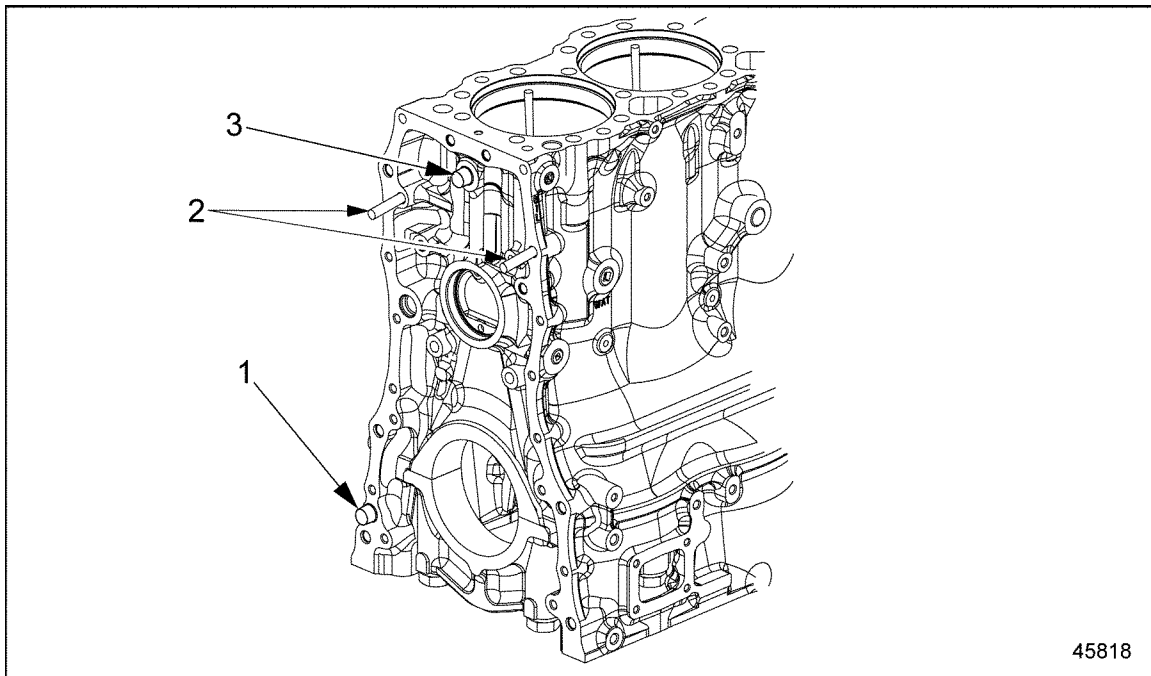


- Using a suitable lifting sling made of leather or cloth, install the gear case onto the guide studs; index the holes in the gear case mating surface with the diamond dowels located at the lower left corner and top center of the engine block. See Figure 1-229.



- Diamond Dowel Location
- Guide Studs

- Diamond Dowel Location

Figure 1-229 **Cylinder Block Diamond Dowel and Guide Stud Location**

4. Install the 14 gear case to cylinder block bolts. See Figure 1-230 for the bolt torque and torque sequence.

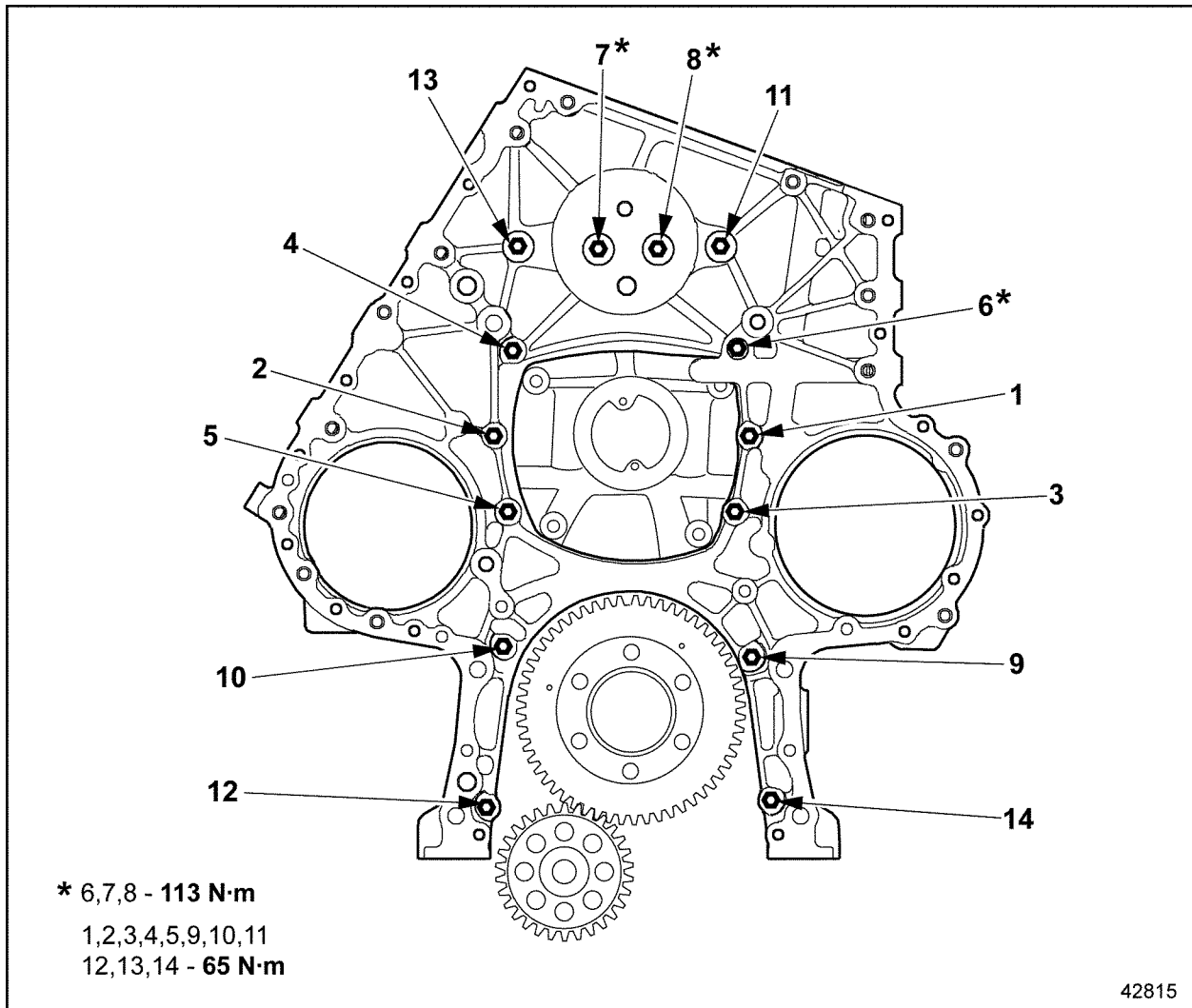


Figure 1-230 Gear Case Torque and Torque Sequence

5. Remove the guide studs from cylinder block.
6. Inspect the bull gear, spindle and adjustable idler gear access opening in the gear case and remove any foreign material.
7. Rotate engine until cylinder No.1 is at TDC.
8. Install the spindle, torque the four bolts to 58-73 N·m (43-54 lb·ft)
9. Install adjustable idler gear. Refer to section 1.31.3.
10. Install bull gear. Refer to section 1.32.3.
11. Install the gear case cover. Refer to section.1.11.3

1.14 CRANKSHAFT VIBRATION DAMPER

A viscous type vibration damper is mounted on the front end of the crankshaft to reduce torsional vibrations to a safe value. See Figure 1-231.

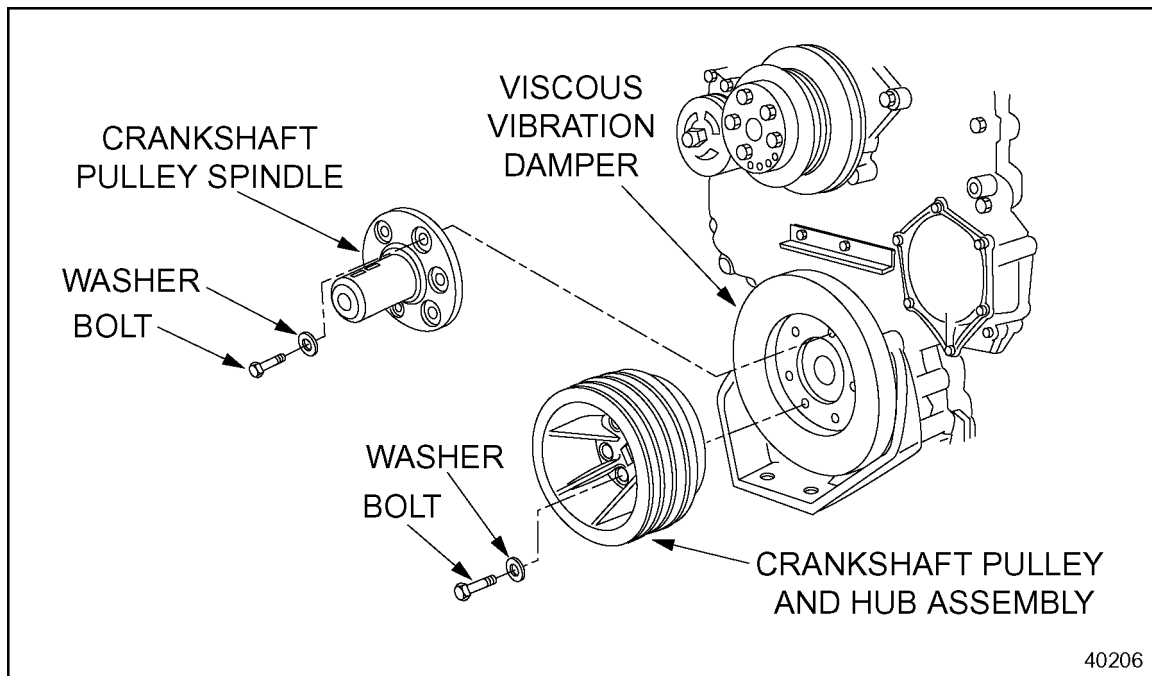
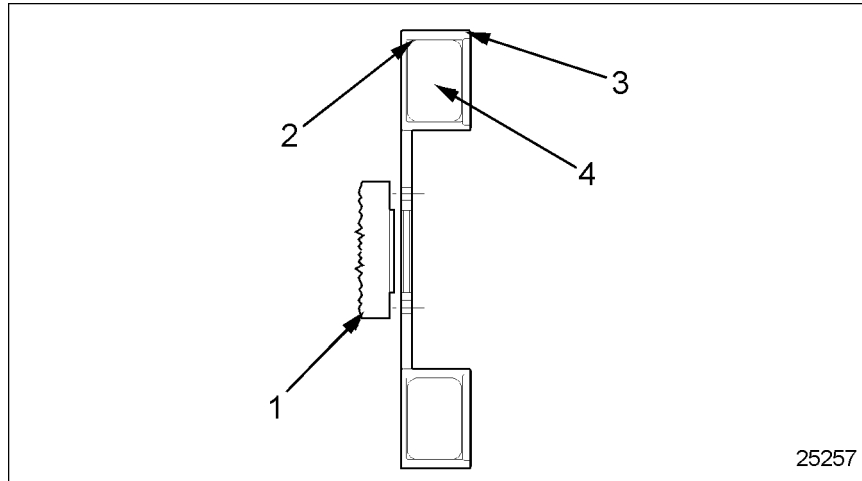


Figure 1-231 Viscous Vibration Damper Mounting with Crankshaft Pulley or Crankshaft Pulley and Hub Assembly with Spindle

Prior to April 1993, 11.1 liter engines with less than 320 hp (238 kW) were equipped with a 313.4 mm (12.34 in.) damper and 11.1 liter engines with 320 hp (238 kW) or more were equipped with a 342.9 mm (13.5 in.) damper, and all 12.7 liter engines, were equipped with a 342.9 mm (13.5 in.) damper.

Beginning in April 1993, all Series 60 engines are built with a 342.9 mm (13.5 in.) damper.

The viscous damper assembly consists of a sealed outer shell, an internal flywheel and a quantity of highly viscous fluid. See Figure 1-232.



- 1. Crankshaft
- 2. Viscous Fluid

- 3. Damper Shell
- 4. Internal Flywheel

Figure 1-232 Viscous Vibration Damper Detail

A properly designed and installed safety shield protects the damper from damage, prevents direct physical contact with the damper during engine operation, and significantly reduces the potential for damper-related personal injury.

Detroit Diesel Corporation does not manufacture, sell or install vibration damper safety shields due to the wide variety of installations in which Detroit Diesel engines are applied. Space restrictions in these numerous applications make it necessary to design an appropriate type of shield for each installation.

The responsibility for designing and installing properly shaped and constructed safety shields, therefore, rests with the OEM (Original Equipment Manufacturer), distributor, or other fabricator designing or manufacturing products in which they apply Detroit Diesel engines.

During operation, the outer shell, which is firmly attached to the crankshaft, turns at the same speed as the crankshaft, its motion being transferred to the flywheel through the fluid within the shell. Since "fluid-drive" is more or less inefficient with frequent speed changes, considerable flywheel slippage will take place as the power impulses are transmitted through the crankshaft. In this type of operation, the slippage is desirable since the acceleration and deceleration of the flywheel in the damper lessens the vibration amplitude, reducing its effects to a level harmless to the engine.

1.14.1 Repair or Replacement of Crankshaft Vibration Damper

To determine if repair is possible or replacement is necessary, perform the following procedure. See Figure 1-233.

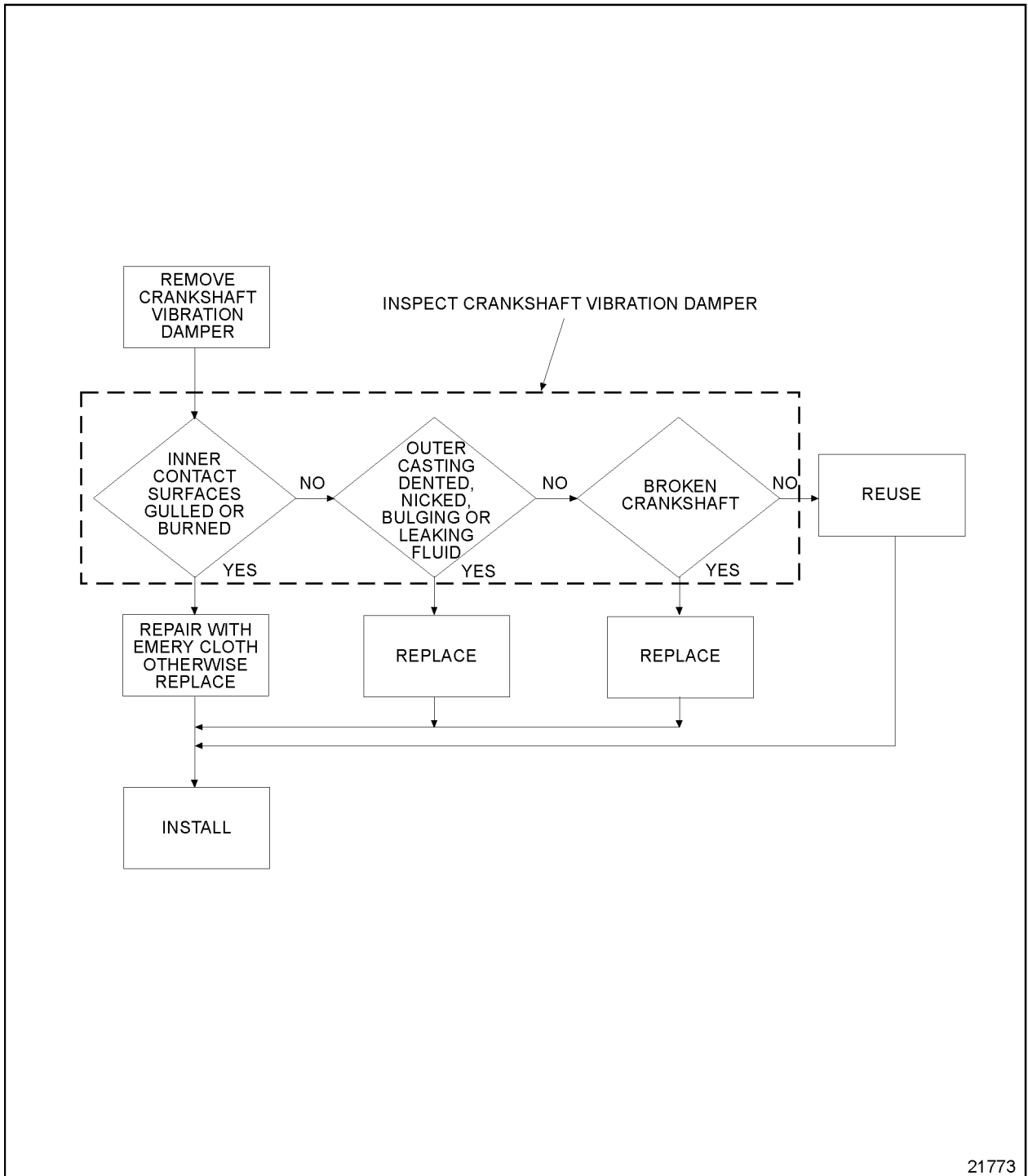



Figure 1-233 Flowchart for Repair or Replacement of Crankshaft Damper

1.14.2 Cleaning and Removal of Crankshaft Vibration Damper

Precleaning is not necessary.

 WARNING:
PERSONAL INJURY
To avoid injury from the projection of tools or other objects that may fall on or behind the vibration damper of an engine, always check and remove these items before starting the engine.

Remove crankshaft vibration damper as follows:

1. Remove the drive belts from the crankshaft pulley. Refer to section 14.6.9.
2. Remove the inspection plug in the bottom of the flywheel housing and install the flywheel lock (J-36375)-A. See Figure 1-234.

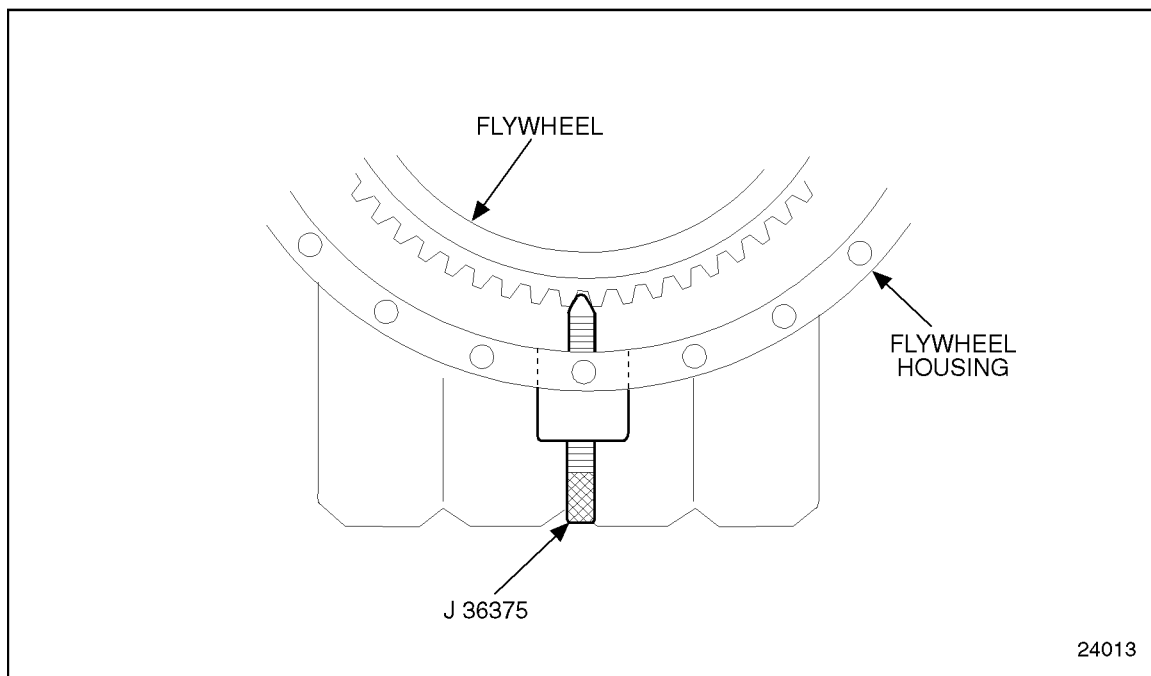


Figure 1-234 Flywheel Lock

3. Thread the center screw of the tool in until the tip of the tool rests between two teeth of the flywheel ring gear.

NOTE:

It may be necessary to bar the engine over (using the square hole in the middle of the crankshaft pulley or the center bolt when the pulley and hub assembly with spindle is used) so that the tool center screw is exactly between two teeth.

4. Tighten the knurled knob finger-tight.
5. Remove the isolated pulley from the spindle by removing the large center bolt (if equipped with this pulley style).
6. Remove two of the six crankshaft pulley or crankshaft pulley spindle to crankshaft special attaching bolts and hardened washers that are 180 degrees apart. Discard the bolts. These bolts are not reusable.
7. Install two guide studs (J-36235) into the holes where the bolts were removed.

NOTICE:

Use care when removing the crankshaft pulley as the vibration damper may come off. If the damper is allowed to fall, internal damage to the damper will result.

8. Remove the remaining four special crankshaft pulley bolts and hardened washers. Discard the bolts. These bolts are not reusable.

NOTICE:

Do not pound with a hammer or pry with other tools to remove the viscous damper from the crankshaft, since the outer shell may be dented and cause the flywheel to turn at the same speed as the outer shell. This renders the damper ineffective. The damper **CANNOT** be repaired.

9. Remove the vibration damper by sliding it off the guide studs.
10. Remove the flywheel lock and guide studs.

1.14.2.1 Inspection of the Vibration Damper

Inspect the vibration damper as follows:

NOTICE:

Dents may render the damper ineffective.

1. Inspect the outer casing of the damper for damage.
 - [a] Check outer casing for dents, cracks, nicks, fluid leaks or bulges.
 - [b] If any dents or cracks are detected, replace with new damper.
 - [c] Bulges or splits indicate that the damper fluid has deteriorated. If any are detected, replace with new damper.
2. Inspect the damper inner contact surfaces and the crankshaft end for damage. See Figure 1-235.
 - [a] Check for galling or burrs.
 - [b] Slight scratches or burrs may be removed with an emery cloth.
 - [c] If deep scratches are detected, replace with new damper.

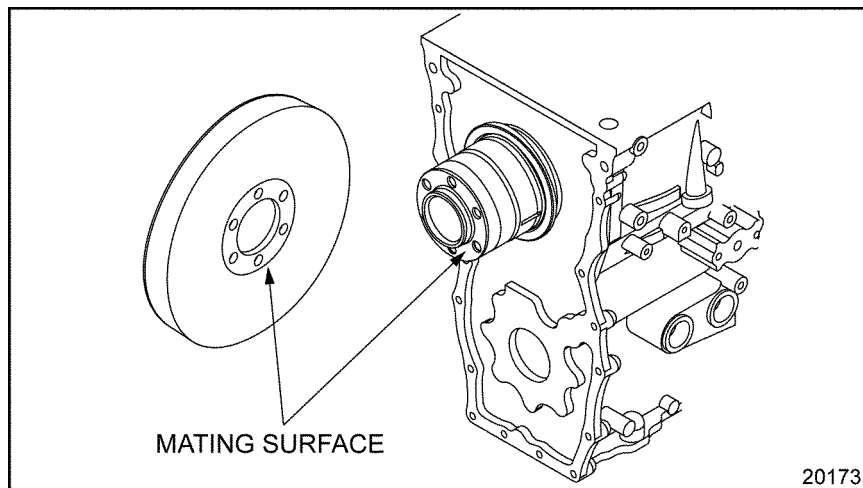


Figure 1-235 Damper and Crankshaft Contact Surfaces