Establishing Leak Tight Seal for 3/4-14NGT Connection for Steel Cylinders – Hand Tight Plus 3 Turns for Wrenching Method

Hand tight engagement occurs when the pitch diameter of the first thread on the valve engages the thread in the cylinder neck with the same pitch diameter. For any new ¾-14NGT thread, mating hand tight engagement occurs nominally after an engagement of 0.339" or, 0.339" x 14 threads/inch = approximately 4 ¾ threads. A manufacturing tolerance of plus or minus one turn is permitted on both the valve and the cylinder threads. Therefore, hand tight engagement can be approximately 2 ¾ to 6 ¾ threads, when oversize and undersize thread tolerance limits are taken into consideration. Three turns are then allowed for wrenching to establish a leak tight seal. Thus, total engaged threads can range from 5 ¾ to 9 ¾ full threads.

Since the length of full threads on a ¾-14NGT valve is 0.7676", the total number of full threads is 0.7676" x 14 threads/inch, or approximately 10 ¾ threads. [The thread length is more on (Cl) threads used for Chlorine service]. If the thread tolerances are such that the valve threads are as large as they can be and the cylinder opening is as small as it can be, the valve enters only 2 ¾ turns for hand tight engagement. That is, if the largest valve is installed in the smallest cylinder, there will be approximately five full threads showing after the three turns for wrenching (2 ¾ plus 3 turns for wrenching minus a total of 10 ¾ threads on valve inlet). Conversely, if the thread tolerances are such that the valve threads are as small as they can be and the cylinder opening is as large as it can be, the valve will enter 6 ¾ turns for hand tight engagement. Thus, if the smallest valve is installed in the largest cylinder, there will be approximately one full thread showing, after the three turns for wrenching. While it is highly improbable that these extremes will be experienced with new parts, this illustrates why the counting of exposed threads is a poor way of ascertaining a sufficiently engaged joint.

Using a predetermined amount of torque to establish a leak tight seal also has some drawbacks. Variations in coefficients of friction, thread damage, type of sealant used, and so on, can influence the amount of applied torque that is necessary to create a seal. For example, if the first thread on the cylinder valve is damaged, much of the torque may be used just to overcome the resistance of the damaged thread.

The "hand tight plus 3 turns for wrenching" identified in CGA V-1, provides a method for engaging the valve to a steel cylinder that is not affected by manufacturing tolerances. However, the number of turns required to establish a hand tight engagement will vary depending on whether the threaded joint is bare metal, whether PTFE tape is applied to the valve, or whether a suitable luting compound is used.

One way to compensate for the above mentioned variables is to first tighten the joint without luting compound or PTFE tape as tight as possible with bare hands, and count the turns needed to accomplish this. Next, apply the luting compound or PTFE tape that is going to be used in actual valve installations and repeat the above hand tightening procedure, again counting turns. The difference between the number of turns to accomplish a hand tight joint with and without luting compound (or PTFE tape) should then be added to the "3 turns for wrenching." For example, consider the instance where 5 turns are needed to make a hand tight engagement with bare metal. When luting compound or PTFE tape is used for this same valve, 4 ½ turns are required to arrive at a hand tight engagement. To establish a leak tight seal, the valve would then be wrenched 3 ½ turns rather than 3 or engaged a total of 8 ½ turns. That is, 5 turns (bare metal hand tight) plus 3 ½ turns (3 turns for wrenching plus ½ turn from tape). In this manner, the effect of the tape or luting compound is adequately taken into account.

Establishing Leak Tight Seal for 1-11 1/2 NGT Connection for Steel Cylinders – Hand Tight Plus 3 Turns for Wrenching Method

Hand tight engagement occurs when the pitch diameter of the first thread on the valve engages the thread in the cylinder neck with the same pitch diameter. For any new 1-11 1/2-NGT thread, mating hand tight engagement occurs nominally after an engagement of 0.400” or, 0.400” x 11.5 threads/inch = approximately 4.6 threads. A manufacturing tolerance of plus or minus one turn is permitted on both the valve and the cylinder threads.
Therefore, hand tight engagement can be approximately 2.6 to 6.6 threads, when oversize and undersize thread tolerance limits are taken into consideration. Three turns are then allowed for wrenching to establish a leak tight seal. Thus, total engaged threads can range from 5.6 to 9.6 full threads.

Since the length of full threads on a 1-11 1/2-NGT valve is 0.9217”, the total number of full threads is 0.9217” x 11.5 threads/inch, or approximately 10.6 threads [Thread length is more on (Cl) threads used for Chlorine service]. If the thread tolerances are such that the valve threads are as large as they can be and the cylinder opening is as small as it can be, the valve enters only 2.6 turns for hand tight engagement. That is, if the largest valve is installed in the smallest cylinder, there will be approximately five full threads showing after the three turns for wrenching (2.6 plus 3 turns for wrenching minus a total of 10.6 threads on valve inlet). Conversely, if the thread tolerances are such that the valve threads are as small as they can be and the cylinder opening is as large as it can be, the valve will enter 6.6 turns for hand tight engagement.

Thus, if the smallest valve is installed in the largest cylinder, there will be approximately one full thread showing, after the three turns for wrenching. While it is highly improbable that these extremes will be experienced with new parts, this illustrates why the counting of exposed threads is a poor way of ascertaining a sufficiently engaged joint.

Using a predetermined amount of torque to establish a leak tight seal also has some drawbacks. Variations in coefficients of friction, thread damage, type of sealant used, and so on, can influence the amount of applied torque that is necessary to create a seal. For example, if the first thread on the cylinder valve is damaged, much of the torque may be used just to overcome the resistance of the damaged thread.

The “hand tight plus 3 turns for wrenching” identified in CGA V-1, provides a method for engaging the valve to a steel cylinder that is not affected by manufacturing tolerances. However, the number of turns required to establish a hand tight engagement will vary depending on whether the threaded joint is bare metal, whether PTFE tape is applied to the valve, or whether a suitable luting compound is used.

One way to compensate for the above mentioned variables is to first tighten the joint without luting compound or PTFE tape as tight as possible with bare hands, and count the turns needed to accomplish this. Next, apply the luting compound or PTFE tape that is going to be used in actual valve installations and repeat the above hand tightening procedure, again counting turns. The difference between the number of turns to accomplish a hand tight joint with and without luting compound (or PTFE tape) should then be added to the “3 turns for wrenching.” For example, consider the instance where 5 turns are needed to make a hand tight engagement with bare metal. When luting compound or PTFE tape is used for this same valve, 4 ½ turns are required to arrive at a hand tight engagement. To establish a leak tight seal, the valve would then be wrenched 3 ½ turns rather than 3 or engaged a total of 8 ½ turns. That is, 5 turns (bare metal hand tight) plus 3 ½ turns (3 turns for wrenching plus ½ turn from tape). In this manner, the effect of the tape or luting compound is adequately taken into account.

Establishing Leak Tight Seal for 3/8-18NGT Connection for Steel Cylinders – Hand Tight Plus 3 Turns for Wrenching Method

Hand tight engagement occurs when the pitch diameter of the first thread on the valve engages the thread in the cylinder neck with the same pitch diameter. For any new 3/8-18NGT thread, mating hand tight engagement occurs nominally after an engagement of 0.240" or, 0.240" x 18 threads/inch = approximately 4.3 threads. A manufacturing tolerance of plus or minus one turn is permitted on both the valve and the cylinder threads.
Therefore, hand tight engagement can be approximately 2.3 to 6.3 threads, when oversize and undersize thread tolerance limits are taken into consideration. Three turns are then allowed for wrenching to establish a leak tight seal. Thus, total engaged threads can range from 5.3 to 9.3 full threads.

Since the length of full threads on a 3/8-18NGT valve is 0.5733", the total number of full threads is 0.5733" x 18 threads/inch, or approximately 10.3 threads. If the thread tolerances are such that the valve threads are as large as they can be and the cylinder opening is as small as it can be, the valve enters only 2.3 turns for hand tight engagement. That is, if the largest valve is installed in the smallest cylinder, there will be approximately five full threads showing after the three turns for wrenching (2.3 plus 3 turns for wrenching minus a total of 10.3 threads on valve inlet). Conversely, if the thread tolerances are such that the valve threads are as small as they can be and the cylinder opening is as large as it can be, the valve will enter 6.3 turns for hand tight engagement. Thus, if the smallest valve is installed in the largest cylinder, there will be approximately one full thread showing, after the three turns for wrenching. While it is highly improbable that these extremes will be experienced with new parts, this illustrates why the counting of exposed threads is a poor way of ascertaining a sufficiently engaged joint.

Using a predetermined amount of torque to establish a leak tight seal also has some drawbacks. Variations in coefficients of friction, thread damage, type of sealant used, and so on, can influence the amount of applied torque that is necessary to create a seal. For example, if the first thread on the cylinder valve is damaged, much of the torque may be used just to overcome the resistance of the damaged thread.

The "hand tight plus 3 turns for wrenching" identified in CGA V-1, provides a method for engaging the valve to a steel cylinder that is not affected by manufacturing tolerances. However, the number of turns required to establish a hand tight engagement will vary depending on whether the threaded joint is bare metal, whether PTFE tape is applied to the valve, or whether a suitable luting compound is used.

One way to compensate for the above mentioned variables is to first tighten the joint without luting compound or PTFE tape as tight as possible with bare hands, and count the turns needed to accomplish this. Next, apply the luting compound or PTFE tape that is going to be used in actual valve installations and repeat the above hand tightening procedure, again counting turns. The difference between the number of turns to accomplish a hand tight joint with and without luting compound (or PTFE tape) should then be added to the "3 turns for wrenching." For example, consider the instance where 5 turns are needed to make a hand tight engagement with bare metal. When luting compound or PTFE tape is used for this same valve, 4 ½ turns are required to arrive at a hand tight engagement. To establish a leak tight seal, the valve would then be wrenched 3 ½ turns rather than 3 or engaged a total of 8 ½ turns. That is, 5 turns (bare metal hand tight) plus 3 ½ turns (3 turns for wrenching plus ½ turn from tape). In this manner, the effect of the tape or luting compound is adequately taken into account.