Timing Belts

Drive Design Recommendations

- Small pulley diameter should not be smaller than the width of the belt to avoid excessive tracking forces.
- A belt must have at least six teeth in mesh with the grooves of a pulley to operate at the rated power.
  - Determine the number of teeth in mesh by taking the Arc of Contact times the number of grooves on the pulley divided by 360, if only 5 teeth are in mesh, multiply the power rating of the belt by 0.8, 4 teeth - 0.6, 3 teeth - 0.4; if only 1 or 2 teeth are in mesh, a drive redesign should be considered
- At least 1 pulley on a drive must be flanged, when the center distance is equal to or greater than 8 times the small pulley diameter, or on vertical shafts, both pulleys should be flanged.
- Timing belt drives are generally a source of noise. An increase in belt speed results in a proportional increase in the frequency of the belt noise. An increase in tension and belt width also results in an increase in noise.
- Care must be taken on drives with long center distances so that the belt does not sag and allow teeth on the slack side to contact teeth on the tight side.
- Idlers should be avoided whenever possible unless used for power takeoff or functional use. If an idler is needed, it should be placed on the slack side of the drive. Inside idlers must have teeth, unless the diameter is greater than that of an equivalent 40 tooth pulley. Flat idlers must not be crowned. Idler diameter must be larger than that of the smallest pulley in the drive.
- The positive grip of timing belts eliminates the need for high initial tension. A properly installed, tensioned and maintained timing belt should be able to run its entire life without retensioning.
- Having a rigid frame is important to prevent a varying center distance under a varying torque load.

Installation

- Ensure shafts are parallel and pulleys are aligned properly. Misaligned pulleys lead to rapid, uneven belt wear. Use a straightedge to check alignment. Angular misalignment should be limited ¼° or 1/16” per foot of span.
- Ensure pulleys are clean and free of contaminants. Check for wear, rust, nicks and foreign material. Replace pulleys if necessary.
- Belt should never be pried or forced onto pulleys, the excessive twisting and stretching forces will damage the tensile members. Always move pulleys close enough to allow belts to be placed freely onto the pulleys. Then adjust pulley centers in order to apply adequate tension to the belt.
- Timing belts need to be tensioned properly in order to maximize life while minimizing bearing/shaft load, noise and tracking.

Tensioning

- Refer to the Bestorq’s “Timing Belt Tensioning” which can be found at Bestorq.com
- Following those guidelines as well as proper drive design and belt care is required to achieve maximum belt life.

Maintenance and Care

- Avoid “crimping” belts. Bending belts to a diameter smaller than that sections smallest recommend pulley will damage the tensile members of the belt and lead to premature failure.
- Too little tension or a varying center distance can allow teeth to jump teeth or “ratchet”, especially on high torque starts. The tension should be gradually increased until this is avoided.
- Ensure that the drive is kept free of debris. An object in the groove of a pulley can easily puncture a timing belt when the belt and pulley mesh.
- Dust or dirt accumulating in the pulley grooves will lead to increased tension in the belt, leading to decreased belt and bearing life.
- Unlike a V-belt drive, oil and grease will not cause slip on a timing belt drive but will still cause damage to the belt. The belt will degrade over time and prolonged exposure to contaminants will lead to premature failure.
- Added loads will decrease belt life. Belt load versus belt life is not linear, so even small increases in belt loads can cause a severe reduction in belt life. Doubling the load on a belt could reduce the belt life to 5%-10% of the original.
- Proper care of a belt is not limited to the time during which the belt is operating on equipment; it also includes proper storage techniques.

Storage

To prevent premature failure, proper storage techniques must be followed for belts:

- Belts should be stored in a cool and dry environment out of direct sunlight. Ideally, belts should be stored in conditions less than 85°F and 75% relative humidity. Adding 15°F to the storage temperature decreases belt life by approximately 50%. Do not store belts at a temperature above 115°F.
- If timing belts are stored on a wall rack, use a saddle with a diameter at least as large as the minimum recommended pulley diameter for that cross section.
- If a machine will be idle for long periods of time (6+ months), the belt tension should be relaxed and the equipment or belt stored in an environment which meets the above guidelines.
- Timing belts are commonly “nested” by placing forming a gentle “C” shape and placing one belt inside another. This can be repeated several times. Do not force belts inside one another or bend belts to too small of a diameter.
- If stored in containers, ensure that the belt is not forced in and distorted. Limit the contents of each container so that the belts at the bottom are not damaged by the rest of the belts.
- Belts should not be exposed to excessive pressures or holding forces that cause permanent deformation.
- Belts should not be stored near windows as this can expose the belts to moisture and sunlight. UV light causes the belt material to degrade and shorten belt life.
- Do not store belts near any type of heater, or in the direct airflow of a heating device.
- Belts should not be stored near any ozone generating device or where they are exposed to solvents or chemicals in the atmosphere.
- Do not store belts on the floor unless they are in a protective container. Floor locations are more likely to be exposed to traffic and chemicals that may damage the belts.
- Do not cause sharp bends or crimp belts. Crimping is when the belts are bent to a diameter smaller than that of the smallest recommended sheave diameter for that cross section. Hanging a belt on a small diameter pin or using a tie or tape near the “end” of the belts can cause irreversible damage to the tensile cord.