EAS20290
ENGINE SPECIFICATIONS

Engine	
Engine type	Liquid cooled 4-stroke, SOHC
Displacement	124.7 cm^3
Cylinder arrangement	Forward-inclined single cylinder
Bore × stroke	52.0 × 58.6 mm (2.05 × 2.31 in)
Compression ratio	11.20 :1
Standard compression pressure (at sea level)	550 kPa/600 r/min (5.5 kgf/cm^2/600 r/min, 78.2 psi/600 r/min)
Minimum–maximum	480–620 kPa (4.8–6.2 kgf/cm^2, 68.3–88.2 psi)
Starting system	Electric starter
Fuel	
Recommended fuel	Premium unleaded gasoline only
Fuel tank capacity	8.5 L (2.25 US gal, 1.87 Imp.gal)
Fuel reserve amount	1.6 L (0.42 US gal, 0.35 Imp.gal)
Engine oil	
Lubrication system	Wet sump
Type	SAE 10W-30, SAE 10W-40, SAE 15W-40, SAE 20W-40 or SAE 20W-50
Recommended engine oil grade	API service SG type or higher, JASO standard MA
Engine oil quantity	
Total amount	1.15 L (1.22 US qt, 1.01 Imp.qt)
Without oil filter element replacement	0.95 L (1.00 US qt, 0.84 Imp.qt)
With oil filter element replacement	1.00 L (1.06 US qt, 0.88 Imp.qt)
Oil filter	
Oil filter type	Paper
Oil pump	
Oil pump type	Trochoid
Inner-rotor-to-outer-rotor-tip clearance	Less than 0.150 mm (0.0059 in)
Limit	0.23 mm (0.0091 in)
Outer-rotor-to-oil-pump-housing clearance	0.130–0.180 mm (0.0051–0.0071 in)
Limit	0.25 mm (0.0098 in)
Oil-pump-housing-to-inner-and-outer-rotor clearance	0.06–0.11 mm (0.0024–0.0043 in)
Limit	0.18 mm (0.0071 in)
Relief valve operating pressure	39.2–78.4 kPa (0.39–0.78 kgf/cm^2, 5.7–11.4 psi)
Pressure check location	Check bolt on cylinder head body

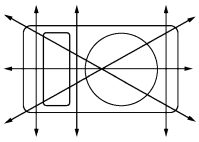
Valve opening temperature	80.5–83.5 °C (176.90–182.30 °F)
Valve full open temperature	95.0 °C (203.00 °F)
Valve lift (full open)	3.0 mm (0.12 in)
Radiator core	
Width	128.0 mm (5.04 in)
Height	258.0 mm (10.16 in)
Depth	24.0 mm (0.94 in)
Water pump	
Water pump type	Single suction centrifugal pump
Reduction ratio	19/38 (0.500)

Spark plug (s)

Manufacturer/model	NGK/CR8E
Spark plug gap	0.7–0.8 mm (0.028–0.031 in)

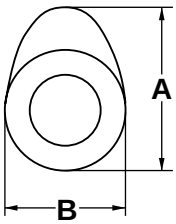
Cylinder head

Volume	9.90–10.50 cm³ (0.60–0.64 cu.in)
Warpage limit	0.03 mm (0.0012 in)

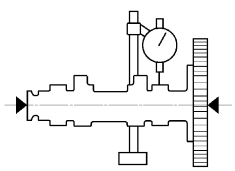


Camshaft

Drive system	Chain drive (left)
Camshaft lobe dimensions	
Intake A	30.225–30.325 mm (1.1900–1.1939 in)
Limit	30.125 mm (1.1860 in)
Intake B	25.127–25.227 mm (0.9893–0.9932 in)
Limit	25.027 mm (0.9853 in)
Exhaust A	30.232–30.332 mm (1.1902–1.1942 in)
Limit	30.132 mm (1.1863 in)
Exhaust B	25.065–25.165 mm (0.9868–0.9907 in)
Limit	24.965 mm (0.9829 in)

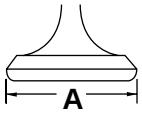
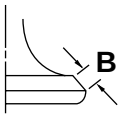
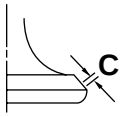
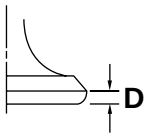


Camshaft runout limit	0.030 mm (0.0012 in)

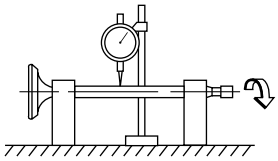


Timing chain

Model/number of links	DID SCR-0404SV/96

Tensioning system	Automatic
Rocker arm/rocker arm shaft	
Rocker arm inside diameter	9.985–10.000 mm (0.3931–0.3937 in)
Limit	10.015 mm (0.3943 in)
Rocker arm shaft outside diameter	9.966–9.976 mm (0.3924–0.3928 in)
Limit	9.941 mm (0.3914 in)
Rocker-arm-to-rocker-arm-shaft clearance	0.009–0.034 mm (0.0004–0.0013 in)
Limit	0.074 mm (0.0029 in)
Valve, valve seat, valve guide	
Valve clearance (cold)	
Intake	0.10–0.14 mm (0.0039–0.0055 in)
Exhaust	0.20–0.24 mm (0.0079–0.0094 in)
Valve dimensions	
Valve head diameter A (intake)	19.40–19.60 mm (0.7638–0.7717 in)
Valve head diameter A (exhaust)	16.90–17.10 mm (0.6654–0.6732 in)
	
Valve face width B (intake)	1.538–2.138 mm (0.0606–0.0842 in)
Valve face width B (exhaust)	1.538–2.138 mm (0.0606–0.0842 in)
	
Valve seat width C (intake)	0.90–1.10 mm (0.0354–0.0433 in)
Limit	1.6 mm (0.06 in)
Valve seat width C (exhaust)	0.90–1.10 mm (0.0354–0.0433 in)
Limit	1.6 mm (0.06 in)
	
Valve margin thickness D (intake)	0.50–0.90 mm (0.0197–0.0354 in)
Valve margin thickness D (exhaust)	0.50–0.90 mm (0.0197–0.0354 in)
	
Valve stem diameter (intake)	4.475–4.490 mm (0.1762–0.1768 in)
Limit	4.445 mm (0.1750 in)
Valve stem diameter (exhaust)	4.460–4.475 mm (0.1756–0.1762 in)
Limit	4.430 mm (0.1744 in)
Valve guide inside diameter (intake)	4.500–4.512 mm (0.1772–0.1776 in)
Limit	4.550 mm (0.1791 in)
Valve guide inside diameter (exhaust)	4.500–4.512 mm (0.1772–0.1776 in)
Limit	4.550 mm (0.1791 in)
Valve-stem-to-valve-guide clearance (intake)	0.010–0.037 mm (0.0004–0.0015 in)
Limit	0.080 mm (0.0032 in)

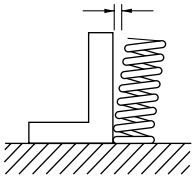
Valve-stem-to-valve-guide clearance (exhaust)	0.025–0.052 mm (0.0010–0.0020 in)
Limit	0.100 mm (0.0039 in)
Valve stem runout	0.010 mm (0.0004 in)



Cylinder head valve seat width (intake)	0.90–1.10 mm (0.0354–0.0433 in)
Limit	1.6 mm (0.06 in)
Cylinder head valve seat width (exhaust)	0.90–1.10 mm (0.0354–0.0433 in)
Limit	1.6 mm (0.06 in)

Valve spring

Free length (intake)	41.71 mm (1.64 in)
Limit	39.62 mm (1.56 in)
Free length (exhaust)	41.71 mm (1.64 in)
Limit	39.62 mm (1.56 in)
Installed length (intake)	35.30 mm (1.39 in)
Installed length (exhaust)	35.30 mm (1.39 in)
Spring rate K1 (intake)	23.54 N/mm (2.40 kgf/mm, 134.41 lb/in)
Spring rate K2 (intake)	36.58 N/mm (3.73 kgf/mm, 208.87 lb/in)
Spring rate K1 (exhaust)	23.54 N/mm (2.40 kgf/mm, 134.41 lb/in)
Spring rate K2 (exhaust)	36.58 N/mm (3.73 kgf/mm, 208.87 lb/in)
Installed compression spring force (intake)	140.00–162.00 N (14.28–16.52 kgf, 31.47–36.42 lbf)
Installed compression spring force (exhaust)	140.00–162.00 N (14.28–16.52 kgf, 31.47–36.42 lbf)
Spring tilt (intake)	2.5°/1.8 mm
Spring tilt (exhaust)	2.5°/1.8 mm



Winding direction (intake)	Clockwise
Winding direction (exhaust)	Clockwise

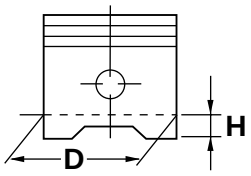
Cylinder

Bore	52.000–52.010 mm (2.0472–2.0476 in)
Wear limit	52.110 mm (2.0516 in)
Taper limit	0.050 mm (0.0020 in)
Out of round limit	0.005 mm (0.0002 in)

Piston

Piston-to-cylinder clearance	0.015–0.048 mm (0.0006–0.0019 in)
Limit	0.15 mm (0.0059 in)
Diameter D	51.962–51.985 mm (2.0457–2.0466 in)

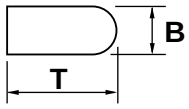
Height H	5.0 mm (0.20 in)



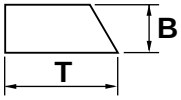
Offset	0.50 mm (0.0197 in)
Offset direction	Intake side
Piston pin bore inside diameter	14.002–14.013 mm (0.5513–0.5517 in)
Limit	14.043 mm (0.5529 in)
Piston pin outside diameter	13.995–14.000 mm (0.5510–0.5512 in)
Limit	13.975 mm (0.5502 in)
Piston-pin-to-piston-pin-bore clearance	0.002–0.018 mm (0.0001–0.0007 in)
Limit	0.068 mm (0.0027 in)

Piston ring

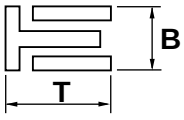
Top ring	
Ring type	Barrel
Dimensions (B × T)	0.80 × 1.90 mm (0.03 × 0.07 in)



End gap (installed)	0.10–0.25 mm (0.0039–0.0098 in)
Limit	0.50 mm (0.0197 in)
Ring side clearance	0.030–0.065 mm (0.0012–0.0026 in)
Limit	0.100 mm (0.0039 in)
2nd ring	
Ring type	Taper
Dimensions (B × T)	0.80 × 2.10 mm (0.03 × 0.08 in)



End gap (installed)	0.10–0.25 mm (0.0039–0.0098 in)
Limit	0.60 mm (0.0236 in)
Ring side clearance	0.020–0.055 mm (0.0008–0.0022 in)
Limit	0.100 mm (0.0039 in)
Oil ring	
Dimensions (B × T)	1.50 × 1.95 mm (0.06 × 0.08 in)

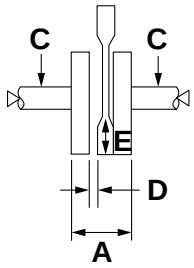


End gap (installed)	0.20–0.70 mm (0.0079–0.0276 in)
Ring side clearance	0.040–0.160 mm (0.0016–0.0063 in)

Crankshaft

Width A	47.95–48.00 mm (1.888–1.890 in)

Runout limit C	0.030 mm (0.0012 in)
Big end side clearance D	0.110–0.410 mm (0.0043–0.0161 in)
Big end radial clearance E	0.004–0.014 mm (0.0002–0.0006 in)



Balancer

Balancer drive method	Gear

Clutch

Clutch type	Wet, multiple-disc
Clutch release method	Inner push, cam push
Clutch lever free play	10.0–15.0 mm (0.39–0.59 in)
Friction plate 1 thickness	2.90–3.10 mm (0.114–0.122 in)
Wear limit	2.80 mm (0.1102 in)
Plate quantity	1 pc
Friction plate 3 thickness	2.90–3.10 mm (0.114–0.122 in)
Wear limit	2.80 mm (0.1102 in)
Plate quantity	3 pcs
Friction plate 2 thickness	2.90–3.10 mm (0.114–0.122 in)
Wear limit	2.80 mm (0.1102 in)
Plate quantity	1 pc
Clutch plate thickness	1.45–1.75 mm (0.057–0.069 in)
Plate quantity	4 pcs
Warpage limit	0.20 mm (0.0079 in)
Clutch spring free length	38.71 mm (1.52 in)
Minimum length	36.77 mm (1.45 in)
Spring quantity	4 pcs
Long clutch push rod bending limit	0.500 mm (0.0197 in)

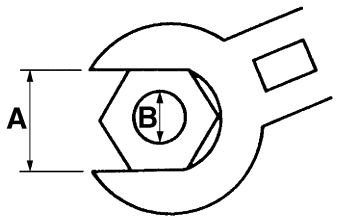
Transmission

Transmission type	Constant mesh 6-speed
Primary reduction system	Helical gear
Primary reduction ratio	73/24 (3.042)
Secondary reduction system	
Secondary reduction ratio	
Operation	
Gear ratio	
1st	34/12 (2.833)
2nd	30/16 (1.875)
3rd	30/22 (1.364)
4th	24/21 (1.143)
5th	22/23 (0.957)
6th	21/25 (0.840)
Main axle runout limit	0.08 mm (0.0032 in)

EAS20320
TIGHTENING TORQUES

EAS20330
GENERAL TIGHTENING TORQUE SPECIFICATIONS

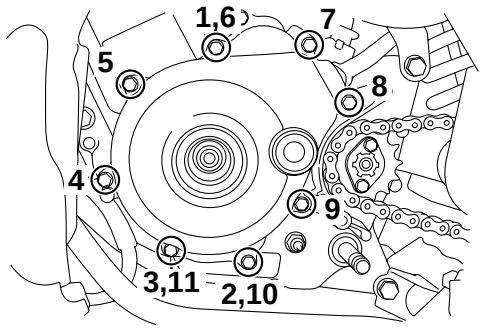
This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided for each chapter of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross pattern and progressive stages until the specified tightening torque is reached. Unless otherwise specified, tightening torque specifications require clean, dry threads. Components should be at room temperature.



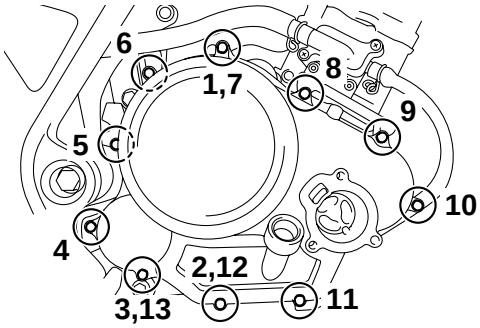
A. Distance between flats
B. Outside thread diameter

A (nut)	B (bolt)	General tightening torques		
		Nm	m·kgf	ft·lbf
10 mm	6 mm	6	0.6	4.3
12 mm	8 mm	15	1.5	11
14 mm	10 mm	30	3.0	22
17 mm	12 mm	55	5.5	40
19 mm	14 mm	85	8.5	61
22 mm	16 mm	130	13.0	94

Generator cover tightening sequence:

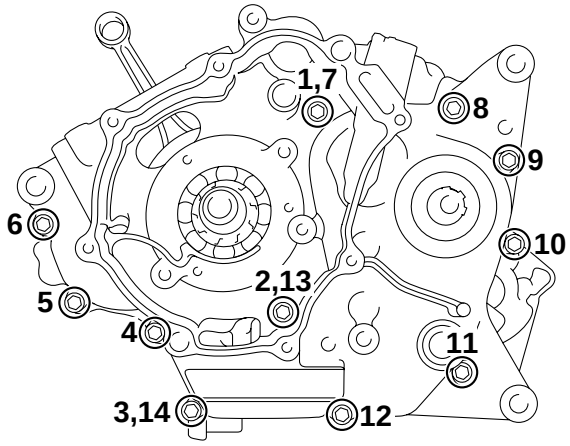


Clutch cover tightening sequence:

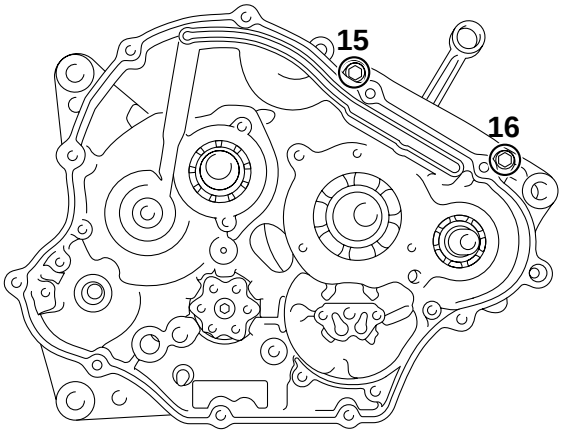


Crankcase tightening sequence:

A



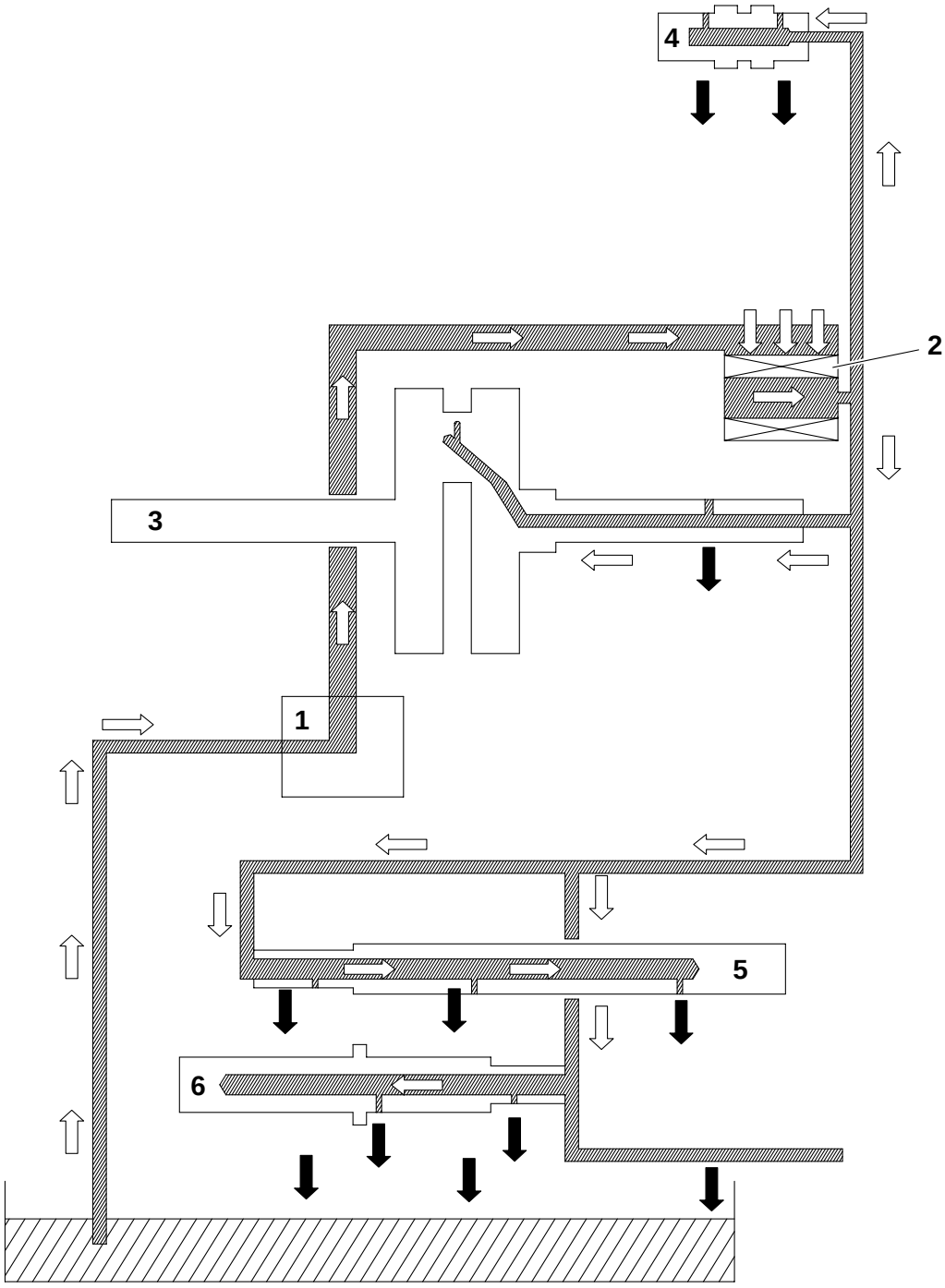
B



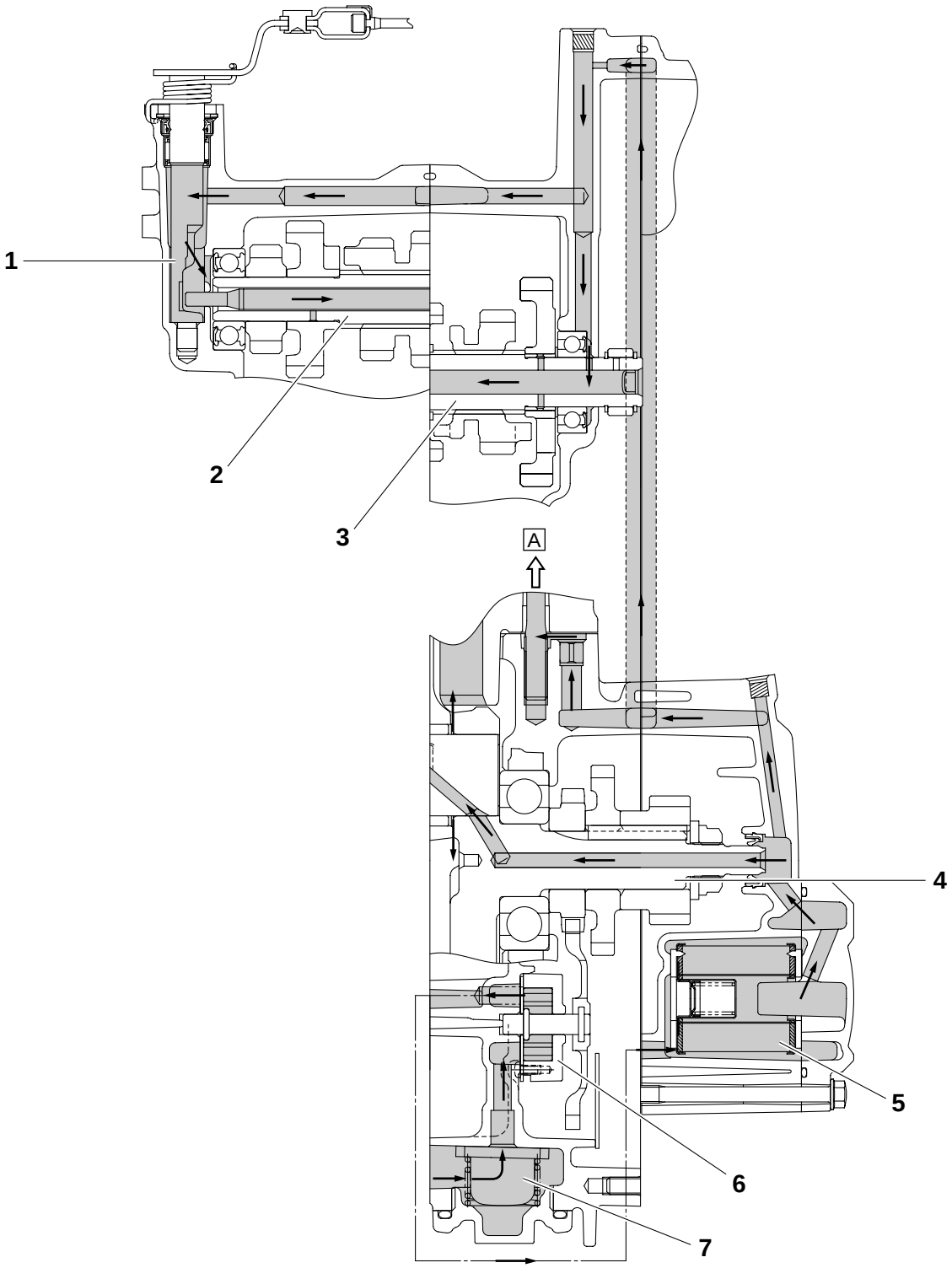
A. Left crankcase
B. Right crankcase

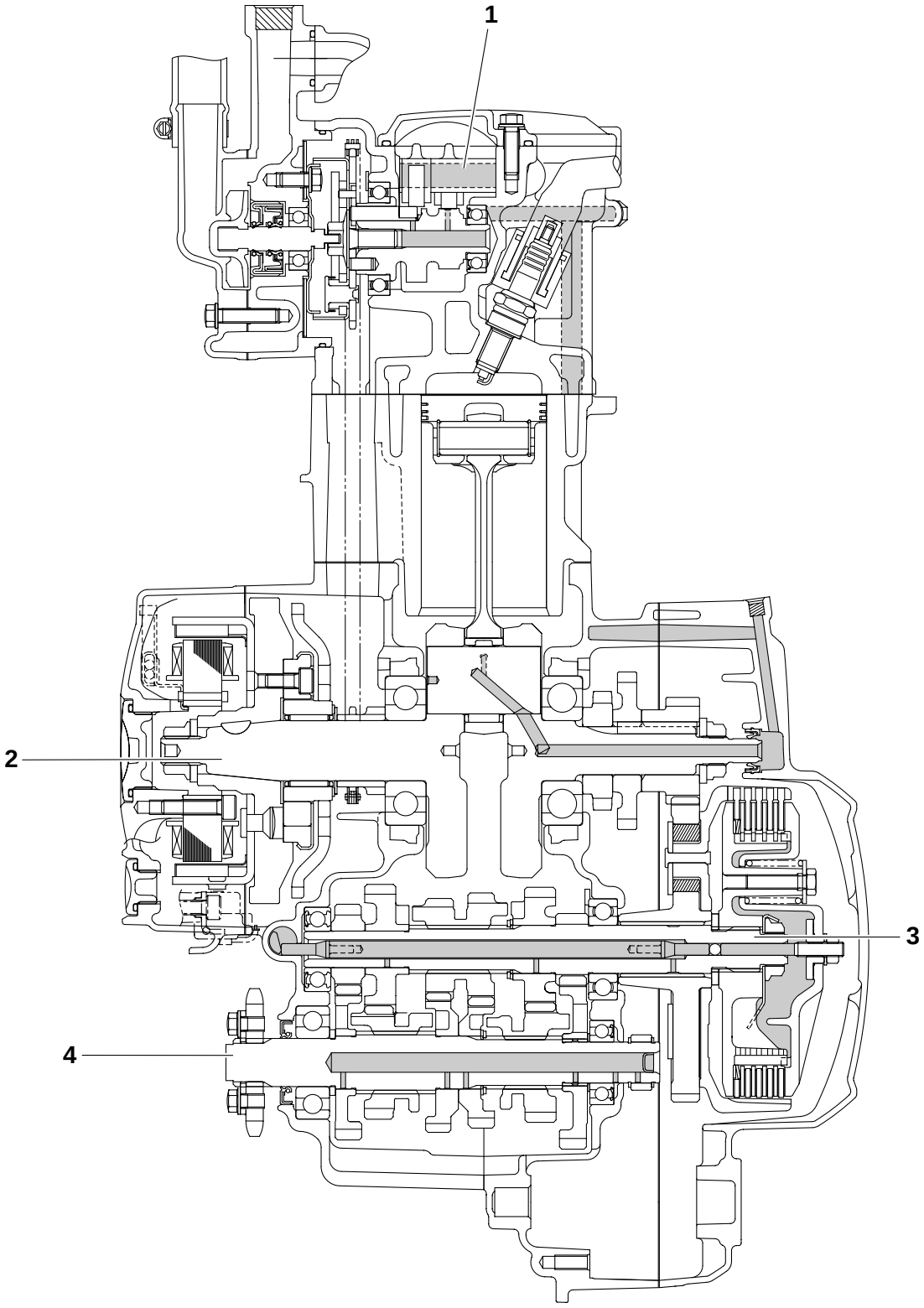
EAS20390
LUBRICATION SYSTEM CHART AND DIAGRAMS

EAS20400
ENGINE OIL LUBRICATION CHART



EAS20410
LUBRICATION DIAGRAMS




1
2
3
4

EAS20472
ENGINE

EAS20520
ADJUSTING THE VALVE CLEARANCE

The following procedure applies to all of the valves.

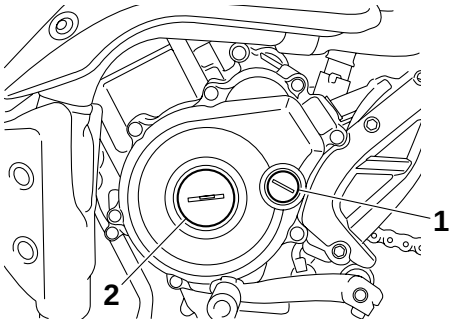
TIP

- Valve clearance adjustment should be made on a cold engine, at room temperature.
- When the valve clearance is to be measured or adjusted, the piston must be at top dead center (TDC) on the compression stroke.

1. Remove fuel tank

2. Disconnect:
   - Spark plug cap
3. Remove:
4. Spark plug
5. Cylinder head cover
6. Cylinder head cover gasket

4. Remove:
   - Timing mark accessing screw “1”
   - Crankshaft end accessing screw “2”



5. Measure:
   - Valve clearance
     Out of specification → Adjust.

Valve clearance (cold)
Intake
0.10–0.14 mm (0.0039–0.0055 in)
Exhaust
0.20–0.24 mm (0.0079–0.0094 in)

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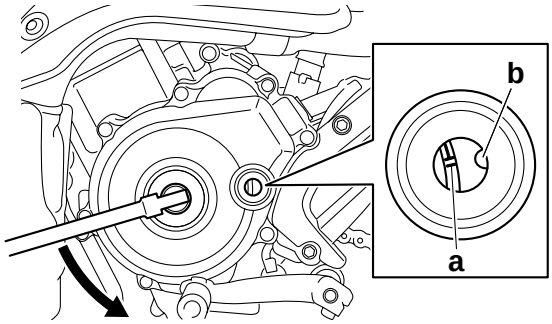
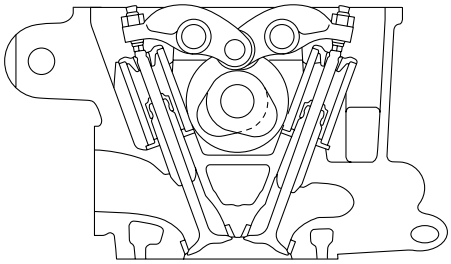
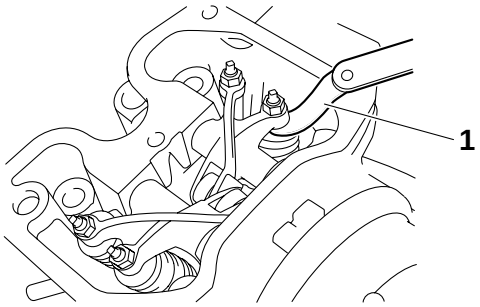
a. Turn the crankshaft counterclockwise.
b. Align the TDC mark “a” on the generator rotor with the stationary pointer “b” on the generator cover.



c. Check that the cam lobes are positioned as shown in the illustration.



d. Measure the valve clearance with a thickness gauge “1”.
   Out of specification → Adjust.



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6. Adjust:
   - Valve clearance

▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼▼

a. Loosen the locknut “1”.
b. Insert a thickness gauge “2” between the end of the adjusting screw and the valve tip.

TIP

The ignition timing is not adjustable.

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4. Remove:
   • Digital tachometer
   • Timing light
5. Install:
   • Timing mark accessing screw
   (along with the O-ring New)

EAS20710

MEASURING THE COMPRESSION PRESSURE

TIP

Insufficient compression pressure will result in a loss of performance.

1. Measure:
2. Valve clearance
   Out of specification → Adjust.

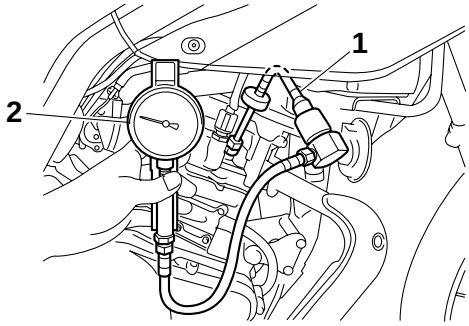
2. Start the engine, warm it up for several minutes, and then turn it off.
3. Disconnect:
   • Spark plug cap
4. Remove:
   • Spark plug

ECA13330

NOTICE

Before removing the spark plug, blow away any dirt accumulated in the spark plug well with compressed air to prevent it from falling into the cylinder.

5. Install:
   • Extension “1”
   • Compression gauge “2”



6. Measure:
   • Compression pressure
   Out of specification → Refer to steps (c) and (d).

Standard compression pressure (at sea level)
550 kPa/600 r/min (5.5 kgf/cm²/600 r/min, 78.2 psi/600 r/min)
Minimum–maximum
480–620 kPa (4.8–6.2 kgf/cm², 68.3–88.2 psi)

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a. Set the main switch to “ON”.
b. With the throttle wide open, crank the engine until the reading on the compression gauge stabilizes.
c. If the compression pressure is above the maximum specification, check the cylinder head, valve surfaces and piston crown for carbon deposits.
   Carbon deposits → Eliminate.
d. If the compression pressure is below the minimum specification, pour a teaspoonful of engine oil into the spark plug bore and measure again.
   Refer to the following table.

Compression pressure (with oil applied into the cylinder)	
Reading	Diagnosis
Higher than without oil	Piston ring(s) wear or damage → Repair.
Same as without oil	Piston, valves, cylinder head gasket or piston ring(s) possibly defective → Repair.

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7. Remove:
   • Extension
   • Compression gauge

8. Install:
   • Spark plug

Spark plug
13 Nm (1.3 m·kgf, 9.4 ft·lbf)

9. Connect:
   • Spark plug cap

EAS28920
CHECKING THE ENGINE OIL LEVEL

1. Stand the vehicle on a level surface.

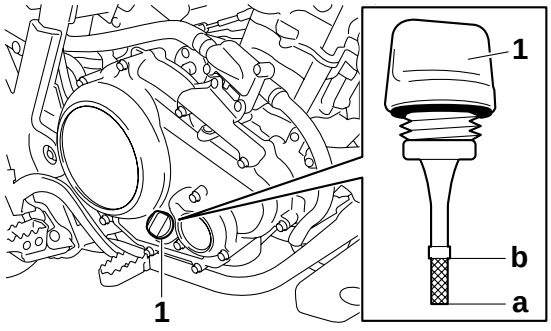
TIP

- Place the vehicle on a suitable stand.
- Make sure the vehicle is upright.

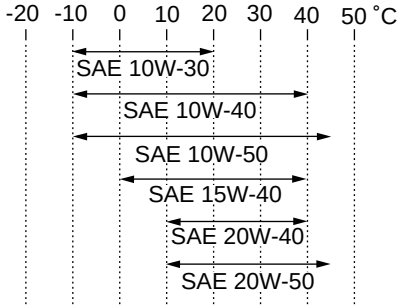
2. Start the engine, warm it up for several minutes, and then turn it off.
3. Check:
   • Engine oil level
   The engine oil level should be between the minimum level mark “a” and maximum level mark “b”.
   Below the minimum level mark → Add the recommended engine oil to the proper level.

TIP

- Before checking the engine oil level, wait a few minutes until the oil has settled.
- Do not screw the engine oil filler cap (dipstick) “1” in when checking the oil level.

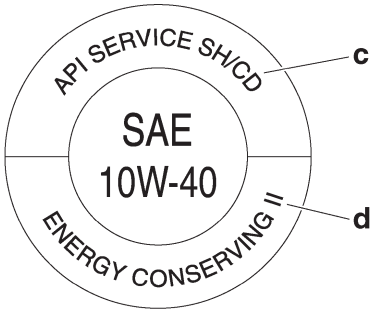


Type
SAE 10W-30, SAE 10W-40, SAE 15W-40, SAE 20W-40 or SAE 20W-50
Recommended engine oil grade
API service SG type or higher, JASO standard MA



ECA22B1020
NOTICE

- **Engine oil also lubricates the clutch and the wrong oil types or additives could cause clutch slippage. Therefore, do not add any chemical additives or use engine oils with a grade of “CD” “c” or higher and do not use oils labeled “ENERGY CONSERVING II” “d”.**
- **Do not allow foreign materials to enter the crankcase.**



4. Start the engine, warm it up for several minutes, and then turn it off.
5. Check the engine oil level again.

TIP

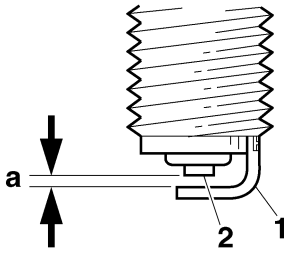
Before checking the engine oil level, wait a few minutes until the oil has settled.

EAS20810
CHANGING THE ENGINE OIL

1. Start the engine, warm it up for several minutes, and then turn it off.
2. Place a container under the engine oil drain plug.
3. Remove:
   • Engine oil filler cap (dipstick) “1”
   • Engine oil drain plug “2”
   • O-ring “3”
   • Spring “4”
   • Engine oil strainer “5”

4. Check:
   • Electrode “1”
   Damage/wear → Replace the spark plug.
   • Insulator “2”
   Abnormal color → Replace the spark plug.
   Normal color is medium-to-light tan.
5. Clean:
   • Spark plug
   (with a spark plug cleaner or wire brush)
6. Measure:
   • Spark plug gap “a”
   (with a wire thickness gauge)
   Out of specification → Regap.

Spark plug gap
0.7–0.8 mm (0.028–0.031 in)



7. Install:
   • Spark plug

Spark plug
13 Nm (1.3 m·kgf, 9.4 ft·lbf)

TIP

Before installing the spark plug, clean the spark plug and gasket surface.

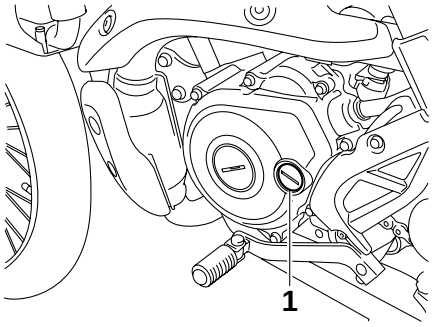
8. Connect:
   • Spark plug cap

EAS20700
CHECKING THE IGNITION TIMING

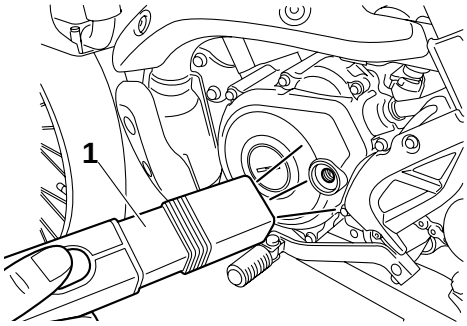
TIP

Prior to checking the ignition timing, check the wiring connections of the entire ignition system. Make sure all connections are tight and free of corrosion.

1. Remove:
   • Timing mark accessing screw “1”



2. Connect:
   • Timing light “1”
   • Digital tachometer



3. Check:
   • Ignition timing

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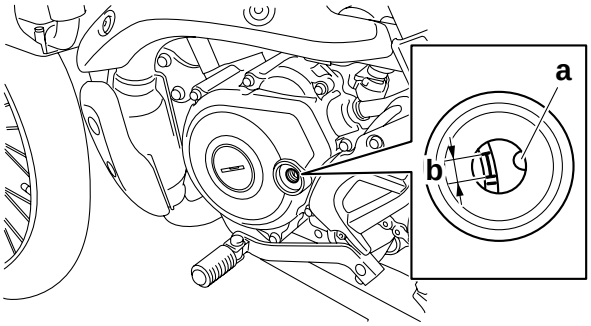
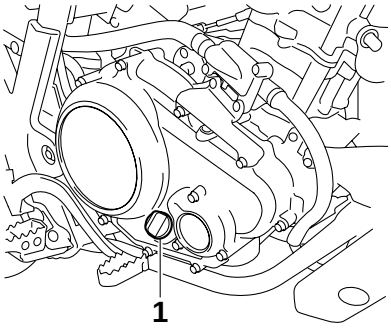
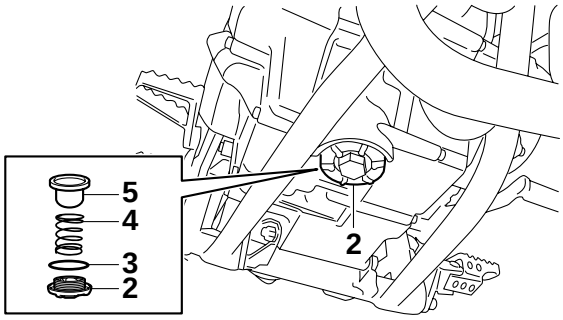
a. Start the engine, warm it up for several minutes, and then let it run at the specified engine idling speed.

Engine idling speed
1400–1600 r/min

b. Check that the stationary pointer “a” on the generator cover is within the firing range “b” on the generator rotor.
   Incorrect firing range → Check the ignition system.







4. Drain:
   • Engine oil
   (completely from the crankcase)
5. If the oil filter element is also to be replaced, perform the following procedure.

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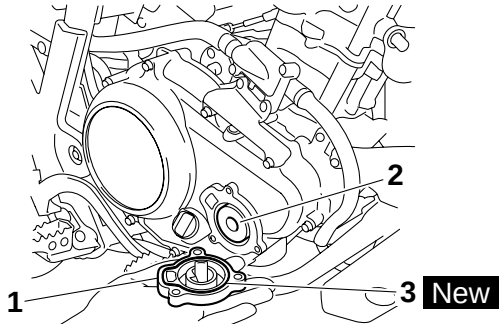
a. Remove the oil filter element cover “1” and oil filter element “2”.
b. Install a new O-ring “3”.



c. Install the new oil filter element and the oil filter element cover.

	Oil filter element cover bolt **10 Nm (1.0 m·kgf, 7.2 ft·lbf)**

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6. Check:
   • Engine oil strainer
   Dirt → Clean.
7. Install:
   • Engine oil strainer
   • Spring
   • O-ring New
   • Engine oil drain plug

	Engine oil drain plug **32 Nm (3.2 m·kgf, 23 ft·lbf)**

8. Fill:
   • Crankcase
   (with the specified amount of the recommended engine oil)

	Engine oil quantity **Total amount** **1.15 L (1.22 US qt, 1.01 Imp.qt)** **Without oil filter element replacement** **0.95 L (1.00 US qt, 0.84 Imp.qt)** **With oil filter element replacement** **1.00 L (1.06 US qt, 0.88 Imp.qt)**

9. Install:
   • Engine oil filler cap (dipstick)
10. Start the engine, warm it up for several minutes, and then turn it off.
11. Check:
   • Engine
   (for engine oil leaks)
12. Check:
   • Engine oil level

13. Check:
   • Engine oil pressure

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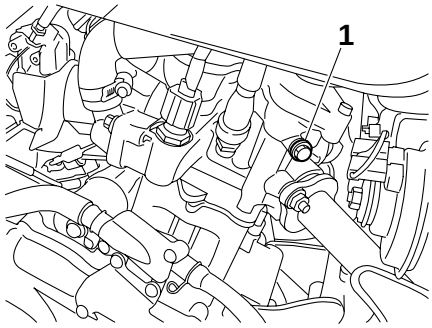
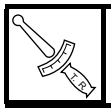
a. Slightly loosen the oil check bolt “1”.



b. Start the engine and keep it idling until engine oil starts to seep from the oil check bolt. If no engine oil comes out after one minute, turn the engine off so that it will not seize.
c. Check the engine oil passages, the oil filter element and the oil pump for damage or leakage.

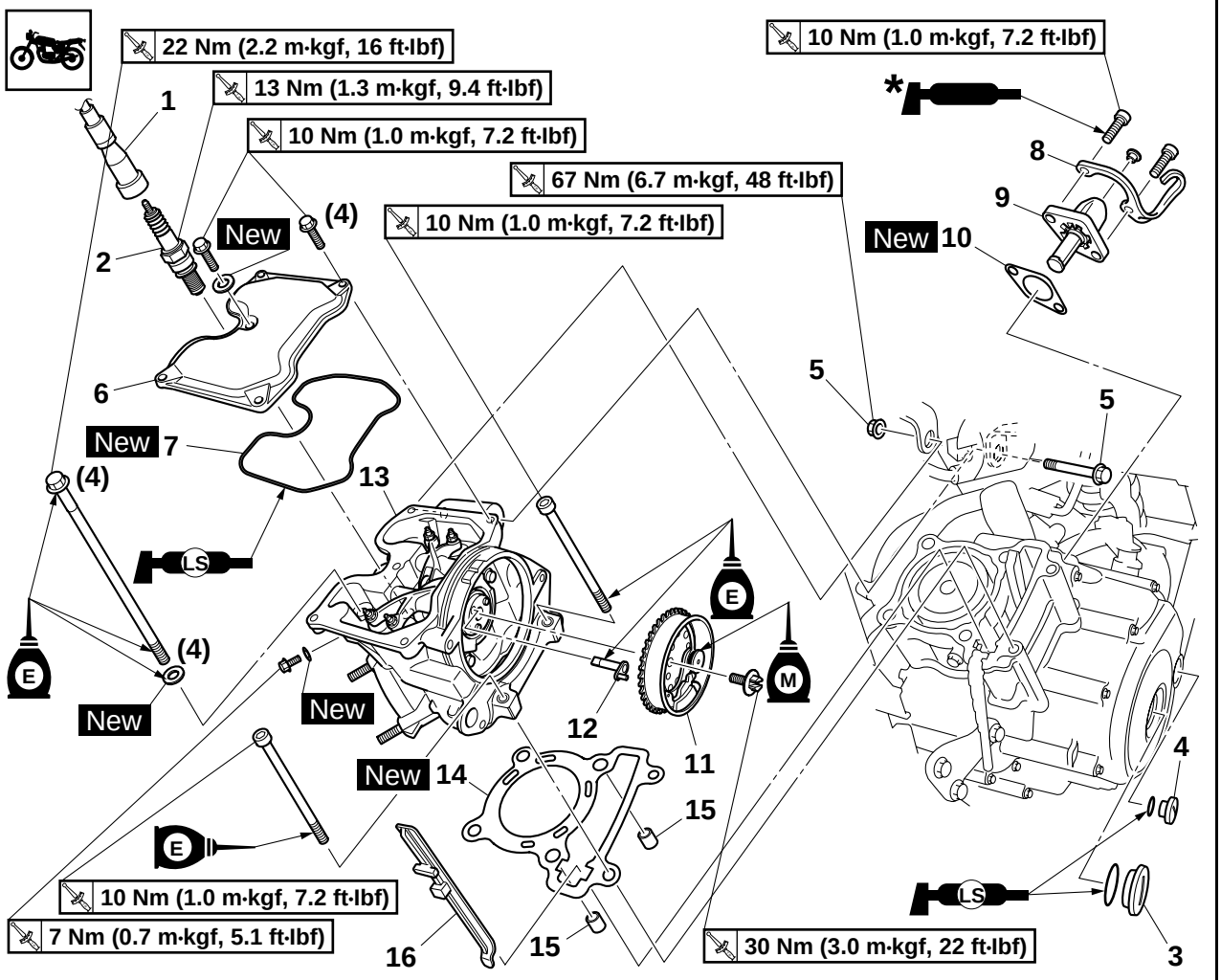
d. Start the engine after solving the problem(s) and check the engine oil pressure again.
e. Tighten the oil check bolt to specification.

	**Oil check bolt** **7 Nm (0.7 m·kgf, 5.1 ft·lbf)**

EAS24100

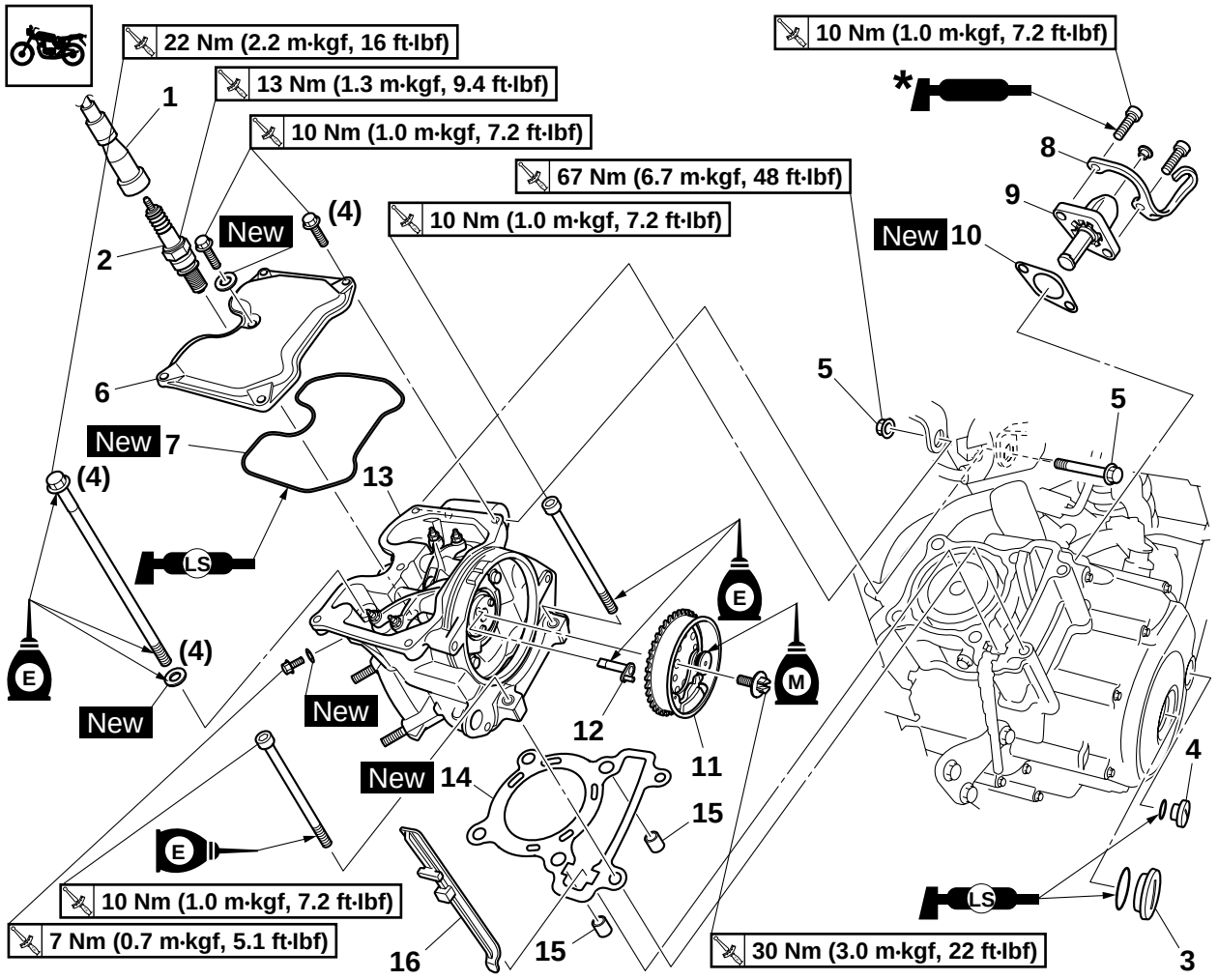
CYLINDER HEAD

Removing the cylinder head



Order	Job/Parts to remove	Q'ty	Remarks
	Seat/Fuel tank cover assembly/Air filter case		
	Coolant		
	Muffler/Exhaust pipe		
	Clutch cable		
	Fuel tank		
	Throttle body/Intake manifold		
	Radiator		
	Thermostat/Coolant temperature sensor		
	Water pump		
1	Spark plug cap	1	
2	Spark plug	1	
3	Crankshaft end accessing screw	1	
4	Timing mark accessing screw	1	

Removing the cylinder head



Order	Job/Parts to remove	Q'ty	Remarks
5	Engine front upper mounting bolt/nut	1/1	
6	Cylinder head cover	1	
7	Cylinder head cover gasket	1	
8	Clutch cable holder	1	
9	Timing chain tensioner	1	
10	Timing chain tensioner gasket	1	
11	Camshaft sprocket	1	
12	Decompression cam	1	
13	Cylinder head	1	
14	Cylinder head gasket	1	
15	Dowel pin	2	
16	Timing chain guide (exhaust side)	1	

EAS24130
REMOVING THE CYLINDER HEAD

1. Align:
   • "I" mark "a" on the generator rotor (with the stationary pointer "b" on the generator cover)

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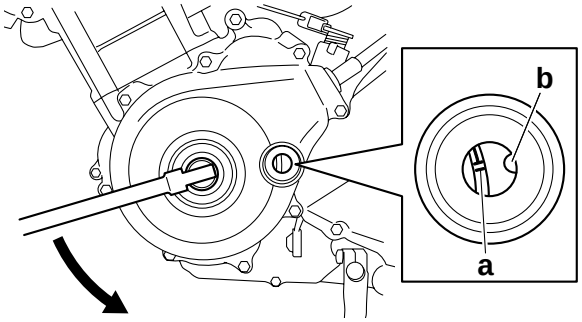
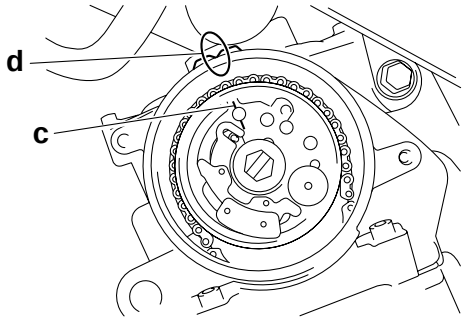
a. Turn the crankshaft counterclockwise.
b. When the piston is at TDC on the compression stroke, align the "I" mark "c" on the camshaft sprocket with the stationary pointer "d" on the cylinder head.





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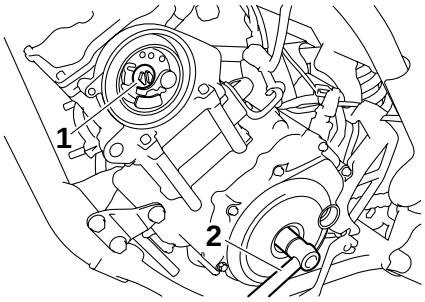
2. Loosen:
   • Camshaft sprocket bolt "1"

TIP

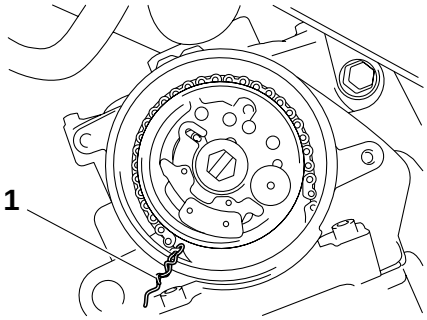
While holding the generator rotor nut with a wrench "2", loosen the camshaft sprocket bolt.



3. Remove:
   • Camshaft sprocket

TIP

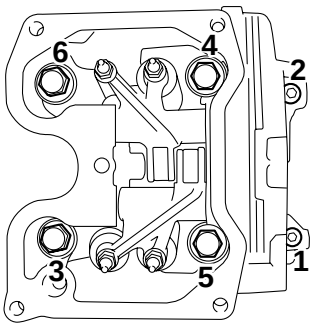
To prevent the timing chain from falling into the crankcase, fasten it with a wire "1".



4. Remove:
   • Cylinder head

TIP

- Loosen the bolts in the proper sequence as shown.
- Loosen each bolt 1/2 of a turn at a time. After all of the bolts are fully loosened, remove them.
- Remove the cylinder head from the right side of the vehicle.

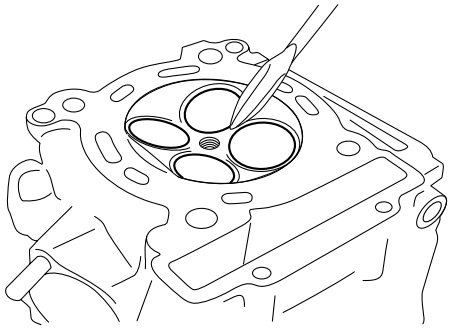


EAS24160
CHECKING THE CYLINDER HEAD

1. Eliminate:
   • Combustion chamber carbon deposits (with a rounded scraper)

TIP

Do not use a sharp instrument to avoid damaging or scratching:
- Spark plug bore threads
- Valve seats



2. Check:
   - Cylinder head
     Damage/scratches → Replace.
   - Cylinder head water jacket
     Mineral deposits/rust → Eliminate.
3. Measure:
   - Cylinder head warpage
     Out of specification → Resurface the cylinder head.

Warpage limit
0.03 mm (0.0012 in)

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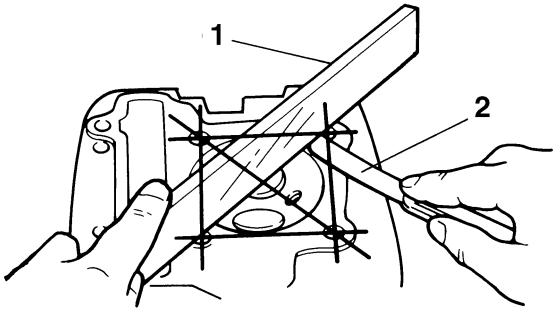
a. Place a straightedge "1" and a thickness gauge "2" across the cylinder head.



b. Measure the warpage.
c. If the limit is exceeded, resurface the cylinder head as follows.
d. Place a 400–600 grit wet sandpaper on the surface plate and resurface the cylinder head using a figure-eight sanding pattern.

TIP

To ensure an even surface, rotate the cylinder head several times.

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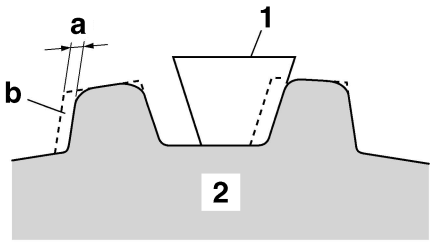
EAS22B1004

CHECKING THE CAMSHAFT SPROCKET AND TIMING CHAIN GUIDE

1. Check:
   - Camshaft sprocket
     More than 1/4 tooth wear "a" → Replace the camshaft sprocket, timing chain and crankshaft as a set.



a. 1/4 tooth
b. Correct
1. Timing chain roller
2. Camshaft sprocket

2. Check:
   - Timing chain guide (exhaust side)
     Damage/wear → Replace.

EAS24200

CHECKING THE TIMING CHAIN TENSIONER

1. Check:
   - Timing chain tensioner
     Cracks/damage/rough movement → Replace.

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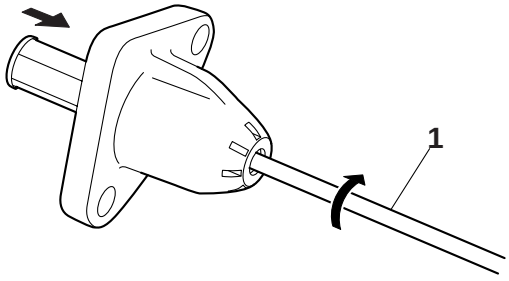
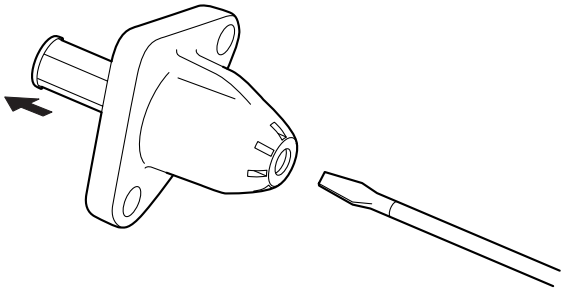
a. Remove the timing chain tensioner cap.
b. While lightly pressing the timing chain tensioner rod by hand, turn it clockwise with a thin screwdriver "1" until it stops.



c. Remove the screwdriver and slowly release the timing chain tensioner rod.



d. Make sure that the timing chain tensioner rod comes out of the timing chain tensioner housing smoothly. If there is rough movement, replace the timing chain tensioner.
e. Install the timing chain tensioner cap.

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EAS22B1005
CHECKING THE DECOMPRESSION SYSTEM

1. Check:
   • Decompression system

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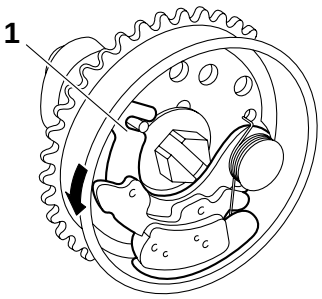
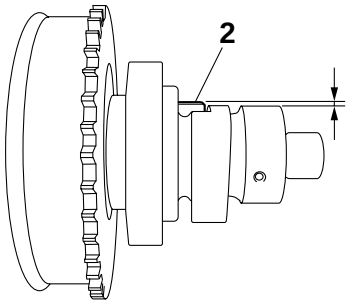
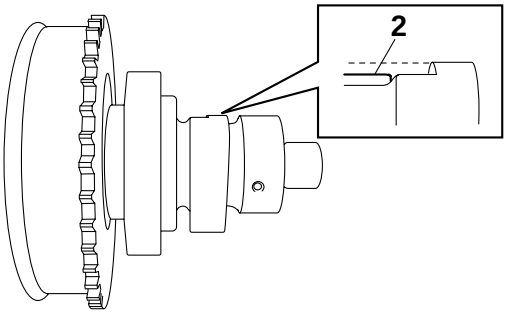
a. Check the decompression system with the camshaft sprocket and the decompression cam installed to the camshaft.
b. Check that the decompression lever “1” moves smoothly.
c. Without operating the decompression lever, check that the decompression cam “2” projects from the camshaft (exhaust cam) as shown in the illustration “A”.
d. Move the decompression lever “1” in the direction of the arrow shown and check that the decompression cam does not project from the camshaft (exhaust cam) as shown in the illustration “B”.



A



B



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EAS24230
INSTALLING THE CYLINDER HEAD

1. Install:
   • Cylinder head

TIP

Pass the timing chain through the timing chain cavity.

2. Tighten:
   • Cylinder head bolts “1”

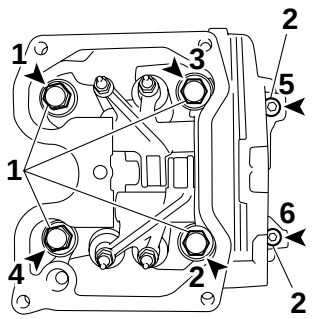
	Cylinder head bolt **22 Nm (2.2 m·kgf, 16 ft·lbf)**

   • Cylinder head bolts “2”

	Cylinder head bolt **10 Nm (1.0 m·kgf, 7.2 ft·lbf)**

TIP

- Lubricate the cylinder head bolts and washers with engine oil.
- Tighten the cylinder head bolts in the proper tightening sequence as shown and torque them in two stages.



3. Install:
   • Camshaft sprocket

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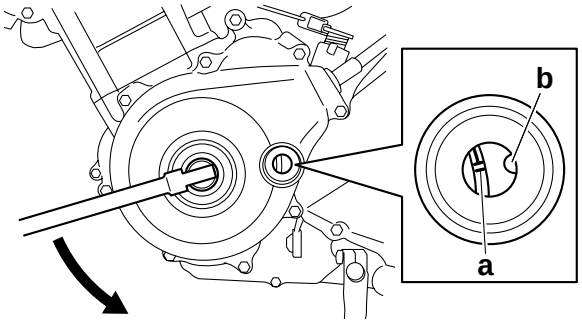
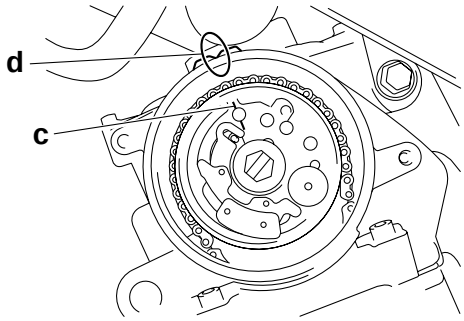
a. Turn the crankshaft counterclockwise.
b. Align the “I” mark “a” on the generator rotor with the stationary pointer “b” on the generator cover.
c. Align the “I” mark “c” on the camshaft sprocket with the stationary pointer “d” on the cylinder head.
d. Install the timing chain onto the camshaft sprocket, and then install the camshaft sprocket onto the camshaft.





TIP

When installing the camshaft sprocket, be sure to keep the timing chain as tight as possible on the exhaust side.

ECA22B1009

NOTICE

Do not turn the crankshaft when installing the camshaft to avoid damage or improper valve timing.

e. While holding the camshaft, temporarily tighten the camshaft sprocket bolt.
f. Remove the wire from the timing chain.

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4. Install:
   • Timing chain tensioner gasket New
   • Timing chain tensioner

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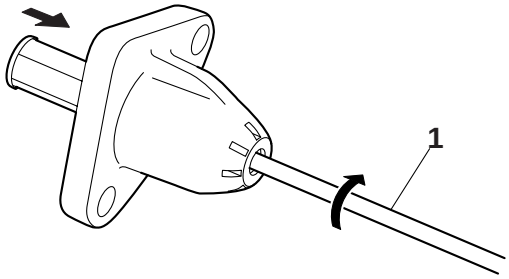
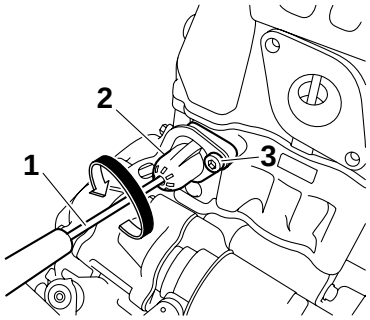
a. Remove the timing chain tensioner cap.
b. While lightly pressing the timing chain tensioner rod by hand, turn it clockwise with a thin screwdriver “1” until it stops.
c. Install the gasket and the timing chain tensioner “2” onto the cylinder, and tighten the timing chain tensioner bolts “3” to specification.

TIP

Apply sealant to the timing chain tensioner bolt threads.

	Timing chain tensioner bolt **10 Nm (1.0 m·kgf, 7.2 ft·lbf)**





d. Turn the timing chain tensioner rod counterclockwise with a thin screwdriver “1”, make sure the rod releases, and then install the timing chain tensioner cap.

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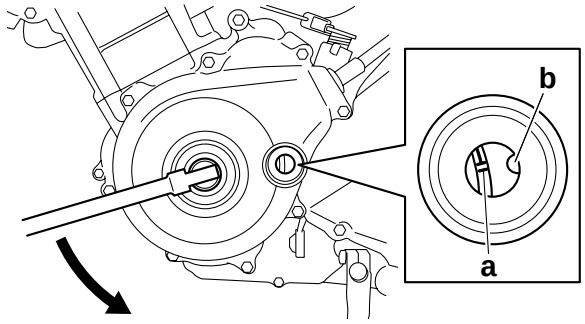
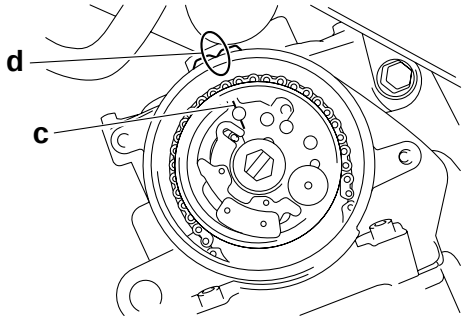
5. Turn:
   • Crankshaft
   (several turns counterclockwise)
6. Check:
   • “I” mark “a”
   Align the “I” mark on the generator rotor with the stationary pointer “b” on the generator cover.
   • “I” mark “c”
   Align the “I” mark on the camshaft sprocket with the stationary pointer “d” on the cylinder head.
   Out of alignment → Correct.
   Refer to the installation steps above.





7. Tighten:
   • Camshaft sprocket bolt

	Camshaft sprocket bolt **30 Nm (3.0 m·kgf, 22 ft·lbf)**

ECA22B1010

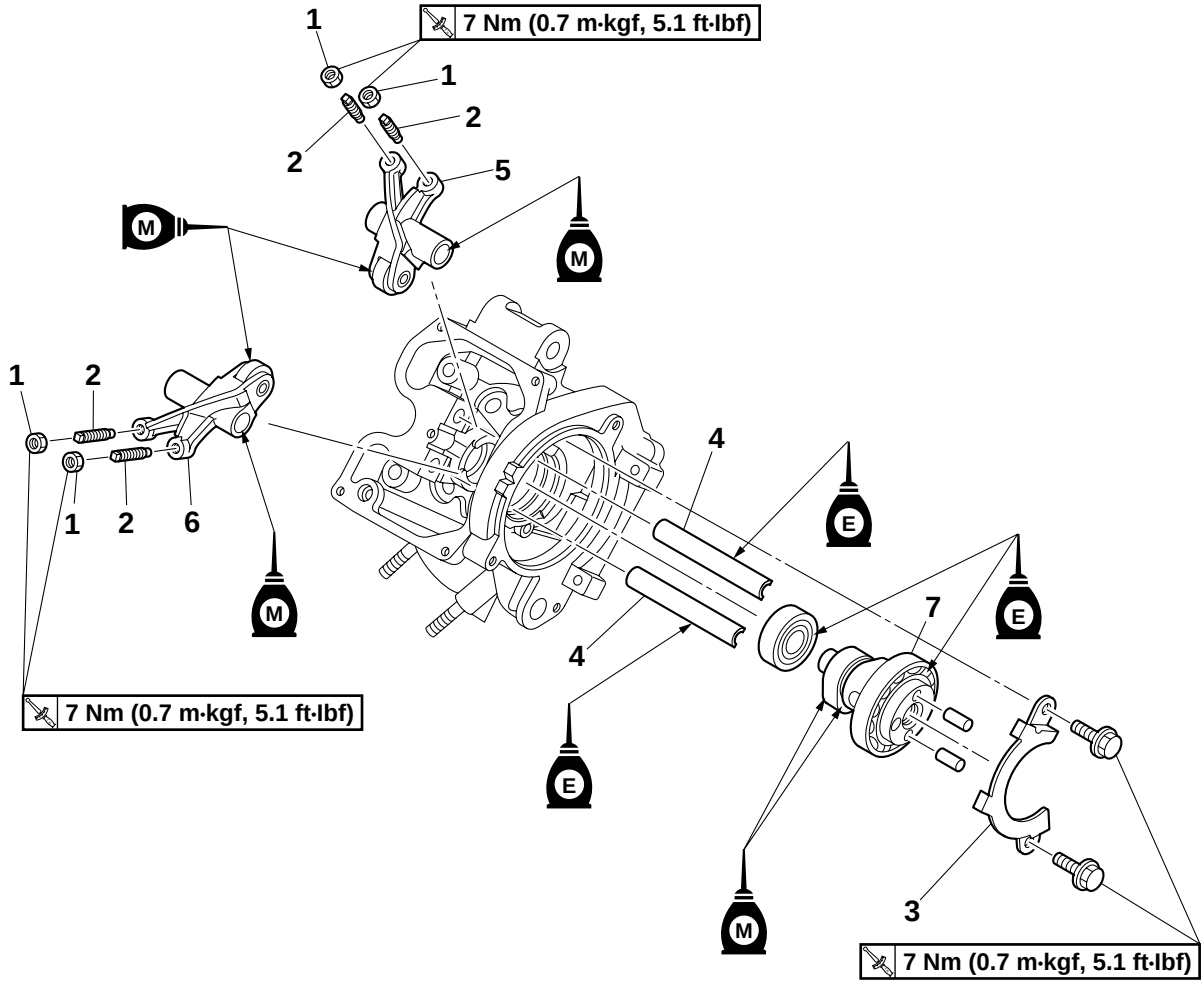
NOTICE

Be sure to tighten the camshaft sprocket bolt to the specified torque to avoid the possibility of the bolt coming loose and damaging the engine.

8. Measure:
9. Valve clearance
   Out of specification → Adjust.

EAS23730
CAMSHAFT

Removing the rocker arms and camshaft

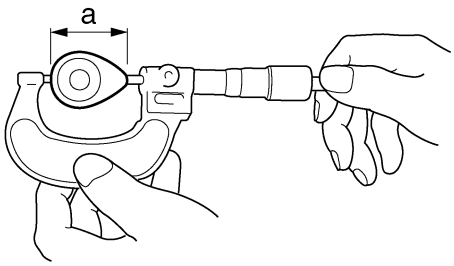


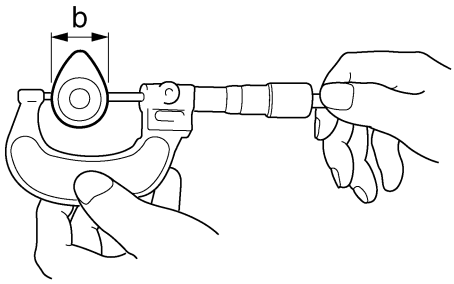
Order	Job/Parts to remove	Q'ty	Remarks
	Cylinder head		
1	Locknut	4	
2	Adjusting screw	4	
3	Camshaft retainer	1	
4	Rocker arm shaft	2	
5	Intake rocker arm	1	
6	Exhaust rocker arm	1	
7	Camshaft	1	
			For installation, reverse the removal procedure.

EAS23840
CHECKING THE CAMSHAFT

1. Check:
   - Camshaft lobes
     Blue discoloration/pitting/scratches → Replace the camshaft.
2. Measure:
   - Camshaft lobe dimensions “a” and “b”
     Out of specification → Replace the camshaft.

Camshaft lobe dimensions
Intake A
30.225–30.325 mm (1.1900–1.1939 in)
Limit
30.125 mm (1.1860 in)
Intake B
25.127–25.227 mm (0.9893–0.9932 in)
Limit
25.027 mm (0.9853 in)
Exhaust A
30.232–30.332 mm (1.1902–1.1942 in)
Limit
30.132 mm (1.1863 in)
Exhaust B
25.065–25.165 mm (0.9868–0.9907 in)
Limit
24.965 mm (0.9829 in)





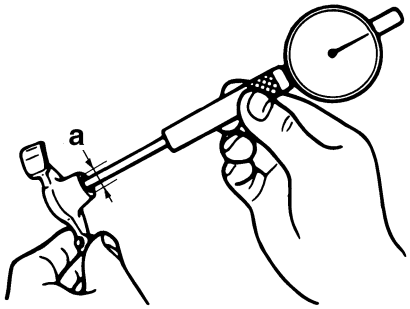
3. Check:
   - Camshaft oil passage
     Obstruction → Blow out with compressed air.

EAS23880
CHECKING THE ROCKER ARMS AND ROCKER ARM SHAFTS

The following procedure applies to all of the rocker arms and rocker arm shafts.

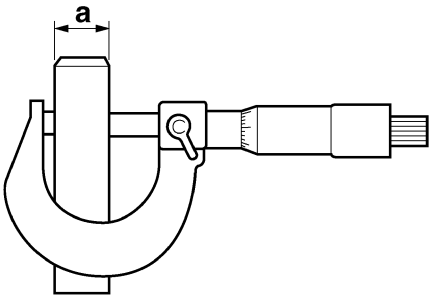
1. Check:
   - Rocker arm
     Damage/wear → Replace.
2. Check:
   - Rocker arm shaft
     Blue discoloration/excessive wear/pitting/scratches → Replace or check the lubrication system.
3. Measure:
   - Rocker arm inside diameter “a”
     Out of specification → Replace.

Rocker arm inside diameter
9.985–10.000 mm (0.3931–0.3937 in)
Limit
10.015 mm (0.3943 in)



4. Measure:
   - Rocker arm shaft outside diameter “a”
     Out of specification → Replace.

Rocker arm shaft outside diameter
9.966–9.976 mm (0.3924–0.3928 in)
Limit
9.941 mm (0.3914 in)



5. Calculate:
   • Rocker-arm-to-rocker-arm-shaft clearance

TIP

Calculate the clearance by subtracting the rocker arm shaft outside diameter from the rocker arm inside diameter.

Out of specification → Replace the defective part(s).

Rocker-arm-to-rocker-arm-shaft clearance
0.009–0.034 mm (0.0004–0.0013 in)
Limit
0.074 mm (0.0029 in)

EAS24040
INSTALLING THE CAMSHAFT AND ROCKER ARMS

1. Lubricate:
   • Rocker arms
   • Rocker arm shafts

Recommended lubricant
Rocker arm inner surface
Molybdenum disulfide oil
Rocker arm shaft
Engine oil

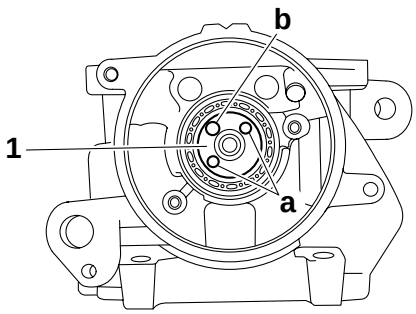
2. Lubricate:
   • Camshaft

Recommended lubricant
Camshaft
Molybdenum disulfide oil
Camshaft bearing
Engine oil

3. Install:
   • Camshaft “1”

TIP

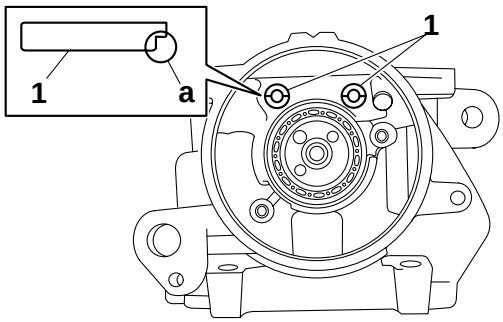
Make sure that the camshaft projections “a” and hole “b” are positioned as shown in the illustration.



4. Install:
   • Rocker arms
   • Rocker arm shafts “1”

TIP

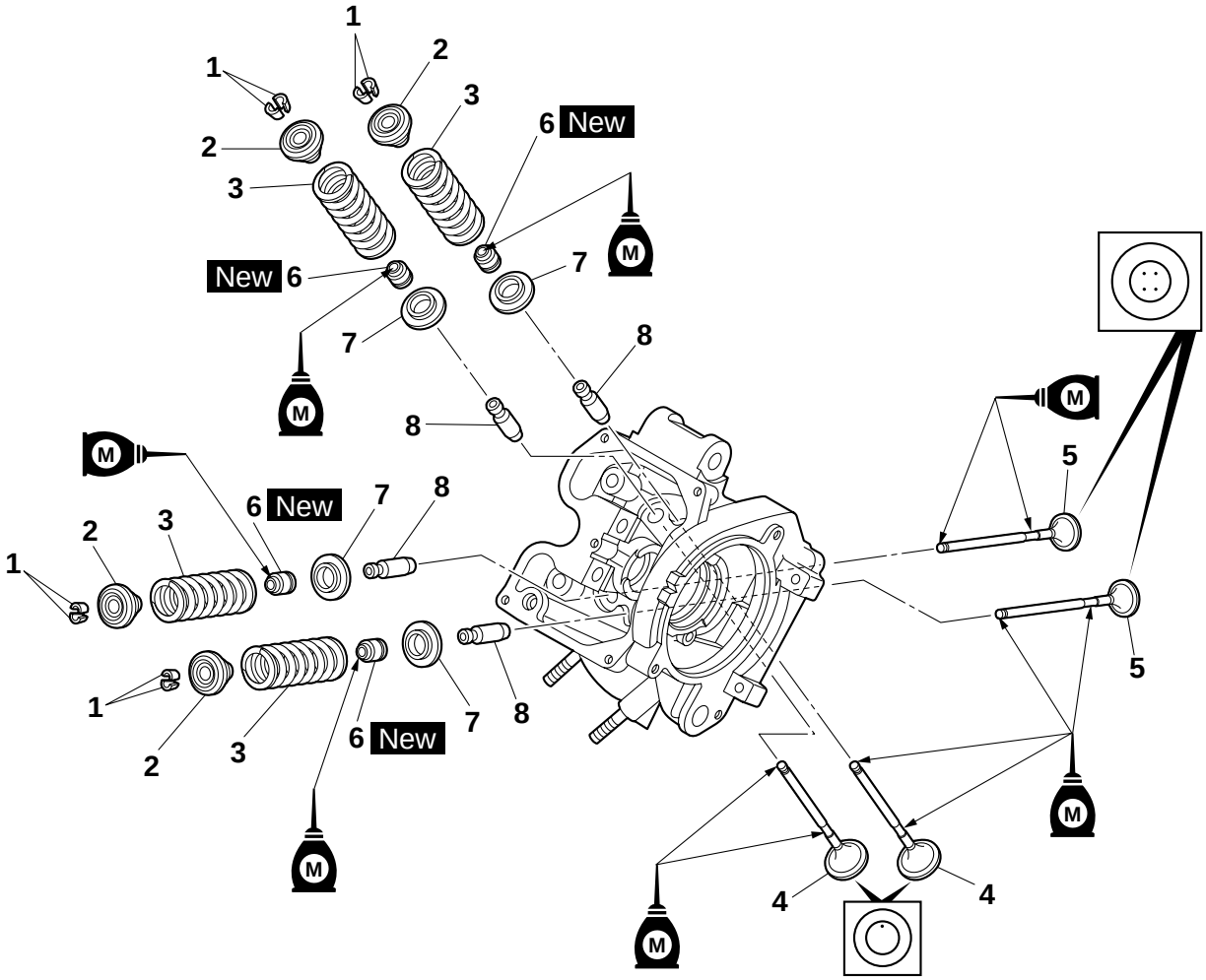
- Make sure that the cutout “a” in each rocker arm shaft is facing downward as shown in the illustration.
- Make sure the rocker arm shafts (intake and exhaust) are completely pushed into the cylinder head.



EAS24270

VALVES AND VALVE SPRINGS

Removing the valves and valve springs



Order	Job/Parts to remove	Q'ty	Remarks
	Cylinder head		
	Rocker arms/Camshaft		
1	Valve cotter	8	
2	Upper spring seat	4	
3	Valve spring	4	
4	Intake valve	2	
5	Exhaust valve	2	
6	Valve stem seal	4	
7	Lower spring seat	4	
8	Valve guide	4	

EAS24280
REMOVING THE VALVES

The following procedure applies to all of the valves and related components.

TIP

Before removing the internal parts of the cylinder head (e.g., valves, valve springs, valve seats), make sure the valves properly seal.

1. Check:
2. Valve sealing
   Leakage at the valve seat → Check the valve face, valve seat, and valve seat width.

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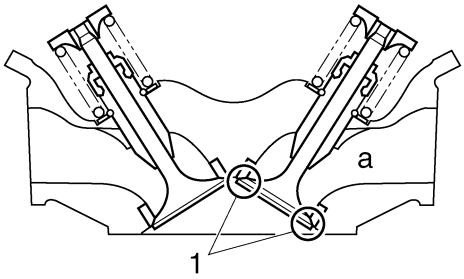
a. Pour a clean solvent “a” into the intake and exhaust ports.
b. Check that the valves properly seal.

TIP

There should be no leakage at the valve seat “1”.



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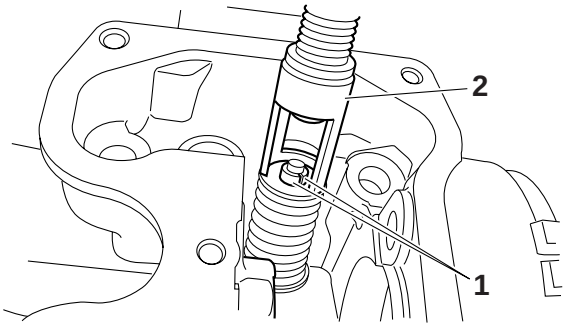
2. Remove:
   • Valve cotters “1”

TIP

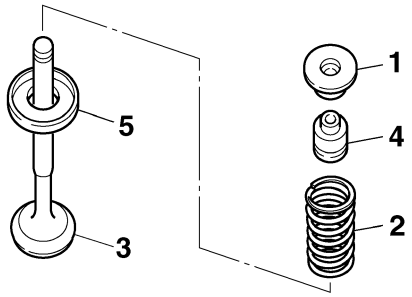
Remove the valve cotters by compressing the valve spring with the valve spring compressor and the valve spring compressor attachment “2”.



3. Remove:
   • Upper spring seat “1”
   • Valve spring “2”
   • Valve “3”
   • Valve stem seal “4”
   • Lower spring seat “5”

TIP

Identify the position of each part very carefully so that it can be reinstalled in its original place.



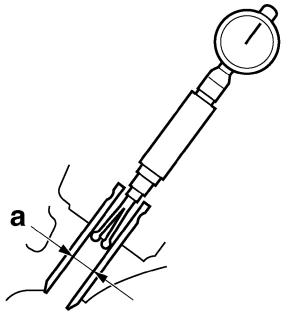
EAS24290
CHECKING THE VALVES AND VALVE GUIDES

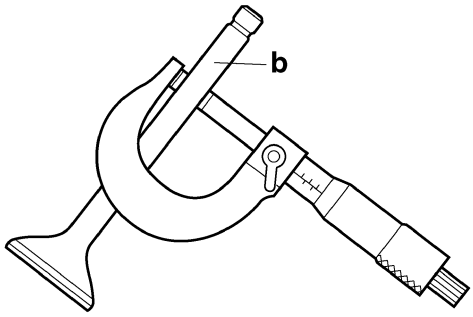
The following procedure applies to all of the valves and valve guides.

1. Measure:
   • Valve-stem-to-valve-guide clearance
   Out of specification → Replace the valve guide.

• Valve-stem-to-valve-guide clearance = Valve guide inside diameter “a” - Valve stem diameter “b”

Valve-stem-to-valve-guide clearance (intake)
0.010–0.037 mm (0.0004–0.0015 in)
Limit
0.080 mm (0.0032 in)
Valve-stem-to-valve-guide clearance (exhaust)
0.025–0.052 mm (0.0010–0.0020 in)
Limit
0.100 mm (0.0039 in)





2. Replace:
   • Valve guide

TIP

To ease valve guide removal and installation, and to maintain the correct fit, heat the cylinder head to 100 °C (212 °F) in an oven.

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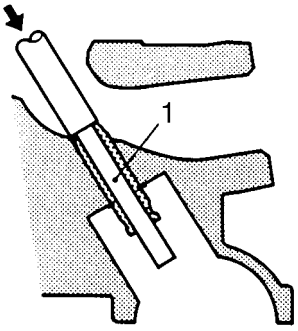
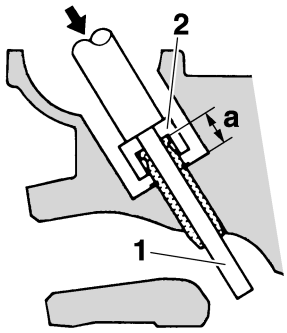
a. Remove the valve guide with the valve guide remover “1”.



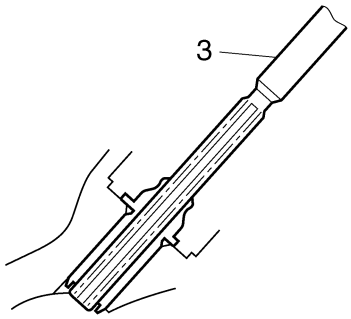
b. Install the new valve guide with the valve guide installer “2” and valve guide remover “1”.

Valve guide position (intake)
17.0–17.4 mm (0.669–0.685 in)
Valve guide position (exhaust)
14.0–14.4 mm (0.551–0.567 in)



a. Valve guide position

c. After installing the valve guide, bore the valve guide with the valve guide reamer “3” to obtain the proper valve-stem-to-valve-guide clearance.

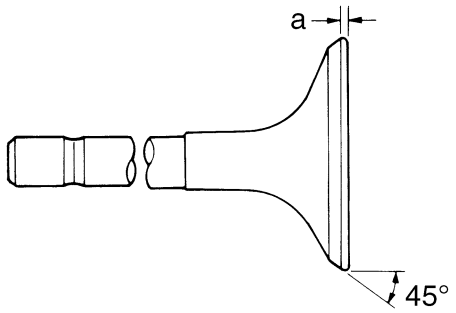


TIP

After replacing the valve guide, reface the valve seat.

3. Eliminate:
   • Carbon deposits
   (from the valve face and valve seat)
4. Check:
   • Valve face
   Pitting/wear → Grind the valve face.
   • Valve stem end
   Mushroom shape or diameter larger than the body of the valve stem → Replace the valve.
5. Measure:
   • Valve margin thickness D “a”
   Out of specification → Replace the valve.

Valve margin thickness D (intake)
0.50–0.90 mm (0.0197–0.0354 in)
Valve margin thickness D (exhaust)
0.50–0.90 mm (0.0197–0.0354 in)

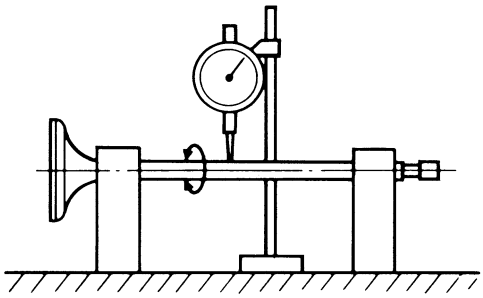


6. Measure:
   • Valve stem runout
   Out of specification → Replace the valve.

TIP

- When installing a new valve, always replace the valve guide.
- If the valve is removed or replaced, always replace the valve stem seal.

Valve stem runout
0.010 mm (0.0004 in)

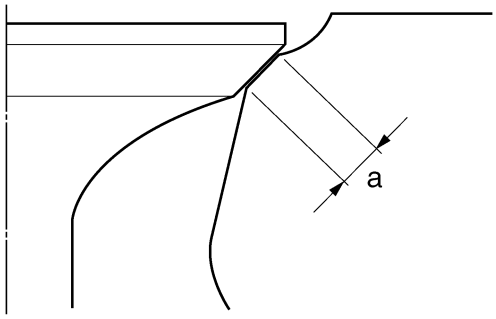


EAS24300
CHECKING THE VALVE SEATS

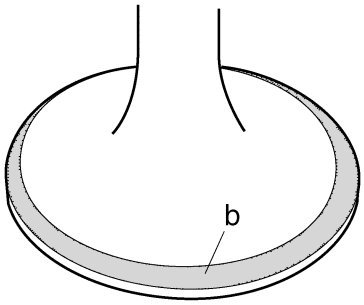
The following procedure applies to all of the valves and valve seats.

1. Eliminate:
   • Carbon deposits
   (from the valve face and valve seat)
2. Check:
   • Valve seat
   Pitting/wear → Replace the cylinder head.
3. Measure:
   • Valve seat width C “a”
   Out of specification → Replace the cylinder head.

Valve seat width C (intake)
0.90–1.10 mm (0.0354–0.0433 in)
Valve seat width C (exhaust)
0.90–1.10 mm (0.0354–0.0433 in)



a. Apply Mechanic’s blueing dye (Dykem) “b” onto the valve face.



b. Install the valve into the cylinder head.
c. Press the valve through the valve guide and onto the valve seat to make a clear impression.
d. Measure the valve seat width.

TIP

Where the valve seat and valve face contacted one another, the blueing will have been removed.

4. Lap:
   • Valve face
   • Valve seat

TIP

After replacing the cylinder head or replacing the valve and valve guide, the valve seat and valve face should be lapped.

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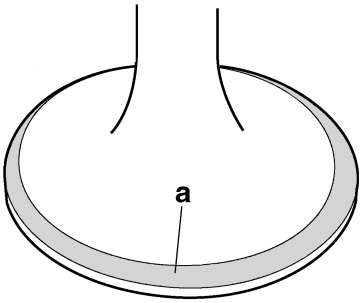
a. Apply a coarse lapping compound “a” to the valve face.

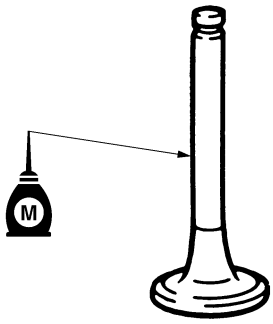
ECA13790

NOTICE

Do not let the lapping compound enter the gap between the valve stem and the valve guide.



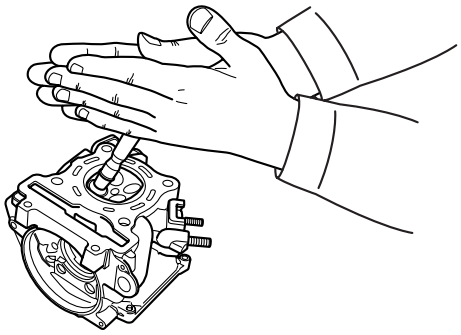
b. Apply molybdenum disulfide oil to the valve stem.



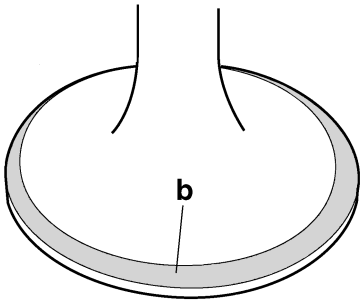
c. Install the valve into the cylinder head.
d. Turn the valve until the valve face and valve seat are evenly polished, and then clean off all of the lapping compound.

TIP

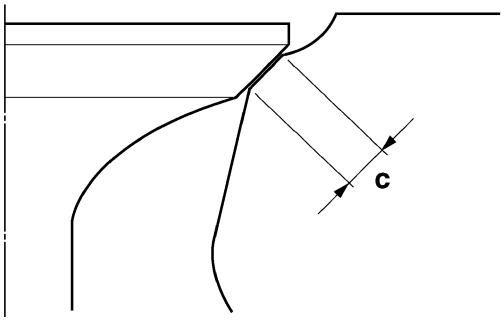
For the best lapping results, lightly tap the valve seat while rotating the valve back and forth between your hands.



e. Apply a fine lapping compound to the valve face and repeat the above steps.
f. After every lapping procedure, be sure to clean off all of the lapping compound from the valve face and valve seat.
g. Apply Mechanic’s blueing dye (Dykem) “b” to the valve face.



h. Install the valve into the cylinder head.
i. Press the valve through the valve guide and onto the valve seat to make a clear impression.
j. Measure the valve seat width “c” again. If the valve seat width is out of specification, reface and lap the valve seat.



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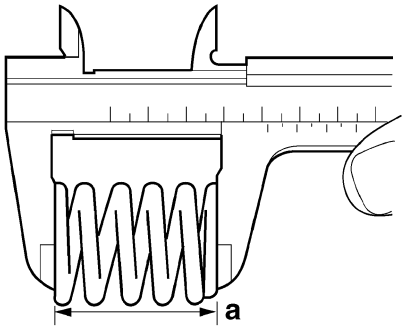
EAS24310

CHECKING THE VALVE SPRINGS

The following procedure applies to all of the valve springs.

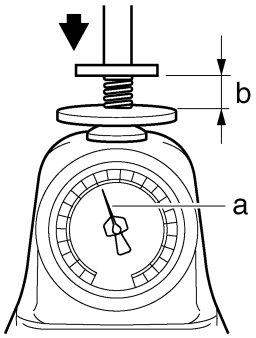
1. Measure:
   • Valve spring free length “a”
   Out of specification → Replace the valve spring.

Free length (intake)
41.71 mm (1.64 in)
Limit
39.62 mm (1.56 in)
Free length (exhaust)
41.71 mm (1.64 in)
Limit
39.62 mm (1.56 in)



2. Measure:
   • Compressed valve spring force “a”
   Out of specification → Replace the valve spring.

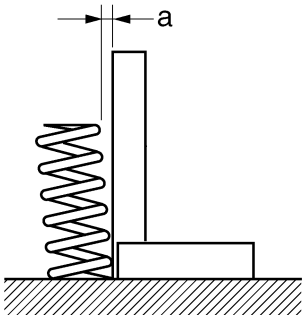
Installed compression spring force (intake)
140.00–162.00 N (14.28–16.52 kgf, 31.47–36.42 lbf)
Installed compression spring force (exhaust)
140.00–162.00 N (14.28–16.52 kgf, 31.47–36.42 lbf)
Installed length (intake)
35.30 mm (1.39 in)
Installed length (exhaust)
35.30 mm (1.39 in)



b. Installed length

3. Measure:
   • Valve spring tilt “a”
   Out of specification → Replace the valve spring.

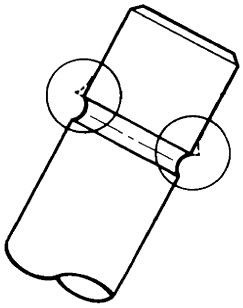
Spring tilt (intake)
2.5°/1.8 mm
Spring tilt (exhaust)
2.5°/1.8 mm



EAS24340
INSTALLING THE VALVES

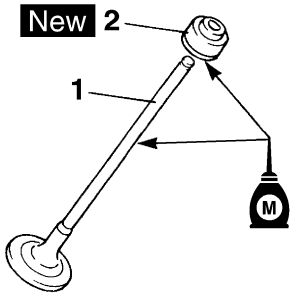
The following procedure applies to all of the valves and related components.

1. Deburr:
   • Valve stem end
   (with an oil stone)



2. Lubricate:
   • Valve stem “1”
   • Valve stem seal “2” New
   (with the recommended lubricant)

Recommended lubricant
Molybdenum disulfide oil

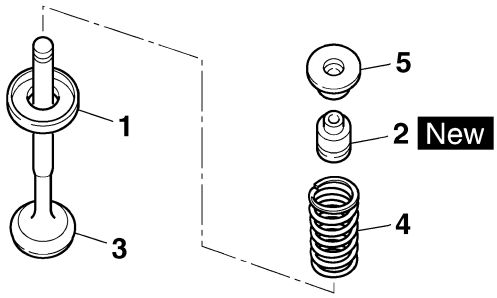


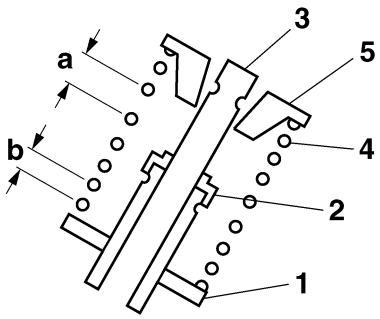
3. Install:
   • Lower spring seat “1”
   • Valve stem seal “2” New

- Valve “3”
- Valve spring “4”
- Upper spring seat “5”
  (into the cylinder head)

TIP

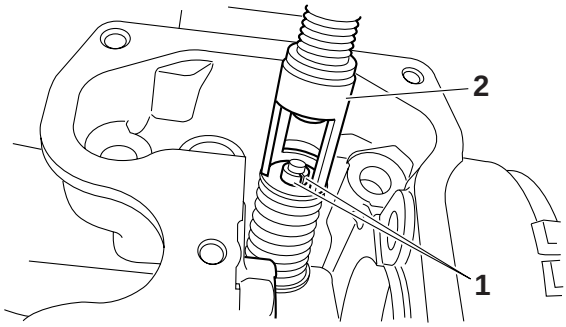
- Make sure each valve is installed in its original place.
- Install the valve springs with the larger pitch “a” facing up.





b. Smaller pitch

4. Install:
   - Valve cotters “1”

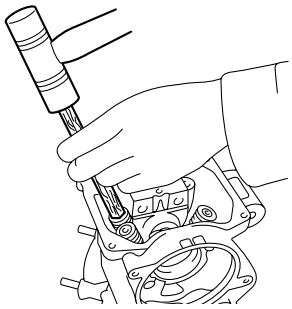


5. To secure the valve cotters onto the valve stem, lightly tap the valve tip with a soft-face hammer.

ECA13800

NOTICE

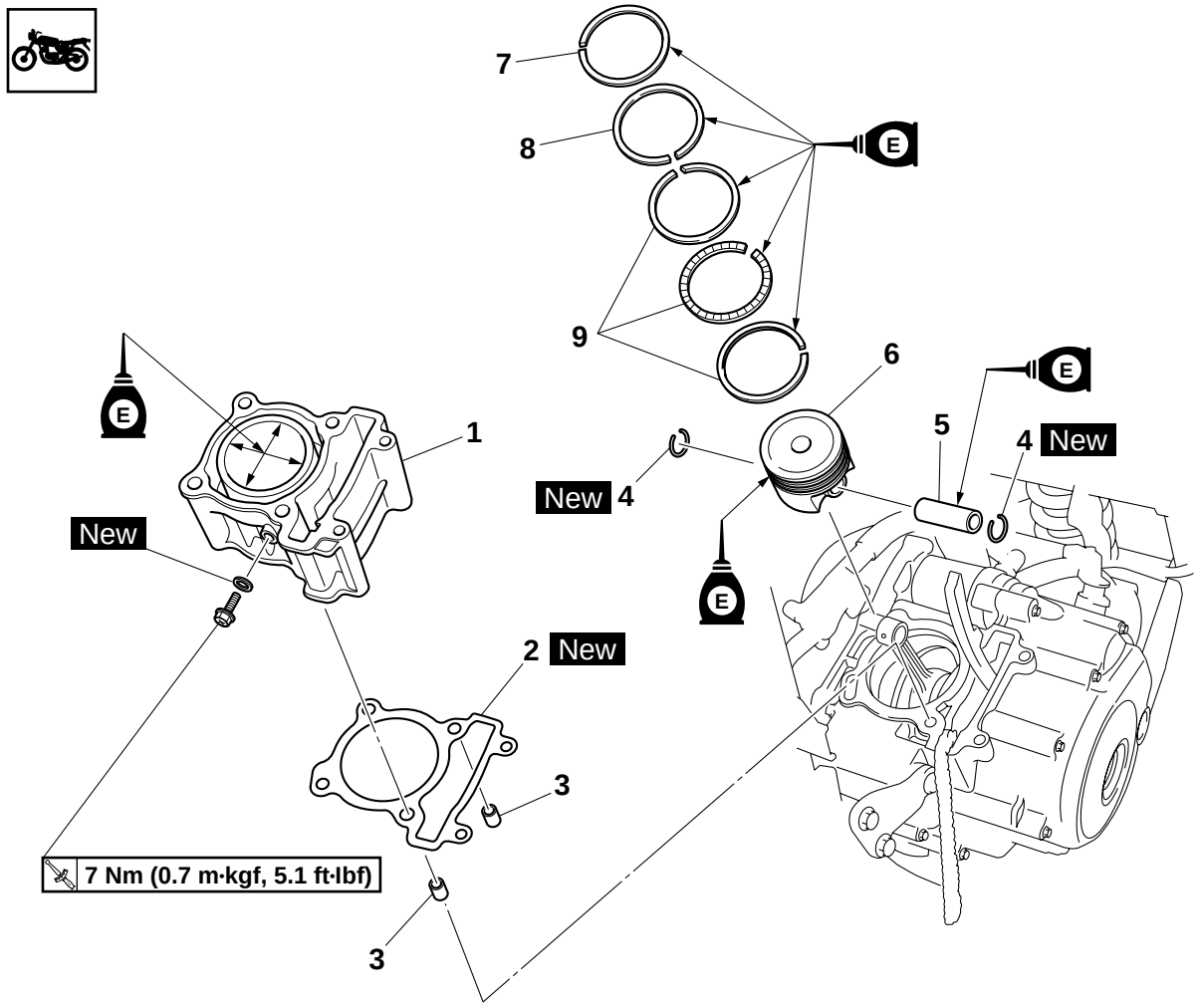
Hitting the valve tip with excessive force could damage the valve.



EAS24350

CYLINDER AND PISTON

Removing the cylinder and piston



Order	Job/Parts to remove	Q'ty	Remarks
	Cylinder head		
1	Cylinder	1	
2	Cylinder gasket	1	
3	Dowel pin	2	
4	Piston pin clip	2	
5	Piston pin	1	
6	Piston	1	
7	Top ring	1	
8	2nd ring	1	
9	Oil ring	1	

EAS24380
REMOVING THE PISTON

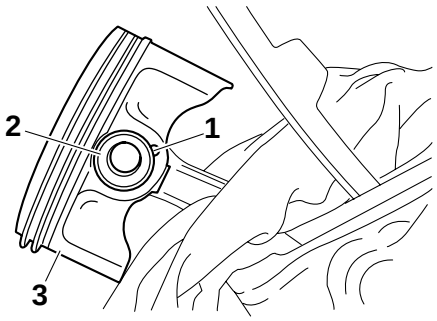
1. Remove:
   - Piston pin clips “1”
   - Piston pin “2”
   - Piston “3”

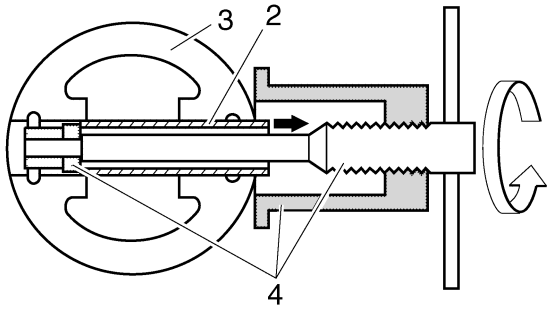
ECA13810
NOTICE

Do not use a hammer to drive the piston pin out.

TIP

- Before removing the piston pin clips, cover the crankcase opening with a clean rag to prevent the piston pin clips from falling into the crankcase.
- Before removing the piston pin, deburr the piston pin clip grooves and the piston pin bore area. If both areas are deburred and the piston pin is still difficult to remove, remove it with the piston pin puller set “4”.

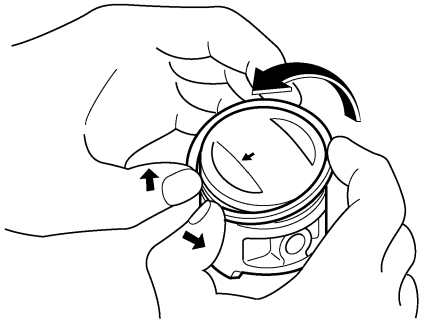




2. Remove:
   - Top ring
   - 2nd ring
   - Oil ring

TIP

When removing a piston ring, open the end gap with your fingers and lift the other side of the ring over the piston crown.



EAS24390
CHECKING THE CYLINDER AND PISTON

1. Check:
   - Piston wall
   - Cylinder wall
     Vertical scratches → Replace the cylinder, and replace the piston and piston rings as a set.
2. Measure:
   - Piston-to-cylinder clearance

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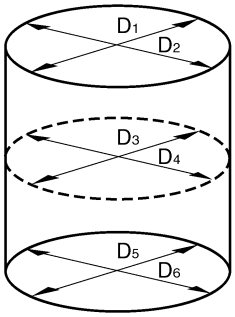
a. Measure cylinder bore “C” with the cylinder bore gauge.



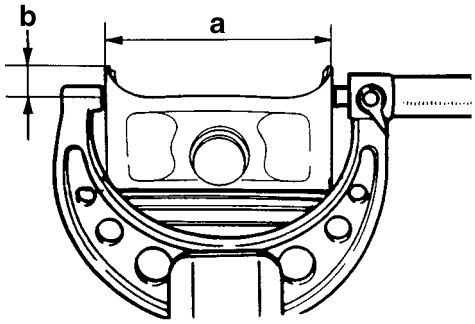
TIP

Measure cylinder bore “C” by taking side-to-side and front-to-back measurements of the cylinder. Then, find the average of the measurements.

Bore
52.000–52.010 mm (2.0472–2.0476 in)
Taper limit
0.050 mm (0.0020 in)
Out of round limit
0.005 mm (0.0002 in)

"C" = maximum of D_1–D_2
"T" = maximum of D_1 or D_2 - maximum of D_5 or D_6
"R" = maximum of D_1, D_3 or D_5 - minimum of D_2, D_4 or D_6

b. If out of specification, replace the cylinder, and replace the piston and piston rings as a set.
c. Measure piston skirt diameter D "a" with the micrometer.



b. 5.0 mm (0.20 in) from the bottom edge of the piston

Piston
Diameter D
51.962–51.985 mm (2.0457–2.0466 in)

d. If out of specification, replace the piston and piston rings as a set.
e. Calculate the piston-to-cylinder clearance with the following formula.

• Piston-to-cylinder clearance = Cylinder bore "C" - Piston skirt diameter "D"

Piston-to-cylinder clearance
0.015–0.048 mm (0.0006–0.0019 in)
Limit
0.15 mm (0.0059 in)

f. If out of specification, replace the cylinder, and replace the piston and piston rings as a set.

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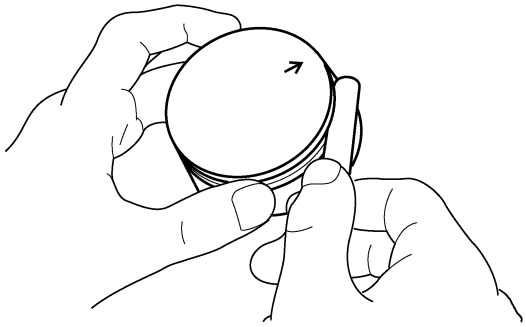
EAS24430
CHECKING THE PISTON RINGS

1. Measure:
   • Piston ring side clearance
   Out of specification → Replace the piston and piston rings as a set.

TIP

Before measuring the piston ring side clearance, eliminate any carbon deposits from the piston ring grooves and piston rings.

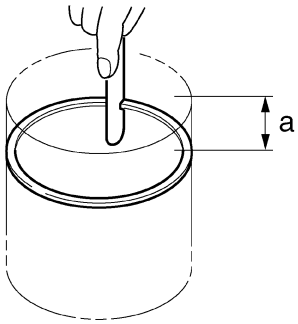
Piston ring
Top ring
Ring side clearance
0.030–0.065 mm (0.0012–0.0026 in)
Limit
0.100 mm (0.0039 in)
2nd ring
Ring side clearance
0.020–0.055 mm (0.0008–0.0022 in)
Limit
0.100 mm (0.0039 in)



2. Install:
   • Piston ring
   (into the cylinder)

TIP

Level the piston ring into the cylinder with the piston crown.



a. 40 mm (1.57 in)

3. Measure:
   • Piston ring end gap
   Out of specification → Replace the piston ring.

TIP

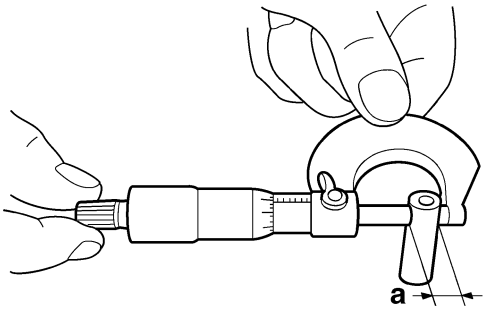
The oil ring expander end gap cannot be measured. If the oil ring rail gap is excessive, replace all three piston rings.

Piston ring
Top ring
End gap (installed)
0.10–0.25 mm (0.0039–0.0098 in)
Limit
0.50 mm (0.0197 in)
2nd ring
End gap (installed)
0.10–0.25 mm (0.0039–0.0098 in)
Limit
0.60 mm (0.0236 in)
Oil ring
End gap (installed)
0.20–0.70 mm (0.0079–0.0276 in)

EAS24440
CHECKING THE PISTON PIN

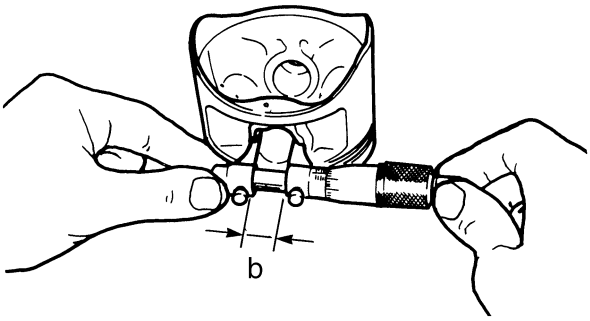
1. Check:
   • Piston pin
   Blue discoloration/grooves → Replace the piston pin, and then check the lubrication system.
2. Measure:
   • Piston pin outside diameter “a”
   Out of specification → Replace the piston pin.

Piston pin outside diameter
13.995–14.000 mm (0.5510–0.5512 in)
Limit
13.975 mm (0.5502 in)



3. Measure:
   • Piston pin bore inside diameter “b”
   Out of specification → Replace the piston.

Piston pin bore inside diameter
14.002–14.013 mm (0.5513–0.5517 in)
Limit
14.043 mm (0.5529 in)



4. Calculate:
   • Piston-pin-to-piston-pin-bore clearance
   Out of specification → Replace the piston pin and piston as a set.

• Piston-pin-to-piston-pin-bore clearance = Piston pin bore inside diameter “b” - Piston pin outside diameter “a”

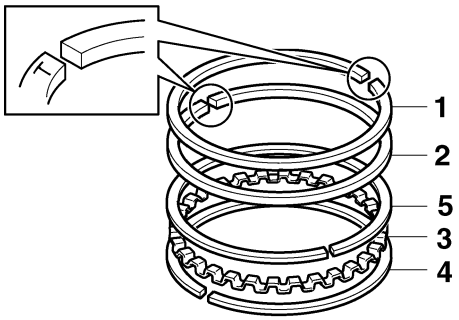
Piston-pin-to-piston-pin-bore clearance
0.002–0.018 mm (0.0001–0.0007 in)
Limit
0.068 mm (0.0027 in)

EAS24450
INSTALLING THE PISTON AND CYLINDER

1. Install:
   • Top ring “1”
   • 2nd ring “2”
   • Oil ring expander “3”
   • Lower oil ring rail “4”
   • Upper oil ring rail “5”

TIP

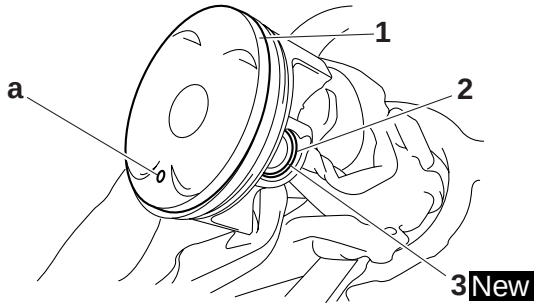
Be sure to install the piston rings so that the manufacturer marks or numbers face up.



2. Install:
   - Piston “1”
   - Piston pin “2”
   - Piston pin clips “3” New

TIP

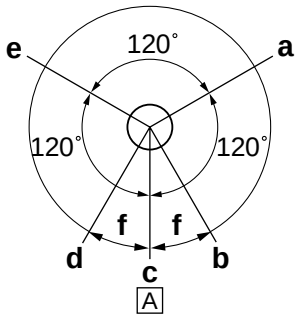
- Apply engine oil to the piston pin.
- Make sure the punch mark “a” on the piston points towards the exhaust side of the cylinder.
- Before installing the piston pin clips, cover the crankcase opening with a clean rag to prevent the clips from falling into the crankcase.



3. Lubricate:
   - Piston
   - Piston rings
   - Cylinder
   (with the recommended lubricant)

	Recommended lubricant **Engine oil**

4. Offset:
   - Piston ring end gaps

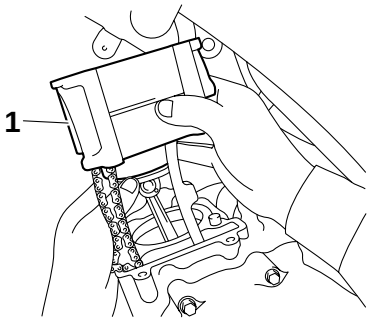


a. Top ring
b. Upper oil ring rail
c. Oil ring expander
d. Lower oil ring rail
e. 2nd ring
f. 20 mm (0.79 in)
A. Intake side

5. Install:
   - Dowel pins
   - Cylinder gasket New
   - Cylinder “1”

TIP

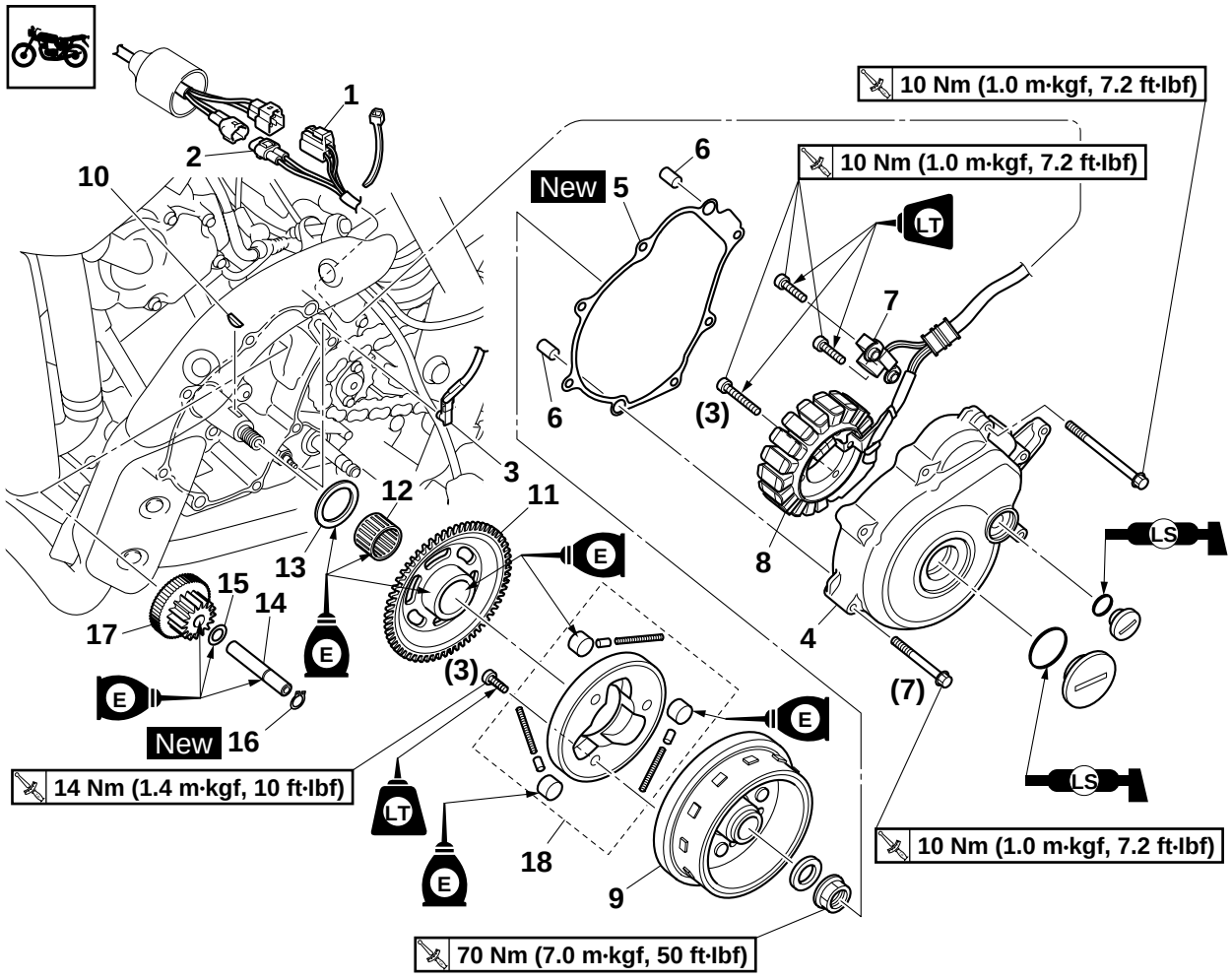
- While compressing the piston rings with one hand, install the cylinder with the other hand.
- Pass the timing chain and timing chain guide (intake side) through the timing chain cavity.



EAS22B1006

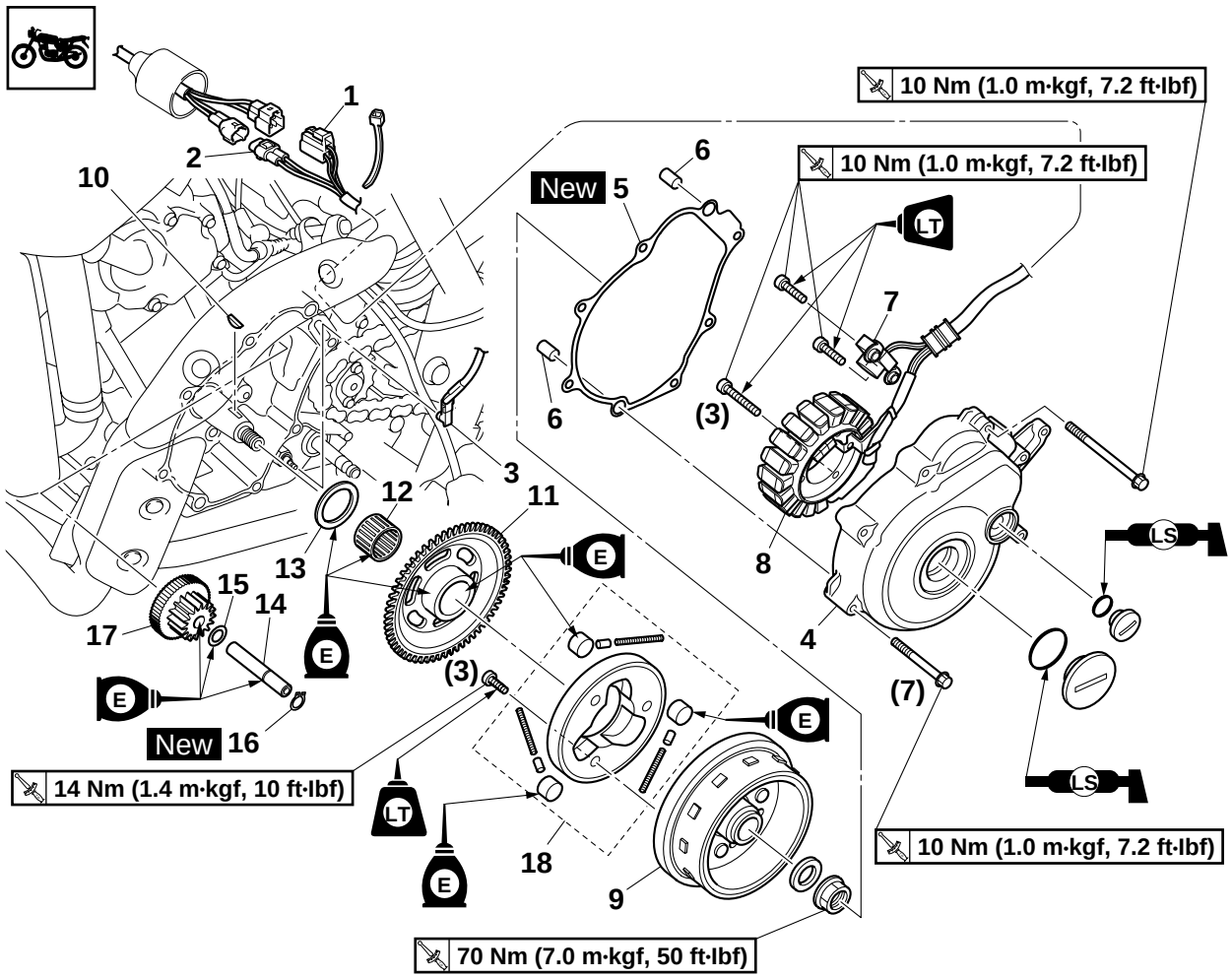
GENERATOR AND STARTER CLUTCH

Removing the generator and starter clutch



Order	Job/Parts to remove	Q'ty	Remarks
	Engine oil		
	Drive sprocket cover		
	Shift pedal		
1	Stator coil coupler	1	
2	Crankshaft position sensor coupler	1	
3	Neutral switch lead connector	1	
4	Generator cover	1	
5	Generator cover gasket	1	
6	Dowel pin	2	
7	Crankshaft position sensor	1	
8	Stator coil	1	
9	Generator rotor	1	
10	Woodruff key	1	
11	Starter clutch gear	1	
12	Bearing	1	

Removing the generator and starter clutch



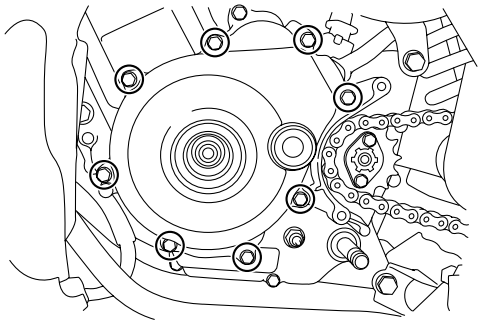
Order	Job/Parts to remove	Q'ty	Remarks
13	Washer	1	
14	Starter clutch idle gear shaft	1	
15	Washer	1	
16	Circlip	1	
17	Starter clutch idle gear	1	
18	Starter clutch assembly	1	

EAS24490
REMOVING THE GENERATOR

1. Remove:
   • Generator cover

TIP

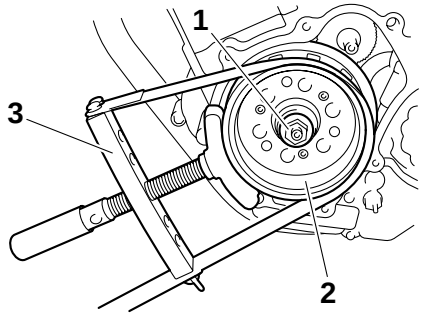
Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.



2. Remove:
   • Generator rotor nut “1”
   • Washer

TIP

- While holding the generator rotor “2” with the sheave holder “3”, loosen the generator rotor nut.
- Do not allow the sheave holder to touch the projections on the generator rotor.



3. Remove:
   • Generator rotor “1”
   (with the flywheel puller “2”)
   • Woodruff key

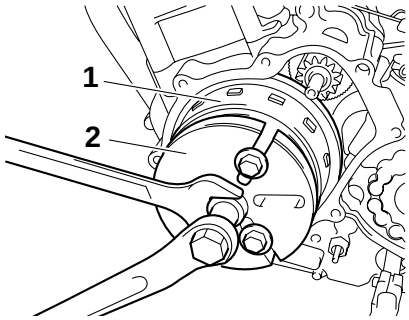
ECA13880

NOTICE

To protect the end of the crankshaft, place an appropriate sized socket between the flywheel puller set center bolt and the crankshaft.

TIP

Make sure the flywheel puller is centered over the generator rotor.

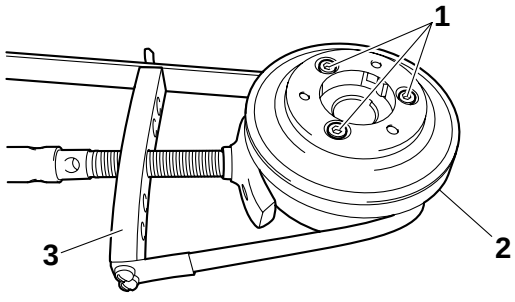


EAS24560
REMOVING THE STARTER CLUTCH

1. Remove:
   • Starter clutch bolts “1”

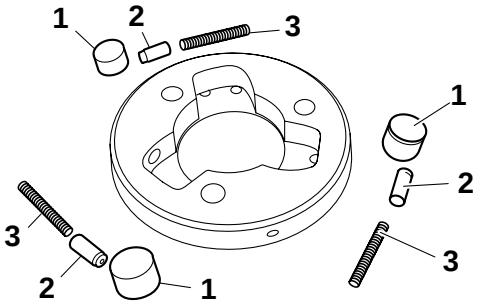
TIP

- While holding the generator rotor “2” with the sheave holder “3”, remove the starter clutch bolts.
- Do not allow the sheave holder to touch the projections on the generator rotor.



EAS24570
CHECKING THE STARTER CLUTCH

1. Check:
   - Starter clutch rollers “1”
   - Starter clutch spring caps “2”
   - Starter clutch springs “3”
     Damage/wear → Replace the starter clutch assembly.



2. Check:
   - Starter clutch idle gear
   - Starter clutch gear
     Burrs/chips/roughness/wear → Replace the defective part(s).
3. Check:
   - Starter clutch gear contact surfaces
     Damage/pitting/wear → Replace the starter clutch gear.
4. Check:
   - Starter clutch operation

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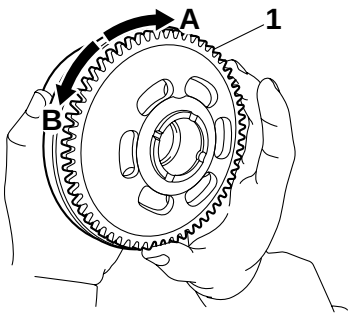
a. Install the starter clutch gear “1” onto the starter clutch and hold the generator rotor.
b. When turning the starter clutch gear clockwise “A”, the starter clutch and the starter clutch gear should engage, otherwise the starter clutch is faulty and must be replaced.
c. When turning the starter clutch gear counterclockwise “B”, it should turn freely, otherwise the starter clutch is faulty and must be replaced.



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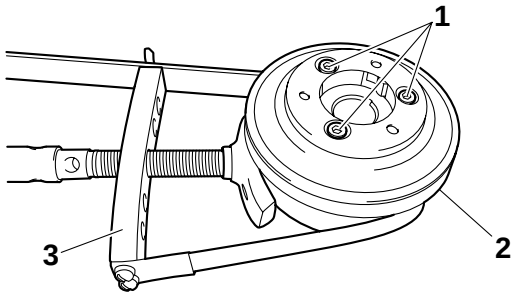
EAS24600
INSTALLING THE STARTER CLUTCH

1. Install:
   - Starter clutch assembly
   - Starter clutch bolts “1”

Starter clutch bolt
14 Nm (1.4 m·kgf, 10 ft·lbf)
LOCTITE®

TIP

- While holding the generator rotor “2” with the sheave holder “3”, tighten the starter clutch bolts.
- Do not allow the sheave holder to touch the projections on the generator rotor.



EAS24500
INSTALLING THE GENERATOR

1. Install:
   - Woodruff key
   - Generator rotor
   - Washer
   - Generator rotor nut

TIP

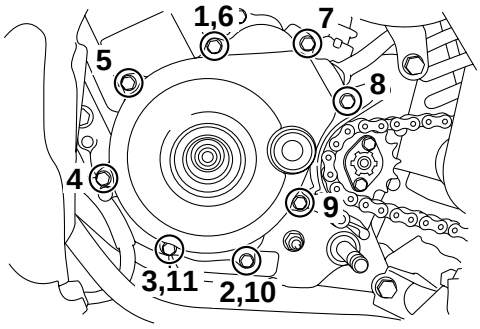
- Clean the tapered portion of the crankshaft and the generator rotor hub.
- When installing the generator rotor, make sure the woodruff key is properly sealed in the keyway of the crankshaft.

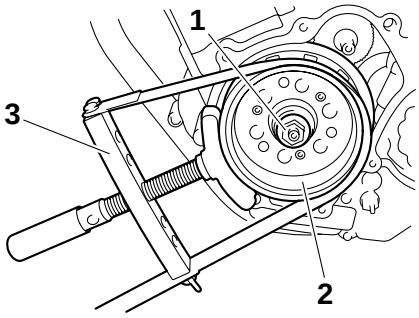
2. Tighten:
   - Generator rotor nut “1”

Generator rotor nut
70 Nm (7.0 m·kgf, 50 ft·lbf)

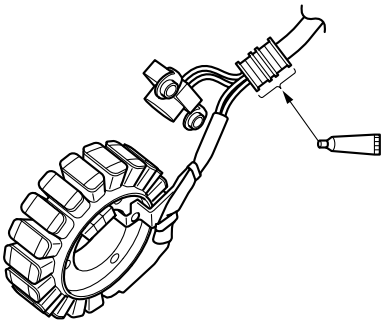
TIP

- While holding the generator rotor "2" with the sheave holder "3", tighten the generator rotor nut.
- Do not allow the sheave holder to touch the projections on the generator rotor.





3. Apply:
   - Sealant
     (to the crankshaft position sensor/stator assembly lead grommet)



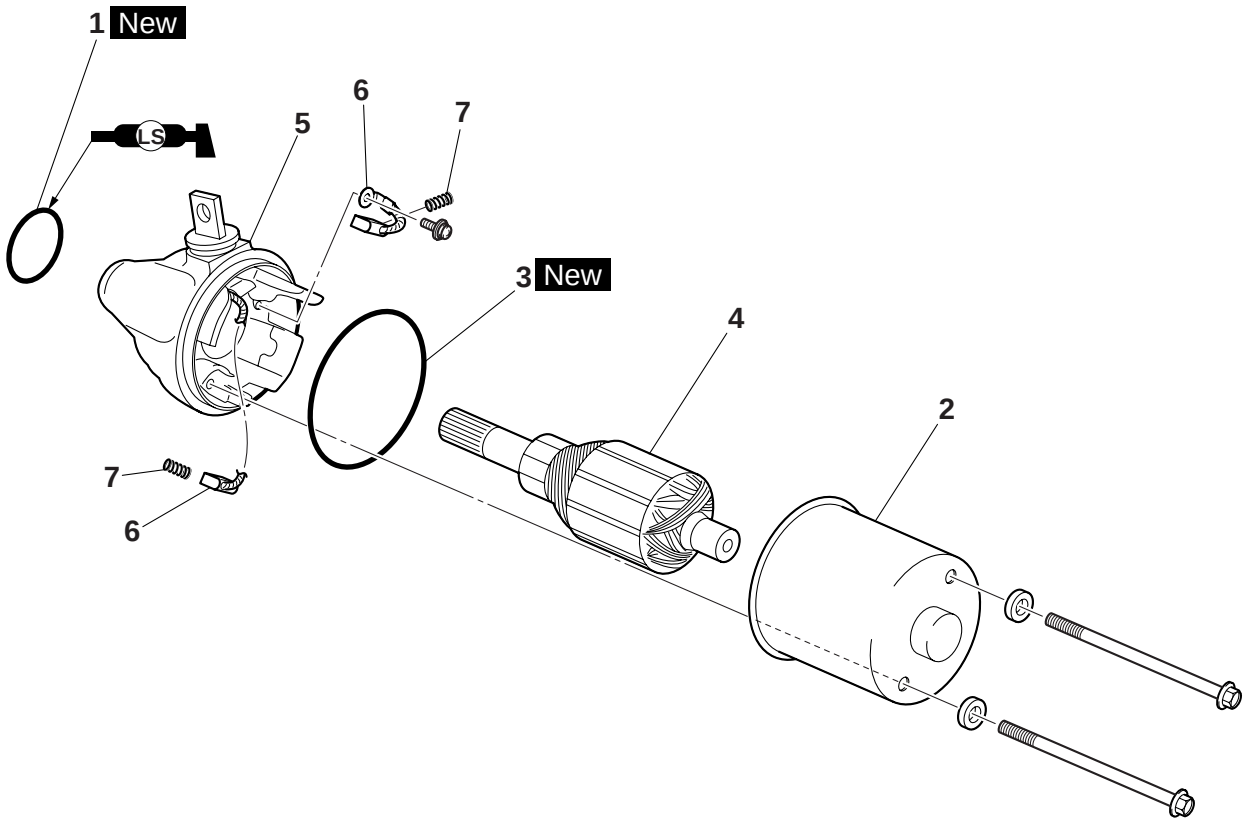
4. Install:
   - Generator cover

	Generator cover bolt **10 Nm (1.0 m·kgf, 7.2 ft·lbf)**

TIP

Tighten the generator cover bolts in the proper tightening sequence as shown.

Disassembling the starter motor

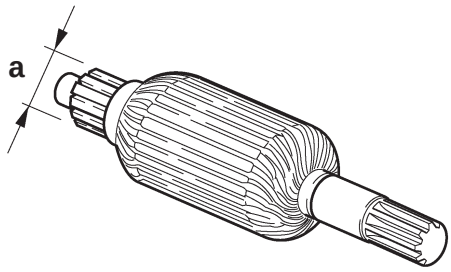


Order	Job/Parts to remove	Q'ty	Remarks
1	O-ring	1	
2	Starter motor yoke	1	
3	O-ring	1	
4	Armature assembly	1	
5	Starter motor front cover/brush holder set	1	
6	Brush	2	
7	Brush spring	2	

EAS24790
CHECKING THE STARTER MOTOR

1. Check:
   • Commutator
   Dirt → Clean with 600 grit sandpaper.
2. Measure:
   • Commutator diameter “a”
   Out of specification → Replace the starter motor.

Limit
16.6 mm (0.65 in)



3. Measure:
   • Mica undercut “a”
   Out of specification → Scrape the mica to the proper measurement with a hacksaw blade that has been grounded to fit the commutator.

Mica undercut (depth)
1.35 mm (0.05 in)

TIP

The mica of the commutator must be undercut to ensure proper operation of the commutator.

4. Measure:
   • Armature assembly resistances (commutator and insulation)
   Out of specification → Replace the starter motor.

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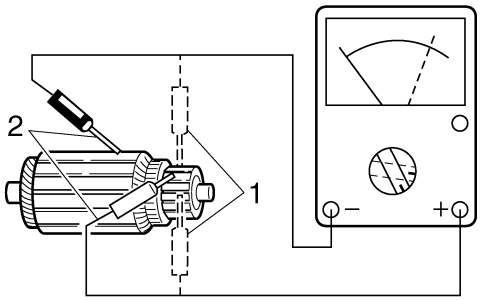
a. Measure the armature assembly resistances with the pocket tester.

Armature coil
Commutator resistance “1”
0.0315–0.0385 Ω
Insulation resistance “2”
Above 1 MΩ

b. If any resistance is out of specification, replace the starter motor.



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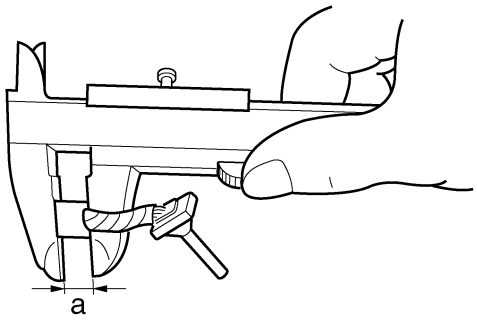
5. Measure:
   • Brush length “a”
   Out of specification → Replace the starter motor front cover/brush holder set.

Limit
3.50 mm (0.14 in)



6. Measure:
   • Brush spring force
   Out of specification → Replace the brush springs as a set.

Brush spring force
3.92–5.88 N (400–600 gf, 14.11–21.17 oz)

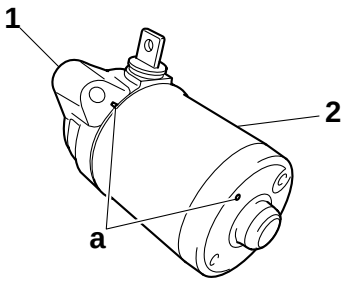
7. Check:
   • Gear teeth
   Damage/wear → Replace the starter motor.
8. Check:
   • Bearing
   • Oil seal
   Damage/wear → Replace the starter motor front cover/brush holder set.

EAS24800
ASSEMBLING THE STARTER MOTOR

1. Install:
   • Starter motor front cover/brush holder set “1”
   • Starter motor yoke “2”

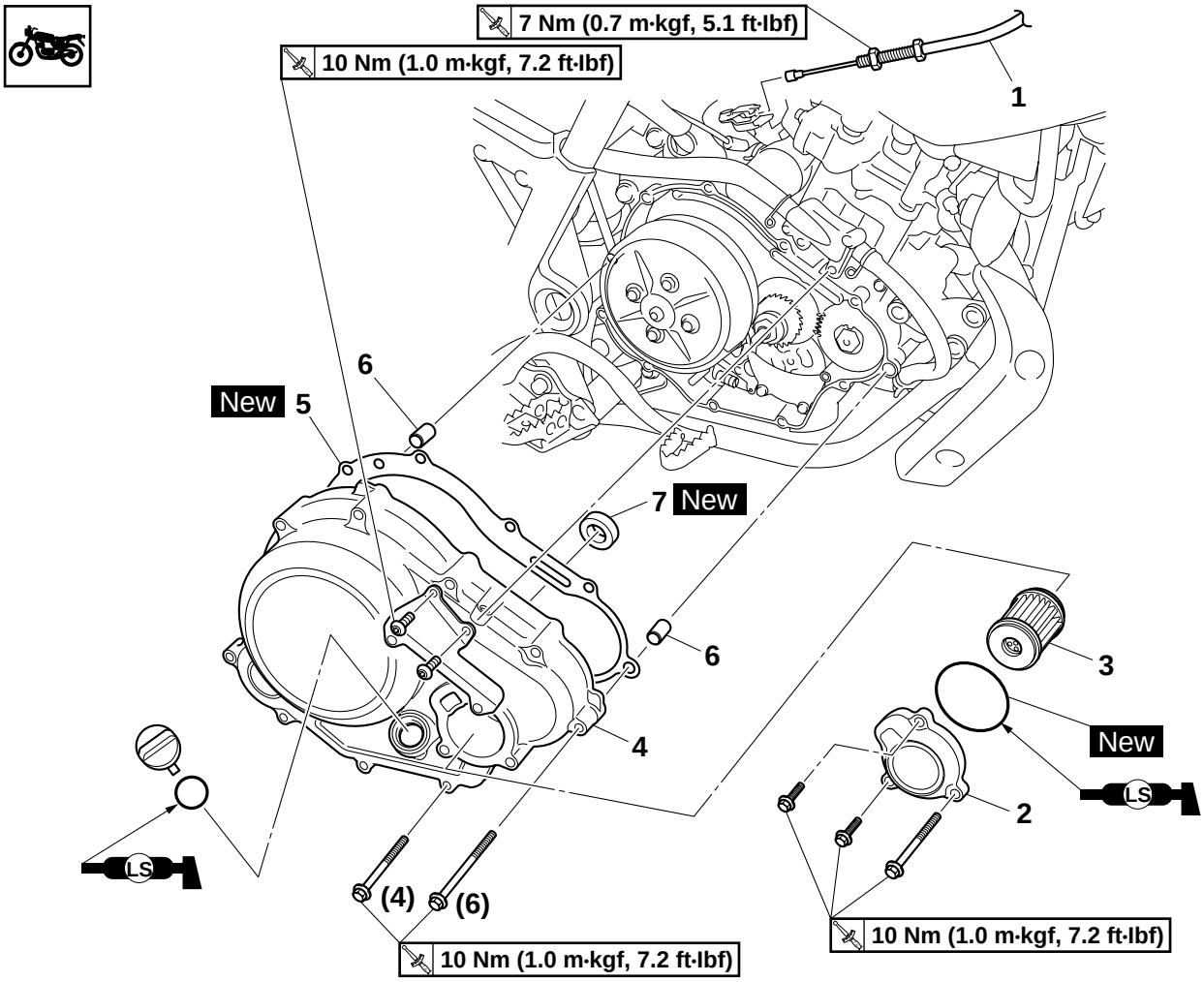
TIP

Align the marks “a” on the starter motor yoke and starter motor front cover/brush holder set.



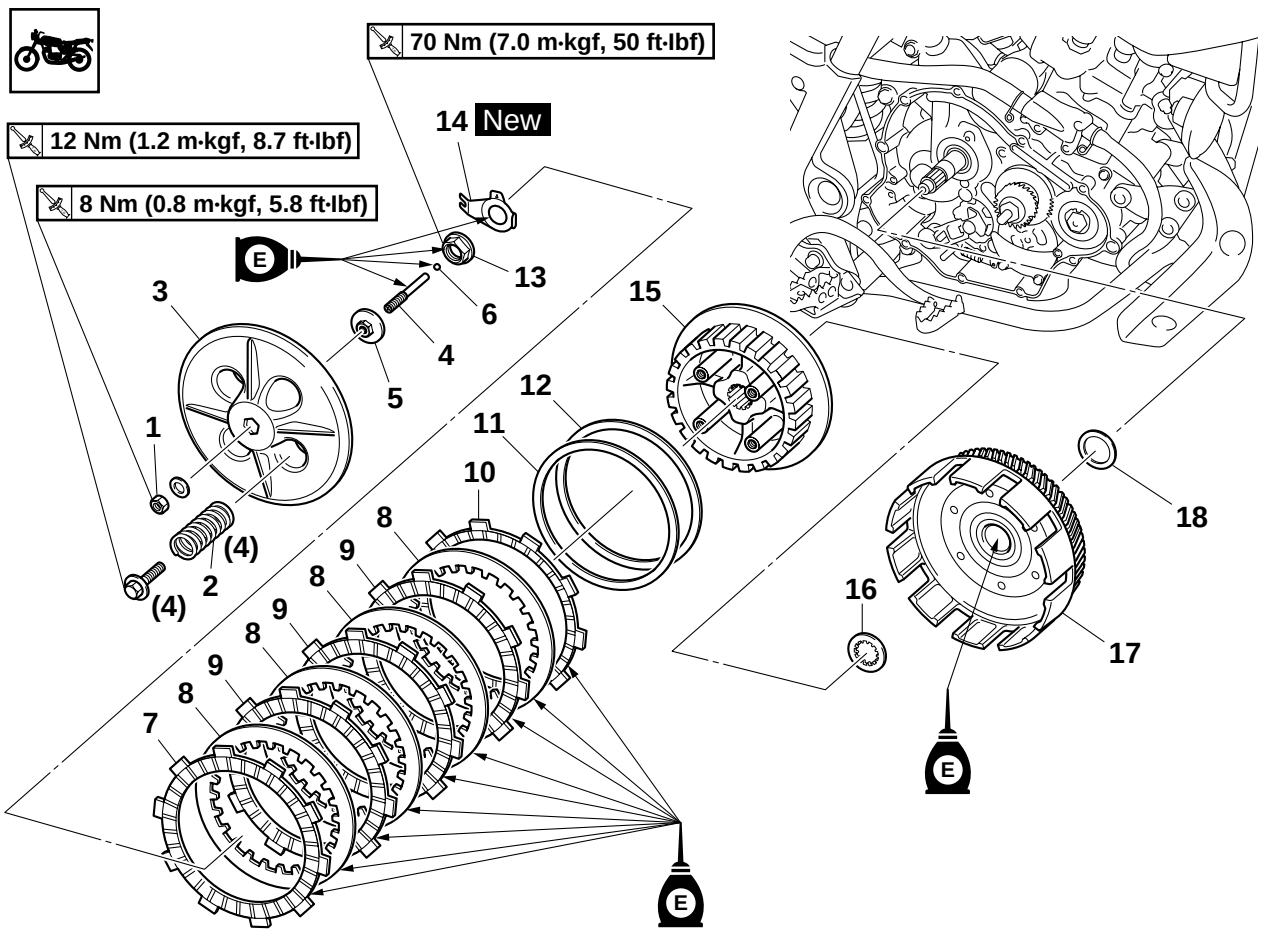
EAS25061
CLUTCH

Removing the clutch cover



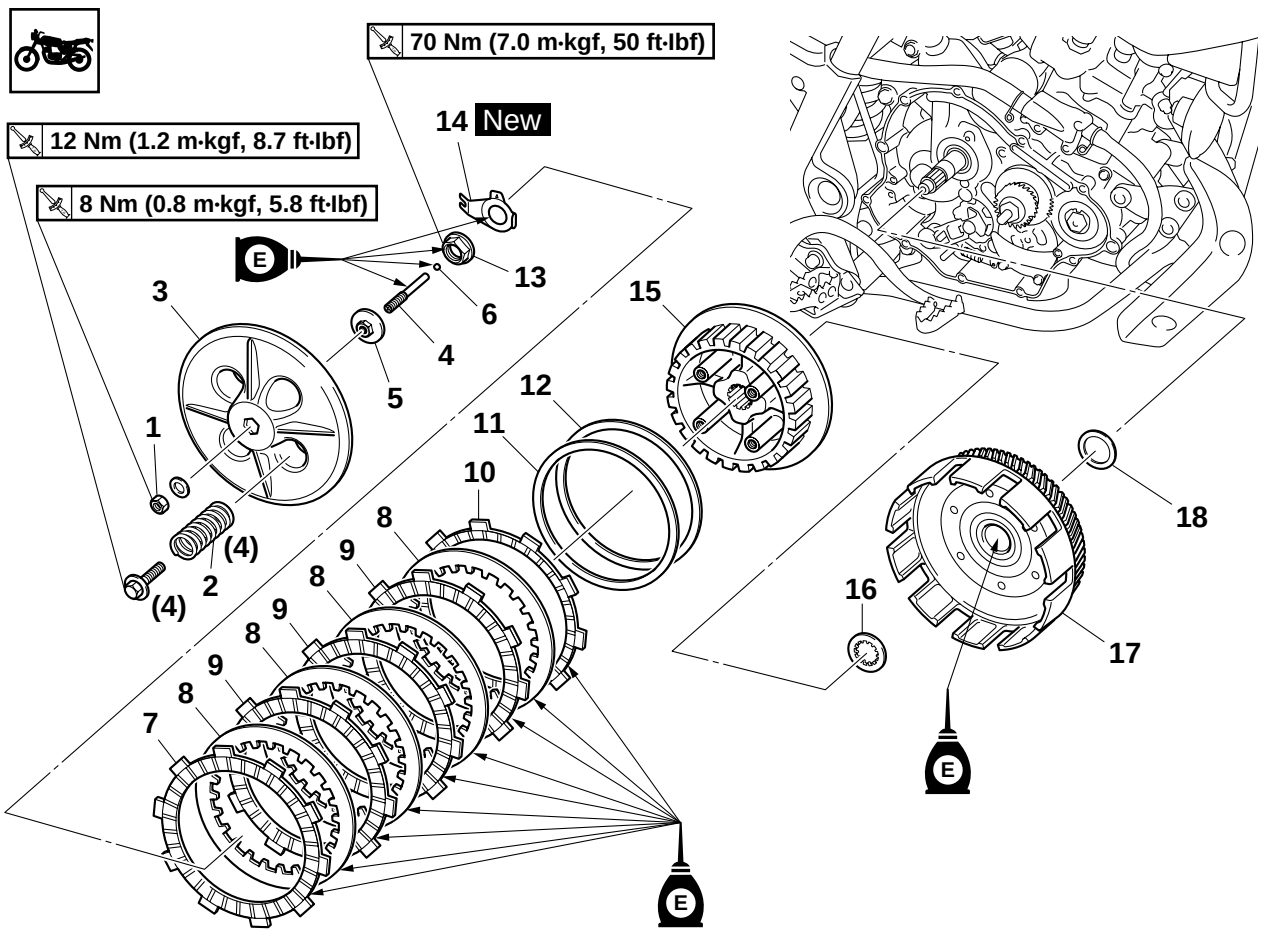
Order	Job/Parts to remove	Q'ty	Remarks
	Engine oil		
1	Clutch cable	1	
2	Oil filter element cover	1	
3	Oil filter element	1	
4	Clutch cover	1	
5	Clutch cover gasket	1	
6	Dowel pin	2	
7	Oil seal	1	

Removing the clutch



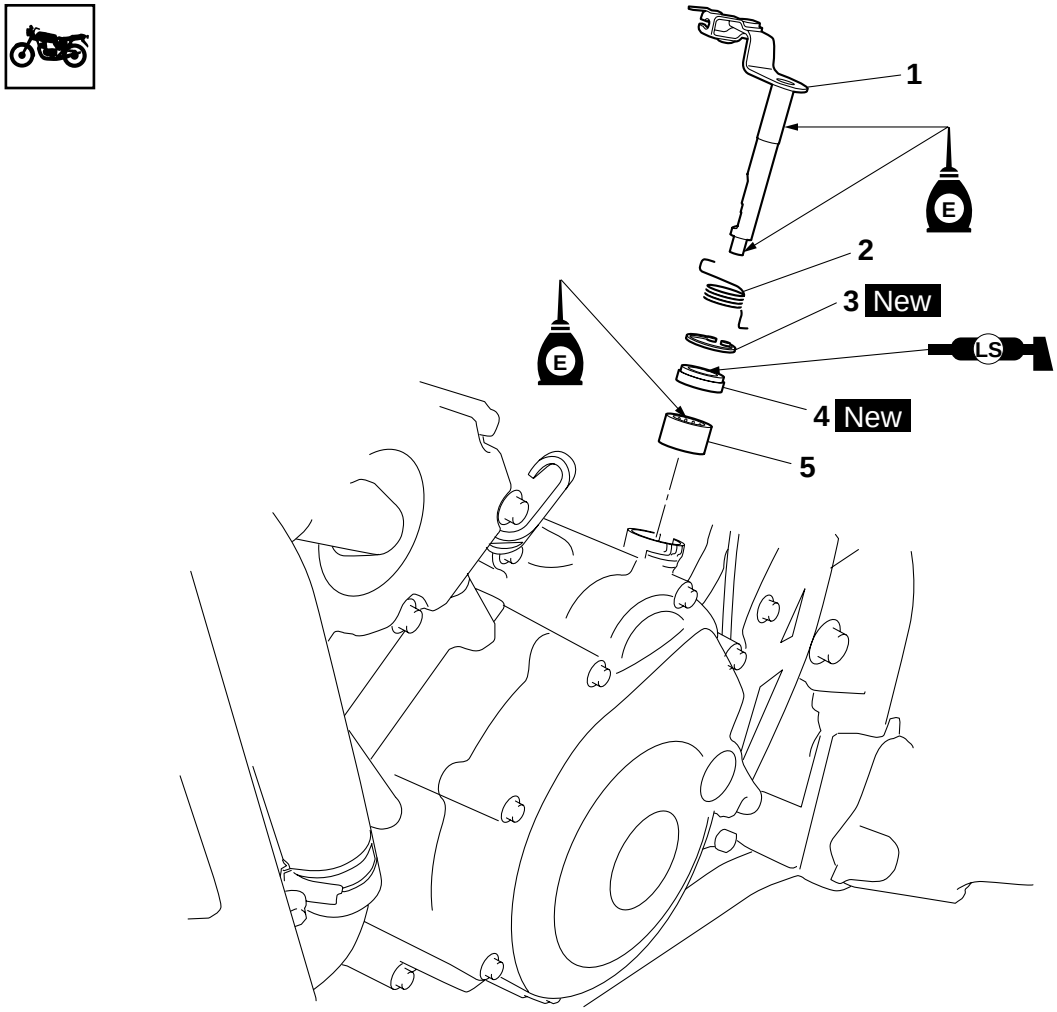
Order	Job/Parts to remove	Q'ty	Remarks
1	Locknut	1	
2	Clutch spring	4	
3	Pressure plate	1	
4	Short clutch push rod	1	
5	Short clutch push rod holder	1	
6	Ball	1	
7	Friction plate 1	1	
8	Clutch plate	4	
9	Friction plate 3	3	Green paint mark
10	Friction plate 2	1	
11	Clutch damper spring	1	
12	Clutch damper spring seat	1	
13	Clutch boss nut	1	
14	Lock washer	1	
15	Clutch boss	1	
16	Thrust washer	1	
17	Clutch housing	1	

Removing the clutch



Order	Job/Parts to remove	Q'ty	Remarks
18	Conical spring washer	1	
			For installation, reverse the removal procedure.

Removing the push lever



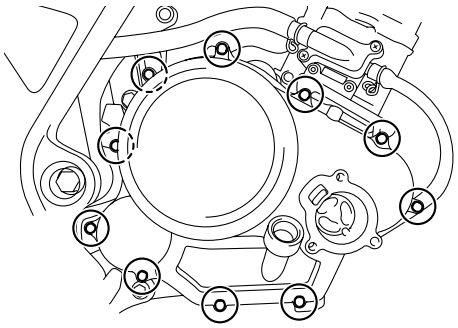
Order	Job/Parts to remove	Q'ty	Remarks
	Exhaust pipe		
1	Clutch push lever	1	
2	Clutch push lever spring	1	
3	Circlip	1	
4	Oil seal	1	
5	Bearing	1	

EAS25070
REMOVING THE CLUTCH

1. Remove:
   • Clutch cover

TIP

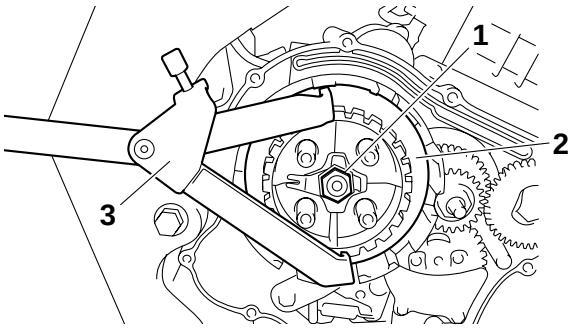
Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.



2. Straighten the lock washer tab.
3. Loosen:
   • Clutch boss nut “1”

TIP

While holding the clutch boss “2” with the universal clutch holder “3”, loosen the clutch boss nut.



EAS25100
CHECKING THE FRICTION PLATES

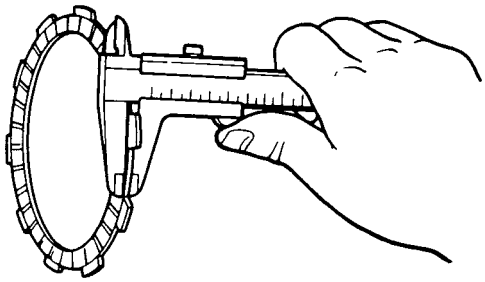
The following procedure applies to all of the friction plates.

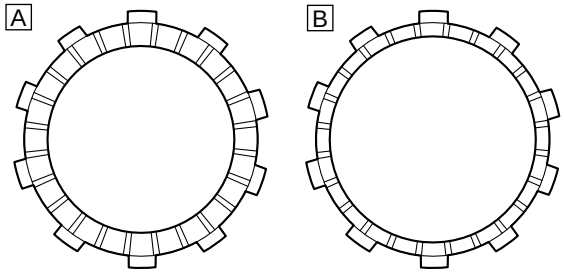
1. Check:
   • Friction plate
   Damage/wear → Replace the friction plates as a set.
2. Measure:
   • Friction plate thickness
   Out of specification → Replace the friction plates as a set.

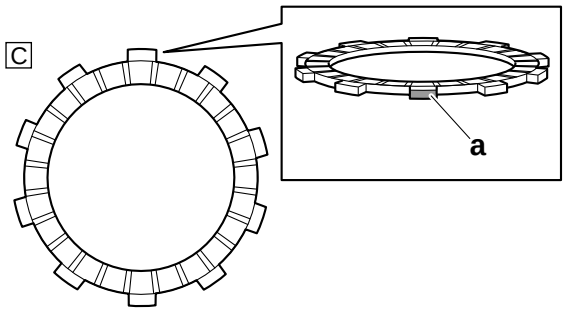
TIP

Measure the friction plate at four places.

Friction plate 1 thickness
2.90–3.10 mm (0.114–0.122 in)
Wear limit
2.80 mm (0.110 in)
Friction plate 2 thickness
2.90–3.10 mm (0.114–0.122 in)
Wear limit
2.80 mm (0.1102 in)
Friction plate 3 thickness
2.90–3.10 mm (0.114–0.122 in)
Wear limit
2.80 mm (0.1102 in)



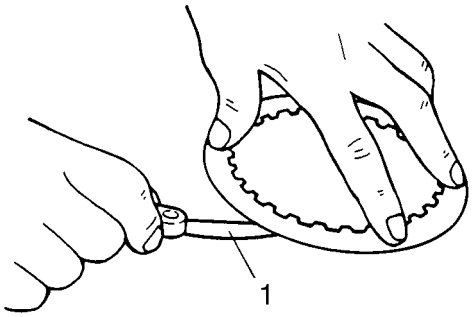




A. Friction plate 1
B. Friction plate 2
C. Friction plate 3
a. Green paint mark

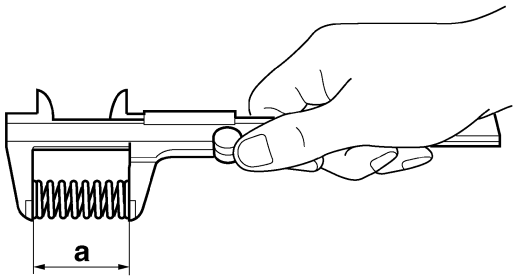
EAS25110
CHECKING THE CLUTCH PLATES
The following procedure applies to all of the clutch plates.
1. Check:
   - Clutch plate
     Damage → Replace the clutch plates as a set.
2. Measure:
   - Clutch plate warpage
     (with a surface plate and thickness gauge “1”)
     Out of specification → Replace the clutch plates as a set.

Clutch plate thickness
1.45–1.75 mm (0.057–0.069 in)
Warpage limit
0.20 mm (0.0079 in)



EAS25140
CHECKING THE CLUTCH SPRINGS
The following procedure applies to all of the clutch springs.
1. Check:
   - Clutch spring
     Damage → Replace the clutch springs as a set.
2. Measure:
   - Clutch spring free length “a”
     Out of specification → Replace the clutch springs as a set.

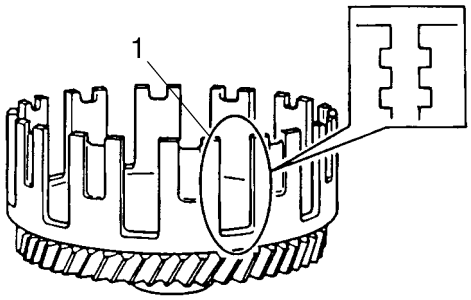
Clutch spring free length
38.71 mm (1.52 in)
Minimum length
36.77 mm (1.45 in)



EAS25150
CHECKING THE CLUTCH HOUSING
1. Check:
   - Clutch housing dogs “1”
     Damage/pitting/wear → Deburr the clutch housing dogs or replace the clutch housing.

TIP

Pitting on the clutch housing dogs will cause erratic clutch operation.

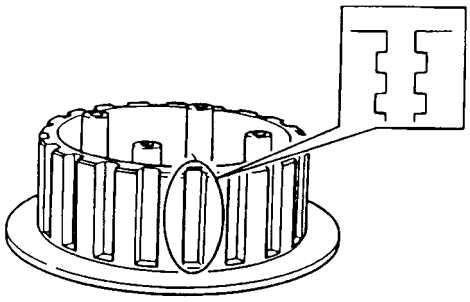


2. Check:
   - Bearing
     Damage/wear → Replace the bearing and clutch housing.

EAS25160
CHECKING THE CLUTCH BOSS
1. Check:
   - Clutch boss splines
     Damage/pitting/wear → Replace the clutch boss.

TIP

Pitting on the clutch boss splines will cause erratic clutch operation.

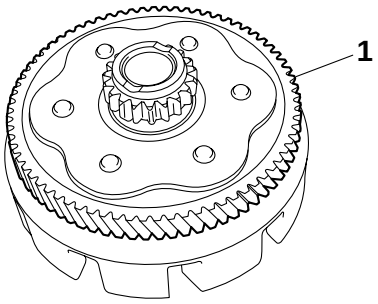


EAS25170
CHECKING THE PRESSURE PLATE
1. Check:
   • Pressure plate
   Cracks/damage → Replace.

EAS22B1007
CHECKING THE CLUTCH PUSH LEVER AND SHORT CLUTCH PUSH ROD
1. Check:
   • Clutch push lever
   • Short clutch push rod
   Damage/wear → Replace the defective part(s).

EAS25200
CHECKING THE PRIMARY DRIVE GEAR
1. Remove:
   • Primary drive gear
   Refer to "BALANCER GEARS" on page 5-53.
2. Check:
   • Primary drive gear
   Damage/wear → Replace the primary drive gear and clutch housing as a set.
   Excessive noise during operation → Replace the primary drive gear and clutch housing as a set.
3. Install:
   • Primary drive gear
   Refer to "BALANCER GEARS" on page 5-53.

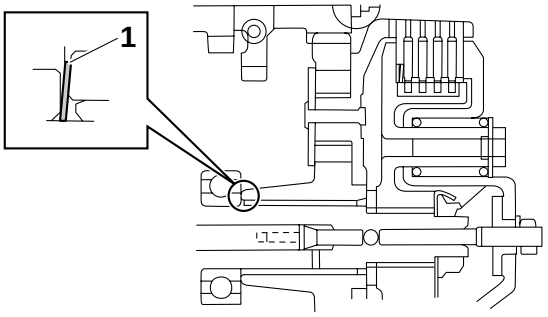
EAS25210
CHECKING THE PRIMARY DRIVEN GEAR
1. Check:
   • Primary driven gear "1"
   Damage/wear → Replace the primary drive gear and clutch housing as a set.
   Excessive noise during operation → Replace the primary drive gear and clutch housing as a set.



EAS25240
INSTALLING THE CLUTCH
1. Install:
   • Conical spring washer "1"

TIP

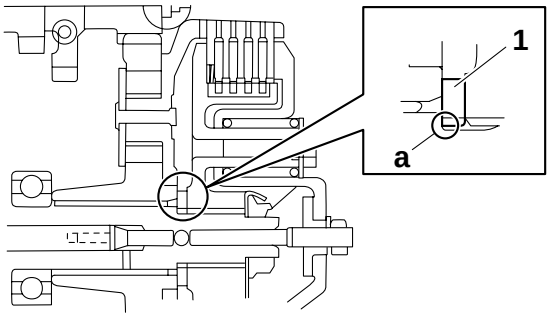
Install the conical spring washer as shown in the illustration.



2. Install:
   • Clutch housing
   • Thrust washer "1"

TIP

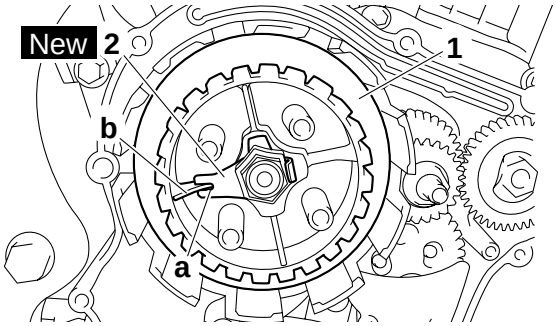
Be sure to install the thrust washer so that its sharp edge "a" is facing away from the clutch boss.



3. Install:
   • Clutch boss "1"
   • Lock washer "2" New
   • Clutch boss nut

TIP

- Lubricate the clutch boss nut threads and lock washer mating surfaces with engine oil.
- Align the notch "a" in the lock washer with a rib "b" on the clutch boss.

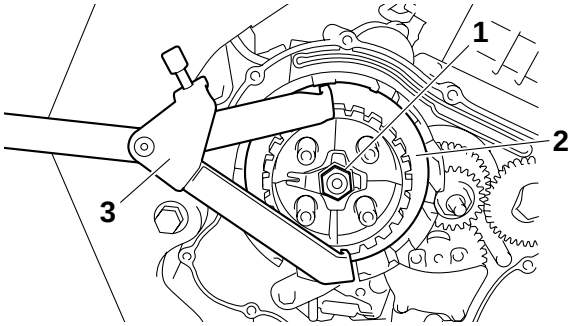


4. Tighten:
   • Clutch boss nut “1”

	Clutch boss nut **70 Nm (7.0 m·kgf, 50 ft·lbf)**

TIP

While holding the clutch boss “2” with the universal clutch holder “3”, tighten the clutch boss nut.



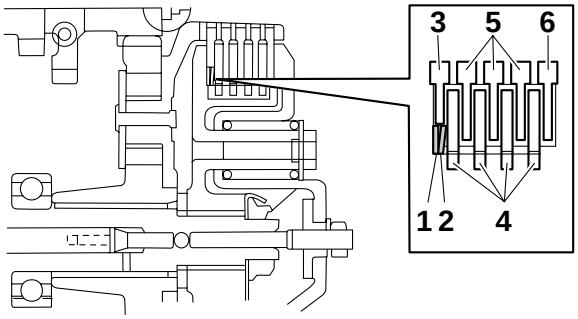
5. Bend the lock washer tab along a flat side of the nut.
6. Lubricate:
   • Friction plates
   • Clutch plates
   (with the recommended lubricant)

	Recommended lubricant **Engine oil**

7. Install:
   • Clutch damper spring seat “1”
   • Clutch damper spring “2”
   • Friction plate 2 “3”
   • Clutch plates “4”
   • Friction plates 3 “5”
   • Friction plate 1 “6”

TIP

- Install the clutch damper spring seat and clutch damper spring as shown in the illustration.
- First, install a friction plate and then alternate between a clutch plate and a friction plate.

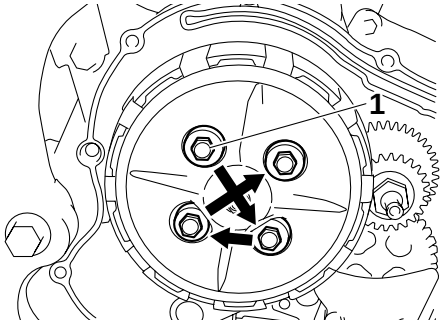


8. Install:
   • Pressure plate
   • Clutch springs
   • Clutch spring bolts “1”

	Clutch spring bolt **12 Nm (1.2 m·kgf, 8.7 ft·lbf)**

TIP

Tighten the clutch spring bolts in stages and in a crisscross pattern.



9. Adjust:
   • Clutch mechanism free play

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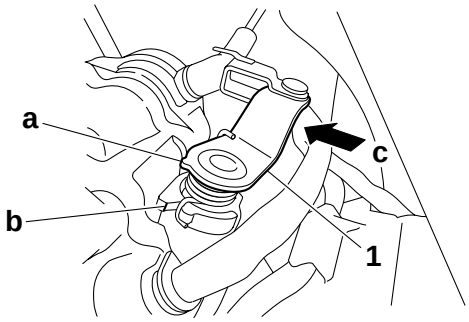
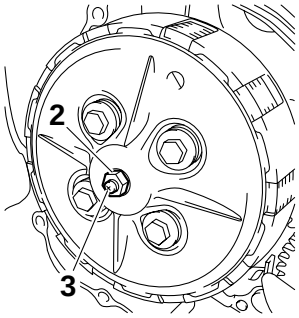
a. Check that the projection “a” on the clutch push lever “1” aligns with the mark “b” shown on the crankcase in the illustration by pushing the clutch push lever manually in direction “c” until it stops.



b. If the projection “a” is not aligned with the mark “b”, align them as follows:
   • Loosen the locknut “2”.

- With the clutch push lever fully pushed in direction “c”, turn the short clutch push rod “3” in or out until the projection “a” aligns with the mark “b”.
- Hold the short clutch push rod to prevent it from moving, and then tighten the locknut to specification.

	Short clutch push rod locknut **8 Nm (0.8 m·kgf, 5.8 ft·lbf)**



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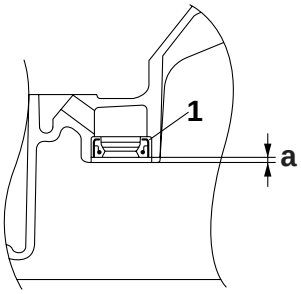
10.Install:
- Oil seal “1”

	Installed depth “a” **1.4–1.9 mm (0.055–0.075 in)**

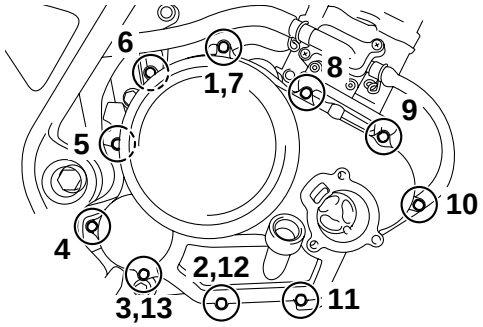


11.Install:
- Clutch cover

	Clutch cover bolt **10 Nm (1.0 m·kgf, 7.2 ft·lbf)**

TIP

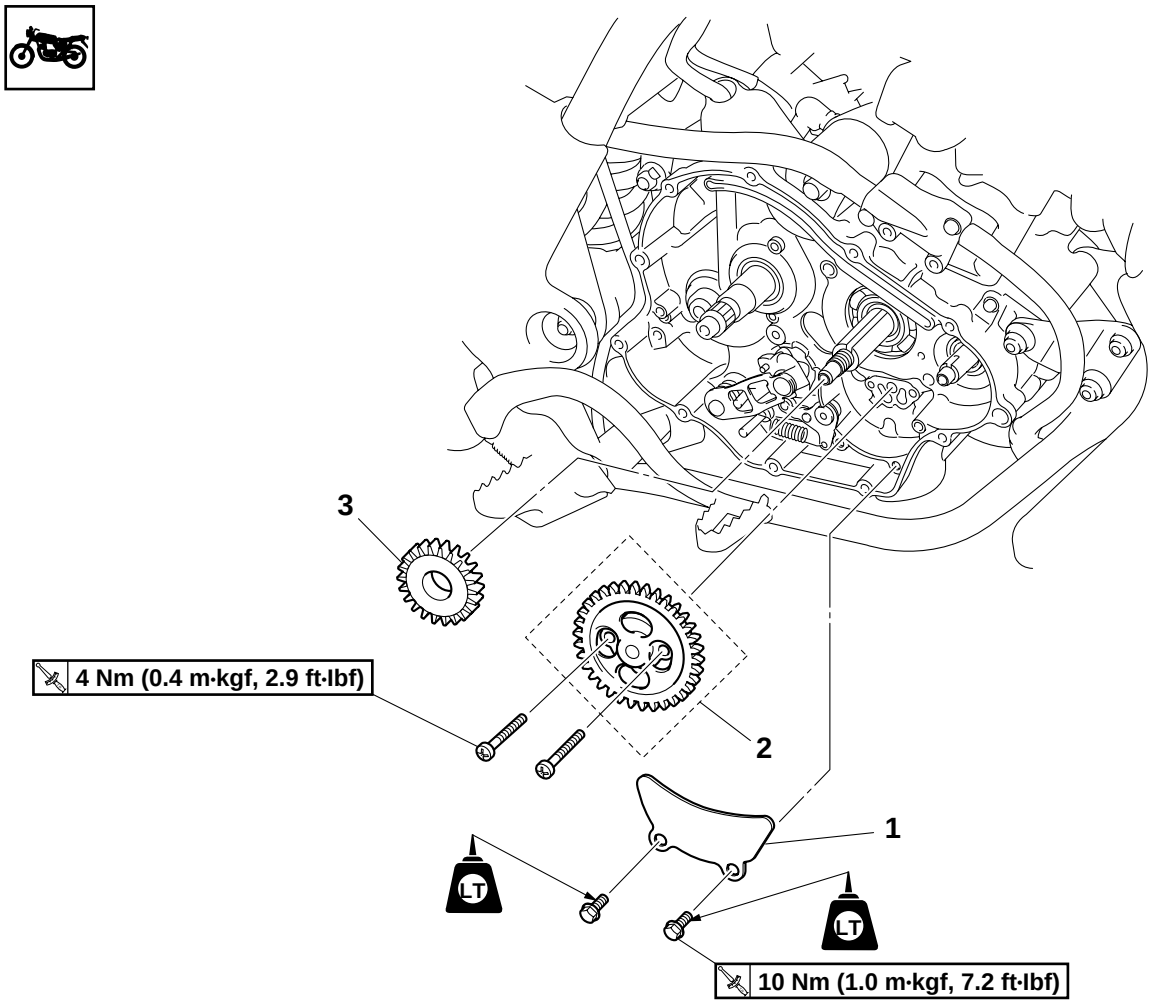
Tighten the clutch cover bolts in the proper tightening sequence as shown.



12.Adjust:
- Clutch cable free play
  Refer to “ADJUSTING THE CLUTCH CABLE FREE PLAY” on page 3-12.

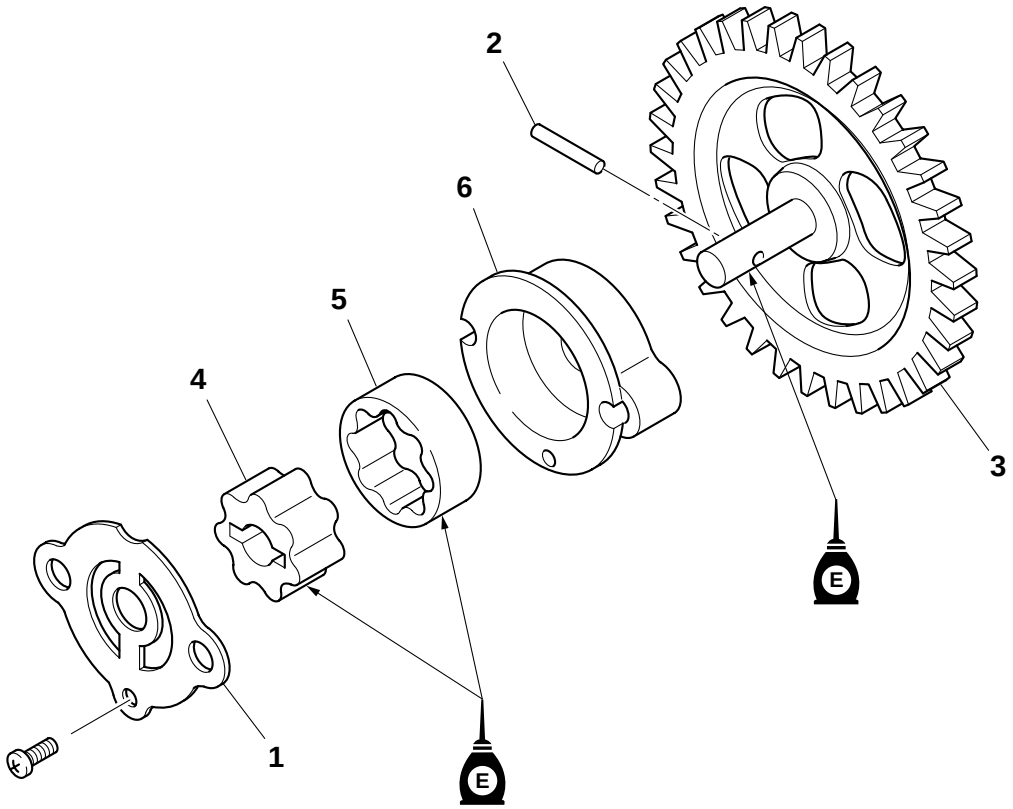
EAS24911
OIL PUMP

Removing the oil pump



Order	Job/Parts to remove	Q'ty	Remarks
	Clutch housing		
	Balancer drive gear		
1	Oil baffle plate	1	
2	Oil pump assembly	1	
3	Oil pump drive gear	1	

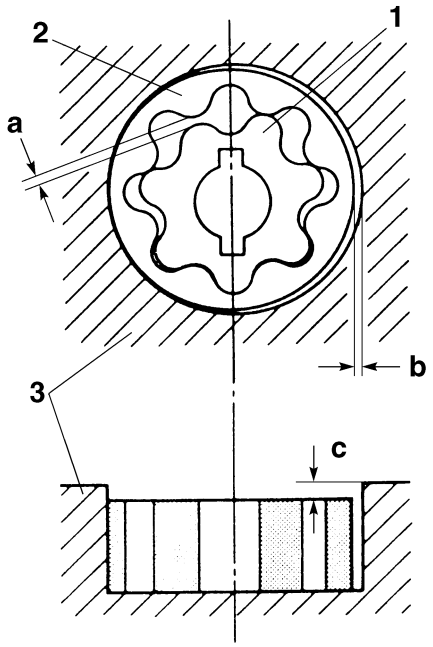
Disassembling the oil pump



Order	Job/Parts to remove	Q'ty	Remarks
1	Oil pump housing cover	1	
2	Pin	1	
3	Oil pump driven gear	1	
4	Oil pump inner rotor	1	
5	Oil pump outer rotor	1	
6	Oil pump housing	1	

EAS24960
CHECKING THE OIL PUMP

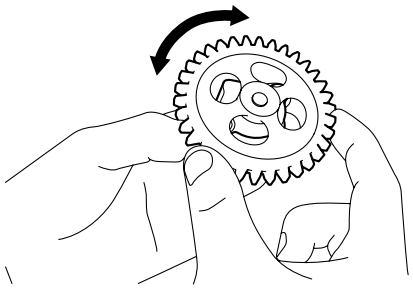
1. Check:
   - Oil pump drive gear
   - Oil pump driven gear
   - Oil pump housing
   - Oil pump housing cover
   Cracks/damage/wear → Replace the defective part(s).
2. Measure:
   - Inner-rotor-to-outer-rotor-tip clearance “a”
   - Outer-rotor-to-oil-pump-housing clearance “b”
   - Oil-pump-housing-to-inner-rotor-and-outer-rotor clearance “c”
   Out of specification → Replace the oil pump.



1. Inner rotor
2. Outer rotor
3. Oil pump housing

Inner-rotor-to-outer-rotor-tip clearance
Less than 0.150 mm (0.0059 in)
Limit
0.23 mm (0.0091 in)
Outer-rotor-to-oil-pump-housing clearance
0.130–0.180 mm (0.0051–0.0071 in)
Limit
0.25 mm (0.0098 in)
Oil-pump-housing-to-inner-and-outer-rotor clearance
0.06–0.11 mm (0.0024–0.0043 in)
Limit
0.18 mm (0.0071 in)

3. Check:
   - Oil pump operation
   Rough movement → Repeat steps (1) and (2) or replace the defective part(s).



EAS25000
ASSEMBLING THE OIL PUMP

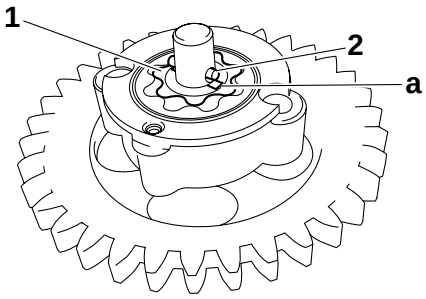
1. Lubricate:
   - Oil pump inner rotor
   - Oil pump outer rotor
   - Oil pump driven gear
   (with the recommended lubricant)

Recommended lubricant
Engine oil

2. Install:
   - Oil pump outer rotor
   - Oil pump inner rotor “1”
   - Oil pump driven gear
   - Pin “2”

TIP

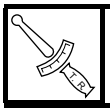
When installing the inner rotor, align the pin “2” in the oil pump shaft with the groove “a” in the inner rotor.



3. Check:
   • Oil pump operation
   Refer to “CHECKING THE OIL PUMP” on page 5-49.

EAS25020
INSTALLING THE OIL PUMP

1. Install:
   • Oil pump assembly

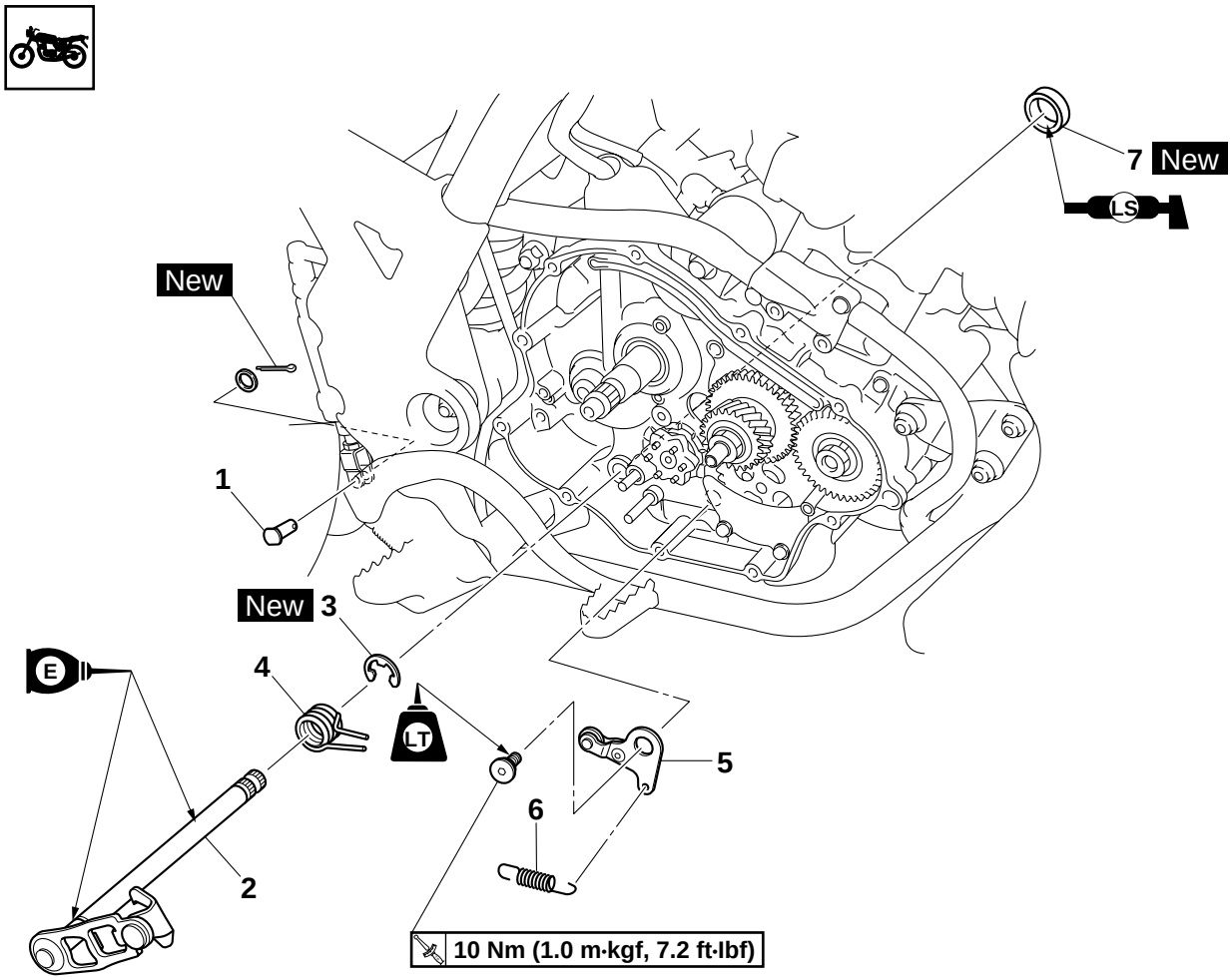
	**Oil pump assembly screw** **4 Nm (0.4 m·kgf, 2.9 ft·lbf)**

ECA22B1011
NOTICE

After tightening the screws, make sure the oil pump turns smoothly.

EAS25410
SHIFT SHAFT

Removing the shift shaft and stopper lever



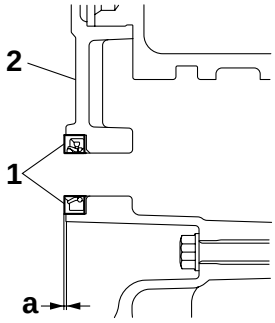
Order	Job/Parts to remove	Q'ty	Remarks
	Clutch housing		
	Shift pedal		
1	Pin	1	
2	Shift shaft	1	
3	Circlip	1	
4	Shift shaft spring	1	
5	Stopper lever	1	
6	Stopper lever spring	1	
7	Oil seal	1	

EAS25420
CHECKING THE SHIFT SHAFT
1. Check:
   - Shift shaft
     Bends/damage/wear → Replace.
   - Shift shaft spring
     Damage/wear → Replace.

EAS25430
CHECKING THE STOPPER LEVER
1. Check:
   - Stopper lever
     Bends/damage → Replace.
     Roller turns roughly → Replace the stopper lever.
   - Stopper lever spring
     Damage/wear → Replace.

EAS25450
INSTALLING THE SHIFT SHAFT
1. Install:
   - Oil seal “1”
     (to the left crankcase “2”)

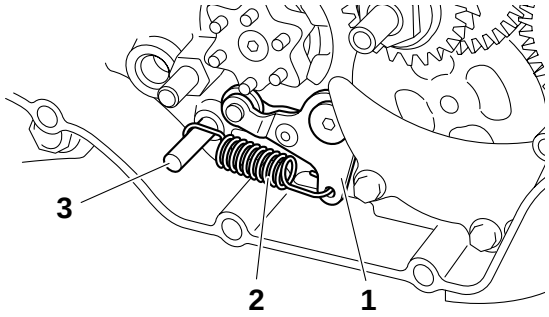
	**Installed depth “a”** **0–0.5 mm (0–0.02 in)**



2. Install:
   - Stopper lever “1”
   - Stopper lever spring “2”

TIP

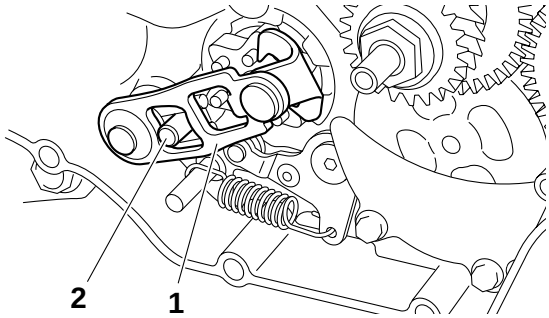
- Install the stopper lever spring as shown in the illustration.
- Hook the ends of the stopper lever spring onto the stopper lever and the crankcase boss “3”.
- Mesh the stopper lever with the shift drum segment assembly.



3. Install:
   - Shift shaft “1”

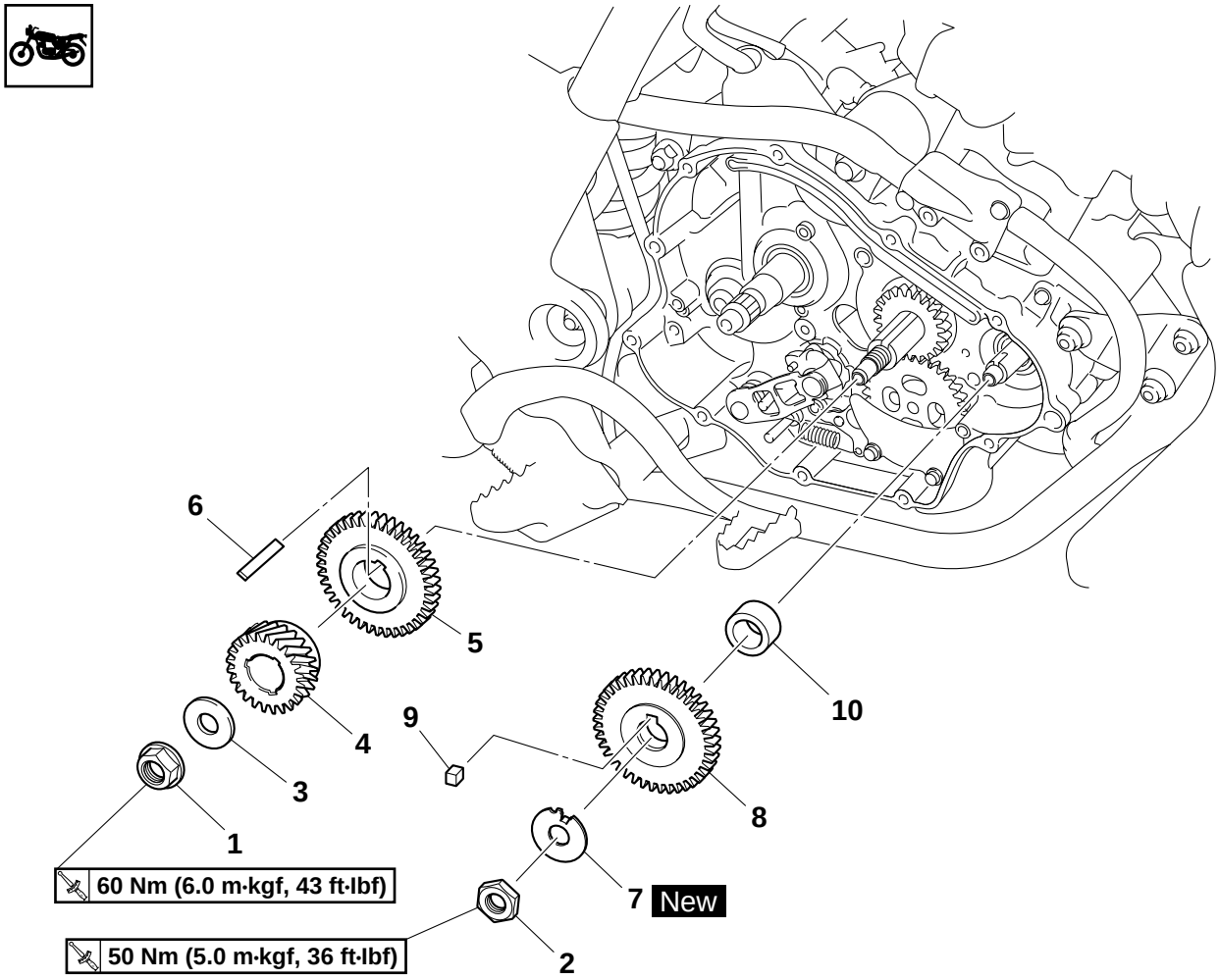
TIP

Hook the end of the shift shaft spring onto the shift shaft spring stopper “2”.



EAS22B1008
BALANCER GEARS

Removing the primary drive gear and balancer gears



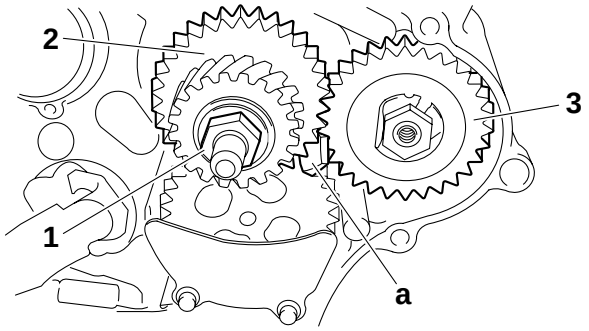
Order	Job/Parts to remove	Q'ty	Remarks
	Clutch housing		
1	Primary drive gear nut	1	
2	Balancer driven gear nut	1	
3	Washer	1	
4	Primary drive gear	1	
5	Balancer drive gear	1	
6	Straight key	1	
7	Lock washer	1	
8	Balancer driven gear	1	
9	Straight key	1	
10	Spacer	1	

EAS22B1009
REMOVING THE PRIMARY DRIVE GEAR AND BALANCER GEARS

1. Loosen:
   • Primary drive gear nut “1”

TIP

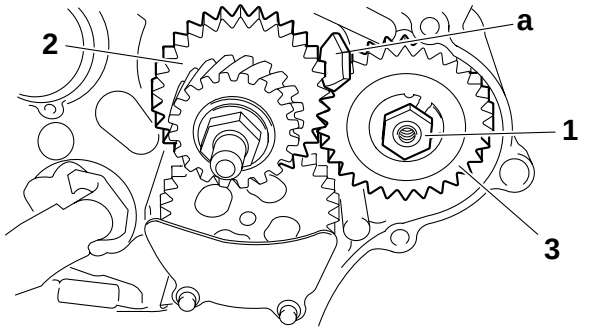
Place an aluminum plate “a” between the balancer drive gear “2” and the balancer driven gear “3”, and then loosen the primary drive gear nut.



2. Straighten the lock washer tab.
3. Loosen:
   • Balancer driven gear nut “1”

TIP

Place an aluminum plate “a” between the balancer drive gear “2” and the balancer driven gear “3”, and then loosen the balancer driven gear nut.



EAS22B1010
CHECKING THE BALANCER GEARS AND PRIMARY DRIVE GEAR

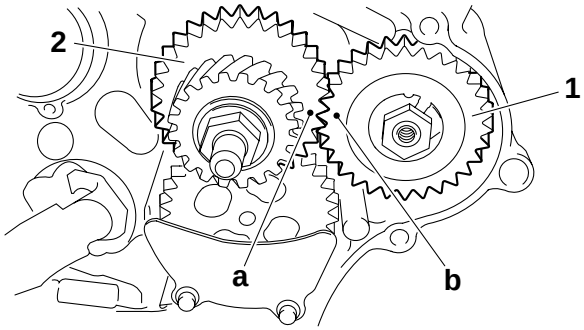
1. Check:
   • Balancer drive gear
   • Balancer driven gear
   Cracks/damage/wear → Replace.
2. Check:
   • Primary drive gear
   Refer to “CHECKING THE PRIMARY DRIVE GEAR” on page 5-44.

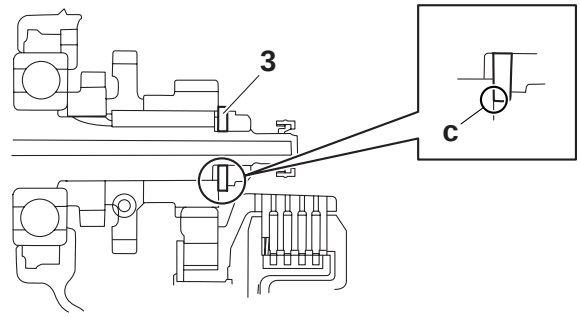
EAS22B1011
INSTALLING THE PRIMARY DRIVE GEAR AND BALANCER GEARS

1. Install:
   • Balancer driven gear “1”
   • Lock washer New
   • Balancer drive gear “2”
   • Primary drive gear
   • Washer “3”
   • Balancer driven gear nut
   • Primary drive gear nut

TIP

- Align the punch mark “a” in the balancer drive gear “2” with the punch mark “b” in the balancer driven gear “1”.
- Be sure to install the washer so that its sharp edge “c” is facing the primary drive gear.





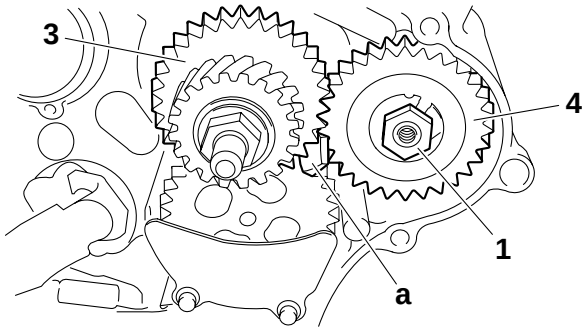
2. Tighten:
   • Balancer driven gear nut “1”
   • Primary drive gear nut “2”

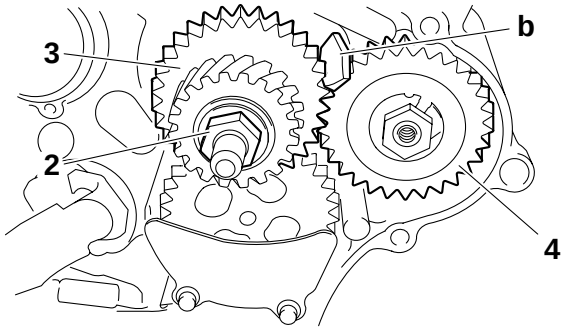
Balancer driven gear nut
50 Nm (5.0 m·kgf, 36 ft·lbf)
Primary drive gear nut
60 Nm (6.0 m·kgf, 43 ft·lbf)

TIP

- Place an aluminum plate “a” between the balancer drive gear “3” and the balancer driven gear “4”, and then tighten the balancer driven gear nut.

• Place an aluminum plate “b” between the balancer drive gear “3” and the balancer driven gear “4”, and then tighten the primary drive gear nut.

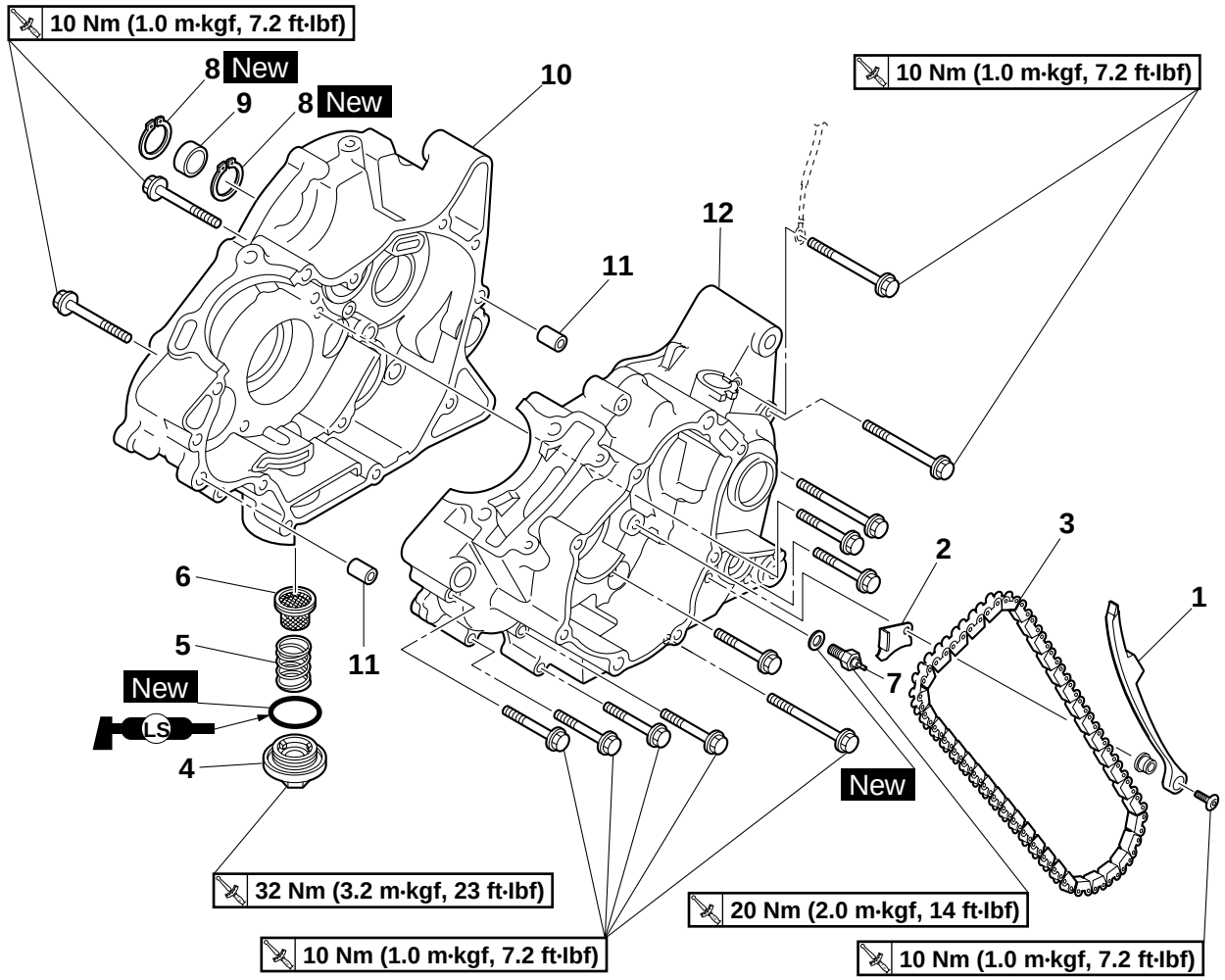




3. Bend the lock washer tab along a flat side of the nut.

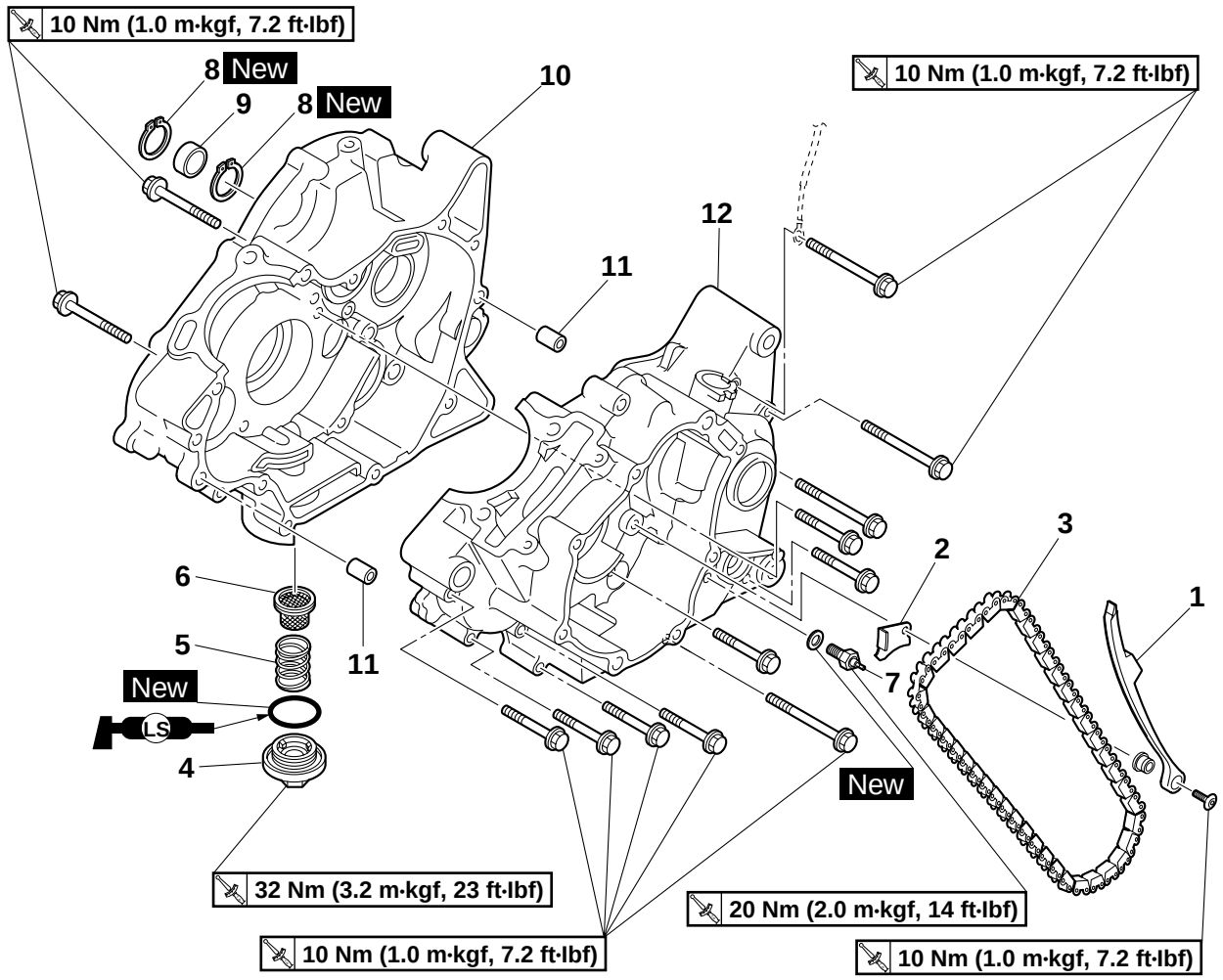
EAS25540
CRANKCASE

Separating the crankcase



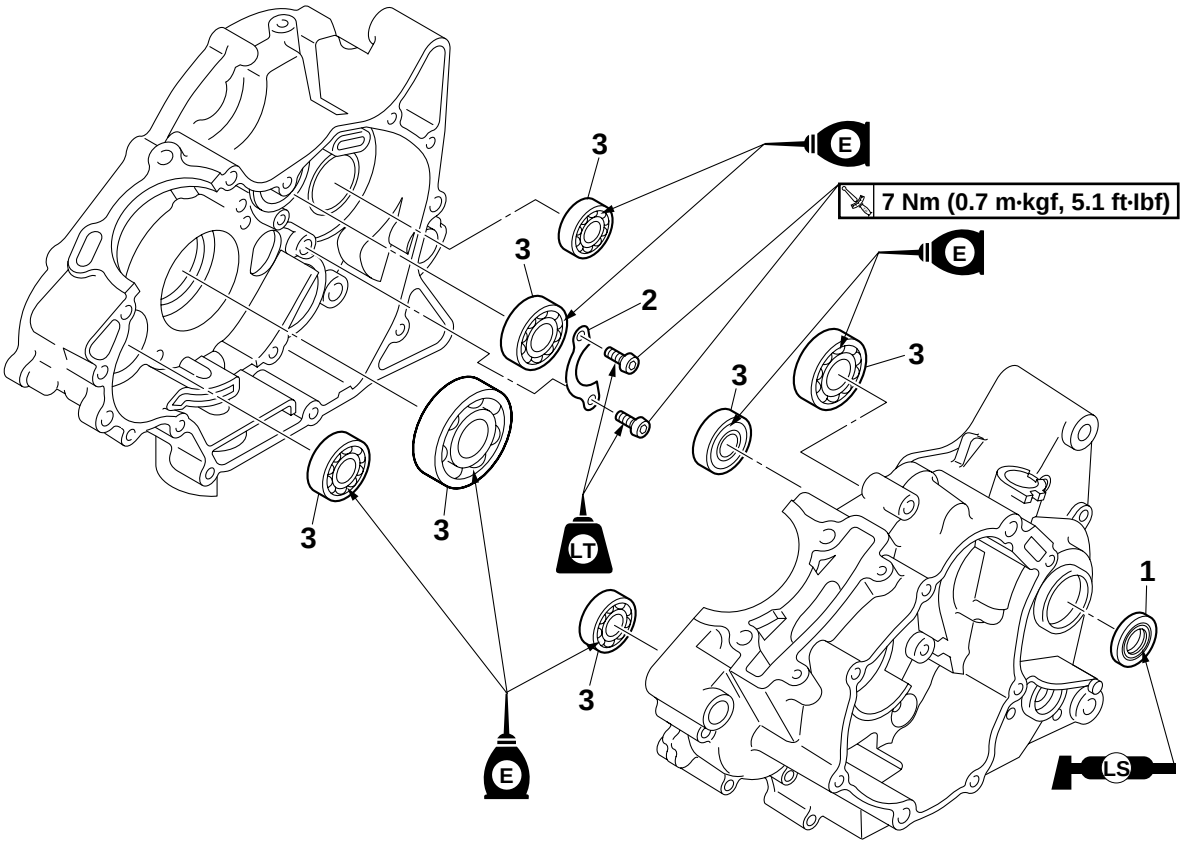
Order	Job/Parts to remove	Q'ty	Remarks
	Engine		
	Cylinder head		
	Cylinder/Piston		
	Clutch housing		
	Oil pump assembly		
	Shift shaft		
	Starter motor		
	Balancer gears		
	Generator rotor		
1	Timing chain guide (intake side)	1	
2	Timing chain guard	1	
3	Timing chain	1	
4	Engine oil drain plug	1	

Separating the crankcase



Order	Job/Parts to remove	Q'ty	Remarks
5	Spring	1	
6	Engine oil strainer	1	
7	Neutral switch	1	
8	Circlip	2	
9	Spacer	1	
10	Right crankcase	1	
11	Dowel pin	2	
12	Left crankcase	1	

Removing the oil seal and bearings



Order	Job/Parts to remove	Q'ty	Remarks
	Crankshaft/Balancer		
	Transmission		
1	Oil seal	1	
2	Bearing retainer	1	
3	Bearing	7	

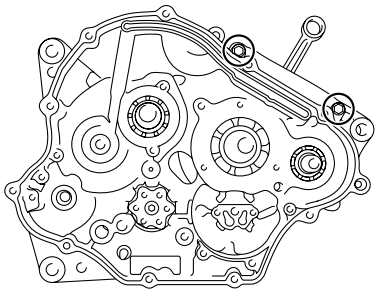
EAS22B1012
SEPARATING THE CRANKCASE

1. Remove:
   • Crankcase bolts

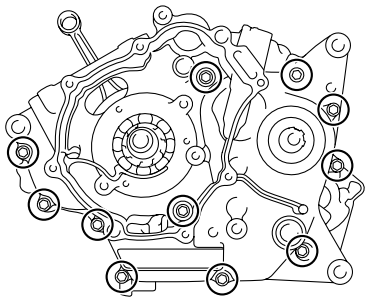
TIP

Loosen each bolt 1/4 of a turn at a time, in stages and in a crisscross pattern. After all of the bolts are fully loosened, remove them.

A



B

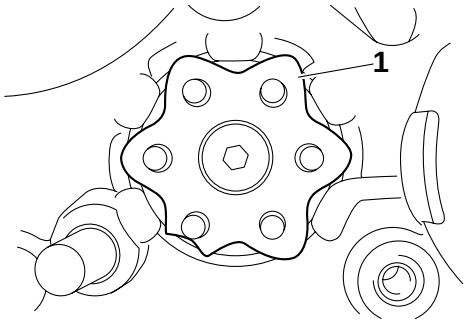


A. Right crankcase
B. Left crankcase

2. Turn:
   • Shift drum segment

TIP

Turn the shift drum segment “1” to the position shown in the illustration. In this position, the shift drum segment teeth will not contact the crankcase during crankcase separation.



3. Remove:
   • Right crankcase

ECA22B1021

NOTICE

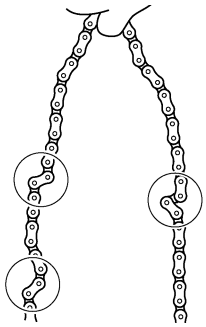
Tap on one side of the crankcase with a soft-face hammer. Tap only on reinforced portions of the crankcase, not on the crankcase mating surfaces. Work slowly and carefully and make sure the crankcase halves separate evenly.

EAS25580
CHECKING THE CRANKCASE

1. Thoroughly wash the crankcase halves in a mild solvent.
2. Thoroughly clean all the gasket surfaces and crankcase mating surfaces.
3. Check:
   • Crankcase
   Cracks/damage → Replace.
   • Oil delivery passages
   Obstruction → Blow out with compressed air.

EAS22B1013
CHECKING THE TIMING CHAIN AND TIMING CHAIN GUIDE

1. Check:
   • Timing chain
   Damage/stiffness → Replace the timing chain and camshaft sprocket as a set.



2. Check:
   • Timing chain guide (intake side)
   Damage/wear → Replace.

EAS22B1014
CHECKING THE OIL STRAINER

1. Check:
   • Oil strainer
   Damage → Replace.
   Contaminants → Clean with solvent.

EAS22B1015
CHECKING THE BEARINGS AND OIL SEAL

1. Check:
   • Bearings
   Clean and lubricate the bearings, and then rotate the inner race with your finger.
   Rough movement → Replace.

• Oil seal
Damage/wear → Replace.

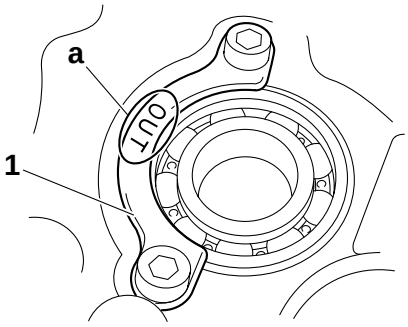
EAS22B1016
INSTALLING THE BEARING RETAINER

1. Install:
   • Bearing retainer “1”

TIP

• Install the bearing retainer “1” with its “OUT” mark “a” facing outward.
• Apply locking agent (LOCTITE®) to the threads of the bearing retainer bolts.

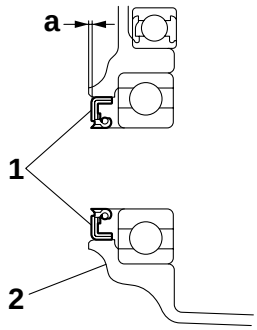
Bearing retainer bolt
7 Nm (0.7 m·kgf, 5.1 ft·lbf)
LOCTITE®



EAS22B1029
INSTALLING THE OIL SEAL

1. Install:
   • Oil seal “1”
   (to the left crankcase “2”)

Installed depth “a”
1.0–1.5 mm (0.04–0.06 in)

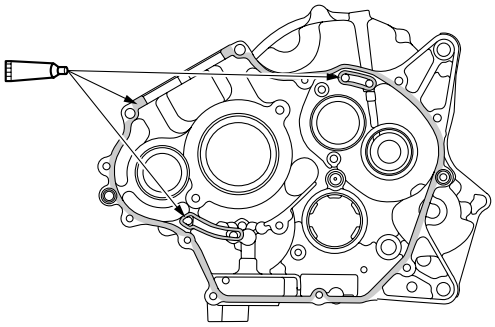


EAS25700
ASSEMBLING THE CRANKCASE

1. Thoroughly clean all the gasket mating surfaces and crankcase mating surfaces.
2. Apply:
   • Sealant
   (to the crankcase mating surfaces)

TIP

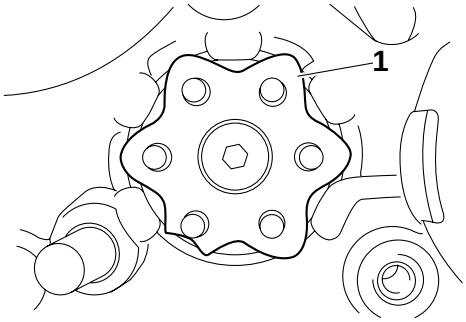
Do not allow any sealant to come into contact with the oil gallery.



3. Install:
   • Right crankcase
   (onto the left crankcase)

TIP

• Turn the shift drum segment “1” to the position shown in the illustration. In this position, the shift drum segment teeth will not contact the crankcase during crankcase installation.
• Tap lightly on the right crankcase with a soft-face hammer.



4. Install:
   • Crankcase bolts

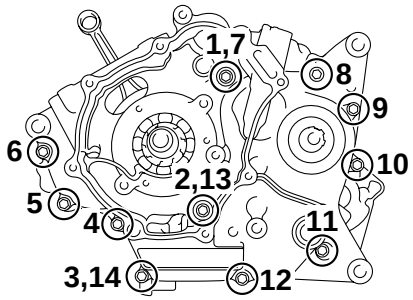
Crankcase bolt
10 Nm (1.0 m·kgf, 7.2 ft·lbf)

TIP

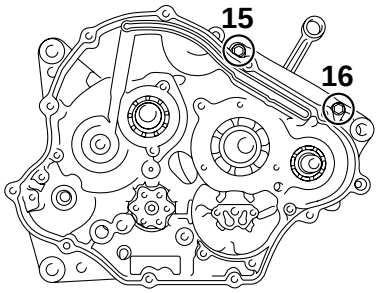
Tighten each bolt 1/4 of a turn at a time, in stages and in the proper sequence as shown.

• M6 × 70 mm : “8–10”, “12”
• M6 × 55 mm : “15”, “16”
• M6 × 45 mm : “1–6”, “11”

A



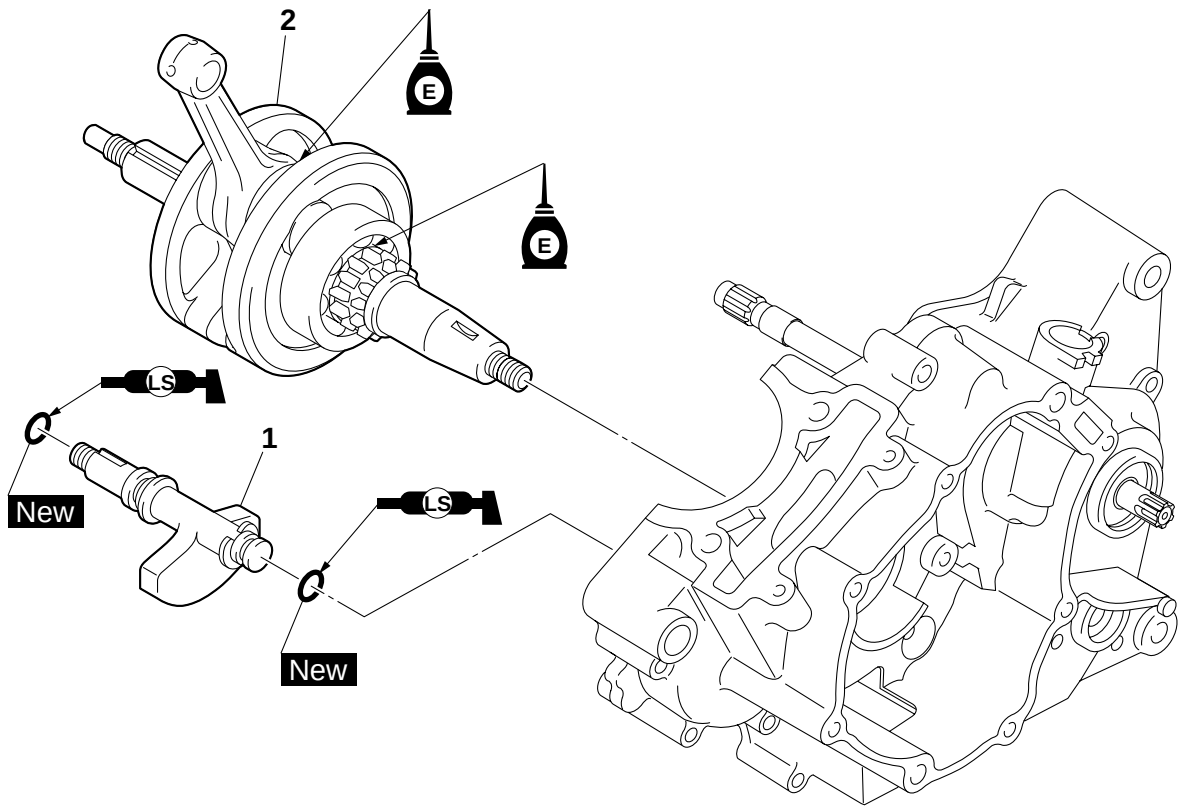
B



A. Left crankcase
B. Right crankcase

EAS25960
CRANKSHAFT

Removing the crankshaft and balancer



Order	Job/Parts to remove	Q'ty	Remarks
	Crankcase		
1	Balancer	1	
2	Crankshaft	1	

EAS22B1017
REMOVING THE CRANKSHAFT

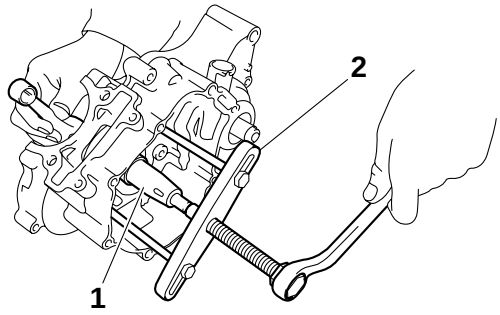
1. Remove:
   • Crankshaft “1”

TIP

• Remove the crankshaft with the crankcase separating tool “2”.
• Make sure the crankcase separating tool is centered over the crankshaft.

ECA22B1006
NOTICE

• To protect the end of the crankshaft, place an appropriate sized socket between the crankcase separating tool bolt and the crankshaft.
• Do not tap on the crankshaft.



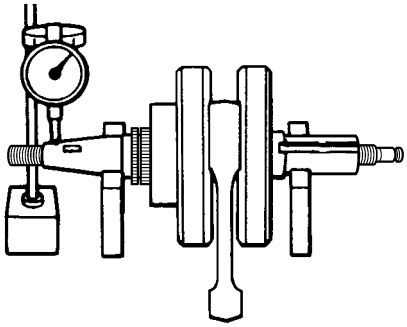
EAS22B1018
CHECKING THE CRANKSHAFT

1. Measure:
   • Crankshaft runout
   Out of specification → Replace the crankshaft, bearing or both.

TIP

Turn the crankshaft slowly.

Runout limit C
0.030 mm (0.0012 in)



2. Measure:
   • Big end side clearance
   Out of specification → Replace the crankshaft.

Big end side clearance D
0.110–0.410 mm (0.0043–0.0161 in)

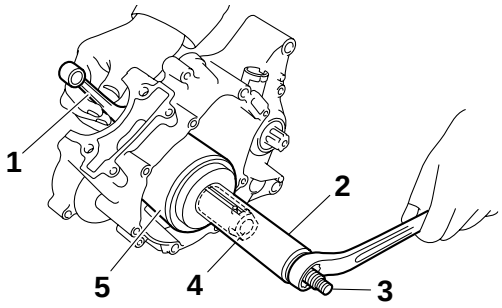
3. Measure:
   • Crankshaft width
   Out of specification → Replace the crankshaft.

Width A
47.95–48.00 mm (1.888–1.890 in)

4. Check:
   • Crankshaft sprocket
   Damage/wear → Replace the crankshaft.
   • Bearing
   Cracks/damage/wear → Replace the crankshaft.
5. Check:
   • Crankshaft journal
   Scratches/wear → Replace the crankshaft.
   • Crankshaft journal oil passage
   Obstruction → Blow out with compressed air.

EAS22B1019
INSTALLING THE CRANKSHAFT

1. Install:
   • Crankshaft “1”



ECA22B1022

NOTICE

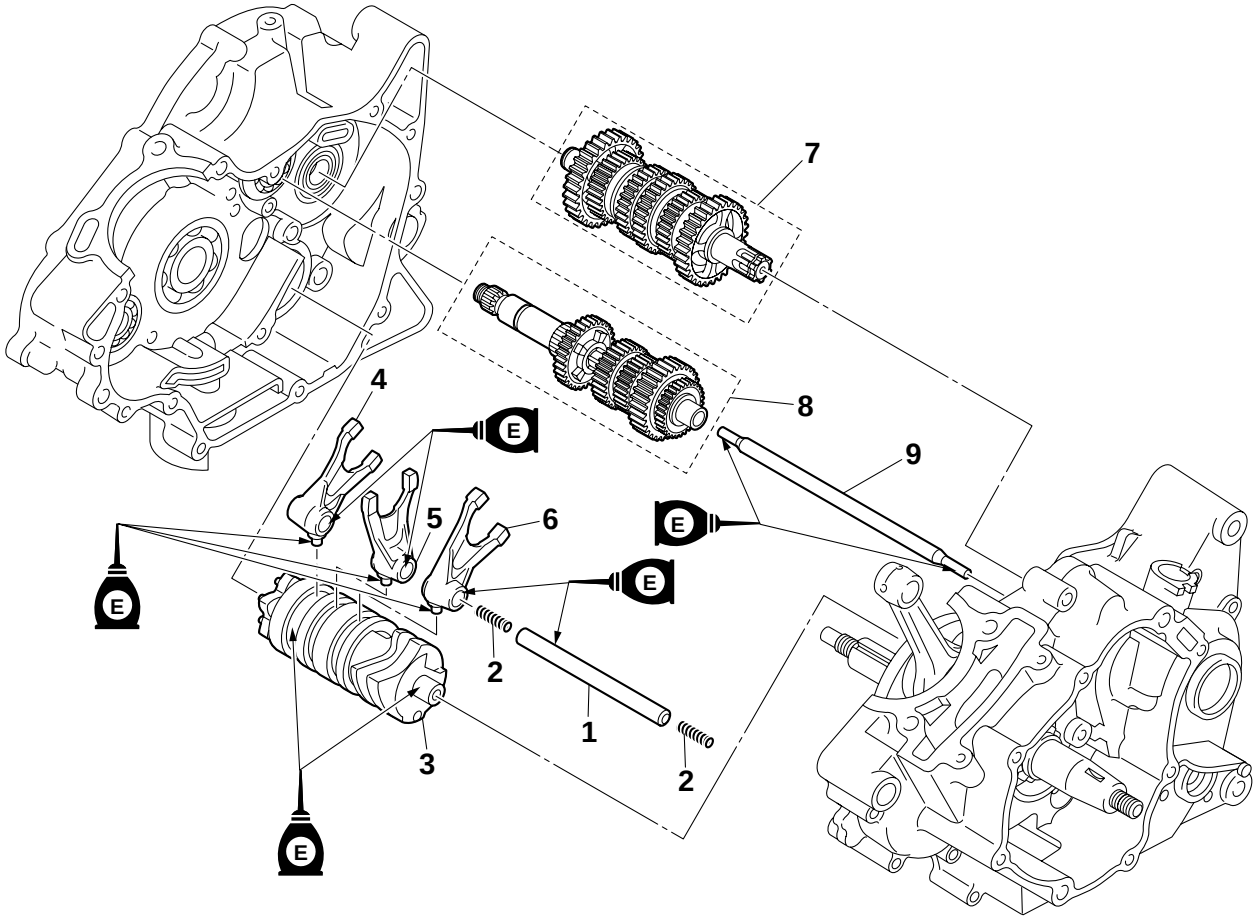
To avoid scratching the crankshaft and to ease the installation procedure, lubricate the oil seal lips with lithium-soap-based grease and each bearing with engine oil.

TIP

Hold the connecting rod at top dead center (TDC) with one hand while turning the nut of the crankshaft installer bolt with the other. Turn the crankshaft installer bolt until the crankshaft bottoms against the bearing.

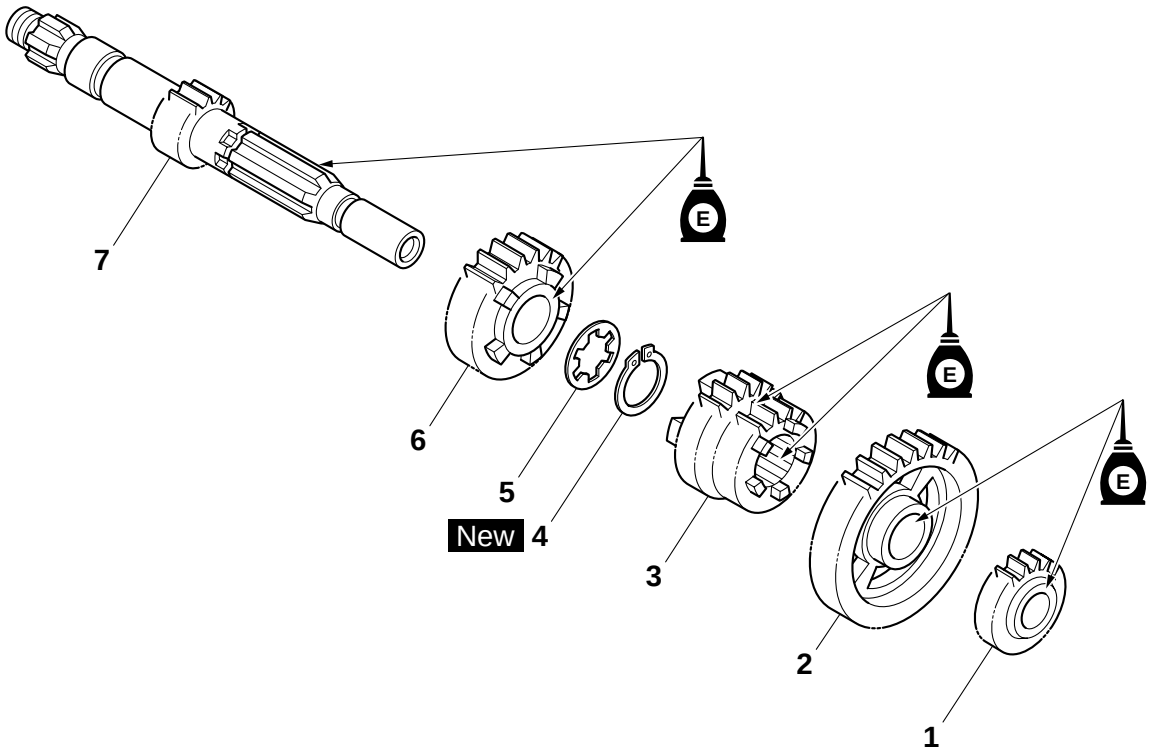
EAS26241
TRANSMISSION

Removing the transmission, shift drum assembly, and shift forks



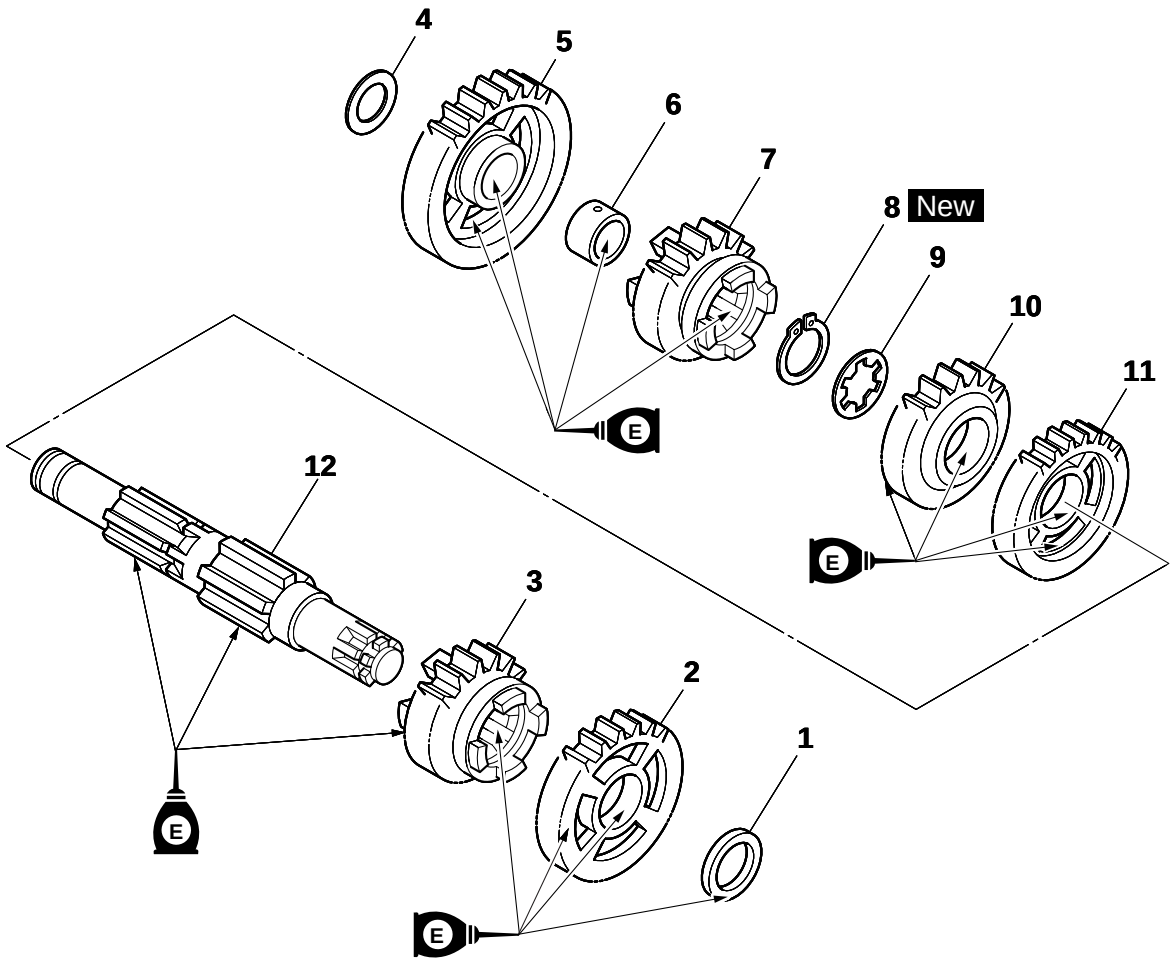
Order	Job/Parts to remove	Q'ty	Remarks
	Crankcase		
1	Shift fork guide bar	1	
2	Spring	2	
3	Shift drum assembly	1	
4	Shift fork-R	1	
5	Shift fork-C	1	
6	Shift fork-L	1	
7	Drive axle assembly	1	
8	Main axle assembly	1	
9	Long clutch push rod	1	

Disassembling the main axle



Order	Job/Parts to remove	Q'ty	Remarks
1	2nd pinion gear	1	
2	6th pinion gear	1	
3	3rd/4th pinion gear	1	
4	Circlip	1	
5	Toothed washer	1	
6	5th pinion gear	1	
7	Main axle/1st pinion gear	1	

Disassembling the drive axle

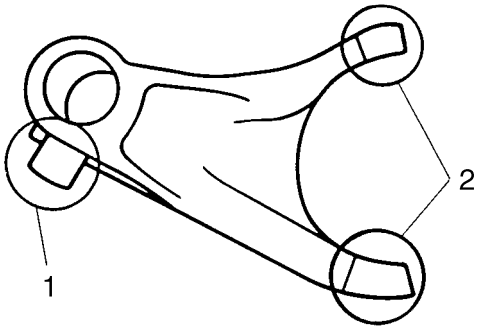


Order	Job/Parts to remove	Q'ty	Remarks
1	Washer	1	
2	2nd wheel gear	1	
3	6th wheel gear	1	
4	Washer	1	
5	1st wheel gear	1	
6	Spacer	1	
7	5th wheel gear	1	
8	Circlip	1	
9	Toothed washer	1	
10	4th wheel gear	1	
11	3rd wheel gear	1	
12	Drive axle	1	

EAS26260
CHECKING THE SHIFT FORKS

The following procedure applies to all of the shift forks.

1. Check:
   - Shift fork cam follower “1”
   - Shift fork pawl “2”
     Bends/damage/scoring/wear → Replace the shift fork.

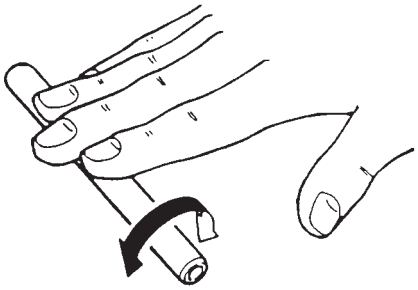


2. Check:
   - Shift fork guide bar
     Roll the shift fork guide bar on a flat surface.
     Bends → Replace.

EWA12840

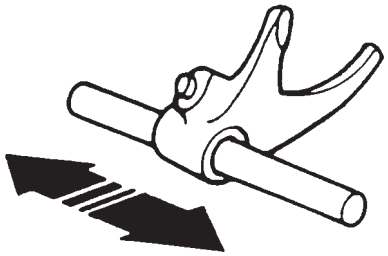
⚠ WARNING

Do not attempt to straighten a bent shift fork guide bar.



319-010

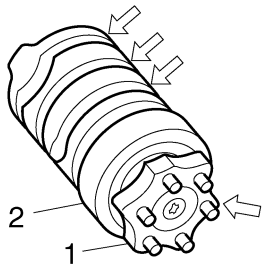
3. Check:
   - Shift fork movement
     (along the shift fork guide bar)
     Rough movement → Replace the shift forks and shift fork guide bar as a set.



319-011

EAS26270
CHECKING THE SHIFT DRUM ASSEMBLY

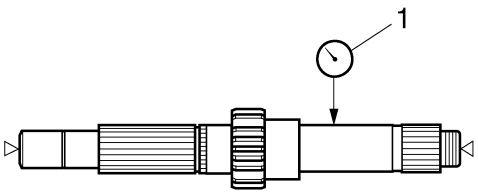
1. Check:
   - Shift drum groove
     Damage/scratches/wear → Replace the shift drum assembly.
   - Shift drum segment “1”
     Damage/wear → Replace the shift drum assembly.
   - Shift drum bearing “2”
     Damage/pitting → Replace the shift drum assembly.



EAS26290
CHECKING THE TRANSMISSION

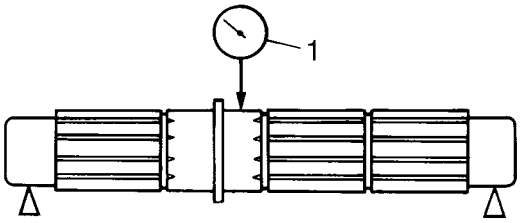
1. Measure:
   - Main axle runout
     (with a centering device and dial gauge “1”)
     Out of specification → Replace the main axle.

	Main axle runout limit **0.08 mm (0.0032 in)**

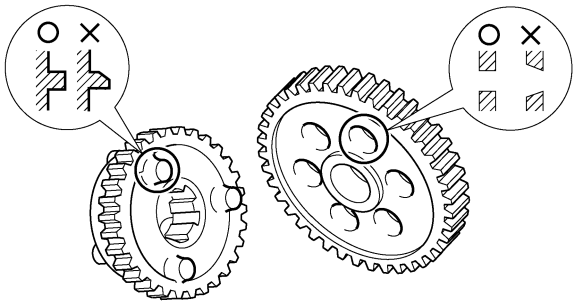


2. Measure:
   - Drive axle runout
     (with a centering device and dial gauge “1”)
     Out of specification → Replace the drive axle.

	Drive axle runout limit **0.08 mm (0.0032 in)**



3. Check:
   - Transmission gears
     Blue discoloration/pitting/wear → Replace the defective gear(s).
   - Transmission gear dogs
     Cracks/damage/rounded edges → Replace the defective gear(s).



4. Check:
   - Transmission gear engagement
     (each pinion gear to its respective wheel gear)
     Incorrect → Reassemble the transmission axle assemblies.
5. Check:
   - Transmission gear movement
     Rough movement → Replace the defective part(s).

EAS22B1030
CHECKING THE LONG CLUTCH PUSH ROD

1. Check:
   - Long clutch push rod
     Cracks/damage/wear → Replace the long clutch push rod.
2. Measure:
   - Long clutch push rod bending limit
     Out of specification → Replace the long clutch push rod.

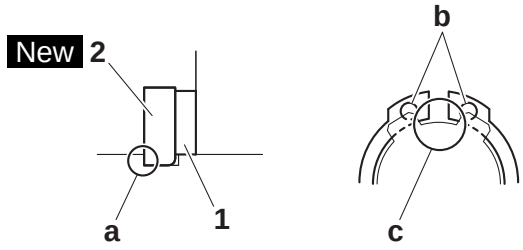
Long clutch push rod bending limit
0.500 mm (0.0197 in)

EAS29020
ASSEMBLING THE MAIN AXLE AND DRIVE AXLE

1. Install:
   - Toothed washer “1”
   - Circlip “2” New

TIP

- Be sure to install the circlip so that its sharp edge “a” is facing away from the toothed washer and gear.
- Be sure the circlip ends “b” are positioned at the axle spline groove “c”.

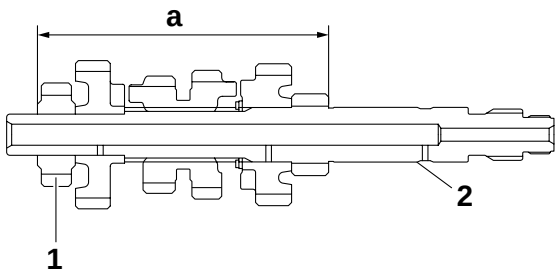


2. Install:
   - 2nd pinion gear “1”

TIP

Press the 2nd pinion gear into the main axle “2”, as shown in the illustration.

Installed depth “a”
106.85–107.05 mm (4.207–4.215 in)

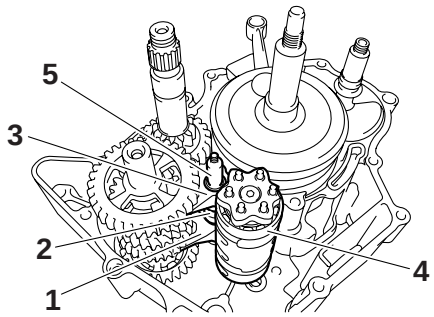


EAS26320
INSTALLING THE SHIFT FORKS AND SHIFT DRUM ASSEMBLY

1. Install:
   - Shift fork-L “1”
   - Shift fork-C “2”
   - Shift fork-R “3”
   - Shift drum assembly “4”
   - Springs
   - Shift fork guide bar “5”

TIP

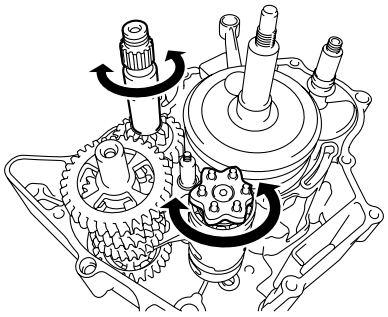
The embossed marks on the shift forks should face towards the right side of the engine and be in the following sequence: “R”, “C”, “L”.



2. Check:
   - Transmission
     Rough movement → Repair.

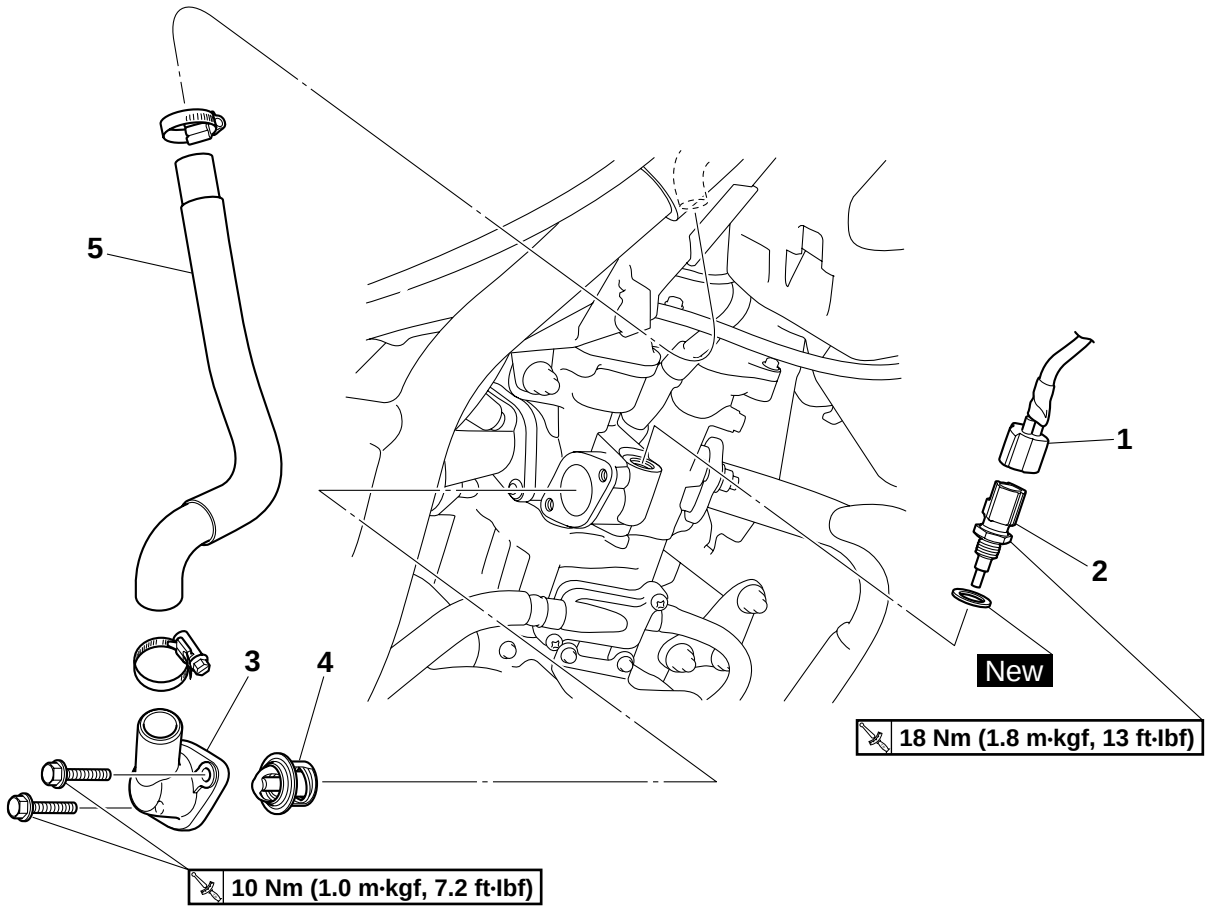
TIP

- Apply engine oil to each gear and bearing thoroughly.
- Before assembling the crankcase, make sure that the transmission is in neutral and that the gears turn freely.



EAS26440
THERMOSTAT

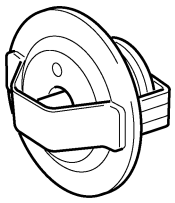
Removing the thermostat



Order	Job/Parts to remove	Q'ty	Remarks
	Coolant		
	Fuel tank cover assembly		
1	Coolant temperature sensor coupler	1	
2	Coolant temperature sensor	1	
3	Thermostat cover	1	
4	Thermostat	1	
5	Radiator inlet hose	1	

EAS26450
CHECKING THE THERMOSTAT

1. Check:
   - Thermostat
     Does not open at 80.5–83.5 °C (176.9–182.3 °F) → Replace.



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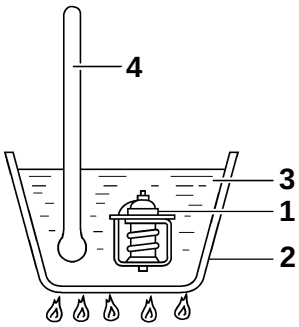
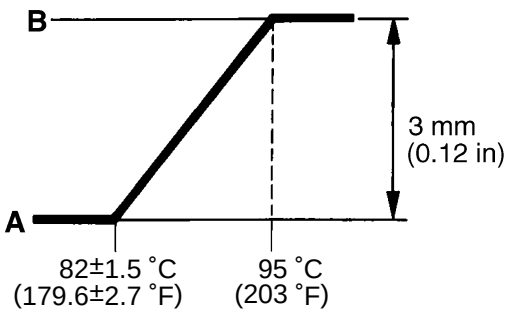
a. Suspend the thermostat “1” in a container “2” filled with water.
b. Slowly heat the water “3”.
c. Place a thermometer “4” in the water.
d. While stirring the water, observe the thermostat and thermometer’s indicated temperature.





A. Fully closed
B. Fully open

TIP

If the accuracy of the thermostat is in doubt, replace it. A faulty thermostat could cause serious overheating or overcooling.

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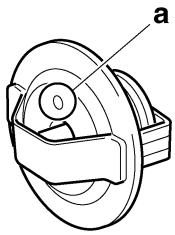
2. Check:
   - Thermostat cover
     Cracks/damage → Replace.
3. Check:
   - Radiator inlet hose
     Cracks/damage → Replace.

EAS26480
INSTALLING THE THERMOSTAT

1. Install:
   - Thermostat

TIP

Install the thermostat with its breather hole “a” facing up.



2. Install:
   - Copper washer New
   - Coolant temperature sensor

	**Coolant temperature sensor 18 Nm (1.8 m·kgf, 13 ft·lbf)**

ECA22B1012

NOTICE

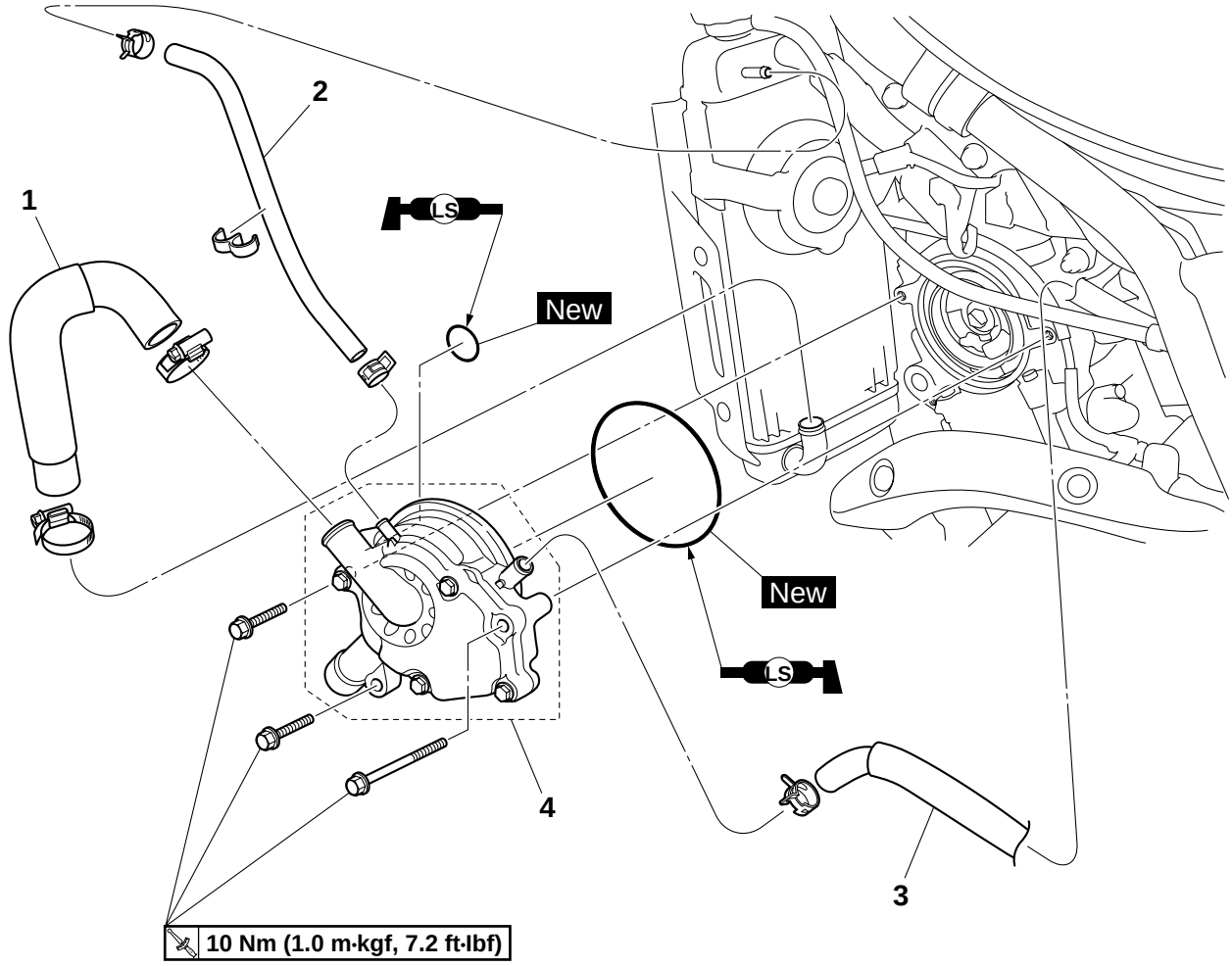
Use extreme care when handling the coolant temperature sensor. Replace any part that was dropped or subjected to a strong impact.

3. Fill:
4. Cooling system
   (with the specified amount of the recommended coolant)

4. Check:
   - Cooling system
     Leaks → Repair or replace all faulty parts.
5. Measure:
6. Radiator cap opening pressure
   Below the specified pressure → Replace the radiator cap.

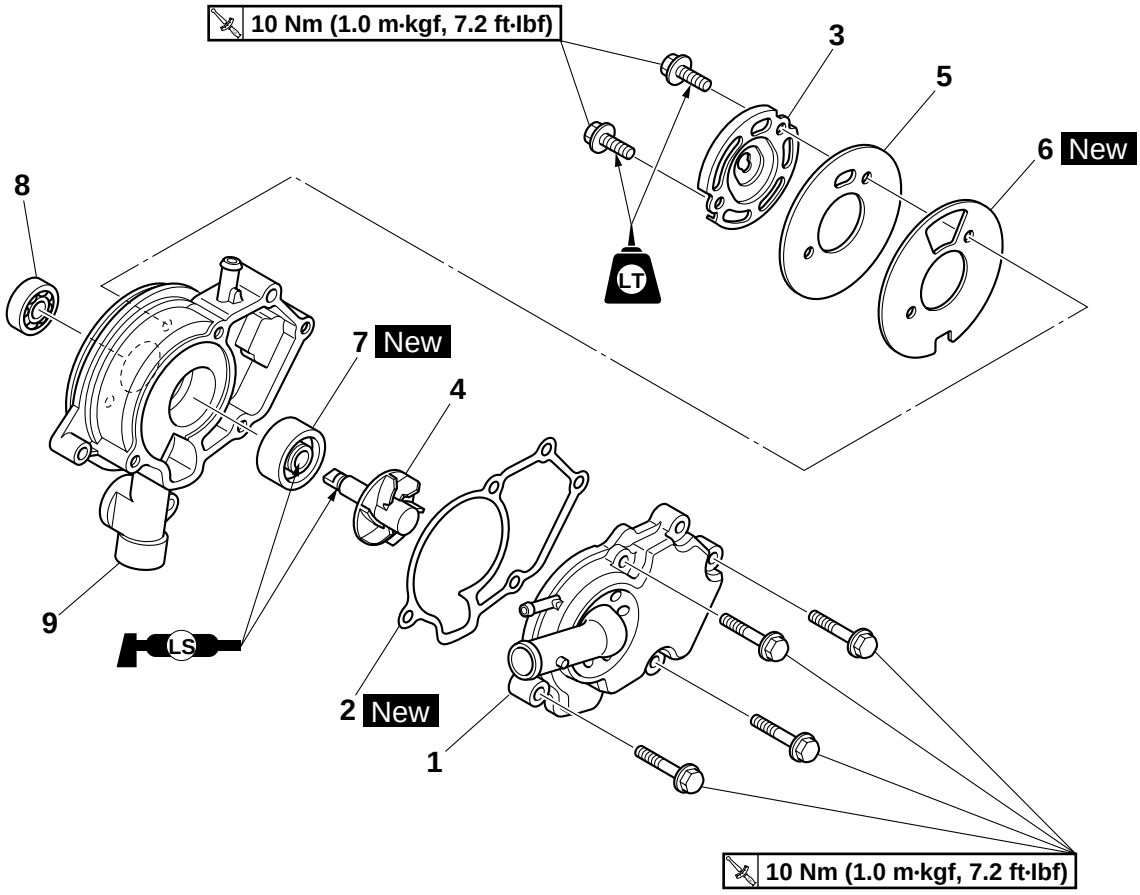
EAS26500
WATER PUMP

Removing the water pump



Order	Job/Parts to remove	Q'ty	Remarks
	Coolant		
	Fuel tank cover assembly		
1	Radiator outlet hose	1	
2	Water pump breather hose	1	
3	Cylinder head breather hose	1	
4	Water pump assembly	1	

Disassembling the water pump



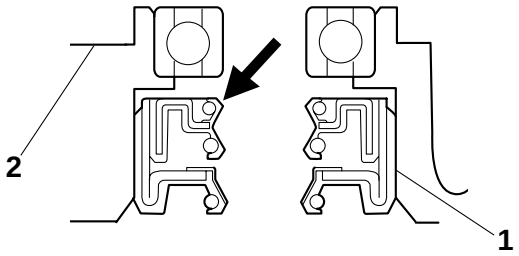
Order	Job/Parts to remove	Q'ty	Remarks
1	Water pump housing cover	1	
2	Water pump housing cover gasket	1	
3	Impeller shaft retainer	1	
4	Impeller shaft	1	
5	Water pump housing plate	1	
6	Water pump housing gasket	1	
7	Water pump seal	1	
8	Bearing	1	
9	Water pump housing	1	

EAS26510
DISASSEMBLING THE WATER PUMP

1. Remove:
   • Water pump seal “1”

TIP

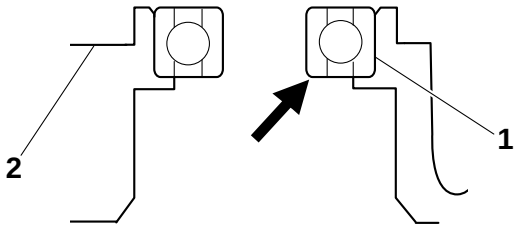
Remove the water pump seal from the inside of the water pump housing “2”.



2. Remove:
   • Bearing “1”

TIP

Remove the bearing from the outside of the water pump housing “2”.



EAS26530
CHECKING THE WATER PUMP

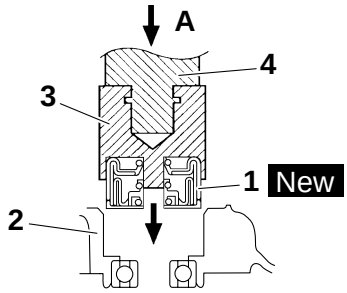
1. Check:
   • Water pump housing cover
   • Water pump housing
   Cracks/damage → Replace.
   • Impeller shaft
   Cracks/damage/wear → Replace.
   • Bearing
   Rough movement → Replace.
   • Radiator outlet hose
   Cracks/damage → Replace.

EAS26560
ASSEMBLING THE WATER PUMP

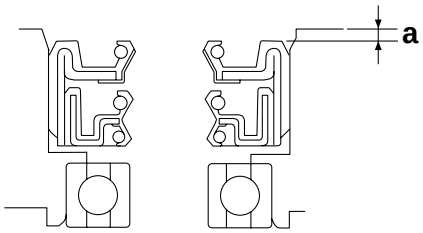
1. Install:
   • Water pump seal “1” New
   (into the water pump housing “2”)

ECA14080
NOTICE

Never lubricate the water pump seal surface with oil or grease.



A. Push down
3. Mechanical seal installer
4. Middle driven shaft bearing driver



a. 0–0.5 mm (0–0.02 in)

2. Lubricate:
   • Water pump seal lip

	Recommended lubricant **Lithium-soap-based grease**

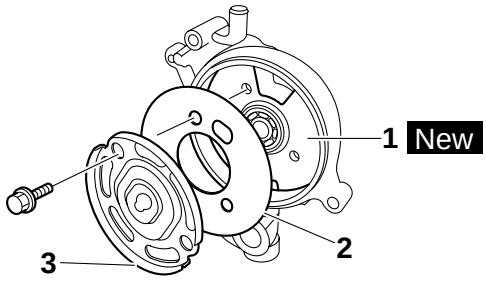
3. Install:
   • Water pump housing gasket “1” New
   • Water pump housing plate “2”
   • Impeller shaft

• Impeller shaft retainer “3”

	**Impeller shaft retainer bolt** **10 Nm (1.0 m·kgf, 7.2 ft·lbf)** **LOCTITE®**

TIP

- Before installing the impeller shaft retainer, lubricate the slit on the impeller shaft end with a thin coat of lithium-soap-based grease.
- Install the water pump housing gasket, water pump housing plate, and impeller shaft retainer as shown in the illustration.
- After installation, check that the impeller shaft rotates smoothly.



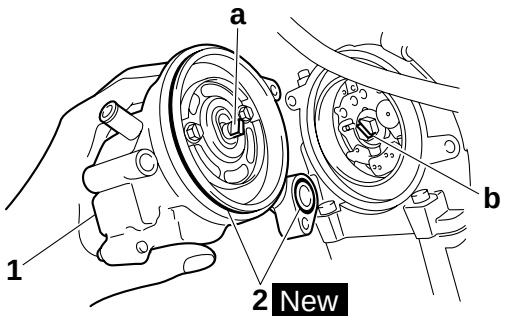
EAS26580

INSTALLING THE WATER PUMP

1. Install:
   • Water pump assembly “1”
   • O-rings “2” New

TIP

- Align the projection “a” on the impeller shaft with the slit “b” on the camshaft sprocket bolt.
- Lubricate the O-rings with a thin coat of lithium-soap-based grease.



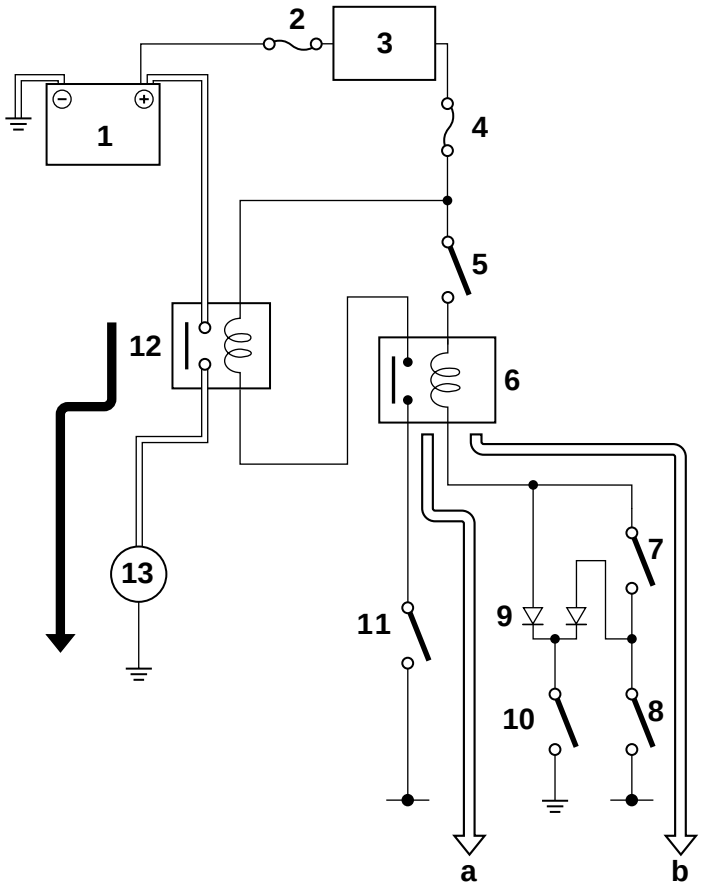
2. Fill:
3. Cooling system
   (with the specified amount of the recommended coolant)
3. Check:
   • Cooling system
   Leaks → Repair or replace all faulty parts.
4. Measure:
5. Radiator cap opening pressure
   Below the specified pressure → Replace the radiator cap.

EAS27180
STARTING CIRCUIT CUT-OFF SYSTEM OPERATION

If the engine stop switch is set to "○" and the main switch is set to "ON" (both switch circuits are closed), the starter motor can only operate if at least one of the following conditions is met:

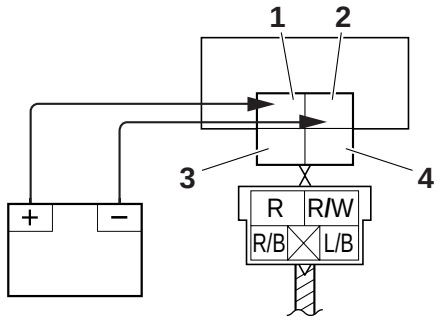
- The transmission is in neutral (the neutral switch circuit is closed).
- The clutch lever is pulled to the handlebar (the clutch switch circuit is closed) and the sidestand is up (the sidestand switch circuit is closed).

The starting circuit cut-off relay prevents the starter motor from operating when neither of these conditions has been met. In this instance, the starting circuit cut-off relay is open so current cannot reach the starter motor. When at least one of the above conditions has been met, the starting circuit cut-off relay is closed and the engine can be started by pressing the start switch "⊜".



a. WHEN THE TRANSMISSION IS IN NEUTRAL
b. WHEN THE CLUTCH LEVER IS PULLED TO THE HANDLEBAR AND THE SIDESTAND IS UP
1. Battery
2. Main fuse
3. Main switch
4. Ignition fuse
5. Engine stop switch
6. Starting circuit cut-off relay
7. Clutch switch
8. Sidestand switch
9. Diode
10. Neutral switch
11. Start switch
12. Starter relay
13. Starter motor

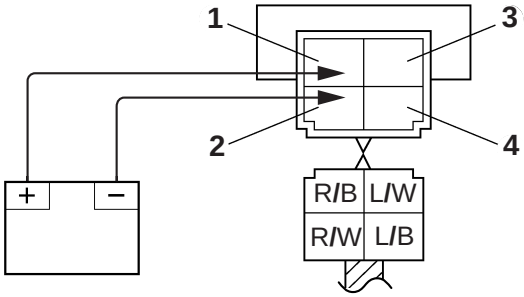
Starter relay



1. Positive battery terminal
2. Negative battery terminal
3. Positive tester probe
4. Negative tester probe

Result
Continuity
(between “3” and “4”)

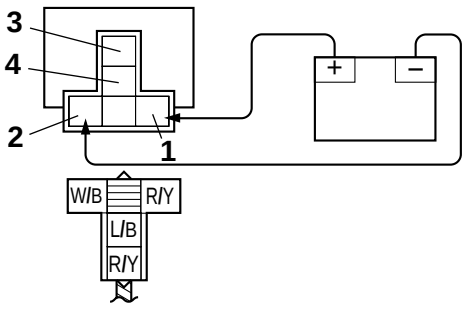
Starting circuit cut-off relay



1. Positive battery terminal
2. Negative battery terminal
3. Positive tester probe
4. Negative tester probe

Result
Continuity
(between “3” and “4”)

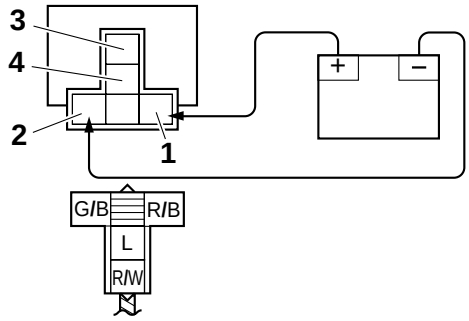
Headlight relay



1. Positive battery terminal
2. Negative battery terminal
3. Positive tester probe
4. Negative tester probe

Result
Continuity
(between “3” and “4”)

Radiator fan motor relay



1. Positive battery terminal
2. Negative battery terminal
3. Positive tester probe
4. Negative tester probe

Result
Continuity
(between “3” and “4”)

EAS22B1024

CHECKING THE TURN SIGNAL RELAY

1. Check:
   - Turn signal relay input voltage
     Out of specification → The wiring circuit from the main switch to the turn signal relay coupler is faulty and must be repaired.

Turn signal relay input voltage
DC 12 V

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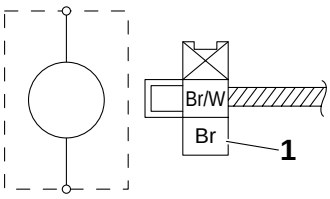
a. Connect the pocket tester (DC 20 V) to the turn signal relay terminal as shown.

- Positive tester probe → brown “1”
- Negative tester probe → ground



b. Set the main switch to “ON”.
c. Measure the turn signal relay input voltage.

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2. Check:
• Turn signal relay output voltage
Out of specification → Replace.

Turn signal relay output voltage
DC 12 V

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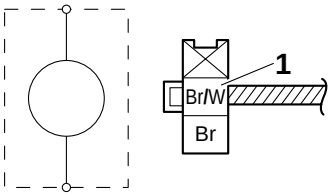
a. Connect the pocket tester (DC 20 V) to the turn signal relay terminal as shown.

• Positive tester probe → brown/white “1”
• Negative tester probe → ground



b. Set the main switch to “ON”.
c. Measure the turn signal relay output voltage.

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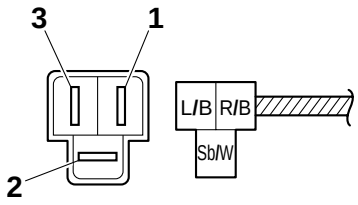
EAS28050
CHECKING THE DIODE

1. Check:
• Diode
Out of specification → Replace.

TIP

The pocket tester or the analog pocket tester readings are shown in the following table.

No continuity
Positive tester probe → blue/black “1”
Negative tester probe → sky blue/white “2”
Continuity
Positive tester probe → sky blue/white “2”
Negative tester probe → blue/black “1”
No continuity
Positive tester probe → red/black “3”
Negative tester probe → sky blue/white “2”
Continuity
Positive tester probe → sky blue/white “2”
Negative tester probe → red/black “3”



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a. Disconnect the diode from the wire harness.
b. Connect the pocket tester ($\Omega \times 1$) to the diode terminals as shown.
c. Check the diode for continuity.
d. Check the diode for no continuity.

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EAS28060
CHECKING THE SPARK PLUG CAP

1. Check:
• Spark plug cap resistance
Out of specification → Replace.

Resistance
5.0 kΩ

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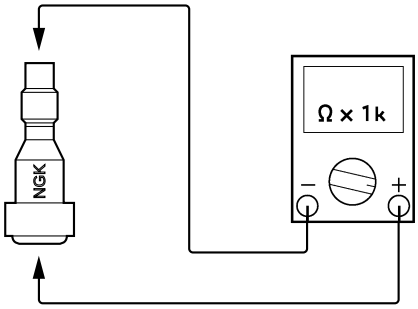
a. Remove the spark plug cap from the spark plug lead.
b. Connect the pocket tester (Ω × 1k) to the spark plug cap as shown.



c. Measure the spark plug cap resistance.

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EAS28090
CHECKING THE IGNITION COIL

1. Check:
   • Primary coil resistance
   Out of specification → Replace.

Primary coil resistance
2.16–2.64 Ω at 20 °C (68 °F)

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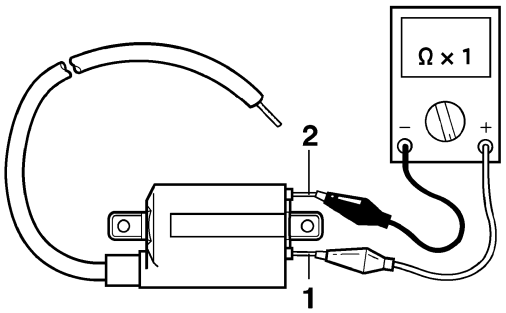
a. Disconnect the ignition coil connectors from the ignition coil terminals.
b. Connect the pocket tester (Ω × 1) to the ignition coil as shown.

• Positive tester probe → red/white “1”
• Negative tester probe → orange “2”



c. Measure the primary coil resistance.

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2. Check:
   • Secondary coil resistance
   Out of specification → Replace.

Secondary coil resistance
8.64–12.96 kΩ at 20 °C (68 °F)

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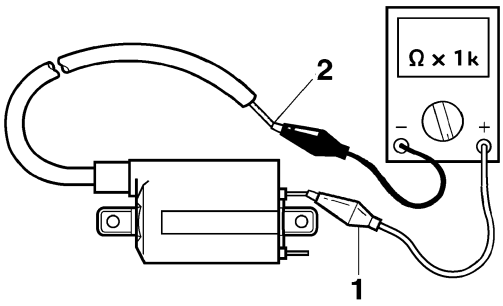
a. Disconnect the spark plug cap from the ignition coil.
b. Connect the pocket tester (Ω × 1k) to the ignition coil as shown.

• Positive tester probe → orange “1”
• Negative tester probe → spark plug lead “2”



c. Measure the secondary coil resistance.

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EAS28930
CHECKING THE IGNITION SPARK GAP

1. Check:
   • Ignition spark gap
   Out of specification → Perform the ignition system troubleshooting, starting with step 5.

Minimum ignition spark gap
6.0 mm (0.24 in)

TIP

If the ignition spark gap is within specification, the ignition system circuit is operating normally.

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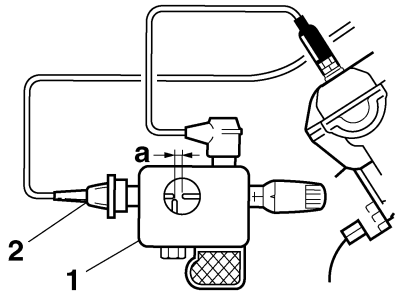
a. Disconnect the spark plug cap from the spark plug.
b. Connect the ignition checker "1" as shown.



c. Set the main switch to "ON" and the engine stop switch to "○".
d. Measure the ignition spark gap "a".
e. Crank the engine by pushing the start switch "≋" and gradually increase the spark gap until a misfire occurs.

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EAS28940
CHECKING THE STARTER MOTOR OPERATION

1. Check:
2. Starter motor operation
   Does not operate → Perform the electric starting system troubleshooting, starting with step 4.

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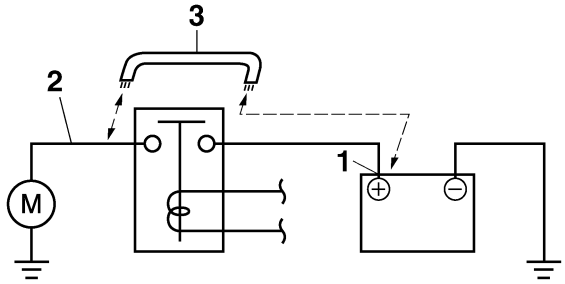
a. Connect the positive battery terminal "1" and starter motor lead "2" with a jumper lead "3".

EWA13810

⚠ WARNING

- **A wire that is used as a jumper lead must have at least the same capacity of the battery lead, otherwise the jumper lead may burn.**
- **This check is likely to produce sparks, therefore, make sure no flammable gas or fluid is in the vicinity.**



b. Check the starter motor operation.

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EAS28150
CHECKING THE STATOR COIL

1. Disconnect:
   - Stator coil coupler (from the wire harness)
2. Check:
   - Stator coil resistance
     Out of specification → Replace the crankshaft position sensor/stator assembly.

Stator coil resistance
0.448–0.672 Ω at 20 °C (68 °F)

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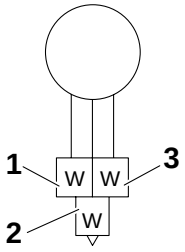
a. Connect the pocket tester (Ω × 1) to the stator coil coupler as shown.

- Positive tester probe → white "1"
- Negative tester probe → white "2"

- Positive tester probe → white "1"
- Negative tester probe → white "3"

- Positive tester probe → white "2"
- Negative tester probe → white "3"



b. Measure the stator coil resistance.

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EAS28170
CHECKING THE RECTIFIER/REGULATOR

1. Check:
   - Charging voltage
     Out of specification → Replace the rectifier/regulator.

Charging voltage
14 V at 5000 r/min

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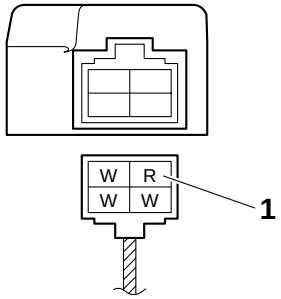
a. Set the engine tachometer to the spark plug lead.
b. Connect the pocket tester (DC 20 V) to the rectifier/regulator coupler as shown.

- Positive tester probe → red "1"
- Negative tester probe → ground



c. Start the engine and let it run at approximately 5000 r/min.
d. Measure the charging voltage.

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