

# Norris Corrosion Service (CS) Sucker Rod

New Premium Rod for Challenging, Corrosive Applications

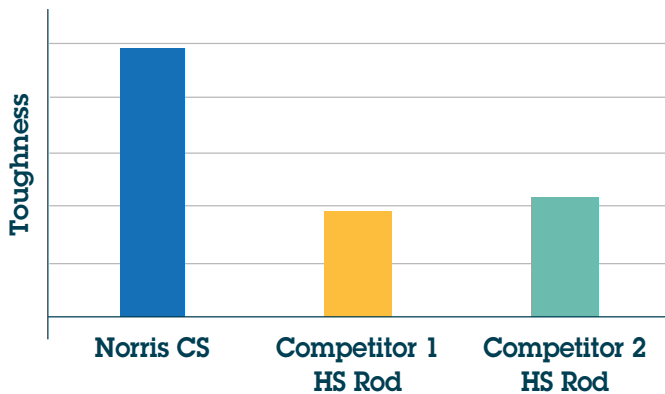
## WHAT IS CORROSION SERVICE?

This premium sucker rod is our answer to customer demands for a rod suitable for deeper, corrosive wells. Combined with field-proven proprietary NOR-PEENING® technology, the CS rod is engineered to enhance corrosion fatigue resistance and improve mechanical fatigue life.



100% US MADE - 100% US STEEL

### TOUGHNESS COMPARISON Norris CS Rod vs. Competitors High Strength Rod



\*Toughness: the ability to absorb energy and plastically deform without fracturing

## HIGH STRENGTH AND TOUGHNESS REDUCES MEAN TIME BETWEEN FAILURE (MTBF)

Moreover, the chemistry of the CS grade rod has been designed to produce a world-class rod for the most challenging oil & gas fields in US and around the world. The chemistry has been micro-alloyed to enhance metallurgical features of the rod, including fine grain size, uniform microstructure leading to superior resistance to fracture, and high fatigue tolerance.

## MECHANICAL PROPERTIES - NORRIS CS SUCKER ROD

ELONGATION  
(8") %

10  
MIN.

AREA OF  
REDUCTION %

50  
MIN.

ULTIMATE  
TENSILE  
STRENGTH (KSI)

130/145

YIELD  
STRENGTH (KSI)

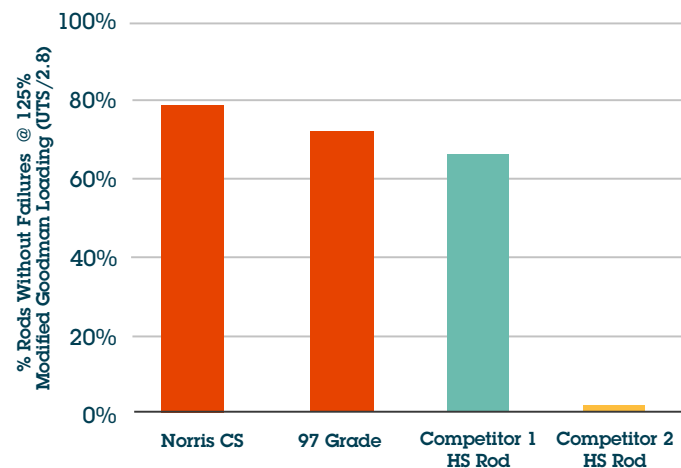
115  
MIN.

## SURFACE ENGINEERED ROD - NOR-PEENING® VALUE ADDED TECHNOLOGY

NOR-PEENING® is a carefully controlled and monitored shot peening process that relies on precise selection and control of a spherical shot peening media, intensity, coverage, and equipment to enhance surface treatment and properties. As a result, NOR-PEENING® creates residual compressive stress and minimizes sensitivity to fatigue and stress corrosion failures. Thus, benefits achieved by NOR-PEENING® include improvement in the following performance areas:

- 1 FATIGUE LIFE
- 2 FATIGUE STRENGTH
- 3 CORROSION TOLERANCE
- 4 NOTCH SENSITIVITY

Different high strength rods were fatigue tested using 125% of maximum allowable modified Goodman (UTS/2.8) loading and the results showed that the Norris CS sucker rod had the best fatigue performance at higher loads.



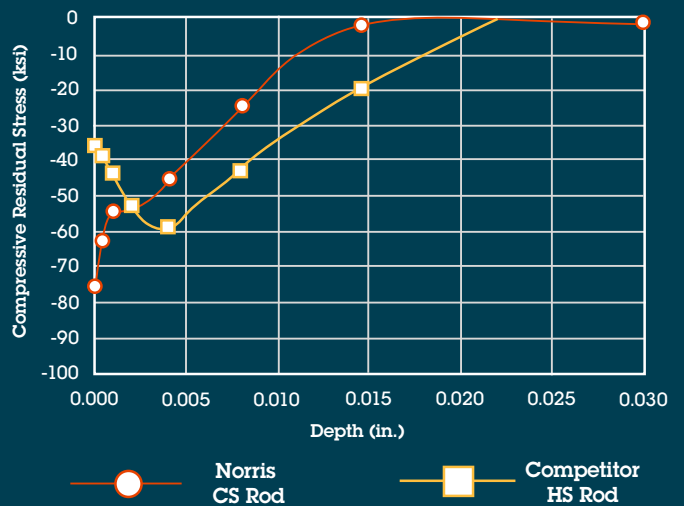
## OPTIMIZED MICROSTRUCTURE WITH VERY FINE GRAIN SIZE

There is a correlation between grain size and mechanical integrity of a sucker rod, as it pertains to service life. The combination of the CS rod chemistry design and our world-class internal manufacturing processes, allow the Norris CS grade to have very fine grain sizes of up to 12 ASTM (5 - 6µm) with optimized microstructure.

## REDUCED SURFACE DECARBURIZATION

Decarburization is a metallurgical process in which the surface is depleted of carbon by high temperatures; it makes the sucker rods susceptible to corrosion pitting and premature failure. The new CS rod has less surface decarburization depth than the competitors, thanks to the highly controlled thermal processes and the effect of NOR-PEENING®

## SURFACE COMPRESSIVE RESIDUAL STRESS PROFILE FROM NOR-PEENING® TECHNOLOGY



FOR ADDITIONAL INFORMATION, PLEASE CONTACT YOUR NORRIS SALES OR TECHNICAL SERVICES REPRESENTATIVE.

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