RUNNING AND HANDLING PROCEDURE FOR U.S. STEEL SEMI-PREMIUM WEDGE THREADED CONNECTIONS	**Procedure: ENG 16** **Revision: 7** **Effective Date: 01/08/2024** **Page: 1 of 25**

1.0 Scope

1.1 This engineering procedure describes the requirements for running and pulling of U. S. Steel (USS) semi-premium wedge threaded connections. No variations from these requirements shall be permitted without written approval from a U. S. Steel representative.

1.2 U.S. Steel recommends the presence of an authorized U.S. Steel Representative to monitor the make-up of all connections.

2.0 Definitions

2.1 Semi-Premium Connections – Proprietary connections that incorporate a thread-only seal.

2.2 Make-up Signature **–** A graph that is generated from the Torque vs. Turn or Torque vs. Time monitoring system. This is also called a make-up graph.

3.0 Reference Documents

3.1 ENG 05 Approved Running and Storage Compounds and Thread Protectors

4.0 Equipment Requirements

4.1 Accessory Equipment

4.1.1 Inspection of all accessory equipment and backup equipment, such as crossovers, safety subs, float equipment and packer assemblies, shall be conducted prior to any operation. Care shall be taken to ensure that the proper connection is threaded on all accessories.

4.1.2 Only accessories threaded by a USS facility or licensed manufacturer or repair shop shall be used.

Prepared by: Becker, Shelby L	Date: 10/03/2023
Reviewed by: Burnap, Andrew C	Date: 10/03/2023
Approved by: Schoenhals, Ryan S	Date: 01/02/2024

4.1.3 Handling plugs/Tool Guides provided by USS may be used.

4.1.3.1 Handling plugs/Tool Guides must be made up hand tight until the connection is snug. Extreme care shall be used to ensure the handling plug/tool guide is not cross-threaded in the box during make-up. Dial calipers, a go/no go gauge, or an equivalent measuring device shall be used to measure the distance between the box face and the external handling plug/tool guide shoulder after make-up. The measured stand-off may not exceed the values listed in Table 1 and Table 2.

Table 1: USS-TALON Acceptable Handling Plug/Tool Guide Stand-off

Size Range	Max. Stand-off
4.500” x 0.250” – 0.290” wall 5.000” x 0.362” – 0.478” wall 5.500” x 0.304” – 0.500” wall 6.000” x 0.400” – 0.453” wall 6.625” x 0.352” – 0.452” wall 7.000” x 0.362” – 0.540” wall 7.625” x 0.328” – 0.375” wall	0.50”
7.625” x 0.430” – 0.500” wall 8.625” x 0.304” – 0.557” wall	0.55”

Table 2: USS-TALON SFC™ Acceptable Handling Plug/Tool Guide Stand-off

Size Range	Max. Stand-off
7.625” x 0.328 – 0.375” wall	0.50”

4.2 Elevators

4.2.1 Slip type or spider type elevators are recommended for all connection types, but mandatory for all USS-TALON HTQ® reduced diameter (RD) and USS-TALON SFC™ couplings. Slip type elevators shall have a setting/striker plate tall enough to accommodate the full coupling length and an opening appropriately sized for the coupling OD being run. Slips shall not be set over the threaded area or any formed area of the connection. Bottleneck elevators may be used for standard coupling ODs.

4.3 Power Tongs, Gauges, Handling Plugs and Torque Recorders

4.3.1 Tongs shall be in good condition with jaws that correctly fit the pipe.

4.3.1.1 Tong jaws that contact the maximum surface area of the pipe as possible are preferred. Greater contact area evenly distributes contact pressure during make-up and minimizes the risk of deforming or crushing the pipe body.

4.3.2 Make-up torque should be accurately measured and controlled. Torque measuring equipment shall be in good working order and cover the appropriate range and be properly calibrated.

4.3.3 If a snub line is used, it shall be set at a 90-degree angle to the arm of the tong.

4.4 Thread Protectors

4.4.1 Properly fitting, clean thread protectors shall be installed on each connection when stored on pipe racks or when pipe is being moved.

4.4.2 It is recommended that thread protectors be removed as close as practical to the start of the casing running. In case the casing running is delayed, thread protectors should be replaced on connections to avoid prolonged exposure to the environment and debris.

4.5 Thread Field Inspection and Repair

4.5.1 Threads shall be thoroughly cleaned and dried prior to inspection to remove all dirt, thread or storage compound, or other residue. Proper cleaning solution shall be used. Do not use metal brushes or other abrasive methods that will cause scratching of the threads.

4.5.2 An authorized USS Representative shall perform a thread inspection to evaluate for damage and corrosion.

4.5.3 Minor anomalies on thread surfaces may be field repaired. After repairs, threads shall be cleaned and dried. Molybdenum Disulfide spray shall be applied to all repaired areas.

5.0 Thread Locking Procedure

5.1 Connections may be assembled with thread locking compound when required.

5.1.1 Pin application: Apply a thin uniform coating of thread locking compound on threads 5 through 10 – starting approximately 1.5” from the pin face covering the entire circumference for about a 2” span. The thread locking compound must be well worked into the thread form.

5.1.2 Box application: Apply an extremely light, uniform coating of the thread running compound to the entire thread surface of the box as per section 6.3.2.

5.1.3 For best results, it is recommended to assemble the connection well within the short time frame specified per the thread locking compound manufacturers recommendation to guarantee material performance on the connections.

5.1.4 A torque in excess of the connection maximum make-up torque may be required to make up connections assembled with thread locking compound.

5.1.5 The use of excessive thread locking compound may result in an improper connection make-up.

6.0 Running Procedure

6.1 Pipe Handling

6.1.1 Care shall be used when handling pipe. Pipe shall not be moved unless the threads, both pins and boxes, are protected with thread protectors. The use of quick release protectors is allowed while moving and running pipe. Pipe shall be lifted with straps, not hooks. If a soft line is used it shall be double wrapped when picking up a joint of pipe.

6.2 Thread Running Compound

6.2.1 Thread compound shall be applied to clean, dry connections.

6.2.1.1 All storage compound shall be removed, and the connection shall be cleaned to remove any foreign material or debris prior to thread compound application.

6.2.2 Thread running compound and applicator shall be free of foreign contaminates (sand, dirt, etc.). It is recommended that a new container of compound be used at the start of each job. Diesel or other thinning agents shall not be added to thread running compound for any reason.

6.2.3 Thread compound shall be specifically designed for use with semi-premium wedge connections. Reference ENG 05 latest revision for a list of approved thread compounds. All other semi-premium wedge connection compounds shall be reviewed and approved by USS Product Engineering prior to use.

6.3 Thread Running Compound Application

6.3.1 Thread compound shall be applied to the entire thread surfaces of **the box connection only. The pin connection shall be bare.**

6.3.2 **An *extremely* light (paper thin),** even layer of thread compound shall be applied such that the thread form is still visible. An example of proper thread compound distribution is shown in Figure 1. The use of a mustache brush is highly recommended for thread compound application. Extreme care should be taken to remove excess thread compound from inside thread roots close to the box ID.

Figure 1: Proper Thread Compound Application

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6.4 Stabbing and thread engagement

6.4.1 A stabbing guide shall be used on the box end to prevent damage to threaded surfaces.

6.4.2 The pipe must be in vertical alignment over the box. Movement or sway of the pipe shall be held to a minimum. Only after the pipe is positioned properly shall the pipe be slowly lowered into the box until the stab flanks of the pin are in contact with the stab flanks of the box.

6.4.3 A weight compensator is recommended, especially when running large diameters and doubles.

6.4.4 Remove stabbing guide after stabbing. Rotate the pipe by hand to insure proper thread engagement. Tongs can be used to slowly rotate the pipe for thread engagement verification if weight restricts doing this by hand. NOTE: Slack shall remain in the snub line and no appreciable torque buildup shall be seen during this process. If connection is not stabbed correctly, rotate the connection counter-clockwise 1/4 to 1/2 turn to correct. Pipe shall not be rocked back and forth during thread engagement.

6.5 Power Make-up

6.5.1 Power tongs are required for make-up. Casing running tools (CRTs) may be used for rotating pipe only. Pipe wrenches, rig tongs or spinning chain shall not be used for connection make-up. Make-up at a steady and controlled speed, shifting from high gear to low gear prior to final make-up. Table 3 lists high gear and low gear RPM. Backup tongs shall be located as close to the power tong as possible to prevent bending during make-up. Back up tongs shall not be set over the box end under any circumstances. The elevator should not be unlatched until the make-up process is complete.

Table 3: Maximum Power Make-up Speeds

Product Line	High Gear RPM	Low Gear RPM
USS-TALON HTQ®	20 Max	5 Max
USS-TALON HTQ® RD	20 Max	5 Max
USS-TALON SFC™	20 Max	5 Max

6.6 Make-up Position and Torque

6.6.1 Make-up acceptance is primarily based on final position, with final torque being a secondary means of verification. Final make-up location shall be verified upon completion of connection make-ups by an authorized USS representative using the triangle stamp and make-up graph.

6.6.2 USS Product Data Sheets provide torque values for USS proprietary connections. The torque values listed are the minimum and maximum recommended make-up torques, as well as the connection maximum operational torque. A connection with an acceptable make-up signature that has a final torque reading within the minimum and maximum torque window shall be considered acceptable. Torque values are recommended and can be affected by field conditions.

6.7 Acceptable / Unacceptable Make-up Position for USS-TALON HTQ® connections

6.7.1 An acceptable make-up position shall be measured with a 1” gauge block or equivalent measuring tool.

6.7.2 With the flat width of the 1” gauge block or measuring tool resting on the pipe, align one edge with the coupling face. The opposite edge should fall within the pin triangle stamp.

6.7.3 Connection make-up is acceptable if the positioned gauge block or measuring tool falls anywhere on or inside of the pin triangle stamp but does not extend beyond the tip the triangle (see Figure 2).

Figure 2: Acceptable Make-up Position USS-TALON HTQ®

6.7.4 An example of an unacceptable make-up is shown below. Note that the 1-inch gauge block is beyond the triangle stamp (Figure 3).

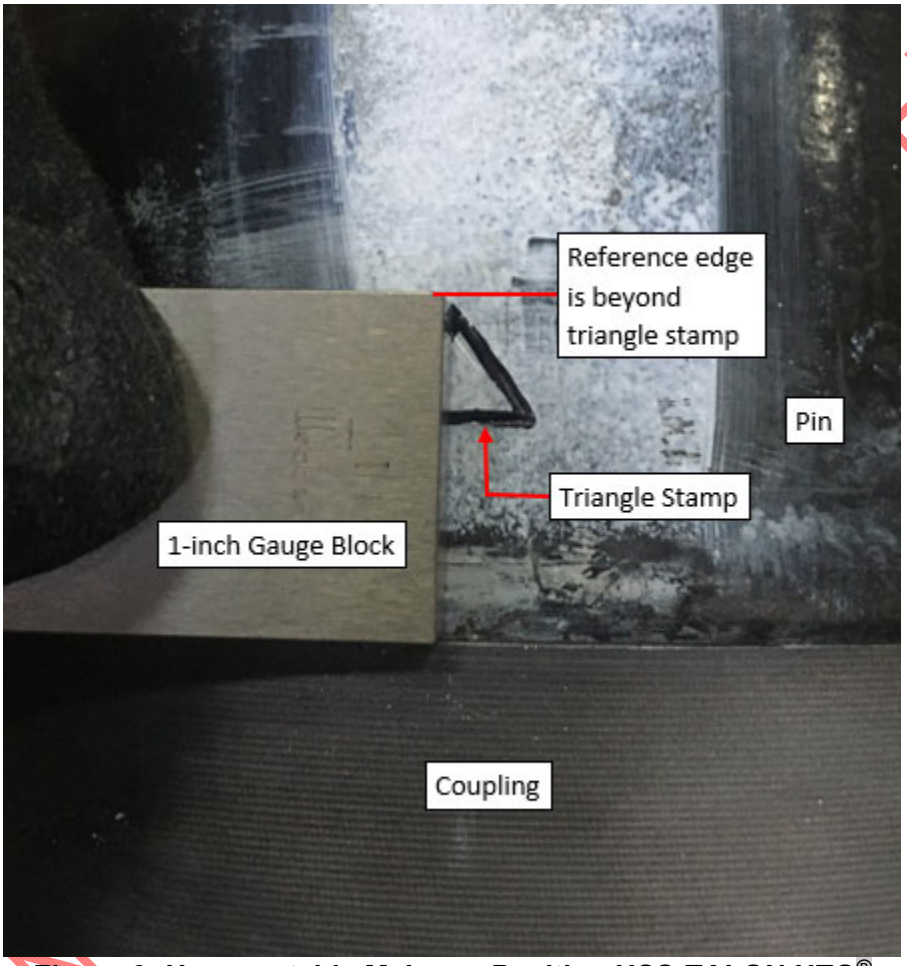

Figure 3: Unacceptable Make-up Position USS-TALON HTQ®

6.8 Acceptable / Unacceptable Make-up Position for USS-TALON SFC™ connections

6.8.1 An acceptable make-up position shall be measured with a 1” gauge block or equivalent measuring tool.

6.8.2 With the flat width of the 1” gauge block or measuring tool resting on the pipe, align one edge with the coupling face. The opposite edge should fall within the pin make-up marker groove.

6.8.3 Connection make-up is acceptable if the positioned gauge block or measuring tool falls anywhere on or inside of the pin make-up marker groove but does not extend beyond the back edge of the groove (see Figure 4).

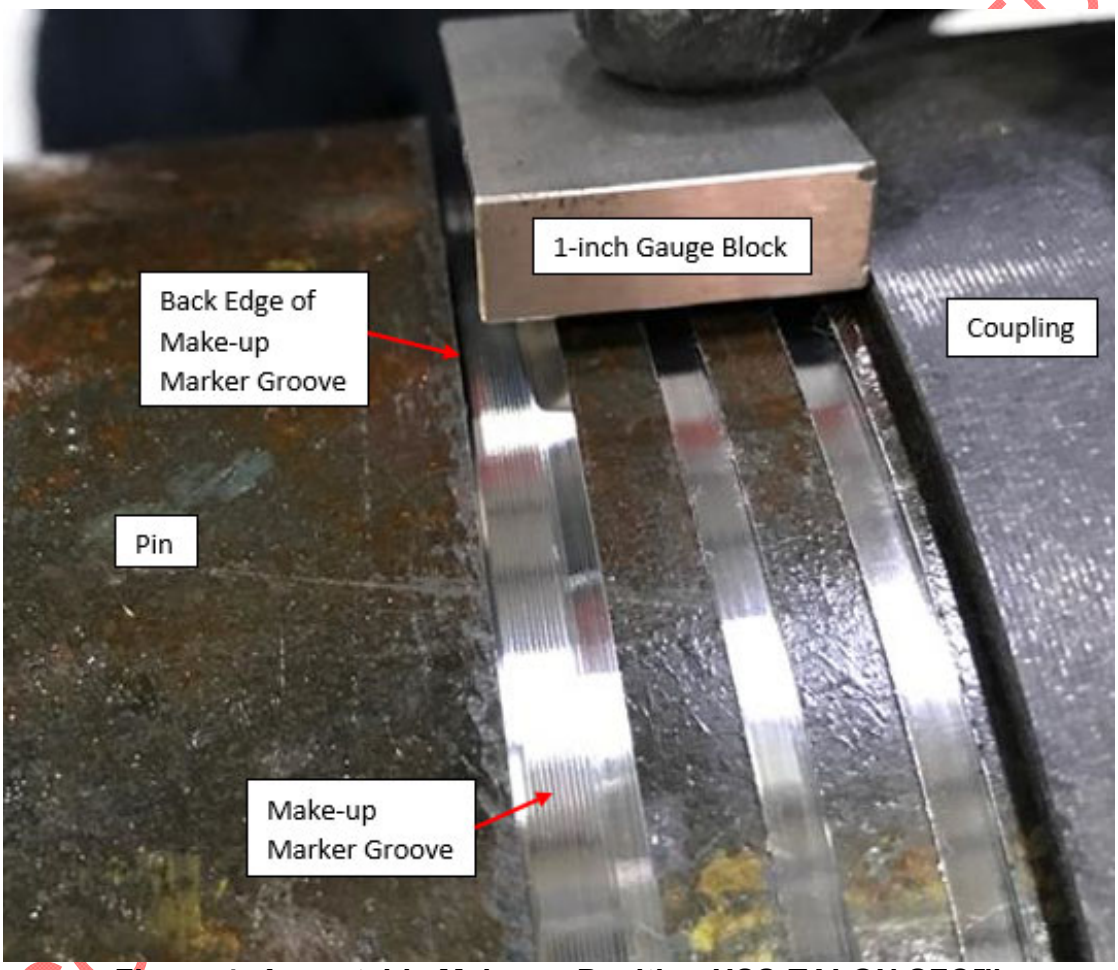

Figure 4: Acceptable Make-up Position USS-TALON SFC™

6.8.4 An example of an unacceptable make-up is shown below. Note that the 1-inch gauge block is beyond the make-up marker groove (Figure 5).

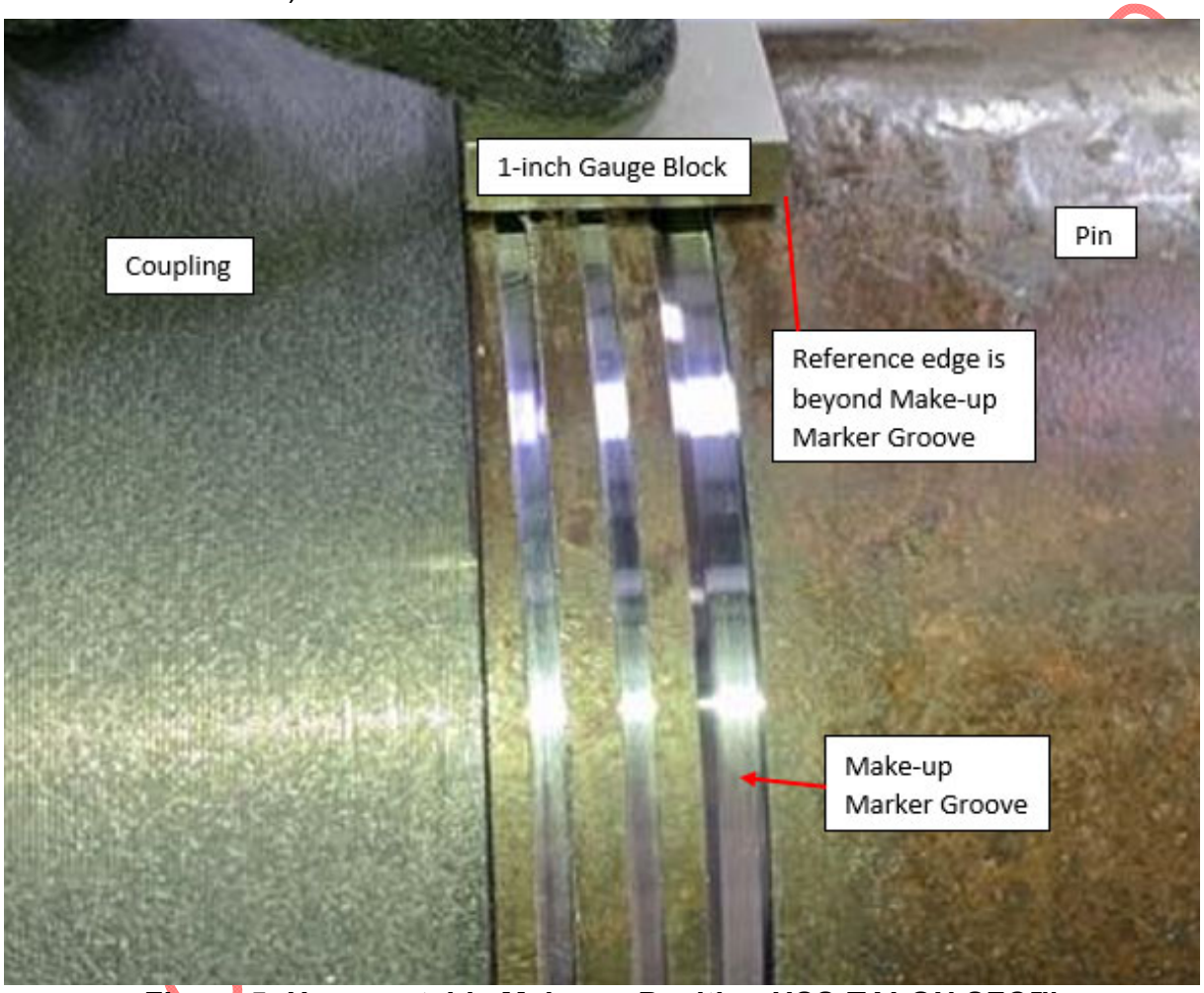

Figure 5: Unacceptable Make-up Position USS-TALON SFC™

6.8.5 Another example of an unacceptable make-up is shown below. Note that the 1-inch gauge block is short of the make-up marker groove (Figure 6).

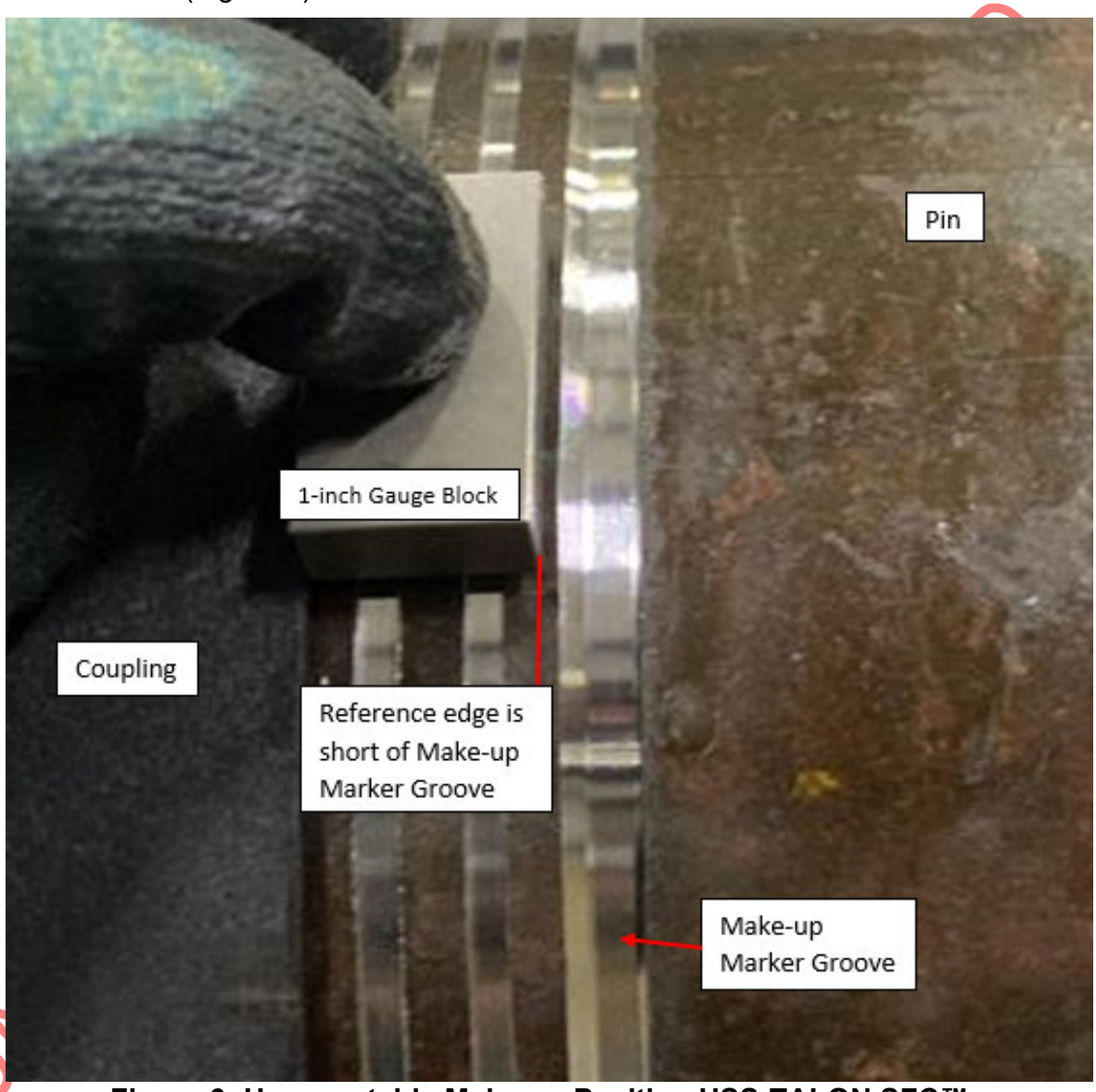

Figure 6: Unacceptable Make-up Position USS-TALON SFC™

6.9 First Run Requirements

6.9.1 The first 30 connections in the string shall be made up per the following procedure to validate running parameters.

6.9.1.1 Make-up the connection within the minimum and maximum torque window provided in the USS Product Data Sheet.

6.9.1.2 Verify proper make-up position as stated in Section 6.7 for USS-TALON HTQ® connections or Section 6.8 for USS-TALON SFC™ connections.

6.9.1.3 If proper make-up position is not achieved, check alignment and re-apply the same or more torque until the 1” gage block (or equivalent) intersects the base of the triangle or the make-up marker groove.

6.9.1.4 If 1” gage block (or equivalent) extends beyond the tip the triangle or the back edge of the make-up marker groove, the connection shall be broken out as outlined in Section 6.10. The pin and box connection shall be rejected, marked appropriately, and not reused.

6.9.2 After 30 consecutive successful make-ups, the make-up position shall be verified every 10 connections. All connections shall be made up to be within the minimum and maximum torque window (Make-up Acceptable Criteria Section 8.1.1). Make-up graphs shall be verified by an authorized USS representative.

6.9.3 The USS authorized rig site services representative has the authority ***to assess and accept connection make-ups***, which are outside the minimum and maximum torque window. When all other make-up requirements are met, the value shall not exceed 10% below or above the recommended torque value.

6.10 Break-out

6.10.1 When break-out of a connection is necessary, backup tongs shall be applied to the pipe body below the coupling.

6.10.2 Elevators shall remain in the relaxed position allowing for free movement of pipe during break-out. Place power tongs and backup as close to each other as possible to prevent bending during break-out. Slowly apply torque required to break-out connection. Never strike the connection to assist in break-out. Doing so will result in damage to the connection and will jeopardize its performance.

A weight compensator should be used during the break-out process whenever possible to prevent damage to the connection. For 8 5/8" and larger OD or heavy wall pipe, break-out with weight compensator is recommended. Use power tongs to back out in low gear until the pipe can be rotated with a strap or chain wrench to complete the removal.

6.10.3 Stop rotation immediately when the pin jumps inside the box. The use of a stabbing guide is required when lifting the pin out of the box. Lift the pin out slowly to avoid damage. Remove power tongs prior to separating the pin from the box connection.

6.10.4 Install clean, dry thread protectors prior to pipe movement.

7.0 Torque Monitoring Equipment

7.1 The use of a computerized torque monitoring system is required for make-up of USS-TALON HTQ® and USS-TALON SFC™ connections. The use of such equipment permanently records the make-up signature and final torque of each connection. It also gives the opportunity to evaluate the connection make-up prior to running the connection in the hole.

7.1.1 Only Torque vs. Turn plots shall be used to evaluate the make-up signature characteristics. Torque versus Time plots are for reference only and should be included if available. Any major anomalies shall require break-out of the connection. Inspection and repair of the connection, if needed, shall be conducted prior to the connection being re-made.

7.2 Setup of torque monitoring equipment

7.2.1 Minimum and maximum recommended make-up torques are listed on the USS connection performance sheet.

7.2.2 Reference torque shall be set between 200 to 600 ft-lbs.

7.2.3 Graph size and scale shall be set to produce a clear signature curve of the make-up. Recommended scale setting for Turns is 3 to 4 on the make-up graph. A maximum of two curves per sheet of paper are permitted on printed output.

8.0 Disposition of Make-up Curves

8.1 Make-up curves or signatures display the relationship of torque vs turns or torque vs. time. These curves demonstrate the make-up characteristics of each connection. The signatures should look similar to other signatures of the entire string of pipe. Any major abnormalities shall result in break-out of the connection to examine for damage and to determine the cause of the unusual graphs. USS authorized rig site services representatives are responsible for acceptance or rejection of the connection make-up curve.

8.1.1 An acceptable make-up signature is shown in Figure 7. The make-up signature shall be defined by the following criteria:

- The final torque shall fall between the minimum and maximum recommended make-up torque.
- The maximum non-linear shoulder torque target shall be equal to 83% of the minimum recommended make-up torque. The start of the linear portion of the make-up graph shall fall below the maximum non-linear shoulder torque target line and shall remain linear until final acceptable torque is achieved.

8.1.2 The make-up position of a connection with this signature shall be verified through an acceptable standoff measurement – 1” gage block or equivalent measuring tool. If proper make-up location is achieved, the connection shall be accepted.

8.1.2.1 If the make-up location has not been achieved, additional torque (up to 90% of connection maximum operating torque) may be applied to the connection to achieve acceptable make-up location.

8.1.2.1.1 Caution: Please ensure that neither pipe nor coupling gets crushed or ovalized during make-up.

8.1.2.2 If the make-up location is beyond the acceptable limit, the connection shall be broken out as outlined in Section 6.10. The pin and box connection shall be rejected, marked appropriately, and not reused.

8.1.3 A questionable make-up signature is defined as an irregular appearing signature that is significantly different than the acceptable make-up signature (Figure 7) and the signatures from the rest of the order. Examples of reject signatures are included:

8.1.3.1 Final torque falling below the minimum torque value (Figure 8). The make-up position of a connection with this signature shall be verified per Section 6.6 (Make-up Position and Torque). If proper make-up location is achieved, the connection shall be accepted. If the make-up location has not been achieved, additional torque (up to 90% of connection maximum operating torque) may be applied to the connection to achieve acceptable make-up location. If the make-up location is beyond the acceptable limit, the connection shall be broken out as outlined in Section 6.10. The pin and box connection shall be rejected, marked appropriately, and not reused.

8.1.3.2 Final torque exceeds the maximum torque value (Figure 9). The make-up position of a connection with this signature shall be verified per Section 6.6. If proper make-up location is achieved, the connection shall be accepted. If the make-up location has not been achieved, additional torque (up to 90% of connection maximum operating torque) may be applied to the connection to achieve acceptable make-up location. If the make-up location is beyond the acceptable limit, the connection shall be broken out as outlined in Section 6.10. The pin and box connection shall be rejected, marked appropriately, and not reused.

8.1.3.3 Yielding or deformation indications prior to final torque release (Figure 10). A connection with this signature shall be broken out and the pin and box connection shall be rejected, marked appropriately, and not reused.

8.1.3.4 Irregularities in the make-up chart (Figure 11). A connection with this signature shall be broken out as outlined in Section 6.10 and inspected.

8.1.4 In the case of a rejected signature curve, the connection in question shall be subjected to a backout evaluation.

8.1.4.1 If the connection make-up signature is rejected, the pin shall be broken out completely to expose the entire pin and box connection.

8.1.4.2 The pin and box shall be thoroughly cleaned and visually inspected for damage to the threads.

8.1.4.2.1 Connections found with detrimental damage in the thread area (galling) or any damage on the connection shall be rejected and marked appropriately. Minor thread damage can be field repaired.

8.1.4.2.2 Connections with no damage may be reassembled.

8.1.4.3 If the second make-up signature is acceptable or similar to the first make-up signature and final torque of the second make-up are within the acceptable limits, the connection shall be considered acceptable.

8.1.4.4 Connections shall not be made up more than three times. After third attempt to get an acceptable make-up signature, the connection shall be rejected, marked appropriately, and shall not be reused.

9.0 Common Causes of Connection Damage

9.1 When connections are experiencing galling or torn metal during break-out of signature rejects, there are some common causes that can be evaluated to correct this issue. Some of these causes are as follows:

9.1.1 Foreign materials (sand, dirt, diesel, or other) on threads and/or in thread compound. Reference Section 6.2.

9.1.2 Insufficient, excess or improperly applied thread compound. Proper thread compound application is critical to connection make-up. Reference Section 6.3.

9.1.3 Misalignment from vertical during stabbing, make-up or break-out. Reference Section 6.4.

9.1.4 Rocking of pipe to correct cross threading. Reference Section 6.4.

9.1.5 Setting backup tongs over box threads. Reference Section 6.5.

9.1.6 Continued rotation of pipe after threads have disengaged during pulling of pipe. Reference Section 6.10.

9.1.7 Improper handling of pipe during storage and movement of pipe. Reference Section 6.1.

9.1.8 Use of accessories with non-authorized USS connections. Reference Section 4.1.

9.1.9 Over-torque of the connection. Reference Section 6.6.

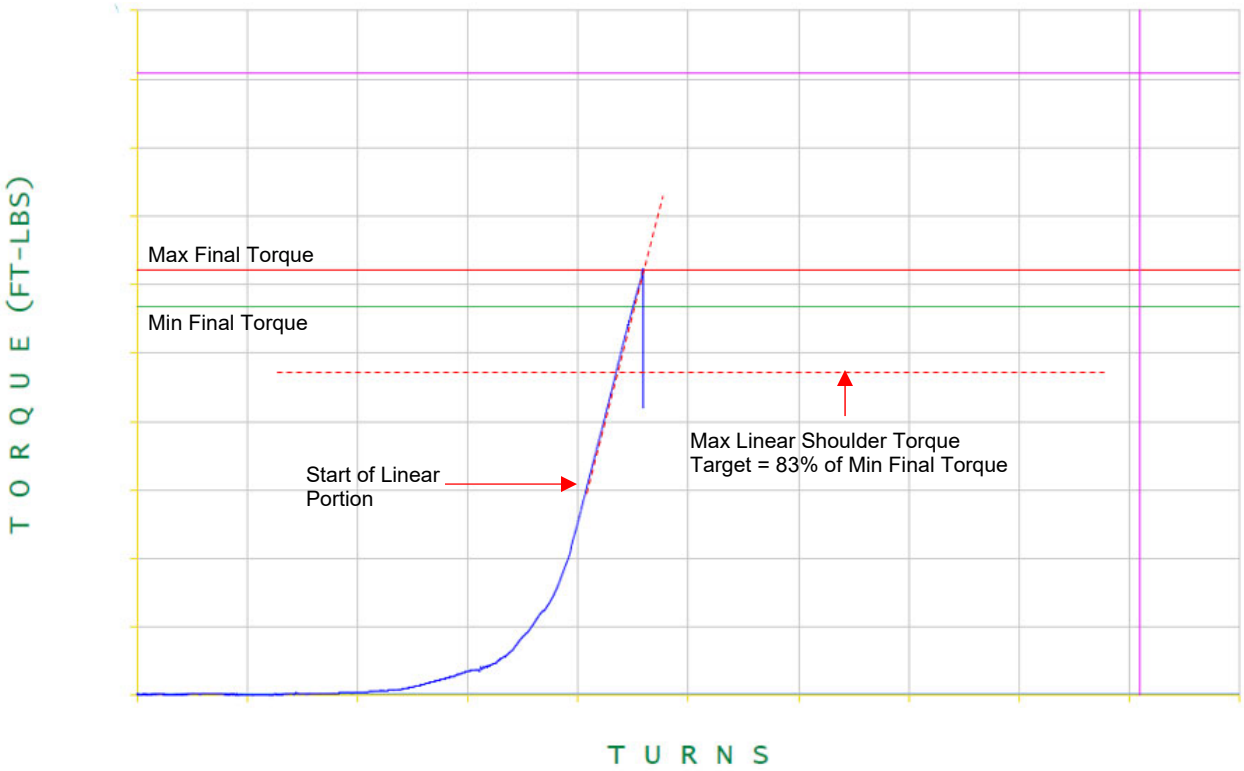

Figure 7: Typical Acceptable Make-up Signature

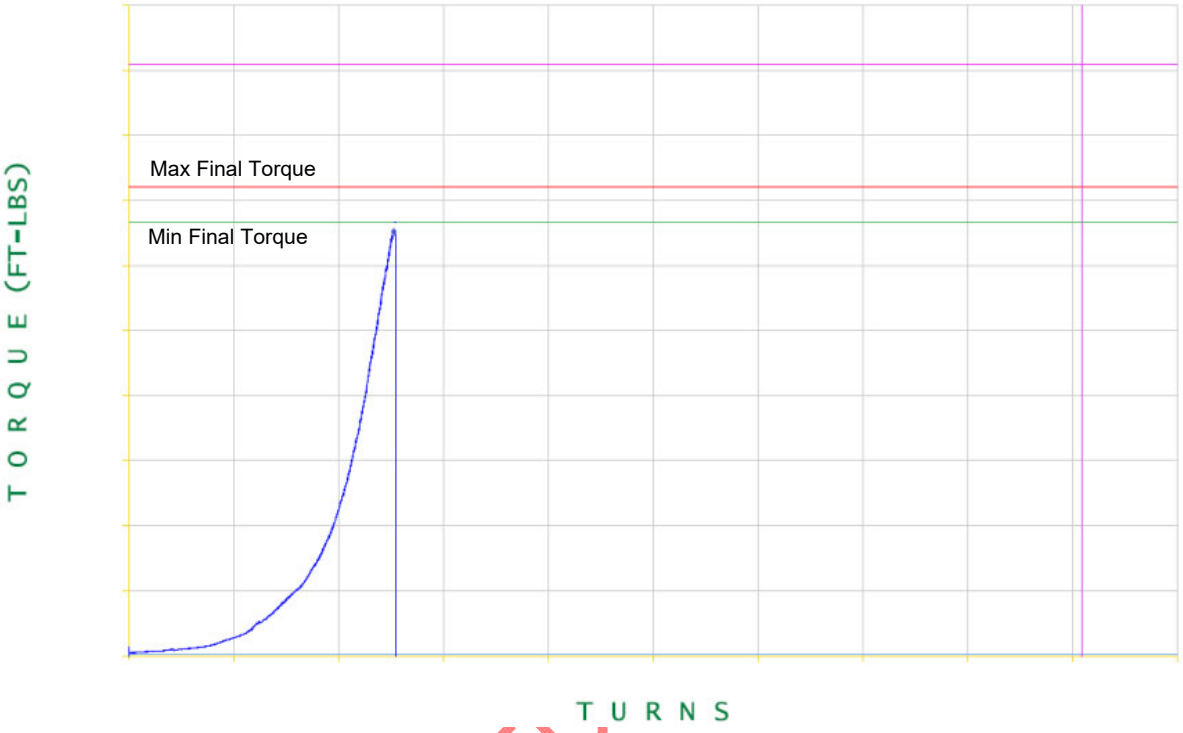

Figure 8: Below Min Final Torque

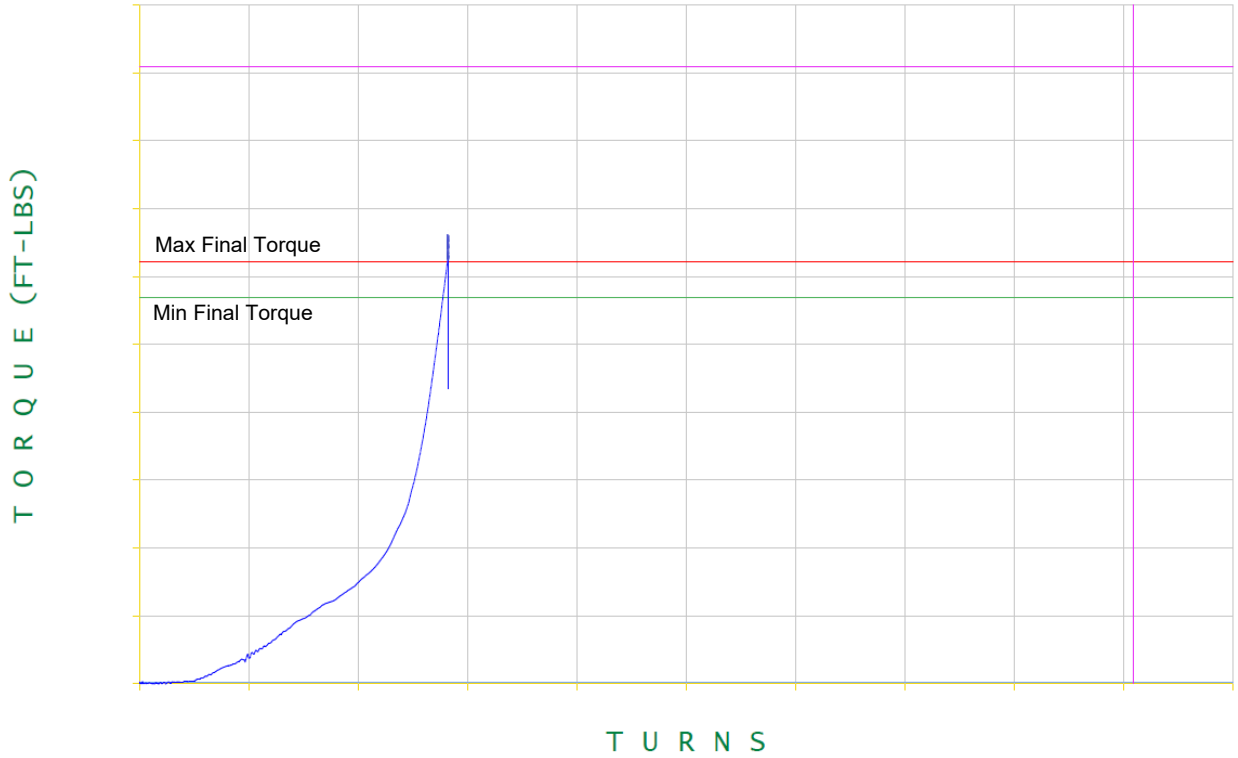

Figure 9: Exceeded Max Final Torque

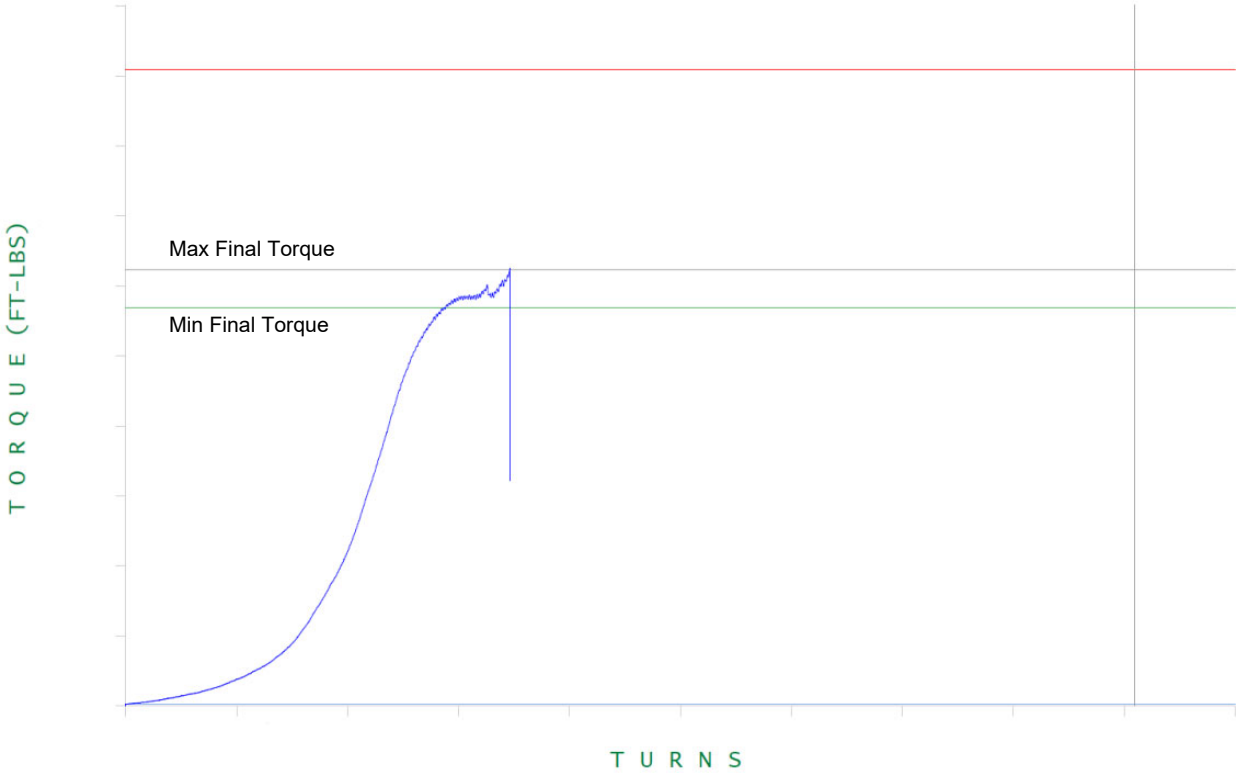

Figure 10: Yielding/deformation prior to final torque (Connection shall be rejected)

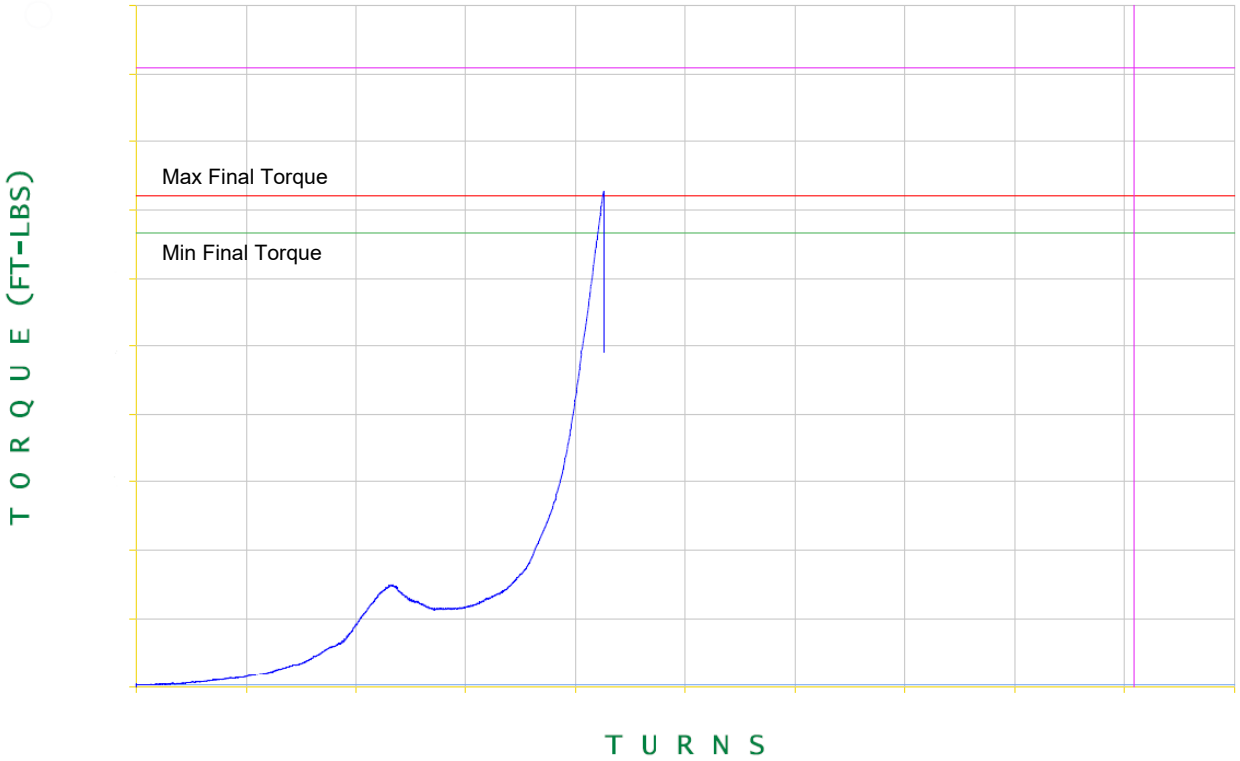

Figure 11: Irregularities in the make-up chart

10.0 Revision History

10.1 Corrected Section 8.1.1 to point to Figure 7.

10.2 All mentions of USS-TALON HTQ™ have been updated to USS-TALON HTQ®.

10.3 Added 4.500” x 0.250” – 0.290” wall configuration to Table 1.