

Recommended Makeup Procedures

Norris recommends the following Circumferential Displacement (CD) method for connecting sucker rods, pony rods and drive rods. Static CD is the most reliable method for consistently making up connections correctly.

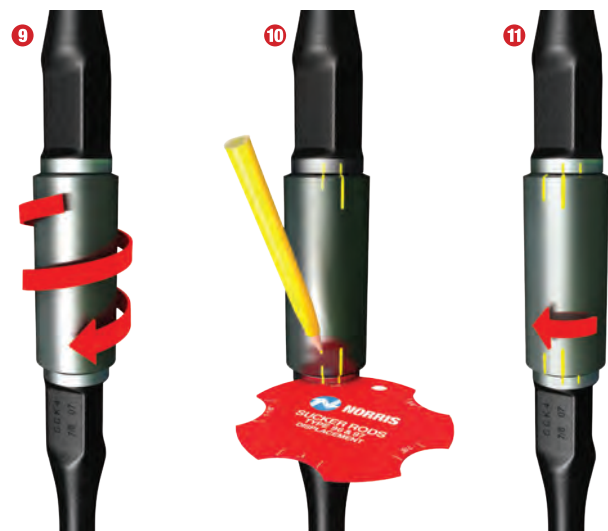
THE STATIC CD METHOD

- 1.** Verify the size and grade of sucker rods and ancillary equipment on location. DO NOT assume that equipment in the well matches the well data sheet. DO NOT assume that the sucker rods or other downhole equipment delivered to the location match the rod string design or work order sheet.
- 2.** Run the subsurface pump and other necessary downhole equipment into the well. (i.e., sinker bars, on-off tools, shear tools, etc.) ALWAYS follow the manufacturers recommendations for all downhole equipment.
- 3.** Pickup the first sucker rod, latch one end into the rod elevator and carry the other end until the sucker rod is hanging freely in the derrick. ALWAYS utilize two people when picking up and handling sucker rods. DO NOT allow the sucker rod to drag on the ground or over other metal objects.
- 4.** Remove the plastic pin protector by hand, with an appropriate spanner wrench or an air impact wrench and 6-point socket. DO remove the protector either by hand, with an appropriate spanner wrench or with an air impact and 6-point socket. DO NOT use any other method to remove the plastic pin protectors.
- 5.** Clean the threads, pin shoulder and coupling face. ALWAYS remove all debris during cleaning. (i.e., dirt, scale, old lubricant, plastic, etc.)
- 6.** Visually inspect the threads, pin shoulder and coupling face for indications of damage (i.e., pitting, wear, dents, etc.). DO remove and replace damaged product prior to installation.
- 7.** Remove one coupling from the box and apply a small amount of sucker rod lubricant to the coupling threads. ASSURE that the sucker rod lubricant has a grease-like consistency and contains corrosion inhibitors and antioxidants. DO NOT use pipe dope, Kopper Kote®, or other lubricants that contain fillers on sucker rod threads.
- 8.** Apply Varsol, or a similar degreasing agent to the pin shoulder and coupling face to remove any remaining lubricant

film. DO use a clean rag for application. DO NOT allow lubricant to remain on the pin shoulder or coupling face.

9. Carefully “stab” the sucker rod onto the pump bushing, pony rod pin, sinker bar pin or coupling, whichever is looking up. Start the lead or first threads by hand. With a rod wrench, spin the connection together until the pin shoulder and the coupling face touch, which is the hand-tight assembly. DO NOT over-tighten. The connection is hand-tight when the pin shoulder and the coupling face touch without extraneous pressure applied.

10. Draw or scribe a vertical line across the top end of the coupling OD and the pin shoulder of the sucker rod. Use an appropriate Circumferential Displacement (CD) Card to measure and draw a second mark across the pin shoulder in the direction of tightening. Repeat the procedure at the bottom end of the coupling. DO assure that you are using the proper CD Card for your application. See the Circumferential Displacement Cards information sheet for details.



11. Use power tongs for final tightening, following the proper procedures for usage and calibration shown below.

Power Tong Calibration and Usage Procedures:

- a.** Back the tong pressure off to zero and position the power tongs on the connection.
- b.** Attain full throttle and maintain constant engine RPM.
- c.** Engage the power tongs and slowly increase the tong pressure until the first drawn mark on the coupling rotates to the second mark on the pin shoulder. The power tongs should come to a complete stop (i.e., the power tongs should stall) while engaged. DO NOT hit (bump) the connection again with the power tongs.

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- d. Run this connection in the well.
- e. Repeat steps 3 through 10 with respect to handling, stabbing, hand-tightening the assembly and marking the connection for the next sucker rod.
- f. Attain full throttle and maintain constant engine RPM.
- g. Engage the power tongs and displace the connection at the current tong pressure setting. The power tongs should come to a complete stop (i.e., the power tongs should stall) while engaged. DO NOT hit (bump) the connection again with the power tongs.
- h. Check the pin shoulder and coupling marks for the correct displacement. If necessary, adjust the tong pressure, break and remake the connection.
- i. Once the correct displacement is obtained, run this connection in the well.
- j. With correct displacement now established, repeat steps 11e through 11i for a total of five times to audit the mechanical integrity of the power tongs and related equipment before proceeding to step 12.

12. Makeup Procedures:

- a. Repeat steps 3 through 9 with respect to handling, stabbing and hand-tightening the connection for next sucker rod.
- b. Attain full throttle and maintain constant engine RPM.
- c. Engage the power tongs and displace the connection at the current tong pressure setting. The power tongs should come to a complete stop (i.e., the power tongs should stall) while engaged. DO NOT hit (bump) the connection again with the power tongs.
- d. Run this connection in the well.

13. Recalibration Recommendations:

- a. Repeat steps 11e through 11i every tenth connection. DO adjust tong pressure as necessary at this step. This will account for changes in the temperature of the hydraulic oil and the resulting change in tong pressure displacement.
- b. Repeat steps 11e through 11i when changing sizes. EVERY change in rod size requires a change in circumferential displacement and an associated change in the tong pressure setting. ALWAYS use the current tong pressure setting for

sub-couplings (i.e., changeover couplings, crossover coupling, combination couplings, etc.).

- c. Repeat steps 11e through 11i after scheduled or unscheduled downtime such as lunch breaks, equipment repairs or other delays. DO adjust tong pressure as necessary at this step. This will account for changes in the temperature of the hydraulic oil and the resulting change in tong pressure displacement.

NOTICE

In addition to using the recommended makeup procedures, Norris also recommends the following:

1. It is imperative that the power tongs and related equipment be maintained in accordance with the manufacturer's recommendations.
2. When using power tongs, it is recommended that the hydraulic oil system be circulated until a normal operating temperature is reached and that this temperature be maintained within a reasonable level through calibration and installation of the rod string.
3. With some power tongs, it may be necessary to loosen the coupling two or three turns to achieve the momentum necessary to make the connection up to the displacement required. *Norris recommends that this practice be kept to a minimum.*
4. Use power tongs for all sizes except 5/8 inch (15,88 mm) for consistent makeup.
5. Use power tongs for breakout to prevent damage to the sucker rod / drive rod connection.
6. When checking CD, the top and bottom mark may not line up exactly in the same position. This is usually not cause for concern. As long as both the top and bottom of the connection are lined up to within the width of the mark on the CD card, the rod is within the correct makeup tolerance.
7. After using the CD method recommended for makeup a total of five times, change all couplings in the rod string prior to the next installation.
8. The makeup torque for all Drive Rod® connections should be close to the maximum ft-lbs (Nm) torque value that the Drive Rod® will be operating at.
 - 1 inch (25,4 mm): 880 – 960 ft-lbs (704-768 Nm).
 - 1-1/4 inch (31,75 mm): 1,600 – 2,000 ft-lbs (2 169,3 – 2 711,6 Nm).
 - 1-1/2 inch (38,1 mm): 2,400 – 3,000 ft-lbs (3 253,9 – 4 067,4 Nm).

