TECHNICAL BULLETIN

PROGRESSING CAVITY PUMPS | LS-TB-004

LIFTING SOLUTIONS

BULLETIN	TOPIC	ISSUE DATE	ISSUED BY
LS-TB-004 V1	TORSIONAL PCP VIBRATIONAL ANALYSIS	DECEMBER 1, 2019	ENGINEERING

BACKGROUND:

To better understand the vibrational characteristics of single lobe progressing cavity pumps (PCP) Lifting Solutions initiated a comprehensive test program that looked at several PCP geometries including Conventional single lobe and TorsionAL single lobe manufactured from various raw bar stock including solid steel, hollow steel and aluminum. The conventional rotor geometry was also analyzed under normal (C28) and loose (C10) compression fit sizing methodologies.

TEST PARAMETERS:

Test Speed	100rpm to 500rpm
Test Pressure	300psi and 400psi
Test Temperature	50oC and 80oC
Vibration Factor	Measured using an accelerometer

ROTOR CONFIGURATIONS:

R1	Conventional Model 68 Single Lobe, Normal Fit C28 (2.8% Compression) Actual Rotor
R2	Conventional Model 68 Single Lobe, Loose Fit C10 (1.0% Compression) Actual Rotor
R3	Torsional Model 60 Single Lobe, Steel Rotor, C30 (3.0% Compression) Actual Rotor
R4	Torsional Model 60 Single Lobe, Aluminum Rotor, C30 (3.0% Compression) Actual Rotor
R5	Torsional Model 60 Single Lobe, Hollow Steel Rotor, C30 (3.0% Compression) Calculated Case

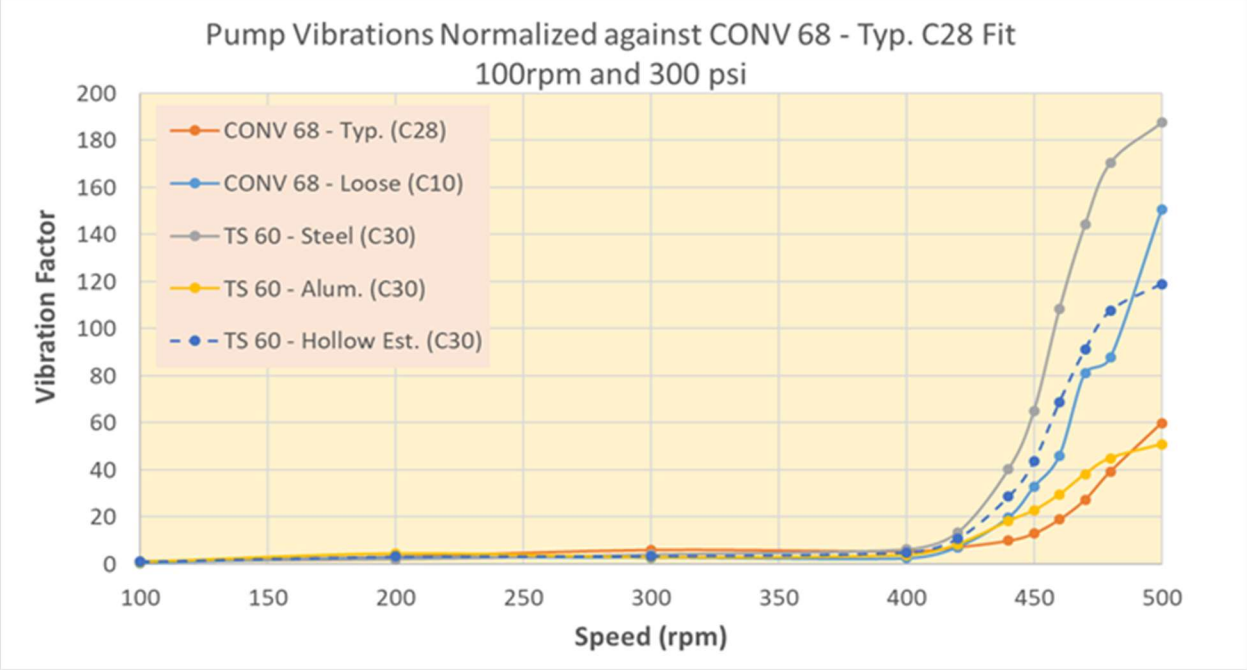
OBSERVATIONS:

A	R2 had less vibration when compared to R1 up to 420rpm but both increased significantly at speeds greater than 420rpm
B	R3 was similar or lower than R1 up to 400rpm where there was a bullish crossover by the R3 rotor. Further investigation is needed to determine if R1 at 300rpm is a bad date point, or if there is an additional harmonic resonance point in play with the conventional geometry.
C	R3 would be a better choice than R1 up to 300rpm. At speeds greater than 300rpm R4 and R5 provide significant benefit. At speeds higher than 400rpm R3 has the highest vibration.
D	Centrifugal forces increase with the square of the speed. This contributes to but does not explain the large increase above 420rpm. These increases must be caused by reaching a natural frequency with corresponding amplification of the vibration.
E	Temperature did not have a significant effect on the test results.

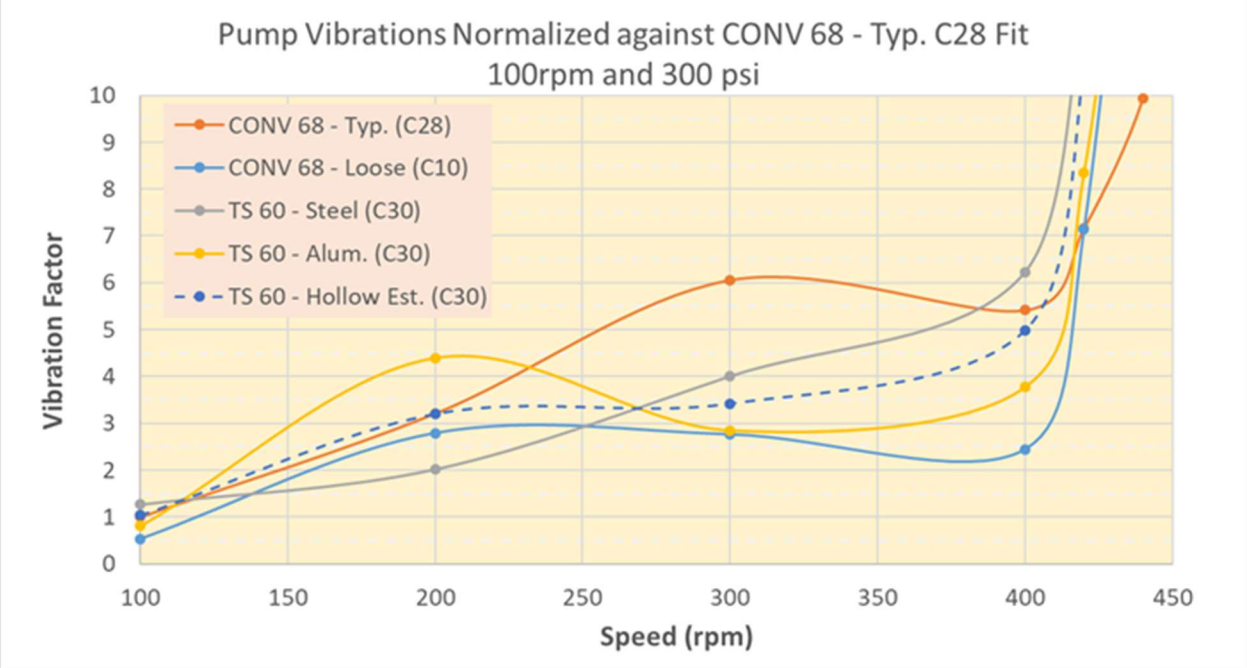
TEST DATA GRAPHING:

A graphical representation of the test program with the results normalized vs each other show significant increases in vibration after 400rpm. The second graph is zoomed in for better comparison detail inside the 100-400rpm range.

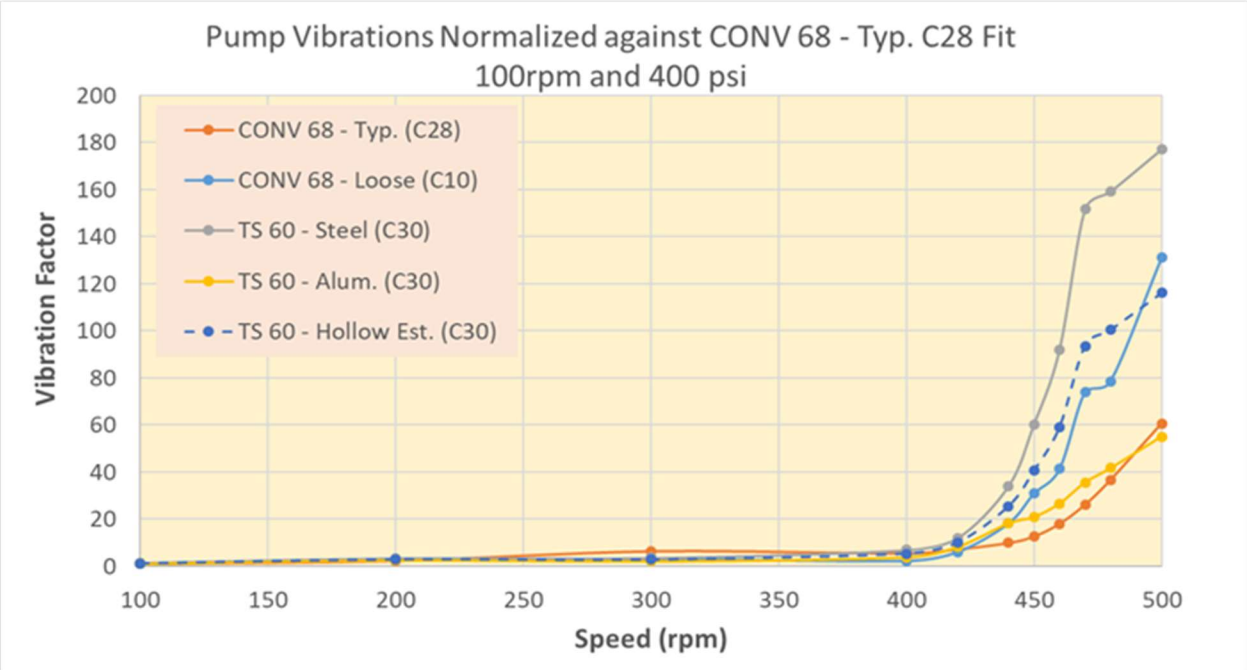
300psi, 100rpm to 500rpm (Full Range)



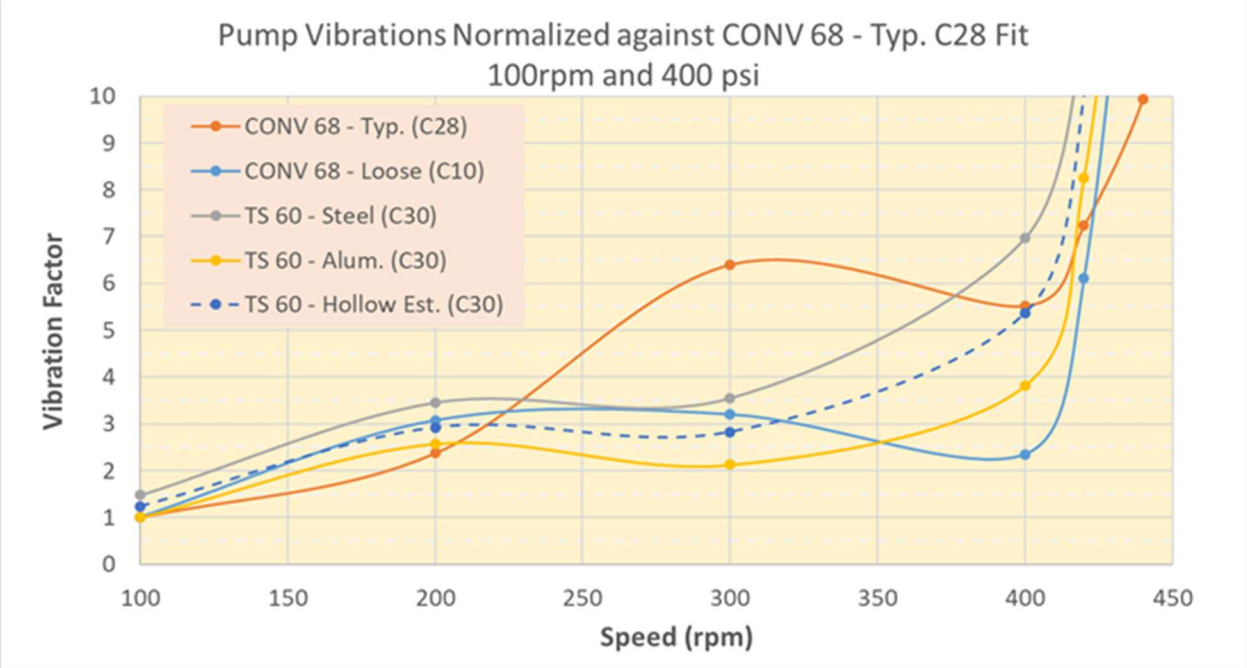
300psi, 100rpm to 400rpm (Zoomed)



400psi, 100rpm to 500rpm (Full Range)



400psi, 100rpm to 400rpm (Zoomed)



CONCLUSION:

The 60 series TorsionAL geometry provides a reduction in vibration over the conventional 68 series geometry by approximately half at 300rpm. At 200rpm and 400rpm the vibrational differences are minimal. Aluminum and hollow rotor sections provide a slight advantage over the steel TorsionAL rotor; however, the significant advantage is at speeds greater than 420rpm.

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