When bolts fail during assembly the first assumption by users is that the bolts are at fault. They contact the supplier and want replacement bolts immediately. Does this sound familiar?

We've been consulted on numerous incidents of this type over the years and I expect to be contacted more times in the future. There are two fundamental factors that should be investigated in a bolt failure; strength of the fastener and installation torque. Below are my suggestions for effectively getting to the bottom of these situations as quickly and thoroughly as possible.

What To Do When A Customer Complains About Breaking Bolts

by Larry Borowski

1. Review the quality documentation you have on the subject bolts and/or nuts to make sure they are reported to be within the requirements of the applicable specification. If you do not have this data in your files contact the manufacturer or distributor from whom you got the parts. If they do not have this information obtain some bolts and/or nuts from the exact lot in question and have them tested for their tensile strength in the case of bolts, and proof load in the case of nuts.
2. If the parts are found not to comply with the applicable specification strength requirements, replace the parts with those that you can prove through documentation and/or testing to meet specification.
3. If the bolts and/or nuts meet their strength requirements (as they usually do) you must determine if the parts are being installed at appropriate torque values. You can determine this by doing the following:

   a. Determine what the appropriate torque value should be for this particular application. You will need to know the fastener's exact thread size, strength level, and finish.

   i. Look for the recommended torque value in a torque specification chart if one is available.

   ii. If an appropriate torque chart is not available calculate the recommended torque value using the formula:

   T = (DKP)/12
   T = Torque (foot pounds)
   D = nominal diameter size in decimal inches
   K = K factor (.2 for plain black bolts, .25 for zinc plated bolts)
   P = desired tensile load (thread tensile stress area X .75 X PSI yield strength)
   Note: the results are divided by 12 to convert inch pounds to foot pounds.

   iii. Instead of doing the calculations yourself you can go to one of the many torque calculators on the Internet.

   b. Ask the customer what torque value they are using to install the subject bolts. If their answer differs greatly from what you determined in the previous step ask them how they settled on the value they are using and share with them what you have determined in step above.

If the customer questions your results the most diplomatic way to get them to reconsider their value is to give them the web site for the torque calculator and let them use it on their own. With this approach the torque value is not based just on your opinion, but is based on the information from a third party who has no interest in your particular issue.

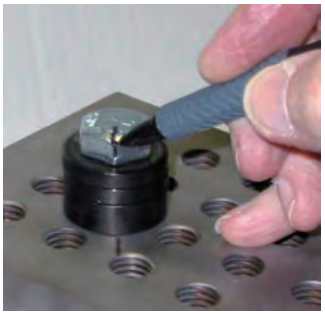
   c. After coming to an agreement on what the torque value should be, ask the customer how they determine that the subject bolts and/or nuts are, in fact, tightened to that value.

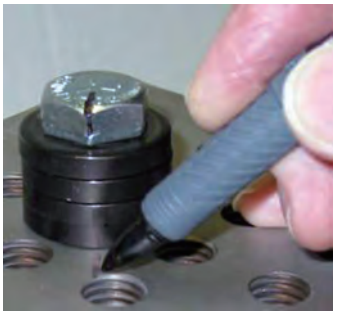
This is critical, because many fastener installers know what torque value they should use, but they do not verify the fact that this value is actually being applied to their parts. Many installers use impact wrenches and have a misconception that these drivers produce a known torque value when they actually do not.

If the user is not verifying the torque they are applying to the subject fasteners you can use the following steps to determine at what value the parts are really seated:

i. Go to the point of assembly in the customer's facility and locate some assemblies that have the subject parts installed in them.

ii. Using a permanent marker draw a mark on a corner of the bolt or nut. Mark a line out on to the surface of the application which lines up with the center of the bolt head and the marked corner.





iii. Loosen the subject bolt or nut.

iv. Make a mark on the outside of an appropriate sized drive socket that corresponds with the line on the corner of the bolt or nut.

v. Affix the socket to a torque wrench that has a greater capacity than the determined tightening torque value.

vi. Run the bolt or nut down close to the application surface and then place the socket which is on the torque wrench on the part so that the mark on the outside of the socket matches the marked corner on the fastener.

Apply torque with the torque wrench until the line on the outside of the socket lines up with the line you marked on the surface of the application before loosening the bolt or nut.

The value indicated on the torque wrench at the point where the marks line up is very close to the value that was originally applied to the bolt or nut when driven in the routine manner by the customer. I recommend that this procedure be repeated on several assemblies and compare the results. It is not a good practice to ever stop with a test or evaluation of only one sample.

In a vast majority of cases when this procedure is employed the results will prove that the customer is installing the suspect bolts at a torque value significantly greater than what they intended. Tightening bolts to torque values beyond the bolt's ultimate strength during the assembly process is the most common source of broken bolts.

Over the years I have been consulted on many customer complaints about failing fasteners. I can safely state that in at least 90% of all investigations it has been proven that the fasteners met all of their specified requirements and the failures were the result of other component problems or inappropriate tighten practices being used by the installer.

When dealing with a complaining customer presenting your opinion against their opinion is not an effective way to try to resolve the issue. By following the procedure described above you will be presenting facts and evidence supporting your position instead of only your opinions. This is a much more effective way to discover the root cause of the fastener failures and resolve the issue with the customer. ■