

Circumferential Displacement Cards

A sucker rod coupling is a rotary-shouldered, friction-loaded, fluid-free connection between sucker rods. For optimum performance of the rod string, it is imperative that all of the connections in the rod string be made up to a specific preload stress value in order to prevent separation between the pin shoulder and the coupling face during normal operating stresses.

There are many inherent variables, which can affect the makeup process. Among these variables are differences in materials, surface finish of the pin shoulder and coupling face and the lubricity of the lubricants, as well as the operating characteristics and mechanical integrity of the power tongs and related equipment.

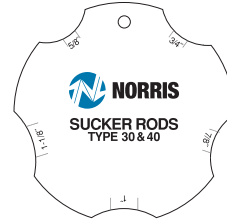
As a result, applied torque has not proven to be the most accurate, nor the most reliable means of measuring the preload stress required for effective makeup.

Effective makeup can be achieved by following the recommendations outlined in Section 5 of API Recommended Practice 11BR (RP 11BR), "Recommended Practice for Care and Handling of Sucker Rods". Both theoretical calculations and strain gauge analysis show that circumferential displacement, beyond hand-tight assembly of the pin shoulder and the coupling face, provides an accurate and repeatable means with which to measure and define the preload stress levels in a sucker rod connection.

The circumferential displacement method involves rotating the coupling face against the pin shoulder after hand-tight assembly. A prescribed dimension will preload the pin and generate a friction force between the coupling face and the pin shoulder. As long as the preload stress is maintained in the connection, the coupling face and the pin shoulder will not separate and the connection should not fail during the course of normal operating stresses encountered in the pumping cycle.

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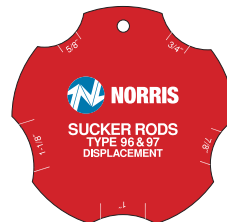
Norris furnishes four circumferential displacement (CD) cards for makeup. The prescribed dimensions are the same for both new and rerun rods.



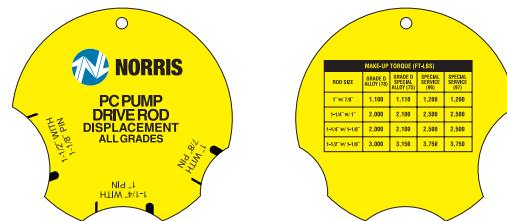
White card - for use with Types 30 and 40 (API Grade C and K) sucker rods



Black card - for use with Types 54, 78, 75 and 90 (API Grade D Carbon, D Alloy and D Special) sucker rods



Red card - for use with Type 96 and 97 sucker rods



Yellow card - for use with Norris Drive Rods®

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The circumferential displacements for Types 30 and 40 (API Grade C and K) and Types 54, 78, 75 and 90 (API Grade D Carbon, D Alloy and D Special) sucker rods are based on circumferential displacement values higher than those shown in API RP 11BR. These displacement values are derived from strain gauge tests for pin pre-stress versus circumferential displacement. Higher pumping loads, typically encountered today, tend to separate the pin shoulder and coupling face at the displacement values recommended in API RP 11BR.

Types C30 and K40 sucker rods	Size		CD card value	
	inches	(mm)	inches	(mm)
	5/8	(15,88)	8/32	(6,35)
3/4	(19,05)	9/32	(7,14)	
7/8	(22,23)	11/32	(8,73)	
1	(25,40)	14/32	(11,11)	
1-1/8	(28,58)	16/32	(12,7)	

Types D54, D75, D78 and D90 sucker rods	Size		CD card value	
	inches	(mm)	inches	(mm)
	5/8	(15,88)	10/32	(7,94)
3/4	(19,05)	13/32	(10,31)	
7/8	(22,23)	16/32	(12,7)	
1	(25,40)	20/32	(15,87)	
1-1/8	(28,58)	22/32	(17,46)	

Types 96 and 97 sucker rods	Size		CD card value	
	inches	(mm)	inches	(mm)
	5/8	(15,88)	11/32	(8,73)
3/4	(19,05)	15/32	(11,9)	
7/8	(22,23)	18/32	(14,28)	
1	(25,40)	23/32	(18,25)	
1-1/8	(28,58)	25/32	(19,84)	
1-1/4	(31,75)	25/32	(19,84)	

Norris drive rods®	Size		CD card value	
	inches	(mm)	inches	(mm)
	1	(25,40)	18/32	(14,28)
1-1/4	(31,75)	25/32	(19,84)	
1-1/2	(38,1)	1	(25,4)	

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).

