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Proper Valve Insertion and Number of Remaining Threads

This is a difficult question. I have heard many different opinions on this issue.

The bottom line is that there must be SOME threads showing after the valve is torqued down, or it may have just run out of threads without a proper connection. Some people have said it must have 2, or 3, or even 5 threads showing. Requiring 3-5 threads showing seems beyond any reasonable limit to me (except for a brand new valve in a brand new cylinder). But 1 or 2 visible threads are absolutely necessary for re-insertion of a used valve.

The Basics:

NGT threads are similar to NPT, except that NGT threads are longer to allow for further tightening and reinsertion.

Valves are manufactured with a minimum required length of full threads. For example, a 3/4"-14 valve requires minimum full thread length of 0.7676" (about 3/4"), and an overall thread length of 0.8750". So at 14 threads per inch, a new valve must have at least 10 – 11 good, full threads (about 3/4" worth of full threads). You will typically see 12 – 13 threads on a 3/4" valve. This is because the last thread (at the top) is in the "thread run out" region (where the die has begun to cut threads, but has not yet made a full cut), and may not be a "full, useable thread". So, we know the last thread at the top is probably not a fully cut, useable thread. This is the difference between the "full thread length" (L_8) and the "overall length" (L_{10}).

On a new valve in a new cylinder, both with specification threads, we will typically see 5 threads showing above the neck of the cylinder.

Upon reinsertion of a used valve into a used cylinder, there must be some provision to ensure that the valve is properly torqued down, and that we have not simply run out of threads without obtaining a proper connection. This is where the rule for a particular number of threads showing comes from. Due to the last thread being in the run out area, we cannot generally claim it as a full thread. Therefore there should always be at least one full thread showing above the neck of the cylinder. However, there is a +/- 1 turn allowable variance when gauging these threads. So, some have argued that "1 thread showing" might actually be off by one thread, therefore a minimum of "2 threads showing" is a very safe and conservative rule to use for cylinder valves. Others, however, believe this to be overkill, and say that "1 full thread showing" is a safe and adequate rule. I will not try to argue against either case. If the person understands the underlying basics and makes their decision for either 1 or 2 threads showing, they are within industry standards.

The sealing on a tapered connection actually occurs at the bottom of the threads, and one visible thread at the top will adequately demonstrate that the threads are fully engaged and have not simply bottomed out.

One other point of consideration in this discussion is that some valves have an undercut area above the last thread. This allows the tap to "run out" into the cut out area, and the top thread is actually a full, useable thread, and can be counted as such.

All of this information can be found in Figure 1 and Table 4 of CGA V-1.

Insertion and Re-insertion

Each time a valve is removed from a cylinder and then reinserted, there is wear that occurs. As a general rule, we lose about 1 thread for each removal / insertion. Based on the above example (and depending on insertion torques), after 3 to 5 removal / insertion cycles, the valve will likely need to be replaced. Many companies follow procedures to determine whether or not a valve will be re-used. If their insertion policy is that there must be 1 full thread showing after insertion, they may determine that an incoming valve with less than 2 full threads showing is unusable (since one thread will be lost upon re-insertion.) If their insertion policy is that there must be 2 full threads showing after insertion, they may determine that an incoming valve with less than 3 full threads showing is unusable.

For a 3/4"-14 valve, the insertion sequence for a **new valve** in a **new cylinder** is as follows:

Initial insertion: Hand tight (L_1 = 0.3390" x 14 threads per inch = 4.7 threads).

Wrenching makeup: (L_3 = 3 threads).

So, when putting a new valve in a new cylinder, we will turn the valve in 4 to 5 turns to reach a hand tight insertion. It will then require approximately 3 more turns to bring the valve up to its full insertion torque.

Once a valve has been torqued into a cylinder, a brass valve will deform to the threads of the cylinder. This is why it is recommended to re-insert the same valve back into the same cylinder. A better seal will be obtained without further deforming the valve.

For a 3/4"-14 valve, the insertion sequence for a **used valve** in a **used cylinder** is different than that described for a new valve in a new cylinder. Once the valve has been torqued into the cylinder, it will now go in more turns before reaching the initial hand tight insertion. We may see 5 to 9 turns to reach hand tight. Then, it will generally not take as many turns to reach the full torque required for a proper connection. Attempting to go a full 3 turns after hand tight on a used valve in a used cylinder may result in an over-torque situation that could damage the valve and neck of the cylinder.

This document is provided as an informational guide only. Each company should determine its own procedures for valve insertion. For further information and specific details, the cylinder and valve manufacturers should be contacted directly.