

## **STUDY AND ANALYSIS OF ANGULAR TORQUING OF ENGINE CYLINDER-HEAD BOLTS USING TORQUE-TO-YIELD BOLTS: A CASE STUDY**

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### **ABSTRACT**

Normally for conventional bolt tightening methods, we use an estimate of resisting in the joint for measuring preload. But with angular torquing, we tighten the bolt with an initial specific 'snug torque', and then tighten it further with an angle to achieve precise clamping. This gives a more accurate tightening of the joint. This is necessary for high performance engines which require the utmost precision of engine head sealing as their engine heads are subject to higher cyclic loads. Hence, we use a new type of bolt called Torque-To-Yield bolt in conjunction with angular torquing to meet this requirement. Torque to yield bolts, also commonly referred to as angle torque or stretch bolts, are used in many of today's modern engines predominantly for cylinder head bolts, but also for main bearing caps. Compared to conventional type bolts, TTY bolts offer the engine manufacturer a number of advantages including; greater flexibility of design, reductions in component costs, more accurate assembly and reliability of seal. Engines designed utilizing TTY head bolts require fewer head bolts to achieve the desired clamping loads than those using conventional bolts. With fewer bolts the engine manufacturer has more flexibility in cylinder head and block design as well as reducing the cost of the engine.

**KEYWORDS:** Bolts, Engine Cylinder-Head, Tightening Beyond Yield, Angular Torquing