

» Design Notes

How to reduce operating costs of low profile conveyors

Low profile conveyors are typically used in 24/7 applications where unplanned downtime or maintenance is intolerable. But the most critical areas of these conveyors that draw maintenance attention are the belt and the pulley/bearing system. Speed, load, accumulation and inclined operation increase forces on these components, highlighting problem areas, such as belt tension.

Belt manufacturers universally cite correct belt tension and crowned pulleys as keys to long belt life and consistent slip-free performance with positive self-tracking. But whether over or under tensioned, incorrect belt tension can cause problems, including bearing overload, miss-tracking, belt slippage, and accelerated component deterioration. Correct tension varies, but typically it will be 1 mm of belt stretch per foot of conveyor length. However, a belt is often a little longer or shorter than its stated size. To ensure correct tensioning, you can use the tail pulley to set tension. Once all belt slack is taken up, tension is set through a scale on each side of the conveyor, where each increment represents the tension setting per foot of conveyor length.

A crowned pulley with a correctly tensioned belt is the preferred way to automatically center the belt. Flat across the center, a crowned pulley produces dual lateral opposing belt forces that balance each other when the belt is centered over the crown. If the



Tool-less swing-up tail pulley permits one-minute belt exchange, while retaining tension setting. Calibrations on both sides permit rapid precise "balanced tension" where each increment represents the tension setting per foot of conveyor length.

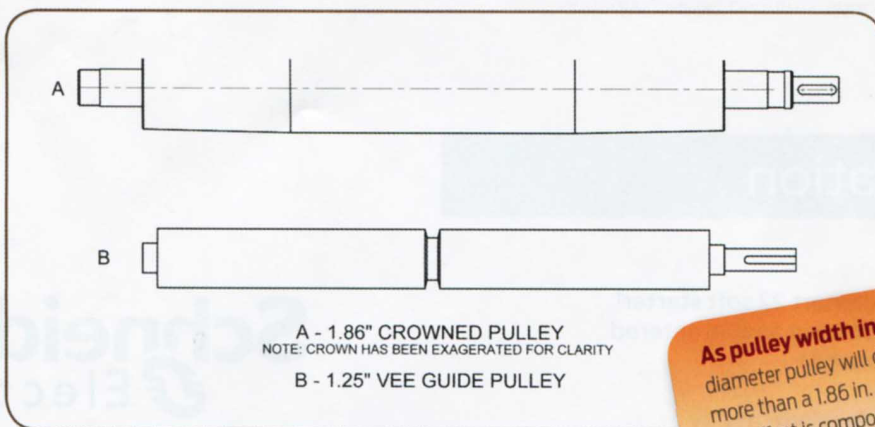
belt moves off center, these forces become unbalanced, resulting in the "higher force" side directing the belt back to its centered position. Crowned pulley systems also allow higher accelerations and speeds with much less belt and component wear.

Properly tensioned belts on crowned pulleys easily withstand moderate short-term lateral forces without major displacement from center. When side loads increase, a V-retainer on the underside of the belt can

limit off-center drift. The V-shaped profile rides in a groove cut into the pulleys (which reduces pulley rigidity), and a groove running the length of the conveyor bed. This approach allows the crowned pulley to quickly center the belt when the external force is removed, minimizing wear on the V-retainer.

Belting manufacturers recommend that V-retainers not be the primary belt tracking system due to the high wear the V-profile incurs. An alternative is to use the V-retainer on the top edge surface of the belt and have it guided and constrained from the top down by a rolling Delrin® V-guide, located opposite the point where the belt experiences side forces.

Low profile conveyor pulleys normally range from 1- to 2-in. diameter, but this small range can produce differences in conveyor capacity and performance, as well as belt, cleat, and bearing life. Logic dictates that a smaller-diameter drive pulley will have a greater tendency to deflect as the conveyor width increases (a 1.25



As pulley width increases, a 1.25 in. diameter pulley will deflect nearly five times more than a 1.86 in. diameter pulley, and this effect is compounded when the pulley is weakened with a V-groove.


in. pulley without a V-groove will deflect nearly five times more than a 1.86 in. pulley with the same load). This creates an inherent "traction" disadvantage for load carrying, and can negate the belt-centering capability of the pulley. In applications that involve reversing, wider conveyors, accumulating or inclined operation, this disadvantage can be problematic. Flexing a belt over a smaller diameter also accelerates belt breakdown.

When scaled up in width, conveyors with small-diameter pulleys often cannot carry proportionally greater loads. For example, a conveyor with a pulley diameter of approximately 2 in., with a correctly tensioned belt, will carry twice the load at 24-in. width than it does at a 12-in. width. This rule of thumb does not hold as pulley diameters approach the 1.25-in. range.

Smaller pulley diameters are limited in producing the proper belt tension needed for automatic centering with a crowned pulley. The resulting loss of "traction" and self-centering are sometimes compensated for by lagging or knurling the pulley, and substituting a longitudinal V-retainer, rather than a crowned pulley, for belt centering. Because the pulley must now have a V-groove in its center, as well as being knurled, its rigidity is further compromised. Knurled pulleys tend to abrade the belt underside and resist tracking, which reduces belt life. Impacted debris in the pulley knurl, or worn knurling, can lead to belt slippage and miss-tracking, as well as accelerated belt, V-retainer and pulley knurl wear. Abrasion can occur without any load on the conveyor, and increases with belt speed.

Bearing life is also affected by pulley diameter. A 1 in. pulley must run at twice the speed of a 2 in. diameter pulley to produce an identical belt speed. Small pulley diameters can result in smaller bearings with lower load capacity running at higher speeds, reducing service life. Ensuring that the bearing outer race cannot rotate in the bearing plate housing can improve bearing performance and avoid the need to replace worn bearing housings.

If a conveyor is used for multiple applications that can be run at lower speeds, a variable speed drive may be desirable. It reduces wear and power consumption, and

provides optimum speed for each application. Information was provided by Charles Mitchell, President, Conveyor Technologies Ltd. 

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