Index Page

FENNER DUNLOP

CONVEYOR BELTING

Belt Tracking

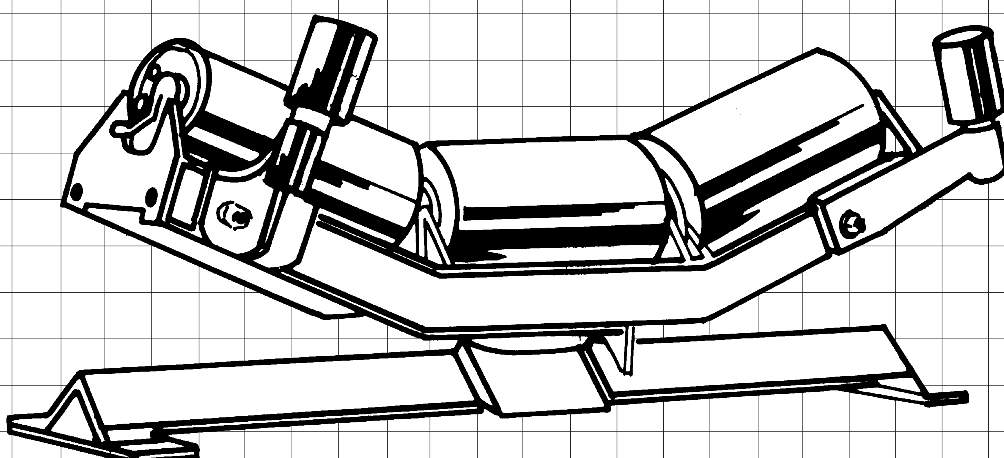


Table of Contents

“Tracking” or training is defined as the procedure required to make the conveyor belt run “true” when empty and also when fully loaded.

Tracking conveyor belt should be approached from a systems point of view. We should first examine some of the components of the conveyor system and see how they effect belt tracking before we discuss the actual methods used to train a belt.

We also need to look at a few non-structural components such as conveyor house keeping, the belt itself and the splice, before we discuss recommended training procedures.

Index Page

I. Conveyor Components

Supporting Structure

The supporting structure is designed to hold conveyor sections firmly and in proper alignment. If it does not, for whatever reason, it is likely to have an effect on belt tracking. Support structure should be checked as a first step in belt tracking. Has a forklift run into the supporting structure and buckled it? Are the anchors firm?

Conveyor sections are bolted to the supporting structure. They should be “square” and “horizontal” (side to side). If the section is “racked” **it must be straightened**. Measure diagonals across the frame. They should be equal. Repeat for total, assembled bed.

Conveyor bed sections (slider or roller) must be properly aligned with no vertical off-set between sections. A taut line should be stretched over the top surface of the bed and adjustments made so that all points are in contact. The entire bed (and each section) must be horizontal (across the width). If they are not, the belt will be pulled by gravity and will “drift” toward the low side unless a compensating force of some kind is exerted on that belt.

Pulleys/Rollers/Idlers

All pulleys, snub rollers, carrying idlers, and return idlers must be square with the frame (perpendicular to belt center line), parallel to each other and level.

“Squaring” with the frame is a good preliminary adjustment. The final adjustment, however, requires that this “squaring” be done with the belt center line as the reference. All pulleys must be at right angles to the direction of belt travel (belt center line).

Crowns

Crowned pulleys for ***lightweight conveyor belt*** can be trapezoidal or radial shaped. Georgia Duck has products to accommodate both styles, however the amount of crown in either case should not exceed 1/8" per foot on the diameter, and should ***not exceed 1/8" total.*** The rate of crown seems to be very important as well as the total amount of crown
in the system.

On short center conveyors, we recommend no crown on the drive (avoid crowns on drive in every case, unless the drive is an end pulley), and to crown the end pulleys. In a few cases we would also crown additional pulleys, but that will depend on the entire design and the amount of crown used.

Remember, for crowns to be effective, there must be enough free span/transition for the belt to elongate and conform. Pretension to get pulley crown conformation is very important, too much pretension can cause pulley deflection and bearing problems. Georgia Duck has specific carcass constructions to meet very short center, wide belt applications in the 1:1 ratio of length to width, and even less. Please consult factory if you have needs in this area.

Crowned pulleys are not recommended for high modulus bulk haulage belting. Steel Cord belting requires fully machined straight faced pulleys through out the system. If a crowned pulley is used on nylon, polyester or aramid style belting the crown should only be placed in a low tension area such as the tail on a conventional head drive conveyor. The tracking forces that the crown exhibits does not effect high modulus bulk haulage belting because the system lacks enough tension to make the crown effective. If you could exert enough tension on the belt to force the belt to conform to the crown, the belt would be subjected to excessive stretch and splice failure could result.

Take-up

The take-up device in a conveyor belt system has three major functions:

1. To establish, and preferably to maintain a predetermined tension in the belt.

2. To remove the accumulation of slack in the belt at startup or during momentary overloads–in addition to maintaining the correct operating tension.

3. To provide sufficient reserve belt length to enable resplicing, if necessary.

Manual, as well as **automatic**, take-up devices are normally used in a typical conveyor belt system. The **manual or screw** take-up consists of a tension pulley (frequently the tail) which can be moved to tighten the belt by means of threaded rods or by steel cables which can be wound on a winch. These give no indication of the tension they establish and are adjusted by trial methods until slippage is avoided. They are unable to compensate for any length changes in the belt between adjustments and thus, permit wide variation in belt tension. Use is generally restricted to short and/or lightly stressed conveyors–**widely used in unit handling.**

The manual take-up must be such that when tension is applied to the pulley, the pulley remains at right angles to the direction of belt travel. Also the tension must be high enough to allow elastic recovery of elongation due to starting forces, load changes, etc.

Automatic take-ups depend upon suspending a predetermined weight (gravity), by activation of a torque motor, by hydraulic pressure, or by spring loading. These devices maintain a predetermined tension at the point of take-up regardless of length changes resulting from load change, start-up, stretch, etc. This permits running the belt at the minimum operating tension and should be used on all long length conveyors and moderate to highly stressed conveyors.

The automatic take-up alignment must be such that the pulley or pulleys are maintained at right angles to the direction of belt travel. In a gravity or spring loaded take-up, the carriage must be guided to maintain the pulley axis on a line perpendicular to the belt center line.

Adequate take-up is essential to satisfactory operation of a belt conveyor. The amount required depends on type of belting and on service conditions. Please refer to belt manufacturer for recommendations.

Normally, when a new belt has been properly installed and tensioned, the take-up roll or pulley (automatic take-up) will be initially set at a position of 25% along the line of travel, leaving 75% of the take-up area available for elongation.

II. Non Structural Components

Cleanliness

Cleanliness is essential to good belt tracking. A buildup (of whatever material) on pulleys and rolls can easily destroy the “perpendicularity” of the roll or pulley face. Foreign matter in essence creates a new roll or pulley crown–adversely affecting tracking.

Likewise, cleanliness is essential to slider bed operation. A buildup of foreign materials (or a roughened portion of the slider bed face) can very easily throw a belt off-center since this will result in a differential of warp tensions across the width of the belt. This can seriously effect training.

Scrapers can be applied directly to bend rolls at the take-up area, on a gravity take-up system, to keep the rolls free from build up. Ploughs installed prior to the tail roll, under the loading section, will prevent belt and pulley damage due to carry back.

Balanced/Neutral

It is extremely important that the final belt construction be “balanced” or “neutral” in terms of the internal stresses imparted to the belt during manufacture. Any unbalanced stress remaining in the belt will likely cause problems in tracking.

Typical belt carcass designs usually utilize a plain weave or twill weave. The “crimp” imposed upon the warp yarns (length-wise yarns) in these types of weaves, as well as the warp tension necessary at the loom are difficult to control. Unbalanced stresses can result. Georgia Duck has a patented tensioning system to minimize this problem.

The resulting “straight/balanced” carcass is kept straight by tensioning during the impregnation and curing steps of manufacture, resulting in a straight belt which is balanced and therefore, **easy to track.**

Camber

If unbalanced warp tensions exist in a conveyor belt, that belt will usually assume a “crescent” or “banana” shape when laid flat upon a horizontal surface. This deviation from a straight line is hereby defined as **“camber.”**

To measure belt camber, it is recommended that the belt be unrolled on a flat surface like the warehouse floor, a flat horizontal driveway, etc. Next, one end of that belt should be grasped (and one end only) and the belt dragged in a perfectly straight line for approximately 10 feet. If the belt is too heavy for one man to move, then one end should be clamped to a forklift and the same procedure performed. At this point, the belt should lie flat. Unequal and unresolved warp tensions in the belt will cause it to assume a “crescent” or “banana” shape.

Camber is measured by drawing a taut line along one edge of the belt and measuring maximum deviation from that taut line to the belt at the point of maximum deviation. Compute % camber as follows:

$$\%\ \text{Camber} = \frac{\text{Maximum Deviation (Inches)}}{\text{Length of taut line (Inches)}} \times 100$$

It is recommended that if the percent camber exceeds one-half of 1%, the belt manufacturer be contacted. In lightweight, unit/package handling .25% is the maximum.

Camber can be instilled into a belt during the slitting operation if one of the slitting knives is dull. A dull slitting knife will tear the fill yarns (cross-wise yarns) rather than cut them. (While the belt is in roll form the side of the belt which had gone through the dull knife will exhibit a “fuzzy” appearance due to the torn fill yarns.) Usually this type of camber will be less than one-quarter of 1% and can be pulled out handily when the belt is properly tensioned.

Skew (Bow)

The fill yarns (weft yarns) in the belt carcass will usually lie along the perpendicular to the belt center line. Any deviation from this perpendicular line by the fill yarn is hereby defined as “skew” or “bow.”

A skewed pick in a plain weave or twill weave is cause for concern since it is generally indicative of unbalanced warp tensions and will usually go hand-in-hand with a significant camber.

In a **straight warp** or **solid woven carcass** design, however, **skew is of little significance.** It is a cosmetic defect and is not indicative of a cambered belt.

Belt Tension

Belt tension must be great enough to prevent slippage between the drive pulley and belt. Tension must also be enough to cause the belt to conform to the crowns, if present.

Slippage will cause excessive wear to both drive pulley lagging and the belt. Further, an excessive heat buildup on the drive pulley lagging can result in rubber reversion. (Reversion is the softening of vulcanized rubber when it is heated too long or exposed to elevated temperatures. It is a deterioration in physical properties, and frequently results in tackiness.) Once the pulley **lagging** has reverted, it frequently will offset onto the bottom side of the conveyor belt which will then distribute the reverted rubber throughout the slider or roller bed of the system. The resulting tackiness between the bed and the belt will certainly drive horsepower consumption up; can actually result in a stalled system, and can cause severe tracking problems.

Square Ends

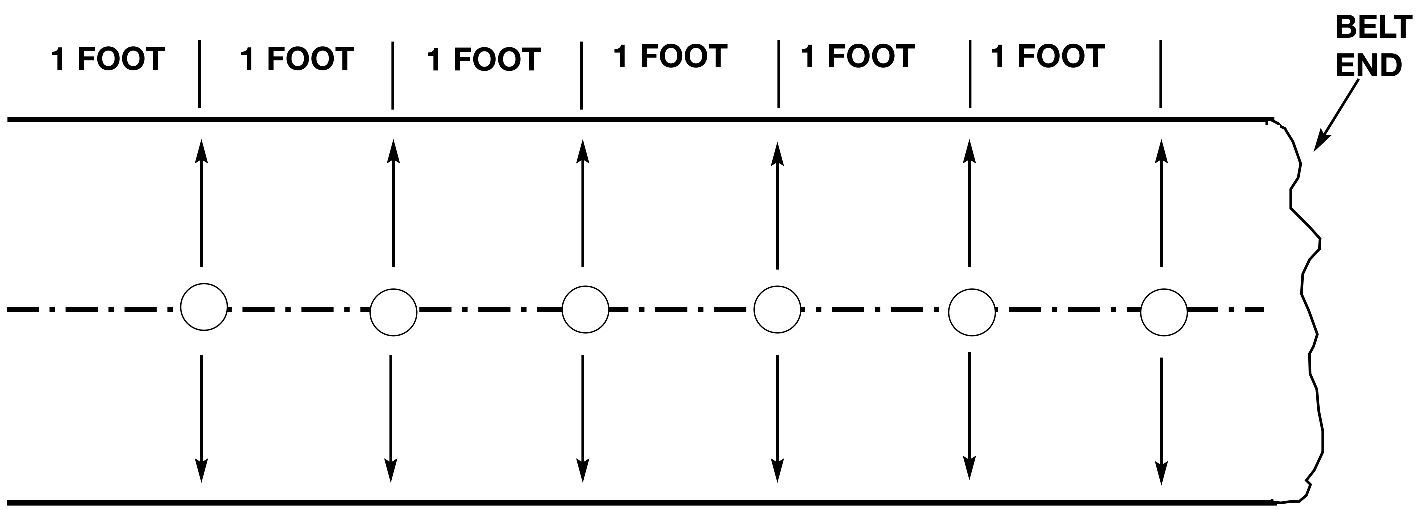
Accurate squaring of the belt ends prior to splicing is essential to belt tracking, and helps distribute stress evenly throughout the splice.

To properly square the belt ends, we recommend the center line method.

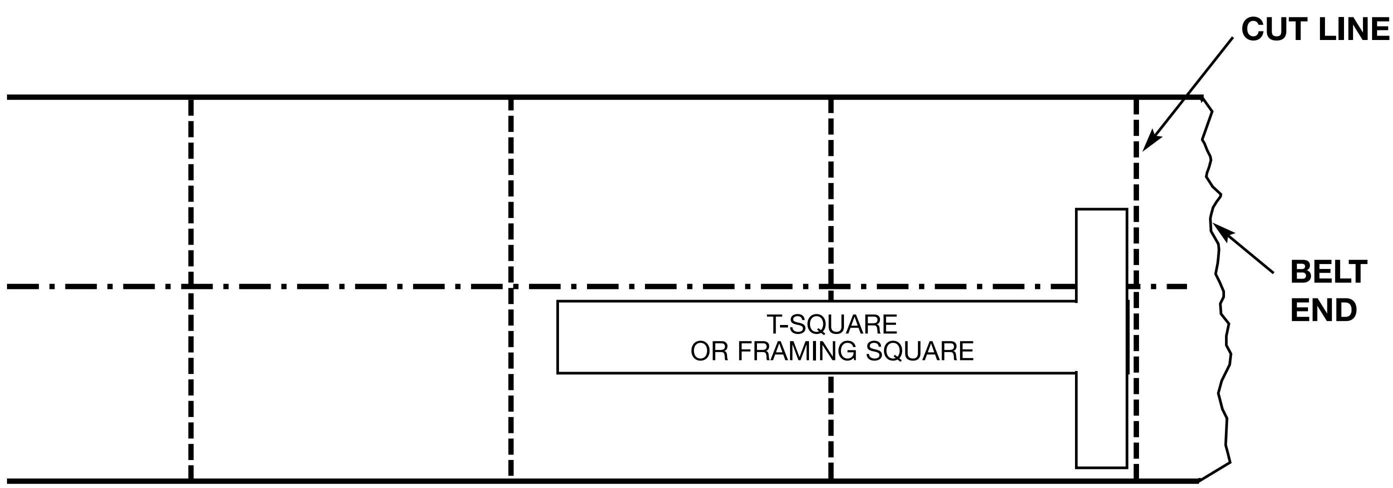
To establish the belt center line, start near the belt end as shown on the next page. Measure the belt width at seven points approximately 1 foot apart. Divide each measurement in two and mark these center points as shown.

Using these seven “center points,” pop a chalk line to form the belt’s center line. Next, using a carpenter square or “T” square, draw a “cut line” across the width of the belt near the belt end as shown. Repeat this for the other belt end.

Using the “cut line” as the guide, cut off the end of the belt with a sharp razor knife. Make sure that the cut is clean and vertical. This operation should then be repeated on the other end of the belt. (Keep in mind that the final belt length may need to include an allowance for such things as diagonal splice, skive taper length, skive overlap, finger punching loss, fastener extension, etc.–depending upon what kind of splice is being performed.)



BELT CENTER LINE



MARKING OF CUT LINE AND OTHER RIGHT ANGLE GUIDE LINES

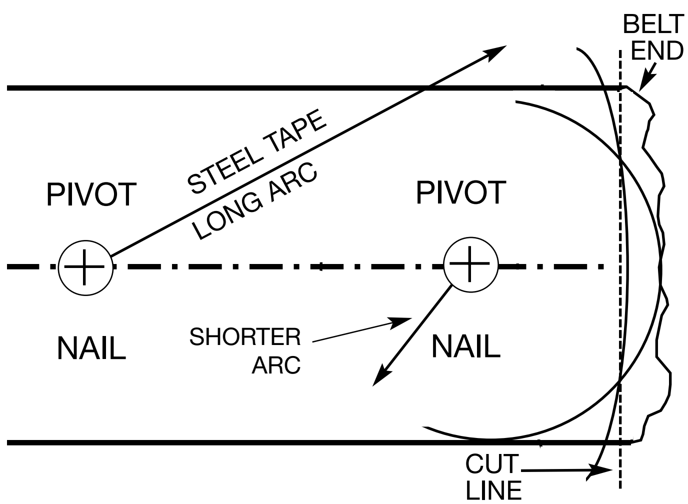
Index Page

An alternative method of squaring belt ends is called the "double intersecting arc" method.

First establish the center line as indicated previously. Once that center line has been established, pick a point on the center line and approximately 2 or 3 times the belt width from the belt end. An arc is now struck, as shown in the following sketch.

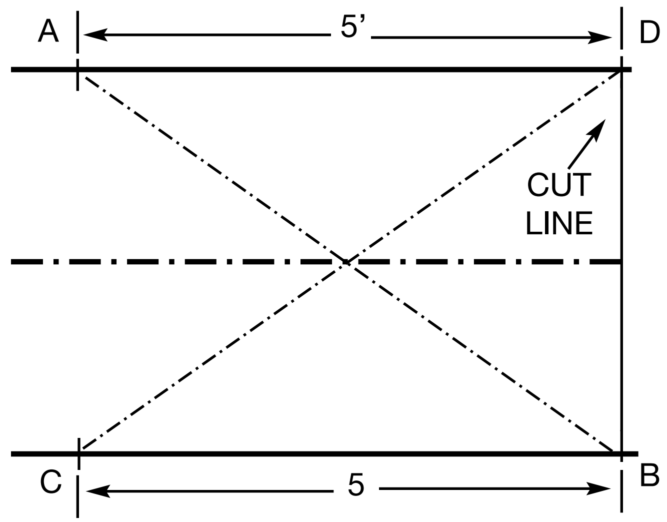
On bulk haulage belting, a nail can be used as the pivot point and an arc is struck with a steel tape. Always mark the edge of the belt with the same side of the tape.

A second arc is now struck as shown. The pivot point in this case is on the center line and is close to the belt end. The arc length is slightly less than one-half of the belt width. Now draw a line from one pair of intersecting arcs to the other. This is the "cut line." This line is perpendicular to the center line of the belt. The reason for this may be edge wear or damage or to eliminate slitting alignment errors. Never assume both edges are straight and parallel.



ALTERNATIVE ARC METHOD OF SQUARING ENDS
JOINING OF THE POINTS WHERE THE ARCS INTERSECT GIVES THE RIGHT ANGLE CUT LINE

Double Check Squareness



PROVING ACCURACY OF SQUARED-CUT END

LENGTH OF DIAGONAL AB IS EQUAL TO LENGTH OF DIAGONAL DC. ALSO AB AND DC INTERSECT ON THE BELT CENTER LINE.

It is always a good idea to double-check the accuracy of the squared and cut end. Measure 5 feet along each edge from the end of the belt, then utilizing a tape measure, check the two diagonals. They should be equal and further, should intersect on the belt center line.

III. General Tracking/Training Procedures

Tracking the belt is a process of adjusting idlers, pulleys, and loading conditions in a manner that will correct any tendencies of the belt to run other than true.

A normal sequence of training is to start with the return run working toward the tail pulley and then follow with the top run in the direction of belt travel. Start with the belt empty. After tracking is completed, run the belt with a full load and recheck tracking.

Tracking adjustment is done while the belt is running and should be spread over some length of the conveyor preceding the region of trouble. The adjustment may not be immediately apparent, so permit the belt to run for several minutes and at least three full belt revolutions after each idler adjustment to determine if additional "tracking" is required.

After adjustment, if the belt has overcorrected, it should be restored by moving back the same idler, and not by shifting additional idlers or rollers.

If the belt runs to one side at a particular point or points on the conveyor structure, the cause will probably be due to the alignment, or leveling of the structure, or to the idlers and pulleys immediately preceding that particular area, or a combination of these factors.

If a section or sections of the belt run off at all points along the conveyor, the cause is possibly in the belt itself, in the belt not being joined squarely, or in the loading of the belt. With regard to the belt, this will be due to camber. Its condition should improve after it is operated under full load tension. It is a rare occasion when a cambered belt (less than 1/2%) needs to be replaced.

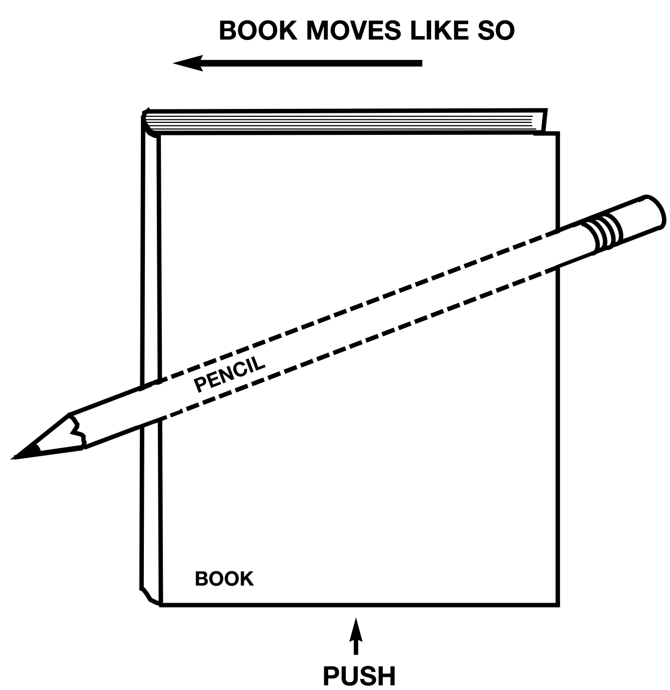
These basic rules can be used to diagnose a belt running poorly. Combinations of these rules sometimes produce cases which do not appear clear-cut as to cause, but if there is a sufficient number of belt revolutions, the running pattern will become clear and the cause disclosed. In those unusual cases where a running pattern does not emerge, it is quite likely that at some point the belt is running so far off that it is fouling structure or mounting brackets, bolts, etc. This results in highly erratic performance and can be a real problem. We would suggest that in this event the full tracking procedure be employed. It is quite likely that the erratic performance will be resolved in the process.

When replacing a used belt, go through the system and square and level all rollers, idlers, pulleys and bed before training a new belt.

Basic/Primary Rule of Tracking

The basic and primary rule which must be kept in mind when tracking a conveyor belt is simple, **"THE BELT MOVES TOWARD THAT END OF THE ROLL/IDLER IT CONTACTS FIRST."**

The reader can demonstrate this for himself very simply by laying a small dowel rod or round pencil on a flat surface in a skewed orientation. If a book is now laid across the dowel rod and gently pushed by one's finger in a line directly away from the experimenter, the book will tend to shift to the left or right depending upon which end of that dowel rod the moving book contacts first.



Pulley Crown on Lightweight and Monofilament Belt

A crowned pulley can be regarded as a special case of our primary rule of tracking as stated above. The right half of the belt is contacting the center of the pulley sooner than it contacts the right edge of that pulley and therefore will tend to move toward the center. The reverse is true of the left half of the belt. The two forces tend to balance one another
by centering the belt.

In addition to this **surface effect,** however, there is a strong internal "balancing of warp tensions occurring." Consider any warp yarn not directly on the center line. If the belt is forced off-center and this warp yarn is drawn toward the mid-point of the crown, tension will be increased on that yarn. As the belt revolves and that yarn seeks to move back to its normal position, this tension will diminish. Yarns on both sides of the belt seek that position which results in the least stress to themselves, consistent with the physical structure across which they are stressed and consistent with their individual position within the matrix of the belt carcass. Accordingly, the belt will shift on the crowned pulley until these stressing forces are balanced and minimized
–centering the belt.

Experiment has shown that a crown is most effective when it has a long unsupported span of belt approaching the pulley. The lateral position of the belt can be influenced by the crown more easily when there is a minimum of resistance being offered by a supporting slider bed or by supporting idlers.

Georgia Duck goes to great lengths to manufacture balanced carcass belts so that the belt will self center and track on the crown.

In most non-unit-handling conveyors this optimum condition does not exist on the top run and consequently, crown on the head pulley is of little value in training the belt. Further, it is a distinct detriment as far as lateral distribution of tension in the belt is concerned. Head pulleys therefore, should be uncrowned in normal circumstances. Tail pulleys and take-up pulleys which may have a fairly long approaching span without support can be crowned with some beneficial results.

The effectiveness of the crown is increased to a length of approximately 10 feet. Lengthening the unsupported span beyond 10 feet does not seem to increase the effectiveness of the crown. Diminishing the length of the unsupported span on the other hand, does diminish the effectiveness of the crown. The shorter the unsupported span, the less effective the crown will be. Snub pulleys can reduce effectiveness by 50% or more.

We recommend a standard pulley crown of 1/16" on radius per foot of pulley face. This results in an increase in pulley diameter at a point 12" from the edge of the pulley of 1/8" above the edge diameter. A crown of 1/8" per foot should be considered maximum. Crowns may be trapezoidal or radius.

It is further recommended that the crown not be carried beyond a point 18" in from the edge of the pulley. If the pulley width is greater than 36" it is recommended that a trapezoidal pulley be used. In other words, that pulley will have a flat face in its center equivalent to the amount that the pulley width exceeds 36". Radius crowns work, but may take a few minutes longer to stabilize.

With the advent of CNC Machining, we see more use of radial crowns, but the same rule regarding maximum crown should apply. **Special Note:** The belt must stretch to conform to the crown or it will not be effective.

Equipment Induced Camber

Camber can be induced into a perfectly straight belt by the roll or rolls preceding the camber. If the roll is cocked, the belt will react and will move toward that end of the roll which it contacts first. This, of course, throws the belt off-center. If now, subsequent structural adjustments center that roll, the belt installation will be left with a cambered appearance. This camber may be removed by simply aligning the roll or rolls which are cocked.

Specific Training Sequence

Emergency

If the conveyor system, including the belt, has been designed, built and installed according to good engineering and manufacturing practice, the belt should track at start-up. There may be minor variations from the ideal because of manufacturing tolerance–this will simply result in a system in which the belt is not tracking absolutely perfectly, but one in which the belt can be operated without belt damage long enough for the tracking sequence to take place. Normally belt width is less than pulley face width and a small amount of belt movement will not cause any damage.

Occasionally, there may be a serious maladjustment or defect in the system which will throw the belt off to such a degree as to threaten belt damage. It may actually be necessary to station men at each end of the conveyor and physically force the belt back in line by means of a smooth, steel bar. In extreme cases it may even be necessary to shut the conveyor down, make any adjustment indicated, and then restring and reposition the belt before start-up. In any case, it is extremely important to avoid belt damage. Once a belt is damaged, it will not necessarily recenter itself.

If the conveyor structure has been checked, appears to be true, and all rolls appear to be perpendicular to the system center line and severe belt tracking problems still persist, it is advisable to shut the system down and establish **a belt center line** as a frame of reference. (Use the technique outlined previously in this discussion.) Now that a belt center line has been established. Use this line as the reference for the adjustment of each individual pulley, snubber, roll, etc. Once all rolls are perpendicular to the belt center line, the belt will track well enough so that the specific training sequence can commence.

(If it was necessary to establish the belt center line, double-check the system structure. Normally, the system center line and belt center line are equivalent. A variance suggests that something has been overlooked in examination of the structure, pulleys, idlers, etc.)

IV. Training Belt on Package or Unit Conveyors

At this point, let us assume that we have a system which is at least operating and with a belt running well enough so that it is not a danger of being damaged. For purposes of our study, let us use the hypothetical conveyor design which follows. Keep in mind that we will follow the general training sequence previously outlined, namely:

1. Return run-working from head toward tail, low tension side.

2. Top run-working from tail toward head, high tension side.

3. First empty, then full; with belt running.

Return Run

Considering the hypothetical conveyor system we have outlined (See Figure #1, page 13), our first consideration will be the first item in the return run–namely, the head pulley snubber (roll #1). From our previous discussion, it is obvious that cocking the head pulley snubber will have very little effect on the tracking since there is essentially no unsupported belt span available to allow the belt to react. However, cocking snubber #1 will tend to throw a camber into the belt which will tend to throw the belt off-center and become apparent at roll #2.

The return idler #2 does have a sufficiently long unsupported span for belt reaction and therefore, cocking idler #2 in a horizontal plane, can have a beneficial tracking effect. (If after we have adjusted idler #2 to the point where the belt is centered on idler #2, examination shows a camber between rolls 1 and 2, this is an indication that roll #1 is not perpendicular to the belt center line and is imparting the camber to the belt in this section.)

If it is necessary to adjust roll #2 to an off-perpendicular position in order to center the belt on roll #2, this off-perpendicular position of roll #2 can cause a subsequent cambering effect. In this particular conveyor design, this cambering effect will be almost totally eliminated by the proximity of roll #3.

If the distance between roll #2 and roll #3 were 8 feet (let us say) this cambering effect could be pronounced. Under these circumstances it may be necessary to compromise and not cock the roll quite as much as we would like. ("Tracking" can be considered a physical embodiment of the art of compromise.)

For purpose of completeness, it should be noted that if one end of roll #2 is lower than the other, the belt will favor that side due to the pull of gravity. This effect may, or may not, be masked by the tracking effect of roll #2.

Idler #3 has little or no tracking effect due to the lack of unsupported span between itself and roll #2. It can, however, be used to control the position of the belt since it does have a cambering effect.

It is important to note at this point that virtually any adjustment you make to these rolls will be slight.

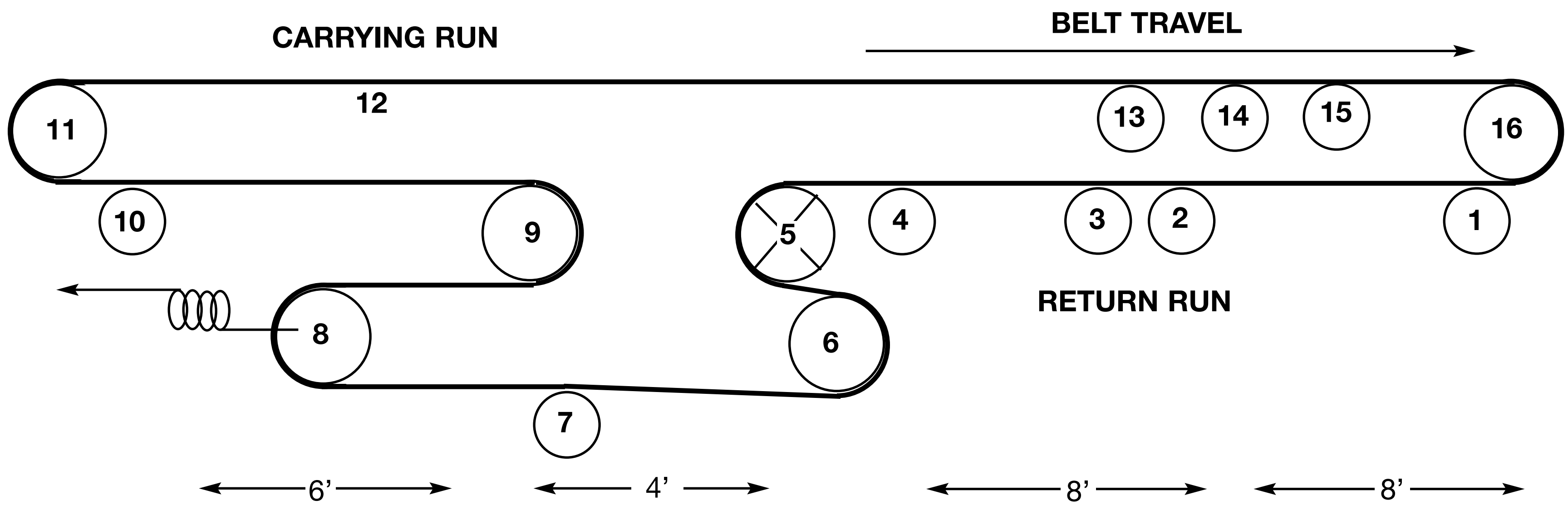
Idler #4 is highly effective as a tracking roll because it does have a good unsupported belt span approaching it. It will induce very little, if any, camber to the belt because of its proximity to roll #5.

Roll #5 on this particular conveyor is our drive pulley and will be a high tension region for the belt. This, coupled with the fact that there is little or no unsupported belt span between itself and roll #4, suggests that this is a poor tracking pulley and should not be crowned. This pulley should be squared to the belt center line and left there.
The same is true for roll #6–the snubber pulley.

Roll #7 will not be very effective for tracking purposes because of the short unsupported belt span, but can be a problem camber-wise if it is not perpendicular to the belt center line. This pulley should be square and left there.

The take-up pulley (#8) does have potential for tracking, as well as for camber, due to the unsupported belt span between itself and rolls #7 and 9.

If, however, we adjust roll #8 so it is off-perpendicular in order to achieve a tracking effect on the belt as it approaches roll #8 from roll #7, that same adjustment will tend to impart camber to the belt as it leaves roll #8 and approaches roll #9. Accordingly, compromise is called for and roll #8 should be perpendicular to the belt center line. Unfortunately, this



TRACKING
HYPOTHETICAL CONVEYOR
FIGURE #1

may not always be possible since roll #8 is a take-up roll and in this case, is spring-loaded. Roll #8 will move from time to time as tensions increase and decrease in the system due to the normal operating cycle. Good engineering practice dictates that roll #8 be constrained in some sort of carriage construction designed to keep it perpendicular to the belt center line at all times. However, there can be tolerance differences, corrosion effects, lack of lubrications, etc., as well as other problems which may, at least momentarily, throw the take-up roll off-square. To avoid the “mistracking effect” this would have, it would be a good idea to impart a self-aligning feature to the take-up roll by crowning it. Further, it is in a low tension portion of the belt circuit and does have a reasonably effective unsupported belt span preceding it.

Roll #9 can exert a reasonable amount of tracking force on the belt because of the unsupported belt span preceding it, but it can also exert a considerable cambering effect since the unsupported belt span between roll 9 and 10 is so large. Here again, compromise is called for–the ideal situation being to simply square pulley #9.

Roll #10 in this design is a snubber and is very important from a tracking point of view. First of all, it has a long unsupported belt span preceding it and therefore is capable of exerting a strong centering influence on the belt. Secondly, the position of this snubber means that it will feed the belt immediately onto the tail pulley and will, in essence, be responsible for positioning of the belt relative to loading. Roll #10 will obviously have little or no cambering effect.

Because of the importance of presenting the belt in a centered manner to the tail pulley, it might be wise to impart a self-aligning feature to roll #10 by crowning it. (Incidentally, this is also a low tension portion of the belt circuit.) Note that the crown will not be as effective as normal due to close proximity of roll #11.

Unless a snub pulley is needed to maintain belt within framework, a snub pulley doesn’t serve us well. The snub causes loss of tracking effectiveness with the tail, more belt flex and costs more. Avoid if at all possible.

The tail pulley (roll #11) should be perpendicular to the belt center line. In this particular design adjusting the tail pulley **will have very little, if any, tracking effect** due to the fact that there is no unsupported belt span between itself and roll #10. The snubber roll (#10) in this particular case has taken over the tracking function of the system. If, on the other hand, there were no roll #10, then the tail pulley would in truth have a tracking function and could effectively be crowned.

The tail pulley (#11) does have a marked cambering effect because of the long span between itself and roll #13. It’s true that this span is supported by a slider bed which tends to modify the cambering effect. However, since the loading point or points will occur somewhere on this section of the belt and probably quite close to the tail pulley, it is important that the tail pulley be squared relative to the center line so as to avoid any camber whatsoever.

The slider bed (#12) can have a marked effect on belt tracking. The slider bed must be level (side to side) since if it is not level the belt will tend to run toward the low side as it is being pulled by gravity. Further, the slider bed needs to be clean and smooth. If it is rough on one side or it has a layer of gummy, sticky, reverted rubber on one side, it will tend to pull the belt toward that side. In this event, the slider bed should be thoroughly cleaned and buffed. The underside of the belt must also be cleaned (do not use solvent based cleaners on belt).

Carrying idlers #13, #14 and #15 do have tracking and cambering effects based upon their distance from each other, and their distance relative to the slider bed and head pulley. The standard roller bed will have the carrying idlers so close together that individually the rolls will have very little tracking or cambering effects. If, however, they are all cocked in one direction, the effect can be marked. Accordingly, we would urge that carrying idlers not be used for tracking unless absolutely necessary and simply be squared relative to the belt center line.

The discharge pulley (#16) is located in a high tension portion of the belt circuit. Further, there is usually little or no unsupported belt span preceding it, which severely limits any tracking effect which can be obtained from the head pulley. Accordingly, it is good practice not to crown the head pulley nor use it for tracking adjustments. If you find that you must adjust the head pulley in order to center the belt, you will, in all likelihood, find that you have merely realigned an off-square head pulley.

Empty/Full

As each adjustment is made on the individual components of the conveyor system, it is necessary to wait a few minutes, and for a minimum of 2 belt revolutions, in order to give the belt time to react and to observe the true effect of the adjustment you have made. If the belt has over-reacted, do not proceed to another adjustment until you first modify the original adjustment and again, observe its effect.

It is possible that once you have made the entire circuit of the conveyor that adjustments made in the latter part of the sequence may have modified or effected adjustments made earlier in the sequence. It is good practice to double-check by going through the entire sequence again, until the belt is tracking as you wish.

Now that the belt is tracking, the conveyor system should run fully loaded and the tracking sequence repeated.

Ideally, loading should be done in the center of the belt. Unfortunately, however, system parameters may prevent this. In this event, you may find it necessary to modify the original adjustments, so as to compensate for the off-center loading. Here again, compromise is called for. The belt must track empty, as well as full, with as little variation as possible. (Note: Expect some variation–full vs. empty.)

Reversible

In reversible conveyor systems, all idlers should be kept at right angles to the direction of belt travel and any correction necessary made with self-aligning idlers, designed for reversing operations.

It might be profitable to consider our hypothetical conveyor, if the belt were now reversed. (See Figure #2, page 16.)

First of all, our sequence would be altered, since we would now start with roll #10, proceed to 9, 8, etc.

Roll #10 would now be functioning as the head pulley snubber. Any adjustment off the perpendicular of roll #10 would have little tracking effect, because there is no unsupported belt span between #11 and #10. Further, such a deviation from the perpendicular would have a substantial cambering effect. Under the circumstances, therefore, it should be set perpendicular to the belt center line.

Our comments relative to roll #9 through #5 inclusive would be substantially the same as before.

Reaction of roll #4, however, would reverse. Previously, it had a tracking effect and no cambering effect. Now, the reverse is true–it has no tracking effect, but considerable cambering effect. Rolls #3 and 2, likewise, have reversed their actions on the belt. Accordingly, all 3 of these rolls should be left perpendicular to the belt center line.

Roll #1 is now the tail pulley snubber rather than the head pulley snubber. Here, again, it has reversed its role and will now exert a significant tracking effect and little cambering effect.

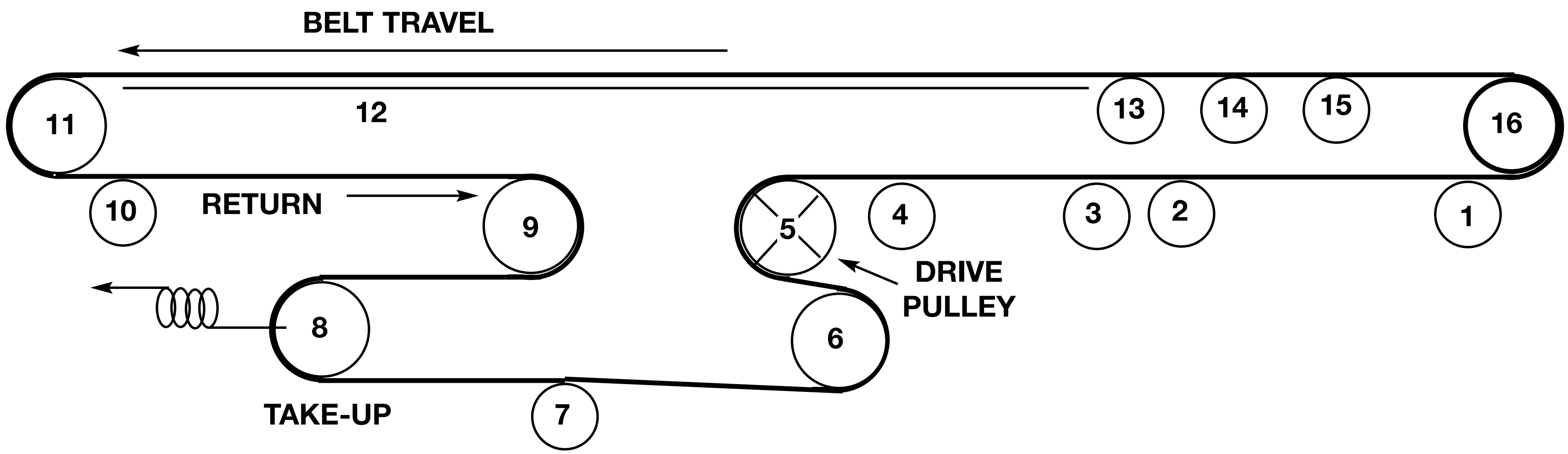
Roll #16 and roll #11 have now reversed positions and accordingly, comments made previously about roll #11 would apply to roll #16 and vice versa.

Comments made previously on items 12 through 15 would essentially hold under these particular conditions.

It is of course, recommended that rolls #11, 13, 14, 15 and 16 simply set perpendicular to the belt center line.

Finally, if this particular conveyor were to be used as a reversible conveyor, serious considerations should be given to replacing return rolls #2 and 3 with a single self-aligning roll. Further, there might be some advantage to crowning both snub rolls (#1 and #10). In this particular case, snub roll #1 would offer considerable tracking effect and would help center the belt on the tail pulley #16. When the belt is reversed, #1 would lose it’s tracking capability, but #10 would pick it up. Further, if #1 were indeed perpendicular to the belt line, it would not cause a camber problem. The same can be said for roll #10.

Index Page



TRACKING
HYPOTHETICAL CONVEYOR
FIGURE #2

Short Center-Wide Belt Conveyors

Short center-wide belt conveyors offer a special tracking challenge, simply because there usually is not enough belt length to stretch the necessary distance for crown conformation. If belt centers are 10 times belt width, these problems do not normally show up; below 5:1 ratio you must be aware of several factors: (1) Amount and type of crown, (2) belt stress/strain curve, (3) tension on belt and (4) location of crowns in the system.

Georgia Duck has products for lightweight material handling systems for length to width ratios of 1:1 and even below, but these are special and all details of conveyors must be discussed with a Georgia Duck distributor or Georgia Duck representative.

Tracking Priority

Finally, we would like to suggest that when tracking a conveyor belt, number one priority should be given to adjusting return idlers followed by adjustment of snubber rolls. If there is no snubber on the tail pulley, then adjusting the tail pulley does become effective and should be used. The head pulley is normally a flat pulley and should be set on a perpendicular to the belt center line. The head pulley should be adjusted for tracking purposes only as a last resort.

V. Training Bulk Haulage Belting

Training a heavy duty belt is similar in a lot of ways to training a light weight belt.

The major difference is that the troughed idlers on the carry side exert a natural gravitational training force. The edges of the belt that are turned up tend to gravitate toward the center of the conveyor, thereby exerting a powerful training action. Many bulk haulage conveyor operators do not attempt to add any other training devices to the carry side of the conveyor, as the troughers do a fine job by themselves.

As with training light weight belt, all major pulleys: head, tail, drive, snubs, bends, and take-up should be parallel, level and square. All idlers and pulleys need to be clean and functioning properly. All loading stations have to be centered so that product is introduced to the center of the belt. Any belt training idlers that are on the system must be in proper working order and be installed in the proper direction. The lagging on the drive pulley should be inspected and replaced, if the lagging is damaged or if the surface is smooth and hard, which can result in slippage. It is good practice to replace rubber lagging when a new belt is installed, particularly if the lagging is old, as the rubber tends to harden with age and become less effective.

The new belt may have some internal stresses from manufacturing; therefore, the best procedure for a new belt is to run it for a while before making any adjustments. This run-in period will relieve most manufacturing stresses that can occur during weaving, treating, calendering, assembly, curing, and slitting. Some belts, after installation, may run perfectly from the beginning. If the new belt will stay out of the frame on the return side, then run it empty for an hour or two, then begin introducing a load to the belt. The belt should be constantly inspected during this break-in period. Full belt contact with all carry side idlers is important due to the training forces that are present with the troughed idler sets.

As stated in the beginning of this brochure, crowned pulleys are not required for bulk haulage belting. Crowned pulleys may offer a minor contribution towards training when the crowned face is used on a low-tension pulley like the take-up or the tail pulley. The crown will have no effect if used on the high tension head pulley or drive pulley. High modulus belt fabrics like nylon, polyester, and aramid do not respond to the centering forces of crowned pulleys; and in some cases, can actually have an adverse effect on the belt. Steel cord belts must have fully machined straight faced pulleys to operate around, because a crown will create adverse stresses in the belt and in the splice.

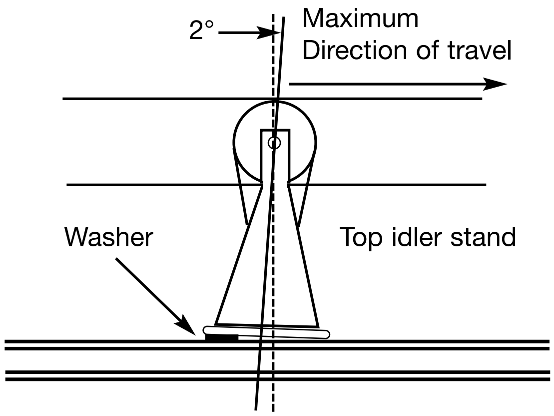
The theory of training a heavy duty belt is to feed the carry side square, use the troughers to keep the belt centered through the discharge, then train the empty belt on the return (slack side).

Self-training idlers should be on 100' centers on the return side, unless the conveyor is out of square, then 50' centers may be required in areas where the frame is out of square. The locations of the self-trainers are very important, as they can not function properly if installed in the wrong place.

The first self-training idler on the return should be placed about 30' behind the head. This allows the training idler to align the belt coming out of the head (into the trainer). . .then 30' past the trainer. Self-training idlers do not work when placed too close to a terminal pulley, snub, bend or take-up. These pulleys have more belt wrap than the training idler, which off-sets any training forces that the idler has. You need at least 30' of free run on each side of the training idler to make it effective. On slow-moving belts, 20' of free area on each side will work. At 800' per minute, the self-training idler should be placed 40' from a major pulley. The trainers can then be spread out over the return. If the take-up is 80' behind the head, place one self-trainer between the head and take-up areas, after the take-up area (20' to 40'); then place the trainers on 100' centers back to within 20' to 40' of the tail. If the self-training return idlers are still not effective, shim the return trainers up to present the trainer with more belt surface area. Equally effective is to use the next size up return run self-trainer–a 5" dia. to a 6" dia. trainer. A good rule of thumb is never skew an idler that has over 90° of wrap, to ensure that the high modulus belt fabric will not be stretched out of square. This method will train the slack side belt, feed the tail square, then run true on the carry side because of the centering forces from the troughers. Self-training troughing idlers should not be shimmed up because the additional pressure that is created on the belt in the idler gap area can cause premature belt failure in the idler junction area.

Another approach to training the slack side of long centered conveyors is the use of 2 roll “V” return idlers. With this type idler (generally 10°), gravity becomes the training force, and the belt edges are not subject to wear from the vertical arms on self-trainers. It should be noted that due to the small degree of angle with this type of return idler, if the frame is severely out of square the belt can run out of the “V” and into the return frame.

In areas along the carry side where the frame is not level and true, the following additional training method can be used. Each individual idler stand can be tilted in the line of travel by placing a washer under the rear legs of the idler stand. This forward tilt is not to exceed 2° from vertical. This is **NOT** to be done with reversing conveyors. The negative side of this training method is that excessive wear on the pulley cover and on the idler can result since the idler is no longer rotating on an axis 90° to the belt path.



Feeder Belts

Short centered feeder belts should be double-checked for squareness with a steel tape. The two terminal pulleys need to be parallel, level and square.

All training should be done on the return, or slack side. On a short conveyor (50' centers, or so) place one large diameter self-trainer on the return side in the middle of the conveyor. This roll can be shimmed up to increase the effectiveness of the roll.

The most important part of the tracking is not to use major pulleys for training; and to allow the trainer to have slack belt feeding into and out of the trainer.

Bi-Directional Belts

Bi-directional belts should only use carry side troughers that are vertical and do not have any tilt added in. All return run self-trainers should be of the bi-directional type.

Bi-directional hardware, such as pulleys, top side idlers and return side idlers must be level, parallel and square.

When pulling the load towards the drive pulley, the tight side is on the carry side and the slack side is on the return. When pulling from the return side, ie., pushing the load, the tight side is on the return and the slack side is on the carry side.

The slack side of the belt will have more catenary, ie., loose belt, to drape over the idlers than the tight side; therefore the idlers on the slack side will have a more influential training effect than idlers on the tight side, ie., less drape over the idler. Therefore it is mandatory that all idlers be level and square.

Skewing an idler on the tight side will allow certain training advantages. When the conveyor reverses, this same idler is now on the slack side, and will have more catenary, or drape, and will now have a greater influence than before.

The reader should also keep in mind another potential problem, when trying to train a bi-directional bulk haulage conveyor. A carry side trougher, when skewed, will have minimum effect when the belt is run empty and pulled over the idler. This same trougher with a load being pulled over it, now becomes even more influential, due to the weight on the belt forcing the belt down on the idler. If you now push the belt in the opposite direction with a load on it, this same idler has an even greater training effect.

These are some of the reasons that make training bi-directional conveyors so difficult. Therefore, all hardware must remain level and square and the use of bi-directional self-trainers is a must.

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10/03