

## THREE GEAR BALANCE GEAR ASSEMBLY

To provide improved vibration reducing characteristics, three balance gear assemblies are being used in some 16 Hp single cylinder engines.

New procedures for installing the crankshaft and timing the balance gears, crankshaft, and camshaft are required. Use the following procedures when engine is equipped with the three gear assemblies.

### CRANKSHAFT INSTALLATION AND BALANCE GEAR-CRANKSHAFT-CAMSHAFT TIMING

Whenever the crankshaft is installed, the balance gears, crankshaft, and camshaft must be timed. Use balance gear timing tool No. NU-10355 (formerly Y-357) to simplify this procedure. If the balance gears must be timed without using the tool, do not install the lower and third balance gear until **after** the crankshaft has been installed.

NOTE: If the valves are installed in the engine, the force exerted against the camshaft may prevent the camshaft from rotating during the timing procedure. Therefore, it is recommended that the valves and valve springs should be removed to make timing easier.

#### Method 1 - With Balance Gear Timing Tool

- Count and mark the teeth on the crankshaft gear, and the lands (notches between teeth) on the camshaft gear as follows:

**Crankshaft** - Locate the primary timing mark on crankshaft. While looking at the PTO end of crankshaft, start with the tooth directly below timing mark and count **five (5)** teeth in a **counterclockwise** direction. Mark the fifth tooth. Refer to Figure 1.

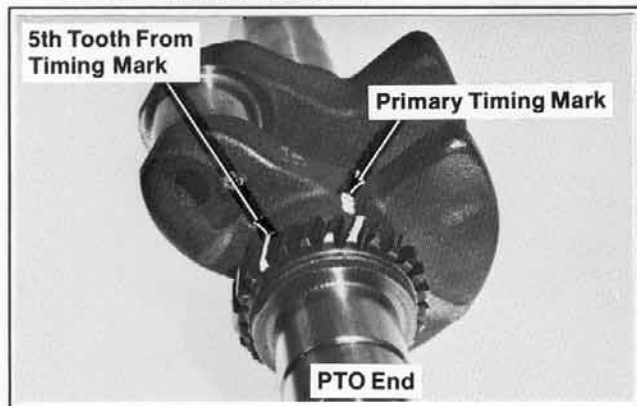


Figure 1. Marking Tooth On Crankshaft Gear.

**Camshaft** - Locate the timing mark on camshaft. Starting with the land next to the timing mark, count **five (5)** lands in a **counterclockwise** direction. Mark the fifth land. Refer to Figure 2.

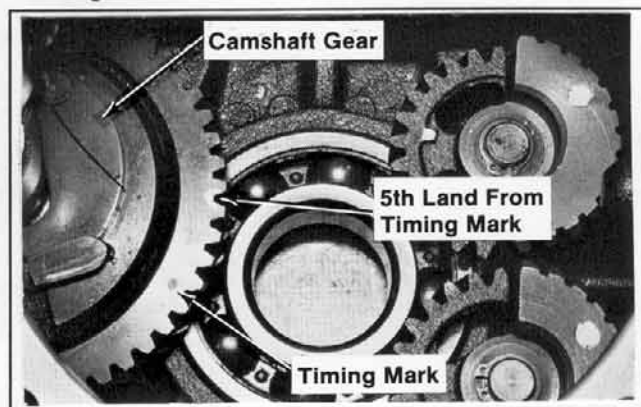


Figure 2. Marking Land On Camshaft Gear.

- Align the primary timing marks on balance gears with the teeth on timing tool. Insert the tool so it meshes with the gears. Hold or clamp the tool against oil pan gasket surface of crankcase. Refer to Figure 3.

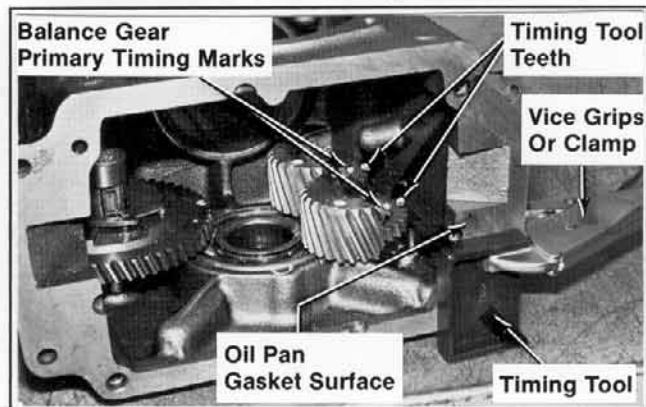


Figure 3. Installing Balance Gear Timing Tool.

3. Lubricate the rear bearing surface of crankshaft. Insert the PTO end of crankshaft through the rear bearing. "Straddle" the primary and secondary timing marks on crankshaft over the rear bearing oil drain. Refer to Figure 4.

Press the crankshaft into the rear bearing until the crankshaft gear is just above the camshaft gear, but not in mesh with it. Do not remove the balance gear timing tool at this time.

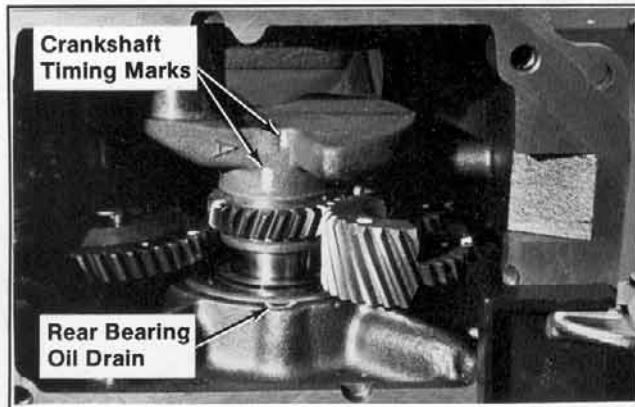


Figure 4. Aligning Crankshaft And Rear Bearing Oil Drain.

4. Align the fifth (5th) land marked on camshaft gear with the fifth (5th) tooth marked on crankshaft gear. Refer to Figure 5.

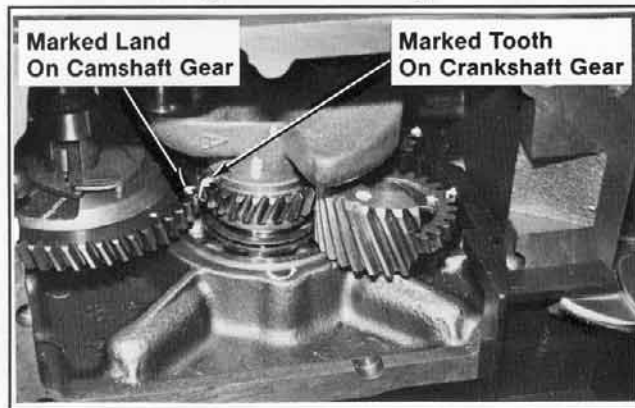


Figure 5. Aligning Camshaft Gear and Crankshaft Gear.

Press the crankshaft all the way into the rear bearing. Make sure the camshaft and crankshaft gears mesh and the marks align while pressing.

5. Remove the balance gear timing tool. Check the timing of the crankshaft, camshaft, and balance gears:

The primary timing mark on crankshaft should align with the secondary timing mark on lower balance gear. Refer to Figure 6.

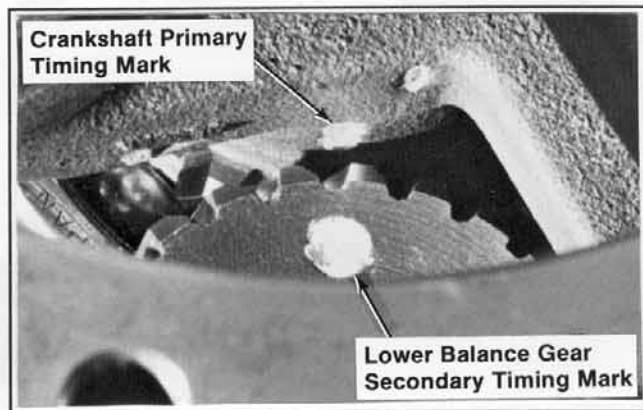


Figure 6. Crankshaft Gear/Lower Balance Gear Alignment

The primary timing mark on crankshaft should align with the timing mark on camshaft. Refer to Figure 7.

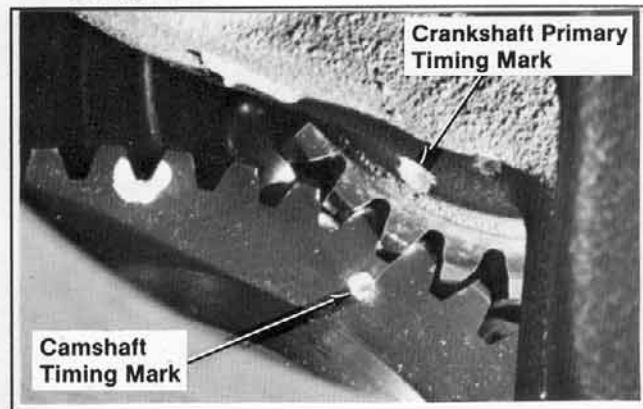


Figure 7. Crankshaft Gear/Camshaft Gear Alignment.

If the marks do not align, the timing is incorrect and must be corrected.

6. Install the 3/8" spacer and one (1) .010" shim spacer to the stub shaft for the third balance gear.
7. Turn crankshaft to position the heavy side of the crankshaft to right side of cylinder block. Refer to Figure 8.

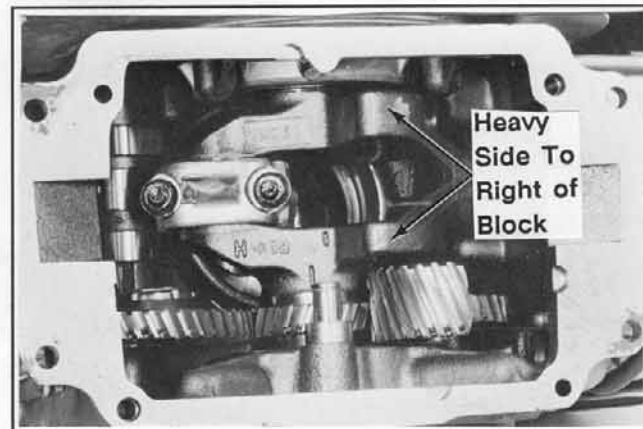


Figure 8. Heavy side of crankshaft right.

8. Hold third balance gear above stub shaft so flat surface is parallel to the flat surface of the other balance gears. Turn it slightly clockwise and lower it into position on stub shaft. When completely seated in position, the flat surface should again be parallel with the flat surface of the other balance gears. Refer Figure 9.

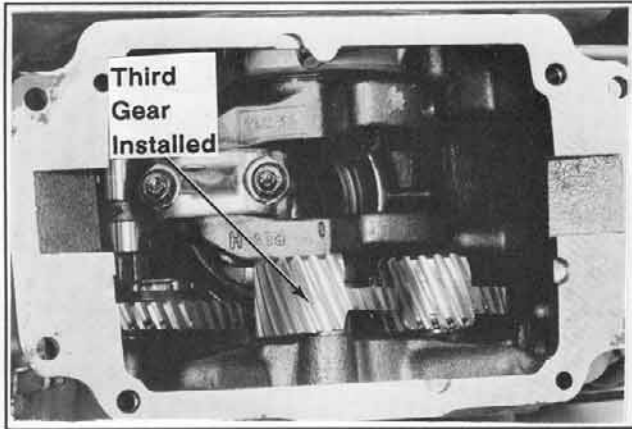


Figure 9. Aligning third gear.

9. Secure the third balance gear to stub shaft using one (1) .020 shim spacer and retaining ring (rounded edge towards gear). Check end play of third gear. Adjust as necessary to .002 - .010.

#### Method 2 - Without Balance Gear Timing Tool

NOTE: The lower and third balance gear should be installed **after** the crankshaft has been installed.

1. Count and mark the teeth on the crankshaft gear, and the land (notches between teeth) on the upper balance gear as follows:  
**Crankshaft** - Locate the primary timing mark on crankshaft. While looking at the PTO end of crankshaft, start with the tooth directly below timing mark and count **twelve (12)** teeth in a **counterclockwise** direction. Mark the twelfth tooth. Refer to Figure 10.

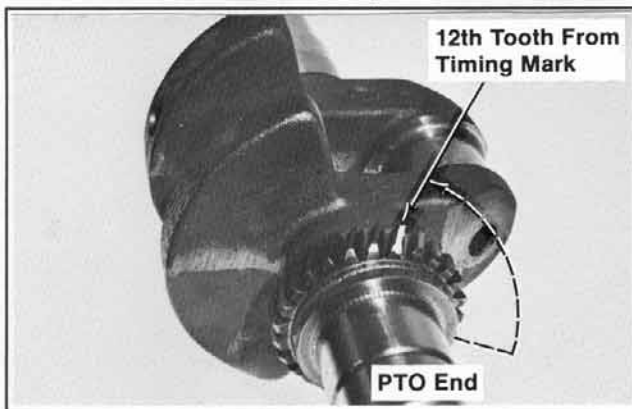


Figure 10. Marking Tooth On Crankshaft Gear.

- Upper Balance Gear** - Locate the secondary timing mark on balance gear. Starting with the land next to the timing mark, count **seven (7)** lands in a **clockwise** direction. Mark the seventh land. Refer to Figure 11.

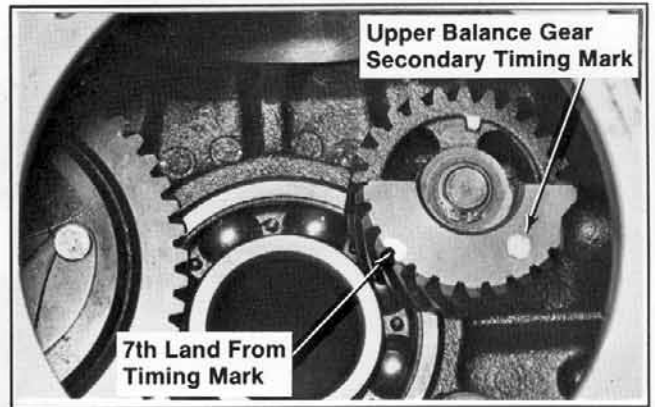


Figure 11. Marking Land On Upper Balance Gear.

2. Lubricate the rear bearing surface of crankshaft. Insert the PTO end of crankshaft through the rear bearing. Align the twelfth (12th) tooth marked on crankshaft gear with the seventh (7th) land marked on upper balance gear. Refer to Figure 12.

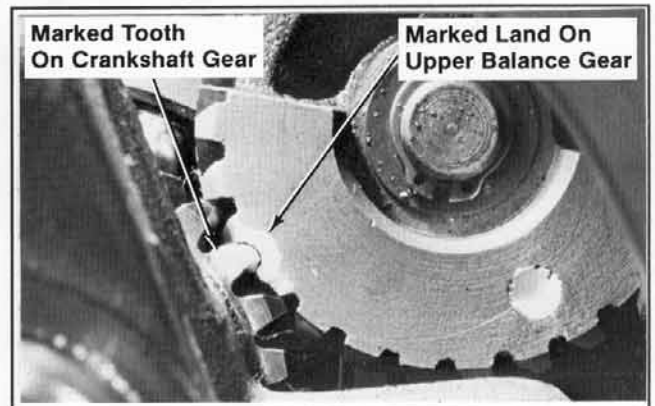


Figure 12. Aligning Crankshaft Gear And Upper Balance Gear.

Press the crankshaft into the rear bearing until the crankshaft gear is just above the camshaft gear, but not in mesh with it.

3. Align the timing mark on camshaft with the primary timing mark on crankshaft.

**CAUTION:** To align the marks, rotate the camshaft only—do not rotate the crankshaft. Rotating the crankshaft could cause the crankshaft gear to come out of mesh (and out of time) with the wide band of teeth on upper balance gear.

Press the crankshaft all the way into the rear bearing. Make sure the camshaft and crankshaft gears mesh and the marks align while pressing. Refer to Figure 13.

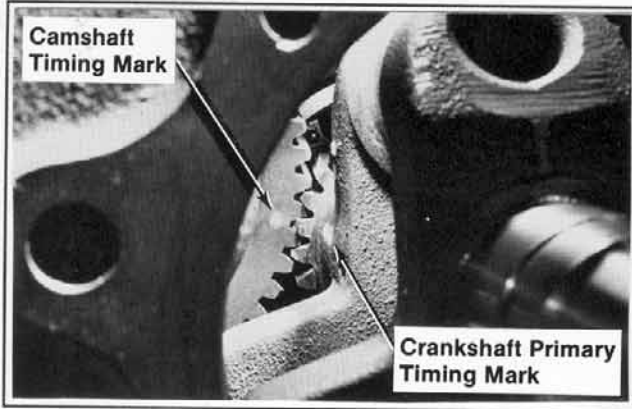


Figure 13. Aligning Camshaft Gear And Crankshaft Gear.

4. Install the 3/8" spacer and one (1) .010" shim spacer to the stub shaft for the lower balance gear. (Refer to the appropriate Service Manual for complete balance gear installation procedures.)
5. Position the crankshaft so it is about 15° past bottom dead center (BDC). Align the secondary timing mark on lower balance gear with the secondary timing mark on crankshaft. Refer to Figure 14.

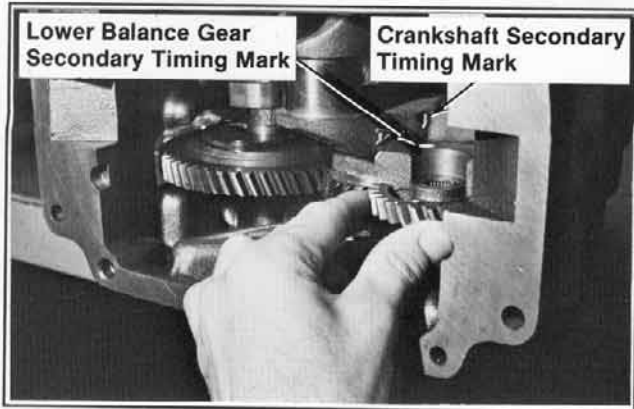


Figure 14. Aligning Lower Balance Gear And Crankshaft.

Install the lower balance gear to the stub shaft. If properly timed, the secondary timing mark on lower balance gear will now be aligned with the primary timing mark on crankshaft. Refer to Figure 15.

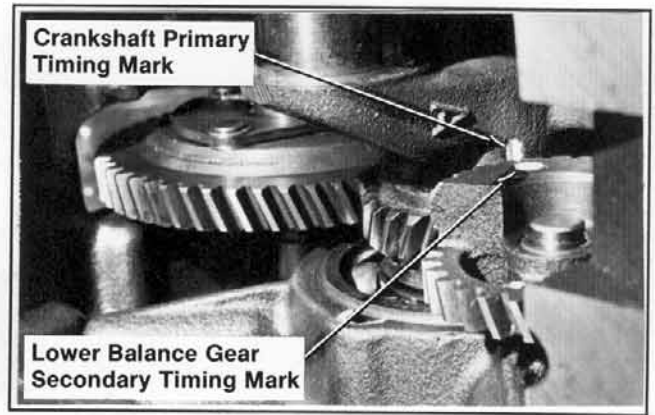


Figure 15. Crankshaft Gear/Lower Balance Gear Alignment.

6. Secure the lower balance gear to stub shaft using one (1) .020" shim spacer and retaining ring (rounded edge towards gear). Check end play of lower balance gear as instructed in the appropriate Service Manual.
7. Check the timing of the crankshaft, camshaft, and balance gears:  
The primary timing mark on crankshaft should align with the secondary timing mark on lower balance gear. Refer to Figure 6.  
The primary timing mark on crankshaft should align with the timing mark on camshaft. Refer to Figure 7.  
The primary timing mark on crankshaft should align with the primary timing mark on upper balance gear. Refer to Figure 16.

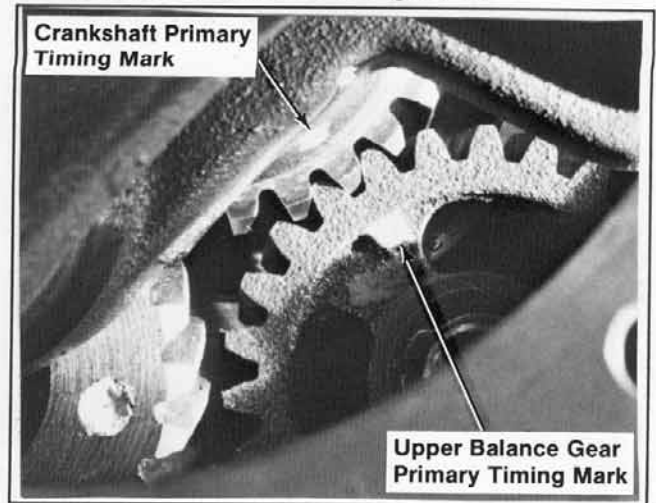


Figure 16. Crankshaft Gear/Upper Balance Gear Alignment.

If the marks do not align, the timing is incorrect and must be corrected.

8. Install the 3/8" spacer and one (1) .010" shim spacer to the stub shaft for the third balance gear.

9. Turn crankshaft to position the heavy side of the crankshaft to right side of cylinder block. Refer to Figure 17.

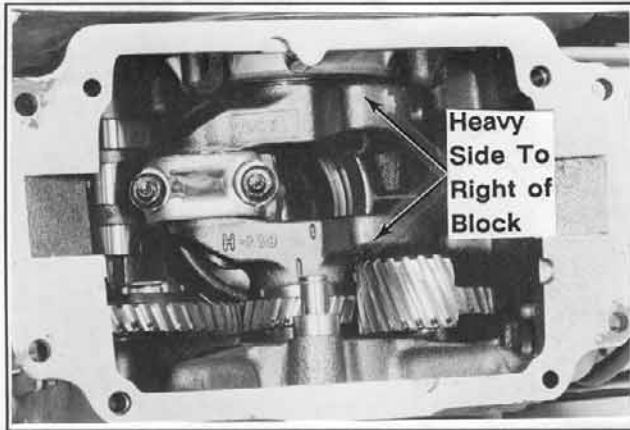


Figure 17. Heavy side of crankshaft right.

10. Hold third balance gear above stub shaft so flat surface is parallel to the flat surface of the other balance gears. Turn it slightly clockwise and lower it into position on stub shaft. When completely seated in position, the flat surface should again be parallel with

the flat surface of the other balance gears. Refer to Figure 18.

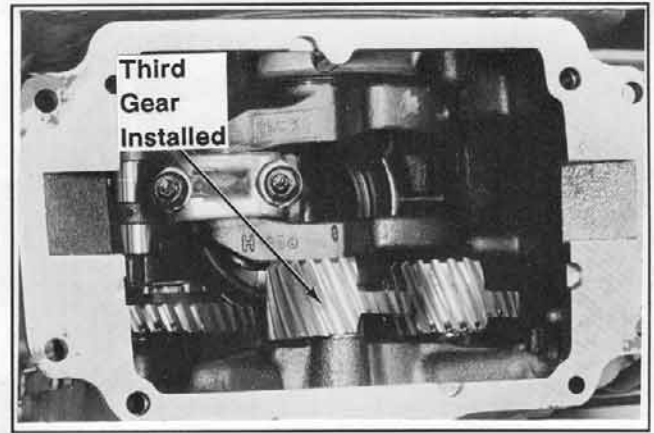


Figure 18. Aligning third gear

11. Secure the third balance gear to stub shaft using one (1) .020" shim spacer and retaining ring (rounded edge towards gear). Check end play of third gear. Adjust as necessary to .002 - .010.

ROUTING	SERVICE MANAGER	SALES MANAGER	PARTS MANAGER	CHIEF MECHANIC	MECHANIC NO.1	MECHANIC NO.2	MECHANIC NO.3	MECHANIC NO.4	RETURN THIS TO
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