Troubleshooting Spiral Belts

Jerky Operation

Jerky operation can be caused by a number of potential problems, including:

- Surging caused by high overdrive
- Rod ends protruding in and hanging up on cage bars
- Stick-slip frictions caused by dirty or otherwise high friction wear surfaces
- Chordal action on the small sprocket at the cage drive
- Drive motor surging or pulsing

Dirty Systems

Process dirt and belt wear debris may contaminate product and reduce the useful life of the belt if the user does not practice proper cleaning. Cleaning practices and schedules are application specific. Reference Technical Bulletin TB-TC-002 for detailed discussion and recommendations.

Ice Build-Up and Damaged Overlays

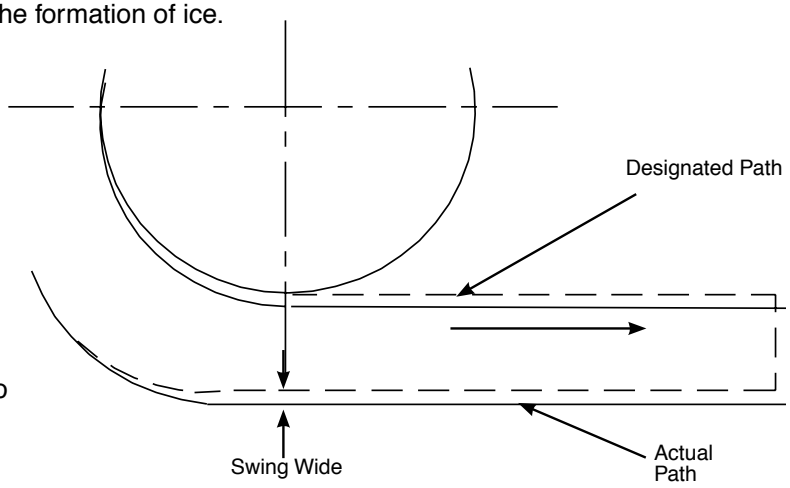
Ice build-up on terminals and support structures is a fairly evident problem but often hard to solve. The apparent solution is to defrost more often to reduce the formation of ice.

Tenting

Tenting is a symptom of too high tension within a lotension system. The solution is to reduce tension and/or to add hold down brackets.

Swing Wide

It is normal for a spiral belt to “swing wide” **(Figure 17)** as it exits the spiral cage, following a path that is offset but parallel to the normal tangent line to the cage. Ideally, the spiral and its out-feed should be designed to incorporate this effect. However, if the spiral design does not allow for the natural tendency of the belt to swing wide, the belt edge may come in contact with the spiral framework. In this case, the usual reaction of the spiral operator is to restrict the path of the belt from swinging wide, typically by use of rollers or shoe guides. This is not recommended as restraining the belt can have several adverse effects on its service life:



[Figure 17]

- The belt can wear through a shoe guide, allowing the edge to snag. This will eventually cause an increase in belt tension and damage the belt edge.
- Outside edge restraints can push individual rods inward. The rods can be held in this inward position by belt tension. There is then a potential for the projecting rods to catch on the vertical cage bar capping, causing damage to the belt, damage to the cage bar capping, and high belt tension.
- If the belt is pushed into a straight tangent path, the tension carried in the outside edge of the belt is shifted to the inside edge of the belt, resulting in a pronounced tendency for one edge of the belt to lead the other.

High Tension

High tension occurs when the coefficient of friction between belt and support rails is higher than coefficient of friction between belt and cage. The estimated system tension is also called the “Radius Weight” of the system.

The formula for this calculation is:

Radius Weight = Radius x Weight x [f(rail) / f(cage)]

Where:

f = friction

Unequal friction conditions can dramatically alter the system’s tensions.

Example:

Assuming a radius to the tension link of 10 ft (3.05 m), and a combined weight of the belt plus load equal to 10 lb/ft (14.9 kg/m), with the rail and cage friction both at 0.2, the radius weight or tension equals 100 lb. (445 Newton’s).

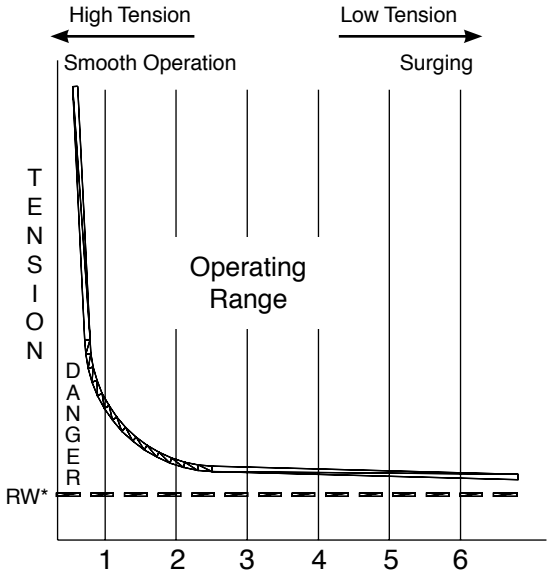
The table below indicates changes in tension when coefficients of friction are altered.

RAILS	CAGE	fr	fc	fr/fc	RW
Normal	Normal	0.2	0.2	1.0	100 (445 N)
Dirty	Normal	0.3	0.2	1.5	150 (667 N)
Normal	Oily	0.2	0.1	2.0	200 (890 N)
Dirty	Oily	0.3	0.1	3.0	300 (1334 N)
Oily	Oily	0.1	0.1	1.0	100 (445 N)
Oily	Normal	0.1	0.2	0.5	50 (222 N)

Changes in the frictional relationships, caused by oil and dirt, can have a beneficial or destructive influence on the belt and its chances for a long useful life.

Another common cause of high system tension is a lack of overdrive. Spiral operators, in an attempt to make the belt operate smoothly, will sometimes reduce the overdrive in the system. By doing so, they also create high belt tension. Often, a compromise between high tension and smoother operation of the system, and greater overdrive with its accompanying looping or surging, is required. In the case of severe or unacceptable surging, system overdrive should be reduced to the point where the belt surging just stops.

Figure 15 shows the effect of overdrive on tension.



[Figure 15]

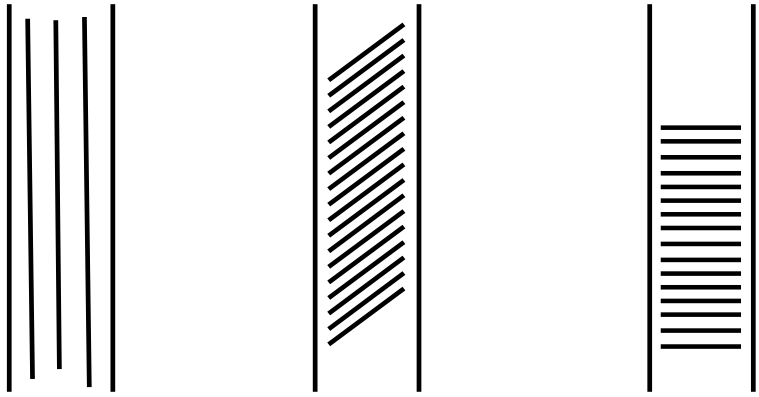
High Tension (Cont.)

By examining the surface of the cage bars, a good estimation of the overdrive can be made. If the wear marks on the cage bar wear strips are nearly vertical,
the system has been operating with little or no overdrive, indicating high tension within the system. The marks are made when the same buttonhead remains on the same cage bar for a long period of time as it rises up or drops down the cage surface.

Wear marks that are 30°–45° to horizontal will indicate an overdrive in the range of 2 to 4 tier heights. In this case, the system is operating with the proper amount of tension.

Finally, nearly horizontal wear marks indicate a very high amount of over-drive. High overdrive is indicative of low tension in the system and is not harm-ful to the belt, even if it causes some surging. If this is not objectionable to the application, the overdrive should not be re-adjusted.

Figure 16 illustrates these markings.



Vertical
Wear Marks
(No Overdrive,
High Tension)

30°–45°
Wear Marks
(Good Overdrive,
Proper Tension)

Horizontal
Wear Marks
(High Overdrive,
Low Tension)

[Figure 16]

other possible causes of high tension within the system include:

- Hold-downs pinching the belt against the support rails
- Belt edge impinging on the conveyor structure
- Hard turning or frozen bearings on a terminal or in the take-up tower area
- Narrow area of the support structure squeezing the belt
- A twisted or crushed cage that has a smaller diameter at the mid-section of its height
- Cage diameter too small to allow continuous contact with the inside belt edge
- Damage to the belt that restricts its ability to collapse correctly around the drum or cage, inhibiting proper belt-to-cage contact and the drum's ability to efficiently drive the belt
- Damage to the belt that restricts its ability to flex on the terminals
- Missing cage bar caps, or wear strips missing from the belt supports
- Rods protruding inward and catching on the cage bars
- Loss of overdrive due to belt pitch elongation, causing higher belt speed with no increase in cage speed; this occurs when overdrive was at lower range of acceptability before stretch