Twin Cam Crankshaft Inspection & Run-Out Specifications

Inspection of Twin Cam crankshaft assemblies are different from previous flywheels and require unique inspection procedures.

Additionally, the run-out specifications listed in 1999-2007 service manuals need to be corrected.

This Tech Tip and the attached video demonstrations ("PLAY VIDEO" buttons) will provide you with new specifications, diagnostic tips, and demonstrate the correct methods for inspecting Twin Cam crankshaft assemblies prior to engine disassembly.

Flywheel Specifications:

Run-Out(crankshaft in the crankcase)	0.0 – 0.010 IN.	0.0 – 0.254 MM
Run-Out (crankshaft on a truing stand)	0.0 – 0.004 IN.	0.0 – 0.102 MM

Flywheel Service Wear Limits:

Run-Out(crankshaft in the crankcase)	0.012 IN.	0.305 MM
Run-Out (crankshaft on a truing stand)	0.005 IN.	0.127 MM

There are several common concepts and techniques essential to accurately measuring run-out we should address first:

- Run-out is determined by total travel of the dial indicator
  When you zero the dial indicator at any one spot you need to note the readings to the left and right of zero.
  In the attached video demonstration you will notice the needle swings 0.002" to the right of zero and 0.001" to the left of zero for a total run-out measurement of 0.003".
- Dial indicators must be set up and zeroed out perpendicular to the shaft
  It must be 90° when viewed from straight on <u>and</u> from the side, never at an angle.
- Measurements taken on a crankshaft while in the crankcase are used to determine if further action or inspection are required
  Specifications will be higher when measured in the crankcases than in a truing stand due to bearing run-out, stack-ups, and shaft length / distance from the bearing races.
- The crankshaft must rotate on the bearing races
  You should never use the shaft centers or threaded holes to rotate the assembly or take readings. Trying to read off from compensator nuts or bolts threaded into the right side crankshaft will produce inaccurate measurements every time.

In a future Tech Tip we will outline and demonstrate the proper procedures for inspecting the state of true on a loose set of Twin Cam flywheels on the bench.

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Scissored crankshafts (when they shift out of true at the crank pin) generally show up in one of two different symptoms: no oil pressure or vibration.

No Oil Pressure

When the right side crankshaft half shifts more than 0.015” it can break the oil pump’s gerotors, resulting in a loss of oil pressure. Diagnostics of a low oil pressure situation is outlined in Section One of the Service Manual, under the Troubleshooting chapter.

After analyzing the system as outlined under “Low Oil Pressure” and confirming a very low to no oil pressure you will need to remove the cam cover for inspection of the oil pump and cam support plate. If you find the oil pump gerotors bound or broken it could be from a contaminate running through the pump or a scissored crankshaft.

REMEMBER – replace the oil lines and drop the oil pan / tank to clean out any debris.

Inspection of the right side crankshaft run-out requires a dial indicator and a flexible mounting arm.

Proper set-up is critical to accurate readings:

- The reading must be taken directly on the crankshaft at the machined surface for the cam support plate bushing
  Do not use bolts or sleeves threaded into the right side crankshaft.
- The indicator must be perpendicular to the shaft
- The engine should be rotated by removing the spark plugs, shifting the transmission into the highest gear, and rotating the raised rear wheel
- Use the machined flat spot in the shaft, that retains the sprocket, as a reference point to zero the dial indicator and start taking measurements
- The Service Wear Limit for crankshaft total run-out in the case is 0.012”

Remember at this point your readings are only an estimate of true crankshaft run-out. If your reading exceeds 0.012” it is very likely the crankshaft needs to be replaced.

If the vehicle is under warranty stop and contact Technical Service to discuss the appropriate repair or inspection procedures before continuing.

If the vehicle is out of warranty you will need to discuss the appropriate repair with the customer (ESP coverage, flywheel replacement, dealer level rebuild, or factory Reman). In order to take a more accurate reading of the crankshaft run-out it will require removing the flywheels from the crankcases.

PLAY VIDEO

Vibration
Crankshaft run-out generally needs to exceed 0.020” to be perceivable to the rider, so it is much more likely that your vibration issues will be resolved by following the checklist provided in Section One of the Service Manual, under the Troubleshooting chapter.

If you have verified correct chassis set-up and eliminated things like bound isolator mounts, power train to frame contact, and other wear items and feel it is necessary to verify the crankshaft’s state of true proceed to inspection of the left crankshaft’s run-out.

1. Primary Drive Inspection
   Remove the primary cover and inspect the driveline.
   - Compensating sprocket assembly, Visual damage, Chain run-out
     Excessive run-out (tight to loose spots) is one symptom of a shifted left side crankshaft half
2. Inspection of the left side crankshaft run-out requires a dial indicator, magnetic base and an angle iron mounting plate, and tools to remove the compensating assembly.
3. Crankshaft run-out inspection procedures
   - Remove the spark plugs and primary chain tensioner assembly
     A late model primary chain auto-tensioner will need to be “reloaded” prior to reinstallation, per Section 6 of the appropriate Service Manual
   - Remove the compensating sprocket assembly, leaving the clutch in place
     Reinstall the sprocket nut or bolt to rotate the engine during inspection.
   - Mount the angle iron to the primary housing gasket surface and attach the magnetic base for the dial indicator parallel to the gasket surface
   - Position the indicator on the end of the shaft at 90° (in both directions) to ensure an accurate reading
   - Mark your start spot with a marker and zero the gauge
   - You will measure directly off the high spot of the splines, and must be careful not to knock the indicator out of zero while taking your readings
     - *Do not bolt on the shaft adapter and attempt to reads off its surface, or attempt to use anything threaded into the shaft. This will provide excessive run-out readings as you are not precisely on center.*
     - *Ignore the low “spikes” you will see on the dial indicator when it drops into the “valleys” of the splined shaft. You are only interested in comparing the differences in height of the high spots of the splines to determine total run-out.*
     - *Don’t worry if you miss one or two of the ten to twenty-four teeth. You should still be able to determine if the Service Wear Limit has been exceeded.*
   - The Service Wear limit of the left crankshaft in the crankcase is 0.012”

If your reading exceeds 0.012” and is under warranty stop and contact Technical Service to discuss the appropriate repair or inspection procedures before continuing.

If the vehicle is out of warranty you will need to discuss the appropriate repair with the customer (ESP coverage, flywheel replacement, dealer level rebuild, or factory Reman). In order to take a more accurate reading of the crankshaft run-out it will require removing the flywheels from the crankcases.

PLAY VIDEO