How to align conveyor belt

Aim:

The object of belt training

is to keep the belt under tension

in the centre of the structure.

Tracking and training of conveyor belt

Any section may be briefly read in any order as required

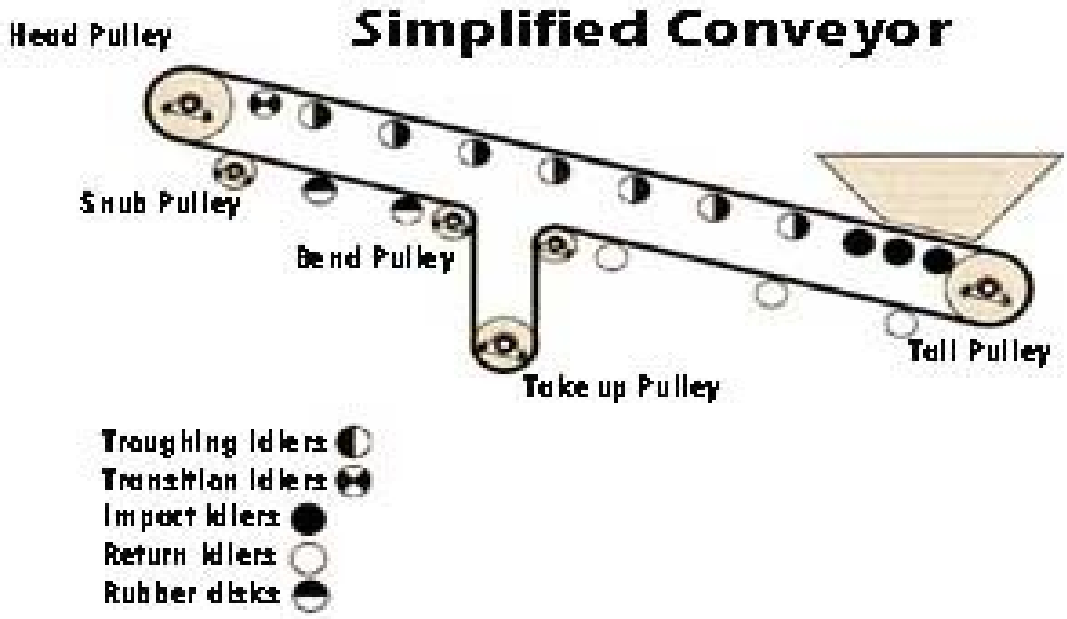
The Tail Pulley - the Boss of belt training

The tail pulley is the training boss of the belt.

The feeder will amplify what the tail pulley does.

Whatever the tail pulley does is what happens on the rest of the belt.

Figure 1



TAIL PULLEY - THE BELT BOSS

For the reason that the tail pulley is the **Belt Boss**, conveyor belt training should commence at least ten to thirty metres[1] on the return run before the tail pulley.[2]

The belt needs to be centred and held centre at this position.

The tail pulley cannot be adjusted if the belt approaching the tail pulley is off centre.

Manually adjust the idler frame direction[3] at the frame where the belt is off centre.

Ensure that the structure is level.[4]

Use a belt trainer should belt wandering prior to the tail pulley still occur.

Once centring of the belt prior to the tail pulley has been achieved then belt training by means of tail pulley alignment can begin.

Tail pulley square to the belt and level is **not negotiable.**

The tail pulley is the boss of the belt.

The feeder amplifies what the tail pulley does.

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1 **Take the belt width and multiply by fifteen, e.g. a 1050 mm belt approximately 15 metres.**
2 **Closer to the tail pulley will result in the tail pulley overriding the idlers and frames.**
3 **The belt will run in the direction that the frame and idlers are pointed in the same way as the wheel of a bicycle or motor vehicle points in order to steer.**
4 **If not place spacers under frame feet.**

Tail pulley alignment:

1-1) If the belt is in the centre at about eighteen metres (for a 1.2 metre belt) from the tail but does not run in the centre of the tail pulley then the tail pulley needs to be aligned.

Should the belt not run centre at this point please see pages 14 to 16 items 1-2 and 1-3.

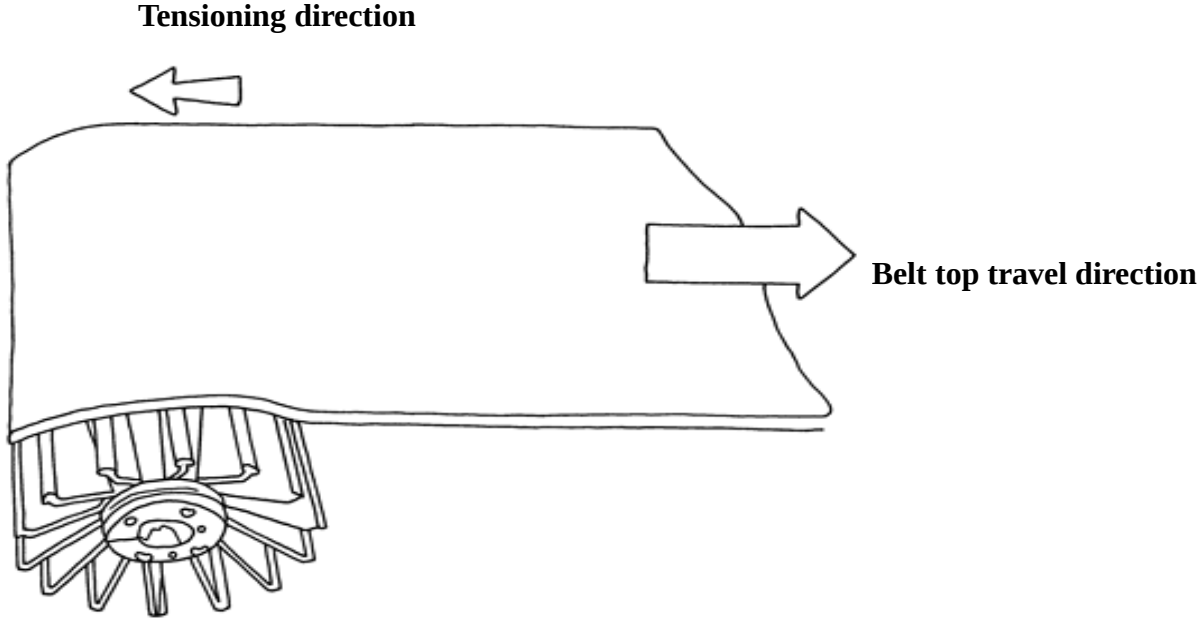
Should the belt wander at this position then please use contact detail on the last page.

1-2) The belt will always run to the point of least tension[5]. Stand behind the tail pulley.

Should the belt be running to the left of centre then tension the left side shaft and bearing by moving it back and away from the head pulley, and/or

1-3) Relax the right side shaft by moving it toward the head pulley. Visa versa should the belt be running on the right of centre.

Figure 2



5 **The belt will run against gravity (and what one would expect) to the highest point. This is because where the idler better supports the belt there is a reduction in conveyor tension. The belt will run to the point of least tension, which is the highest point.**
Makes sense, doesn't it.

1-4) If the belt has run off the edge of the pulley it will not climb back on easily.

Use an effective return belt trainer about ten to fifteen metres before the tail pulley.

Slack the belt so that it can be placed in the centre of the pulley.

Adjust the pulley as in 1-2 and 1-3 above by moving the plumber block half a percent of the belt width (for example 5 mm for a 1050 mm belt).

1-5) The head pulley may be adjusted in the same way by increasing or decreasing tension.

1-6) Run the belt for two (2) revolutions before making further adjustments[6].

1-7) When the belt is trained the **Belt Boss** will be square to the head pulley (evenly tensioned) and level.

Should the tail pulley only be able to be adjusted vertically or if further information is required then please make use the contact detail as soon as possible.

Google the link below for a video on how to adjust a tail pulley.

https://www.youtube.com/watch?v=eKkJN7WkCfw

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6 **Whatever change is made will effect the training on the rest of the belt.**

2) Carry (trough-top) and return run idler adjustment:

2-1) The belt is now running in the centre toward the feeder. If after the feeder the belt misaligns;

The cause may be poor feeder to belt alignment which is costly to correct.

More likely it is the condition of the product that has changed.

Wet product could feed differently to dry product resulting in the belt being forced off centre for different moisture or size conditions beyond your control.

Adjust the frames or toe-in the idlers. See pages 10 to 14. If the feeder conditions cause the belt to wander use the contact detail for a trough belt trainer between feed points and/or after the last feed point.

2-2) Now the belt is trained after the feed points.

Should the belt misalign toward the head pulley then manual training will be required.

Check that the belt is level. The belt will run to the highest point.

2-3) Also the belt will run in the direction that the frames and idlers are pointed.

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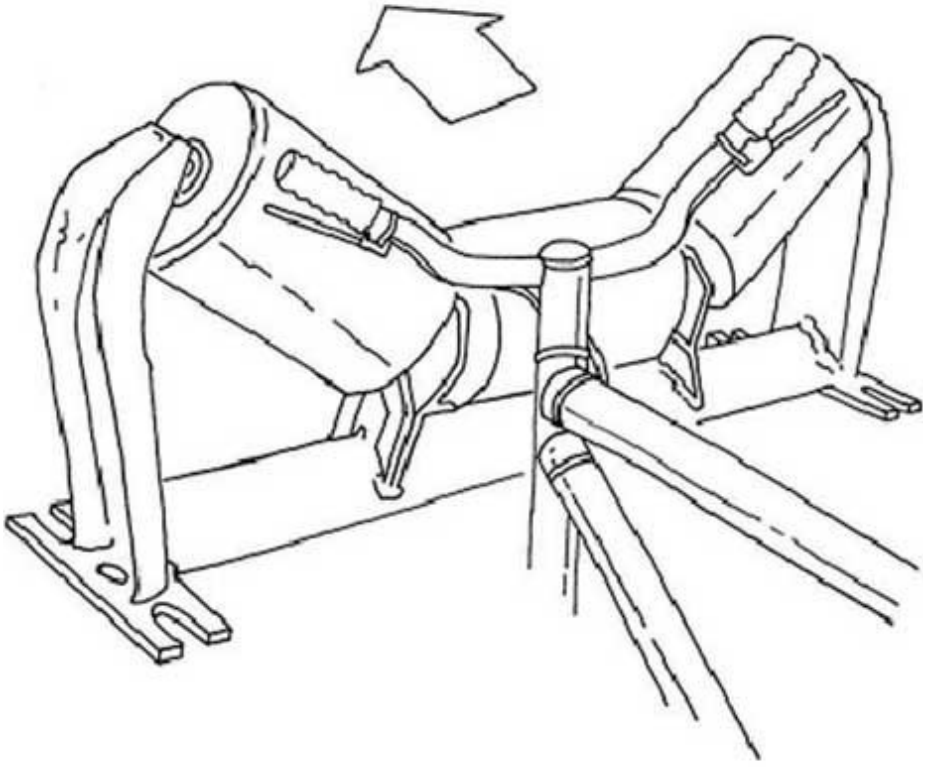
Figure 3 See the bicycle effect below.

Belt direction



If handle bars are pointed to the left the wheel is pointed left and the bicycle runs to the left.

Pointing the frame and idlers toward the left will run the belt toward the left.

If the belt wanders left and right then please use the contact detail for further information.

Problem: The belt runs to one side when it is empty and to the opposite side when loaded

Solution: The frames need to be levelled. If already level and the problem persists then please use the contact detail as soon as possible.

Causes of belt wandering

First of all some of them are beyond your control.

Carcass - uneven carcass tension in new belt

Although manufacturers come very close to braiding with equal tension in the strands of the carcass it is nearly impossible to have all strands at exactly the same tension.

At the time of installation the belt may wander until the strands with the most tension have stretched and only then will the carcass tension be the same throughout the weave.

By this time the belt is said to have 'run in'. Meanwhile damage to the belt edge may have occurred.

Sun

The **sun** may heat one side of the structure in the morning and the other side in the afternoon.

This results in steel expansion which will change the direction that the frames and idlers are pointed, causing the belt to track in different directions at different times of the day.

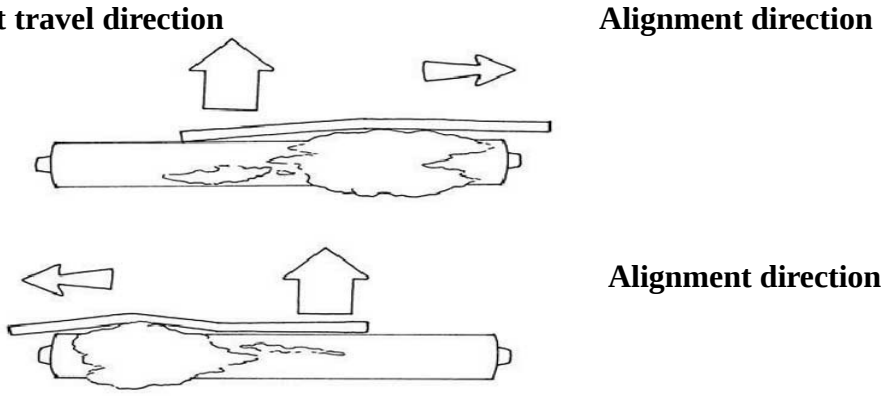
Wind

A sea breeze or **wind** blowing will cause the the belt to track differently as compared to when there is no wind. This has happened in coastal Namibia (formerly South West Africa).

Dirt

Should an idler or idlers build up with **dirt** the belt will misalign to the highest point[7]. This is also applicable to the carry run trough idlers.

Figure 4



Splices

Joints may be installed at an angle to allow for scraper cleaning purposes which will not affect belt tracking, but,

1) The two ends of the belt must be aligned and centred even if one side of the belt is ripped.

2) The belt must be aligned along the the **length** of the belt, not only squared at the ends where the splicing takes place.

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7 **The belt will run against gravity (and what one would expect) to the highest point. This is because where the idler better supports the belt there is a reduction in conveyor tension. The belt will run to the point of least tension, which is the highest point.**
Makes sense, doesn't it.

1) Toe-in the idlers

Since nothing is ever absolutely square it is better to have moderate toe-in by deliberate design than toe-out by accident. (Please request the brochure "Idler square to the belt versus idler toe-in")

The conveyor industry is learning from the motor car industry regarding toe-in.

Motor manufacturers specify moderate toe-in in order to keep the vehicle steady in a straight line on the road.

Should the wheels point toe-out the straight line travel will become erratic over the road.

The world standard for conveyor belts is to have the wing idlers in toe-in configuration.

The international specification with which the SABS complies calls for a toe-in of approximately one degree.

See the SANS 1313-1: 2012 Edition 4 section 6.4.4 (Please ask for a copy to be emailed to you)

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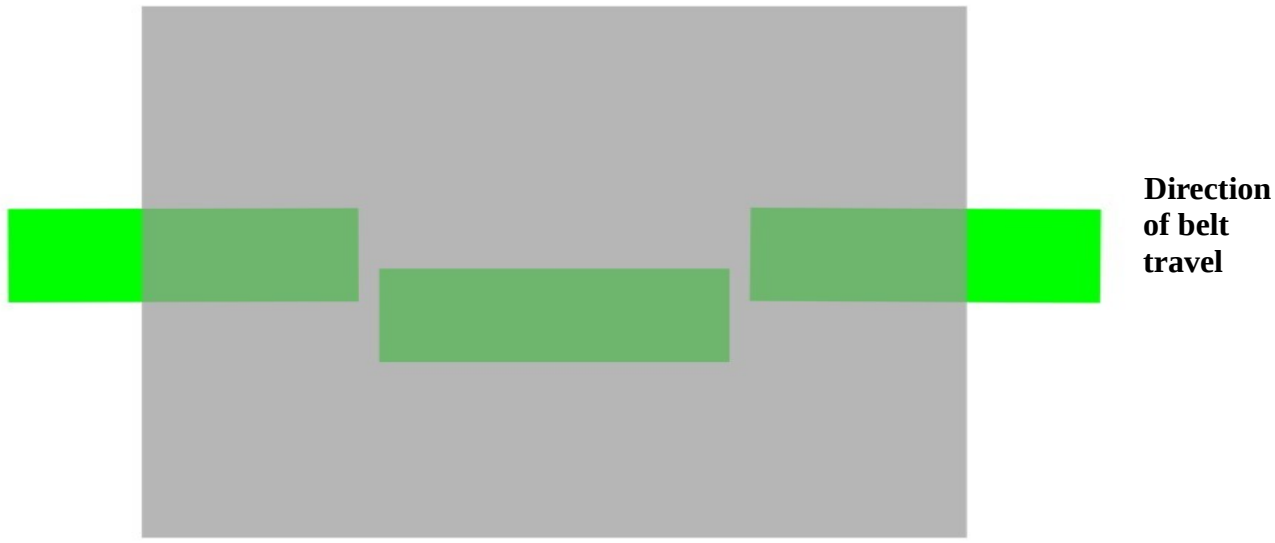
Figure 5: Plan view of an antiquated conventional standard for three roll trough idlers.

Idler as square as possible to the belt dogma results in half the idlers being toe-out[8].



International worldwide and SABS standard

The specification is that the outer section of the frames should be forward by approximately one degree[9].

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8 **The frame should be as square as possible but the idlers should be toe-in.**
9 **The degree is not important provided that it is positive toe-in and moderate.**

Figure 6: Belt in the centre results in equal toe-in pressure on the belt from each side idler.

The plan (view from above) is exaggerated for toe-in demonstration purposes.

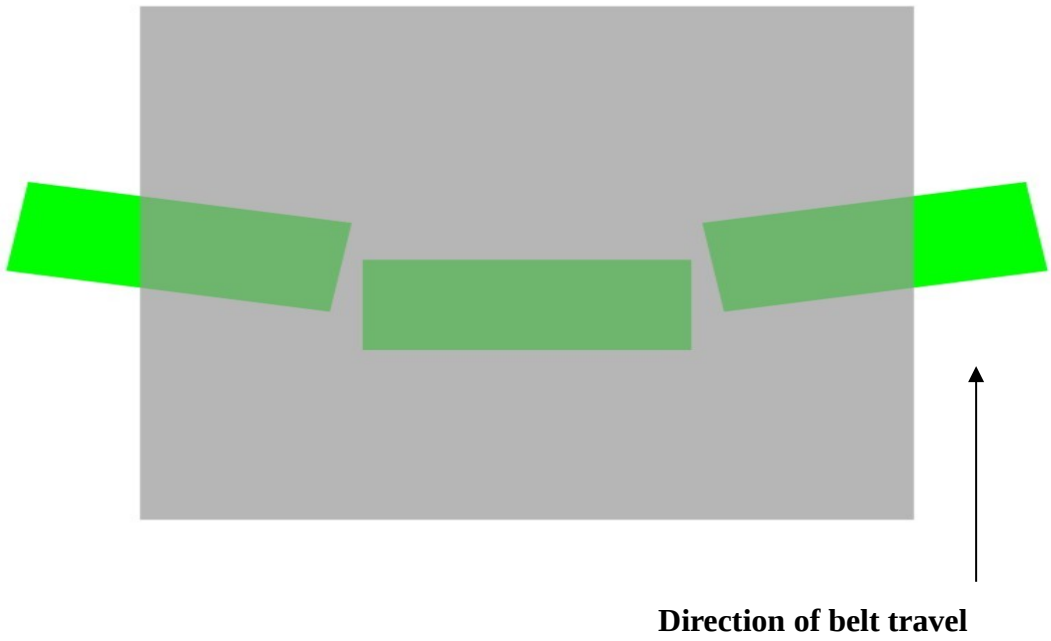

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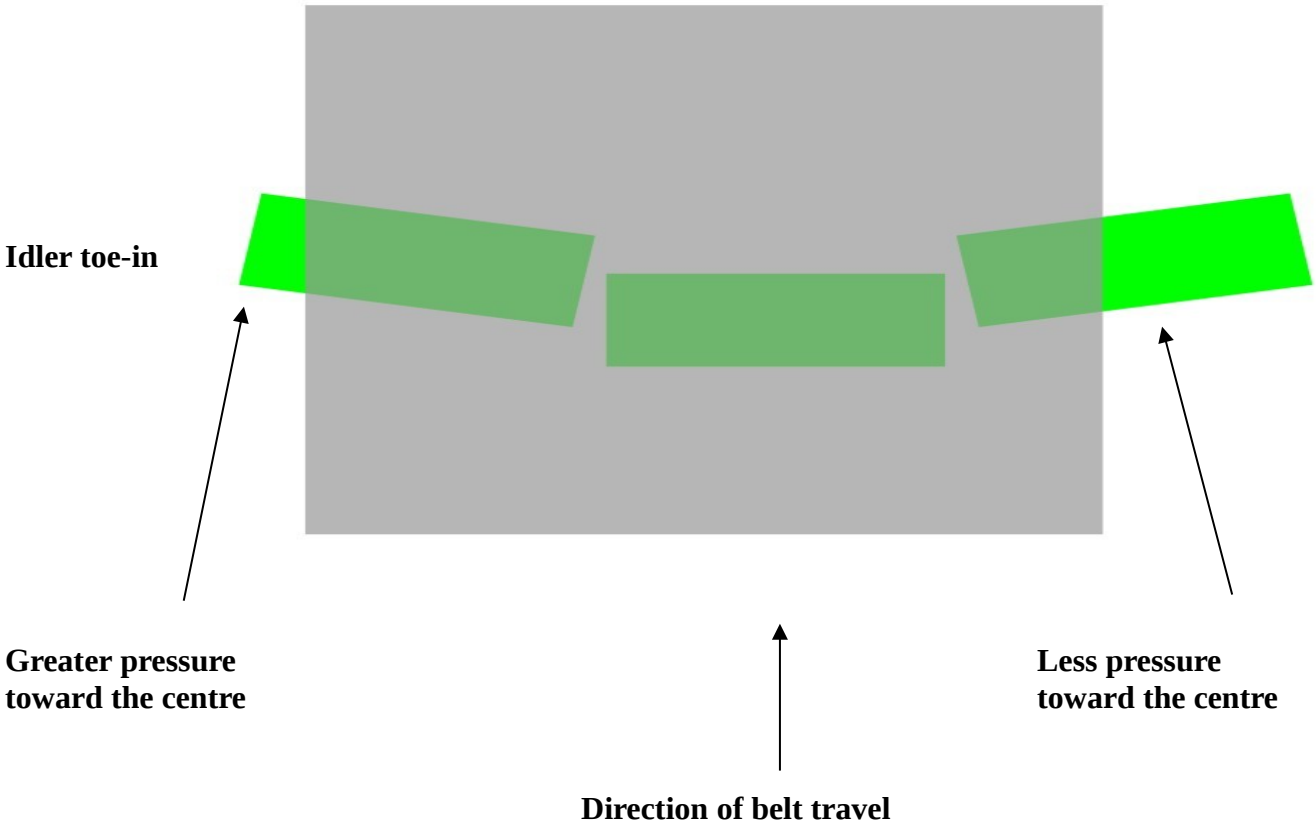
Figure 7: Belt off centre results in greater toe-in pressure on the belt from the left idler and less from the right idler.

(The view is from above and the toe-in is exaggerated for demonstration purposes.)[10]



1-1) Toe-in the side trough idlers instead of knocking the frames.

The toe-in configuration allows for the belt to auto correct conveyor centralizing.

As the belt runs off centre there a is larger percentage of the belt on the the left idler and less on the right side.

10 **The SABS specification is for a approximately one degree. The degree is not important provided that it is positive toe-in and moderate.**

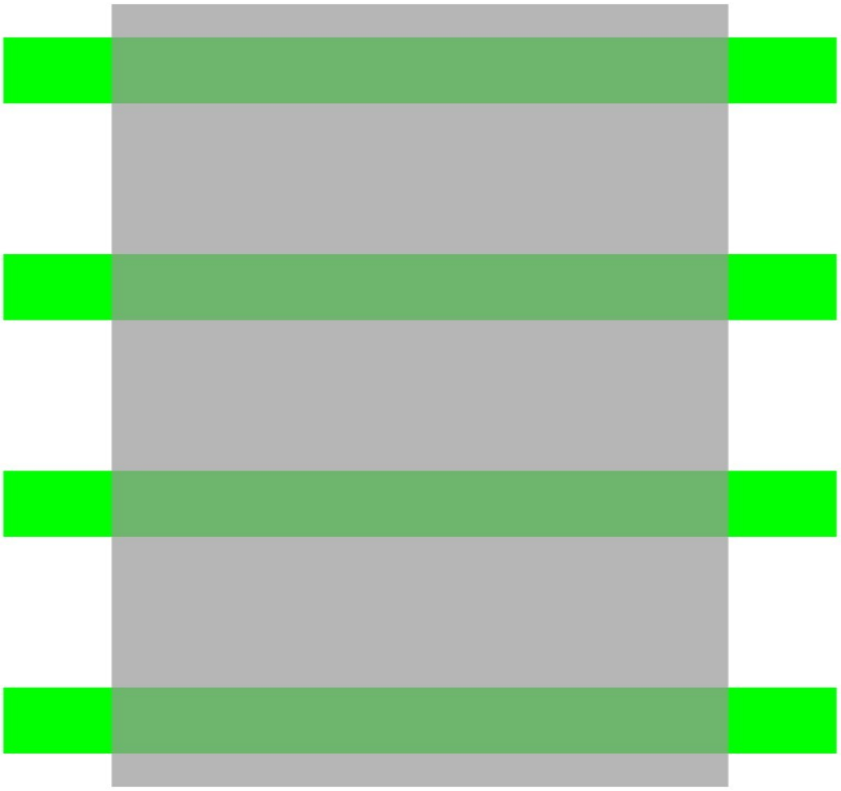
The increase in tracking pressure from the left side and the decrease from the right side automatically corrects the centralizing of the belt.

No swivelling mechanism is required. Therefore no swivelling mechanism maintenance is required. A swivelling mechanism stuck in the wrong direction will damage the belt.

To find out how to toe-in your idlers without changing or modifying the frames please use the contact detail.

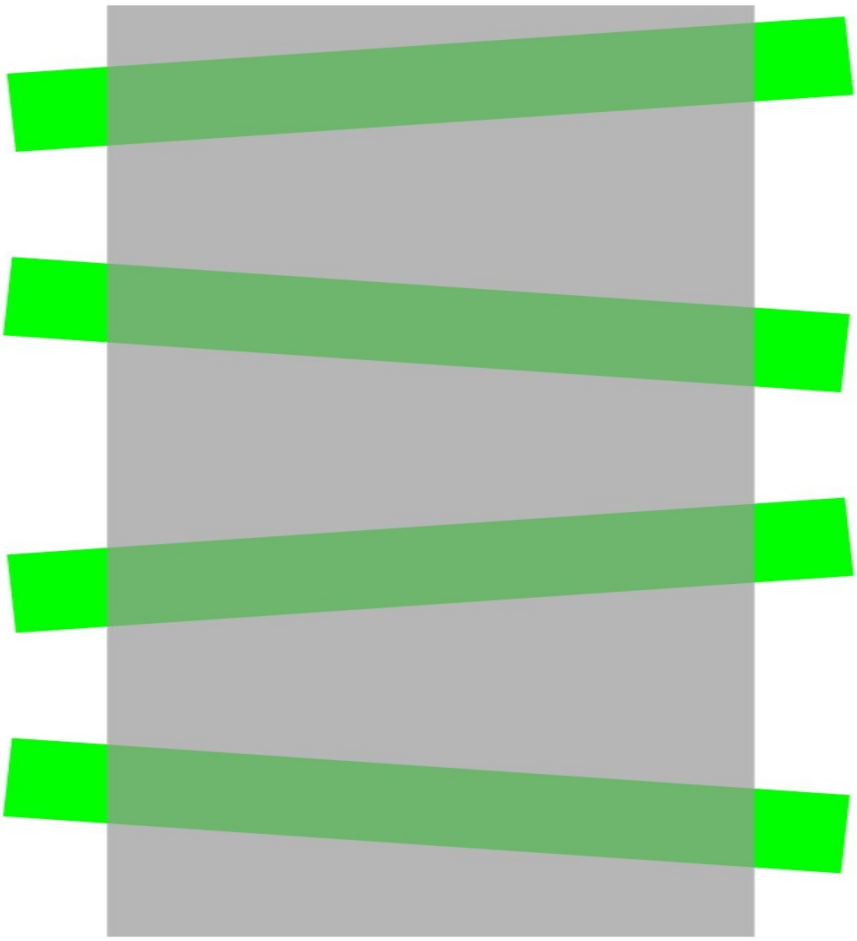
1-2) Toe-in the flat return idlers.

Figure 8: Idler as square as possible to the belt is currently the most common utilisation, **but**



A large number of belt operators successfully use toe-in for return run belt tracking.

Figure 9: The degree of toe-in is exaggerated and is restricted to no further than what the frame slots allow.



Toe-in is done on the return run even though the flat return idlers are metres apart.

Set every alternate idler in opposing directions toward the belt centre line. The use of the slots on the drop brackets are more than sufficient for this purpose and is less than one degree.

Should the belt consistently train to one side then point a few idlers in succession toward the centre from the side where the miss alignment takes place and/or adjust the height of the drop brackets by shimming.

Slotted plate is recommended or washers may be used for adjusting/shimming the height of the drop brackets in order to track a flat return idler.

Should shimming or knocking of the drop brackets not track the return run of the belt please use the contact detail as soon as possible.

1-3) Toe-in of the v-return idlers.

Adjusting a v-return frame and idlers by knocking the frames has minimal to no effect on belt tracking. Toe-in is not effective with a v-return type of configuration.

Washers may be used for adjusting the height of the frame in order to track a v-return.

Should height adjustment not track the v-return run of the belt please use the contact detail.

Conveyor belt designers should ensure that the return run idlers should be flat return or of a dual flat return configuration – a v-return design shoves the belt into the steel structure[11].

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11 **The belt runs to the highest point because that is the point of least tension. There is less tension on that point on the belt where the idler best supports the belt, the highest point.**

1-4) Toe-in the centre trough idlers instead of knocking the frames.

As with the flat return above every alternative centre idler on the trough may be set in a toe-in configuration to promote belt training.

The centre idler accounts for the largest portion of belt training capability on the conveyor trough.

Knocking a frame has exactly the same effect as the toe-in of the centre idler excepting that the degree of toe-in is less controllable.

Toe-in takes place on every frame and auto corrects belt centralizing. Frame knocking does not have an auto corrective function as all three idlers are pointed by the frame in one direction.

Training idler toe-in removes the need for frame knocking. The frames should remain as square as possible to the belt.

Uncontrolled frame knocking with the associated possible excessive sideways action of the idler on the belt results in additional idler and belt wear.

The international specification of one degree should not be exceeded. This will ensure that the elasticity of the rubber on the belt is not exceeded.

Instead of scuffing wear taking place the toe-in is moderate and is taken up by the elasticity of the rubber belt.

The antiquated idea of the idler being square to the belt position makes no sense considering that the same specification calls for slots in the idler frame feet.

Idler toe-in[12] auto corrects belt misalignment[13] and may also be used on the centre idler in the same way as successive flat returns are used for belt training. Please see pages 13 to 15.

Idler toe-in can be done by simply replacing worn out idlers with training idlers within a few percent of the same cost. Please use the contact detail on the last page for further information on using tidlers (training idlers) to replace standard idlers.

It is **not necessary** to;

A) Replace frames – not required.
B) Buy trainers with an excessive variable steering mechanism – not required.

It is r**ecommended** that;

A) As idlers expire that they be replaced with tidlers (training idlers).
B) That should belt wander occur please use the contact detail to obtain toe-in trainers.

An additional advantage of toe-in with return idlers - Conveyor cleaning

A free benefit of the return idler toe-in is that more fine dirt is removed from the belt pit holes.

A scraper compresses fine dirt into uneven belt surfaces that the idlers, especially tidlers, remove.

Underneath each return idler a heap of fine dirt will be noticed. This is as a result of the pit holes in the belt being compressed and then opened as the pit hole passes over a return idler.

With the return idlers being set to a one degree alternating angle, the effect of the idlers on the pit holes is increased by this moderate sideways action. This additional action removes more fine dirt from the pit holes and scars in the belt than is the case with ordinary square flat return idlers.

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12 **It does not matter whether the toe-in is one percent or half a percent, so long as it is toe-in.**
13 **As the belt misaligns a higher proportion of the belt surface is on the outer idler causing that idler to become more effective at centering the misalignment. Conversely the opposite idler produces less directional pressure allowing the belt to centre. See figure 6.**

2) **Crown your tail pulley** (Never crown a drive pulley)

Please note that the crowning a tail pulley is not effective on a new belt. This should not lead to discarding this method of belt training.

Typically a new belt takes one to two weeks to run in.

Once the belt has run in the sides of the belt have greater tension than the centre[14].

A belt is slacker in the centre than toward the edges because

A) the trough action stretches the belt
B) the product weight stretches the belt[15].

As the sides of the belt move toward the centre of a crowned pulley, where the diameter is greater, the edge of the belt is pushed away from the centre because of the increased tension.

That is how and why a crowned tail pulley tracks and trains a belt.

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14 **Lay the old belt on a flat surface. The edges will be flat on the ground and the centre rippled. The amount of visible ripple will indicate the percentage of crown required.**
15 **The heavier the material the more the centre of the belt will be stretched.**

How to crown your tail pulley

For rubber lagged pulleys crown the centre third of the pulley to height to about one percent of the belt width[16]. The crown increases rapidly in diameter at an angle of forty five degrees.

Figure 10:

16 **A 1500mm wide belt should have a crown of approximately 12 to 15 mm**

For epoxy lagged tail pulleys the crown could be of a convex shape.[17]

It can be seen from the two crowned pulleys lying side by side in the picture below that toward the ends there is a gap visible. This convex design is for a crowned tail pulley on a steel cord belt.

In the centre the crown should be approximately 0.75 % in height of the belt width.

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17 **Less than 1% of the belt width. Typically 7 to 8 mm at the crown apex for a 1050 mm belt.**

Precautions before installing a new belt

The uneven tension in a new conveyor carcass causes belt wandering. By the time the belt has run in the edges could be ripped[18]. This exposes the new belt carcass which then draws in moisture and begins the carcass rotting process. Install return run belt trainers in the critical areas, those are, before the tail pulley, drive and take-up.

For belt training prior to the tail pulley please see pages 14 to 16.

If belt centring cannot be achieved prior to the tail pulley it is recommended that a return run trainer be installed in front of the tail pulley before the new belt is pulled through. Please use the contact detail.

Should the feeder have consistently pushed the old belt off centre then use the contact detail for the installation of a trough trainer at this point before the new belt is pulled in.

The key to belt training is moderate toe-in as with a tidler (training idler)

The elasticity of the rubber on the conveyor belt will not be exceeded by the tidler toe-in.

The flexibility of the rubber belt reduces the scuffing wear that would otherwise take place on the idlers and the belt provided that the toe-in is moderate.

Excessive frame slot with idler steering (only acceptable for a flat return) as well as excessive variable steering training mechanisms should be avoided.

Idlers should have deliberate moderate toe-in and not be as square as possible to the belt thus avoiding accidental toe-out.

Should the conveyor belt still misalign after all of the above has been introduced please request a visit by contacting Hutch as soon as possible on mobile +27(0)8 33 27 33 00 or alternatively by emailing Info@TracknTrain.co.za

18 **The steel structure also trains the belt. The conveyor cannot misalign further and has nowhere else to go. The point of least tension for the belt is on the ground next to the structure. The object of belt training is to keep the belt under tension in the centre of the structure.**