

## 1. SCOPE

This document outlines the methods, equipment, and criteria for the field inspection and repair of DUO double shoulder rotary shouldered connections to Complete Tubular Products requirements.

This document is intended to provide guidelines only for DUO double shoulder connections and is not meant to replace or supersede any documentation specific to any other connections.

To properly support the DUO connection Complete must be informed immediately once the number of connections requiring rethreading or refacing exceed 5% of the total lengths being inspected.

## 2. EQUIPMENT

### 2.1. Hand Tools

- 12-inch (300 mm) steel ruler with 1/64" (0.5mm) graduations
- OD and ID spring calipers
- Long stroke depth caliper with wide extension base attachment
- Triangular file
- Flapper wheel
- Buffing wheel

### 2.2. Gauges

- DUO thread profile gauge
- DUO transition thread tool

### 2.3. Documentation

- Connection data sheets as required
- Field inspection dimension drawings – latest revision

Connection Name	Pin Drawing	Box Drawing
DUO (all)	T000284	T000285

## 3. PRE-INSPECTION

- 3.1.1. All threads and shoulder surfaces shall be cleaned and dried adequately to allow for a full visual inspection. Cosmetic corrosion should be removed using a method which will not damage or remove any material from the connection, for example a wire wheel buffer.

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3	JUN 9 2021	DMK	--	THREAD LENGTH RECORDING REQUIREMENTS
4	MAR 23 2022	DMK	--	REVISION 4.12 & 5.8
5	APR 22 2024	DMK	--	REVISION 5.3 & 5.4

**4. VISUAL INSPECTION**

**4.1. Primary Seal Shoulder**

- 4.1.1. The primary seal shoulder must be free of galls, nicks, washes, fins, or any other damages which could compromise pressure holding ability or connection stability after make-up.
- 4.1.2. Damage not exceeding 1/32" (0.8mm) in depth that crosses less than 30% of the radial seal width or less than 25% of the circumference may be deemed acceptable. Damage above these limits must be repaired by refacing the entire seal surface.
  - 4.1.2.1. Any refacing repair should only remove enough material to repair the damage. A maximum of 1/32" (0.8mm) may be removed in a single refacing operation, and a maximum of 1/16" (1.6mm) may be removed from the connection before re-threading is required. If damage is not completely removed in a single refacing operation the remaining damage is less than the limits outlined in section 4.1.2 the connection shall be determined acceptable. If the connection is furnished with benchmarks, refer to the field inspection drawings for further measurements and details.
  - 4.1.2.2. If the pin and box connection lengths are within inspection tolerances, the primary seal shoulder and the secondary shoulder must be refaced at the same time to ensure the connection length remains constant. Following acceptable refacing operations the connection length dimension shall be checked; see sections 5.5 and 5.8.
  - 4.1.2.3. Note that any refacing operation requires reworking of the bevel diameter; see section 5.2.
  - 4.1.2.4. Refacing in the field must be completed using a barrel refacer supplied by Complete. If the repairs are sent to a machine shop, Complete shall be notified and given first right to perform the machine shop refacing. If Complete is unable to accept the repairs, refacing shall be sent to only a Complete licensed repair facility.

**4.2. Eccentric Wear**

- 4.2.1. Evaluate the box connection tool joint OD for eccentric wear. If eccentric wear is suspected, dimensional inspection shall be conducted on the box counterbore wall thickness at the point of minimum thickness; see section 5.4

**4.3. Pin Tool Joint ID**

- 4.3.1. Examine the ID of the pin tool joint for wear or erosion affecting the overall diameter or concentricity. If a change in concentricity or diameter is detected, a dimensional inspection of the altered ID region shall be conducted; see section 5.6.

**4.4. Secondary Shoulder**

- 4.4.1. Damage to this surface is not critical unless the damage interferes with make-up, driftability, or torsional capacity of the connection. Washes, dents, scratches and cuts smaller than 1" (25.4mm) in length which do not cause connection rejection due to shortening of the connection length will not affect this surface.
- 4.4.2. Erosion from the inner diameter of the secondary shoulder exceeding beyond the 45° internal bevel and present around the entire circumference of the secondary shoulder shall be cause for rejection.
- 4.4.3. Damage which protrudes from this surface may be removed by filing.
- 4.4.4. Use a straight edge across the pin nose to detect deformation of the pin nose geometry including swelling, crushing or tapering of the secondary shoulder face. If there is evidence of such damage, the pin nose OD and ID shall be measured; see section 5.7.

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**4.5. Transition Threads**

- 4.5.1. The transition region of the DUO connection is designed to allow for damage and subsequent field repair to be performed without compromising the performance of the connection.
- 4.5.2. Transition threads may be located by directly measuring the connection based on the appropriate field inspection drawing, or by utilizing the appropriate DUO transition thread tool as shown in Figure 1 and Figure 2. It is recommended that the threads be identified with a paint marker for ease of inspection.

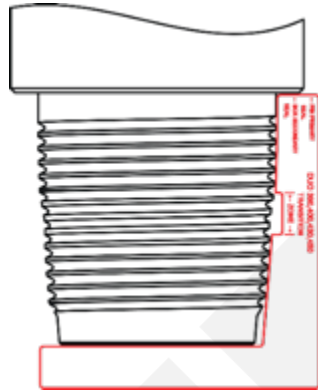


Figure 1 - PIN TRANSITION REGION

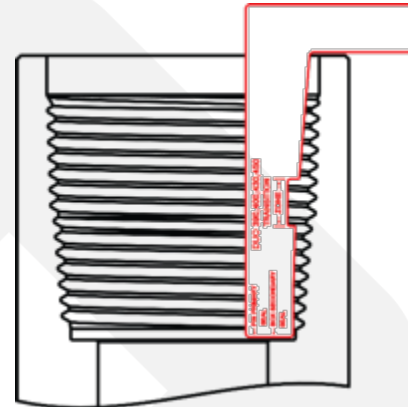


Figure 2 - BOX TRANSITION REGION

- 4.5.3. All surface damage to thread crests and thread flanks within this region is to be field dressed and/or field repaired using a round-corner triangular file and/or flapper wheel and/or soft buffing wheel.
- 4.5.4. Damage to this region involving partially missing or destroyed threads, cracking in the thread root or thread flank, or other similarly catastrophic damage shall require rethreading of the connection.
- 4.5.5. Thread lead within, and across, the transition region cannot be accurately measured and as such is not to be inspected.

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**4.6. Load-bearing Threadform (.75" and 2.0" Taper)**

- 4.6.1. Thread flanks shall be free of damages exceeding 1/16" (1.6mm) in depth, or 1/8" (3.2mm) in diameter. Thread roots shall be free of damage extending below the radius of the thread form. Thread crests shall be free of damage which could interfere with proper makeup.
- 4.6.1.1. Material protruding outside the thread form may be removed by hand with a round-corner triangular file or appropriate soft deburring wheel
- 4.6.2. The thread profile shall be verified for both taper regions using the thread profile gauge as shown in Figure 3 to Figure 6. If the profile gauge does not mesh evenly in the thread and show normal contact, a dimensional inspection of the thread lead within a single taper region shall be conducted; see section 5.1.

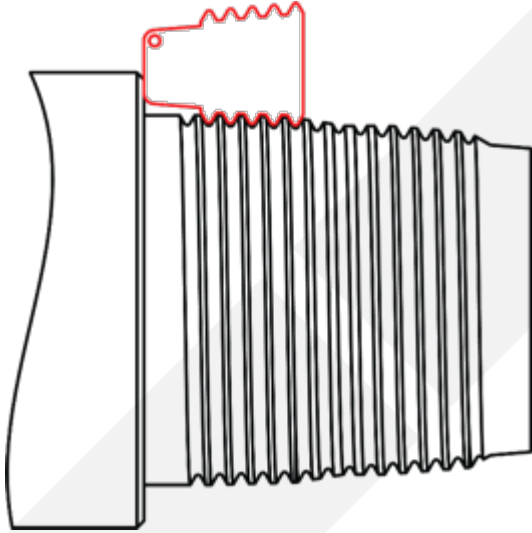


Figure 3 - 0.75 TPF THREAD PROFILE PIN

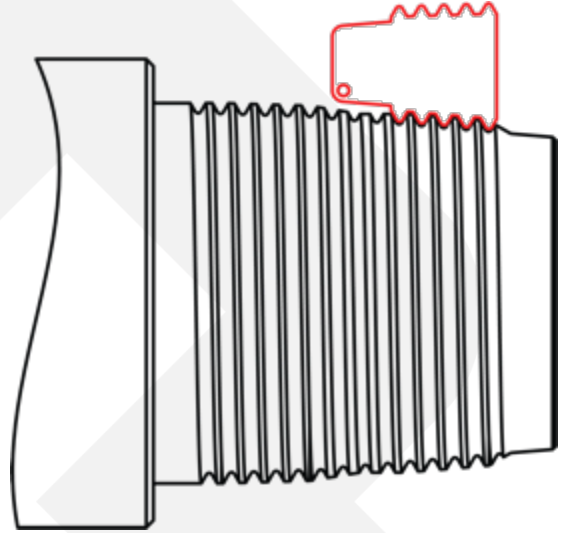


Figure 4 - 2.00 TPF THREAD PROFILE PIN

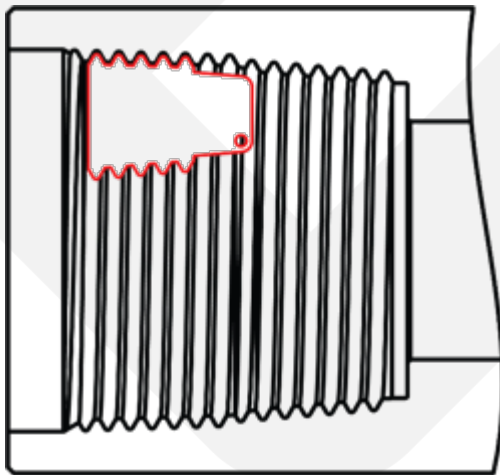


Figure 5 - 0.75 TPF THREAD PROFILE BOX

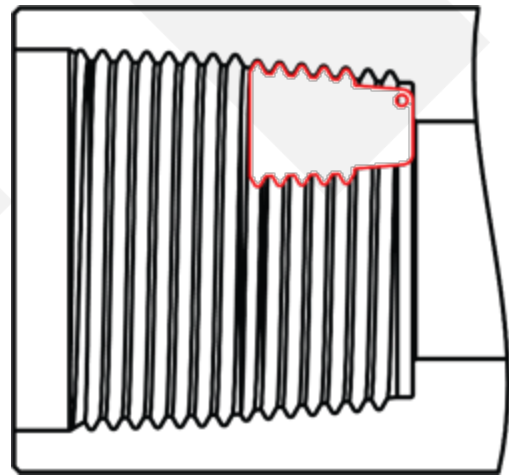


Figure 6 - 2.00 TPF THREAD PROFILE BOX

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## 5. DIMENSIONAL INSPECTION

All dimensional measurements shall be compared to the appropriate field inspection drawings and/or connection data sheets to determine acceptance/rejection of a connection. All dimensions below indicated as **Record** shall be 100% recorded. All dimensions below indicated as **Check** do not require recording unless the dimension is found to be outside of specifications.

### 5.1. Check Lead

5.1.1. If the profile gauge does not mesh properly in the thread form for either tapered section, the thread length shall be checked to ensure it is within field inspection tolerance. If thread length is acceptable, the thread lead shall be measured over a 1" interval and may not deviate by more than 0.003". Note: Lead gauge calibration shall be completed with the DUO™ lead gauge standard. Measuring lead within the transition region may result in inaccurate values.

5.1.1.1. Connections failing this inspection shall be inspected for cracking and re-threaded, provided no cracks are detected.

### 5.2. Check Bevel Diameter

5.2.1. Bevel diameter of the box and pin shall be verified. If the OD is less than the standard bevel diameter and an alternative smaller OD bevel diameter is not presented in field inspection literature, the bevel diameter becomes void and a 1/32" x 45° chamfer becomes effective.

### 5.3. Record Box OD

5.3.1. The OD of the box tool joint shall be measured at a distance 1.0" ± 1/4" (25mm ± 6.4mm) from the primary seal shoulder to determine the minimum diameter value. Connection OD's found below the corresponding connection bevel diameter shall be identified for an adjusted MUT. No adjustments to MUT shall be made without consultation with Complete Tubular Products.

5.3.1.1. Box OD measurements shall be evaluated for indications of out-of-roundness. No box OD measurement may deviate from the average box OD by more than 1/32" (0.8mm)

### 5.4. Check Box Counterbore

5.4.1. The ID of the box counterbore shall be verified, but this dimension is not to be used for acceptance/rejection. It is required to test for box swelling and evaluate the need to verify the connection length.

5.4.2. If eccentric wear is suspected, the box counterbore wall thickness shall be measured. The minimum wall thickness shall be measured at the point of greatest eccentric wear and classified according to the minimum values listed on drawing T000285 latest revision.

### 5.5. Check Box Connection Length

5.5.1. The distance between the primary seal shoulder and secondary shoulder shall be verified. If found to be out of specification, the measurement shall be taken in at least two locations 180° apart around the thread axis.

5.5.1.1. The depth caliper/micrometer extension base must span completely across the box connection counterbore.

5.5.1.2. If the connection length is found to be outside of the required inspection dimensions, the box connection length shall be recorded on the drill pipe report. Box length repair may be made by refacing the connection. Refacing limits are the same as for repairing damaged surfaces; see section 4.1.

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**5.6. Check Pin Tool Joint ID**

5.6.1. If a visual inspection warrants, the pin tool joint ID shall be verified in the region approximately under the last-full depth thread nearest the primary shoulder approximately 1-2" (25-50mm) from the primary seal.

**5.7. Check Pin Nose OD and ID**

5.7.1. All DUO connections have a tapered pin nose OD making this dimension difficult to properly evaluate thus this dimension is not to be used for acceptance/rejection is only to test for indications of pin nose swelling and tapering and to evaluate the need to verify the connection length.

5.7.2. Pin nose ID shall be measured 1/2" (13mm) in from the secondary shoulder face. This dimension is only to be used for rejection if it compromises the driftability of the tool joint.

**5.8. Check Pin Connection Length**

5.8.1. The distance between the primary seal shoulder and secondary shoulder shall be verified. If found to be out of specification, the measurement shall be taken in at least two locations 180° apart around the thread axis.

5.8.1.1. The depth caliper/micrometer extension base must span completely across the pin connection nose.

5.8.1.2. If the connection length is found to be outside of the required inspection dimensions, the dimension shall be recorded on the drill pipe report. Pin length repair may be made by refacing the connection. Refacing limits are the same as for repairing damaged surfaces; see section 4.1.

**5.9. Record Tool Joint Tong Space**

5.9.1. A minimum tong space of 6" (150mm) is required for box and pin tool joints. In addition, the minimum box tong space shall ensure that hardbanding is not present over the box threads and shall be at least equal to the connection length +1" (+25mm).

**6. POST-INSPECTION/REPAIR**

**6.1. Protection**

6.1.1. Threadform elements and shoulders should always be phosphate coated; however, lightly worn coating is acceptable and can be repaired with a molybdenum disulfide repair kit. (i.e. – Molycote products or similar).

6.1.2. Threadform elements and shoulders field repaired by filing or refacing and exposing raw metal shall be evenly coated in an appropriate oilfield thread spray (i.e. – Garco "oil country" thread spray or similar) after inspection to prevent corrosion during storage.

6.1.3. Thread protectors shall be inspected to be free and clean of debris and foreign materials and reinstalled tightly.

**6.2. Rethreading**

6.2.1. All connections that fail to meet the requirements stipulated in this or any other relevant field inspection documents must be rethreaded by Complete or a licensed Complete repair facility.

6.2.1.1. All torque shoulders, seal surfaces, and thread elements must be machined back to raw metal.

6.2.1.2. After rethreading, connections must be phosphate coated.

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