TECHNICAL BULLETIN

PROGRESSING CAVITY PUMPS | LS-TB-002

LIFTING SOLUTIONS

BULLETIN	TOPIC	ISSUE DATE	ISSUED BY
LS-TB-002 V1	PCP BALANCED COMPRESSION FIT	MARCH 9 2019	ENGINEERING

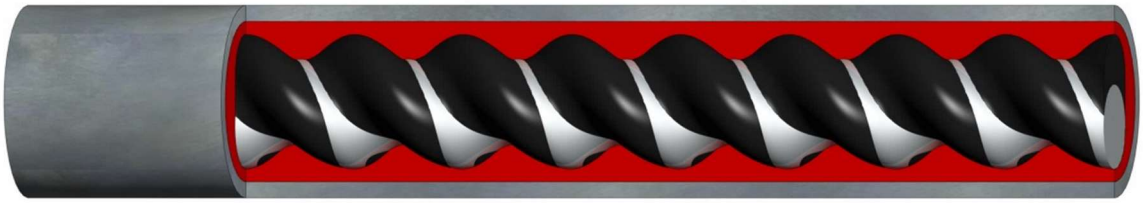
BACKGROUND:

The fit between the rotor and stator in a progressing cavity (PC) pump is an important engineering consideration that is critical to successful pump operation. Historical sizing practices used theoretical cavity sizes based on core measurements and cavity shrinkage rates after stator injection and vulcanization. The rotor size was then selected based on theoretical interference values between the rotor and the estimated stator dimensions. This sizing philosophy worked to achieve a desired baseline test efficiency but created conditions of over/under compression of the elastomer in both the stator major/minor planes. These poor compression states have detrimental effects on torque, efficiency and pump longevity.

BALANCED COMPRESSION FIT:

The balanced compression fit sizing methodology starts with a stator cavity that is molded and measured resulting in a precise understanding of the finished stator dimensions. Every manufactured stator is measured to determine accurate minor diameter measurements of each. The rotor size is calculated based on precision measurements with the final rotor dimensions resulting in equal balanced compression on the stator major/minor as a function of the elastomer thickness in each plane. The immediate benefit of a balanced compression fit is maximum pump efficiency with the lowest possible pump torques (exclusively from the frictional component).

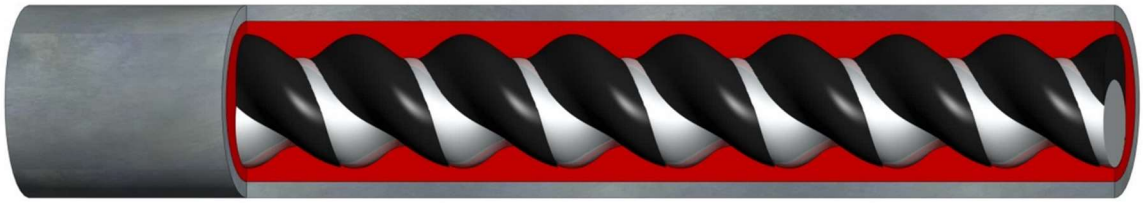
Major Compression	Minor Compression	Pump Efficiency	Pump Torque	Longevity
BALANCED	BALANCED	HIGH	NORMAL	Pump efficiency is optimized, torque is minimized. Seal lines are consistent. The rubber is not overstressed in any plane



OVER COMPRESSION:

Over compression of the elastomer results in increased torque and heat in the pump primarily from increased frictional torque. Frictional torques will be a high percentage of the pump total torque. Hysteresis and missing rubber are typical failure modes.

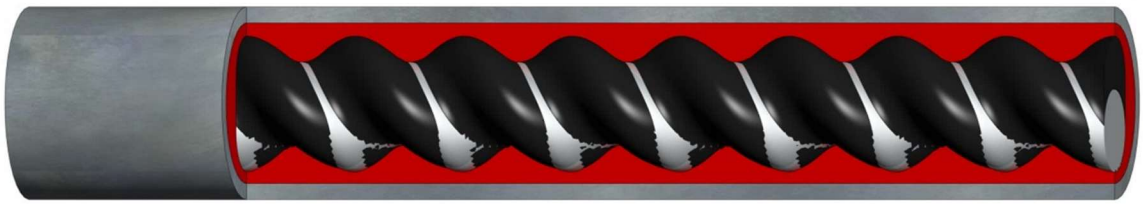
Major Compression	Minor Compression	Pump Efficiency	Pump Torque	Longevity
NORMAL	HIGH	FLATLINE	HIGH	Excessive friction from over compression of the stator minor diameter results in increased torque and wear on the stator minor diameters/flank. High baseline test efficiency.
HIGH	NORMAL	NORMAL	HIGH	Excessive friction from over compression of the stator major diameter. Excessive rotor wear and potential to embed particles during cavity sweep with over compression.



UNDER COMPRESSION:

Under compression of the elastomer results in immature seal breakdown. Pump efficiency is weak and quickly reduced with small amounts of wear. Defects in the seal line will lead to premature seal break down, short run life. The typical failure modes include fluid washing and associated poor pump efficiency.

Major Compression	Minor Compression	Pump Efficiency	Pump Torque	Longevity
NORMAL	LOW	LOW	LOW	Poor seal and overall wear ability. Breakdowns in the seal line happen easily and fluid washing may result.
LOW	NORMAL	LOW	LOW	Seal line breaks down in the major plane resulting in inefficient cavity sweep and seal line breakdown.



CONCLUSION:

Balanced compression fit is the key to optimal fictional torques, increased pump run times and contributes to a reduction in several common PCP failure modes including missing rubber from hysteresis or over compression and fluid washing due to poor sealability and under compression.

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