

ENDLESS ROD KEBOND

ENHANCED CORROSION PROTECTION

CORROSION AND WEAR PROTECTION SOLUTIONS

Barrier coatings protect sucker rod from corrosion which is a major contributor to fatigue failures that are common in rod strings used in Progressing Cavity Pump (PCP) and Reciprocating Rod Pump (RRP) applications. Corrosion damage results in stress risers on the rod surface that can lead to cracks which when exposed to cyclic load over time propagate across the rod body eventually leading to failure (as shown below in Figure 1).

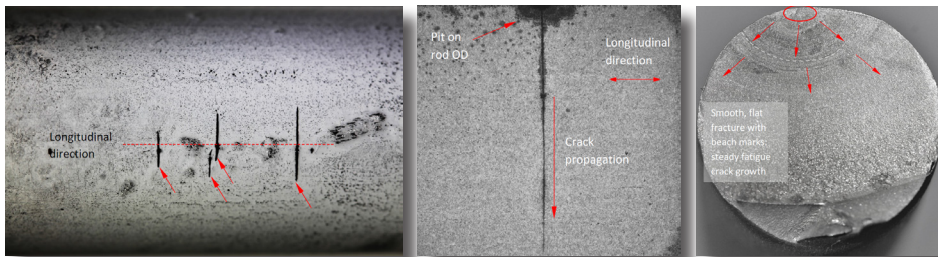


Figure 1, Surface corrosion, surface cracking and fatigue propagation

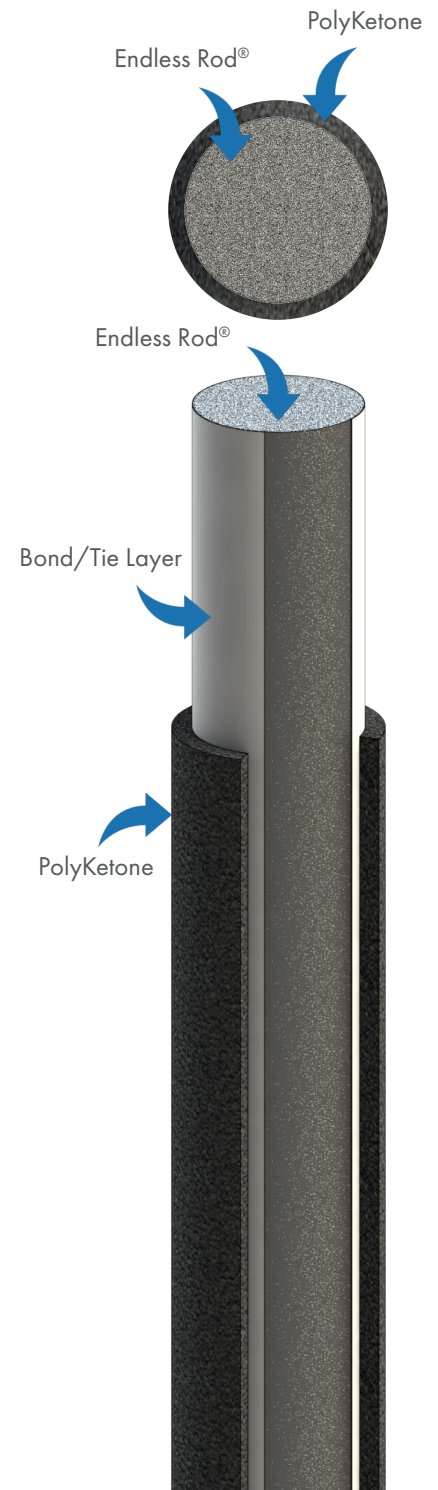
Certain coatings reduce the rod/tubing contact friction resulting in lower torque in PCP applications and lower axial loads in RRP applications. Reduced friction also has the potential to decrease tubing wear particularly in more aggressive environments.

ENDLESS ROD® (ER) KEBOND (POLYKETONE BONDED)

Lifting Solutions continues to innovate on the success of our original EthyFlex Endless Rod® (ER) product with our new KeBond technology. Development started in 2021 and its commercialization in 2023 included the addition of a new state of the art coated rod manufacturing line to produce KeBond as well as provide flexibility for a wide range of future material and product developments. Extensive research and development included improvements to our fleet of derrick and truck mounted gripper service equipment and development of specialized processes including welding, coating repair and fishing.

KeBond incorporates a bonded composite design that includes an engineered thermoplastic (Polyketone) outer coating that is resistant to aggressive oilfield fluids and can withstand elevated temperatures. The bonded high strength design enables servicing at high loads and associated depths which combined with the improved fluid and temperature resistance significantly expands the application operating envelope including into deeper RRP applications.

KeBond is available in all Lifting Solutions ER grades and sizes. It is manufactured with our standard 0.100in (2.5mm) coating thickness to extend runtime under aggressive wear conditions.





ENDLESS ROD® KEBOND SPECIFICATIONS

Bare Rod Diameter in (mm)	Coated Rod Diameter in (mm)	Coated Rod Weight lbs/ft (kg/m)	Maximum Rod Weight lbs (kg) *	Maximum Vertical Depth ft (m) *
0.875 (22.2)	1.075 (27.2)	2.21 (3.30)	20000 (9091)	9030 (2752)
1.000 (25.4)	1.200 (30.4)	2.86 (4.26)	20000 (9091)	6986 (2129)
1.125 (28.6)	1.325 (33.6)	3.59 (5.35)	20000 (9091)	5565 (1696)

* Max pulling weights and associated vertical depths are referenced at 50°C (122°F) and may need to be reduced at elevated temperatures.

KEBOND APPLICATION GUIDE

Attribute	Recommendation
Artificial Lift Type	Progressing Cavity Pump (PCP), Reciprocating Rod Pump (RRP)
Wellbore Profile	Vertical, slant and directional with curvature up to 12 degree/30m (100ft)
Oil Resistance	Up to 50 API
Gas Resistance	Very Good resistance to CO ₂ and CH ₄ Excellent resistance to H ₂ S
Solids Resistance	Excellent resistance to sand and abrasives
Chemical Resistance	Very Good resistance to Acids, Corrosion Inhibitors and Parrifin Treatment - Consult Lifting Solutions Technical Support for additional compatability testing and recommendations
Downhole Temperature	Up to 80°C (176°F)
Field Strippable?	No, KeBond can not be stripped from the bare rod.

ENDLESS ROD PRODUCT LINE COMPATABILITY

Rod Grade	Material	Corrosion Resistance	Minimum Tensile Strength (ksi)	Minimum Yield Strength (ksi)	Max. Average Hardness (HRC)
D	C-Mn	Poor	115	85	28
DS	C-Mn	Poor	140	115	36
CD	Cr-Mo	Good	115	90	28
CS	Cr-Mo	Good	140	115	36
ND	Ni-Cr-Mo	Good	115	90	28
NS	Ni-Cr-Mo	Good	140	115	36
ALL	Multi-layer bonded composite thermoplastic coating	Excellent	KeBond coating can be applied to any of the individual rod grades		