TECHNICAL BULLETIN

PROGRESSING CAVITY PUMPS | LS-TB-005

LIFTING SOLUTIONS

BULLETIN	TOPIC	ISSUE DATE	ISSUED BY
LSI-TB-005 D1	PCP ELASTOMER COMPATABILITY TESTING OVERVIEW	MARCH 9 2020	ENGINEERING

BACKGROUND

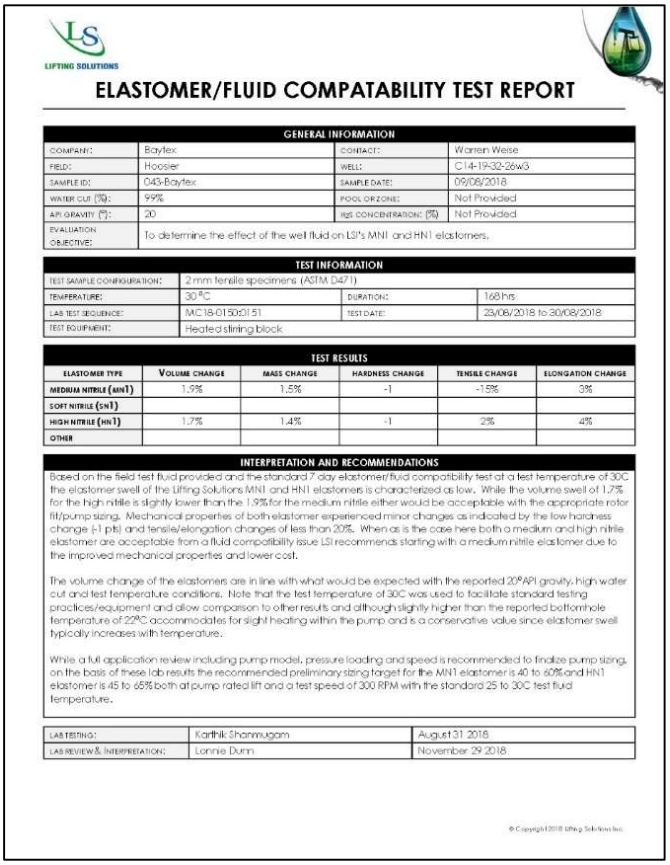
To provide an engineered rotor/stator fit in applications where swell is anticipated Lifting Solutions conducts elastomer compatibility testing based on ASTM D471. This process exposes elastomer samples to various fluids under controlled conditions followed by measurement of changes to the elastomer including volumetric swell, mass change and various mechanical properties before and after.

STANDARD TEST METHOD

Our standard test method includes 168hr (7day) immersion testing of 2mm elastomer test specimens. Test fluids include wellbore fluids, workover chemicals and standard reference fluids at specified concentrations. Testing chambers are temperature controlled and keep the samples agitated as required to maintain adequate fluid emulsion and specimen exposure. Testing does not consider the impacts of gas as it is completed at atmospheric pressures.

TEST RESULTS (SINGLE FLUID)

Test results are recorded in a database that allows generation of a specific single fluid compatibility report containing general information about the sample collected (who, what and where) as well as information about the tests being conducted. A tabular summary documents the elastomer type and corresponding volume, mass, hardness, tensile and elongation changes. An interpretation section provides detailed commentary on the test results as well as an elastomer recommendation with a target baseline test efficiency, temperature and speed.



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ELASTOMER/FLUID COMPATABILITY TEST REPORT

GENERAL INFORMATION

COMPANY:	Baytex	CONTACT:	Warren Weise
FIELD:	Hoosier	WELL:	C14-19-32-26W3
SAMPLE ID:	043-Baytex	SAMPLE DATE:	09/08/2018
WATER CUT (%):	99%	POOL OR ZONE:	Not Provided
API GRAVITY (°):	20	H2S CONCENTRATION: (%)	Not Provided
EVALUATION OBJECTIVE:	To determine the effect of the well fluid on LSI's MN1 and HN1 elastomers.		

TEST INFORMATION

TEST SAMPLE CONFIGURATION:	2 mm tensile specimens (ASTM D471)		
TEMPERATURE:	30 °C	DURATION:	168 hrs
LAB TEST SEQUENCE:	MC18-0150-0151	TEST DATE:	23/08/2018 to 30/08/2018
TEST EQUIPMENT:	Heated stirring block		

TEST RESULTS

ELASTOMER TYPE	VOLUME CHANGE	MASS CHANGE	HARDNESS CHANGE	TENSILE CHANGE	ELONGATION CHANGE
MEDIUM NITRILE (MN1)	1.9%	1.5%	-1	-15%	3%
SOFT NITRILE (SN1)					
HIGH NITRILE (HN1)	1.7%	1.4%	-1	2%	4%
OTHER					

INTERPRETATION AND RECOMMENDATIONS

Based on the field test fluid provided and the standard 7 day elastomer/fluid compatibility test at a test temperature of 30C the elastomer swell of the Lifting Solutions MN1 and HN1 elastomers is characterized as low. While the volume swell of 1.7% for the high nitrile is slightly lower than the 1.9% for the medium nitrile either would be acceptable with the appropriate rotor fit/pump sizing. Mechanical properties of both elastomer experienced minor changes as indicated by the low hardness change (-1 pts) and tensile/elongation changes of less than 20%. When as is the case here both a medium and high nitrile elastomer are acceptable from a fluid compatibility issue LSI recommends starting with a medium nitrile elastomer due to the improved mechanical properties and lower cost.

The volume change of the elastomers are in line with what would be expected with the reported 20°API gravity, high water cut and test temperature conditions. Note that the test temperature of 30C was used to facilitate standard testing practices/equipment and allow comparison to other results and although slightly higher than the reported bottomhole temperature of 22°C accommodates for slight heating within the pump and is a conservative value since elastomer swell typically increases with temperature.

While a full application review including pump model, pressure loading and speed is recommended to finalize pump sizing, on the basis of these lab results the recommended preliminary sizing target for the MN1 elastomer is 40 to 60% and HN1 elastomer is 45 to 65% both at pump rated lift and a test speed of 300 RPM with the standard 25 to 30C test fluid temperature.

LAB TESTING:	Karthik Shanmugam	August 31 2018
LAB REVIEW & INTERPRETATION:	Lonnie Dunn	November 29 2018

TEST RESULTS (MULTI FLUID SUMMARY)

Single fluid summaries can also be combined to generate a multifluid summary that compares a range of completed tests. These summary reports allow for detailed cross reference of multiple tests grouped by client, API density range or another category as required.

INTERPRETATION

Based on a median major/minor stator elastomer thickness, the resulting dimensional change would be around 0.005" on the majors and 0.015" on the minors (tighter) for every 1% of elastomer swell. In addition to the aromatic swell measured, the thermal component is responsible for approximately 1% swell for every 25oC of temperature increase.

Volume swell characterization and its effects on sizing:

<2%	Low	Little impact on pump sizing
2 to 5%	Moderate	Requires consideration in pump sizing
5 to 10%	High	Pump sizing challenging/normally iterative
>10%	Extreme	Application not recommended

Hardness changes:

<5%	Low	Allowable
>5%	Moderate	Requires application consideration

Tensile/Elongation changes:

<25%	Low	Allowable
>25%	Moderate	Requires application consideration

CONCLUSION

Understanding the effects of produced fluids and workover chemicals on progressing cavity pump elastomers is an important consideration in determining the optimal baseline test efficiency. Fluid compatibility testing combined with accurate rotor/stator measurements and a balanced compression fit is the key to optimized torque, efficiency and the longevity associated with a proper engineered rotor/stator fit.

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