Joint Relaxation and Torque Auditing

Joint relaxation occurs to some extent in all fastened joints. It is caused by the surface of part(s) embedding or by "soft parts" such as gaskets, plastics or spongy material, which collapses under the clamping force created in a torque fastening condition. For correctly designed joints, relaxation is small and can be virtually ignored. However, relaxation is a particular problem on joints where gaskets, or parts such as spring washers and plastics, are utilized. On these fastening joints it can take a long time before the joint settles, which results in a reduction of the clamping force until the joint condition stabilizes.

The physical phenomenon for the collapse of material is often referred to as "creep."

The creep effect is most obvious and dramatic immediately after the clamping force has been applied. In many tightening applications the majority of the creep, the reduction of clamp load (and sometimes static torque), appears within the first 10-50 milliseconds.

There are techniques that can be used to reduce the effect of "creep":

1. Torque the fastener down, then untighten the joint and retighten it.
2. Redesign of the fastening joint (for example, replace soft gaskets with a sealing compound).
3. Torque the fastener, wait briefly and then apply torque again (can be repeated in several steps).
4. Use a power assembly tool with a low RPM setting to apply the final torque.

With the introduction of sophisticated electric DC tooling and other assembly tools (www.applifast.com/assemblytools), it has become more and more common for these torque tools to be chosen to help resolve any "joint relaxation" from incurring during fastening process. Depending on the joint design, technique option 3 is quite often selected.

Auditing of fasteners to prevent failures

The goal of auditing is to improve process results. To do this it is necessary to gather information for evaluation and analysis. Fastening error can never be eliminated if proper technique and tools are not used. Therefore, auditing is a necessary interrogatory to gain information about how a job was performed even when the process is being controlled perfectly.

Using quality electric DC tooling and the proper fastening technique makes a safer world through accuracy and precision. Controlling torque is absolutely essential for companies to ensure the quality, safety and reliability of their manufactured goods isn't compromised. The failure of a fastener that isn't properly tightened can lead to catastrophic or latent failures. Fasteners with excessive torque can snap, cause premature failure or strip threads.

The critical question must be asked: If proper joint design and proper torque application still do not guarantee that effective tension has been achieved, how do we know if the installed fastener meets the specification intended by the designer?

The answer is in auditing, a process used to validate, inform and confirm, or defined as:

Auditing –

> noun: the systematic examination of records for verification and validation, an independent, objective assurance of records
>
> verb: to check for purposes of verification any records of (a business or person) / to perform an audit on (a business or person)

Even the most sophisticated fastening systems require torque calibration to ensure their accuracy or repeatability. Therefore, auditing is a vital interrogatory to gain information about how a job was performed even when the process is being controlled perfectly. Clearly auditing is a preventative quality measure to help eliminate possible failure. Without an audit process, probable risks of errors, failures or other additional costs remain.

Because of variation in joints and the difficulty to create exact tension, it must be expected that Torque Auditing also has its pros and cons.

Traditionally there are there three main audit methods. These include first movement in the fastening direction, first movement in loosening direction (breakaway) and determining the rotation angle by marking the fastener; loosening it and determining the torque required to move the fastener back to the original position. While these methods can achieve the intended purpose they have drawbacks.

First Movement

1. First movement testing in the fastening direction is performed with a hand torque device. It is necessary to load the fastener and observe the movement. The problem is that it is difficult to perform as first movement is difficult to "feel" with a measuring tool and it is extremely difficult to observe movement. First movement can be done by hand with a dial or digital tool, it can be done with an outboard transducer with angle encoder, but this requires fixturing of the transducer that is often challenging. This method provides an estimate of the current torque but gives no indication of how much movement is required to achieve the desired torque if the current torque is less than the desired torque. Further, if done incorrectly, it can radically increase the joint load.

Breakaway – Loosening Direction

2. Breakaway is a loosening test of the fastener and as a rule is always less than the actual torque. Breakaway provides data on what it will take to "break loose" a fastener under load. Loosening the fastener is not practical where a system is being audited "live" and loosening the fastener could cause leakage. Further, if done incorrectly, it can cause the joint to be incorrectly tightened, creating more problems than answers. If locking compounds or other joint security devices is used, this is not an effective method of testing, as the audit results will be inconsistent.

Mark, Loosen and Retighten

3. This is a test where the bolt and application is marked with chalk or similar, then the bolt is loosened and retightened to the original marking. This is often not practical and again it gives no indication of how much torque is required to achieve the desired torque if the current torque is less than the desired torque.