RUNNING AND HANDLING PROCEDURE FOR U. S. STEEL USS-LIBERTY FJM® CONNECTION	Procedure: ENG 09 Revision: 6 Effective Date: 12/17/2024 Page: 1 of 13

1. Applicable Connections

1.1. USS-LIBERTY FJM®

2. Scope.

2.1. The purpose of this specification is to provide a procedure to aid in the successful running and pulling of U. S. Steel (USS) USS-LIBERTY FJM® Premium Integral Connections. This document provides a procedure to avoid common causes of pipe and connection damage due to improper rig running and handling practices. Failure to follow this procedure may result in improper connection make-up and/or performance.

3. Definitions.

3.1. **Premium Integral Connections** – Proprietary connections designed to thread both pin and box connection on the pipe body (no coupling required) that incorporate a metal-to-metal seal configuration to create a gas tight seal.

3.2. **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.

4. Reference Documents.

4.1. ENG-05 Approved Running and Storage Compounds and Thread Protectors.

5. Equipment.

5.1. Accessory equipment

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

5.1.2. Only accessories threaded by a USS facility or licensed manufacturer or repair shop shall be used. Unauthorized USS connections can jeopardize the entire string resulting in catastrophic consequences.

Prepared by: TUMA, KEITH A	Prepared date: 08/05/2024
Reviewed by: BECKER, SHELBY L	Reviewed date: 08/06/2024
Approved by: SCHOENHALS, RYAN S	Approved date: 12/17/2024

5.2. Elevators

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

5.3. Handling Plugs and Safety Clamps

5.3.1. Handling plugs are available for each size and weight of USS-LIBERTY FJM® Premium Integral Connections. Handling plugs are not designed to support more than a single stand of pipe. Handling plug threads must be cared for and maintained. Threads shall be cleaned, inspected, and handled to prevent damage. To ensure proper thread engagement, both the handling plug and pipe box threads shall be free of any dirt, paint, and storage compound or thread compound. Handling plugs shall be fully made up by hand then tightened by bumping up with a bar. Handling plugs also provide protection of the box threads from damage by tools which may be run inside the pipe.

5.3.2. On flush joint connections, it is recommended that a safety clamp (wedding band, dog collar) be used in addition to the handling plug. The safety clamp shall be used until sufficient weight, or the manufacturer's rating of the safety clamp is achieved and /or customer's recommendation as required. The safety clamp shall be removed completely and not allowed to ride the pipe while pipe is being lowered into the well bore.

5.4. Power Tongs, Gages, and Torque Recorders

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

5.4.2. 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.

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

5.5. Thread Protectors

5.5.1. Properly fitting and clean thread protectors shall be applied to connections when stored on pipe racks or when it is being moved.

5.6. Thread Field Inspection

5.6.1. 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.

5.6.2. An authorized USS Rig Site Services Representative shall perform a thread inspection to evaluate thread integrity.

5.6.3. 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 re-cleaned and dried. Molybdenum Disulfide spray shall be applied to all repaired areas.

6. Thread Locking Procedure.

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

6.2. Pin application: Apply a thin, uniform coat of thread running compound to seals and shoulder covering the entire circumference. Running compound on first two threads is acceptable. Apply a thin, uniform coat of thread locking compound on the first half of the threads covering the entire circumference. The thread locking compound shall be well worked into the thread form. Avoid overlap of running compound and thread locking compound during application.

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

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

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

6.6. Mixing of thread running compound and thread locking compound is acceptable at the mating areas.

7. Running Procedure.

7.1. Pipe handling

7.1.1. Extra 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.

7.2. Thread running compound

7.2.1. Thread compound shall be applied to clean, dry connections. All storage compounds shall be removed to avoid a mixture of storage and running compounds during make-up.

7.2.2. Thread running compound shall be free of foreign contaminants (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.

7.2.3. Thread compound shall be specifically designed for use with premium connections. Reference ENG 05 latest revision. All other premium connection compounds shall be reviewed and approved by USS Product Engineering prior to use.

7.2.4. Thread running compound application

7.2.5. Pin Connection: A light coat of thread compound shall be applied to both internal seal and external seal/shoulder area. In addition to seals, thread compound shall be applied to threads between the external seal extending to the midpoint of the pin. The compound shall fill approximately 1/4 to 1/3 of the thread height.

7.2.6. Box Connection: A light coat of thread compound shall be applied to the internal seal area. In addition, thread compound shall be applied to threads between internal seal extending to the midpoint of the box. The compound shall fill approximately 1/4 to 1/3 of the thread height.

7.3. Stabbing and thread engagement

7.3.1. A stabbing guide shall be used on the pipe box thread to prevent damage to thread and seal surfaces.

7.3.2. 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.

7.3.3. A weight compensator shall be used, especially when running doubles or triples.

7.3.4. Remove stabbing guide after stabbing. Rotate the pipe by hand to insure proper thread engagement. Tongs may 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 should 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.

7.4. Power Make-up

7.4.1. Power tongs are required. The use of pipe wrenches, rig tongs or spinning chain shall not be used. Make-up at a steady and controlled speed, usually between 5 and 10 RPM's. 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 are not to be set over the box connection. The elevator should not be latched until the make-up process is complete.

7.5. Make-up Torque

7.5.1. USS Connection Performance Data Sheets provide torque values for all integral connections. The torque values listed are the minimum and maximum recommended make-up torques, as well as the connection yield torque. 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.

7.5.2. In isolated cases, the USS 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.

7.6. Breakout

7.6.1. When breakout of a connection is necessary, backup tongs shall be applied to pipe body below the connection.

7.6.2. 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.

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

7.6.4. 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.

7.6.5. Install clean, dry thread protectors to the connection prior to pipe movement.

7.7. Torque Monitoring Equipment

7.7.1. The use of a computerized torque monitoring system is highly recommended for make-up of USS integral 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.

7.7.2. Torque vs Turns 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.

7.7.3. Setup of torque monitoring equipment

7.7.3.1. Minimum and maximum recommended make-up torques are listed on the USS Connection Performance Data Sheet.

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

7.7.3.3. 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.

7.7.3.4. Minimum Shoulder Torque is 20% of minimum final make-up torque. Maximum Shoulder Torque is 80% of minimum final make-up torque.

8. 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 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.

8.1.1. 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.

8.1.2. 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:

8.1.2.1. 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.

8.1.2.2. 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.

8.1.2.3. 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.

8.1.2.4. 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.

8.1.2.5. 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.

8.1.2.6. 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.

8.1.3. In the case of a rejected signature curve, the connection in question shall follow a backout evaluation.

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

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

8.1.3.3. 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.

8.1.3.4. Connections with no damage shall be reassembled.

8.1.3.5. 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.

8.1.3.6. 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.

9. Common Causes of Connection Damage.

9.1. 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:

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

9.1.2. Insufficient 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 breakout. 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 6.7.

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

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

9.1.9. Over torque of the connection. See section 6.6.

10. Revision Notes:

10.1. Updated Document name.

10.2. Added Section 1.0.

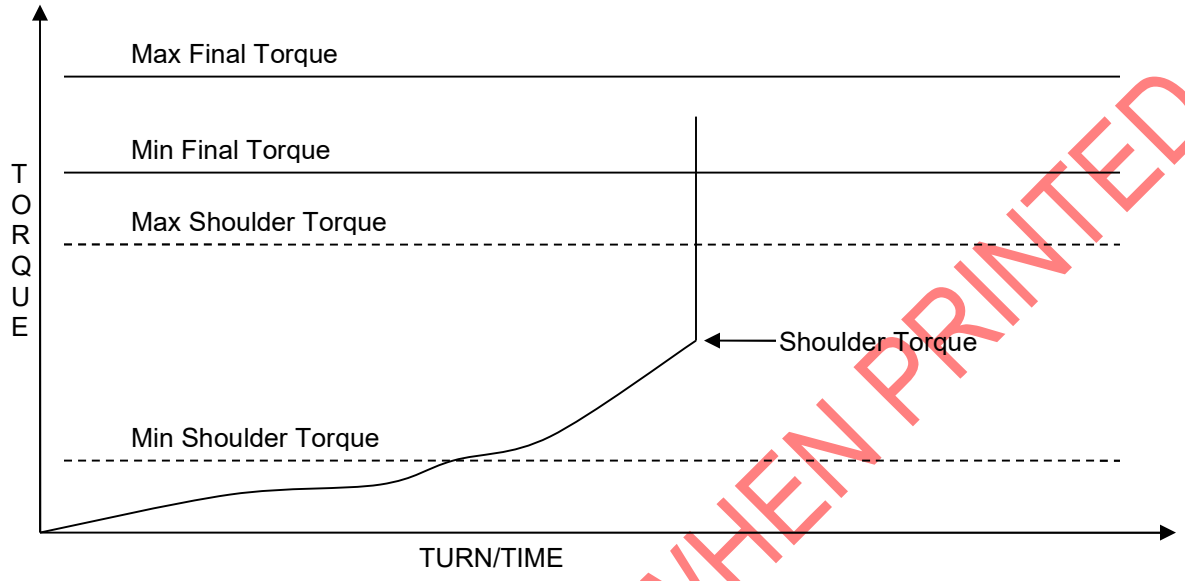

Figure 1: Typical Acceptable Make-up Signature

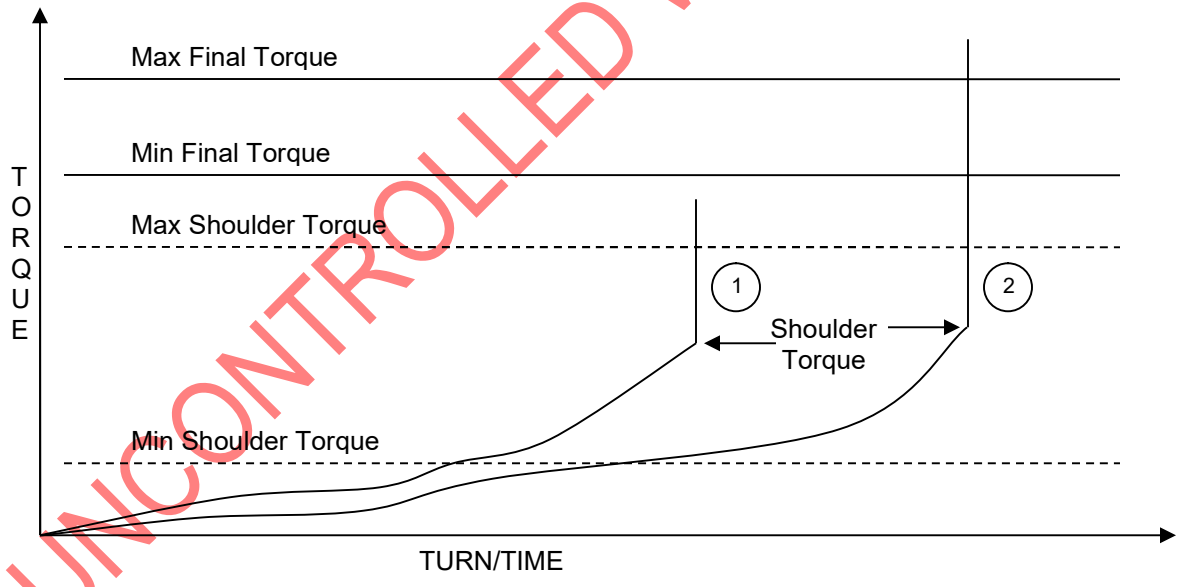

Figure 2: 1. Below Min Final Torque (Breakout and evaluate)
2. Exceeded Max Final Torque (Breakout and evaluate)

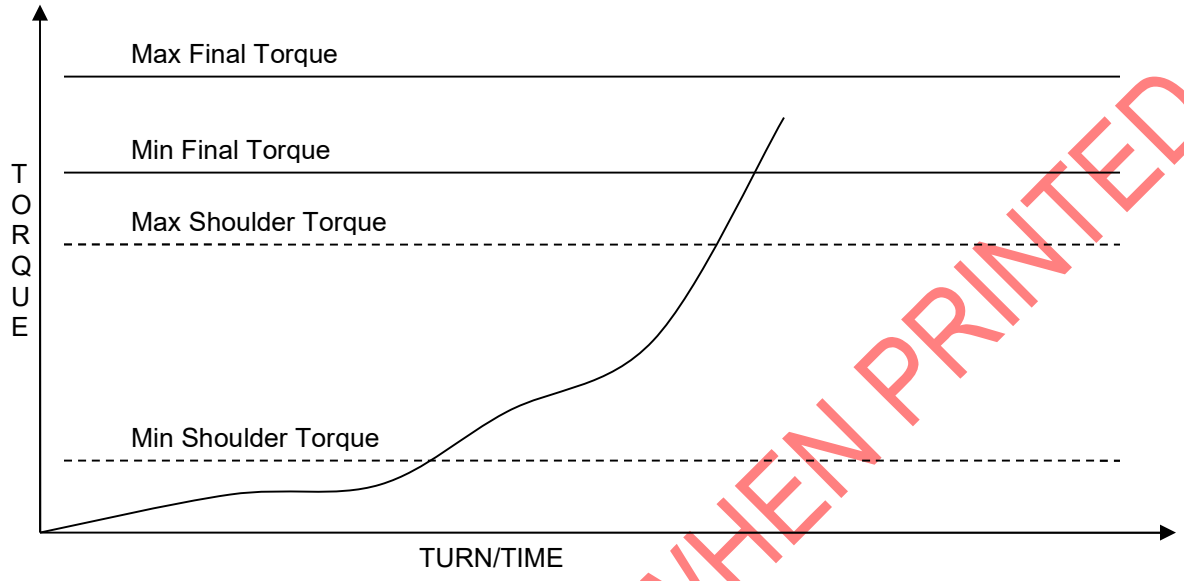

Figure 3: No visible shoulder (Breakout and evaluate)

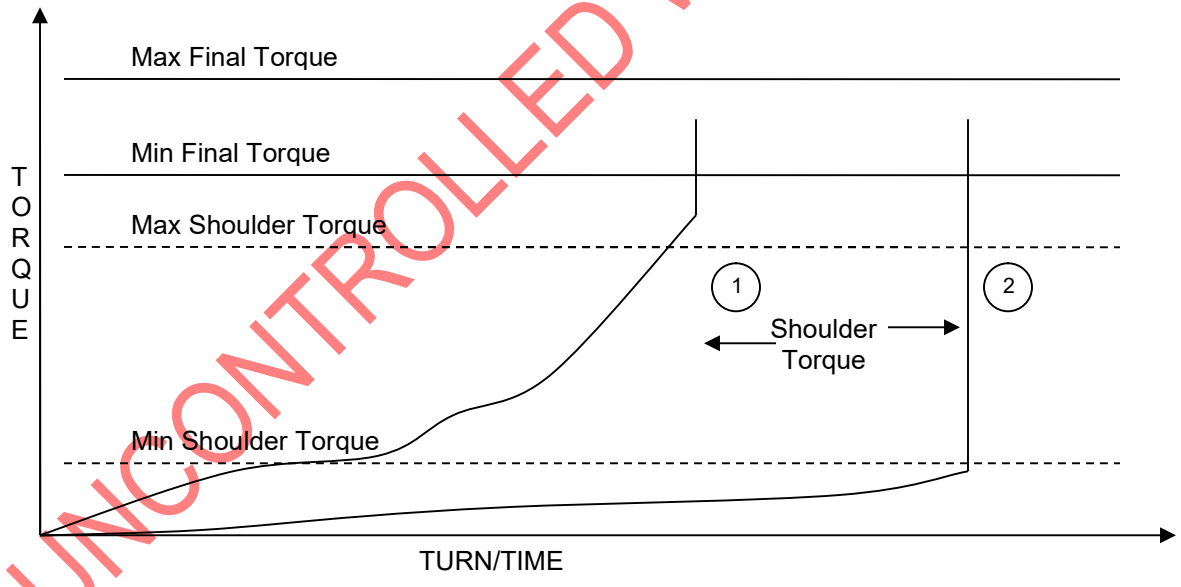

Figure 4: 1. High shoulder (Breakout and evaluate)
2. Low shoulder (Breakout and evaluate)

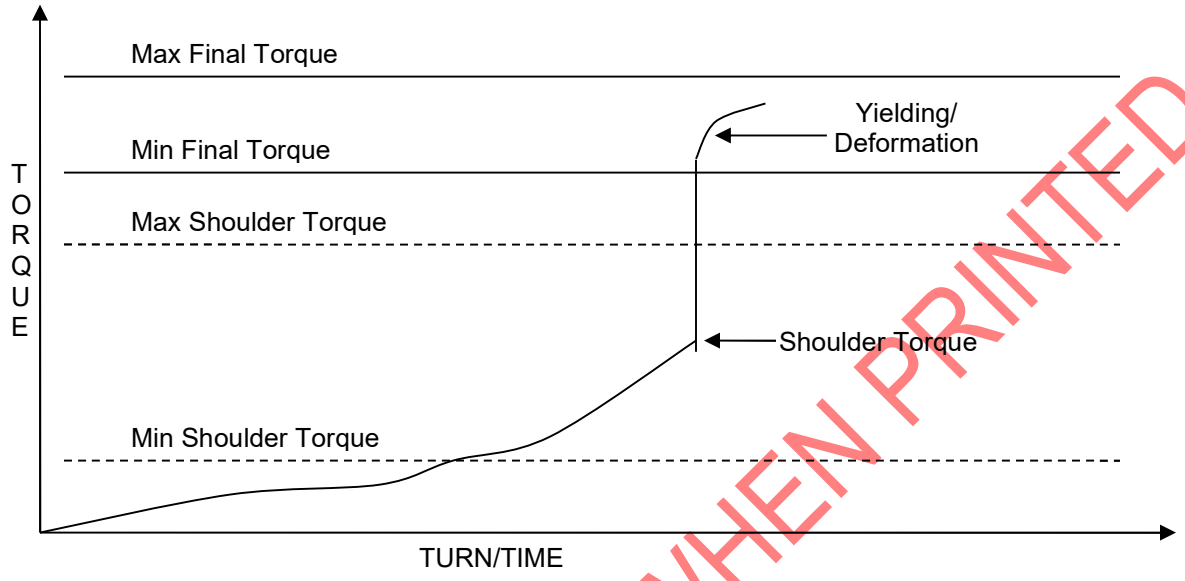

Figure 5: Yielding/deformation prior to final torque (Connection shall be rejected)

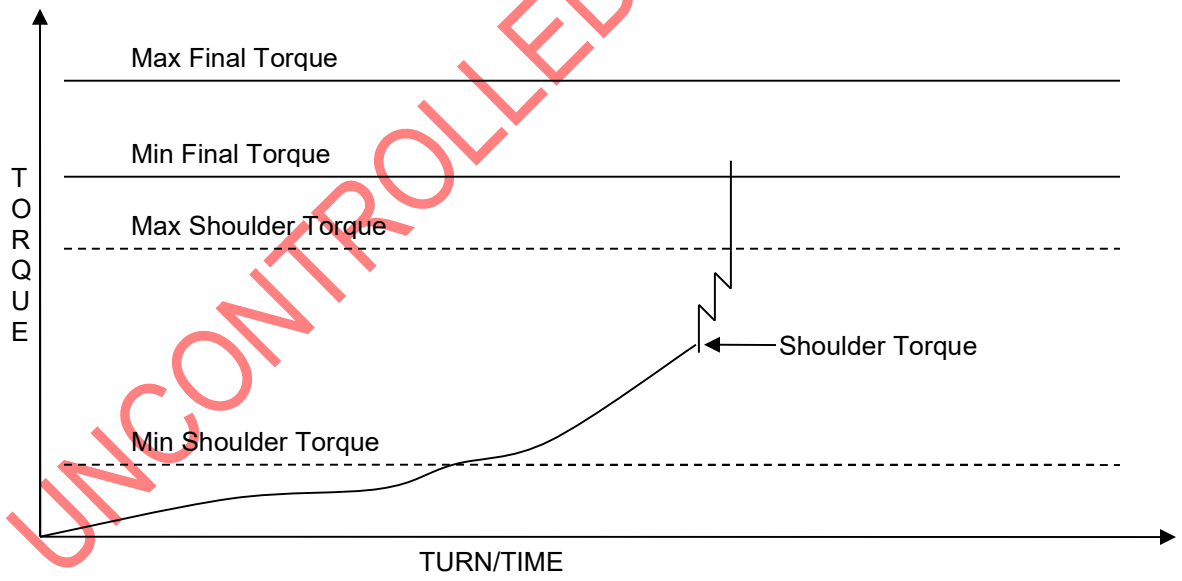

Figure 6: Interrupted rotation during make-up (Breakout and evaluate)

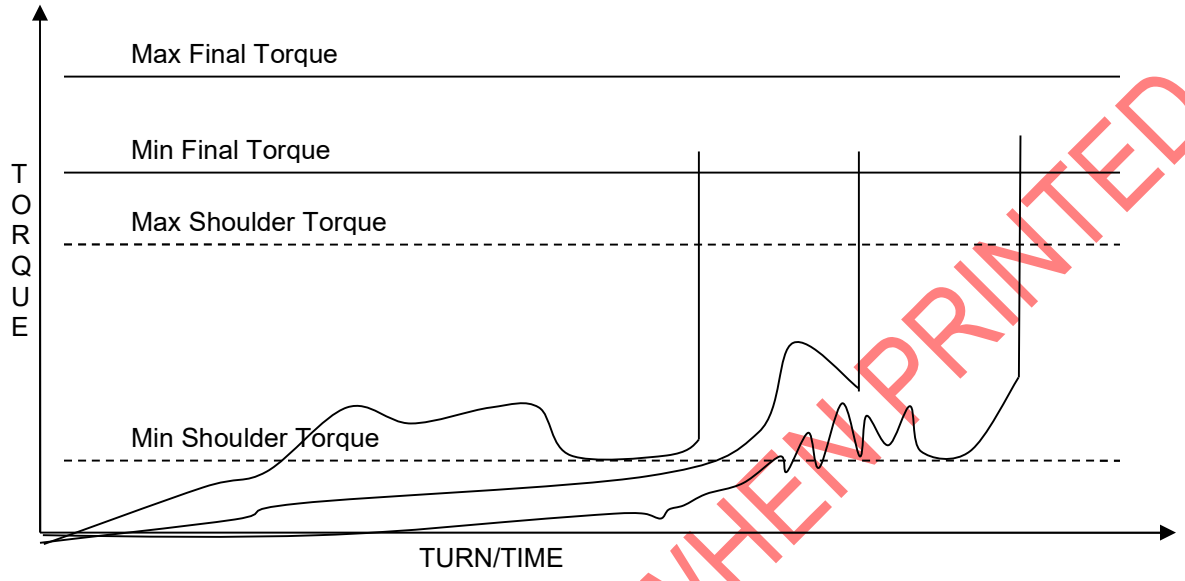

Figure 7: Irregularities prior to shoulder (Breakout and evaluate)