Gear Pump Division

Low Noise Hydraulics

Parker

ENGINEERING YOUR SUCCESS.

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Low Noise Hydraulics

Sound reduction has become a pressing issue in the Fluid Power Industry....

As a result, Fluid Power component manufacturers are designing products with this in mind.
Three Sources of Noise

- **By the pump**

- **Fluid Borne Noise** - Pressure pulsation produced

- **Air Borne Noise** - The result of something vibrating

- **Structure Borne Noise** - Vibration of the pump housing and circuit components as a result of pulsation
What is Noise?

DBA versus Harmonics

- Decibel on the A scale (DBA) - a unit for expressing sound intensity on a scale of from 0 for the average least perceptible sound to about 130 for the average pain level.

- Harmonic - component frequency of a harmonic motion that is an integral multiple of the fundamental frequency.
Noise in hydraulic systems is generally caused by the pressure pulsation's being transmitted thru the hose, to structural components elsewhere on the machine to the point where they resonate with and amplify the pump pulsation.
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Chromatic Scale

FUNDAMENTAL FREQUENCY RANGE OF MUSICAL INSTRUMENTS, VOICES AND GEAR PUMP HARMONICS

CHROMATIC SCALE

INSTRUMENTS

VOCIES

HARMONIC OF 12 TEETH

FREQUENCY Hz

RANGE BETWEEN 750 AND 2250 REV/MIN
Low Noise Hydraulics

- Low Noise units
- Interest for some years
- Multi Tooth 20T Gears
- Objectionable Tone

- DFC Dual Flank Contact
- Good pulsation reduction
- Improved efficiency
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Dual Flank Contact (DFC) Gears
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Ripple Cancellation

FLOW RATE

1 TOOTH CYCLE

Qs

Qm

HARMONICS OF TOOTH FREQUENCY

100

25 11 6 4 2.8

STANDARD - SINGLE FLANK CONTACT GEARS

FLOW RATE

1 TOOTH CYCLE

Qs

Qm

HARMONICS OF TOOTH FREQUENCY

25 6 2.8

DUAL GEAR AND DUAL FLANK CONTACT GEARS
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Pressure Ripple - Standard Pump

![Graph showing pressure ripple and harmonic tooth frequency]

- Harmonic Tooth Frequency
- Frequency: 0 to 2 kHz
- Time: 0 to 52 mS
- Pressure: 0 to 5 bar
- 3.298 bar peak at Harmonic Tooth Frequency 1
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Pressure Ripple - Standard Pump

- 3.343 bar
- 7.930 bar

Shaft
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Gear Pump Flow Ripple

- Split Gear and Dual Flank Contact (DFC) Pump 12 teeth
  Flow ripple 3.6% of mean flow

- Standard Single Flank Contact (SFC) Pump 12 teeth
  Flow ripple 14.4% of mean flow
Low Noise Hydraulics

- Stealth Split Gear
- Good cancellation reliability
- Two frame sizes in Production
- Excellent cancellation expensive to produce (4 Gears)
- PGP511S
- PGP620S
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- Stealth Split Gear Set
How does split gear work

- Gear teeth phased by 1/2 tooth pitch
- Some Flow / Pressure ripple cancelled
- 1st harmonic of tooth - cancelled
- 2nd harmonic of tooth - remains
- 3rd harmonic of tooth - cancelled
- 4th harmonic of tooth - remains
- Higher harmonics of tooth - not significant
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- Stealth Split Gear Set
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Dual Flank Contact (DFC) Gears
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Pressure Ripple - Split Gear Pump
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Pressure Ripple - Dual Flank Contact
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Manitou
Telehandler
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Fluid Borne Noise - Manitou Machine

Standard 2PR 037 Pump Pressure Ripple on Manitou Machine

- Speed (rev/min)
- Frequency (0 - 1 kHz)
- Pressure (0 - 2 bar)
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Fluid Borne Noise - Manitou Machine

Split Gear 2SR 037 Pump Pressure Ripple on Manitou Machine
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Air Borne Noise - Manitou Machine
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Air Borne Noise - Manitou Machine
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• Crown - Noisy Pump
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- Crown - Quiet Pump
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Crown Noise Frequency Analysis

Air Borne Noise ABN

Gear Tooth Harmonic at 3,625 rev/min

Quiet Pump 1SX100
Fitted with figure 'D' Bushes

Voice

Noisy Pump 1SX100
Fitted with SHC figure '8' Bushes

0 Hz 1 2 3 4 5 6
Frequency 5 kHz

Time
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New Holland Backhoe
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New Holland Control Lever Vibration

Comparison of Control Lever Vibration
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- Textron HR9016 Machine