

<b>BULLETIN</b>	<b>TOPIC</b>	<b>ISSUE DATE</b>	<b>ISSUED BY</b>
LS-TB-001 V2	PC PUMP ELASTOMER OVERVIEW	MARCH 9, 2018	ENGINEERING

Stator elastomers and their associated bonding systems strongly influence the performance of progressing cavity (PC) pumps in downhole artificial lift applications. Lifting Solutions develops its own proprietary elastomers for its PC pump product line. Several elastomers are available to ensure an optimal match with the range of different PC pump applications.

Elastomer development follows a rigorous process starting with small-scale laboratory testing of potential elastomer formulations to evaluate processing, mechanical, dynamic and fluid compatibility characteristics. Based on this lab testing the best formulations are scaled-up to production volumes to enable stator process trials and bonding system selection. Once refined test stators undergo final elastomer and bond evaluation as well as extended duration (25M cycle) pump validation under aggressive conditions. Subsequently elastomers undergo significant field testing before commercial release.

Quality control testing is performed on elastomer raw material batches prior to release for use in stator manufacturing. Test samples are taken from every manufactured stator and subjected to bond testing and elastomer hardness testing to ensure the final product meets specified acceptance criteria.

## ELASTOMER TYPES:

**Soft Medium Nitrile (SN1):** Low hardness medium nitrile elastomer with excellent mechanical properties including tear and elongation allowing the handling of large solids without damage. Enables higher interference rotor fit allowing for significant stator material loss before volumetric efficiency declines. Recommended for heavy oil applications with moderate to high abrasive levels.

**Medium Nitrile (MN1):** General purpose medium nitrile elastomer with good mechanical properties and good resistance to water and moderate aromatic levels. Recommended for heavy oil applications with low to moderate abrasives, medium oil applications up to 25<sup>o</sup>API and coalseam gas dewatering applications.

**High Nitrile (HN1):** High nitrile elastomer with good mechanical and dynamic properties. Excellent water resistance and very good oil resistance. Recommended for medium and light oil applications up to 35<sup>o</sup>API.

Elastomer Code	Nitrile Level (%ACN)	Hardness (Shore A)	Temp Limit	Max. API Gravity	Water Resistance	Abrasive Resistance	High H2S	High CO2
SN1	32 to 36	55 to 60	80°C	15	Very Good	Excellent	Fair	Fair
MN1	32 to 36%	65 to 70	100°C	20 (25*)	Very Good	Very	Good	Good
HN1	40 to 45%	70 to 75	100°C	30 (35*)	Excellent	Good	Good	Good

\*Suitability of upper API gravity (X) depends on specific application conditions including oil chemistry, water cut and temperature – recommend fluid compatibility test for confirmation and rotor sizing.

## ELASTOMER SELECTION AND PUMP SIZING:

The Lifting Solutions Material Laboratory has capabilities to conduct produced fluid elastomer and bond compatibility testing to assist with application screening, elastomer selection and pump rotor sizing. Elastomer data sheets including elastomer/bond compatibility data with standard test fluids as per ISO 15136-1 Section 7.2.7/Annex A are available upon request.