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EXPERIENCE INNOVATION PRODUCTIVITY

Belt Tracking

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Introduction

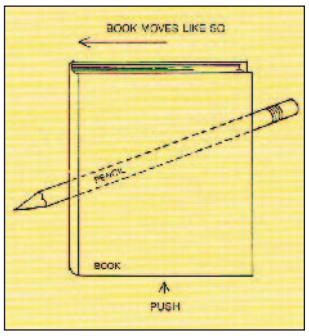
Tracking (Training) is defined as the procedure required to make the conveyor belt run "True" under all operating conditions. A conveyor belt must run "True" to avoid material spillage at the transfer points and a conveyor belt must run "True" to avoid damage to the edge of the conveyor belt and conveyor components.

The realization is that plant personnel walk past conveyors many times each day, but unless the belt tears or the conveyor stops running, the belt receives little attention. The result: poorly designed and maintained conveyor systems that will no doubt waste a significant amount of money over the course of a production season.

The potential savings obtained by increasing belt life, reducing spillage, maintenance cost, clean up costs and down time have proven to far exceed any resources spent tracking your belt "True". The great thing is; you don't necessarily need to spend any money.

Rule zero

Rule 'zero' comes before any other rule. The one fundamental rule of tracking a conveyor belt is that the belt moves toward that end of the roller which it contacts first. The reader can demonstrate this rule very simply by laying a round pen or pencil on a flat surface in a skewed orientation. Lay a book across the pencil and gently push it with your finger in a line directly away from you. The book will tend to shift to the left or right depending upon which side of the pencil the moving book contacts first. This may seem obvious to some when simplified to this diagram but we all need to be aware that this is exactly what we are doing when we adjust an idler or pulley's orientation.



To counter this; ALL pulleys, snub rollers, carrying idlers and return idlers must be SQUARE with the frame (perpendicular to the belt centerline) and parallel to each other. Keep this rule in mind as you read on.

(image source *http://www.besser.com/servicetips/trackingconveyorbelt.htm)*

History and Developments

In the past; the benefits of tracking a conveyor belt have been grossly under rated. Whilst each bulk handling industry is different (some much harsher than others), there was a common misunderstanding that the tracking process is "too hard" or "too expensive" to warrant spending valuable time and resources getting it right.

Ineffective and dangerous practices are being phased out as safety becomes stricter and as knowledge improves. These improper activities included throwing dirt at the tail pulley, adjusting pulley orientation by moving its bearing housings forward or backward and adjusting idler orientation.

Since then, our understanding has given us the chances to go directly to the cause of tracking problems, allowing us to design and implement proper solutions to counter and eliminate these causes.

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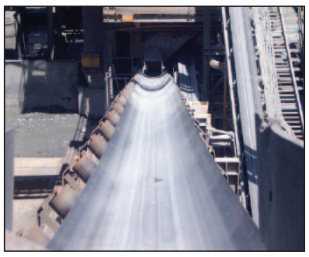
Belt Tracking

So what causes belt mistracking?



Everything! Technically, any external force non normal to the conveyor will affect your belts alignment. Fortunately most of these forces are negligible. There are however, 7 contributing variables which you will need to be aware of:

1. Material builds up on conveyor belt & rollers. Usually caused by spillage at transfer points and/or an ineffective belt cleaning system.

2. Loading of belt not centralized. Unfortunately physics is a harsh mistress. Gravity will try to bring the load to centre of the trough, pushing the belt outwards. Usually if your idlers are aligned, you can track your belt 'true' before the loading point and if your loading is centralized there is no real reason for your belt to cause costly tracking problems.

3. Extreme weather. Strong winds across the conveyor can directly cause the belt to move off centre. Heavy rainfall can cause slippage between the drive pulley and the belt.

4. Belt tension not satisfactory. Belt must be tensioned enough to conform to crown on crowned pulleys and to prevent slippage between head pulley and belt.

5. Out of round or seized rollers giving the belt contact forces asymmetric to the centerline.

6. Belt Camber. If unbalanced tensions exist in a conveyor belt, over time this will cause the belt to assume a "banana" shape when laid flat. The deviation from a straight line is known as "camber".

$$\text{Camber (\%)} = \frac{(\text{Maximum deviation (mm)} \times 100)}{(\text{Length of warped section (mm)})}$$

It is recommended that if the percent camber exceeds ½% on a polyester warp belt construction, or 1% on a nylon warp belt construction, the belt manufacturer should be contacted.

7. Disobeying rule 'zero'. Attempting tracking by moving pulley bearings forward and backwards, adjusting orientation of trough & return idlers. The advantage of this method is that this is a quick fix and it will get you out of trouble for a short period.

The disadvantage is that this is a quick fix; moving pulley bearings affects belt tensioning and will more often than not make things worse in the long run and restrict you to a life of spillage, belt damage, adjustments and headaches.

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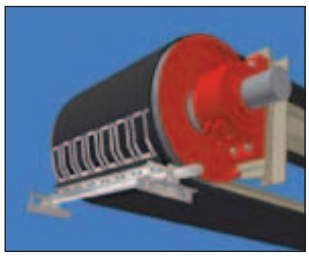
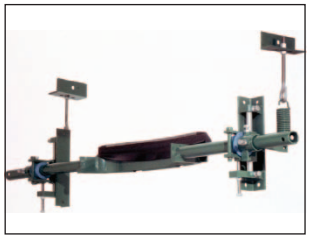
Belt Tracking

Current tracking aids available



Now that we understand the primary causes of belt mistracking, we can determine which cause is affecting you and hence which tracking solution is appropriate. Here is a general list of solutions available.



Belt Cleaners

There are two main types of belt scrapers; primary and secondary. Primary belt scrapers are designed to remove between 65 and 75% of material left on the conveyor after discharge; it is a common misunderstanding that a primary scraper can/should clean your belt any more than this, often resulting in maintenance crew over tensioning the cleaner; causing belt damage and/or uneven frictional forces on your belt. The purpose of the primary scraper is to clean the bulk material and to enable effective operation of the secondary scraper which will clean the remaining fines on belt and hence prevent the material from wearing, seizing or building up on your return rollers.

Primary Belt Scrapers:
These scrapers are available in various sizes and shapes; generally available with various tip specifications and properties to suit your application.

Tungsten carbide, for instance, is a very hard and dense compound of Tungsten and Carbon atoms; this is an extremely popular and thorough cleaning tip. However, tungsten tips are very harsh and should not be installed on worn or damaged belts at the risk of damaging belt further.

Polyurethane tips, on the other hand, are much more forgiving on your belt. These can be used on damaged belts, they should also absorb impact from clips and fasteners if installed and tensioned correctly.

Installation position is vital for maximum effectiveness of any belt scraper. Your supplier should provide you with a recommended installation position based on your pulley diameter and belt profile (thickness).

Secondary Belt Scrapers:
These scrapers remove sticky and fine particles adhering to the belt after load discharge, usually installed underneath the head pulley, just after the primary cleaner. Secondary scrapers (if not overloaded) will prevent these fines from reaching your return rollers and support structures.

Other Belt Cleaners

Some other types of scrapers:
V-Plows are scrapers which clean the inside of your belt to prevent spillage (usually from transfer points) from accumulating on rollers and more specifically; your tail pulley.

Motorized Brush Cleaners are bristled cleaners which will brush your belt clean with a rotary action. They are ideally suited to cleated, chevron, reversible and mechanically joined belts. These are great for removing wet, dry, sticky, hydroscopic, statically charged or abrasive products.

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Belt Tracking

Belt support & appropriate skirting

Supporting your belt, especially at highly vulnerable areas like transfer points is vital for eliminating belt sag and hence spillage. Where impact belt support is overkill for the application, there are light duty options available.

Spillage whilst costing a lot of time and money; also contributes significantly to roller build up, seizing and hence belt tracking problems. You must eliminate belt sag where material is escaping and you must install and maintain proper skirting, minimizing chances that particles big or small can escape the conveyor.

Conveyor idlers, rollers and other

There are many simple yet extremely effective rollers available to assist with tracking problems. These are usually a very cost effective fix to most tracking problems.

Offset idlers are a great start to tracking your belt 'true'. If you recall rule zero, 'the belt moves towards that roller which it contacts first' then bringing the centre roller forward by using an offset frame would greatly assist the tracking process. Whilst brilliant for single direction conveyors; installing these offset idlers on a reversible conveyor is impractical (in reverse direction, the belt will meet side rollers first).

Side guide rollers are very common throughout most bulk handling industries. These rollers are generally installed perpendicular to the belt at severe points of belt mistracking. They do not technically 'track' your belt, but they will disallow your belt from tracking past a certain point.

Belts running over flat cylindrical pulleys will find any reason to wander off. To prevent this, one pulley (usually the head pulley) is "crowned", machined to a slightly "spindle" shaped profile.

When the flat belt on "crowned" pulley is off-center and the pulley rotating, the belt will quickly move up to the largest radius at the top of the crown and stays there, it is somewhat misunderstood exactly which forces on a crowned pulley will cause the belt to centralize, it is believed that it is a combination of increased force and hence friction at crown and also increased velocity ($V = \omega.r$ so assuming angular velocity (ω) is constant, velocity (V) will increase as radius (r) increases). You must always remember however to ensure that your tensioning is such that the belt conforms to the "crown".

Limberollers can replace standard trough idlers; they consist of a flexible cable assembly which turns on its own axis while suspended between sealed bearing housings. They will automatically centre the load and therefore track the belt.

Rubber Disc Return Tracking rollers or RDRT rollers have spaced rubber discs which contribute to eliminating roller build up by breaking up the material which is usually in the centre of the belt. This may not be due to ineffective cleaners; it could be simply a dusty environment. If a return roller diameter changes on one side due to build up; the belt will track accordingly.

Some conditions are completely uncontrollable. Namely weather. Where high speed winds or heavy rain is affecting your belts alignment; a Conveyor Hood system may be necessary for protecting your product and belt.

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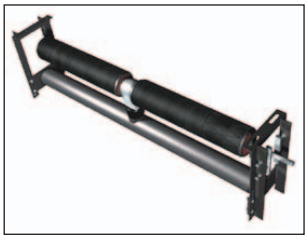
Self tracking hardware



There are countless self tracking idlers. The best use simple physics which allow the tracking unit to pivot based on which direction your belt is moving. There are single and dual pivot trackers which are usually determined by the belt width. If you are looking to install a self tracking unit, make sure that it will suit your application. For example, in dusty environments you need to ensure the unit has good quality bearings and seals which ensure the tracker is free to pivot and free to rotate under all circumstances.

Inverted V trainers sit on your stringers and tension the belts return side downward in a reverse V shaped trough. This disallows the belt to creep out of line using simple gravity principles. These idlers are terrific for reversing conveyors, but generally not recommended for conveyors >30m long.

How to track a reversing conveyor

This is arguably the most difficult conveyor application to track 'true' and to track 'true' consistently. But does it need to be? Fortunately the answer is 'No'. Exactly the same rules and guidelines apply for tracking a reversing conveyor. As mentioned earlier; offset idlers cannot be used. There are however idlers available with dual centre rollers, which effectively create an offset configuration in both directions. These are quite costly and hence standard inline frames are generally installed in these applications.

Conclusion

Tracking problems cause huge and unnecessary expenses, including material waste, maintenance, component failure, clean up costs, significant damage to belt and structures and of course, downtime. Whether designing a new conveyor or maintaining an existing one, tracking your belt 'true' is not and will never be a costly exercise compared to the expenses of not tracking your belt 'true'.

Be sure to speak to your conveyor hardware specialist for a more in depth solution to your specific tracking issue, because tracking is something worth getting right.

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