UTV Desertcross 1000cc HVAC Series
UTV Workcross 1000cc HV Series

Maintenance Manual

Shandong ODES Industry Co. Ltd.

Foreword

This manual contains such content as introductions on overhaul, maintenance, overhauling program, dismantling, assembling, troubleshooting and service data of UTV1000-13/12

This manual will help you know the vehicle beter so that you can assure your customers of fast and reliable service.

This manual hass been prepareed on the basis of the latest specifications at the time of publication.If modifications have been made sine then,differences may exist between the content of this manual and the actual vehicle.

Illustrations in this manual are used to show the basic principles of operation and work procedures.They may not represent the actual vehicle exactly in detail.

Manufacturer reserves the right of no prior notice on product improvement or modification. Repair and maintenance shall be carried out according to actual situation of vehicle.

WARNING

Inexperienced mechanics or mechanics without the proper tools and equipment may not be able to properly perform the services described in this manual. Improper repair may result in injury to the mechanic and may render the vehicle unsafe for the rider.

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1. GENERAL INFORMATION

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PRECAUTIONS

1. Do not make engine under operation at a closed place or place with poor ventilation for a long time.
2. If engine stops operation, please do not touch it or silencer to avoid burning.
3. Due to high corrosiveness, battery fluid (dilute sulphuric acid)) may cause burns to skin and eyes. In case of splashing it to skin, please clean it with water and see the doctor immediately. In case of splashing it to clothes, please wash it with water immediately. Keep battery fluid far away from Children.
4. Cooling liquid is toxic. Do not drink it or splash it to skin, eyes and clothes. once splashing it to skin, please wash it with a lot of soapy water. In case of splashing it to eyes, please wash eyes immediately and see the doctor. In case of drinking cooling liquid, resulting in vomit, please see the doctor. Keep cooling liquid far away from children.
5. Wear proper working suit, boots and hat. If necessary, please wear long-sleeve working suit and gloves for operation.
6. Gasoline is highly inflammable. No smoking or firing. At the same time, fire sparks shall be avoided. Vaporized gasoline is explosive as well. Operation shall be carried out at places with good ventilation.
7. Battery may produce explosive hydrogen in charging. Please ensure charging at places with good ventilation.
8. Use legal parts, lubricating oil and lubricating grease.
9. Before overhauling, please clean soil and dust.
10. Keep accessories of each part well for correct assembly.
11. Replace dismantled gasket, O-shaped ring, piston pin retainer and cotter pin.
12. Retainer of rubber ring may be deformed after dismantling. So, please do not use loose and soft retainer.
13. Please wash and dry dismantled parts. Use lubricant on the surface of moving parts. For correct installation, please measure data well in dismantling process.
14. If do not know length of screw, please install screws one by one to ensure their corresponding depth.
15. Pre-tighten bolts and nuts and then tighten them with designated torque from the big to the small and from the inside to the outside.
16. Check whether rubber parts are aged. If necessary, replace them. Keep rubber parts far away from grease.
17. If necessary, special tools can be used.

18. Rotate inside and outside races of bearing to ensure flexibility of balls.
    a) If axial or radial resistance is too large, please replace it. If there is concave-convex on the surface, please use oil for washing. If no effect is achieved with washing, please replace it.
    b) If bearing cannot be clamped tightly in pressing into machine or axle, please replace bearing.
19. Please install a side dust proof bearing at correct direction. In installation of open or double-face dust proof bearing, pay attention to that marks of manufacturer shall be outward.
20. In cleaning and drying bearing, please keep bearing support still. Before installation, please carry out lubrication with oil or lubricating oil.
21. Please correct install elastic retaining ring. Assembling after opening can ensure installation of snap ring into slot.
22. After assembly, please check whether all parts are of perfect tightening and flexible movement.
23. Brake fluid and coolant may damage shell and plastic and rubber parts. In case of being splashed by them, please use water for washing.
24. In installing pipeline, please insert them to bottom of connecting pipeline. In installing pipe clamp, please install them to groove if there is. As for pipeline or pipe clamp that cannot be tightened, please replace them.
25. Do not mix soil or dust into engine and/or hydraulic braking system.
26. Before installation, please clean gasket and spacer of engine shell. Use oil stone to polish scratch of joint face evenly.
27. Do not twist or bend too much cable. Twisted or damaged cables may cause inflexible operation.
28. In assembling protective caps of parts, insert cap into groove if any.

TECHNICAL SPECIFICATIONS

Item		Parameter	
Dimensions		UTV1000-13A	UTV1000-12A
Overall length		3364mm(132.4in)	4164mm(163.9in)
Overall width		1870mm(73.6in)	1870mm(73.6in)
Overall height		1947mm(76.7in)	1947mm(76.7in)
Seat height		491mm(19.3in)	491mm(19.3in)
Wheelbase		2322mm(91.4in)	3122mm(122.9in)
Ground clearance		324mm(12.6in)	324mm(12.6in)
Engine			
Type		2 cylinders,SOHC , water cooling	
Number of valves		8(mechanical adjustment)	
Cylinder diameter		91 mm/3.6in	
Piston stroke		75 mm/3.0in	
Compression ratio		10.3：1	
Displacement		976cc	
Maximum power		53Kw/6500rpm	
Maximum torque		85N.m/5500 rpm	
Idle speed		1250±50rpm	
Lubrication	Type	Wet tank lubrication, oil filters can be changed	
	Oil pressure	350KPa at 6000rpm	
	Type of oil	5W-40/SJ	
	Oil quantity	2200mL	
	Replacement of capacity	1850mL	
Fuel	Type	Unleaded gasoline only 93# or higher	
	Fuel pressure	350 kpa	
	Fuel tank capacity	50.3L	
Valve clearance	Intake	0.05 to 0.09mm(0.002in to 0.004in)	
	Exhaust	0.10 to 0.15mm(0.004 in to0.06in)	
Diameter of valve rod(IN)	New	4.960 to 4.975mm(0.195in to 0.196in)	
	Service limit	4.930mm(0.194in)	
Diameter of valve rod(EX)	New	4.945 to 4.965mm(0.195in to 0.195in)	
	Service limit	4.930mm(0.194in)	
Valve seat contact width(IN)	New	1.05 to 1.35mm(0.04in to 0.05in)	
	Service limit	1.8mm(0.07in)	
Valve seat contact width(EX)	New	1.25 to 1.55mm(0.049in to 0.06in)	
	Service limit	2mm(0.079in)	
Valve guide diameter	New	5.000 to 5.015mm(0.1969in to 0.1974)	
	Service limit	5.050mm（0.199in）	
Free length of valve spring	New	40.5mm(1.594in)	
	Service limit	39mm(1.535in)	
Rocker arm bore diameter	New	12.000 to 12.018mm(0.472in to 0.473in)	
	Service limit	12.030(0.474in)	

Rocker arm shaft diameter	New	11.983 to 11.994mm(0.472in to 0.472in)
	Service limit	11.97mm(0.471in)
Piston measurement	New	90.955 to 90.962mm(3.580in to 3.581in)
	Service limit	90.9621to 90.970mm(3.581in)
Cylinder measurement	Size “A”	90.995 to 91.003mm(3.582in to 3.583in)
	Size “B”	91.0031 to 91.010mm(3.583in)
Clearance of cylinder - piston	New	0.033 to 0.048mm(0.0013in to 0.0019in)
	Service limit	0.090mm（0.0035in）
Piston ring type	1st	Upper compression ring, rectangular
	2nd	Lower compression ring, tapered face
	3rd	Oil scraper ring
Piston ring end gap	New 1st	0.25 to 0.40mm(0.0098in to 0.016in)
	New 2nd	0.35 to 0.45mm(0.014in to 0.018in)
	New 3rd	0.20 to 0.70mm(0.008in to 0.028in)
	All service limit	1.50mm（0.059in）
Piston/ring groove clearance	New 1st	0.03 to 0.07mm(0.0012in to 0.0028in)
	New 2nd	0.02 to 0.060mm(0.0008in to 0.0024in)
	New 3rd	0.01 to 0.045mm(0.0004in to 0.0018in)
	All service limit	0.15mm(0.006in)
Intake cam height	New	32.99 to 33.15mm(1.299in to 1.305in)
	Service limit	32.0993m(1.264in)
Exhaust take cam height	New	32.96mm to 33.12mm(12.977in to 1.304in)
	Service limit	32.93mm(1.296in)
Camshaft main bearing journal	New	34.959 to 34.975mm(1.377in to 1.377in)(Timing chain side) 21.959 to 21.980mm(0.865in to 0.865in)(Spark plug side)
	Service limit	34.94mm(1.376in)(Timing chain side) 21.95mm(0.864in)(Spark plug side)
Camshaft main bearing journal bore	New	35.000 to 35.025mm(1.378in to 1.379)(Timing chain side) 22.000 to 22.021mm(0.867in to 0.86)(Spark plug side)
	Service limit	35.040mm(1.38in)(Timing chain side) 22.040mm(0.868in)(Spark plug side)
Crankshaft main journal diameter	New	42.024 to 42.040mm(1.654in to 1.656in)
	Service limit	42.000mm(1.654in)
Crankshaft radial clearance	Service limit	0.06mm(0.0024in)
Crankshaft deflection	Service limit	0.07mm(0.0028in)
Crankshaft pin diameter	New	40.009 to 40.025mm(1.575in to 15.758in)
	Service limit	39.990mm(1.574in)
Connecting rod big end diameter	Service limit	40.100mm(1.579in)
Connecting rod big end radial clearance	Service limit	0.09mm(0.00354in)

Connecting rod big end axial clearance	New	0.2 to 0.5mm(0.0079in to 0.0197in)
	Service limit	0.6mm(0.0237in)
Connecting rod small end diameter	New	20.010 to 20.020mm（0.7878in to 0.788in）
	Service limit	20.060mm(0.79in)
Piston pin diameter	New	19.996 to 20.000mm(0.787in to 0.787)
	Service limit	19.980mm(0.787in)
Spark plug	Type/manufacturer	DCPR7E/ NGK
	Gap	0.6 to 0.7mm(0.024in to 0.028)
Transmission type		CVT(Continuously Variable Transmission)
Continuously variable ratio		0.78 to 3.32
Drive belt width	Service limit	32mm(1.26in)
Gearbox type		Dual range(H/L) with park, neutral and reverse
Gearbox oil	Capacity	1500mL(GL-4-90)
Gear ratio	H	10.914
	L	26.884
	R	23.721
Capacity of cooling liquid	Type	Ethyl glycol/water mix(-35℃)
	Maximum load	3500ml
	Capacity of water tank	600ml
Cooling liquid temperature thermostat	Valve opening	65C◦
	Fan opening	88C◦
Magneto generator output		625W@6000rpm
Crankshaft position sensor value of resistance		774 to 946 Ω@20℃
Tire		
Type		Tubeless
Pressure		48 to 62KPa
Size Front		27×9–14(Rim 14×7.5)
Size Rear		27×11–14(Rim 14×9)
Brakes		
System		Front and rear unified
Type Front		Dual disc brake
Type Rear		Dual disc brake
New disk thickness		5.0mm(0.197in)(Front) 5.0mm(0.197in)(Rear)
Minimum disk thickness		5.0mm(0.197in)(Front) 5.0mm(0.197in)(Rear)
Maximum disk warpage		0.2mm(0.0079in)
Operation		Foot operation
Suspension and shock absorber		
Front suspension		Double wishbone
Rear suspension		Double wishbone
Front shock absorber		Coil spring / oil damper

Front shock absorber travel		130mm(5.118in)
Rear shock absorber		Coil spring / oil damper
Rear shock absorber travel		160mm(6.30in)
Drive train		
Front differential		Shaft driven/single auto-lock differential
Front differential ratio		10：36
Rear axle		Shaft driven/single differential
Rear axle ratio		9:33
Front differential oil capacity		200mL(GL-4-90)
Rear differential oil capacity		220mL(GL-4-90)
Electrical		
Ignition system		EFI-DELPHI
Battery	Type	Maintenance Free
	Voltage	12V
	capacity	45AH
Fuses	AC	40A
	Wiper motor	30A
	EPS	40A
	EFI control	10A
	Horn & light control	15A
	EFI & Dash display	20A
	Fan & brake light	40A
	Top light	30A
	Dump bed & Rear diff lock	30A
	Headlights,driving lights,steering lights	30A
	Power supply	15A
Head lamp（High beam / low beam）		12V55W/55W&12V 30W/20W
Fog light		Front：12V0.4W&12V 6W Rear：12V0.35W
Tail light		12V&12V 1.8W
Indicator light		Front：12V 0.35W&12V 0.4W Rear：12V 0.4W&12V 0.4W
Turn light		Front：12V5W&12V 6W Rear：12V0.8W&12V 6W

TIGHTENING TORQUE

Locking devices (e.g.: locking tabs, elastic stop nuts ,self-locking fasteners ,etc.) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be renewed.

In order to avoid a poor assembling, tighten screws, bolts or nuts in accordance with the following recommended torque value:

Grade	Torque(N·m)					
	M6	M8	M10	M12	M14	M16
4.6	4～5	10～12	20～25	36～45	55～70	90～110
5.6	5～7	12～15	25～32	45～55	70～90	110～140
6.8	7～9	17～23	33～45	58～78	93～124	145～193
8.8	9～12	22～30	45～59	78～104	124～165	193～257
10.9	13～16	30～36	65～78	110～130	180～201	280～330
12.9	16～21	38～51	75～100	131～175	209～278	326～434

CAUTION

Be sure to use the proper tightening torque for the proper strength grade. Always torque screws, bolts and / or nuts in a criss-cross sequence.

As for important tightening torques , please refer to following standards.

Installation location	Specifications (mm)	Torque N.m(ft.lbs)
Fastening bolt of engine	M10	60-65(44.3-48)
Fastening nut of suspension arm	M12	78-100(57.6-73.8)
Bolt of rear shock absorber	M12	78-100(57.6-73.8)
Bolt of front shock absorber	M10	60-65(44.3-48)
Fastening nut of wheel rim	M12	90-110(66.4-81.2)
Nut of wheel hub	M22/M24	280-300(206.7-221.4)
Bolt of rear brake/stop pump (calipers)	M10	60-65(44.3-48)
Bolt of brake/stop disc	M8	24-28(17.7-20.7）
Bolt of front brake/stop pump (calipers)	M10	60-65(44.3-48)
Lock nut of steering rod	M12	120-140(88.6-103.3)
Lock bolt of steering gearbox	M12	140(103.3)
Bolt of exhaust pipe	M8	18-26(13.3-19.2)
Fastening nut of rear differential	M10	80(59)
Fastening nut of front differential	M10	80(59)
Bolt of front propeller shaft flange	M8	35-40(25.8-29.5)
Bolt of front propeller shaft flange	M10	70-80(51.7-59)
Spark plug	M12	18(13.3)
Water temperature sensor	M12	16(11.8)
Oil pressure switch	M10	12.5(9.2)
Adjusting nut of valve clearance	M6	12(8.9)
Main pulley bolt	M12	100(73.8)
Driven pulley bolt	M10	60(44.28）
Magneto flywheel bolt	M16	150(110.7)
Magneto stator bolt	M6	12.5(9.2)

One way bolt	M8	30(22.1)
Engine oil drain plug	M18	30(22.1)
Gearbox oil drain plug	M18	30(22.1)
Decompression valve plug	M22	25(18.5)
Cylinder head bolt	M10	60(44.3）
Cylinder head bolt	M6	12.5(9.2)
Connecting rod bolt	M9	60(44.3）
Timing chain wheel bolt	M6	15(11.1)
Front output shaft flange bolt	M12	100(73.8)
Rear output shaft flange bolt	/	/

2. PERIODIC MAINTENANCE

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MAINTENANCE SCHEDULE

In order to maintain the best performance and economical performance of vehicles, suggestions on intervals for necessary regular maintenance are listed. Following maintenance is calculated in km, mile and hour based on firstly appeared data.

However, keep in mind that if the vehicle isn't used for a long period of time, the month maintenance intervals should be followed.

Items marked with an asterisk should be performed by a dealer as they require special tools and technical skills.

In case of complicated road conditions, regular maintenance shall be carried for vehicles.

ITEM	ROUTINE	Whichever Comes first ⇨		INTIAL			EVERY	
			month	1	3	6	6	12
			Km (mi)	320 (200)	1,200 (750)	2,400 (1,500)	2,400 (1,500)	4,800 (3,000)
			hours	20	75	150	150	300
Valves*	● Check vale clearance. ● Adjust if necessary.			O		O	O	O
Cooling system	● Check coolant leakage. ● Repair if necessary. ● Replace coolant every 24 months.			O	O	O	O	O
Spark plug	● Check condition. ● Adjust gap and clean. ● Replacement every 24 months			O	O	O	O	O
Air filter elements	● Clean. ● Replacement every 24 months			Every 20-40 hours (More often in wet or dusty areas.)				
Crankcase breather system*	● Check breather hose for cracks or damage. ● Replace if necessary.					O	O	O
Exhaust system*	● Check for leakage. ● Tighten if necessary. ● Replace gasket(s) if necessary.					O	O	O
Fuel line*	● Check fuel hose for cracks or damage.. ● Replacement fuel hose every 48 months ● Replacement fuel filter every 24 months					O	O	O

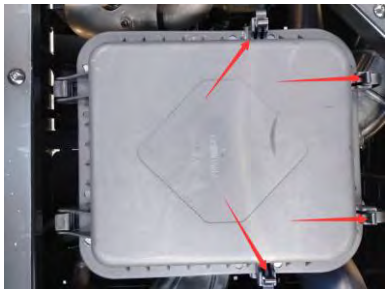
Engine oil	● Replace (Check oil level every month) .			O		O	O	O
Engine oil filter	● Replace.			O		O		O
Differential and gearbox oil	● Check oil level/oil leakage. ● Replacement every 24 months.			O				O
ITEM	ROUTINE	Whichever Comes first ⇨		INTIAL			EVERY	
			month	1	3	6	6	12
			Km (mi)	320 (200)	1,200 (750)	2,400 (1,500)	2,400 (1,500)	4,800 (3,000)
			hours	20	75	150	150	300
Brake*	●Check operation/brake pad wear/fluid leakage. ●Brake fluid needs to be above the lowest position. ●Correct if necessary. Replace pads/disk if worn to the limit.			O	O	O	O	O
Accelerator pedal*	●Check operation and free play.			O	O	O	O	O
Wheels*	●Check balance/damage/ run out ●Repair if necessary.			O		O	O	O
Wheel bearings*	●Check bearing assemblies for looseness or damage.. ●Replace if damaged.			O		O	O	O
Front and rear Suspension*	●Check no deformation and looseness. ●Correct if necessary.					O		O
Steering system*	●Check operation and no looseness. ●Repair if damage. ●Check toe-in/Adjust if necessary.			O	O	O	O	O
Rear knuckle pivots and suspension arms*	●Lubricate with lithium-soap-based grease.					O	O	O
Drive shaft universal joint*	●Lubricate with lithium-soap-based grease.					O	O	O
Engine mount*	●Check for cracks or damage. ●Correct bolt tightness.					O	O	O
Front and rear axle boots*	●Check operation. ●Replace if damage.			O				O
Stabilizer bushings*	●Check for cracks or damage.					O	O	O
Fittings and fasteners*	●Check all chassis fittings and fasteners. ●Correct if necessary.			O	O	O	O	O
Battery	●End connection			O		O	O	O
Lamp and steering indication	●Operation			O	O	O	O	O
AC compressor drive belt	● Check degree of tightness and Adjust. ● Replacement every 24 months			O	O	O	O	O

AIR CLEANER

In case of driving in dusty environment, air filter shall be cleaned regularly. It is of great possibility to accelerate wear to engine if there is not filtering element or worn filtering element is used. So, please keep air filter under good conditions all the time. If vehicle is used in dusty area, inspect more frequently than specified in MAINTENANCE SCHEDULE.

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. never remove or modify any component in the air filter housing. The engine management system is calibrated to operate specifically with these components. Otherwise, engine performance degradation or damage can occur.Check and clean the air cleaner element in the following manner:

Remove the middle seat.



Release 4 clamps and remove air filter housing cover.

CAUTION:PREVENT CLAMPS FROM FALLING.

Release clamp and remove air filter.

Blow low pressure compressed air on filter element to clean it.

Properly re-install removed parts in the reverse order of their removal. pay attention to the seal gasket of air filter housing is not skew.

CAUTION

1.If liquid /deposits are found, squeeze and dry the foam filter. Replace filter element if damaged.
2.Do not start engine if liquid or deposit are found. If there is oil in the air filter housing, check engine oil level. Oil level may be too high.
3.Inspect the air cleaner element for tears, a torn element must be replaced.

VALVE CLEARANCE

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

Check the intake and exhaust valve clearances at the distances indicated above and adjust the valve clearances to specification,if necessary.

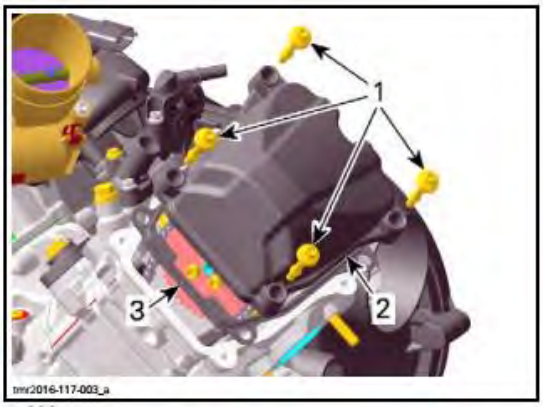
Valve clearance is to be checked when the engine is cold.The intake and exhaust valves must be checked an adjusted when the piston is at TOP-DEAD –CENTER(TDC) on the compression stroke.

Lift the rear cargo bed.
Remove middle seat, seat back guard plate and the heat shield.

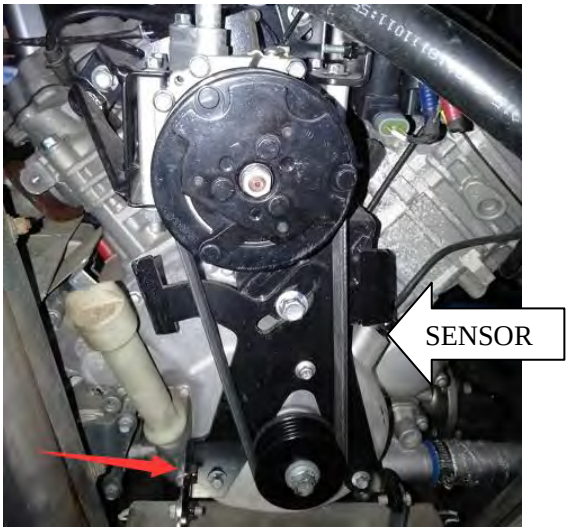
Remove spark plug cable and spark plug of both cylinders.

Remove the valve cover of both cylinders.

1. screws
2. Valve cover
3. Gasket

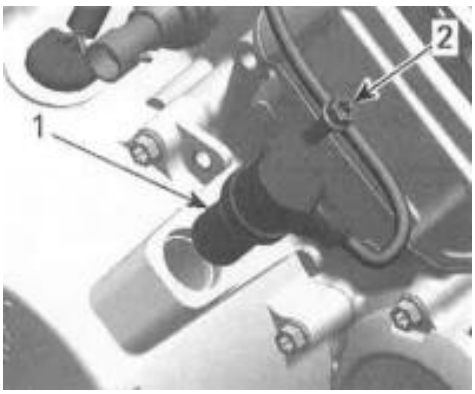


Remove the bolt M6X16 and remove the AC compressor drive belt cover.



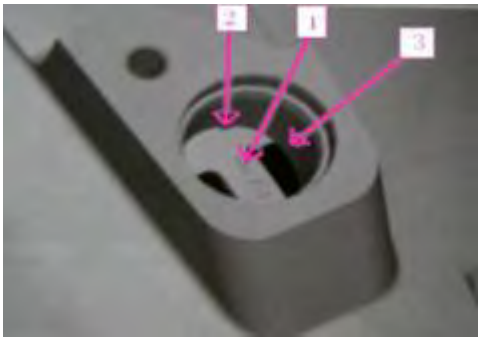
Remove the crankshaft position sensor.

1. Crankshaft position sensor
2. Screw



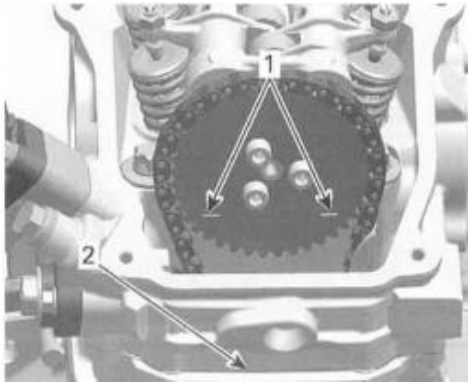
Valve clearance of cylinder 2

Use a 13 mm socket to turn crankshaft until piston 2, rear is at TDC ignition.



When rear piston is at TDC ignition, marks on magneto flywheel “2” and on the magneto cover are aligned.

1. Mark “2” on magneto flywheel
2. Notch on magneto cover
3. Crankshaft position sensor location



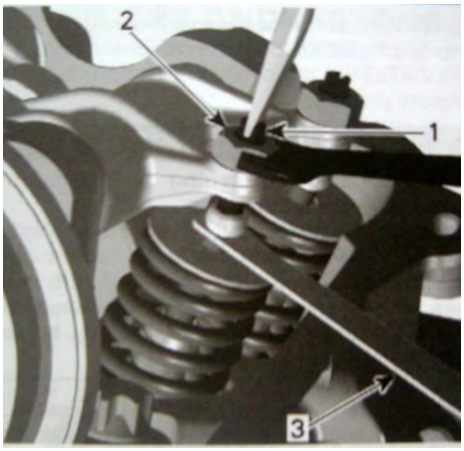
At TDC ignition, the printed marks on the camshaft timing gear have to be parallel to cylinder head base. If not, use socket to turn crankshaft 360°

1. Printed marks on camshaft timing gear
2. Cylinder head base

Insert the feeler gauge between the valve stem end and adjusting screw on the rocker arm to check the clearance.

If the valve clearance is out of specification, adjust valves as follows.

Valve clearance	
Intake	0.06 to 0.10mm(0.00236 to 0.00394 inches)
Exhaust	0.11 to 0.15mm(0.00433 to 0.00591 inches)



Use mean valve of exhaust/intake to ensure a proper valve adjustment.

Hold the adjustment screw at the proper position and torque the locking nut.

Repeat the procedure for each valve.

1. Adjustment screw
2. Adjustment nut
3. Feeler gauge

CAUTION

Securely tighten the locknut after completing adjustment.

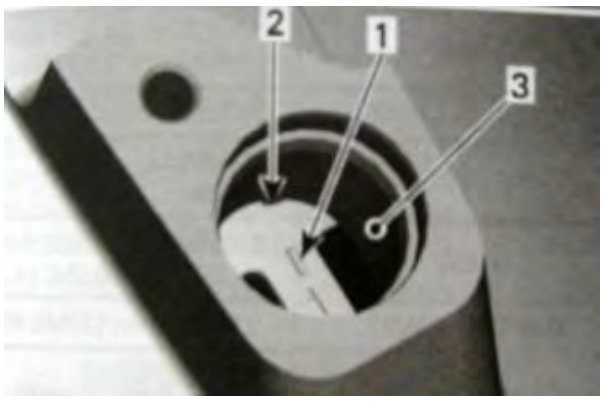
Valve clearance adjustment locknut: 12N.m(8.856Lbf.ft)

Valve clearance of cylinder 1

Using a 13 mm socket, turn crankshaft 280 °counterclockwise.

Until marks on magneto flywheel “1” and magneto cover are aligned.

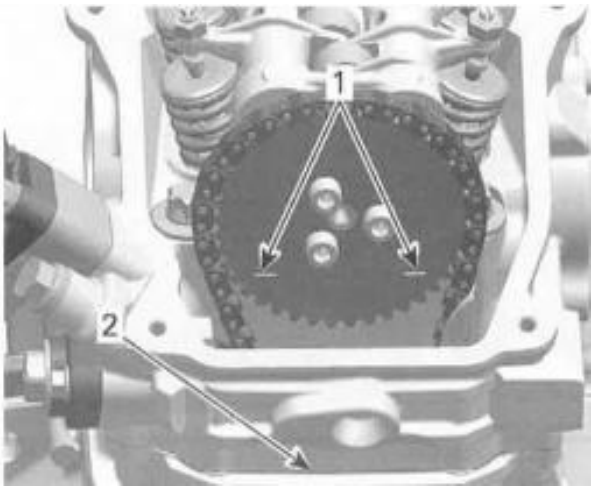
1. Mark “1” on magneto flywheel
2. Notch on magneto cover
3. Location of crankshaft position sensor



At TDC ignition, the printed marks on the camshaft timing gear have to be parallel to cylinder head base as per following illustration.

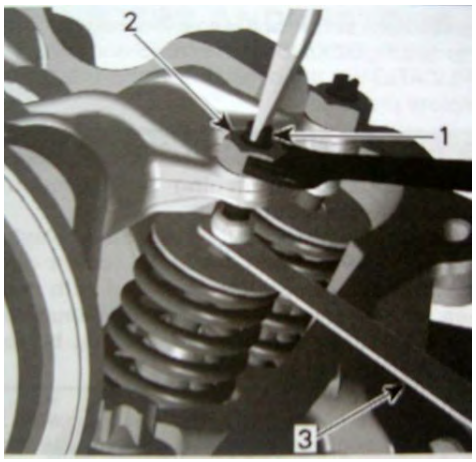
TYPICAL

1. Printed marks on camshaft timing gear
2. Cylinder head base



Insert the feeler gauge between the valve stem end and adjusting screw on the rocker arm to check the clearance.

If the valve clearance is out of pecification, adjust valves as follows.



Valve clearance	
Intake	0.06 to 0.10mm(0.00236 to 0.00394 inches)
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Use mean valve of exhaust/intake to ensure a proper valve adjustment.

Hold the adjustment screw at the proper position and torque the locking nut.

Repeat the procedure for each valve.

1. Adjustment screw
2. Adjustment nut
3. Feeler gauge

Valve clearance adjuster locknut: 12N·m(8.856Lbf.ft)

CAUTION

Securely tighten the locknut after completing adjustment.

Install the valve cover of both cylinders, spark plug cable and spark plug of both cylinders, the crankshaft position sensor and AC compressor drive belt cover.

SPARK PLUG

In case of serious wear or burn to electrode or burn to insulator by spark plug or damage to thread etc, please replace it with new spark plug

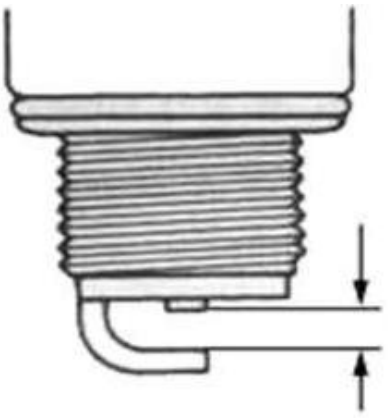
In case of carbon deposit, please use proper tools for cleaning.

Spark plug gap

Use clearance gauge to measure clearance of spark plug.

In case of exceeding designated range, then adjust the gap.

0.7-0.9mm(0.028-0.035inches)



Spark plug heat range

Check the spark plug heat range by observing the electrode color. If the electrode of the spark plug is appearing wet or dark color, replace the spark plug with a hotter type one. If it is white or appearing glazed, replace the spark plug with a colder type one.

Standard type: DCPR8E（NGK）

Colder type: DCPR9E（NGK）

Hotter type: DCPR7E（NGK）

CAUTION

In order to avoiding damaging cylinder cap thread, firstly use hands to tighten spark plug and then use spark plug wrench to tighten cylinder cap with designated torque.

THROTTLE CABLE PLAY

Before starting the engine, check the gas pedal to be sure it is operating correctly. Make sure the gas pedal fully returns to the idle position as soon as it is released.

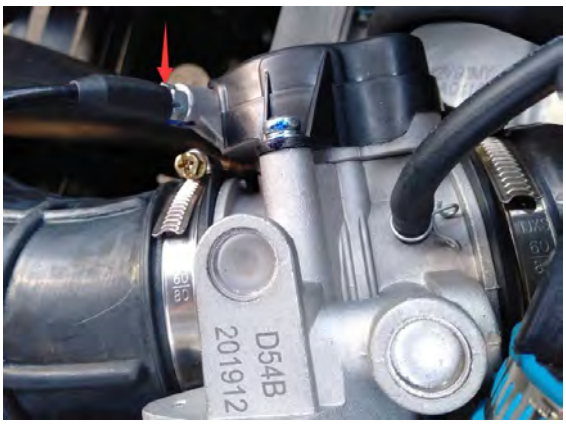
Check the free play and adjust if needed. Press the throttle to make sure it moves smoothly without sticking and snaps back automatically when it is released Check to see that the gas pedal operates correctly. It must operate smoothly and fully spring back to the idle position when released. Have a dealer repair if necessary for proper operation.

Check throttle pedal free play:
3 - 5mm(0.118-0.197inches)
In case of out of range: → adjustment

Lift the rear cargo bed.Remove middle seat, seat back guard plate and the heat shield.

Loose throttle cable (bracing cable).Turn adjuster to adjust free play of throttle pedal.

After adjustment, tighten nut.



If free play after adjustment cannot reach designated requirement or there is viscosity for throttle valve, replace it with new throttle cable.

ENGINE OIL

Oil level verification

Strictly follow this procedure, otherwise wrong oil level may be indicated.

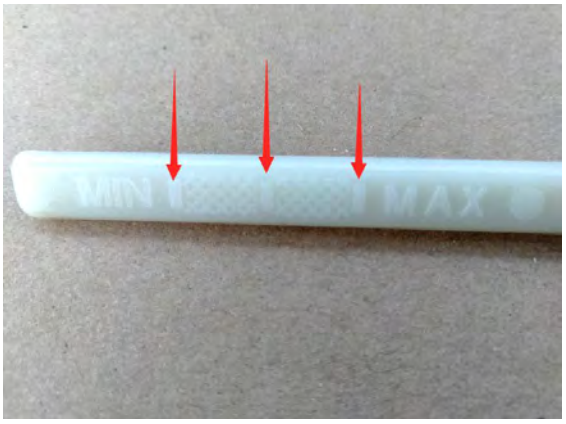
1. Ensure vehicle is on a level surface.
2. The engine must be cold.

CAUTION

If just stop engine,Wait at least half hours to allow oil to flow down to crankcase then check oil level.

3. Lift the rear cargo bed.

4. Remove dipstick and wipe clean stem.
5. Fully screw in dipstick to check oil level.
6. Remove dipstick and read oil level. Oil level must be between minimum and maximum marks on dipstick.It should be near or equal to the upper mark.
7. There is a capacity of 300 ml between the two marks. Refill oil as necessary and recheck oil level. Do not overfill.
8. Wipe any spillage.Install and propery tighten the dipstick.
9. Lower the rear cargo bed.



Replace engine oil

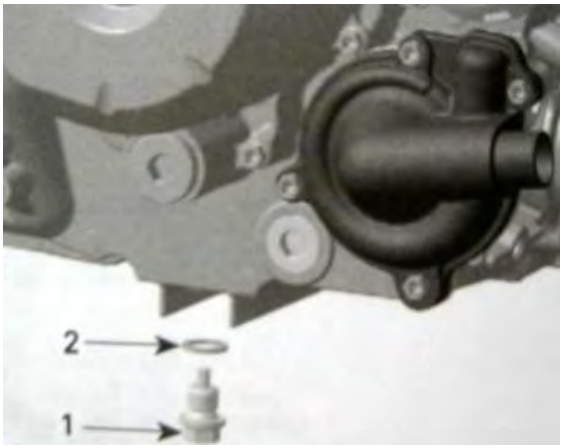
Prior to change the oil, ensure vehicle is on a level surface. Oil and oil filter must be replaced at the same time. Oil change and oil filter replacement should be done with a warm engine.

WARNING

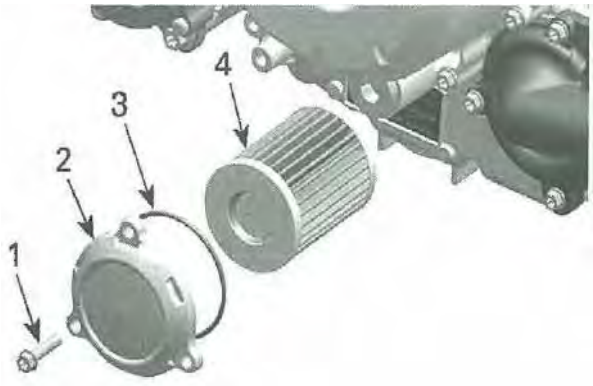
The engine oil can be very hot. Wait until engine oil is warm.

CAUTION

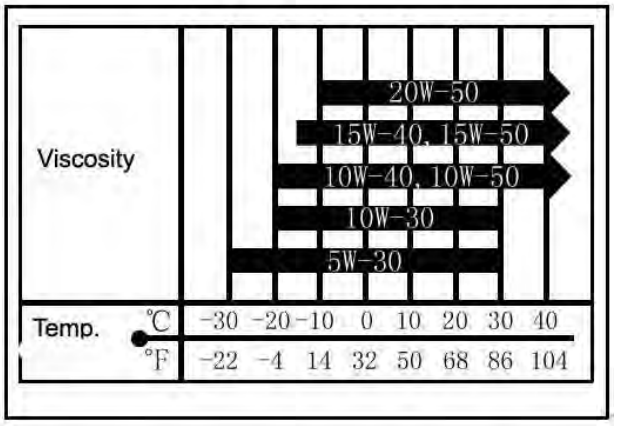
Dispose oil and filter as per your local environmental regulations.



1. Ensure vehicle is on a level surface.
2. Start engine and let idle for a few minutes.
3. Stop engine. Wait a few minutes to allow oil to flow down to crankcase.
4. Lift the rear cargo bed.
5. Remove dipstick.
6. Raise the vehicle, support it securely. Place a drain pan under the engine drain plug area.
7. Clean the drain plug area.
8. Unscrew drain plug then remove dipstick.
   1) Drain plug
   2) Gasket ring
9. Allow oil to drain completely from crankcase.



10. Clean the magnetic drain plug from metal shavings and residue.
11. Install a new gasket ring on drain plug. Torque drain plug to 30 N.m(22Lbf.ft).
12. Remove oil filter screws, oil filter cover and oil filter.
    1) Oil filter screw
    2) Oil filter cover
    3) ring
    4) Oil filter



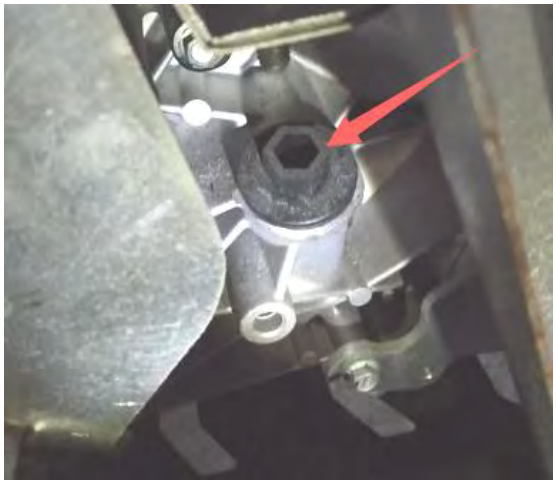
13. Check and clean the oil filter inlet area for dirt and other contamination.
14. The installation is the reverse of the removal procedure. Pay attention to install a new gasket on oil filter cover.
15. Refill engine with a SAE 10W-40 API SJ classification engine oil, Oil change capacity with filter 2200mL.
16. Check the oil level with the dipstick. Refer to OIL LEVEL VERIFICATION above.
17. Run engine to ensure oil filter and drain plug areas are not leaking.

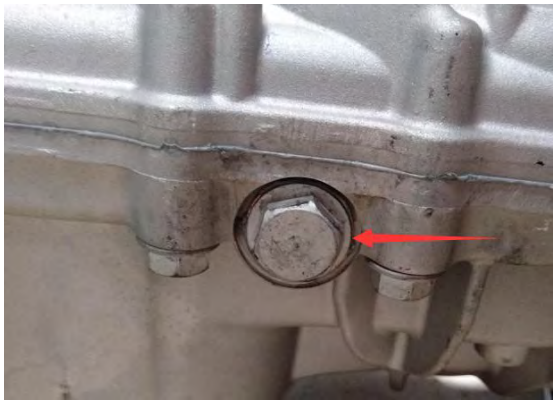
CAUTION

In order to expand service life of vehicle, please use grade SJ standard engine oil conforming to API with its viscosity indication being SAE10W/40. If viscosity of engine does not reach SAE 10W/40, make corresponding selection according to drawing.

Replace gearbox oil

Prior to change the gearbox oil, ensure vehicle is on a level surface, should be done with a warm engine.



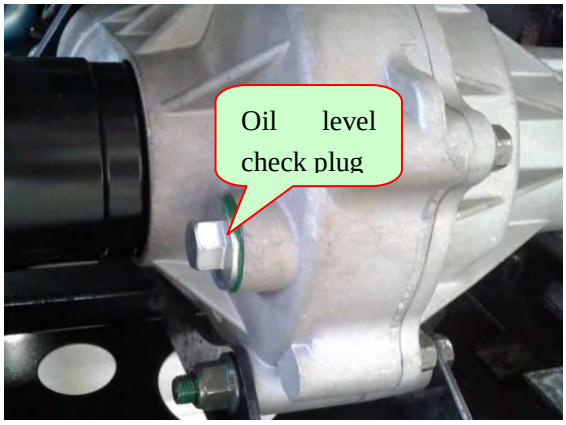


1. Drive vehicle for a few minutes.
2. Ensure vehicle is on a level surface.
3. Stop engine and wait a few minutes.
4. Lift the rear cargo bed.
5. Remove the oil level check dipstick.
6. Place an oil pan under the gearbox case, and then drain oil completely by removing the drain plug.
7. Tighten the drain plug to 30 N.m(22Lbf.ft).
8. Pour the specified oil(GL-4-90) about 1500mL by syringe through the oil level check hole.
9. Tighten the oil level check dipstick.

FRONT DIFFERENTIAL OIL

To change the front differential oil, locate the vehicle on a level position and carry out the following steps.

Clean the oil level check plug area and remove the oil level check plug.



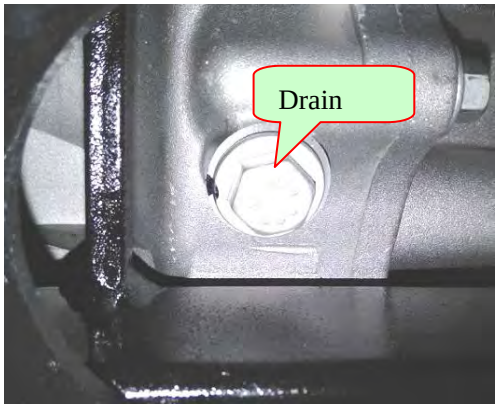
Clean the drain plug area.

Place an oil pan under the front reducer case, and then drain oil completely by removing the drain plug.

Tighten the drain plug to 20 N.m. (14.76Lbf.ft)

Pour the specified oil(GL-4-90) about 150~180mL by syringe through the oil level check plug hole until the oil over flows.

Tighten the oil level check plug to 20 N.m(14.76Lbf.ft).



STEERING SYSTEM

Park vehicle at flat ground and hold steering wheel for wobbling to up, down, left and right.Check whether there is loosing. In case of wobbling, tighten nut or dismantle steering column for further inspection.

Park vehicle at flat ground and turn steering wheel left or right slowly to see whether it can be turned flexibly. In case of obstacles, check whether it is caused by main cable or other wiring installation. If it is not caused by above situations, please check the bottom of steering tie rod and see whether steering column bearing is damaged or not.

Park vehicle on flat ground, make sure the tire pressure for right and left tires is same and set to the proper specification, set the front wheels in the straight position, then place a load of 75kg on the driver side seat.

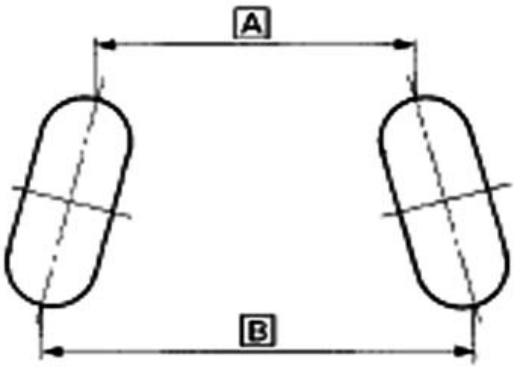
Measure the distance A and B of the front wheels and calculate the difference.

Toe-in.:B -A= 5mm(0.197inches)

A: front of front wheel

B: rear of front wheel

Out of range of toe-in: →Adjust nut of tie rod.



CAUTION

After adjusting toe-in, fist rotate steering wheel from center position to the left and right completely, to ensure that is the same corner, then slowly run vehicle to see whether its direction can be controlled.

BRAKING SYSTEM

Check to see if any brake fluid is leaking out of the pipe joints or the brake fluid reservoir. Apply the brakes firmly for one minute. If there is any leakage, have the vehicle inspected by an authorized dealer.

Test the brakes at slow speed after starting out to make sure they are working properly. If the brakes do not provide proper braking performance, inspect the brake system. If needed, have the vehicle inspected by an authorized dealer.

Brake fluid level

Check the brake fluid level by observing the lower limit line on the brake fluid reservoir.

When the brake fluid level is below the lower edge, replenish with brake fluid DOT4.

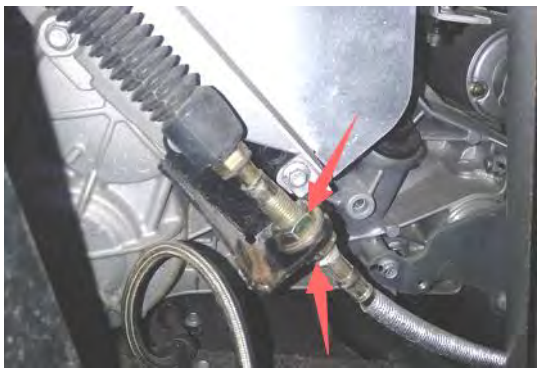
Brake pedal adjustment

The brake pedal stroke is 30～40mm(1.18~1.57inches). If less than equal 30mm, it will be a hidden dangers, must adjust the brake pin connecting the brake pedal.

GEAR SHIFT

Check the shift lever as to change gearshift from P to R N H L and reverse smoothly. Also the meter display is correct.If not,need to adjust.

Lift the rear cargo bed.
Unscrew the two adjust nuts on the rear side of the shift cable.
Select the shift lever to N and confirm meter display N.
Tighten the nuts of the shift cable equably.



COOLING SYSTEM

To prevent rust formation or freezing condition, always replenish the system with the premixed coolant or with 50% antifreeze and 50% water. Do not use tap water, straight antifreeze or straight water in the system. Tap water contains minerals and impurities which build up in the system. During cold weather, straight water causes the system to freeze while straight antifreeze thickens and does not have the same efficiency. Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

Cooling liquid may be reduced by natural evaporation. Regularly check horizontal position of cooling liquid.

Coolant level verification

Park vehicle at flat ground, check horizontal line of cooling liquid by looking at the side of the auxiliary radiator through the front wheel of driver side direction.

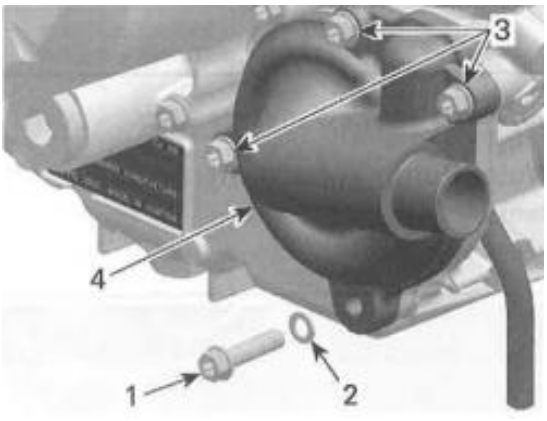
Check the level of cooling water in fluid reservoir (auxiliary radiator) is between upper and lower critical levels.
Add coolant if level is below the MIN mark(use a funnel to avoid spillage).Do not overfill.

CAUTION

To avoid potential burns, do not remove the radiator cap or loosen the cooling drain plug if the engine is hot. Never drain or refill cooling system when engine is hot.

Coolant replacement

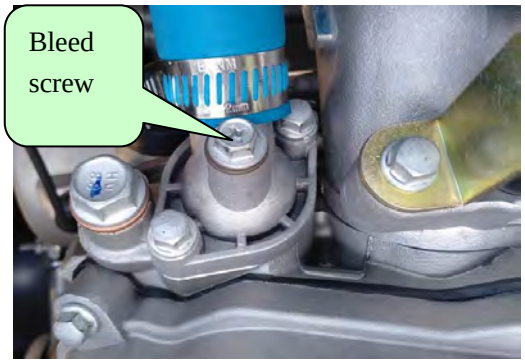
Park vehicle at flat ground.
Remove the front service cover.
Remove the radiator pressure cap.
Lift the rear caro bed.
Partially unscrew coolant drain plug located below water pump housing.



1. Coolant drain plug
2. Sealing ring,
3. Screws
4. Water pump housing

When coolant is drained completely, remove cooling drain plug completely,and replace a new sealing ring. Then screw the coolant drain bolt and torque it to 10 N.m(7.38Lbf.ft).

Unscrew bleed screws on top of thermostat housing.
Both cylinders must be bled.
Unscrew bleed bolt on top of raditor.



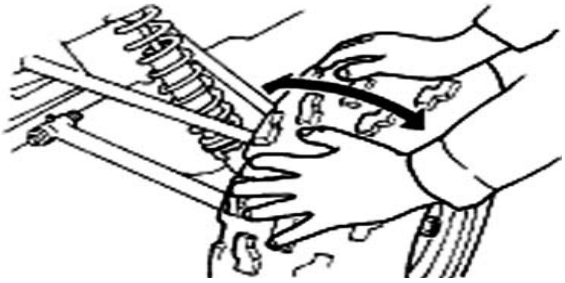
Fill up the radiator with coolant, when the coolant comes out by the thermostat housing hole, install the bleed screws with its gasket ring and torque to 10 N.m(7.38Lbf.ft).
Start the engine and let idling.
Continue adding coolant to radiator, when the coolant comes out by the radiator bleed hole, install the bleed bolt with its gasket ring and torque to 10 N.m(7.38Lbf.ft).
Press and relax the throttle pedal five times to bleed air bubbles completely.
Refill coolant to radiator, and install the the radiator pressure cap.
Run engine until radiator fans open(Must all the fans work).

Stop the engine. When engine has completely cooled down, recheck coolant level in the coolant radiator, Top up if necessary.

CAUTION

Check the general condition of hoses and clamps for tighten.Check the leak indicator pipe in front of water pump for oil and coolant.

WHEELS



Lift wheels up at horizontal position and ensure no load to each wheel.

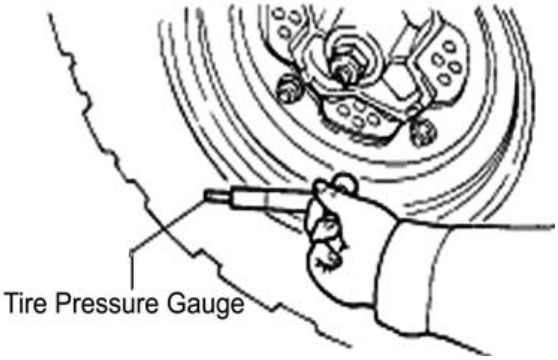
Shake wheels to left and right to see whether their connecting parts are installed tightly and check whether they can be swung.

No adequate tightening: → tightening

Swing: → replace rocker arm

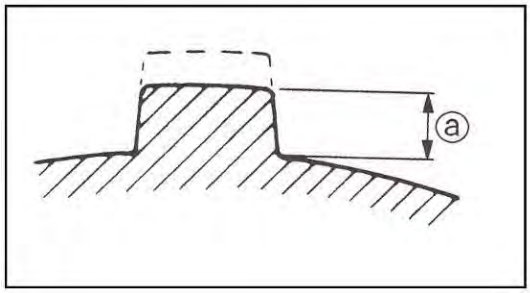
Tire pressure

Improper tire pressure will lower comfort of operation and driving and may lead to wear to side edges of tires.



Tire thread.

When the tire groove decreases to 6 mm (0.24 in) due to wear, replace the tire.



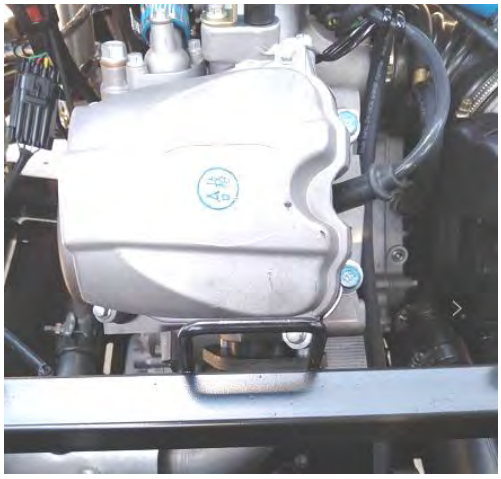
ENGINE COMPRESSION PRESSURE

The compression pressure reading of a cylinder is a good indicator of its internal condition. The decision to overhaul the cylinder is often based on results of a compression test.

Before measuring cylinder pressure, ensure installation and tightening of cylinder cap bolt with designated torque and reasonable clearance of valve.

Standard cylinder pressure: 0.9～1.2Mpa(130.5PSI~174PSI)

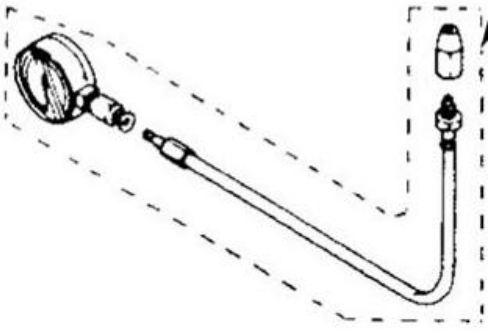
Too low cylinder pressure may cause the following:



- Excessive wear to cylinder;
- Wear to piston or piston ring;
- Blockage of piston ring in groove;
- Close valve seat;
- Damage to cylinder lining or faults of other parts

Measure engine compression pressure:

1. Warm up engine.
2. Ensure full charging of battery.
3. Lift the rear cargo bed.
4. Remove middle seat, seat back guard plate and the heat shield.
5. Remove spark plug cable.
6. Dismantle spark plugs.
7. At spark plug hole, install cylinder pressure meter.
8. Press button of start for several seconds. Record indication of maximum cylinder pressure.



ENGINE OIL PRESSURE

Check the engine oil pressure periodically. This will give a good indication of the condition of the moving parts. The engine oil pressure test should be done with a warm engine 90℃ and the recommended oil.

Lift the rear cargo bed.

Remove the AC compressor drive belt cover.

Remove the oil pressure switch wire connector and switch on the right of engine.

Install oil pressure gauge and adapter hose.
Start engine on idle speed. The engine oil pressure should be within the following values.

Oil pressure	1250 RPM	6000 RPM
Minimal	70kPa (10.2PSI)	300kPa (43.5PSI)
Nominal	150kPa (21.8PSI)	350kPa (50.8PSI)
Maximal	250kPa (36.3PSI)	450kPa (65.3PSI)

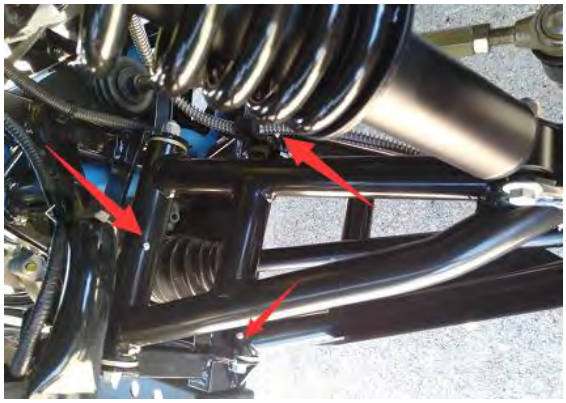
Remove oil pressure gauge and adapter hose.

Installation oil pressure switch to 12 N.m(8.86Lbf.ft)
and the oil pressure switch wire connector.
Lower the rear cargo bed.

SUSPENSION SYSTEM

Check suspension arm for:cracks/pitting/bending/distortion.
Check suspension arm abnormal play:side to side/up and down.If any play is detected,inspect bushings and cushions.
Check ball joint for:dammage/pitting/play.
Check ball joint bellows for:damage/cracks.
Lubricate both suspension arms with lithium-soap based grease. There are grease fittings on each suspension arm. Check operation and for leakage.

Grease fitting location of front suspension arms.



Grease fitting location of rear suspension arms.

Lubricate rear knuckles with lithium-soap based grease. There are two grease fittings on each rear knuckle.

HVAC SYSTEM

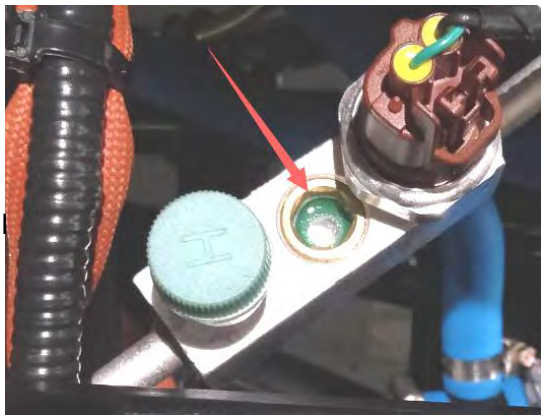
The refrigerant

Refrigerant type:R134a
Refrigerant capacity:about 550g(MXU)　600g(MXU-6)
HVAC system working pressure in summer at engine idle speed: Low pressure side 150—250kPa(22~36PSI), High pressure side 1400—1600kPa(203~232PSI)

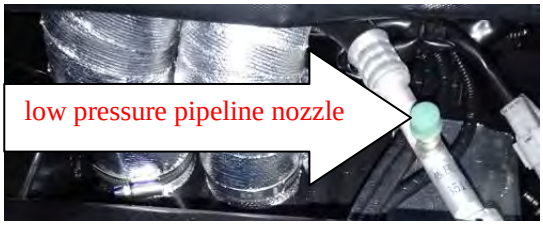
Whether refrigerant is shortage

Remove the front service cover.

Check the air bubbles from sightglass in the pipe between condenser and evaporator.If there are a lot of air bubbles all the time when the compressor is running. Need to refill refrigerant.



Keep the AC system running.Refill refrigerant by low pressure pipeline nozzle use special equipment.



WARNING

If refill refrigerant by a R134a bottle.Must keep the bottle at upright position.Otherwise AC compressor will be broken due to liquid refrigerant comes into lower pressure pipeline.

CAUTION

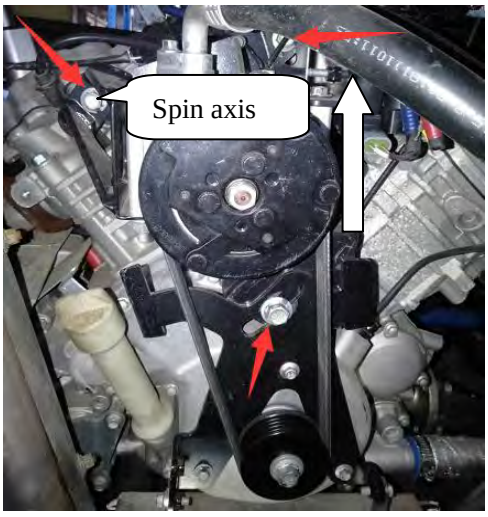
If can not see a few air bubbles from sightglass when AC compressor just tarts,means refrigerant is overfilled.

The AC compressor drive belt

The degree of belt tightness:
7-15mm(0.28~0.59inches) at 100N(22.5Lbf)
If out of range,need to adjust the degree of belt tightness.
Lift the rear cargo bed.
Remove the AC compressor drive belt cover.

Unscrew the 3-M10 bolts of AC compressor bracket.
Move up the AC compressor.

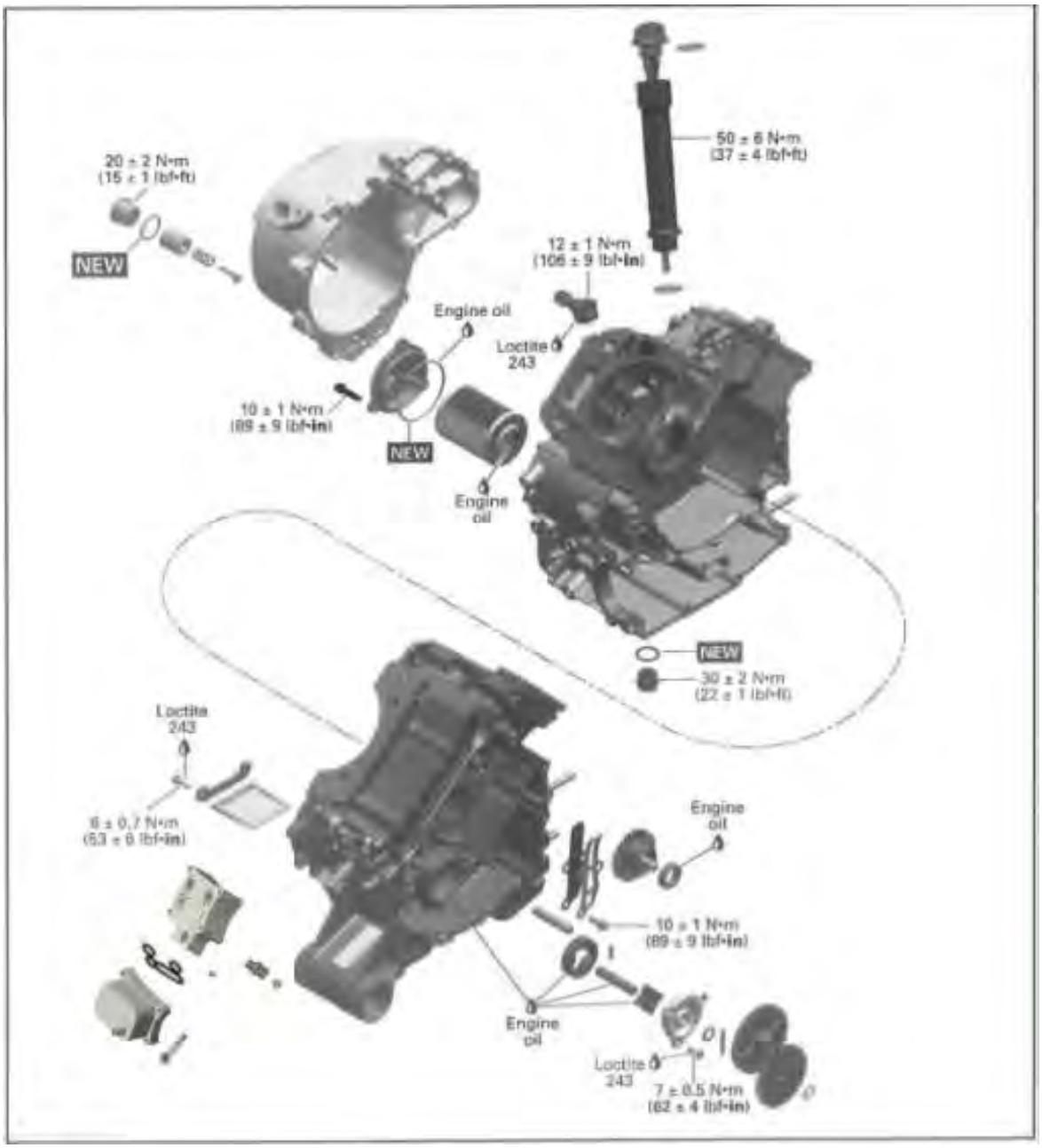
Tighten the 3-M10 bolts at 40~60N.m (30~44Lbf.ft) .Install the AC compressor drive belt cover,Lower the rear cargo bed.



3. ENGINE

ENGINE LUBRICATION CIRCUIT.....3-2	COOLING SYSTEM.....3-10
MAGNETO AND STARTER.....3-22	CYLINDER HEAD NO.1.....3-30
CYLINDER HEAD NO.2.....3-31	CYLINDER AND PISTONS.....3-32
TIMING CHAIN.....3-54	ENGINE DRIVE SHAFT.....3-65
CRANKCASE AND PTO COVER.....3-66	CRANKSHAFT.....3-67
GEARBOX COMPONENTS.....3-93	GEARBOXCOMPONENTS.....3-94

ENGINE LUBRICATION CIRCUIT



1. Camshaft bearings
2. 0il pressure switch
3. 0il filter
4. 0il pressure regulator valve
5. 0il strainer
6. 0il pump
7. Crankshaft main bearings
8. Crankshaft support bearing
9. Connecting rod' bearings

INSPECTION

ENGINE OIL PRESSURE

NOTE : The engine oil pressure test should be Done with a warm engine100°C(212°F) and the recommended oil.

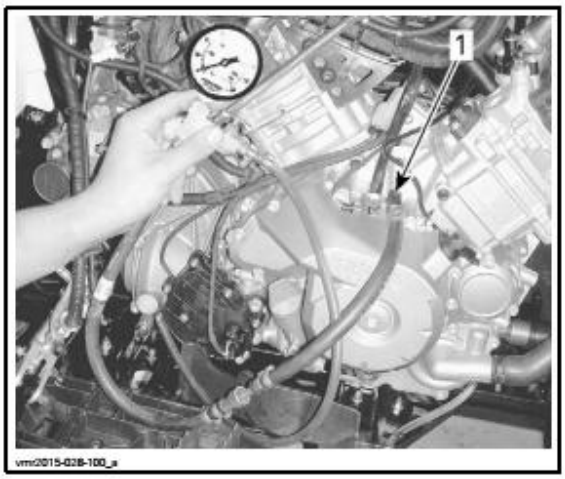
Remove the oil pressure switch. Refer to OIL PRESSURE SWICH in this subsection.

Use the pressure gauge with the proper adapter hose.

REQUIRED TOOL	
PRESSURE GAUGE	
ADAPTER HOSE	

The engine oil pressure should be within the following values.

OIL PRESSURE	1250 RPM	6000 RPM
MINIMAL	70kPa(10PSI)	300kPa(44PSI)
NOMINAL	150kPa(22PSI)	350kPa(51PSI)
MAXIMA L	250kPa(36PSI)	450kPa(65PSI)



1f the engine oi1 pressure is out of specifications, check the points described in TROUBLESHOOT--INE in this subsection.

Remove oil pressure gauge and adapter hose.

NOTE: To remove adapter hose from oil pressure gauge, use the disconnect tool.

REQUIED TOOL	
DISCINNECT TOOL	

Reinstall the oil pressure switch,

TROUBLESHOOTING

LOW OR NO OIL PRESSURE

1. Oil level is too low.

-Refill engine with recommended engine oil Refer to OIL LEVEL VERIFICATION in the PERIODIC MAINTENANCE PROCEDURES subsection.

-Check for high oil consumption ,refer to HIGH OIL CONSUMPTION in the TROUBLESHOOT -ING subsection.

-Check for engine oil leaks. For leak indicator hole,refer to COOLING SYSYTEM INSPECTION in the PERIODIC MINTENANCE PROCEFURES subsection.Rapair if necessary.

2. Use of unsuitable engine oil type.

-Replace engine oil by the recommended engine 0il.

3. Clogged oil filter.

-Replace oil and oil fi1ter at the same time.

4. Defective oil pressure switch.

-Test oil pressure switch, see procedure in this subsection.

5. Defective or worn oil pump.

-Check oil pump, see procedure in this subsection. 6. Defective engine oil pressure regulator.

Check engine oil pressure regulator ,see procedure in this subsection.

7. Worn plain bearings in crankcase.

-Check plain bearings clearance, refer to BOTTOM subsection.

8. Clogged engine oil strainer.

Check engine oil strainer, see procedure in this subsection.

OIL CONTAMINATION

1. Defective water pump seal ring or rotary seal.

- Check for oil or coolant leak from indicator hole near water pump, refer to COOLING

SYSTEM INSPECTION in the PERIODIC MAINTENCE PROCEFURES subsection.
Replace seal if necessary.
2. Cylinder head or cylinder base gasket leak
-Retighten cylinder head to specified torque, refer to TOP END subsection .replace gasket if tightening does not solve the problem.
3.Engine internal damage.
-Repair engine.
4.Oil cooler gasket leak.
-Replace oil cooler gasket and change engine oil.

HIGH OIL CONSUMPTION

1. Leaking breather oil seal.
-Check if the oil seal of the breather is brittle, hard or damaged. Refer to BOTTOM END subsection.
2. Valve stem seals worn or damaged.
-Replace valve stem seals.
3. Worn piston rings(blue exhaust smoke).
-Replace piston rings.

PROCEDURES

OIL COOLER （HD 10 ENGINE ONLY）

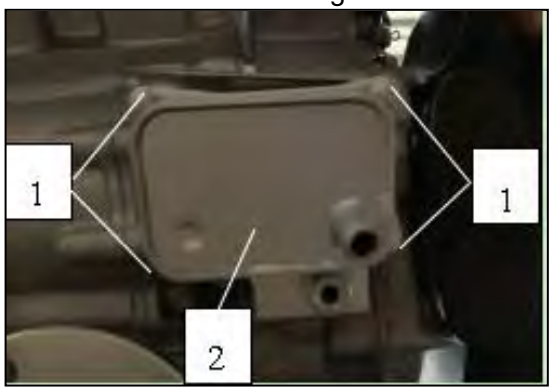
Oil Cooler Access

Remove thefuel tank to reash the oil cooler. Refer to FUEL TANK AND FUEL PUMP subsection.

Oil Cooler Removal

Refer to the PERIODIC MAINTENCE PROCEDURES subsection to:
- Drain engine oil.
- Drain engine coolant.

Remove oil cooler retaining screws.



1 .Retaining screws
2. Oil cooler

Place rags or towels under oil cooler to catch re-maining oil and coolant.

Inspecting Oil Cooler

Check oil cooler for cracks or other damage.
Replace if necessary.

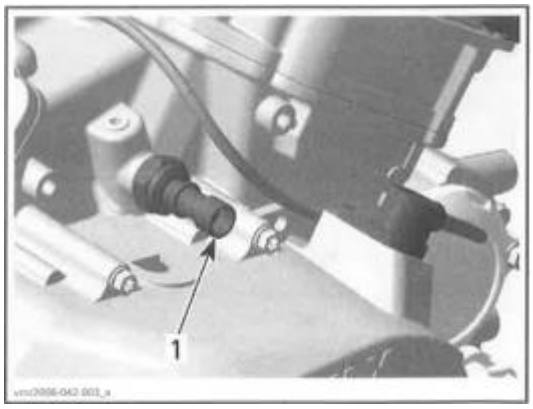
Installating Oil Cooler

For installation, reverse the remova1 procedure.
Pay attention to the following details.
Wipe off any oil and coolant spillage.
Install a NEW gasket.
Refer to PERIODIC MAINTENCE PROCEDURES subsection and carry out the following:
- Refill engine oil with recommended oil and at the proper oil lever.
- Refill and bleed cooling system.

OIL PRESSURE SWITCH (OPS)

Oil Pressure Switch Location

The oil pressure switch is located at engine MAG side above the magneto cover.



1. Oil pressure switch

Oil Pressure Switch Access

Open the cargo box to reach the engine

Oil Pressure Switch Activation

The oil pressure switch activates when the engine
oil pressure is lower than the operating pressure range.

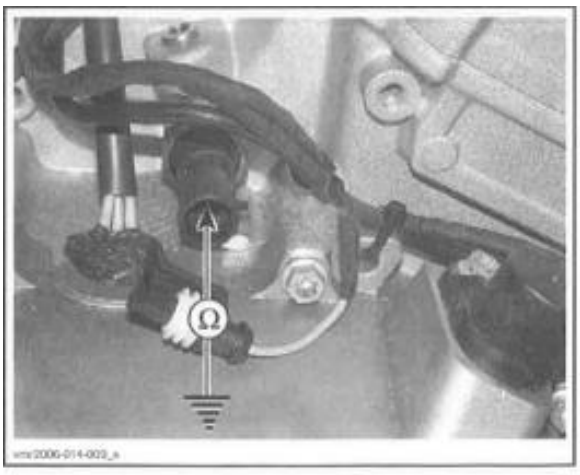
OIL PRESSURE SWITCH OPEATING PRESSURE
30kpa ±10kap (4.35PSI ±1.45 PSI)

To check the function of the oil pressure switch, an oil pressure test has to be performed. Refer to ENGINE OIL PRESSURE in this subsection.
If the engine oil pressure is good perform the oil pressure switch resistance test.

Testing the Oil Pressure Switch Resistance

Disconnect the connector from the oil pressure switch.
Use a multimeter to check the resistance between as shown.

OPS CONNECTOR		ENGINE NOT RUNNING	ENGINE RUNNING
PIN		RESISTANCE(Ω)	
4	Engine ground	Close to 0Ω (normally reaches	Infinite(open) when pressure 30kPa±10kPa (4.35PSI±1.45PSI)



If resistance values are incorrect, replace the oil pressure switch.
If the values are correct, check wiring.

Removing the Oil Pressure Switch

Unplug the oil pressure switch connector.
Unscrew and remove oil pressure switch.

Installing the Oil Pressure Switch

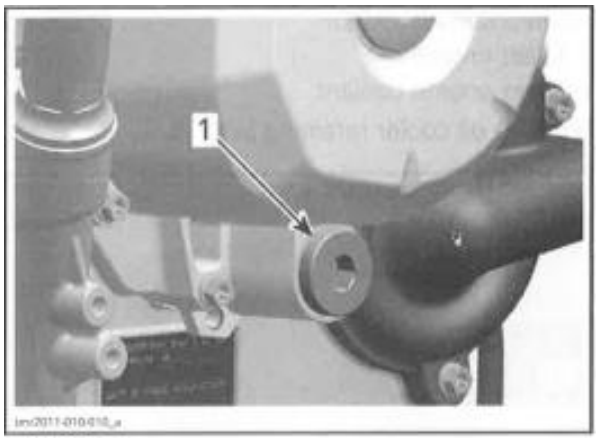
Tighten oil pressure switch to specified torque.

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Oil pressure switch	12N·m±1 N·m (106lbf·in±9lbf·in)

ENGINE OIL PRESSURE REGULATOR

Oil Pressure Regulator Location

The oil pressure regulator is located on the engine magneto side(inside magneto cover).



1. Engine oil pressure regulator

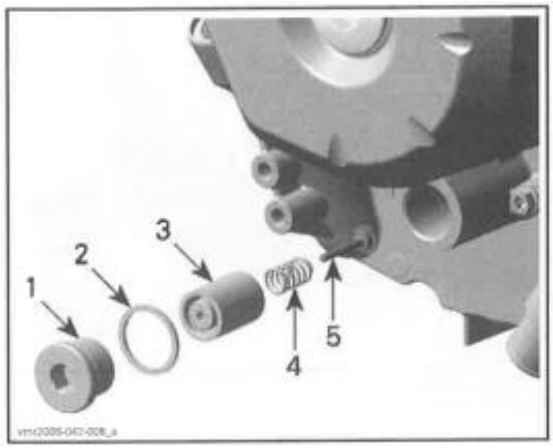
NOTE: The oil pressure regulator system works when the oil pressure exceeds 400kPa (58PSI).

Oil Pressure Regulator Access.

Remove plug screw and pull oil perssure regulator out.

Oil Pressure Regulator Removal

Remove plug screw and pull oil pressure regulator
out.



1. Plug screw
2. Gasket ring
3. Pressure regulator housing
4. Spring
5. Pressure regulator valve

Inspecting the Oil Pressure Regulator

Inspect pressure regulator housing and valve for scoring or other damages.

Check spring for free length.

SPRING FREE LENGTH	
NEW NOMINAL	39mm(1535in)
SERVICE LIMIT	37 mm(1457in)

NOTE: Replace worn or damaged components.

Clean bore and thread in the magneto housing from metal shavings and other contaminations.

Installating Oil Pressure Regulator

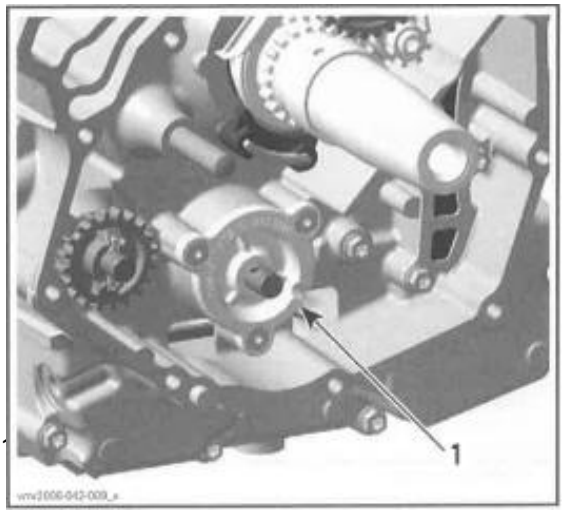
For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: At installation always replace the gasket ring of the plug screw by a new one.

OIL PUMP

Oil Pump Location

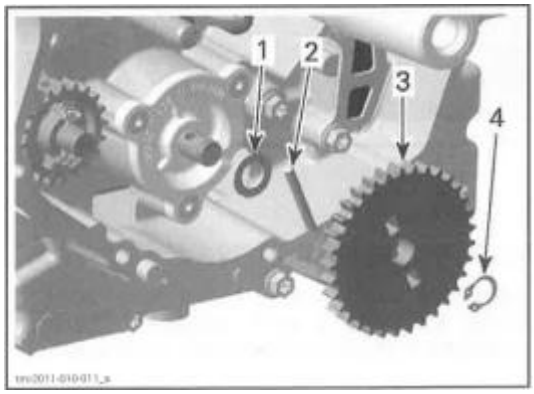
The oil pump is located on the engine PTO side (behind PTO cover).



Oil Pump Removal

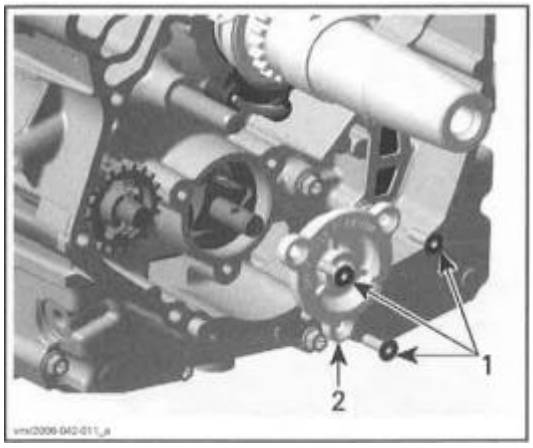
Remove the PTO cover. Refer to PTO COVER in the BOTTOM END subsection.

1. Remove:
- Retaining ring
- Oil pump gear
- Needle pin
- Thrust washer.



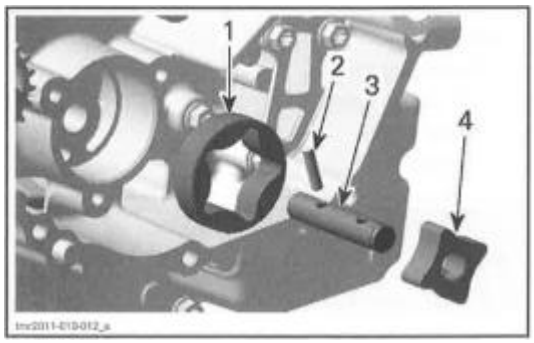
1.Thrust washer
2. Needle pin
3.Oil pump gear
4. Retaining ring

2. Remove oil pump cover screws and pull oil pump cover out..



1. Retaining screws
2. Oil pump cover

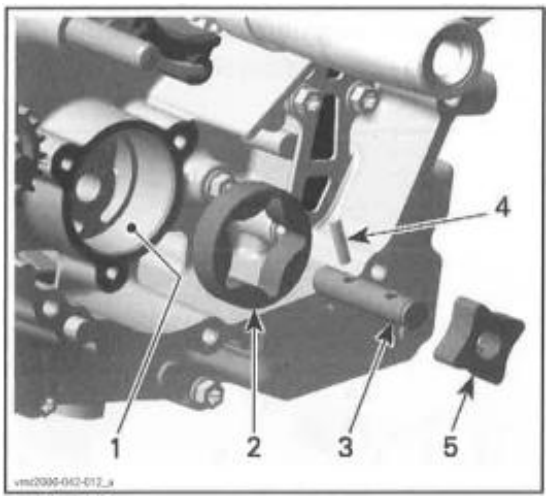
3. Remove oil pump shaft with needle pin and inner rotor.
4. Remove outer rotor.



1. Outer rotor
2. Needle pin
3. Oil pump shaft
4. Inner rotor

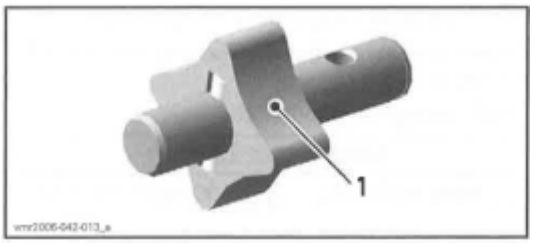
Inspecting the Oil Pump

Inspect oil pump and oil pump cover bore for marks, scratches or other damages. Check for scratches in crankcase between outer rotor and oil pump bore. If so, replace damaged parts.
Check oil pump cover for damages and for surface straightness with a straightedge.



1. Oil pump bore
2. Outer rotor
3. Oil pump shaft
4. Needle pin
5. Inner rotor

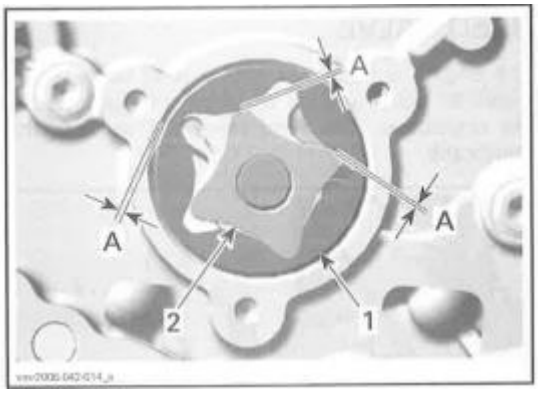
Check inner rotor for corrosion pin holes or other damages. If so, replace oil pump shaft assembly.



1. Pittings on the teeth

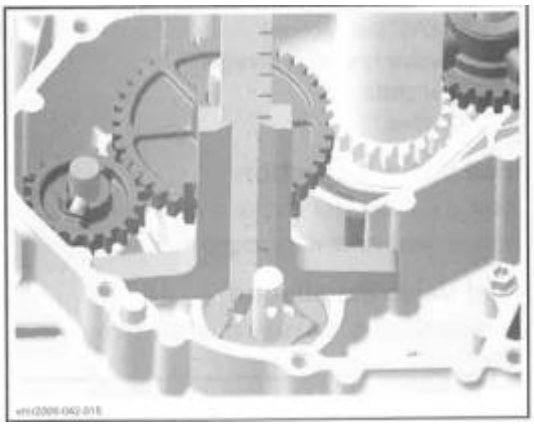
Using a feeler gauge, measure the clearance of inner and outer rotors as shown.

CLEARANCE OF INNER AND OUTER ROTOR	
SERNICE LIMIT	0.25mm (.0098in)

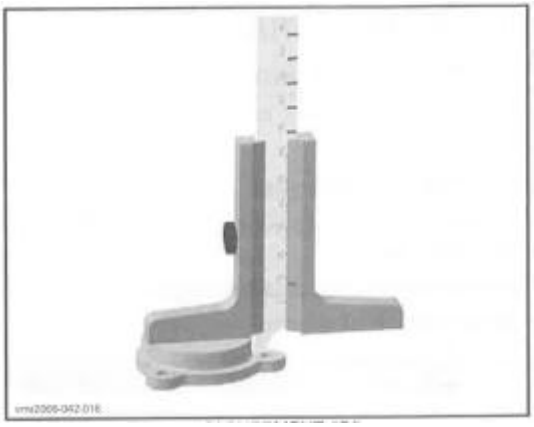


1. Outer rotor
2. Inner rotor
A. 0.25mm (0.0098in)

If clearance of inner and outer rotors exceeds the Tolerance, replace oil pump rotors. Ensure to also check oil pump cover. If damaged, replace the complete oil pump assembly.
If clearance between outer rotor and its bore in crankcase exceeds the tolerance, replace the complete oil pump rotors and/or the crankcase.
Using a depth gauge, measure the axial clearance of the oil pump as shown.



OIL PUMP- MEASUREMENT "A″



OIL PUMP COVER- MEASUREMENT "B″

Substract measurement "B" from measurement "A" to obtain axial clearance.

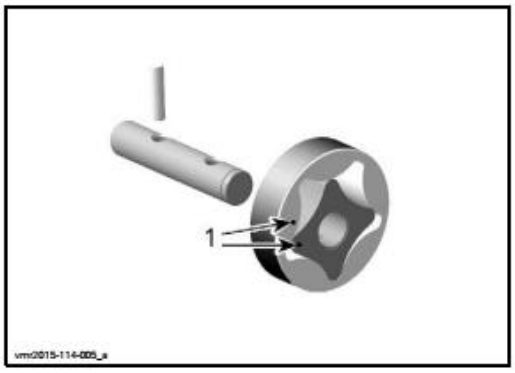
OIL PUMP AXIAL CLEARANCE	
SERVICE LIMIT	0.2 mm(.0079in)

NOTE: When the axial clearance of the oil pump shaft assembly increases, the oil pressure decreases.

Installating the Oil Pump

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

NOTE: When installing the oil pump rotors, make sure both markings are on the outer side.



1. Markings

After reinstallation of the remaining parts, check for smooth operation of the oil pump assembly.

Testing the Oil Pump Function

After engine is completely reassembled, start engine and make sure oil pressure is within specifications (refer to ENGINE OIL PRESSIRE in this subsection).

ENGINE OIL STRAINER

Oil Strainer Location

The engine oil strainer is located between both crankcase halves.

Removing the Oil Strainer

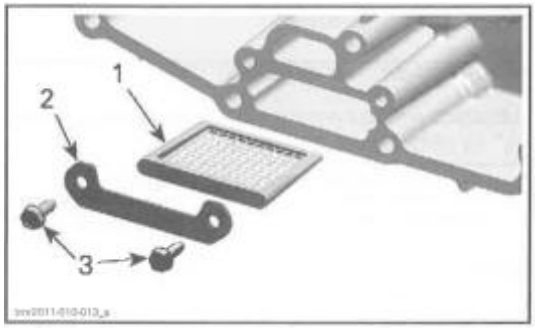
Separate crankcase halves .Refer to BOTTOM END subsection.

Remove:

-Screws

-Retaining plate

-Engine oil strainer



1. Engine oil strainer
2. Retaining plate
3. Screws

Cleaning and Inspecting Oil Strainer

Clean engine oil strainer with a part cleaner then use an air gun to dry it.

▲WARNING
Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

Check engine oil strainer for cracks or other damage. Replace if damaged.

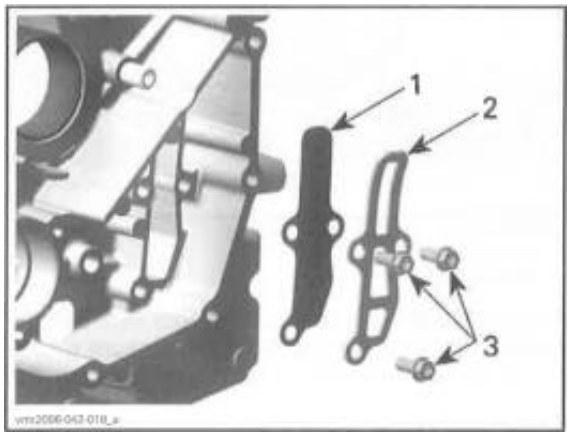
Installating theOil Strainer

The installation is the reverse of the removal procedure.

OIL STRAINER RETAINING SCREWS	
Service product	卡夫特 k-027
Oil strainer reatining screws	6N·m± 0.7N·m (53lbf·in±6lbf·in)

REED VALVE

The engine is equipped with a reed valve which prevents accumulation of larger oil quantities in the crankcase. The reed valve is fitted into the crankcase.



1. Reed valve
2. Stopper
3. Screws

Reed Valve Removal

Remove:

-PTO cover (refer to PTO COVER in the BOTTOM END subsection)

- Reed valve retaining screws
- Stopper plate
- Reed valve.

Inspecting the Reed Valve

Check reed valve for cracks or other damage. Replace reed valve if damaged.

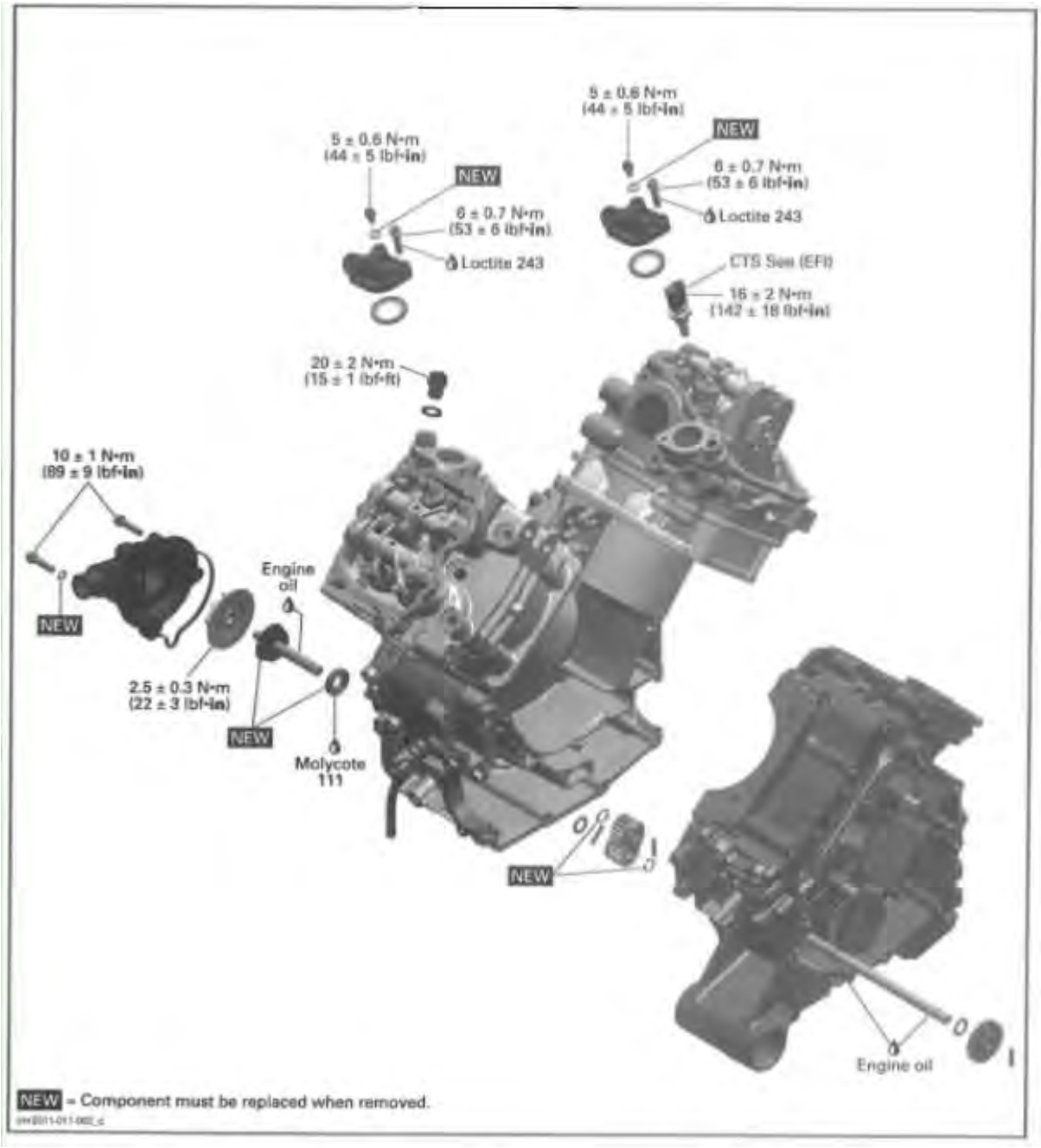
Inspecting the Reed Valve

The installation is the reverse of the removal procedure.

TIGHRENING TORQUE	
Reed valve reating screws	10N·m±1N·m (89lbf·in±9lbf·in)

COOLING SYSTEM

WATER PUMP



GENERAL

NOTICE Never start engine without coolant. Some engine parts such as the rotary seal on the water pump shaft can be damaged.

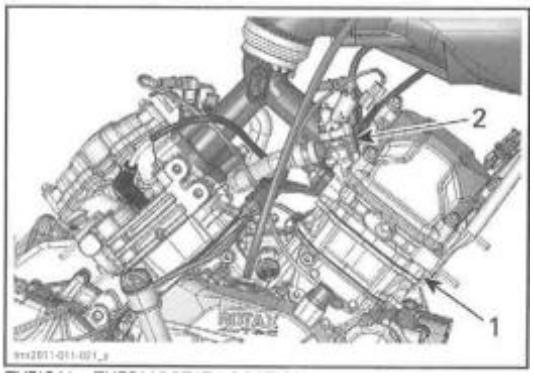
PROCEDURES

THERMOSTAT

The thermostat is a single action type.

Thermostat Location

The thermostat is located in the thermostat housing at the top of the front cylinder(RH side).



TYPICAL-THERMOSTAL LOCATION 800R MODEL

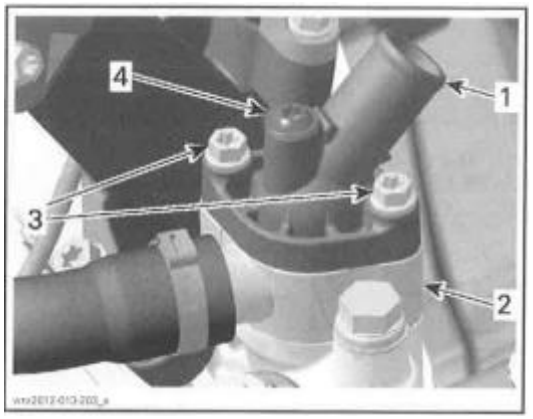
1. Front cylinder
2. Thermostat housing

Thermostat Removal

1. Install a hose pincher on both radiator hoses

REQUIRED TOOL
LARGE HOSE PINCHER

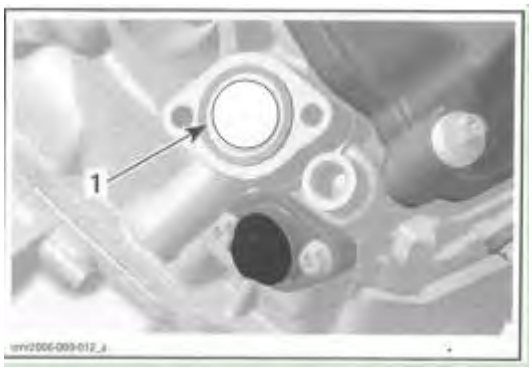
2. Drain remainder of cooling system, refer to PERIODIC MAINTENANCE PROCEDURES subsection.
3. Remove thermostat housing screws and remove thermostat cover.



THERMOSTAT LOCATION FRONT CYLINDER HEAD

1. Thermostat cover
2. Thermostat housing
3. Cover screws
4. Bleed screw

4. Pull thermostat and gasket from thermostat housing.



1. Thermostat with gasket

WATER PUMP HOUSING

Water Pump Housing Location

1t is located on the engine MAG side (RH side of engine).

Water Pump Housing Access

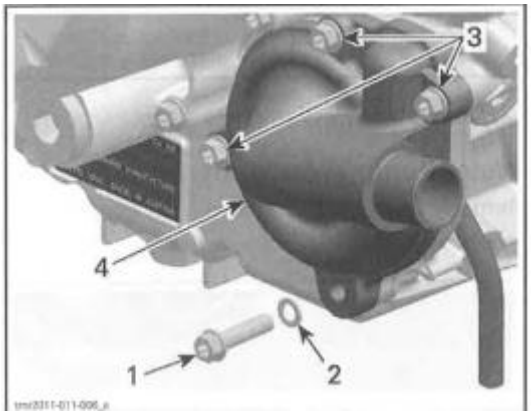
Remove fuel tank. Refer to FUEL SYSTEM subsection.

Water Pump Housing Removal

△WARNING
To avoid potential burns, do not remove the radiator cap or loosen the coolant drain plug if the engine is hot.

Drain cooling system. Refer to PERIDIC MAINTENANCE PROCEDURES subsection.
Remove radiator outlet hose from water pump housing.

Remove screws retaining water pump housing.

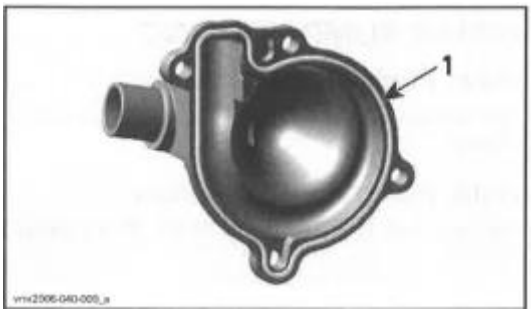


1. Coolant drain plug
2. Sealing ring,
3. Screws
4. Water pump housing

Pul1 water pump housing to remove it.

Inspecting the Water Pump Housing

Check if gasket is brittle, hard or damaged and re-place as necessary.



1. Gasket

Installating the Water Pump Housing

The installation is the opposite of the removal procedure.

NOTICE To prevent leaking ,take care that the gasket is exactly in groove when you reinstall the water pump housing.

Tighten screws of water pump housing in a criss cross sequence to specification.

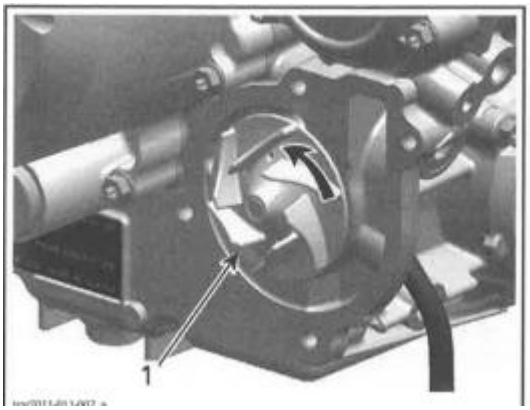
TIGHTENING TORQUE	
Water pump housing screws	10N·m±1 N.m (89lbf·in±9lbf·in)

WATER PUMP IMPELLER

Removing theWater Pump Lmpeller

Remove water pump housing.

Unscrew impeller.



1. Turn counterclockwise unscrew

NOTICE Water pump shaft and impeller have right-hand threads. Remove by turning counterclockwise and install by turning clockwise.

Water Pump Impeller Inspection

Check impeller for cracks or other damage. Replace impeller if damaged.

Water Pump Impeller Installation

The installation is the opposite of the removal procedure.

NOTICE Be careful not to damage impeller fins during installation.

WATER PUMP SHAFT AND SEALS

Use these guidelines to service these parts

DEFECTIVE RART	ACTION
Rotary seal	Replace: - Rotary seal - Oil seal (assembled engine)
Oil seal	Replace: -Rotary seal - Oil seal (assembled engine)
Water pump shaft	Replace: - Water pump shaft assembly (including rotary seal) - Oil seal (engine disassembled)

NOTICE Rotary seal must be replaced if water pump shaft is to be replaced.

Water Pump Seals Replacement

(Assembled Engine)

NOTE: Read and thoroughly understand the entire procedure before starting it.

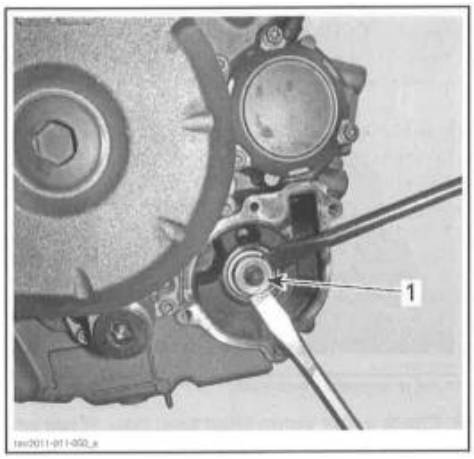
Removing theSeals

Remove water pump housing, refer to WATER PUMP HOUSING in this subsection.

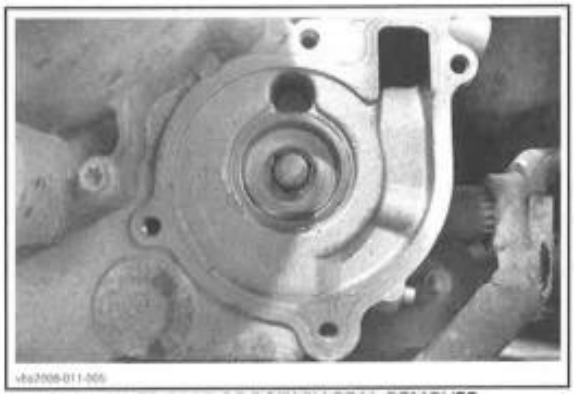
1. Remove the following parts, see procedure in this subsection.

- WATER PUMP HOUSING
- WATER PUMP IMPELLER

2. Carefully pry out inner part of the rotary seal using2screwdrivers.

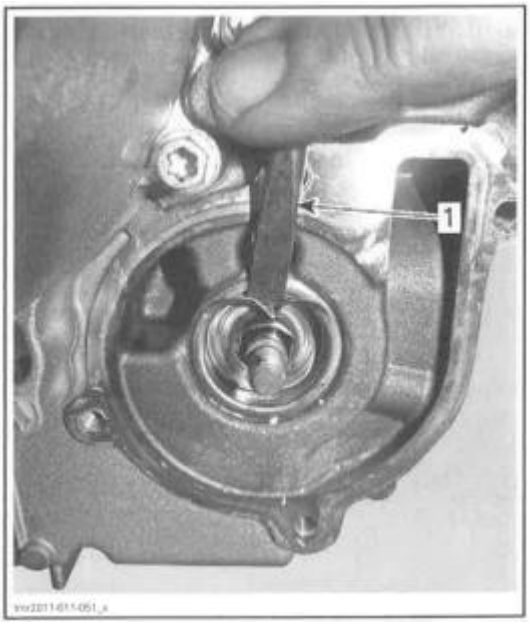


7. Inner part of rotary seal



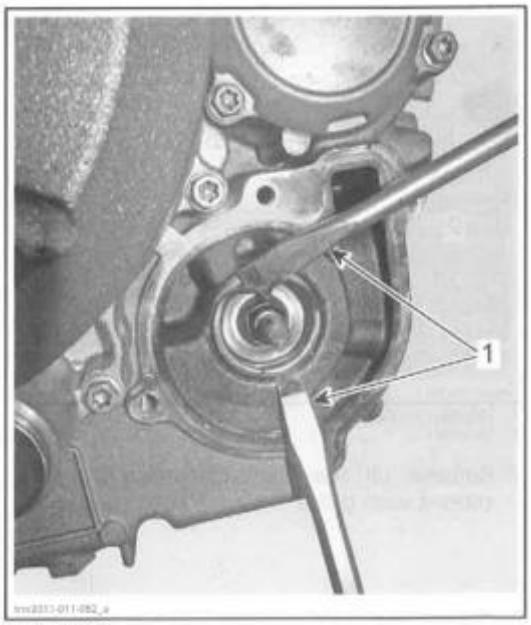
TYPICAL – INNER PARTS OF ROTARY SEAL REMOVED

3. Carefully bend down the outer part of rotary seal lip using a smal1 chisel.



1. Small chisel

4. Use 2 screwdrivers and carefully remove the outer part of the rotary seal.

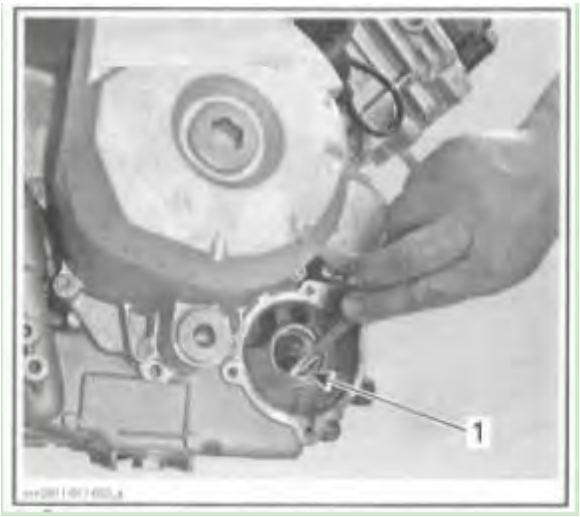


1. Screwdrivers

NOTICE Be careful not to damage the crankcase while removing outer part of the rotary seal.

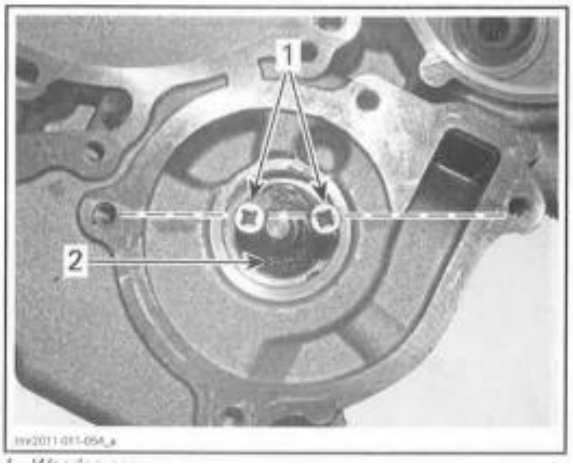
5. Thoroughly remove carefully sealing residue and burr of rotary seal using a scraper.

NOTICE Be careful not to damage water pump shaft.



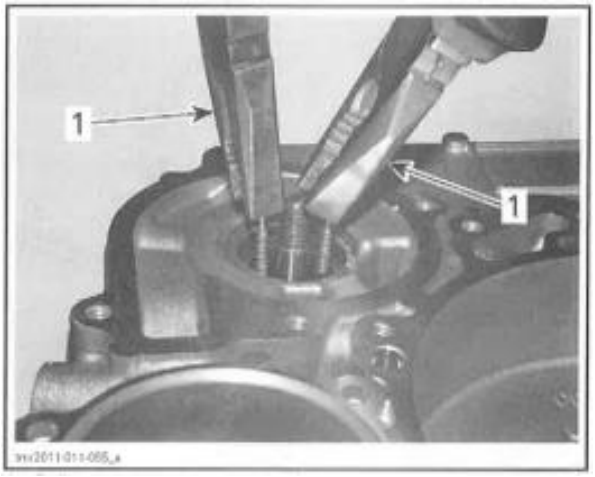
1. Scraper

6. Install 2 wooden screws in the seal



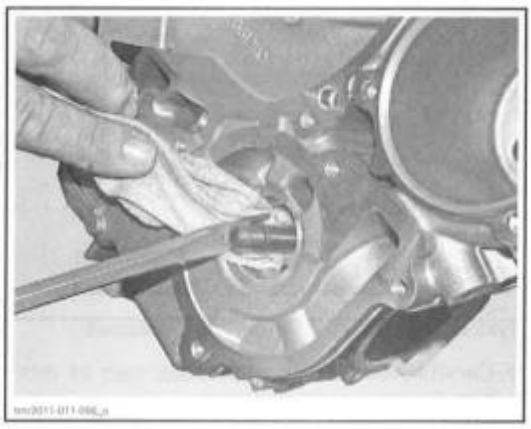
1. Wooden screws
2. Oil seal

7. Remove oil seal from crankcase by pulling screws with pliers.



1. Pull on screws to remove seal

8. Check water pump shaft axial play.If not adequate, engine must be disassembled to replace the water pump shaft.
9. Clean oil seal seat.



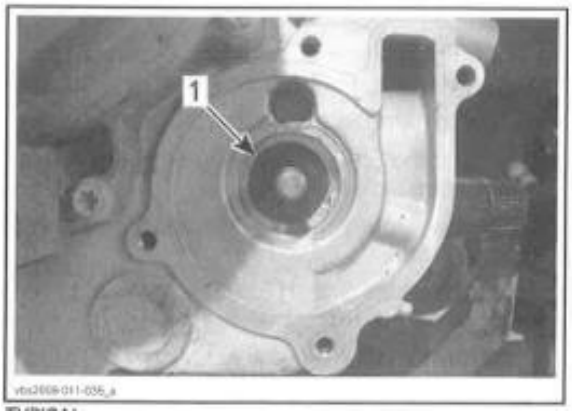
Seals Installation

1. Apply engine oi1 on water pump shaft.
2. Apply grease to the lips of the oil seal.
3. Carefully install the oil seal over the water pump shaft.
4. Push the oil seal into the water pump cavity.

REOUIRED TOOL
17mm(11/16in) deep socket

OIL SEAL INSTALLATION

5. Ensure that the oi1 seal is properly seated in water pump cavity.

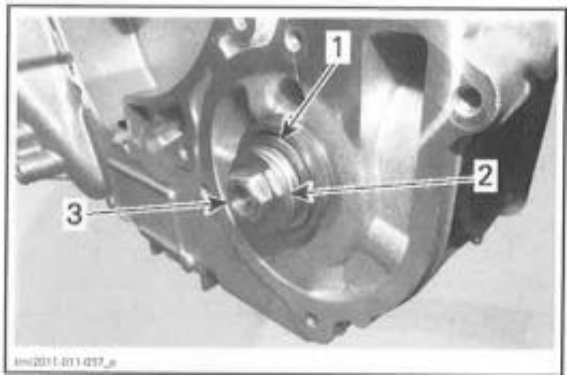


TYPICAL

1. Oil seal proper/y seated
6. Apply engine oil on water pump shaft.
7. Place rotary seal onto water pump shaft and pull out water pump shaft by hand.

NOTICE Do not install the rotary seal completely into the crankcase to prevent the water pump shaft plastic gear from breaking. Push it partia1ly in then pull the shaft.

8. Place a robust M8 flat washer onto water pump shaft.
9. Install a M8×1.25 nut onto water pump shaft by hand.
10. Then thread nut1-1/2 turns to pull the shaft into rotary seal.



1. Rotary seal
2. M8 robust flat washer
3. M8×1.25 nut

11. Remove M8 nut.

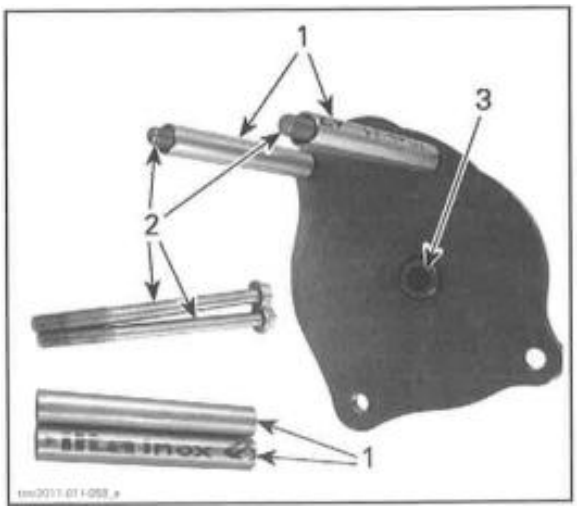
NOTE: The robust M8 flat washer remains on water pump shaft.

12. Install rotary seal installation tools on crankcase as follows.

REQUIRED TOOLS
ROTARY SEAL PUSHER PLATE
4×M6×85 screws
4×tubes70mm(2.75in)
SEAL PUSHER

ROTARY SEAL PUSHER PLATE

SEAL PUSHER



ROTARY SEAL PUSHER PLATE ASSEMBLY

1. 4×tubes (70mm(2.75in) length)
2. 4×screws M6×85
3. Plane surface on pus1ler bolt

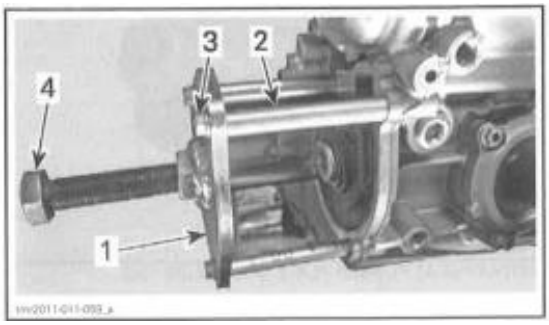
NOTE: Make sure pusher bolt has a plane surface.

12.1 Apply a little grease at the end of tool pusher bolt.

12.2 Ensure that pusher bolt is completely unscrewed.

12.3 Instal1 rotary seal pusher plate on crankcase by tightening M6 screws.

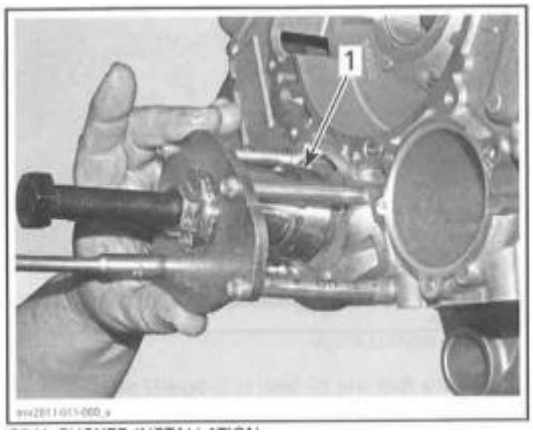
NOTICE Do not use pneumatic or electric tools for tightening screws.



ROTARY SEAL PUSHER PLATE INSTALLTION

1. Rotary seal pusher plate
2. Tube (70mm (2.75in)length)
3. M6×85 screw
4. Pusher bolt

12.4 Install seal pusher between rotary seal pusher plate and water pump shaft.



SEAL PUSHER INSTALLTION

1. Seal pus1lerai1gneol with pusher bolt

12.5 lighten the pusher bolt by hand until it stops against the sea1 pusher.

13. Carefully thread the pusher bolt1-1/2 turns.

14. Ensure that the rotary seal is going straight into crankcase.

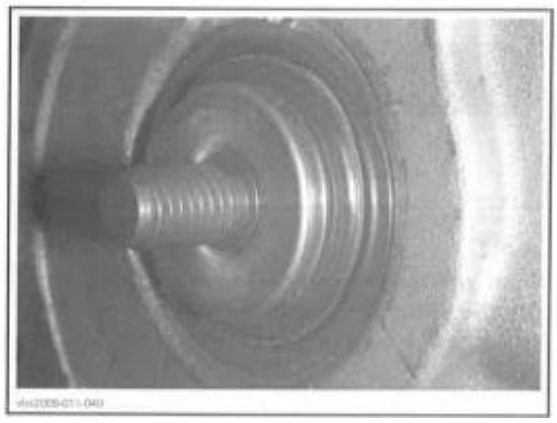
15. Remove rotary seal installation tools from crankcase.

Repeat the steps9 to15 until rotary sea1 is completely seated in the crankcase.

16. Remove tools from crankcase.

ROTARY SEAL PROPERLY SEATED ON CRANKCASE

17. Carry out the final adjustment of the water pump shaft as follows.
17.1 Instal1 M8×1.25 nut onto water pump shaft.
17.2 Carefully thread M8 nut until the rotary seal is flush with the end of water pump shaft threads.



WATER PUMP SHAFT PROPERYL ADJUSTED WISH ROTARY SEAL

NOTICE The water pump shaft must be properly adjusted with rotary seal.
The water pump shaft must move freely while pushing it toward the crankcase.
18. Install the following parts, see procedure in this subsection
- WATER PUMP IMPELLER
- WATER PUMP HOUSING

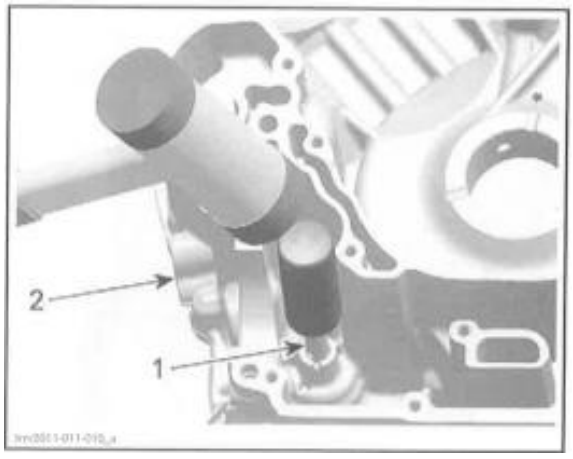
19. Refill and bleed cooling system. Refer to PERIODIC MAINTENANCE PRODUCEDURES subsection.
20. Check cooling system for leaks

Water Pump Shaft and Seals Replacement (Disassembled Engine)

Water Pump Shaft and Seals Removal

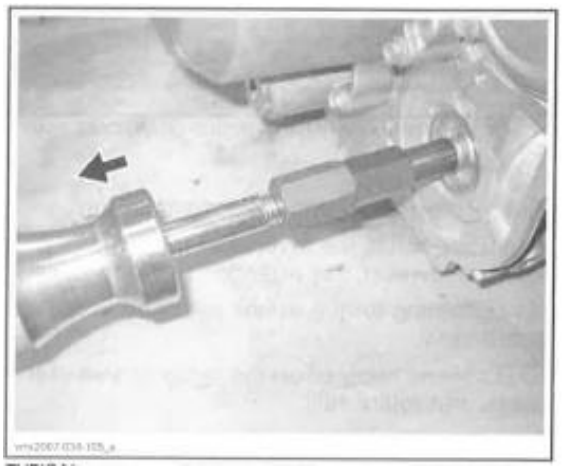
1. Remove the following parts:
- WATER PUMP HOUSING
- WATER PUMP IMPELLER
- WATER PUMP GEARS
2. Push out water pump shaft with inner portion of rotary seal from inside of crankcase MAG side.

REQUIED TOOL
Soft hammer



1. Water pump shaft
2. Crankcase MAG side

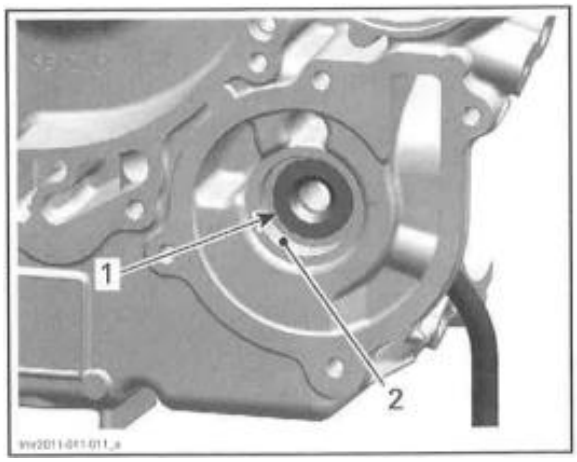
3. Remove outer part of rotary seal.
4. Install expander snugly against outer part of rotary
seal and pu11 seal out.



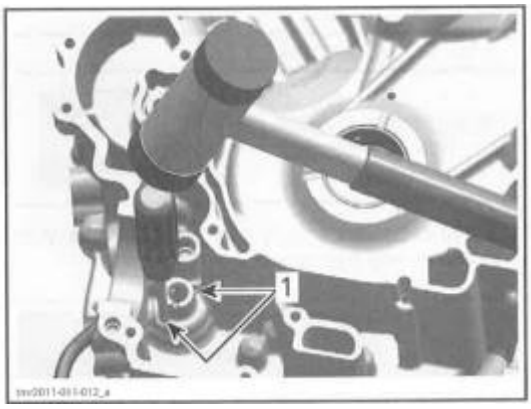
TYPICAL

5.Remove oil seal from inside of crankcase MAG side using a pusher tool.

NOTICE Be careful not to damage the rotary seal surface in crankcase.



1. Oil seal
2. Machined surface for rotary seal



OIL SEAL REMOVAL-FROM INSIDE CRANKCASE MAG SIDE

1. Orifices for oil seal removal

Water Pump Shaft and Seals Installation

The installation is there verse of the removal procedure. However, pay attention to the following.

Use tightening torque values specified in the exploded view.

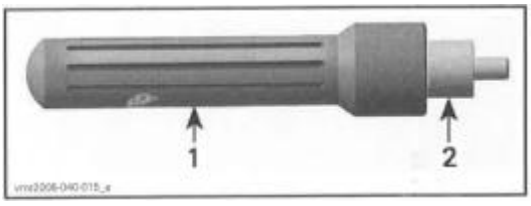
NOTE: Never apply oil on the press fit area of the

oil seal and rotary seal.

Clean rotary seal surface of any old sealant.

Install oil seal.

REQUIED TOOL
OIL SEAL PUSHER
HANDLE

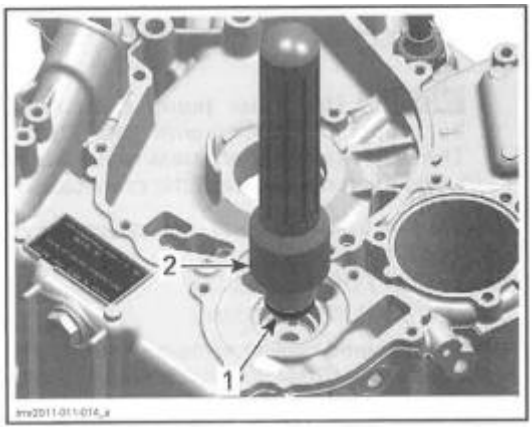


1.Handle

2. Pusher

When installing the oil seal on the pusher, make sure the sealing lip points outwards.

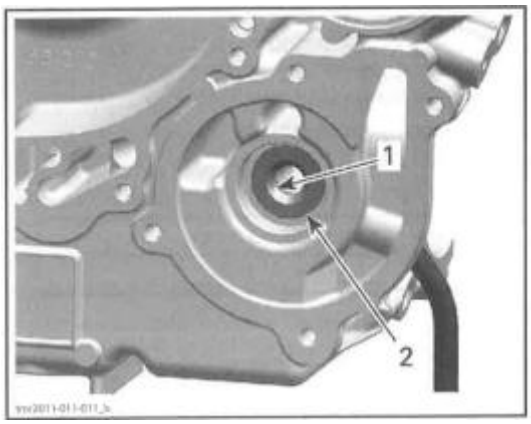
Push NEW oil seal in place.



1. Oil seal
2. Installer handle with oil seal pusher

Lubricate sealing lip of the oil seal.

SERVICE PRODUCT	
Sealing lip of the oil seal	DOW CORNING 111

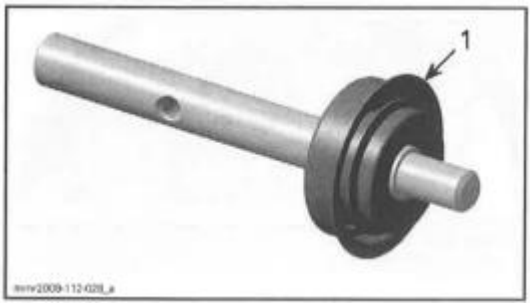


1. Sealing lip
2. Oil seal properly installed

Apply engine oil on the water pump shaft and intermediate shaft.

Slide NEW water pump shaft assembly into crankcase.

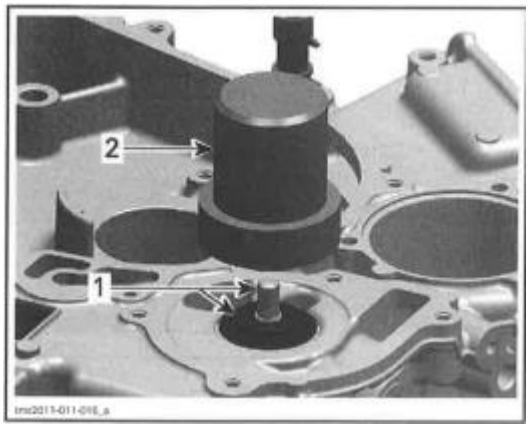
REQUIED TOOL	
SEAL PUSHER	



1. Surface where rotary seal is pushed by tool

Assembing the Water Pump Shaft

NOTICE Never use a hammer for rotary seal installation. Only use a press to avoid damaging the ceramic component.

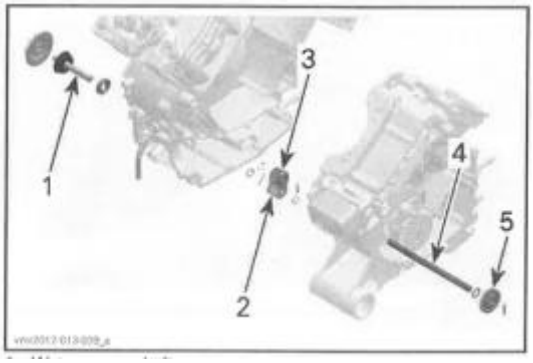


1. Water pump shaft with rotary seal
2. Water pump seal installer

NOTICE After installation, water pump shaft with rotary seal must rotate freely.

WATER PUMP GEARS

Water Pump Gears Identification

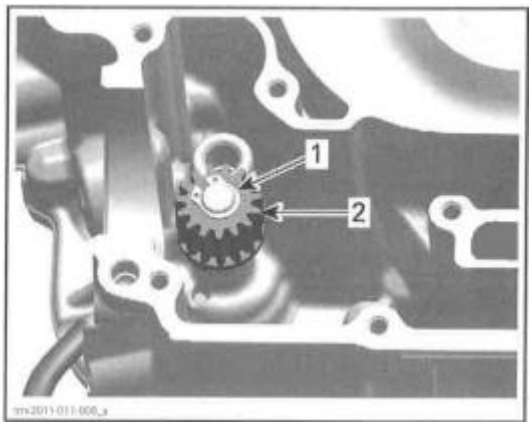


1. Water pump shaft
2. Water pump gear
3. Water pump intermediate drive gear
4. Water pump intermediate shaft
5. Water pump drive gear (see BOTTOM END subsection

Water Pump Gears Inspection

Water Pump Gear

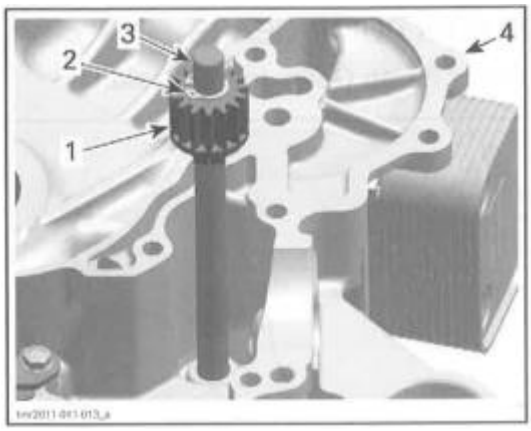
Inspect water pump gear for wear and damage on the snap mechanism to the needle pin. Replace if damaged.



CRANKCASE MAG SIDE
1. Circlip
2. Water pump gear

Water Pump Intermediate Drive Gear

Check water pump intermediate drive gear for wear or broken teeth. Replace if damaged.



CRANKCASE PTO SIDE
1. Water pump Intermediate drive gear
2. Circlip
3. Water pump intermediate shaft
4. Crankcase PTO side

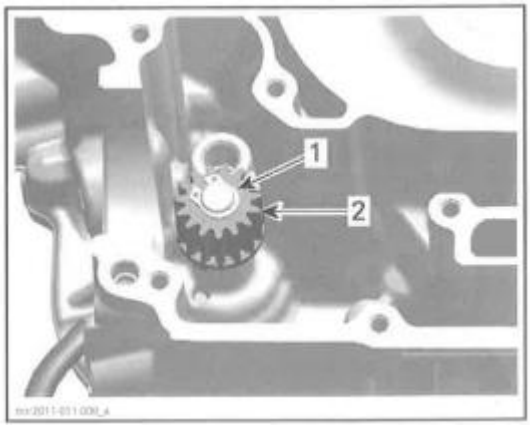
Water Pump Drive Gear

See BOTTOM subsection,

Water Pump Gears Removal

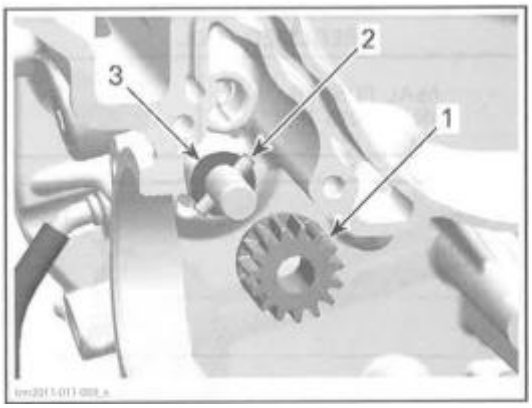
Water Pump Gear

1. Remove circlip retaining water pump gear and
discard it.



CRANKCASE MAG SIDE
1. Circlip
2. Water pump gear

2. Remove the following parts
- Water pump gear
- Needle pin
- Thrust washer.

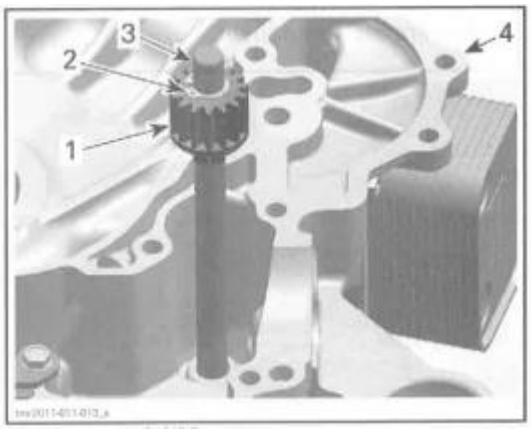


CRANKCASE MAG SIDE

1. Water pump gear
2. Needle pin
3. Thrust Washer

Water Pump Intermediate Drive Gear

1. Remove clrclip retaining water pump intermediate drive gear and discard it.



CRANKCASE PTO SIDE

1. Water pump intermediate drive gear
2. Circlip
3. Water pump intermediate shaft
4. Crankcase PTO side

2. Remove the following parts:
- Water pump intermediate drive gear
- Needle pin.

Water Pump Drive Gear

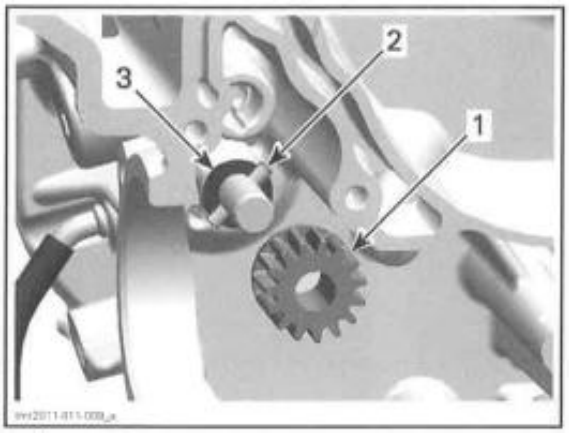
See BOTTOM END subsection.

Water Pump Gears Installation

Water Pump Gear

Install the following parts on water pump shaft.
- Thrust washer
- Needle pin
- Water pump gear.

NOTICE A missing thrust washer will cause a leaking rotary seal.

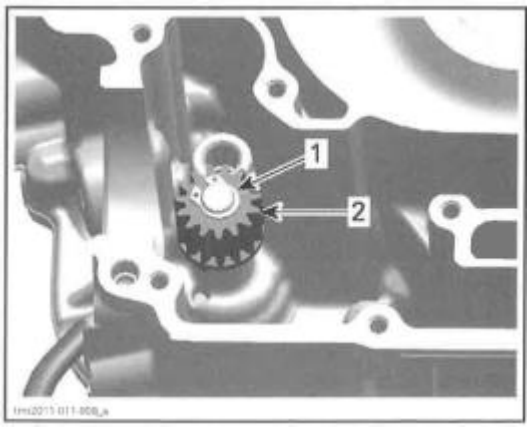


1. Water pump gear
2. Needle pin
3. Thrust washer

NOTE: Ensure water pump gear snaps properly onto needle pin.

Install NEW circlip to retain water pump gear.

NOTICE Never use the circlip a second time. Always install a NEW one.



1.Circlip
2. Water pump gear

Water Pump Intermediate Drive Gear

Install the following parts on water pump intermediate shaft.
- Needle pin
- Water pump intermediate drive gear.

Install NEW circlip to retain water pump intermediate drive gear.

NOTICE Never use the circlip a second time. Always install a NEW one.

Water Pump Drive Gear See BOTTOM END subsection.

MAGNETO AND STARTER

PROCEDURES

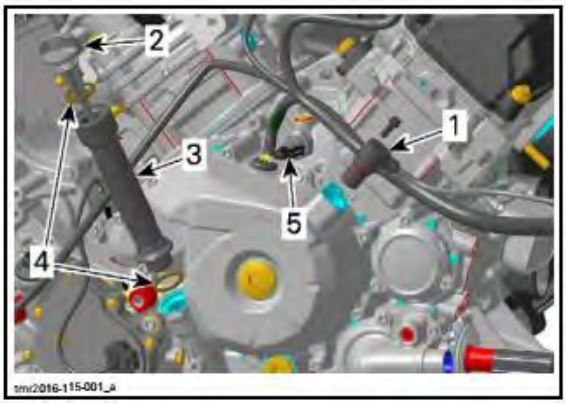
MAGNETO COVER

Magneto Cover Access

Remove fuel tank, refer to FUEL TANK AND FUEL PUMP

Removing the Magneto Cover

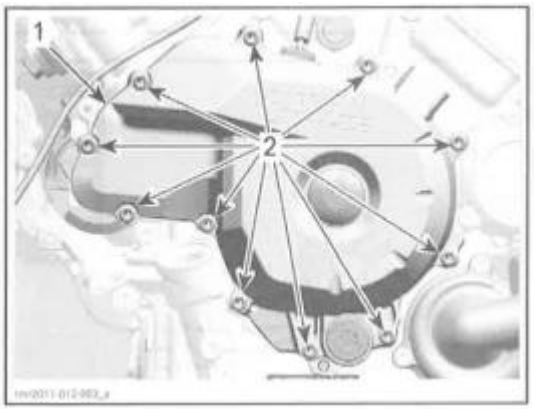
Drain engine oil (refer to PERIODIC MAINTENANCE PROCDURES subsection).
Remove crankshaft position sensor (CPS) and cut tie raps.
Remove dipstick and oi1 level tube with O-rings.
Disconnect oil pressure switch (OPS) connector.



1. Crank position sensor (CPS)
2. Dipstick
3. Oil level tube
4. O-rings
5. Oil pressure switch (OPS)connector.

Disconnector stator connector from vlitage regulator /rectifier,refer to STATOR ACCESS in this subsection.

Remove magneto cover retaining screws



1. Magneto cover
2. Retaining crews

Pull out magneto cover.
NOTE: If required, remove stator and harness from magneto cover.

Inspecting and Cleaning the Magneto Cover

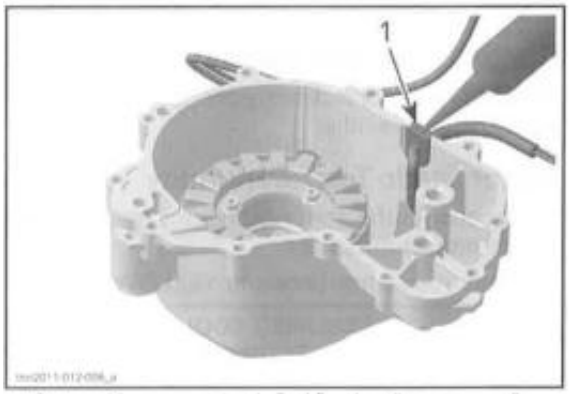
Check magneto cover for cracks or other damage. Replace if necessary.
NOTE: Clean all metal components in a nonferrous metal cleaner. Use LOCTITE CHISEL (GAS- KET REMOVER), or suitable equivalent.

▲WARNING
Wear safety glasses and work in a well ventilated area when working with strong chemical products. Also wear suitable nonabsorbent gloves to protect your hands.

Installating the Magneto Cover

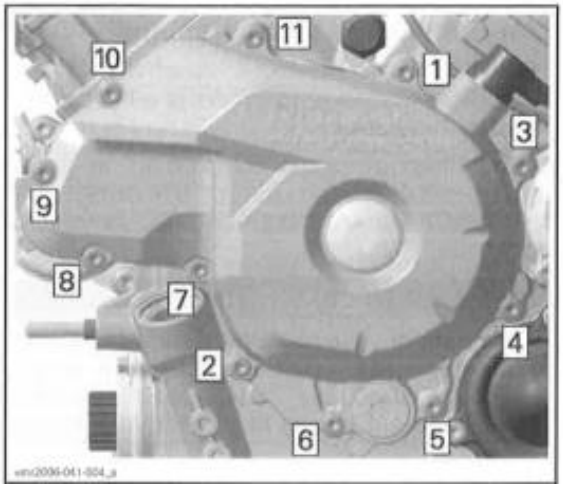
For installation, reverse the removal procedure. However, pay attention to the following.
NOTE: Install a NEW magneto cover gasket.
Apply sealant on stator cable grommet as shown in next illustration.

REQUIED TOOL	
Stator cable grommet	DREI BOND SEALING COMPOUND



1. Stator cable grommet (apply Drei Bond sealing compound

Tighten screws using the following sequence



TIGHTENING SEQUENCE

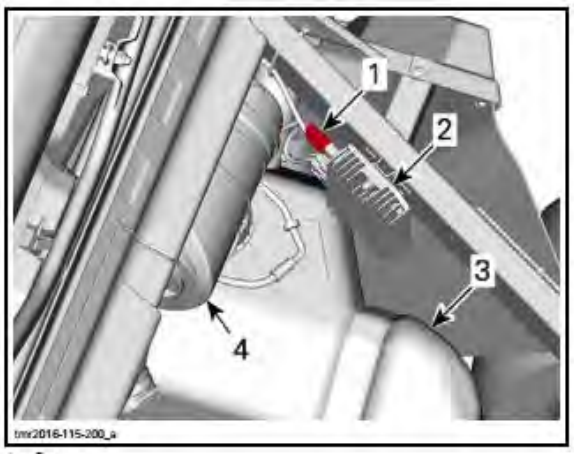
TIGHTENING TORQUE	
Mangneto cover screws	10N.m±1N.m （89lbf.**in**±9lbf.**in**）

Refill engine with recommended oi1.

STATOR

Stator Connector Access

The stator is directly connected to the voltage regulator/rectifier.



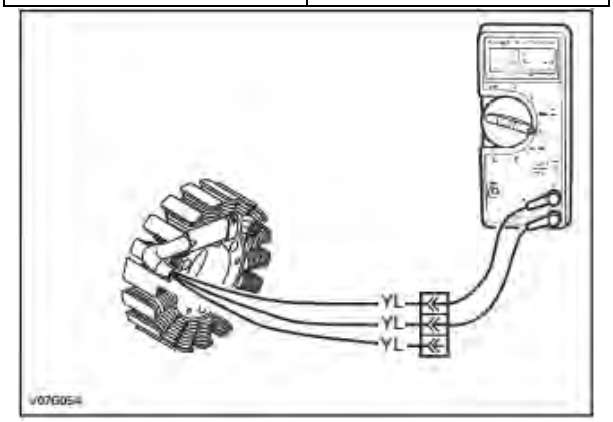
1. Stator connector
2. Voltge regulator/revotifier
3. Fuel tank
4. Air filter housing

Testing the Stator Static Continuity

1. Disconnect the stator connector from the voltage regulator/rectifier.
2. Check resistance between YELLOW wires.

REQUIED TOOL	
FLUKE115 MULTIMETER	

TERMINAL	RESISTANCE@ 20°C(68°F)
1 and2	0.15 - 0.30Ω
1 and3	
2 and3	



TYPICAL

3. If any reading is out of specification, replace stator.
4. Re-plug connectors properly.

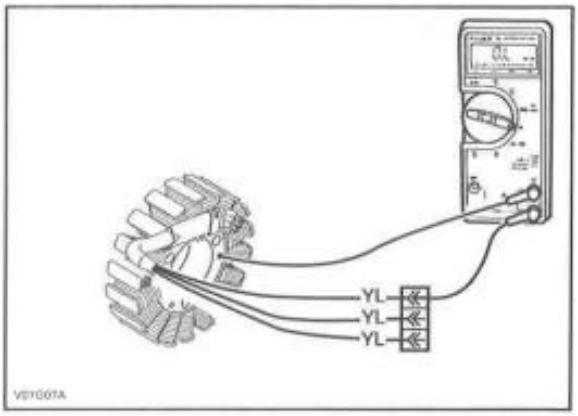
Stator Static Test: Insulation

1. Disconnect the stator connector from the voltage regulator/rectifier.
2. Connect multimeter between any YELLOW wire(on stator connector) and engine ground.

REQUIED TOOL	
FLUKE115 MULTIMETER	

NOTICE Never insert a multimeter probe into a terminal as it would ruin the terminal. Probe terminals only by touching.

TEST PROBES	RESISTANCE@ 20°C(68°F)
Any YELLOW wire and engine ground	Infinite(open circuit)

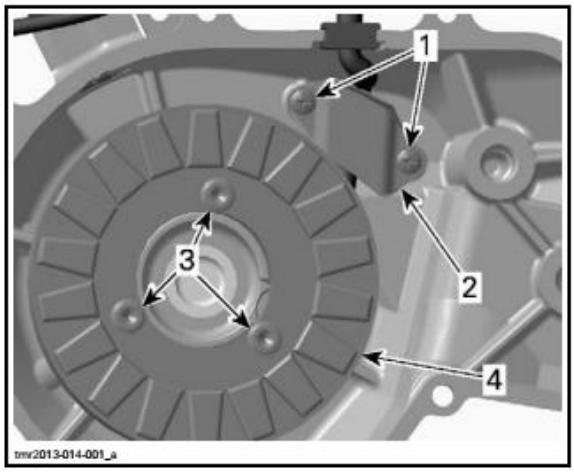


TYPICAL

3. If there is a resistance or continuity, the stator coils and/or the wiring is shorted to ground and needs to be repaired or replaced.
4. Re-plug connectors properly.

Removing the Stator

Remove MAGNETO COVER.See procedure in this subsection.
Remove:
-Holding strip screws
-Stator retaining screws
-Stator



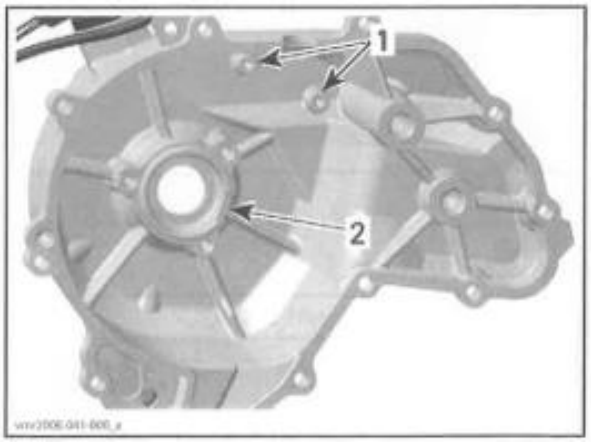
1. Holding strip screws
2. Wire holding strip
3. Stator retaining screws
4. Stator

Inspecting the Stator

Check stator windings and insulation for cracks or other damages. If damaged replace it. Check if stator wires are brittle, hard or otherwise damaged.

Installating the Stator

For installation, reverse the removal procedure. However, pay attention to the following.
NOTICE When installing the stator take care to route wires properly and install retaining strip.
NOTE: There is only one position for the stator (notch in the magneto housing cover).



1. Threads for cable holding strip
2. Notch for stator

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Holding strip screws	4N·m± 0.3N·m (35lbf·in±3 lbf·in)

TIGHTENING TORQUE	
Staror retaining screws	10N·m± 1N·m (89lbf·in±9 lbf·in)

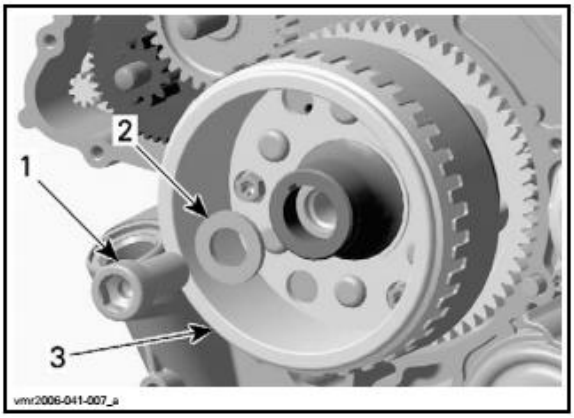
ROTOR

Removing the Rotor

Remove MAGNETO COVER. See procedure in this subsection.
Lock crankshaft(refer to CRANKSHAFT LOCKING PROCEDURE in the BOTTOM END subsection).

REQUIRED TOOL	
CRANKSHAFT LOCKING BOLT	

Heat screw in order to break the Loctite.
Remove screw and washer securing rotor to crankshaft.

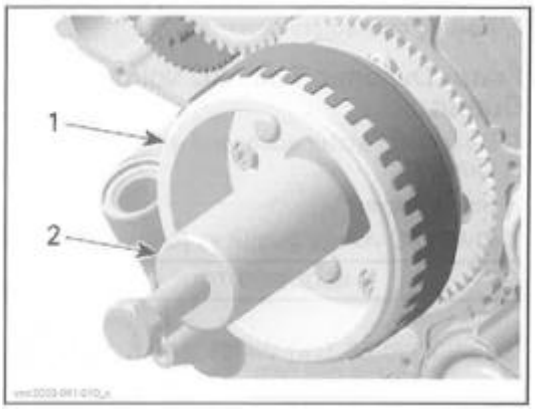


1. Screws M16
2. Washer
3. Rotor

Remove rotor.

REQUIRED TOOL	
MAGNET0 PULLER	
CRANKSHAFT PROTECTOR	

NOTE: Use grease to place protector on crankshaft end prior to screw on the magneto puller.

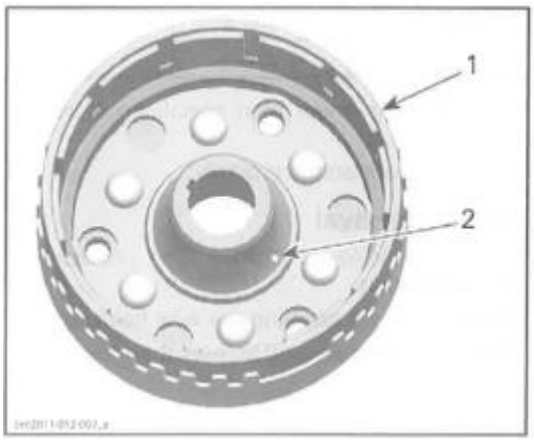


1. Rotor
2. Magneto puller

Screw magneto puller bolt to remove rotor.

Inspecting the Rotor

Check inner side of rotor for scratches or other damage.
Blow pressurized air in the rotor oil bore and make sure it is not clogged.



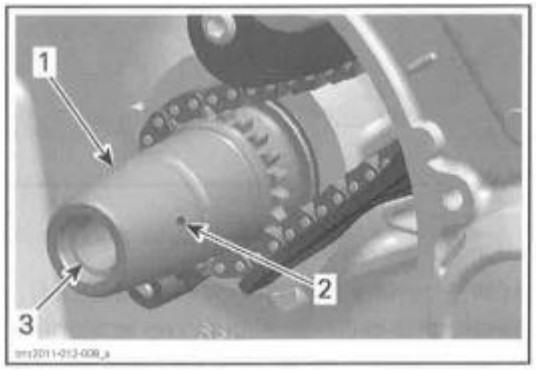
1. Rotor
2. Oil bore

Check keyway of the rotor for wear or damages.
Check if trigger wheel teeth are bent or otherwise damaged.
Check woodruff key and keyway on the crankshaft for wear or damages.
Replace parts as necessary.

Installating the Rotor

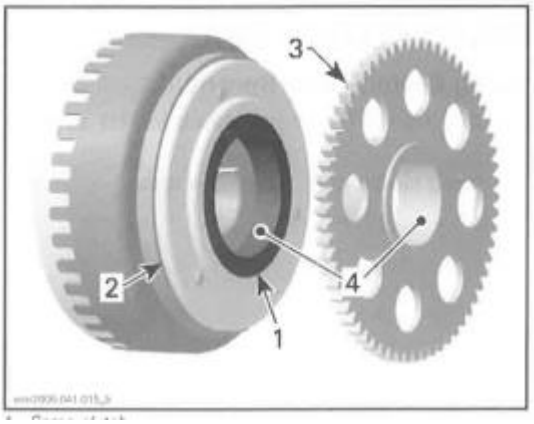
For installation, reverse the removal procedure.
However, pay attention to the following.
Use PULLEY FLANGE CLEANER to clean following:
- Crank shaft taper
- Oil passage in crank shaft taper
- Thread in crankshaft
- Rotor taper
- Oil bore in rotor.

NOTICE Taper on crankshaft and rotor must be free of grease.



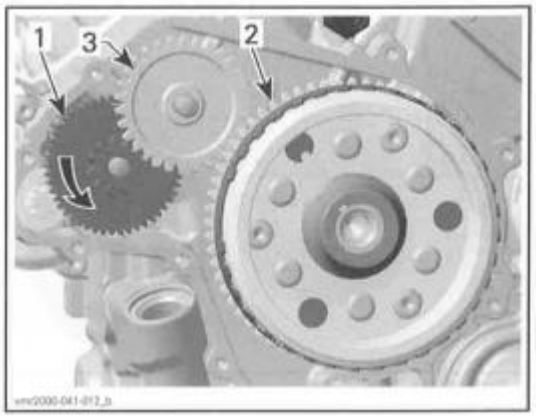
1. Crankshaft (MAG side)
2. Oil passage
3. Threads

Oil sprag clutch and instal1 sprag clutch gear.



1. Sprag clutch
2. Sprag clutch housing
3. Sprag clutch gear
4. Apply engine oil here

Slide rotor onto crankshaft. The woodruff key and the keyway must be aligned.
Rotate starter double gear counterclockwise to align intermediate gear teeth with sprag clutch gear.



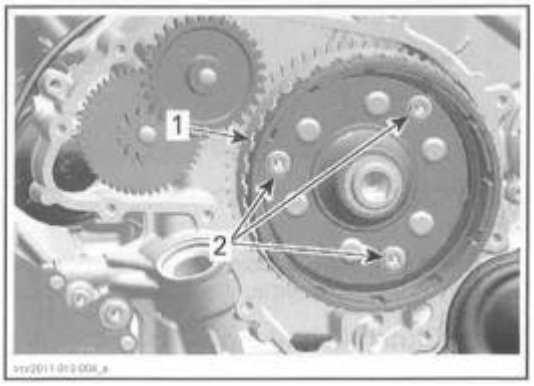
1. Starter double gear
2. Sprag clutch gear
3. Intermediate gear

ROTOR RETAINING SCREW	
Service product	德邦 2569
Tightening torque	150N·m±10N·m (111 lbf·ft±7lbf·ft)

SPRAG CLUTCH

Sprag Clutch Removal

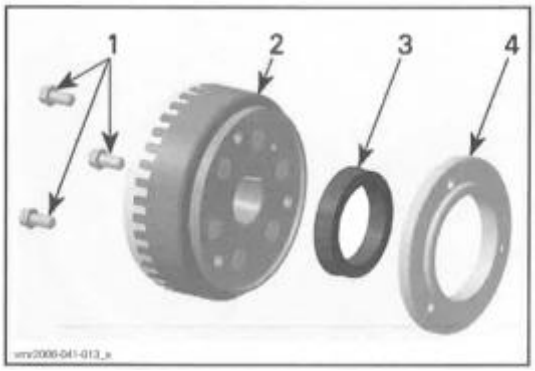
Remove MAGENTO CIVER. See procedure in this subsection.
Heat sprag clutch housing screws in order to break the Loctite.
Loosen screws.



1. Rotor
2. Sprag clutch housing screws

Remove rotor,refer to ROTOR in this subsection.

Remove sprag clutch gear.
Remove sprag clutch housing screws and sprag clutch housing.



1. Sprag clutch housing screws
2. Rotor
3. Sprag cluth
4. Sprag clutch housing

Inspecting the Sprag Clutch

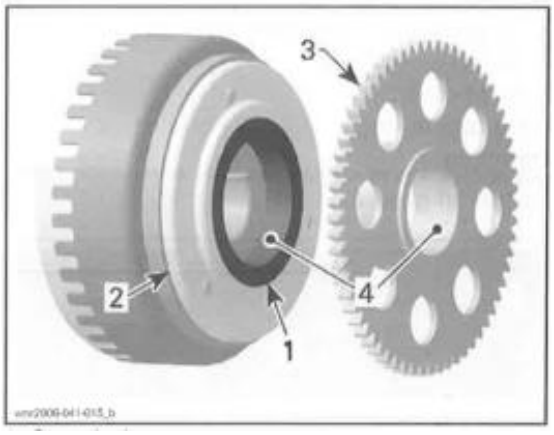
Inspect sprag clutch and sprag clutch housing for wear and damage.
Also check the collar of the sprag clutch gear.
Rotate sprag clutch gear in sprag clutch.
NOTE: Sprag clutch must lock in counterclockwise direction.

SPRAG CLUTCH FUNCTION TEST
1. Lock

NOTE: Sprag clutch, housing and gear must be replaced at the same time, if damaged.

Installating the Sprag Clutch

For installation, reverse the removal procedure.
Pay attention to the following details.
Use PULLEY FLANGE CLEANER to clean following:
-Threads in sparg clutch housing
-Threads of sparg clutch housing screws.
Apply 德邦 2569 on threads of sprag clutch housing screws.
Install screws but do not torque yet.
Apply engine oil on sprag clutch and sprag clutch gear needle bearing.



1. Sprag clutch
2. Sprag clutch housing
3. Sprag clutch gear
4. Apply engine oil here

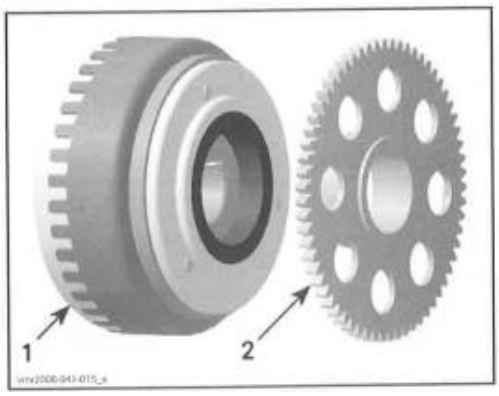
Insta11 rotor, refer to ROTOR in this subsection.
Tighten sprag clutch housing screws to specification.

TIGHTENING TORQUE	
Sprag clutch housing screws	30N·m±2N·m (22 lbf·ft±1lbf·ft)

SPRAG CLUTCH GEAR

Sprag Clutch Gear Removal

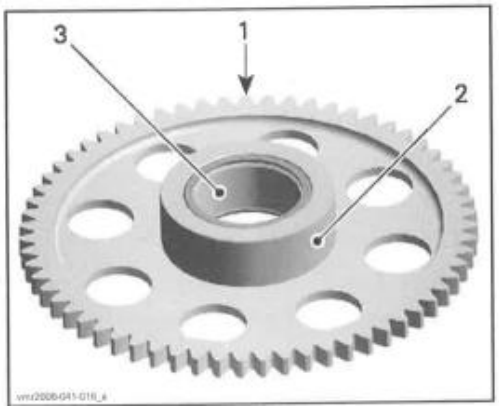
Remove ROTOR. See procedure in this subsection.
Pul1 sprag clutch gear out of the rotor.



1. Rotor
2. Sprag clutch gear

Inspecting the Sprag Clutch Gear

Inspect gear, especially teeth and sprag clutch Collar, for wear and other damage.
Check needle bearing condition. Replace sprag clutch gear if necessary.



INSPECT
1. Teeth
2. Collar
3. Needle bearing

Installating the Sprag Clutch Gear

The installation is the reverse of the removal Procedure.
NOTE: Apply engine oil on needle bearing and Collar of sprag clutch gear.

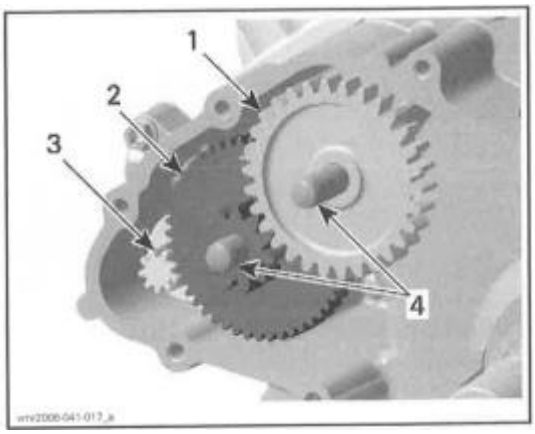
STARTER DRIVE GEARS

Starter Drive Gear Location

The starter drive gears are located on the engine MAG side behind the magneto cover.

Removing the Starter Drive Gear

Remove MAGENTO COVER. See procedure in this subsection.
Remove location pins, starter double gear and intermediate gear.



1. Intermediate gear
2. Starter double gear
3. Starter gear
4. Location pins

Inspecting the Starter Drive Gear

Inspect gears and location pins for wear and dam- age.
Replace parts as necessary.

Installating the Starter Drive Gear

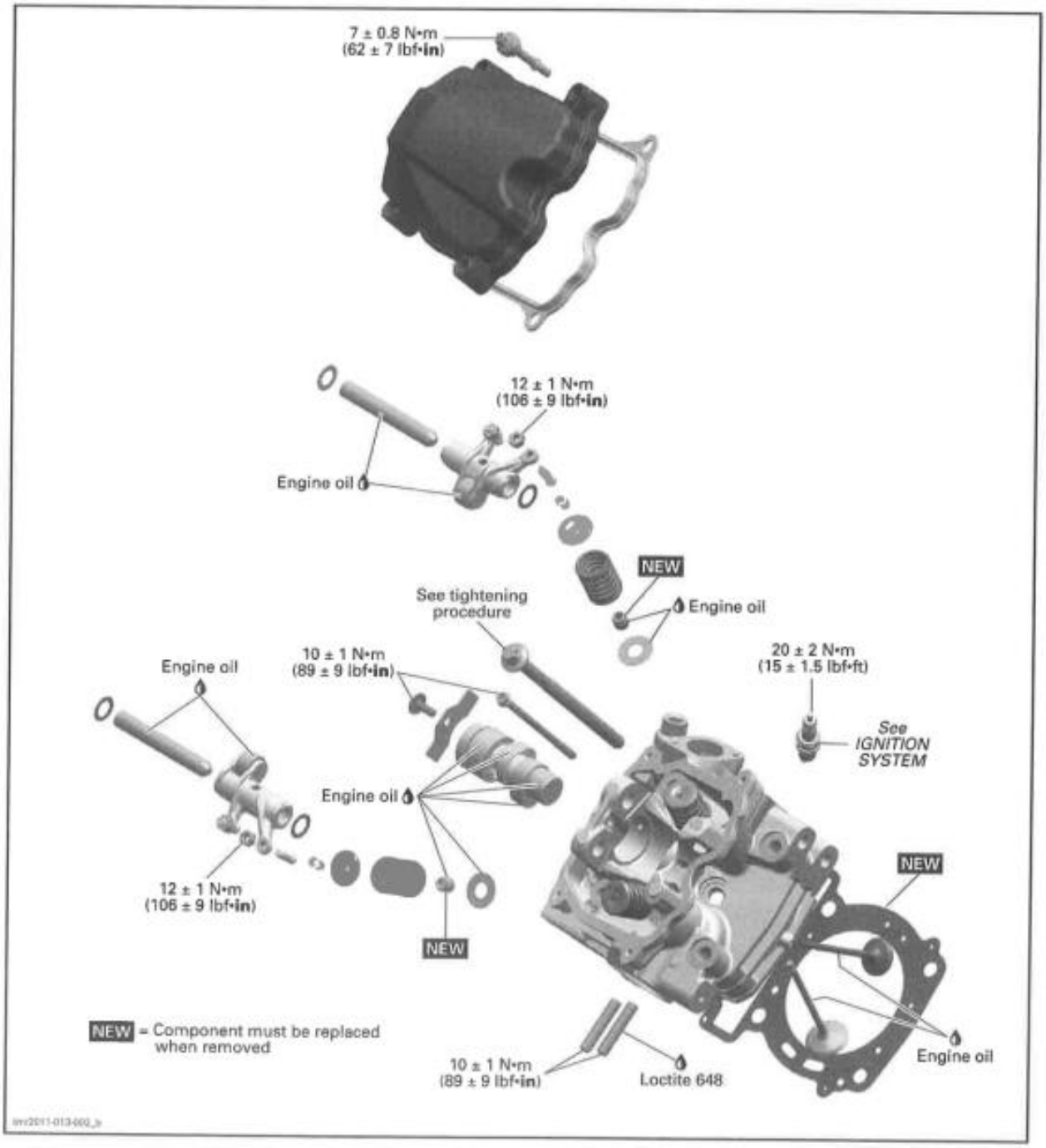
The installation is the reverse of the removal Procedure. Pay attention to the following details.
Apply LOCTITE 767 (ANTISEIZE LUBRICANT) (p1N2g3 8oo o7o) on starter gear before installing
the starter double gear.
Apply engine oil on location pins.

ELECTRIC STATER

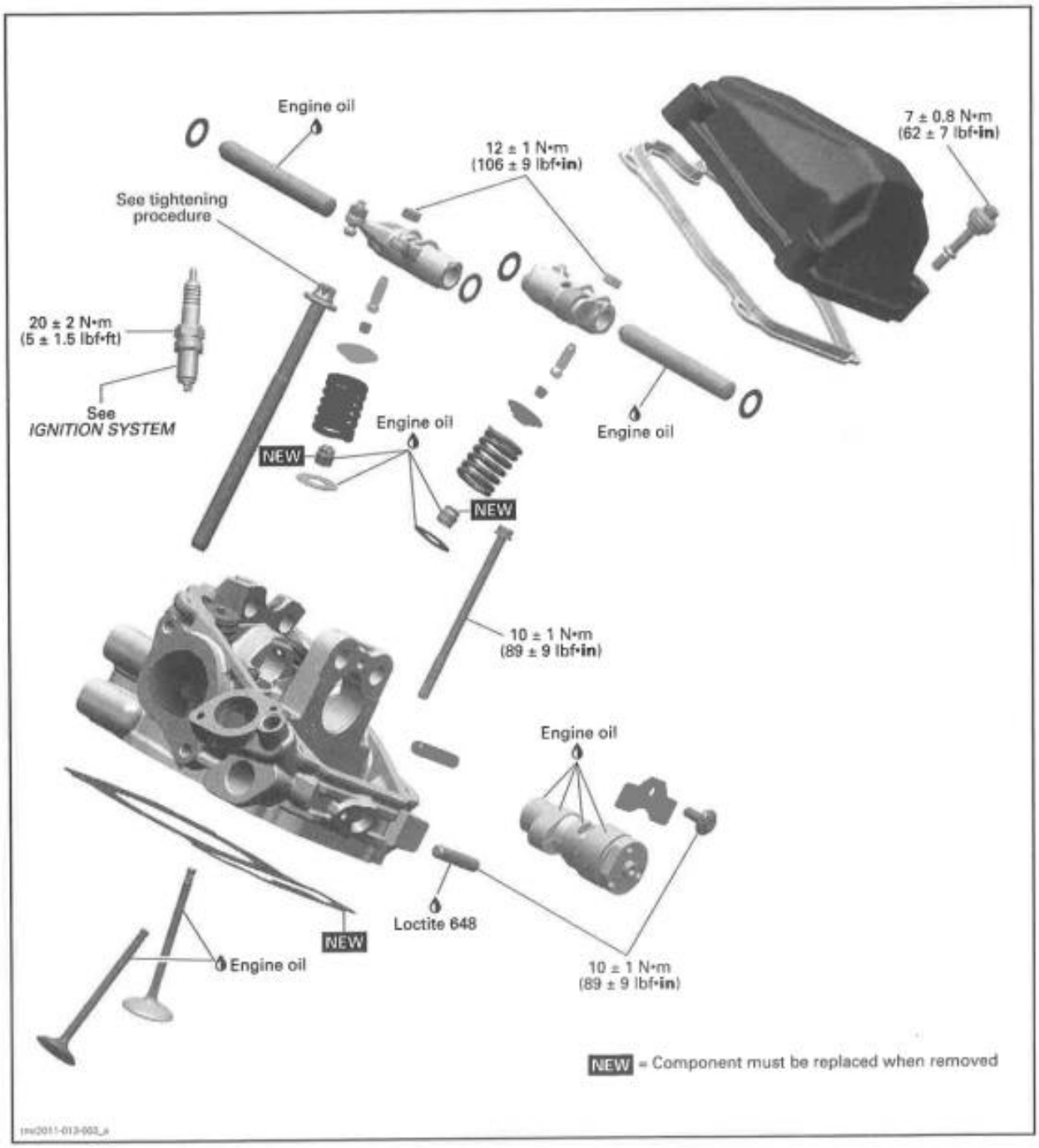
Staer Access

To reach the stater,open the cargo box .
Stater is located under rear cylinder.

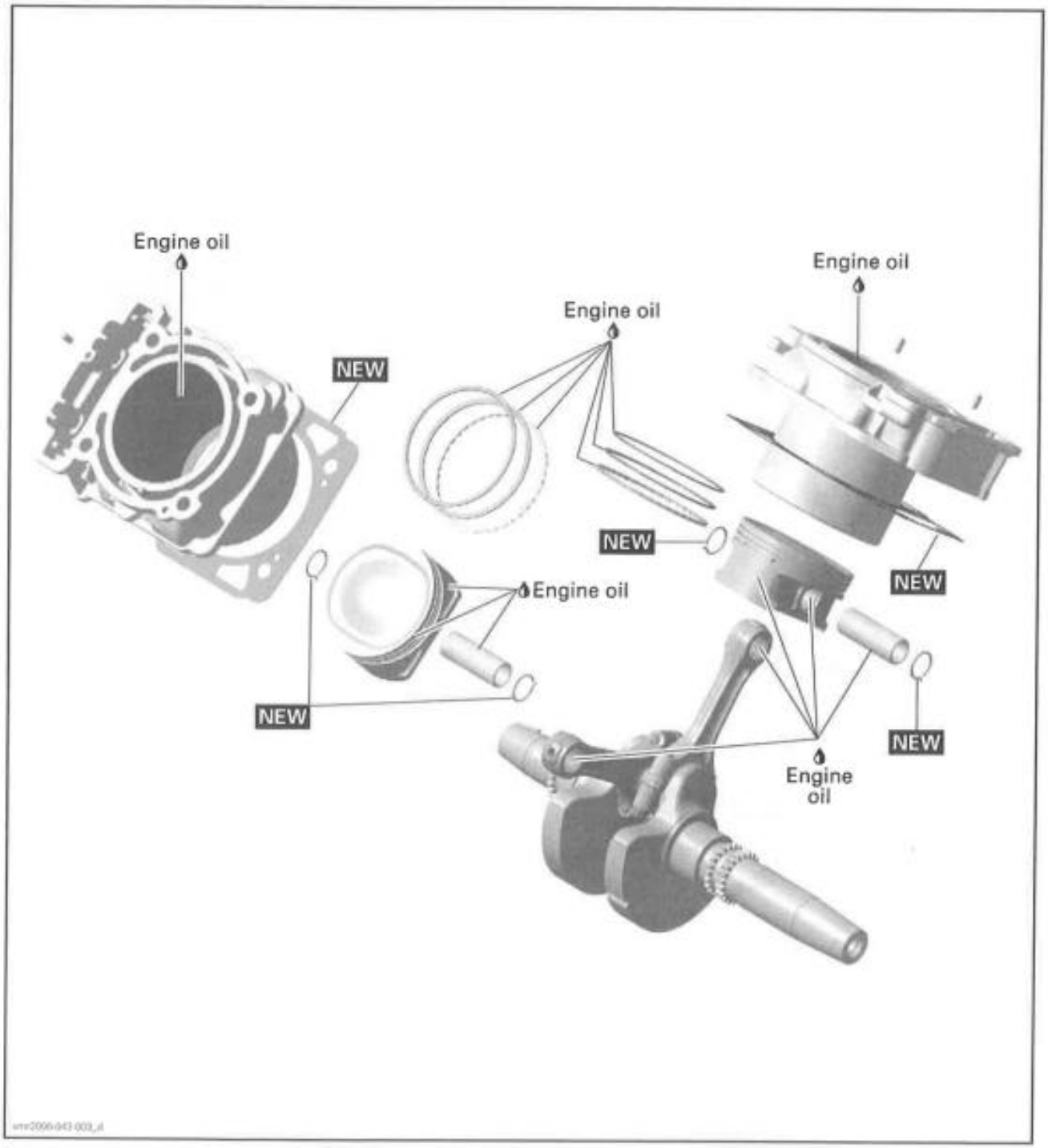
CYLINDER HEAD NO.1



CYLINDER HEAD NO.2

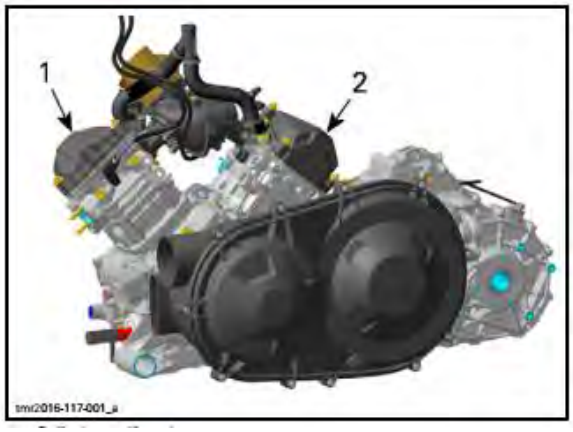


CYLINDER AND PISTONS



GENERAL

Special reference are made in the text for procedures which are different for cylinder no. 1 and cylinder no. 2.



1. Cylinder 1 (front)
2. Cylinder 2 (rear)

When diagnosing an engine problem, always perform a cylinder leak test.
NOTE: Even though the following procedures do not require the engine removal, many illustrations show the engine out of the vehicle for more clarity.
IMPORTANT: Note position of parts on disassembly. This may help to find the root cause of a problem.A component that is not replaced should be reinstalled in the same position as originally mounted.

INSPECTION

LEAK TEST

Before performing the cylinder leak test , verify the following:
- Clamp(s) tightness
- Radiator and hoses.

NOTE: For best accuracy, the leak test should be done with the engine at normal operating temperature.

△WARING
Prevent burning yourself on hot engine parts.

Preparation

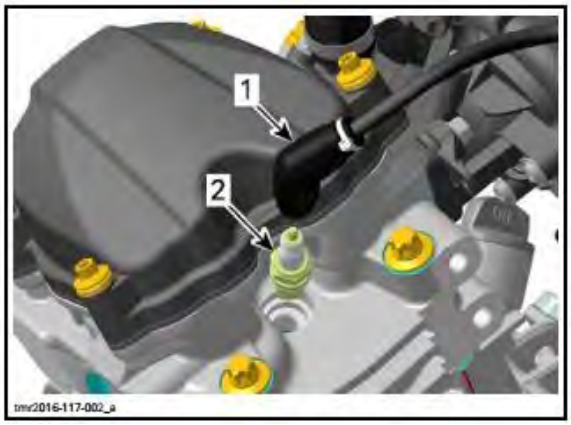
Disconnect battery

△WARING
Always respect this order for disassembly; disconnect BLACK (-) cable first.

Remove radiator cap.

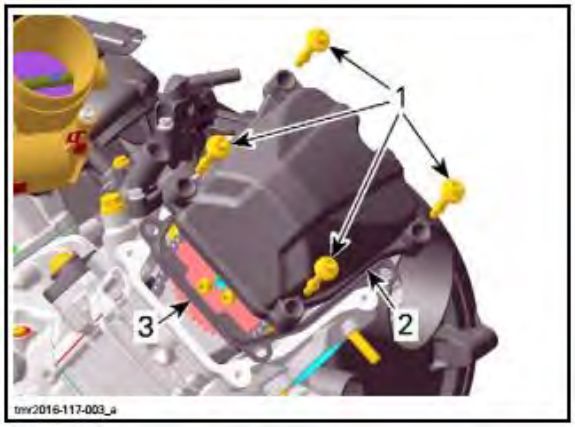
△WARING
To prevent burning yourself only remove the radiator cap by wearing the appropriate safety equipment.

Unplug spark plug cable.
Clean spark plug area and remove spark plug from cylinder head.



1. Spark plug cable
2. Spark plug

Remove valve cover.



1. Valve cover screws
2. Valve cover
3.Gasket

Rotate crankshaft until piston is at ignition TDC.
To turn crankshaft, there are two possible procedures.

First Procedure

Turn the drive pulley.

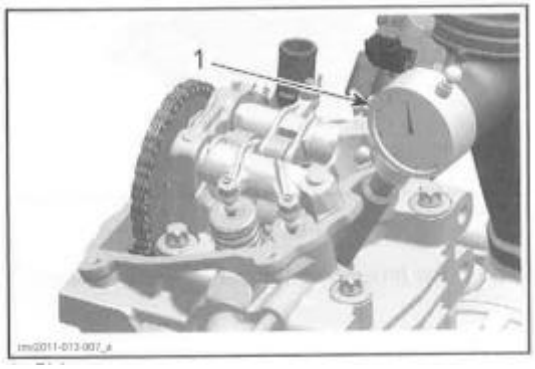
Second Procedure

1. Remove plug screw with O-ring from magneto cover.
2. Use a14 mm Allen key and turn crankshaft.

NOTICE Turn only clockwise to avoid loosening of magneto flywheel Allen screw.

Set the piston to precisely ignition TDC.

REQIRED TOOL	
TDCDIAL INFICATOR	

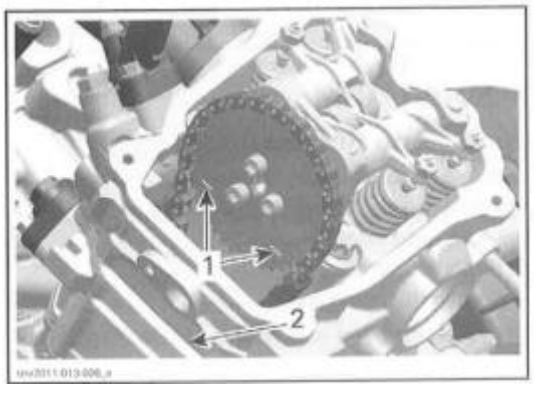


1. Dial gauge

NOTE: If a dial gauge is not available , use a screw driver or another similarly suitable tool.

NOTICE Do not scratch or damage piston/ cylinder surface.

NOTE: At ignition TDC the marks on the camshaft timing gear have to be parallel to cylinder head base as per following illustration.



1. Marks on camshaft timing gear
2. Cylinder 1leaol base

Leak Test

REQIRED TOOL	
ENGINE LEAK DOWN TEST KIT	

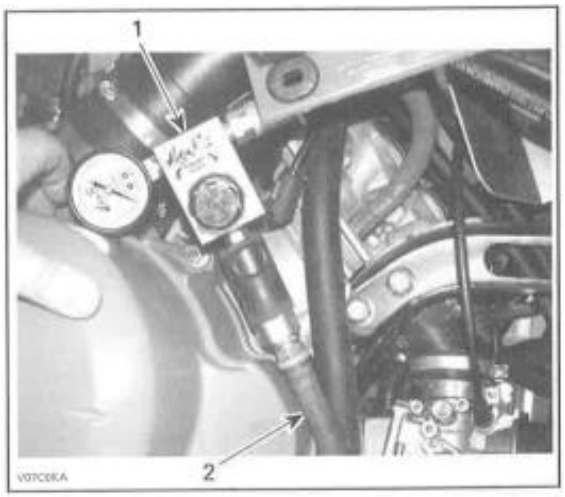
Connect leak tester to adequate air supply

Set needle of measuring gauge to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure.

Install gauge adapter into previously cleaned spark plug hole.

Supply combustion chamber with air pressure.



TYPICAL

1. Leak tester
2. Air supply hose

Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDIT1ON
0% to15%	Excellent condition
16% to25%	Good condition
26% to40%	Fair condition; reduced engine performance
41% and higher	Poor condition , diagnose and repair engine

NOTE: To make sure there is no false reading due to a valves not perfectly seated, tap each valve adjustment screw (on the rocker) using a soft hammer.

Diagnosis

Listen for air leaks .
_ Air escaping in intake port/throttle body means leaking intake valve(s).
_ Air escaping in exhaust port means leaking exhaust valve(s).
_ Air bubbles in the coolant (radiator) means leaking cylinder head gasket.
_ Air/coolant escaping from cylinder/head means damaged gasket(s) and/or loosened screws.
_ Air escaping into crankcase area means excessively worn cylinder and/or broken piston rings.
_ Air/oil escaping from crankcase means damaged gasket and/or loosened screws(refer to BOTTOM END subsection).
NOTE: For all the checkpoints mentioned above, see the appropriate engine section to diagnose and repair the engine.

Reassembly

Reverse the preparation procedure. Ensure to respect torque values and use of appropriate Products / lubricants. Refer to exploded views in other subsections of this manual as required.

PROCEDURES

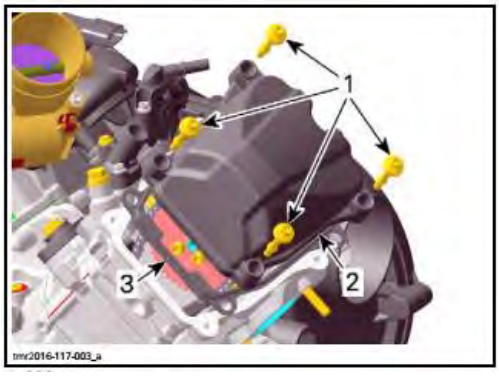
VALVE COVER

Valve Cover Access Cylinder 1(front).

Remove the engine service cover located on the rear upper bulkhead.
Cylinder 2(rear) Simply open the cargo box.

Removing the Valve Cover

Remove:
- valve cover screws
- valve cover.
- gasket



1. Valve cover screws
2. Valve cover
3. Gasket

Repeat the procedure for the other valve cover if required.

Inspecting the Valve Cover

Check the gasket on the valve cover if it is brittle, cracked or hard. If so, replace the gasket.

Installating the Valve Cover

For installation, reverse the removal procedure. Tighten valve cover retaining screws to specified torque in a criss -cross sequence.

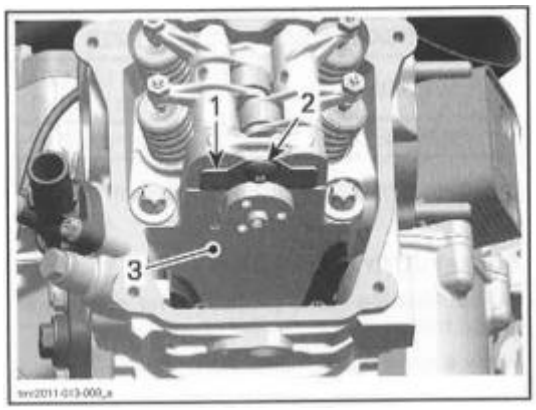
TIGHTENING TORQUE	
Valve cover screws	7N·m±0.8N·m (62lbf·in ± 7 lbf·in)

ROCKER ARM

Rocker Arm Removal

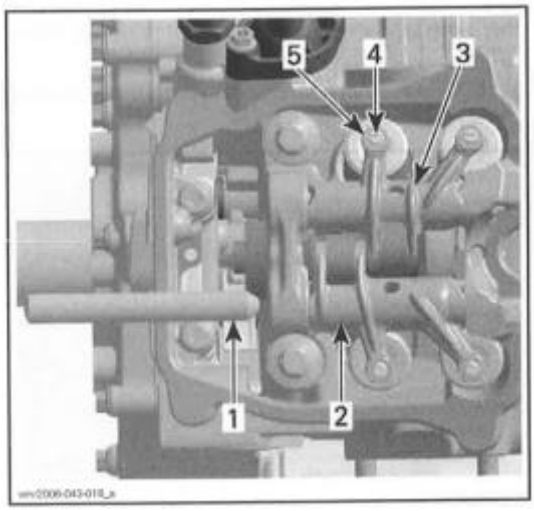
Remove valve cover.
Refer to TIMING CHAIN subsection and remove the following parts:
- Timing chain tensioner
- Camshaft timing gear.

Remove pan head screw and camshaft retaining plate.



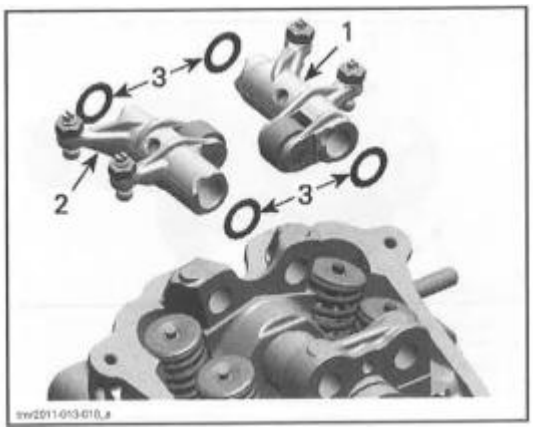
1. Camshaft retaining plate
2. Pan head screw
3. Cylinder head

Remove rocker arm shafts



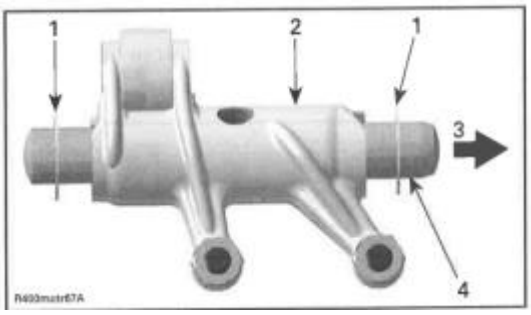
1. Rocker arm shaft
2. Rocker arm (exhaust side)
3. Rocker arm (intake side)
4. Adjustment screw
5. lock nut

Remove rocker arm assembly(exhaust side and intake side) with adjustment screws and lock nut
Remove thrust washers.



1. Rocker arm (exhaust side)
2. Rocker arm (intake side)
3. Thrust washers

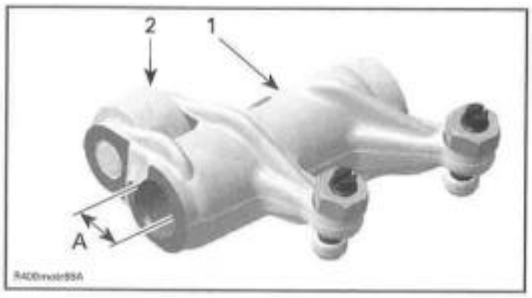
NOTICE Pay attention not to lose thrust washers or
drop them into the timing chain compartment.



1. 2 thrust washers
2. Rocker arm (exhaust side)
3. Cylinder head (spark plug side)
4. Big taper to spark plug side

Inspecting the Rocker Arm

Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.
Check the rocker arm rollers for free movement, wear
and excessive radial play. Replace rocker arm assembly
if necessary.

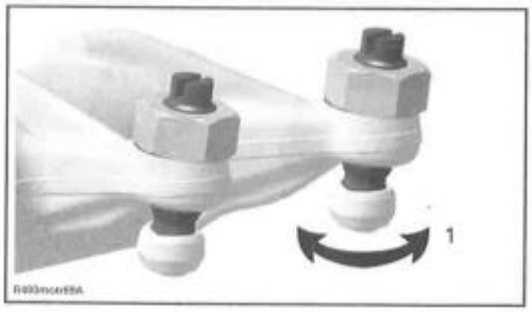


1. Rocker arm (exhaust side)
2. Roller
A. Bore for rocker arm shaft

Measure rocker arm bore diameter. If diameter is out of specification, change the rocker arm assembly.

ROCKER ARM BORE DIAMETER	
NEW	12.036mm to12.050mm .4739in to.4744in)
SERVICE LIMIT	12.060 mm (.4748in)

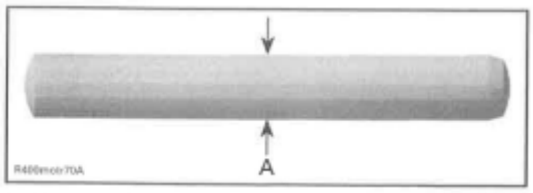
Check adjustment screws for free movement, cracks and/or excessive play.



1. Free movement of adjustment screw top

Rocker Arm Shaft Inspection

Check for scored friction surfaces; if so, replace parts.
Measure rocker arm shaft diameter



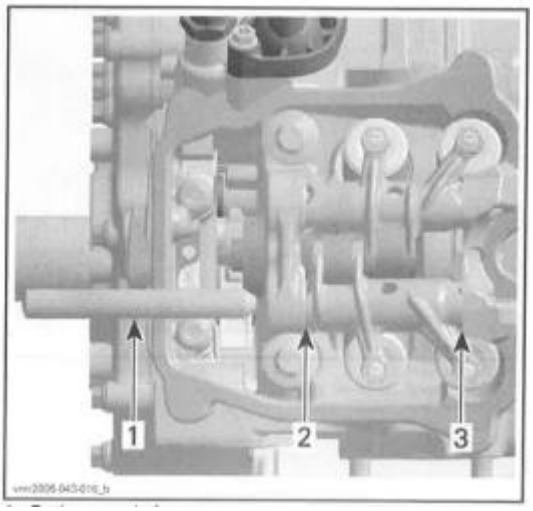
A. Measure rocker arm shaft diameter here

ROCKER ARM SHAFT DIAMETER	
NEW	12.00mm to12.018mm (.4724in to.4731 in)
SERVICE LIMIT	11.990mm(.472in)

Any area worn excessively will require parts replacement.

Installating theRocker Arm

NOTE: Use the same procedure for exhaust and intake rocker arm.
Apply engine oil on rocker arm shaft.
Install the rocker arm shafts with the chamfered edge first and use following procedure.
Insert a rocker arm pin through rocker arm pin bore.
Install a thrust washer at timing chain side, then the proper rocker arm(exhaust side or intake side).
Push in rocker arm shaft until its chamfer reaches
the end of rocker arm bore.

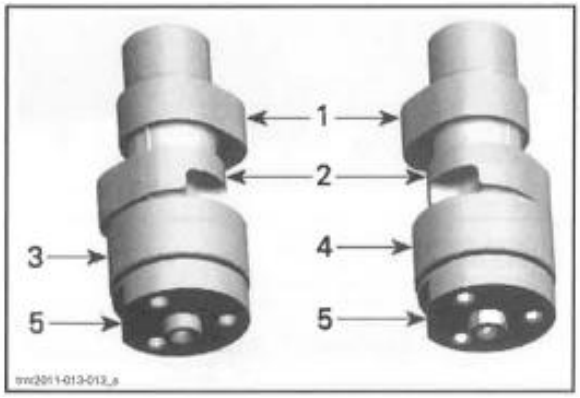


1. Rocker arm shaft
2. Thrust washer (timing chain side)
3. Thrust washer (spark plug side)

Place the other thrust washer and push rocker arm shaft to end position.
Install the camshaft retaining plate.
Adjust valve clearance, refer to PERODIC MAINTENANCE PROCEDURE

CAMSHAFT

NOTE: The engine is equipped with two different camshafts.



1. Intake cam
2. Exhaust cam
3. Camshaft of cylinder1
4. Camshaft of cylinder1
5. Flat spot

Removing the Camshaft

The removal procedure is the same for both camshafts.

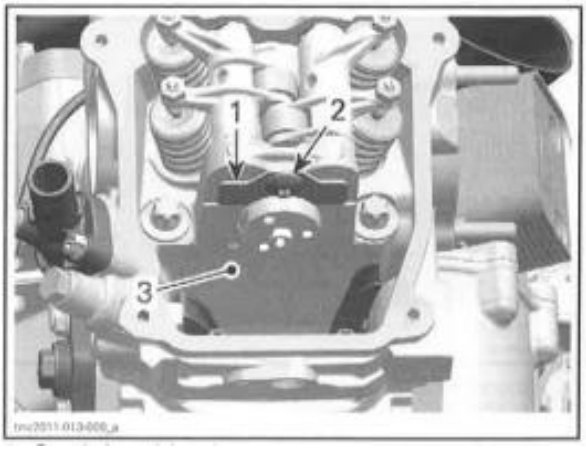
NOTICE Each camshaft is different in design. Thus, it is important not to mix up any parts of the camshaft assembly with that of the other cylinder. Keep parts as a group.

Remove valve cover(see VALVE COVER in this subsection).

Refer to TIMING CHAIN subsection and remove the following parts:

- Timing chain tensioner
- Camshaft timing gear.

Remove the camshaft retaining plate.

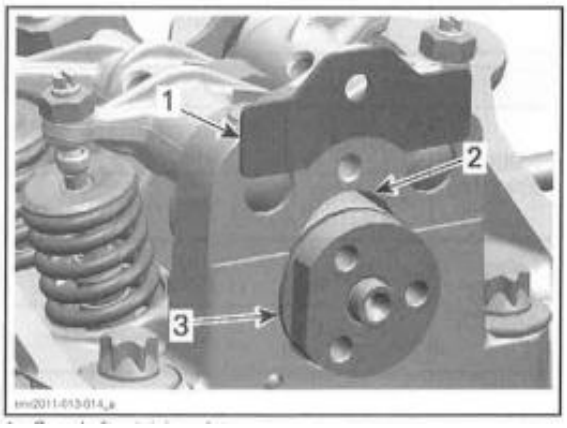


1. Camshaft retaining plate
2. Pan head screw
3. Cylinder head

Remove rocker arms (see ROCKER ARM in this subsection).

Remove the camshaft.

NOTE: For removal rotate camshaft so that intake/ exhaust lobe shows to upper side of cylinder head.



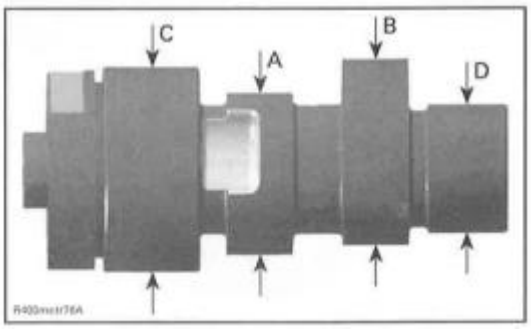
1. Camshaft retaining plate
2. Area for camshaft lobes
3. Camshaft

Inspecting the Camshaft

Inspecting the Camshaft Lobe

Check each lobe for scoring, scuffing, cracks or other signs of wear.

Measure camshaft lobe height using a micrometer



A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft journal (timing chain side)
D. Camshaft journal (spark plug side)

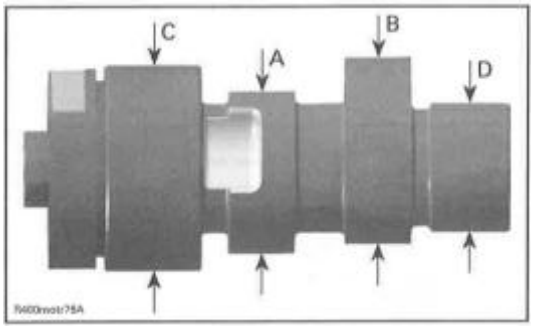
CAMSHAFT LOBE (EXHAUST)		
HD8 ENGINE	NEW	32.950mm to33.150 mm (1.2972in to1.3051 in)
	SERVICE LIMIT	32.930 mm(1 2965 in)
HD10 ENGINE	NEW	32.860 mm to33.060 mm (1.294in to1.302in)
	SERVICE LIMIT	32.840 mm(1 .293in)

CAMSHAFT LOBE (INTAKE)		
HD8 ENGINE	NEW	32.890mm to33.090 mm (1.2949in to1.3028 in)
	SERVICE LIMIT	32.870 mm(1. 2941 in)
HD10 ENGINE	NEW	32.960 mm to33.160 mm (1.298in to1.306in)
	SERVICE LIMIT	32.940 mm(1 .297in)

Measure camshaft bearing in cylinder head . Refer to CYLINDER HEAD INSPECTION in this subsection.

Inspecting the Camshaft Journal

Check each journal for scoring, scuffing, cracks or other signs of wear.
Measure camshaft journal using a micrometer .



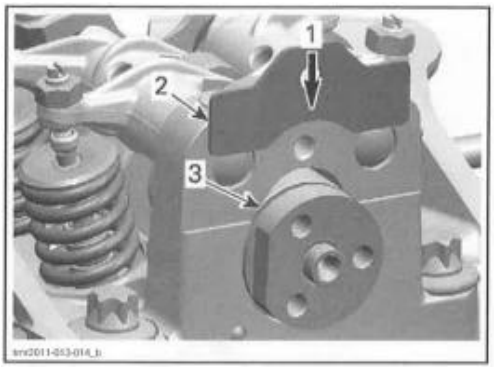
A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft journal (timing chain side)
D. Camshaft journal (spark plug side)

CAMSHAFT JOURNAL (TIMING CHAIN SIDE)	
NEW	34.959mm to34.975mm (1 3763 in to1 .377 in)
SERVICE LIMIT	34.950 mm(1 .376 in)

CAMSHAFT JOURNAL (SPARK PLUG SIDE)	
NEW	21 959 mm to21 980 mm (.8645in to.8654in)
SERVICE LIMIT	21 .950 mm(.8642 in)

Installating the Camshaft

For installation, reverse the removal procedure. Pay attention to the following details.
NOTICE The camshafts are not identical in design. Do not invert the camshafts during assembly. Any mix-up of the components will lead to engine damage.
Place the camshaft retaining plate in the slot of the camshaft.



1. Direction of movement
2. Camshaft retaining plate
3. Slot retaining camshaft

For other parts, refer to proper installation procedure.

CYLINER HEAD

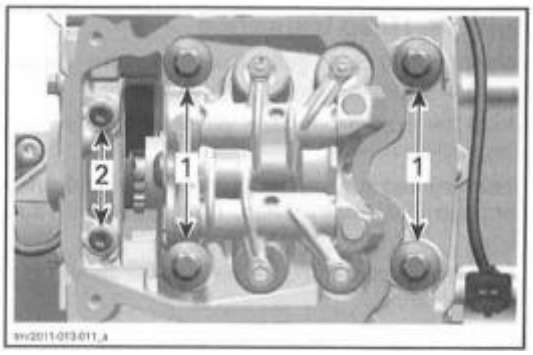
Cylinder Head Access

Cylinder 1(front)
The engine removal is required to work on cylinder 1.
Cylinder 2(rear)
Simply open the cargo box.

Removing the Cylinder Head

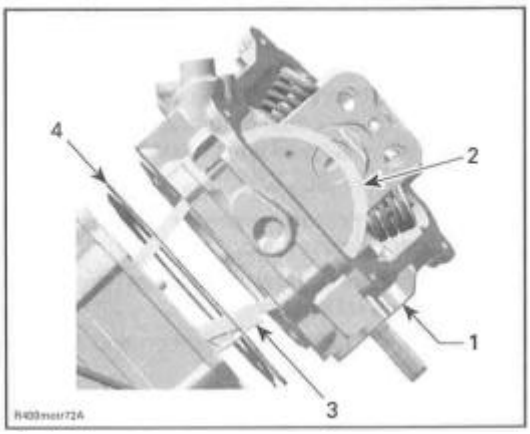
Drain coolant. Refer to ENGINE COOLANT REPLACEMENT in the PERIODIC MAINTENANCE PRODURES subsection.
NOTE: Before removing cylinder head, blow out remaining coolant by air pressure. During cylinder head removal, the remaining coolant in cylinder head could overflow into the engine and a little quantity of coolant could drop into the engine. In this case, the engine oil will be contaminated.
Disconnect spark plug wire.
Disconnect temperature sensor connector, located at rear cylinder head.
Remove the valve cover and its gasket (see VALVECOVER in this subsection).
Refer to TIMING CHAIN subsection and remove the following parts:
- Timing chain tensioner
- Camshaft timing gear.

First remove the M6 cylinder he1id screws, then the M10 cylinder head screws.



1. Cylinder head screws M 10
2. Cylinder head screws M 6

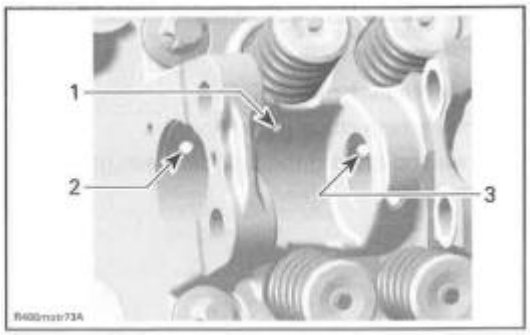
Pull up cylinder head.
Remove timing chain guide (fixed).
Remove and discard the cylinder head gasket,



1. Cylinder head
2. Timing chain
3. Chain guide (fixed)
4. Cylinder head l gasket

Inspecting the Cylinder Head

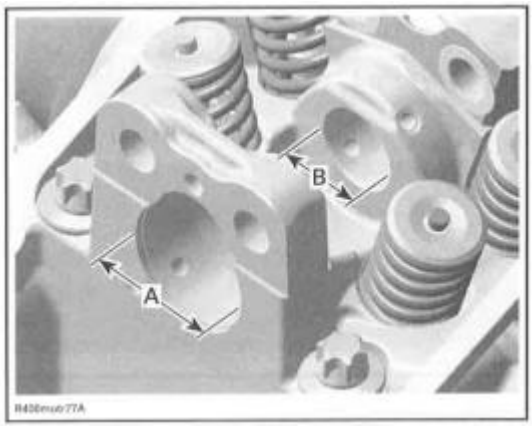
Inspect timing chain guide (fixed) for wear, cracks or other damages. Replace if necessary.
Check for cracks between valve seats, if so, replace cylinder head.
Check mating surface between cylinder and cylinder head for contamination. If so, clean both surfaces.
Clean oil support through the cylinder head from contamination.



1. Oil port to lubricate camshaft lobes intake /exhaust
2. Oil supply to camshaft bearing journal (timing chain side)
3. Oil supply to camshaft bearing journal (spark plug side)

Inspecting theCylinder Head Camshaft Bearing

Measure camshaft bearing in cylinder head.

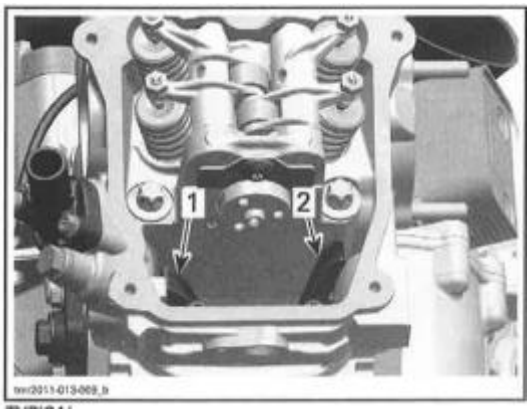


A. Cam shaft bearing (timing chain side)
B. Cam shaft bearing (spark plug side)

CAMSHAFT BEARING (TIMING CHAIN SIDE)	
NEW	35.000 mm to35.025mm (1.378in to1.3789in)
SERVICE LIMIT	35.040 mm(1 3795 in)
CAMSHAFT BEARING (SPARK PLUG SIDE)	
NEW	22.000mm to22.021 mm (.8661 in to.867in)
SERVICE LIMIT	22.040 mm(.8677 in)

Cylinder Head Installation

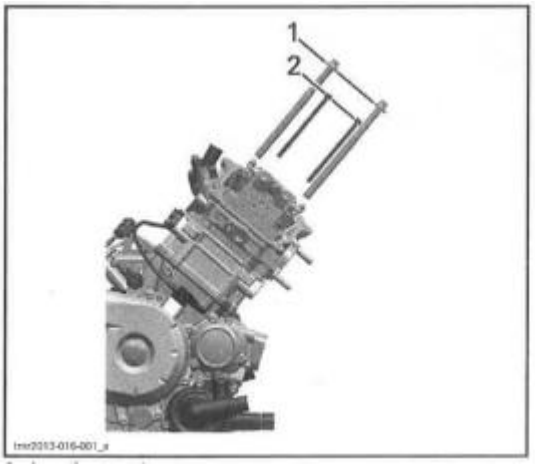
NOTE: Never invert front and rear cylinder heads.
On the 800R, cylinder heads are not identica1.
For installation, reverse the removal procedure.
Pay attention to the following details.
Ensure dowel pins are in place.
NOTICE Timing chain guide (fixed) has to be fixed between cylinder and cylinder head.



TYPICAL
1. Timing chain guide (tensioner side) mounted in crankcase
2. Timing chain guide (fixed) between cylinder ,and cylinder head

Install a NEW cylinder head gasket.
Install cylinder head screws in correct position.

NOTICE Cylinder head screws have different sizes and lengths.

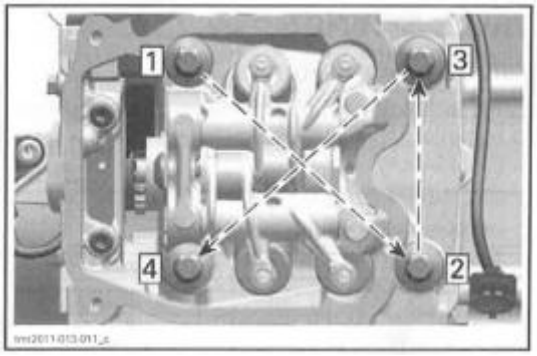


1. Location no. 1
2. Location no. 2

CYLINDER HEAD SCREW IDENTIFICATION		
HD8 engine	Location no. 1	M10×140
	Location no. 2	M6×85
HD10 engine	Location no. 1	M10×159
	Location no. 2	M6×105

Tighten M10 cylinder head screws FIRST as per following specifications.

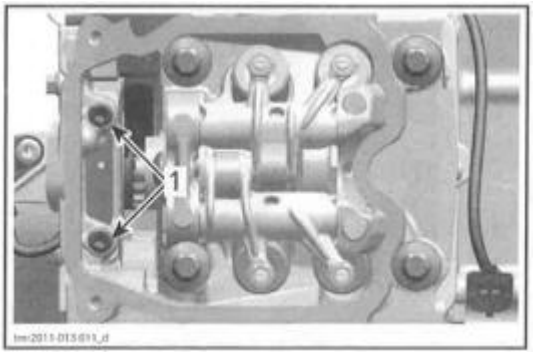
NOTE:Always perform one step on all M10 cylinder hend screws before going to the next step.



TIGHTENCE SEQUENCE-M10 CYLINDER HEAD SCREWS

TIGHTENING TORQUE		
M10 cylinder hend screws	Step A	20N·m±1N·m (15lbf·ft±1 lbf·ft)
	Step B	180°＋/－5°

Tighten M6 cylinder head screws as per following specification.



1. M6 Screws

TIGHTENING TORQUE	
M6 cylinder head screws	10N·m±1N·m (89lbf·ft±9 lbf·ft)

Check timing chain guide (tensioner side) for movement.

On cylinder1, install the plenum bracket, refer to INTAKE MANIFOLD subsection.

VALVE SPRINGS

Valve Spring Removal

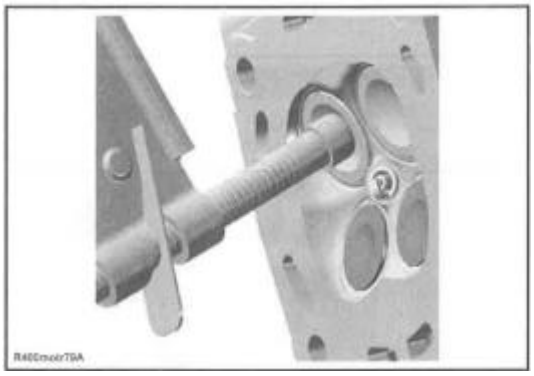
Refer to following procedures in this subsection to remove:

- CAMSHAFT
- CYLINDER

Compress valve spring.

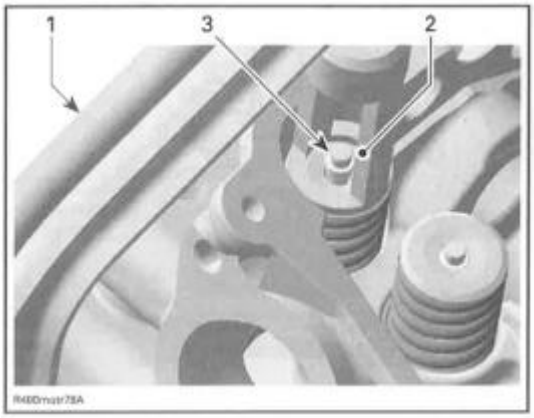
REQUIRED TOOL	
VALVE SPRING COMPRESSOR	
VALVE SPRING COMPRESSOR CUP	

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



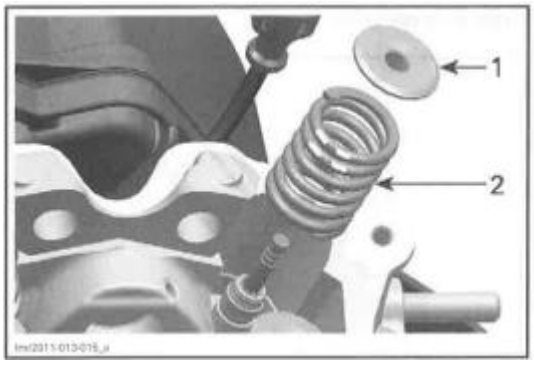
LOCATE VALVE SPRING COMPRESSOR CLAMP IN CENTER OF THE VALVE

Remove valve cotters,



1. Valve spring compressor clamp
2. Valve spring compressor cup
3. Valve cotter

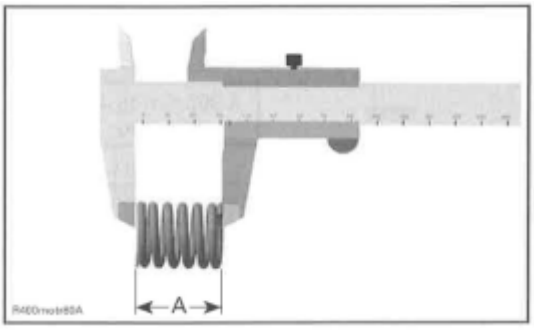
Remove tools and withdraw valve spring retainer and valve spring.



1. Valve spring retainer
2. Valve spring

Valve Spring Inspection

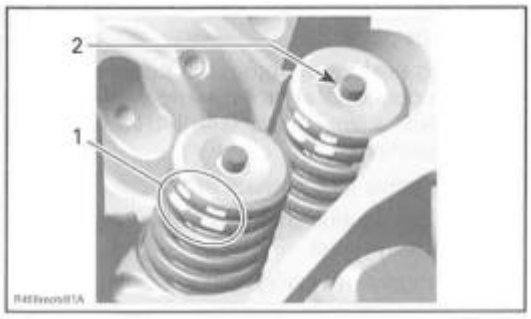
Check valve spring for visible damage. If so, replace
valve spring.
Check valve spring for free length and straightness.



A. Valve spring length

VALVE SPRING FREE LENGTH	
NEW	40.81 mm(1.607in)
SERVICE LIMIT	39.00 mm(1 535in)

Replace valve springs if not within specifications.
Installating the Valve Spring
For installation, reverse the removal procedure. Pay attention to the following detai1s.
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.



1. Position of the valve spring
2. Valve cotter

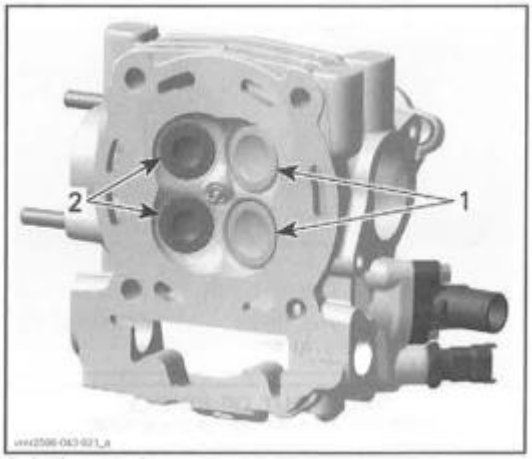
After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

NOTICE An improperly 1ocked valve spring will cause engine damage.

VA LVES

Removing the Valve

Remove valve spring, see VALVE SPRING in this subsection.
Push valve stem, then pull valves (intake and exhaust) out of valve guide.



1. Intake valve 31mm
2. Exhaust valve 27 mm

Remove valve stem seal and discard it

REQUIED TOOL	
SNAP-ON PLIERS	

Valve Inspection

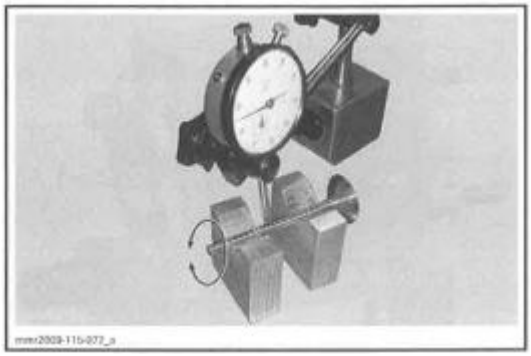
Whenever valves are removed always inspect valve guides.Refer to VALVE GUIEDS in this subsection.

Valve Stem Seal

Always install NEW seals whenever valves are removed.

Valve

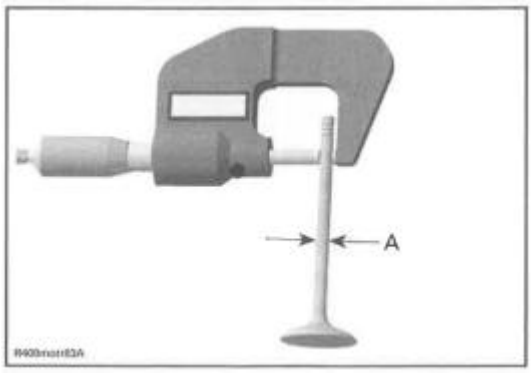
Inspect valve surface, check for abnormal stem wear and bending. If out of specification, replace
by a new one.



VALVE OUT OF ROUND (INTAKE AND EXHAUST VALVES)	
NEW	0.005mm(.0002 in)
SERVICE LIMIT	0.06 mm(.0024in)

Valve Stem

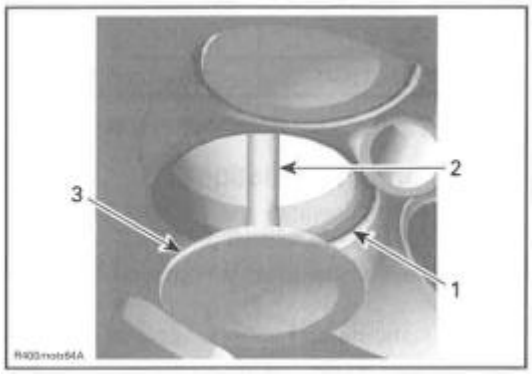
Measure valve stem in three places using a micrometer.
Replace valve if valve stem is out of specification or has other damages such as wear or friction surface.



A. Valve stem diameter

VALVE STEM DIAMETER	
EXHAUST VALVE	
NEW	4.956mm to4.970 mm (.1951 in to.1957in)
SERVICE LIMIT	4.930mm(.1941 in)
INTAKE VALVE	
NEW	4.966mm to4.980 mm (.1955in to.1961 in)
SERVICE LIMIT	4.930mm(.1941 in)

Valve Face and Seat

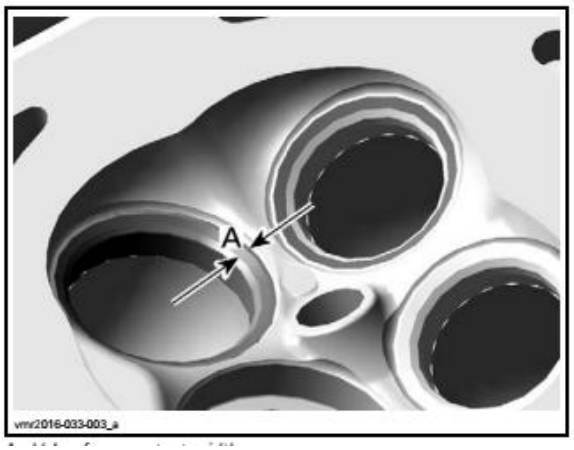


1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

Check valve face and seat for burning or pittings 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 1ts seat with a lapping tool (see VALVE GUIDEA in this subsection).
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	1.25mm to1.55mm (.049in to.061 in)
SERVICE LIMIT	2.00 mm(.079 in)
INTAKE VALVE	
NEW	1.05mm to1.35mm (.041 in to.053in)
SERVICE LIMIT	1.80mm(.071 in)

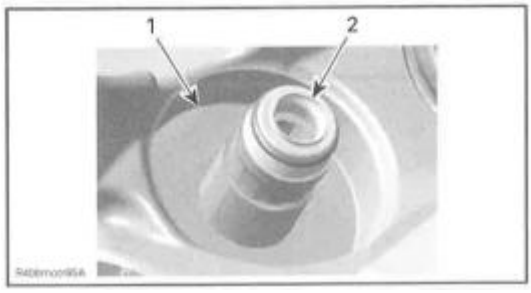
If valve seat contact width is too wide or has dark spots, replace the cylinder head.



A. Valve face contact width

Installating the Valve

For installation, reverse the removal procedure. 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 insta1l it.
NOTICE Be careful when valve stem is passed through sealing lips of valve stem sea1.



1. Thrust washer
2. Sealing lips of valve stem seal

To ease installation of cotters, apply oil or grease
on them so that they remain in place while releasing the spring.
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.
NOTICE An improperly locked valve spring will cause engine damage.

VALVE GUIDES

Valve Guide Inspection

Always replace valve stem seals whenever valve guides are removed.

Measure valve guide in three places using a small bore gauge.

NOTE: Clean valve guide to remove carbon deposits before measuring.

Replace valve guide if it is out of specification or has other damages such as wear or friction surface.

VALVE GUIDE DIAMETER (INTAKE AND EXHAUST VALVES	
NEW	4.998mm to5.018mm (.1968in to.1976in)
SERVICE LIMIT	SERVICE LIMIT 5.050 mm(.1988 in)

Removing the Valve Guide

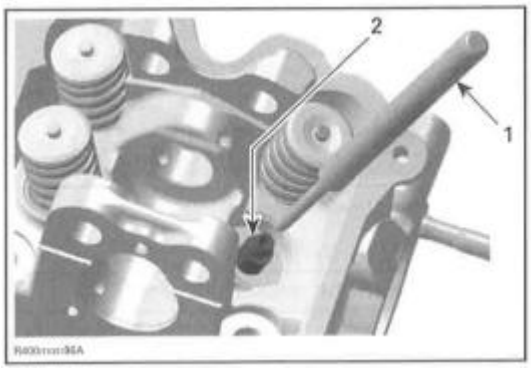
Refer to following procedures in this subsection to remove:

- Cylinder head
- Valves.

NOTE: Clean valve guide area from contamination before removal.

Drive the valve guide out of cylinder head.

REQUIED TOOL	
Hammer	
VALVE GUIDE REMOVER 5 MM	



1. Valve guide remover
2. Valve guide

Installating the Valve Guide

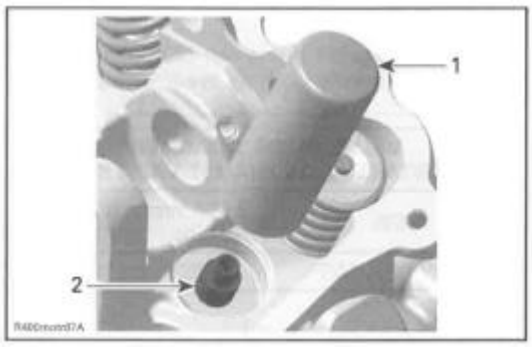
For installation, reverse the removal procedure.

Pay attention to the following details.

Clean the valve guide bore before reinstalling the valve guide into cylinder head.

Install valve guide.

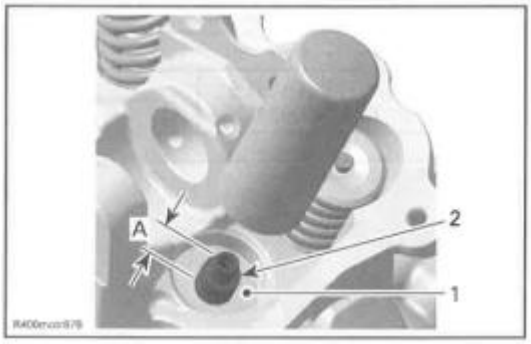
REQUIED TOOL	
VALVE GUIDE INSTALLER	



1. Valve guide installer
2. Valve guide

NOTE: Apply LOCTITE767 (ANTISEIZE LUBRICANT) on valve guide prior to install it into the cylinder head.

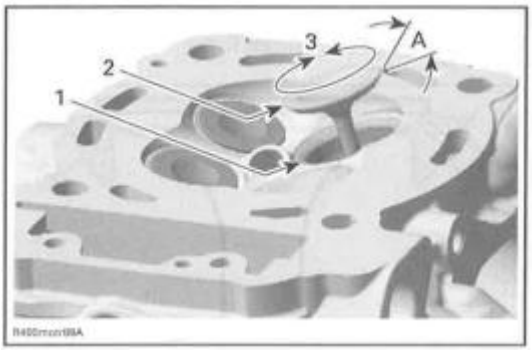
NOTICE Push valve guide in the cold cylinder head as per following illustration.



1. Thrust surface of cylinder head
2. Valve guide
A. Measurement from thrust surface to valve guide top

VALVE GUIDE(MEASUREMENT“A”)	
NEW	14.00mm to14.40mm (.5512 in to .5669 in)

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



1. Valve seat
2. Valve face (contact surface to valve seat)
3. Turn valve while pushing against cylinder head
A. Valve seat angle 45°

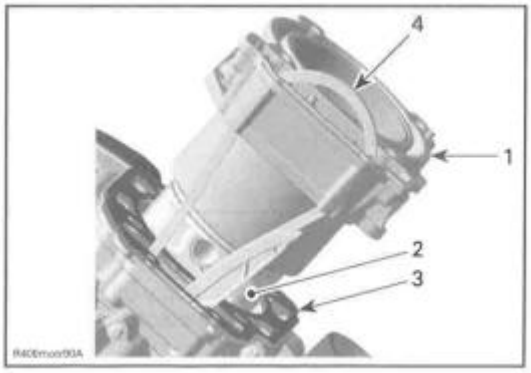
NOTE: Ensure to seat valves properly. Apply marking paste to ease checking contact pattern. Repeat procedure until valve seat/valve face fits together.

CYLINDER

Cylinder Removal

Refer to TUMING CHAIN subsection and remove the following parts:
- Timing chain tensioner
- Camshaft timing gear.

Remove the cylinder head (see CYLINDER HEAD in this subsection).
Pull cylinder.
Discard cylinder base gaskets.



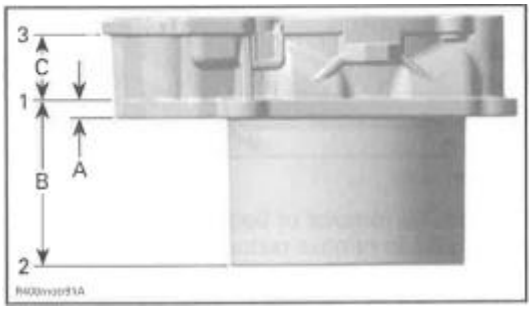
1. Cylinder
2. Piston assembly
3. Cylinder base gasket
4. Camshaft timing chain

Inspecting the Cylinder

Check cylinder for cracks, scoring and wear ridges on the top and bottom of the cylinder. If so, replace cylinder.

Cylinder Taper

Measure cylinder bore at3 recommended positions.



A. First measurement (from cylinder bottom)
B. Second measurement
C. Third measurement

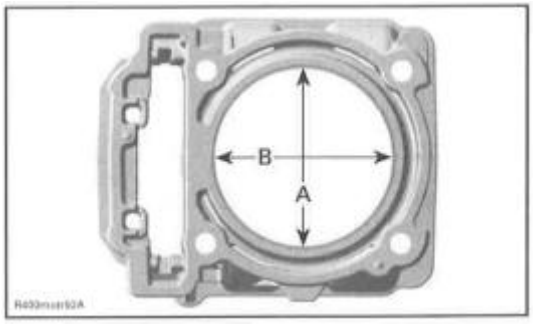
CYLINDER TAPER MEASUREMENTS		
ENGINE	MEASUREMENT	SPECIFICATION
HD8 engine	A	5mm(.197in)
	B	63mm(2.48in)
	C	32 mm(1 26in)
1000 engine	A	5mm(.197 in)
	B	58 mm(2.283 in)
	C	52 mm(2.047 in)

CYLINDER TAPER SPECIFICATION	
NEW (MAXIMUM)	0.038mm(.0015in)
SERVICE LIMIT	0.090 mm(.0035in)

Distance between measurements should not exceed the service limit mentioned above. Otherwise,
replace cylinder and piston rings.

Cylinder Out of Round

Measure cylinder diameter:
-in piston axis
-perpendicular to piston axis.
NOTE: Use the same measuring points as described in CYLINDER TAPER.



A. Perpendicular to crankshaft axis
B. Parallel to crankshaft axis

CYLINDER OUT 0F ROUND	
NEW (MAXIMUM)	0.015mm(.0006in)
SERVICE LIMIT	0.020 mm(.0008 in)

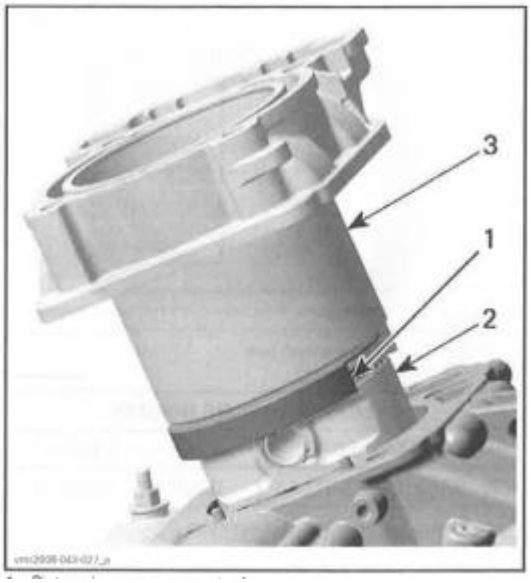
Installating the Cylinder

For installation, reverse the removal procedure.
Pay attention to the following details.
NOTICE Always replace cylinder base gasket before installing the cylinder.
NOTE: Make sure piston rings are properly spaced, refer to PISTION in this subsection.
Apply engine oil:
- In the bottom area of the cylinder bore
- On the piston rings
- On the compressor tool.

Compress piston rings.

REQUIED TOOL	
PISTON RING COMPRESSOR	

First mount cylinder 2.
NOTE: The cylinder can not be pushed fully over the piston unless the piston is located at TDC.
Then remove the CRANKSHAFT LOCKING BOLIT.
Crank the engine further and position piston1 at TDC.
Mount cylinder 1.
Put timing chain through the chain pit then put the cylinder in place.



1. Piston ring compressor tool
2. Piston
3. Cylinder

NOTICE Chain guide has to be fixed between cylinder
and cylinder head.
NOTE: After both cylinders are installed, turn crankshaft until piston of cylinder2 is at TDC and lock crankshaft. Refer to CRANKSHAFT BOTTOM END subsection.
Install cylinder head and the other parts in accordance with the proper installation procedures.

PISTON

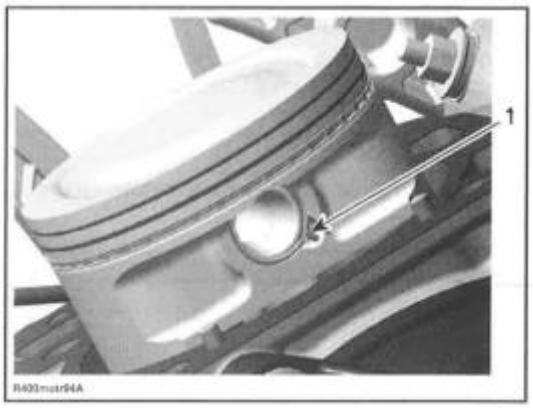
Removing the Piston

Refer to following procedures in this subsection to remove:
- Cylinder head
- Cylinder.

Place a rag under piston and in the area of timing chain compartment.

△WARNING
Piston circlips are spring loaded

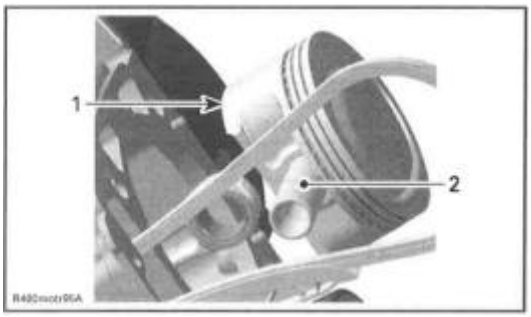
Remove one piston circlip and discard it.



1. Piston circlip

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

Push piston pin out of piston.



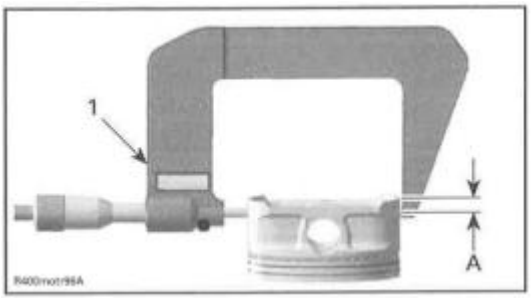
1. Piston
2. Piston pin

Detach piston from connecting rod.

Inspecting the Piston

Inspect piston for scoring, cracking or other damages.Replace piston and piston rings if necessary.

Using a micrometer, measure piston at8mm (.315in) perpendicularly (90°) to piston pin.



1. Measuring perpendicularly (90°) to piston pin

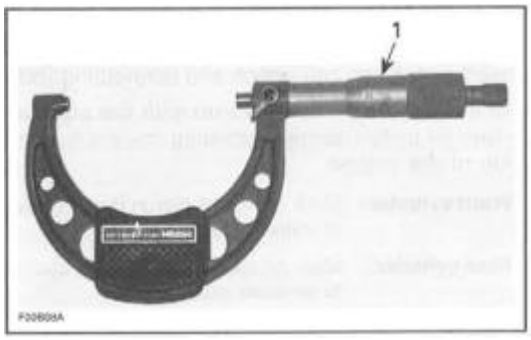
A. 8mrn (.315in)

The measured dimension should be as described in the following tables. If not, replace piston.

PISTON MEASUREMENT	
NEW	90.950 mm to90.966mm (3.5807in to3.5813in)
SERVICE LIMIT	90.850 mm(3.577 in)

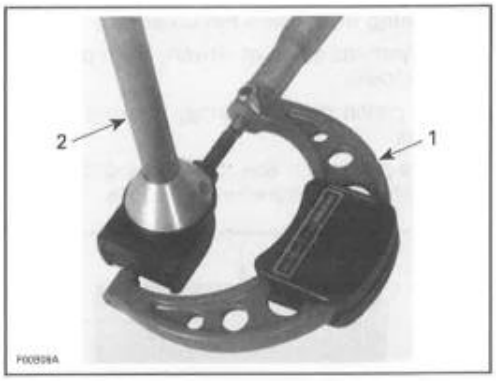
Piston/Cylinder Clearance

Adjust and lock a micrometer to the piston dimension.

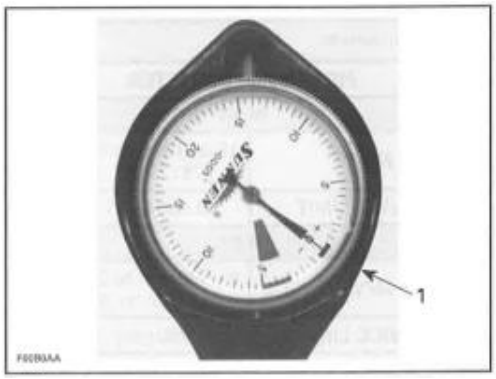


1. Micrometer set to the piston dimension

With the micrometer set to the dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0(zero).



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



TYPICAL

1. Indicator set to 0(zero)

Position the dial bore gauge20 mm (.787 in) above cylinder base, measuring perpendicularly (90°) to piston pin axis.

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

PISTON/CYLINDER CLEARANCE	
NEW	0.027mm to 0.057 mm (.0011 in to.0022in)
SERVICE LIMIT	0.100 mm(.0039 in)

NOTE: Make sure used piston is not worn.

If clearance exceeds specified tolerance, replace piston by a new one and measure piston/cylinder clearance again.

NOTE: Make sure the cylinder bore gauge indicator is

set exactly at the same position as with the micrometer, otherwise the reading will be false.

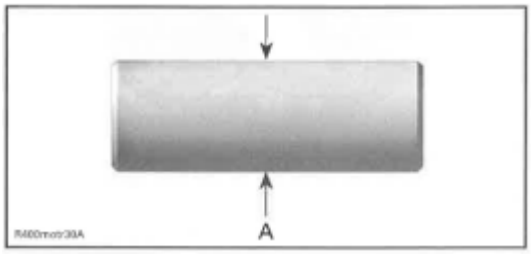
Connecting Rod/Piston Pin

Clearance

Using synthetic abrasive woven, clean piston pin from deposits .

Inspect piston pin for scoring, cracking or other damages.

Measure piston pin . See the following illustration for the proper measurement positions.

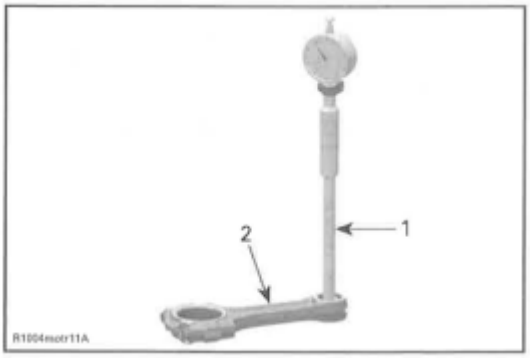


A. Piston pin diameter

PISTON PIN DIAMETER	
HD8	
NEW	19.996mm to20.000 mm (.7872in to.7874in)
SERVICE LIMIT	19.980 mm(.7866 in)
HD10	
NEW	21.996mm to22.000 mm (.866in to.8661 in)
SERVICE LIMIT	21 .980 mm(.8654in)

Replace piston pin if diameter is out of specifications.

Measure inside diameter of connecting rod small end bushing .



1. Bore gauge
2. Connecting rod

CONNECTING ROD SMALL END DIAMETER	
HD8	
NEW	20.010 mm to20.020 mm (.7878in to.7882in)
SERVICE LIMIT	20.060 mm(.7898 in)
HD10	
NEW	20.010 mm to20.020 mm (.7878in to.7882in)
SERVICE LIMIT	20.050 mm(.7894in)

Replace connecting rod if diameter of connecting rod sma1l end is out of specifications. Refer to BOTTOM END subsection for removal procedure. Compare measurements to obtain the connecting rod/piston pin clearance.

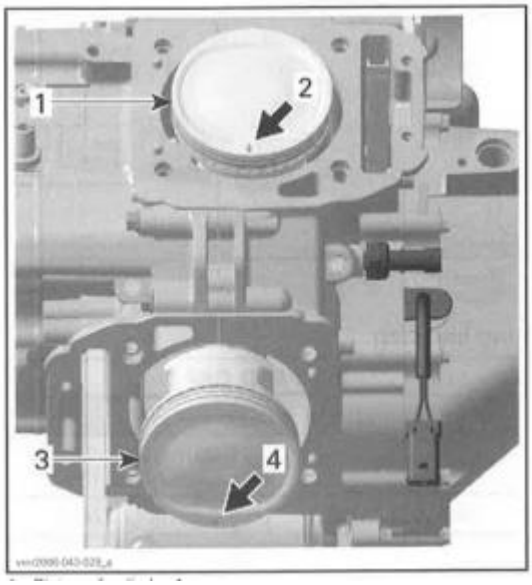
CONNECTING ROD/ PISTON PIN CLEARANCE	
SERVICE LIMIT	0.080mm(.0031 in)

Installating the Piston

For installation, reverse the removal procedure. Pay attention to the following details.
Apply engine oi1 on the piston pin.
1nsert piston pin into piston and connecting rod.
For each cylinder, Install piston with the punched arrow on piston dome is pointing toward the rear side of the engine.

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

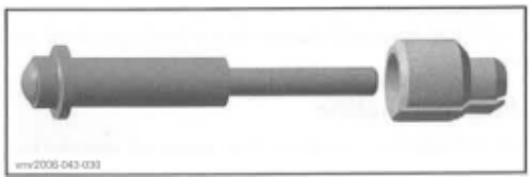
Rear cylinder: Mark on top of piston must show to exhaust side.



1. Piston of cylinder 1
2. Mark on piston must show to intake side of cylinder 1
3. Piston of cylinder 2
4. Mark on piston must show to exhaust side of cylinder 2

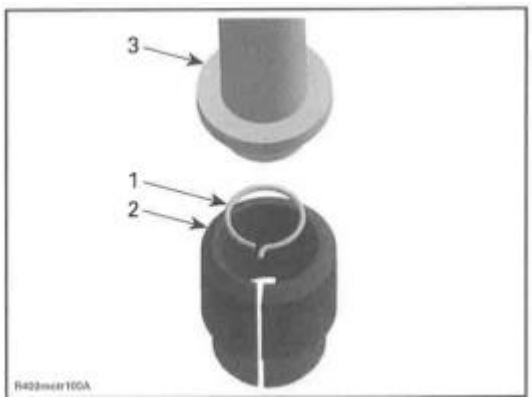
Use the piston appropriate circlip installer to assemble the NEW piston circlip as per following procedure:

ENGINE TYPE	TOOL
HD8	PISTON CIRCLIP INSTALLER
HD10	PISTON CIRCLIP INSTALLER



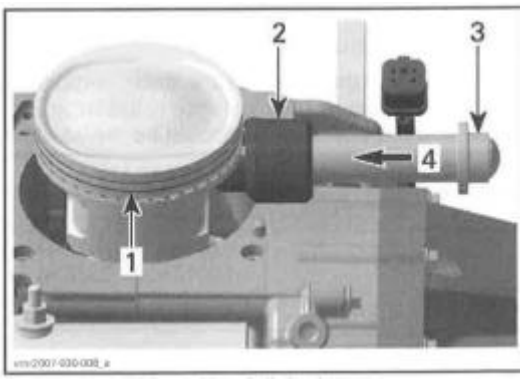
TYPICAL

NOTICE Always replace disassembled piston circlip(s) by NEW ones. Place a rag on cylinder base to avoid dropping the circlip inside the engine.
Place circlip in sleeve as per following illustration.



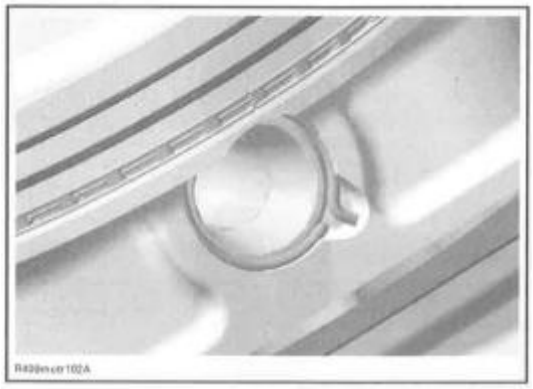
1. Circlip
2. Sleeve
3. Assembly jig from piston clip installer

Push taper side of assembly jig until circlip reaches middle of sleeve.
Align sleeve with piston pin axis and push assembly jig until circlip engages in piston.



1. Hold piston while pushing circlip in place
2. Sleeve
3. Assembly jig
4. Direction to push circlip

NOTE: Take care that the hook of the piston circlip is positioned properly.



CORRECT POSITION OF THE PISTON CIRCLIP

PISTON RINGS

Removing the Ring

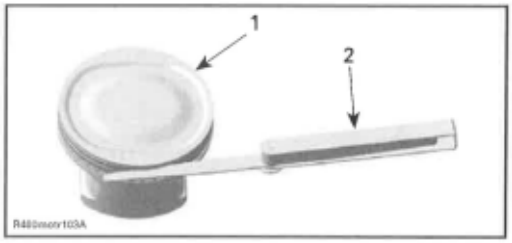
Remove the piston (see PISTON in this subsection).

Inspecting the Ring

Ring/Piston Groove Clearance

Using a feeler gauge measure each ring/piston groove clearance . If the clearance is too large, the piston and the piston rings should be replaced.

RING END GAP	
UPPER COMPRESSION RING	
NEW	0.03mm to 0.07mm (.0012in to.0028in)
SERVICE LIMIT	0.150mm(.0059in)
LOWER COMPRESSION RING	
NEW	0.02 mm to 0.06mm (.0008in to.0024in)
SERVICE LIMIT	0.150mm(.0059in)
OIL SCRAPER RING	
NEW	0.01 mm to 0.18mm (.0004in to.0071 in)
SERVICE LIMIT	0.250mm(.0098in)



1. Piston
2. Feeler gauge

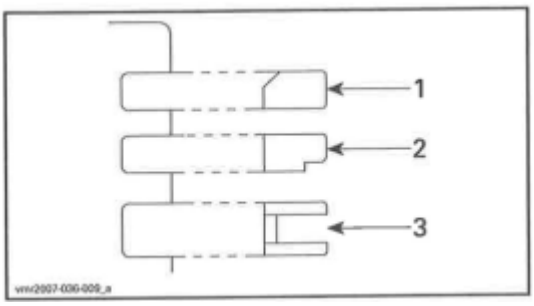
Ring End Gap

RING/PISTON GR00VE CLEARANCE	
UPPER COMPRESSION RING	
NEW	0.20 mm to 0.40 mm (.008in to.016in)
SERVICE LIMIT	0.60 mm(.024in)
LOWER COMPRESSION RING	
NEW	0.20 mm to 0.40mm (.008in to.016in)
SERVICE LIMIT	0.70 mm(.028 in)
OIL SCRAPER RING	
NEW	0.20 mm to 0.70mm (.008in to.028in)
SERVICE LIMIT	1 .00 mm(.039in)

To measure the ring end gap place the ring in the cylinder in the area of 8mmto16mm (5/16in to 5/8in) from top of cylinder.
NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.
Using a feeler gauge, check ring end gap. Replace ring if gap exceeds above described specified tolerance.

Installating the Ring

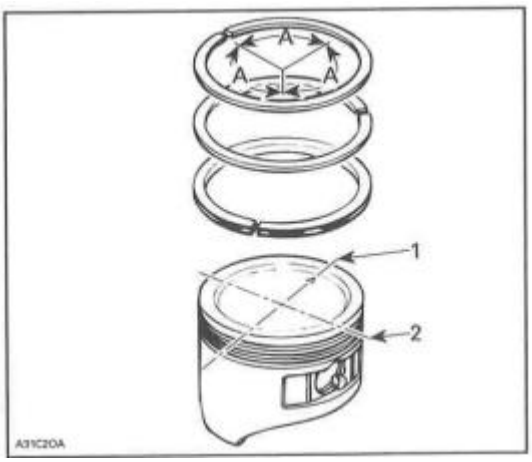
For installation, reverse the removal procedure. Pay attention to the following details.
NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.
NOTE: First install spring and then rings of oil scraper ring.
Install the oil scraper ring first, then the lower compression ring with the word “N” and “TOP” facing up, then the upper compression ring with the word “N” and “TOP” facing up.



1. Upper compression ring
2. Lower compression ring
3.Oil scraper ring

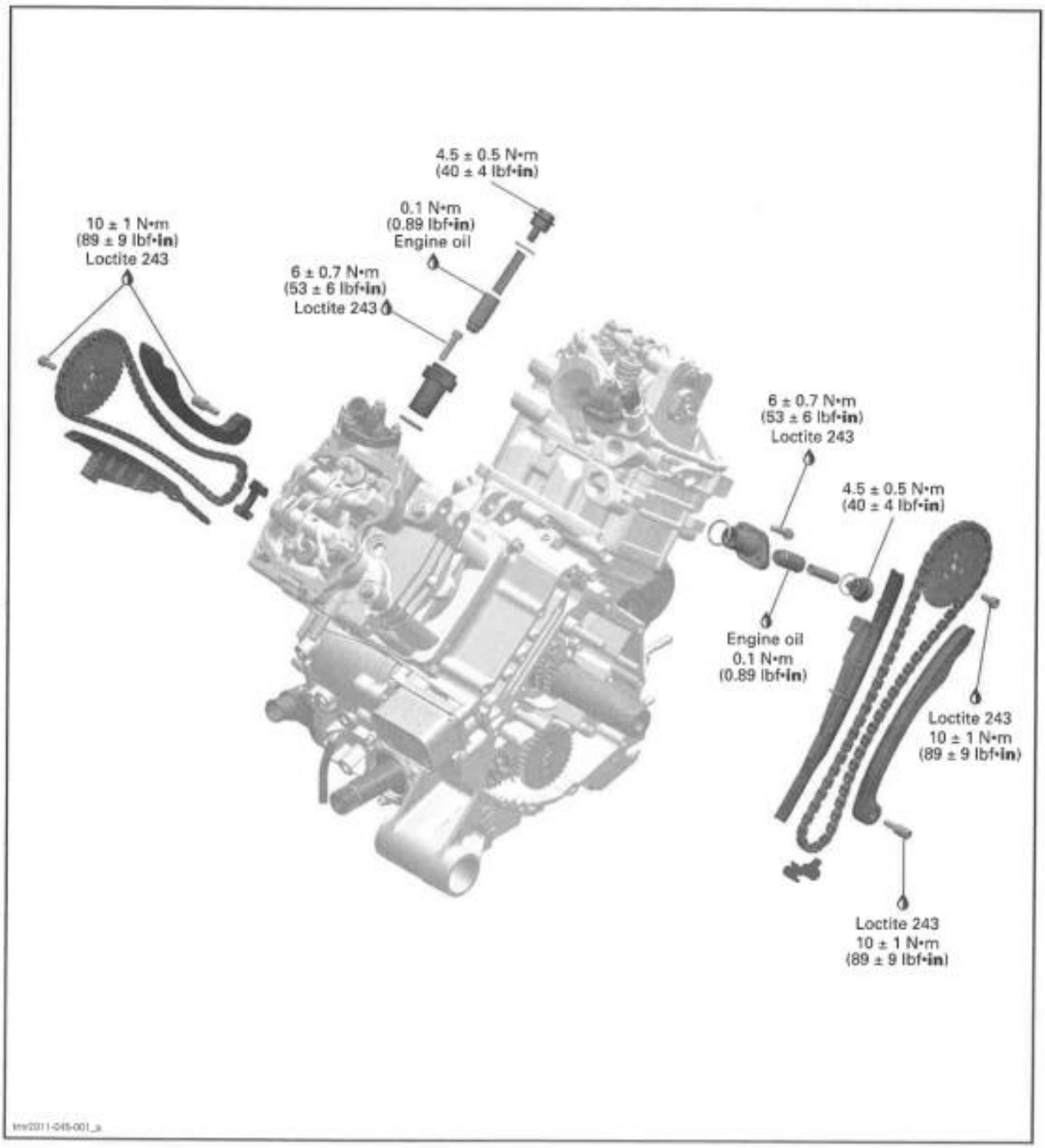
NOTICE Ensure that top and second rings are not interchanged.

Check that rings rotate smoothly after installation.
Space the piston ring end gaps120° apart and do not align the gaps with the piston pin bore or the thrust side axis.



1. DO NOT align ring gap with piston thrust side axis
2. DO NOT align ring gap with piston pin bore axis
A. 120°

TIMING CHAIN



GENERAL

IMPORTANT: Note position of parts on disassembly. This may help to find the root cause of a problem. A component that is not replaced should be reinstalled in the same position as originally mounted.

TROUBLESHAOOTONG

UNUSUAL ENGINE NOISE OR VIBRATION
1. IMPROPER VALVE CLEARANCE ADJUSTMENT AND/OR WORN OUT ROCKER ARM(S)
-Readjust valve clearance and/or replace defective part(s), refer to TOP END subsection.
2. DEFECTIVE CHAIN TENSIONER
-Replace chain tensioner
3. WORN OUTTIMING CHAIN GUIDE(S)
-Replace chain guide(s)
4. STRETCHED TIMING CHAIN OR WORN OUT TIMING GEARS
-Replace timing chain and timing gears.
5. LOOSE TIMING GEAR RETAINING SCREWS
-Retighten screws to recommender torque.
6. INCORRECT CAMSHAFT TIMING
-Replace damaged components and readjust camshaft timing.

ENGINE LACKS ACCELERATION OR POWER

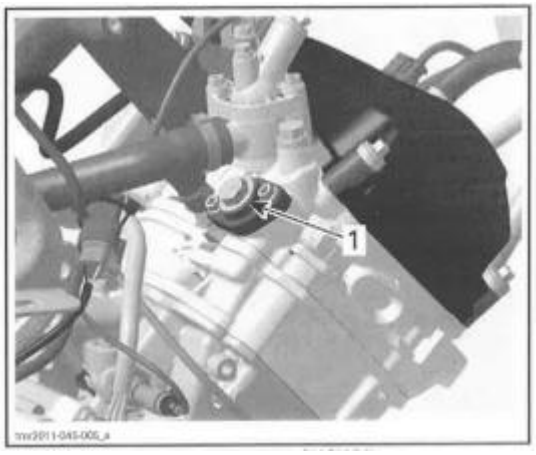
1. INCORRECT CAMSHAFT TIMING
_Replace damaged components and readjust camshaft timing.

PROCEDURES

TIMING CHAIN TENSIONERS

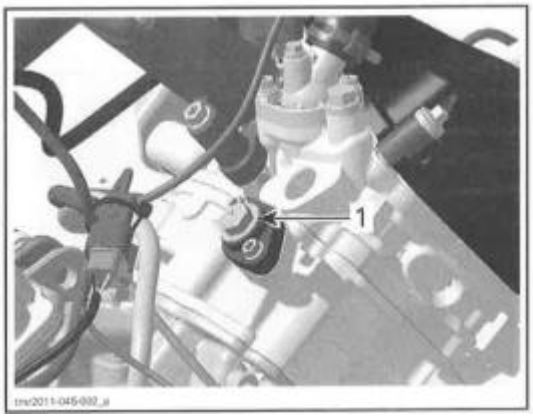
Timing Chain Tensioner Location

HD8 Engine
The timing chain tensioner is located in the cylinder head.



HD8 Engine-(FRONT CYLINDER SHOWN)
1. Timing chain tensioner

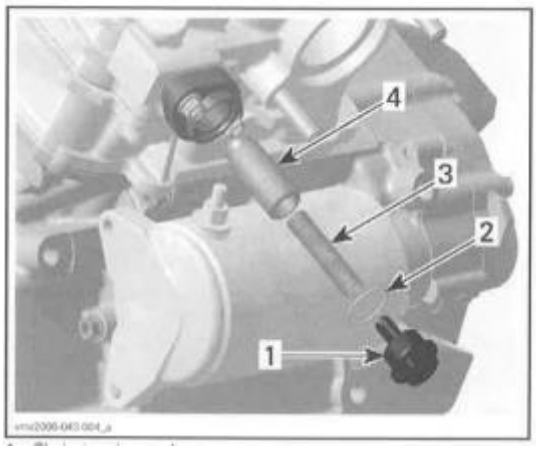
HD10 Engine
The timing chain tensioner is located in the cylinder.



HD10 Engine-(FRONT CYLINDER SHOWN)
1. Timing chain tensioner

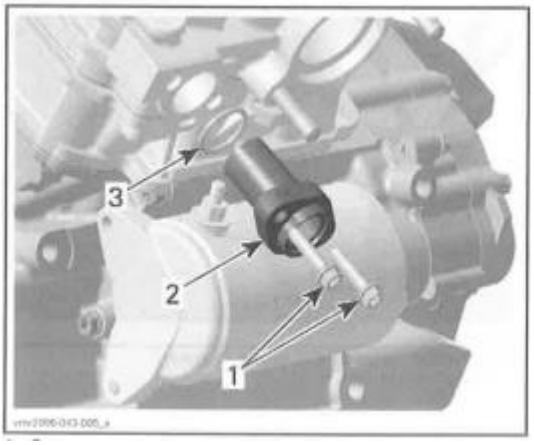
Removing the Timing Chain Tensioner

1. Make sure the respective cylinder is set to TDC ignition. Refer to CAMSHAFT TIMING GEARS in this subsection.
2. Carefully unscrew chain tensioner plug and release spring tension.
△CAUTION Tensioner is spring loaded.
3. Remove:
- O-ring
- Spring
- Chain tensioner plunger



1. Chain tensioner plug
2. O-ring
3. Spring
4. Chain tensioner plunger

4. Remove:
- Chain tensioner housing retaining screws
- Chain tensioner housing
- O-ring.

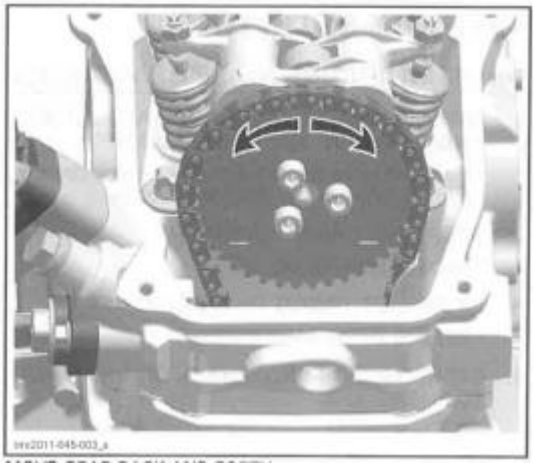


1. Screws
2. Chain tensioner housing
3. O-ring,

Inspecting theTiming Chain Tensioner

Check the chain tensioner housing and plug for cracks or other damages. Replace if necessary.
Check chain tensioner plunger for free movement and/or scoring.
Check if 0-rings are brittle, cracked or hard. Replace if necessary.
Check spring condition. Replace if bent, broken or worn.

Timing Chain Tensioner Installation
1. For installation, reverse the removal procedure.
However, pay attention to the following.
NOTE: Before installing the chain tensioner make sure, that the camshaft timing gear can be moved back and forth.

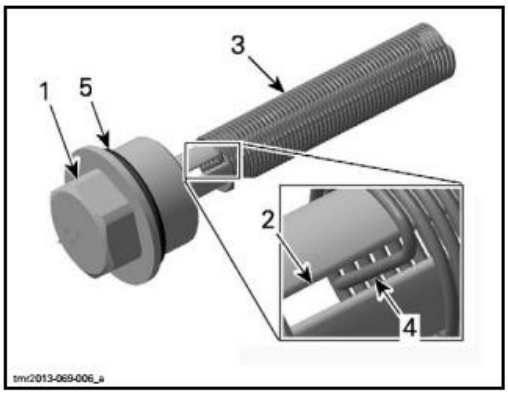


MOVE GEAR BACK AND FORTH

2. Apply engine oil on the plunger before insta1lation.
3. Slightly turn the camshaft timing gear in order to get the timing chain play on the tensioner side.
4. Slightly screw the plunger in until the timing chain allows no more back and forth movement of the camshaft timing gear.
5. Screw the plunger in an additional 1/8 turn to reach the required specified torque.

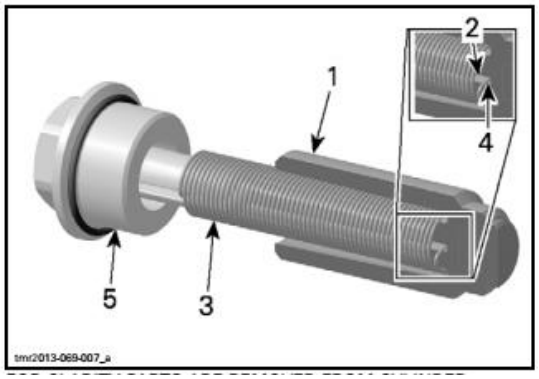
TIMING CHAIN TENSIONER ADJUSTMENT (TORQUE)
0.1 N·m(.9lbf·in)

NOTICE Improper adjustment of the timing chain will lead to severe engine damage.
6.Pace the O-ring on chain tensioner screw plug.
7.Fit the spring on one side into the slot of the plug.



1. Plug
2. Slot
3. Spring
4. Spring end
5. O-ring

8.Fit the spring on other side into the slot of the plug.



FOR CLARITY PARTS ARE REMOVED FROM CYLINDER

1. Plug
2. Notch
3. Spring
4. Spring end
5. Plug with O-ring

NOTE: Turn spring only clockwise in order to fit the spring end into the notch of the plunger to avoid loosening the plunger during spring installation. Do not pre1oad the spring.

9. Then compress the spring and screw the plug in.

NOTE: To avoid overstressed timing chain, the plug must engage into threads within the first full turn.

10. Remove locking tool and install all other removed parts.

11. Finally, tighten the plug.

TIGHTENING TORQUE	
Chain tensioner plug	4.5 N·m±0.5N·m (40lbf·in±4 lbf·in)

CAMSHAFT TIMING GEARS

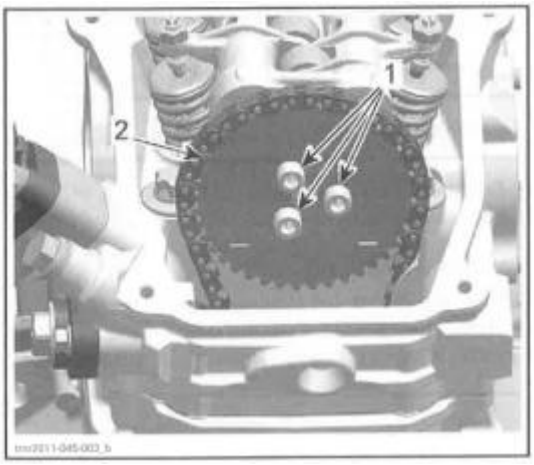
Camshaft Timing Gear Removal

Remove the valve cover , refer to TOP END sub section.

Turn crankshaft to TDC ignition of the respective cylinder and lock magneto flywheel, see CAMSHAFT TIMING in this subsection.

Unscrew timing chain tensioner. Refer to TIMING CHAIN TENSIONERS in this subsection.

Remove camshaft timing gear retaining screws.



1. Camshaft timing gear retaining screws
2. Camshaft timing gear

NOTE: Secure timing chain with a piece of wire.

Inspecting the Camshaft Timing Gear

Check camshaft timing gear for wear or deterioration.

If gear is worn or damaged, replace it as a set with

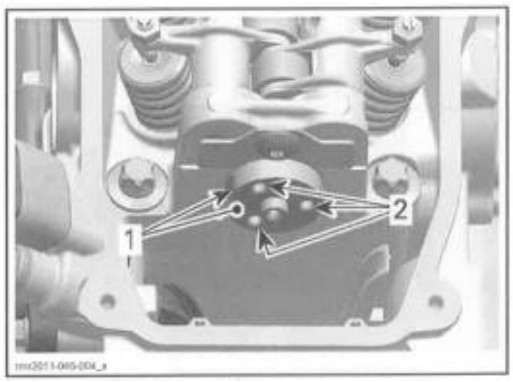
the timing chain.

For crankshaft gear, refer to BOTTOM END subsection, see CRANKSHAFT.

Camshaft Timing Gear Installation

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

1. Clean mating surface and threads of camshaft prior installing camshaft timing gear.



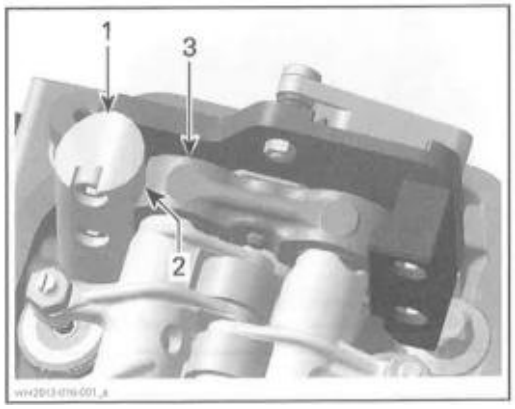
1. Mating surface on camshaft
2. Threads for camshaft screws

2. Crankshaft must be set to TDC ignition position before installing the timing chain, refer to CAMSHAFT TIMING in this subsection.

3. Insta1l the camshaft timing tool on the cylinder head.

REQUIED TOOL	
CAMSHAFT TIMING TOOL	

NOTE: Align tube of camshaft adjustment tool properly with machined radius on cylinder head.

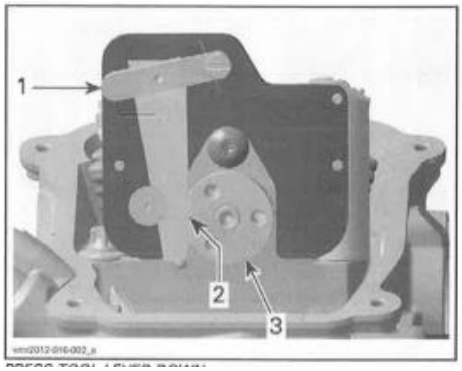


CAMSHAFT TIMING TOOL INSTALLED

1. Tube (camshaft adjustment tool)
2. Machined radius (camshaft adjustment tool)
3. Cylinder head

4. Set camshaft to TDC ignition position by aligning the camshaft flange flat spot with the tool lever.

NOTE: In addition, to ensure proper camshaft timing, press camshaft adjustment tool lever downwards.



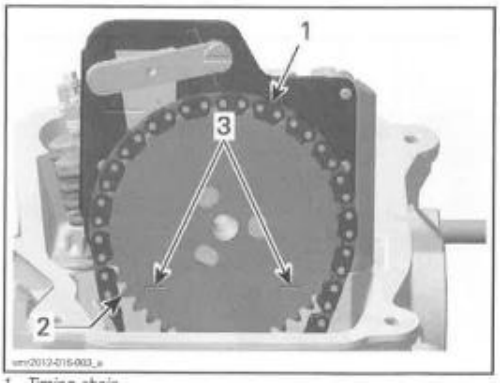
PRESS TOOL LEVER DOWN

1. Lever
2. Flat spot
3. Camshaft

NOTICE Crankshaft and camshaft must be locked at TDC ignition position to place camshaft timing gear and timing chain in the proper position.

5. Place camshaft timing gear along with the timing chain on the camshaft.

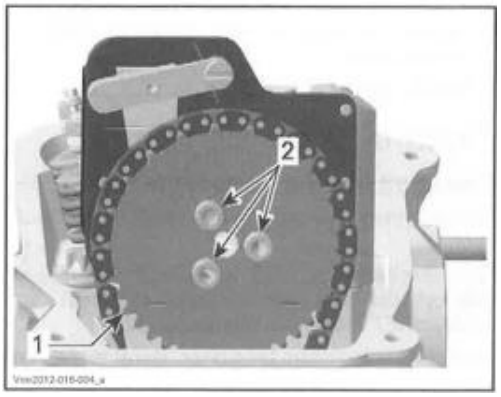
NOTE: The printed marks on the camshaft timing gear must be parallel to the cylinder head base.



1. Timing chain
2. Camshaft timing gear
3. Printed marks on camshaft timing gear

6. Install and adjust timing chain tensioner , refer to TIMING CHAIN TENSIONERS in this subsection.

7. Install and tighten camshaft timing gear retaining screws to specified torque.



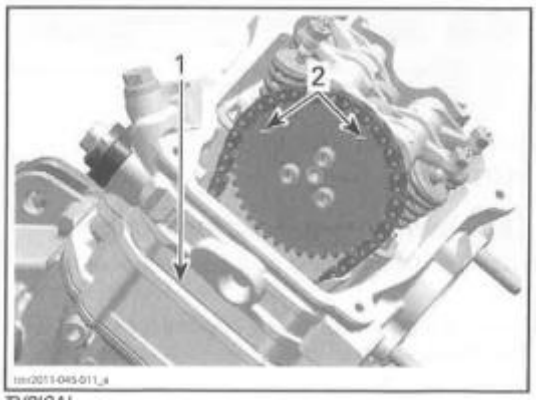
1. Camshaft timing gear
2. Timing gear retaining screws

CAMSHAFTTIMING GEAR RETAINING SCREWS	
Service product	卡夫特 K-0271
Tightening torque	10N·m±1N·m (89lbf·in 士 9lbf·in)

8. Remove the CAMSHAFTTIMING TOOL

Camshaft Timing

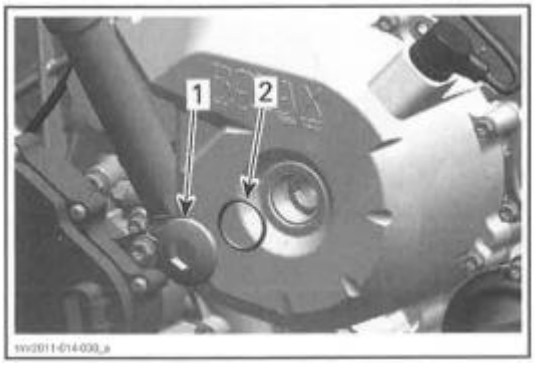
NOTE: If a piston (of cylinder1 or2) is set to TDC ignition, the camshaft timing gear of the opposite cylinder must be in the following position.



TYPICAL
1. Cylinder head base
2. Marks on timing gear of the opposite cylinder

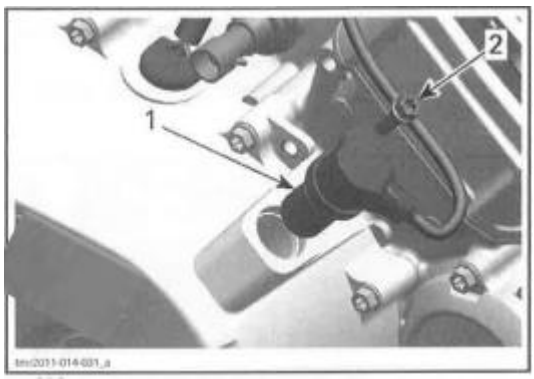
Camshaft Timing Piston No. 2 (rear)

1. Remove spark plugs of both cylinders
2. Remove valve covers of both cylinders.
3. Remove the plug and 0-ring of magneto cover.



1. Plug
2. O-ring

4. Remove the crankshaft position sensor (CPS),



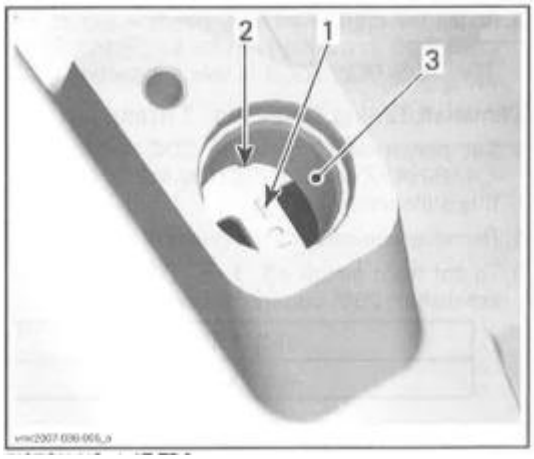
1. CPS
2. Screw

5. Set piston no. 2to TDC ignition by turning the crankshaft.

REQUIED TOOL
Allen key 14mm

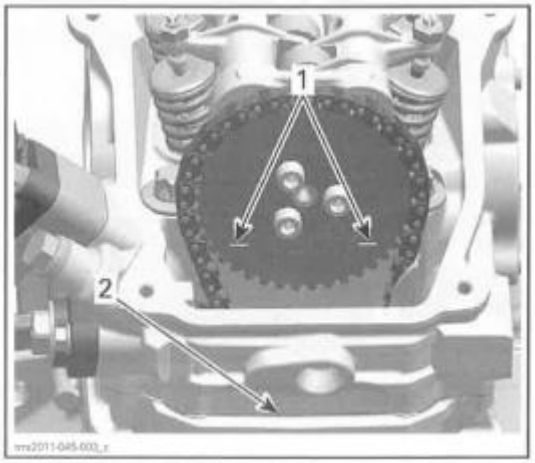
1. Allen key14mm

5.1 The rear piston is at TDC when it's index mark on the magneto flywheel is aligned with notch in the magneto cover.



PISTON N0. 2 AT TDC
1. Mark “2” on magneto flywheel
2. Notch on magneto cover
3. Crankshaft position sensor location

5.2 Confirm printed marks on the camshaft timing gear are parallel to cylinder head base, in the lower position.
NOTE: If printed marks on camshaft timing gear are not as specified, turn crankshaft 360°.
NOTE: In this position the piston is set to TDC ignition.



TYPICAL – PISTON AT TDC IGNTION
1. Printed marks on camshaft timing gear
2. Cylinder head base

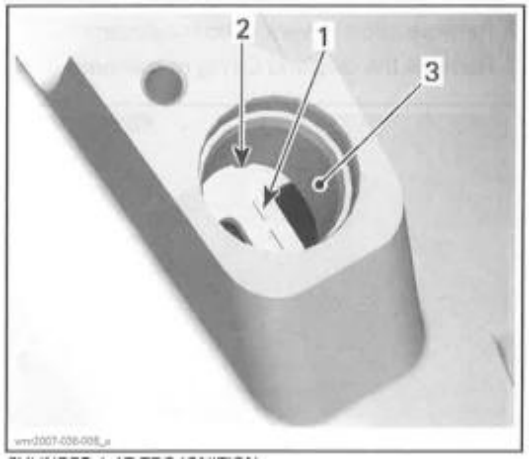
6. Install the crankshaft TDC position tool to lock crankshaft in position. Refer to CRANKSHAFT TDC POSITION TOOL in this subsection.

Camshaft Timing Piston No. 1 (front)

1. Set piston no. 2 (rear) to TDC ignition, see CRANKSHAFT TIMING PISTON NO. 2(READ) in this subsection.
2. Remove crankshaft TDC position tool.
3. To set front piston no. 1 to TDC ignition turn crankshaft 280° counterclockwise.

REQUIED TOOL
Allen key 14mm

TURN CRANKSHAFT 280°COIUNTERCLOCKWISE
1. Allen key14 mm
3.1 The front piston is at TDC when it's index mark on the magneto flywheel is aligned with the notch in the magneto cover.

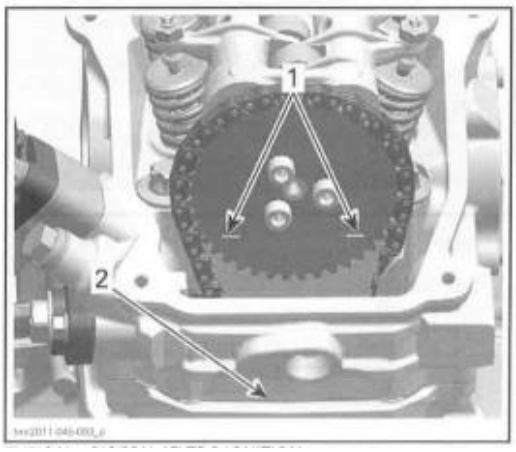


CYLINDER 1 AT TDC IGNTION

1. Mark “1” on magneto flywheel
2. Notch on magneto cover
3. Location of crankshaft position sensor

3.2 Confirm printed marks on the camshaft timing gear are parallel with cylinder head base, in the lowest position.

NOTE: In this position the piston is set to TDC ignition.



TYPICAL – PISTON AT TDC IGNTION

1. Printed marks on camshaft timing gear
2. Cylinder head base

Crankshaft TDC Position Tool

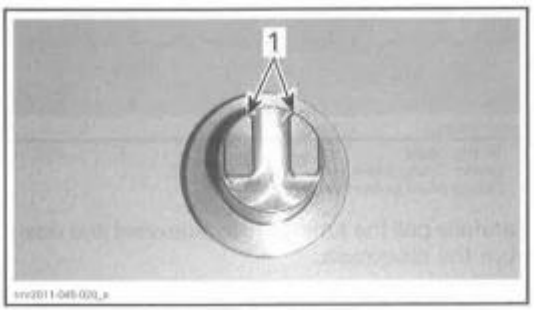
Installation

NOTICE Never use crankshaft TDC posotion tool to remove or tighten drive CVT screw or rotor retaining screw. Damage to the teeth of the trigger whell on the rotor will occur.

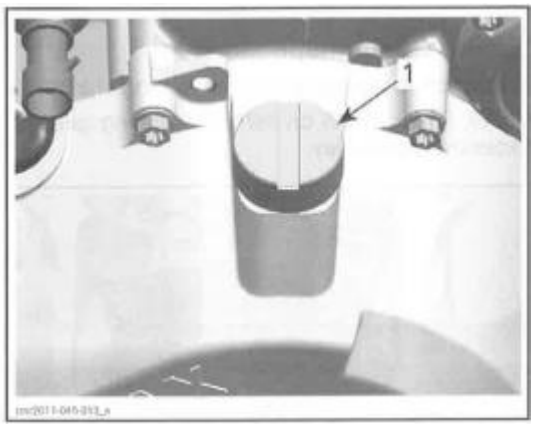
Install tool in magneto cover CPS bore.

REQUIED TOOL	
CRANKSHAFT TDC POSITION TOOL	

NOTE: Make sure to match the teeth on the crankshaft TDC position tool with the magneto rotor.



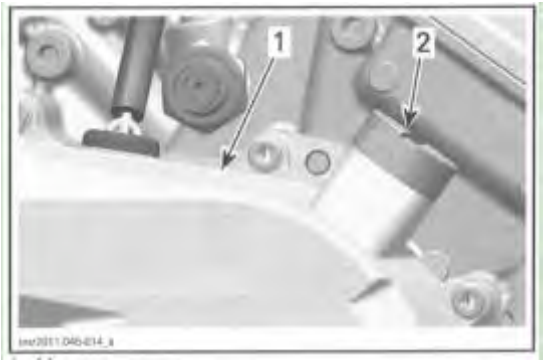
1. Crankshaft TDC position tool teeth (end view)



MAGNETO COVER

1. Crankshaft TDC position tool installed in CPS bore

NOTICE Tool must be fully inserted.



1. Magneto cover
2. TDC position tool

TIMING CHAIN

The engine is equipped with two timing chains.
- MAG side timing chain is located behind the magneto cover.
- PTO side timing chain is located behind the PTO cover.

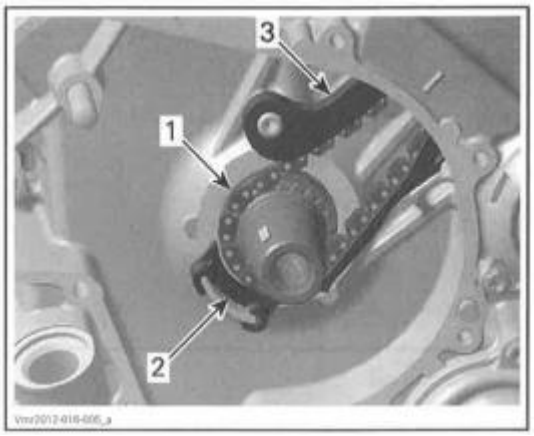
Removing the Timing Chain (MAG Side)

Refer to MAGENTO SYSTEM subsection and remove following parts:
- Magneto cover
- Rotor
- Sprag clutch gear.

Refer to TOP END subsection and remove following parts:
- Valve cover.

Refer to following procedures in this subsection and remove following parts:
- Chain tensioner
- Camshaft timing gear.

Remove timing chain guide (tensioner side) and lower timing chain guide.



1. Timing chain
2. Lower timing chain guide
3. Timing chain guide (tensioner side)

Carefully pull the timing chain downwards and sideways, then out of the crankcase.

Removing theTiming Chain (PTO Side)

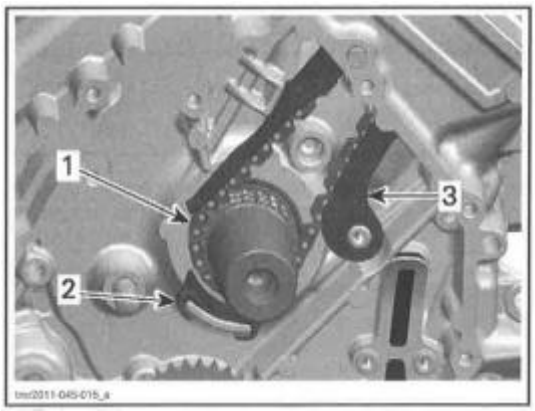
NOTE: Mark the operating direction of the timing chain and check for excessive radial play before removal. Refer to INSPECTING THETIMING CHAIN.

Refer to BOTTOM END subsection and remove following parts:
- PTO cover
- Breather gear
- Intermediate gear.

Refer to PTO END subsection and remove following parts:
- Valve cover.

Refer to following procedures in this subsection and remove following parts:
- Chain tensioner
- Camshaft timing gear.

Remove timing chain guide (tensioner side) and lower timing chain guide.

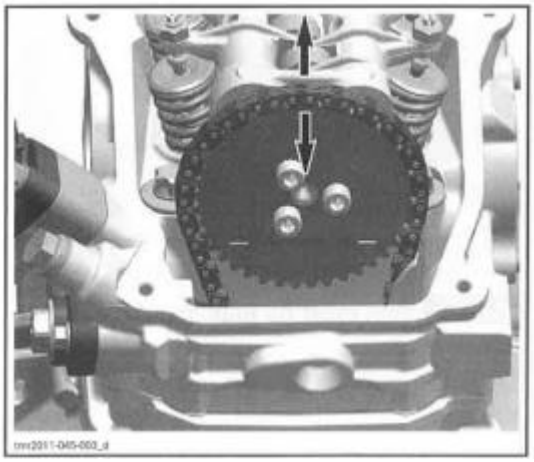


1. Timing chain
2. Lower timing chain guide
3. Timing chain guide (tensioner side)

Carefully pull the timing chain sideward and down from the crankcase.

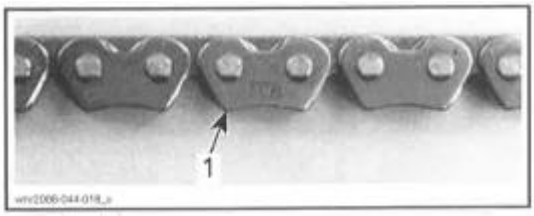
Inspecting the Timing Chain

Inspection is the same for both timing chains.
Check timing chain on camshaft timing gear for excessive radial play.



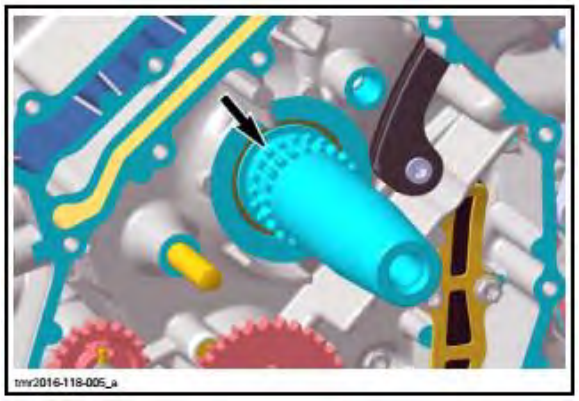
CHECK TIMING CHAIN RADIAL PLAY

Check chain condition for wear and teeth condition.



1. Timing chain

If chain is excessively worn or damaged, replace
it as a set (camshaft timing gear and timing chain).
Check timing chain guides for wear, cracks or deforming. Replace as required.
NOTE: Check also the timing chain guide (tensioner side).
Check if crankshaft timing gears are excessively worn or damaged.
Replace if necessary. Refer to CRANKSHAFT in the BOTTOM END subsection.

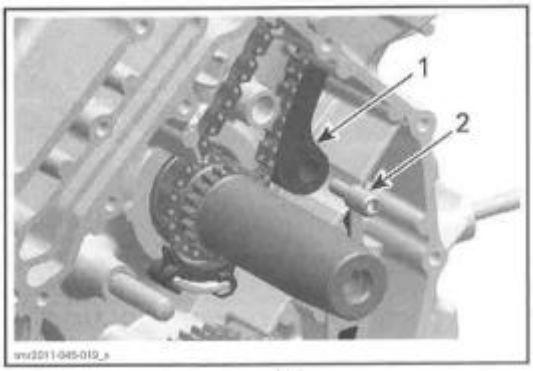


Installating theTiming Chain

The installation is essentially the reverse of the removal procedure, but pay attention to the following details.
NOTE: Installation is the same for both timing chains.
Install timing chain with camshaft timing gear.
NOTE: Ensure to carry out proper valve timing, refer to CAMSHAFT TIMING GEARS in this subsection.
NOTICE Improper valve timing will damage engine components.

TIMING CHAIN GUIDE

(TENSIONER SIDE)



1. Timing chain guide (tensioner side)
2. Bearing screw

Removing the Timing Chain Guide

(Tensioner Side)

Refer to TIMING CHAIN in this subsection

Inspecting the Timing Chain Guide

(Tensioner Side)

Check timing chain guide for wear, cracks or deforming. Replace if necessary.

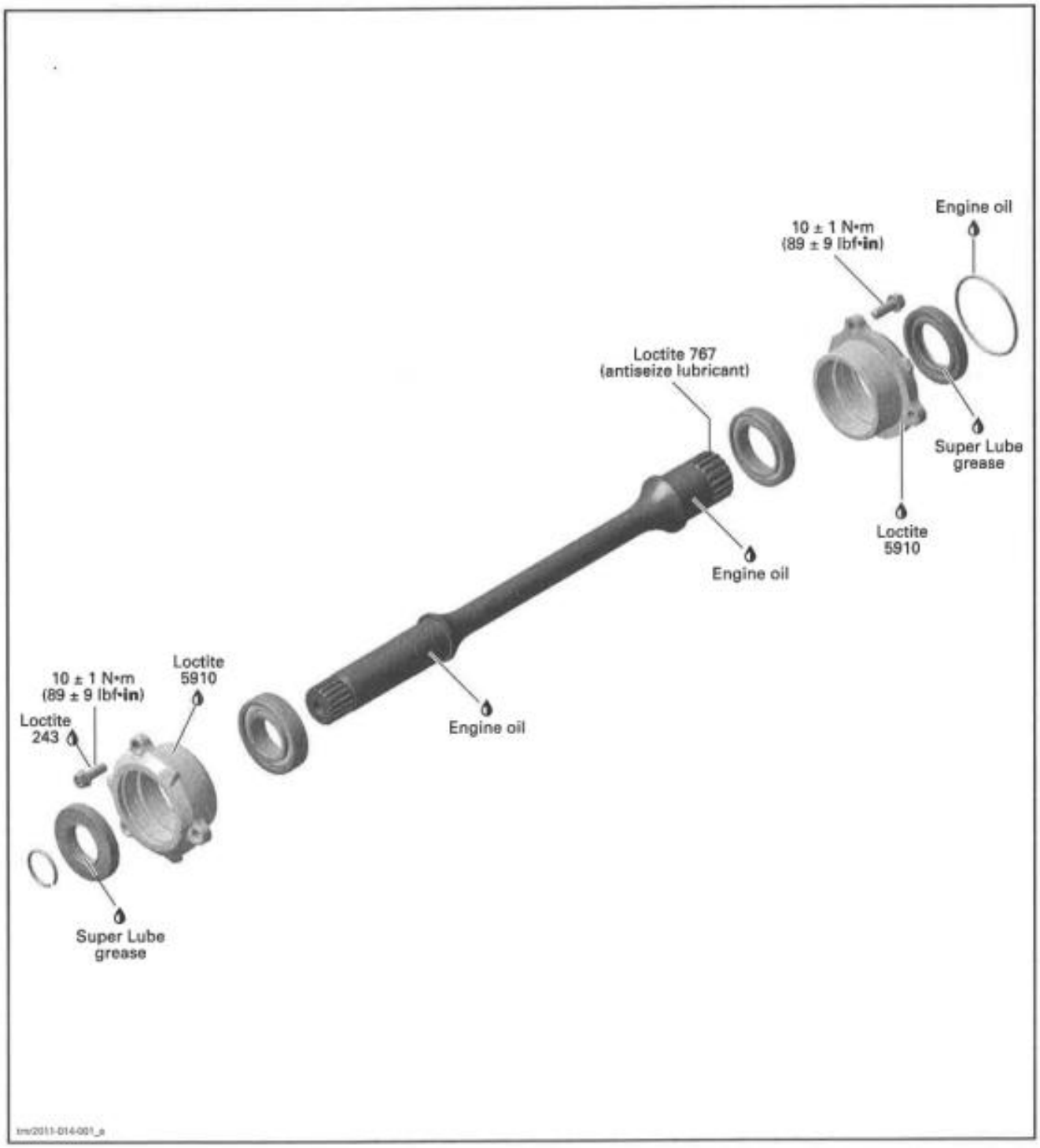
Insalling the Timing Chain Guide

(Tensioner Side)

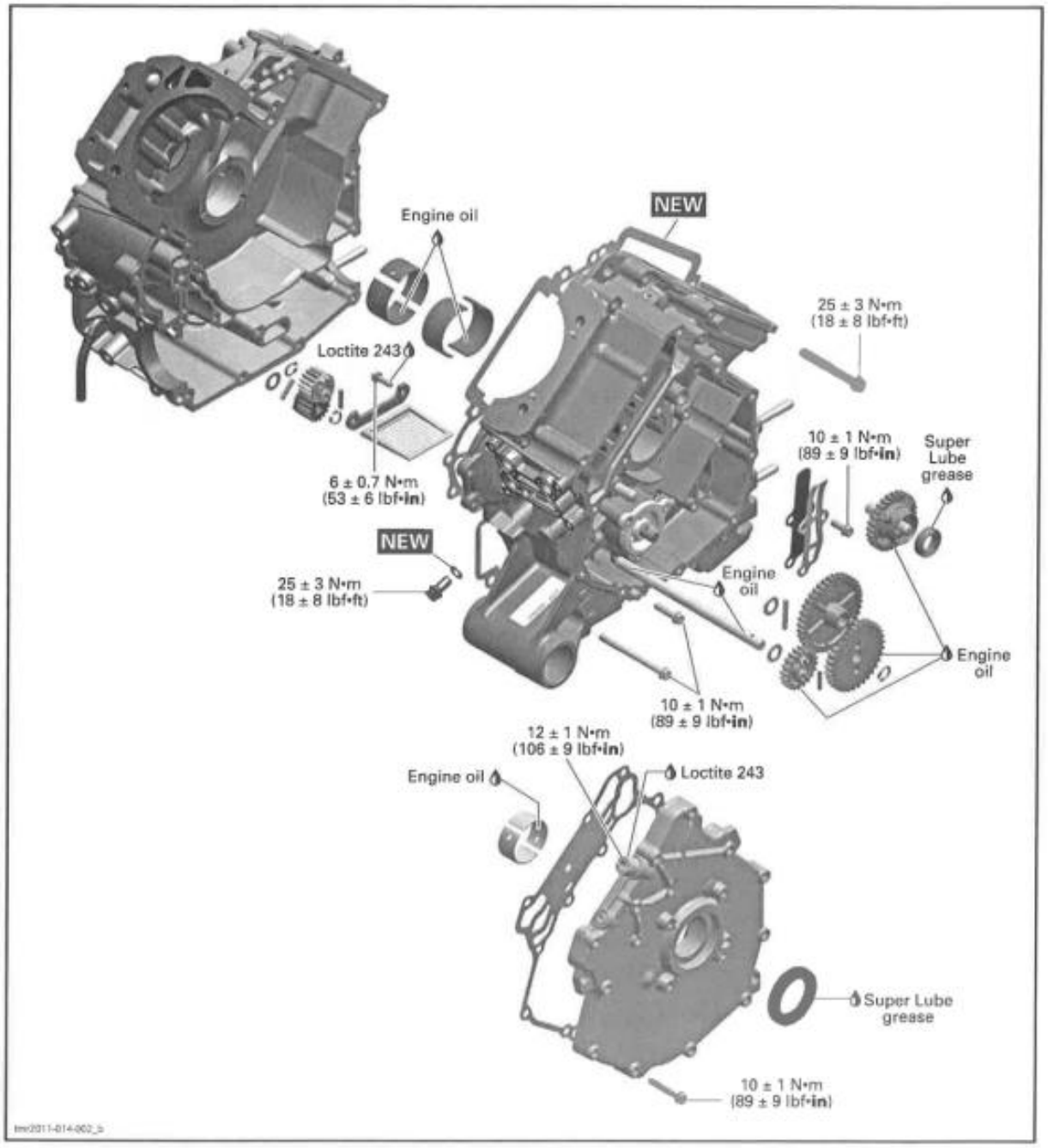
The installation is the reverse of the removal procedure.

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Timing chain guide bearing screw	10N·m 士 1 N·m (89lbf·in±9lbf·in)

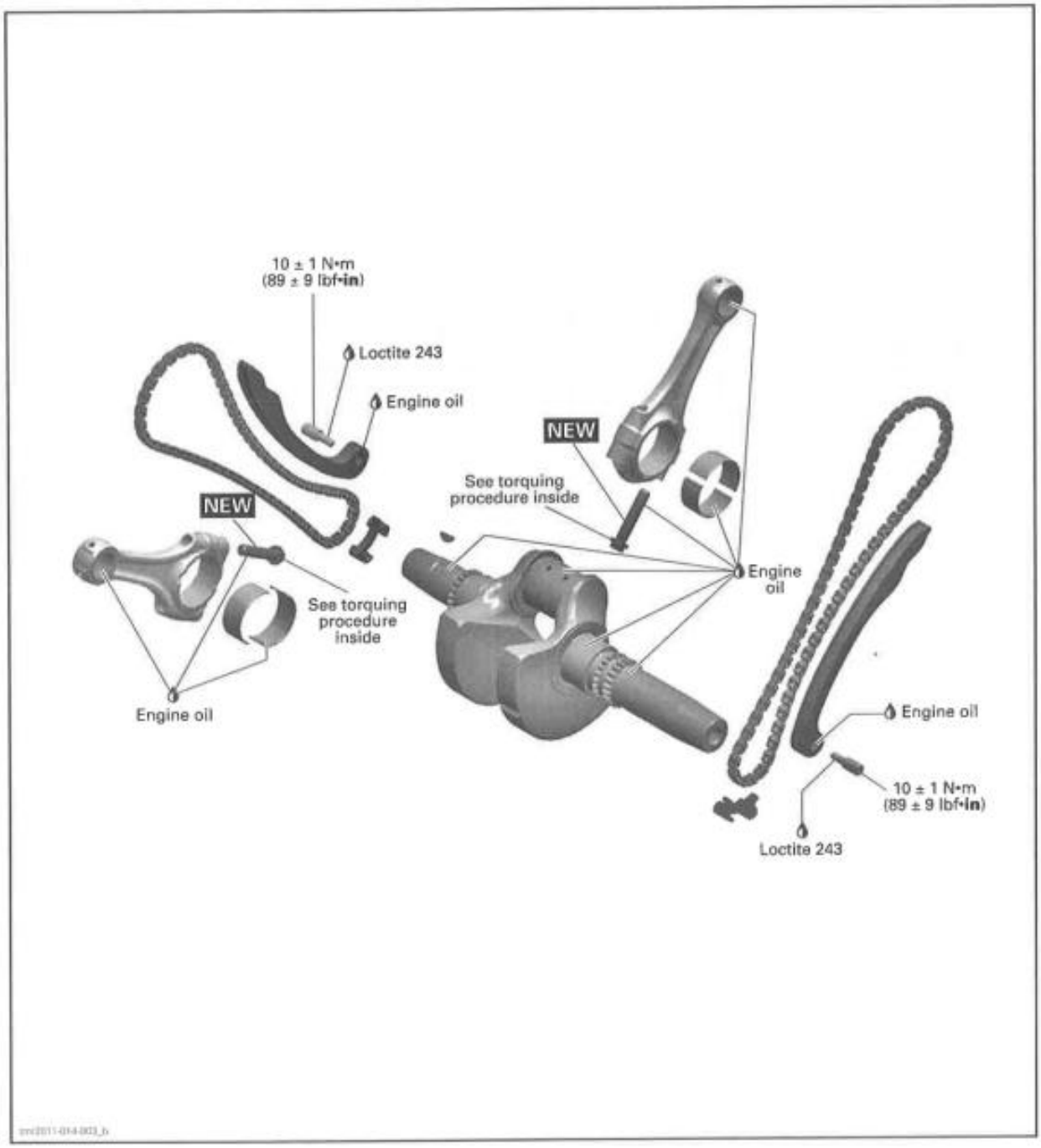
ENGINE DRIVE SHAFT



CRANKCASE AND PTO COVER



CRANKSHAFT


10 ± 1 N•m
(89 ± 9 lbf•in)
Loctite 243
Engine oil
NEW
See torquing procedure inside
NEW
See torquing procedure inside
Engine oil
Engine oil
Engine oil
10 ± 1 N•m
(89 ± 9 lbf•in)
Loctite 243

GENERAL

IMPORTANT: Note position of parts on disassembly. This may help to find the root cause of a problem. A component that is not replaced should be reinsta1led in the same position as originally mounted.

PROCEDURES

ENGINE DRIVE SHAFT

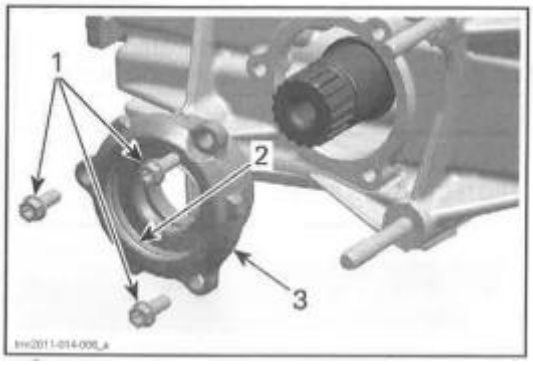
NOTE: The engine drive shaft transmits the power from the gearbox to the front differentia1 and is located inside the crankcase.

Removing the Engine Drive Shaft

Remove the engine. Refer to ENGINE REMOVAL AND INSTALLATION subsection.

Removing the Rear Bearing Cover Detach gearbox from engine, refer to GEARBOX AND 4×4 COUPING UNIT subsection.

Removing the bearing cover and its O-ring.



1. Bearing cover screws
2. O-ring
3. Bearing cover gearbox

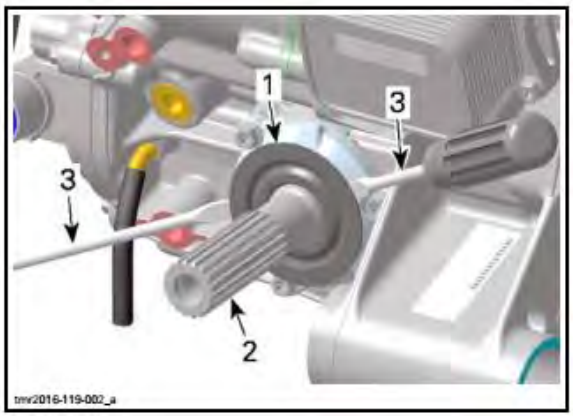
Removing the Front Bearing Cover

NOTE:The front bearing cover can be repalaced with the engine installed.

Life and support vehicle.

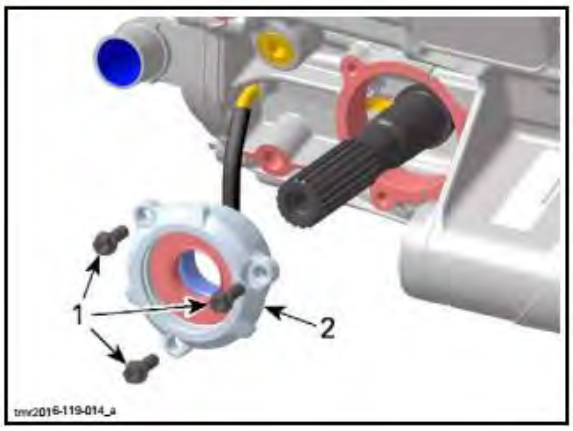
Remove the front drive shaft. Refer to FRONT DRIVE subsection.

Remove cover washer from drive shaft using 2 screw drives.



1. Cover washer
2. Drive shaft
3. Screwdrivers

Rrmove the bearing cover

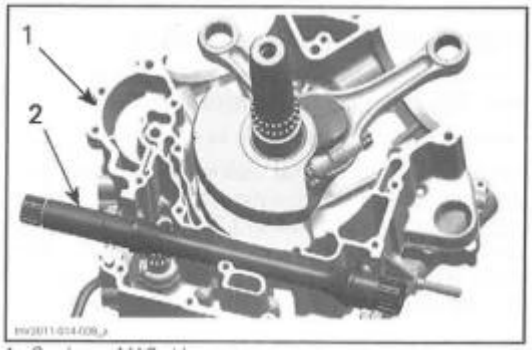


1. Bearing cover screws
2. Bearing cover

Removing the Engine Drive Shaft

Split crankcase , refer to CRANKCASE in this subsection.

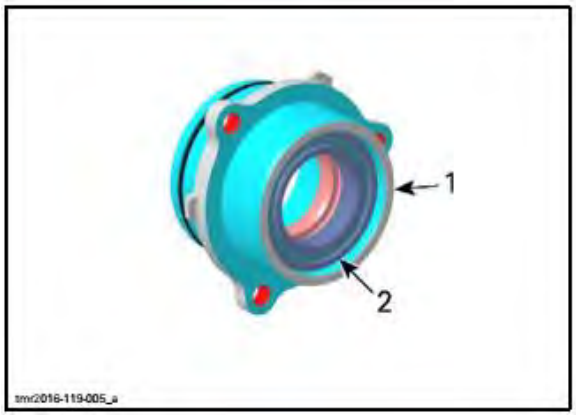
Remove engine drive shaft from the crankcase.



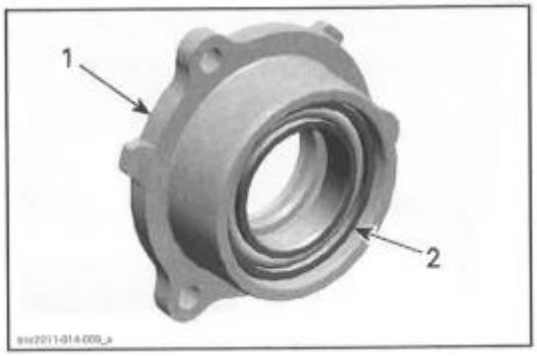
1. Crankcase MAG side
2. Engine drive shaft

Inspecting the Engine Drive Shaft

Replace oil seals and/or O-ring (bearing cover gearbox side) if they are brittle , hard or damaged.
Check drive shaft bearings for contamination and/or metal shavings. Check if bearings turn freely and smoothly. Replace if necessary.



1. Rear bearing cover
2. Drive shaft bearing

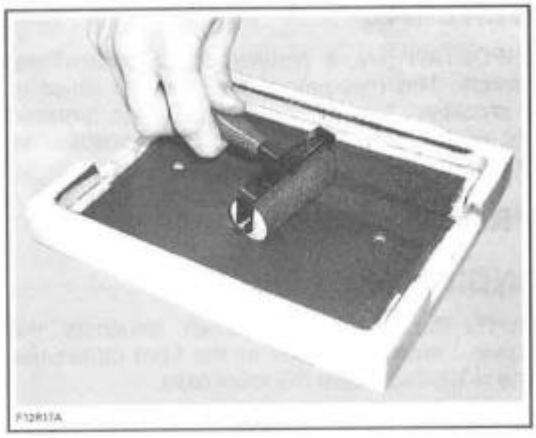


1.Front bearing cover
2. Drive shaft bearing

Check drive shaft for cracks, bend, pitting or other visible damages.
Check drive shaft splines for wear or damages.
Check oil seal running surface of the drive shaft for scratches. Replace if necessary.

Installating the Engine Drive Shaft

The installation is the reverse of removal procedure. Pay attention to the following details.
Clean all metal components in solvent.
Crankcase surfaces and bearing covers are best cleaned using a combination of LOCTITE CHISEL (GASKET REMOVER) and a brass brush. Brush a first pass in one direction then make the final
brushing perpendicularly (90°) to the first pass.
NOTICE Do not wipe with rags. Use a new clean hand towel only.
Use a suitable installer for installing bearings.
Use LOCTITE5910 on mating Su faces.
IMPORTANT: When beginning the application of the bearing cover sealant, the assembly and the first torquing should be done within10 minutes. it is suggested to have all you need on hand to save time.
Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller50mm-75mm (2in_3in), available in arts products suppliers for printing, and rol1 the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on bearing cover surfaces.



Do not apply in excess as it will spread out inside crankcase.

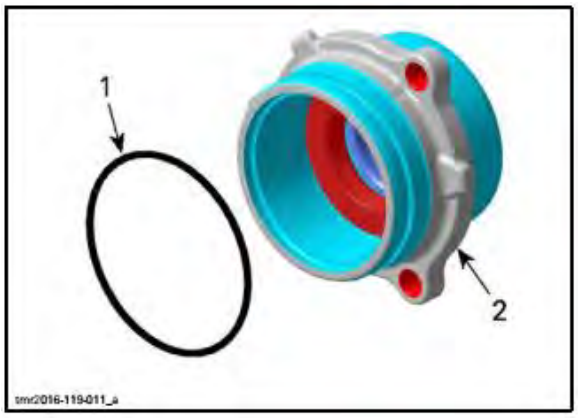
NOTE: It is recommended to apply this specific sealant as described here to get a uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant (using a finger w1ll not affect the adhesion).

Installating the Rear Bearing Cover

Check O-ring on bearing cover if brittle,hand or damaged Replace if necessary.

Luvricate O-ring.

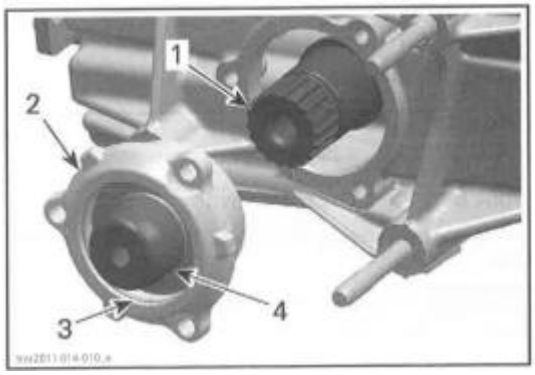
O-RING LUBRICATION	
Service product	Engine oil



1. O-ring
2. Bearing cover

For bearing cover installation on gearbox side, protect the oil seal to avoid damaging the sealing lip.

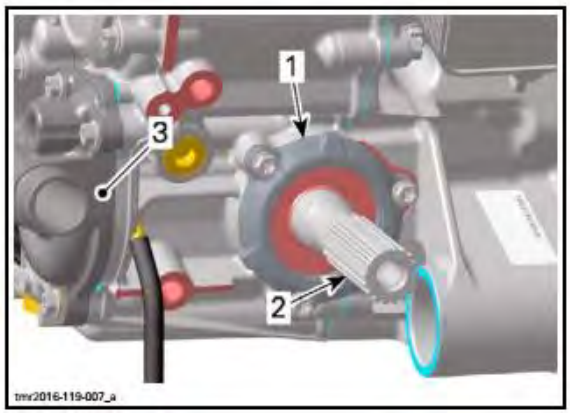
REQUIED	
ERIVE SHAFT OIL SEAL	



1. Drive shaft
2. Bearing cover gearbox side
3. O-ing
4. Protection sleeve

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Rear bearing cover screws	10N·m 士 1 N·m (89lbf·in 士 9lbf·in)

Installating the Front Bearing Cover

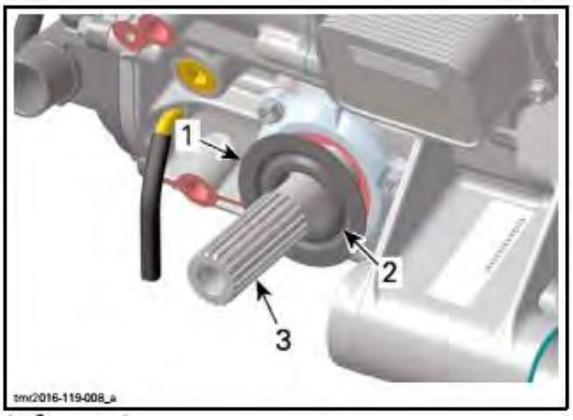


1. Bearing cover
2. Drive shaft
3. Water pump cover

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Front bearing cover screws	10N·m 士 1 N·m (89lbf·in 士 9lbf·in)

Place NEW cover washer on drive shaft.

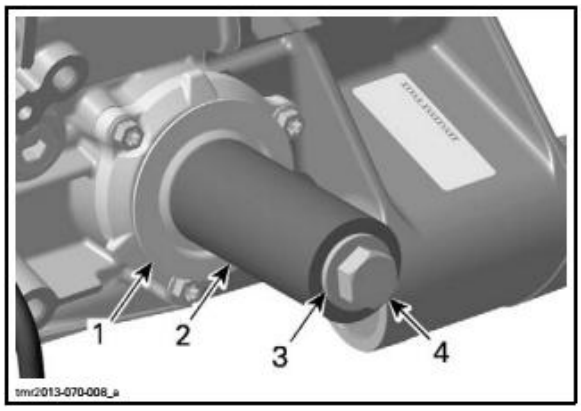
NOTE:Groove must face outwards the engine



1. Cover washer
2. Groove
3. Drive shaft

Press cover washer on drive shaft

REQUIED YOOL	
COVER WASHER INSTALLER	
Flat washer	
M12×1.25×35 hexagonal screw	



1. Cover washer
2. Cover washer installer
3. Flat washer
4. M12×1.25×35 hexagonal screw

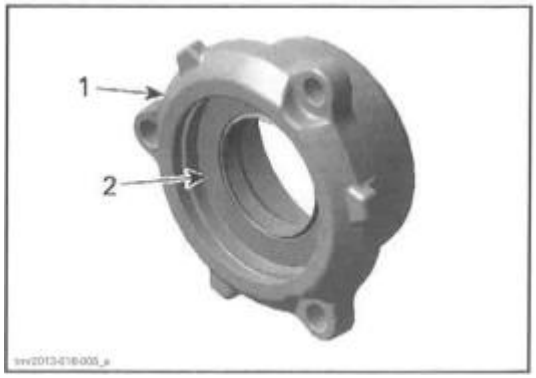
Installating the Engine Drive Shaft

Finally check for axial play of the drive shaft

Front Oil Seal Replacement

(Engine Drive Shaft)

1. Remove front propeller shaft.Refer to FRONT DRIVE subsection
2. Remove the front bearing cover, refer to ENGINE DRIVE SHAFT REMOVAL / INSTALLATION in this subsection.
3. Remove drive shaft seal from bearing cover.



1. Bearing cover
2. Oil seal

4. Install drive shaft oil seal.

1. Bearing cover
2. Oil seal
3. Oil seal installer

REQUIED TOOL	
ERIVE SHAFT OIL SEAL INSTALLER	

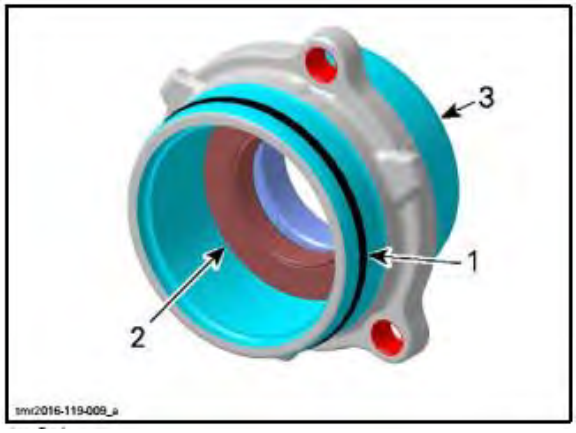
5. Reinstall remaining parts in the reverse order of removal.

REAR OIL SEAL

(ENGINE DRIVE SHAFT)

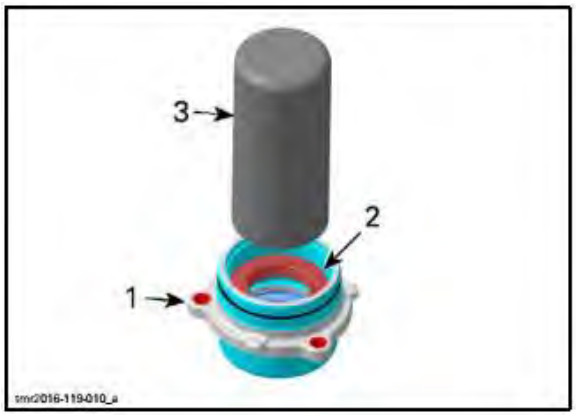
Rear Oil Seal Replacement (Engine Drive Shaft)

1. Remove rear bearing cover , refer to ENGINE DRIVE SHAFT REMOVAL / INSTALLATION in this subsection.
2. Remove drive shaft seal from bearing cover.



1. Bearing cover
2. O-ring
3. Bearing cover

3.Install drive shaft oil seal.



1. Bearing cover
2. Oil seal
3. Oil seal installer

REQUIED	
ERIVE SHAFT OIL SEAL	

4. Reinstall remaining parts in the reverse order of removal.

PTO COVER OIL SEAL

To replace oil seal it is not necessary to remove engine from vehicle.

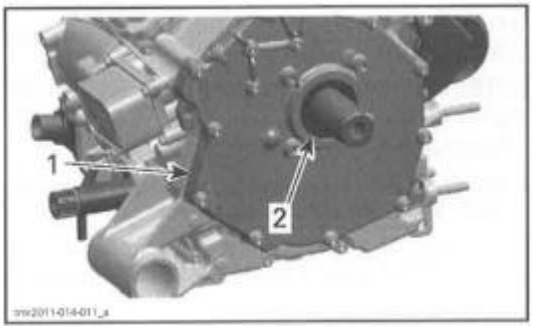
Removing the PTO Oil Seal

Refer to CONTINUOUSLY VARLABLE TRAINSMISSION (CVT) subsection to remove the following parts:

- CVT cover
- Drive pulley
- Driven pulley
- CVT air guide.

Remove oil seal with a small flat screwdriver.

NOTICE Avoid scoring surfaces with tool.



1. PTO cover
2. Oil seal

Inspecting the PTO Oil Seal

Check oil seal running surface of crankshaft PT0

side for grooves. Replace if necessary.

Installating the PTO Oil Seal

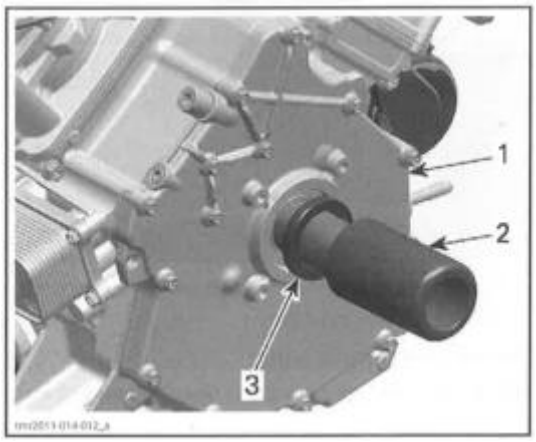
The installation is the reverse of the removal procedure.

Pay attention to the following details.

NOTICE Oil seal must be installed with sealing lip toward the engine.

Push oil seal in place.

REQUIED TOOL	
PTO COVER OIL SEALINTALLER	



1. PTO cover
2. Oil seal installer
3. Oil seal

PTO COVER

Removing the PTO Cover

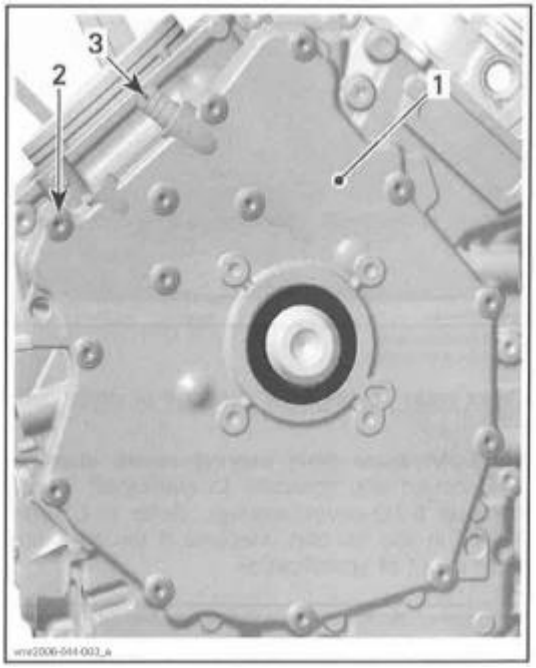
Refer to CONTINUOUSLY VARLABLE TRAINSMISSION (CVT) subsection to remove the following parts:

- CVT cover
- Drive pulley
- Driven pulley
- CVT air guide.

Disconnect vent hose.

Remove PTOcover screws and pul1 PTO cover.

▲WARNING
Always wear skin and eye protection. Chemicals can cause skin rash, skin burns and severe eye injury.



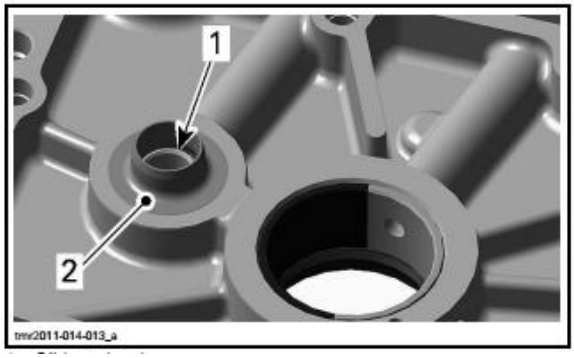
1. PTO cover
2. PTO cover screws
3. Vent hose nipple

Inspecting the PTO Cover

Check the PTO cover for cracks or other damage. Replace PTO cover if damaged.

Clean oil breather bore in PTO cover from contaminations with part cleaner then use pressurized air to dry it.

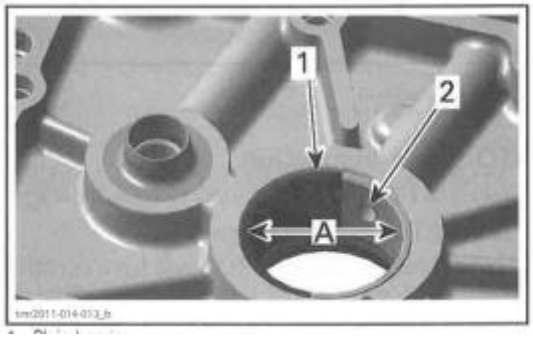
Check surface of sealing sleeve for wear or other damages. Replace PTO cover if damaged.



1. Oil breather bore
2. Surface of sealing sleeve

Check plain bearings for scorings or other damages.

NOTE: Measure plain bearing inside diameter (PTO cover) and compare to crankshaft journal Diameter (PTO cover bearing). Refer to CRANK SHAFT in this section.Replace if the measurement is out of specification.



1. Plain bearing
2. Oil bore

A. Measure plain bearing inside diameter

PLAIN BEARING INSIDE DIAMETER (PTO COVER)	
SERVICE LIMIT	34.120 mm(1 .3433 in)

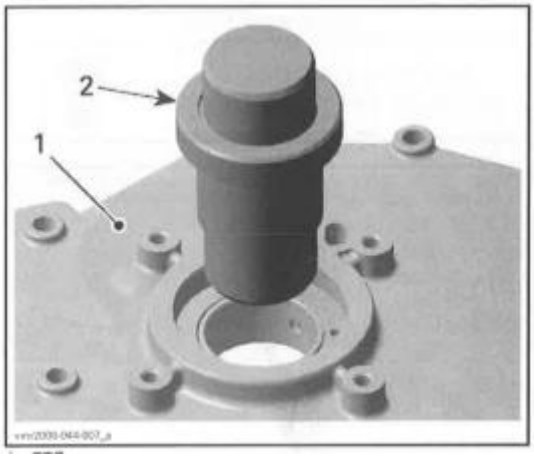
Plain Bearing Replacement (PTO Cover)

Removing the Plain Bearing

NOTICE Unless otherwise instructed, never use a hammer to install plain bearings. Use a press only. Carefully remove the PT0 oil seal with a screwdriver, without damaging the PT0 cover. Press out the plain bearings from the outside towards the inside.

REQUIED TOOL	
PLAIN BEARING REMOVER / UNSTALLER	

The PTO cover has to be supported from below with suitable support with straight surface, in order to prevent damage of the sealing surface.



1. PTO cover
2. Plain bearing remover /installer

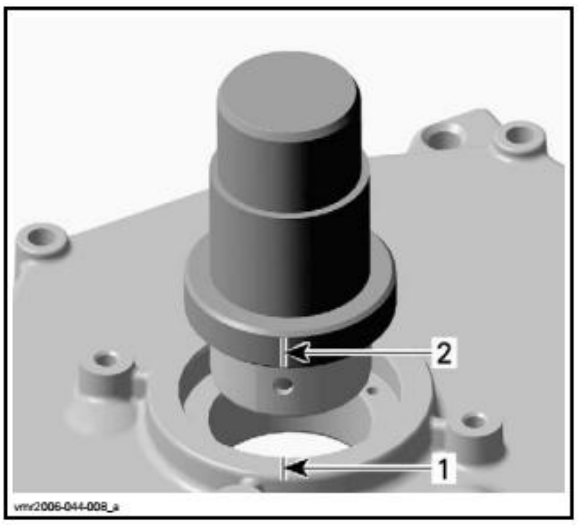
Installating the Plain Bearing

NOTE: Do not lubricate plain bearings and/or PT0 cover for installation.

Install plain bearings in a cool PTO cover.

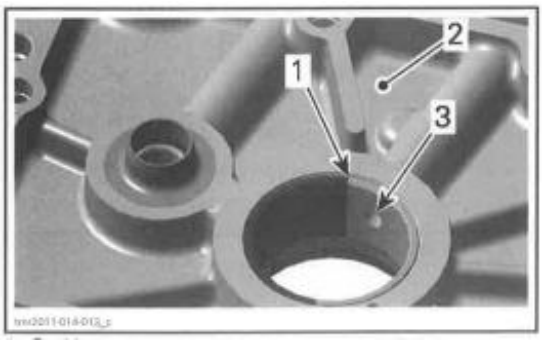
REQUIED TOOL	
PLAIN BEARING REMOVER / UNSTALLER	

NOTICE Mark position of oil bore on PTO cover and on plain bearing remover/installer. Align mark on plain bearing remover/installer with mark on PTO cover.



1. Mark position of oil bore on PTO cover
2. Mark position of oil bore on plain bearing remove/installer

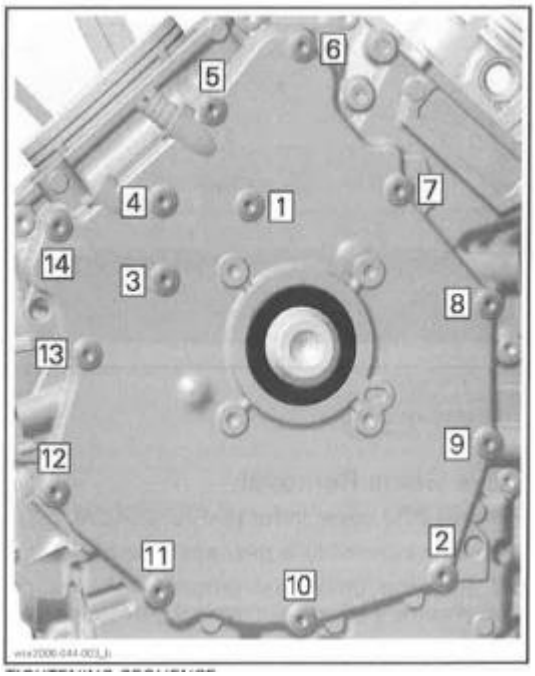
Carefully press-in the plain bearings in the same direction as during disassembly, from the outside towards the inside. Support PT0 cover with suitable support with straight surface, in order to prevent damage of the sealing surface.
NOTE: Wrong oil bore position will stop oil supply to plain bearings and wil1 damage the engine.
NOTICE The partition of the plain bearings must be positioned near to oil bore in counterclockwise direction.



1. Partition
2. PTO cover (inside)
3. Oil bore

Installating the PTO Cover

For installation, reverse the removal procedure. Pay attention to the following details.
NOTE: At installation, replace PTO cover gasket and oil seal.
Tighten PTO cover screws following the illustrated sequence.



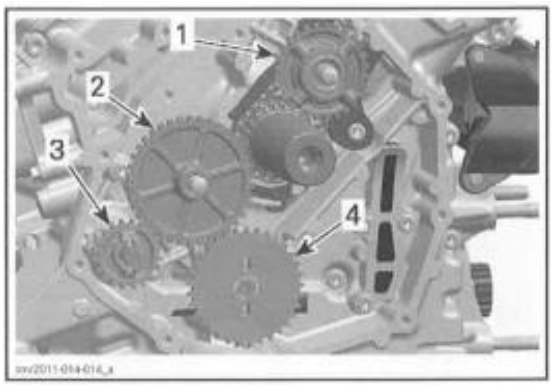
TIGHTENING SEQUENCE

TIGHTENING TORQUE	
PTO cover screws	10N·m ± 1 N·m (89lbf·in ± 9lbf·in)

DRIVE GEARS

Drive Gears Location

The engine is equipped with a breather gear which prevents engine oil coming out through the breathing system into the air intake system. The drive gears are located on the engine PTO side behind the PTO cover.

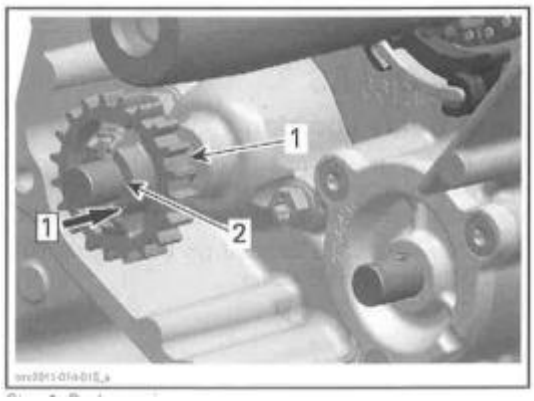


1. Breather gear
2. Intermediate gear
3. Water pump drive gear
4. Oil pump drive gear

Removing the Drive Gears

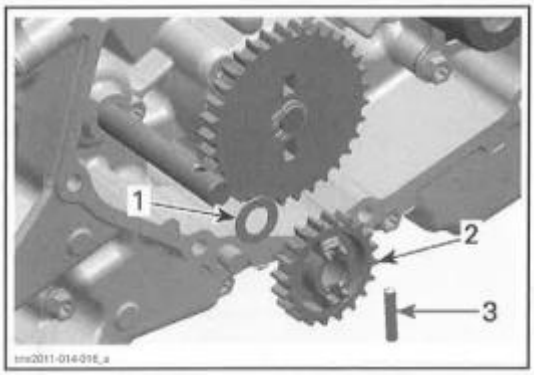
Remove PTOcover (refer to PTO COVER).
Withdraw intermediate gear and breather gear.

For oil pump drive gear removal, refer to OIL PUMP in the LUERICATION subsection.
To remove water pump drive gear, pull the shaft assembly a bit out and turn it about one teeth until it stays out.
Then push water pump drive gear in.



Step: Push gear in
1. Water pump drive gear
2. Intermediate shaft

Remove needle pin and pull water pump drive gear out.
Remove thrust washer from intermediate shaft.



1. Thrust washer
2. Water pump drive gear
3. Needle pin

Inspecting the Drive Gears

Intermediate Gear/Oil Pump Drive Gear/Water Pump Drive Gear
Inspect gears for wear or other damage. Replace
if damaged.

Breather Gear

Check if oil seal is brittle, hard or damaged. Replace
if necessary.

1. Breather gear
2. Oil seal

Inspect gear for wear or other damage.
Check ball bearing for excessive play and smooth operation. Replace breather gear assembly if necessary.

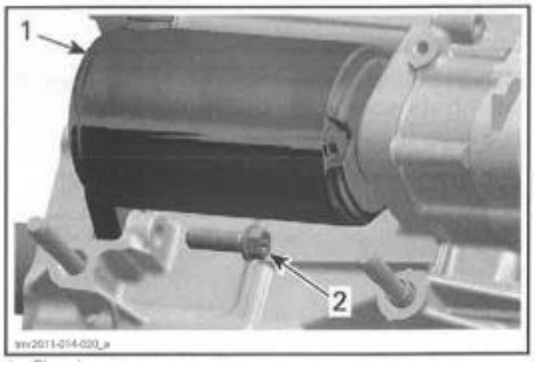
Installating the Drive Gears

The installation is essentially the reverse of the removal procedure.
Adequately oil the ball bearing of the breather gear.

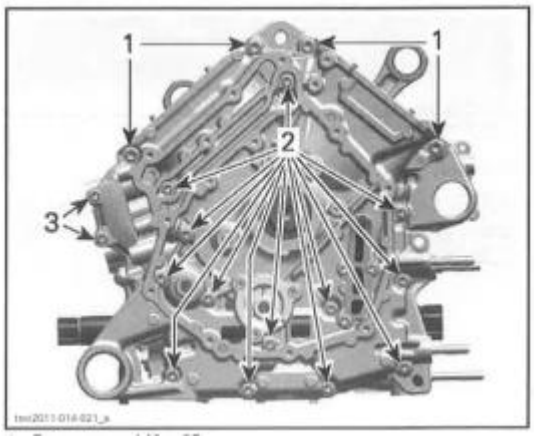
CRAN KCASE

Disassembing the Crankcase

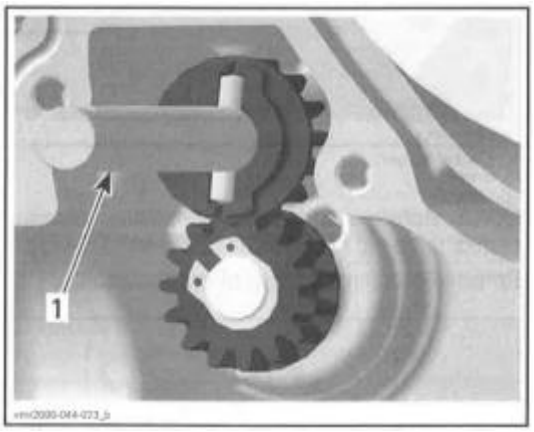
1. Refer to PEROIDIC MAINTENANCE PROCEDURES subsection and:
1.1 Drain cooling system.
1.2 Drain engine oil.
1.3 Drain gearbox oil.
2. Lock crankshaft. Refer to CRANKSHAFT LICKING PROCEDURES in the this subsection.
3. Refer to COUNTINUOUSLY VARIABLE TRAINSMISSION (CVT) subsection to remove following parts:
- CVT cover
- Drive pulley
- Driven pulley
- CVT air guide.
4. Remove engine from vehicle. Refer to ENGINE REMOVAL AND INSTALLATION subsection.
5. Detach gearbox from engine. Refer to GEARBOX AND 4×4 COUPLING UNIT .
6. Refer to MAGENTO SYSTEM subsection to remove the following parts:
- Magneto cover
- Rotor with sprag clutch gear
- Starter drive gears.
7. Refer to following procedures in this subsection to remove the following parts:
- PTO cover
- Drive gears
- Bearing covers of engine drive shaft.
8. Refer tonM/~0 al-1l,4//Vsubsection to remove following parts:
- Chain tensioners
- Camshaft timing gears
- Timing chains
- Timing chain guides.
9. Refer to TIMING CHAIN subsection to remove following parts:
- Front cylinder head
- Rear cylinder head
- Cylinders.
10. Refer to COOLING SYSTEM subsection to remove following parts:
- Water pump housing.
11. Refer to LUBRICATION SYSTEM subsection to remove following parts:
-Oil filter
-Oil cooler
-Oil pump drive gear.
NOTE: Oil pump removal from crankcase is not necessary, but recommended to see condition of oil pump (refer to LUBRICATION SYSTEM subsection).
12. Remove electric starter.



1. Electric starter
2. Screw
NOTE: Before splitting the crankcase, measure crankshaft axial play. Refer to CRANKSHAFT.
Remove retaining screws of crankcase.

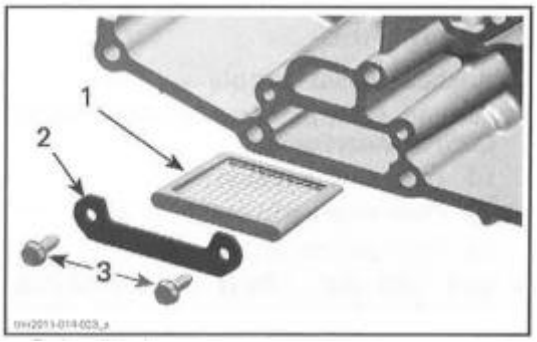


1. 4 screws M8x65
2. 13 screws M16x75
3. 2 screws M6x25
Carefully split crankcase halves.
NOTE: During disassembly, do not damage the sealing surfaces of the crankcase halves.
Pull crankshaft out of crankcase.
Remove the water pump intermediate shaft.



1. Water pump intermediate shaft

Remove engine oil strainer.
NOTE: Oil strainer removal for inspection and cleaning is recommended. Refer to LUBRICATION SYSTEM subsection.



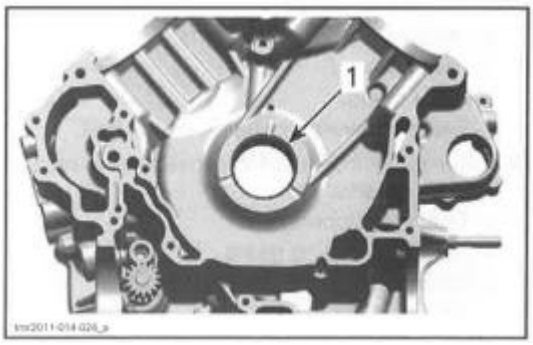
1. Engine oil strainer
2. Retaining plate
3. Screws

Cleaning the Crankcase

Clean crankcase using a part cleaner.
Dry crankcase using compressed air .
Blow the oil supply lines.

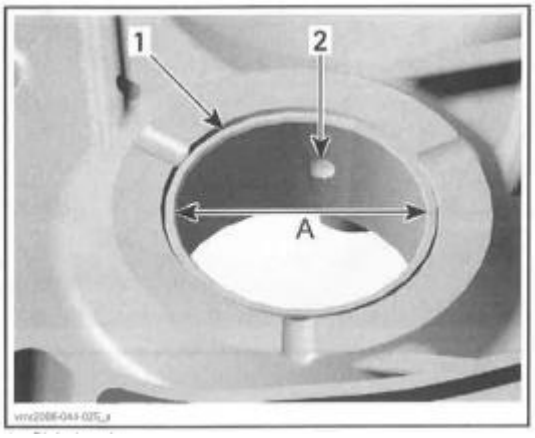
Inspecting the Crankcase

Check crankcase halves for cracks or other damage. Replace if damaged.
Check MAG and PTO plain bearings in for scoring or other damages.



1. Plain bearing

NOTE: Measure plain bearing inside diameter and compare to PT0/MAG main journa1 diameters of crankshaft (refer to CRANKSHAFT). Replace if the measurements are out of specification.



1. Plain Bearing
2. Oil bore
A. Measure plain bearing inside diameter

MAIN BEARING INSIDE DIAMETER(PTO/MAG)	
SERVICE LIMIT	42.100 mm(1 6575in)

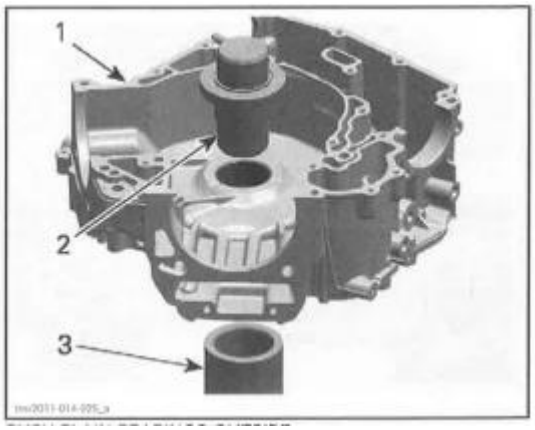
Plain Bearing Replacement (Main)

Removing the Plain Bearing

NOTICE Always support crankcase halves properly when 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 bearings.
Carefully press the plain bearings out, from the crankcase half inside towards the outside.

REQUIED TOOLS	
CRANKCASE SUPPORT MAG/PTO	
PLAIN BEARING REMOVER/INSTALLER	

NOTE: During disassembly, make sure not to damage the sealing surfaces of the crankcase halves.

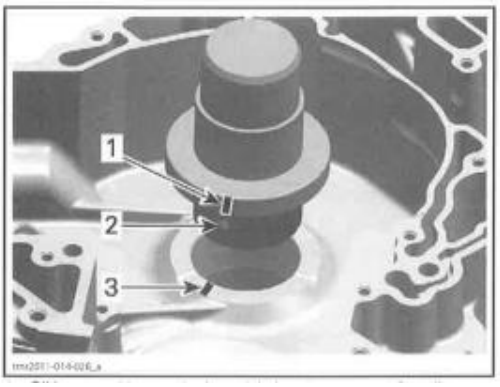


PUSH PLAIN BEARING OUTSIDE
1. Crankcase half
2. plain bearing remover/installer
3. Crankcase support sleeve

Installating the Plain Bearing (Main)
NOTICE Unless otherwise instructed, never use hammer to install plain bearings. Use press only.
NOTE: Place the proper crankcase support sleeve under crankcase halves before installing the plain bearings (refer to BEARING REMOVAL PROCEDURE)
Carefully press in the plain bearings in the same direction as during disassembly, from the crankcase inside towards the outside.
During reassembly, make sure not to damage the sealing surfaces of the crankcase halves.
Install plain bearings in a cold crankcase.
NOTE: Do not lubricate plain bearings and/or crankcase for installation.

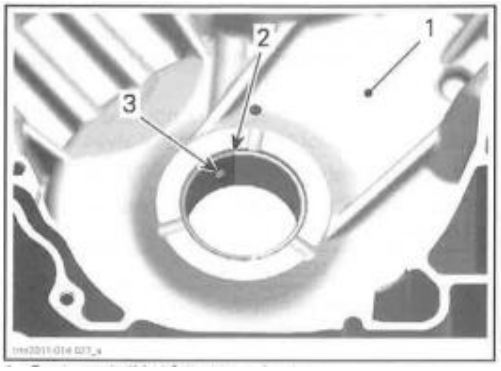
REQUIED TOOLS	
PLAIN BEARING REMOVER/INSTALLER	

Use an O-ring (φ42×1 mmto1.5mm (.04into.06in) thickness) to hold plain bearings in place during installation .The O-ring will disappear in the groove
of the plain bearing remover/installer.
Mark position of plain bearing oil bore on plain bearing remover/installer.
Mark position of oil bore on crankcase half.
Align mark on plain bearing remover/installer with mark on crankcase half.



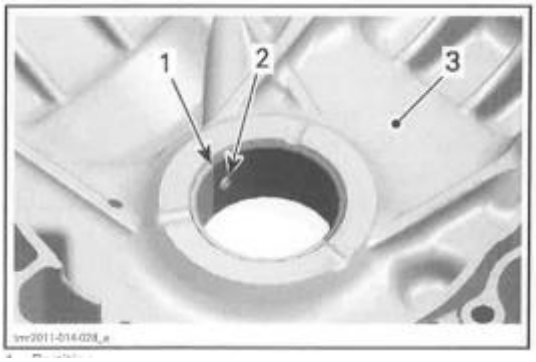
1. Oil bore position marked on plain bearing remover/installer
2. Plain bearing oil bore
3. Oil bore position marked on crankcase

NOTICE Misalignment of the plain bearing and crankcase oil bores will prevent proper oil supply to plain bearings.
Carefully press in the plain bearings from inside the crankcase towards the outside.
NOTICE The partition of the plain bearings in crankcase half MAG side must be positioned near to oil bore in clockwise direction.



1. Crankcase half MAG (inside surface)
2. Partition
3. Oil bore

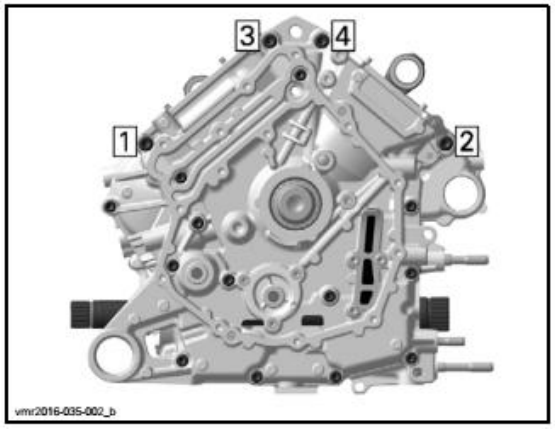
NOTICE The partition of the plain bearings in crankcase half PT0 side must be positioned near to oil bore in counterclockwise direction.



1. Partition
2. Oil bore
3. Crankcase half PTO (inside)

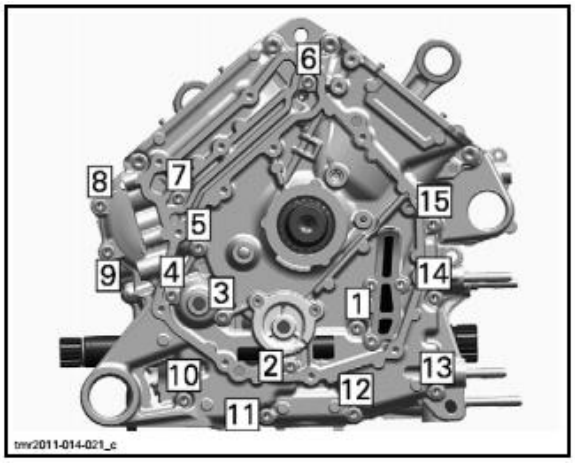
Assembing the Crankcase

The assembly of crankcase is essentially the reverse of removal procedure. However, pay attention to the following details.
Install a NEW crankcase gasket.
Oil the plain bearings before mounting the crankshaft.
NOTICE Correctly reinstall crankshaft (refer to CRANKSHAFT)
Properly reinstall engine oil strainer and screws. Refer to LIBRICATION SYSTEM subsection.
Reinstall water pump intermediate shaft and gears. Refer to WATER PUMP GEARS in the COOLING SYSTEM subsection.
Tightening sequence for screws on crankcase is as per following illustration.



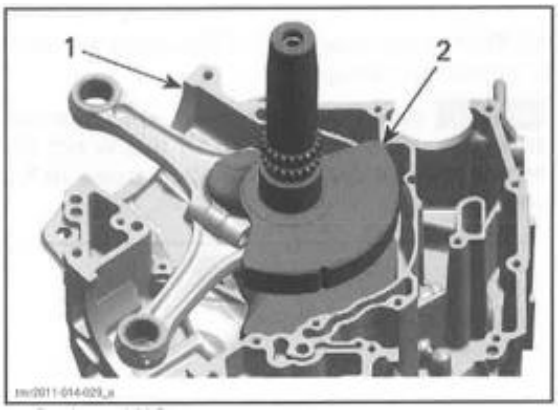
M8 SCREWS TIGHTENCE SEQUENCE

TIGHTENING TORQUE	
M8 crankcase screws	25N·m±3N·m (18lbf·ft±2 lbf·ft)



TIGHTENING TORQUE	
M6 crankcase screws	10N·m±1N·m (89lbf·ft±9lbf·ft)

CRANK SHAFT



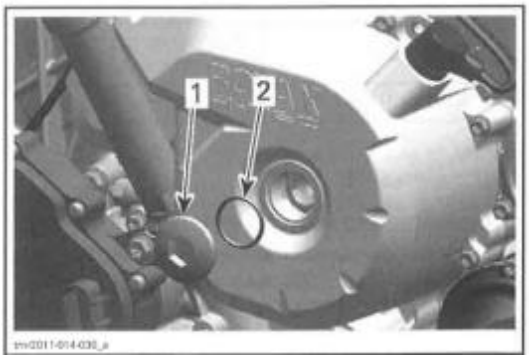
1. Crankcase MAG
2. Crankshaft

Crankshaft Locking Procedure

NOTE: When crankshaft is locked, the rear piston no. 2 is at TDC. Crankshaft can not be locked at piston no.1 TDC.
NOTICE To see if the rear piston no. 2 is at TDC ignition refer to CRANKSHAFT TIMING GEAR in the TIMING CHAIN subsection.

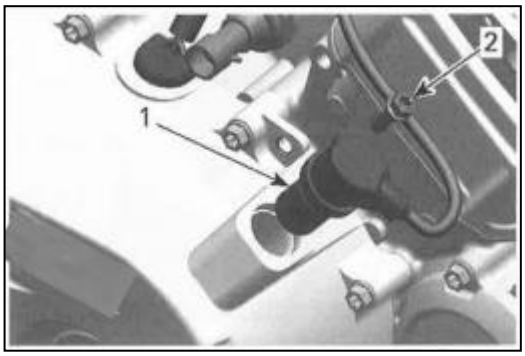
Remove:

1. Spark plug cables and spark plugs of both cylinders.
2. Plug screw and 0-ring of magneto cover.



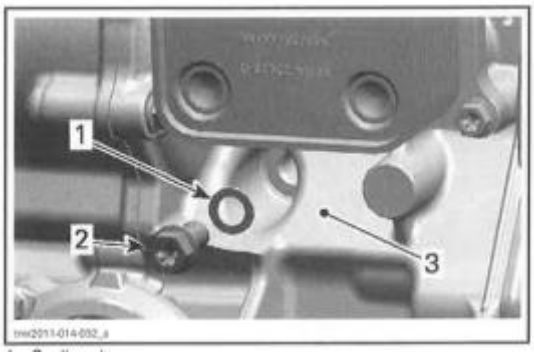
1. Plug screw
2. O-ring

3. Crankshaft position sensor.



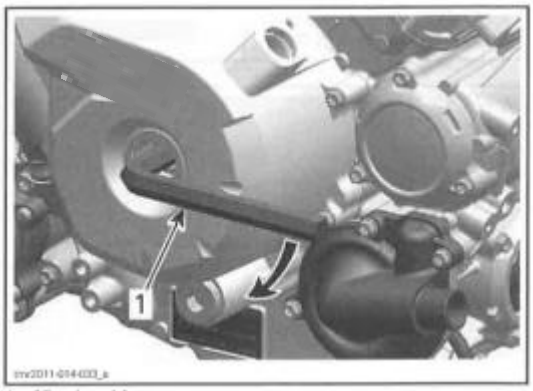
1. Crankshaft pisition sensor
2. Screw

4. Plug screw and discard sealing ring



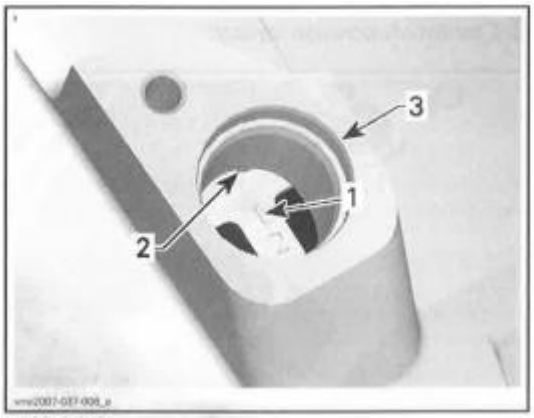
1. Sealing ring
2. Plug screw
3. Crankcase PTO side, front side

Use a 14 mm Allen key to turn crankshaft until piston no. 2 is at TDC.



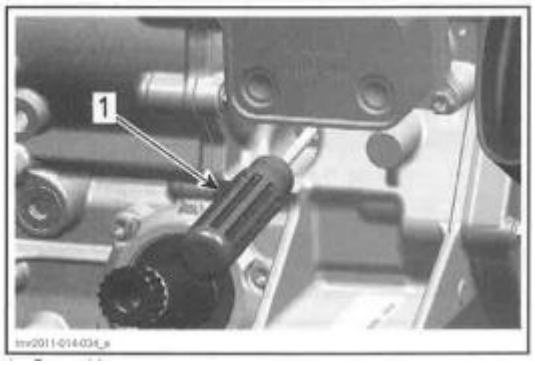
1. Allen key14 mm

When rear piston is at TDC marks on magneto flywheel "2" and on the magneto cover are aligned .



1. Mark“2”on magneto flywheel
2. Notch on magneto cover
3. Crankshaft position sensor location

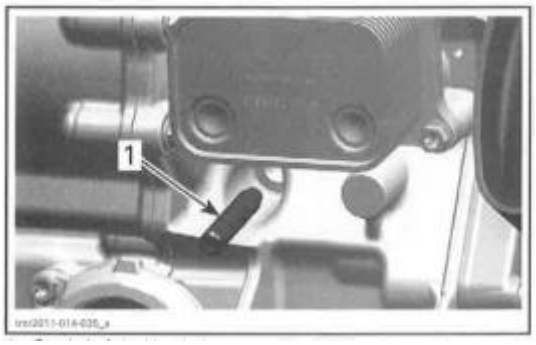
Use a screwdriver to check if the groove in the crankshaft is aligned with the hole.



1. Screw driver

Lock crankshaft

REQUIED TOOL	
CRANKSHAFT LOCKING	



1. Crankshaft locking bolt

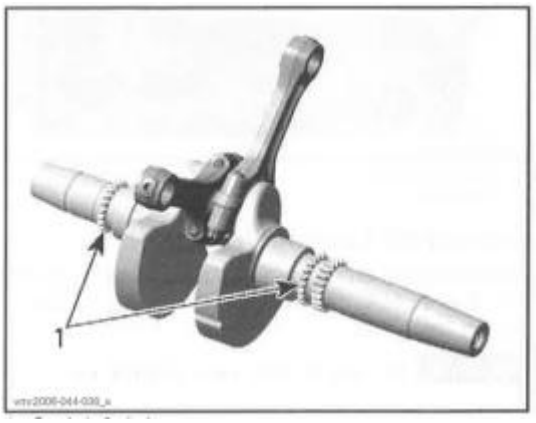
Gradually insert the tool in the crankshaft groove. Make sure that the tool tip enters the groove and does not jam on the crankshaft balancer surface.

Removing theCrankshaft

Refer to CRANKCASE

Inspecting the Crankshaft

NOTE: Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear.
NOTE: Replace crankshaft if the gears are worn or otherwise damaged.
NOTICE Components out of specifications always have to be replaced .If this is not observed, severe damage may be caused to the engine.



1. Crankshaft timing gears

Crankshaft Axial Play

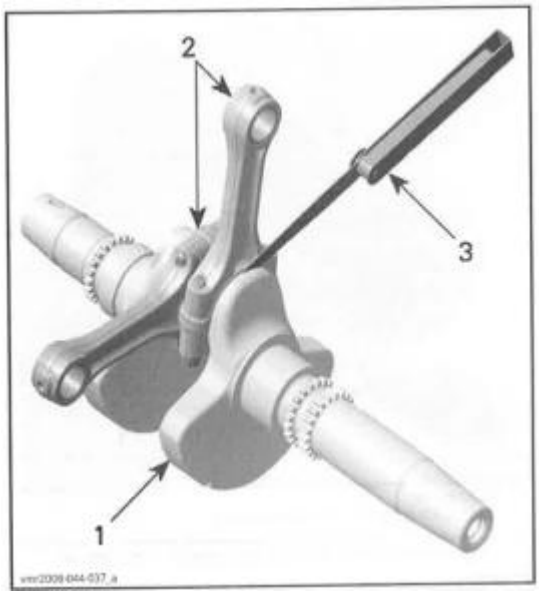
NOTE: Axial play needs to be measured before splitting the crankcase.
Measure play on PT0 end, using a dial indicator.

CRANKSJAFT AXIAL PLAY	
NEW	0.200 mm to 0.500 mm (.008in to.02in)
SERVICE LIMIT	0.600 mm(.024in)

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

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rods and crankshaft counterweight . If the distance exceeds specified tolerance, replace the crankshaft.



1. Crank shaft
2. Connecting rods
3. Feeler gauge

CONNECTING ROD BIG END AXIAL PLAV		
HD8 ENGINE	NEW	0.200 mm to 0.500 mm (.008in to.02in)
	SERVICE LIMIT	0.600 mm(.024in)
HD10 ENGINE	NEW	0.250 mm to 0.550 mm (.01 in to.022in)
	SERVICE LIMIT	0.600 mm(.024in)

Connecting Rod/Piston Pin Clearance

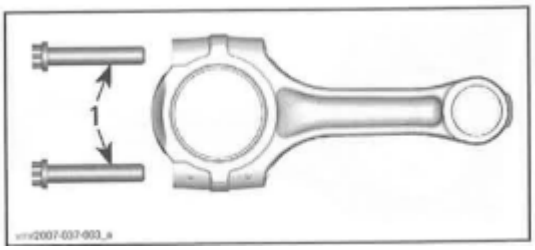
Refer to TOP END section.

Connecting Rod Big End Radial Play

NOTE: prior to remove connecting rod from the crankshaft, mark big end halves together to ensure a correct reinstallation (cracked surface fits in only one position).

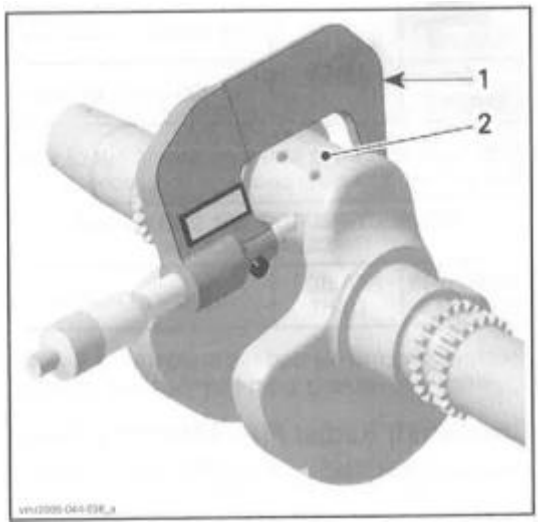
Remove connecting rods from crankshaft.

NOTICE Connecting rod screws are not reusable. Always discard screws and replace by NEW ones. It is recommended to install new plain bearings when reinstalling connecting rods.



1. Connecting rod screws

Measure crankpin . Compare to inside diameter of connecting rod big end.



1. Micrometer
2. Crankpin area for plain bearing

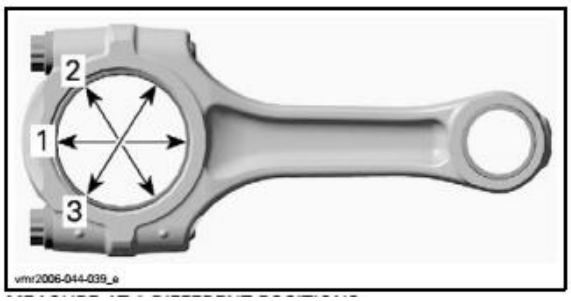
CRANK PIN DIAMETER		
HD8 ENGINE	NEW	40.009mm to40.025mm (1.5752in to1.5758in)
	SERVICE LIMIT	39.990 mm(1 .5744in)
HD10 ENGINE	NEW	41 .986 mm to42.010 mm (1 653in to1.6539in)
	SERVICE LIMIT	41 967mm(1 6522 in)

If the crank pin diameter is out of specification, replace crankshaft.

To measure the connecting rod big end diameter, use the OLD connecting rod screws.

Install the OLD plain bearings as they were mounted initia11y.

Carry out the tightening procedure described in CRANKSHAFT ASSEMBLY in this subsection.



MEASURE AT 3 DIFFERENT POSITIONS

CONNECTING ROD BIG END RADIAL		
HD8 ENGINE	SERVICE LIMIT	40.100mm(1.5787in)
HD10 ENGINE		42.100mm(1.6575in)

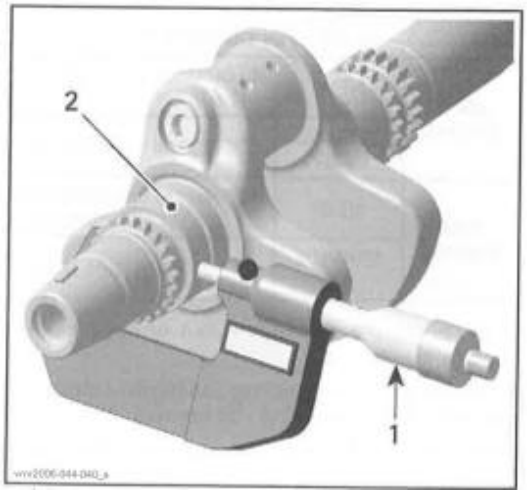
If connecting rod big end diameter is out of specification, replace plain bearings and recheck.

CONNECTING ROD BIG END RADIAL CLEARANCE		
HD8/HD10 ENGINES	SERVICE LIMIT	0.09mm(.0035in)

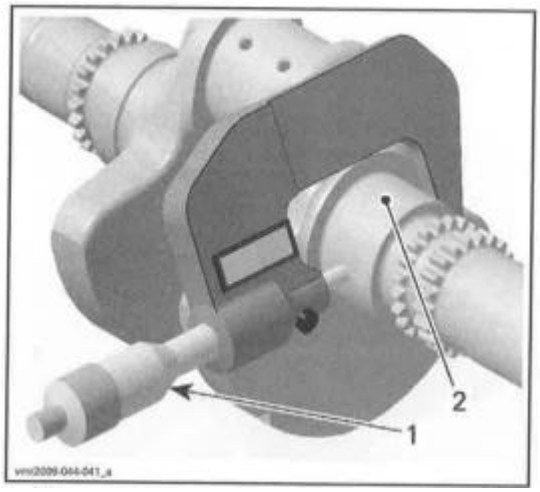
If connecting rod big end radial clearance is out of specification, replace plain bearings and recheck.

Crankshaft Radial Play MAG/PTO Side

Measure crankshaft on MAG/PTO side . Compare to inside diameter of MAG/PT0 plain bearing (refer to CRANKCASE).



1. Micrometer
2. Crankshaft area for MAG plain bearing



1. Micrometer
2. Crankshaft area for PTO plain bearing

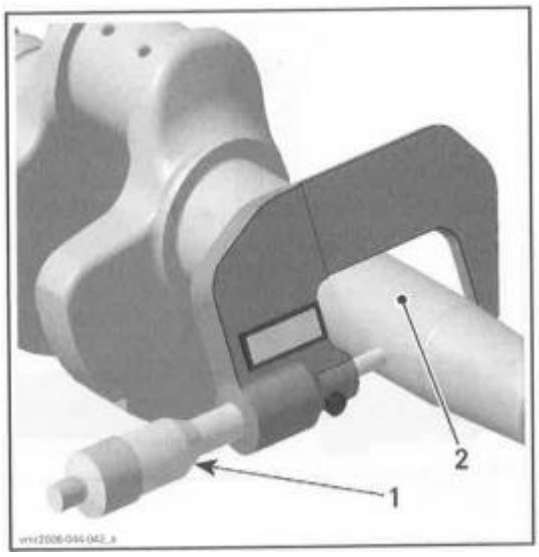
CRANKSHAFT MAIN BEARING JOURNAL DIAMETER (MAG/PTO SIDE)	
NEW	42.016mm to42.040mm (1.6542in to1.6551 in)
SERVICE LIMIT	42.000mm(1.6535in)

CRANKSHAFT RADIAL PLAY (MAG/PTO SIDE)	
SERVICE LIMIT	0.07 mm(.0028in)

Crankshaft Radial Play

(PTO Cover Bearing)

Measure crankshaft journal diameter (PTO cover bearing) . Compare to plain bearing inside diameter (PTO cover). Refer to PTO COVER in this subsection.



1. Micrometer
2. Crankshaft journal (PTO support bearing)

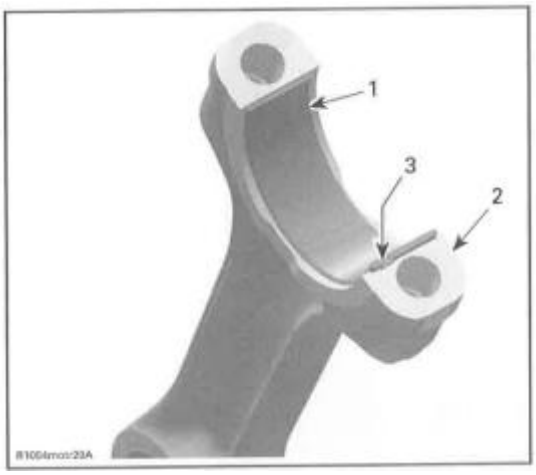
CRANKSHAFT JOURNAL DIAMETER (PTO COVER BEARING)	
NEW	34.004mm to34.020 mm (1.3387ln to1.3394in)
SERVICE LIMIT	33.998 mm(1 3385in)

CRANKSHAFT RADIAL PLAY (PTO COVER BEARING)	
SERVICE LIMIT	0.10 mm(.0039 in)

If crankshaft journal diameter is out of specification, replace crankshaft.
If crankshaft radial play (PTO cover bearing) out of specification, replace plain bearings and recheck.

Assembling the Crankshaft Assembly

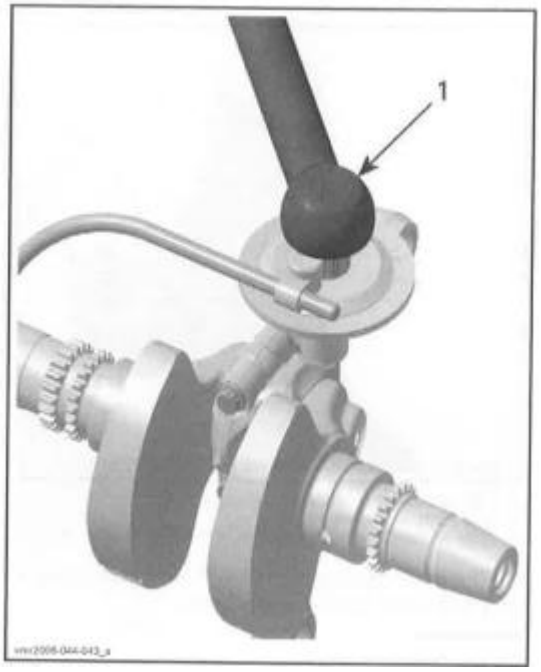
For assembly, reverse the disassembly procedure.
Pay attention to following details.
Clean the split surface on both sides (cracked area) carefully with compressed air.
Put plain bearings correctly in place.



1. Half plain bearing of connecting rod big end
2. Split surface of the connecting rod
3. Nose of plain bearing in line with connecting rod groove

Oil the plain bearing surface of the connecting rod and crank pin before installation.
NOTICE Lower cap and rod must match together since there is a cracked surface.
Oil NEW connecting rod screws
NOTICE Always use NEW connecting rod screws at final assembly. They are not reusable.
Thread screws in the connecting rods, then tighten as per fo11owing procedure.
NOTICE Strictly adhere following instructions:
- Do not apply any thread locker.
- The running direction of the big end bearings and of the piston pins must not chan9e.
- Always perform each step on both connecting rod
-Failure to strictly follow procedure may cause connecting rod screws to loosen and lead to Severe engine damage.

REQUODE TOOLS
Torque wrench
Angle torque wrench

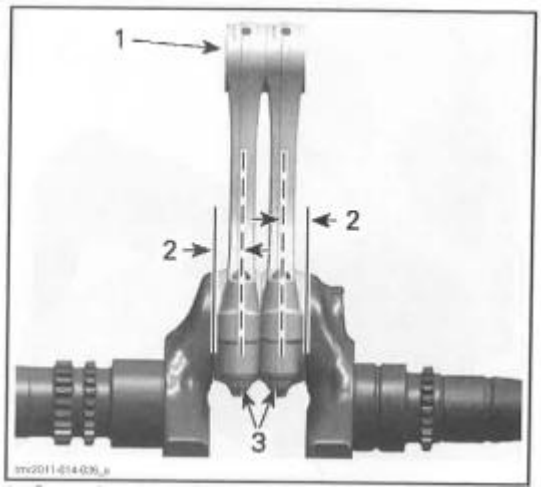


1. Angle torque wrench

HD8 Engine:
NOTE: NEW connecting rods can be installed either way.

CONNECTING RODS SCREWS TIGHTENING SEQUENCE	
1	Tighten to1/2 of specified torque
2	Tighten to20N·m±2N·m (15lbf·ft±1 lbf·ft)
3	Torque by an additional 60 ± 5° turn using an angle torque wrench

HD10 Engine:
NOTICE Connecting rods are asymmetric.
There must be no gap between the small ends when they face each other.



1. Connecting rod small ends
2. Connecting rod offset
3. Connecting rod screws

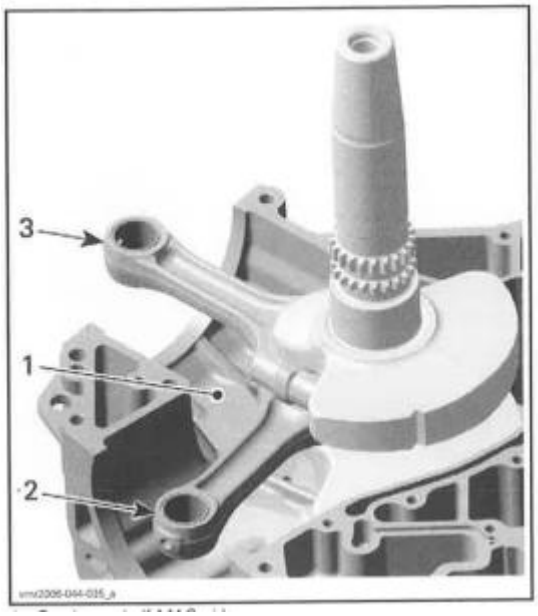
CONNECTING RODS SCREWS TIGHTENING SEQUENCE	
1	Tighten to1/2 of specified torque
2	Tighten to30N·m±2N·m (22lbf·ft 土 1 lbf·ft)
3	Torque by an additional 90±5° turn using an angle torque wrench

Crankshaft Installating

For installation of crankshaft in crankcase reverse the removal procedure. Pay attention to the fol_ lowing details.

Do not mix up the connecting rods of cylinders1 and2 during installation.

NOTICE Observe the correct installation position when fitting the crankshaft with the connecting rods. The connecting rod MAG side has to face cylinder no. 1.



1. Crankcase half MAG side
2. Connecting rod cylinder 1
3. Connecting rod cylinder 2

TRANSMISSION (CVT)

GENERAL

NOTE:For a better understanding,the following illustration are taken with engine out of vehicle.

To perform the following instruction,it is not necessary to remove engine.

This CVT is lubrication free. Never lubricate any components except drive pulley hub.

△WARING
Never touch CVT while engine is running. Never drive vehicle when CVT cover is re-moved.

△WARING
Any drive pulley repairs must be performed by an authorized Can-Am dealer. Subcompo-nent installation and assembly tolerances re-quire strict adherence to procedures detailed.

△WARING
The clutch assembly is a precisely balanced unit. Never replace parts with used parts from another clutch assembly.

PROCEDURES

CVT COVER

CVT Cover Access

Tilt the cargo box.

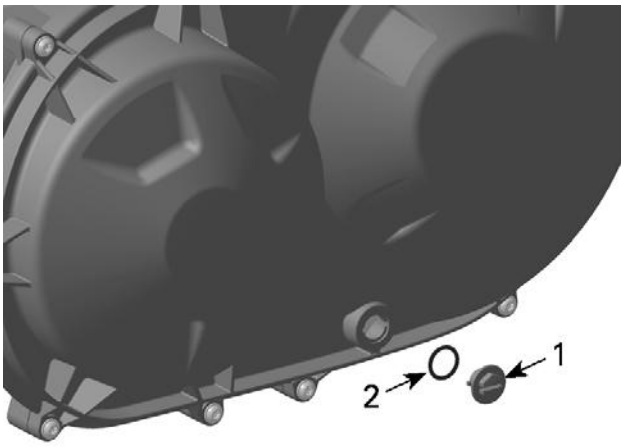
Remove the rear deflector on the driver side.

The wheel can also be removed to make more room.

Draining the CVT Cover

If water is present in CVT cover, it can be drained as follows:

1. Turn bayonet cap 90° counterclockwise to open it.
2. Remove bayonet cap and O-ring.



TIGHTENING TORQUE	
Bayonet cap	2N.m±0.2N.m （18lbf.in±2lbf.in）

NOTICE If any debris entered the CVT cover, CVT must be cleaned and inspected.

Removing the CVT Cover

Remove:

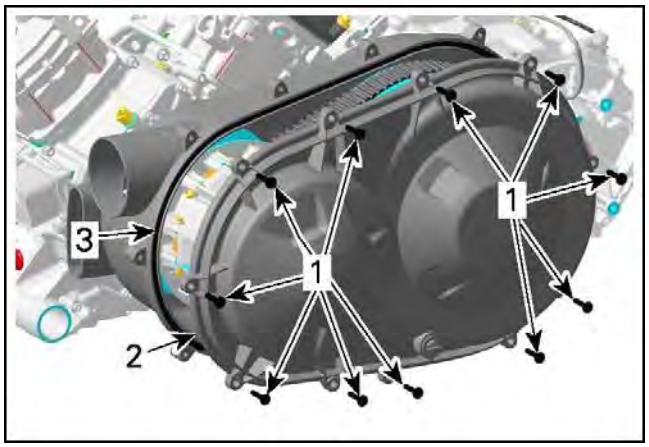
– Retaining screws

– CVT cover

– Gasket.

NOTE: Remove the center top screw last to sup-port the cover during removal.

NOTICE Do not use and impact tool to remove CVT cover screws



1. Retaining screws

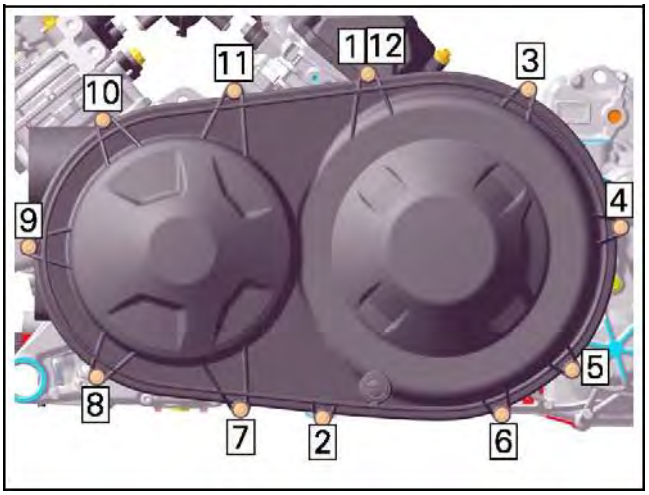
2. CVT cover

3. Gasket

Installing the CVTCover

Install the center top screw of first.

Tighten the CVT cover retaining screws as per fol-lowing sequence.



TIGHTENING TORQUE	
CVT cover retainingscrews	6N.m±0.7N.m （53lbf.in±6lbf.in）

DRIVE BELT

Removing the Drive Belt

NOTICE In case of a drive belt failure, the CVT, cover and air outlet must be cleaned.

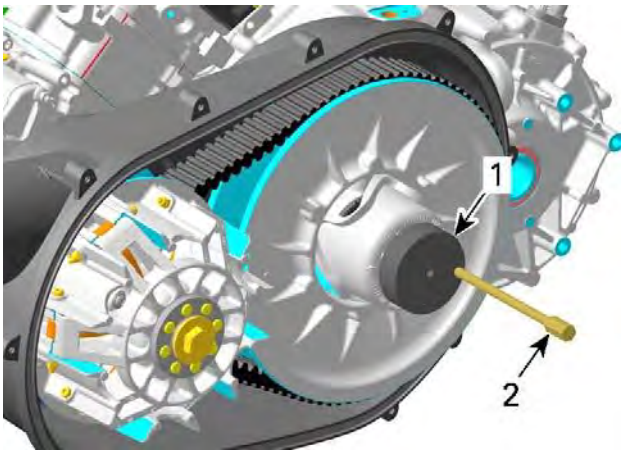
Remove *CVT COVER*.

REQUIED TOOL	
DRIVEN PULLEY EXTRACTOR	
DRIVEN PULLEY ADAPTER	

Screw in the driven pulley adapter into the driven pulley shaft.

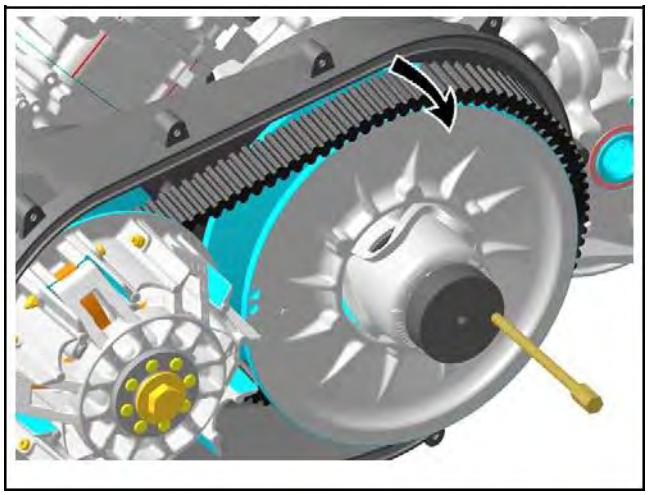
Screw in the driven pulley extractor into the threaded offset hole of the adapter.

Tighten the extractor to open the pulley.



1.Driven pulley adapter
2.Driven pulley extractor

To remove belt, slip the belt over the top edge of fixed sheave, as shown.



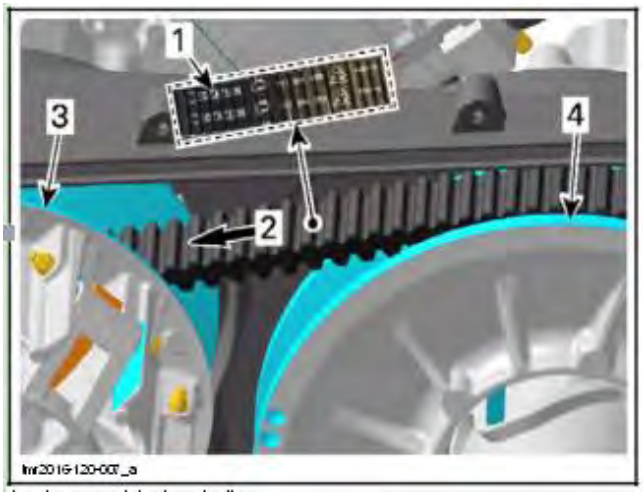
Inspecting the Drive Belt

For drive belt inspection refer to *DRIVE BELT INSPECTION* in the *PERIODIC MAINTENANCE PROCEDURES* subsection.

Installing the Drive Belt

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

The maximum drive belt life span is obtained when the drive belt has the proper rotation direc-tion. Install it so that the arrow printed on belt is pointing towards front of the vehicle, viewed from top.



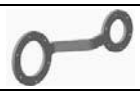
1.Arrow printed on belt
2.Rotation direction
3.Drive pulley (front)
4.Driven pulley (rear)

DRIVE PULLEY

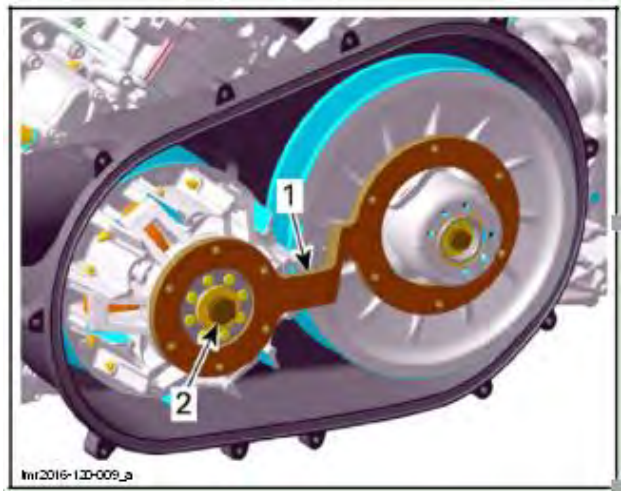
Removing the Drive Pulley

1.Remove *DRIVE BELT*, see procedure in this subsection.

2.Lock the drive pulley.

REQUIED TOOL	
CLUTCH HOLDER	

3.Loosen the drive pulley screw.



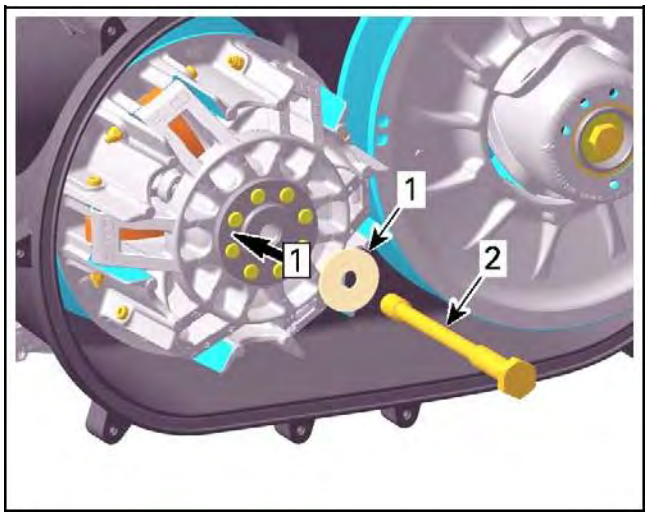
1. Clutch holder
2. Drive pulley screw

NOTICE Never use any type of impact wrench for drive pulley removal.

NOTE: Do not unscrew the drive pulley screw completely.

5. Remove service tool.
6. Apply axial pressure with your hand on the gov-ernor cup until clutch puller for removal is in-stalled.
7. Remove drive pulley screw and spring washer.

⚠ **CAUTION** Sliding sheave of drive pulley is spring loaded.

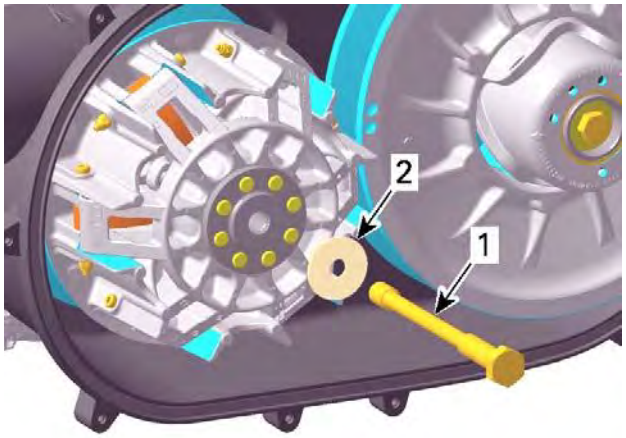


Step 1: Push
1. Spring washer
2. Drive pulley screw

8. Screw clutch puller in fixed sheave to remove drive pulley.

NOTICE Use only recommended tool.

REQUIED TOOL	
CLUTCH HOLDER	



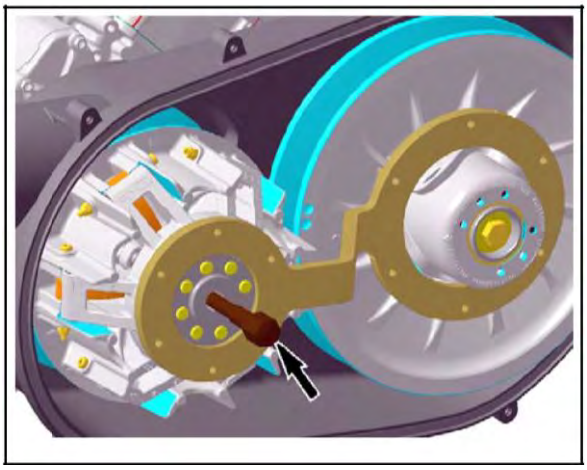
Disassembling the Drive Pulley

Drive Pulley

Screw clutch puller into fixed sheave shaft about 63 mm (2-1/2 in).

Raise drive pulley by the sliding sheave while knocking on the puller head to disengage fixed sheave.

NOTICE Never tap on governor cup.



1.Drive pulley screw
2.Conical spring washer

⚠ WARNING

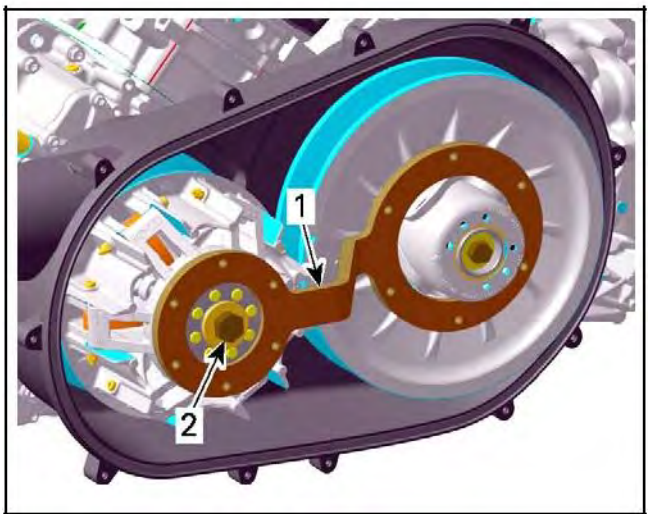
Never substitute conical spring washer and/or screw with jobber ones. Always use ODES genuine parts for this particular case.

Lock the drive pulley as per removal procedure.

Tighten drive pulley screw to specified torque.

NOTICE Never use any type of impact wrench for drive pulley installation.

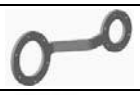
TIGHTENING TORQUE	
Drive pulley screw	120N.m± 8 N•m (89lbf.ft±6lbf.ft)



1.Clutch holder
2.Drive pulley screw

DRIVEN PULLEY

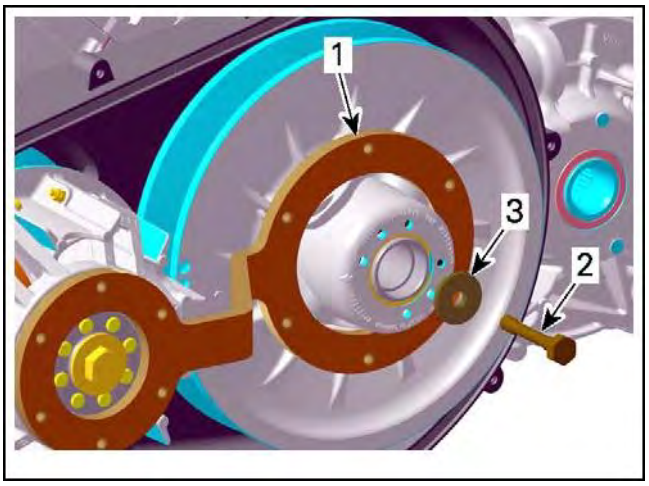
Removing the Driven Pulley

REQUIRED TOOLS	
CLUTCH HOLDER	
DRIVEN PULLEY ADAPTER	
DRIVEN PULLEY EXTRACTOR	

1.Remove:
- – CVT cover
- – Drive belt.

2.Install the clutch holder.

3. Remove:
- – Driven pulley screw (discard it)
- – Collar washer.



1.Clutch holder
2.Driven pulley screw (discard)
3.Collar washer

4.Remove the clutch holder.

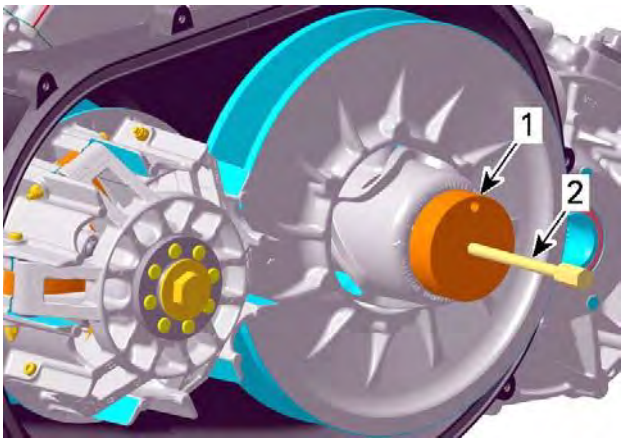
5.Pull the driven pulley out of the vehicle.

5.1If removed, reinstall the DRIVEN PULLEY ADAPTER.

5.2Screw in the DRIVEN PULLEY EXTRACTOR in the center hole of the driven pulley adapter.

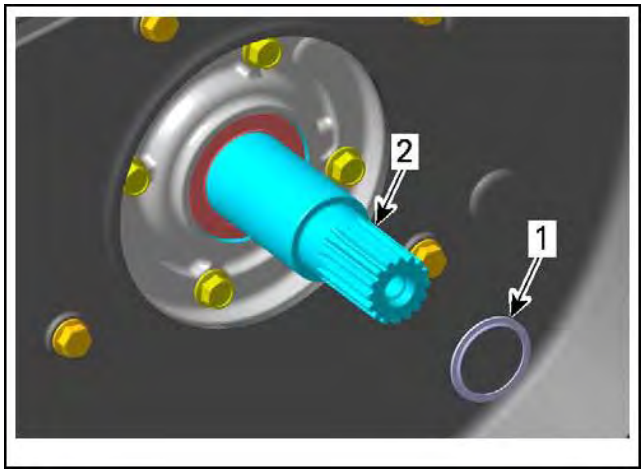
5.3Tighten the extractor until driven pulley is free.

5.4Remove tools from the driven pulley.



1. Driven pulley adapter
2. Driven pulley extractor

4. Remove thrust washer from countershaft.



1.Thrust washer
2.Countershaft

CVT AIR GUIDE

Removing the CVT Air Guide

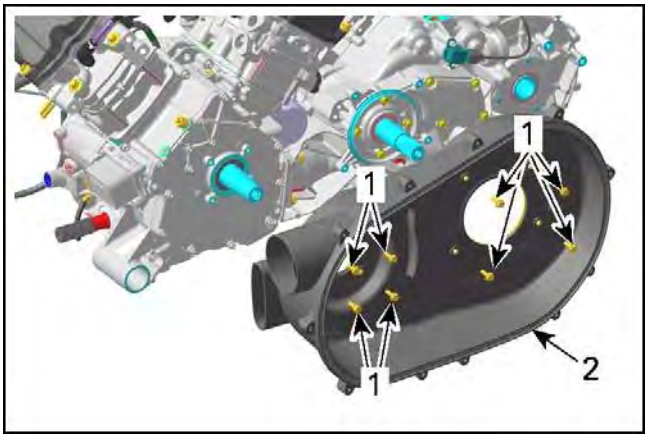
Remove:

– DRIVE PULLEY

– DRIVEN PULLEY

Unscrew the clamps retaining the CVT air hoses.

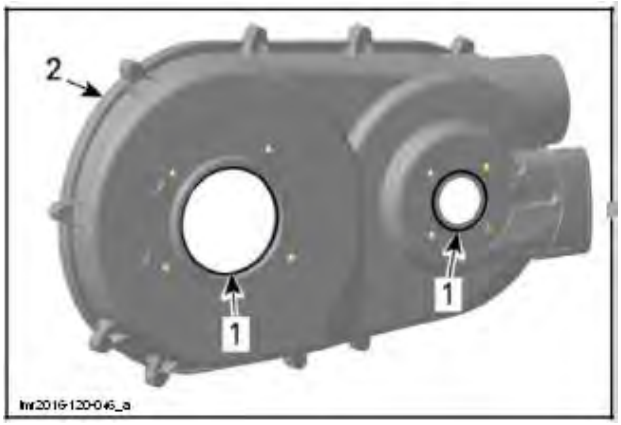
Remove CVT air guide.



1.Retaining screws

2.CVT air guide

Remove and discard O-rings

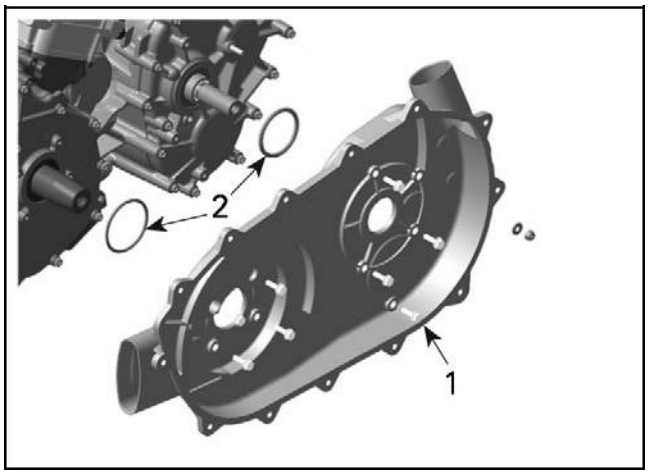


1.CVT air guide

2.O-rings

Inspecting the CVT Air Guide

Clean CVT air guide from contamination



1.CVT air guide

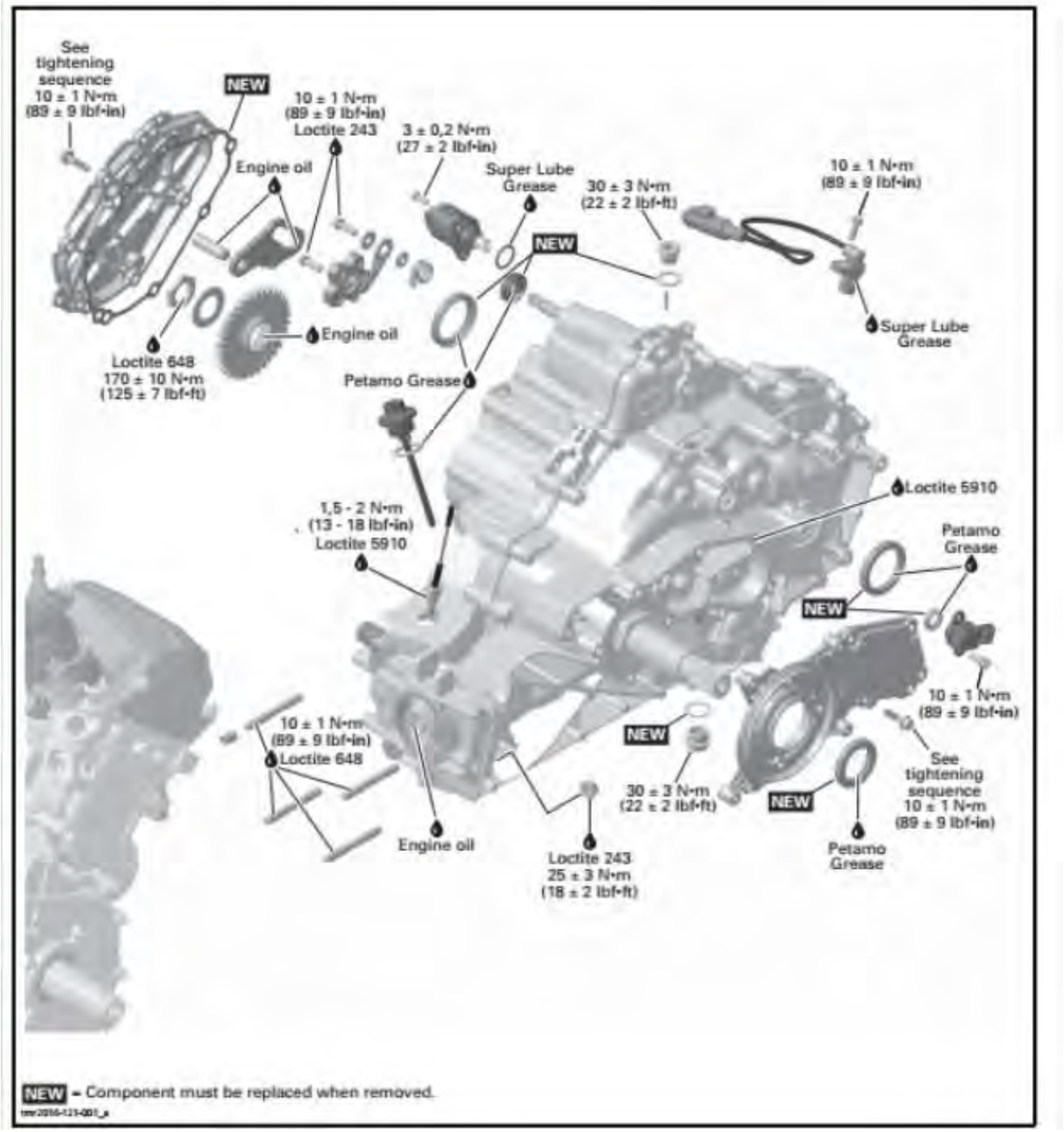
2.O-rings

Installing the CVT Air Guide

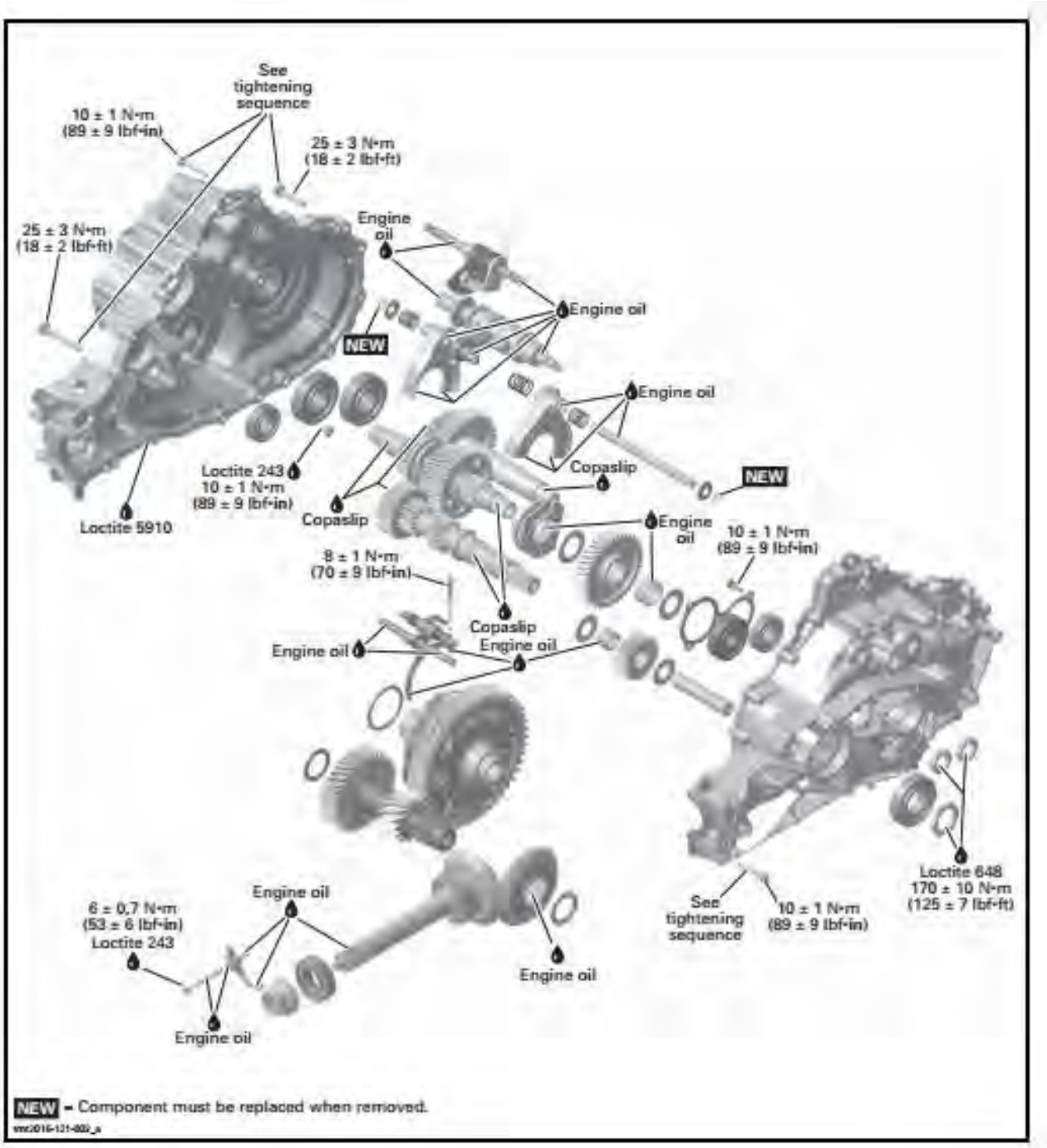
For installation reverse the removal procedure

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
CVT air guide retaining	10 N•m ± 1 N•m (89 lbf•**in** ± 9 lbf•**in**)

GEARBOX COMPONENTS

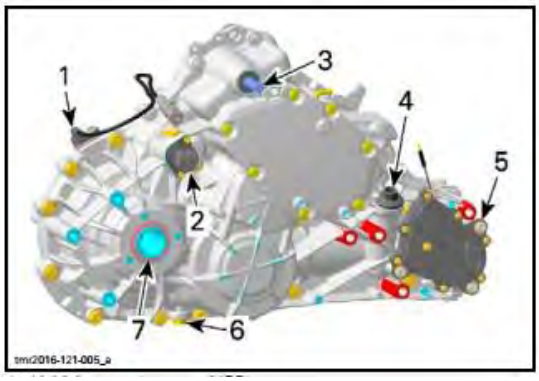


GEARBOXCOMPONENTS

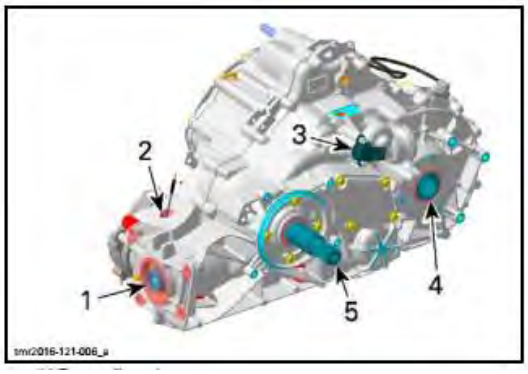


GENEAL

GEARBOX OVERVIEW



1. Vehicle speed sensor (VSS)
2. Differerntial locking actuator
3. Shift shaft
4. Gearbox oil
5. 4WD actuator
6. Magnetic drain plug
7. Rear differential output shaft



1. 4WD couping sleeve
2. 4WD indicator switch
3. Gearbox position sensor(GBPS)
4. Rear differential output shaft
5. Shift shaft

TROUBLESHOOTING

UNUSUAL GEARBOX NOISE AND/OR VIBRATIONS

1. Low oil level in gearbox.

-Oil leakage from gearbox .Replace damaged(s) and/or oil seal（s）

2. Defective bearings.

-Bearing(s) do(es) not turn smoothly. Replace bearing(s).

3.Damaged or worn gears.

-Inspect gears for damages or missing teeth. Replace respective gears.

GEARINDICATION FAILS

1. Defective gearbox position sensor (GBPS)

-Perform a gearbox position sensor test.

-Damaged wires .Repair as required.

GEAR(S) IS (ARE) HARD TO SHIFT

1. Incorrect shifter cable adjustment.

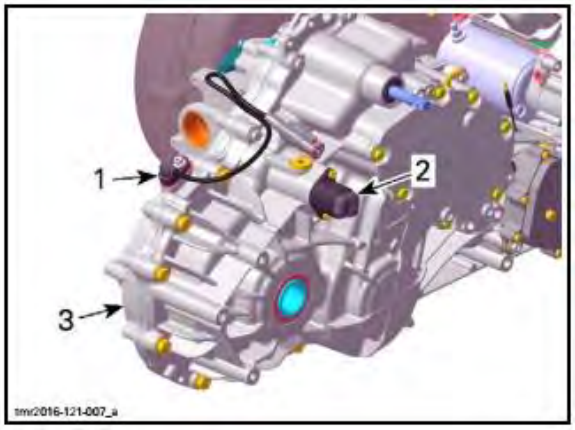
-Adjust shifter cable (refer to SHIFTER CABLE in SHIFTER subsection.

PROCEDURES

VSS (VEHICLE SPEED SENSOR)

VSS Location

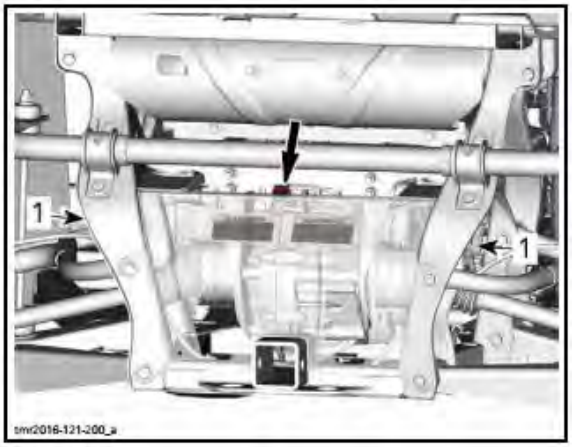
The vehicle speed sensor is located on the rear top side of the left gearbox housign.



1. VSS (Vehicle Speed Sensor)
2. Differerntial locking actuator
3. Left housing of gearbox

VSS Access

The VSS is accessible by the rear of the vehicle.



1. Go through the side to access the VSS

VSS Wire Identification

FUNCTION	PIN	COLOR
12-volt input from fuse F5	A	RED
Speed signal (to ECM-A E1)	B	WHITE
Ground(to ECM-A D4)	C	BLACK/GREEN

VSS Circuit Protection

CONDITION	CIRCUIT PROTECTION
Supplied with main relay activated	Fuse5 of fuse block1 (from main relay R2)

Testing theVSS Input Voltage

1. Turn ignition switch ON.
2. Back-probe the VSS connector and measure voltage.

REQUIRED TOOLS	
BACK PROBE TEST WIRES	
FLUKE115 MULTIMETER	

VSS INPUT VOLAGE TEST		
TEST PROBES		RESULIT (KEY ON)
PIN A (RED wire)	PIN C (BLACK/GREEN wire)	Battery voltage

If voltage is not as specified, test positive and ground separately.

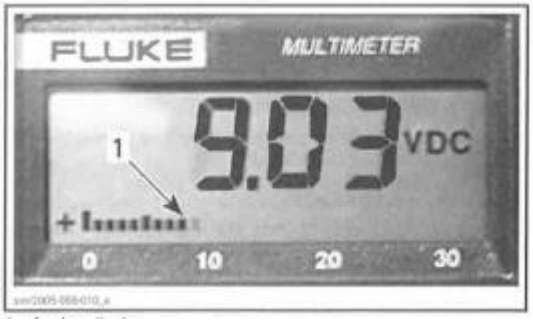
Testing the VSS Signal

1. Lift rear of vehicle so that rear wheels are off the ground.
2. Set transmission to2WD and to Neutral.
3. Turn ignition switch ON.
4. Back-probe the VSS connector and measure voltage while slowly rotating rear wheels by hand.

REQUIRED TOOLS	
BACK PROBE TEST WIRES	
FLUKE115 MULTIMETER	

VSS INPUT VOLAGE TEST		
TEST PROBES		RESULIT (KEY ON)
PIN B (WHITE wire)	PIN C (BLACK/GREEN wire)	Alternate reading between battery voltage and 0 Vdc

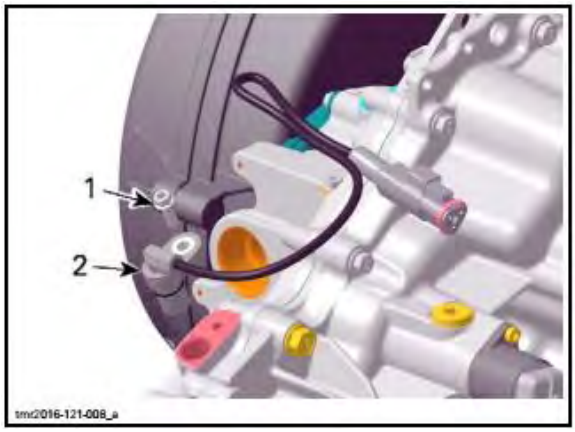
NOTE: Since we measure pulsating voltage, the numeric display will continuously change.The analog display may be easier to follow.



1. Analog display

Removing theVSS

Disconnect VSS connector.
Remove screw retaining the VSS.
Using a long screwdrive,pull out the VSS.



SEVEAL PARTS REMOVED FOR CLARITY
1. Screw
2. VSS

VSS Installation

For installation, reverse the removal procedure.
Pay attention to the following.
Lubricate VSS O-ring.

VSS O-RING	
TEST PROBES	SUPER LUBE GREASE

TIGHTENING TORQUE	
VSS retaining screw	10N.m±1N.m (89lbf.in±9lbf.in)

GEARBOX POSITION SENSOR

（GBPS）

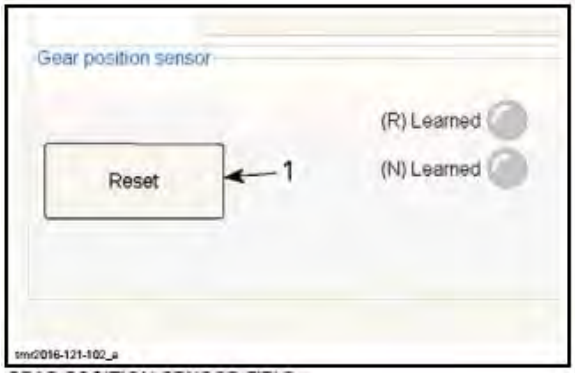
GBPS Reset

When replacing the gearbox position sensor (GBPS), it is required to reset (re-zero) its values for proper operation.
A reset must be carried out each time any of the following parts has been replaced:
- Gearbox assembly
- Shift drum
- GBPS
- ECM.

1. Connect vehicle to the latest applicable version
Of B.U.D.S. software, refer to COMMUNICATION TOOL AND B.U.D.S. subsection.
2. In B.U.D.S., select the following:
- Read Data button
- Setting page tab
- ECM tab.

1. Setting page tab
2. ECM tab

3.Set shaift lever in NEUTRAL position
4.In the Gear Position Sensor fireld, click on the Rest button.



GEAR POSITION SENSOR FIELD
1. Rest buton
A message will be displayed if the operation is successful.
If an error occurred or the GBPS is not within the allowed range while resetting, the ECM will generate a fault code and will not accept the setting.
5. If a fault message is displayed, follow the instructions in the message(s).
6. Check for fault codes.

If a fault code is generated:
- Carry out the service action.
- Reset the fault code.
- Repeat the reset procedure.

7. Close and disconnect B.U.D.S.
NOTE: Do not turn ignition key OFF.
8. Verify gears engagement.
8.1 With the vehicle on ground and in NEUTRAL position, start engine.
8.2 During4-5 seconds, rev engine to2500±200 RPM.
8.3 Let engine returns to idle.
8.4 Select an other position(P，R，H or L). Repeat substeps8.2 and8.3 until all position are verified.
NOTE: The vehicle must be in movement to complete the procedure on R, H and L position.

GBPS Access

Tilt the cargo box

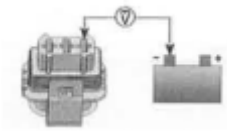
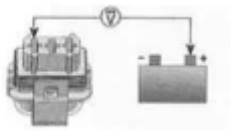
Testing tje BGPS input Voltage
NOTE: Prior to conduct testing, check fault codes in B.U.D.S.
Set shift lever in NEUTRAL position.
Back-probe the GBPS connector .

REQUOED TOOL	
BACK PROBE TEST WIRES	

Test as follow：

MULITIMETER PROBE POSITIONS	VOLITAGE
PIN1 and PIN3 of the GBPS connector 	5 volts

If voltage is adequate, check GBPS singal wire.
If there is no voltage, check each GBPS input as follows.

MULITIMETER PROBE POSITIONS	VOLITAGE
PIN1 connector(pin1) and battery ground 	5 volts
GBPS connector (pin3) and battery + terminal 	Battery voltage

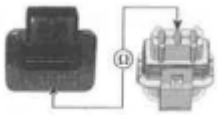
If there is no voltage, check wires and connector pins. Replace or repair defective parts and reset fault codes.

Testing the GBPS Communication

Link Continuity

Unplug connector "A" from ECM and connect it to the ECM ADAPTER TOOL

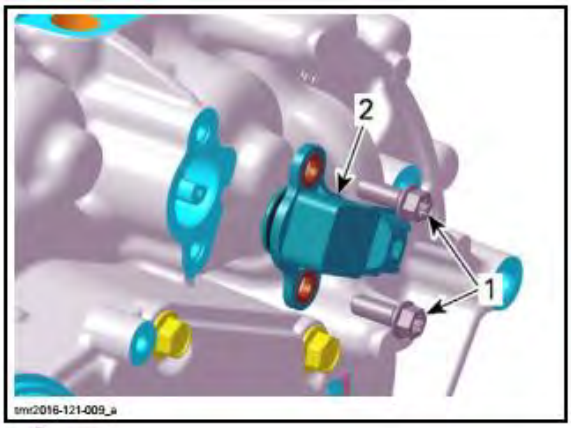
REQUOED TOOL	
ECM ADAPTER TOOL	

MULITIMETER PROBE POSITIONS	RESISTANCE @20°C(68°F)
GBPS connector(pin2) and ECM adapter tool (pin F4) 	lBelow1Ω

If resistance is out of specification, check wires and connectors. Repair and reset fault codes.
If resistance is good and the other tests succeeded, replace the GBPS and reset fault codes.
NOTE: The GBPS must be reset.

Removing the GBPS

Set shift lever in NEUTRAL position.
Unplug GBPS connector.
Remove screws and withdraw GBPS.

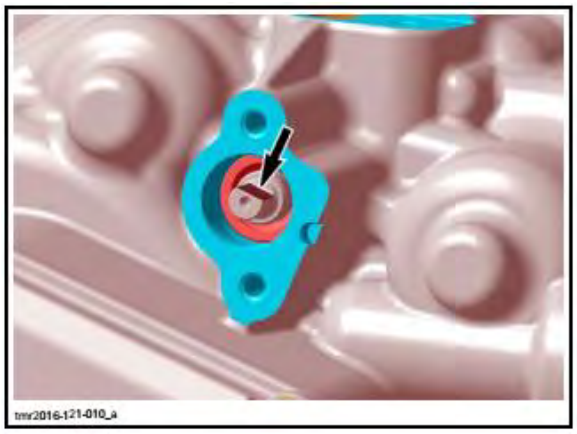


1. Screws
2. Gearbox Position Sensor (GBPS)

Installating the GBPS

For installation, reverse the removal procedure.
Pay attention to the following details.
Shift lever must be in the NEUTRAL position.
Align GBPS with the flat on the shift drum shaft.

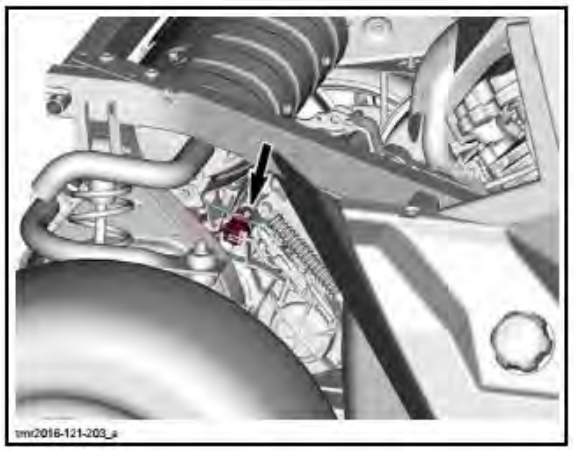
NOTE:Do not force to install GBPS if shaft flat is not properly aligned. If alignment is incorrect,check shift rod adjustment.



Reset the GBPS. Refer to GBPS RESET in this subsection.

DIFFERENTIAL LOCKING ACTUATOR

Differential Locking Actuator Access
Tilt the cargo box,



Testing the Differental Locking Actuator
Testing the Differenfal Looking Actuator Function

1.Set shaift lever on NEUTRAL
2.Turn ignition switch to ON. Do not shart the engine.
3.Place the rear differential switch in LOCK position.

NOTE: The rear differential is locked when the switch is pushed upwareds.
4.Lift the rear of the vehicle until rear wheels are off the groud ,
5.Turn a rear wheel.
-If both wheels turn,the actuator is in LOCK position. Continue with step 6.
-If only one wheel turns, check the switch position and turn the wheel again.if the resule is the same,carry out TESTING THE DIFFERENTIAL LOCKING ACTUATOR RESISTANCE.
6.Move the rear differential switch UNLOCK position.
NOTE:The rear diffferential is unlock when the switch is pushed downwards.
7.Turn a rear wheel.
-If only one wheel turns the actuator and its electrical system work properly .

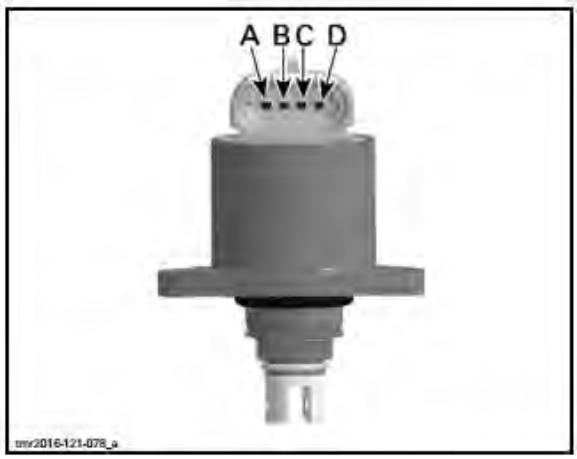
-If both wheels turn, check the switch position and turn the wheel again

Tisting the Differerntial Locking Actuator Resistance

Disconnevt differential locking actuator connector .
Set muliimeter to Ω

REQUIRED TOOLS	
FLUKE 115 MULTIMETER	

Probe terminals as per following table



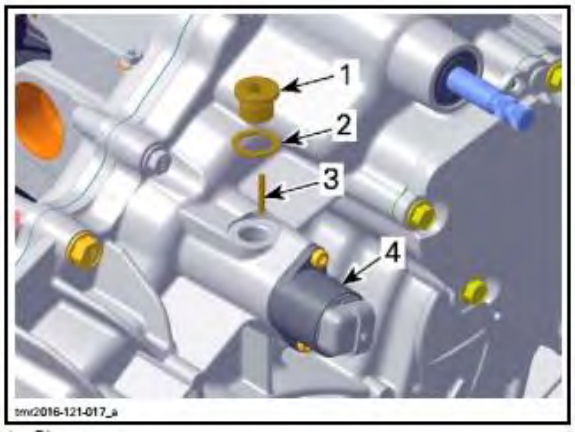
If resistance is mot within specifications,replace the actuator.
If resistance tests good,reconnect the actuator connector.
Install ECM-A connector on ECM adapter.

REQUIRED TOOLS	
ECM ADAPTER TOOL	

Using a multmeter,recheck resistance as per table.

ACTUATOR CONNECTOR		MEASUREMENT
PIN		RESSTANCE Ω @20℃（68°F）
A	C	28-34Ω
B	D	

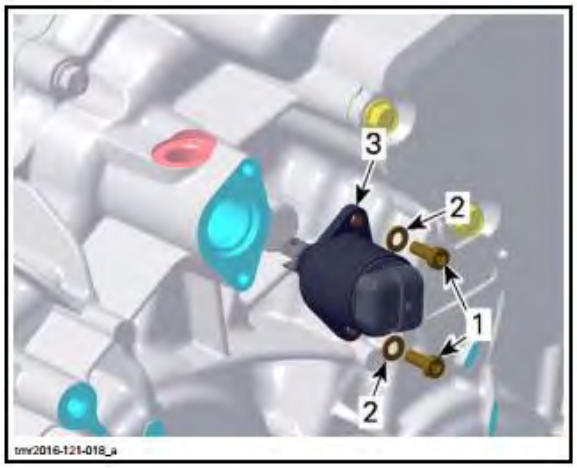
If resistance value is connect replace ECM,refer to ECM REPLACEMENT in the ELECTRONIC FUEL INJECTION(EFI)subsection.
If resistance value is connect,repair the conntctor or replace the wiring harness between ECM connector and actuator.
Removing the Differntial Locking Acyuator
Remove:
-Plug screw
-Sealing ring (discard it)
-Pin



1. Plug screw
2. Seaing ring
3. Pin
4. Differential locking actuator

Remove:
-Retaining screws
-Washers
-Differential locking actuator.

ECM CONNECTOR		MEASUREMENT
PIN		RESSTANCE Ω @20℃（68°F）
A-C2	A-C1	28-34Ω
A-B2	A-A4	



1. Retaining screws
2. Washers
3. Dfferential locking actuator

Installing the Differential Locking Actuator

Lubricate actuator O-ring

DIFFERENTIAL LOCKING ACYUATOR O-RING	
Service product	SUPER LUBE GREASE

Tighten retaining screws to specification

TIGHTENING TORQUE	
Differential locking actuator retaining screws	3N.m±0.2N.m （27 lbf.ft±2 lbf.ft）

Install a NEW sealing ring and tighten plug screw to specification.

TIGHTENING TORQUE	
Plug screws	30N.m±3N.m （22 lbf.ft±2 lbf.ft）

GEARBOX OIL SEALS

Replacing the Gearbox Oil Seal

Replace oil seals if they are brittle, hard or damaged.

A small flat screwdriver can be used to remove most of these oil seals.

NOTICE Avoid scoring parts during oil seal removal.

When replacing an oil seal, take this opportunity to inspect the following:

-Check bearings behind each oil seal for contamination and/or metal shavings.

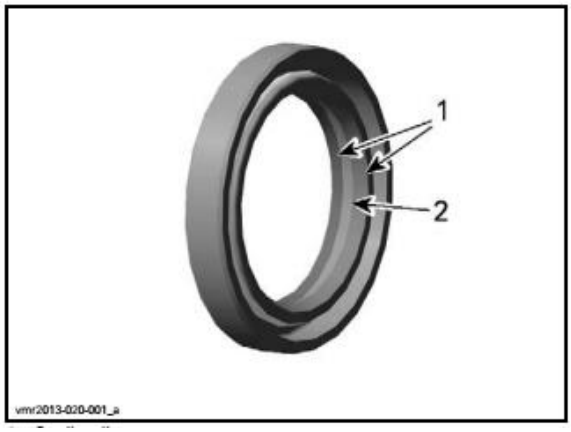
-Check oil seal running surfaces for scratches.

Lubricating the Oil Seal

When installing or reinstalling oil seals,use PETAMO GREASE GHY 133N to :

-Lubricate sealing lips aii around.

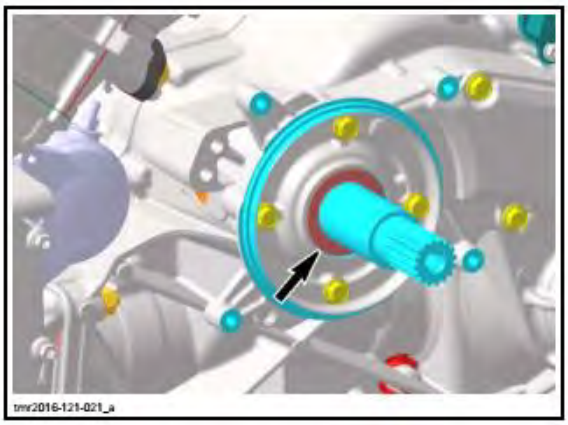
-Fill up the between sealing lips halfway aroiund the permetre.



1. Sealing lips
2. Room between sealing lips

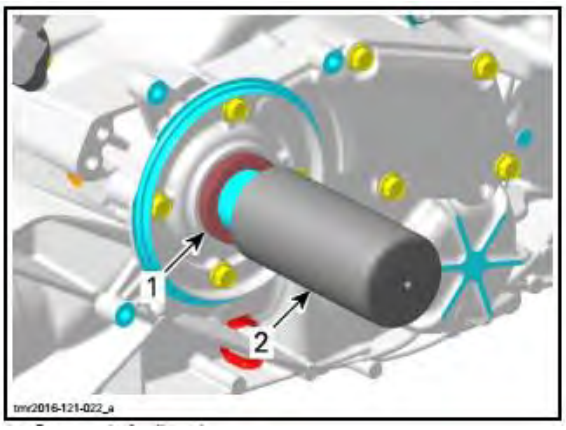
Countershaft Oil Seal

To replace the countershaft oil seal, remove:
-Drive and driven pulleys
-CVT air guide.



Install countershaft oil seal.

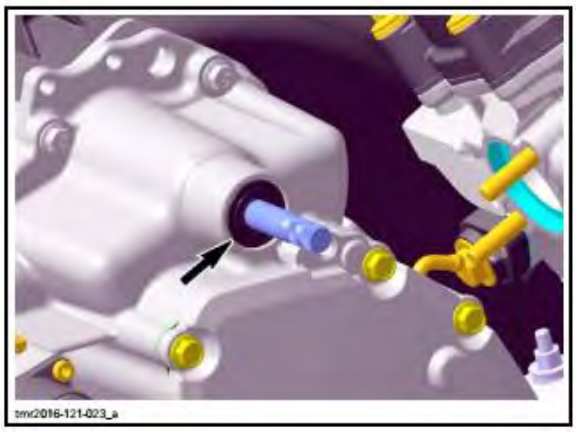
REQUIRED TOOL	
OIL SEAL INSTALLER (COUNTERSHAFT)	



1. Countershaft oil seal
2. Oil seal installer

Shift Shaft Oil Seal

Remove the shaft plate. Refer to SHIFTER subsection.
The shift shaft oil seal can be removed without removing the gearbox from the vehicle.



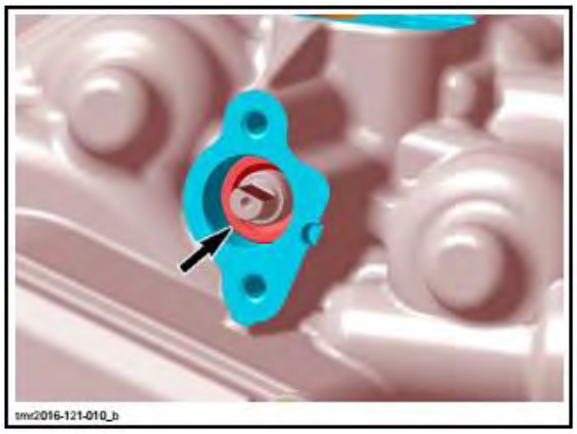
Use a suitable tube with the proper diameter to install the oil seal.
If gearbox housing is apart, use following tools for shift shaft oil seal installation.

REQUIRED TOOL	
OIL SEAL INSTALLER (GEARBOX)	
HANDLE	

NOTICE Oil seal must be installed with sealing lip toward gearbox.

Shift Drum Shaft Oil Seal

To replace the shift drum shaft oil seal, remove the GBPS (GEARBOX POSITION SENSIR). See procedure in this subsection.

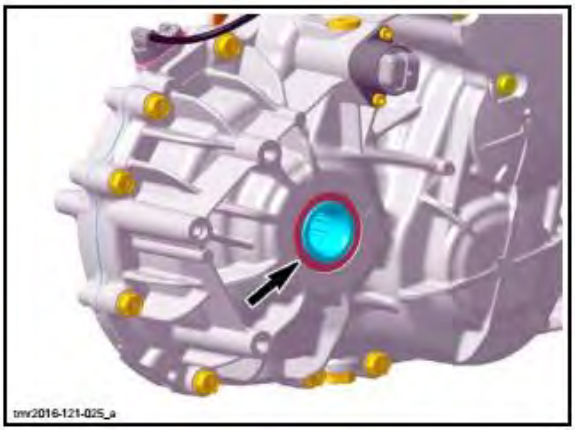


Use a suitable tube with the proper diameter to install the oil seal.

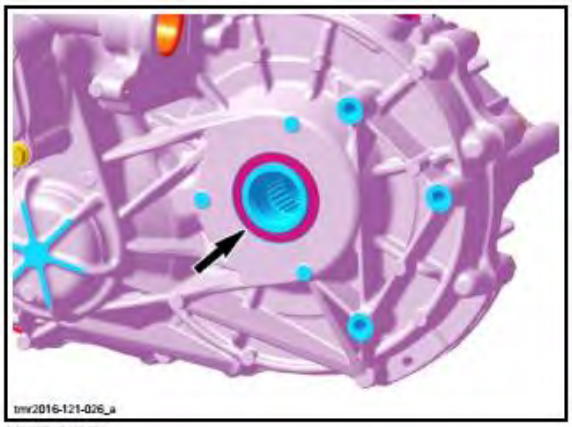
NOTICE Oil seal must be installed with sealing lip toward gearbox.

Output Shaft Oil Seal

Remove the aooropriate drive shaft. Refer yo REAR DRIVE subsection.



RIGHT SIDE

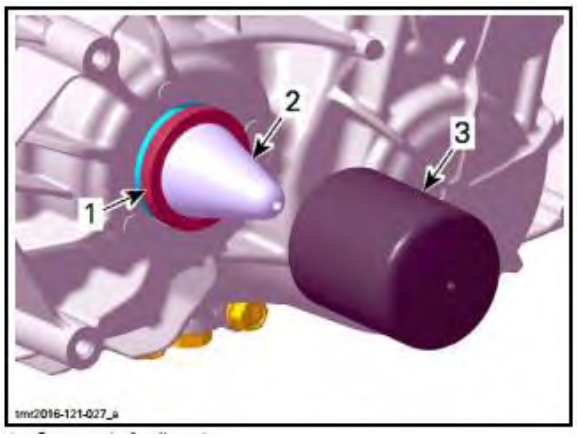


LEFT SIDE

Punch a sharp screwdrive thought oil seal for removal.

Place oil seal on output shaft and install it using the following tools.

REQUIRED TOOL	
SLEEVE INSTALLER	
OIL SEAL INSTALLER (DIFFERENTIAL OUT PUT)	



1. Output shaft oil seal
2. Eeve installer
3. Oil seal installer

GEARBOX ASSEMBLY

Removing the Gearbox Assembly

Remove engine from vehicle. Refer to ENGINE REMOVAL AND INSTALLATUON for the procedure.

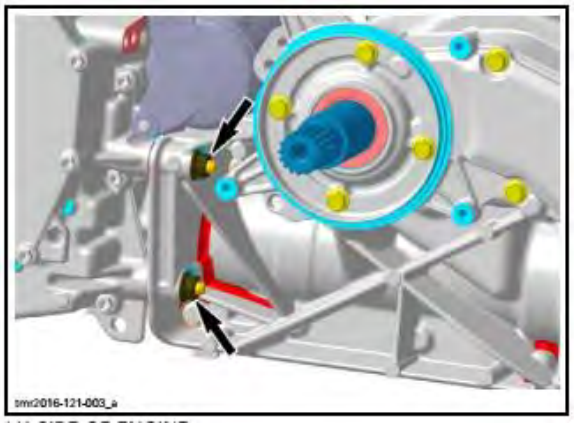
Refer to COUNTINOUSLY VARIABLE TRANSMISSION (CVT) subsection to remove following parts:

- CVT cover
- Drive and driven pulleys
- CVT air guide.

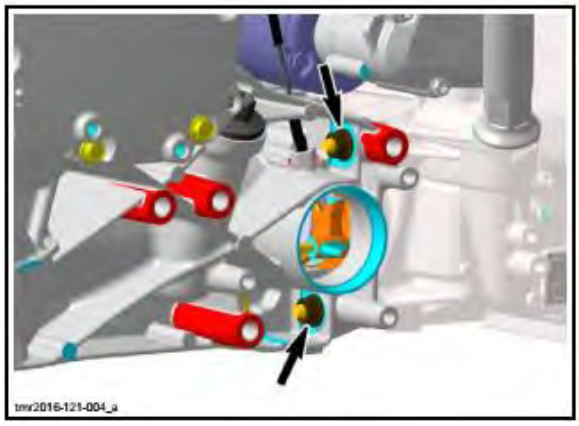
Drain gearbox. Refer to GEARBOX OIL REPLACEMENT in PERIODIC MAINTEANCE PROCDURES subsection.

Remove 4WD ACTUATOR see procedure in this subsection.

Unscrew the four (4) gearbox retaining nuts.



LH SIDE OF ENGINE



RH SIDE OF ENGINE

Pull gearbox to separate it from engine.

Installing the Gear box

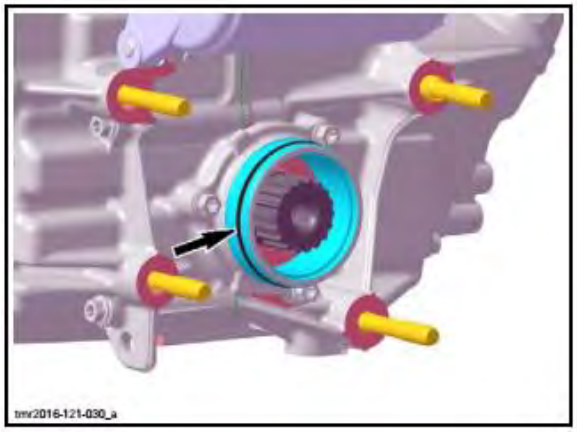
For installation reverse the removal procedure.

Pay attention to following.

Before gearbox installation check O-ring on bearing cover if brittle,hard or damaged.Replace if necessary.

Lubricate O-ring on rear bearing cover.

O-RING LUBRICATION	
Service product	Engine oil



Tighen gearbox retaining nuts to specification

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Gearbox retaining nuts	25N.m±3N.m （18 lbf.ft±2 lbf.ft）

After installation refill gearbox oil,refer to PERIODIC MAINTENANCE PRODURES subsection.

GRARBOX HOUSING

Disassembing the Gearbox Housing

See prucedures in this subsection to remove:

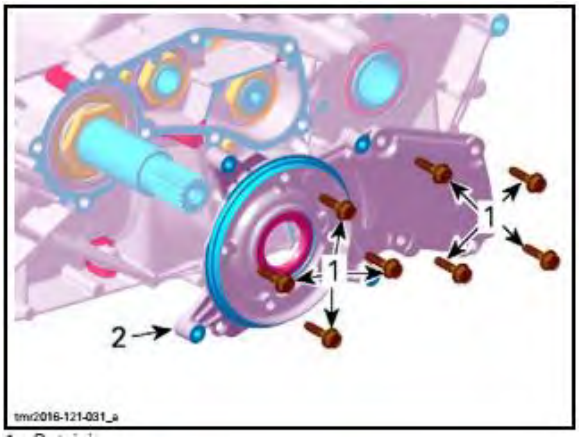
-4WD ACTUATOR

-GBPS (GEARBOX POSITION SENSOR)

-DIFFERENTIAL LOCKING ACTUATOR

Set gearbox to PARK position.

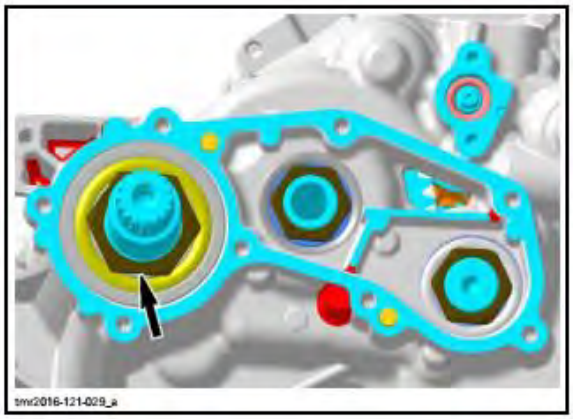
Remove bearing cover.



1. Retaining screws
2. Bearing cover

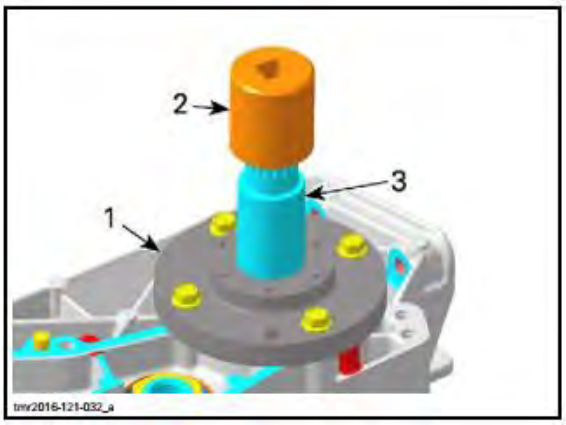
Remove countershaft nut.

△ **CAUTION** Nut can loosen abruptly.



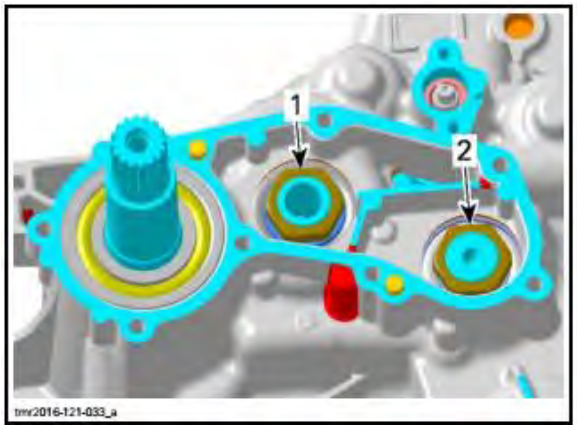
REQUIRED TOOL	
M34 SOCKET	
SPLINES SOCKET1/2	

NOTICE Turn spline socket clockwise to loosen the nut.



1. M34 socket
2. Spline socket
3. Countershaft

Remove nuts of main shaft and instermediate shaft.



1. Main shaft nut
2. Intermediate shaft nut

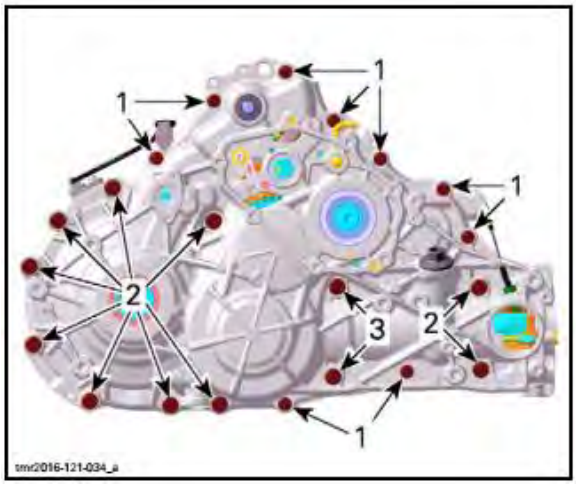
Refer to GEARBOX AND SHAFTING MECHANISM in this subsection and remove:

Parking lock gear

-Index washer.

Remove all gearbox housing screws:

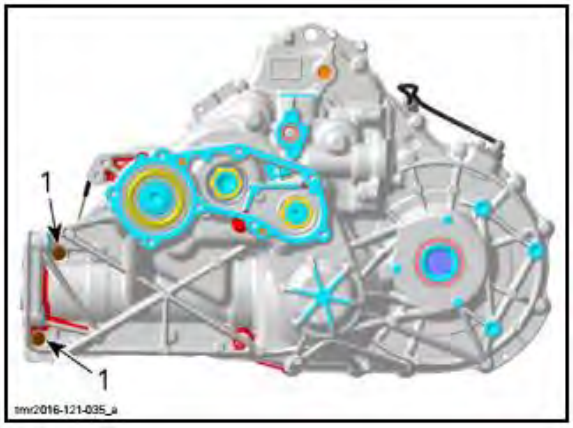
1. Start removing the M6 screws.
2. Then remove the M8 screws.



1.11 screws M6×45

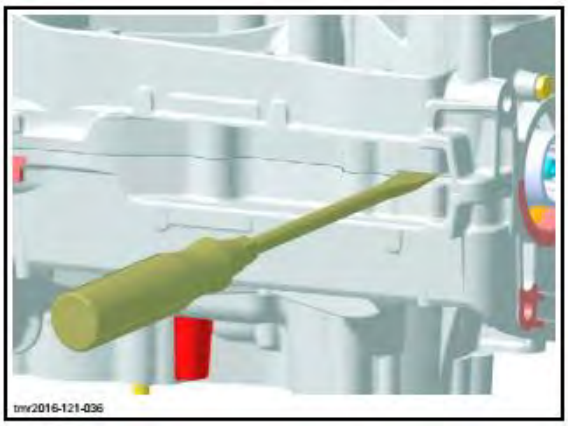
2.10 screws M8×45

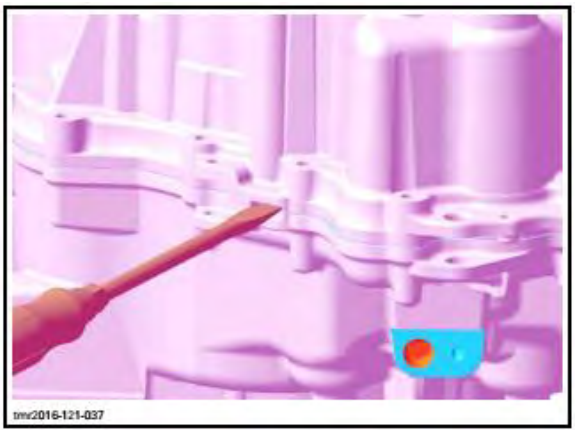
3.2 screws M8×65

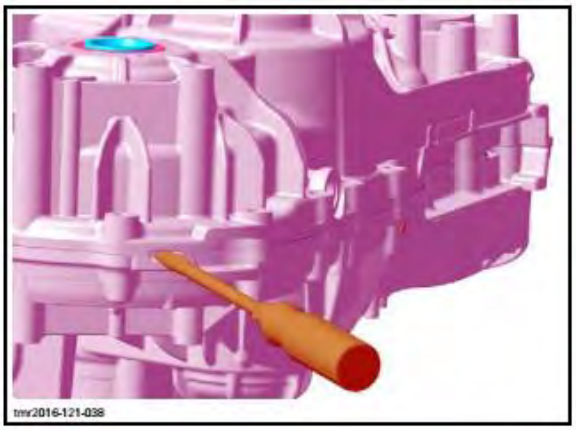


1.2 screws M6×45

Separte gearbox housing,use 2 big screwdrivers.







If necessary, refer to proce dures in this subsection and remove:
-GEARBOX AND SHAIFTING MECHANISM
-PUTPUT SHAFT AND COUPLING MECHANISM
-REAR DIFFERENTIAL AND LOCKING MECHANISM.

Inspecting the Gearbox Housing

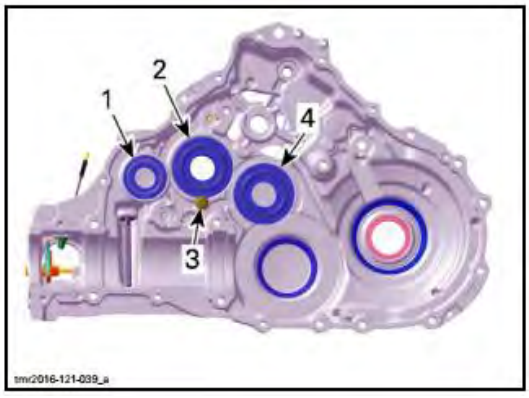
Check gearbox ball bearings for: contamination and/or metal shavings.
Check if ball bearings turn freely and smoothly.
Replace if necessary.

Bearing Replacement

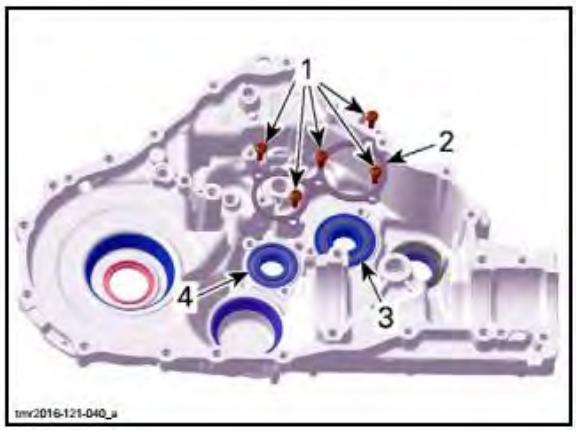
If necessary heat housing up to 100℃（212°F）before removing ball bearings.

△WARNING
Clean oil, outside and inside, from housing before heating.

NOTICE Always support gearbox housings properly when ball bearings are removed. Housing damages may occur if this procedure is not performed correctiy.
Use a blind hole bearing puller ball bearings of :
-Countershaft(right cover)
-Inrermediate shaft(right cover)
Remove retaining plate securing the main shaft and internediate shaft bearings in the left housing.
Remove screw securing the main shaft bearing in the right cover.
Use a suitable puller to remove ball bearings of:
-Main shaft(right and left cover)
-Countershaft (left cover)
-Intermediate shaft (left cover)



RIGHT GEARBOX HOUSING
1. Ball bearing countershaft
2. Ball bearing main shaft
3. Screw
4. Ball bearing intermediate shaft



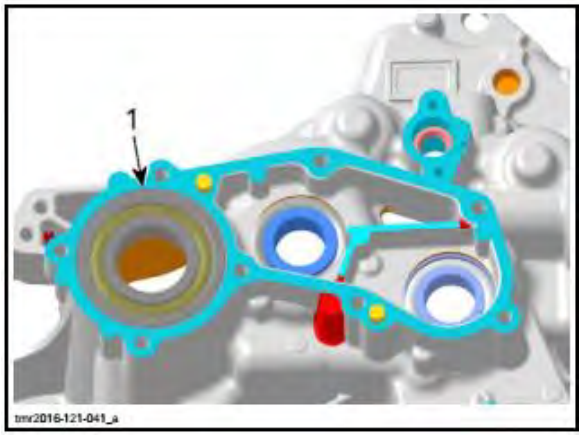
LEFT GEARBOX HOUSING

1.Screw

2.Retaining plate

3.Ball bearing main shaft

4.Ball bearing intermediate shaft



LEFT GEARBOX HOUSING

1. Ball bearing countershaft

Unless otherwise instructed,never use hammer to install ball bearings.Use press machine oniy.

If necessary heat housing up to100°C(212°F) before removing ball bearings.

△WARNING
Clean oil, outside and inside, from housing before heating.

Place new bearing in freezer for 10 minutes before installation.

Use a suitable installer for installing ball bearings of countershaft,main shaft and intermediate shaft.

NOTE:Place gearbox housings on a wood stand before installing ball bearings.

TIGHTENING TORQUE	
Retaining plate screws	10N.m±1N.m （89 lbf.ft±9 lbf.ft）

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Retaining screws main shaft bearing (right cover)	10N.m±1N.m （89 lbf.ft±9 lbf.ft）

Install new oil seals with the proper installer(refer to GEARBOX OIL SEALS in this subsection)

Assembing the Gearbox Housing

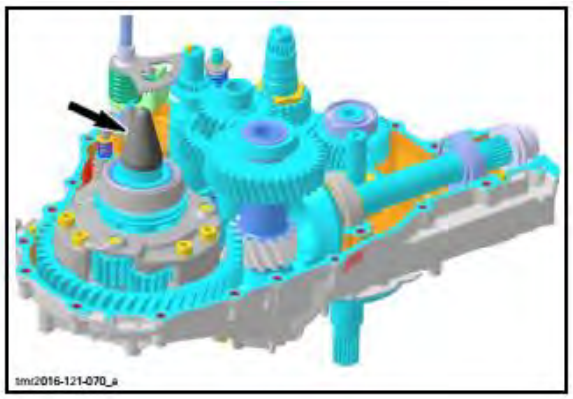
Clean aii metal components in a solvent. Gearbox housing mating surface are best cleaned using a combination of LOCTITE CHISEL(GASKET REMOVER)and a brass bursh.Bursh a first pass in one direction then make the final bushing perpendiculary (90°)to the first pass cross (hatch).

NOTICE Do not wipe with rages,use a new clean hand towel only.

IMPORTANT:When beginning the application of the gear housing sealant,the assembly and the first torquing should be done within 10 minutes. It is suggested to have aii you need on hand to save time.

Place sleeve installer in rear differential.

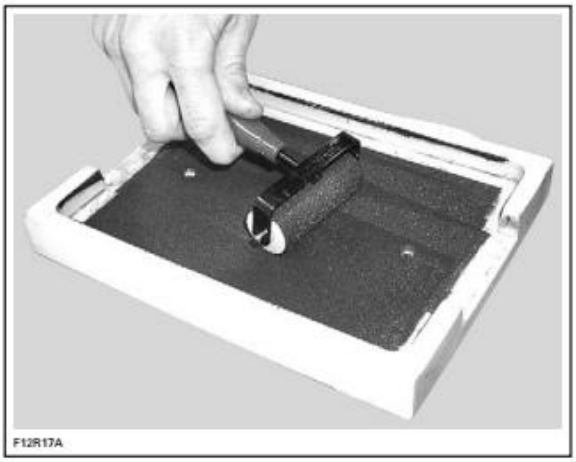
TIGHTENING TORQUE	
SLEEVE INSTALLER	



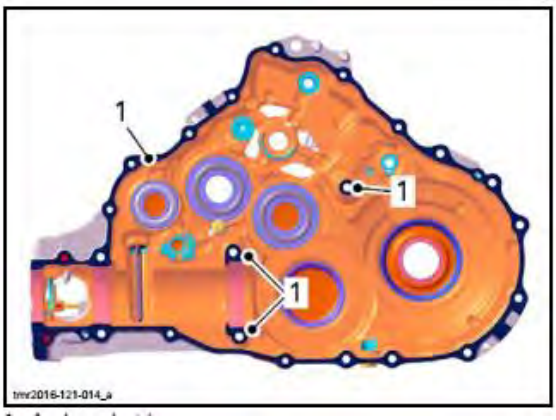
Apply sealant on mating surface.

GEARBOX HOUSING MATING SURFACE SEALANT	
Service product	卡夫特 k-0271

Use a plexiglall plate and apply some sealant on it .Use a soft rubber roller (50mm-75mm),available in arts products suppliers for printing,and roll the sealant to get a thin uniform coat on the plate (spread as necessary).When ready,apply the sealant on gearbox housing mating surfaces,

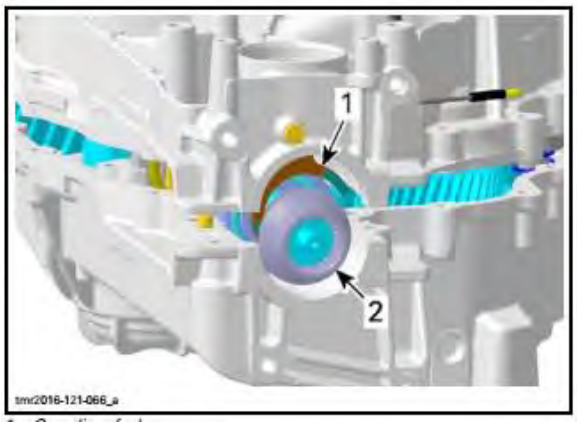


Do not aopply in excess as it will spread out inside gearbox housing.
NOTE: It is recommended to apply this specification without lumps. If you do not use the roller method,you may use your finger to uniformly distribute then sealant(using a finger not affect the adhesion).



1. Apply sealant here

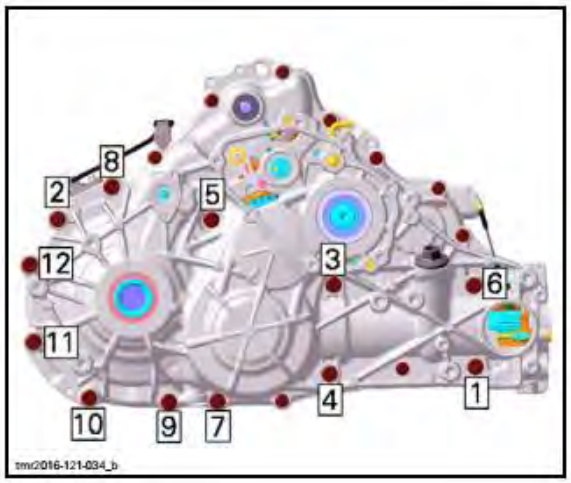
Durning installation of the rght hearbox housing align the coupling fork with the groove in the coupling sleeve.



1. Coupling fork
2. Coupling sleeve

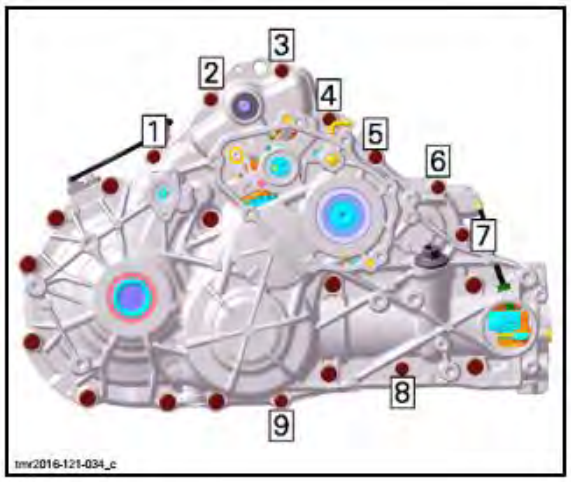
Install all gearbox housing screws.
Tighten M8 gearbox housing screws as per fllowing sequence.

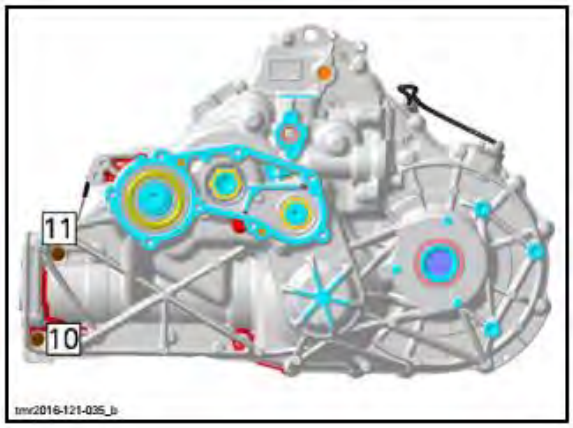
TIGHTENING TORQUE	
M8 gearbox housing screws	25N.m±3N.m （18 lbf.ft±2 lbf.ft）



Tighten M6 gearbox housing screws as per fllowing sequence.

TIGHTENING TORQUE	
M6 gearbox housing screws	10N.m±1N.m （89 lbf.ft±9 lbf.ft）





Refer to GEARBOX AND SHAIFT MECHANISM in this subsection to install:

-Index lever

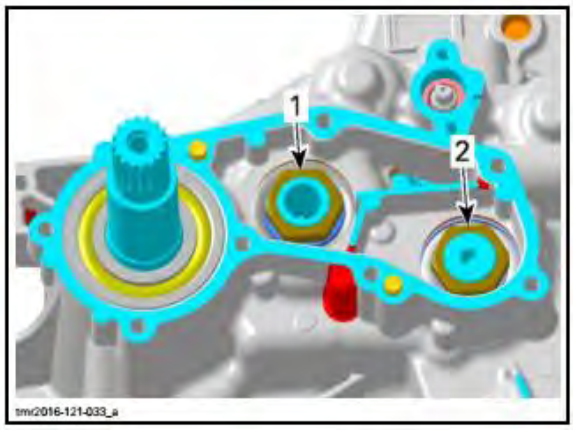
-Index washer

-Parking lock gear

Set gearbox to PARK position.

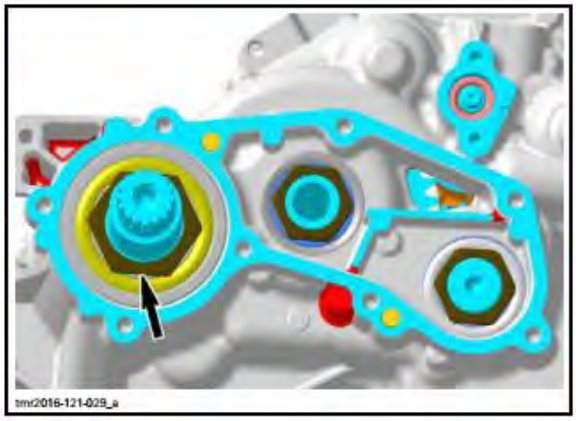
Tighten main shaft and intermediate shaft nuts to specification.

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
main shaft and intermediate shaft nuts	10N.m±1N.m（89 lbf.ft±9 lbf.ft）



1. Main shaft nut
2. Intermediate shaft nut

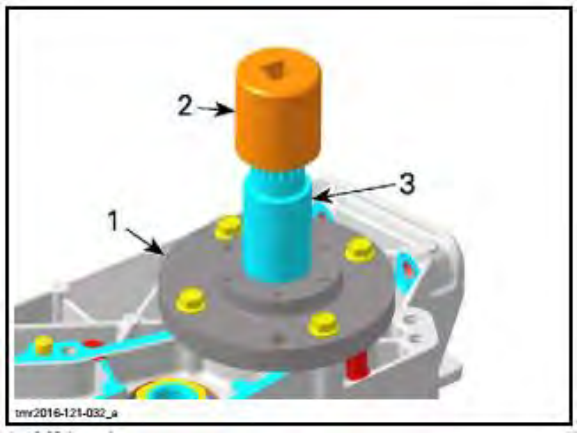
Tighten countershaft nut to specification



TIGHTENING TORQUE	
Service product	
Countershaft nut	170N.m±10N.m（125 lbf.ft±7 lbf.ft）

REQUIRE TOOL	
M34 SOCKET	
SPLINE SOCKET 1/2”	

NOTICE Turn spline socket counterclockwise to tighten the nut.



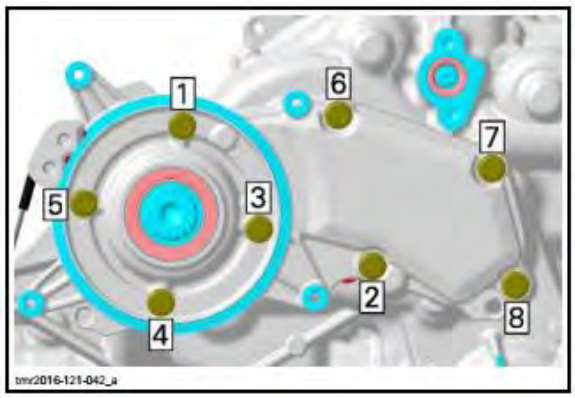
1. M34 socket
2. Spline socket
3. Countershaft

Apply sealant on mating surface of bearing housing.

BEARING HOUSING MATING SURFACE SEALANT	
Service product	

Install bearing housing screws and tighten them as per following sequence.

TIGHTENING TORQUE	
Bearing housing screws	10N.m±1N.m （89 lbf.ft±9 lbf.ft）



GEARBOX AND SHIFTING MECHANISM

Disassenbling the Gearbox and Shifting Mechanism

NOTE:Durning gearbox and shafting mechanism disassembly,inspect the condition of each part closely.

Index Lever,Index Washaer and Parking Locking Lever

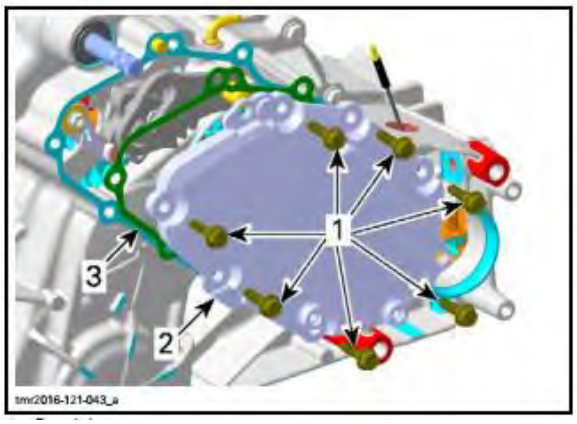
Set gearbox to PARK position.

Remove:

-Reating screws

-Gearbox cover

-Gasket(discare it)



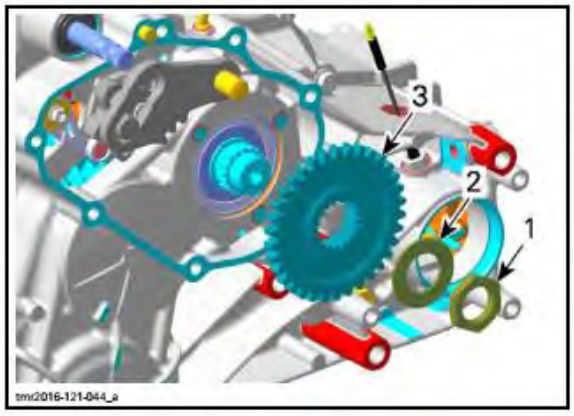
1. Retaining screws
2. Gearbox cover
3. Gasket

Remove:

-Nut

-Spring washer

-Park locking gear

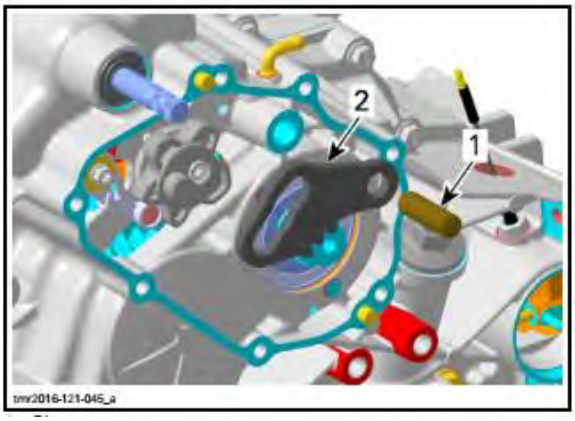


1. Nut
2. Spring washer
3. Praking locking gear

Remove:

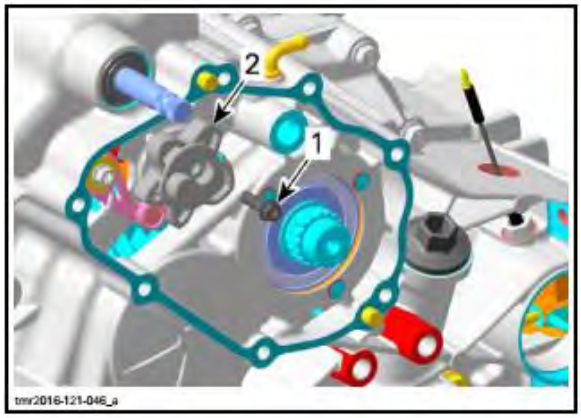
-Pin

-Parking locking lever.



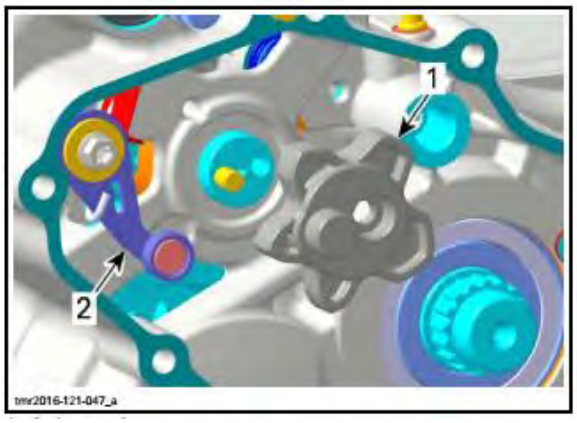
1. Pin
2. Parking locking lever

Remove screw retaining the index washer to the shaft drum,



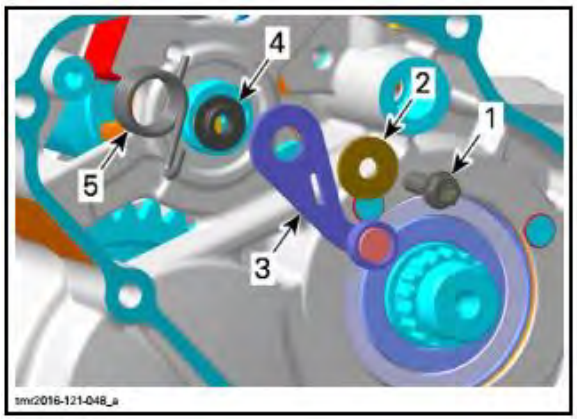
1. Screw
2. Index washer

Insert a flat screwdriver in the slot of index lever. Turn screwdriver clockwise and remove index washer.



1. Index washer
2. Index lever

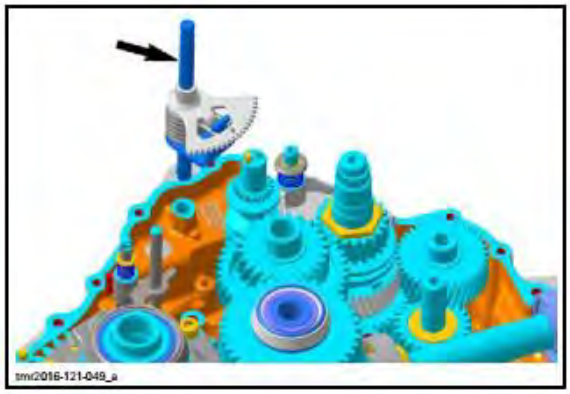
Remove the index lever with washer,step ring and spring.



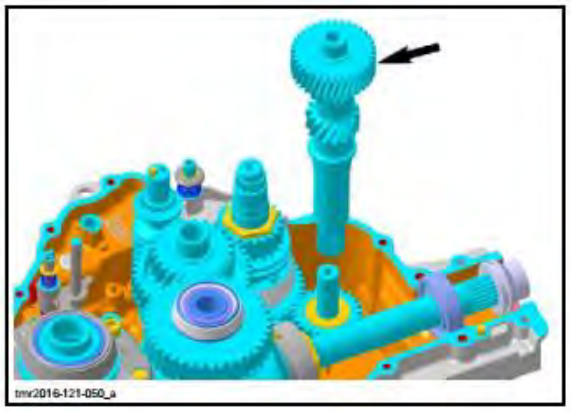
1. Screw
2. Washer
3. Index lever
4. Step ring
5. Index spring

Shift shaft Assembly

Separaate gearbox housing,refer to GRARBOX HOUSING in this subsection.
Withdraw shift shafe assembly.

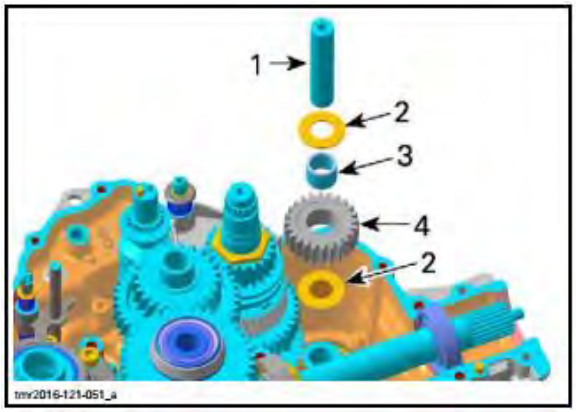


Countershaft and Reverse Intermediate Gear
Separate gearbox housing,refer to GEARBOX HOUSING inthis sunscetion.
Use a soft hammer to push out countershaft from gearbox housing CVT side.



Remove:
-Bearing pin
-Reverse intermediaye gear
-Needle bearing
-Thrust washer

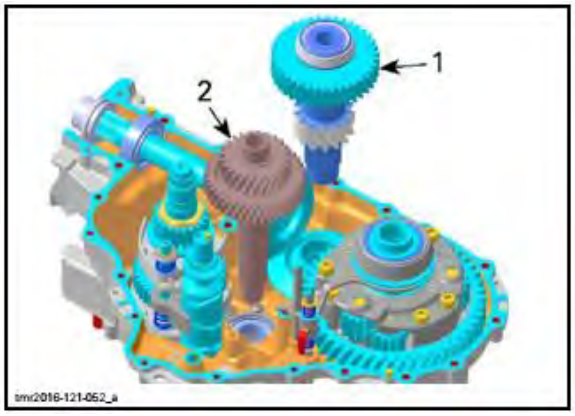
NOTE:Take care not to lose lower thrust washer durning remova.



1. Bearing pin
2. Thrust washer
3. Needle bearing
4. Reverse intermediate gear

Pinion Drive Shaft and Intermediate Shaft
Separate gearbox housing,refer to GEARBOX HOUSING in this subsection.
Remove:
1. Pinion drive shaft
2. Intermediate shaft

NOTE: Bevel gear and distance shim remain in gear box housing.

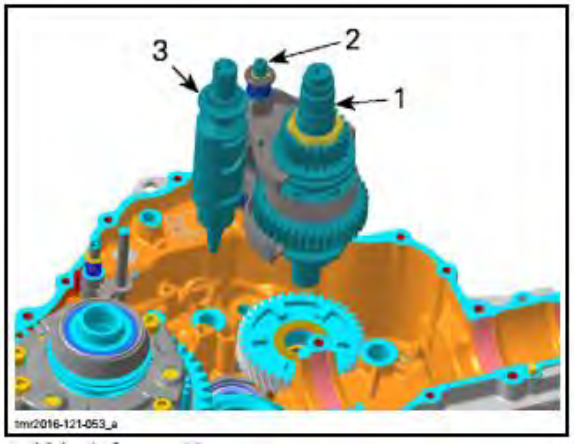


1. Pinion drive shaft
2. Intermedication shaft

Main Shaft,Shift Fork Shaft

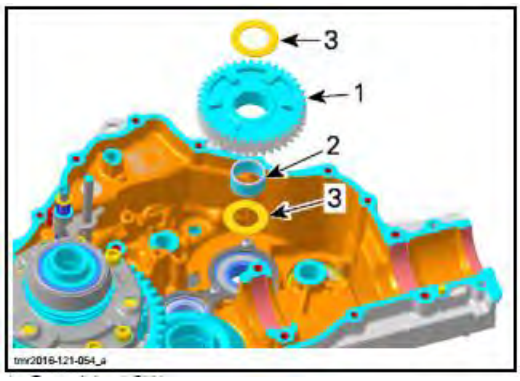
Assembly and Shift Durm.

Separate gearbox housing,refer to GEARBOX HOUSING in this subsection.
See produres in this subsection to remove:
-Pinion drive shaft
-Intermedication shaft.
-Countershaft
-Reverse intermedication gear.
Remove main shaft assembly together with shift fork shaft assembly and shaift durm.



1. Main shaft assembly
2. Shift fork shaft assembly
3. Shift durm

Remove:
-LOW range gear
-Needle bearing
-Thtust washer



1. Free pinion LOW range rear
2. Neddle bearing
3. Thrust washer

Disassembly the Shift Fork Shaft Assembly

NOTICE Springs are not identical.Mark them to reinstall them in thier orangial position.

Remove :

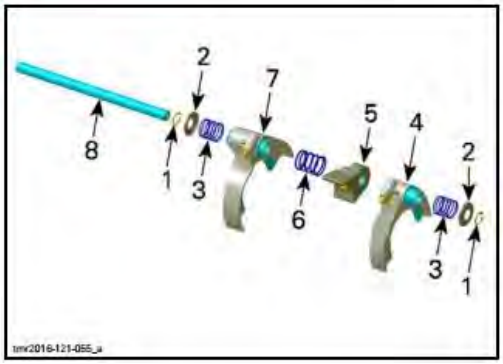
-Snap rings(discard them)

-Spring seats

-Springs

-Shift forks

-Shifting block.



1. Snap rings
2. Spring seat
3. Outer spings
4. Shift fork HIGH
5. Shifting block
6. Center spring
7. Shift fork LOW/REVERSE
8. Shift fork shaft

Inspeting the Gearbox and Shifting Mechanism

Always verify for the following when inspecting gearbox components:

-Gear teeth damage

-Worn or scoured bearing surfaces

-Rounded engagement dogs and slots

-Worn shaift fork

-Worn splines on shafts and shaifting sleeves.

Bearings

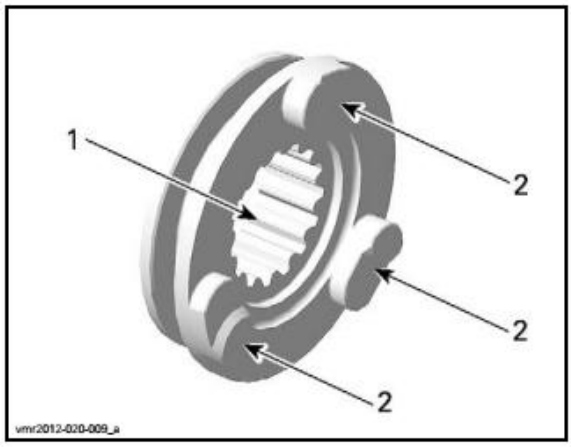
When gearbox is removed check gearbox ball bearings for contamination and/or metal shavings.

Check if ball bearing turn freely and smoothly.

Replace if necessary,refer to GEARBOX HOUSING in this subsection.

Shifting Sleeves

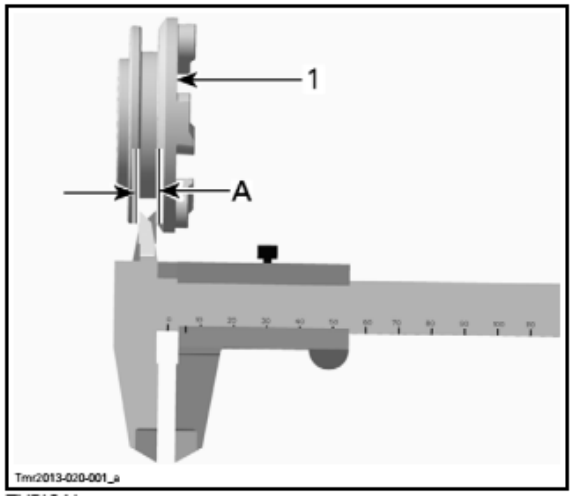
Check shaifting sleeves for worn inner splines and roundde or damaged engagement dogs.



TYPICAL

1. Inner splines
2. Enagement dogs

Measure the width of shift fork engagement groove.



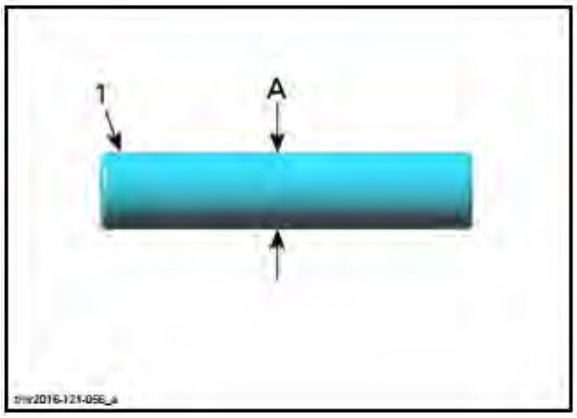
TYPICAL

1.Shifting sleeve

A.Width of shaift fork engagement groove.

WIDTH OF SHIFT FORK ENGAGEMENT GROOVE	
NEW	5.30mm to 5.40mm（.209in to .213in）
SERVICE LIMT	5.50mm（.217in）

Shafts check bearing pin of reverse intermediate gear for wear.

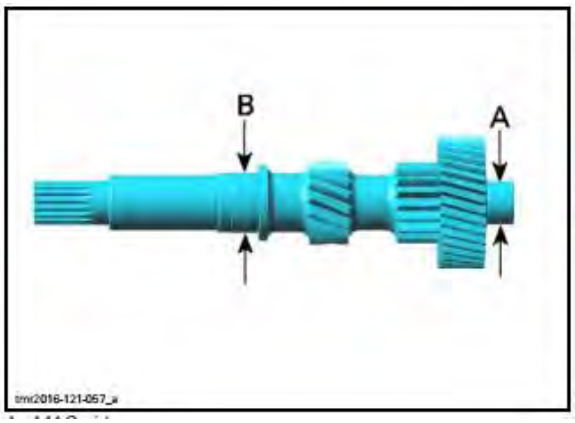


1.Bearing pin

A.Outre diameter

BEARING PIN OUTER DIAMETER	
NEW	24.987mm to 25.000mm（.984in to .984in）
SERVICE LIMT	24.977mm（.9833in）

Check countershaft bearing journals for wear.

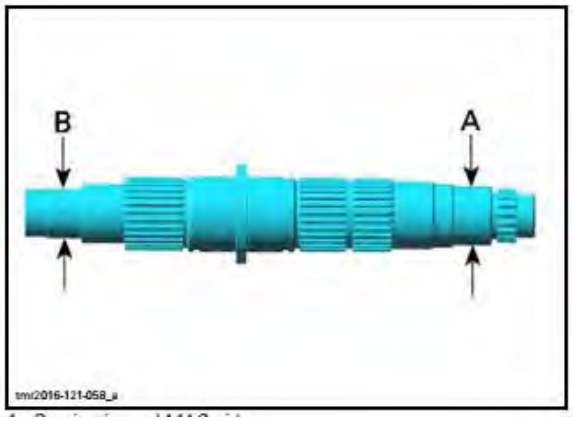


A.MAG side

B.Bearing journal CVTside

COUNTERSHAFT BEARING JOURNALS	
MAG SIDE	
NEW	19.977mm to 19.990mm（.786in to .787in）
SERVICE LIMT	19.973mm（.786in）
CVT SIDE	
NEW	24.977mm to24.990mm（.983in to .984in）
SERVICE LIMT	24.970mm（.983in）

Check main shaft for wear.



A.Bearing journal MAG side

B.Bearing journal CVTside

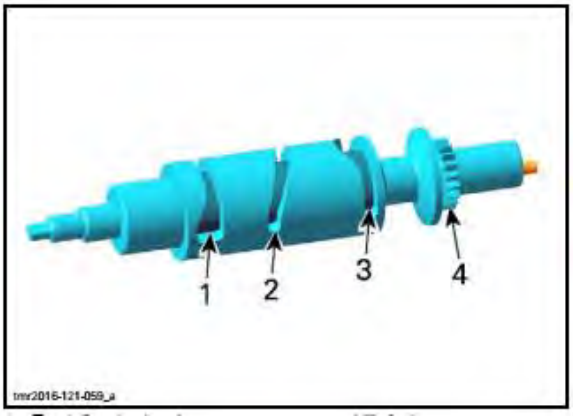
MAIN SHAFT BEARING JOURNAL CVT/MAG SIDE	
NEW	16.980mm to 16.991mm（.669in to .669in）
SERVICE LIMT	16.976mm（.668in）

Shift Shaft

Check shaift shaft for worn splines and gears
Check shaift shaft spring fir damages.

Shift Durm

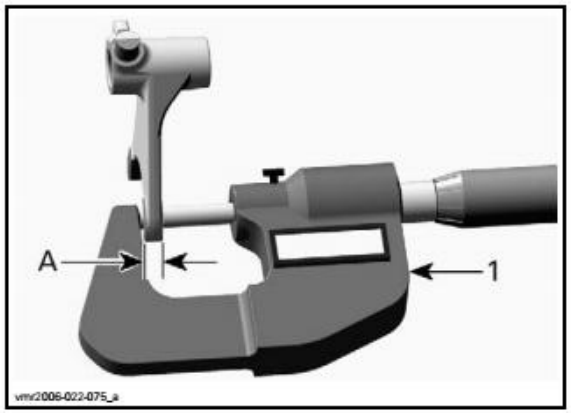
NOTICE Do not dissassemble shaft durm.
Check shaift durm tracks for scouring or heavy wear.like rounded engagement slots.



1.Track for the low/reverse range gear shaift fork
2.Track for the shifting block
3.Track for the high range gear shift fork
4.Shift durm gear

Shift Forks

Check both shaift forks for visible damage,wear or bent shaft fork claws.
Check engagement rollers for wear and smooth movement.
Measure the shift fork claw thickness.



TYPICAL
1.Micromerer
A.Shift fork claw thickness

MAIN SHAFT BEARING JOURNAL CVT/MAG SIDE	
NEW	16.980mm to 16.991mm（.669in to .669in）
SERVICE LIMT	16.976mm（.668in）

Shift Fork Shaft

Check shaift fork shaft for visible damage or wear.
Check if shaft fork shaft is straight.

Index Lever and Parking lever

Index lever with toller must move freely.
Check parking lever for cracks or other damages.

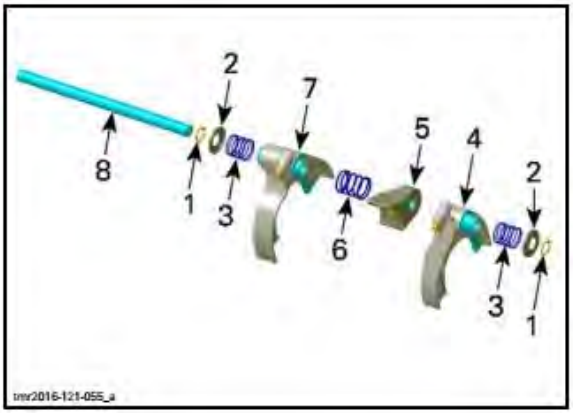
Assembling the Fearbox and Shifting Mechanism

The assembly of gearbox is essentially the reverse of disassembly procedure. However,pay attention to the following details.

BALL BEARING SEATS LUBRICATION	
Service product	COPASLIP

Assembling the Shift Fork Shaft Assembly
NOTICE Spring are not identical.

Install:
-NEW snap rings.
-Spring seats.
-Springs
-Shift forks
-Shifting block.

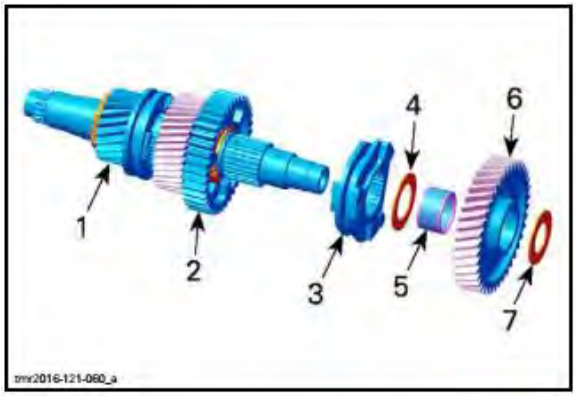


1.Snap rings
2.Spring seat
3.Outer springs
4.Shift fork HIGH
5.Shifting block
6.Center spring
7.Shift fork LOW/REVERSE
8.Shift fork shaft

Main Shaft,Shift Fork sHAFT Assembly and Shift Durm

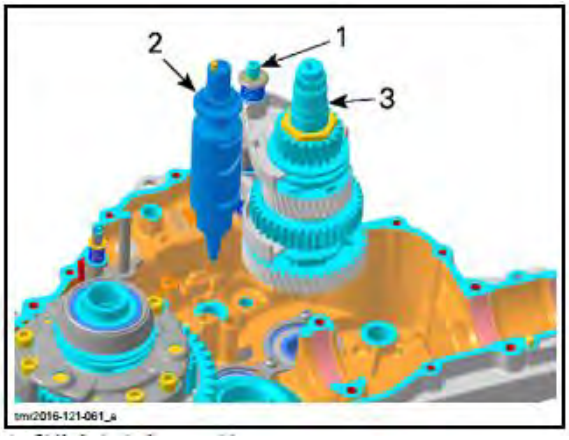
Install shaifting sleeve,thrust washer and LOW gear pinion on main shaft assembly.

NOTE:Check if shaifting sleeve engrages connectly in reverse gear.



1.Main shaft assembly
2.Reverse gear
3.Shifting sleeve
4.Thrust washer
5.Needle bearing
6.LOW gear pinion
7.Thrust washer

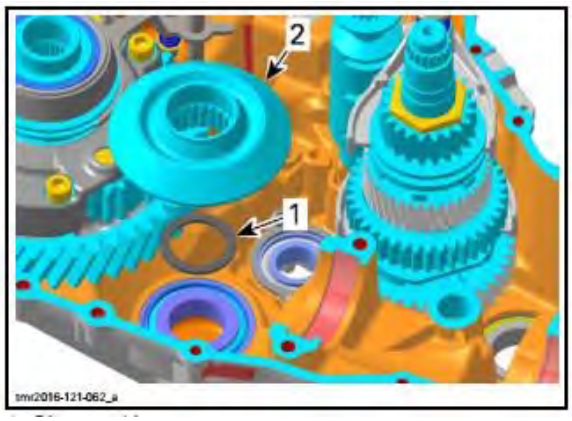
Install shaift fork shaft assembly,shift durm and main shaft assembly together into gearbox housing.



1.Shift fork shaft assembly
2.Shift durm
3.Main shaft assembly

Pinion Drive Shaft and Intermediate Shaft

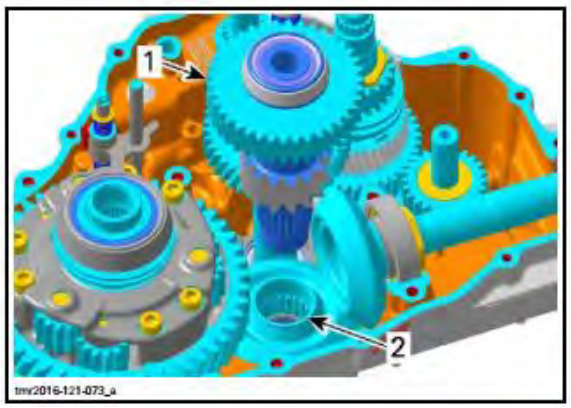
Ensure distance shaim and bevel gear are placed on the pinion drive shaft bearing in geaibox housing.



1.Distance shim
2.Bevel gear

Install:
1.Intermediate shaft
2.Pinion drive shaft

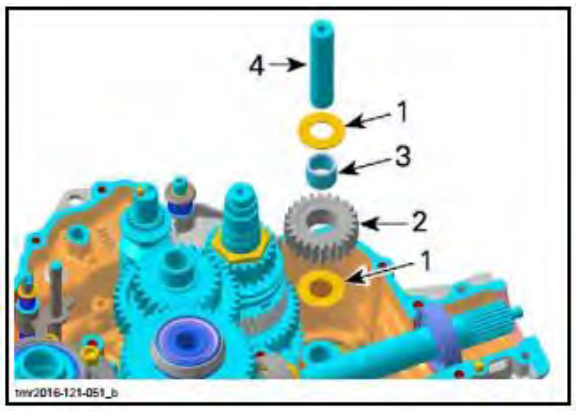
Carefully fit pinion drive shaft into inner solines of bevel gear.



1.Pinion drive shaft
2.Bevel gear solines

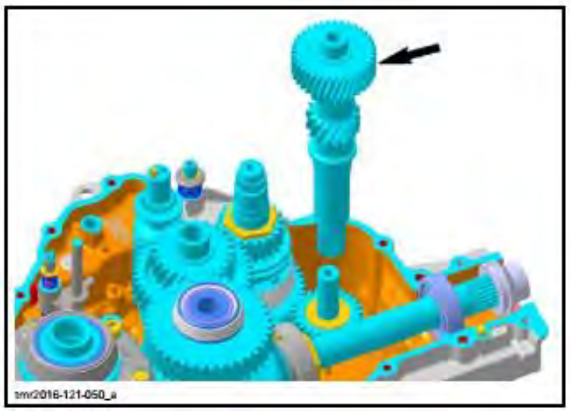
Countershaft and Revise Intermediate Gear

Intall:
-Reverse intermediate gear
-Needle nearing
-Thrust washer
-Bearing pin.



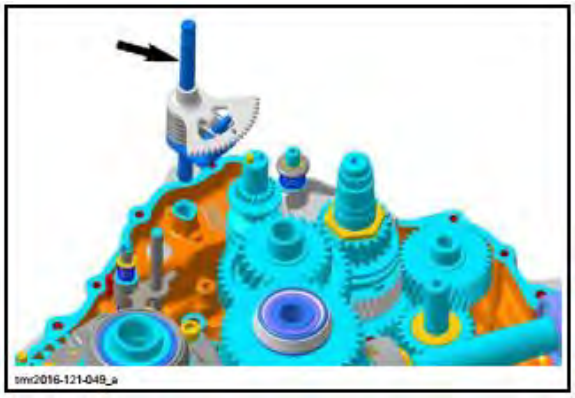
1.Thrust washers
2.Reverse intermediate gear
3.Needle bearing
4.Bearing pin

Install countershaft from.

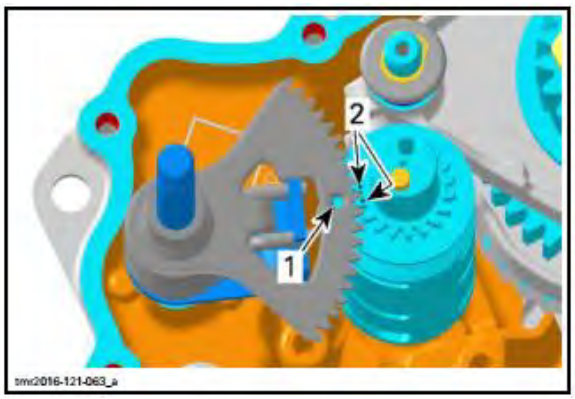


Shift Shaft Assembly

Install shaft shaft assembly.



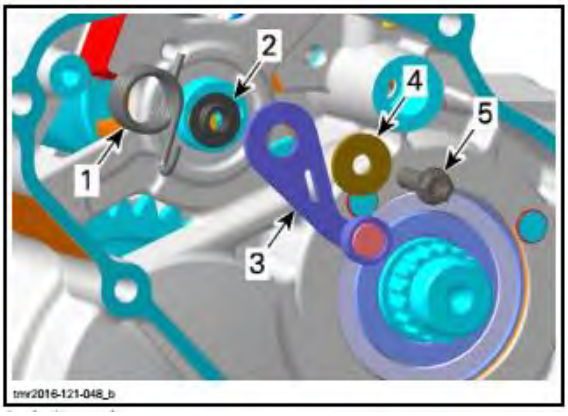
Align mark on shift shaft with marks on shift durm gear.



1.Mark on shift shaft
2.Marks on shift durm gear

Index Lever, Index Washer and Parking lock Lever

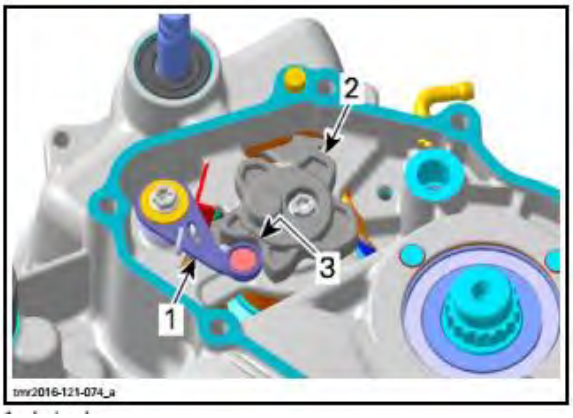
Fit step ring into index lever



1.Index spring
2.Step ring
3.Index lever
4.Washer
5.Screw

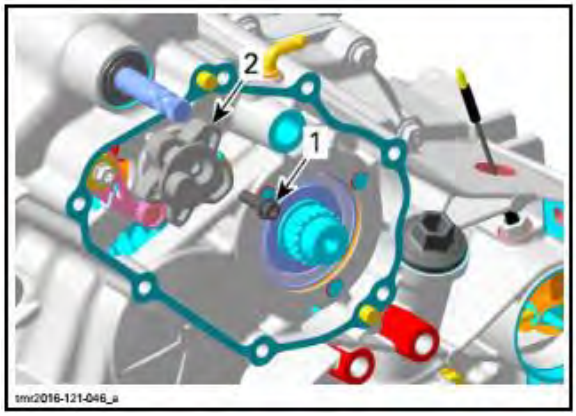
TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Index lever retaining screw	10N.m±1N.m（89 lbf.ft±9 lbf.ft）

Install index washer on shift durm.
Insert a flat scerwdrive in the slot of the index lever.turn scerwdrive clockwise and engage lever in index washer in NEUTRAL position as per following illustrating.



1.Index lever
2.Index washer
3.NEutral position

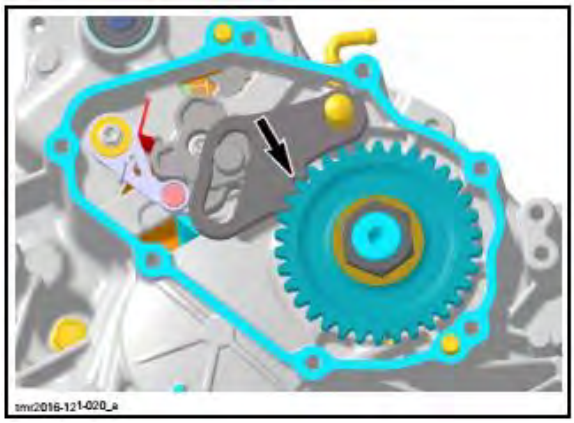
Install screw retaining the index washer to the shift drum.



1.Screw
2.Index washer

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Index washer retaining screw	10N.m±1N.m（89 lbf.ft±9 lbf.ft）

Install:
-Parking locking gear
-Spring washer
-Nut
-Pin
-Park locking lever
Set gearbox to PARK position.

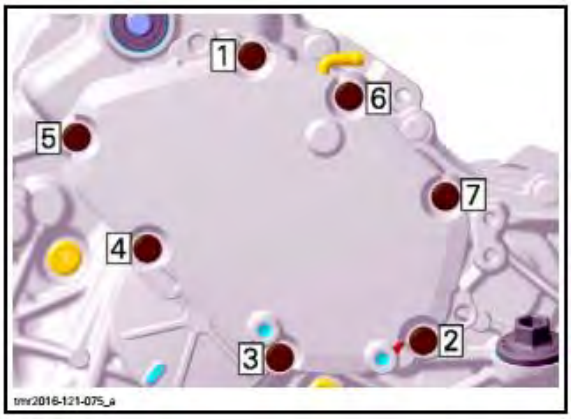


PARK LOCKING LEVER ENGAGED
Tighten nut to specification.

TIGHTENING TORQUE	
Service product	卡夫特 k-0271
Park locking gear nut	170N.m±10N.m（125 lbf.ft±7 lbf.ft）

Install gearbox cover with New gastet.
Tighten gearbox cover screws as per following sequence.

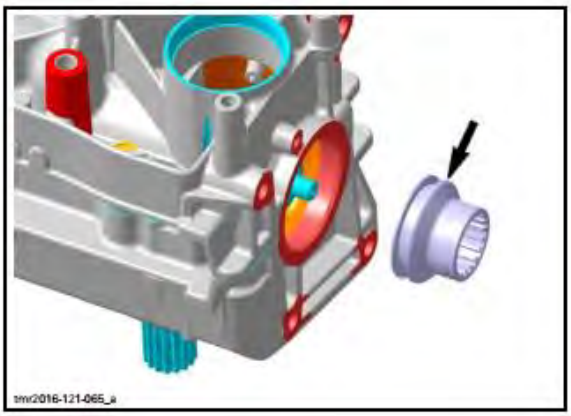
TIGHTENING TORQUE	
Gearbox cover screws	10N.m±1N.m （89 lbf.ft±9 lbf.ft）



OUTPUT SHAFT AND 4×4 COUPLING MECHANISM

Removing the Out put Shaft and 4×4Coupling Mechanism

Drain gearbox oil.Refer to GEARBOX OIL REPLACEMENT in PERIODIC MAINTENANCE PROCEDURES subcestion.
Pull out 4×4 coupling sleeve.



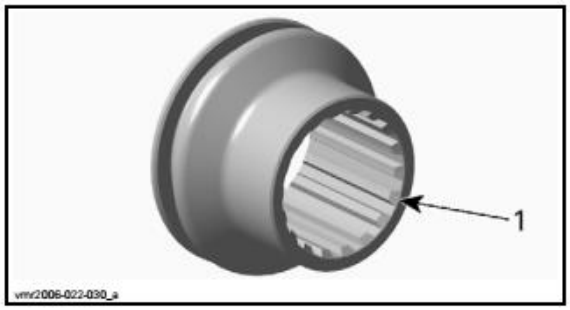
Inspecting the Output Shaft and 4×4 Coupling Mechanism

Output Shaft

Check output shaft and its gear for cracks,bend,pitting or other visible damages.
Check output shaft splines for wear or other damades.
Check if output shaft bearing turn freely and smoothly.
Replace oil seal if brttle,hand or damaged.

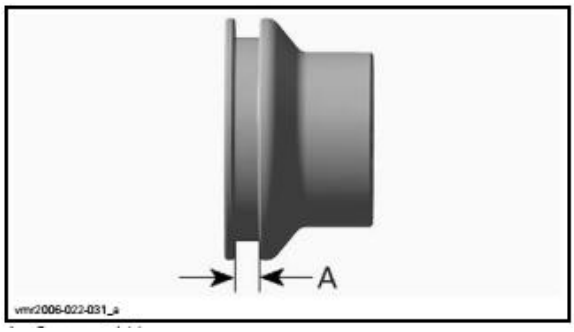
4×4 Coupling Sleeve

Check splines of coupling sleeve for wear or other damages.



1. Inspect splines

Measure the coupling sleeeve groove width.



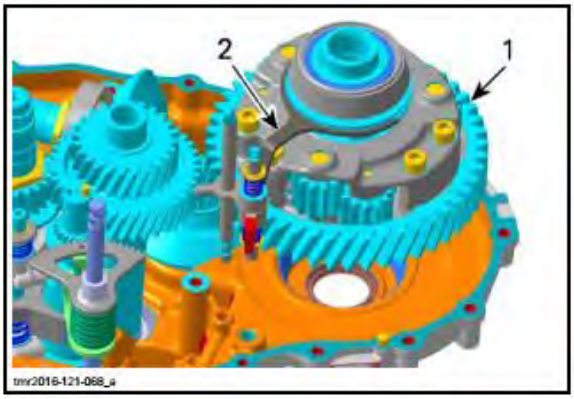
A.Groove width

COUPLING SLEEVE GROOVE WIDTH	
NEW	5.25mm to 5.35mm （.207in to .211in）
SERVICE LIMT	5.50mm（.217in）

REAR DIFFERENTIAL AND LOCKING MECHANISM

Removing the Rear Different and Locking Mechanism

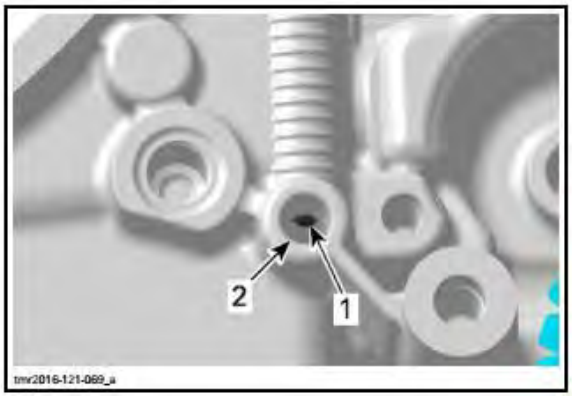
Separte gearbox housing,refer to GRARBOX HOUSING in this subsection.
Remove rear differential together with locking mechanism.
Take care not losing the distance shin underneath tapered roller bearing.



1.Rear differential
2.Locking mechanism

Inspecting the Rear Differential and Locking Mechanism

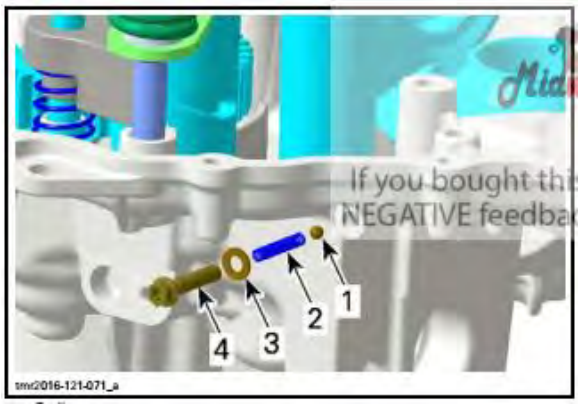
Check for ball of locking mechanism setting in gearbox housing.



1.Ball
2.Bore of lockiong mechanism in gearbox housing

Installing the Rear Differential and Locking Mechanism

Install:
-Ball
-Spring
-Sealing ring
-Screw.

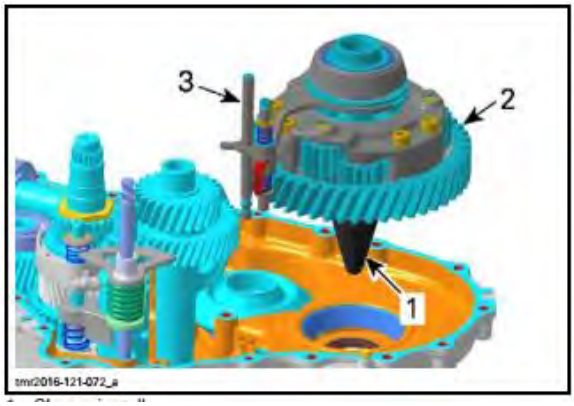


1.Ball
2.Spring
3.Sealing ring
4.screw

TIGHTENING TORQUE	
Screw	8N.m±1N.m （71 lbf.ft±9 lbf.ft）

Install rear differential togetuer with locking mechanism.

REQUIRED TOOL	
SLEEVE INSTALLER	

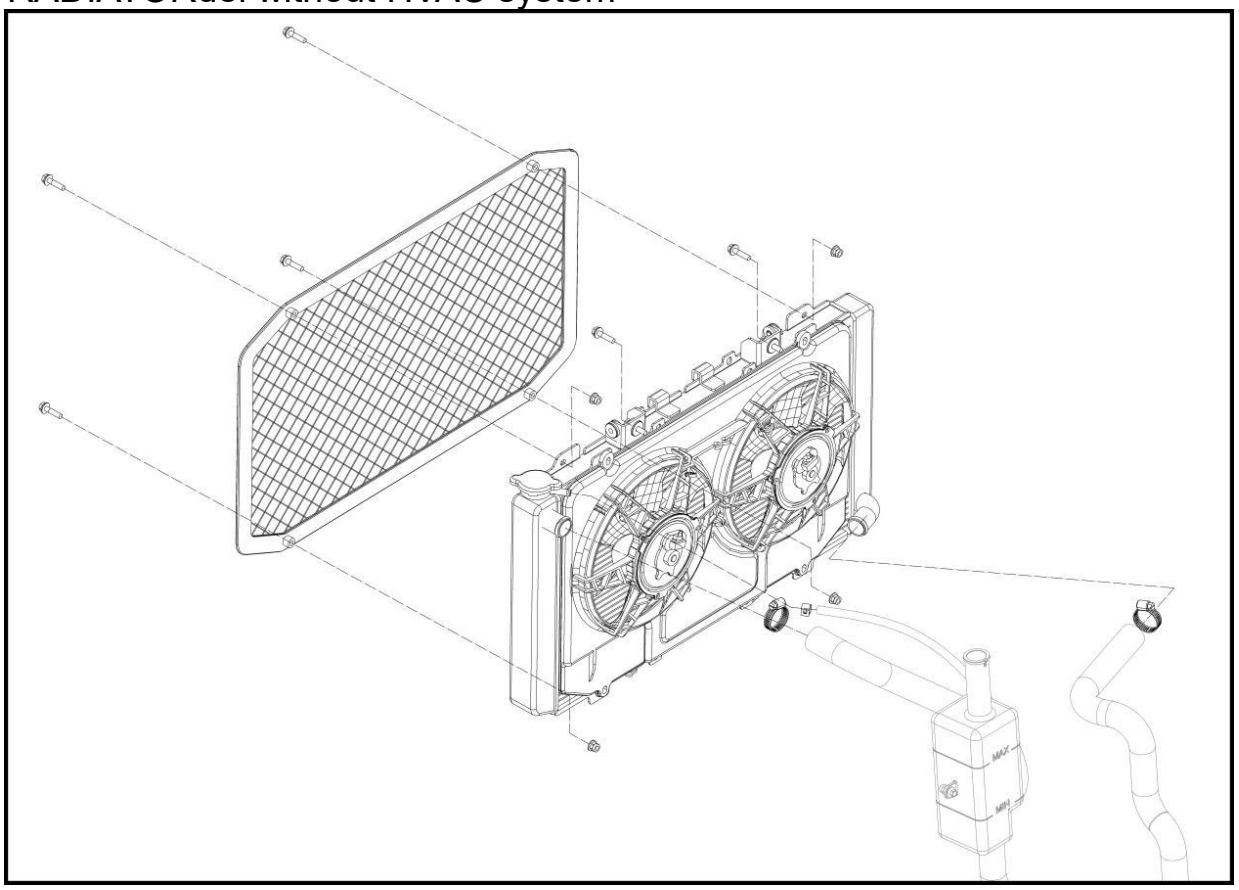


1.Sleeve installer
2.Rear differential
3.Locking mechanism

4. COOLING SYSTEM

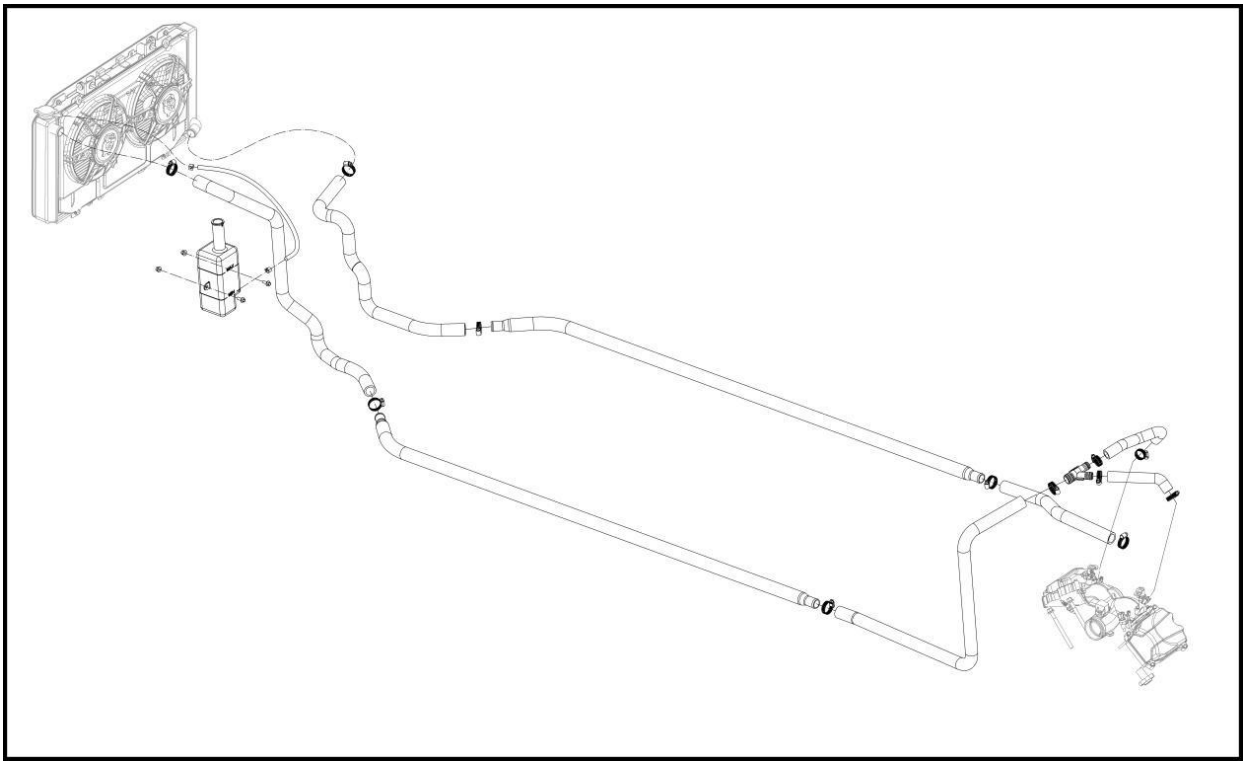
RADIATORdel without HVAC system.....4-2	COOLING HOSES.....4-2
RADIATOR..... 4-3	COOLING HOSES..... 4-3

RADIATORdel without HVAC system



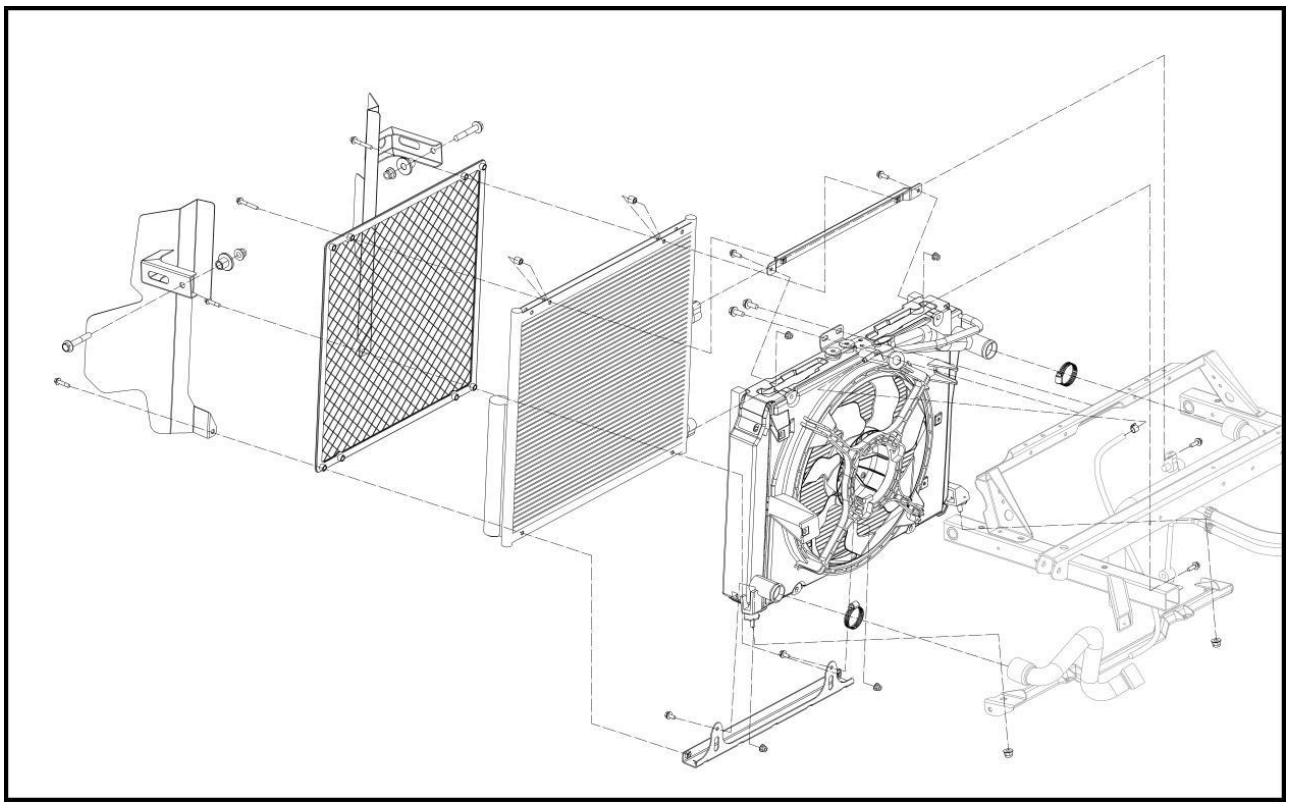
COOLING HOSES

Model without HVAC system



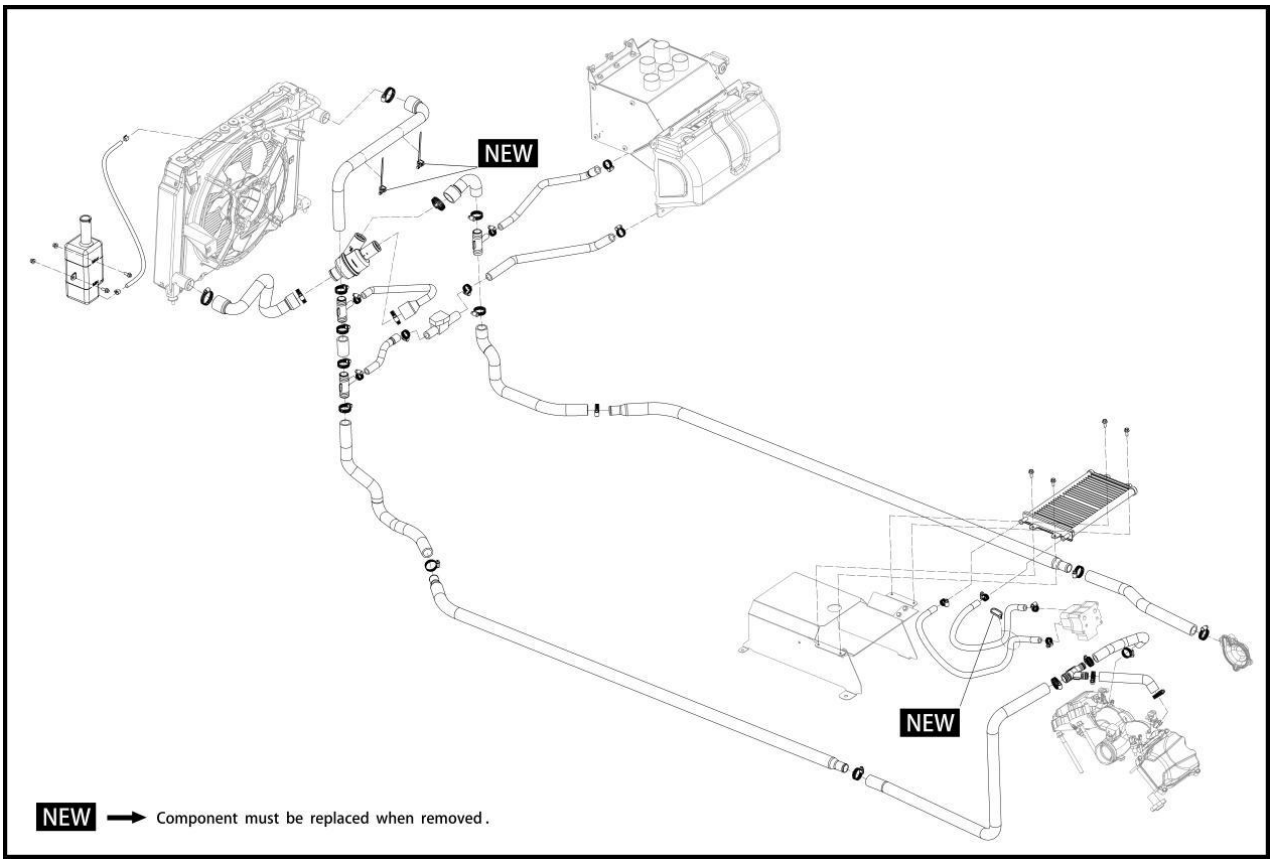
RADIATOR

Model with HVAC system



COOLING HOSES

Model with HVAC system



GENERAL

NOTICE Never start engine without coolant.Some engine parts such as the rotary seal on the Water pump shaft can be damaged .

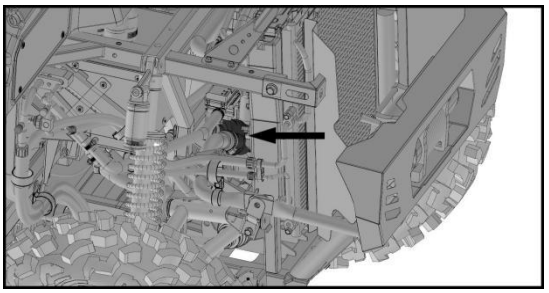
PROCEDURES

THERMOSTAT

The thermostat is a single action type .

Thermostat Location

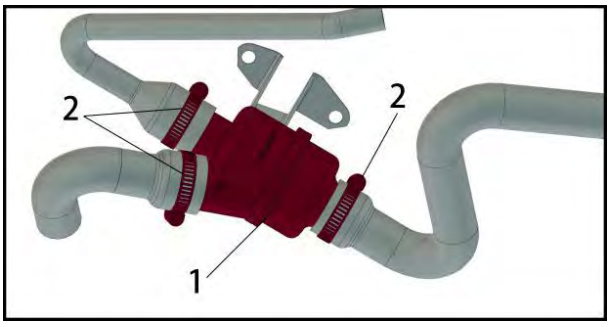
The thermostat is mounted in-line in the cooling system circuit .



THERMOSTAT LOCATION - BEHIND RADIATOR, UNDER EVAPORATOR COVER

Removing the Thermostat

1.Clamp the three hoses on both ends of the thermostat with a tie.
2.Remove clamps that secure hoses to thermostat.
3.Remove a bolt holding the thermostat.
4.Remove thermostat.



1. Clamps
2. Thermostat

Testing the Thermostat

To check thermostat, put it in water and heat the water.

THERMOSTAT OPENING TEMPERATURE	
Starts to open	82℃（179.6℉）
Fully open	92℃（197.6℉）

Replace thermostat if it does not begin to open at specified temperature.

Installing the Thermostat

The installation is the reverse of the removal procedures.
Refill cooling system.

NOTICE **The cooling system must be bled as specified.**

Check for coolant leaks.

RADIATOR

Inspecting the Radiator

Check radiating fins for clogging or damage.
Remove insects, mud or other obstructions with compressed air or low pressure water.

Removing the Radiator

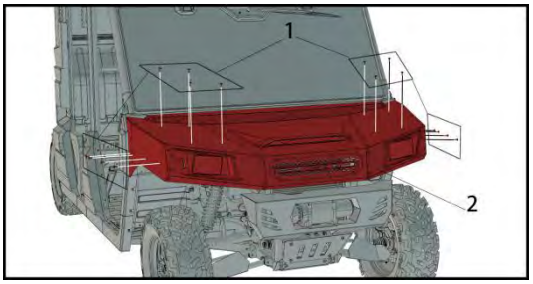
1. Install a hose pincher on both radiator hoses.

2. Remove the following parts to reach radiator:

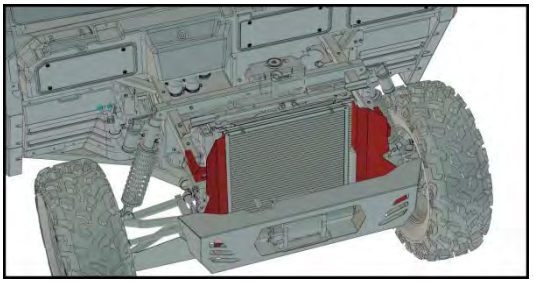
– Front fenders (Remove the 12 bolt,and selectrical connector)

– Remove air deflector

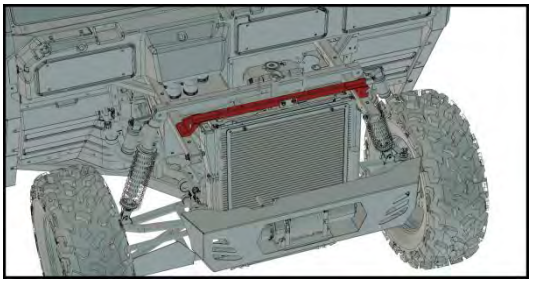
– Remove radiator frame.



Front fenders② (Remove the 12 bolts①,and selectrical connector)



Remove air deflector



Remove radiator frame

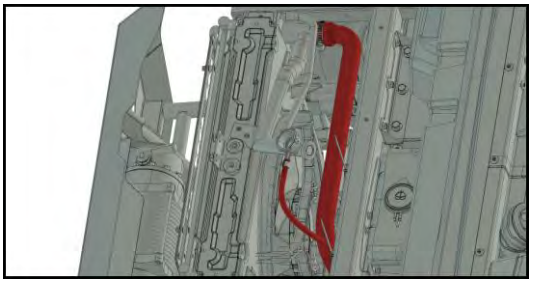
3. Remove the following parts from the radiator:

– Radiator inlet hose and coolant reservoir vent hose

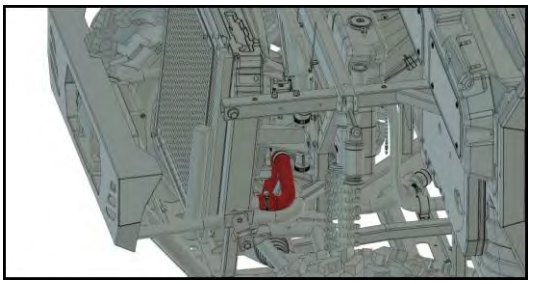
– Radiator outlet hose

– Condenser(Remove the condenser retaining bolts only,Do not remove the condenser line)

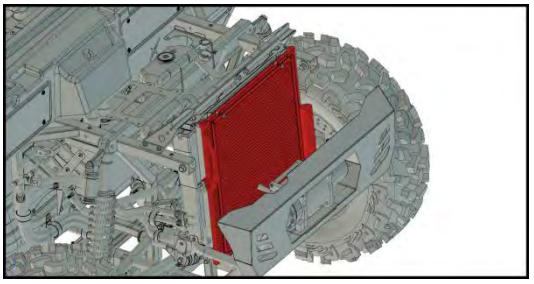
– Radiator mounting nut (2 at bottom of radiator).



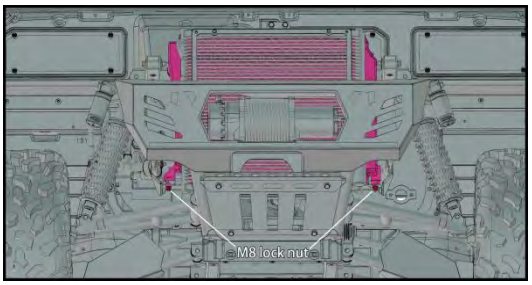
Radiator inlet hose and coolant reservoir vent hose



Radiator outlet hose



Condenser(Remove the condenser retaining bolts only,Do not remove the condenser line)



Radiator mounting nut (2 at bottom of radiator)

4. Disconnect cooling fan electrical connector.

5. Carefully remove radiator.

Installing the Radiator

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

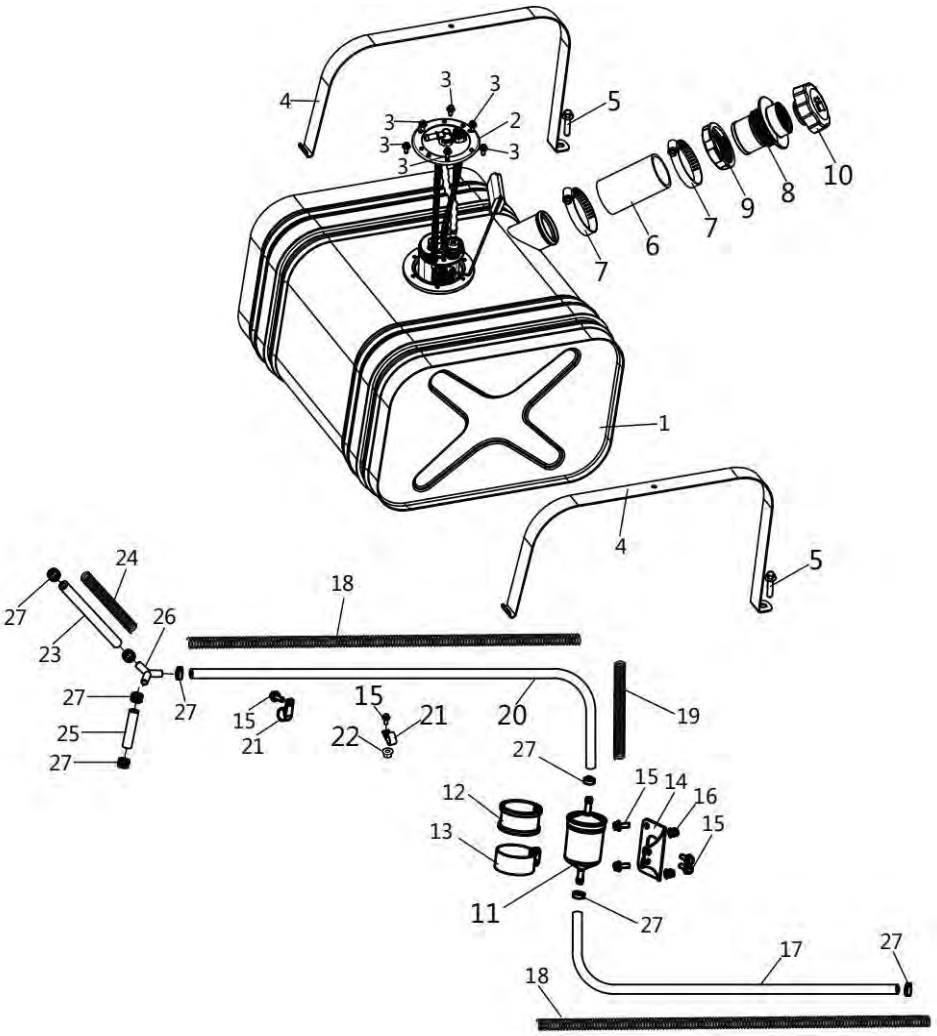
Fill radiator with the recommended coolant.

Bleed the cooling system.

Check for coolant leaks from radiator and hoses.

5. FUEL SYSTEM

FUEL PRESSURE ~~TEST~~		5-2	FUEL FI~~LTER~~	—	5-2
FUEL ~~PUMP~~	—	5-3	FUEL ~~TANK~~	—	5-4



The fuel system of a fuel injection system holds much more a pressure than on carbureted vehicle. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here.

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses. Proceed with care when removing/installing pressure test equipment or disconnecting fuel line connections. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the engine compartment. Do not allow fuel to spill on hot engine parts and/or electrical connectors. Never use a hose pincher on injection system high pressure hoses. Replace any damage or deteriorated fuel lines.

When the repair is completed, ensure that all hoses are connected and secured.

Always perform the fuel pressure test if any component has been removed. A pressure test must be done before turning the ignition key to ON and setting the engine stop switch to RUN. The fuel pump is activated each time in these conditions.

To locate a leak, pressurize the system. Check for leaking fuel or fuel odor. Spray soapy water on all hose connections and injectors. Air bubbles will show the leaking area.

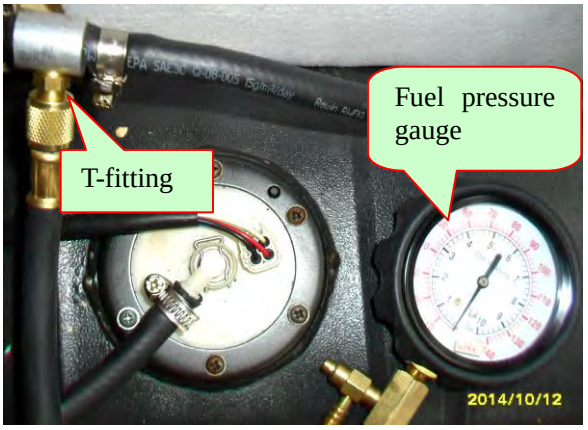
Inspect the fuel lines, fuel tank, fuel tank cap for damage, clogging and leakage of fuel. If any damages are found, replace the defective parts with the new ones.

FUEL PRESSURE TEST

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.
Before proceeding to the pressure test ensure the battery is fully charged. Battery voltage must be over 12 volts.
Ensure there is enough gas in fuel tank.

Remove left seat.

Disconnect outlet hose.
Install fuel pressure gauge and T-fitting between disconnected hoses.
Turn ignition key ON and set engine stop switch to RUN and observe fuel pressure. Turn ignition key off then back on. Repeat the test.



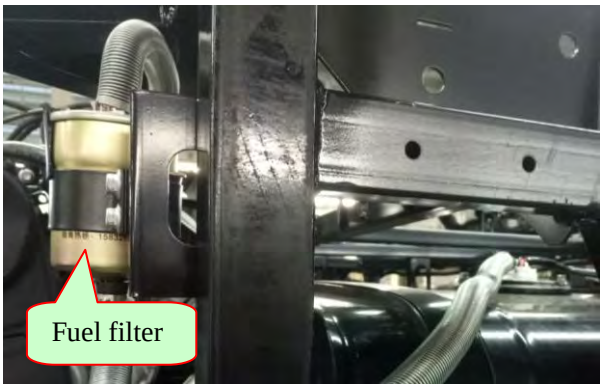
Standard fuel pressure: 350kpa.
A rapid pressure drop indicates leakage is from the fuel rail, If there is not leaking then replace fuel pump.
A slow pressure drop indicates leakage either from the fuel injector or from the fuel pressure regulator. Check fuel injector and the fuel pressure regulator for leaks. If it is not leaking then replace fuel pump module.
If no leakage, start engine and observe fuel pressure. The fuel pressure should be the same as above. If pressure is within limits, fuel pump and the fuel pressure regulator are working adequately.

Remove pressure gauge from inlet hose. Reconnect inlet hose.

FUEL FILTER

Replace fuel filter as per amintenance schedule.

Filter Removal
Remove clamps and pull hoses off.
Detach filter from body.



Filter inspection
If fuel filter is suspected to be clogged, it may be checked as follows:
Using low compressed air, check if fuel filter is clogged. Air should flow easily through filter. In doubt, install a new filter.

Filter installation
Use arrow on filter to position it according to fuel flow.

FUEL PUMP

Fuel pump electrical test.

When turning ignition key ON, the fuel pump should run for 5 seconds to build up the fuel pressure in the system.

If the pump does not work, disconnect the connector from the fuel pump.
Install a temporary connector to the fuel pump connector. Apply 12V to this test harness.

CAUTION

Running the fuel pump a few minutes with reverse polarity can damage the pump.

If pump does not run, replace a new pump.

Other wise, check fuse and if good, probe terminals of fuel pump connector on vehicle harness or its connector, Repair or replace appropriate part.

Fuel pump removal

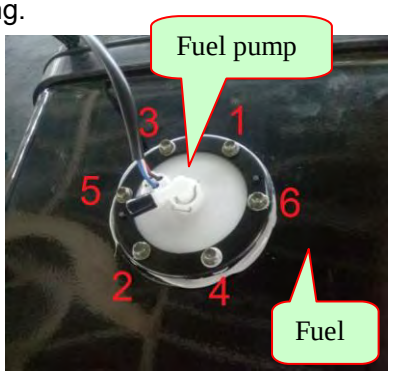
Remove fuel pump outlet hose and harness.
Remove fuel pump retaining screws.
Gently push pump up.

CAUTION

While pulling out the fuel pump, pay attention to fuel sensor float arm. Float arm can get stuck and bend which can reduce the fuel sensor capabilities.

Fuel pump installation

For installation, reverse the removal process but pay attention to the following.
Install a new gasket.
Pay attention to pump orientation.
Tighten retaining screws as per illustrated sequence.
Install hose properly on OUT nipples and harness.



FUEL SENSOR

The level sensor is part of the fuel pump module mounted inside the fuel tank.

Inspection

Dismantle the fuel pump module mounted inside the fuel tank(refer to above steps)
Turn on ignition swtich.
Use hands to shake fuel sensor's floating device,locating floating device to see whether it is fit with indication of fuel meter.

Turn off the ignition switch and disconnect connector,measure resistance:
Lower:BLUE/WHITE:6-9Ω
Lift:BLUE/WHITE:90-95Ω

If the resistance is not within empty and full values,replace fuel pump module. If the fuel level sensor is good,try a new multifunction gauge.

Inspection

Install fuel sensor to fuel tank. Connect connector and hose.Turn on fuel supply switch,and check whether
Functions of fuel meter is normal or not.
Fuel leskage is not allowed.

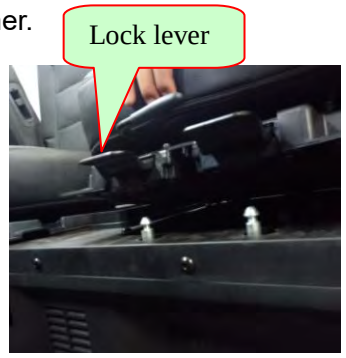
FUEL TANK

Fuel tank draining

Never perform this operation when the engine and/or the exhaust system is/are hot.
Never sue a hose pincher on injection system high pressure hoses.
Remove fuel tank cap and siphon gas in an approved fuel container.

Fuel tank removal

Remove the seat by lift 2 lock lever.

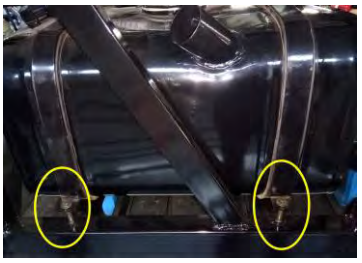


Remove the rear boby guard(right).
Remove the right guard.

Disable fuel pump by removing the electrical connector from the fuel pump.
Remove fuel pump outlet hose.

Remove fuel pump retaining screws and hoops.

Remove the bolts of fuel tank retaining.



Pull front side of the fuel tank upward,
continue lifting movement until you can remove the fuel tank completely.

Fuel tank inspection

Inspect fuel tank for any damage or cracks which may result in fuel leaks. If so replace tank with a new one. Inspect tank and protector attachment points for damage. Inspect protector for damage.

Fuel tank installation
For installation, reverse the removal process but pay attention to the following.
Reconnect fuel pump connector and fuel hose.
Tighten retaining screws.
Refuel tank and ensure there are no leaks.

Fuel pump installation
For installation, reverse the removal process but pay attention to the following.
Install a new gasket.
Pay attention to pump orientation.
Tighten retaining screws as per illustrated sequence.
Install hose properly on OUT nipples and harness.

FUEL TANK

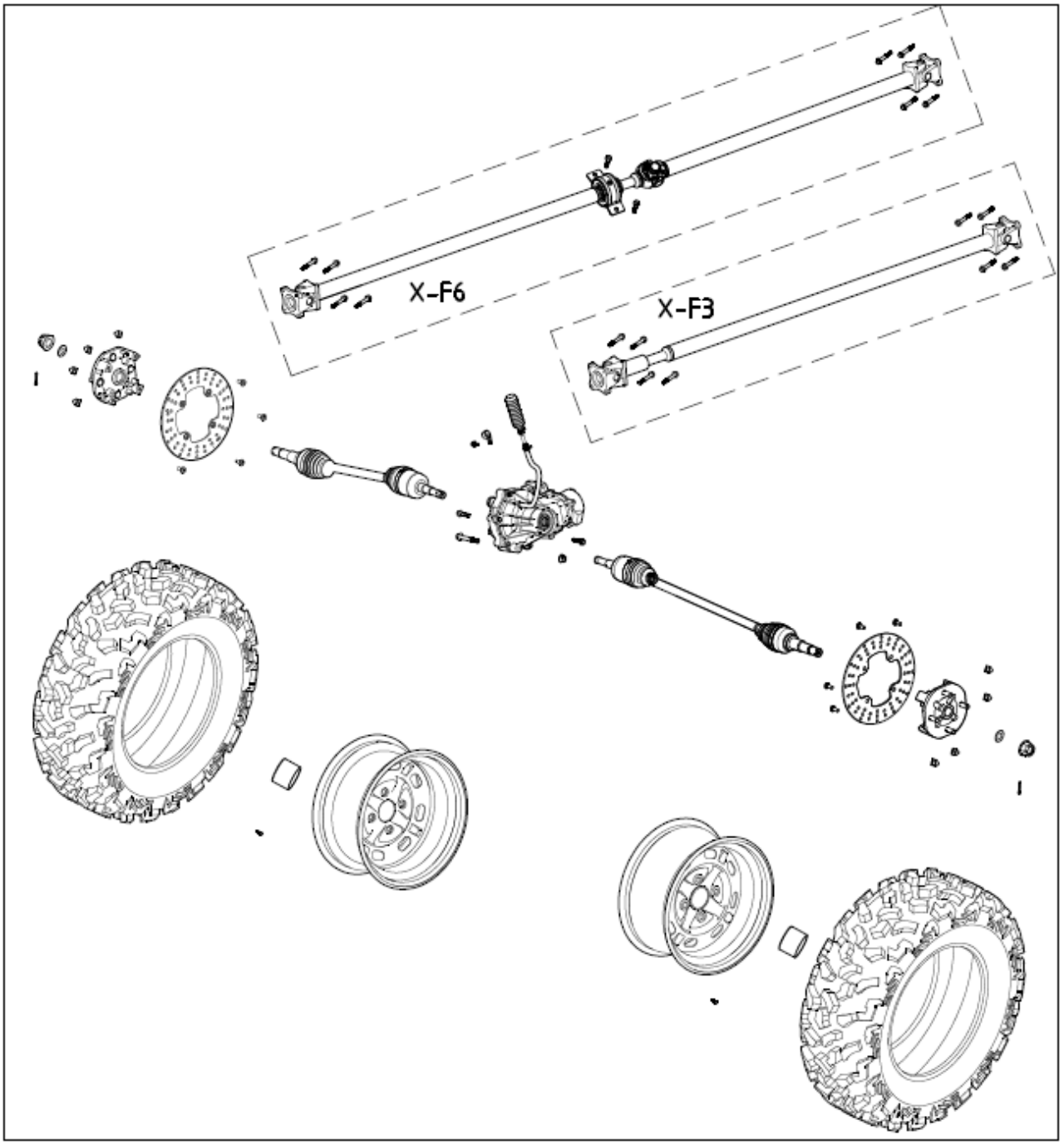
Fuel tank draining
Never perform this operation when the engine and/or the exhaust system is/are hot.
Never sue a hose pincher on injection system high pressure hoses.
Remove fuel tank cap and siphon gas in an approved fuel container.

Fuel tank removal
Disconnect vent line from body.
Fuel tank inspection
Inspect fuel tank for any damage or cracks which may result in fuel leaks. If so replace tank with a new one. Inspect tank and protector attachment points for damage. Inspect protector for damage.
Fuel tank installation

6. DRIVE TRAIN

FRONT DRIVE.....6-1	FRONT PROPELLER SHAFT.....6-2
FRONT WHEEL HUB.....6-3	FRONT DRIVE SHAFT.....6-4
FRONT DIFFERENTIAL.....6-5	REAR DRIVE.....6-8
REAR PROPELLER SHAFT.....6-8	REAR WHEEL HUB.....6-8
REAR DRIVE SHAFT.....6-8	REAR DIFFERENTIAL.....6-8

FRONT DRIVE



FRONT PROPELLER SHAFT

Removal

Place vehicle on PARK position and select 4WD.aas

Remove left and right seats, gear shift handle and engine shield.

Unscrew propeller shaft bolt on engine side.

Loosen the right front wheel nut.
Raise the front of vehicle, support it securely on jack stands.

Remove the right front wheel and the ball joint of tie rod from the steering knuckle.

Remove propeller shaft bolts on front differential side.

Inspection

Inspect the propeller shaft for wear or damage. If any defects are found, replace the propeller shaft with new one.

Check if U-joint moves freely in all direction.

Check bellows for holes or brittleness.

F-X3

F-X6

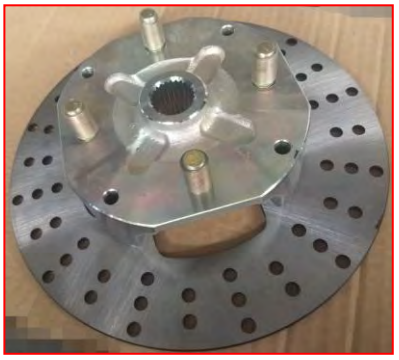
Installation

Installation is the reverse of removal procedure. Ensure tighten the bolts to the specified torque.

Installation location	Specifications (mm)	Torque N.m(kgf.m)
Bolt of front propeller shaft flange	M8	40(4.1)
Bolt of front propeller shaft flange	M10	80(8.2)

FRONT WHEEL HUB

Removal



Raise the front of vehicle, support it securely on jack stands and remove front wheel.

Remove cotter pin, castellated nut and belleville washer.

Remove the caliper from knuckle.

Pull the wheel hub to remove it.

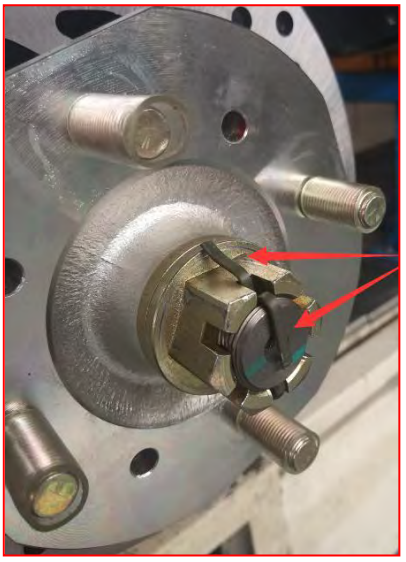
Inspection

Check wheel hub for cracks or other damages.

Check inner splines and wheel rim bolts for wear or other damages.

If any damage is detected on wheel hub, replace it with a new one.

Installation



The installation is the reverse of removal procedure.

Install washer so that the inside diameter protrudes outward and contacts the nut.

Tighten the castellated nut on the drive shaft end to 300N.m and further tighten until one of its grooves is aligned with a cotter pin hole. Install a new cotter pin and the wheel cap. Fold one pin of cotter pin over drive shaft end.

FRONT DRIVE SHAFT

Removal

Remove the appropriate wheel hub.

Remove the guard plate of brake caliper

Remove the fixing clip of brake hose on the knuckle.

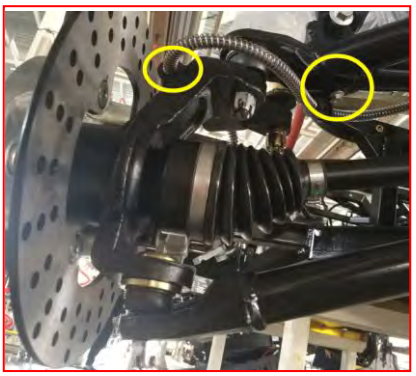
Remove the shock absorber.

Remove the ball joint of tie rod from the steering knuckle.

Remove the nuts of knuckle upper and lower ball joint.

Remove the knuckle.

Pull drive shaft out of differential.



Inspection

Inspect the condition boots. If there is any damage or evidence of leaking lubricant, replace them.

Check splines for excessive wear. Replace if necessary. If the splines on plunging joint are worn, a check of differential inner splines should be done.

Check the ring at teh end of drive shaft. If wear is apparent, replace the wear ring.

Check if the bearing in kunckle move freely and smoothly. If not, replace them.

Installation

Apply grease to the splines and insert the end of drive shaft in differential and pull joint a little to make sure that the stop ring is locked in differential side gear groove.

Insert the other end of drive shaft in the knuckle and install the knuckle to the lower suspension arm. Install and torque the ball joint retaining bolts to 45N.m

Install all other removed parts.

FRONT DIFFERENTIAL

Remove

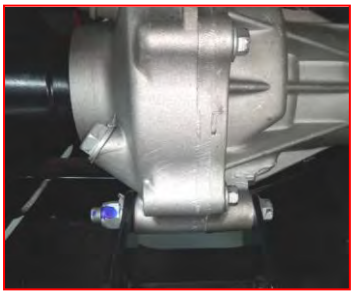
Clean the drain plug area.Place an oil pan under the front reducer case,and then drain oil completely by removing the drain plug.

Raise front of vehicle, support it securely on jack stands and remove front wheels.

On both sides, remove the drive shafts.

Remove lower differential bolts.

Remove the front differential.



Inspection

Inspect the gear case, case cover, bearing, oil seals and dust seal for wear or damage. If any damage or wear is found, replace the oil seal or dust seal with a new one.

Check back lash and drag torque.

Check the breather rubber case for wear or damage. Also, check that the joint of rubber case fits tightly.

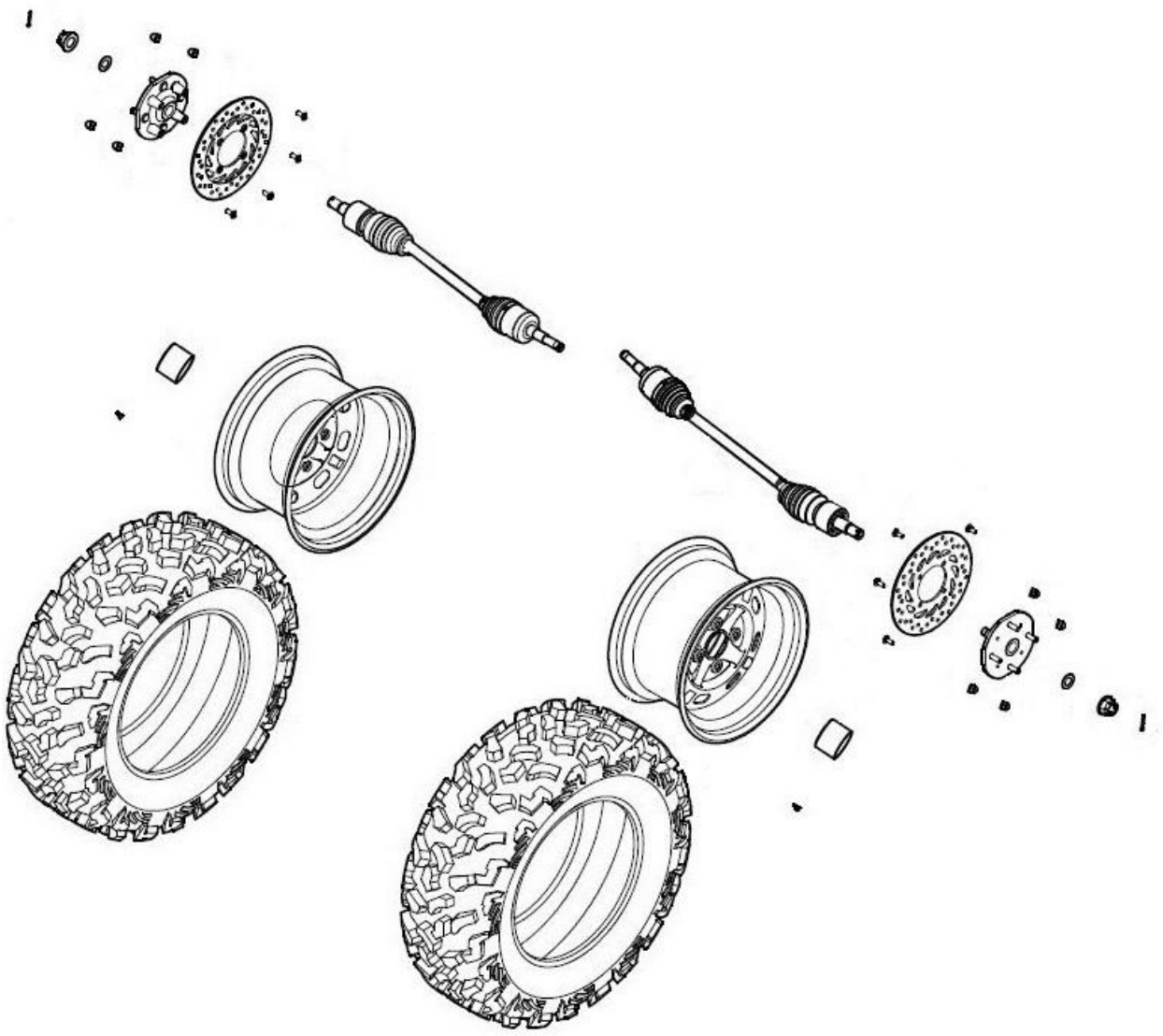
Installation

The installation is the reverse of the removal procedure. Pay attention to refill the oil. (GL-4-90).

Ensure tighten the bolts to the specified torque.

Installation location	Specifications (mm)	Torque N.m(kgf.m)
Mounting nut of wheel rim	M10	60(6.1)
Nut of wheel hub	M22	300(30.6)
Fastening nut of front differential	M10	80(8.2)
Bolt of front propeller shaft flange	M8	40(4.1)
Bolt of front propeller shaft flange	M10	80(8.2)

REAR DRIVE



REAR WHEEL HUB

Removal

Loosen wheel nut of the appropriate.

Install a jack stand under the frame to lift the rear of vehicle off the ground until the shock absorber is fully extended.

Remove the rear wheel.

Remove cotter pin, castellated nut and belleville washer.

Remove the caliper from knuckle.

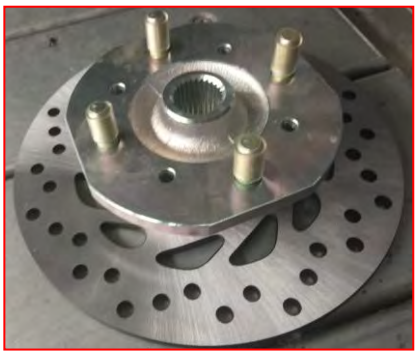
Pull the wheel hub to remove it.

Inspection

Check wheel hub for cracks or other damages.

Check inner splines and wheel rim bolts for wear or other damages.

If any damage is detected on wheel hub, replace it with a new one.



Installation

The installation is the reverse of removal procedure.

Install washer so that the inside diameter protrudes outward and contacts the nut.

Tighten the castellated nut on the drive shaft end to 300N.m and further tighten until one of its grooves is aligned with a cotter pin hole. Install a new cotter pin and the wheel cap. Fold one pin of cotter pin over drive shaft end.

REAR DRIVE SHAFT

Removal

Remove the appropriate wheel hub.

Remove bolt that attach the shock absorber to the lower suspension arm.

Detach lower suspension arm from knuckle.

Separate knuckle from upper suspension arm.

Remove the caliper.

Pull drive shaft out of differential.

Inspection

Inspect the condition boots. If there is any damage or evidence of leaking lubricant, replace them.

Check splines for excessive wear. Replace if necessary. If the splines on plunging joint are worn, a check of differential inner splines should be done.

Check the ring at teh end of drive shaft. If wear is apparent, replace the wear ring.

Check if the bearing in kunckle move freely and smoothly. If not, replace them.

Installation

Apply grease to the splines and insert the end of drive shaft in differential and pull joint a little to make sure that the stop ring is locked in differential side gear groove.

Insert the other end of drive shaft in the knuckle and install the knuckle to the upper suspension arm.

Install all other removed parts.

Ensure tighten the bolts to the specified torque.

Installation location	Specifications (mm)	Torque N.m(kgf.m)
Mounting nut of wheel rim	M10	60(6.1)
Nut of wheel hub	M22	300(30.6)
Bolt of PARK brake caliper	M10	80(8.2)

TIRES AND WHEELS

When the tires are replaced, never install a bias tire with a redial tire. such a combination could create handling and/or stability problems.

Dot mix tires of different size and/or de-sign on the same axle.

Front and rear tire pairs must be the identical model and manufacturer.

For unidirectional tread pattern, ensure that the tires are installed in the correct direction of rotation.

The radial tires must be installed as a complete set.

In dismantling tires, use special crowbar and rim protection device.

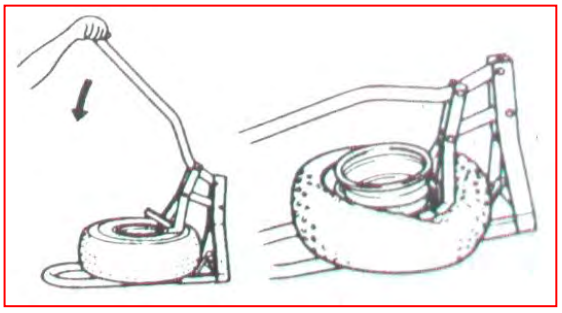
Tire replacement

Use jack to support vehicle and ensure its no dropping.

Remove the wheels.

After removing the air valve cap, release the tire pressure by depressing the valve.

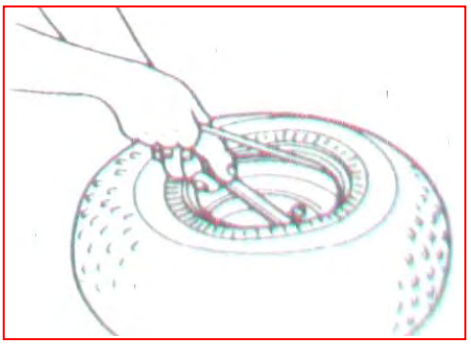
Dismount the bead from the rim completely.



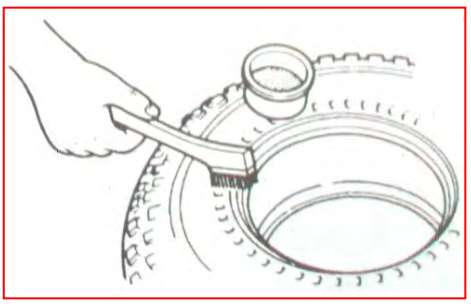
Separate the tire from the rim by using a set of tire levers and rim protectors.

CAUTION

When using the tire lever, do not scratch or hit the sealing portion of the wheel or it may cause air leakage.



Apply tire lubricant to the new tire bead and the flange of the rim. But never apply grease, oil or gasoline to the tire bead because they will deteriorate the tire.



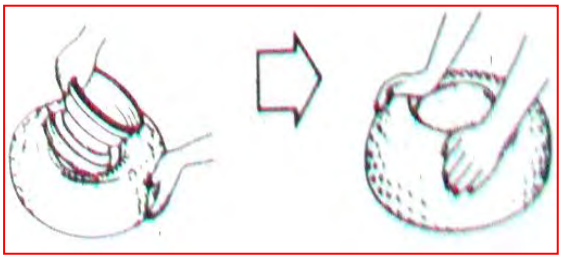
CAUTION

The standard tire fitted on this vehicle is AT27x9-14 for the front and AT27x11-14 for the rear.

The use of tires other than the standard may cause instability. It is highly recommended to use the specified tire.

Inspect the sealing portion of the rim for contamination and distortion before installing the tire on the rim.

Mount the new tire on the rim.



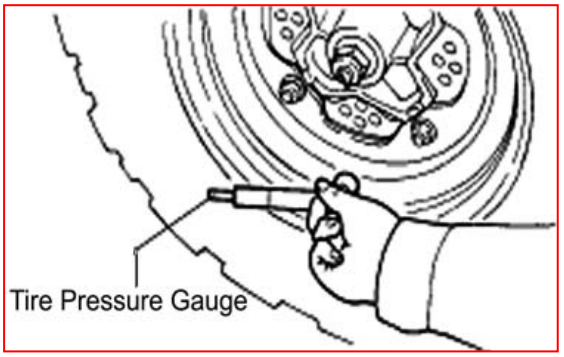
CAUTION

When installing each tire, make sure the arrow on the tire points in the direction of rotation. Also make sure the outer side of the wheel rim is facing outward.

Inflate the tire to seat the tire bead.

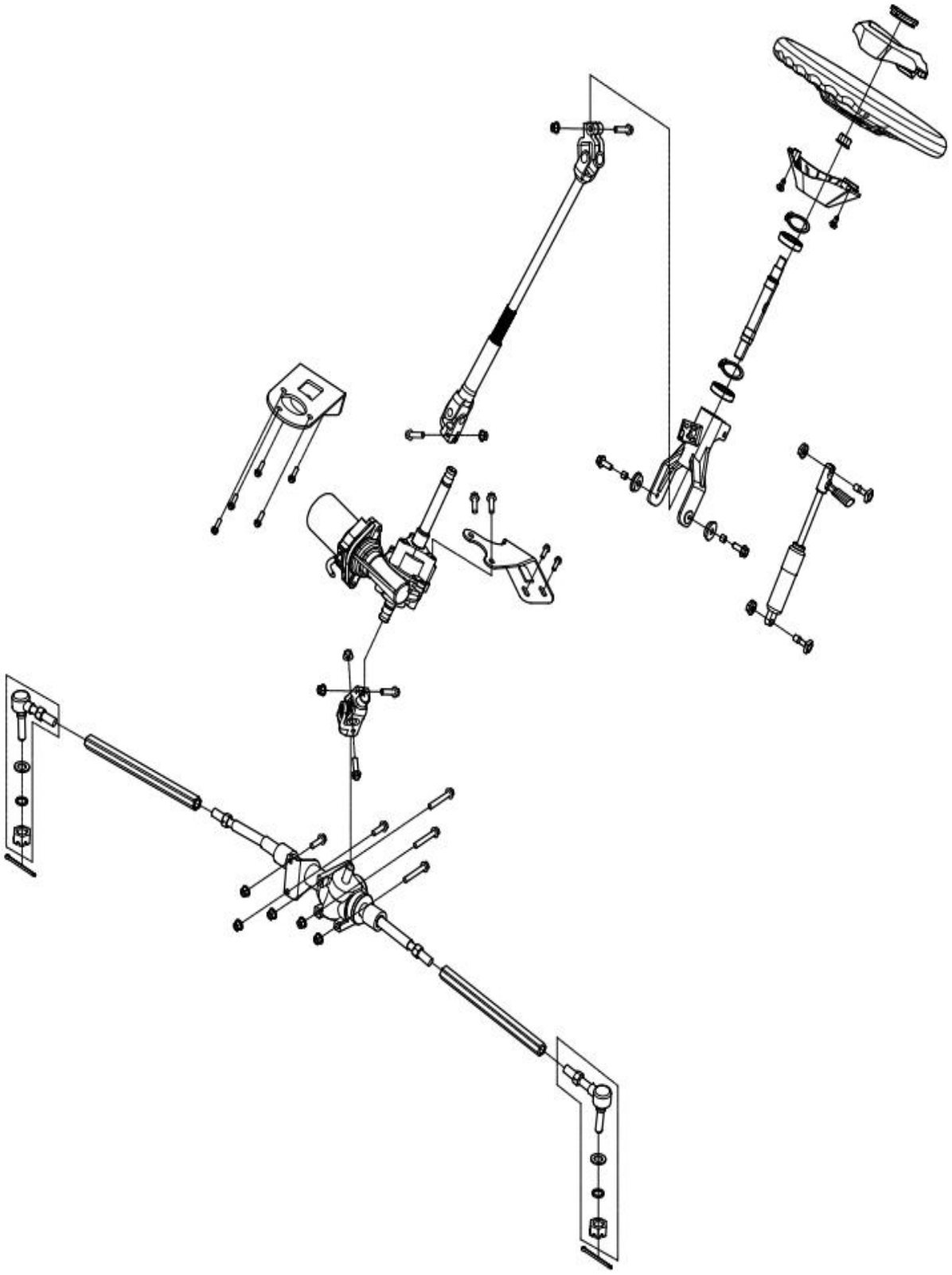
Check the rim line cast on the tire side walls. It must be equidistant from the wheel rim all the way around. If the distance between the rim line and the wheel rim varies this indicates that the bead is not properly seated. If this is so, deflate the tire completely, and unseat the tire bead on bosh sides. Then coat the bead with clean water and re-seat the tire.

Adjust the tire pressure to specification.



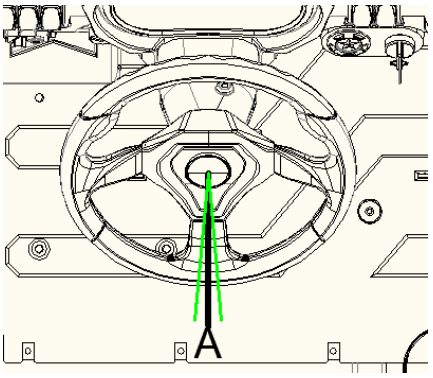
7. STEERING SYSTEM

ADJUSTMENT.....7-2	TROUBLESHOOTING.....7-3



ADJUSTMENT

ALIGNING THE WHEELS



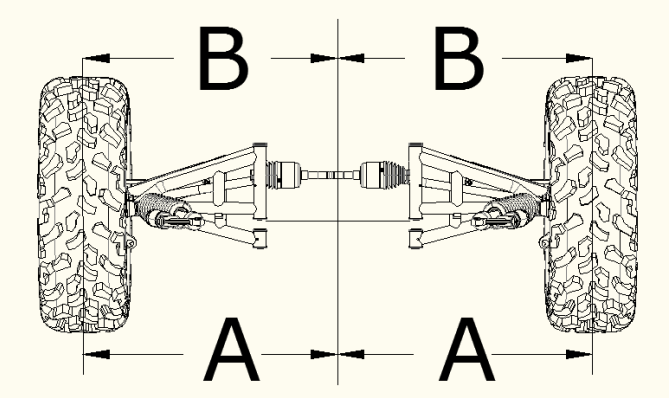
1. Place vehicle on a level surface.

2. Inflate tires to recommended pressure.

3. Find rack and pinion center to center as follows:

3.1 Calculate the total steering wheel rota-tions from side to side.

3.2 Position the steering wheel at half the total rotations.



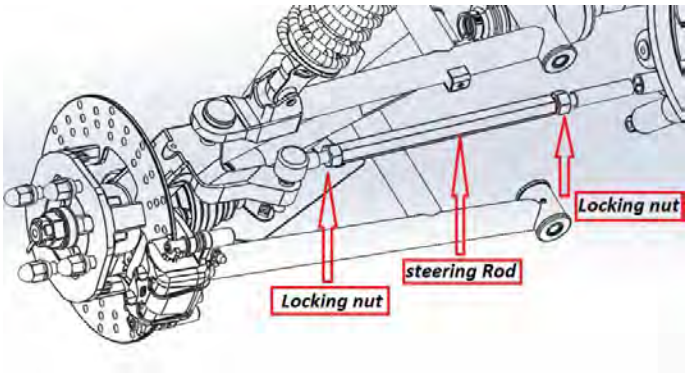
NOTICE：Steering wheel angle ± 5°

Front Toe Adjustment

4.Adjust the tire，mmmmmake sure the tire is 10 degrees inside

4.1 Adjust the tire inclination angle by adjusting the steering Rod；

4.2 Measure the distance between vehicle center and each wheel.



4.3 Before adjust，lock steering wheel at Center.

Adjustment Range
Distance=A-B≤5mm

4.4 Steering Tie Rod nut locking .

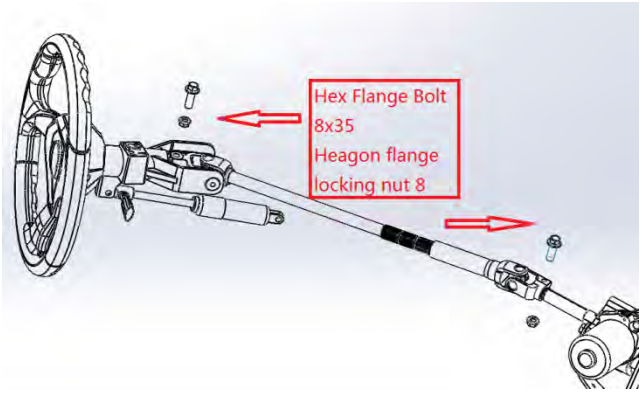
TROUBLESHOOTING

1. STEERING COLUMN

1.1 Remove the backboard (Middle) 、 Backboard (Side) and Column Shroud

1.2 Remove screws on each side of the steering support.

1.3 Remove steering column from vehicle.



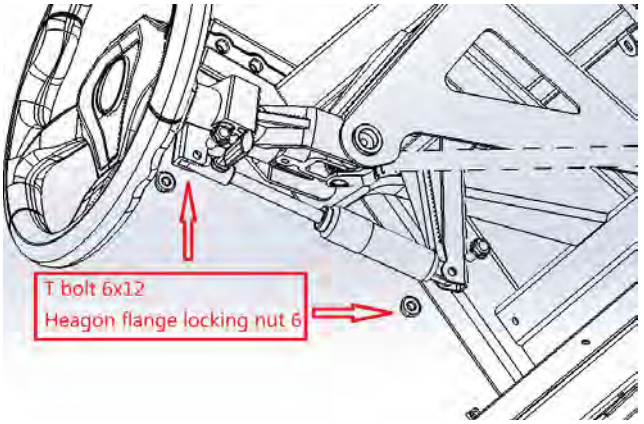
Inspecting：Check steering shaft for wear, cracks or bending.Ensure universal joints are not worn and move freely；

Replace if necessary.

Installing：The installation is the reverse of the removal pro-cedure.

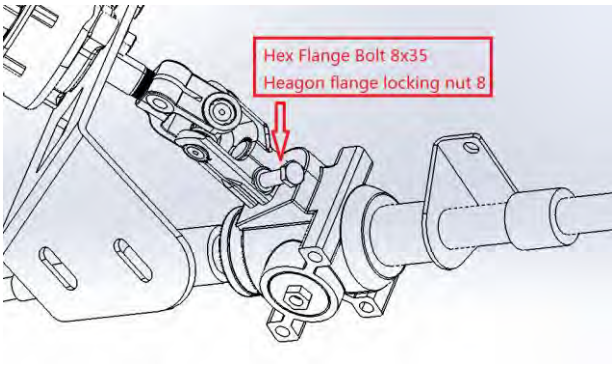
2. Air Spring

Remove relevant retaining bolts and nuts



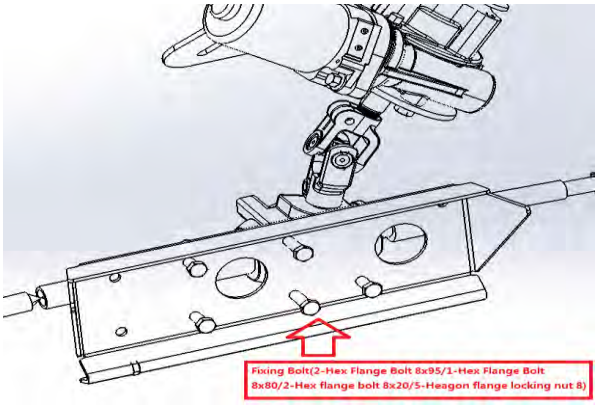
3. Redirector Assembly

3.1 Remove the cover



3.2 Remove steering booster body retaining bolts

3.3 Remove the retaining bolts of Redirector Assembly



3.4 Remove the tie Rod

Inspecting：Check Internal spline for wear, cracks or bending.Ensure universal joints are not worn and move freely，Whether there is a rotation gap

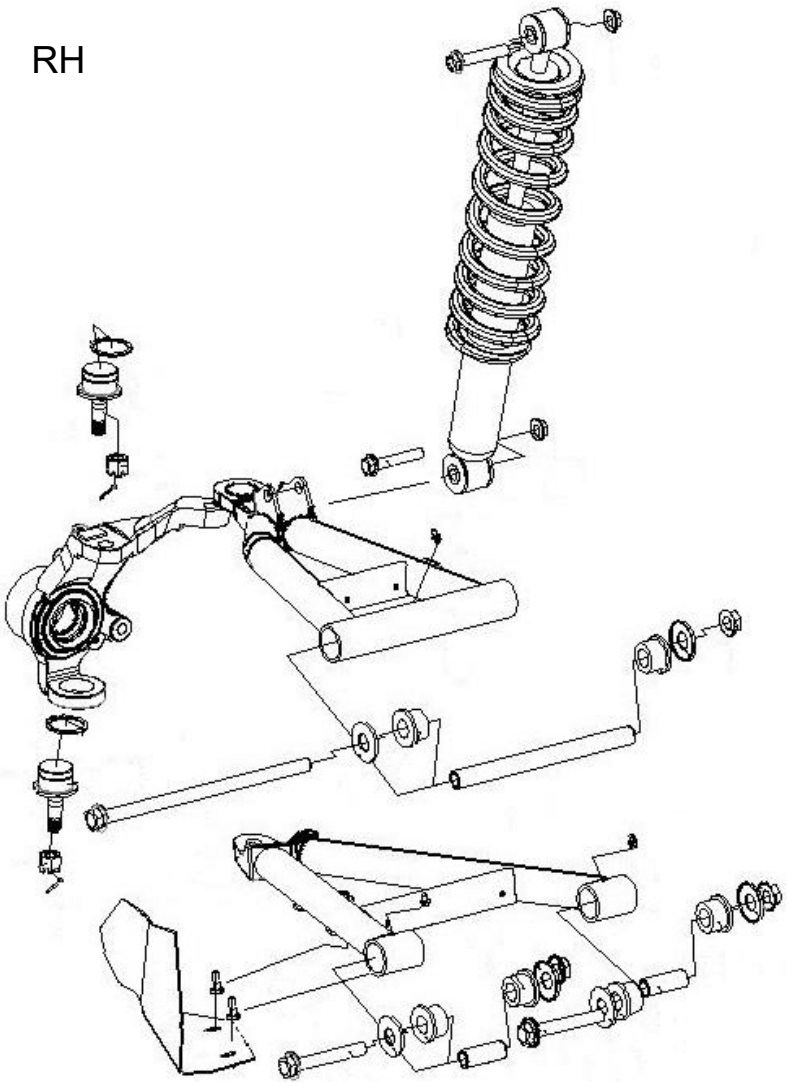
Replace if necessary

Installing：The installation is the reverse of the removal pro-cedure

8. SUSPENSION SYSTEM

FRONT SUSPENSION.....8-1	REMOVAL AND DISASSEMBLY.....8-2
INSPECTION.....8-2	SHOCK ABSORBER.....8-2
KNUCKLE.....8-2	LOWER SUSPENSION ARM.....8-3
UPPER SUSPENSION ARM.....8-3	REASSEMBLY.....8-3
REAR SUSPENSION .8-4	REMOVAL AND DISASSEMBLY.....8-4
INSPECTION.....8-5	SHOCK ABSORBER.....8-5
KNUCKLE.....8-5	LOWER SUSPENSION ARM.....8-6
UPPER SUSPENSION ARM.....8-6	REASSEMBLY.....8-6

FRONT SUSPENSION



The procedure explained below is the same for the RH and LH sides unless otherwise noted. During assembly or installation, use the torque values and service products as in the torque table.

In order to prevent collapse of vehicle, please do not dismantle left and right suspensions simultaneously.

Before overhauling front suspension system, please ensure stable support of vehicle

REMOVAL AND DISASSEMBLY

Loosen wheel nut of the appropriate.

Install a jack stand under the frame to lift the front of vehicle off the ground until shock absorber is fully extended then.

Remove wheels, brake caliper and hub remove steering knuckle from ball cage tie rod.

INSPECTION

Shock absorber

Inspect the shock absorber for oil leakage or damage, inspect the bushing for wear or damage. If any damage are found, replace the front shock absorber with a new one.

Extend and compress the piston several times over its entire stroke. Check that it moves smoothly and with uniform resistance with rod up. Any of the following conditions will denote a defective shock:

- A skip or hang up when reversing stroke at mid-travel.
- Seizing or binding conditions except at extreme end of either stroke.
- A gurgling noise after completing one full compression and extension stroke.

Replace shock if any these conditions are found.

Knuckle

Inspect the knuckle for damage. If any damages are found, replace the knuckle with a new one.

Check ball joint for damage, pitting, looseness and roughness. If so ,replace it.

Checl ball joint bellows for cracks. Change if necessary.

Check bearing and seal for damage or wear, If any damages or wear are found, replace a new one.

Rotate the inner race by hand to inspect for abnormal noise and smooth rotation.

Lower Suspension Arm

Inspect the suspension arm and for damage or distortion. If any damages or distortion are found, replace the suspension arm with a new one.

Move suspension arm from side to side. There should be no noticeable loose. Replace bushing if necessary.

Move suspension arm up and down.There should be no noticeable loose. Replace bushing if necessary.

Upper Suspension Arm

Inspect the suspension arm and for damage or distortion. If any damages or distortion are found, replace the suspension arm with a new one.

Move suspension arm from side to side. There should be no noticeable loose. Replace bushing if necessary.

Move suspension arm up and down.There should be no noticeable loose. Replace bushing if necessary.

Check ball joint for damage, pitting, looseness and roughness. If so ,replace it.

Checl ball joint bellows for cracks. Change if necessary.

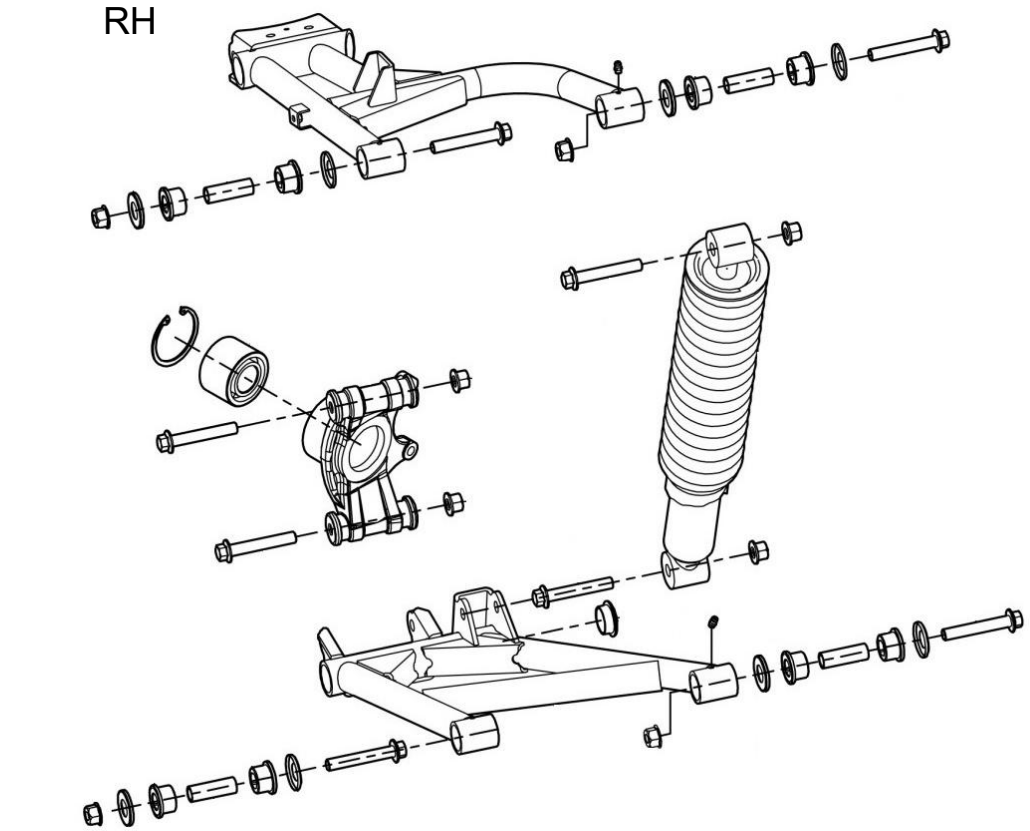
REASSEMBLY

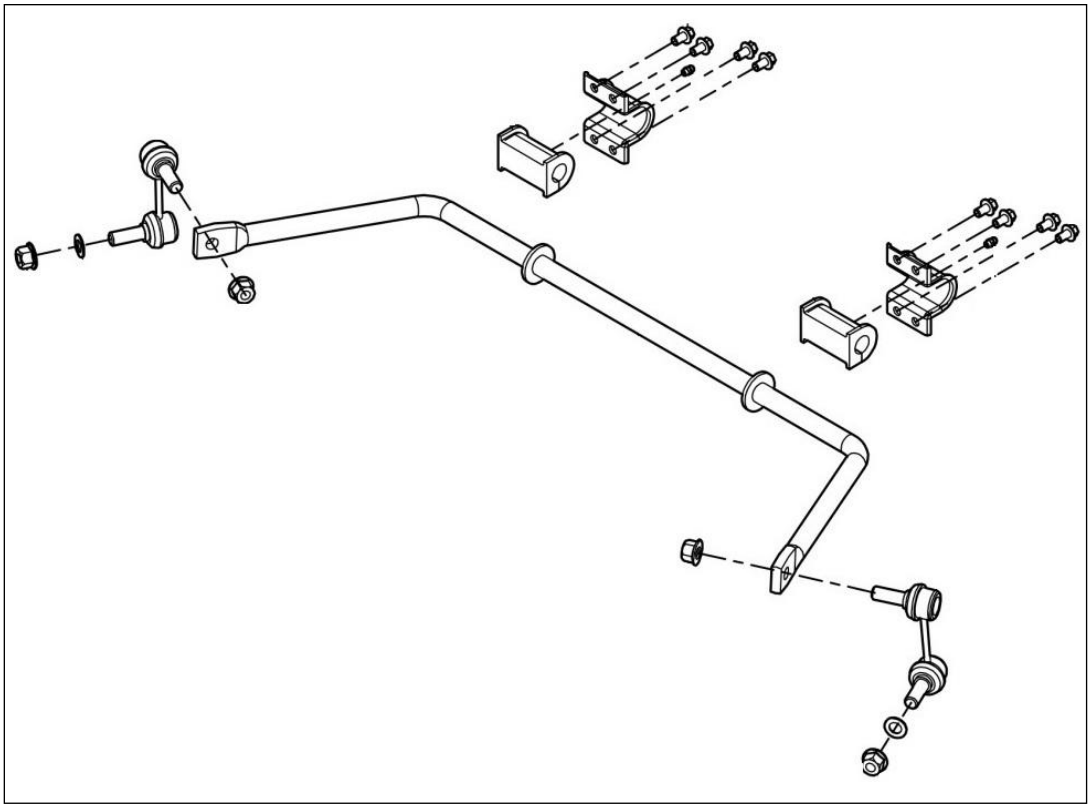
Reassemble and remount the front suspension in the reverse order of removal and disassembly. Pay attention to the following points.

1. Install the washers and tighten the knuckle nuts to the specified torque.
2. Replace the removed cotter pins with new cotter pins.

REAR SUSPENSION

RH





The procedure explained below is the same for the RH and LH sides unless otherwise noted.
During assembly or installation, use the torque values and service products as in the torque table

REMOVAL AND DISASSEMBLY

Loosen wheel nut of the appropriate.
Install a jack stand under the frame to lift the rear of vehicle off the ground until the shock absorber is fully extended.
Remove wheels, brake caliper and hub
remove steering knuckle from ball cage tie rod

INSPECTION

Shock absorber

Inspect the shock absorber for oil leakage or damage, inspect the bushing for wear or damage. If any damage are found, replace the rear shock absorber with a new one.

Extend and compress the piston several times over its entire stroke. Check that it moves smoothly and with uniform resistance with rod up. Any of the following conditions will denote a defective shock:

- A skip or hang up when reversing stroke at mid-travel.
- Seizing or binding conditions except at extreme end of either stroke.
- A gurgling noise after completing one full compression and extension stroke.

Replace shock if any these conditions are found

Knuckle

Inspect the knuckle for damage. If any damages are found, replace the knuckle with a new one.

Check bearing and seal for damage or wear, If any damages or wear are found, replace a new one.

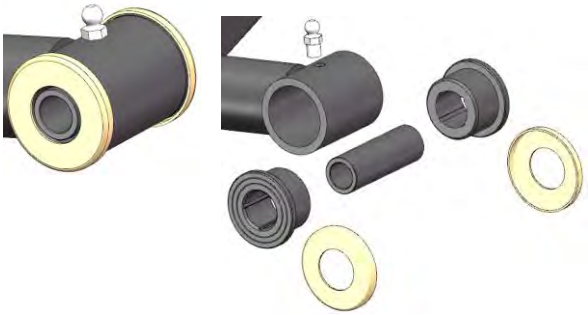
Rotate the inner race by hand to inspect for abnormal noise and smooth rotation

Lower Suspension Arm

Inspect the suspension arm and for damage or distortion. If any damages or distortion are found, replace the suspension arm with a new one.

Move suspension arm from side to side. There should be no noticeable loose. Replace bushing if necessary.

Move suspension arm up and down.There should be no noticeable loose. Replace bushing if necessary.



Upper Suspension Arm

Inspect the suspension arm and for damage or distortion. If any damages or distortion are found, replace the suspension arm with a new one.

Move suspension arm from side to side. There should be no noticeable loose. Replace bushing if necessary.

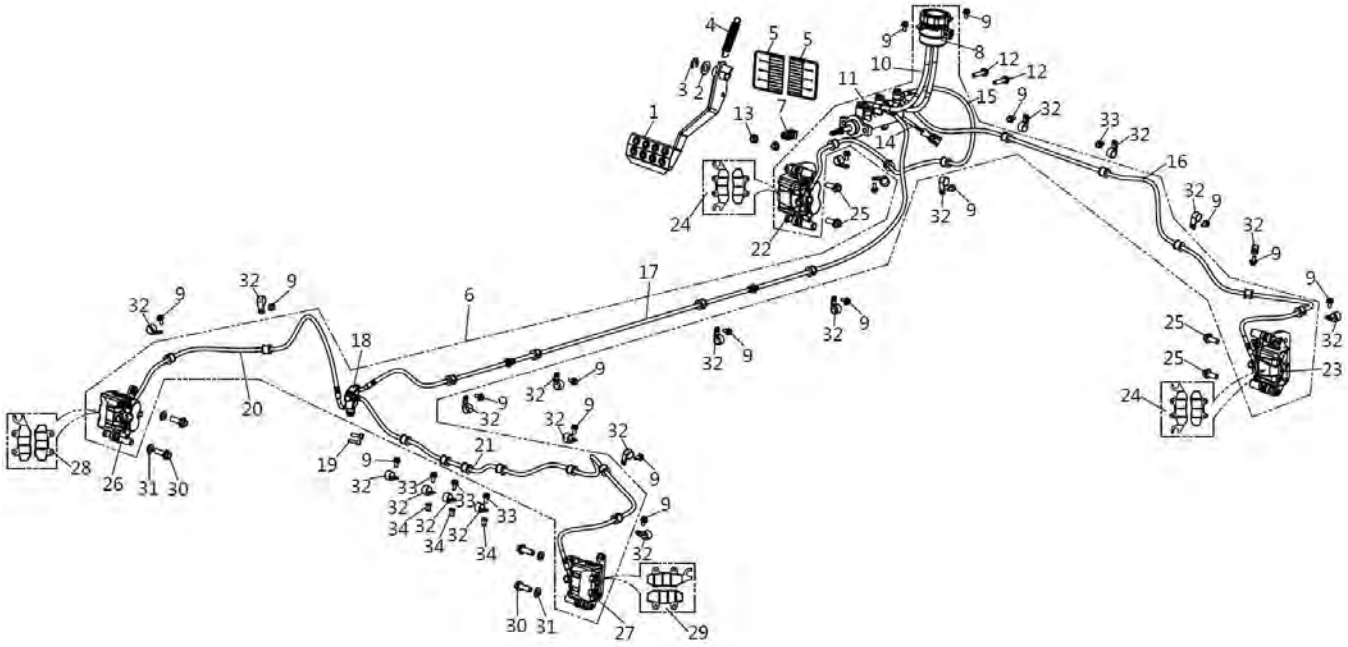
Move suspension arm up and down.There should be no noticeable loose. Replace bushing if necessary.

REASSEMBLY

Reassemble and remount the rear suspension in the reverse order of removal and disassembly. Pay attention to lubricate rear knuckles with lithium-soap based grease.

9. BRAKES SYSTEM

NOTICE.....9-2	BRAKE FLUID REPLACMENT.....9-3
BRAKE PADS REPLACMENT.....9-4	

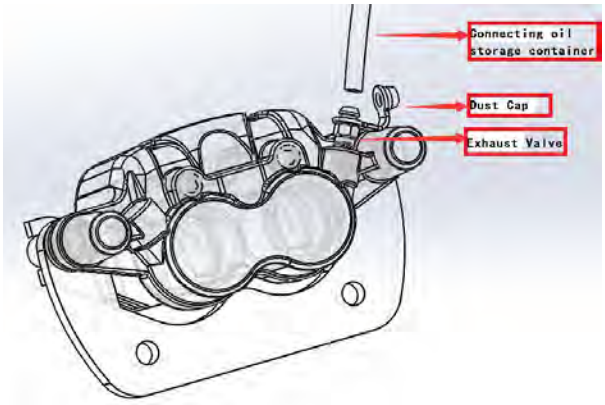


NOTICE：

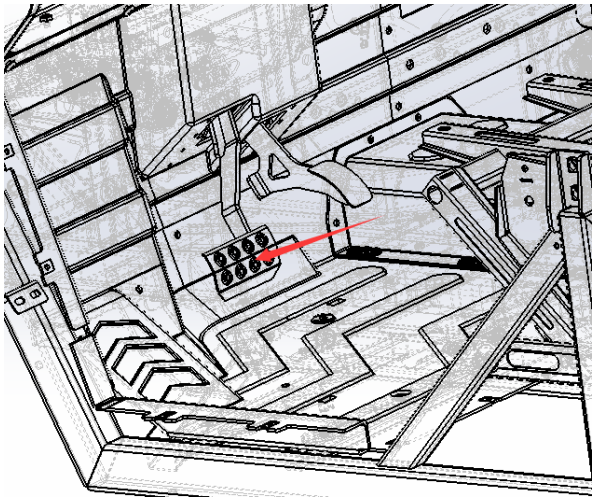
1. This brake system is filled with an ethylene glycol based DOT4 brake fluid. Do not use or mix different types of fluid, such as silicone-based or petroleum-based brake fluids；
2. Do not use any brake fluid taken from old, used or unsealed containers. Never reuse brake fluid left over from the last servicing or which has been stored for a long periods of time；
3. When storing brake fluid, seal the container completely and keep it away from children；
4. When replenishing brake fluid, take care not to get dust into fluid；
5. Always clean zhe area around a brake component beforce servicing；
6. A contaminated brake disc or brake pad reduces braking performance. Discard contaminated pads and clean the brake disc with high quality brake cleaner or neutral detergent；
7. Brake fluid may cause damage to surfaces of plastic and rubber parts. Keep it far away from these parts.

BRAKE FLUID REPLACMENT

1. Place the vehicle horizontally，Four wheels off the ground，Remove the tire
2. Remove the oil cap from the oil pump，Use a needle to pump out the old brake fluid，pump in fresh brake fluid.



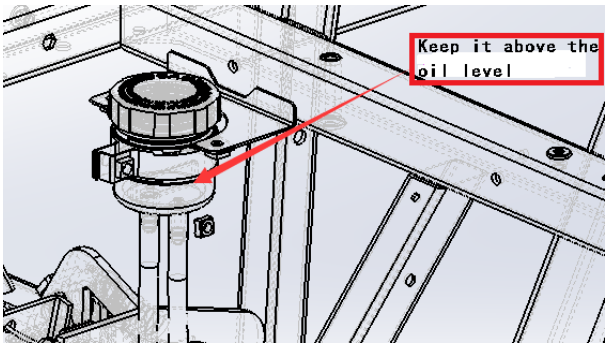
3. Loosen the dustproof leather cap of the exhaust valve on one of the Calipers, insert the exhaust valve at one end of the hose, and introduce an oil storage container at the other end.



4. Loosen the exhaust valve and press the brake pedal until the old brake fluid is completely eliminated and the new brake fluid flows out.
5. Tighten the exhaust valve and press the brake pedal deeply several times. Make sure that the brake pedal is pressed completely when you press it, and lift it quickly when you release the brake pedal，After a number of times, the gas valve easily open, so that the oil along the hose flow into the oil storage container, to eliminate the brake pedal tension，Tighten the exhaust valve again, press the foot brake pedal deeply, and press the pedal to release the Exhaust Valve; repeat several times until the exhaust brake fluid is free of bubbles.
6. Complete the other three calipers according to the above method.

NOTION：

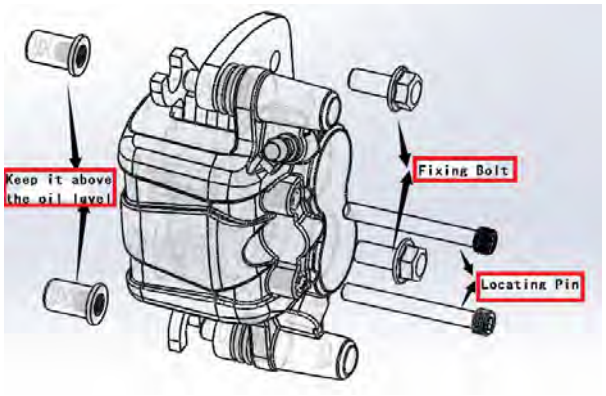
1. Exhaust Valve Locking Torque 6N.M.
2. Four calipers operation, priority after the wheel operation, in accordance with the principle from far and near.
3. Brake system oil drainage at the same time, pay attention to supplement the oil storage pump, to ensure that there is visible oil.



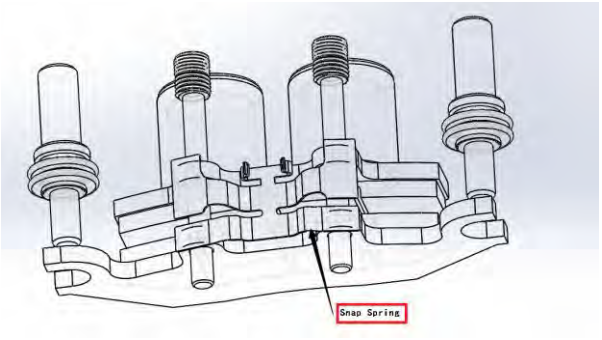
4.Cover the dust-proof leather cap and the oil storage cap and the sealing gasket.

BRAKE PADS REPLACMENT

1. Take off the tire.
2. The fixing shaft pin of the brake Caliper fixing bolt and the disc brake shoe is removed respectively.



3. Remove the disc brake shoes.
4. Make sure the shoe spring is in place and install the new shoe.



5. Dowel Pin by pushing the pad on the Pad Spring to align the pad groove and Caliper Body.

(1). Fastening Torque of Brake Shoe axle PIN 18N.M.

(2). The fastening Torque of the fastening bolt of the brake caliper is 80N.M.

(3). Do not operate the brake pedal during or after removal of the brake pads.

(4). When replacing brake pad, replace the whole set, otherwise the braking performance will be adversely affected.

(5). After changing the brake pad, press the brake pedal several times to check whether the brake is normal, and then check whether there is any change in the amount of brake fluid.

Brake disc maintenance

Disassembly

1.Remove the tyres.
2.Remove the calipers and the drive plate.
3.Remove the disc brake from the drive disc

Check

Check the brake disc for cracks or damage and measure the thickness with a micrometer. If you find any damage or thickness below the service limit, please replace the new brake disc.
Minimum limit thickness of front brake disc: 3.5 mm.
Minimum limit thickness of rear brake disc: 3.0 mm.
Use a scale to measure warpage，If warping exceeds the use limit, replace with a new brake disc.
Maximum warp of brake disc: 0.3 mm.

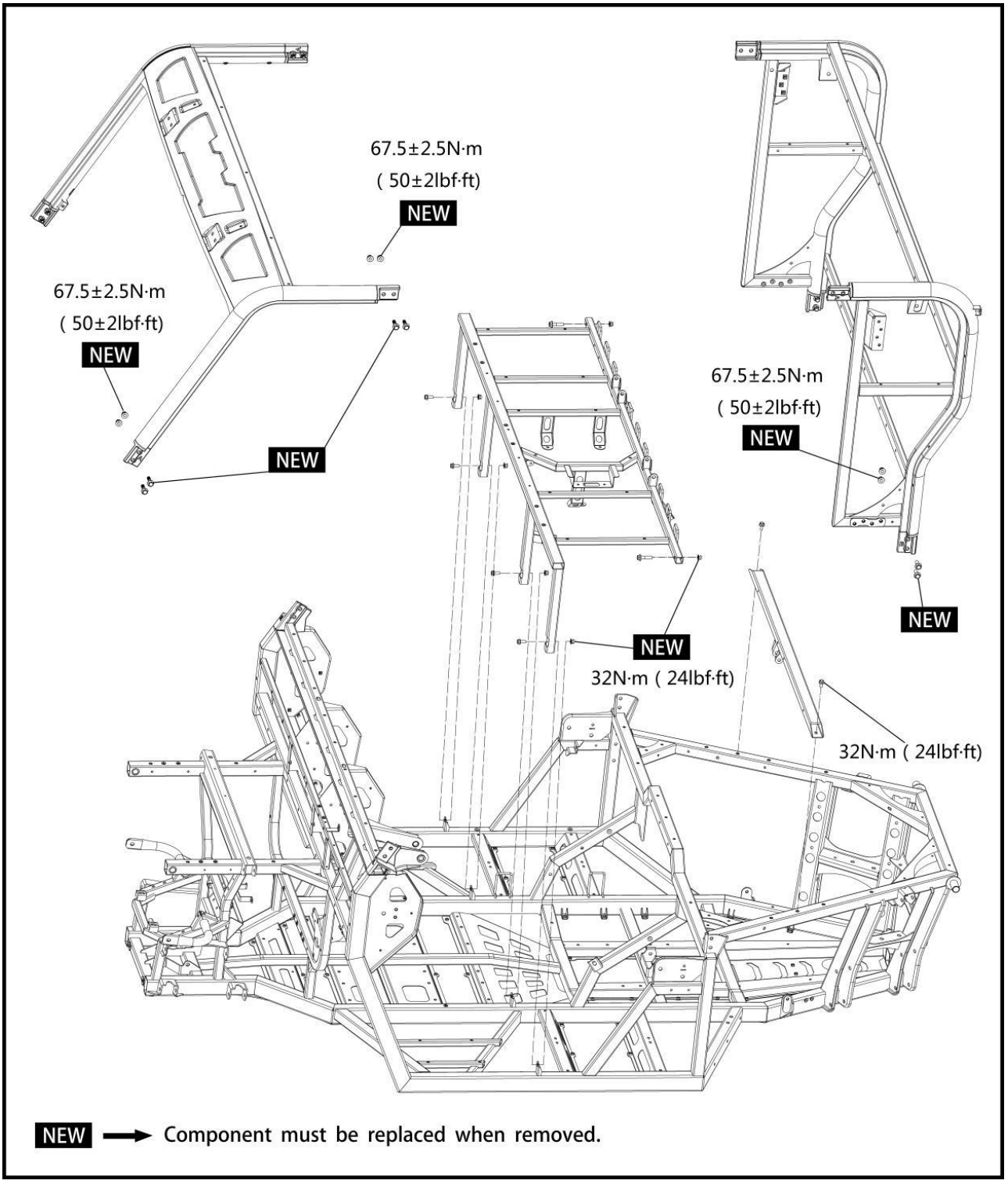
Assembly and assembly

Assemble and reassemble brake discs in reverse order of disassembly and disassembly， Note the following points：
1.Mount the disk to the drive with the letters facing out.
2.Make sure the disc brake pads are clean and free of any greasy substances.
3.The fastening moment of disc brake fixing bolt is 26N.M.

10. CHASSIS

FRAME.....10-1	PROCEDURES.....10-2

FRAME



PROCEDURES

CAGE

WARNING Never modify the mounting points of the shoulder nets and the seat belts. If they are found modified or damaged, contact a BRP service representative.

WARNING Never drill holes, weld or modify the cage. Since this is an important protection component, any modification might compromise passenger safety.

Cage Inspection

Check cage for bending, cracks, weld damages or any other damage.

WARNING Any damaged cage components must be replaced.

Cage Installation

WARNING When the cage mounting bolts are removed, they must be replaced with new ones or under exceptional conditions, have their threads cleaned then have glue thread applied. Ensure to use only 10.9 grade fasteners.

1. Assemble cage rear section onto vehicle. Do not tighten fasteners.
2. Assemble cage front section onto vehicle. Do not tighten fasteners.
3. Assemble both cage sections together. Do not tighten fasteners.
4. Make sure completed assembly is properly centered without any stressed components. Apply proper torque to all fasteners.

FRAME

Frame Inspection

Check frame for bending, cracks, weld damages or any other damage. Replace frame as necessary.

11.HVAC SYSTEM

AC SYSTEM.....11-2	Compressor.....11-4
Compressor electromagnetic clutch.....11-4	Condenser 11-5
Evaporator.....11-6	TXV.....11-6
Pressure switch.....11-7	A/C Hose.....11-7
Refrigerant discharge and filling.....11-8	HEATING SYSTEM.....11-11
Electric valve.....11-12	Heater core.....11-13
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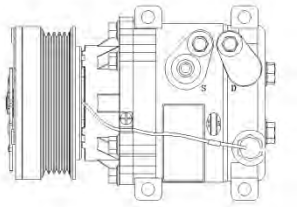
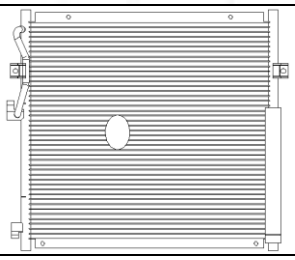
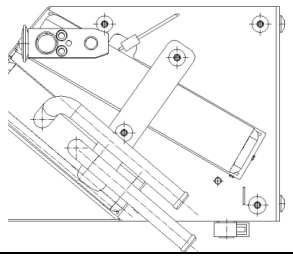
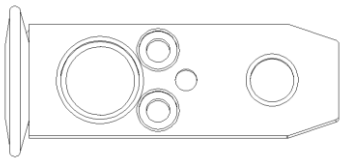
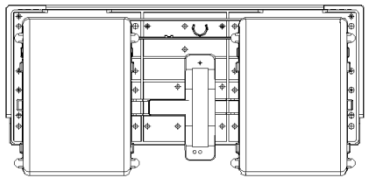
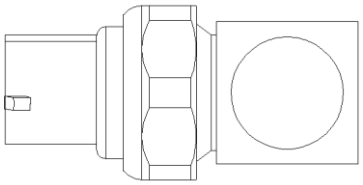
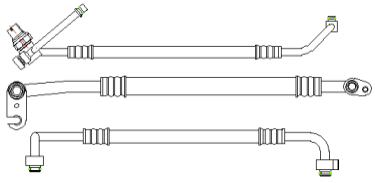
Blower speed switch.....11-18	CONTROL SYSTEM.....11-20
HVAC and temperature switches.....11-21	Electronic thermostat.....11-21
NTC.....11-22	

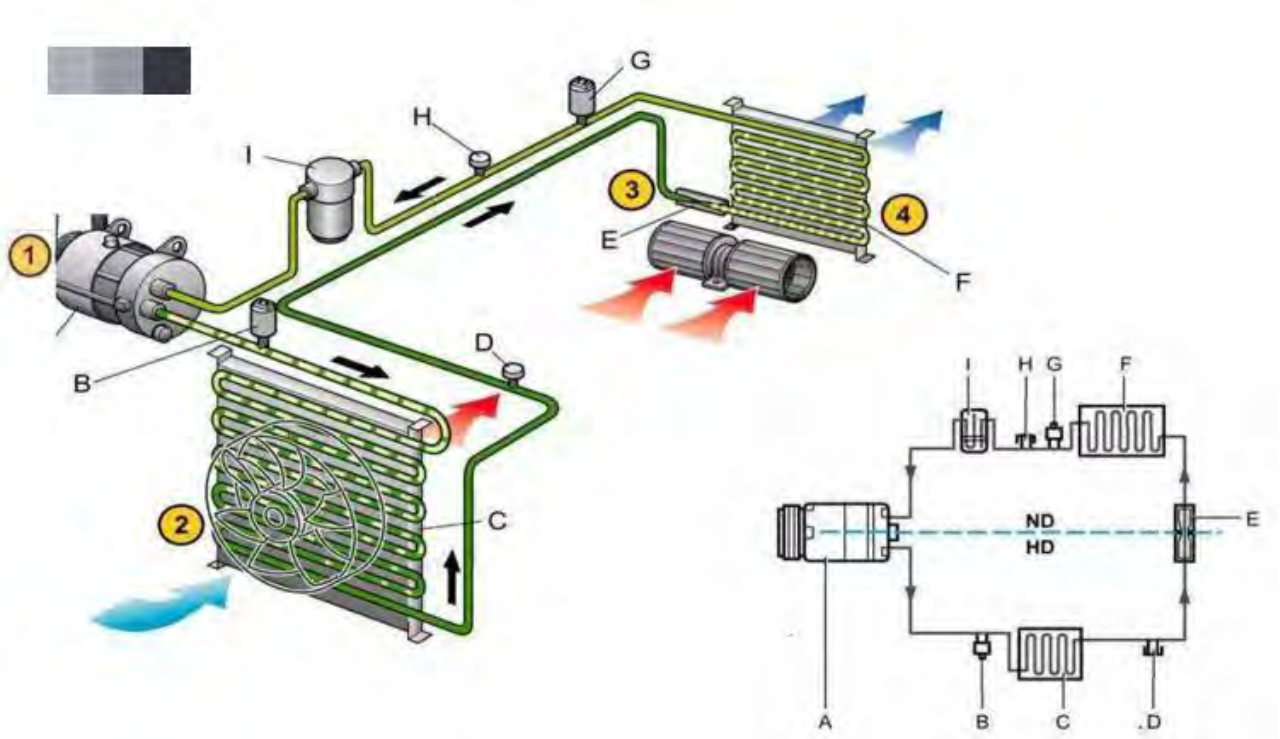
Note: The amount of R134a filled in the factory is 660g.

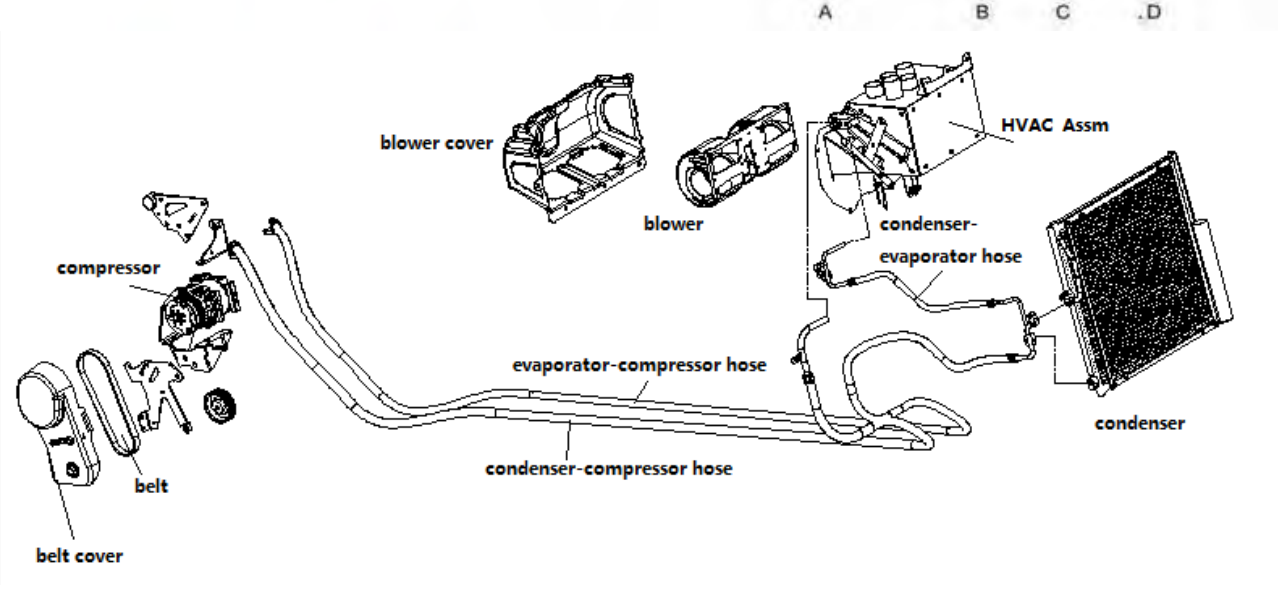
The basic components of HVAC system are**: AC system, heating system, air supply system and control system.**

AC SYSTEM

AC system consists of: **compressor, condenser, evaporator, TXV, blower, pipe, electrical components.**

PARTS	Sketch Map	Function
Compressor		Compress the refrigerant and circulate it in the system
Condenser		The gaseous refrigerant discharged from the compressor is cooled to make it into liquid refrigerant
Evaporator		The refrigerant expands and absorbs heat from the air
TXV		Throttling and depressurization
Blower		Blow the hot air to the evaporator, and blow out the cool air from each air outlet
pressure switch		When the pressure of the AC system is too high or too low, the AC system will stop working, protect the pipe or stop the compressor
A/C Hose		Refrigerant circulation pipe





The compressor is driven by the engine, and the refrigerant is sucked in from the evaporator and compressed to increase its pressure, and then sent to the condenser through the high-pressure hose. The condenser is installed in front of the radiator. The refrigerant is cooled by the cooling fan of the engine and the ventilation of the car, and becomes liquid.

After the refrigerant gives off heat, it is filtered and drained by the drying filter.

The liquid refrigerant is pressed to the expansion valve under high pressure. Due to the limited flow function of the expansion valve, the refrigerant flow can be automatically adjusted according to the heat load in the vehicle compartment, so that the liquid refrigerant enters the evaporator after the limit.

When the refrigerant suddenly enters the evaporator with large capacity, the pressure drops due to the volume increasing, and then changes from liquid state to gas state. At the same time, it absorbs a large amount of heat to cool the air flowing through the evaporator, and then the air is sent into the cabin by the blower to reduce the temperature in the cabin.

The gaseous refrigerant with heat is sucked into the compressor to start the next cycle.

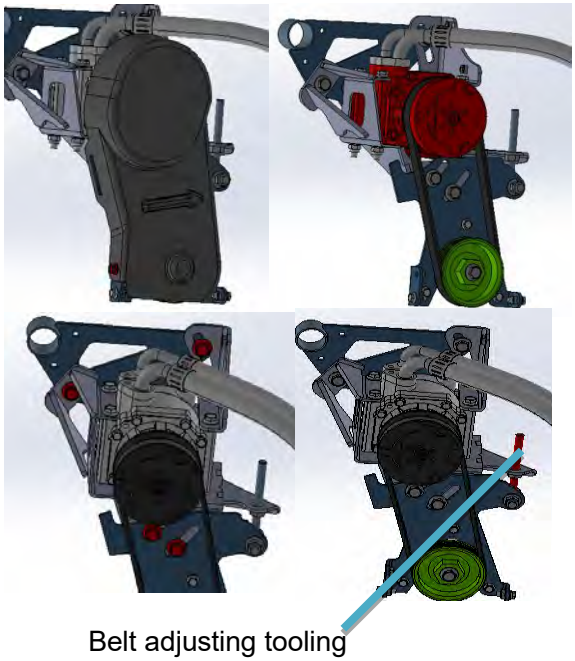
Compressor

Compressor is the heart of the AC system. It is driven by the engine to compress the low-temperature and low-pressure refrigeration steam into high-temperature and high-pressure steam. Through the compression work of the compressor, the heat of the low-temperature heat source is transferred to the high-temperature heat source, and the heat is transferred to the environment; at the same time, it also provides power for the refrigerant cycle of the refrigeration system.

Inspection and adjustment of belt

1. Remove the screw and remove the belt cover.
2. Use professional tooling Adjust the belt tightness.
3. If the belt tightness is not within the range, loosen 4 bolts first，

Then adjust the belt tightness or change the belt.



Belt adjusting tooling

Belt tightness	TOOL
Belt deflection: 9-12mm(100N)	

4.Reassembly is the reverse of removal.

NOTE:

If the belt needs to be replaced, please follow the specified specifications and models.

Belt size	EL(mm)
5pk670（GATES）	**670±5**

WARNING

Turn off the ignition key and shift the gear to P. pay attention to the exhaust pipe to avoid scalding.

Compressor electromagnetic clutch

The function of the electromagnetic clutch is to transmit the power of the engine to the compressor through the pulley. When refrigeration, the electromagnetic clutch coil is electrified to generate magnetic force, and the clutch armature is closed to drive the compressor spindle to run. After cooling, cut off the coil power supply, the magnetic force disappears, the pulley rotates over the bearing, and the compressor stops running.

Parameters of electromagnetic clutch	
Rated voltage	DC12V
Minimum pull-in voltage	DC9V
Breakaway torque	≥23N.M
Rated power	48W（4A）
Maximum speed	10000rpm
Groove type	5PK

REQUIRED TOOL	
UNIT 115 MULTIMETER	

Unplug the connector of electromagnetic clutch and measure the resistance between terminal and ground.

Set the multimeter to 20Ω.

TEST probes	Resistance
Terminal and ground	3±0.5Ω

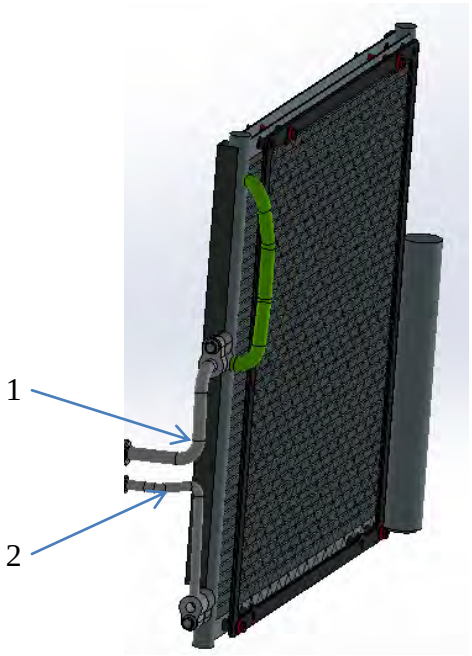
If the resistance is not within the range, the electromagnetic clutch needs to be repaired or replaced.

Condenser

The condenser is a kind of heat exchanger. The function of the condenser is to distribute the heat of the high temperature and high pressure refrigerant gas discharged from the compressor to the air outside the vehicle through the tube wall and fins of the condenser. The refrigerant gas flows in the pipeline and gradually condenses into refrigerant liquid.

The condenser is installed in front of the radiator with 4 screws.

The upper pipe is condenser-compressor pipe,
and the lower one is condenser-evaporator pipe.



1. condenser-compressor pipe
2. condenser-evaporator pipe

NOTE

If you need to remove the pipe,
please refer to the ***refrigerant discharge and filling first.***

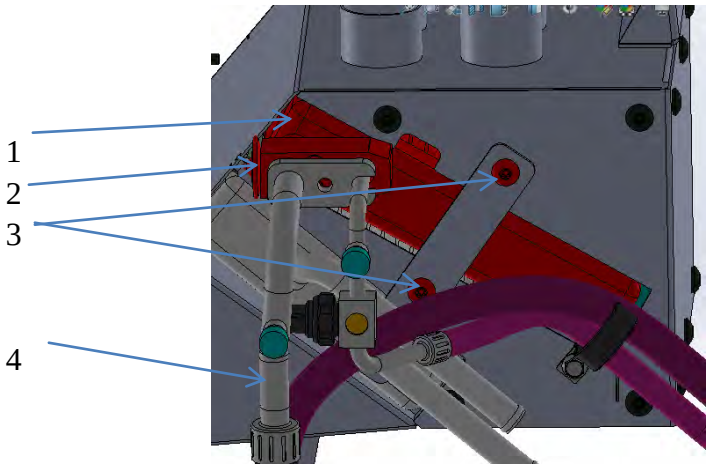
Evaporator

The evaporator is also a kind of heat exchanger, but opposite to the condenser, its function is to vaporize the low-temperature and low-pressure refrigerant liquid after throttling, absorb a lot of heat in the air in the car, so as to cool the air in the car.

It is installed in the HVAC assembly and compressed with 2 bolts

Removing the evaporator

1.Remove the following 2-M6×16screws.
2.Remove the pressing plate.
3.Remove the evaporator-compressor pipe and condenser-evaporator pipe.
4.Remove the evaporator.



1.evaporator
2.TXV
3.2-M6×16screws
4.Evaporator-compressor pipe

Installing the evaporator

The installation is the reverse of the removal procedure.

NOTE

ALSO if you need to replace the evaporator ,
please refer to the ***refrigerant discharge and filling first.***

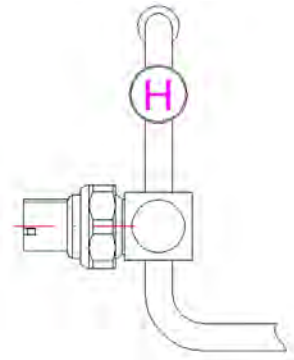
TXV

① The high temperature and high pressure refrigerant liquid is changed into low temperature and low pressure refrigerant liquid by throttling and depressurizing, and then sent to the evaporator for evaporation.
② Adjust the flow of refrigerant according to the change of refrigeration load, so as to keep the temperature in the car stable and the refrigerant working normally.
③ Control refrigerant flow to prevent liquid hammer and abnormal overheating.

NOTE

The TXV and evaporator are an assembly. If the TXV is broken, the whole assembly needs to be replaced.

Pressure switch



PARAMETER		
Refrigeration	HP 3.14MPa OFF	455.4185 psi
HFC-134a	LP 0.196MPa OFF	28.4274 psi

The pressure switch which protects the system in normal pressure. is installed on the condenser-evaporator hose.

REQUIRED TOOL	
UNIT 115 MULTIMETER	

Unplug the connector of pressure switch and measure the two terminals.

Set the multimeter to “DIODE”

Whether there is a beep when measuring within the normal pressure range.

NOTE

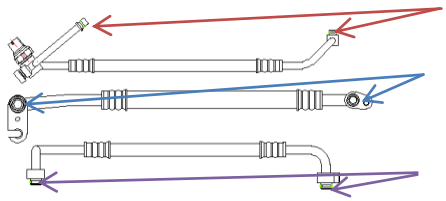
replace the pressure switch, the refrigerant should be drained first, Refer to the ***refrigerant discharge and filling***.

A/C Hose

The hose needs to be replaced in case of leakage, wear and aging.

NOTE

replace the hose, the refrigerant should be drained first, Refer to the ***refrigerant discharge and filling***.



2-φ6.8×φ1.9（mm）

2-φ13.4×φ2.4（mm）

2-φ10.8×φ2.4（mm）

O-ring

NOTE

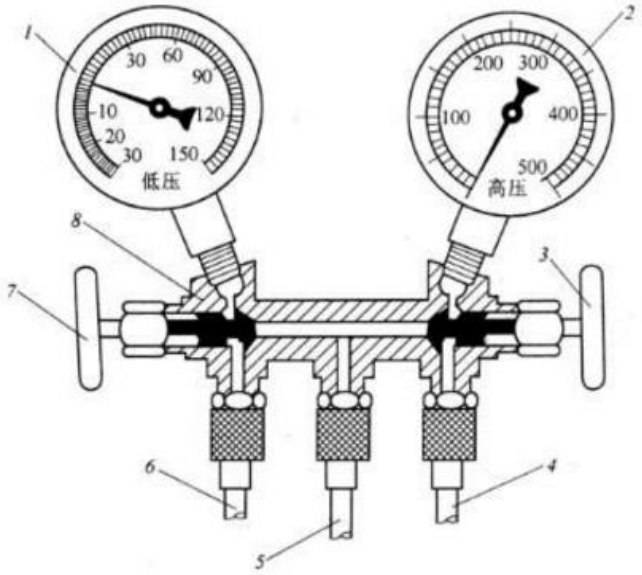
When replacing a new hose, pay attention to the integrity of the **O-ring** and apply an appropriate amount of lubricating oil at the interface. The lubricating oil model is ***PAG56***.

Refrigerant discharge and filling

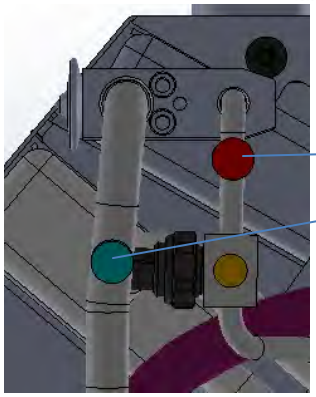
REQUIRED TOOLS	
Manifold Pressure Gage	AUTO refrigerant changer
	

Refrigerant discharge

When the refrigeration accessories need to be replaced, the refrigerant must be drained first. The following is operated by the manifold pressure gauge.



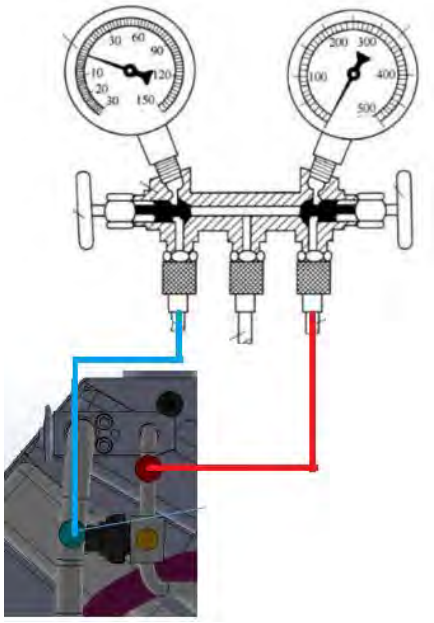
1. Low meter(blue)
2. High meter(red)
3. High pressure manual valve(red)
4. High pressure hose(red)
5. Service hose(yellow or green)
6.Low pressure hose(blue)
7.Low pressure manual valve(blue)



1 High port

2 Low port

1. Close the high and low manual valves of the meter valve first, connect the pipeline, and pay attention to the connection method of high pressure pipe and low pressure pipe.



2. Slowly open the low-pressure manual valve and slowly drain the refrigerant. A small amount of refrigerant flowing out of the refrigerant should be collected by an oil collector.
3. When the pressure of the low-pressure gauge drops to 345kpa, slowly open the high-pressure manual valve, and pay attention not to open too much. If there is more refrigerant oil flowing out at this time, it means that the discharge speed is too fast, and the high and low pressure manual valves should be adjusted down.
4. When the pressure gauge drops to 0, it means that the discharge is finished. At this time, the valve on the gauge valve should be closed.
5. Measure the collected frozen lubricating oil. If the oil quantity exceeds 15g, add the same amount of new frozen lubricating oil.

Note Do not mix different brands of oil.

Leak detection of the system

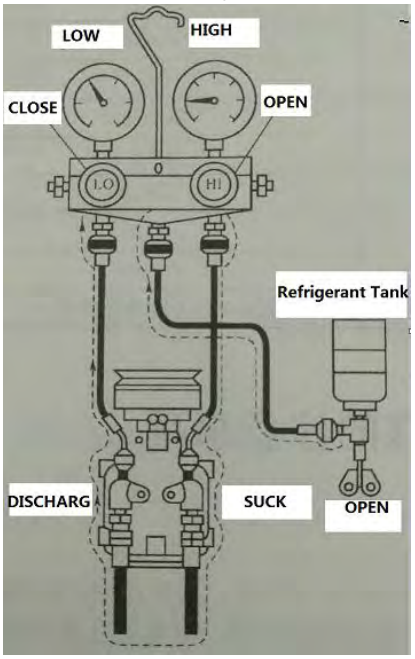
Connect the hose to the high and low pressure interfaces correctly, connect the maintenance hose to the pressure equipment, open the high and low pressure valves, and fill the system with dry nitrogen (or dry compressed air) with the pressure of about 1.8MPa. Then stop inflation, close the high and low pressure valve valves, and coat the joints of the system with soap water for leakage detection. After holding for 20 minutes, the pressure did not change significantly.

Vacuum system

Connect the hose, connect the maintenance connector to the vacuum pump, open the high and low pressure valves,maintenance hose valve and start the vacuum pump. The vacuum time should not be less than 20 minutes. If the automatic filling machine is used, the vacuum degree should reach 99.1kpa.

Refrigerant filling

After the vacuum is qualified, close the high and low pressure valves at the same time, connect the Yellow pipeline to the bottle opener, and then screw the bottle opener into refrigerant R134a, rotate the bottle opener to pierce the refrigerant bottle, and then rotate the bottle opener to release the refrigerant. (at this time, the red and blue switches of the high and low pressure meters are all closed), the air in the maintenance pipeline can be discharged, and the refrigerant can be seen to be ejected.

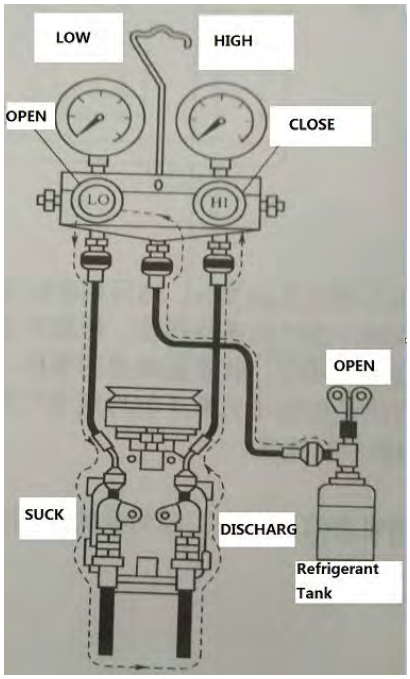


High port filling

Turn on the high-pressure filling knob (red), and fill with high-pressure. At this time, the refrigerant is added into the system as a liquid (refrigerant bottle is inverted), and a bottle (220g) is added. In this process, it is forbidden to start the air conditioning system.
After filling, close the high-pressure filling knob.

Low port filling

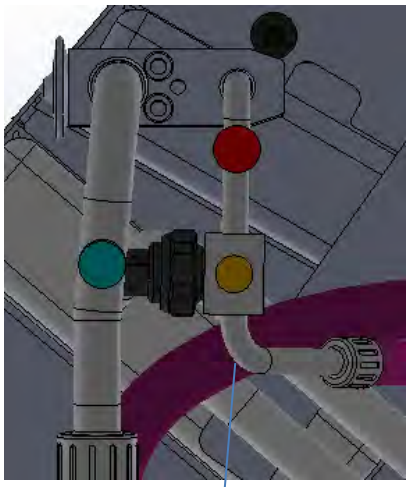
Take off the bottle opener slowly to prevent frostbite caused by the rapid ejection of residual refrigerant. Replace the new refrigerant bottle, repeat the above refrigerant opening and exhaust process, turn on the low pressure filling knob (blue), and keep the high pressure (red) closed. At this time, the refrigerant is added into the system in gaseous state. Keep the refrigerant bottle upright, start the air conditioning system, and adjust the blower to the maximum, maintain the idle state.



During the low-pressure filling process, when replacing the refrigerant bottle, turn off the low-pressure knob (blue) first, and repeat the Yellow pipeline exhaust process. Continue filling according to the low-pressure filling method, observe the sight glass on the condenser-evaporator hose, and the filling is completed when there is no obvious bubble. Turn off the engine, turn off the high and low pressure knobs.

Pressure range	
Low meter	High meter
0.15-0.2MPa	**1.45-1.5MPa**

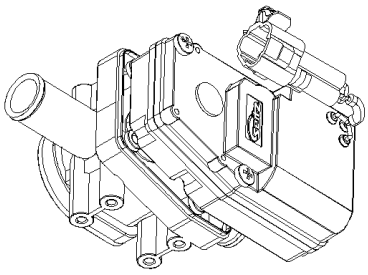
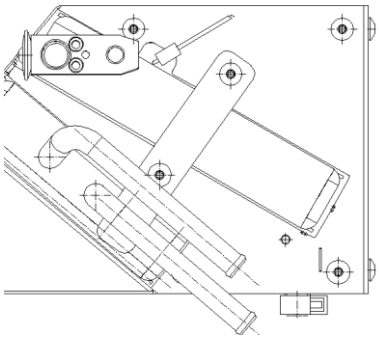
Test conditions: The temperature of the evaporator suction inlet is 30-35 ℃, the engine speed is 2000rpm, the temperature switch is set to the maximum cooling gear, and the blower is at the max.

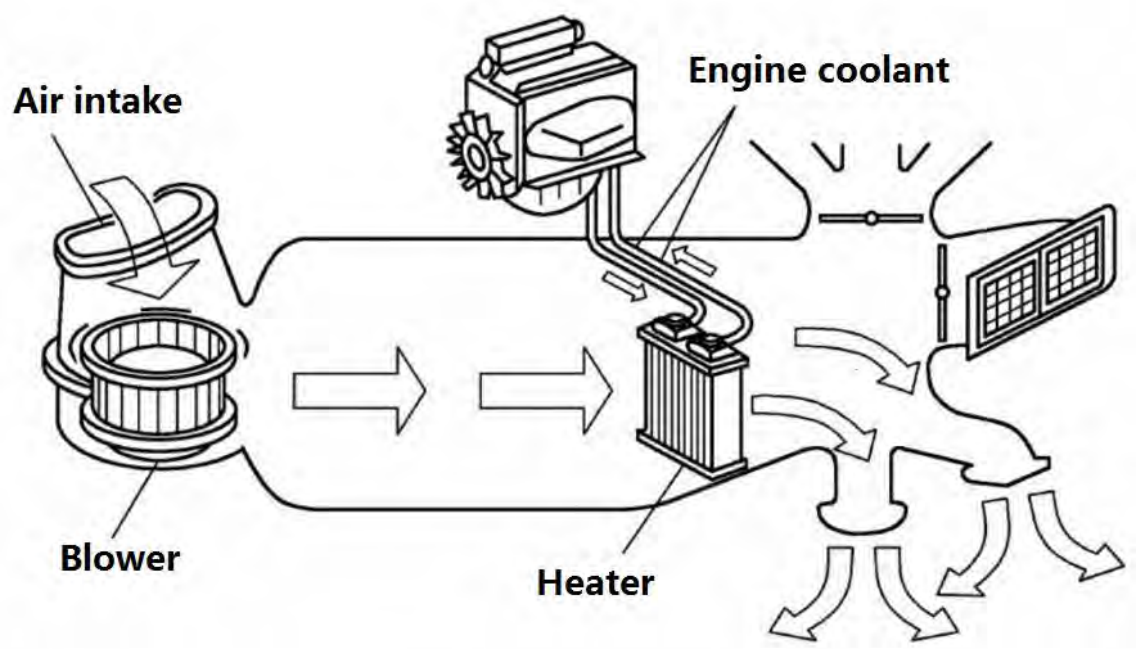


Sight glass

Remove the manifold pressure gauge, and tighten the interface cap.

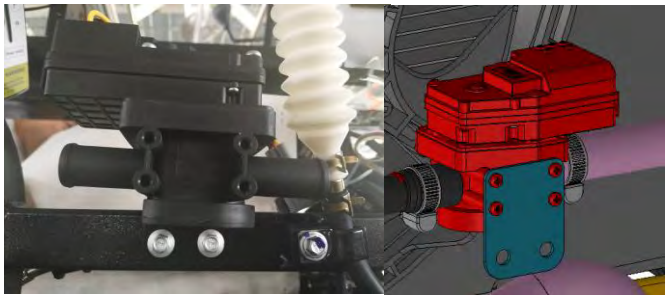
HEATING SYSTEM

PARTS	Sketch Map	Function
Electric valve		The heater control valve opens to allow coolant to pass through. When the coolant circulates, it heats up the unit.
Heater core		The coolant flows through the heater core and the blower blows air through the heater core, which heats up the interior of the vehicle.

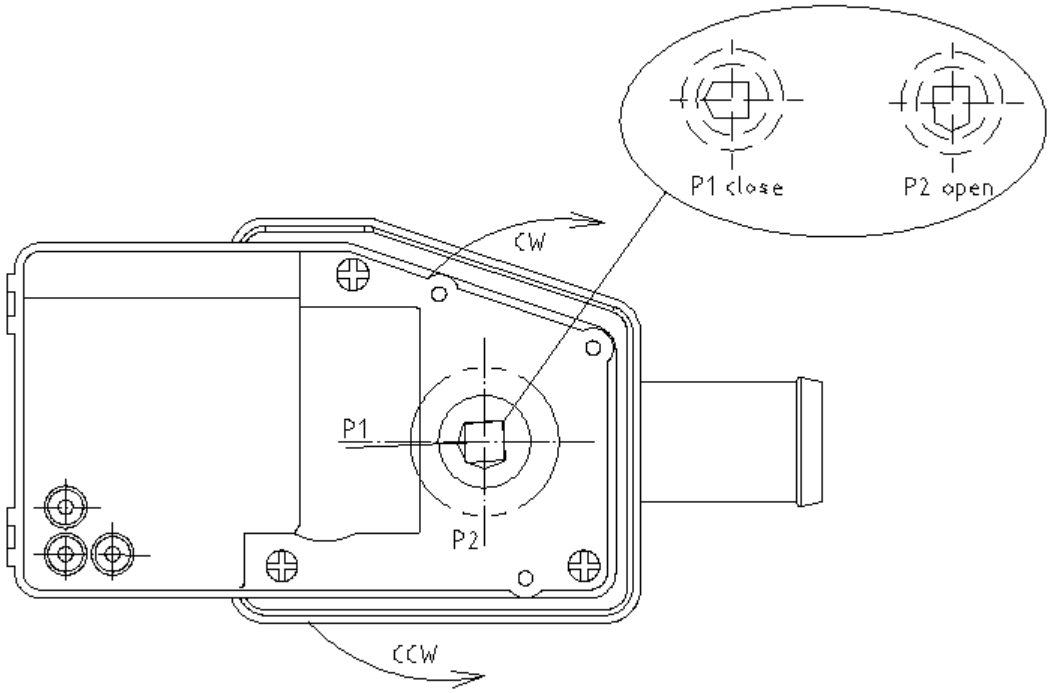


Electric valve

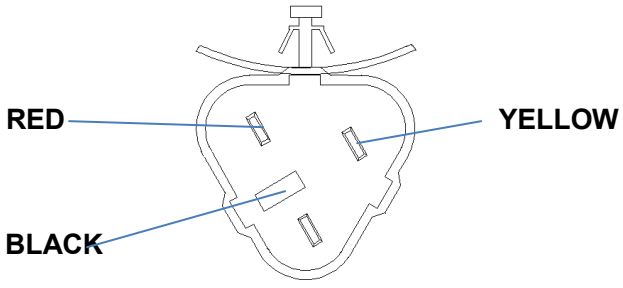
The valve is installed in the coolant passage of the engine to control whether the engine coolant enters the heater.



The electric valve is fixed on the water valve fixing plate with four self tapping screws, and the water valve fixing plate is fixed on the front cross beam of the frame with 2-M6×16 bolts.



Wire color			Direction	Position
red	black	yellow		
12V+	12V-	12V+	CCW	P2
12V+	12V-		CW	P1



Testing the Heater Control Valve

1. Remove the heater control valve actuator.
2. Follow the menu make heater control valve to full open and full closed positions.

If the heater control valve does not:

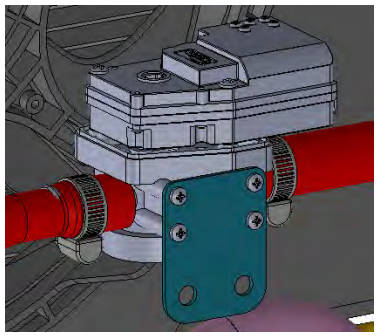
– Fully open;

– Fully close;

replace the heater control valve assembly.

Removing the Heater Valve Assembly

1. Disconnect valve connector.
2. Remove 2-M6×16 bolts and four self tapping screws.
3. Remove the hoses.



4. Remove the heater valve.

Installing the Heater Control Valve Assembly

The installation is the reverse of the removal procedure.

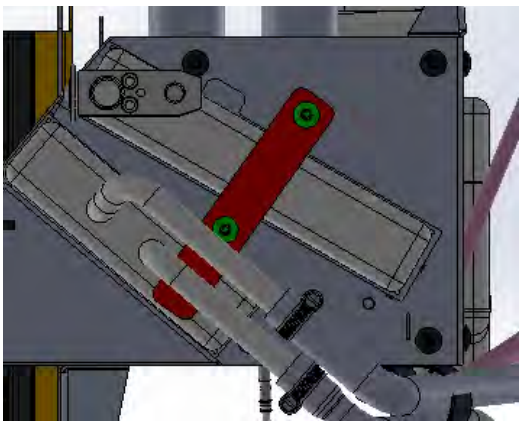
NOTE Fill the cooling system with the recommended coolant.Check for coolant leaks from radiator and hoses.

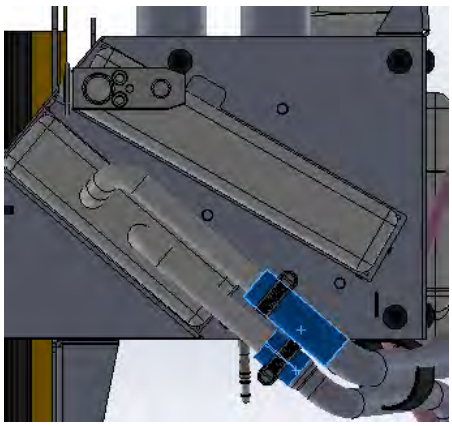
Heater core

The heater is a kind of heat exchanger. When the high-temperature coolant flows through the heater, it exchanges heat with the cold air in the car, never achieving the purpose of heating in the car and defrosting the windows.

Removing the Heater Core

1. Remove two bolts and remove the pressing plate.
2. Remove the pipeline on the heater core.
3. Remove the heater core.





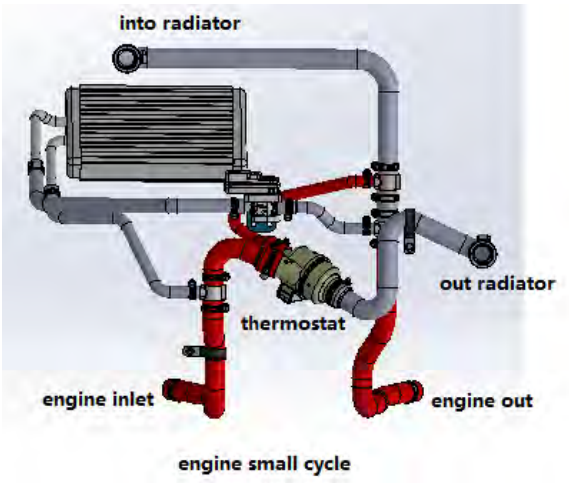
Installing the Heater Core

The installation is the reverse of the removal procedure.

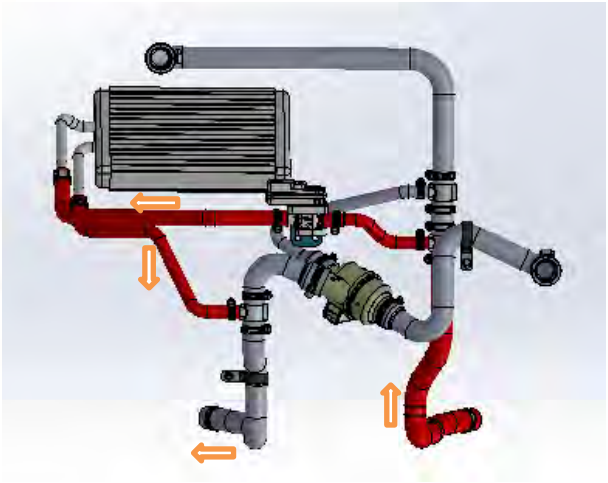
NOTE Fill the cooling system with the recommended coolant.Check for coolant leaks from radiator and hoses.

Three circulation modes of engine coolant

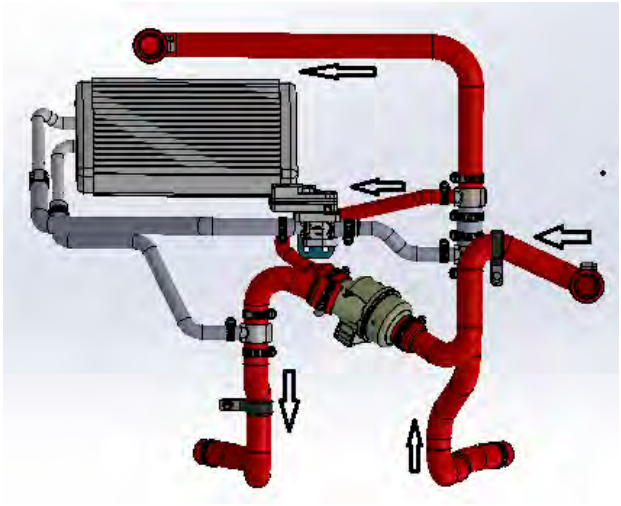
Engine coolant small cycle



Heating cycle



Engine coolant cycle



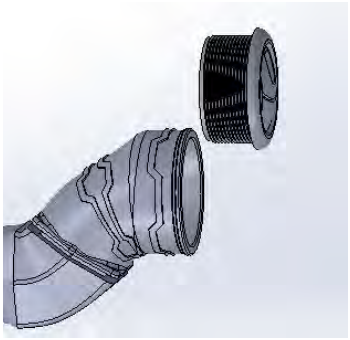
AIR SUPPLY SYSTEM

The air in the car is forced into the HVAC assembly by the blower, and then sent to the cabin after passing through the filter screen and ventilation pipe to realize the heating or cooling in the cabin.

Air outlet louver

Removing the Outlet Louver

The air outlet is inlaid on the air outlet elbow and can be removed by gently prying with a flat head screwdriver.



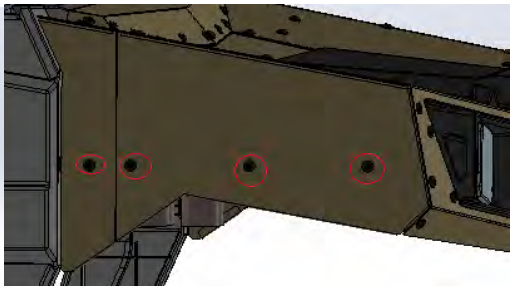
Installing the Outlet Louver

The installation is the reverse of the removal procedure.

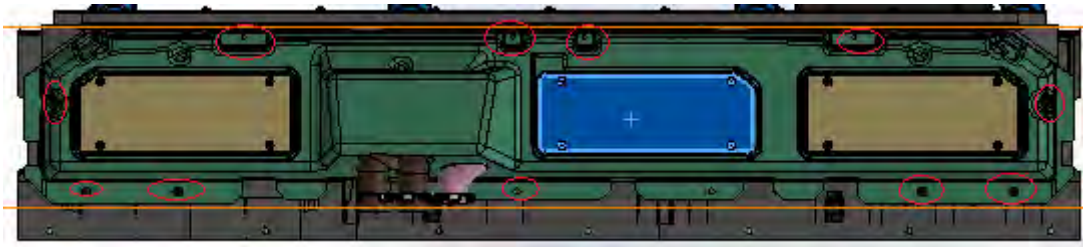
Air ducts

Removing the AIR DUCTS

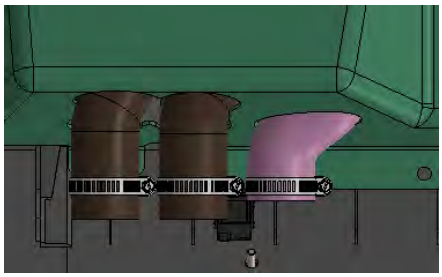
1. Remove the headlamps connector.
2. Remove the following nuts.



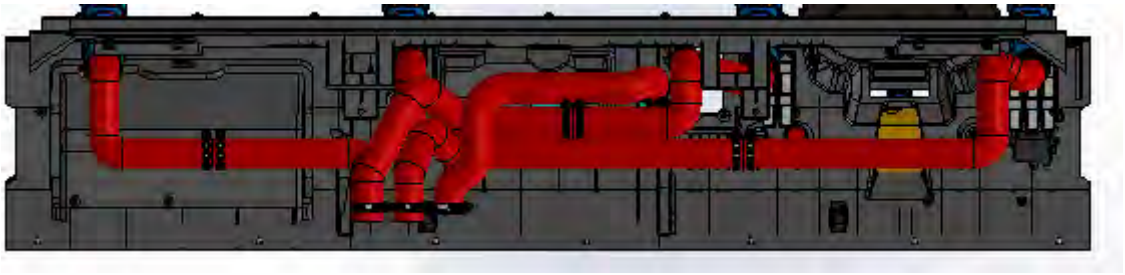
3. Remove the hood.
4. Remove the following nuts and snap-fasteners.



5. Remove the following 5 Clamps.



6. Pull the five ducts out of the breakwind.
7. Remove the breakwind.



8. Remove the clamps and then pull the ducts out ou the air outlet elbows.

9. Remove the stainless steel pipe.
10. Remove the ducts.

Installing the Air Ducts

The installation is the reverse of the removal procedure.

Blower

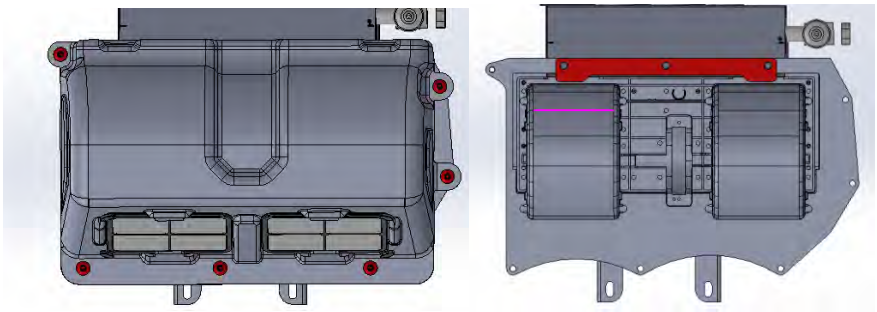
The blower assembly includes the blower resistor,the blower motor and the blower fans.

GENERAL

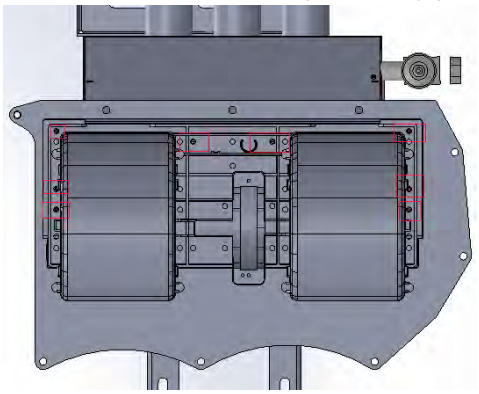
In the following procedures the vehicle cab is removed for clarity.

Removing the blower

1. Remove the following nuts (6).
2. Remove the blower cover.
3. Remove the following nuts(3) and the pressing plate.
4. Unplug the connectors.



5. Remove the following screws(8).



6.Remove the blower.

Installing the blower

The installation is the reverse of the removal procedure.

Testing the Blower Motor

Turn the vehicle key switch to ON.

Turn the blower speed switch to low, medium1,medium2,then high.

BLOWER TROUBLESHOOTING CHART		
Is blower working?	YES →	Everything is OK
NO↓		
Check ACPOWER connector	NO →	Refer to wiring diagram
YES↓		
Check blower fuse (15A). Is fuse burnt?	YES →	Replace fuse Is blower working?
NO↓		
Bypass blower speed switch		
↓		
Blower turns?	YES →	Replace blower speed switch Is blower working?
	NO →	Replace blower and motor assembly Is blower working?
NO↓		
Check wiring harness, connectors,and ground		
↓		
Harness and connectors good?	NO →	Repair or replace defective part(s)

Blower Motor resistor

The blower motor resistor provides electrical resistance in series to the blower motor.

The fan speed control switch sends current to one blower resistor pin based on selected fan speed.

Adding resistance to the circuit slows the blower motor.

Removing resistance from the circuit speeds the blower motor.

Testing the Blower Motor Resistor

The blower motor resistor cannot be tested independently from the blower motor.

1. Turn the fan on to low, medium1, medium2,then high.
2. Read the voltage at the blower assembly connector for each speed.

If battery voltage is available at each pin of the blower assembly connector and the blower motor does not come on. Ensure there is a good ground.If all electrical tests are OK. Replace the blower assembly.

Blower speed switch

The blower speed switch sends current to one pin of the blower motor resistor depending on selected speed.

The blower speed switch also supply power to AC switch, so AC switch can control AC system.

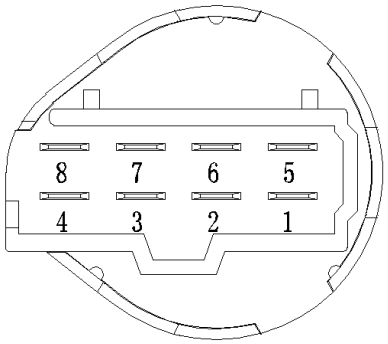
Testing the Blower Speed Switch

1. Disconnect blower speed switch.
2. Ensure battery voltage is available at pin 1 and 5 (switch side).
3. Disconnect blower speed switch.
4. Test resistance as per following table.

REQUIRED TOOL	
UNIT 115 MULTIMETER	

Set the multimeter to “200Ω”

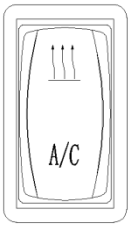
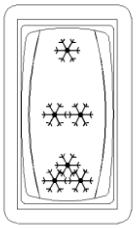
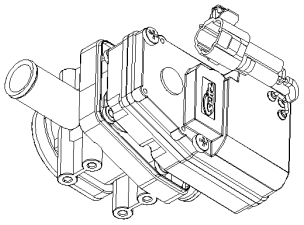
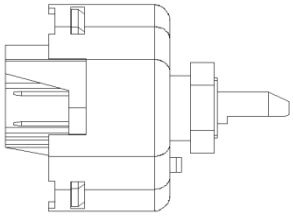
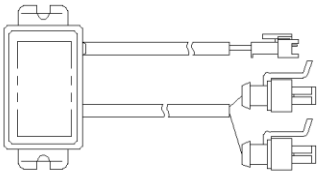
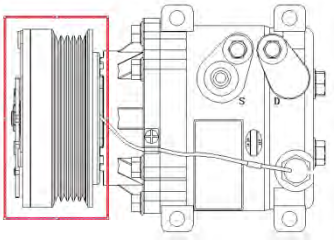
SPEED	PINS	SPECIFICATION
Off	1 and 8	O.L
	5 and any pin	O.L
Any speed	1 and 8	0Ω
Low	5 and 3	0Ω
Medium1	5 and 6	0Ω
Medium2	5 and 2	0Ω
High	5 and 7	0Ω



Replace blower speed switch if test is not as per specifications.

CONTROL SYSTEM

The purpose of the control system is to make the air conditioning system work normally and maintain the required comfortable temperature and air supply conditions in the car. There are a series of control elements and actuators in the air conditioning system.

PARTS	Sketch Map	Function
HVAC SWITCH		Control HVAC system heating or cooling
Temperature Control switch		Adjust the evaporation temperature of evaporator surface
Electric valve		The heater control valve opens to allow coolant to pass through. When the coolant circulates, it heats up the unit.
Blower speed switch		Turn the blower to low, medium1,Medium2 and high.
Electronic thermostat		According to the temperature Control switch to control different temperature points（only for AC）
Compressor electromagnetic clutch		The power of the engine is transmitted to the compressor through the pulley

HVAC and temperature switches

Remove the switches refer to ***electrical system switches.***

Electronic thermostat

Removing the electronic thermostat

1. Remove the hood refer to the ***AIR DUCTS.***
2. Remove two bolts fixing the glass kettle.
3. Remove the glass kettle.
4. Remove two M5 screws from the glass kettle bracket.
5. Remove the electronic thermostat.

Installing the electronic thermostat

The installation is the reverse of the removal procedure.

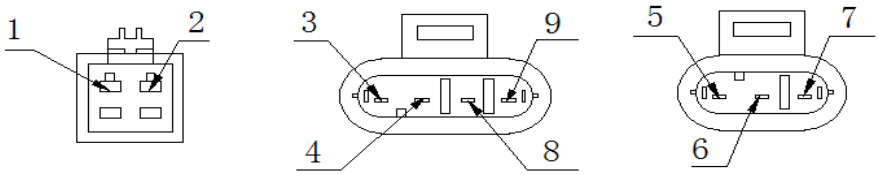
Testing the electronic thermostat

Test the electronic thermostat as per following table.

REQUIRED TOOL	
UNIT 115 MULTIMETER	

Set the multimeter to “200Ω”

Test condition	Pin3 connect the battery(+),pin9 connect the ground.NTC is connected between pin1 and pin2.	
Pins	SPECIFICATION 4 and 8	Resistor
7(yellow) to ground	O.L	＞6KΩ
	0Ω	＜5.4KΩ
6(white) to ground	O.L	＞5.7KΩ
	0Ω	＜4.9KΩ
5(blue) to ground	O.L	＞5.2KΩ
	0Ω	＜4.4KΩ



Replace electronic thermostat if test is not as per specifications.

NTC

NTC is installed on the surface of evaporator.

Removing the NTC

1. Remove the evaporator refer to the *EVAPORATOR.*
2. *Remove the NTC.*


Installing the NTC

The installation is the reverse of the removal procedure.

Testing the NTC

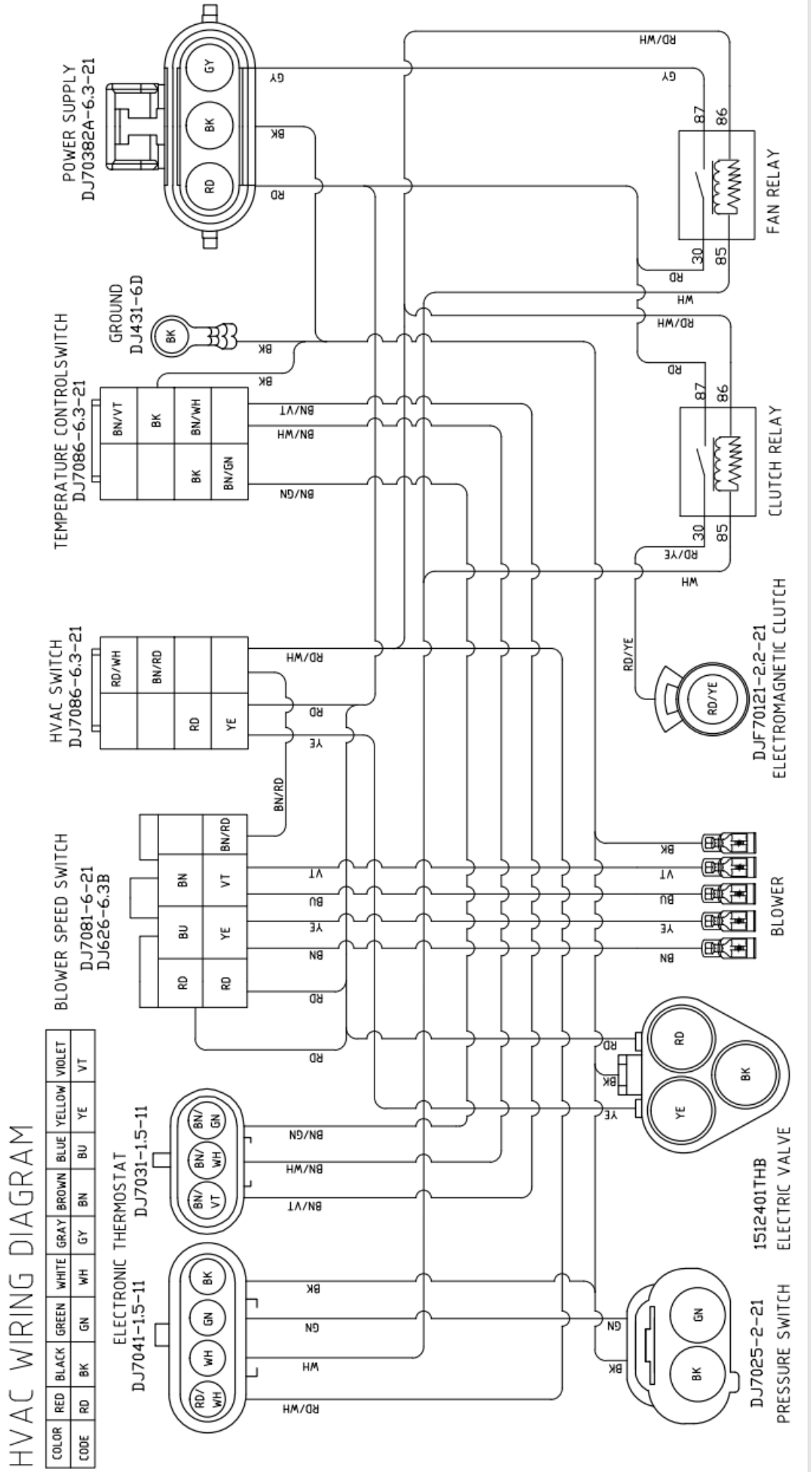
REQUIRED TOOL			
UNIT 115 MULTIMETER		Thermostatic bath	

Set the multimeter to “20KΩ”

Put the NTC into the thermostatic bath, adjust the temperature and test the resistance of NTC as per following table.

Temperature（℃）	Rmin（KΩ）	Rstandard（KΩ）	Rmax（KΩ）
-1	6.785	7.006	7.227
0	6.483	6.650	6.816
1	6.114	6.314	6.515
2	5.797	5.998	6.198
3	5.498	5.699	5.899
4	5.217	5.417	5.616
5	4.951	5.150	5.347
6	4.701	4.898	5.094
7	4.464	4.660	4.864
8	4.241	4.435	4.627
9	4.031	4.222	4.412

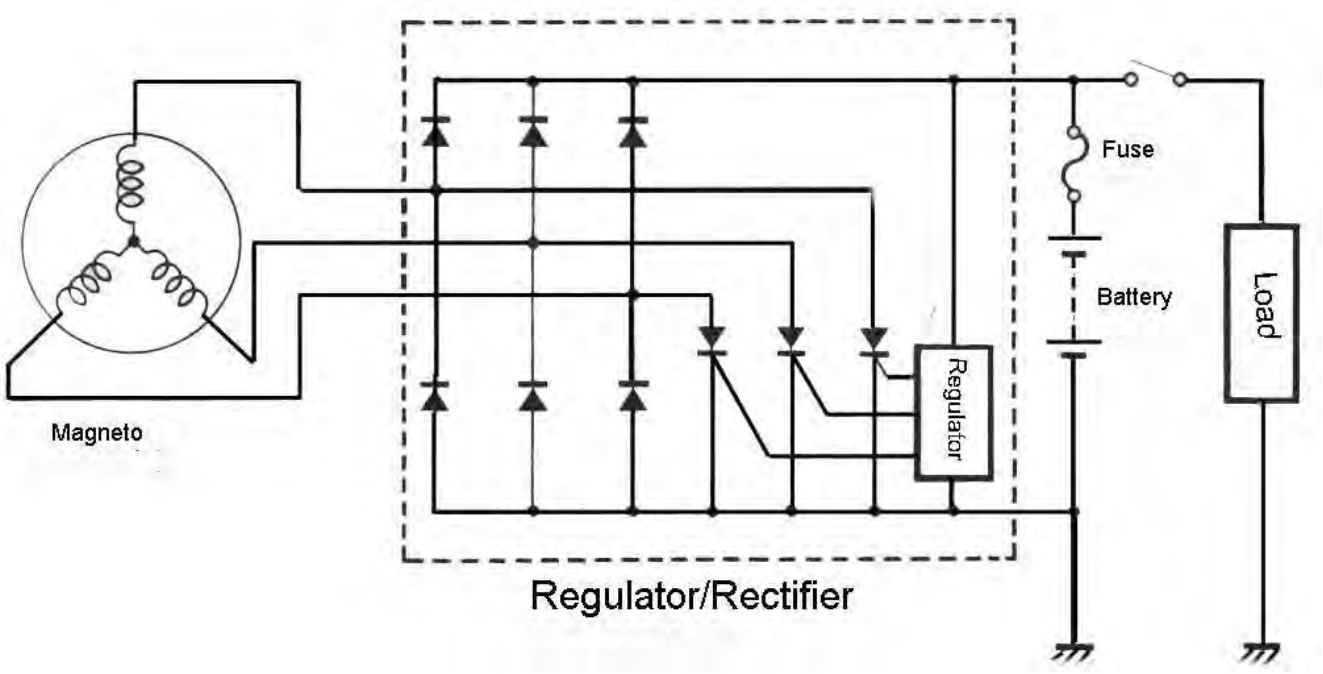
Replace the NTC if test is not as per specifications.


HVAC WIRING DIAGRAM
COLOR RED BLACK GREEN WHITE GRAY BROWN BLUE YELLOW VIOLET
CODE RD BK GN WH GY BN BU YE VT
POWER SUPPLY DJ70382A-6.3-21
GROUND DJ431-6D
TEMPERATURE CONTROLSWITCH DJ7086-6.3-21
HVAC SWITCH DJ7086-6.3-21
BLOWER SPEED SWITCH DJ7081-6-21 DJ626-6.3B
ELECTRONIC THERMOSTAT DJ7041-1.5-11
DJ7031-1.5-11
FAN RELAY
CLUTCH RELAY
DJF70121-2.2-21 ELECTROMAGNETIC CLUTCH
BLOWER
1512401THB ELECTRIC VALVE
DJ7025-2-21 PRESSURE SWITCH

12. ELECTRICAL SYSTEM

CHARGING SYSTEM.....12-2	STARTING SYSTEM.....12-8
EFI SYSTEM.....12-11	MULTIFUNCTION GAUGE.....12-14
HEADLIGHTS.....12-15	RELAY AND FUSE.....12-16
SWITCHES.....12-17	

CHARGING SYSTEM



GENERAL

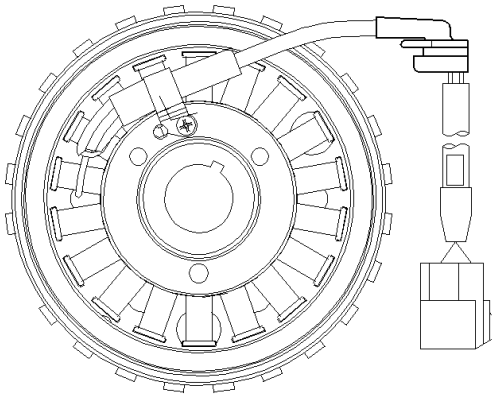
SYSTEM DESCRIPTION

The purpose of the charging system is to keep the battery at a full state of charge and to provide the electrical system with the required electrical power for normal vehicle operation.

Magneto

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

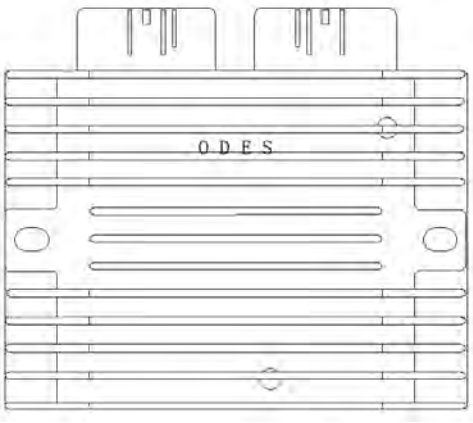
The magneto has a 3 phase series stator.



Voltage Regulator/Rectifier

The rectifier receives AC current from the magneto and transforms it into direct current (DC).

The voltage regulator, included in the same unit, limits voltage to prevent any damage to electrical components.



Battery

The battery supplies DC power to the electric starter for cranking the engine. During engine starting, it also supplies DC power to the entire electrical system.

At low engine RPM operation and high current load conditions, it supplements the magneto output and helps to maintain a steady system voltage.

INSPECTION

CHARGING SYSTEM OUTPUT

First ensure that battery is in good condition prior to performing the following tests.

Testing the Output Voltage Using multimeter.

1. Start engine with the less consumption as possible (no lights, no accessories).
2. Increase engine RPM as specified in the following table and read voltage in the multimeter.

OUTPUT VOLTAGE TEST	
ENGINE SPEED	VOLTAGE (DC)
4000 RPM	14.5 ± 0.5V

If voltage is above specification, replace voltage regulator/rectifier.

If voltage is below specification, check stator output and wiring harness prior to concluding that voltage regulator/rectifier is defective.

Check stator

Stator Connector Access

The stator is directly connected to the voltage regulator/rectifier.

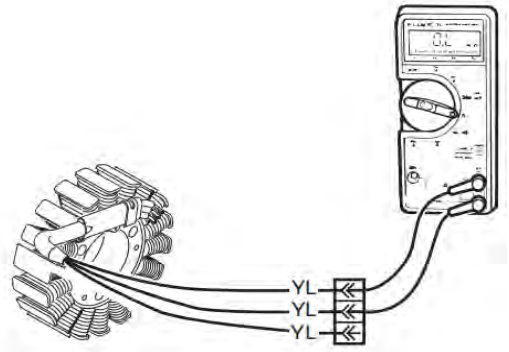
Testing the Stator Continuity

1. Disconnect the stator connector from the voltage regulator/rectifier.
2. Check resistance between YELLOW wires.

REQUIRED TOOL	
UNIT 115 MULTIMETER	

TERMINAL	RESISTANCE @ 20°C (68°F)
1 and 2	0.15 - 0.30 Ω
1 and 3	
2 and 3	

3. If any reading is out of specification, replace stator.
4. Re-plug connectors properly.



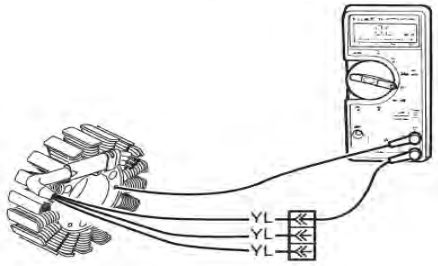
Testing the Stator Static Insulation

1. Disconnect the stator connector from the voltage regulator/rectifier.
2. Connect multimeter between any YELLOW wire (on stator connector) and engine ground.

REQUIRED TOOL	
UNIT 115 MULTIMETER	

TEST PROBES	RESISTANCE @ 20°C (68°F)
Any YELLOW wire and engine ground	Infinite (open circuit)

3. If there is a resistance or continuity, the stator coils and/or the wiring is shorted to ground and needs to be repaired or replaced.
4. Re-plug connectors properly.



Check battery

1. Connect a battery load tester.
2. Ensure proper test conditions.

If battery voltage drops below specification during test,replace battery and perform a CHARGING SYSTEM LOAD TEST.

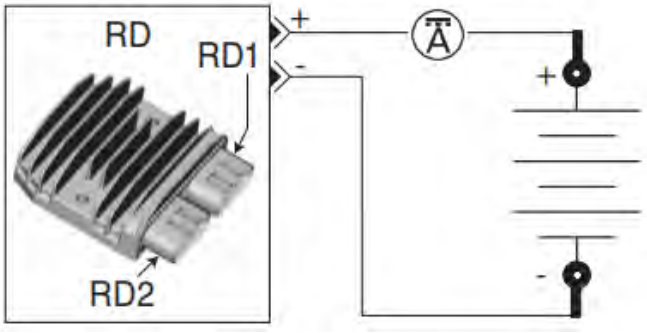
TEST CONDITIONS	
Initial battery voltage‡	Above 12.5 Vdc
Engine	OFF
Load	3 times the amp-hour (AH) rating
Time	15 seconds
‡ Required for accurate testing	

SPECIFICATION	
Battery	Above 9.6 Vdc

CHARGING SYSTEM LOAD TEST

1. Connect a battery load tester.
2. Start vehicle and read voltage on tester.

SPECIFICATION	
Voltage	12.5 - 15 Vdc



If voltage is above specification, replace regulator and continue CHARGING SYSTEM LOAD TEST.

3. Connect an ammeter around RD1-1 wire.

DC CURRENT TEST WITH INDUCTIVE AMMETER
1. Output connector of voltage regulator
2. Ammeter clamped over RED wire

4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
Time	15 seconds
‡ Required for accurate testing	

5.Read amperage on ammeter.

45±5Amps

NOTE: With a fully charged battery and no electrical loads, specification is less than 10A.

If amperage or voltage is not within specification,verify magneto and wires. Replace:

- Voltage regulator if magneto test is within specifications.
- Magneto if magneto test is not within specifications.

VOLTAGE REGULATOR (RD)

Testing the Voltage Regulator Continuity

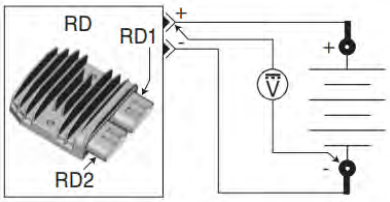
Due to internal circuitry, there is no static test available

Voltage Regulator Wire Identification

FUNCTION	PIN	COLOR
12Vdc output	RD1-1	RD
12Vdc ground	RD1-3	BK
12Vac input	RD2-1	BK
12Vac input	RD2-2	BK
12Vac input	RD2-3	BK

Testing the Voltage Regulator Power

1. Check voltage at RD1-1.



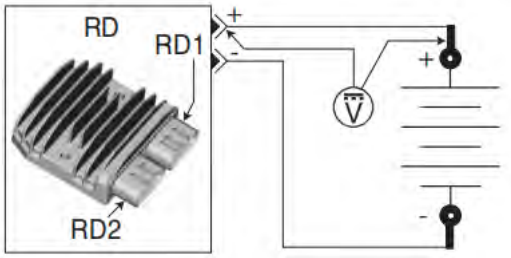
TEST CONDITIONS	
RD1-1	Hot at all times

BACKPROBE	PROBE	SPECIFICATION
RD1-1	BAT2 (-)	Battery voltage

2. Connect a battery load tester.
3. Start vehicle.
4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
Time	15 seconds
‡ Required for accurate testing	

5.Measure voltage drop.

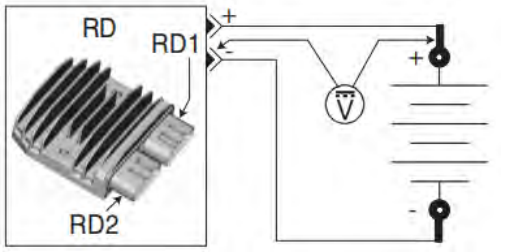


BACKPROBE	PROBE	SPECIFICATION
RD1-1	BAT1 (+)	Under 0.2 Vdc

If voltage drop is above specification, locate and repair damaged connector/wire.

Testing the Voltage Regulator Ground

1. Check ground at RD1-3.



TEST CONDITIONS	
RD1-3	Permanent ground

BACKPROBE	PROBE	SPECIFICATION
RD1-3	BAT1 (+)	Battery voltage

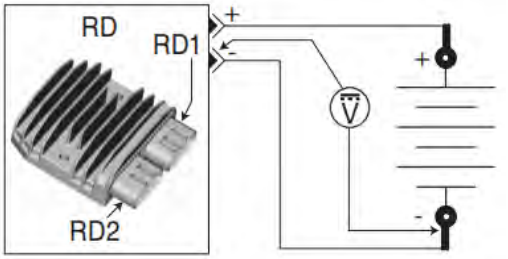
2.Connect a battery load tester.

3. Start vehicle.

4. Ensure proper test conditions.

TEST CONDITIONS	
Battery voltage at idle‡	Above 12.6 Vdc
Engine	Increase to 4000 RPM
Load	As required to decrease battery voltage to 12 Vdc
Time	15 seconds
‡ Required for accurate testing	

5.Measure voltage drop.



BACKPROBE	PROBE	SPECIFICATION
RD1-3	BAT2 (-)	Under 0.4 Vdc

If voltage drop is above specification, locate an

BATTERY

Refer to battery manufacturer's instructions for proper filling, activation and routine charging rocedures.

Battery Access

The battery is located underneath the driver's seat.

Removing the Battery

1. Remove under seat storage compartment if equipped.

2. Remove battery cover

3. Disconnect BLACK (-) cable first, then the RED (+) cable.

NOTICE Always respect this order for removal; disconnect BLACK (-) cable first.

4.Remove battery.

Cleaning the Battery

Clean the battery rack, cables and battery posts

using a solution of baking soda and water.

Remove corrosion (if so) from battery cable terminals and battery posts using a firm wire brush.

Rinse with clear water and dry well.

Inspecting the Battery

Visually inspect battery casing for cracks or any other damages. If casing is damaged, replace battery and thoroughly clean battery support with a water and baking soda solution.

Inspect condition of battery posts, battery support, holding strap and strap attachment points and wire terminal lugs.

Battery Storage

It is not necessary to remove the battery during vehicle storage but it is recommended for long term storage.

If the battery is left in the vehicle during storage or used infrequently, disconnect the BLACK (-) negative battery cable to eliminate battery current drain from the electrical equipment.

Recharge the battery once a month with an approved battery charger as per manufacturer's recommendations.

Clean battery, battery support and connections as required.

For other recommendations during storage, refer to battery manufacturers instructions.

⚠ WARNING

Ensure battery is stored in a safe place, out of reach for children.

Activating a New Battery

Refer to the instructions provided with the battery.

Charging a Battery

⚠ WARNING

Always wear safety glasses and charge in a well ventilated area. Never charge or boost a battery while it is installed on vehicle. Do not open the sealed cap during charging. Do not place battery near open flame.

NOTICE **If battery becomes hot, stop charging and allow it to cool before continuing.**

NOTE: If battery pressure increases due to overcharging, the valve opens to release excess pressure, preventing battery damage.

An automatic charger is a fast and convenient way for error-proof charging.

Always follow the battery manufacturer's charging instructions.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V and Above 11.5V

STANDARD CHARGING (RECOMMENDED)	
APPROXIMATE TIME	CHARGE
4 - 9 HOURS	2 A

QUICK CHARGING	
APPROXIMATE TIME	CHARGE
50 MINUTES	10 A

Installing the Battery

NOTICE **Always connect RED (+) cable first then BLACK (-) cable.**

STARTING SYSTEM

GENERAL

SYSTEM DESCRIPTION

The starting system is composed of an electric starter supplied in current by the battery through a solenoid.

The starter solenoid receives a 12 volt input from the ignition switch and the ground signal is provided by the Gear controller.

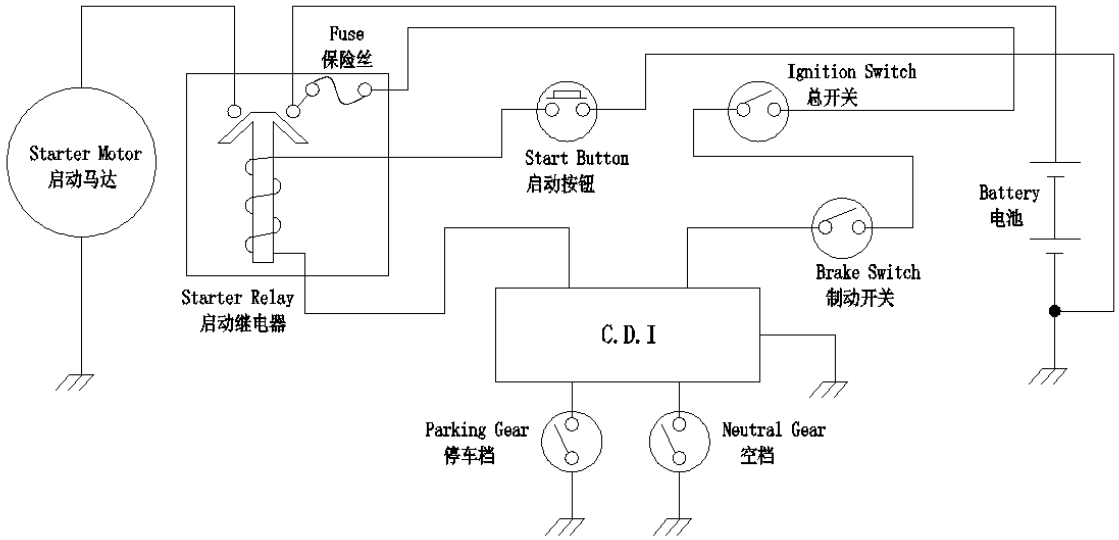
- Transmission in Park or Neutral position and/or brake pedal held.
- Ignition switch turns to the start position and hold until the engine starts.

PROCEDURES

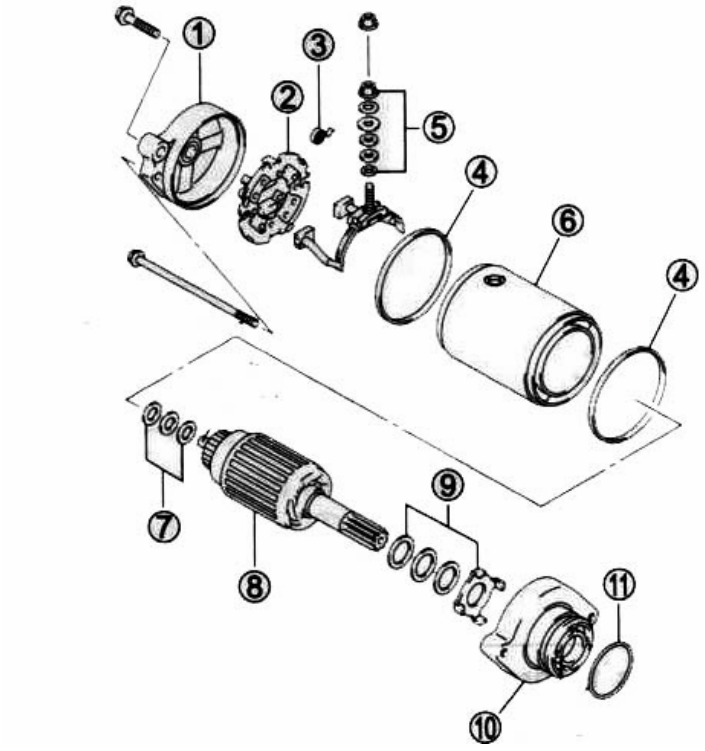
STARTER SOLENOID

Starter Solenoid Access

The starter solenoid is located beside the fuse box and the battery , underneath driver's seat..



Starter motor



① Bracket
② Brush Seat
③ Brush Spring
④ O-ring
⑤ Shims
⑥ Motor Housing
⑦ Washers
⑧ Armature Coil
⑨ Washer Kit
⑩ Inner Bracket
⑪ O-ring

Brush

Z Check the brush on the brush holder whether it is worn abnormal, cracked or not smooth.

Worn, cracked, or not smooth: → Replace

Rectifier

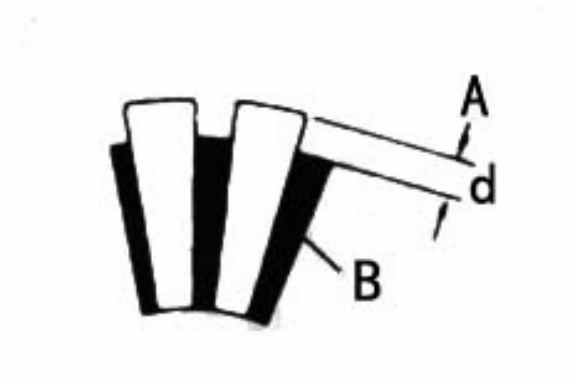
Z Check the rectifier whether it is discolored, abnormal wear or concave.

Abnormal wear or damage: → Replace

Z If the rectifier is discolored, grind it with sanding paper, then wipe it with a clean fabric.

Z If there is concave, scrape off insulator B, so that the distance with A is d.

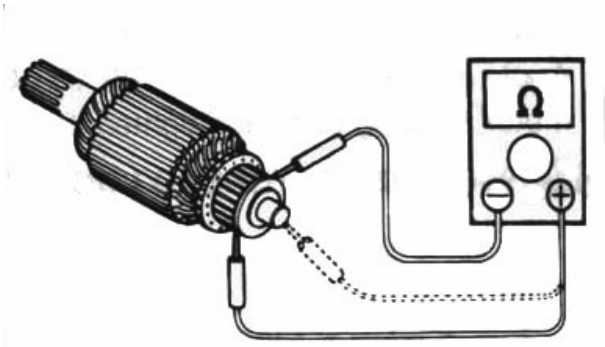
d≥1.5mm



Armature coil

Z Test the connection between each wire and the armature coil with the multimeter.

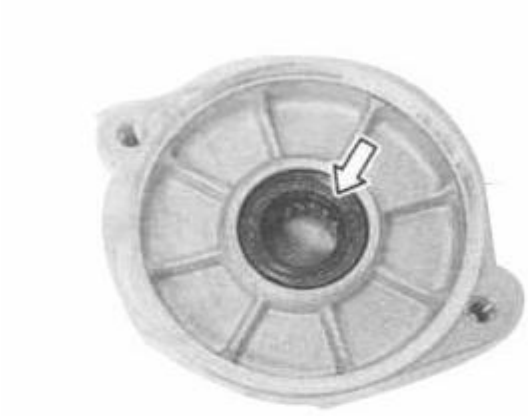
Z If they are not connected, replace the armature shaft.



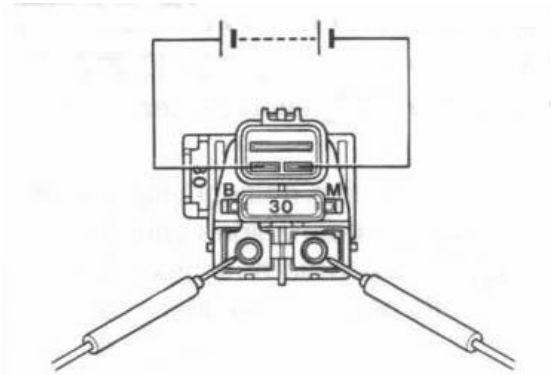
Oil seal

Z Check the oil seal lip for damage or leak.

Damage or leakage: →Replace the starter motor.



Starter relay

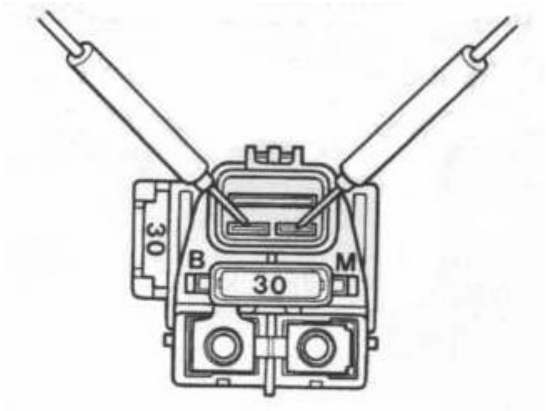


Z Inter-terminal voltage is 12V. Test the direct connection of positive and negative poles with the multimeter.

Z If the starter relay clicks and connected, the starter relay is OK.

Z When there is no voltage of 12V, they are not connected, the starter relay is OK.

Note: Do not apply battery voltage on the starter relay for more than 2 seconds. This will result in overheating or damaging the relay coil.



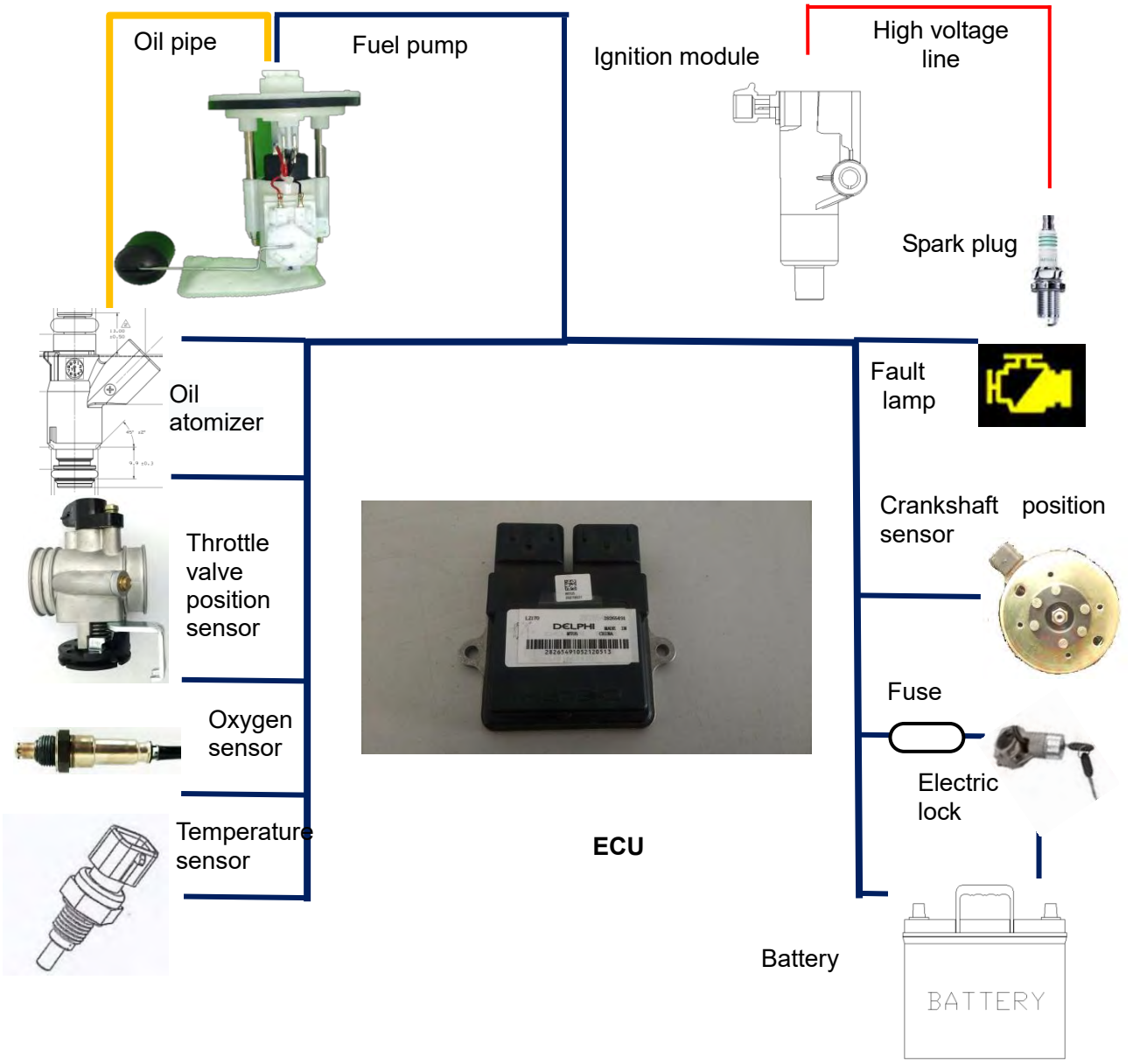
Z Measure the coil resistance with the multimeter. If the resistance exceeds the specified value, replace the starter relay.

The multimeter is set to 1x10Ω.

Starter relay coil resistance: 3-5Ω

EFI SYSTEM

Schematic diagram of EFI system



The function of EFI system includes two parts: fuel injection management and ignition management, which are realized by the following institutions.

(1). ECU: it is responsible for the receiving of sensor signal, the formulation of control strategy, and the issue of control signal.

(2). Oil supply device: it is composed of oil pump, tubing and injector. The pump pressurizes the fuel to 250 KPA. The injector is installed on the engine inlet to control the injection timing and fuel injection amount.

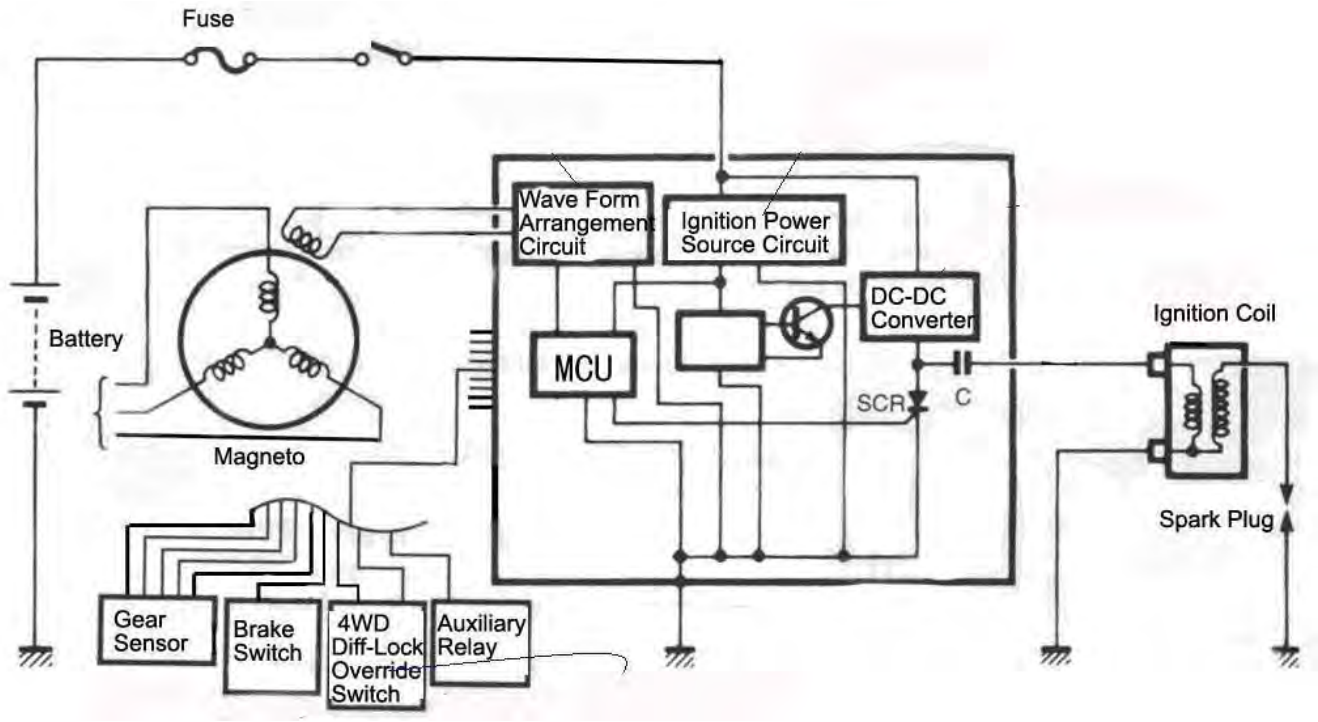
(3). Ignition device: it is composed of ignition module, high voltage wire and spark plug. The ignition module has a DC capacitor igniter and a high voltage ignition coil, which can raise the voltage of the battery from 12V to more than 15000V, which also can be transported to the spark plug by high-voltage wire to generate spark discharge.

(4). Sensors: including: a. The oxygen sensor, which mounted on an exhaust pipe to detect oxygen concentration in exhaust gases, can realize the closed-loop regulation of the mixture concentration,

and when the closed-loop adjustment, the output of 0 ~ 0.9V alternating signal can be achieved; b. cylinder temperature sensor, which is installed on the engine cylinder head to detect the engine body temperature, will affect the starting thickening amount; c. Crankshaft position sensor, which is integrated on magneto to provide crankshaft angle signal, is the time reference for fuel injection and ignition control; d. The throttle position sensor is mounted on the throttle body to measure the rotation angle of the throttle valve.

(5). Other: including：a. throttle body, which controls air intake through throttle pull wire; b. Fault alarm lamp, which is installed on the dashboard for fault alarm; c. Battery, door lock, fuse for power supply to EFI system.

Ignition system



Ignition coil

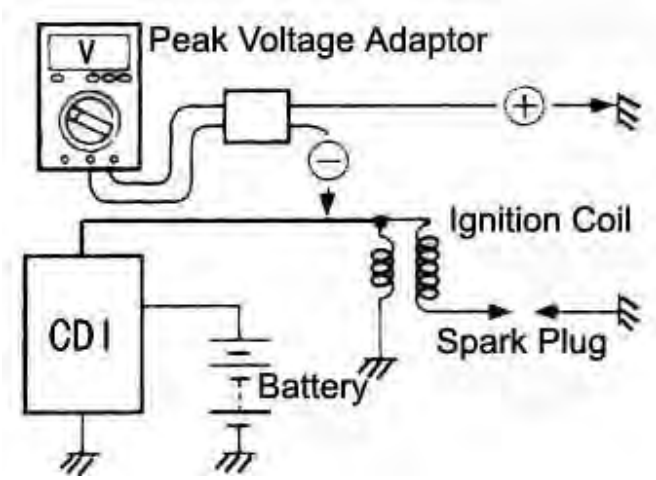
Primary peak voltage of ignition coil

Z Remove the spark plug cap as shown in the right figure. Install the new spark plug to the cap. The cylinder is connected to grounding.

Z Connect the multimeter and the peak voltage adapter as follows:

+Probe: BK wire or grounding wire

-Probe: Br / yellow wire



NOTE:

Z Make sure the battery voltage ≥ 12V. The ignition coil wires are connected.

Z When using multimeter and the peak voltage adapter, please refer to the user manual.

Z Move the gear to the neutral position, turn on the ignition device.

Z Press the start button and crank the engine for a few seconds. Then measure the primary peak voltage of the ignition coil;

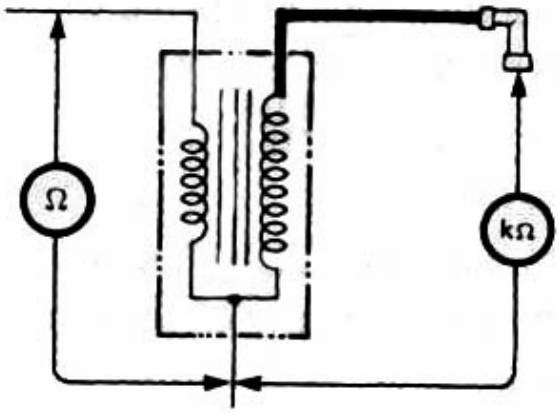
Z Repeat the steps above for several times. Measure the maximal value of the primary peak voltage.

Set the multimeter at the AC voltage position.

Primary peak voltage of ignition coil: ≥150V

Note: Do not touch the test probes or spark plug, in case of electric shock.

Z If the voltage is lower than the standard value, check the ignition coil and coupling coil.



Resistance of ignition coil

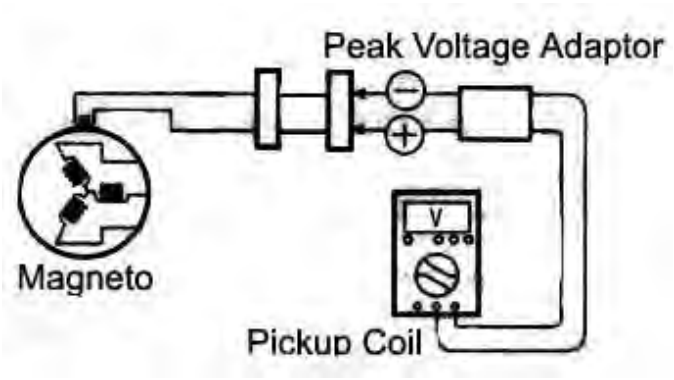
Z Disconnect the ignition coil wires and spark plug cap. Remove the ignition coil;

Z Measure the resistance of the primary and secondary windings of the ignition coil with the multimeter. If the resistance of two coils is close to the specified value, the ignition coil is in good condition.

Resistance of ignition coil

Primary winding:0.58±0.058 Ω (terminal - ground)

Secondary coil: 7.1±0.71 (terminal - spark plug cap)



Peak voltage of coupling coil

Z Check the peak voltage of the coupling coil with following steps.

Z As shown in right figure, connect the multimeter with the peak voltage adapter.

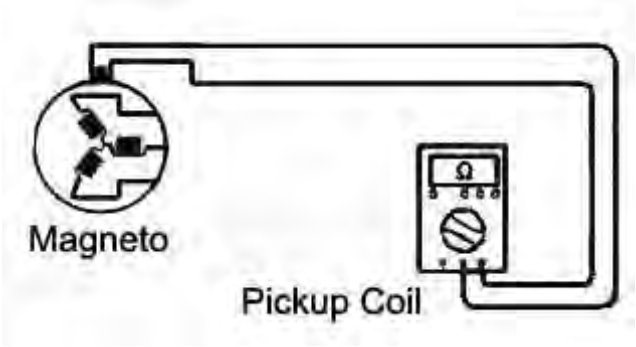
+Probe: Green/white wire

-Probe: BL/Y wire

Z Move the gear to the neutral position, turn on the ignition device.

Z Press the start button and crank the engine for a few seconds, and then measure the primary peak voltage of the coupling coil;

Z Repeat the steps above for several times. Measure the maximal value of the primary peak voltage.



Put the multi meter at AC voltage step.

Peak voltage of coupling coil: ≥4V

Z If the voltage is lower than the standard value, replace coupling coil.

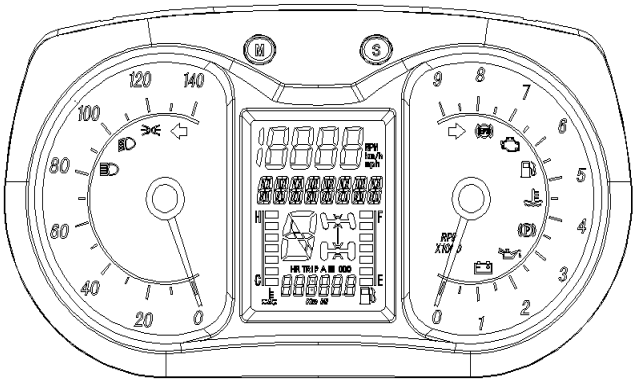
Resistance of coupling coil

The multi meter is put at 1x100Ω step.

Resistance of coupling coil: 135±5Ω

Z If the resistance is not within the specified value, replace the coupling coil.

MULTIFUNCTION GAUGE



TYCO 2203663-5 (BK)						TYCO 2203663-6 (GRAY)					
PIN	FUNCTION	COLOR	PIN	FUNCTION	COLOR	PIN	FUNCTION	COLOR	PIN	FUNCTION	COLOR
P1	Fuel level gauge ground	BK/WHITE	P10	BATTREY-	BK	P1			P10	TURN LEFT (+)	BLUE/WHITE
P2	Fuel level gauge supply	PINK/WHITE	P11			P2			P11	TURN RIGHT (+)	PURPLE/WHITE
P3			P12	BATTERY (+12V)	ORANGE/RED	P3			P12	HIGH BEAMS (+)	BLUE
P4	Fuel level gauge supply	GREEN/PURPLE	P13	IGNITION (+12V)	BLUE/RED	P4	EPS SIGNAL	BLUE/ORANGE	P13	LOW BEAMS (+)	WHITE
P5			P14			P5	Oil pressure	BLUE/BK	P14	BACKLIGHT (+)	WHITE
P6	CAN-L	ORANGE/BK	P15	rpm	GREEN/RED	P6			P15		
P7	CAN-H	YELLOW	P16			P7			P16		
P8			P17			P8			P17		
P9			P18			P9			P18		

The above picture is the GAUGE function and interface definition of the instrument.

Check the indicator lights with the following steps.

Each signal indicator has different signals, .According to the corresponding information in the table, check with the multimeter.

HEADLIGHTS

Headlight Wire Identification

VEHICLE WIRE AT HEADLIGHT CONNECTOR	SELECTION	APPLICATION
BLUE	HI BAEM	12 Vdc power
WHITE	LO BEAM	12 Vdc power
BLUE/WHITE	TURN LEFT	12 Vdc power
PURPLE/WHITE	TURN RIGHT	12 Vdc power
BROWN/WHITE	DRIVING LAMP	12 Vdc power
BLACK(BK)	ALL the above	GROUND

Testing the Taillight/Brake Light

Disconnect Taillight/Brake Light connector.

Using a multimeter, measure the voltage on headlight connector as follows

	WIRE COLOR		VOLTAGE
BRAKE LIGHTS	RED/BK	BLACK(BK)	BATTERY VOLTAGE
REVERSING LIGHTS	ORANGE/BK	BLACK(BK)	
POSITION LIGHTS	WHITE/BK	BLACK(BK)	
TURN LEFT	BLUE/WHITE	BLACK(BK)	
TURN RIGHT	PURPLE/WHITE	BLACK(BK)	

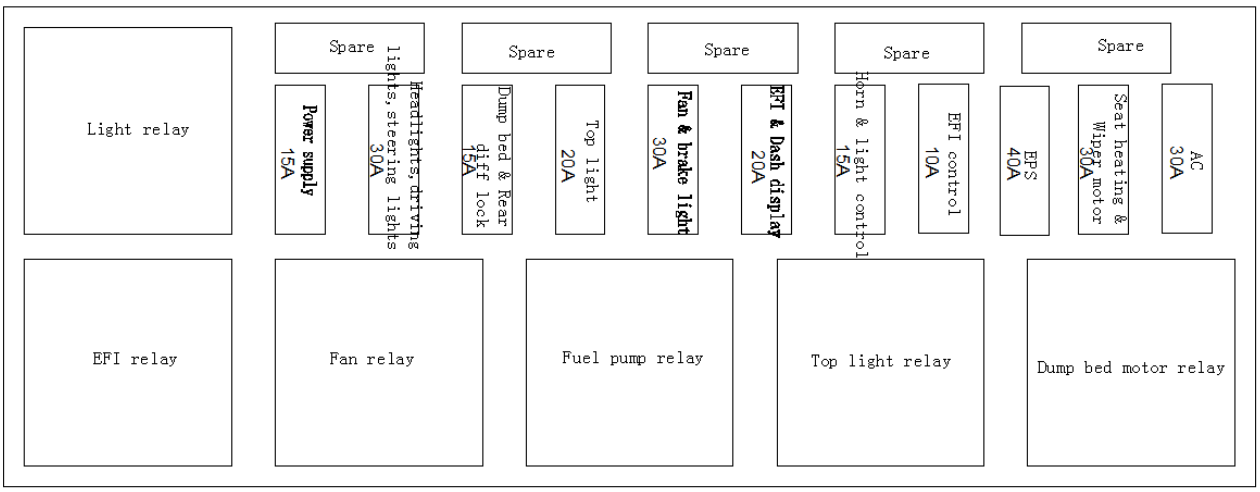
FUNCTION	PIN	COLOR
12V INPUT	1	BROWN/YELLOW
12V OUTPUT	2	RED/BK

If a LEDs in the taillight or brake light fail, the entire taillight must be replaced.

Maintenance Soon Message

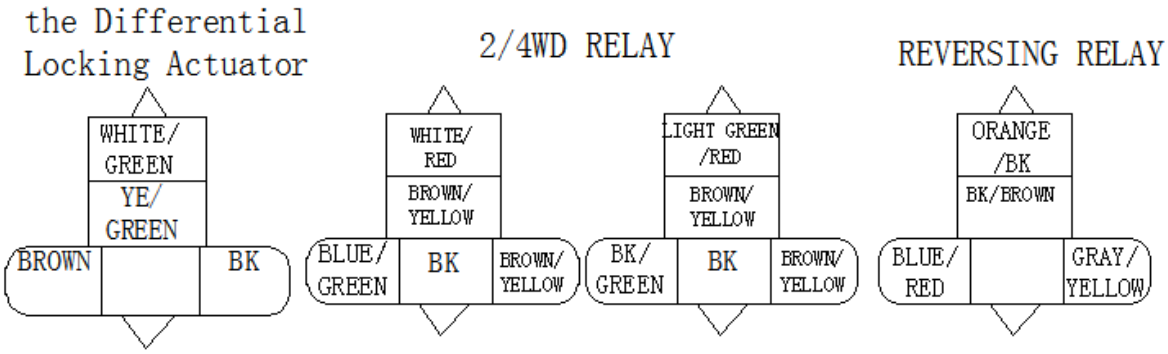
1. Select PARK.
2. Turn ignition switch to ON. Do NOT start engine.

RELAY AND FUSE

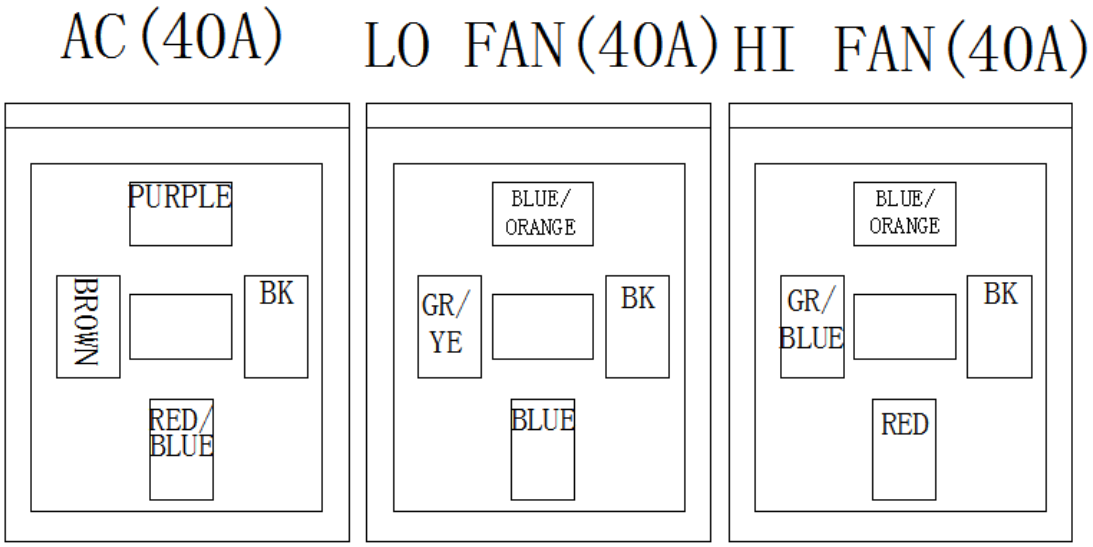


Functional definition of relays and fuses.Check fuse first whatever any system doesn't work.

AND spare fuses for reserve.



These above four relays on the battery box.



These above three relays fixed on the front frame.

NOTE：Please refer to wiring diagram for specific function of fuse and relay.

SWITCHES

PROCEDURES

CONSOLE SWITCHES

Switches Access

The switches connectors can be reached by the openings underneath the dash.

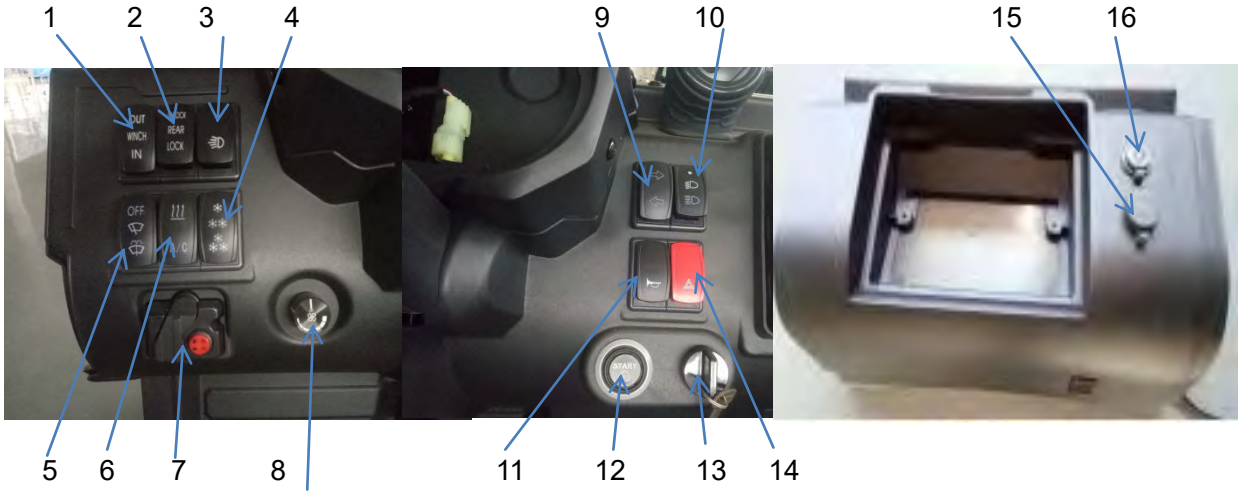
Replacing a Switch

Disconnect electrical connector.Release retaining clips, then push switch out of the console.

1.Retaining clips

For installation, reverse removal procedure.

NOTE: **Switches Wire Identification refer to the wiring diagram.**



NO.	FUNCTION	NO.	FUNCTION
1	WINCH SWITCH	9	TURN SIGNAL
2	the differential locking	10	HI LO BEAMS
3	TOP LAMP	11	HORN
4	AC T℃	12	BUTTON START
5	WIPER	13	IGNITION KEY
6	HVAC	14	HAZARD
7	2/4WD	15	auxiliary DC jack
8	HVAC FAN control	16	USB

Ignition key,USB,2/4WD,BUTTON START,HVAC FAN control and auxiliary DC Jack are fixed on dashboard with nuts.

NOTE: The nut of the ignition switch is fixed outside the dashboard,USB and auxiliary DC jack nuts are fixed inside the dashboard.

All functions are controlled by ignition switch except auxiliary DC jack.USB output voltage 5V, refer to wiring diagram for switches with the multimeter,the multimeter is set to DC20V.

Inspecting an Electrical Connection

When replacing an electric or electronic component, always check electrical connections. Make sure they are tight, make good contact, and are corrosion-free. Dirty, loose or corroded contacts are poor conductors and are often the source of a system or component malfunction.

Pay particular attention to ensure that pins are not bent or pushed out of their connectors.

Ensure all wire terminals are properly crimped on wires, and connector housings are properly fastened.

13. TROUBLESHOOTING

ELECTRICAL SYSTEM.....13-1	COOLING SYSTEM.....13-1
MAGNETO SYSTEM.....13-2	LUBRICATION.....13-3
CYLINDER AND HEAD.....13-4	CRANKSHAFT.....13-5
GEARBOX.....13-5	COUPLING UNIT.....13-6
CVT.....13-7	ENGINE GENERAL.....13-10
HVAC SYSTEM..... 13-13	FAULT CODES..... 13-16

ELECTRICAL SYSTEM

Symptom: NO SPARK OR POOR SPARK

1. Refer to ignition system.

Symptom: STARTER DOES NOT TURN

1. Refer to starting system.

Symptom: STARTER TURNS BUT DOES NOT CRANK THE ENGINE

1. Refer to starting system.
2. Check gear condition on electric starter.
   - ■ Worn and/or damaged starter gear. Replace electric starter and/or starter drive.
3. Check condition of starter pinion gear.
   - ■ Worn and/or damaged starter pinion and/or ring gear. Replace starter drive and/or drive pulley fixed sheave.
4. Check splines on starter drive.
   - ■ Poor movement of pinion gear on splines. Clean and/or replace starter drive.

Symptom: STARTER TURNS BUT STARTER DRIVE DOES NOT MESH WITH RING GEAR

1. Refer to starting system.

Symptom: STARTER KEEPS RUNNING

1. Refer to starting system.

COOLING SYSTEM

Symptom: HIGH ENGINE OPERATING TEMPERATURE

1. Check coolant level.
   - ■ Coolant level lower than recommended. Refill(refer to cooling system).
2. Check mud/dust in radiator fins.
   - ■ Radiator fin obstructed, hard air cooling. Clean radiator fins.
3. Check cooling fan and connection(must all fan can work).
   - ■ Fan motor faulty. Replace.
   - ■ Wire harness is brittle or hard (no connection). Replace.
4. Check radiator fan switch and fuse.
   - ■ Faulty fan switch and/or faulty fuse. Replace defective part(s).
5. Check radiator condition for leakage.

- Radiator cracked or deformed. Replace radiator.

6. Check for air bubbles in cooling system.

- Air in cooling system. Refill and bleed cooling system (refer to cooling system).

7. Check temperature sensor for electrical/mechanical failure.

- Temperature sensor defective. Replace.

8. Check thermostat.

- Thermostat defective (does not open when engine gets hot). Replace (refer to cooling system).

9. Check leak indicator hole (in crankcase MAG side-water pump housing area) if coolant leaks.
   - Coolant leaking from indicator hole means a damaged water pump rotary seal. Replace rotary seal (refer to cooling system)..
10. Check condition of hoses and hose clamps fixation.
    - Hoses are brittle and/or hard. Replace.
    - Hose clamps are loose. Retighten clamps.
11. Check condition of impeller located on the water pump shaft.
    - Impeller wings broken and/or impeller threads are damaged. Replace (refer to cooling system).
12. Check gasket on water pump housing.
    - Gasket on water pump housing leaks. Retighten screws and/or replace gasket.
13. Check cylinder head and/or cylinder base gasket.
    - Worn out gasket(s) is (are) causing coolant leakage. Replace.
14. Check coolant drain screw on water pump housing MAG side.
    - Copper ring on drain screw leaks. Retighten screw and/or replace copper ring.
15. Check intermediate gear(s) behind of PTO cover.
    - Worn out and/or broken gear(s) is/are causing less coolant supply. Replace worn out and/or broken gear(s) (refer to bottom end).
16. Check if water pump shaft is seized.
    - Water pump shaft does not turn. Replace defective part(s).

MAGNETO SYSTEM

Symptom: <u>BATTERY NOT CHARGING OR CHARGING VOLTAGE INADEQUATE</u>

1. Check battery

- Battery shows less power. Reload battery.

2. Check magneto for damage and/or electrical failure.

- Radial position of rotor wrong due to broken woodruff key. Replace woodruff key.
- Coating on stator winding is damaged. Replace stator.

- Resistance value is out of specification (refer to technical specifications). Replace magneto.
- Connector on magneto is damaged and/or has electrical failure. Repair and clean contacts of connector.

3. Check voltage regulator/rectifier.

- Refer to charging system.

4. Check wiring harness for cracks or other damages.

- Harness shows electrical failure and/or other damages. Replace/repair wiring harness.

LUBRICATION

Symptom: LOW OR NO OIL PRESSURE/HIGH OIL CONSUMPTION

1. Check oil level and search for leakage on crankcase and/or sealing parts.

- Crankcase is leaking due to damage. Rebuild engine with new crankcase and gasket parts. Use recommended oil (refer to technical specifications).
- Crankcase is leaking due to loose screws. Retighten screws with recommended
- torque
- Sealing rings, O-rings and/or gaskets are brittle, hard or damaged. Replace damaged parts.
- Piston rings worn out (blue colored engine exhaust emission). Replace piston rings (refer to cylinder and head).
- Piston rings are broken (low compression). Replace piston rings (refer to cylinder and head).
- Valve stem seal damaged and/or sealing lip is hard and/or brittle. Replace all valve stem seals.

2. Check oil filter for contamination.

- Oil filter clogged. Replace oil and oil filter at the same time. Use recommended oil (refer to technical specifications).

3. Check oil drain plug on engine bottom.

- Plug is loose and/or gasket ring is missing. Retighten the plug and/or place gasket ring.

4. Check leak indicator hole if oil leaks (in crankcase MAG side-water pump housing area).

- Oil leaking from leak indicator hole means a damaged oil seal on water pump shaft.
  Replace oil seal (refer to cooling system).

5. Check oil pressure switch function.

- Oil pressure switch damaged. Replace oil pressure switch.

6. Check oil orifice(s) on the oil pump suction side.

- Oil orifice(s) is (are) clogged. Clean from contamination. Replace oil and oil filter if necessary (refer to maintenance or lubrication system).

7. Check oil pump function.

■ Oil pump rotor is out of wear limit. Replace oil pump (refer to lubrication system).

■ Oil pump seized due to oil leakage and/or air inclusion. Replace oil pump (refer to lubrication system).

■ Gears driving oil pump are broken or otherwise damaged. Replace gears.

■ Incorrect oil being used. Use recommended oil (refer to technical specifications).

8. Check oil pressure regulator valve (spring) function.

■ Valve spring damaged (valve always open). Replace spring.

■ Valve piston is worn or broken. Replace valve piston (refer to lubrication system).

■ Valve piston stays open due to contamination. Clean or repair valve piston.

9. Check plain bearings in crankcase for heavy wear.

■ plain bearings out of specification (increased clearance). Replace plain bearings (refer to bottom end).

10. Check engine oil strainer in crankcase.

■ Oil strainer is clogged due to contamination. Clean or replace strainer and diagnose causes. Replace possible damaged parts (refer to bottom end).

Symptom: OIL CONTAMINATION (white appearance)

1. Check leak indicator hole (in crankcase MAG side-water pump housing area) if water and oil leaks.

■ Leakage of oil/water mixture from indicator bore means damaged water pump seal ring and rotary seal. Replace sealing ring, rotary seal and change oil, oil filter and/or coolant (refer to lubrication system, cooling system and bottom end).

2. Check cylinder head and/or cylinder base gasket..

■ Gasket damaged or leaking. Retighten cylinder head with recommended torque and/or replace gasket.

3. Check tightening torque of cylinder head screws.

■ Screws not properly tightened. Retighten screws to recommended torque and replace oil.

4. Check oil for particles (may indicate possible engine internal damages).

■ Oil contamination due to metal or plastic particles. Replace possibly damaged part(s) including oil and oil filter. Use recommended oil (refer to technical specifications).

CYLINDER AND HEAD

Symptom: UNUSUAL ENGINE NOISE AND/OR VIBRATION

1. Check noise coming from cylinder head area.

■ Improper valve clearance adjustment. Readjust valve clearance and/or replace defective part(s).

■ Faulty chain tensioner. Replace spring and/or mechanism.

■ Chain guide worn out. Replace chain guide.

■ Stretched chain and/or worn out sprockets. Replace chain and sprockets.

- Sprocket screws got loose. Retighten screws with recommended torque.
- Rocker arm(s) is (are) worn out (valve adjustment). Readjust valve clearance and/or replace rocker arm(s).
- Incorrect camshaft timing adjustment. Replace damaged components and readjust camshaft timing (refer to cylinder and head).

Symptom: OIL CONTAMINATION ON CYLINDER AND/OR HEAD

1. Check screws for torque.

- Loose screws. Retighten screws with recommended torque.
- Gaskets are brittle, hard, worn out or otherwise damaged. Replace damaged gaskets, O-rings or the V-ring on breather.

CRANKSHAFT

Symptom: UNUSUAL ENGINE NOISE AND/OR VIBRATION

1. Check noise coming from crankshaft area..

- Crankshaft plain bearings are damaged,. Replace crankshaft plain bearings.
- Connecting rod plain bearings are damaged. Replace connecting rod plain bearings.
- Magneto rotor got loose. Replace damaged components and retighten rotor retaining screw with recommended torque (refer to MAGNETO SYSTEM).

GEARBOX

Symptom: UNUSUAL GEARBOX NOISE AND/OR VIBRATION

1. Check oil level in gearbox.

- Oil leakage from gearbox. Replace damaged gasket(s) and/or oil seal(s), torque screws and refill with oil up to specified level (refer to TECHNICAL SPECIFICATIONS and GEARBOX)

2. Check bearings in the gearbox for free movement.

- Bearing(s) do(es) not move freely. Replace bearing(s)

3. Check for knocking noise.

- Tooth of gears are damaged and/or worn. Replace respective gears.

Symptom: GEAR INDICATION FAILS.

1. Check contact screws on gear housing center.

- Check contact screw outside for contamination and wetness. Clean contact screw and screw for wiring harness.
- Contact(s) is (are) corroded and/or contact screw for wiring harness got loose. Clean contact surface and retighten contact screw(s) with recommended torque.
- Wiring harness has broken cables. Replace wiring harness.
- Shifting indicator switch(es) pin(s) is (are) worn and/or damaged. Replace shifting indicator switch(es).

Symptom: GEAR(S) IS (ARE) HARD TO SHIFT

1. Check shift shaft splines and/or shift forks for wear and/or damages.

- Shift shaft is worn out and/or shows damaged splines. Replace shift shaft.
- Shift drum track(s) and/or splines is (are) worn out or damaged. Replace shift drum and damaged part(s).
- Shift fork(s) is (are) worn out and/or engagement pins are damaged. Replace shift fork(s).
- Shift fork(s) is (are) worn out and/or fork(s) is (are) damaged. Replace shift fork(s).
- Shift gear(s) is (are) worn out. Replace shift gear(s).
- Shifting indicator switch(es) pin(s) is (are) worn out (no rounding on top of pin). Replace shifting indicator switch(es).

2. Check spring on shift shaft in gearbox.

- Broken spring. Replace the spring (refer to GEARBOX).

COUPLING UNIT

Symptom: 4 WHEEL DRIVE INDICATION FAILS

1. Check contact screw on gear housing right side for damage and/or wear.

- Shifting indicator switch pin is worn and/or damaged. Replace shifting indicator switch.
- Contact is corroded and/or contact screw for wiring harness got loose. Clean contact surface and retighten contact screw with recommended torque.
- Wiring harness has broken cable. Replace wiring harness.

Symptom: 4 WHEEL DRIVE DOES NOT ENGAGE OR DISENGAGE

1. Check actuator wireharness are loose.
2. Remove the actuator cover, and check if actuator is stuck or over travel.

- Eliminate the binding or return to normal position by hand.

3. Check actuator and/or actuator shifting fork for wear and/or damages.

- Check if selector works properly. If so, check actuator.
- If selector is out of specifications, check wires, connectors and/or replace selector.
- Actuator shifting fork is worn out and/or damaged. Replace shifting fork of actuator.
- Check function of actuator. Replace if actuator is not turning, refer to GEARBOX.

4. Check shifting sleeve splines and/or shifting fork for wear and/or damages.

- Check sleeve shows damaged splines. Replace shifting sleeve (refer to GEARBOX).
- Shifting fork is worn out and/or engagement pin is damaged. Replace shifting fork.

CVT

Symptom: UNUSUAL ACCELERATION BEHAVIOR

1. Check drive belt condition.

■ Belt is too narrow (drive belt engagement is higher in drive pulley).replace belt if width is less than specified.

2. Check lever condition on drive pulley sliding sheave and/or roller(s) on governor cup.

■ Lever(s) on drive pulley sliding sheave is (are) worn and/or damaged. Replace all levers at the same time (lever kit).

■ Roller(s) is (are) worn and/or damaged. Replace governor cup assembly.

3. Check drive/driven pulley sliding sheave for free axial movement.

■ Sliding sheave is stuck. Replace damaged part(s).

4. Check condition of drive/driven pulley spring.

■ Drive pulley spring tension is too smooth and/or damaged. replace spring.

■ Driven pulley spring tension is too stiff. Replace spring.

5. Check if cam of driven pulley is worn.

-- Replace if out of specifications.

6. Check condition of fixed and sliding sheaves (drive and driven pulley).

■ Check surface of fixed and sliding sheaves (drive and driven pulley) for grooves or other damages.

7. Check valve adjustment.

■ Intake and/or exhaust valves are not adjusted correctly. Adjust valves.

8. Check engine condition.

■ Low engine compression.

9. Check ignition condition.

■ Faulty spark plug. Install new spark plug(s).

10. Check differentials operation.

■ Vehicle on Neutral is hard to move. Repair or replace defective part(s).

Symptom: ENGINE MAXIMUM RPM IS TOO HIGH AND VEHICLE TOP SPEED IS NOT REACHED.

1. Check drive/driven pulley area for contamination and/or water intrusion.

■ CVT area is contaminated with water, dirt or oil. Clean CVT system and replace damaged part(s).

2. Check drive/driven pulley spring tension.

■ Drive pulley spring tension is too stiff. Replace spring.

■ Driven pulley spring tension is too smooth and/or damaged. Replace spring.

Symptom: DRIVE PULLEY NOISE IN IDLE SPEED

1. Check slider shoes (drive pulley).

■ Worn slider shoes (increased clearance between governor cup and drive pulley sliding sheave). Replace all slider shoes at the same time (slider shoes kit).

2. Check driven pulley sliding mechanism (between driven pulley outer and inner sheave).

- Mechanism is stuck and/or damaged. Replace driven pulley assembly.

5. Check roller(s) and/or levers for wear (located on sliding sheave of drive pulley).

- Roller(s) on governor cup is (are) worn out and/or damaged. Replace governor cup assembly.
- Lever(s) on drive pulley sliding sheave is (are) worn out and/or damaged. Replace all levers at the same time (lever kit).

6. Check drive pulley screw for torque.

- Loose screw. Retighten screw with recommended torque.

7. Check one-way clutch condition on drive pulley sliding sheave（if have）.

- Bearing(s) do(es) not move freely. Replace damaged part(s) and lubricate inside of one-way clutch.
- Spring sleeve(s) inside one-way clutch is (are) worn out. Replace both sleeves and springs and lubricate inside of one-way clutch.
- Spring(s) inside one-way clutch is (are) worn out. Replace both pins and springs and lubricate inside of one-way clutch.

Symptom: DRIVE PULLEY NOISE WHEN ACCELERATING/DECELERATING

1. Check if belt runs in dry condition.

- Drive pulley area is wet/contaminated due to water/dirt intrusion. Clean driven pulley area and/or drain water out of CVT cover.

2. Check drive/driven pulley screw for torque.

- Loose screw on drive pulley. Retighten screw with recommended torque.

3. Check cam and driven pulley fixed sheave for wear.

- Cam and/or drive pulley fixed sheave out of wear limit and/or damaged. Replace damaged part(s).

4. Check torque gear fixed in driven pulley sliding sheave for wear.

- Torque gear out of wear limit and/or damaged. Replace torque gear).

5. Check for foreign particles in CVT area (stones, dirt, etc.).

- Small particles damaged belt and/or pulley surface(s). clean system and replace damaged parts.

Symptom: VIBRATIONS ORIGINATING FROM DRIVE PULLEY

1. Check tightening torque of drive pulley screw.

- Moving sliding sheave. Retighten screw.

2. Check fixed sheave bushings.

- Excessive gap between bushings and fixed sheave shaft, thus restraining sliding sheave movements. Replace fixed sheave assembly.

3. Check if slider shoes are present and/or placed in correct position.

- Slider shoe(s) is (are) missing and/or damaged. Replace all slider shoes at the same time (slider shoes kit).

Symptom: VIBRATIONS ORIGINATING FROM DRIVEN PULLEY

1. Check fixed and sliding sheave bushings on driven pulley.

- Excessive gap between bushings and CVT shaft, thus restraining sliding sheave movements. Replace fixed and/or sliding sheave of driven pulley, polish CVT shaft area with fine emery cloth and wipe clean with a cloth.

Symptom: PULLEYS DO NOT DOWN/UP SHIFT PROPERLY.

1. Check drive pulley bushings (cleanliness, wear, etc.)

- Check items 1 and 2 of UNUSUAL ACCELERATION BEHAVIOR.
- Bushings stick to fixed sheave pulley shaft. Clean or replace.
- Spring seat sticks to sliding sheave pulley bushing. Clean system and/or replace sliding sheave pulley.
- One-way clutch(if have) does not operate properly. Clean system and/or replace damaged part(s).

2. Check driven pulley spring tension.

- Driven pulley spring tension is too weak or broken. Replace.
- Driven pulley cam is worn or damaged. Replace.

Symptom: BELT GLAZED EXCESSIVELY OR HAVING BAKED APPEARANCE

1. Check if CVT air intake and/or outlet is clogged.

- CVT area heats up due to contamination. Clean air intake and/or outlet from contamination.
- Fans located on drive pulley is worn or damaged. Replace.

2. Check if pulley sheaves are clean.

- Oil on pulley surfaces. Clean pulley sheaves and replace belt.
- Water intrusion in CVT area. Find root cause and repair. Drain water and replace belt.

Symptom: BELT WORN EXCESSIVELY IN TOP WIDTH.

1. Check drive belt width.

- Considerable wear. Replace belt if narrower than specified (refer to CONTINUOUSLY VARIABLE TRANSMISSION (CVT) OR TECHNICAL SPECIFICATIONS).

2. Check driver belt identification number.

- Wrong type of belt. Replace belt with an appropriate drive belt.

3. Check for localized belt wear caused by belt slippage.

- Localized wear. Replace belt.

Symptom: BELT DISINTEGRATION.

1. Check drive belt lifetime is exceeded..

- Clean CVT system and rebuild with a new drive belt.

2. Check drive belt identification number.

- Excessive belt speed. Using unspecified type of belt. Replace belt with proper type of belt.

3. Check if pulley sheaves are clean.

- Oil on pulley surfaces. Clean pulley surfaces with fine emery cloth and wipe clean using pulley flange cleaner and a cloth.
- Drive/driven pulley sheaves are damaged through stones inside CVT area. Clean pulley surfaces with fine emery cloth, wipe clean with a cloth or replace drive/driven pulley sheaves and belt.

ENGINE GENERAL

Symptom: ENGINE CRANKS BUT FAIL TO START

1. Check fuel level in fuel tank and fuel pressure. Ensure fuel pump was not disabled.
- Whether can hear the voice the fuel pump running
- Low or no fuel pressure. Replace defective part(s)

2. Check battery voltage.
- Battery is discharged and starter works not properly. Charge battery

3. Check fault codes in DELPHI EFI system.
- Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT)

4. Check if spark plug connectors fit on spark plugs (refer to IGNITION SYSTEM).
5. Check spark plugs.
- Define spark plugs (no spark) or wrong spark plug gap. Readjust gap and clean spark plugs or replace.

6. Check for fuel on spark plugs.
- Flooded engine (spark plugs wet when removed). Activate engine drowned mode and crank engine with rags over the spark plug holes.

7. Check fuel injectors.
- Plugged or faulty injector(s).Replace defective part(s).

8. Check idle bypass valve.
- Stuck or defective..

9. Check encoder wheel.
- Bent tooth. Refer to MAGNETO SYSTEM.

10. Check engine compression.
- Insufficient engine compression. Replace defective part(s).

Symptom: ENGINE DOES NOT START

1. Electrical problem.
- Determine if the electrical system works correctly (fuse(s), battery, wiring harness, etc.). refer to IGNITION SYSTEM.

2. Problem with fuel system (carburetor, fuel pump, hoses, etc.).
- Clean, inspect, repair or replace defective parts. Replace defective part(s).

3. Check engine compression.
- Insufficient engine compression. Replace defective parts.
- Valve seat worn and/or damaged. Repair by performing valve guide procedure (refer to CYLINDER AND HEAD). Readjust valve clearance.

4. Internal engine problem.
- Overhaul engine to find defective parts. Refer to the appropriate section in ENGINE.

Symptom: ENGINE HARD TO START

1. Check idle bypass valve.
- Stuck or defective. Refer to ENGINE MANAGEMENT.

2. Check closed throttle and idle actuator with DELPHI.

- Wrong TPS zero setting/idle bypass valve reset. Refer to ENGINE MANAGEMENT.

3. Check engine compression.

- Wrong adjustment (likely too tight). Refer to ENGINE MANAGEMENT.

4. Check engine compression.

- Insufficient engine compression. Replace defective part(s) refer to LEAK TEST.

5. Verify spark plug condition.

- Defective, improperly set, worn out, fouled. Identify source of problem and correct. Replace.

6. Check fuel level in fuel tank and fuel pressure.

- Low or no fuel pressure. Replace defective part(s) refer to FUEL TANK AND FUEL PUMP.

7. Check CAPS (camshaft position sensor).

- Defective sensor/wiring. Refer to ENGINE MANAGEMENT.

Symptom: ENGINE SUDDENLY TURNS OFF

1. Perform engine leak test.

- Damaged head gasket and/or seal and/or leaking inlet/exhaust valve(s). replace and/or repair defective parts.

1. Check spark plugs condition and/or gap.

- Fouled spark plugs or wrong spark plug gap. Readjust gap and clean spark plugs or replace..

2. Piston seizure.

- Spark plugs heat range is too hot. Install spark plugs with appropriate heat range (refer to TECHNICAL SPECIFICATIONS).
- Compression ratio is too high. Install genuine parts.
- Poor oil quality. Use recommended oil.
- Leaks at air intake manifold (engine gets too lean). Retighten screws or replace air intake manifold gasket.
- Snow/water intrusion through intake system into combustion chamber. Clean intake system and replace defective part(s).

3. Melted and/or perforated piston dome; melted section at ring end gap.

- Spark plugs heat range is too hot. Install recommended spark plugs (refer to TECHNICAL SPECIFICATIONS).
- Coolant less than recommended level (engine gets too hot). Repair cooling circuit and/or refill with recommended liquid.
- Poor quality and/or wrong fuel. Clean from contamination and use appropriate fuel (refer to TECHNICAL SPECIFICATIONS).

4. Piston color is dark due to seizure on intake and exhaust side.

- Cooling system leaks and lowers coolant level. Tighten clamps or replace defective parts. Add antifreeze in cooling system until appropriate level s reached. Replace damaged parts.

5. Cracked or broken piston.

- Cracked or broken piston due to excessive piston/cylinder clearance or engine overheating. Replace piston. Check piston/cylinder clearance (refer to CYLINDER AND HEAD).

6. Check piston rings and cylinder surface for grooves.

- Poor oil quality. Use recommended oil.
- Contamination through engine intake. Replace defective part(s) and use new air filter.

7. Check crankshaft, rocker arms movement.

- Oil pump failure due to lack of oil. Repair and replace defective parts and use new recommended oil.
- Oil contamination due to clogged oil filter/oil strainer. Replace oil and oil filter at the same time, replace defective part(s).

8. Check valve springs exhaust/intake.

- Broken valve spring damages the cylinder head, valve(s), rocker arm(s), piston, piston rings and connecting rod. Replace defective part(s).

9. Check if fuel supply is sufficient.

- Low fuel level.
- Clogged fuel filter or fuel injector filter.
- Fuel line is contaminated and/or bent. Clean and/or replace defective part(s).

Symptom: ENGINE BACKFIRES

1. Check spark plugs.

- Carbon accumulation caused by defective spark plugs. Replace spark plugs.

2. Check leakage on intake manifold.

- Air leak on intake system. Retighten screws and/or replace intake manifold gasket.

3. Check exhaust air leaking.

- Exhaust gasket is leaking. Retighten screws and/or replace exhaust gasket.

4. Check intake valve(s) for leaking.

- Intake valve(s) is (are) leaking. Repair or replace valve(s).

5. Check if fuel supply is sufficient.

- Fuel line is contaminated and/or bent (engine gets lean). Clean and/or replace defective part(s).

6. Check engine ground.

- Poor engine ground. Clean.

Symptom: ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM

1. Check spark plugs condition and/or gap.

- Fouled spark plugs or wrong spark plug gap. Readjust gap and clean spark plugs or replace.

2. Check spark plugs type.

- Improper spark plugs heat range. Install recommended spark plugs (refer to TECHNICAL SPECIFICATIONS).

3. Perform engine leak test.

■ Damaged head gasket and/or seal and/or leaking intake/exhaust valve(s). replace and/or repair defective parts.

4. Check for water in fuel (wrong fuel).

■ There is water in fuel or wrong fuel. Drain fuel system, search for leakage and refill it with appropriate fuel.

5. Check engine compression.

■ Worn piston(s) and/or piston ring(s). Replace defective part(s).+

6. Check fuel pressure.

■ Low fuel pressure. Perform fuel pressure test (refer to FUEL SYSTEM).

7. Check air intake system.

■ Air filter is clogged due to contamination. Replace air filter.

8. Check if EMS (engine management system) is in limp home mode. Check fault codes in DELPHI EFI system.

■ Check if electrical actuator(s) is/are defective. Replace defective part(s).

9. Check drive belt.

■ Worn. Replace belt if its width is less than specified.

Symptom: HIGH ENGINE OPERATING TEMPERATURE

1. Check if cooling system shows any failure (see COOLING SYSTEM).

■ System is leaking. Repair and/or replace damaged part(s).

2. Check function of lubrication system (see LUBRICATION SYSTEM).

■ Lubrication is not working properly. Repair and/or replace damaged part(s).

3. Check condition and heat range of spark plugs.

■ Melted spark plug tip or inadequate heat range. Replace.

4. Check air leakage on engine intake.

■ Leakage causes overheating. Replace/repair damaged part(s).

5. Check air inlet and outlet of the CVT cover.

■ Air circulation is clogged (overheating). Clean air circulation from contamination.

■ Drive belt worn and/or damaged. Replace belt with an appropriate drive belt (refer to TECHNICAL SPECIFICATIONS).

HVAC SYSTEM

Symptom: LACKING HEATING

1. Engine running time is too short, and the coolant is too cool.

■ Engine running at least 10 minutes.

2. Check air inlet filter

■ Air filter is clogged due to contamination. Clean air filter.

3. Temperature switch is not working.

■ Replace a new switch.

4. Temperature controlled solenoid valve is clogged or not working.
   - ■ Replace a new solenoid valve.
5. Check coolant level.
   - ■ Coolant level lower than recommended. Refill(refer to cooling system).

Symptom: LACKING COOLING

1. Check air inlet filter.
   - ■ Air filter is clogged due to contamination. Clean air filter.
2. Check condenser.
   - ■ Condenser fins obstructed, hard air cooling. Clean condenser fins.
3. Check cooling fan and connection(must all fan can work).
   - ■ Fan motor faulty. Replace.
   - ■ Wire harness is brittle or hard (no connection). Replace.
4. Check AC compressor.
   - ■ Compressor is not working.Replace.
   - ■ Compressor belt loose and/or worn. Adjust or Replace belt with an appropriate drive belt.
5. Refrigerant is shortage.
   - ■ Check the air bubbles from sightglass in the pipe between condenser and evaporator.If there are a lot of air bubbles all the time when the compressor is running. Refill refrigerant.
6. Heating solenoid valve can not close completely.
   - ■ Solenoid valve is damaged.Replace

Symptom: AC COMPRESSOR DOES NOT START

1. Refrigerant is serioue shortage.
   - ■ There is NO pressure in the pipe.Refill refrigerant.
2. Temperature switch is not working.
   - ■ Replace a new switch.
3. Temperature controller system is damaged.
   - ■ Replace a new sensor or/and controller.
4. The electromagnetic clutch of compressor is not working.
   - ■ Replace a new electromagnetic clutch.
5. Internal AC compressor problem.
   - ■ Replace a new AC compressor.

Symptom: NO WIND AT THE OUTLET

1. Air outlet hose loose or damaged.
   - ■ Connect or replace new hose.
2. Temperature switch is not working.
   - ■ Replace a new switch.
3. Electrical problem.
   - ■ Determine if the electrical system works correctly (fuse(s), battery, wiring harness, etc.).
4. Air blower assy is not working.
   - ■ Replace a new blower.

Symptom: HVAC SYSTEM NOISE

1. AC compressor drive belt is too loose or tight.

■ Adjust the belt degree of tightness .

2. Compressor belt is worn.

■ Replace belt with an appropriate drive belt.

3. Air blower assy is damaged.

■ Replace a new blower.

4. Internal AC compressor problem.

■ Replace a new AC compressor.

FAULT CODES

A fault code is an indication that a glitch or malfunction is detected by the self-diagnostic system.

Read fault code

Lift the front hood and look for the WHITE harness connector of fault diagnosis tester behind the battery box.

Unplug the protector, connect the fault diagnosis tester by special data cable.Turn on the key power switch, select the opration menu on the diagnosis tester and read fault code.

P0118: Coolant/Oil Temperature Sensor Circuit High Voltage or Open
P0117: Coolant/Oil Temperature Sensor Circuit Low Voltage
P0113: IAT Circuit High Voltage or Open
P0112: IAT Circuit Low Voltage
P0108: MAP Circuit High Voltage
P0107: MAP Circuit Low Voltage or Open
P0563: System Voltage High
P0562: System Voltage Low
P0123: TPS Circuit High Voltage
P0122: TPS Circuit Low Voltage or Open
P0201: Injector 1 Circuit Malfunction
P0202: Injector 2 Circuit Malfunction
P0650: MIL Circuit Malfunction
P0032: O2A Heater Circuit Low Voltage
P0031: O2A Heater Circuit High Voltage
P0232: FPR Coil Circuit High Voltage
P0230: FPR Coil Circuit Low Voltage or Open
P0351: Cylinder 1 Ignition Coil Malfunction
P0352: Cylinder 2 Ignition Coil Malfunction
P1693: Tachometer Circuit Low Voltage
P1694: Tachometer Circuit High Voltage
P0505: Idle Speed Control Error
P0131: O2A Circuit Low Voltage
P0132: O2A Circuit High Voltage
P0337: CKP Sensor No Signal
P0336: CKP Sensor Noisy Signal
P0171: COMMON OBD: System too Lean (Bank 1)
P0172: COMMON OBD: System too Rich (Bank 1)
P0174: COMMON OBD: System too Lean (Bank 2)
P0850: COMMON OBD: Park/Neutral Switch Input Circuit
P0137: COMMON OBD: 02 Sensor Circuit Low Voltage (Bank 1 Sensor 2)
P0138: COMMON OBD: 02 Sensor Circuit High Voltage (Bank 1 Sensor 2)
P0038: COMMON OBD: HO2S Heater Control Circuit High (Bank 1 Sensor 2)
P0037: COMMON OBD: HO2S Heater Control Circuit Low (Bank 1 Sensor 2)
P0445: COMMON OBD: Evaporative Emission Control System Purge Control Valve Circuit Shorted
P0444: COMMON OBD: Evaporative Emission Control System Purge Control Valve Circuit Open
P0500: COMMON OBD: Vehicle Speed Sensor A Malfunction
P0601: COMMON OBD: Internal Control Module Memory Check Sum Error

Clear fault code

After correcting the problem that caused the fault code, there two ways to clear fault code:

1) By the fault diagnosis tester.
2) Put the key power switch at the OFF position for at least 30 seconds, then switch the key (OFF -- ON) for 5 times within 3 seconds quickly and continuously, and then wait at least 30 seconds for the last time at the OFF position. Turn on the key power switch, if the failure light is not ON means the operation is successful.