



ROYAL ALLOY

350 Series Engine Workshop Manual



Single-cylinder · four-stroke · water-cooled · SOHC four-valve · CVT

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CHAPTER 1

Technical specifications

General	
Engine type	Single-cylinder, four-stroke, water-cooled, four-valve, horizontal, single overhead camshaft (SOHC)
Clutch	Dry, centrifugal
Transmission	CVT (continuously variable) with fixed-mesh final reduction
Starting system	Electric start
Overall dimensions	730 × 427 × 325 mm
Net weight	37.5 kg

Performance	
Maximum net power	20.5 kW (±5%) at 8,000 rpm (±5%)
Maximum torque	27.5 N·m (±5%) at 6,000 rpm (±5%)
Minimum stable idle speed	1,700 ± 100 rpm
Minimum specific fuel consumption	340 g/kW·h

Engine data	
Bore × stroke	75 × 70 mm
Displacement	309.3 mL
Compression ratio	11 : 1
Ignition system	Contactless electronic ignition (PEI)
Ignition advance	5° BTDC at 1,700 rpm
Lubrication	Pressure and splash
Valve clearance, intake (cold)	0.08 – 0.12 mm
Valve clearance, exhaust (cold)	0.13 – 0.17 mm
Spark plug	NGK CR8EKB
Spark plug gap	0.7 – 0.8 mm
Thermostat	Starts to open at 85 ± 3 °C; fully open at 95 ± 3 °C

Fuel, lubricants and coolant	
Fuel	Unleaded petrol, 92 RON or higher (GB/T 17930-2016)
Engine oil	SJ 10W-40 (Shell) (GB 11121-2006)
Gear oil	GL-5 80W-90 (Shell) (GB 11121-2006)
Engine oil capacity	1,300 mL new or rebuilt engine · 1,100 mL at oil change
Gear oil capacity	250 mL new or rebuilt engine · 240 mL at oil change
Coolant	Ethylene-glycol antifreeze containing corrosion inhibitors. Recommended: Chongqing Yiping Chemical Co., Ltd, grade 4916

Antifreeze mixing ratios

CAUTION In low ambient temperatures, antifreeze must be mixed according to the table below.

Grade 4916 antifreeze, manufactured by Chongqing Yiping Chemical Co., Ltd.

Antifreeze concentrate (% by volume)	Distilled water (% by volume)	Freezing point (°C)
100	0	-41.5
80	20	-29
60	40	-18
40	60	-12

CHAPTER 2

Use and maintenance

2.1 Checking the oil level

Check the oil either with the engine cold, or 3 minutes after stopping an engine that has idled for 60 seconds. Keep the engine level, then remove the crankcase dipstick **(A)** and the gearbox dipstick **(B)**. The oil level on each should be between the upper and lower marks.

- If the level is below the lower mark, top up with oil of the correct grade until it is between the marks.
- If the level is above the upper mark, drain oil until it is between the marks.
- After adding or draining oil, recheck the level using the method above.

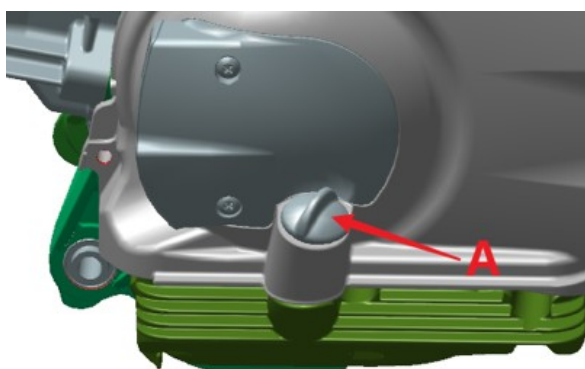


Figure 1 Crankcase dipstick (A)

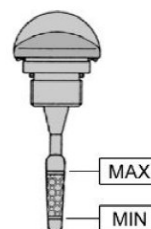


Figure 2 Crankcase dipstick level marks

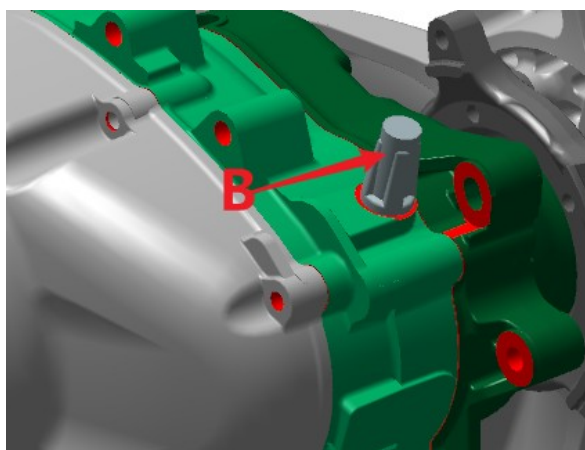


Figure 3 Gearbox dipstick (B)

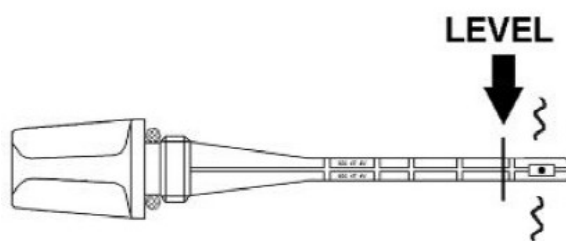


Figure 4 Gearbox dipstick level mark

2.2 Checking the coolant

- With the engine cold and level, check the coolant level in the expansion tank. It should be between the upper and lower marks. If it is below the lower mark, top up promptly with coolant of the same specification.
- To bleed the system, loosen the bleed screw **(C)** on the pressure-relief unit. When coolant flows steadily from the bleed hole with no air bubbles, tighten the bleed screw (torque **4 – 6 N·m**). Fill the system with coolant and refit the filler cap. The level in the expansion tank should be between the upper and lower marks.

CAUTION Failing to bleed all air from the cooling system will reduce cooling performance and, in severe cases, may damage the engine.

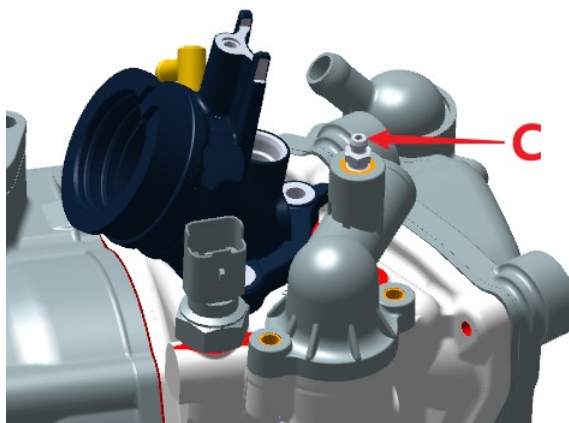


Figure 5 Cooling system bleed screw (C)

2.3 Starting the engine

Pre-start checks

1. Check that no parts are loose or missing.
2. Make sure the motorcycle is securely supported on its stand, and that the throttle, brakes and other controls work correctly.
3. Make sure there is fuel in the tank.
4. Make sure the battery is sufficiently charged.

Starting

Switch the ignition on, apply the brake (hand lever), and press the electric start button on the right handlebar. If necessary, open the throttle slightly to help the engine start.

NOTE Do not operate the starter for more than 5 seconds at a time. Wait 10 seconds between attempts.

After starting

Let the engine idle for 3 – 5 seconds before riding off so that the lubrication system can begin circulating oil. Avoid high speeds and heavy loads until the engine has warmed up.

WARNING Do not touch rotating or hot parts when working near a running engine.

2.4 Normal riding

Open the throttle gradually to move off. As engine speed rises, the CVT automatically adjusts the belt position and the motorcycle pulls away. Once under way, control road speed with the throttle to suit the conditions.

NOTE Do not snap the throttle open when moving off.
Avoid sudden braking while riding.

2.5 Running-in

For the first **1,000 km** after a new engine is fitted:

- do not ride at high speed for long periods;
- do not exceed 80% of maximum engine speed;
- do not ride at full throttle.

Carry out the first service at **1,000 km** to deal with the wear that occurs during running-in and to keep the engine performing well.

2.6 First service

At **1,000 km**, replace the engine oil, oil filter and gear oil, and check and retighten fasteners, as shown in the maintenance schedule (section 2.8). Use only the oil grades specified by the manufacturer. Never use inferior-quality oil.

CAUTION Avoid prolonged skin contact with oil and wash thoroughly after contact. Used oil and its containers are harmful to health and the environment. Do not dispose of them with household waste — follow local environmental regulations.

2.7 Spark plug

Replace the spark plug every **10,000 km**. When fitting a new plug, check the gap (**0.7 – 0.8 mm**).

2.8 Maintenance schedule

These intervals are the same as in the Royal Alloy 350 Series Owner Manual.

Key: I = inspect and clean, adjust if necessary · C = clean · R = replace · A = adjust · L = lubricate

Interval (× 1,000 km)	1	5	10	15	20	25	30	35	40	45	50
Bolts and nuts — retighten if necessary	I		I		I		I		I		I
Variator cover plastic sliders			R		R		R		R		R
Clutch bell		C	C	C	C	C	C	C	C	C	C
Spark plug			R		R		R		R		R
Drive belt			R		R		R		R		R
Throttle cable	A		A		A		A		A		A
Air filter		C	C	C	C	C	C	C	C	C	C
Variator cover filter			I		I		I		I		I
Oil filter	R		R		R		R		R		R
Valve clearance			A		A		A		A		A
Brake system	I	I	I	I	I	I	I	I	I	I	I
Electrics and battery	I		I		I		I		I		I
Brake fluid **	I		I		I		I		I		I
Coolant **	I		I		I		I		I		I
Transmission oil *	R		I		R		I		R		I
Engine oil *	R	I	R	I	R	I	R	I	R	I	R
Headlamp alignment			A		A		A		A		A
Variator rollers			R		R		R		R		R
Road test	I		I		I		I		I		I
Variator pulley			I		I		I		I		I
Radiator	I/C	I/C	I/C	I/C	I/C	I/C	I/C	I/C	I/C	I/C	I/C
Wheels and tyres	I	I	I	I	I	I	I	I	I	I	I
Suspension			I		I		I		I		I
Steering	I		I		I		I		I		I
Fuel line ***	I		I		I		I		I		I
Anti-dive bearing	I	I	I	I	R	I	I	I	I	R	I

* Check level every 3,000 km (1,800 miles).

** Replace every 2 years.

*** Replace every 4 years.

Checks before every ride

- Oil level.** Check the oil before riding. If the level is below the lower mark on the dipstick, top up to between the upper and lower marks.

- b. **Coolant level.** Check the coolant before riding. If the level in the expansion tank is below the lower mark, top up before starting the engine. In winter, use 100% high-quality antifreeze to prevent freezing.

WARNING Never open the expansion tank cap while the engine or radiator is hot. Boiling coolant and steam can spray out under pressure and cause serious injury.
Antifreeze can burn the skin and eyes. Wear suitable protection to prevent contact.

Engine service items

- a. **Engine oil.** Replace at 1,000 km and then every 10,000 km. Inspect at 5,000 km and every 10,000 km after that (15,000, 25,000 km ...). Check the level every 3,000 km. If the oil deteriorates, change it sooner.
- b. **Oil filter.** Replace at 1,000 km and then every 10,000 km (filter cover **(D)** torque **25 – 30 N·m**).
- c. **Gear oil.** Replace at 1,000 km, 20,000 km and 40,000 km; inspect at 10,000 km, 30,000 km and 50,000 km. Check the level every 3,000 km.
- d. **Valve clearance.** Adjust every 10,000 km to specification (cold engine): intake **0.08 – 0.12 mm**, exhaust **0.13 – 0.17 mm**.
- e. **Air filter.** Clean every 5,000 km. Regularly check the seal at every joint of the air filter housing so that unfiltered air cannot enter the cylinder.
- f. **Spark plug.** Replace every 10,000 km. If a plug needs cleaning between replacements, soak it in petrol for 3 – 4 hours to soften carbon deposits, scrape them off, brush clean, then allow to dry.
- g. **Throttle body.** Not a scheduled item. If there is noticeable loss of power, unstable idle or black smoke, remove the throttle body and clean it. Cleaning by a qualified technician is recommended.
- h. **Coolant.** Inspect at 1,000 km and every 10,000 km; replace every 2 years.
- i. **Fasteners.** Check and retighten at 1,000 km and every 10,000 km.

WARNING When removing carbon deposits, keep flames and the spark plug well away from petrol. Wipe up any spilled petrol immediately.

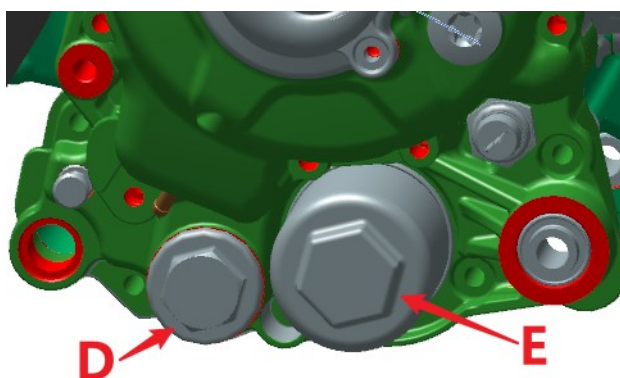


Figure 6 Oil drain bolt / filter cover (D) and oil filter (E)

2.9 Changing the engine and gear oil

Engine oil

1. Stand the motorcycle on level ground on its stand. Remove the oil drain bolt **(D)** on the side of the right crankcase and allow a few minutes for the oil to drain completely. Check that the filter cover and sealing ring are in good condition, making sure the O-ring on the filter cover does not fall out during assembly, then refit (torque **25 – 30 N·m**).

2. Remove the oil filter **(E)** and fit a new one. Apply a little oil to the filter sealing ring before fitting, then tighten (torque **11 – 13 N·m**).
3. Remove the dipstick **(A)** from the oil pan and add **1,100 mL** of the correct grade of oil (**1,300 mL** after a new or rebuilt engine). Check that the oil level is correct, then refit and tighten the dipstick.

Gear oil

1. Remove the gearbox oil drain bolt **(F)** and allow a few minutes for the gear oil to drain from the transmission.
2. Fit the copper washer to the drain bolt, refit it to the transmission cover and tighten (torque **15 – 18 N·m**).
3. Remove the gear oil dipstick **(B)** at the rear of the left case and add **240 mL** of the correct grade of gear oil (**250 mL** after a new or rebuilt engine). Refit the dipstick, check that the level is correct, then tighten.

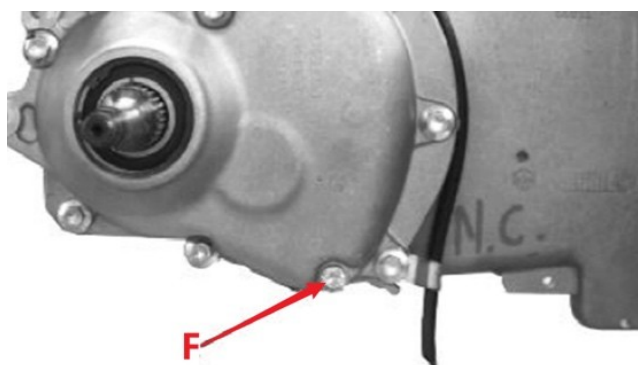


Figure 7 Gearbox oil drain bolt (F)

2.10 CVT inspection

Every **10,000 km**, replace the drive belt and variator rollers, and inspect the variator pulley, buffer blocks and variator cover filter. Clean the clutch bell every **5,000 km**.

2.11 Engine disposal

An engine that has reached the end of its life must be passed to an authorised vehicle recycling and dismantling facility, in accordance with the applicable end-of-life vehicle regulations.

CHAPTER 3

Engine fault-finding

3.1 Hard starting or failure to start

System / symptom	Possible cause	Remedy
Operation	Incorrect starting procedure	Follow the instructions in this manual
Fuel system	Fuel tap off, or fuel tank empty	Turn the tap on or add fuel
	Fuel tap or fuel filter blocked	Clean and clear the fuel lines
	Fuel injector blocked	Replace the injector
	Mixture too rich or too lean	Replace the ECU
Ignition / electrical	Spark plug: heavy carbon deposits	Remove carbon and wash in petrol
	Spark plug: incorrect gap	Adjust the gap
	Spark plug: electrodes burnt	Replace
	Ignition coil faulty	Replace
	Igniter faulty	Replace
	Magneto coil faulty, or solder joint detached	Replace, or re-solder
	Poor connection or broken wire	Check and reconnect
Air intake and compression	Air leak at intake manifold joints	Tighten the connecting bolts
	Air filter blocked	Clean the air filter
	Low compression: spark plug not sealing	Tighten the spark plug
	Low compression: cylinder head gasket leaking	Tighten the cylinder head bolts and nuts
	Low compression: valve leaking	Regrind or replace the valve
	Low compression: piston rings or cylinder badly worn	Replace the piston rings or cylinder
	Carbon build-up in the exhaust port or silencer	Remove carbon and clear the silencer
	Valve clearance too large or too small	Adjust the clearance
Other	Incorrect fuel	Replace with the correct fuel

3.2 Poor idling

System / symptom	Possible cause	Remedy
Idle speed too high	Throttle sticking or cable too tight	Adjust
	Carbon deposits in the throttle body, idle speed regulator or idle bypass passage	Clean the affected parts
Unstable idle	Ignition timing incorrect	Set the ignition timing to specification
	Fuel injector leaking or blocked	Replace
	Throttle position sensor faulty	Clean or replace
	Spark plug gap too small	Adjust the gap to specification

3.3 Unstable running

System / symptom	Possible cause	Remedy
Fuel system	Fuel line partially blocked	Clear the fuel lines
Electrical	HT lead or ignition coil leaking	Replace
	Capacitor faulty or leaking	Replace
	Heavy carbon build-up between the spark plug electrodes	Remove carbon deposits

3.4 Engine overheating

System / symptom	Possible cause	Remedy
Poor cooling	Cooling system damaged	Repair or replace parts
	Engine run at high speed for a long time while stationary	Stop and allow to cool before continuing
Overload, or prolonged high-speed running	Prolonged riding on poor road surfaces	Change riding style or stop temporarily
	Prolonged full-throttle riding	Moderate throttle use
	Silencer blocked	Remove carbon deposits
Lubrication	Oil level too low	Top up or change the oil
	Incorrect grade or poor-quality oil	Change to the correct grade

3.5 Engine cuts out

System / symptom	Possible cause	Remedy
Fuel system	Fuel tank empty	Add fuel
	No fuel supply: fuel line blocked	Clean the fuel line

System / symptom	Possible cause	Remedy
	No fuel supply: fuel injector leaking or blocked	Replace the injector
Electrical	Loss of ignition	Check the wiring in sequence from the spark plug to the magneto
Engine seizure	Piston seized in the cylinder	Repair or replace
	Other mechanical seizure	Identify the cause, then repair or replace

3.6 CVT faults

System / symptom	Possible cause	Remedy
CVT slipping	CVT abnormally worn or damaged	Adjust, repair or replace
	Drive belt worn or damaged	Replace
	Drive pulley rollers, ramps or friction plates abnormally worn	Replace
	Driven pulley spring weak or broken	Adjust, repair or replace

CHAPTER 4

Engine electrical schematic

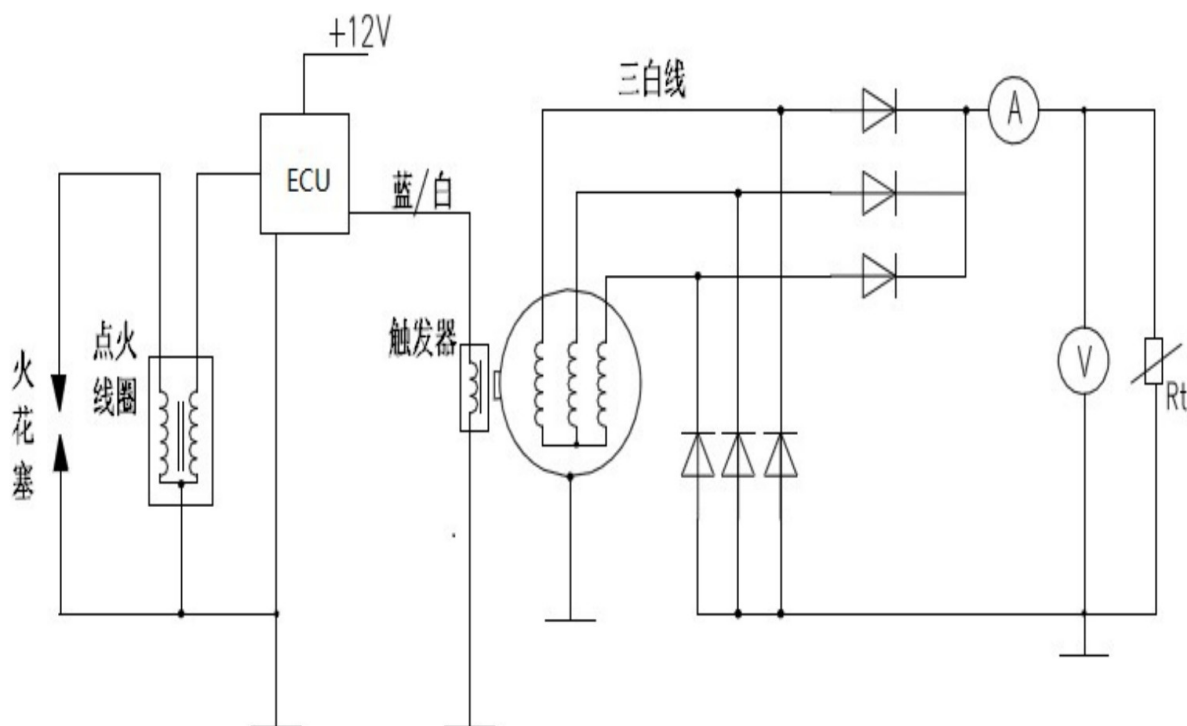


Figure 8 Engine ignition and charging circuit

Key to diagram labels

Diagram label	Component
火花塞	Spark plug
点火线圈	Ignition coil
ECU	Engine control unit (supplied from +12 V)
蓝/白	Blue/white wire — trigger signal to ECU
触发器	Trigger (pick-up) coil
三白线	Three white wires — magneto stator output
Diodes	Rectifier bridge
A / V	Ammeter / voltmeter (test points)
Rt	Load

CHAPTER 5

Cooling system fault diagnosis

5.1 Coolant temperature too high

Symptoms: the engine lacks power, the temperature gauge needle stays in the red zone for a long time, and coolant boils and is expelled from the reservoir. (A needle that enters the red zone only momentarily and promptly returns to normal does not indicate this fault.)

Possible causes:

1. Temperature gauge or thermal switch damaged.
2. Insufficient coolant in the radiator, or the radiator or hoses mounted too low, causing poor circulation.
3. Hoses or water jackets blocked.
4. Water pump not working properly.
5. Fan incorrectly fitted or damaged.
6. Air lock in the cooling circuit (poor bleeding).
7. Expansion tank not vented to atmosphere.
8. Prolonged low-speed, high-load operation.

5.2 Temperature gauge not reading or reading incorrectly

1. Temperature gauge or sensor faulty.
2. Thermostat faulty.

5.3 Coolant leaks

1. Water pump mechanical seal leaking.
2. Coolant hoses damaged.
3. Cylinder head gasket damaged. Remove the radiator cap and open the throttle moderately; if coolant at the filler neck bubbles heavily, replace the cylinder head gasket.
4. Hose clip broken or loose, causing a leak. Retighten or replace the clip.
5. Radiator damaged and leaking.

CHAPTER 6

Engine number location

The engine number is stamped on the left-hand crankcase in the position shown (marked 发动机机号, "engine number").

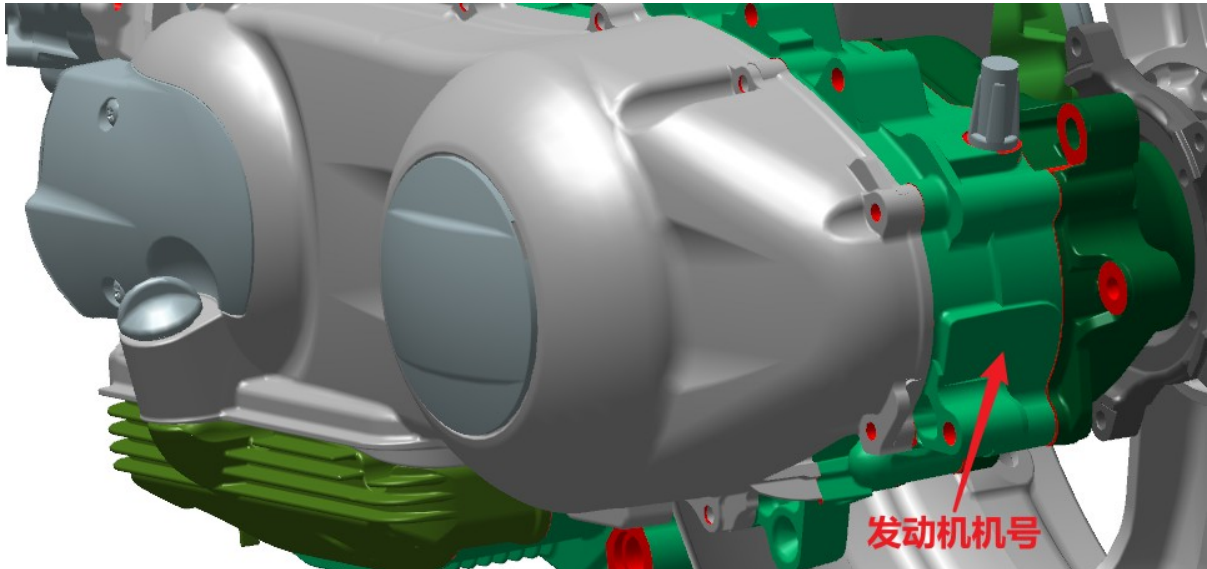


Figure 9 Engine number stamping location



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