

NOTES

- Carefully clean case mating surfaces (gray shaded area).
- Apply 1 mm (0.04 in.) VRSC Crankcase Sealant (HD-99650-02) following black line.
- Apply sealant only as indicated - DO NOT seal all mating surfaces.

NOTE

Excess VRSC Crankcase Sealant squeezed into the crankcases during assembly can clog the oil pick up.

21. Adjust speed and pressure to apply a 1 mm (0.04 in.) bead of sealant to the lower case half.

sm00890

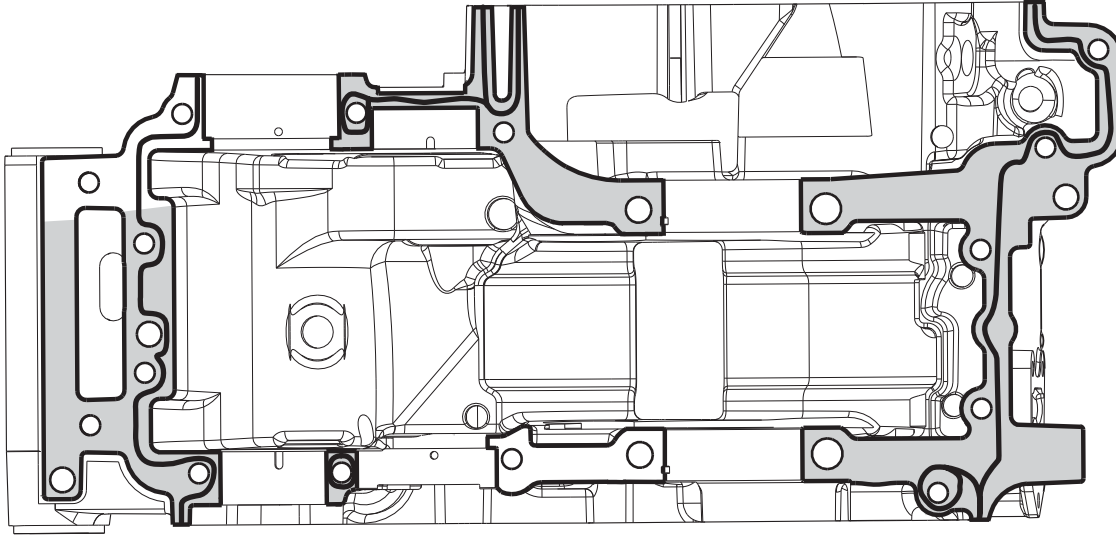
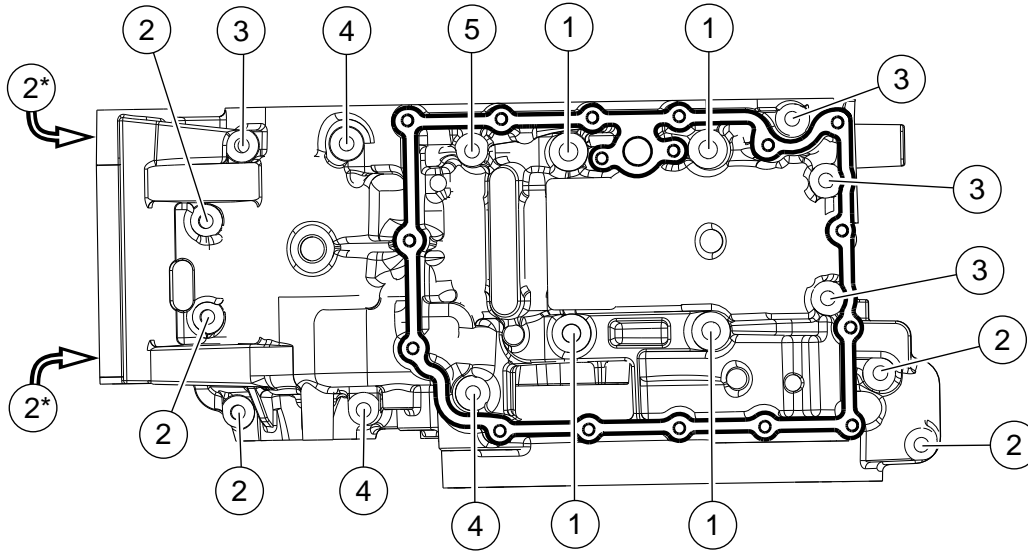


Figure 7-57. Lower Case Sealant Path

sm00891



1. M10x150 (Part No. 968M)
2. M8x40 (Part No. 970M)
3. M8x90 (Part No. 1025M)
4. M8x120 (Part No. 973M)
5. M8x160 (Part No. 972M)

Figure 7-58. Case Fastener Sizes (\*Insert from upper case half)

### NOTES

- Lower case with the transmission gears in place is heavy. Get assistance when lifting lower case.
  - It is also possible when using rolling engine stand and engine cradle to mate cases vertically when engine is positioned with starter facing upward.
22. See [Figure 7-59](#). Position lower case half over the LOWER CRANKCASE ALIGNMENT DOWELS (Part No. HD-45310).
  23. See [Figure 7-60](#). When the counterbalancer gear and the primary crankshaft gear are close to engagement, remove the COUNTERBALANCER ALIGNMENT PIN (Part No. HD-45311).

### NOTE

Confirm the correct alignment of the counterbalancer gear and the primary crankshaft gear timing marks. Engine damage will occur if the counterbalancer gear and the primary crankshaft gear are not correctly timed.

24. See [Figure 7-61](#). Hand position the counterbalancer gear so the timing marks are aligned exactly as shown.
25. Verify that transmission input and output shafts spin freely.
26. See [Figure 7-58](#). Match and thread-in all 19 case fasteners.

### NOTE

Be sure to tighten counterbalancer gear at this time.

27. See [Figure 7-62](#). Tighten Counterbalancer Gear. Hold crankshaft with 1/2 in. drive extension and wrench while tightening counterbalancer gear fastener to 50 Nm (37 ft-lbs) plus 90°.

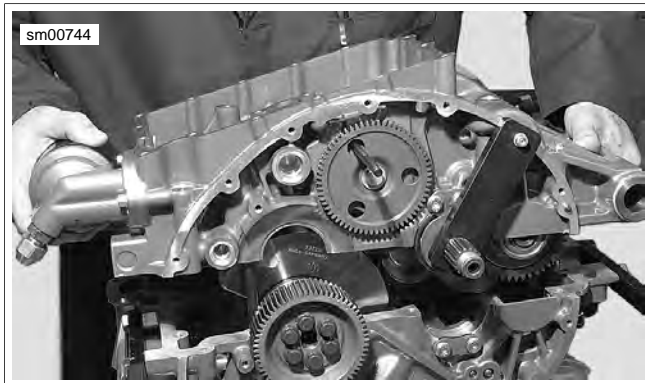


Figure 7-59. Lower Case Over Alignment Dowels

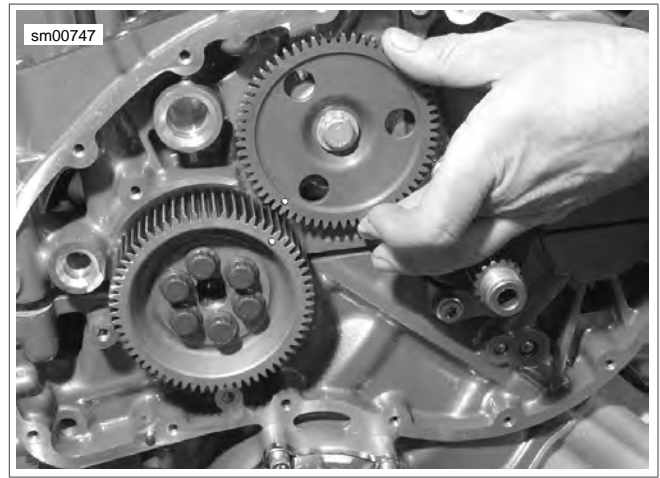


Figure 7-60. Lower Case Over Alignment Dowels

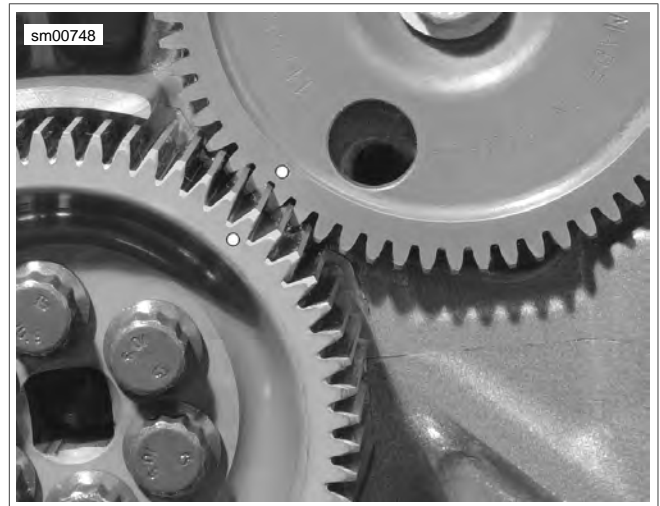


Figure 7-61. Marks Aligned

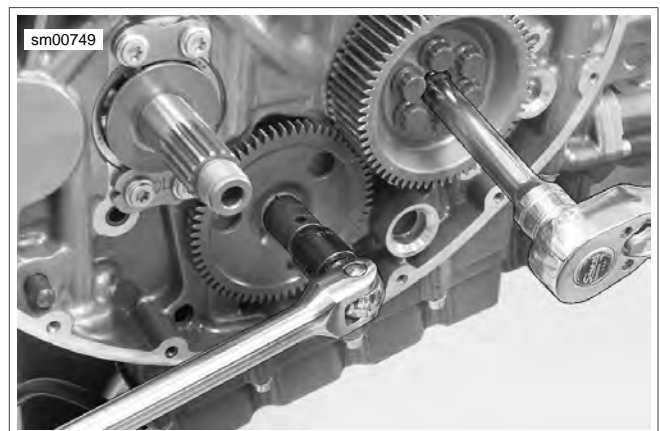


Figure 7-62. Tighten Counterbalancer Gear

### NOTE

The correct torque sequence for the case fasteners requires 2 steps. First, all 19 case fasteners including the 4 main bearing bolts are tightened to 25 Nm (18.4 ft-lbs). Second, the 4 main

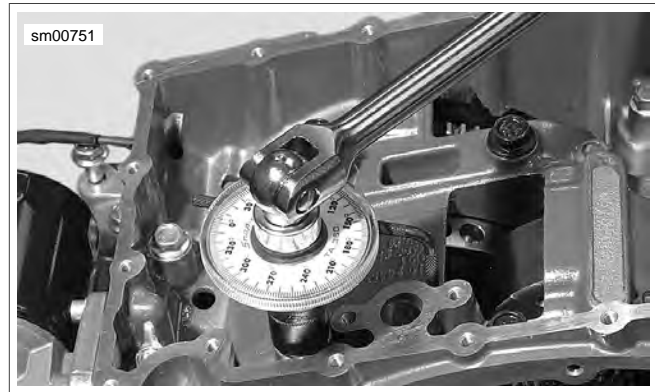
bearing bolts are backed off one full turn, tightened to 15 Nm and then turned an additional 90°. Use the detailed procedure presented in the following steps. Refer to [Table 7-5](#).

28. See [Figure 7-64](#). Tighten in sequence all 19 case fasteners to 25 Nm (18.4 ft-lbs).
29. Dab a marker next to each torqued fastener as it is tightened.
30. See [Figure 7-64](#). Torque in sequence the 4 M10 x 150 main bearing bolts (1, 2, 3, 4) main bearing bolts in this sequence.
  - a. Loosen (counterclockwise) each main bearing bolt (1, 2, 3, 4) one full turn (- 360°).
  - b. See [Figure 7-64](#). Torque in sequence each main bearing bolt (1, 2, 3, 4) to 15 Nm (11 ft-lbs).
  - c. See [Figure 7-63](#). Position the TORQUE ANGLE GAUGE (Part No. Snap-on TA360) per instruction sheet and tighten each bolt an additional quarter turn (+ 90°).

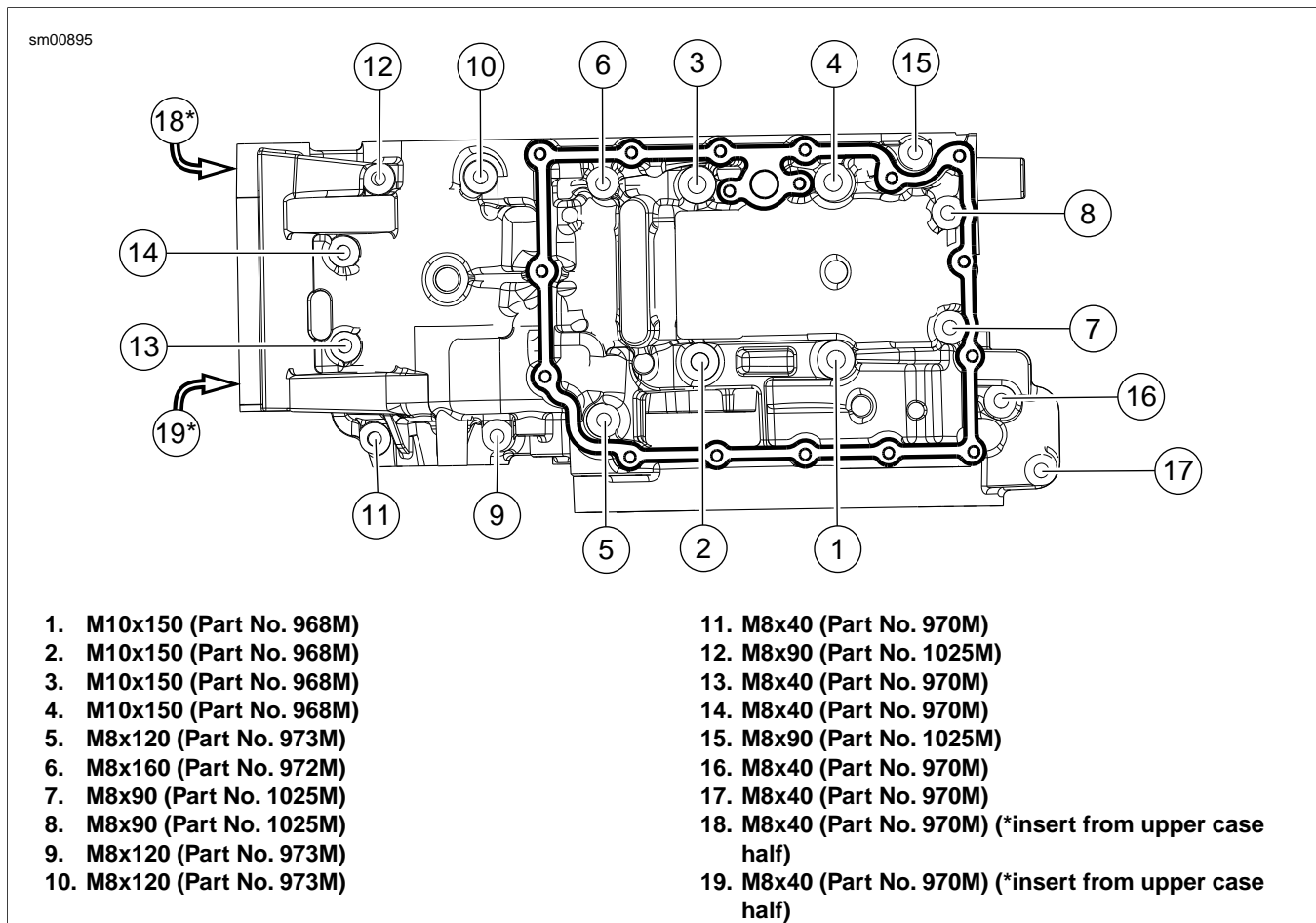
**NOTE**

The notation for this torque sequence is written: 25 Nm - 360°, 15 Nm + 90°.

31. Dab a second mark next to each torqued main bearing bolt to identify which bolts have been tightened with the complete sequence.



**Figure 7-63. Torque Angle Gauge**



**Figure 7-64. Engine Case Torque Sequence**

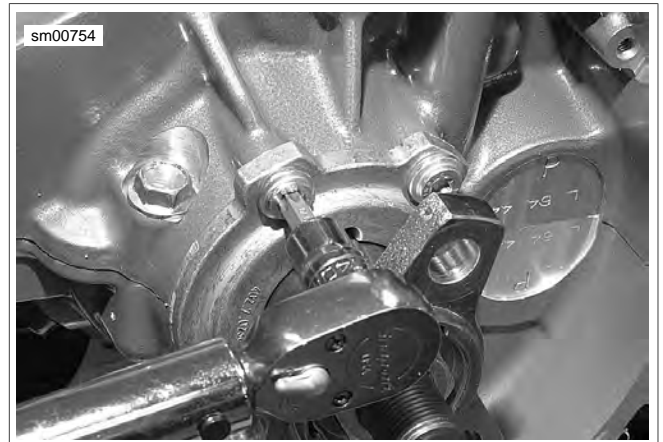
**Table 7-5. Engine Case Fastener Torque**

FASTENER #	TORQUE	
	NM	FT-LBS
1 through 19 (in sequence)	25	18.4
1, 2, 3, 4 (in sequence)	Backoff (-) 360°	
1, 2, 3, 4 (in sequence)	15	11
1, 2, 3, 4 (in sequence)	Tighten (+) 90°	

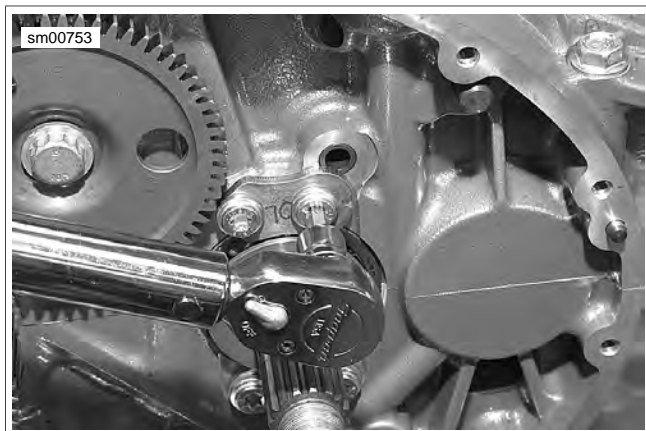
32. See [Figure 7-65](#). Tighten the upper and lower input bearing retainer fasteners to 23 Nm (17 ft-lbs).
33. See [Figure 7-66](#). Install the lower case two drive sprocket flange seal retainer fasteners and tighten all four drive sprocket flange seal retainer fasteners to 23 Nm (17 ft-lbs).
34. See [Figure 7-67](#). Place **new** oil pan gasket in position. Install oil pickup and fasteners. Tighten to 9.7 Nm (86 in-lbs).
35. See [Figure 7-68](#). Install oil pan and fasteners. Tighten to 9.7 Nm (86 in-lbs).

**NOTE**

For engine rebuild procedure, see steps 30-51 of [3.11 ENGINE BOTTOM END SERVICE](#) to continue engine rebuild.



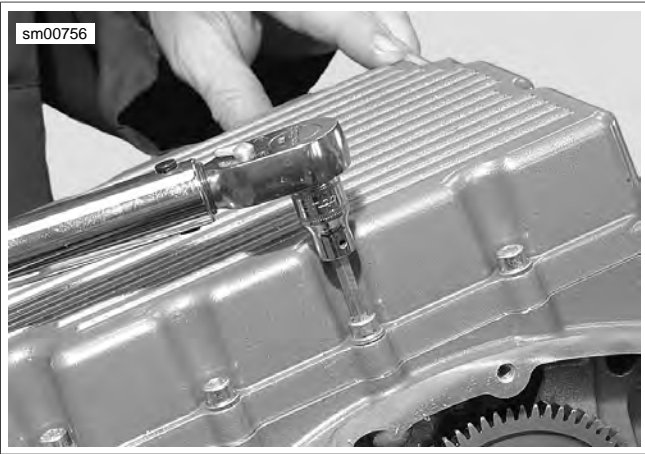
**Figure 7-66. Drive Sprocket Flange Seal Retainer**



**Figure 7-65. Input Bearing Retainer**



**Figure 7-67. Oil Pickup**



**Figure 7-68. Oil Pan**

## REMOVAL

PART NUMBER	TOOL NAME
HD-34902-B	BIG-TWIN MAINSHAFT PRIMARY BEARING RACE REMOVER AND INSTALLER
HD-45490	BALANCER BEARING REMOVER/INSTALLER TOOLS
HD-46582	COUNTERBALANCER BEARING INNER RACE REMOVER AND INSTALLER
SNAP-ON SRPC3890	PLIERS

### NOTE

In order to break counterbalancer gear loose, it is necessary to hold the counterbalancer gear with the crankshaft drive gear. Once the fastener is loose, the engine case halves can be separated. See [7.3 TRANSMISSION](#).

1. See [Figure 7-69](#). Before separating the case halves and removing the crankshaft, use a 1/2 in. drive extension and breaker bar to rotate engine clockwise until timing marks are aligned.

### CAUTION

Do not use Counterbalancer Alignment Pin to remove or tighten counterbalancer fastener. Pin can bend and bind in hole. (00550b)

2. Hold crankshaft with a 1/2 in. drive extension and wrench and loosen counterbalancer gear retaining fastener.
3. See [Figure 7-70](#). Remove fastener and gently pry counterbalancer gear from shaft. Discard gear and fastener.

### NOTE

The counterbalancer gear retaining fastener is one-time-use only. Always use a **new** fastener when installing counterbalancer gear.

### NOTE

Use **PLIERS** (Part No. Snap-on SRPC3890) for removal/installation of the retaining rings.

4. See [Figure 7-71](#). Remove outer retaining ring.

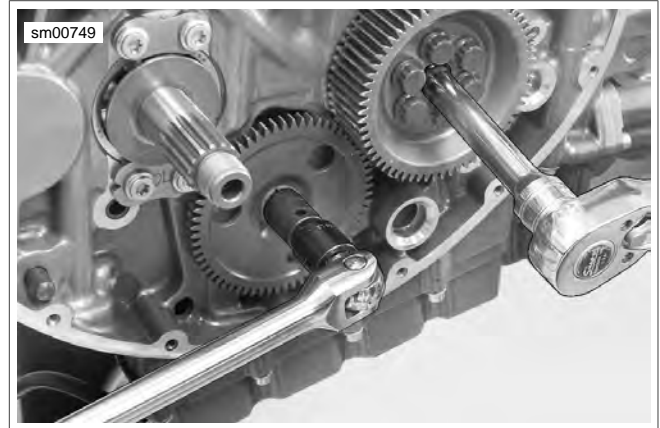


Figure 7-69. Tighten Counterbalancer Gear

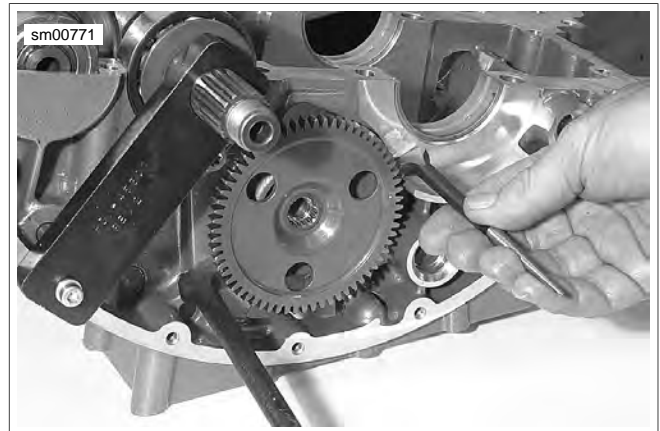


Figure 7-70. Remove Counterbalancer Gear

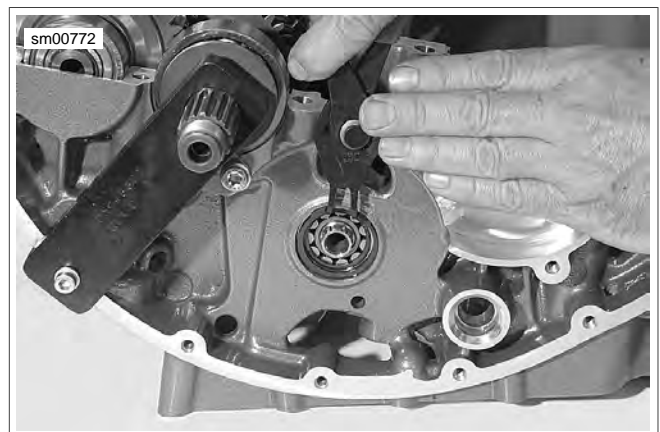


Figure 7-71. Remove Retaining Ring

5. See [Figure 7-72](#). Thread end of BALANCER BEARING REMOVER/INSTALLER TOOLS (Part No. HD-45490) into balancer shaft.
6. See [Figure 7-73](#). The counterweight must be rotated and held upright in the position shown to prevent binding

against the case. The tool will pull the outboard bearing and balancer through the case. When the bearing is free, remove tool and bearing.

7. See [Figure 7-74](#). Counterbalancer can be removed from engine.

**WARNING**

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

8. See [Figure 7-75](#). Remove outboard inner retaining ring.

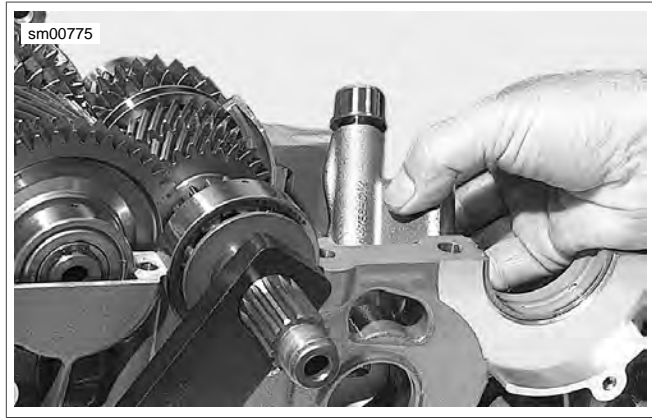


Figure 7-74. Remove Counterbalancer

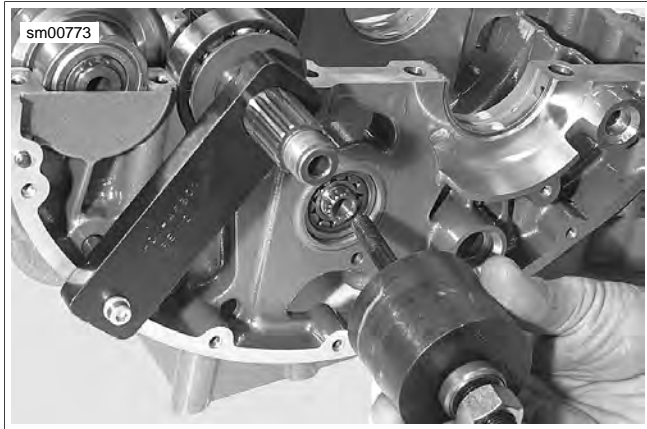


Figure 7-72. Counterbalancer Tool



Figure 7-75. Outboard Inner Retaining Ring

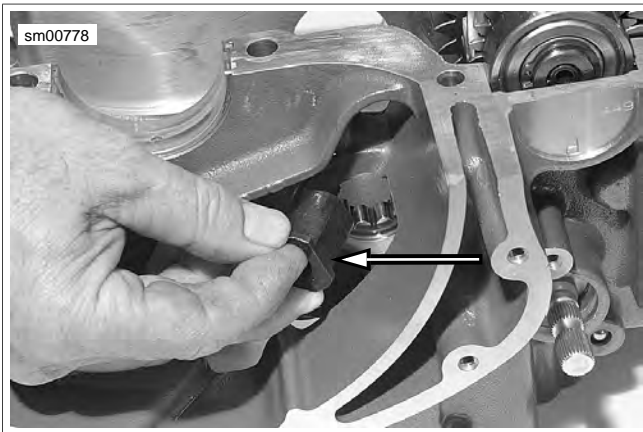


Figure 7-73. Remove Counterbalancer Outboard Bearing

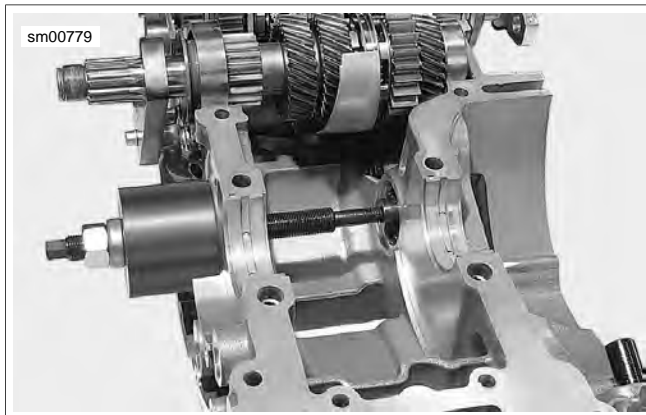
9. See [Figure 7-77](#). Position the bearing removal insert as shown. Note the position of the flat.
10. See [Figure 7-78](#). Thread puller rod into insert.
11. See [Figure 7-79](#). Hold screw end of puller and turn large nut to remove the bearing.
12. See [Figure 7-76](#). Remove inboard retaining ring.



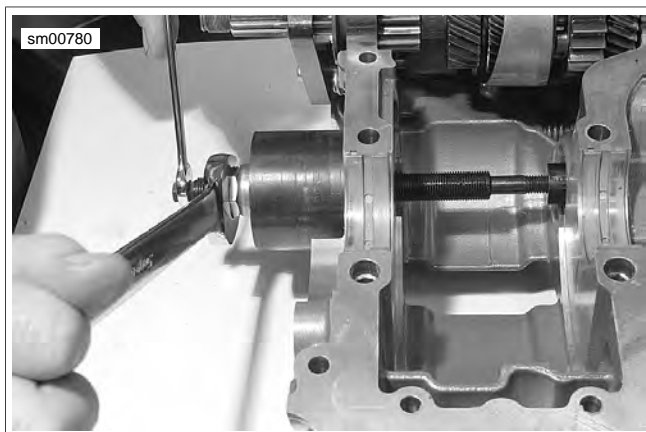
Figure 7-76. Counterbalancer Inboard Retaining Ring



**Figure 7-77. Bearing Removal Insert**



**Figure 7-78. Position Puller**



**Figure 7-79. Remove Bearing**

**NOTE**

*If counterbalancer bearings are being replaced, ALWAYS replace the inner race.*

13. See [Figure 7-80](#). Fit the lower half of the COUNTERBALANCER BEARING INNER RACE REMOVER AND INSTALLER (Part No. HD-46582) with pin hole over back of inner race. Fit push screw into hole of lower puller half.

14. Position upper puller half around inboard inner bearing race. Slide connecting collar over the halves.
15. See [Figure 7-81](#). Turn push screw to remove inboard bearing inner race.
16. See [Figure 7-82](#). Using an BIG-TWIN MAINSHAFT PRIMARY BEARING RACE REMOVER AND INSTALLER (Part No. HD-34902-B) from in the outboard end of the counterbalancer shaft, remove the outboard bearing inner race.



**Figure 7-80. Counterbalancer Bearing Inner Race Remover and Installer (HD-46582)**



sm00782



Figure 7-81. Remove Bearing Race

sm00783



Figure 7-82. End Cap from HD-34902-B

## INSTALLATION

PART NUMBER	TOOL NAME
HD-45311	COUNTERBALANCER ALIGNMENT PIN
HD-45490	BALANCER BEARING REMOVER/INSTALLER TOOLS

1. See [Figure 7-83](#). Press **new** inner race of inboard bearing even with the end of the counterbalancer.
2. See [Figure 7-84](#). Press **new** outboard bearing race flush against the shoulder of the balancer.

sm00784

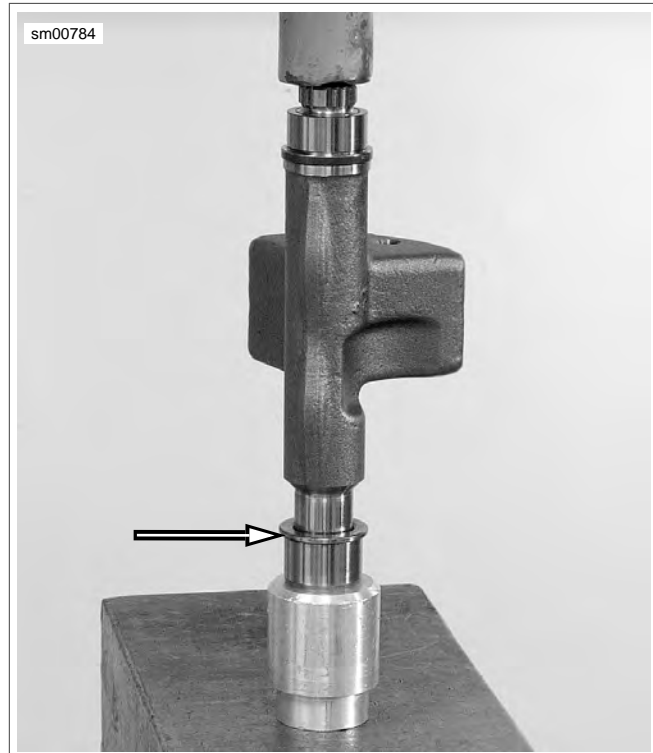
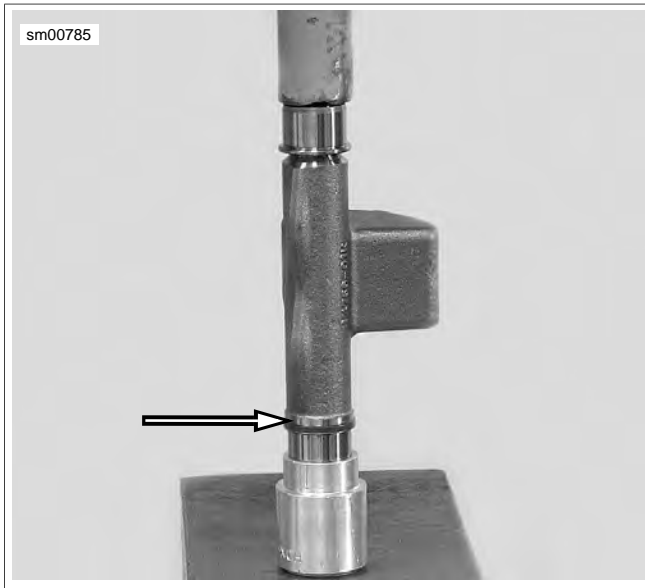
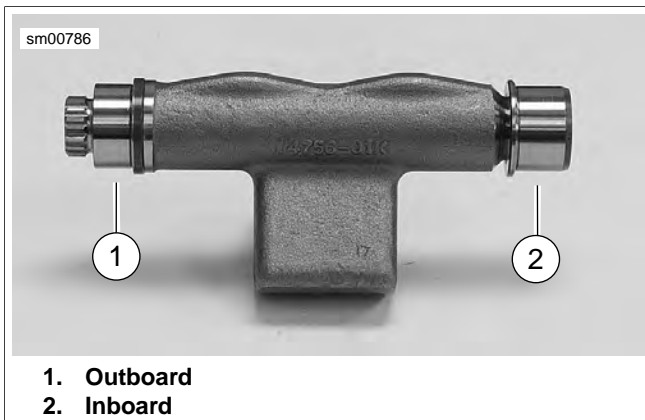


Figure 7-83. Inboard Bearing Race



**Figure 7-84. Outboard Bearing Race**



**Figure 7-85. Installed Inner Races**

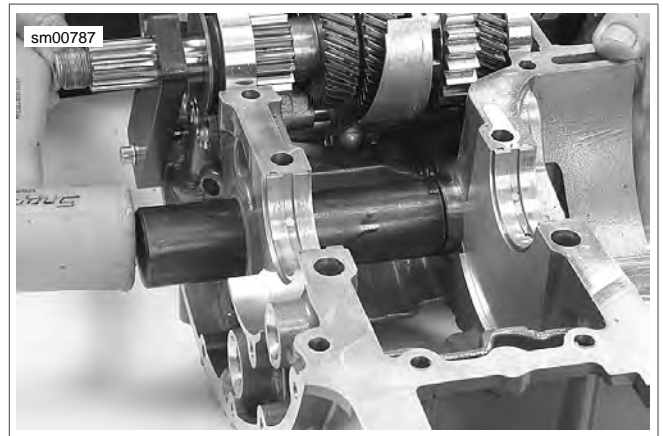
3. See [Figure 7-85](#). Inboard bearing race is even with the end of the counterbalancer shaft. Outboard bearing race is fully seated against shoulder of counterbalancer.

**NOTE**

Use Harley-Davidson Motorcycle Oil 20W50 to thoroughly lubricate bearing surfaces and case bores before bearing installation.

**NOTE**

When installing bearings, always drive/push against the side of the bearing with the manufactures lettering/part number.



**Figure 7-86. Inner Balancer Bearing Installation**

4. See [Figure 7-86](#). Using the bearing installer from the BALANCER BEARING REMOVER/INSTALLER TOOLS (Part No. HD-45490) drive the inner counterbalancer bearing into the case with a soft faced hammer, until the retaining ring groove is visible.
5. See [Figure 7-87](#). Install inner retaining ring. Be certain retaining ring is fully seated.
6. See [Figure 7-88](#). Install outboard bearing inner retaining ring. Be certain retaining ring is fully seated.

**NOTE**

Use Harley-Davidson Motorcycle Oil 20W50 to thoroughly lubricate bearing surfaces and case bores before bearing installation process. Use Lubriplate No. 105 Assembly Grease (NAPA Part No. 765-2651) on inner races.

7. See [Figure 7-89](#). Position counterbalancer in case.

**NOTE**

When installing bearings, always drive/push against the side of the bearing with the manufactures lettering/part number.

8. See [Figure 7-90](#). Start bearing by hand. Insert tapered guide from the BALANCER BEARING REMOVER/INSTALLER TOOLS (Part No. HD-45490).



**Figure 7-87. Inner Balancer Bearing Installation**