# Synchronous Drive System Noise
# PA NOTE

PowerGrip®, PowerGrip® HTD® and Poly Chain® GT® belts, like any other power transmission drive system, will exhibit certain noise levels. This is true not only for synchronous belts, but also for V-belts, chain and gear drives. The noise levels may be attributed to the belt or may be the result of the equipment or immediate environment. In some cases noise may result from poor design, worn or damaged components, and user misuse or abuse.

**Definition:**

Noise can be described as an unwanted or unpleasant sound, or in the more severe cases, too-loud a sound.

When describing noise levels, we are concerned with two criteria - frequency and decibel (dBA) levels. Frequency, or pitch, is defined in terms of Hertz. The human ear is typically capable of distinguishing frequencies in the area of 20 to 20,000 Hertz. Frequencies above and below this range are generally not perceived by the human ear. The level or intensity of noise is measured in terms of decibels, dBA. Most industrial noise standards are written in terms of the "A" weighted scale.

**How is Sound Perceived?**

Sound travels through the air as pressure waves. These small disturbances in the air pressure cause the human ear drum to vibrate at a similar frequency and intensity. In addition to measuring the frequency of these pressure waves, sound measuring equipment can electronically transform the noise into a decibel level which can then be used to verify compliance to various standards or to compare one drive system to another.

Some typical noise levels, in dBA, are listed below:

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|---|---|
| Whisper | 20 dBA |
| Normal Speech | 60 dBA |
| Busy Office | 80 dBA |
| Textile Weaving Plant | 90 dBA |
| Canning Plant | 100 dBA |
| Punch Press | 120 dBA |
| Air Raid Siren | 130 dBA |
| Jet Engine | 160 dBA |

Within the normal hearing band for the human ear, lower frequency (i.e., lower pitch) levels will be less objectionable. These are often described as an annoying hum or rumbling noise. Higher frequencies, such as a whining or screeching noise, will be most objectionable and present the greatest concern to drive system designers, and of course, to equipment operators or others in the immediate area of the drive.

The Occupational Safety & Health Administration (OSHA) Safety & Health Standards 2206 (29CFR1910) describe the federal noise standards to which industry must generally adhere. In addition to the above-named standard, there

are numerous other standards issued on state and local levels and also specific standards issued within an industry or within a specific company.

**Designing Drives to Reduce Noise**

When designing PowerGrip® HTD® belt or other synchronous drive systems, several general guidelines for noise reduction can be considered:

1. Minimize belt speeds. By slowing down the drive, the noise level is reduced and the frequency of any generated noise is lower. This often puts the frequency of the drive system into that unobjectionable area.

2. Minimize belt width. Using the narrowest belt that can handle the design loads at the design speed will help minimize noise levels.

3. Maximize small sprocket diameter. By using the largest pitch diameter for the small sprocket, noise levels will be reduced. This will also lead to improved belt life. Note however that larger sprockets result in faster belt speeds (see statement #1) so some optimization is required.

4. Minimize vibration of equipment. Vibration causes air displacement, which causes noise. Dampening vibration of the equipment will lower noise from the system in general.

5. Minimize air transmission paths. By considering drive location and/or using acoustical guards, the air displacement path is blocked and effectively reduces noise.

When evaluating an existing drive that is generating objectionable noise, be thorough. Remember the belt drive may not be the only source for noise. Improperly maintained bearings or shafts, weak supporting structures and other rotating or sliding parts in the total system may also be a source for noise.

When checking the drive, evaluate carefully alignment and tension.

Alignment--

A drive with excessive misalignment, generally greater than 1/4 degree, will more likely generate noise than a properly aligned drive. Consider both parallel and angular misalignment. Also, properly aligned drives will yield improved belt life.

Tension--

Improperly tensioned drives will more likely generate noise. Belt tension should not be too high or too low. Too low a tension can also lead to shortened belt life or ratcheting, while too high a tension will add undue stress to bearings, shafts and other related components.

**Other Noise Reduction Solutions:**

In addition to design considerations, there are several other accepted methods of reducing belt drive noise:

1. Split Width Belts. Although this method generally results in only very small reductions, approximately 2-4 dBA, tests have shown it will help. When using wide belts, the drive can be split into two standard width belts, i.e., one 170 mm = two 85 mm wide belts.

2. Reduced Noise Belt. A more effective solution is to consider the RN belt. Tests show it can lower noise levels by about 5-10 dBA. It will also reduce the higher frequencies that are most irritating to the human ear. RN belts are currently available only for 14 mm pitch belts. [RN belts superceded by 14M PowerGrip® GT® by 1993.]

3. Acoustical Noise Guard. The most effective method since it can result in noise reductions of from 10-25 dBA. The actual level of noise reduction depends on the type of guard, i.e., partial or full guards. A Belt Drive Acoustic Guard Design Manual is available from Gates. It contains additional discussion on noise and a belt drive enclosure drawing. It will assist the designer/user in determining the most effective type of guard and implementing its design and installation. [Publication is out-of-date and out of print.]

**Noise Calculations**

As a general rule, after monitoring a number of field applications, those drives most likely to be candidates for objectionable noise generation involve 14mm pitch belts in widths greater than 85 mm operating at belt speeds aver 3500 rpm. Gates also has a program to calculate the estimated noise level of specific drives. However, we must note that extensive laboratory studies, using highly instrumented equipment, have not yet provided a method for predicting when noise will or will not occur on any specific application. For additional assistance, contact Denver Application Engineering.