Other critical engine fasteners include cylinder head bolts or head studs (depending on engine design) and the crankshaft main bearing cap bolts or studs. When it comes to critical fasteners, these are typically designed and manufactured to extremely rigorous specifications. Companies that produce critical fasteners of this type typically test every manufacturing run to ensure the quality of each piece. Testing typically means testing to failure and sacrificing randomly selected components to ensure that the others meet the needed specifications.

The connecting rod fasteners are designed, manufactured and installed with the specific application requirements established so as to apply adequate clamping force to hold the rod cap, rod bearings and the connecting rod together on the crankshaft. If the connecting rod fasteners loosen, this will allow a slight deflection movement and separation of the connecting rod cap from the connecting rod. As the dynamic reciprocating forces alternate, it causes an ongoing cycle of stretching and relaxing that ultimately fatigues the rod bolt to the point that it fails.

Typically when a rod bolt fails, it breaks. Even if the second fastener on the rod is not loose, it will sustain damage and break, too. At this point, the rod cap comes off and the connecting rod separates from the crankshaft with enough force to send it through the engine case. Keep in mind that there is very little room inside the engine crankcase beyond the turning radius of the rotating crankshaft assembly. This type of failure is not unusual in a racing engine that has been over-revved; of course, this is not possible in the 2014 GT3, due to the PDK transmission. Porsche has been designing and manufacturing racing and high performance road engines for years; why would the connecting rod fasteners become compromised or fail?

Connecting Rod Fastener Failure Scenarios

1. The connecting rod bolts were too loose: The factory didn't tighten the rod fasteners properly.

2. Too-tight connecting rod nuts; Torque to Yield (TTY) fasteners compromised: Over-tightened connecting rod fasteners can cause premature component failure.

3. Material failure: Defect in manufacturing and/or metallurgical defects.

4. Engineering issue: Under-designed fastener (tensile strength too weak), application for the particular fastener incorrect, RPM too high for that particular fastener, and/or inadequate radiuses where threads start/end.

5. Component damaged prior to or during installation: A nick, scratch, dent, or even corrosion on the surface of the fastener can cause a stress riser (failure point).

6. Incorrect procedure during installation: Lubrication issue with threads or head of fastener and/or machine, robot and or tool defect causing incorrect tightness or installation.

7. Connecting rod bearing failure causing fastener failure: Connecting rod bearing failure caused by lack of lubrication, connecting rod bearing failure caused by pre-ignition/detonation and/or incorrect tolerances of bearing to crankshaft.

8. A part that has exceeded its lifespan (stressed too many times): Obviously not the issue in this particular situation.

Note: Anything that can make the rod bearing cap loose will lead to fastener failure.

Why do rod fasteners loosen? Generally, the rod fasteners will loosen due to an insufficient preload between the connecting rod and the rod end cap. The preload is the tension or clamping force being generated by the connecting rod fastener at the connection between the rod and the rod cap. This preload must exceed the dynamic forces acting against the fastened joint so that under no situation where the engine is operated within its design parameters (including its maximum RPM) will the connection become compromised.

As noted above, there is significant dynamic force acting against the connecting rod and the rod end cap. If the engineering department has done its job and designed a fastener capable of producing the clamping force necessary to hold everything together, that fastener must also be installed in such a way that the design preload tension is achieved.

Consider a bolt to be like a spring: When a bolt is installed to connect two components together and the nut is turned down to its maximum safe capacity, the bolt will stretch. It is at this point that the bolt is applying its maximum tension or clamping force to the connection.

A bolt has a specific amount of elasticity or stretch which is designed and built into it. The uninstalled bolt length can be measured; if it is then installed and tightened within its correct preload limits and re-measured, the bolt will be longer than in its relaxed, previously measured state. Uninstall the bolt and measure it again, and you'll see it has returned to its original length. This is known as elastic deformation: The fastener will stretch under tension but return to its original parameters when the tension is removed.

The amount of acceptable bolt stretch is specific to the material and design of the fastener and the manufacturer's testing and specifications, which some fastener manufacture's suggest is at 80 to 90 percent of a bolt's yield point. An example of an acceptable stretch for one rod bolt supplier for a Porsche racing engine is 0.0095 to 0.0100-inch stretch, or roughly one-hundredth of an inch. At this point, the bolt is providing maximum clamping force. If, however, the bolt is over-tightened beyond its safety stretch factor, the bolt will not return to its original length. If after removing the bolt and re-measuring its uninstalled length, you found that the bolt grew 0.0006 from its original length, the fastener is damaged and must be replaced. This is called plastic deformation; the fastener has been tightened beyond its yield point.

With regard to rod bolt fasteners "loosening," if the fastener was properly designed for its intended application—taking into account all of the engine's dynamic operating parameters—then the rod bolt was incorrectly installed or there must be a defect in the component(s). The rod bolt must be installed with the proper bolt stretch taking place. This ensures that the preload tension on the rod end joint is correct and that the bolt will not come loose.

Connecting rod bolts that are not installed with the correct amount of