RUNNING AND HANDLING PROCEDURE FOR U.S. STEEL USS-LIBERTY TC® CONNECTION	Procedure: ENG 03 Revision: 10 Effective Date:12/17/2024 Page: 1 of 14

1.0 Applicable Connections

1.1 USS-LIBERTY TC®
1.2 USS-LIBERTY TC® RD (Reduced Diameter)

2.0 Scope.

1.1 This engineering specification describes the requirements for running and pulling of U. S. Steel (USS) premium and semi-premium internally shouldered threaded and coupled connections. No variations from these requirements shall be permitted without written approval from U. S. Steel product engineering.

3.0 Definitions.

2.1 Internally Shouldered Threaded and Coupled Connections – Proprietary connections that incorporate an internal shoulder configuration.

2.2 Premium Connections – Proprietary connections that incorporate a metal-to-metal seal configuration with an internal shoulder to create a gas tight seal.

2.3 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. See figures 1-7.

2.4 Shoulder Torque – The mating of the two torque shoulders and evidenced by increasing torque with no additional turns on the Torque vs. Turn graph. See figures 1, 2, and 4.

3.0 Reference Documents.

3.1 ENG 05 Approved Running and Storage Compounds and Thread Protectors.

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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, licensed manufacturer, or repair shop shall be used. Unauthorized USS connections can jeopardize the entire string resulting in catastrophic consequences.

4.2 Elevators

4.2.1 Slip type or spider type elevators are recommended. Slips shall not be set over the threaded area or any formed area of the connection. Bottleneck elevators shall not be used.

4.3 Power Tongs, Gauges, and Torque Recorders

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

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

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

4.5 Thread Protectors

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

4.6 Thread Field Inspection

4.6.1 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 or seals.

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

4.6.3 Minor anomalies on thread and torque shoulder surfaces may be field repaired. Damage to seal surfaces, other than very minor oxidation, is cause for rejection. After repairs, threads and seal shall be cleaned and dried. Molybdenum Disulfide spray shall be applied to all repaired areas.

5.0 Thread Locking Procedure.

5.1 A combination of thread running compound and thread locking compound shall be used when thread locking compound is required.

5.1.1 All internally shouldered threaded and coupled connections.

5.1.1.1 Pin application: Apply a thin, uniform coat of thread running compound to seal (if applicable), shoulder and first two threads on pin, covering the entire circumference. Apply a thin, uniform coat of thread locking compound on the remainder of the threads on the pin, including the imperfect thread area, covering the entire circumference. The thread locking compound must be well worked into the thread form.

5.1.1.2 Box application: Apply a thin, uniform coat of thread running compound to the seal (if applicable), shoulder, and first two threads adjacent to seal area in box, covering the entire circumference. No thread locking compound shall be applied to the box.

5.1.1.3 A torque in excess of the connection maximum make-up torque may be required to shoulder the connections.

5.1.1.4 The use of excessive thread locking compound may result in a no shoulder situation.

5.1.1.5 Leaching of thread running compound and thread locking compound is acceptable at the mating areas.

6.0 Running Procedure.

6.1 Pipe handling

6.1.1 Extreme care shall be used when handling pipe. Pipe shall not be moved unless the threads, both pins and boxes, are protected with thread protectors. 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. All of the storage compound shall be removed to avoid a mixture of storage and running compounds during make-up.

6.2.2 Thread running compound 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 foreign thinning agents shall not be added to thread running compound for any reason.

6.2.3 Reference ENG 05 latest version for approved running compounds. All other connection compounds shall be reviewed and approved by USS Product Engineering prior to use.

6.3 Thread running compound application.

6.3.1.1 All Internally shouldered threaded and coupled connections.

6.3.1.2 Thread compound shall be applied to the entire thread and seal surfaces of both the pin and the box connection. The compound shall fill approximately 1/4 to 1/3 of the thread height.

6.4 Stabbing and thread engagement

6.4.1 A stabbing guide shall be used on the coupling thread to prevent damage to thread and seal surfaces.

6.4.2 The pipe must be in true vertical alignment over the box. Movement or sway of the pipe shall be held to a minimum. Only after the pipe is positioned properly, the pipe shall 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 doubles or triples.

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. The connection shall be free running without torque required. 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 from stab board during thread engagement.

6.5 Power Make-up

6.5.1 Power tongs are required. 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 seal engagement. High gear RPM shall be less than 12 RPM. Low gear RPM shall be 5 RPM or less. Make-up to within the recommended make-up torque range. 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 coupling. The elevator should not be latched until the make-up process is complete.

6.6 Make-up Torque

6.6.1 USS Connection Performance Data sheets provide torque values for USS proprietary connections. The torque values listed are the minimum and maximum recommended make-up torques, the connection yield torque, or the operational torque as stated on the USS Connection Performance Data sheet. The minimum and maximum recommended make-up torques can be averaged to obtain an optimum torque however, 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.

6.6.2 In isolated cases, the USS authorized rig site services representative has the authority to accept connections, which are outside the minimum and maximum torque window at their discretion. The value shall not exceed 10% below or above the recommended torque value.

6.7 Breakout

6.7.1 When breakout of a connection is necessary, backup tongs shall be applied to the center of the coupling.

6.7.2 Elevators shall be unlatched prior to breakout. Place power tongs and backup tongs as close to each other as possible to prevent bending during breakout. Slowly apply torque required to break out connection. Never strike the connection to assist in breakout. Doing so will result in damage to the connection and will jeopardize its performance.

6.7.3 A weight compensator should be used during the breakout process whenever possible to prevent damage to the connection.

6.7.4 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.

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

6.8 Torque Monitoring Equipment

6.8.1 The use of a computerized torque monitoring system is highly recommended for make-up of USS proprietary connections. The use of such equipment permanently records the make-up signature, shoulder torque, 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.

6.8.1.1 Torque vs. Turn plots are preferred over Torque vs. Time plots. These plots shall be evaluated for signature characteristics. Any major anomalies shall require breakout of the connection. Inspection and repair of the connection, if needed, shall be conducted prior to the connection being re-made.

6.8.2 Setup of torque monitoring equipment

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

6.8.2.2 Reference torque shall be set at 5% of the minimum recommended torque.

6.8.2.3 Graph size and scale shall be set to produce a clear signature curve of the make-up. A maximum of two curves per sheet of paper are permitted on printed output.

6.8.2.4 Minimum Shoulder Torque is 20% of minimum published make-up torque. Maximum Shoulder Torque is 80% of minimum published make-up torque.

7.0 Disposition of Make-up Curves.

7.1 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 breakout of the connection to examine for damage and to determine the cause of the unusual graph. USS Rig Site Services representatives are responsible for acceptance or rejection of the connection make-up curve.

7.1.1 An acceptable make-up signature is shown in figure 1. A distinct shoulder shall be present and shall fall in between the minimum and maximum shoulder torque values. The final torque shall fall between the minimum final torque and the maximum final torque values.

7.1.2 A rejected make-up signature is defined as an irregular appearing signature that is significantly different than the acceptable make-up signature (figure 1) and the signatures from the rest of the order. Some examples of reject signatures are:

7.1.2.1 Final torque falling outside the final torque maximum and minimum values (figure 2). A connection with this signature shall be broken out and inspected as outlined in section 7.1.3.

7.1.2.2 No distinct and visible shoulder (figure 3). A connection with this signature shall be broken out and inspected as outlined in section 7.1.3.

7.1.2.3 Shoulder torque value falling outside the shoulder torque maximum and minimum values (figure 4). A connection with this signature shall be broken out and inspected as outlined in section 7.1.3.

7.1.2.4 Yielding or deformation indications prior to final torque release (figure 5). A connection with this signature shall be broken out and the pin and box connection shall be rejected.

7.1.2.5 Interrupted rotation during make-up (figure 6). A connection with this signature shall be broken out and inspected as outlined in section 7.1.3.

7.1.2.6 Irregularities in the make-up chart prior to shouldering (figure 7). A connection with this signature shall be broken out and inspected as outlined in section 7.1.3.

7.1.3 In the case of a rejected signature curve, the connection in question shall be subjected to a back-out evaluation.

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

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

7.1.3.2.1 Connections found with detrimental damage in the thread area (galling) or any damage on the seal surface, the connection shall be rejected and marked appropriately.

7.1.3.2.2 Connections with no damage may be reassembled.

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

7.1.3.4 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 and shall not be used.

8.0 Common Causes of Connection Damage.

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

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

8.1.2 Insufficient or improperly applied thread compound. Proper thread compound application is critical to connection make-up. Reference section 6.3.

8.1.3 Misalignment from vertical during stabbing, make-up or breakout. Reference section 6.4.

8.1.4 Rocking of pipe to correct cross threading. Reference section 6.4.

8.1.5 Setting backup tongs over box threads. Reference section 6.5.

8.1.6 Continued rotation of pipe after threads have disengaged during pulling of pipe. Reference section 6.7.

8.1.7 Improper handling of pipe during storage and movement of pipe. See section 6.1.

8.1.8 Use of accessories with non-authorized USS connections. See section 4.1.

8.1.9 Over torque of the connection. See section 6.6.

9.0 Revision Notes:

9.1 Updated to new naming title for ease of identification.

9.2 Added Applicable Connections as Section 1.

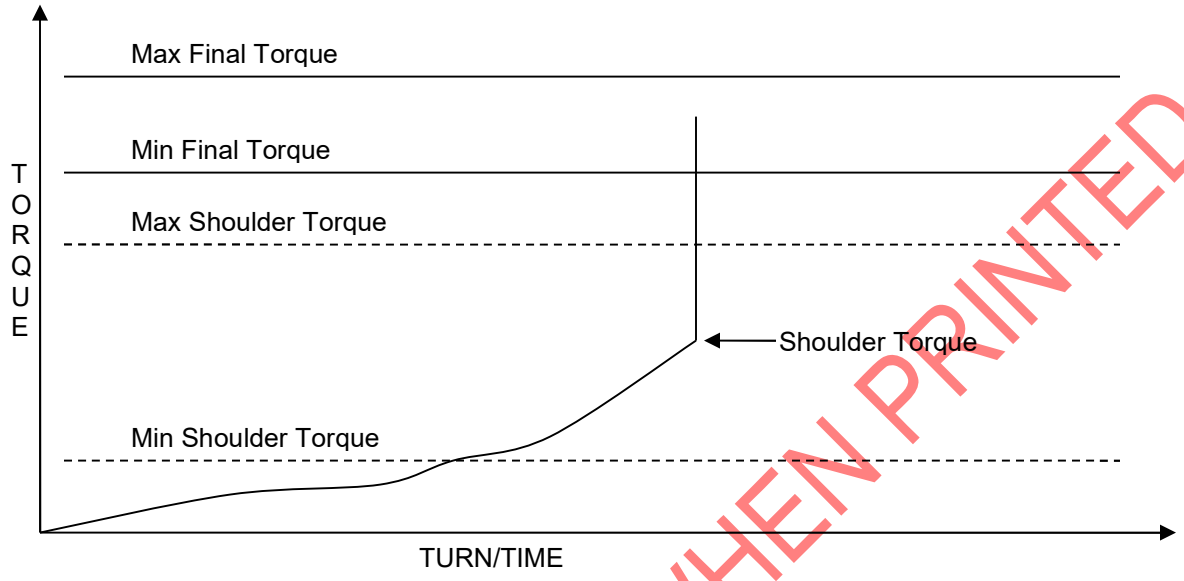

Figure 1 Typical Acceptable Make-up Signature

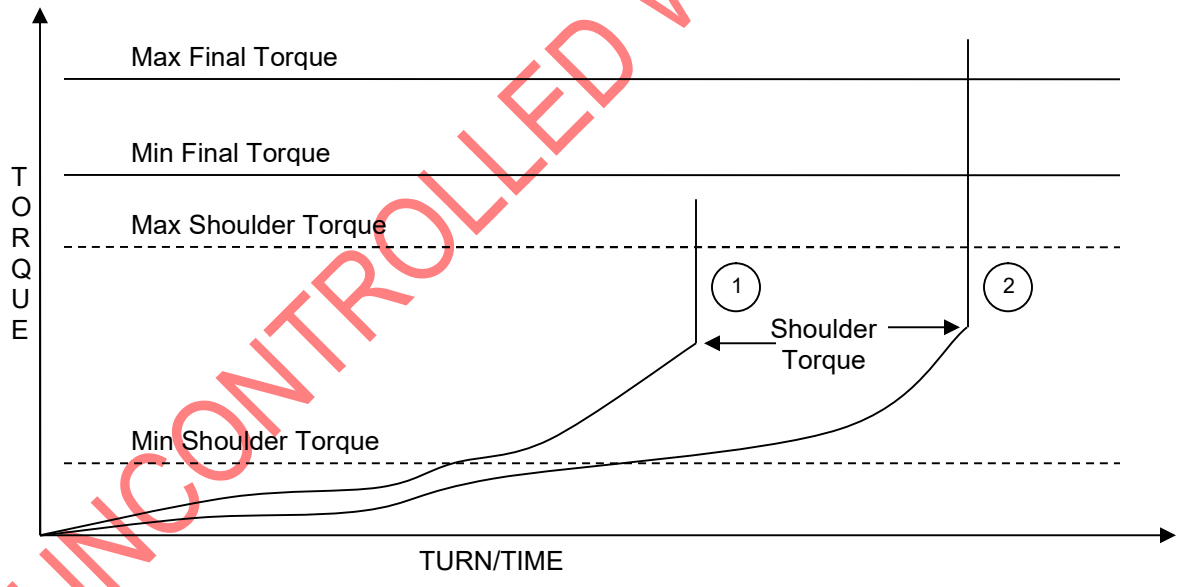

Figure 2 1. Below Min Final Torque (Breakout and evaluate)

2. Exceeded Max Final Torque (Breakout and evaluate)

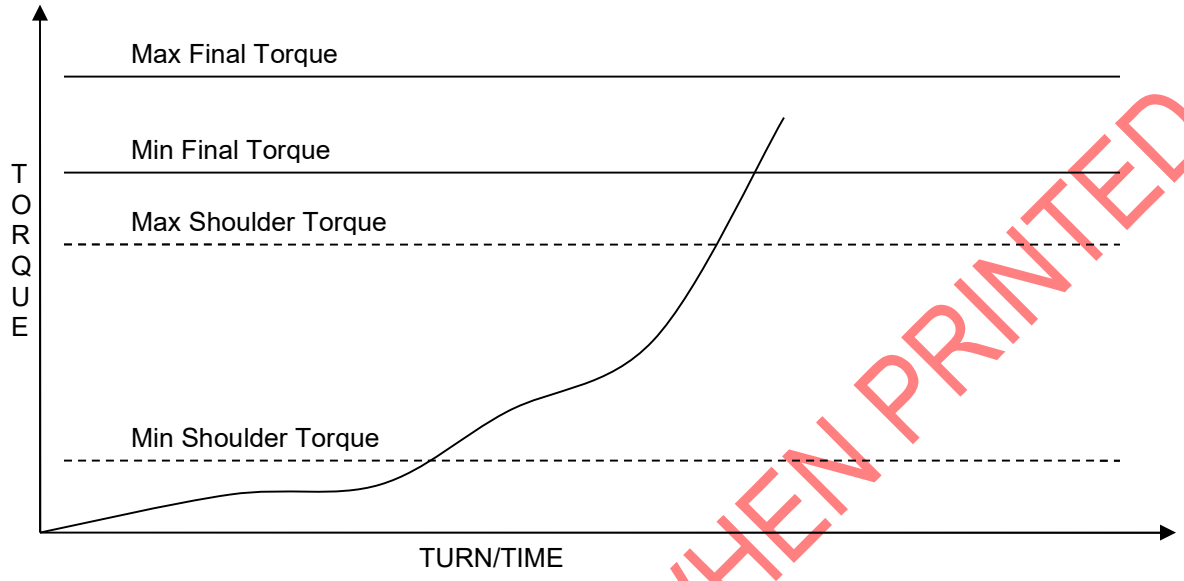

Figure 3 No visible shoulder (Breakout and evaluate)

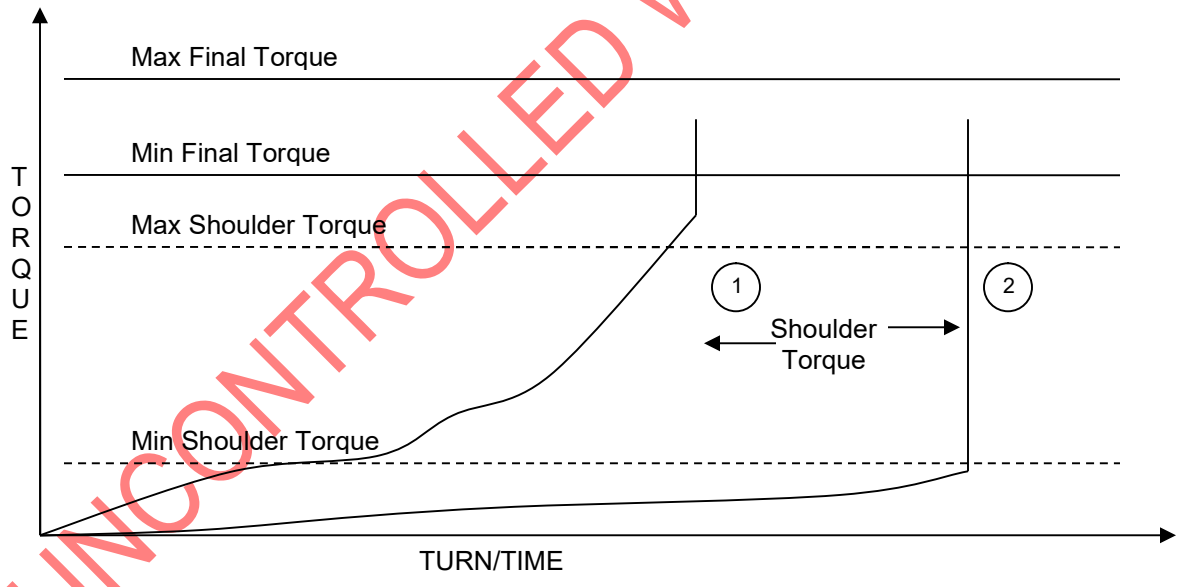

Figure 4 1. High shoulder (Breakout and evaluate)

2. Low shoulder (Breakout and evaluate)

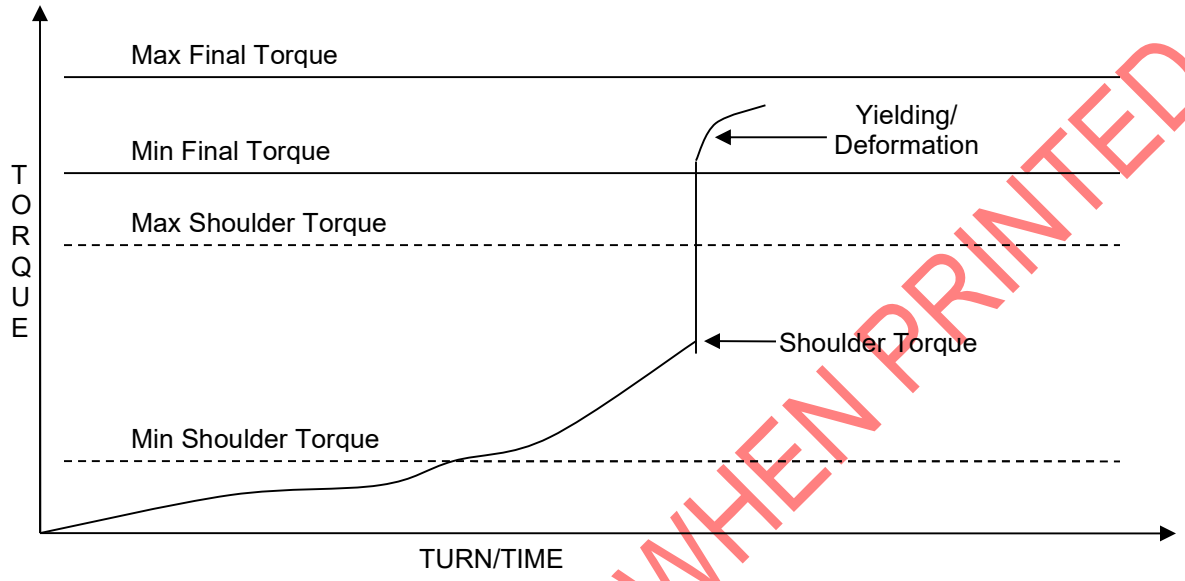

Figure 5 Yielding/deformation prior to final torque (Connection shall be rejected)

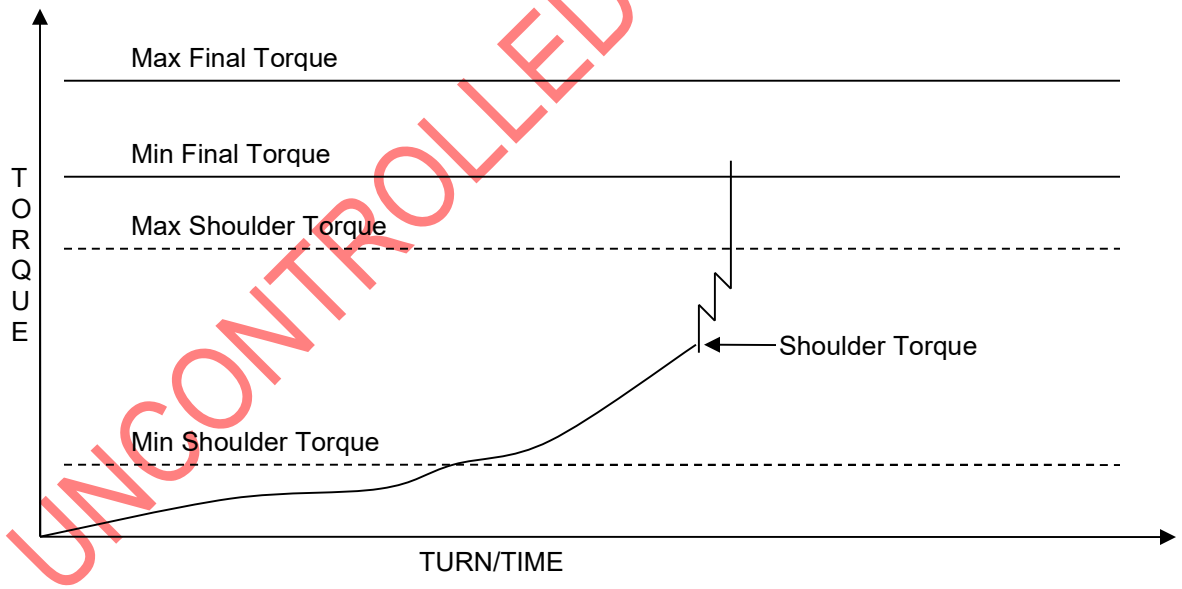

Figure 6 Interrupted rotation during make-up (Breakout and evaluate)

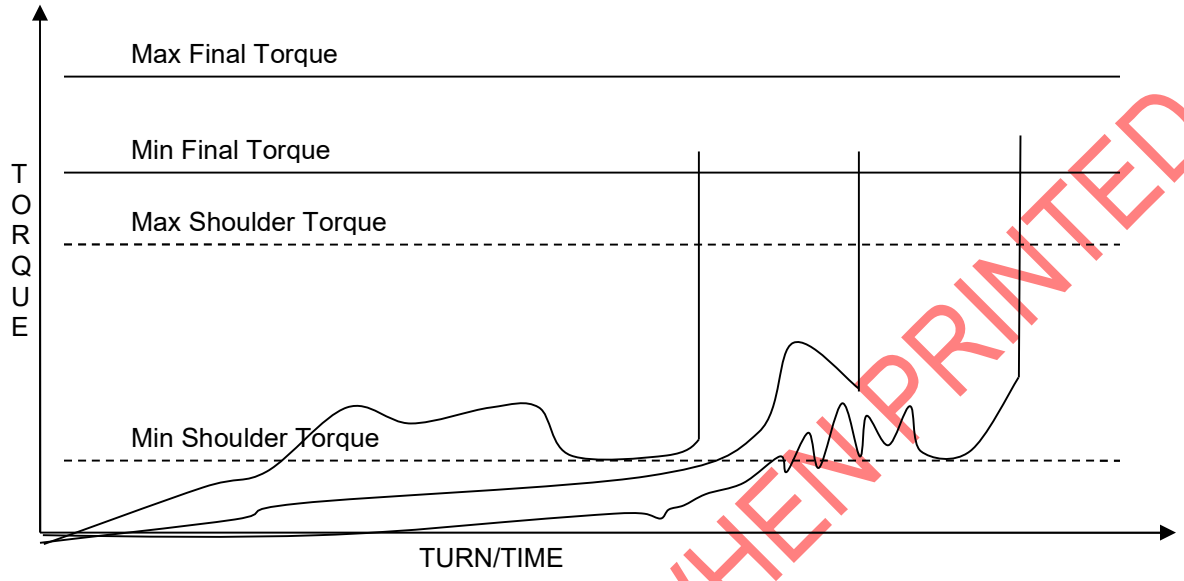

Figure 7 Irregularities prior to shoulder (Breakout and evaluate)