TECHNICAL BULLETIN

ENDLESS ROD | LS- TB-024

LIFTING SOLUTIONS

BULLETIN NO.	TOPIC	ISSUE DATE	ISSUED BY
TB-024 V1	ER PRODUCT SELECTION OVERVIEW	JULY 26, 2021	ENGINEERING

BACKGROUND

Proper rod selection is important in any rod driven application. To determine the best grade and size one must evaluate a variety application factors including wellbore geometry and curvature components, pump size and torque requirements, produced fluid properties and corrosive elements as well as abrasive and wear considerations. In the presence of corrosion, the fatigue limit of continuous rod is dramatically reduced. In many cases a coating may be required to mitigate corrosion or improve wearability.

It is common practice to source larger diameter rod with superior yield strength and higher hardness in situations where rod breaks are prevalent. Although this sounds good in theory this is generally counterintuitive when the contributing factors to the failure mode are considered.

This technical bulletin will attempt to breakdown the contributing factors and outline critical considerations beneficial to the decision-making process.

ROD STRING SELECTION CRITERIA

Whether you are designing a conventional sucker rod or continuous rod string, there are four factors that are typically considered during product selection.

Factor	Commentary
Metallurgy (Rod Grade)	Simply refers to the mixture of the steel. Specific alloying elements are added to the steel to provide better mechanical properties, performance, and corrosion resistance. Rod grades include: • D Grade, AISI 15 Series Carbon Steel • C Grade, AISI 41 Chrome Molly Alloy Steel • N Grade, AISI 43 Series Nickle Chrome Molly Steel
Diameter (Rod Size)	As the rod diameter increases so does its ability to transmit torque. The larger the diameter, the higher the torque rating. Rod sizes include: • 3/4 in, 7/8 in, 1 in, 1 1/8 in, 1 3/16in In a cyclic bending situation larger diameter rod is stiffer and the outer surface is farther from the neutral center axis of the bend. This results in more stress on the outer members in highly deviated wells.
Heat Treatment (Rod Hardness)	Hardness is tied directly the material yield strength. The higher the hardness the higher the yield strength, torque capability and better the wearability. Harder rod is more resistant to bending and when deployed in highly deviated wells will be under more stress. Heat treatment includes: • Low Strength (28 HRC) and High Strength (36 HRC)
Coating	Coating the rod is an effective method to mitigate corrosion and wear. Corrosion pits become stress concentration points that encourage fatigue crack propagation and significantly reduce rod string life. Wearable elements are added to coated rod to improve wear resistance and reduce the coefficient of friction between the rod and tubing string. Coating options include:

	• Gen 1, HDPE Reinforced Coating for corrosion and wear. • Gen 2, Proprietary Coating for deeper, hotter wellbores.

Table 1 – Rod String Selection Factors

ROD STRING SELECTION

The diagram below can be used as a guide for rod string selection. The blue quadrants represent product selection factors while the green arrows serve as a guide in determining when to move from one quarter to the other or up and down inside a given quadrant based on the problem at hand.

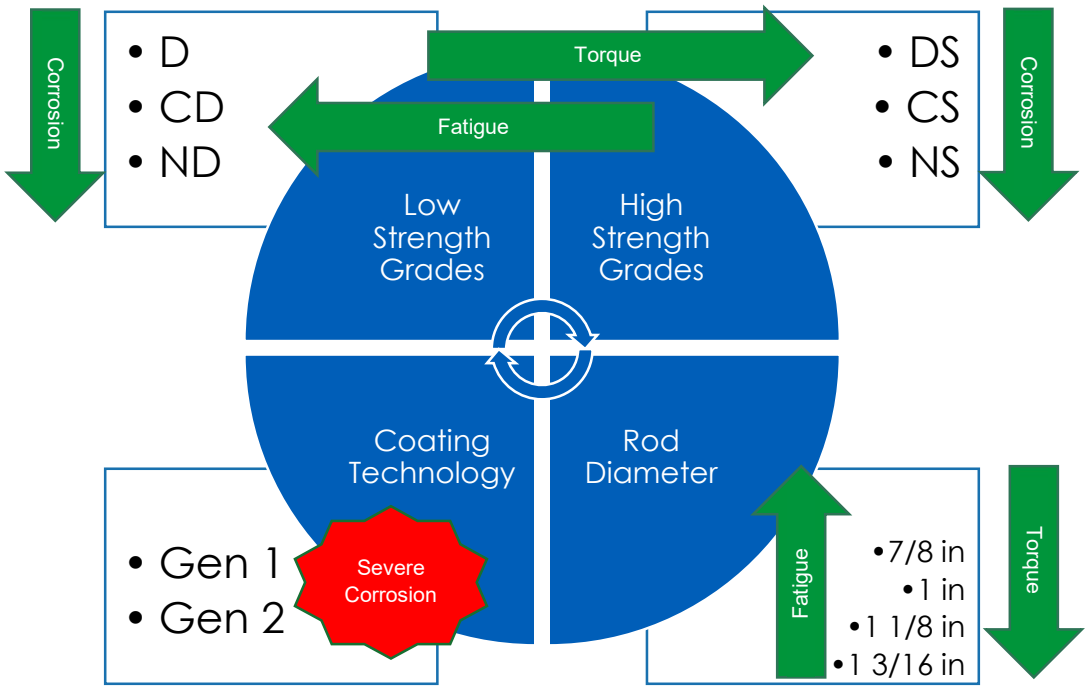

Diagram 1, Rod String Selection Guide

CONCLUSION

There are many variables applicable to rod driven systems. The study of how rod, tubing strings, produced fluids and wellbores interact is extremely complex. A basic understanding of the product line and application factors is critical to making consistent recommendations across the organization. By understanding historical failure modes, the selection guide will point in the right direction towards a consistent educated recommendation for rod strings.