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Gates Compass™ Power Transmission CD-ROM version 1.2
The Gates Rubber Company
Denver, Colorado USA

Synchronous and V-Belt Drive Tensioning
PA NOTE

Static Tension

What is the best tension for a V-belt drive? You might ask this question when the belt is on the verge of slipping under the highest possible load. This slipping point may not be easily found and does not allow for changes in belt growth, wear or even environmental conditions such as humidity. Since synchronous belts cannot slip on a sprocket, the best tension is the minimum tension that will keep the belt's teeth properly seated in the grooves under peak loads.

With too little tension in a V-belt drive, slippage can occur and lead to spin burns, cover wear, overheating of the belt, and even overheating of the bearings. Not enough tension in a synchronous drive will cause premature tooth wear or possible ratcheting (jumping teeth) that will destroy the belt or possible shaft breakage. Too much tension overloads bearings and bracketry and can lead to early bearing failure. Overtensioning will also shorten belt life.

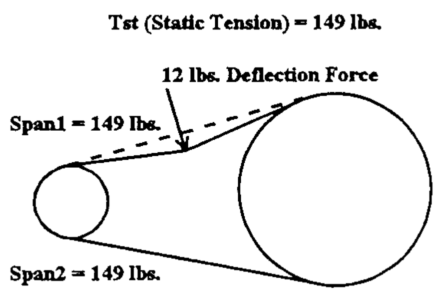

Figure A

Total tension required in a belt drive depends on the type of belt, the design horsepower (horsepower x service factor) and the RPM of the drive. Since running tensions cannot generally be measured, it is necessary to tension a drive to a static tension (a stationary installation tension). The most common method of establishing a static tension is by the force/deflection method. As shown in Fig. A, once a calculated force is applied in the center of a span with a known deflection, the recommended static tension will be established. Most design catalogs will provide force and deflection formulas. Gates computer design programs can also provide these calculations.

When installing new synchronous or V-belts for the first time (or after a belt has been removed from a drive), installation tensions should be set higher. Generally 1.4 to 1.5 times the normal static tension. This higher static tension is necessary because drive tension drops rapidly during the seating in process. This extra initial tension does not adversely affect bearings because it decays so rapidly. For maintenance retensioning of existing drives, tension can be 1.2 to 1.3 times the normal static tension as shown if Fig. B.

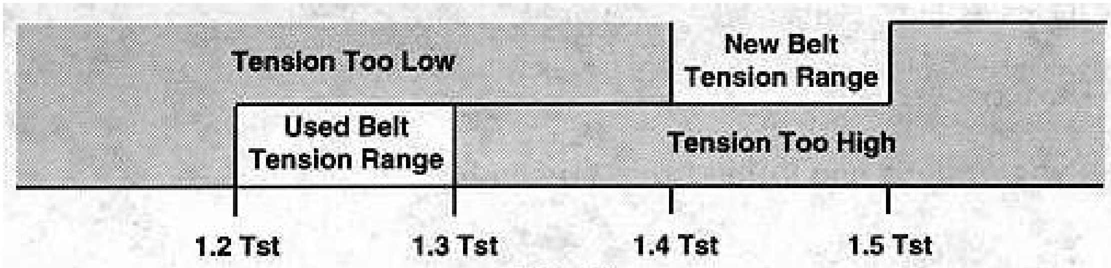

Fig. B

It has always been recognized that we must give the user some tolerance on tension (since it is difficult to install to an exact value), so we have used the idea of a range. The closer a belt drive can be installed to the ideal 1.0 tension value, the lower the stress on all drive components.

These calculations are per belt, strand or rib. If multiple belts/ribs are used, the static tension and deflection forces should be multiplied by the number of belts/ribs when tensioning the entire drive. It is not necessary to multiply the deflection distance by the number of belts/ribs.

Belt Pull

The preceding discussion dealt with static tensions only. For a two-point stationary drive the span tensions are shown in Fig. A. Once a drive starts operating, different tensions will develop in a drive. Usually most drives operate near a 5:1 tensioning ratio as show in Fig. C. It is under these dynamic tensions (working tensions) that a force is imposed on the bearing (belt pull) that is much greater than the static force belt pull. A vector analysis of these dynamic tensions is shown in Fig. C.

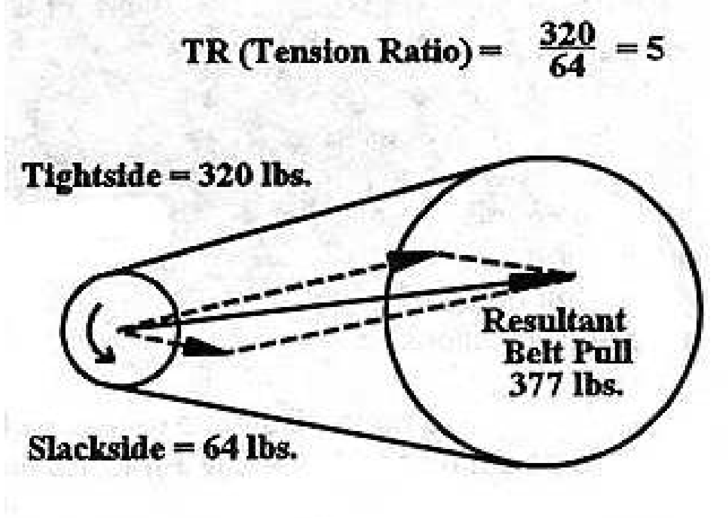

Fig. C