

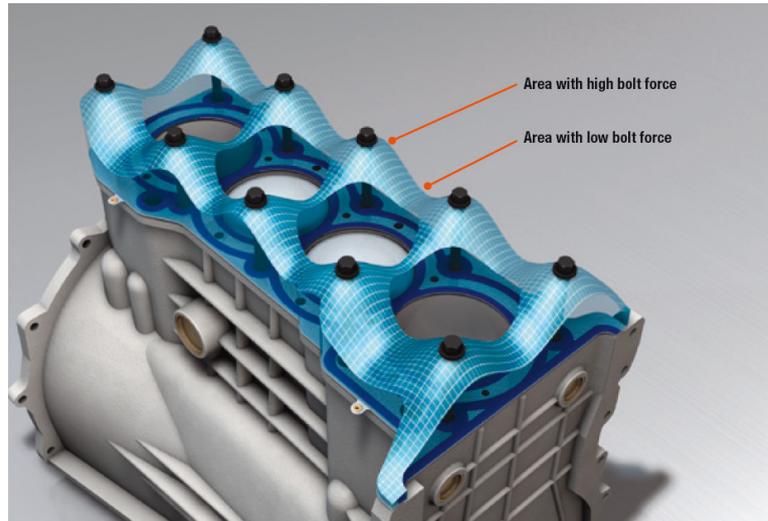
Practical Tips: Cylinder head "Stretch" bolts

Connecting element

Cylinder head bolts are the connecting elements between engine block, cylinder-head gasket, and cylinder head. The bolt tightening force is an important factor for the sealing of combustion chamber, lubricant and coolant channels - a task that must be performed perfectly with cold or extremely hot engines, at negative and high positive pressures.

Surface pressure

When tightening (torquing) the cylinder head bolts, the bolt force generates the surface pressure, which is essential for achieving a perfect seal. The quality of the bolt and the correct torque procedure have a big effect on surface pressure and therefore the quality of the seal.



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Stretch bolts are designed so that they can be elongated beyond their elastic limit into the plastic region without problems. When a specific tightening torque has been reached, the bolts are turned further through a defined angle, which pre-loads them into the plastic region. Consequently, no re-torquing is necessary - but the bolts cannot be reused!

Stretch bolts.

Bolts that are tightened beyond their elastic limit (the point they are no longer able to return to their original shape) into the plastic region ensure high and uniform bolt clamping forces - an important requirement for reliable sealed joints without re-torquing.

Angle torque method.

Firstly the bolt is snugged down to the cylinder head to a pre-determined torque. With the second tightening angle step, the bolt is tightened into the plastic region - i.e. it becomes permanently deformed. Using the angle torque method, the variations in bolt clamping force lie in a range of $\pm 10\%$. Using the simple torquing method with several steps, the variations will be $\pm 30\%$ of the calculated bolt clamping force.

A perfect repair only with new bolts

With the angle torque method the head bolts are elongated plastically, i.e. permanently. When dismantled the old bolts are longer than new bolts and permanently deformed. During the engine's warm-up period, the bolt is stretched even more. This applies in particular for all-aluminium and bi-metal engines as the two materials have different thermal expansion rates. In the worst case, a bolt that is reused can break, or it can "bottom" in the threaded hole of the engine block and cause damage. Therefore to guarantee a professional repair cylinder head bolts should always be replaced.