



TENSIONING SYNCHRONOUS BELTS

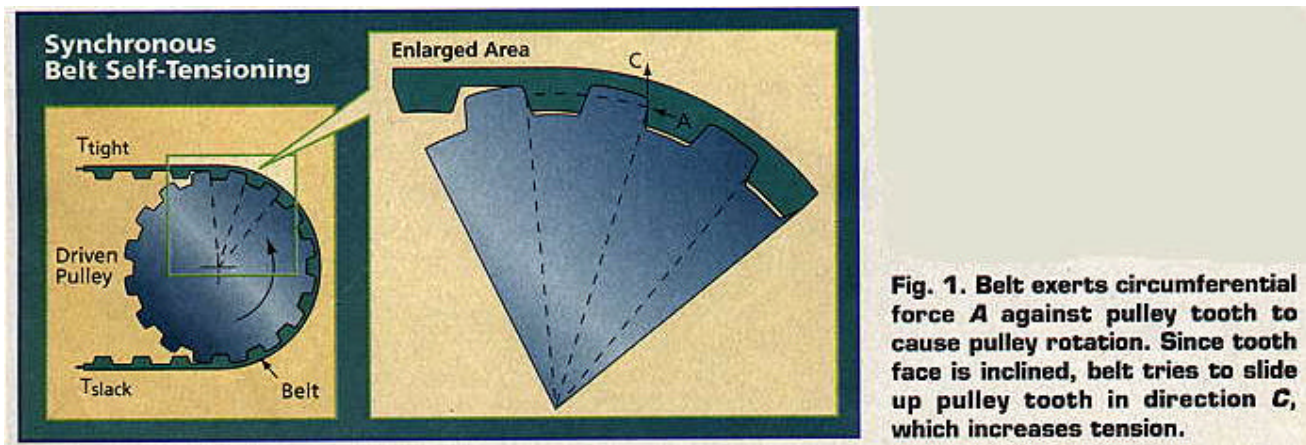
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Tensioning has entered the computer age through the use of electronic, non-contacting sonic meters.

Proper installation tension is essential in any belt drive for optimum performance and reliability. Ideal tension is the lowest amount that properly seats the belt in the sprockets during maximum loading at all points around the drive. Optimum tension leads to maximum belt life and lowest bearing loads for a given application of power transmission.

Laboratory testing has shown that synchronous belts, like V-belts, operate ideally at approximately a 5:1 tension ratio (tight side to slack side tensions). The correct installation tension for a belt depends on drive geometry and loading. Procedures for calculating these tensions are relatively straight-forward and found in most belt manufacturers' drive design manuals.

While overtensioning a belt can impose higher bearing loads and lead to reduced belt life, undertensioning can be just as detrimental to the life of the drive. When the belt is too loose, and inherent "self tensioning" characteristic results in belt teeth climbing out of the sprocket grooves, leading to increased stresses on the teeth, accelerated tooth wear, and reduced belt life (Fig. 1).



In most cases, the entrance to the driven sprocket on the slack side of the drive is where the belt begins to ride out, if undertensioned. Severe undertensioning can lead to belt ratcheting or jumping of teeth. At that point, significant shaft separation forces are instantly developed in the drive, resulting in damage to bearings, shafts, other drive components, and the belt. Using ideal tension helps prevent excessive belt wear without overstressing bearings and other drive components.

For any belt application, there are means to calculate and measure proper installed static tension. One method for measuring ideal tension employs a sonic metering device. This device operates on the transverse vibration of strings theory, which basically holds that a belt, like a string, vibrates at a specific natural frequency based on its tension, mass, and span length.



About the size of a portable telephone, sonic tension meters are easily held in one hand and operate on either batteries or ac adapter. The meter features a built-in keypad which the operator can use to enter the necessary belt drive parameters.

To measure tension with this meter, weight, width, and span length of the belt must be entered. The operator simply strums the non-moving belt to set it vibrating. When the measure button is pressed, the device instantly processes the variations in sound pressure emanating from the vibrating belt span. A liquid crystal readout automatically displays the frequency of the belt vibration in Hertz, or converts the frequency to a measurement of static tension.

When the belt is tapped or strummed, it first oscillates in a wide range of modes, but the higher and lower frequency modes decay faster than the fundamental mode. This leaves a continuous sinusoidal wave that is related to a specific belt tension (Fig. 2).

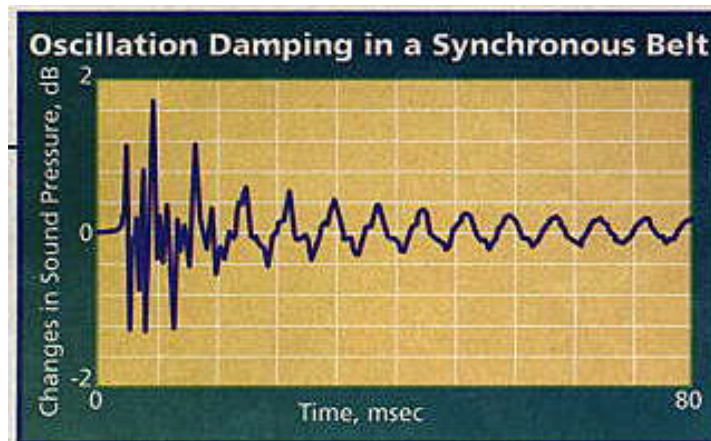
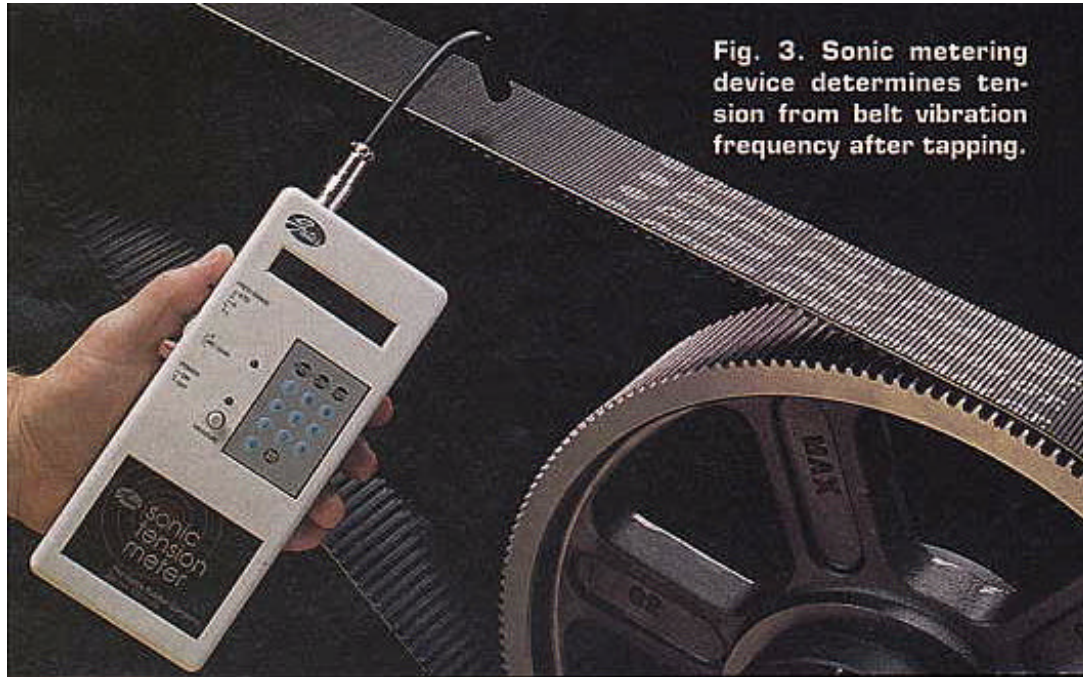


Fig. 2. High and low-frequency modes decay leaving a sinusoidal wave related to belt tension.

Sonic tension meters (Fig. 3) are capable of measuring with greater accuracy and consistency than traditional methods. The measurement is nonintrusive, meaning the belt tension is not changes during the measuring process. The device also eliminates human error that can result from using push-type gauges or pull-type scales. Measurements are repeatable regardless of the operator.



Sonic tension meters prove especially effective in confined spaces where conventional measuring tools are not feasible or drive guards restrict access to belts. The meters come with flexible sensors easily positioned in tight spaces for measuring small belt drives. On other drives, it is often possible to save time by positioning the meter's sensor over the belt without removing the drive guard.

Tension should not be adjusted when the drive is running. However, a strobe can be used to observe and record the belt/sprocket relationship while operating under normal load.

Once it is determined that the drive needs tightening or loosening, the drive can be shut down, followed by normal lockout/tagout procedures and adjustments based on observations using the strobe. This procedure can be repeated until optimum tension is achieved as indicated by the belt slightly lifting off the driven sprocket on the slack side at normal loading conditions. For drives with very high peak loads, tension may be increased to prevent ratcheting at these high loads.



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The Gates Rubber Company
Denver, Colorado USA



Adjustment Tips

Whenever adjustment on used belts is required, always check for unusual wear, which may indicate problems with the drive design or preventative maintenance program.

Clean belts and sprockets with a rag that's slightly dampened with a light, nonvolatile solvent. Soaking or brushing the solvent on the belt is not advisable. Avoid sanding or scraping the belt with a sharp object to remove grease or debris.

Check alignment, which is very critical with synchronous belt drives, and remember to check other drive components such as sprockets, bearings, and shafts for alignment, lubrication, and wear.

Never pry or use force when installing new belts over sprockets. Take up center distance on the drive until proper tension is observed on the meter; then rotate the drive by hand for a few revolutions and recheck tension.

Tighten motor mounting bolts to the correct torque and be sure all drive components are secure. Any change in drive centers during operation results in poor belt performance. A final tension check should be made after the motor bolts are tightened.

While synchronous belts should not require further tensioning, it is good practice to observe performance of the drive during operation. Look for anything abnormal about the way the belt travels around the drive. Listen for any unusual noises. Be alert to the smell of warm rubber. If a problem is detected, shut down the machine and check bearings and the motor. If they feel hot, belt tension may be too loose or too tight, or bearings may be misaligned or not properly lubricated.