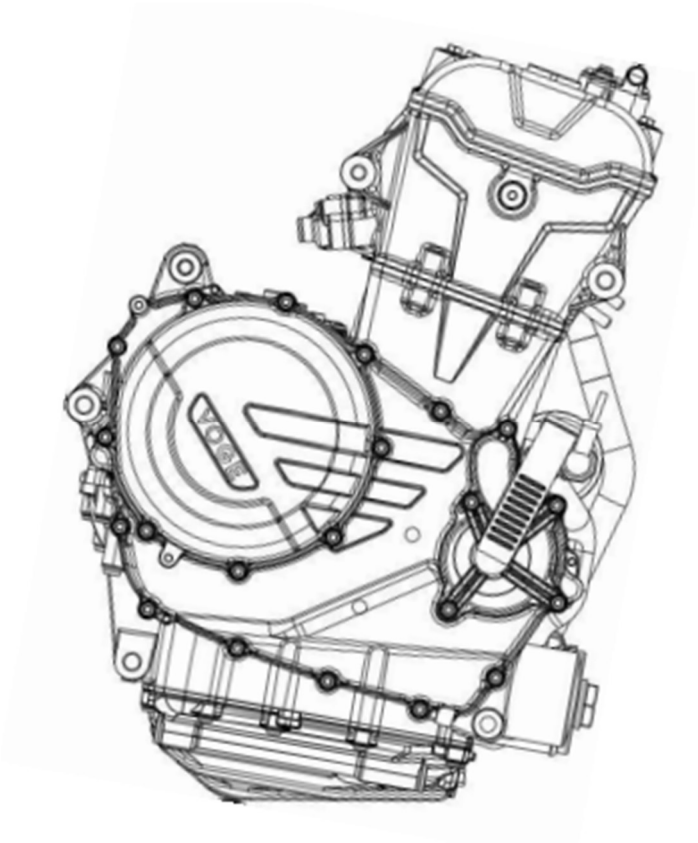
Engine KEL800

Service Manual

LXFD0901-054



Chongqing Loncin Engine co.ltd. **Feb. 2025**

Foreword

There are more and more motorcycles getting onto market with each passing day, and new structure and technologies are also adopted. For all the Loncin users and service workers know well about the maintenance, adjustment and repair for engine KEL800, we made this service manual and hope which bring you more convenience when you need them.

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Content list

1. Summary

Rules for maintenance

1. Please adopt the Loncin motor co.ltd. produced or suggested spare parts, lubricant or other auxiliary materials when maintenance is necessary. In case materials were adopted fail to meet Loncin standard, it may damage your motorcycle.

2. When maintenance is necessary, please adopt the tools, bolt, nut and screw in metric standard, the ones out of metric standard such as imperial standard are not allowed, because they are not interchangeable to metric ones.

3. When parts were replaced or re-assembled, please also replace their washer, o-ring, split pin and locking piece.

4. Please fasten the bolt or nut with bigger diameter or inside first, then fasten the rest in alternative angle sequence, unless there is another specially stipulated sequence.

5. Wash up the removed parts by cleanser. Coat the moving surface with lubricant before re-assembling.

6. When re-assembled, please check and confirm the correct re-assembly and proper operation, turn, move and operate them for checking.

7. Dispose the used oil, lubricant, pollutants and abandoned parts by strictly following laws and other state regulations.

Specification

Normal specification

	Items	Data
Engine	Type	LX284MW
	Displacement	798ml
	Cylinders and angle	Left：1，Right：2；19°
	Cylinder bore × Stroke	84mm×72mm
	Combustion chamber	24.7ml
	Compression ration	12：1
	Air system kit	Double cam at top
	Lubrication system	Forced pressure ＋Splashing lubrication
	Cooling system	Water cooling
Transmission system	Clutch	Multiple wet layers
	Gear box	International 6 gears
	Primary transmission ratio	1.816
	End transmission ratio	
	Gear transmission ratio	/
		1^{st} ： 2.833　　2nd ： 2.215
		3rd ： 1.667　　4th：1.333
	Gearshift method	5^{th} ： 1.087　　6^{th} ： 0.96
		1-N-2-3-4-5-6
Electrical system	Ignition system	FTI 1-2
	Starting system	Electrical starting
	Lighting system	Battery
	Spark plug specification	LMAR8J-9E（NGK）
	Spark plug clearance	0.9mm
	Rectifier regulator	3 phases complete wave regulator

Cooling system specification

Items		Specification
Thermostat	Initial temperature	82℃
	Complete temperature	95℃
	Valve rise	≥7mm

Lubrication system specification

Unit：mm

Items		Standard	Maintenance limit
Oil capacity	Without element replaced	2.6 L	—
	When oil filter replaced	208 L	—
	When engine broke up	3.2 L	—
Oil we suggest		The engine oil we suggest： SG10W-40 API quality grade：SG or higher （Please don't adopt energy saving oil which marked up on API service label） JASO T903 Standard：MA Viscosity：SAE10W-40	—
Opening pressure for oil pressure sensor		At 80℃ or normal temperature ： 15～19.6Kpa	—
Gap between internal and external rotor for main/sub oil pump		0.15max	--

Cylinder head/Valve specification

Unit:mm

Items			Standard	Maintenance limit
Pressure in cylinder of electrical starting			450-850KPa	—
Valve gap		Air inlet	0.15～0.20	—
		Air exhaust	0.20～0.25	—
Swinging arm	Inner diameter	In/Exhaust	8.013-8.028	8.06

and its shaft	of arm			
	Outer diameter of shaft	In/Exhaust	7.983-7.995	7.96
	Clearance between arm and shaft	In/Exhaust	0.018-0.045	0.10
Camshaft	Height of protrusion for cam	Air inlet	35.80-35.86	35.78
		Air exhaust	35.80-35.86	35.78
	Clearance between journal and hole		0.028-0.62	0.10
	Run-out		--	0.02
Valve and its guiding tube	Rod diameter of valve	Air inlet	4.975-4.990	4.965
		Air exhaust	4.965-4.980	4.955
	Inner diameter of valve guiding tube	In/Exhaust	5.000-5.012	5.056
	Clearance between valve rod and its guiding tube	Air inlet	0.010-0.037	0.07
		Air exhaust	0.020-0.047	0.08
	Width of valve base	In/Exhaust	1-1.2/1.1-1.3	1.6/1.7
Free length of valve spring		In/Exhaust	46.3	--
Flatness of cylinder head		**0.05**		--

Clutch and gearshift device specification

Unit：mm

Items		**Standard**	**Maintenance limit**
Clutch	Spring free length	50.4	49.5
	Driving plate thickness	2.92-3.08	2.8
	Driven plate thickness	2.22-2.32	2.1
	Driving plate flatness	**0.1**	0.3
Clutch collar	Inner diameter	24.992-25.007	25.02
	Outer diameter	34.992-35.005	34.98

Gearshift arm kit	Diameter for gearshift spindle	11.957-11.984	11.93

Magneto and starting clutch specification

Unit：mm

Items	Standard	Maintenance limit
Outer diameter for plate-shaped gear	51.705-51.718	51.685
Inner diameter for plate-shaped gear	68.364-68.390	68.42

Case and transmission specification

Unit: mm

Items		Standard	Maintenance limit
Transmission system	Inner hole diameter of main shaft $5^{th}/6^{th}$ gear	31.025-31.050	31.10
	Outer diameter of main shaft $5^{th}/6^{th}$ collar	30.984-31.000	30.96
	Inner diameter of main shaft $5^{th}/6^{th}$ collar	28.000-28.021	28.04
	Outer diameter of main shaft gear end	27.676-27.980	27.92
	Gap between collar and main shaft $5^{th}/6^{th}$ gear	0.025-0.066	0.10
	Gap between 5^{th} gear collar and main shaft	0.020-0.054	0.10
	Gear hole diameter of counter shaft $2^{nd}/3^{rd}/4^{th}$ gear	36.000-36.021	36.04
	Outer diameter of counter shaft collar $2^{nd}/3^{rd}/4^{th}$ gear	34.959-34.975	34.92
	Gap between collar and counter shaft $2^{nd}/3^{rd}/4^{th}$ gear	0.025-0.062	0.10
	Inner diameter of counter shaft 2^{nd} collar	33.000-33.021	33.04
	Shaft diameter size of counter shaft	32.959-32.980	32.92
	Gap between collar and shaft	0.020-0.062	0.10
Turning fork and its shaft	Shaft diameter of turning fork shaft	11.957-11.968	11.95

	Inner diameter of turning fork	12.000-12.018	12.03
	Gap between turning fork and its shaft	0.032-0.061	0.08
	Thickness of fork tip	5.93-6.00	5.9

Specification for crankshaft, piston, cylinder body and balancing shaft

Unit：mm

Items			Standard	Maintenance limit
Crankshaft	Clearance at bigger end of connecting rod		0.1-0.25	0.30
	Clearance between shaft pad on bigger end of connective rod and journal of connective rod		0.033-0.059	0.08
	Clearance between journal of crankshaft and shaft pad		0.030-0.060	0.08
	Clearance between balancing shaft journal and shaft pad		0.030-0.060	0.08
	Crankshaft run-out		0.03	0.05
	Balancing shaft run-out		0.015	0.04
Cylinder	Cylinder bore		83.994-84.006	84.05
	Cylindricity		0.005	0.10
	Roughness		Ra0.2-Ra0.35	--
Piston, piston pin and piston rings	Diameter of basic circle for piston		83.961-83.974	83.900
	Diameter for pin's hole		19.009-19.015	19.03
	Diameter of piston pin		18.994-19.000	18.98
	Clearance between piston and its pin		0.009-0.021	0.05
	Closing clearance of piston ring	1st ring	0.15-0.30	0.4
		2nd ring	0.20-0.40	0.5
		Oil ring	0.20-0.70	1.0
	Clearance between piston ring and its groove	Clearance between 1st ring and its groove	0.030-0.070	0.10
		Clearance between 2nd ring and its groove	0.020-0.070	0.10
Clearance for cylinder matching			0.020-0.045	0.10

Smaller end of connecting rod and its inner diameter	19.017-19.027	19.04
Matching clearance between connecting rod and its pin	0.017-0.033	0.05

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Torque

Cooling system

Items	**Qty.**	**Thread diameter mm**	**Torque N.m**	**Note**
Installation nut for impeller	1	6	12	
Bolt for water pump cover (Include water drainage bolt)	4	6	11	
Bolt for water and oil exchanger	1	20	59	
Bolt for thermostat cover	2	6	10	

Cylinder head and valves

Items	**Qty.**	**Thread diameter mm**	**Torque N.m**	**Note**
Cylinder head bolt	6	9	5N.m+15N,m+90˚+90˚	Coat thread and plate part with oil
Cylinder head bolt	2	6	11	
Camshaft bracket bolt	12	7	15	Coat thread and plate part with oil

Camshaft sprocket wheel bolt	6	6	15	
Swinging arm shaft screw	2	10	16	Add flat washer
Cylinder head cover bolt	5	6	12	
Tensioner base end bolt	1	10	16	Add seal ring
Tensioner base fixing screw	2	6	11	
Cylinder head side tensioning bolt	1	6	12	
Thermostat cover bolt	2	6	11	
Spark plug	2	10	17	
Water temperature sensor	1	12	14	Coat thread with sealant 1577

Clutch and gearshift device

Items	**Qty.**	**Thread diameter mm**	**Torque N.m**	**Note**
Clutch central case and locking nut	1	22	190	Coat thread and plate part with oil
Bolt for check plate	1	6	12	Coat thread with Loctite 243
Locating bolt for five star plate	1	8	24	Coat thread with Loctite 243
Clutch lift plate bolt	3	6	12	

Gearshift arm limit plate bolt	1	6	12	Coat thread with Loctite 243
Gearshift arm locating bolt	1	8	28	Coat thread with Loctite 243
Locating bolt for hydraulic clutch lower pump	3	6	10	Coat thread with Loctite 243

Lubrication system

Items	**Qty.**	**Thread diameter mm**	**Torque N.m**	**Note**
Fixing bolt for oil pump	6	10	11	
Fixing nut for driven wheel of oil pump	1	6	12	Thread for nut is left turning, coat thread with Loctite 243
Fixing bolt for oil sucking tube	2	6	11	
Seal plug	1	24	22	
Secondary filter	1	20	12	

Magneto and starting clutch

Items	**Qty.**	**Thread diameter mm**	**Torque N.m**	**Note**
Starting clutch fastening bolt	6	8	30	Coat thread with Loctite 243
Magneto rotor bolt	1	12	135	Coat thread with oil
Magneto stator bolt	4	6	11	Coat thread with Loctite 243

Trigger fixing bolt	1	6	11	Coat thread with Loctite 243
Wire pressing plate bolt	1	6	11	Coat thread with Loctite 243

Case body and transmission system

Items	Qty.	Thread diameter mm	Torque N.m	Note
Check plate of main shaft bearing	3	6	11	Coat thread with Loctite 243
Check plate of balancing shaft bearing	3	6	16	Coat thread with Loctite 243
Locating bolt for gearshift drum bearing	2	6	12	Coat thread with Loctite 243
Nut for sprocket wheel	1	22	127	
Oil passage plug for oil pump (Taper)	1	14	30	Coat thread with sealant 1577
Case oil passage screw	2	16	22	Coat thread with sealant 1577
Secondary filter joint	1	24	27	Coat thread with Loctite 243
Oil pressure sensor	1	R1/8 taper shaped thread	11	Coat thread with sealant 1577
Crankcase combination bolt	6	10	10 N .m + 80˚	Coat thread with oil
Crankcase combination bolt	10	8	5 N.m + 80˚	Coat thread with oil
Crankcase combination bolt	6	6	11	Coat thread with oil
Left front cover bolt	13	6	11	
Left decorative cover	1	32	10	
View hole cap	1	14	7	

Right crankcase cover and clutch operation cover bolt	19	6	11	
Oil bottom case bolt	15	6	11	
Socket hex. screw for oil bottom case	2	14	22	Add flat washer
Driving sprocket wheel for counter shaft	1	22	127	Coat thread with Loctite 243

Crankshaft, piston, cylinder body and balancing shaft

Items	**Qty.**	**Thread diameter mm**	**Torque N.m**	**Note**
Connective rod bolt	4	9	10N.m+15N.m+90°	Coat thread and plate part with oil
Fastening bolt for rear balancing shaft driven gear	1	8	35	Coat thread with Loctite 243

Positions for sealing and lubrication

Engine

Material	**Position**	**Note**
Sealant	Contact surface of crankcase Seal ring of cylinder head cover (Angle place) Contact surface of left front cover Contact surface of right crankcase cover Contact surface of oil bottom case Wire outlet port of magneto	

Oil in engine	Complete surface of inner and outer rotor of oil pump Complete surface for swinging arm shaft Working surface for swinging arm Sliding surface of rod end of valve rod Complete surface of timing chain Surface for journal of camshaft and the cam Inner surface of cylinder hole Outer surface of piston, piston pin's hole and groove of piston ring Outer surface of piston pin Complete surface of piston ring Complete surface of clutch friction plate Sliding surface of clutch pushing rod Rod part of gearshift spindle and turning plate Complete surface of double gear shaft Complete surface of starting clutch Complete surface of gearshift fork shaft Inner surface of shaft pad on bigger end of connective rod of crankshaft Inner hole for smaller end of connective rod for crankshaft Gear(Primary, crankcase, starting deceleration) Sliding surface of plate shaped gear Turning area of each bearing Surface for each o-ring (Except water seal ring)	
Multi-functional lubricant	Seal ring of starting motor	
Degreaser	All contact surface, installation taper surface of left end rotor of crankshaft	

2. Maintenance

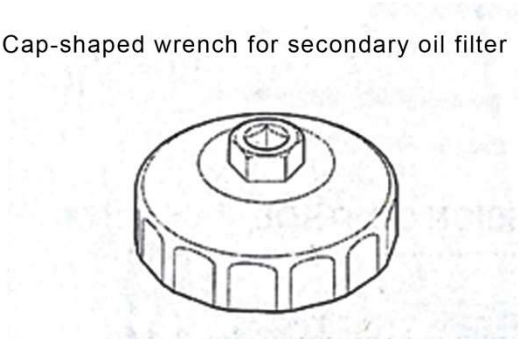
Maintenance information

Summary

- Please lay motorcycle on horizontal ground before all the operations.

Tool

Cap-shaped wrench for secondary oil filter



Specification for maintenance

Please inspect according to <Periodic Maintenance table> in <User Manual>.

I: Inspection, clean it up, adjust, lubricate or replace when it was necessary. C: Clean up. R: Replace

L: Lubricate.

The maintenance below need you know something about machinery. Some items (Especially with mark * and **), they may need more skills or tools and information.

Form list for periodic maintenance

Ref.No.	Period / Items	X1000km	1	6	12	18	24	30	36
		Month	1	6	12	18	24	30	36
*1	Spark plug				I		R		

*2	Oil in engine		R	R	R	R	R	R	R
*3	Secondary oil filter		R	R	R	R	R	R	R
*4	Valve clearance							I	
*5	Coolant		I	I	I	I	R	I	I
*6	Cooling system			I	I	I	I	I	I
*8	Fuel tube			I	I	I	I	I	I
9	Breathing tube of crankcase			C	C	C	C	C	C
10	Secondary air supplement system				I		I		I
11	Clutch system		I	I	I	I	I	I	I

Caution：1. More frequent maintenance is necessary in case usually drive under dusty or wet conditions.。

2. *Means special tools, data or skill is necessary, which needs be done by Loncin dealer.

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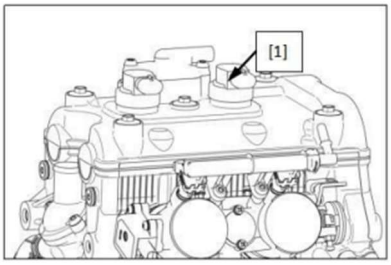
Spark plug

Remove fuel tank and air filter the parts which sheltering motorcycle

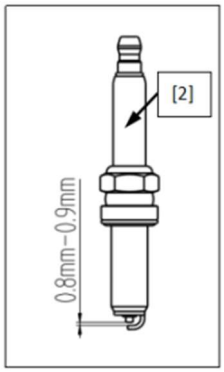
- Remove pressing plate of ignition coil and pull off socket plug of ignition coil.
- Remove ignition coil.
- Remove spark plug [2].



Caution:

Clean up surroundings of spark plug by blowing it of air gun before removing spark plug, meanwhile make sure there is not any dust dropping into combustion chamber.

Check and confirm there is not any crack and damage on insulator pieces, also check if there is damage, dirt, and color fading on terminals, please replace spark plug if it is necessary.



Check spark plug:

- Clean up terminal of spark plug by iron wheel or cleaner for it only.
- Check gap between central and side terminal by feeler gauge. The gap of spark plug is: 0.80-0.90mm
  When it is necessary, please get terminal bending to adjust the gap.
- Assemble and fasten spark plug by hand to cylinder head, then fasten the spark plug to given torque.

Torque: 17N.m

Valve gap

Check

Caution:

Please check and adjust valve gap under cold condition (When engine temperature is below 35℃)

Remove parts below:

- Cylinder head cover kit, the cove and seal ring.
- Left decorative cover, view hole cap and o-ring.

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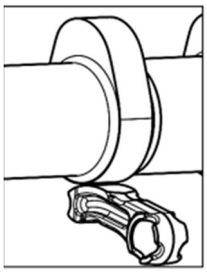
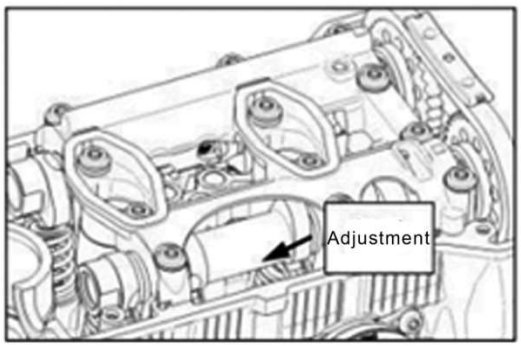
- Turn the crankshaft counter-clockwise, get the basic circle position of Intake/exhaust camshaft aligning to valve arm respectively, as picture shows.



- Insert feeler gauge between protrusions on swinging arm and camshaft to check valve gap of each cylinders.
  Valve gaps: IN: 0.15mm-0.20mm EX: 0.20-0.25mm
  Caution:
  Take each valve gap into record for an easy reference of replacement for washers when adjusting valve gaps.



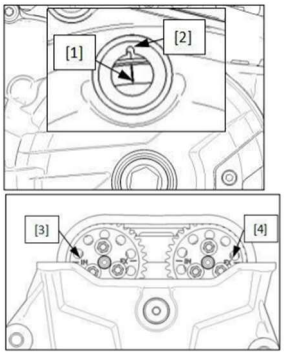
If the valve gap is out of range above, please remove bracket of camshaft, then remove the camshaft, open swinging arm, them suck washer out by magnetic bar, replace adjusting washer of valve for a new one and adjust it into given range as below:

- Turn the crankshaft clockwise, get scale line TL on rotor of magneto to timing mark “IN” on timing driven gear of air intake, “EX” of air exhaust and surface of cylinder head, while mark “IN” [3] pointing at intake side and “EX” [4] pointing air exhaust side.

Caution:

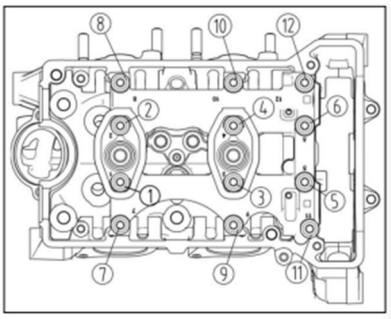
If the timing mark is not at given position keep turning crankshaft by 1 round counter-clockwise (360°), get mark TL on rotor aligning groove on left cover.

- Remove bolt of tensioner base tail , o-ring, installation bolt on both sides, tensioner base, seal ring of base, and the tensioner. (Details refer to Chapter 5th).



- Remove bolt for camshaft bracket, camshaft bracket and the camshaft kit. (Details please refer to Chapter 5).
  Caution:
  To avoid damage on cylinder head, camshaft, and its bracket, please loosen according to Ref. No on camshaft bracket 12→1.
  Please don’t remove installation bolt on timing driven gear of camshaft.

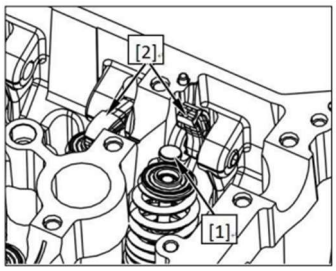
- Open swinging arm and remove its adjusting washer.
  Caution:
- Please prevent washer dropping into crankcase and hole of spark plug.
  Mark up all washers, ensure the correct re-assembly.
- By tools of tweezers and magnetic bar, the washer may be easily removed
- Measure thickness of washer [1] and take it into record.
- There are washers with 89 different thickness could be selected, whose difference between adjacent two is 0.010mm (1.720-2.600mm)
- Measure the thickness by micro gauge to ensure the correct thickness.
- Please calculate thickness for new washer by formula below:
  A=(B-C)+D
  A: Thickness for new washer B: Valve gap in record C: Given valve gap D: Thickness of removed washer

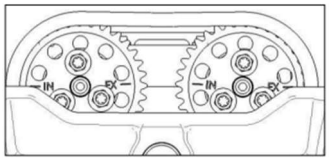


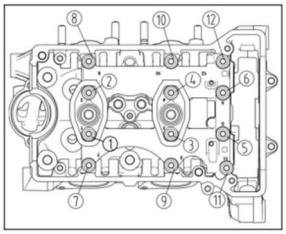
- Coat the end part of valve rod with oil, then assemble new washer [1] according to its original position to valve spring base.
- Close valve swinging arm [2].
- Coat journal of camshaft with oil, then confirm once again the position of crankshaft.
- Hang the timing chain on timing driven gear, assemble air intake and exhaust camshaft, meanwhile making sure timing mark “IN” on timing driven gear aligning to surface of cylinder head and faces to air intake side, and the mark “EX” on timing driven gear of air exhaust and aligned to cylinder head surface and faces to air

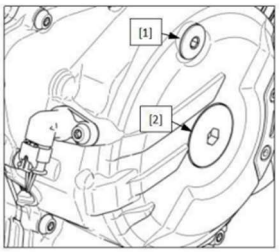
exhaust side.

- Replace bolt, washer and seal ring of camshaft bracket for a new one, assemble camshaft bracket and fasten bolt. (Details refer to Chapter 5).









Caution:

Fasten the bolt on camshaft bracket by twice according to Ref. No of 1→12.

- Check and assemble tensioner and its base, the release the tensioner. (Details refer to Chapter 5th).
- Turn crankshaft by two rounds counter clockwise, then measure valve gap once again according to method above.
- If the valve gap is correct, please make the next assembly, if it is incorrect, please adjust valve gap once again according to steps above.
- Assemble cylinder head cover. (Details please refer to Chapter 5th).
- Assemble view hole cap and seal ring [1], left decorative cover and seal ring [2].

Torque for view hole cap: 7N.m, fastening torque for left decorative cover: 10N.m

Oil in engine

Check oil level

Start engine and let it idly run for 3-5 minutes, then stop engine and lay motorcycle by 2-3 minutes.

Put motorcycle on flat ground and keep it upright.

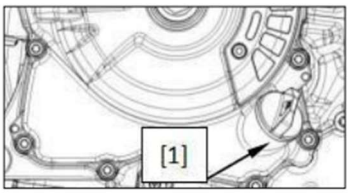
- Remove oil gauge [1], wipe it up and then insert it in to oil port (Without fastening), then take it once again to check oil level.

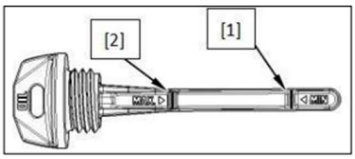
If the oil level is lower than the oil line [1] (MIN), please fill it up by times with less volume each time, after every filling-up, please confirm the oil level by ways above until it reached middle place between scale lines (MAX) and (MIN). Meanwhile, please pay attention to:

When checking oil level, please make sure the motorcycle is upright, please don't check oil and remove oil gauge when motorcycle is holding by side stand only, otherwise the checking result may be wrong.

Before checking, please let it idly run and lay it according to ways above, otherwise the measuring result may be

incorrect.





Oil drainage

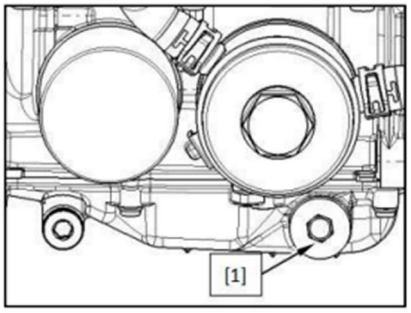
Start engine to warm it up for 3-5 minutes.

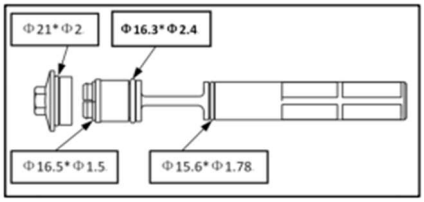
Stop engine and lay it on flat ground and keep it upright.

- Remove seal plug kit [1], then drain the oil off.
- Wash seal plug kit, and replace it if it is necessary.
- When oil drained off, assemble new seal ring until the plug sealed.

Assemble seal plug kit, then fasten it to given torque.

Torque: 22N.m



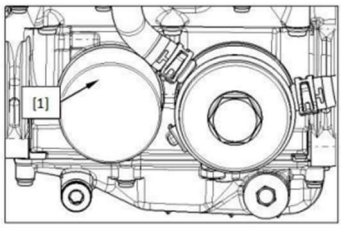


Caution:

The specification for seal ring must be correct.

Replacement for secondary oil filter

- Remove the secondary oil filter [1] by its spanner.
- Coat the threaded part of new secondary oil filter with oil, also the seal ring.
- Assemble secondary oil filter and fasten it to given torque.
  Torque: 12N.m.



Oil filling-up

Put motorcycle on flat ground and keep it upright.

- Fill up crankcase with oil of given specification from hole of oil gauge. Oil capacity: Without replacing secondary oil filter: 2.6L. Replace secondary oil filter: 2.8L engine
  When broke up: 3.2L.
  Check oil level and make sure there is not any oil leakage.
  Oil with given specification: SL 10W-40
  Quality grade of API: SL or higher (Please don't adopt the round service label of API which is marked up of energy saving) JASO T903 standard: MA
  Viscosity: SAE10W-40
- Check and confirm if the o-ring of oil gauge is perfect, please replace if it is necessary.
- Coat surface of o-ring with oil, then assemble oil gauge.

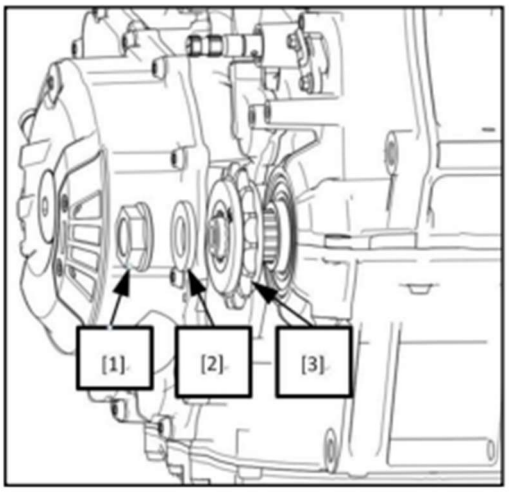
Driving sprocket wheel of counter shaft

Removal

- Remove locking nut [1] on counter shaft.
- Remove flat washer [2] and sprocket wheel [3] of counter shaft

Check

- Check wear-out on tooth surface of sprocket wheel.
- Check if there is damage on sprocket wheel.



Assembly

- Clean up greasy dirt on gear surface before assembling.
- The re-assembly is opposite to disassembly.

Torque for nut of sprocket wheel: 127N.m

3. Cooling system

Maintenance information

Summary

⚠ Warning
Please don’t remove the cover of heat radiator when the engine and radiator completely cooled down, otherwise the coolant may inject or splash out and get you injured.

● Use the running water may damage the engine

● Fill up the sub tank with coolant, except filling up of draining off, please don’t remove the cover of heat radiator.

● The coolant touches the painting surface is not allowed.

● Check the leakage when the cooling system was maintained by the tester of cooling system.

Items		Speicification
Thermostat	Initial temperature	82℃
	Complete temperature	95℃
	Valve rise	Not smaller than 7mm

Troubleshooting

Too high the engine temperature

- Malfunction in coolant sensor
- The thermal valve failed to be opened
- Malfunction on heat radiator’s cover
- Coolant is not enough

- Passage, soft hose and water tube of heat radiator blocked up
- Air got into circulation system
- Malfunction in motor of cooling fan
- Malfunction in water pump

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Too low the engine temperature

- Malfunction in coolant sensor
- Malfunction in cooling fan motor

Coolant leakage

- Seal ring of coolant passage gets aged
- Malfunction on cover of heat radiator
- Gasket of cylinder head gets damaged or aged
- The joint of soft hose or tube clamp get loose
- Soft hose gets damaged or aged
- Heat radiator is broken
- The cover of thermostat or tube joint of water pump’s cover is flexible.

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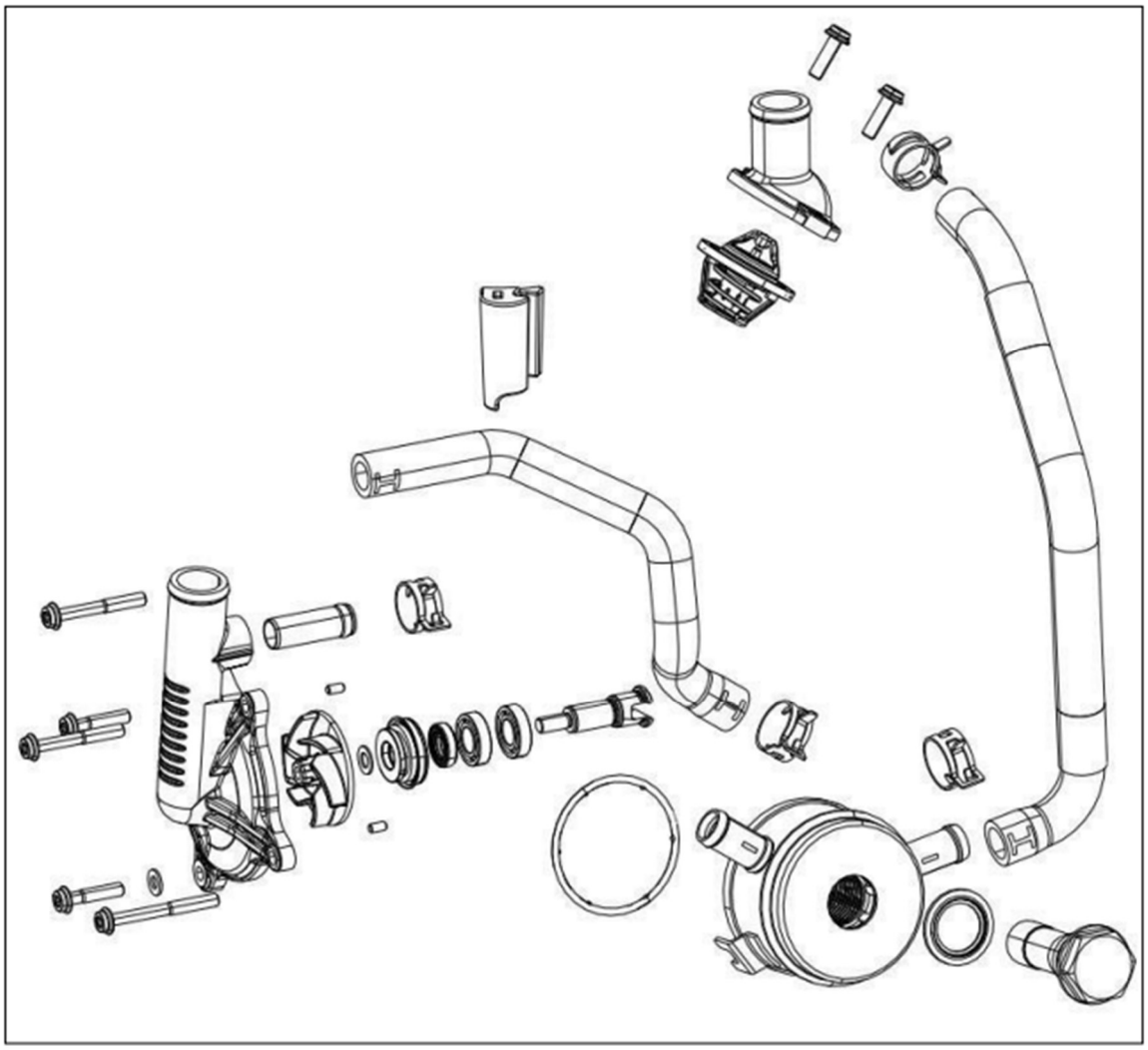
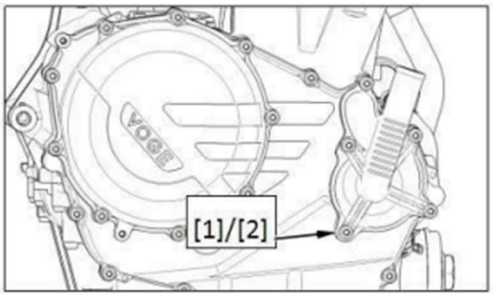
Layout diagram for cooling system



Coolant replacement

Coolant drainage



- Keep motorcycle upright and fix it.
- Remove water drainage bolt [1] and flat washer [2].
- Remove heat radiator cover and drain coolant off.
- Replace flat washer for a new one, then assemble water drainage bolt.
- Fasten water drainage bolt to correct torque.

  T**orque:**

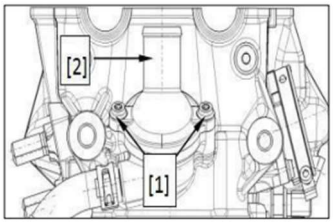
  Water drainage bolt: 11N.m

  Caution:

  Remove heat radiator cover when engine already cooled down, otherwise the hot coolant may get man injured.

Filling-up for cooling system and air exhaust

- Fill up with coolant through the port on heat radiator.
- Shift engine to neutral gear. Start engine and let it idly run for 2-3 minutes.
- Start and stop throttle for 3-4 times to exhaust all the air in system.
- Stop engine, fill up with coolant if it is necessary.
- Assemble heat radiator cover and fasten it in place.

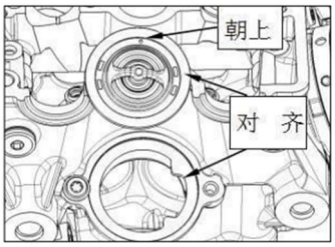


Thermostat

Removal/Assemble

Drain off coolant and remove sheltering parts.

- Remove bolt [1] and thermostat cover [2].
- Remove thermal valve from cylinder head.



The re-assembly is opposite to disassembly.

Torque:

Bolt for thermostat cover: 11N.m

Caution:

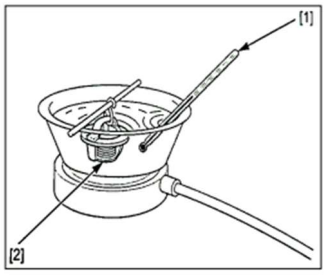
When assembling thermostat, the air exhaust hole [1] faces upwards.

Check/Inspection

- Check if there is damage on external surface of thermostat [1].
- Check if the seal ring [2] is damaged, please replace if it is necessary.
- If the thermal valve gets opened under room temperature, please replace it.

- Heat up water to working temperature by electric furnace for 5 minutes. The suspend thermostat [2] in hot water to check its function.

  Caution:
- Please wear heat insulation gloves and make suitable protection for eyes.
- Keep combustible material far away from electrical parts.
- Please don’t let the thermostat and thermal meter touch the bottom, otherwise the measured result may be wrong.



Initial opening temperature of thermostat:

82±2℃

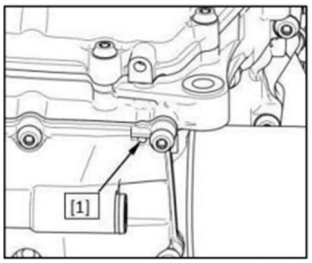
Complete height when opened:

When temperature is 95℃ and not less than 7mm

If thermostat is opened out of given temperature range, please replace it.

Water pump cover and impeller

Check sealing performance



- Check overflow hole [1] on water pump and confirm if there is leakage.

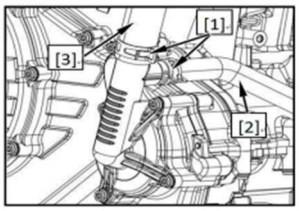
Caution:

Because the moving and static seal ring need to be lubricated by coolant, so tiny leakage is normal situation.

Confirm if there is coolant leakage when starting engine.

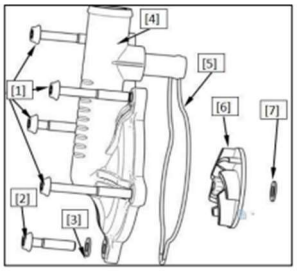
The water pump cover is integrated on right crankcase cover, please replace right crankcase cover kit if it is necessary.

Disassembly/Re-assembly



- Drain off coolant, put motorcycle in flat ground and keep it upright.
- Loosen tube clamp [1], then loosen water tube [2] of sub circulation and the water intake tube [3].

Remove parts below:



- Bolt [1] of water pump cover
- Water drainage bolt [2] and flat washer [3].
- Water pump cover [4].
- Remove o-ring [5] from water pump cover.
- Remove impeller [6] of water pump from right crankcase cover.
- Remove flat washer [7].

The re-assembly is opposite to disassembly.

Torque:

Installation bolt for impeller of water pump: 12N.m

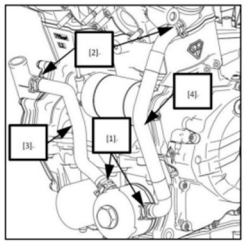
Bolt for water pump cover: 11N.m

Caution:

- Please don’t let o-ring of water pump cover touch oil.
- O-ring dropping off when assembling is not allowed.

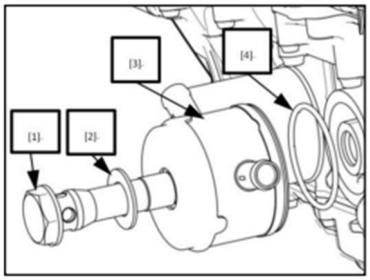
Oil water exchanger

Removal/Re-assembly



- Drain off oil from engine.
- Drain off coolant
- Loosen tube clamp [1], clamp [2] and remove water tube [3] and [4].

- Remove bolt [1], seal ring [2] and thermal exchanger [3] between oil and water.
- Remove o-ring [4] from exchanger.
  The re-assembly is opposite to disassembly.

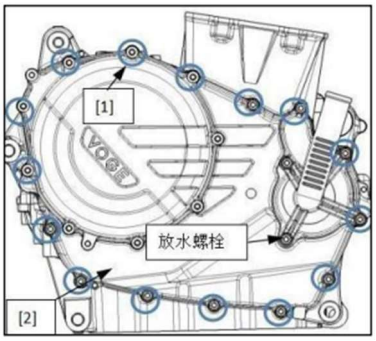


- Coat the new o-ring with oil.
- Align gap on exchanger to protrusion on crankcase.
- The pre-assemble seal washer onto bolt, then fasten bolt to given torque.
  Torque: 59N.m
- Fill up crankcase with oil of given specification.
- Fulfill cooling system and exhaust all air in it.

Right crankcase cover kit

Removal

- Remove water drainage bolt and copper washer, drain off coolant in engine.
- Loosen bolt [1] on right crankcase cover by 2-3 times.
  Caution:
  Lay a clean oil tray under engine, please the water pump is press-fitted on right crankcase cover, so when removing it, there may be some oil overflow. When assembled, please fill up with oil with given specification to give level.



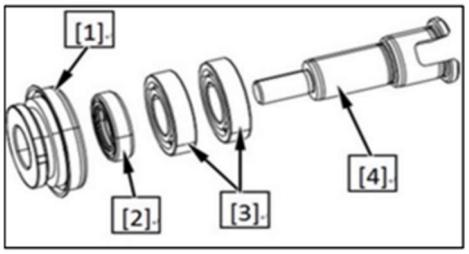
Remove parts below:

- Bolt
- Right crankcase cover kit [2]
- Cooling pump cover.

Remove positioning pin, clean up residual sealant on contact surface between crankcase and its cover. Please

don’t damage the contact surface.

- Static and moving ring [1] for cooling system
- Oil seal [2] of cooling pump
- Cooling pump shaft [3]
- Cooling pump shaft [4]

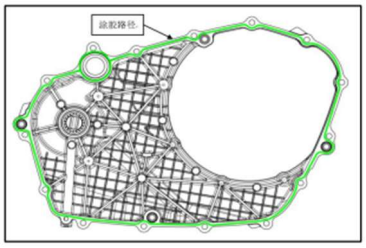


Caution: If the parts above damaged, please replace right crankcase cover and water pump for a new one.

Assembly:

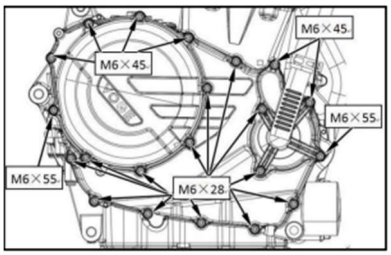
The re-assembly is opposite to disassembly.

Fastening torque for bolt of right crankcase cover: 11N.m



Caution:

- Coat right crankcase cover with sealant, whose path is shown as figure.
- Fill up crankcase with oil of give specification, and check if there is oil leakage.
- When sealant coated, lay it above 4 hours, make sure the sealant dried up completely.
- Specification of fastening bolt for right cover is referring to figure .



4. Lubrication system

Maintenance information

Summary

- When repairing the oil pump, we needn't remove the engine from frame.
- The pre-condition for all maintenance steps in this Chapter is drain off the oil in engine.
- When disassembling and re-assembling the oil pump, please don't let dust or dirt get into engine.
- Any part in oil pump passed the limit for maintenance, please replace the oil pump as a complete set.
- When the oil pump re-assembled, please check the oil leakage and correct oil pressure.
- Check the oil pressure indicator for engine and the EOP switch.

Specification for lubrication system Unit：mm

Items		Standard	Maintenance limit
Oil capacity	After oil replaced	2.6 L	—
	When oil filter replaced	2.8 L	—
	When engine broke up	3.2 L	—
The oil we suggest		Recommended oil： SL10W-40 API quality grade：SL or higher （Don't adopt the one with round label of API service for energy saving）JASO T903 standard：MA Viscosity：SAE10W-40	—
Opening pressure for oil pressure sensor		15-19.6 kpa	—
Gap between external and internal rotors		0.15max	--

of main/sub oil pump		

Troubleshooting

Too low the oil level

- Too heavy the oil consumption
- Oil leakage on external components
- Piston ring worn out or without assembling in place
- Cylinder worn out
- The seal of core shaft worn out
- Valve guiding tube worn out

Too low the oil pressure & 0 oil pressure

- Too low the oil level
- Oil filtering screen was blocked up
- Pressure relief valve for oil pressure is seized up when getting open
- Transmission chain of oil pump broke up or dropped off
- Teeth of driving and driven gear of oil pump broke up
- Oil pump damaged

Too high the oil pressure

- Relief valve of oil pressure fails to be opened
- Jet hole for main oil passage are blocked up

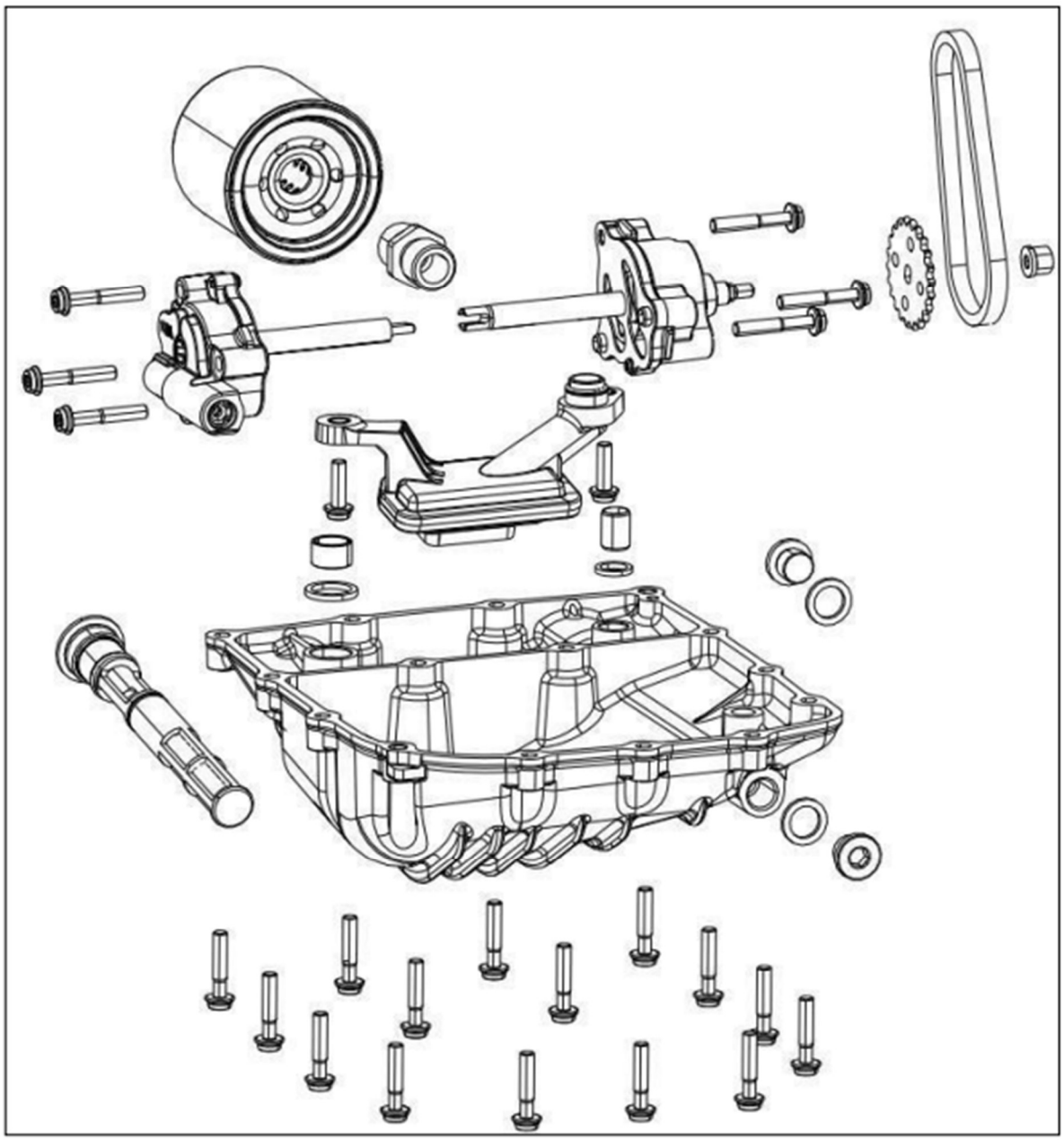
Oil gets dirty

- Didn’t replace oil and filtering screen periodically
- Piston ring gets damaged

Oil emulsified

- Gasket of cylinder head gets damaged
- Water passage of cylinder head cracked
- Water pump of engine gets damaged
- Water got into engine

Lubrication system diagram



Oil pressure inspection

Caution:

- When engine is working, if oil pressure meter keeps stable, please check pressure gauge before check the oil pressure.
- Remove oil pressure [1] of engine, then assemble accessory of oil pressure gauge into switch base.
- Connect oil pressure measuring meter to its accessories.
- Check oil oil, please fill up with oil if it is necessary.
- Start engine and let it reach working temperature (Around 80℃). The adjust the engine rotation, then read the oil pressure.

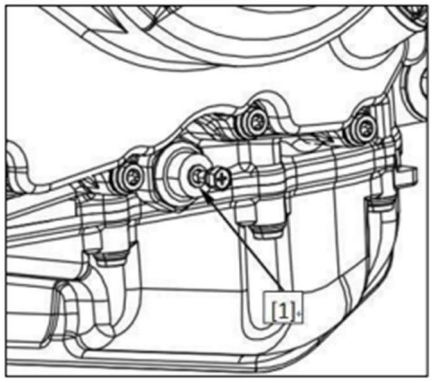
Standard:

When it is at 1250rpm/80 ℃, the data is ≥100kPa;

When it is at 5000rpm/80 ℃, the data is ≥300kPa;

Stop engine and remove tools:

Assemble oil pressure sensor.



Oil pump

Removal/Re-assembly for main oil pump

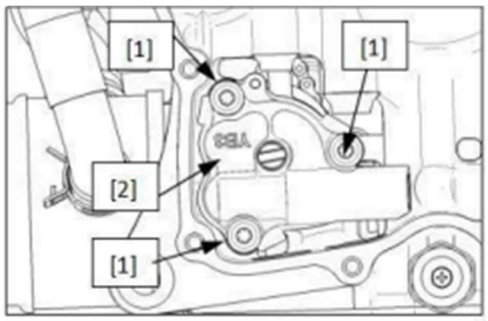
Remove left cover kit, rotor of magneto and plate-shaped gear.

- Remove bolt [1] and oil pump [2].
- The re-assembly is opposite to disassembly, then fasten the bolt of oil pump to given torque.

Torque: 11N.m

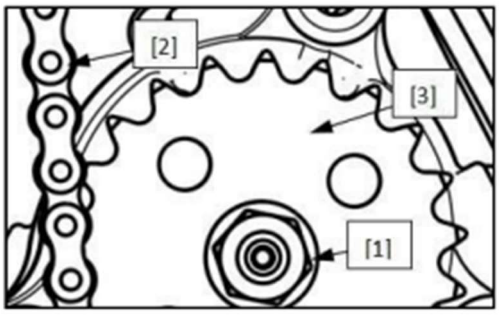
Caution:

- When assembling, please turn the oil pump shaft by suitable tool for a nice meshing-up at flat end of two oil pumps.

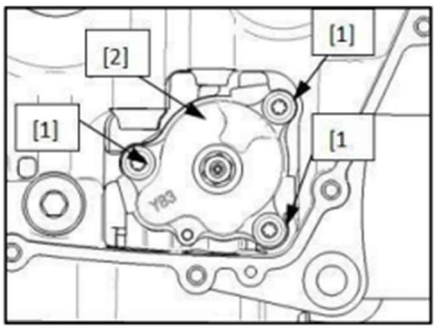


Removal/Re-assembly for sub oil pump

- Remove fastening nut (Left thread) [1] of driven gear of oil pump.
- Remove chain [2] and driven gear [3] of oil pump.
  The re-assembly is opposite to disassembly.
- Coat fastening nut for driven gear with Loctite, then fasten it to given torque.
  Torque: 12N.m

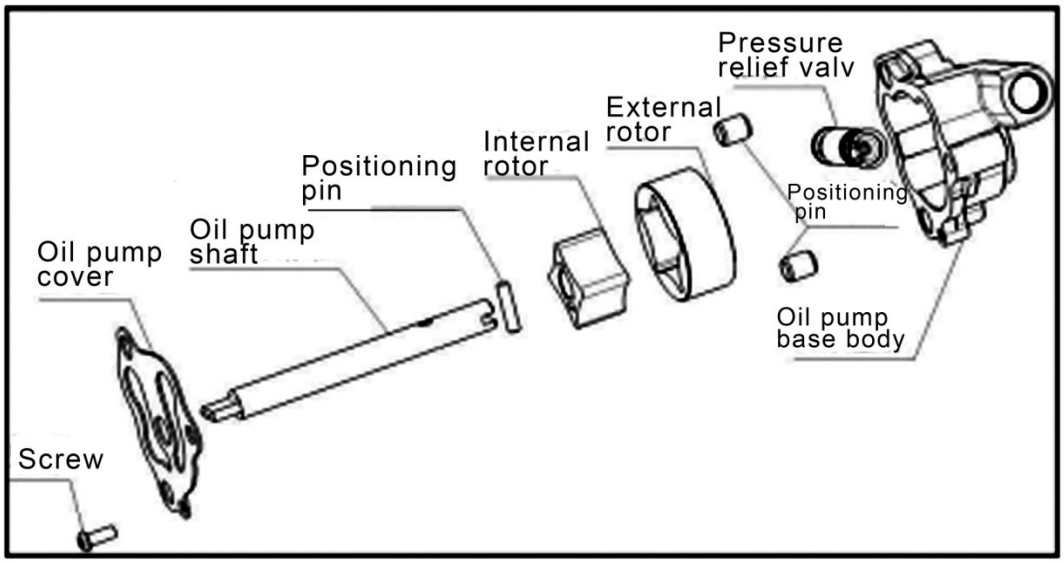


- Remove fastening bolt [1] of oil pump and then the pump [2].
  The re-assembly is opposite to disassembly.
- Fasten the bolt for oil pump to given torque.
  Torque: 11N.m.
  Caution:
  Align the grooves on shaft on main and sub oil pump.

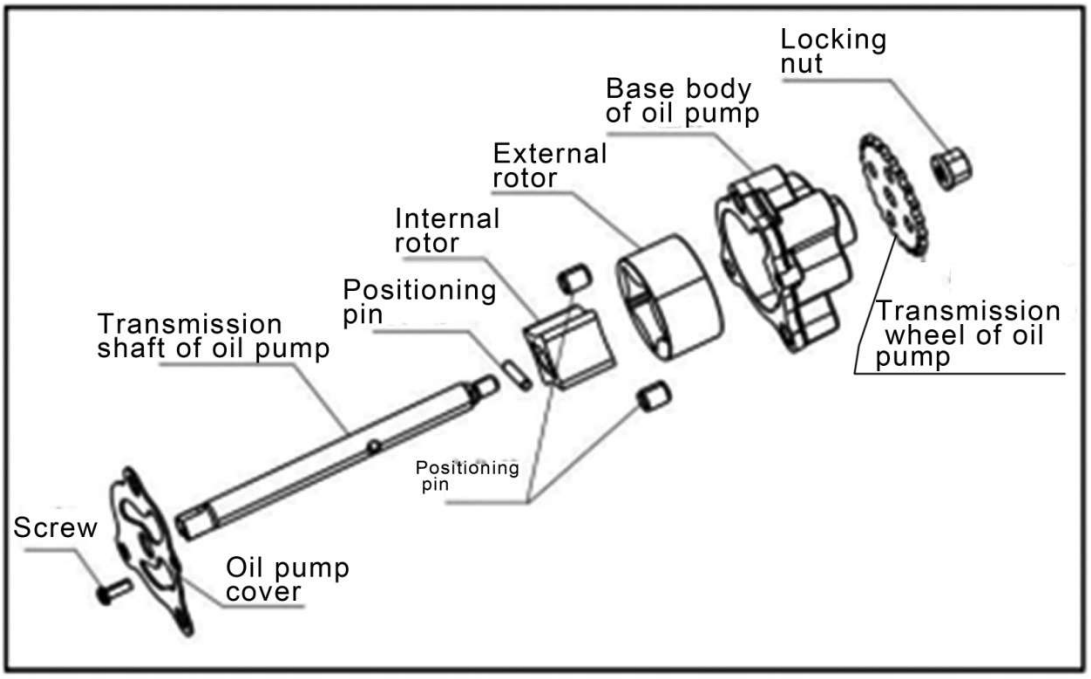


Disassembly/Re-assembly

The disassembly and re-assembly for main oil pump is as below:



The disassembly and re-assembly for sub oil pump is as below:



Inspection:

Check if there is damage, wear-out, distortion or burn-out on parts below.

- Oil pump shaft
- Positioning pin
- Internal rotor
- External rotor
- Base body of oil pump

Measure oil pump gap according to specification of lubrication kit.

If any parts passed maintenance limit, please replace the complete kit of oil pump.

Pressure relief valve

Disassembly/Re-assembly

- Remove main oil pump.
- Remove elastic circlip [].
- Break down pressure relief valve.
- Remove collar [2], pressing spring [4], and pushing bar [4] for oil control.

Inspection:

Check if there is wear-out, scratch and damage on pushing bar for control valve.

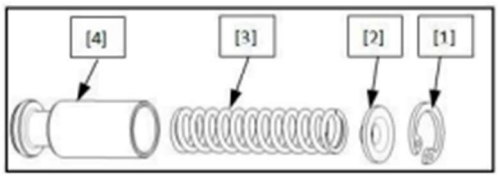
Check if there is fatigue or damage on spring.

The re-assembly for relief valve is opposite to disassembly.

Caution:

Please correctly assemble elastic circlip into groove.

Any parts above damaged, please replace the complete kit of oil pump.

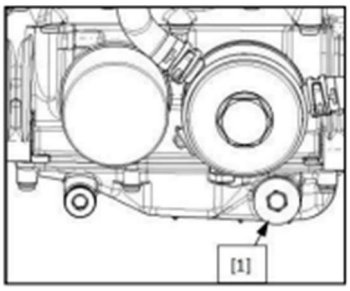


Oil bottom case and oil absorption tube

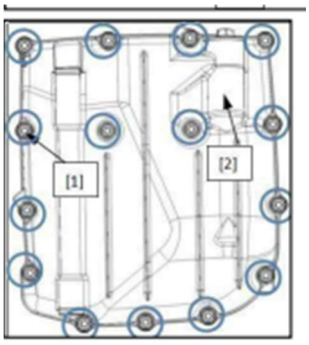
Disassembly

Remove all the parts sheltering oil bottom case.

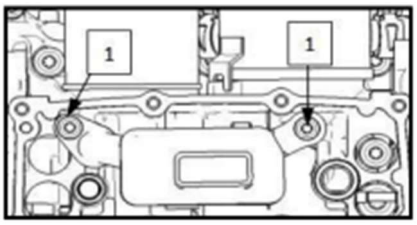
- Remove seal plug [1] and drain off oil.



- Remove bolts [1] on oil bottom case by diagonal sequence, then remove oil bottom case [2].



- Remove 2 pieces of fastening bolt [1].



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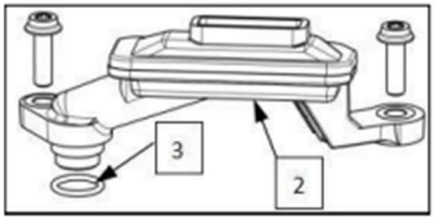
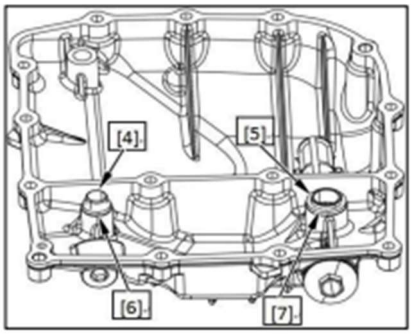
- Oil absorption tube [2] and seal ring [1]. Clean up filtering screen and check if there is damage on it.



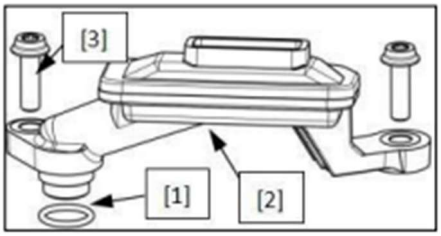
- Remove collar [4] and [5], then seal ring [6] and [7].



Re-assembly

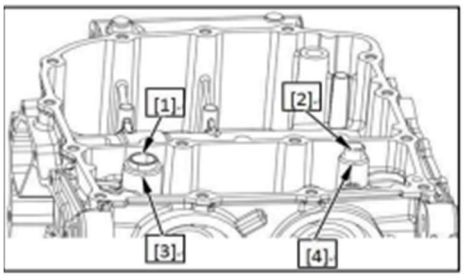
- Clean up residual sealant on installation surface of oil bottom case.
- Replace seal ring [1] for a new one, then assemble it onto oil absorption tube [2].
- Assemble oil absorption tube into crankcase, then fasten 2 pieces of bolt [3], then fasten it to given torque.

Torque: 11N.m



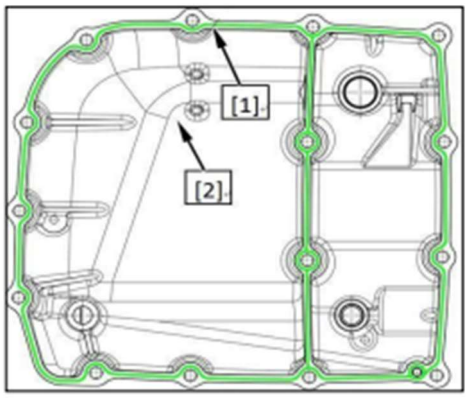
- Assemble 2 pieces of collar [1] and [2] onto corresponding hole on crankcase body, then assemble seal ring [3] and [4] onto collar.
- Coat installation surface of oil bottom case with sealant [1] according to standard path then assemble the case [2] in place.
- Assemble oil bottom case and bolts onto crankcase body.
- Fasten the bolts according to diagonal sequence, then turn them to given torque.

Torque: 11N.m.



Caution:

- Coat the oil bottom case with sealant, them assemble, then put it aside without moving above 4 hours, make sure start engine once again when the sealant totally dried up.
- Please avoid missing assembly for 2 pieces of collar and seal ring, otherwise it is bad for oil intake of engine even get engine damaged.


[1]
[2]

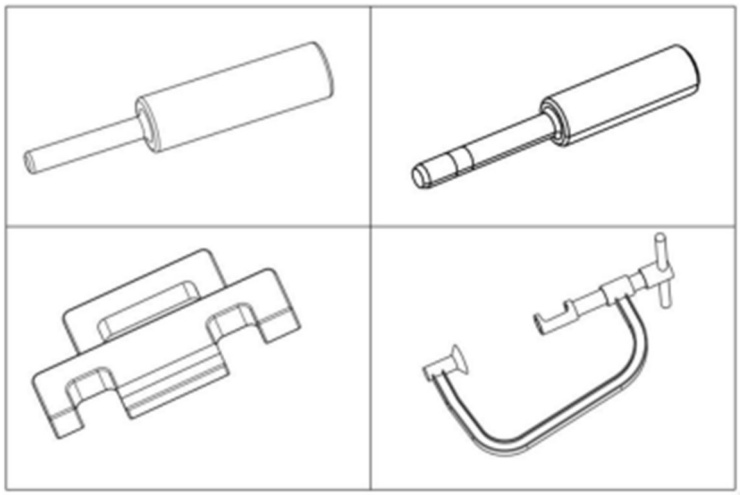
5 Cylinder head and air system kit

Maintenance information

Summary

- This chapter includes the inspection and maintenance for cylinder head and air system kit.
- When repairing tensioner kit, it needn't remove engine from frame. When repairing the camshaft and swinging arm, removal for engine is completely up to actual needs; But when repairing the cylinder head and valves, we need remove the engine from frame.
- When disassembling the components, mark up the removed parts for a correct re-assembly.
- Before checking, wash up all the removed parts by cleanser, then dry them up by compressed air.
- The lubricant on camshaft is got through the oil passage in cylinder head and its cover, in this case, before re-assembling the cylinder head and its cover, wash up their oil passage first.
- Please don't damage the contact surface when disassembling the cylinder head and its cover.
- Please check all seal rings, confirm if there is damage or permanent distortion on them, replace for new ones if it is necessary.

Tools:



Specification for cylinder head/Air system kit

Unit：mm

Items			Standard	Maintenance limit
Cylinder pressure under electrical starting			450-850KPa	—
Valve clearance		Air inlet	0.15～0.20	—
		Air exhaust	0.25～0.30	—
Swinging arm and its shaft	Internal diameter of swing arm	Inlet/Exhaust	8.013-8.028	8.06
	External diameter of swinging arm shaft	Inlet/Exhaust	7.983-7.995	7.96
	Clearance between swinging arm and its shaft	Inlet/Exhaust	0.018-0.045	0.10
Camshaft	Protrusion height of cam	Air inlet	35.80-35.86	35.78
		Air exhaust	35.80-35.86	35.78
	Clearance between journal and hole		0.028-0.062	0.10
	Runout		—	0.02
Valve, guiding tube of valve	Valve rod's diameter	Air inlet	4.975-4.990	4.965
		Air exhaust	4.965-4.980	4.955
	Internal diameter of valve's guiding tube	Inlet/Exhaust	5.000-5.012	5.056
	Clearance between valve rod and its guiding tube	Air inlet	0.01-0.037	0.07
		Air exhaust	0.02-0.047	0.08
	Width for gate line of base ring	Inlet/Exhaust	1-1.2/1.1-1.3	1.6/1.7
Free length of valve spring		Internal diameter	46.3	--
Flatness of cylinder head		—		0.05

Troubleshooting

- Malfunction at the top place of engine is usually bad for engine performance. We can find out these malfunctions by compression test, also we can find them by detective rod or stethoscope to know where the engine noise comes from, even can reach the top part of engine.
- In case the power output of engine is weak when it under low speed, please check if there is white smoke in beathing tube of crankcase. In case the soft hose is smoky, please check the jamming on piston ring.

When engine is working under low speed, too low the compressing pressure, difficult starting or poor performance

- Valve
  - Incorrect adjustment for valve clearance
  - Valve burned out or got bent
  - Wrong valve timing
  - The valve spring got cracked
- Cylinder head
  - The gasket of cylinder head with leakage or damage
  - Cylinder head gets bow, twist or crack
  - Spark plug is flexible
- Cylinder, piston or piston ring worn out

Compressing overpressure, overheat or cylinder knock

- Too much carbon buildup on piston head or in combustion chamber

Smoky

- Cylinder head
  - Valve rod or guiding tube worn out
  - Sealing piece for valve rod damaged
- Cylinder, piston, or piston ring worn out

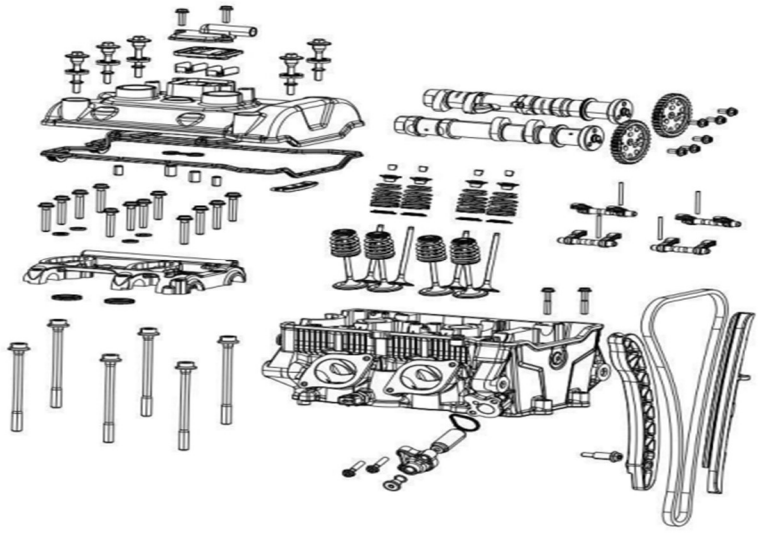
Noisy

- Cylinder head
  - Incorrect adjustment for valve clearance
  - Valve gets jammed or its spring cracked
  - Camshaft worn out or damaged
  - Swinging arm and its shaft worn out
  - Swinging arm and valve rod's end worn out
  - Chain of cam gets flexible or worn out
  - Timing chain worn out
  - Teeth of cam's sprocket wheel worn out
- Cylinder, piston and piton ring worn out

Poor idling

- Too low the compressing pressure in cylinder
- Wrong phase position of cam

Components layout



Cylinder compression test

- Before testing, start engine and warm it up by 1 minute.
- Stop engine, remove spark plug and turn the gear to neutral.
- Assemble the pressure gauge and its connector into installation hole of spark plug and make sure it is firmly assembled.
- Turn accelerator grip to full position.
- Press starting button and keep for seconds until the reading result stopped rising, at this moment the result is the highest pressure.

Compression pressure: 450-850kPa

Caution:

- Before testing compression pressure of engine, please make sure cylinder head nut and bolt are fastened according to given torque, and the valve gap is correct.
- Before testing, please make sure electric power is enough, the poor power of battery may lead to wrong testing result.
- Before testing, please keep motorcycle upright.

Analysis for low pressure:

- Leakage of cylinder head gasket
- Wrong adjustment for valve gap
- Valve leakage
- Cylinder wall wear-out
- Piston or its rings wear-out
- Piston ring seized up in its groove
- Too much carbon buildup on valve, leads to poor contact to valve base.

Cylinder head cover

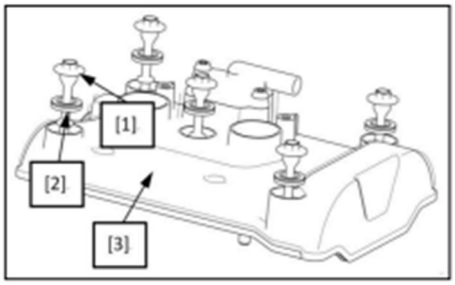
Disassembly/Re-assembly

Caution:

- The maintenance for cylinder head cover, removal for engine from frame needs be judged by its actual

structure of motorcycle.

- Remove sheltering parts such as fuel tank covering on cylinder head cover.
- Remove secondary air intake tube
- Remove bolt [1] for cylinder head cover and rubber base [2].
- Remove cover [3] from cylinder head.

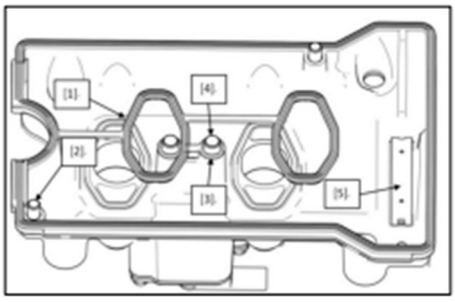


- Remove seal ring [1] and positioning pin [2] from cover.
- Remove seal ring [3] of secondary air intake, check positioning pin [4].
- Check if pressing plate [5] is flexible or dropped off, if it is, please replace for a new one.

The re-assembly is opposite to disassembly, check positioning pin of cylinder head cover, then assemble the cover and fasten its bolt to given torque.

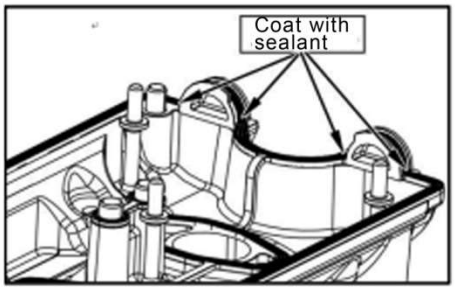
Torque:

Bolt for cylinder head cover: 12N.m



Caution:

- Replace seal ring for cylinder head cover for a new one.
- When assembling, please assemble seal ring of cover into its groove on cover.
- Coat the sharp angle of protrusion on seal ring with sealant.



Secondary air intake

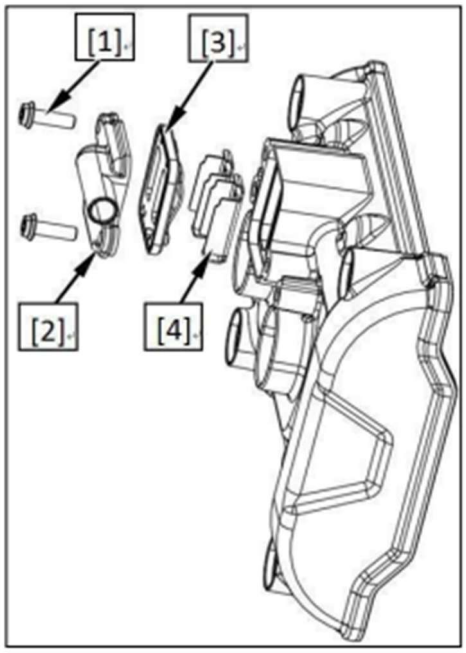
Removal

- Remove fastening bolt [1] for secondary air intake valve cover.
- Remove tube joint [2].
- Remove spring piece valve [3].
- Remove fire-proof screen [4]

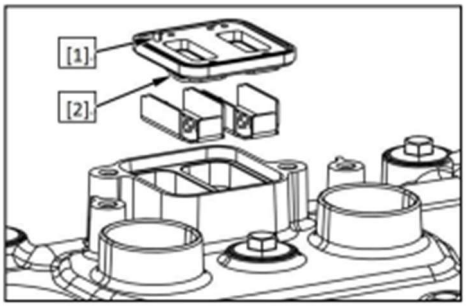
Check and confirm if there is damage, wear-out or jamming on parts above, please replace if it is necessary.

Re-assembly

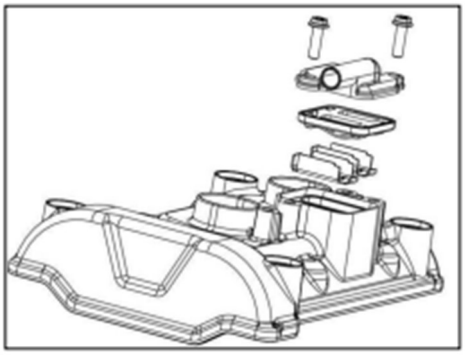
- Assemble fire-proof screen onto cylinder head cover, the protrusion side of the screen faces upwards and locating hole align the positioning pillar on cylinder head cover.



- Assemble spring piece valve to fire-proof screen, the valve piece [2] faces downwards and the protrusion [1] faces upwards and left front.



- Assemble tube joint, and left the air intake tube faces left.
- Assemble fastening bolt and fasten it to given torque.

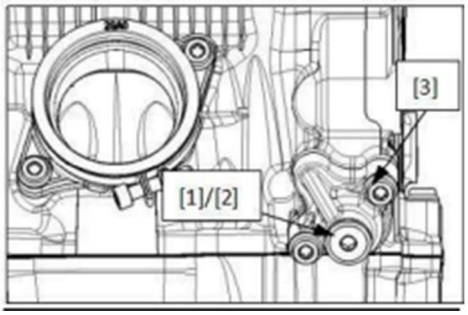


Tensioner kit and its components

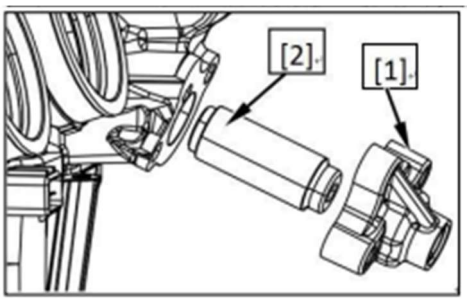
Removal

The removal and inspection for tensioner needn't remove engine from frame.

- Remove parts sheltering tensioner.
- Remove socket hex. screw [1] and seal ring [2].
- Remove 2 pieces of fastening bolt [3] for tensioner.



- Remove tensioner base [1].
- Remove tensioner [2].



Inspection for tensioner

- Check if there is damage, jamming or returning failure of steel ball [1] on tail of tensioner.

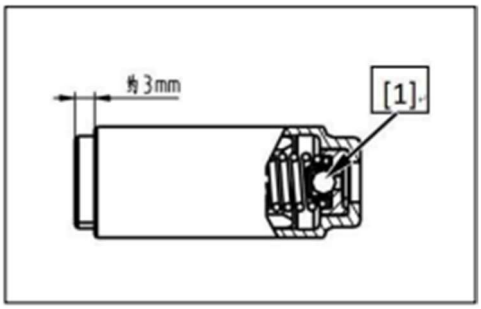
The tensioner gets back to initial status.

- Compress tensioner to the lowest position, make sure it is at initial status, at this moment, the tensioner doesn't bounce up any more, and there is a 3mm distance from front end to external circle of tensioner.

Caution:

- The tensioner with oil in it and already used, its compression may fail due to oil sealing in half way of operation, at this moment, please adopt tool without sharp angle, slightly press out steel ball [1] at tail for pressure relief when tensioner returning, repeat this operation until tensioner got back to initial status.

- When pressing out the steel ball at tail part, please don’t leave damage on steel ball, otherwise it may lead to pressure relief of tensioner even lead to engine noise.

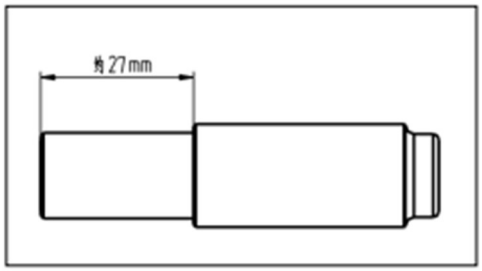


Inspection for bounce-up of tensioner

- When the tensioner is at initial status, keep press tail end of tensioner by 2mm, then release, at this moment and tensioner may bounce up by itself, under this case, the tail end of tension is 27mm to external circle.

Caution:

- Repeat the operation of returning to initial status and bounce up, make sure the performance of tensioner is normal, and could be returned back to initial status.



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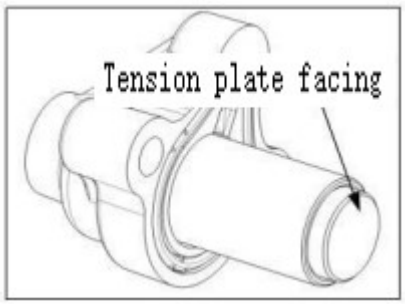
Assemble tensioner base

- Get tensioner back to its initial position.
- Assemble tensioner to cylinder head.
- Assemble seal ring of tensioner base to the base.
- Assemble tensioner base and its seal ring to cylinder head.
- Assemble bolt of tensioner base and fasten to given torque.

Torque: 11N.m



Release tensioner

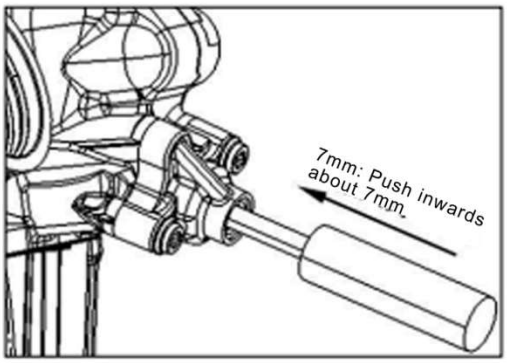
- Insert the tail part of tail of tensioner base by pillar-shaped tool, then push tensioner inwards by 7mm, then move back, meanwhile, then tensioner bounce out forward shall be felt.
- Push inwards by tool for inspection once again, at this moment the tensioner already released, it could not be

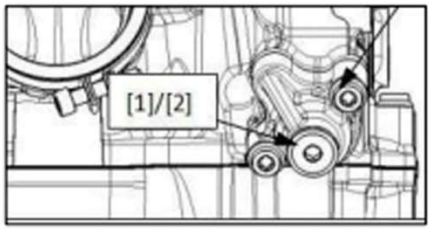
pushed in a large range.

Caution:

- The tool head must be not a sharp one, and diameter shall not be less than 7mm, otherwise it may damage the steel ball of one-way valve at tensioner tail, which lead to pressure relief even damage on engine.
- The tensioner must be released when assembled, otherwise the tensioner would not work and get engine damaged.
- Assemble hex. screw [1] and seal ring [2], then fasten it to given torque.

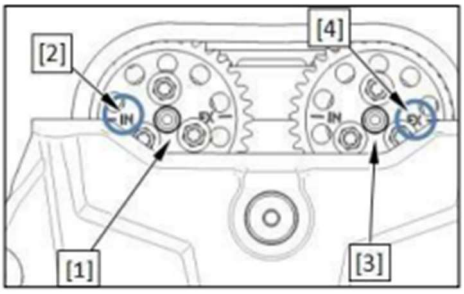
Torque: 16N.m



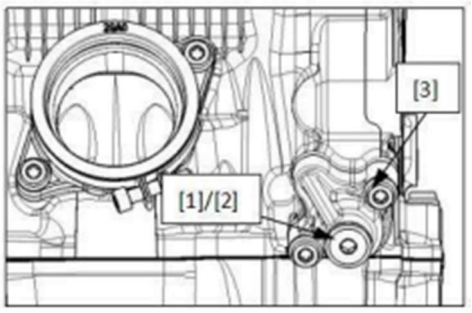


Camshaft

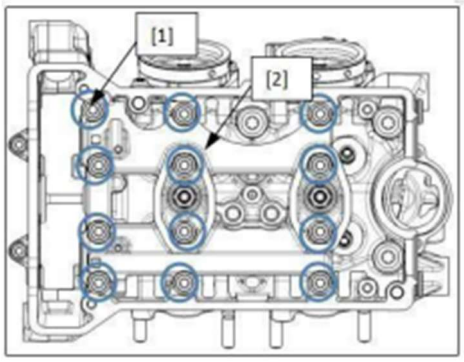
- Remove cylinder head cover.
- Turn crankshaft, meanwhile viewing camshaft, align mark “IN” [2] on air intake cam sprocket [1] to upper surface of cylinder head. As figure shows, align mark “EX” [4] on air exhaust cam sprocket [3] to upper surface of cylinder head as figure shows.



- Remove socket hex. screw [1] and seal ring [2].
- Remove 2 pieces of fastening bolt [3] for tensioner base.
- Remove the tensioner.



- Loosen bolt [1] for camshaft bracket alternatively by 2-3 times, then remove.
- Remove camshaft bracket [2] from cylinder.
- Remove camshaft.



Caution:

- From outside to inside, alternatively loosen bolts of camshaft bracket by several times, otherwise the bracket is easy to be broken.
- When taking the bolt, please prevent it dropping into crankcase.
- The positioning pin on camshaft bracket needn't be removed, please don't forcedly remove the pins.
- Please confirm if the lower seal ring of camshaft bracket is missing, please replace it for a new one if it damaged.

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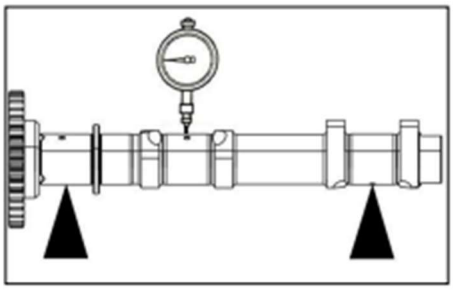
Inspection

Check if there is damage, wear-out, distortion, burn-out or oil passage blocking-up on parts below.

- Cam sprocket/camshaft
- Camshaft bracket/positioning pin/seal ring
- Pressing plate of cam sprocket.

Measure each parts according to specification for cylinder head kit/air system kit.



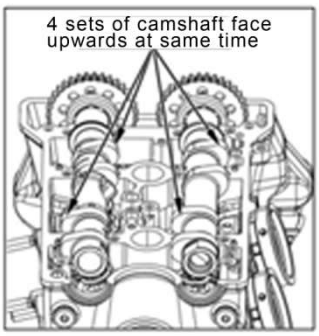
Camshaft runout

- Hold up journal on both sides of camshaft.
- Put a micrometer above middle journal.
- Turn the camshaft by 2 rounds (720˚), then read the runout.
  Maintenance limit: 0.04mm.

Check oil gap for camshaft

- Wipe up oil on camshaft, cylinder head and camshaft bracket.
- Assemble camshaft onto cylinder head.
- Turn the cam of air intake and exhaust, get base circle of 4 cams meshing up to swinging arm, please prevent cam ejecting the valve as figure shows.
- Lay a plastic gap gauge [1] vertically on top of camshaft journal, please bypass the oil hole.
- Make sure positioning pin on camshaft bracket aligning to the pin's hole on cylinder head.

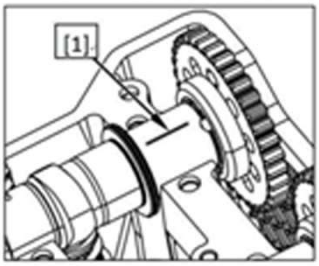
- Assemble the camshaft bracket to its corresponding position.
- Assemble bolts for camshaft and fasten to given torque (Refer to following chapter)
- Remove camshaft bracket, measure each width for plastic gap gauge, in which the widest one is oil gap. **Maintenance limit: 0.10mm.**



When it passed the maintenance limit, please replace camshaft for a new one and measure oil gap once again. If the gap still passed limit, please replace camshaft bracket and cylinder head as a complete kit.

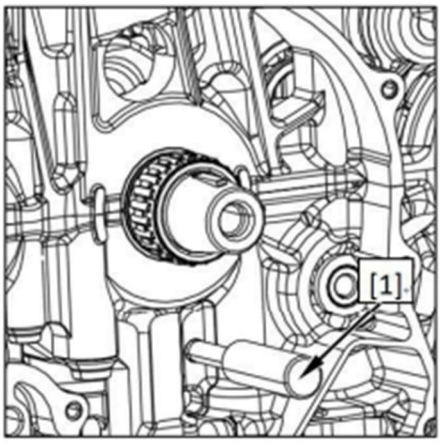
Caution:

- During checking of oil gap, please don't turn camshaft and bypassing and oil hole.
- The bolt must be fastened in place by required torque and sequence.



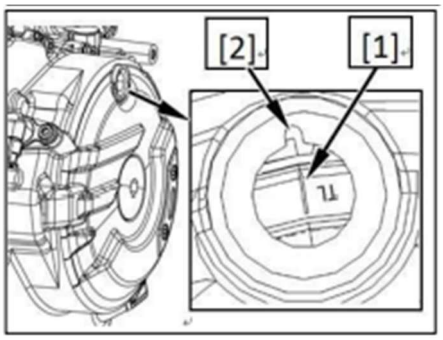
Assembly

- Remove left cover kit, magneto rotor, plate-shaped gear, double gear, and turn crankshaft, align positioning hole on crankshaft to that on lower case body, then insert a tool [1] with diameter of ϕ8 as figure shows.



If camshaft, timing sprocket, crankshaft, cylinder head and case body needn't be replaced, the timing for chain could adopt a simple way as below

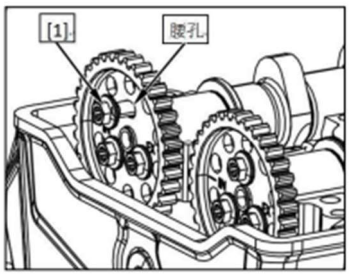
- Remove upper decorative cover of left front cover and view hole cap, then turn crankshaft counter clockwise, then align mark "TL" [1] on magneto rotor to gap center [2] of view hole cap.



Caution:

- Adopt positioning hole is with higher precision, so it's a better choice.

- If any parts in camshaft, timing chain, crankshaft, cylinder head and case body replaced, please make location by positioning hole for this work.
- The positioning tool must be a shaft with higher precision, the clutch tapper could be a substitution.
- Loosen bolt [1] for sprocket wheel of air intake and exhaust camshaft, get the sprocket wheel could be freely moved in range of its hole.



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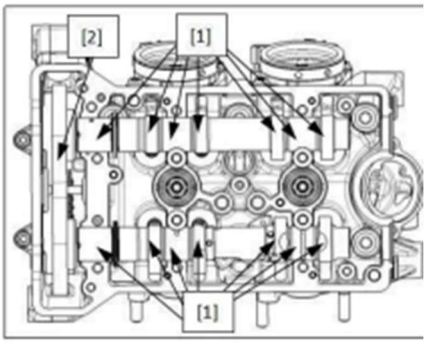
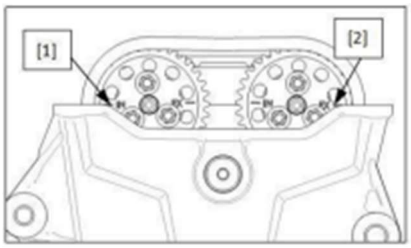
Caution:

- Please correctly identify air intake and exhaust camshaft, the one with relief valve is exhaust camshaft, otherwise it is the intake one.
- When loosening bolts, please protect camshaft to avoid damage on it.
- The sprocket wheel bolts needn't be all loosened, loosen it until the plate part of bolt without pressing sprocket wheel, the sprocket wheel could be freely moved in its hole.
- If the camshaft, timing sprocket, crankshaft, cylinder head, case body and timing chain without replacing, the bolt for sprocket wheel of camshaft needn't be removed, the camshaft and sprocket wheel could be assembled together.



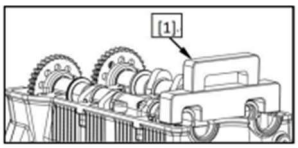
- Coat the cam, journal and all the thrust surface with oil. Coat all the surface of chain [2] of cam with oil.
- Assemble chain of cam and sprocket wheel, then assemble camshaft onto cylinder head.

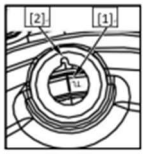
  Caution:
- Before assembling, please check and confirm the positioning of each swinging arm is correct while adjusting washer without dropping off.



- Make sure the chain on exhaust side is tension, and the chain between two sprocket is tension, adjust meshing between sprocket wheel and chain, align mark "IN" [1] of air intake side and "EX" [2] of exhaust side to upper surface of cylinder head as figure shows.

- Fix the position of camshaft by tools for it only and pay attention to:
- When tools assembled, confirm once again the crankshaft already fixed or the mark "TL" [1] on magneto rotor aligned to gap center [2] on view hole cap.
- Assemble lower seal ring of camshaft bracket, then assemble camshaft bracket to cylinder head.
- Fasten bolts for camshaft bracket according to its number on bracket, fasten the bolts by several times.





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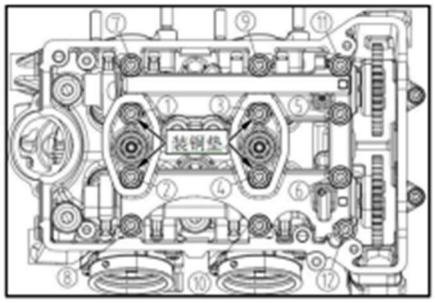
Torque: Pre-fasten by several times to 5N.m, then fasten to 15N.m by correct sequence.

Caution:

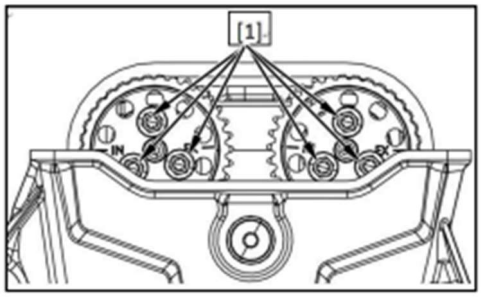
- Coat threaded part of each camshaft bolt and its plate part with oil.

- Missing assembly for copper washer at central 4 places is not allowed.
- Adjust the tensioner to initial status, then assemble it and its accessories. (Refer to chapter above).
- Release tensioner and make sure the chain is in tension, then assemble bolt at tail. (Refer to chapter above).



- Confirm once again the correct assembly for fixing tools of crankshaft and camshaft.
- Fasten 4 pieces of bolt [1] for sprocket wheel of camshaft.
- Remove fixing tools for crankshaft and camshaft, turn crankshaft by 180˚, expose the other 2 pieces of bolt for sprocket and fasten.

  Torque: 14N.m
- Turn crankshaft by 2 rounds, then confirm once again position of crankshaft and scale line on camshaft.



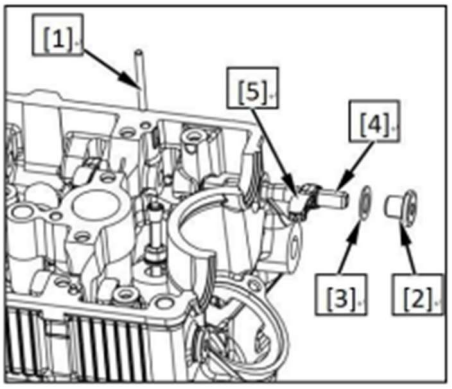
51

Swing arm

Removal

Remove camshaft kit.

- Remove positioning pin shaft [1] for swinging arm shaft on cylinder head.
- Remove socket screw [2] and copper washer [3] on left side of cylinder head.
- Suck swinging arm shaft [4] out by magnetic bar.
- Remove swinging arm [5].



Inspection

Check and confirm if there is damage, wear-out, distortion, burn-out or oil passage blocking-up on parts below.

- Swinging arm
- Swinging arm shaft

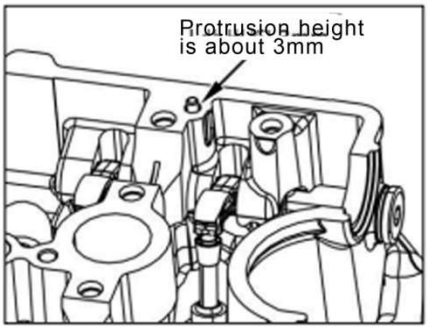
Measure each part and its gap according to specification of cylinder head kit/air system kit. Any part passed maintenance limit, please replace.

Assembly

- Coat sliding, thrust and external surface of swinging arm and its shaft with oil.
- Assemble swinging arm and its shaft, then insert positioning pin into swinging arm shaft for limiting on cylinder head.
- Slightly move swinging arm shaft left and right to ensure correct meshing between positioning pin and positioning groove for swinging arm shaft, when it correctly meshed up, the positioning pin is usually higher than cylinder surface by 3mm.
- Assemble socket hex. screw and copper washer, then fasten.

Torque:

Socket hex. screw: 16N.m



Caution:

- When disassembling or re-assembling swinging arm, please make sure there is not any valve adjusting washer dropping off.

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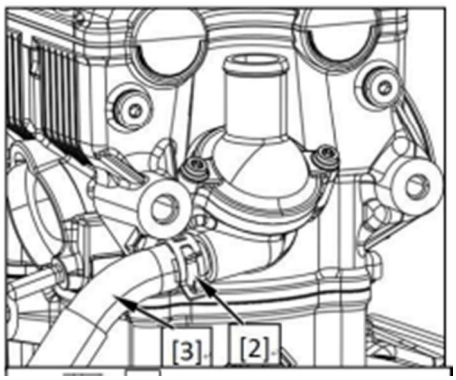
Cylinder head

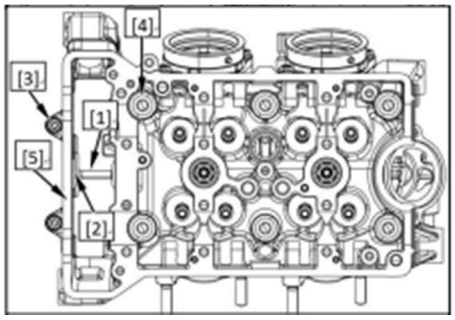
Removal

When disassembling cylinder head, please remove engine from frame first.

- Loosen tube clamp [2] and water tube [3] for sub circulation.

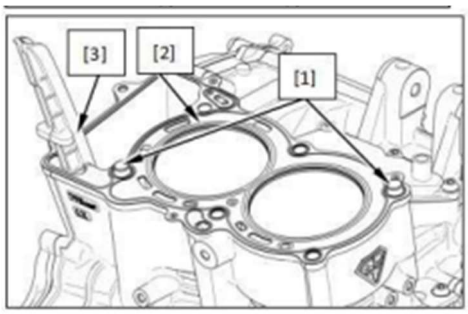


- Remove tensioning bolt [1] for chain chamber and seal ring [2].
- Remove 2 pieces of fastening bolt [3] of size M6 for cylinder head on the right.
- Loosen 6 pieces of bolt [4] M9 on cylinder head alternatively by 2-3 times, then remove bolt.
- Remove cylinder head [5].



Caution:

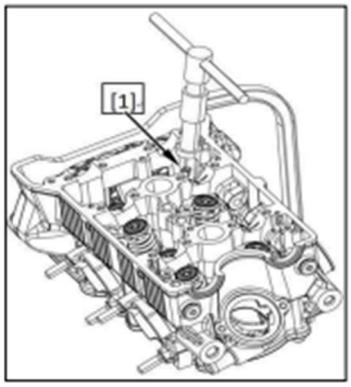
- Please suspend chain for cam by ling to prevent it dropping into crankcase.
- Please don't heavily knock cylinder, please don't adopt any tool for lever bar and leave damage on contact surface.
- When removing fastening bolt M9 on cylinder head, please loosen them by several times, please don't fasten any one by a single time.
- When it removed, please prevent contact surface of cylinder head from damage, collision and scratch.
- Remove positioning pin [1], gasket [2] and guiding plate [3] for chain.



Disassembly

Remove parts below:

- Spark plug
- Coolant temperature sensor
- Remove valve clip [1] by tools for this work only.



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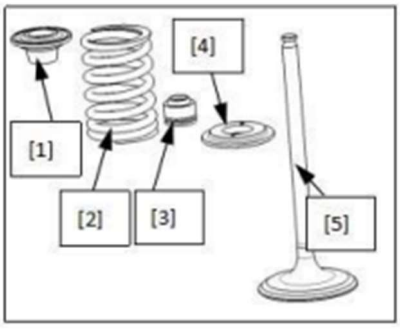
Remove compression tool for valve spring and parts below:

- Upper valve spring base [1].
- Valve spring [2].
- Oil shield cover [3].
- Lower valve spring base [4].
- Valve [5].
  Caution:
- To prevent permanent distortion of valve spring, please don't heavily compress valve spring when disassembling.
- When removing, please mark up all the parts for an easy re-assembly.

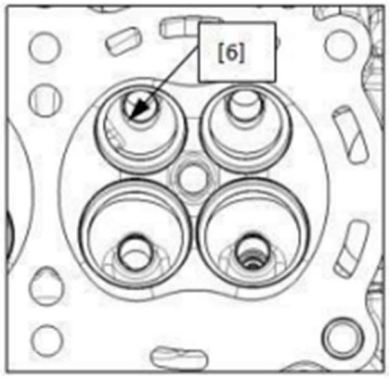


Inspection

Check and confirm if there is damage, wear-out, distortion, burn-out or oil passage blocking-up on parts below.

- Cylinder head.
- Valve spring
- Valve
- Guiding tube [6] for valve
- Chain guiding plate

Measure each part and its gap according to specification of cylinder head kit/air system kit. Any part passed maintenance limit, please replace.



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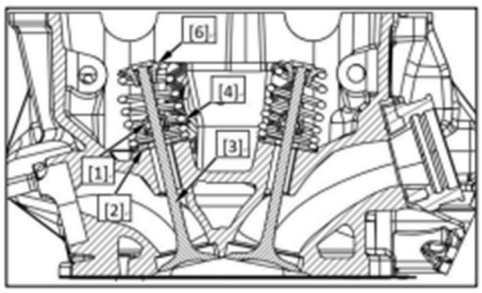
Assembly for cylinder head

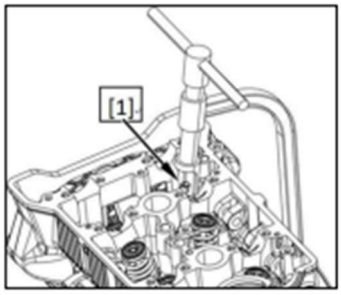
- Clean up carbon buildup in combustion chamber and surface of cylinder head gasket.
- Wash cylinder head kit by solvent, then blow all the oil passage by compressed air.
  Caution:
- Please don’t damage contact surface of cylinder body and surface of valve base.
- Lubricate new oil shield cover [1] by oil.
- Assemble lower valve spring base [2] and oil shield cover.
- Lubricate sliding surface and bar end for each valve bar by oil.
- Insert valve [3] into its guiding tube, slowly turn the valve when inserting it in to prevent damaging oil shield cover.
- Assemble valve spring, the side with coil in bigger size faces to combustion chamber.
- Assemble base ring [6] for upper valve spring.

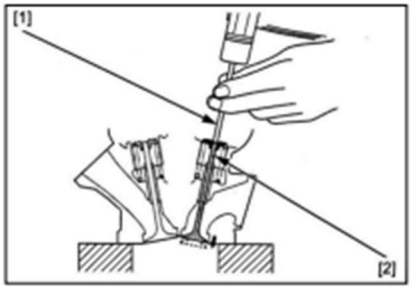


- Assemble valve clip [1] by tools for this work only.
- Hold up cylinder head on working bench to prevent damaging valve. Put suitable tool [1] into guiding tube [2] of valve. Slightly knock the tool for a stable assembly for valve clip.

Assemble parts below:

- Coolant temperature sensor
- Spark plug





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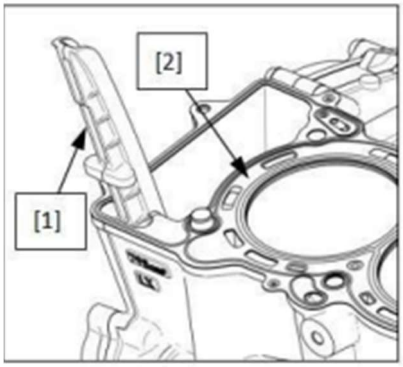
Assembly

- Clean up residual gasket on contact surface of cylinder.
  Caution:
- Please don’t let dust and impurity drop into cylinder.
- Before assembling, please confirm once again if there is damage, collision, scratch, impurity and distortion on contact surface of cylinder head.
- Assemble chain guiding plate [1], align its protrusion to groove on cylinder, make sure its bottom is in groove on crankcase.
- Assemble positioning pin and new gasket [2].
- Get timing chain through cylinder head, then assemble cylinder head onto crankcase body.



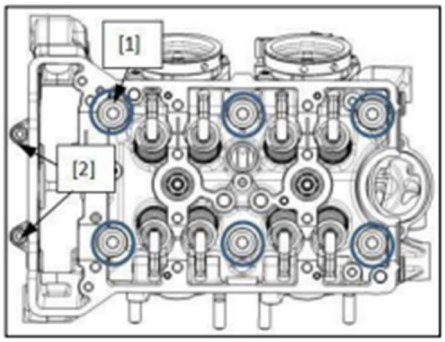
Caution:

- Please don’t let positioning pin scratch contact surface of cylinder head when assembling.
- Make sure the positioning pin is correctly assembled.
- Totally clean up threaded part and base surface for bolt M9 for cylinder head fastening, then wipe them up. Coat threaded part of bolt for cylinder head with engine oil. Alternatively assemble and fasten cylinder head bolt by 2-3 times, then fasten to given torque.

Torque: The 1st step is 5N.m, 2nd is 15N.m, 3rd step by 90°, 4th step by 90°.

- Assemble and fasten bolt (M6) [3] for cylinder head.

Torque: 11N.m



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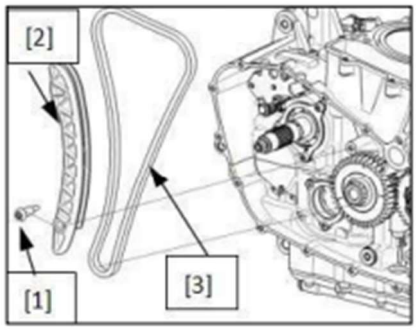
Timing chain/Tensioning plate

Removal

Remove parts below:

- Cylinder head kit.
- Right crankcase cover kit.

- Remove bolt [1] of guiding plate from case body.
- Remove tensioning and guiding plate [2].
- Remove timing chain [3].



Inspection

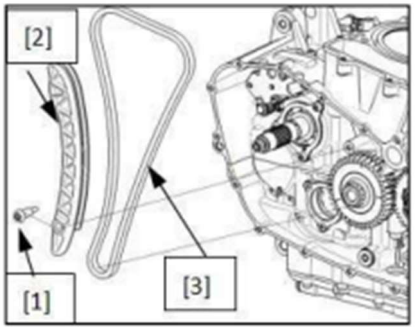
Check if there is scratch, damage, wear-out and distortion on parts below. Please replace if it is necessary.

- Timing chain.
- Chain tensioning plate.

Assembly

- Coat all the surface of timing chain [3] with oil, get it through chain chamber and suspend it onto timing and driving wheel of crankshaft.
- Get tensioning plate [2] through chain chamber and assemble it to case body.
- Coat threaded part of bolt of tensioning plate with Loctite and get it through the plate and fasten it in place.

Torque: 12N.m.



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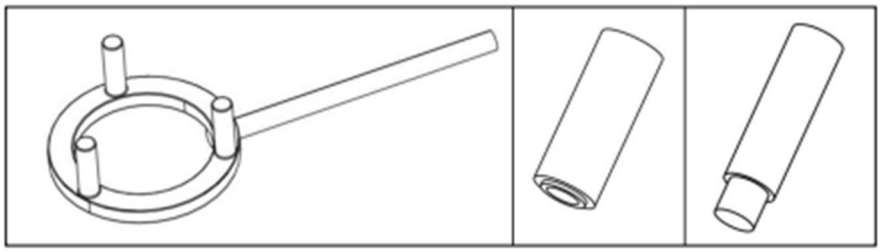
6 Clutch and gearshift kit

Maintenance

Summary

- The maintenance for clutch and gearshift device in this chapter needn't remove the engine from frame.
- The oil level and viscosity has influence on separation of clutch. When the clutch failed to separate or the motorcycle is still in low speed when clutch separated, please check the oil level before clutch maintenance.

Tool(S):



Specification for clutch and gearshift device

Unit：mm

Items		**Standard**	**Maintenance limit**
Clutch	Spring free length	50.4	**49.5**
	Driving plate thickness	2.92-3.08	2.8
	Driven plate thickness	2.22-2.32	2.1
	Driven plate flatness	0.1	0.3
Clutch collar	Internal diameter	24.992-25.007	25.02
	External diameter	34.992-35.005	34.98
Gearshift arm kit	Diameter for gearshift spindle	11.957-11.984	11.93

Troubleshooting

Too strong the pushing for clutch lever or too weak

- Lower hydraulic pump for clutch seized up
- The pushing kit of clutch got damaged
- Malfunction in bearing of clutch's pushing rod
- Hydraulic oil is not enough

Clutch skidding in acceleration

- Hydraulic kit jamming or failed to return
- Driving friction plate worn out
- Poor performance for clutch spring

When clutch separated or failed to separate, the motorcycle is still under low speed

- Too wide the free travel of clutch lever, separation for clutch is not enough
- The flatness for friction plate is not correct
- Wrong viscosity or incorrect additive
- Wrong operation for clutch

Difficult gearshift

- Incorrect adjustment for clutch play
- Wrong operation on clutch
- Wrong viscosity of oil
- The gearshift fork gets damaged or bent
- The shaft of gearshift fork gets bent
- The claw of gearshift fork gets bent
- The five-star shaped turning plate gets damaged
- The guiding groove on gearshift drum gets damaged

Gearshift plate fails to return

- The poor elasticity of returning spring of gearshift spindle or it gets cracked
- Gearshift spindle gets bent or damaged

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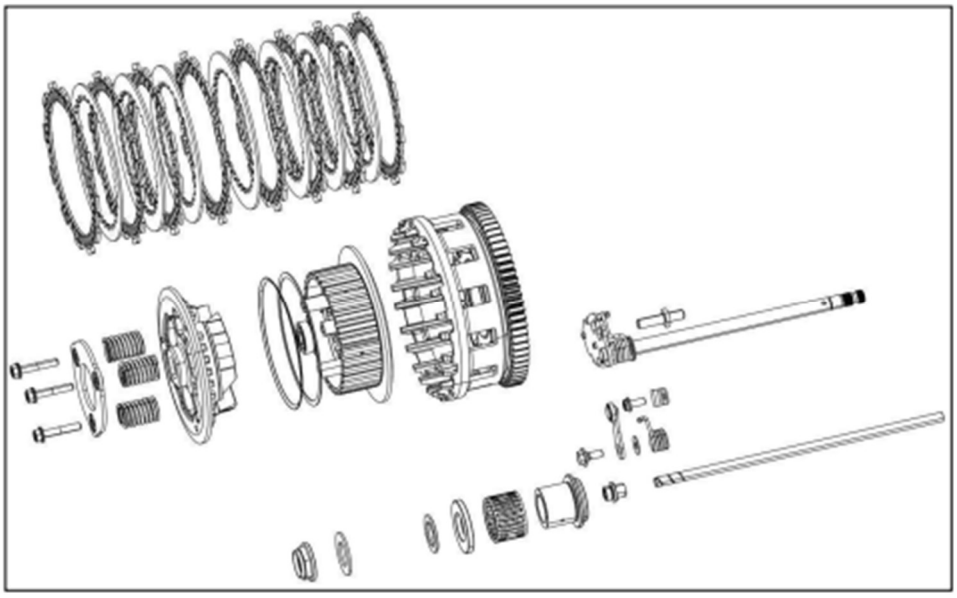
Components layout



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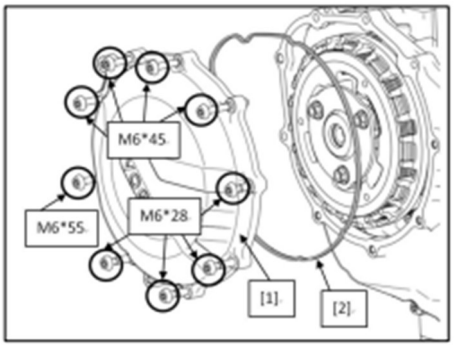
Clutch

Removal

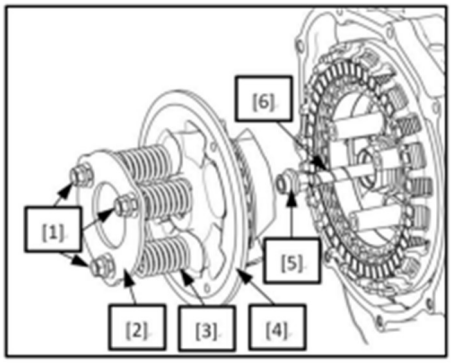
- Remove 9 pieces bolt of operation cover of clutch.
- Remove operation cover [1] of clutch and seal ring [2].



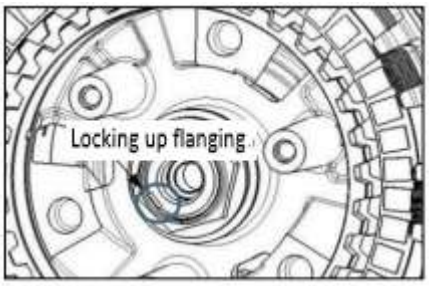
- Loosen bolt [1] of clutch lift plate alternatively and by 2-3 times, remove bolt, lift plate [2] and main spring [3] of clutch.
- Remove clutch pressing plate [4], pushing bar [5] and ejection bar [6].

Caution:

- When clutch lift cover removed, please don’t press down clutch operation lever, otherwise the lower pump of clutch may damage.



- Break up locking flange on locking nut at clutch center.
  Caution:
- Please don’t damage threaded part of main shaft.



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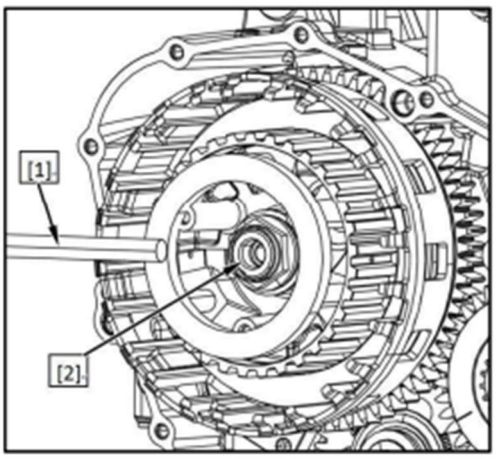
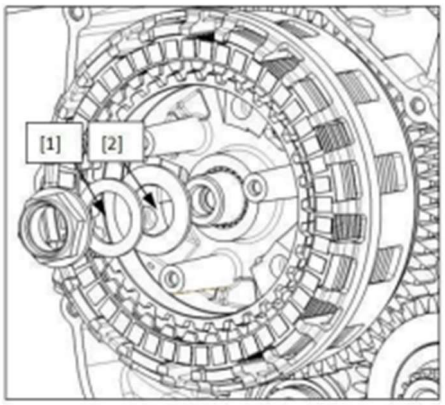
- Fix clutch central case by its fixing tool [1]. Remove locking nut [2].

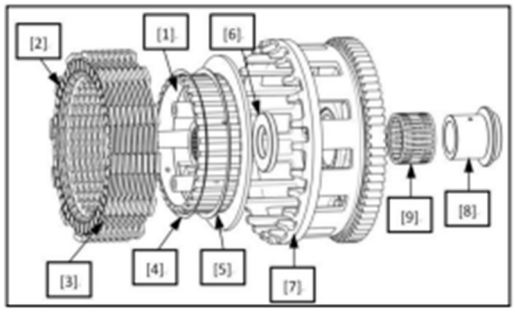


- Remove disc shaped washer [1] and flat washer [2].



Remove the parts below:

- Central case [1]
- Clutch driving plate [2]
- Clutch driven plate [3]
- Disc shaped washer [4]
- Flat washer [5]
- Flat washer [6]
- Clutch outer case [7]
- Clutch collar [8]
- Clutch needle bearing [9]



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Inspection

Check and confirm if there is scratch, damage, wear-out and distortion on parts below. If there is malfunction above, please replace.

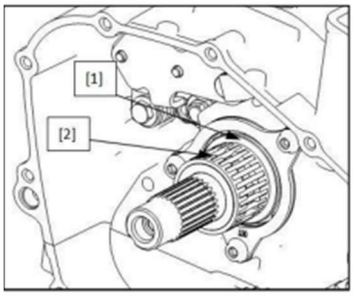
- Clutch pushing bar
- Bearing for clutch lift plate
- Clutch lift plate
- Spring
- Central case
- Flat washer

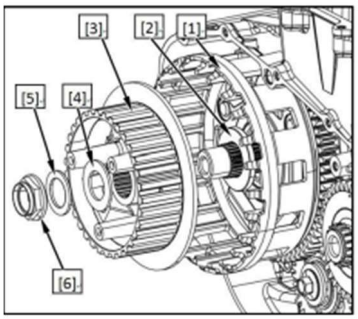
- Disc shaped spring
- Clutch driven plate
- Clutch outer case/Primary driven gear/Needle bearing
- Clutch collar

Check each part according to specification for clutch and gearshift kit, any part passed maintenance limit, please replace.

Assembly

- Coat external surface [1] of clutch outer collar with oil, then assemble it onto main shaft.
- Assemble needle bearing [2] to external surface of clutch collar.





- Assemble clutch outer case [1], flat washer [2].
- Assemble clutch central case [3] get spline of central case aligned to external spline of main shaft.
- Assemble flat washer [4].
- Assemble disc shaped washer [5], please get mark “OUTSIDE” facing outside.
- Coat threaded part of clutch locking nut with fresh oil.
- Assemble locking nut [6] to main shaft.
- Fix central case by tool, then fasten the locking nut to given torque, then get the flange pf nut to groove on main shaft.

  Torque: 190N.m

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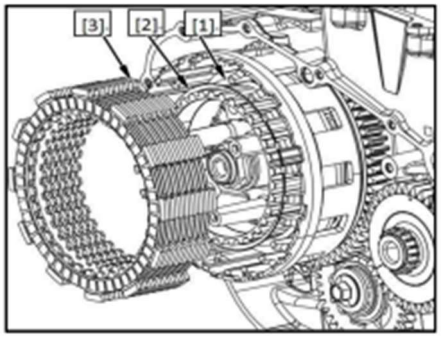
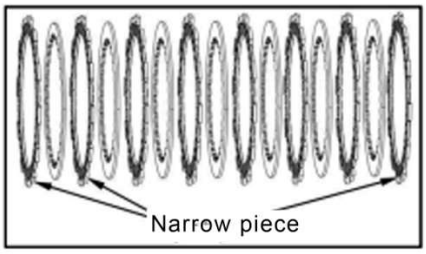
  Assemble flat washer and butterfly shaped spring to central case.
- Coat clutch plate with fresh oil.
- From driving plate [3], assemble driving and driven plate [4] in turn.



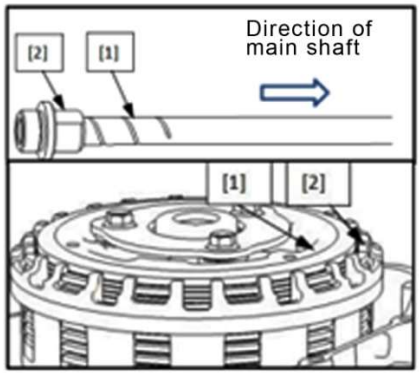
Caution:

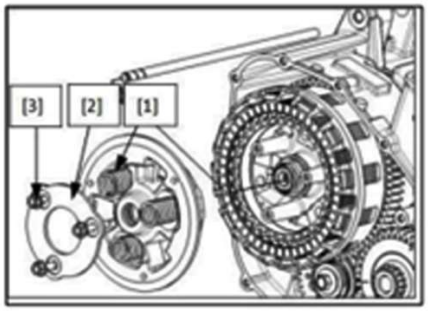
- The bigger end of disc shaped washer [3] faces outside.
- The 1st, 7th and 8th driving plate are narrow ones, others are wide ones.
- Align the 7th driven gear's teeth to that of pressing gear, others align to teeth of central case.
- Replace driving and driven plates as a complete kit.



Assemble tappet [1] inside main shaft hole, whose oil groove faces outside.

- Assemble smaller pushing bar [2] and whose flat end facing to main shaft.
- Align teeth of pressing plate to that of driven plate, then assemble pressing plate to central case.
  Caution:
- Confirm if the pressing plate is assembled in place as figure shows, the inclining end of pressing plate surface [1] aligns to end surface of [2] of outer case, if the height difference falls short of meeting demands, it mostly because the driven plate on top fails dropping into groove on pressing plate, whose re-assembly is necessary.
- Assemble clutch main spring [1], lift plate [2] and its bolt [3], then fasten to given torque.
  Torque: 12N.m





- Caution: Replace clutch spring as a complete kit.

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Clutch lower hydraulic pump

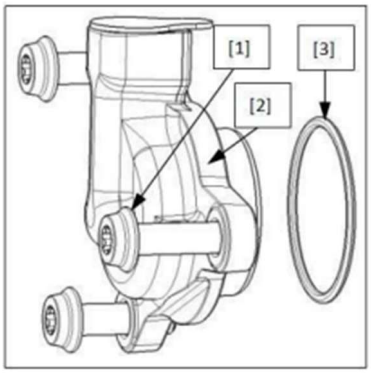
Removal

When removing hydraulic lower pump separately, it needn't break down clutch. Remove related parts sheltering the pump.

- Remove 3 pieces of fastening bolt [1].
- Remove clutch lower hydraulic pump [2] and seal ring [3].

Caution:

- When the pump removed, please don't press down the clutch operation lever.
- Please don't break down the lower pump, if replacement is necessary, please replace the complete pump kit.



Assembly

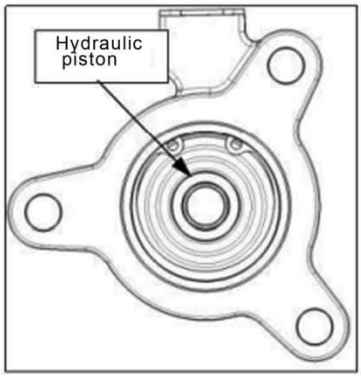
- The re-assembly is opposite to disassembly.

- When assembling the bolt, please coat the threaded part with Loctite and fasten it to given torque by 2-3 times.

Torque: 10N.m

Caution:

- If replace the lower pump for a new one, please check and press down it piston until could be easily pushed and moved, then assemble it into hole of case body.
- When fastening the bolt, please pay attention to whenever if the pump is jamming in hole of case body, make sure assemble 3 pieces of bolt by several times with evenly force, otherwise please take the pump body and assemble once again.
- If replace the pump body for a new one, please fill up with fresh hydraulic oil once again, then exhaust air in it.

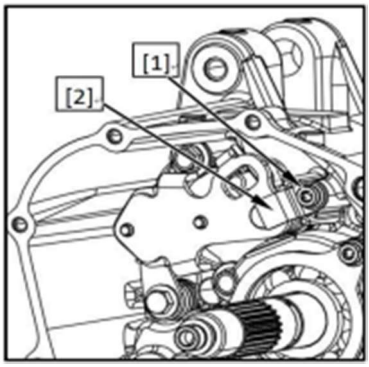


Gearshift kit

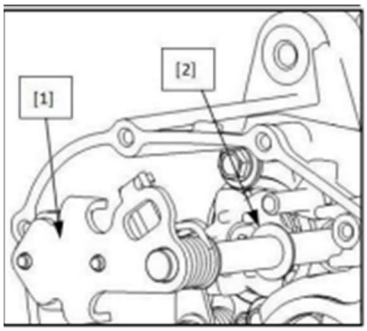
Removal

Before removing, please disassemble clutch kit and gearshift pedal kit.

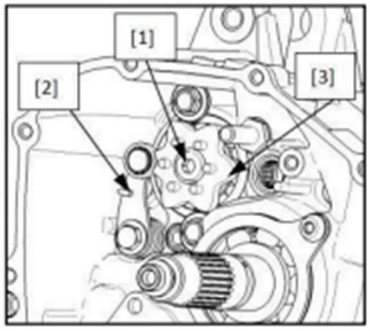
- Clean up dirt on spline of gearshift spindle.
- Remove bolt [1] and limit plate [2].



- Pull out gearshift spindle kit [1] and thrust washer [2] from crankcase.



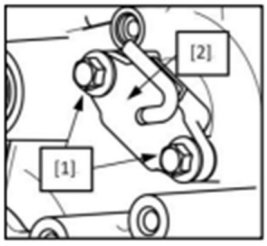
- Remove fastening bolt [1] for five-star plate.
- Pry up check plate [2] by screwdriver, then remove five-star plate [3] as figure shows.



Remove parts below:

- Positioning pin [1]
- Positioning bolt [2] of check plate
- Check plate [3]
- Flat washer [4]
- Returning spring [5]

- Remove bolt [1] for gear indicator then remove gear indicator [2].



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Inspection

Check if there is damage, wear-out or distortion on parts below, please replace if it is necessary.

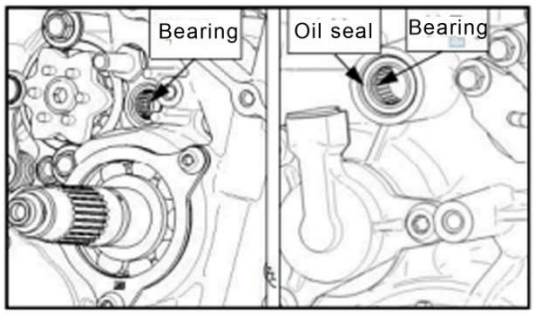
- Five star plate
- Check plate
- Returning spring of check plate
- Needle bearing of gearshift arm
- Oil seal of gearshift arm

Caution:

- Because the needle bearing on both sides of gearshift arm are assembled on case body in advance, please check them on case body directly to confirm if it is necessary to be replaced, if replacement is needed, please

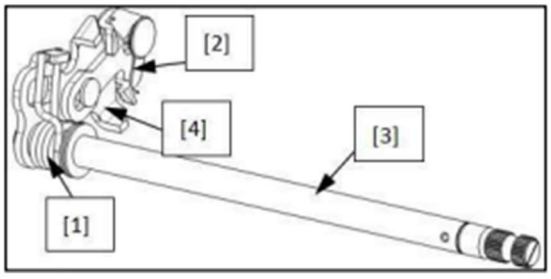
remove the bearing by their pulling device, then press-fit new bearing to bottom of hole for bearing.

- Check oil seal of gearshift arm on case body directly to confirm if it is necessary to replace, if replacement is needed, please press-fit oil seal when gearshift kit already assembled in place.



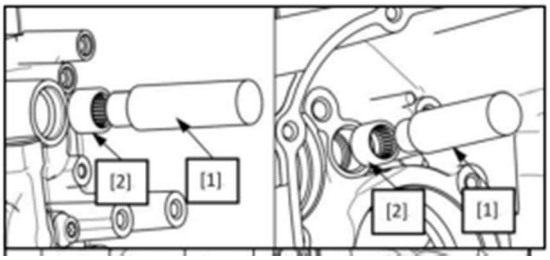
Gearshift arm

- Check if there is damage or fatigue on twist spring [1] of gearshift arm and spring [2] for gearshift turning plate, please replace the gearshift arm kit if it is necessary to be replaced.
- Check if there is wear-out or bending on gearshift spindle [3].
- Check if there is damage, wear-out or distortion on turning plate [4] of gearshift. If replacement is needed, please replace gearshift arm as a complete kit.

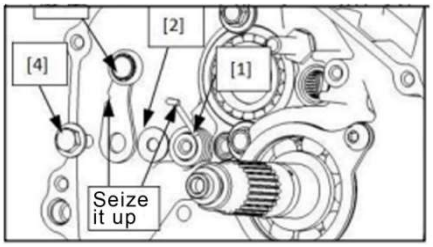


Assembly

- Press-fit 2 pieces of needle bearing [2] onto upper case body by tool [1], if bearing needn't to be replaced, this step could be ignored.

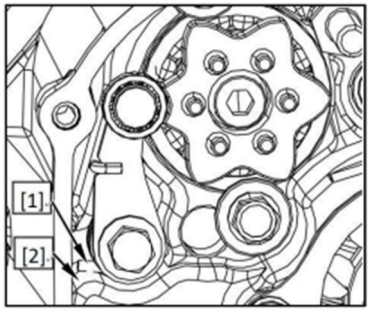


- Coat threaded part of bolt of check plate with Loctite.
- Assemble returning spring [1], washer [2] and check plate [3], then get the hook of spring into groove of check plate.
- Assemble and fasten bolt [4] of check plate to given torque.
  Torque: 12N.m

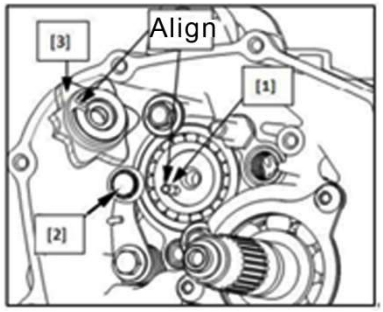


Caution:

- Please correctly assemble twist spring end [1] and protrusion [2] on case body.
- Check plate and ensure its normal swinging.

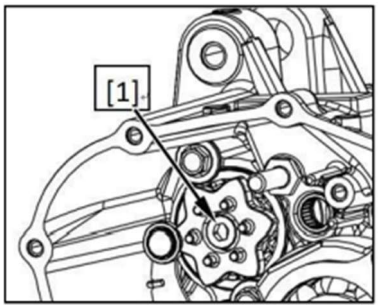


- Assemble positioning pin [1] to its hole on gearshift drum.
- Fix up check plate [2] by screwdriver.
- Assemble five-star plate [3], then align the groove on it to positioning pin.

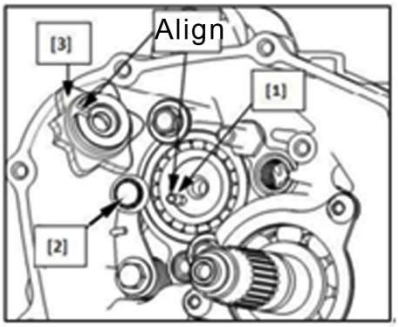


- Coat threaded part of positioning bolt [1] of five-star plate with Loctite. Assemble fixing bolt for five-star plate, then fasten to give torque.

Torque:24N.m

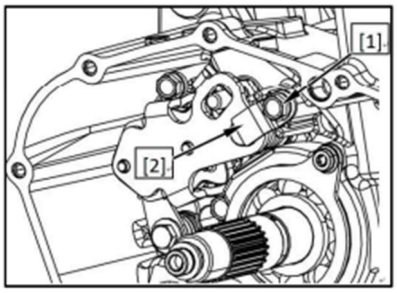


- Coat the external surface of gearshift spindle with fresh oil. Assemble thrust washer [1] and gearshift arm [2] into crankcase, then align installation hole of returning spring to locating bolt of gearshift arm.

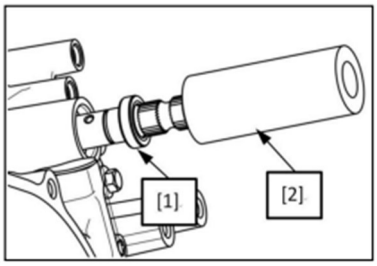


- Coat threaded part of bolt of pressing plate with Loctite.
- Assemble pressing plate [2] and bolt [1], then fasten to given torque.

Torque: 12N.m



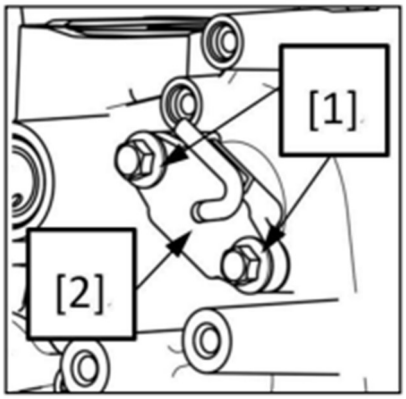
- Get lip of oil seal [1] inward and press-fit it onto case body by tool[2], the distance between upper surface of oil seal to surface of bearing hole is 1.5mm. If it needn't replace seal ring, this step could be ignored.



- Assemble gear indicator [1] along direction of wire outwards side onto upper case body, then fasten the 2 pieces of bolt [2] to given torque.

  Torque: 3N.m

  Caution:
- Check and confirm smooth gearshift when assembled.

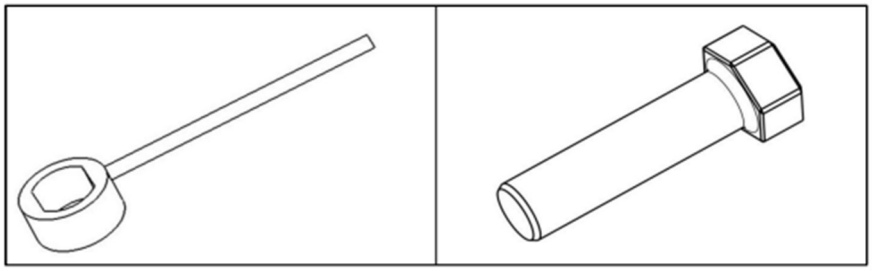


7 Electric starting kit

Summary

- The chapter introduces maintenance for stator, rotor of magneto and electric staring kit. All operation above needn’t remove the engine from frame.
- The side cover of this engine is coated with sealant, when maintenance finished, please put it aside and wait above 4 hours to let the sealant totally dried up, before that, please don’t start engine, otherwise the sealing performance of cover would be poor even lead to oil leakage from engine.

Tool(S):



Specification for electric starting kit

Unit:mm

Items	Standard	Limit
External diameter for shaft jacket of starting plate shaped gear	51.705-51.718	51.685
Internal diameter for outer case of starting clutch	68.364-68.390	68.42

Troubleshooting

Starting motor is running, while engine failed starting

- Malfunction in starting clutch
- Malfunction in double gear or its shaft of starting motor
- Smaller gear of starting motor in malfunction or worn out
- Malfunction in driving gear of starter
- Malfunction in socket plug of trigger or wire connection

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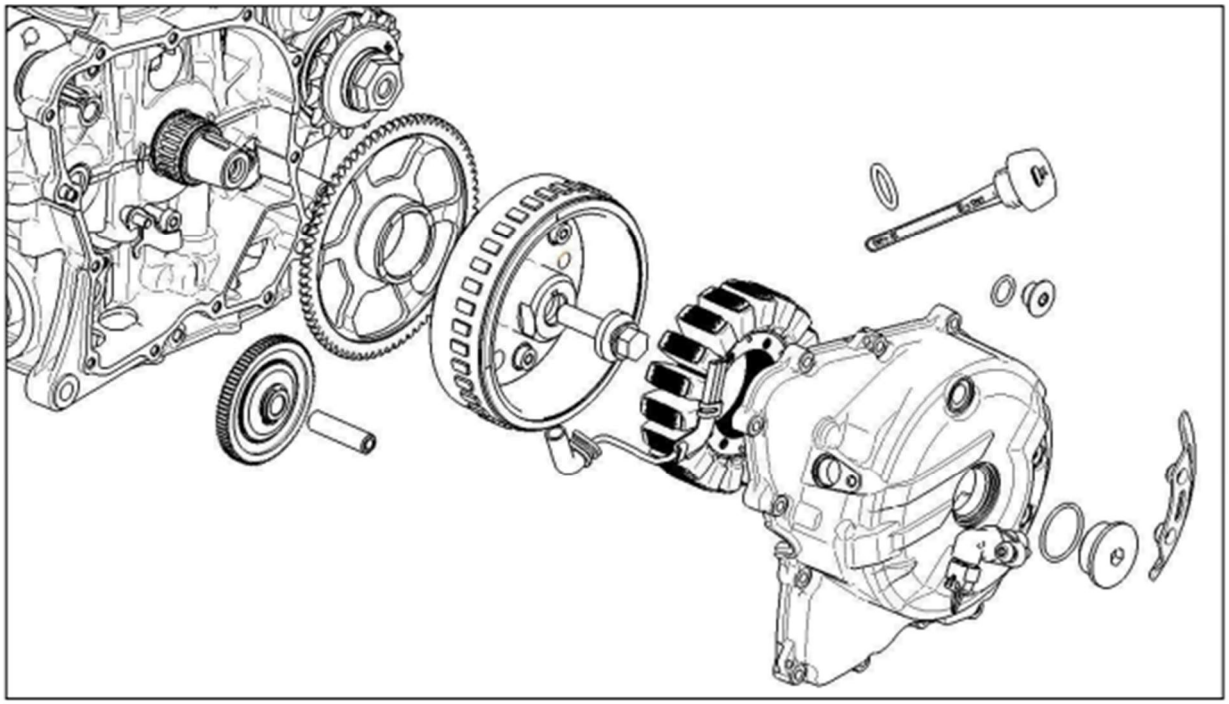
Components layout



Left crankcase cover

Disassembly/Re-assembly

Caution:

- When removing left crankcase cover, lay a clean oil tray under engine to prevent oil flowing out. When re-assembled, fill up with appointed oil to given level.
- When removing, please keep motorcycle upright on flat ground.

Remove parts sheltering left front cover, then cut off socket plug of trigger and connector of magneto starter.

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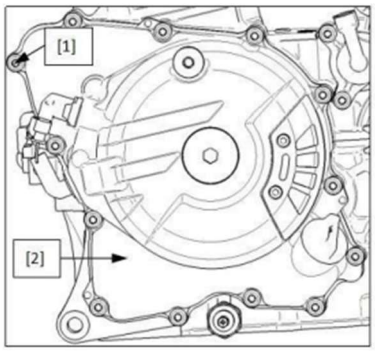
Loosen bolts [1] for left front cover by diagonal sequence and several steps.
Remove the parts below:

- Oil gauge
- Bolt
- Left front cover [2]

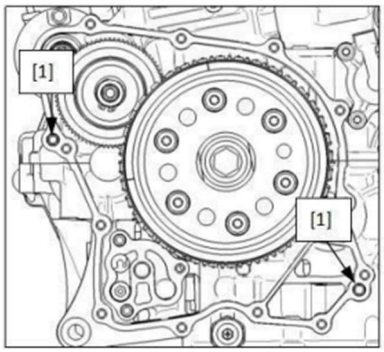
Caution:

- The left front cover (Stator) is under magnetic stress from rotor, please be careful when removing it.



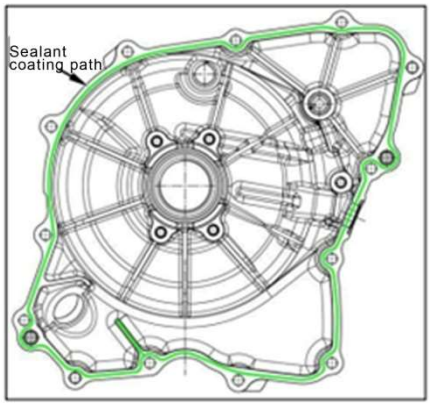
- Remove positioning pin [1].
- Clean up residual gasket on contact surface of crankcase and its cover.
  The re-assembly is opposite to disassembly.

Torque:
Bolt of left front cover: 11N.m



Caution:

- Coat contact surface of crankcase with sealant for end surface as figure shows.
- Coat contact surface between V-shaped rubber of wire outlet port of stator and cover with sealant.



Magneto stator and trigger

Removal/Re-assembly

Remove left front cover.

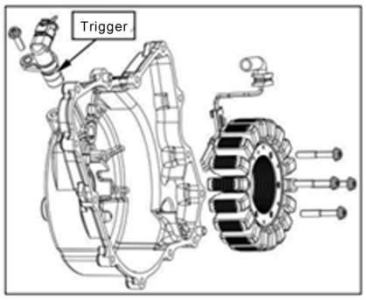
- Remove fastening bolt of installing stator and trigger.
- Remove trigger and stator of magneto.

  Caution:
- Coat threaded part of bolt for stator and trigger with Loctite.
- Coat contact surface between V-shaped rubber of wire outlet port of stator and cover with sealant.

The re-assembly is opposite to disassembly.

Torque:

Bolt for trigger and magneto stator: 11N.m

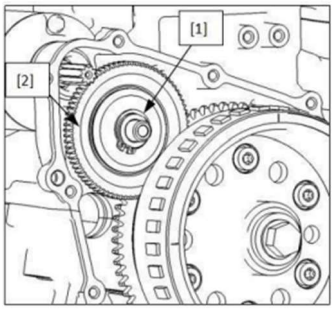


Rotor of magneto

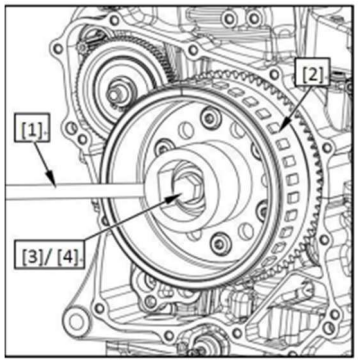
Removal

Remove left front cover.

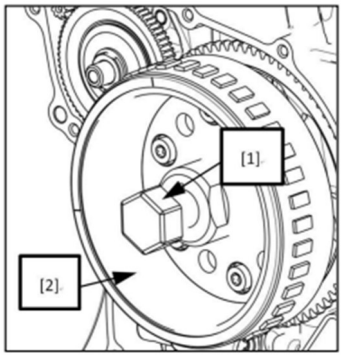
- Remove double gear [2] and its shaft [1].



- Fix rotor [2] by its fixing tool [1], then remove bolt [3] and washer [4].



- Remove rotor [2] by its removal tool [2].



Inspection

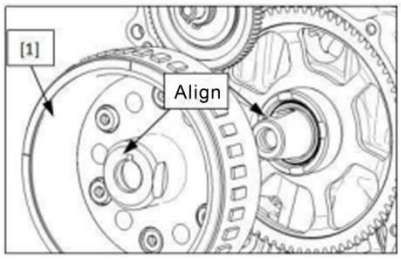
Check and confirm if there is scratch, damage, wear-out or distortion on parts below, please replace for a new one if it is necessary.

- Double gear shaft
- Double gear
- Semi-round key
- Needle bearing

Assembly

- Totally clean up oil in hole of rotor and taper surface of crankshaft.
- Assemble rotor [1], please align semi-round key on crankshaft to its groove on rotor.

  Caution:
- Before assembling, please confirm correction assembly of semi-round key and without dropping off, if it dropped off, it may damage engine.



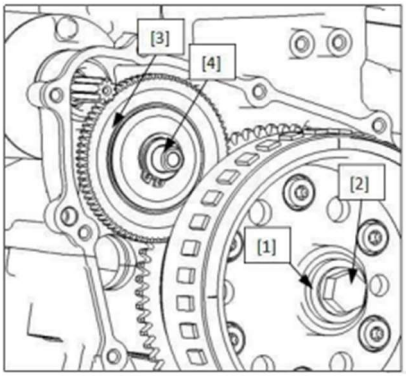
- Coat threaded part of rotor bolt with fresh engine oil.
- Assemble washer [1] and rotor bolt [2].

- Fix magneto rotor by its fixing tool, then fasten the bolt to given torque.
  Caution:
- Please adopt fixing tool for rotor to prevent turning.

Torque:

Fastening bolt for magneto rotor: 135N.m

- Coat external surface of double gear shaft with oil.
- Assemble double gear [3] and its shaft [4].



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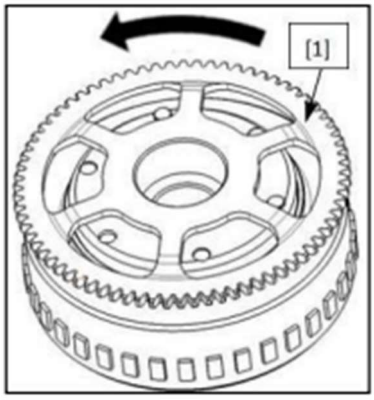
Starting clutch and plate-shaped gear

Inspection for operation of starting clutch

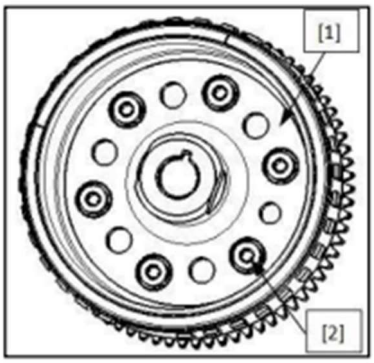
- Remove rotor
- Check operation performance by turning plate shaped gear [1].
- Check smooth counter clockwise turning for plate gear without clockwise turning.



Removal

Remove rotor.

- Turn the plate gear counter clockwise and remove it.
- Fix rotor [1] of magneto, then remove fastening bolt [2] of starting clutch.



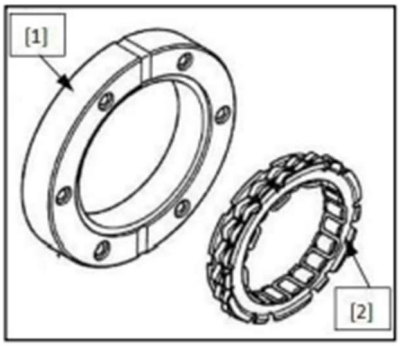
- Remove starting clutch kit.
- Remove starting clutch [2] from its outer case [1].

Inspection

Check if there is scratch, damage, wear-out or distortion on parts below, please replace if it is necessary.

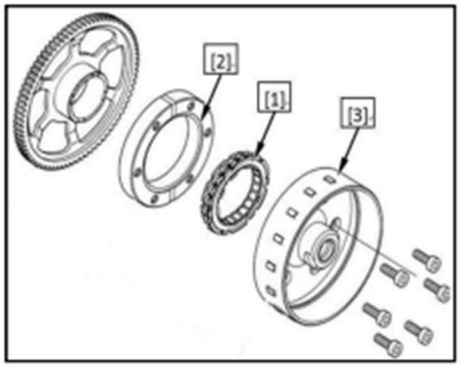
- Plate shaped gear
- Outer case of clutch
- Starting clutch

Make sure each part meet demand of system specification of electric starting kit. Any part passed maintenance limit, please replace.



Assembly

- Coat contact surface of clutch with fresh engine oil.
- Assemble starting clutch [1] to outer case [2] of it.
- Assemble starting clutch kit to rotor [3].



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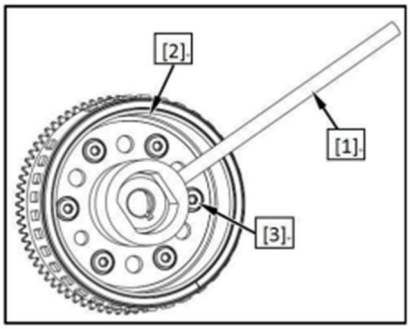
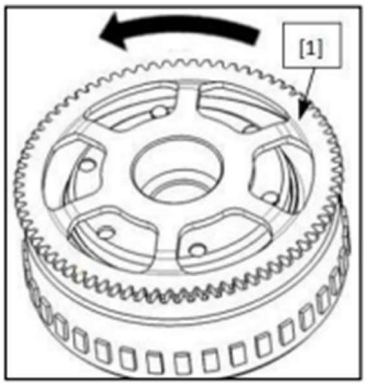
Fix the rotor [2] by its fixing tool [1].

- Coat threaded part of clutch fastening bolt with Loctite.
- Assemble and fasten 6 pieces of fastening bolt to given torque.

Torque: 29N.m



- Turn the plate shaped gear [1] counter clockwise, the assemble the gear into outer case of starting clutch.
- Check operation performance of starting clutch.



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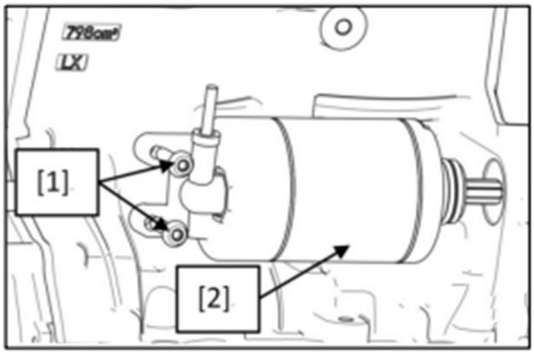
Starting motor kit

Removal/Re-assembly

- Remove wire joint of starting motor.

  Caution:
- When removing, please fix lower nut of wire joint by spanner to prevent the turning and damage exposed wire joint of motor.
- Remove fastening bolt [1] of starting motor.
- Move starting motor [2] backwards and remove it.



Inspection:

Check and confirm if there is scratch, damage, wear-out and distortion on parts below. Please replace if it is necessary.

- Seal ring of starting motor.
- The flexibility for starting motor only.

Make sure each part meets demand of specification for electric starting kit. Any parts passed maintenance limit, please replace.

The re-assembly is opposite to disassembly.

Torque:

Fastening bolt for starting motor: 11N.m

Caution:

- When assembling, please fasten bolt on upper side first, then the lower one.

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8 Case body and transmission system

Maintenance information

Summary

Break up the crankcase for the maintenance below：

- Transmission system
- Crankshaft

Remove the parts below before breaking up crankcase:

- Left front cover kit
- Magneto rotor and plate-shaped gear
- Main, sub oil pump and related accessories.
- Oil water exchanger and water tube
- Secondary oil filter
- Right crankcase cover
- Driven sprocket of oil pump
- Clutch kit and its accessories
- Oil bottom case kit
- Oil absorbing tube kit and its accessories
- Cylinder head kit
  - Please don’t damage the combination surface of case body when repairing.
  - Wash and clean the oil passage before re-assembling crankcase.
  - Before combining the case, coat the combination surface with sealant for end surface evenly, the surplus sealant needn’t be cleaned up.
  - Select shaft pad for connective rod, main shaft and balancing shaft according to correct color, select the shaft pad according to the requirement in its <Selection Table>, wrong oil gap may heavily damage the engine.

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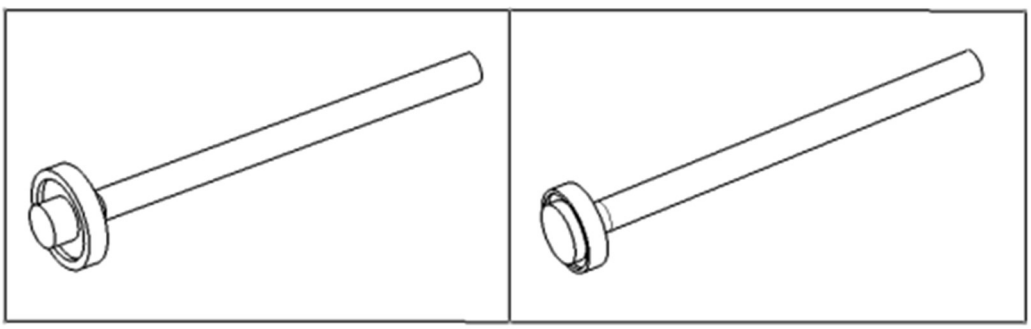
Tool(S):



Specification for case body and transmission system

Unit：mm

Items		Standard	Maintenance limit
Transmission device	Inner hole diameter for 5/6th gear of main shaft	31.025-31.050	31.10
	Outer diameter for collar of 5/6th gear	30.984-31.000	30.96
	Inner diameter for collar of 5/6th gear	28.000-28.021	28.04
	Outer diameter for main shaft gear end	27.967-27.980	27.92
	Gap between collar and 5/6th gear of main shaft	0.025-0.066	0.10
	Gap between 5th gear collar and main shaft	0.020-0.054	0.10
	Hole diameter of 2/3/4th gear of counter shaft	36.000-36.021	36.04
	Outer diameter of collar of 2/3/4th gear of counter shaft	34.959-34.975	34.92
	Gap between collar and 2/3/4th gear of counter shaft	0.025-0.062	0.10
	Inner diameter of 2nd gear collar of counter shaft	33.000-33.021	33.04
	Journal size of counter shaft	32.959-32.980	34.92
	Gap between collar and shaft	0.020-0.062	0.10
Fork and its shaft	Shaft diameter of turning fork shaft	11.957-11.968	11.95

	Fork inner diameter	12.000-12.018	12.03
	Gap between fork and shaft	0.032-0.061	0.08
	Thickness of fork tip	5.93-6.00	5.9

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Troubleshooting

Difficult gearshift

- Gearshift fork got distorted
- Gearshift's shaft got distorted
- Ratchet of gearshift's fork got distorted
- Guiding groove on gearshift drum got damaged
- Gearshift arm got distorted
- Check plate damaged

Noisy engine

- Transmission gear got worn out or damaged
- Transmission bearing got worn out or damaged

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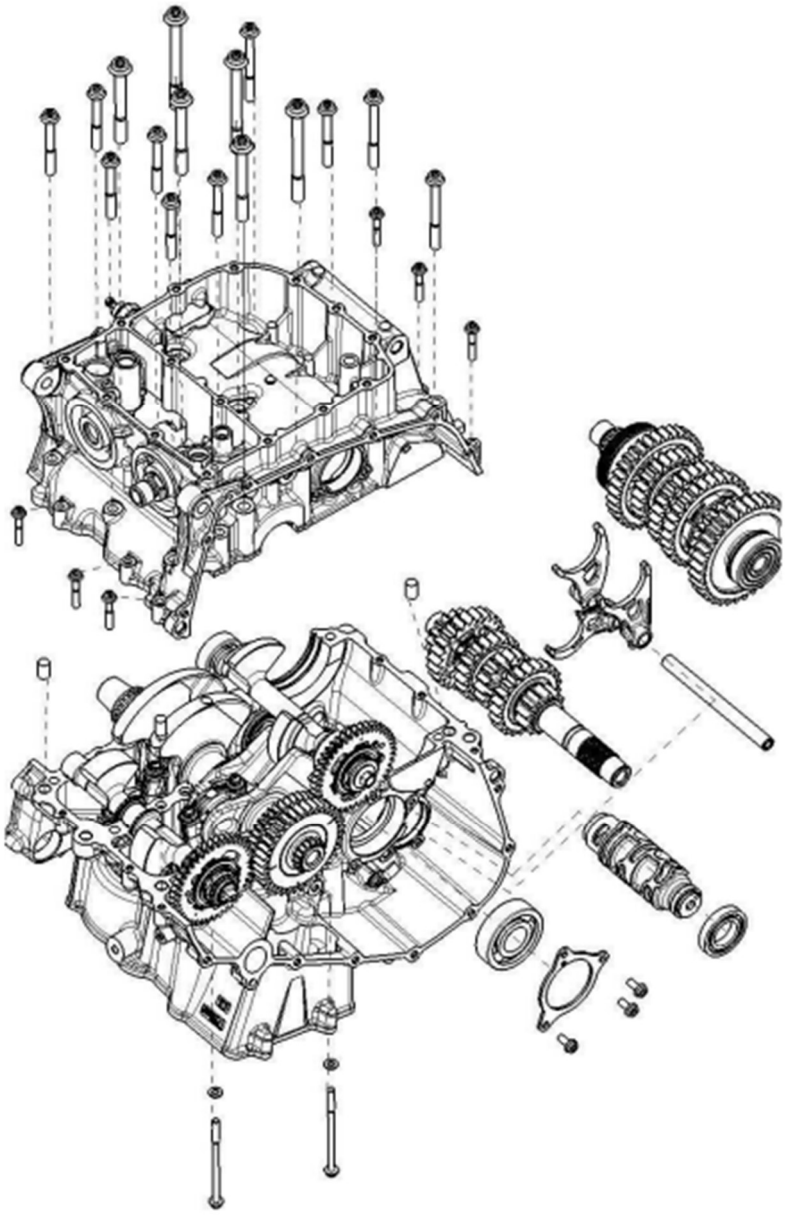
Components layout



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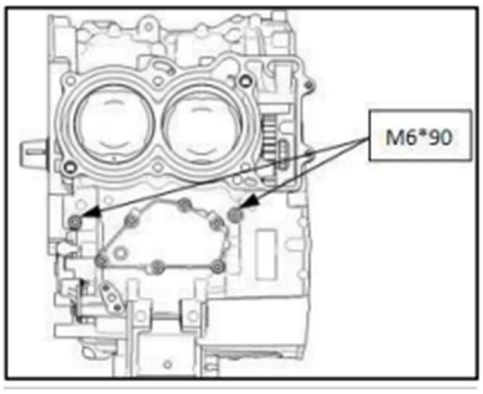
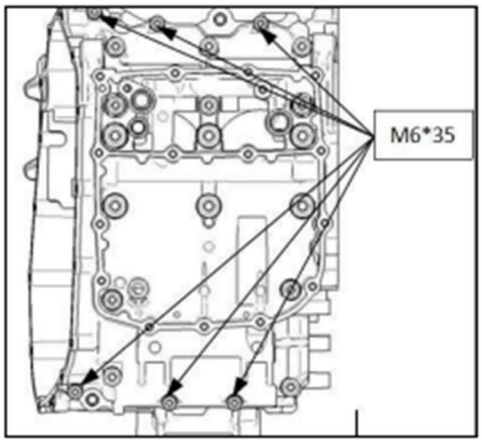
Crankcase body

Removal

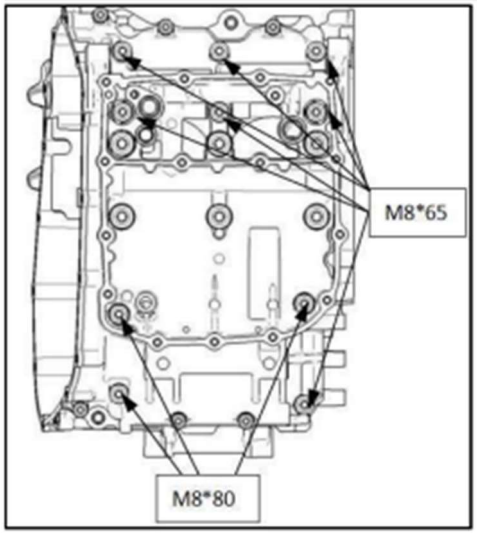
- Remove other parts impacting case body breaking-up.
- Loosen and remove 2 pieces of bolt M6*90 on direction of cylinder and copper washer.



- Turn over the crankcase body.
- Loosen and remove 6 pieces of bolt M6*35 as figure shows by 2-3 times.



- Loosen and remove 10 pieces of bolt M8 on case body by 2-3 times.



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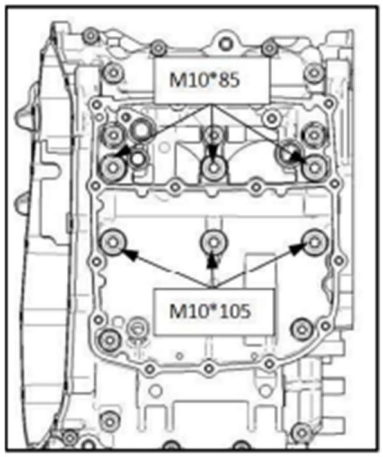
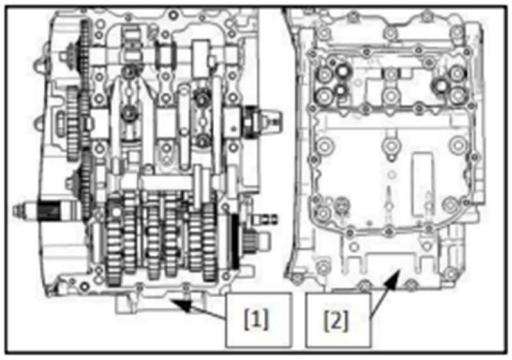
- Loosen and remove 6 pieces of bolt M10 on case body as figure shows by 2-3 times.



- Remove lower crankcase body [2] from upper crankcase body [1].

Caution:

- Please don't pry up contact surface of crankcase by screwdriver, otherwise the contact surface may damaged and bad for sealing performance.
- Remove the parts need to be repaired. (Please refer to corresponding chapter in Service Manual.



Assembly

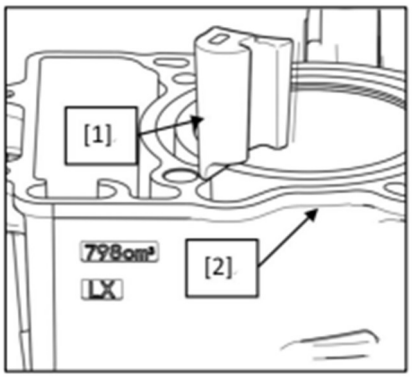
- Wash contact surface between upper and lower case body, remove original sealant, please don't damage the contact surface.
- Check if there is oil passage blocking-up, wash oil passage if it is necessary.
- If case body needs to be replaced, assemble the upper and lower case body, if it needn't, please ignore assembly for case body, assemble other parts directly.

Caution:

- If replacement for case body is necessary, please replace the upper and lower ones together as a kit, please don't replace one of them singly.

Assembly for upper case body

- Assemble rubber bar [1] of water proof into upper case body [2] as direction showing in figure, the press-fit the rubber bar, until upper end surface is not higher than upper surface of cylinder body.
- Assemble other parts of upper case body. (Details please refer to corresponding part in this Manual).



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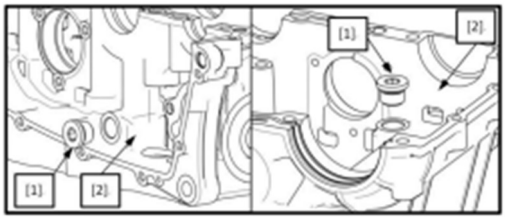
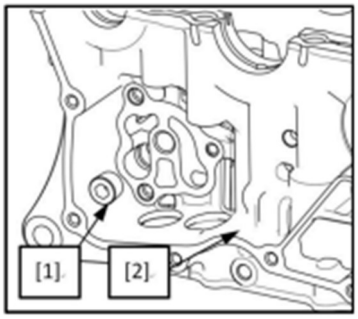
Assembly for lower case body

- Coat 2 pieces of socket hex. screw [1] with Loctite then assemble into lower case body [2].

Assembling torque for socket hex. screw: 22N.m



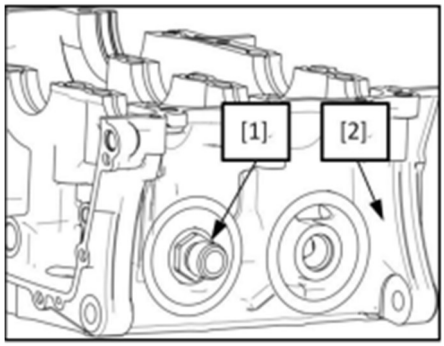
- Coat one plug [1] with Loctite and then assemble into lower case body [2].



- Coat bigger end of tube joint [1] with Loctite then assemble into lower case body [2].

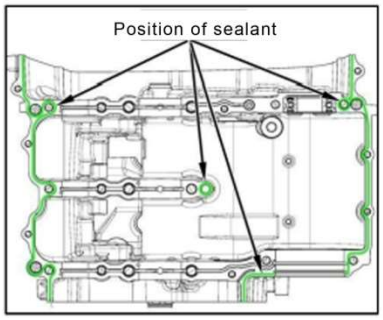
Torque: 27N.m

- Assemble other parts of lower case body. (Details please refer to corresponding part in this Manual).



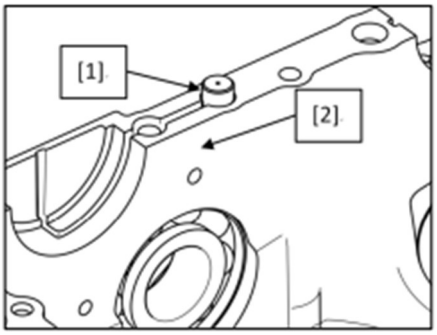
Case combination

- Evenly coat contact surface of lower body with sealant.
  Caution:
- Too much coating is not allowed.
- Please don’t coat place of shaft pad and oil passage with sealant.

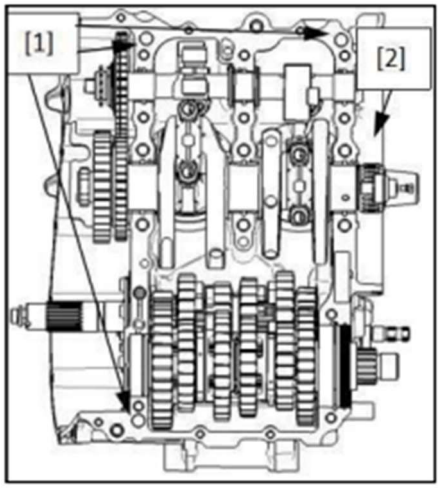


Wash plug of oil passage

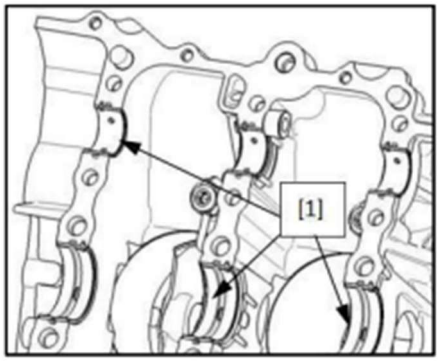
- Check if there is blocking-up in oil passage plug, please replace the plug if it is necessary.
- Assemble plug [1] of oil passage onto upper case body [2], when assembling, get the side with bigger hole diameter faces to upper case body.



- Assemble 3 pieces of positioning pin [1] into upper case body [2].



- Coat shaft pad [1] of journal of main shaft in lower case body with oil.



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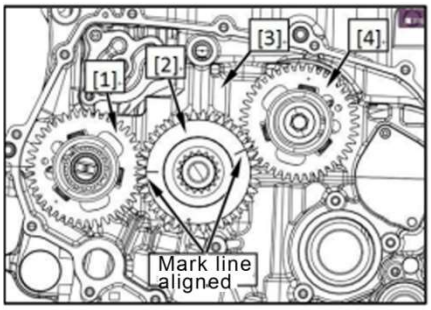
- Before case combination, please turn the crankshaft, get piston of left cylinder at upper stopping point, confirm scale lines on driven gear [1] of front balancing shaft and driven gear [2] on balancing shaft of crankshaft aligned while meshing up correctly.
- Take lower case body [3] for combination, meanwhile turning rear balancing shaft [4], get scale lines on driven gear of rear balancing shaft and driving gear on balancing shaft of crankshaft aligned while meshing up correctly.

  Caution:
- Please don’t get rid of sealant when combining cases.
- When case combination achieved, please check gear alignment between front, rear balancing shaft and crankshaft as picture shows.

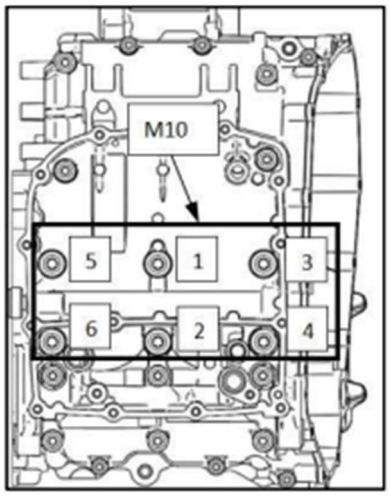


Assemble case combination bolt.

Caution:

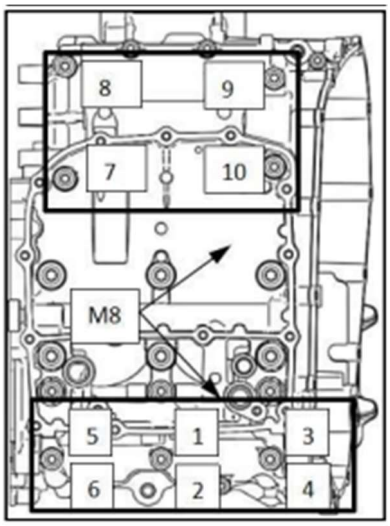
- Fasten bolt of main shaft journal in crossing angle.
- Coat threaded part of bolt M10 and M8 with oil before assembling to increase axial stability of extension.
- When assembling, please don’t wipe up oil on bolt surface.
- Confirm the firm assembly of upper and lower crankcase body.
- Pre-fasten 6 pieces of bolt M10 to 10N by 2-3 times as figure shows.
- Turn 6 pieces of bolt M10 by 80˚ as sequence showing in figure.

Torque: 10N.m+80˚



- As figure shows, pre-fasten 10 pieces of bolt M8 to 5N by 2-3 times.
- Fasten 10 pieces of bolt M8 by 80˚ as figure shows.

Torque: 5N.m+80˚



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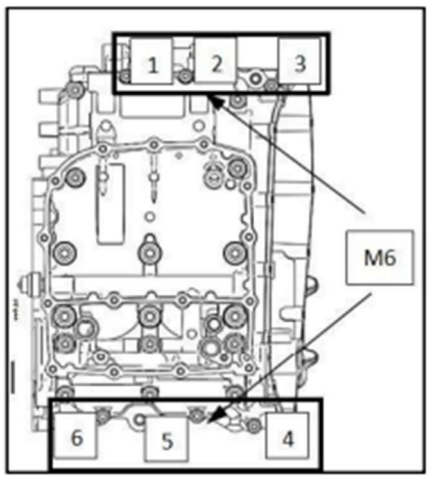
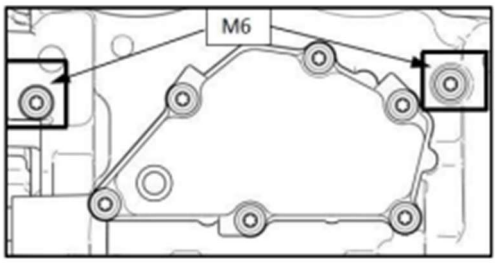
- Fasten 6 pieces of bolt M6 to given torque by 2-3 times as figure shows.

Torque: 11N.m



- Turn over the case body and let its bottom face downwards.
- Assemble new copper washer and 2 pieces of case combination bolt, then fasten to given torque.

Torque: 11N.m



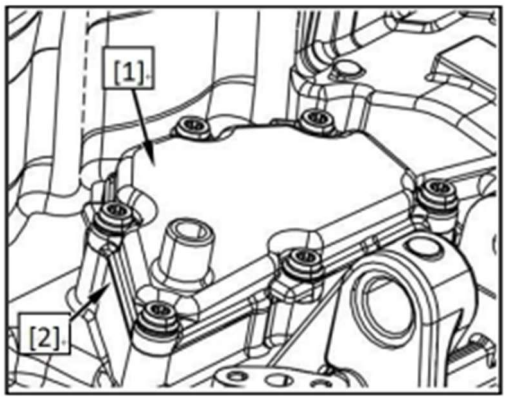
Breathing groove cover

Removal

- Remove 6 pieces of bolt M6 on breathing groove cover.
- Remove breathing groove cover [1] and its gasket [2].

Caution:

- If the gasket damaged or distorted, please replace it for a new one.
- Check inside of maze, please wash and clean it up if it is necessary.



Assembly

- Re-assembly by the opposite sequence to disassembly of related parts.
- Assemble 6 pieces of bolt M6, then fasten to given torque.
- **Torque: 11N.m**

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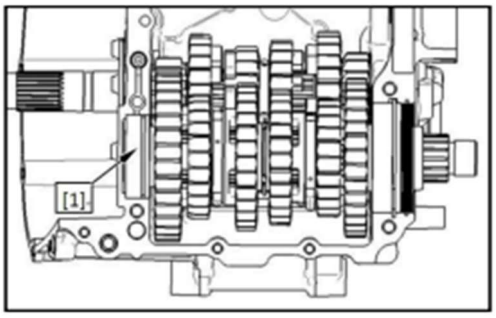
Transmission kit

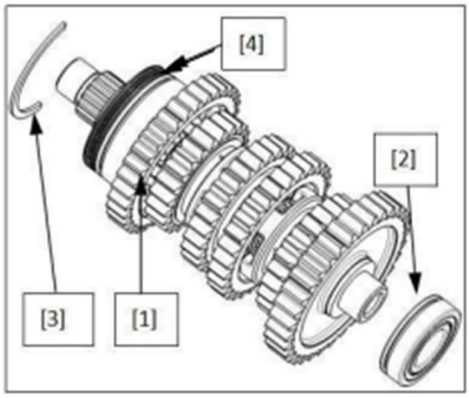
Disassembly and re-assembly

Remove parts of gearshift kit (Refer to Chapter 7th)-

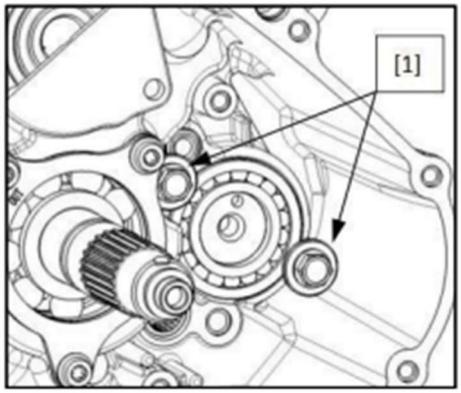
- Remove counter shaft kit [1].



- Break down counter shaft kit [1], bearing [2], shoulder circlip [3] and oil seal [4] according to demands.



- Remove limit bolt [1] of bearing of gearshift drum.



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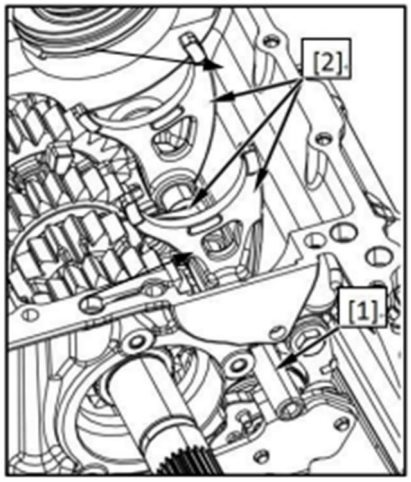
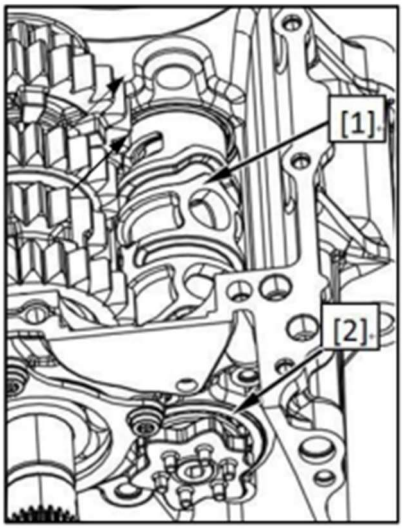
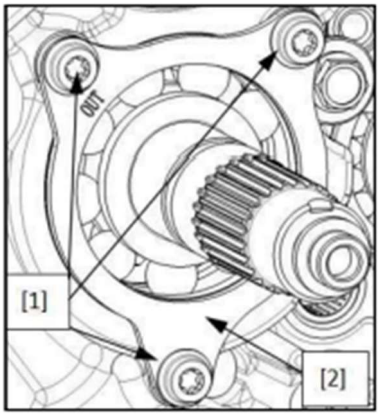
Remove turning fork shaft [1] from lower installation hole, then remove the fork [2].



- Remove gearshift drum [1] and its bearing [2].

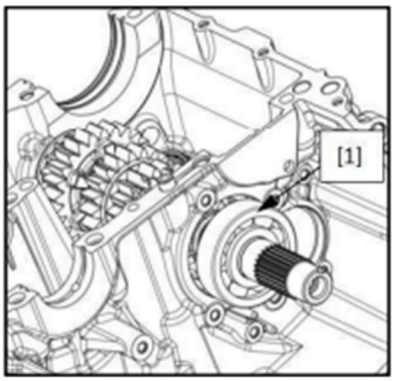


- Remove bolt [1] and pressing plate [2] of main shaft bearing.

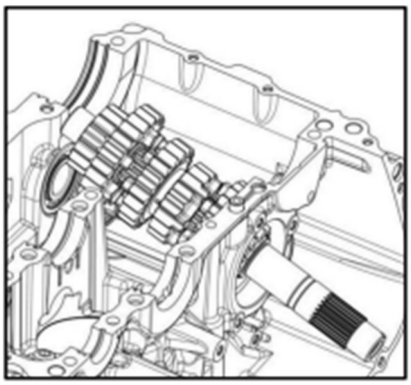


90

- Slide and move main shaft kit on upper crankcase body, then remove right side bearing [1] of main shaft.

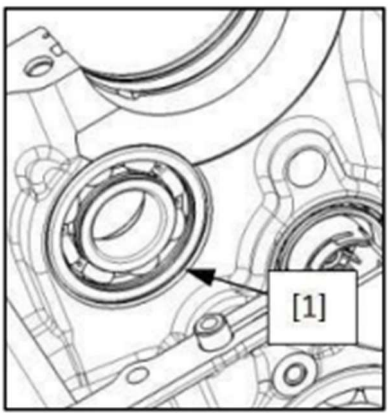


- Make main shaft incline and remove it.



Replace left bearing of main shaft

- Remove left side bearing [1] by its pulling tool.



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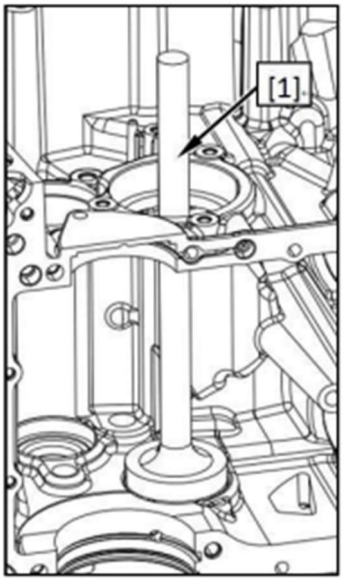
- Get seal cover of left bearing of main shaft face downwards, then knock the new bearing by tool [1] for it only from its upper side into upper crankcase until it completely in place.

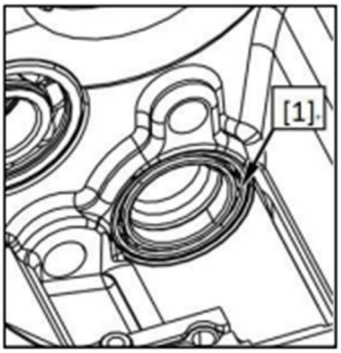
Caution:

- Please don’t let inner ring of bearing under stress singly when press-fitting.



Replace left side bearing of gearshift drum

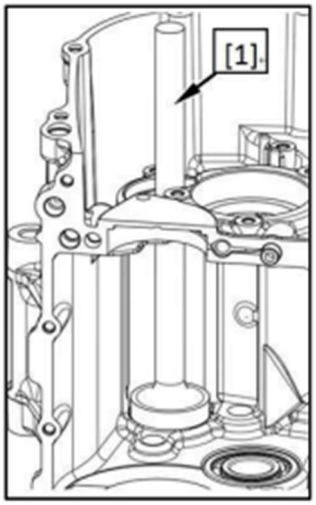
- Remove left side bearing [1] by its pulling tool.



- Knock new left bearing for gearshift drum by tool [1] for it only into upper crankcase from its upper side until it completely in its place.

Caution:

- Please don’t let inner ring of bearing under stress singly when press-fitting.



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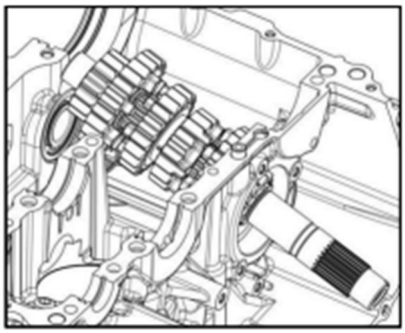
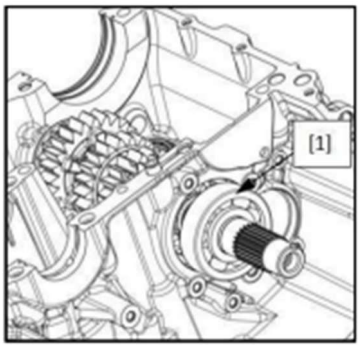
Assembly for main and counter shaft

- Assemble main shaft kit into upper crankcase body.

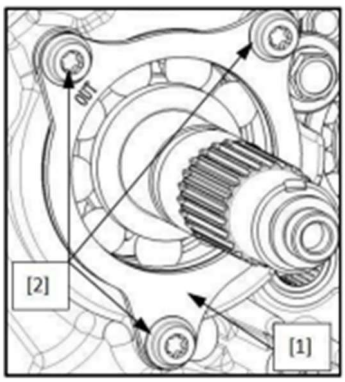


- Coat the right side bearing of main shaft with oil, then assemble the right bearing [1] into upper crankcase body. When assembling bearing, please get its side with mark facing outwards.



- Assemble pressing plate [1] of main shaft bearing and bolt [2], before assembling, please coat threaded part of bolt with Loctite.

Torque: 11N.m



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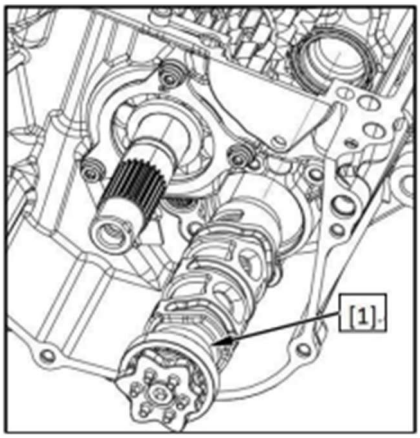
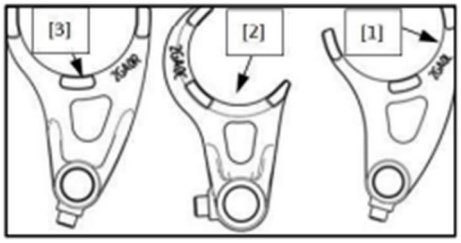
- Coat the external surface of gearshift drum and its bearing with oil.
- Assemble gearshift drum kit [1] onto upper crankcase body.



There are marks on forks
Mark: “L”[1]: Left fork
“C”[2]” Central fork
“R”[3]; Right fork

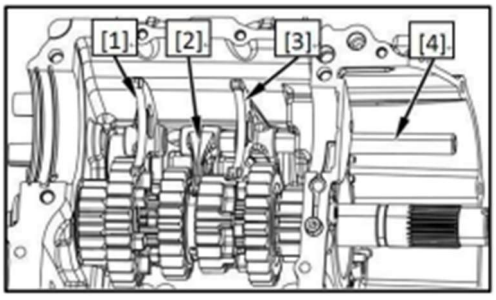
- Coat guiding arear of turning fork and place of guiding pin with oil.



- Coat surface of turning fork shaft [4] with oil.
- Insert fork shaft into case body, then assemble right fork [3], central one [2] and left fork [1] in turn.

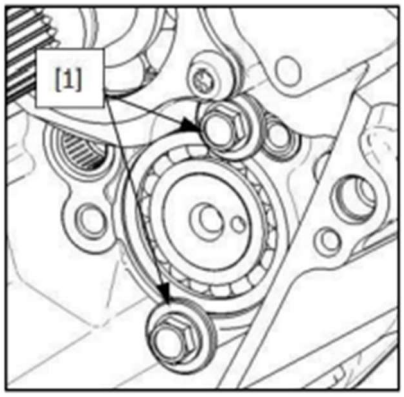
Caution:

- The mark on fork faces to right side, while guiding pillar of fork and guiding groove on gearshift drum are correctly meshing up.
- Insert the middle fork into main shaft kit.
- The left and right fork face to installation holes on counter shaft.



- Coat threaded part of bolt of washer of gearshift drum with Loctite.
- Assemble washer of gearshift drum and the bolt in place, then fasten the bolt to given torque.

Torque: 12N.m



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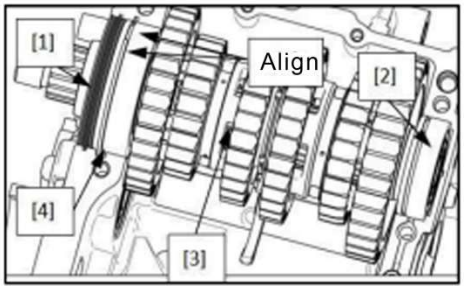
- Before assembling, please pre-assemble new oil seal [1] and right side bearing [2] on counter shaft onto counter shaft, the lip of oil seal faces inside of case body, when assembling right side bearing, the seal cover faces to outside of case body.
- Assemble counter shaft kit.
- When assembling, correctly insert left and right fork into installation groove on counter shaft.
- When assembled, adjust axial position of counter shaft until the upper limit groove on left bearing of counter shaft aligned to upper limit groove on case body, when they aligned, assemble shoulder circlip [4].
- Assemble crankcase body.



9 Crankshaft, piston, cylinder bore and balancing shaft

Maintenance information

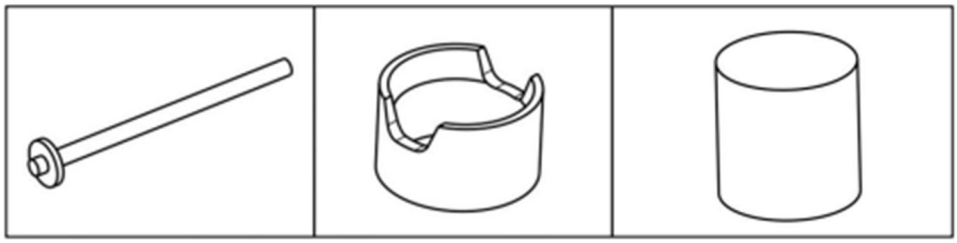
Summary

●When maintaining the crankshaft, balancing shaft, cylinder body, piston/connecting rod and nozzle, the crankcase must break up. How to break up the crankcase refer to its corresponding chapter.

● Mark up connecting rod body, cover of the rod and shaft pads and well put aside to make sure the correct re-assembly.

● The connective rod and main shaft's journal get matched according to their color, select the crankshaft's pad according to its color. When the new pad selected, confirm the clearance of oil film by plastic feeler gauge, the wrong clearance of oil film may heavily damage the engine.

Tool(s):



Specification for crankshaft, piston, cylinder body and balancing shaft

Unit：mm

Items		Standard	Limit
Crankshaft	Clearance in bigger end of connecting rod	0.1-0.25	0.50
	Clearance between pad on bigger end of connective rod and crankshaft journal	0.033-0.059	-
	Clearance between journal of front balancing shaft and its pad	0.030-0.060	-
	Clearance between journal of crankshaft and pad	0.030-0.060	-

	Runout of crankshaft		0.03	0.05
	Runout of front balancing shaft		0.015	0.04
Cylinder	Cylinder bore		83.994-84.006	84.05
	Cylindricity		0.005	0.10
	Roughness		Ra0.2-Ra0.35	-
Piston, piston pin and piston ring	Diameter for base circle of piston		83.961-83.974	83.900
	Diameter of pin's hole		19.009-19.015	19.03
	Diameter for piston pin		18.994-19.000	18.98
	Clearance between piston and piston pin		0.009-0.021	0.05
	Closing clearance for piston ring	1st ring	0.15-0.30	0.4
		2nd ring	0.20-0.40	0.5
		Oil ring	0.20-0.70	1.0
	Clearance between piston ring and ring groove	Clearance between 1st ring and groove	0.030-0.070	0.10
		Clearance between 2nd ring and groove	0.030-0.070	0.10
Cylinder matching clearance			0.020-0.045	0.10
Internal diameter of smaller end of connecting rod			19.017-19.027	19.04
Matching clearance between connecting rod and pin			0.017-0.033	0.05

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Troubleshooting

Too low the cylinder pressure, difficult starting or poor performance under low speed

- Wear-out, jamming or damage on piston ring
- Cylinder head/Piston worn out or damaged

Too high the pressure in cylinder, cylinder body overheat or cylinder knocking

- Too much the carbon buildup on the top of piston or in combustion chamber

Too much waste gas

- Cylinder body, piston or its ring got worn out

- Wrong assembly for piston ring
- Scratch on piston or cylinder wall

Engine noisy

- Piston pin or the hole for pin got worn out
- Smaller end of connecting rod got worn out
- Cylinder body, piston or its ring got worn out
- Connective rod or journal of main shaft worn out

Engine vibration

- Too strong the runout of crankshaft
- Wrong alignment for balancing shaft gears

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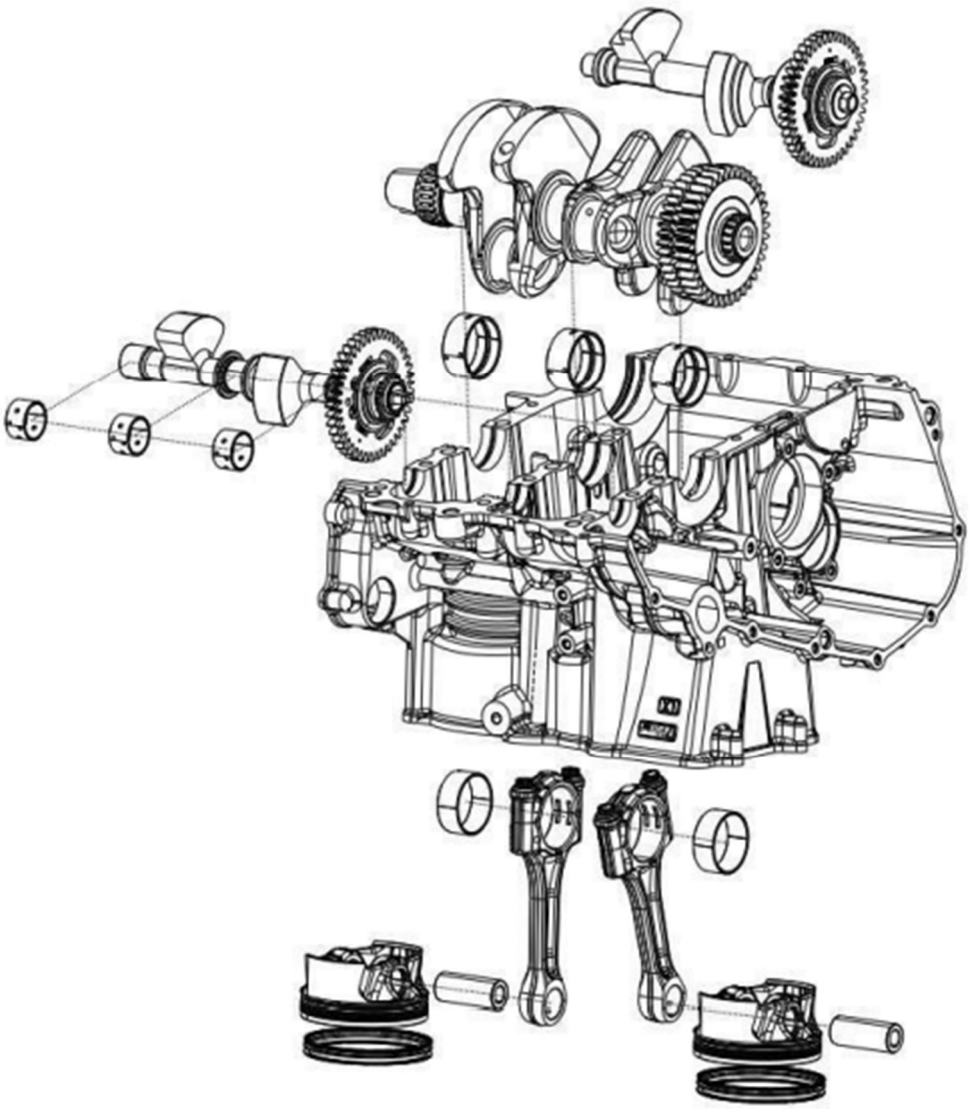
Components layout



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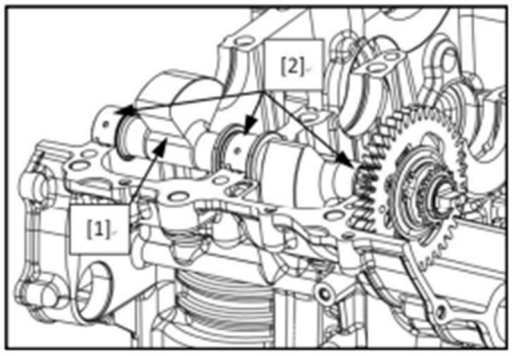
Front balancing shaft kit

Removal

Break up upper and lower crankcase body.

- Remove front balancing shaft [1].
- Remove shaft pad [2] of balancing shaft.

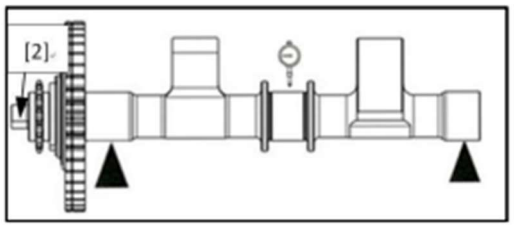


Inspection

- Hold up journal on both sides of balancing shaft.
- Put a micrometer above middle journal.
- Turn the balancing shaft by 2 rounds (720°), then read the run-out.

Maintenance limit: 0.04mm

- Check if there is wear-out or damage on flat side [2] of water pump of balancing shaft,.



Check and confirm if there is collision, damage, wear-out and distortion on parts below, please replace if it is necessary.

- Driven gear of balancing shaft
- Driven sub gear of balancing shaft
- Pressing spring of driven gear
- Balancing shaft
- Driving gear of oil pump

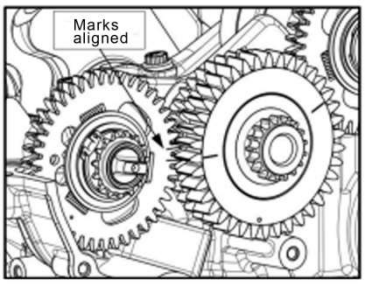
Assembly

Before assembling front balancing shaft, please assemble crankshaft and connective rod in place, then assemble shaft pad in place.

- Turn the crankshaft of left cylinder to upper stopping point, at this moment, the mark “I” of driving gear on balancing shaft face to shaft hole of front balancing shaft.
- Mark “II” on gear of balancing shaft aligned to “I” on driving gear, then assemble them in place.

Caution:

- Make sure the gear on balancing shaft correctly aligned, otherwise different gap between connective rod and balancing shaft may get engine damaged.



Crankshaft and connective rod

Side clearance inspection

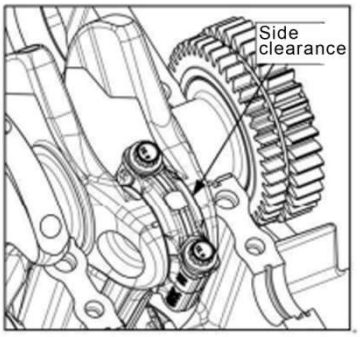
Break up upper and lower crankcase body.

- Remove front balancing shaft kit.
- Measure side clearance of bigger end of connective rod.

Maintenance limit: 0.50mm。

In case clearance passed limit, please replace connective rod.

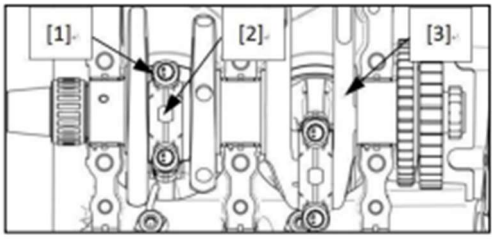
Confirm side clearance once again, in case still passed limit, please replace crankshaft.



Removal

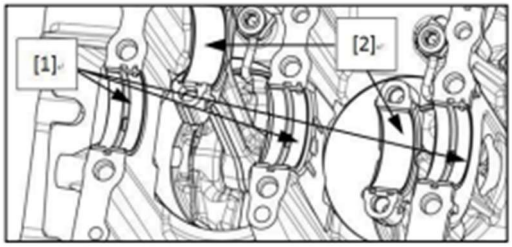
Caution:

- Please don’t change position of shaft pad, the shaft pad must be assembled in its initial position, otherwise it may break correct clearance for oil film and get engine damaged.。
- Break up upper and lower crankcase body.
- Mark up connective rod cover and shaft pad before removing to ensure correct re-assembly.
- Remove bolt [1] for connective rod and its cover [2]. Please avoid damage on connective rod, main shaft journal and shaft pad.
- In case connective rod cover is difficult to be removed, slightly knock side of cover.
- Remove crankshaft [3].



Caution:

- Before removing crankshaft, push piston of left cylinder to upper stopping point to avoid damaging on connective rod, also make matching-up between scale lines on crankshaft and balancing shaft easier.
- Remove shaft pad [1] of main shaft journal from upper and lower crankcase body.
- Remove crankshaft pad [2] of journal from bigger end of connective rod and its cover.

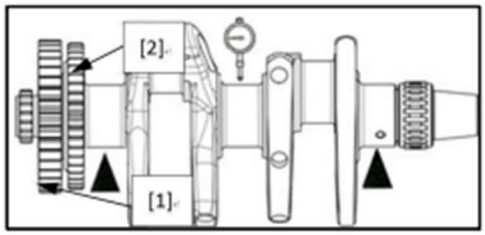


Inspection

- Hold up crankshaft journal both sides.
- Put a micrometer right above middle of main shaft journal, get it bypassing of oil groove and oil hole.
- Turn crankshaft by 2 rounds（720°）, read its run-out.

Maintenance limit: 0.05 mm

Check damage or wear-out on primary driving gear [1] and that on driving gear [2] of balancing shaft.



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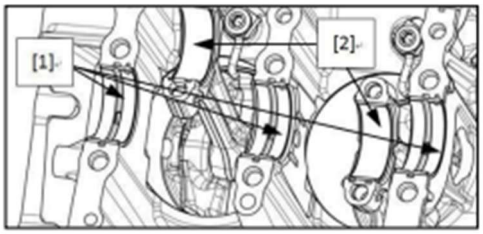
Re-assembly

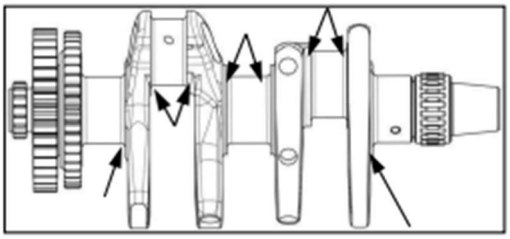
- Assemble shaft pad [1] of main shaft journal and that [2] of connective rod to their original place.

Caution:

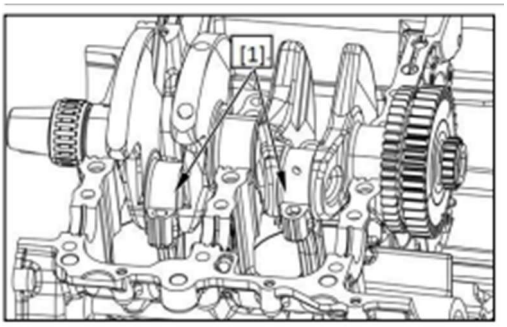
- Please don’t change position of shaft pad, the shaft pad must be assembled in its initial position, otherwise it may break correct clearance for oil film and get engine damaged.

- Coat internal surface of shaft pad for main shaft journal in upper crankcase and shaft pad in bigger end of connective rod with oil.
- Coat thrust surface of crankshaft with oil as picture shows.

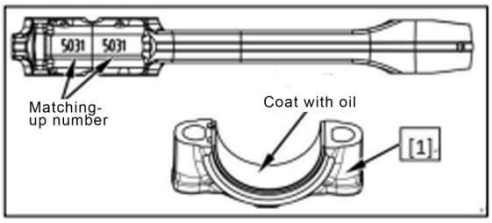




- Safely put crankshaft above crankcase, then put connective rod into its bigger end [1], (Please don't damage connective rod, main shaft journal and shaft pad), assemble crankshaft into upper crankcase.



- Assemble cover [1] of connective rod by matching up codes on its bigger end and side.
- Make sure all the parts are re-assemble to their original place as removal signs showing when removing them.



- Coat internal surface of pad on cover and rod part of connective bar with oil.
- Coat threaded part and its base of connective rod cover with oil.

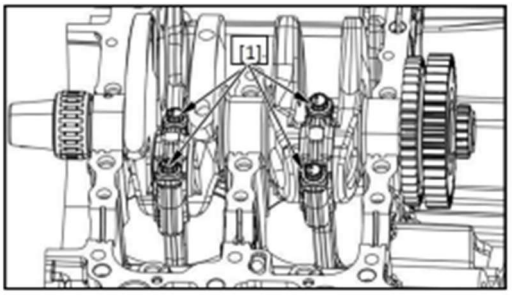
Assemble connective bolt [1] of connective rod cover and fasten to given torque by 2-3 times in alternative way.

Torque: 5N.m+15N.m+90

Caution:

- The bolt on connective rod is unable to be removed or fastened by several times, this operation is bad for its elasticity even lead to engine damage.

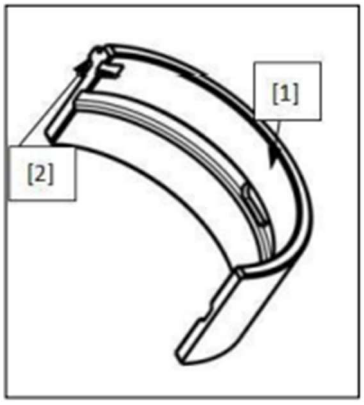
- The bolt on connective rod must be replaced for a new one when it removed and maintained.



Shaft pad of journal for main shaft

Inspection for shaft pad

- Remove crankshaft.
- Check if there is wear-out or spalling of shaft pad [1] for journal if main shaft.
- Check if there is damage on protrusion [2] of shaft pad.
- In case there is damage on shaft pad for journal of main shaft, please choose the correct one for replacement.



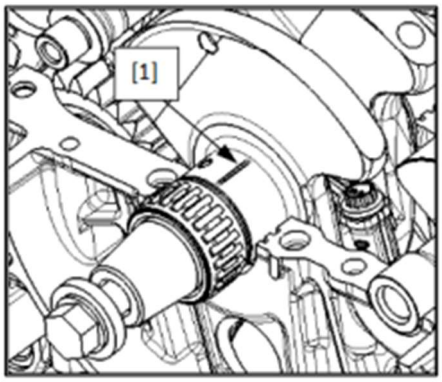
Inspection for oil clearance

- Remove crankshaft.
- Wipe up all the oil on shaft pad and journal of main shaft.
- Assemble crankshaft into upper crankcase.
- Put a plastic gap gauge [1] on each journal of main shaft bypassing oil hole.
- Assemble upper and lower crankshaft and fasten the case combination bolts according to requirement (Details please refer to Chapter 8th).

Caution:

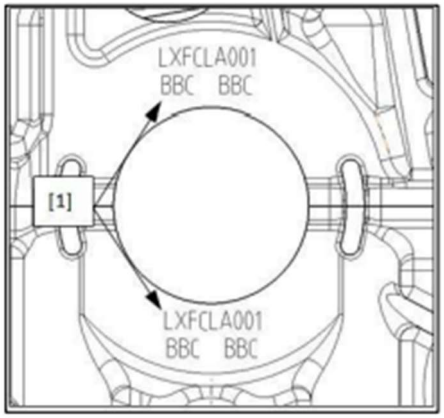
- When check oil clearance, please get bypassing oil hole and don't turn crankshaft.
- The bolt must be fastened to given torque according to required sequence.
- Measure each widest width for plastic clearance gauge on main shaft journal when it was squeezed to confirm oil clearance. In case oil clearance passed

maintenance limit, select correct shaft pad for replacement.



Shaft pad selection

- Take the number [1] for inner diameter for installation hole of shaft pad on left side of upper and lower crankcase into record. As picture shows (First 3 number above hole of left crankshaft (A, B or C), which means the sequence for inner diameter of installation hole for main shaft pad from left to right).



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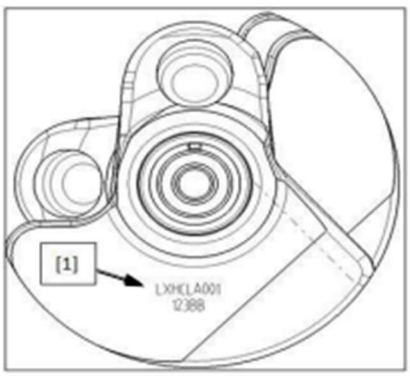
- If crankshaft needs be replaced, its record is on weighting piece of crankshaft, with corresponding number [1] (The number 1, 2 or 3 on weighting piece of crankshaft) means code for outer diameter of main shaft journal, whose sequence is from left to right side).



- Choose shaft pad color [1] by mutual reference for code number between main

shaft journal and shaft pad.

Thickness for shaft pad of main shaft journal:

Thick

Brown:

Green:

Yellow:

Thin

Matching-up form list for shaft pad of crankshaft pin:

Crankshaft / Case body			Outer diameter for crankshaft and main shaft journal		
			1	2	3
			37.994-38.000mm	37.988-37.994mm	37.9982-37.988mm
Hole diameter for crankcase	A	42.000-42.006mm	Yellow	Yellow	Green
	B	42.006-42.012mm	Yellow	Green	Green
	C	42.012-42.018mm	Green	Green	Brown

Re-assemble shaft pad

- Clean up outer surface of shaft pad and its installation hole on crankcase. Make sure there is not any oil, impurities and burrs.
- Re-assemble shaft pad [1] for main shaft journal into installation hole of crankcase, align each protrusion to groove.

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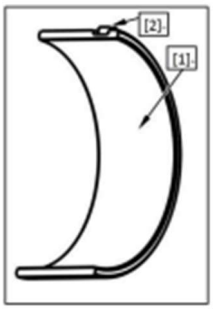
Shaft pad for connective rod

Remove crankshaft

- Check if there is wear-out or spalling for shaft pad [1] of connective rod.
- Check if there is damage on protrusion [2] of shaft pad. In case the shaft pad for connective rod gets damaged, select shaft pad for replacement

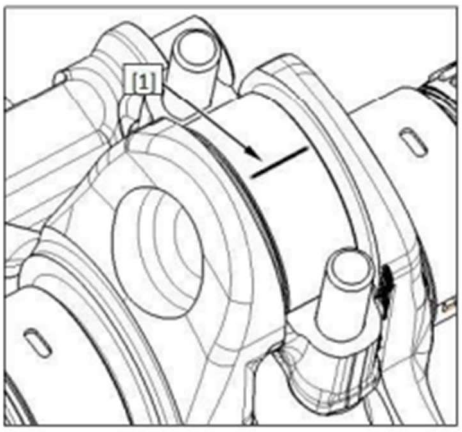


Check oil clearance

- Remove crankshaft
- Wipe up oil on shaft pad and connective rod
- Clean up contact surface between bigger end and cover of connective rod.
- Assemble crankshaft into upper crankcase.
- Assemble bigger end of connective rod into rod body.
- Put a plastic gap gauge [1] vertically on each connective rod bypassing oil hole.
- Fasten bolt for connective rod according to given torque and required sequence.

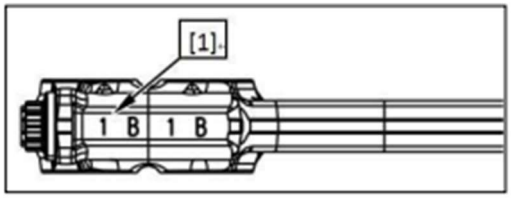
Caution:

- When check oil clearance, please get bypassing oil hole and don't turn crankshaft.
- The bolt must be fastened to given torque according to required sequence.
- The bolt on connective rod is unable to be removed or fastened by several times, this operation is bad for its elasticity even lead to engine damage.
- The bolt on connective rod must be replaced for a new one when it removed and maintained.
- Measure each widest width for plastic clearance gauge on main shaft journal when it was squeezed to confirm oil clearance. In case oil clearance passed maintenance limit, select correct shaft pad for replacement.

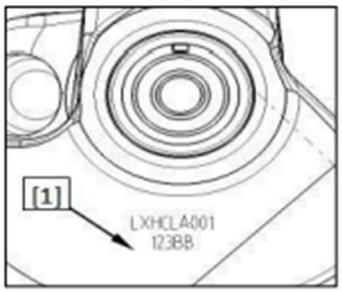


Selection for shaft pad

- Take code [1] for inner diameter of bigger end of connective rod into record (The number at side of bigger end (Such as 1 or 2) means code for inner diameter for bigger end of connective rod.



- If crankshaft needs be replaced, take corresponding code [1] on weighting piece of crankshaft into record (Letter A or B on weighting piece of crankshaft, which means outer diameter of connective rod, whose sequence is from left to right).



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- If recycling use for crankshaft is needed, please measure outer diameter of connective rod by micrometer.
- Choose color for replaceable pad shaft [1] by mutual reference between bigger end of connective rod and the rod itself in Shaft pad color table.

Thickness for shaft pad of connective rod:

Thick

Brown:

Green:

Yellow:

Thin

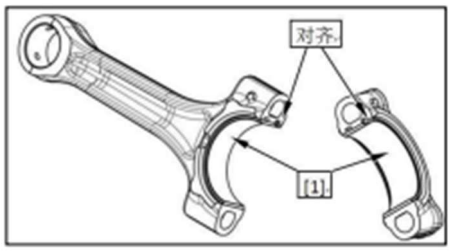
Shaft pad color table for connective rod:

Crankshaft / Connective rod			Outer diameter of connective rod	
			A	B
			37.992-38.000mm	37.984-37.992mm
Inner	1	41.000-41.008mm	Yellow	Green

diameter for hole of bigger end of connective rod	2	41.008-41.016mm	Green	Brown

Assemble shaft pad

- Clean up external surface of shaft pad, cover and bigger end of connective rod.
- Assemble shaft pad [1] into cover and bigger end of connective rod, get each protrusion aligned to groove.



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Shaft pad of front balancing shaft

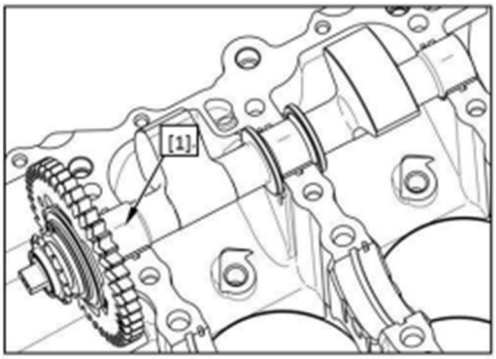
Inspection for shaft pad

Remove front balancing shaft kit.

- Check if there is wear-out or spalling of shaft pad [1].
- Check if there is damage on protrusion [2] of shaft pad. In case there is damage on shaft pad, please choose the correct one for replacement.

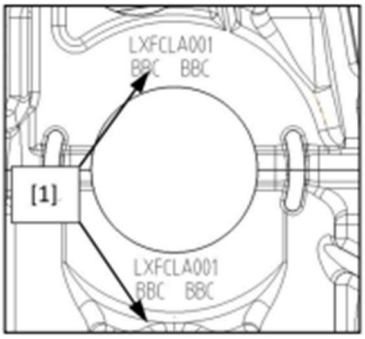
Inspection for oil clearance

- Remove front balancing shaft, wipe up all the oil on shaft pad and journal of balancing shaft.
- Assemble crankshaft into upper crankcase.
- Put a plastic gap gauge [1] on each journal of balancing shaft bypassing oil hole.
- Assemble upper and lower crankcase and fasten the case combination bolts according to requirement (Details please refer to Chapter 8th).



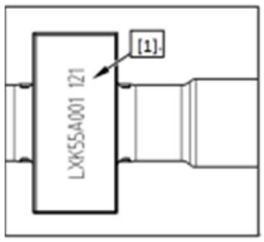
Caution:

- When check oil clearance, please get bypassing oil hole and don't turn balancing shaft.
- The bolt must be fastened to given torque according to required sequence.
- Measure each widest width for plastic clearance gauge on balancing shaft journal when it was squeezed to confirm oil clearance. In case oil clearance passed maintenance limit, select correct shaft pad for replacement.



Shaft pad selection

- Take the number [1] for inner diameter for installation hole of shaft pad on left side of upper and lower crankcase into record. As picture shows (Last 3 number above hole of left crankshaft (A, B or C), which means inner diameter of installation hole for balancing shaft pad from left to right).
- If front balancing shaft needs be replaced, record its number on weighting piece of front balancing shaft with corresponding number [1] (The number 1, 2 or 3 on weighting piece of crankshaft) means code for outer diameter of balancing shaft journal, whose sequence is from left to right side).



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Choose replaceable pad color [1] by mutual referring between journal of balancing shaft and its pad according to Shaft pad color table.

Thickness for shaft pad of front balancing shaft:

Thick

Blue:

Black:

Brown:

Green:

Yellow:

Blue:

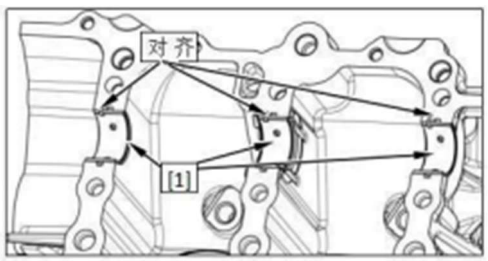
Thin

Shaft pad color table for front balancing shaft:

Balancing shaft / Case body			Hole diameter for balancing shaft		
			1	2	3
			6.000-26.006mm	26.006-26.0124mm	26.012-26.018mm
Shaft diameter for front balancing shaft	A	22.994-23.000mm	Yellow	Green	Brown
	B	22.988-22.994mm	Green	Brown	Black
	C	22.992-22.998mm	Brown	Black	Blue

Assemble shaft pad

- Clean up external surface of shaft pad and its installation hole on crankcase.
- Assemble shaft pad [1] of front balancing shaft into installation hole and groove on crankcase, then align each protrusion to groove.



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Rear balancing shaft

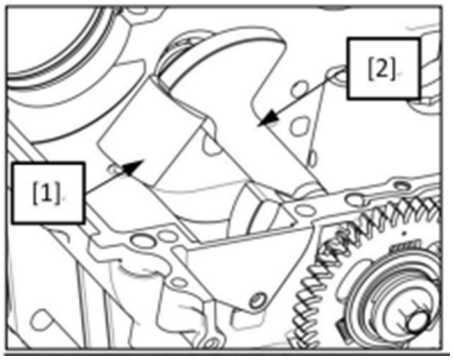
Removal

Break apart upper and lower crankcase body.

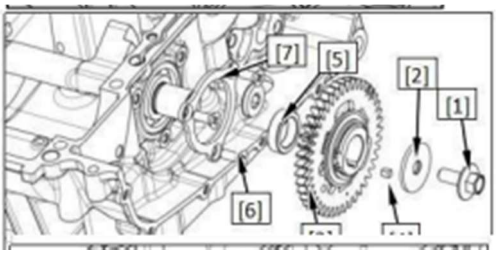
- Fix rear balancing shaft [2] by tool [1].

Caution:

- Please choose the tool with bigger diameter as possible, otherwise the operation during maintenance may damage case body.



- Remove bolt [1] and flat washer [2].
- Remove driven gear [3] of balancing shaft and square shaped key.
- Remove collar [5] and fastening bolt [6] for pressing plate of balancing shaft bearing.
- Remove pressing plate [7] for balancing shaft bearing.

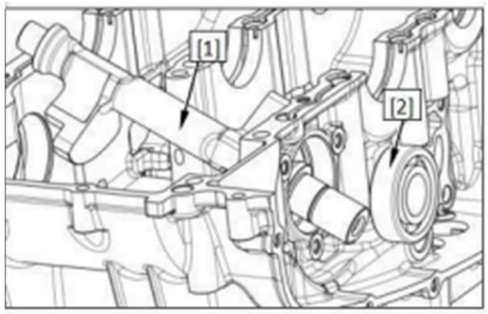


- Get balancing shaft moving to right side in crankcase, then remove the bearing [2] on the right side of balancing shaft.
- Get balancing shaft inclining and remove it [1].

Inspection:

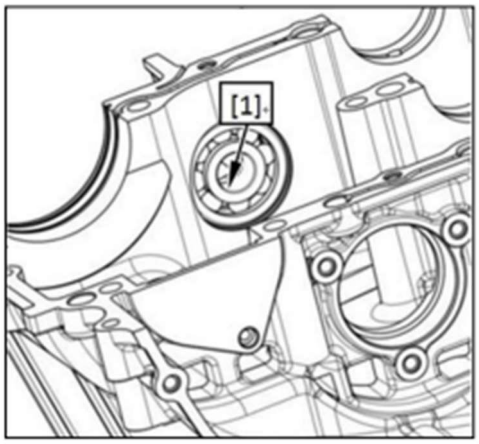
Check and confirm if there is collision, damage, wear-out and distortion on parts below, please replace if it is necessary.

- Driven gear of balancing shaft
- Sub gear for driven gear of balancing shaft
- Pressing spring of driven gear
- Balancing shaft
- Bearing of balancing shaft
- Pressing plate of balancing shaft
- Fastening screw for balancing shaft



Replacement for left side bearing of balancing shaft

- Take out the smaller bearing [1] on balancing shaft from upper crankcase by its pulling tool.



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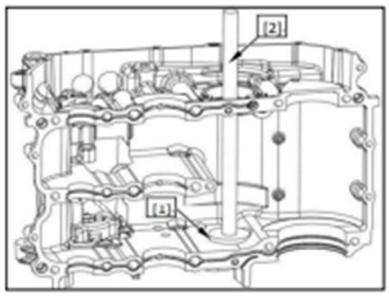
- Assemble a new left side bearing [1] into upper crankcase by tool [2] for this work only, slightly knock the bearing until it is completely in its place (Knocking along vertical angle, the bearing side with mark facing upwards).

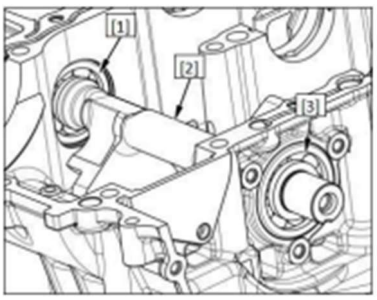
Caution:

- When press-fitting bearing, please let inner ring of bearing free from stressing.
- When assembled, please check and confirm the free turning for bearing.



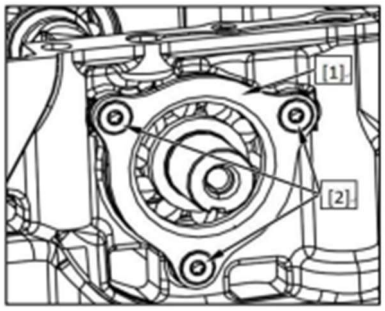
Assembly

- Coat left side bearing [1] of balancing shaft with oil.
- Assemble balancing shaft [2] into lower crankcase.
- Coat right side bearing [3] with oil and assemble it into lower crankcase (When assembling the bearing, whose side with mark facing outwards).

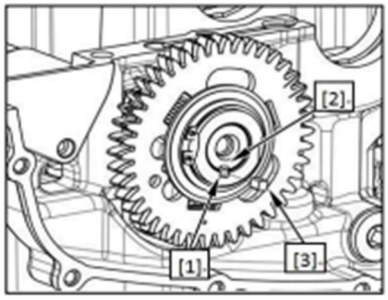


- Assemble pressing plate [1] of balancing shaft bearing and its bolt [2].
- Coat threaded parts of bolt for pressing plate of balancing shaft with Loctite.
- Fasten bolt for pressing plate to given torque.

Torque: 15N.m

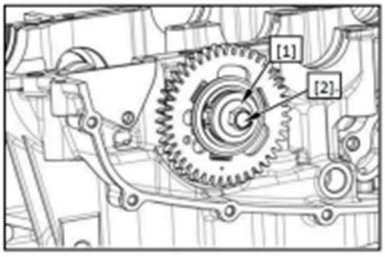


- Assemble driven gear for balancing shaft, get key groove [1] on gear align to that [2] on balancing shaft, then assemble square key [3] into groove.



- Fix balancing shaft by tool.
- Assemble flat washer [1] and bolt [2].
- Coat bolt with Loctite then fasten.

Torque: 35N.m



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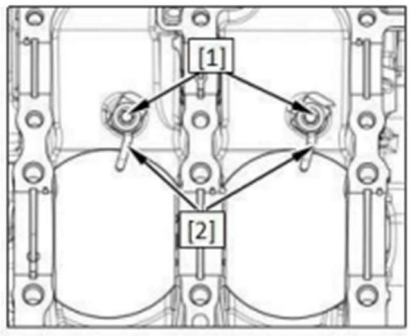
Oil nozzle on piston

Removal

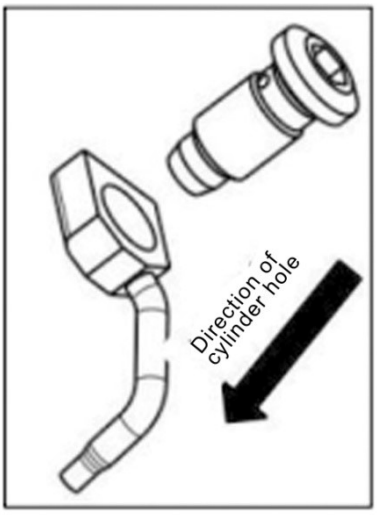
- Remove 2 pieces of oil through bolt [1].
- Remove 2 pieces of oil nozzle [2].



Assembly

- Get oil nozzle face to side of cylinder bore, assemble oil through bolt, then make positioning for its step.
- Fasten 2 pieces of oil through bolt to given torque.

Torque:25N.m



Piston/Cylinder body

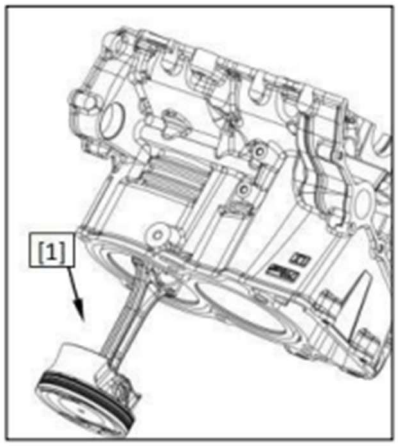
Removal for piston/Connective rod kit

Caution:

- Before removing piston, wrap bigger end of connective rod by a clean fiberless fabric to prevent damaging cylinder sleeve.
- Please don't try to remove piston/connective rod kit from bottom of cylinder hole, which will be seized up at joint between cylinder sleeve and upper crankcase body.
- Please don't change the position for shaft pad, the pad must be re-assembled

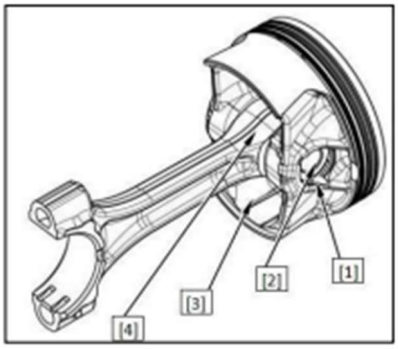
back to initial position, otherwise the oil film clearance will be wrong, which lead to engine damage.

- Before removing piston, please clean up carbon buildup at lip of cylinder bore, otherwise it may leave scratch on piston rings.
- Remove front balancing shaft, crankshaft and cooling nozzle of piston.
- Remove piston/connective rod kit from top of cylinder body.



Removal for piston

- Remove circlip [1] of steel wire by tweezers.
- Push out piston pin [2] from piston [3] and smaller end [4] of connective rod, then remove the piston.

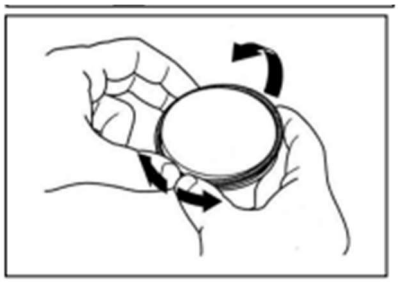


Removal for piston ring

- Get opening for each piston ring apart, then remove the ring upwards along the opposite position to opening of piston ring.

Caution:

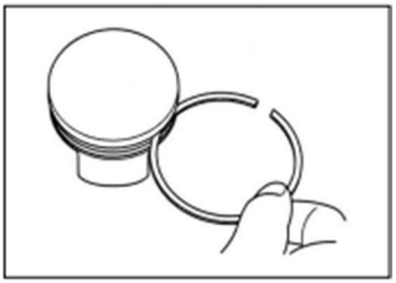
- Please don’t separate the opening apart too far to prevent damaging the piston ring. Please avoid scratch on piston when removing its rings



- Clean up carbon buildup in groove of piston ring by piston ring which is about throwing away.。

Caution:

- *Please don't use steel brush to avoid scratching piston ring.*



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Inspection

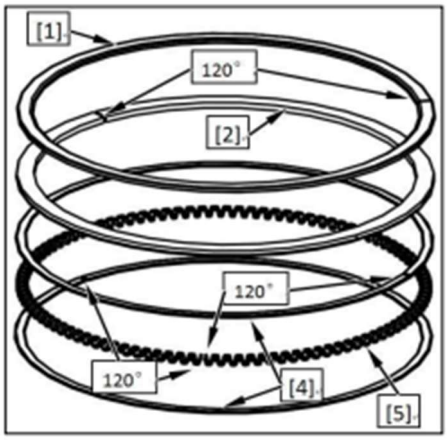
Check if there is scratch, damage, wear-out, distortion, burn-out or oil passage blocking-up on parts below.

- Cylinder body
- Piston
- Piston ring
- Piston pin
- Smaller end of connective rod
- Measure all the parts according to specification for crankshaft/piston/cylinder body/balancing shaft and calculate their clearance.
- Any parts passed maintenance limit must be replaced.

Re-assemble piston ring

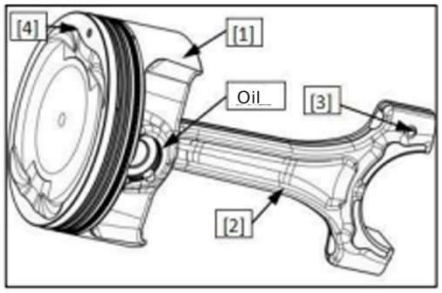
- Totally clean up groove of piston ring then re-assemble piston ring.
- Coat the complete surface of piston rings and their grooves with engine oil.。
- Please don't damage piston and its rings during re-assembling.
- When re-assembling, get the side of piston ring with mark facing upwards。
- Mark "1RPD" : Ring 1st [1].
- Mark "2R" : Ring 2nd [2].
- When re-assembling oil ring, assemble liner ring [5] first, then the scratching ring [4].

- Get mutual crossing angle for piston ring opening by 120. The dislocation for position of opening for scratching ring is shown as picture.



Re-assemble piston

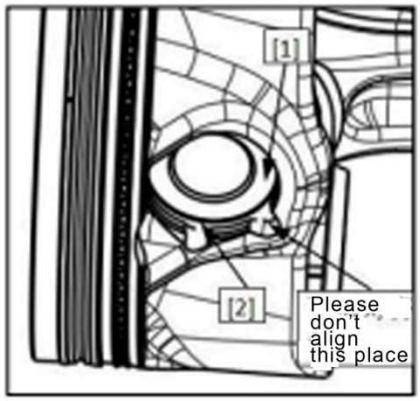
- Coat internal surface of hole for piston pin with oil.
- Coat internal surface of smaller end of connective rod with oil.
- When assembling piston [1] and connective rod [2], get protrusion [3] on connective rod acing to mark [4] of "○" on piston.
- Coat external surface of piston pin with oil.



- Re-assemble piston pin [1]， then fix it by new circlip [2] of steel wire.

Caution:

- Make sure circlip of steel wire assembled in place.
- Please don't align opening on circlip to gap on piston.



- Coat cylinder wall and thrust surface of piston with oil.
- Assemble piston/connective rod kit [2] into cylinder by compression tools [1] could be bought from market (When assembling, the side on piston with mark "●" facing to air intake direction).

Caution:

- When re-assembling piston, please don't damage its top surface, especially don't damage matching place to cylinder hole.
- Please don't damage cylinder sleeve and crankshaft pin by connective rod.
- When use connective rod in recycling way, please replace its bolts for new ones.
- Before assembling, please remove oil nozzle of piston to prevent damaging by connective rod.
- Slightly knock piston into cylinder body by plastic hammer (Make sure compressing tools for piston ring is flatly put on upper surface of cylinder body).