BOLT SCIENCE

March 2020 Newsletter

Fatigue Failure of an M16 Flanged Bolt

Investigating fastener failure can provide invaluable insight into the correct application and assembly of fasteners. In the image below we can see the failure of an M16 flanged fastener of strength grade 12.9. This fastener failed as a result of fatigue failure.

Following a detailed investigation of the assembly, the torque specification was too low. The torque specified was 180 Nm that resulted in a preload of 71000 N. This preload was insufficient to prevent the forces applied to the bolt opening the joint causing high alternating stresses to be sustained by the bolt.
The problem was resolved by increasing the tightening torque applied to the bolt so that a higher proportion of its yield strength was used.

The strength of the fastener was not being utilised, reducing the preload that the fastener was capable of providing. A tightening torque of 300 Nm was subsequently specified that resulted in a preload of 119000 N that was

UNTIGHTENING OF NUTS & BOLTS

If a nut is untightened immediately after being tightened, the torque needed to untighten it will be less than that needed to tighten it. This is due to the portion of the torque which actually stretches the bolt always acting in the untightening direction. Hence when a nut is immediately untightened, usually about 20% less torque is needed than was needed to tighten it in the first place.

As the time passes from when the nut was tightened, the torque needed to untighten it tends to increase. After half a day or so, the release torque can be typically up 10% greater than the tightening torque. This is due to a number of effects including embedding of the contact surfaces and changes in temperature affecting the friction conditions. Such effects typically increase the friction and hence a greater release torque is required. Because of such friction changes, the use of torque auditing methods (measuring the backoff - or crack-off torque or the tightening or crack-on torque) to assess if the bolt being tightened correctly is only accurate if it is completed shortly after the assembly was tightened.

The greater the changes in the temperature and environment experienced by a bolted joint, the more rapid are the changes in the friction and subsequent change to the release torque. In sub-sea applications, sustaining elevated or low temperatures, significant changes in the friction conditions can rapidly occur. The properties of any lubricant will change over time, which in some applications, can lead to galling of the surfaces resulting in a dramatic increase in the release torque i.e. by as much as 50% to 100% of the tightening torque.

occur making removal of the nuts problematic without destroying the bolt. In such circumstances nut splitters and similar measures are needed for nut removal.

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DID YOU KNOW?

Helical spring lock washers have been in use for well over 100 years. They are still used on many applications in the belief that they will will "lock" the nut/bolt to the joint and prevent loosening. The body of evidence, based upon both experience and experimental results, is that they do not prevent loosening and can be shown to actually speed up the rate of loosening in many cases.

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About the Author

Bill Eccles formed Bolt Science in 1992. The company is a provider of independent technical expertise in bolted joint technology. Bill has extensive experience in the design, analysis and installation of bolted joints and has published several technical papers on the subject. He has a Doctorate in Engineering on The Self-Loosening of Threaded Fasteners and has delivered training courses around the world on the analysis of bolted joints and bolting technology. To find out more please visit www.boltscience.com.

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