WP0268
Dodge® synchronous drives: noise
Dodge Customer/Order Engineering
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All mechanical drives be it synchronous, v-belt, chain or gear drives generate some amount of noise. However, there is particular concern about the amount of noise made by synchronous drives. This paper focuses on the concept of noise, the cause of noise in synchronous drives and the way to reduce the noise.

What is a noise? Noise can be described as an unwanted or unpleasant sound or too loud of a sound. When describing noise levels, two criteria need to be considered; frequency and intensity. Frequency, or pitch, is defined in terms of Hertz (Hz). The human ear can distinguish frequencies in the region of 20 to 20,000 Hz. The intensity, or perceived loudness, of noise is measured in decibels (dBA). Due to the wide range of noise intensity, it is easier to express decibels on a logarithmic scale. Because of the log scale, if something is 40dBA louder than something else, the perceived loudness is actually 10,000 times greater.

Some noise levels in dBA are listed below:

	dBA
Whisper	20
Normal speech	60
Busy office	80
Textile weaving plant	90
Canning plant	100
Punch press	120
Air raid siren	130
Jet engine	160

How is sound perceived? Sound travels in the air as pressure waves. This disturbance in air pressure causes the human ear drum to vibrate at a similar frequency and intensity. Sound measuring instruments measure both the frequency of the pressure waves and the noise level. This information can be used to verify compliance or compare one drive system to another.

Within the normal hearing band for the human ear, lower frequency levels like annoying hum or rumbling noise will be less objectionable. Higher frequencies like whining or screeching noise will be more objectionable and present greater concern to a drive system designer or equipment operator. The occupational safety & health administration (OSHA) defines the federal noise standards to which the industry adheres. In addition to OSHA there are numerous states which have their own specific standards.

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There are three components associated with synchronous drive noise.

1. Impact between the teeth and the sprocket causes slapping noise.
2. As each belt tooth enters or exits the sprocket tooth, air is compressed and makes a sound like air escaping the balloon.
3. Since a tight fit is required between the belt and sprocket teeth to minimize backlash, a tensioned belt can resonate like a guitar string.

What can be done while designing a synchronous drive to reduce noise? To minimize noise produced by synchronous drives, keep the following points in mind.

1. Minimize belt speed. By reducing the speed, the noise level is reduced, and the frequency of the noise is lower.
2. Minimize belt width. Using a narrower belt will help in reducing noise.
3. Maximize small sprocket diameter. By using the largest possible pitch diameter for the small sprocket, this can help reduce noise level. However, this would also lead to higher rim speed, so some amount of optimization is needed.
4. Use acoustical guards. Acoustical guards help block the air displacement path, leading to reduced noise. This method can reduce noise by appox 10-20 dBA.
5. Split wide belts. This method generally results in reduction of noise by appox 2-4 dBA.. Instead of using one wide belt, a drive may be split into two thinner belts. For example, two 85mm belts may be used in place of one 170mm wide belt.

The following needs to be checked to prevent increased noise due to installation problems.

1. Alignment. A drive with excessive misalignment (greater then ¼°) will generate more noise than a properly aligned drive.
2. Tension. Improperly tensioned drives, both too high or too low are likely to generate more noise.

Please contact Dodge application engineering at 864-284-5700, or e-mail us at DodgeEngineering@abb.com, with any questions or comments.

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