Application Guide

Conveyor Belt Scale Application Guide

51548
Rev. 1 10/2021

Disclaimer

Every effort has been made to provide complete and accurate information in this manual. However, although this manual may include a specifically identified warranty notice for the product, Fairbanks Scale makes no representations or warranties with respect to the contents of this manual, and reserves the right to make changes to this manual without notice when and as improvements are made.

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AMENDMENT RECORD

Conveyor Belt Scale Application Guide

Installation Manual
Document 51548

Manufactured by

Fairbanks Scales Inc.

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Table of Contents

Section 1: Overview

1.1. Introduction

This guide is designed to give installers or service technicians new to conveyor belt scales and conveyors a basic understanding of the scale components and conveyors as well as to how they work together. It is in no way intended to replace the service manual for the scale, conveyor, or equipment that the scale will be installed onto and therefore these manuals should be followed as well.

The information in this guide is confidential and should be treated as such. Any copies of this guide in part or its entirety can only be done with the express written approval from Fairbanks.

1.2. Safety Precautions

Because work on conveyor systems and all heavy machinery is hazardous and major injury and death can occur, it is expected that only experienced professionals will install and service this type of equipment. It is crucial that you follow Fairbanks' safety policy, as well as, all OSHA and or MSHA regulations. Please make sure you have read and fully understand the operation of the equipment and safety guidelines for any work done on conveyors, portable crushing, and screening equipment, or transloading equipment. As some conveyors are automated, "Lock out! Tag out! & Test" prior to starting work on any equipment.

The safety of the installer and maintenance personnel is a priority when installing, servicing & maintaining any conveyor belt scale & components. If you are not familiar with the scales and the conveyor operation and procedures, you must first seek assistance from someone with the necessary experience to help familiarize you with the equipment.

Fairbanks is in no way liable for damages or injury incurred resulting from the installation. Use the Fairbanks Test Weight system for safe calibration. This eliminates the need to handle free weights on ladders and catwalks.

1.3. General Service Policy

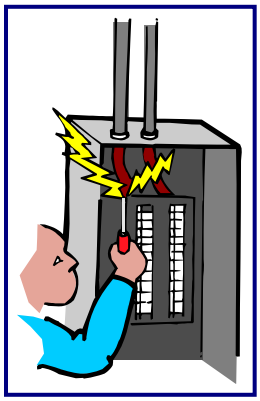
Prior to installation, always verify that the equipment satisfies the customer's requirements as supplied, and as described in this manual.

- If the equipment cannot satisfy the application and the application cannot be modified to meet the design parameters of the equipment, **the installation should *NOT* be attempted.**
- Instructions within this manual apply to the instrument and its specific accessories. Installation procedures for printers and other peripherals are given in manuals specifically provided for those units. The instructions include a pre-installation checkout which must be performed either at the service center before the technician goes to the site, or at the site before he places the equipment in service.

- All electronic and mechanical calibrations and/or adjustments required to make this equipment perform to accuracy and operational specifications are considered to be part of the installation, and are included in the installation charge. **Only those charges which are incurred as a result of the equipment's inability to be adjusted or calibrated to performance specifications may be charged to warranty.**
- Absolutely no physical, electrical, or program modifications other than selection of standard options and accessories are to be made to this equipment. Electrical connections other than those specified may not be performed, and no physical alterations (mounting holes, etc.) are allowed and will immediately void warranty.

All load cells, load cell cables, and all interconnecting cables used for the scale components must be located a minimum of thirty-six inches (36") away from all single and multiple phase high energy circuits and electric current-carrying conductors.

- This includes, but is not limited to **digital weight instruments, junction boxes, sectional controllers**, and **power supplies**.
- This includes any peripheral devices, such as **printers, remote displays, relay boxes, remote terminals, card readers**, and **auxiliary data entry devices**.
- Scale components themselves must also be at least **thirty-six inches (36") away** from other high energy components, including the following devices.
- Any machinery with outputs of **120, 240**, or **480 VAC**.
- High voltage wiring runs and stations, AC power transformers, overhead or buried cables, electric distribution panels, electric motors, florescent and high intensity lighting which utilize ballast assemblies, electric heating equipment, traffic light wiring and power, and all relay boxes.



- Scale components are not designed to operate on internal combustion engine driven electric generators and other similar equipment.
  - *This includes all digital weight Instruments and peripheral devices.*
- Electric arc welding can severely damage scale components, such as digital weight Instruments, junction boxes, sectional controllers, power supplies, and load cells.
- The Service Technician's responsibility that all personnel are fully trained and familiar with the equipment's capabilities and limitations before the installation is considered complete.

1.4. Pre-Installation Guidelines

The following points should be checked and discussed with the **Area Sales Manager and/or customer**, if necessary, before the technician goes to the site and installs the equipment.

- If the installation process might disrupt normal business operations, tell the customer and ask that they make ample arrangements.
- Is properly-grounded power available at the installation location?
- Be sure that the equipment operator(s) are available for training.
- The service technician reviews the recommended setup with the Area Sales Manager or Area Service Manager, and together they identify all necessary variations to satisfy the customer's particular application.

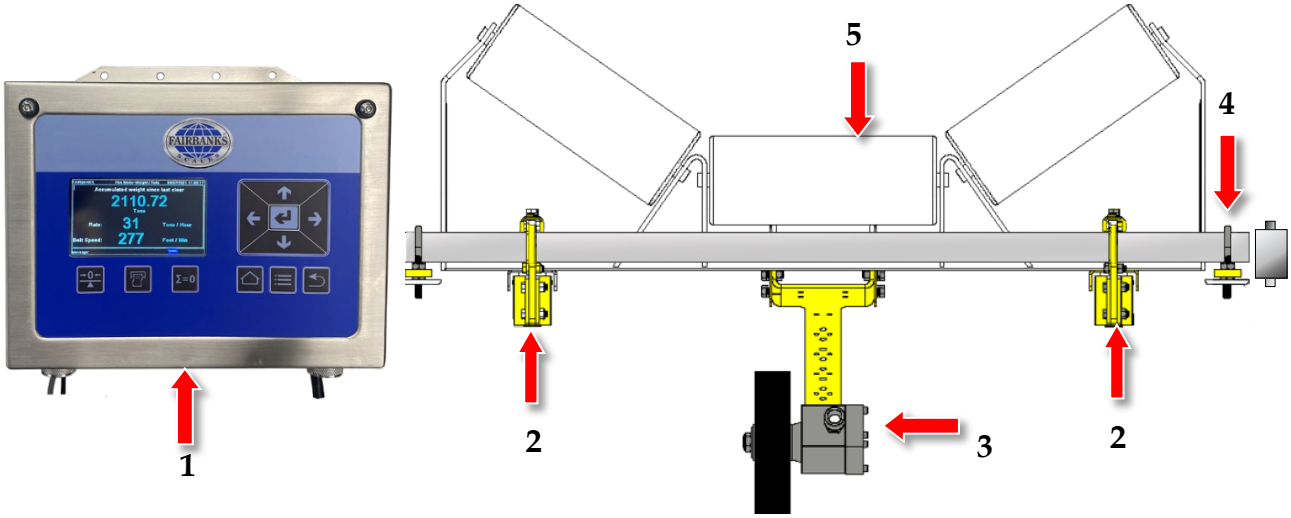
Follow these guidelines when unpacking all equipment.

- Check in all components and accessories according to the customer's order.
- Remove all components from their packing material, checking against the invoice that they are accounted for and not damaged.
  - Advise the shipper immediately, if damage has occurred.
  - Order any parts necessary to replace those which have been damaged.
  - Keep the shipping container and packing material for future use.
  - Check the packing list.
- Collect all necessary installation manuals for the equipment and accessories.
- Open the equipment and perform an inspection, making certain that all hardware, electrical connections, and printed circuit assemblies are secure.
- Do not reinstall the cover if the final installation is to be performed after the pre-installation checkout.

Position the equipment with these points in mind.

- Intense direct sunlight can harm the display.
- Do not locate near magnetic material or equipment/instruments which use magnets in their design.
- Avoid areas which have extreme variations in room temperatures. Temperatures outside the instrument’s specifications will affect the weighing accuracy of this product.

1.5. Scale Components and Purpose



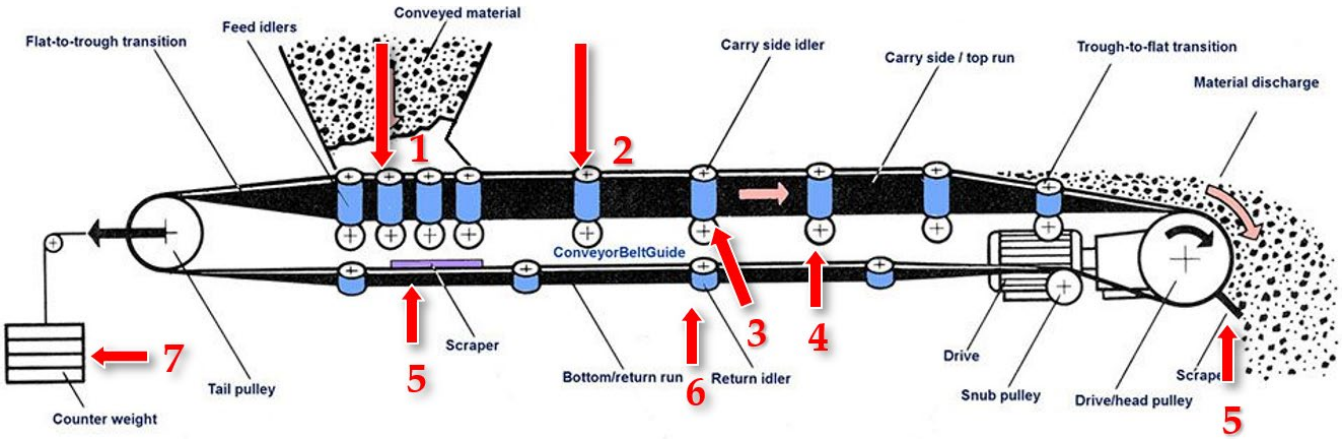
1	**Integrator** – An instrument with a large graphic display used to calibrate the scale and access a wide variety of data.
2	**Load Cell A & B** - Consists of a strain gauge which takes an excitation voltage and changes the signal voltage to the Integrator, depending on the amount of force / Load applied to the load cell.
3	**Speed Sensor -** Creates pulses and it sends a signal to the integrator so speed can be calculated.
4	**Mounting Hardware** - Hardware needed to install the scale.
5	**Conveyor Idler** - The existing idler is mounted to the Load Cell Assemblies (the weight sensors).

Section 2: Conveyor Parts Identification and Function

It is important to make sure the conveyor that the scale is going to be installed onto is in good condition and that any issues will not affect the scale's performance and accuracy.

Conveying material is one of the fastest and most cost-effective methods of moving material.

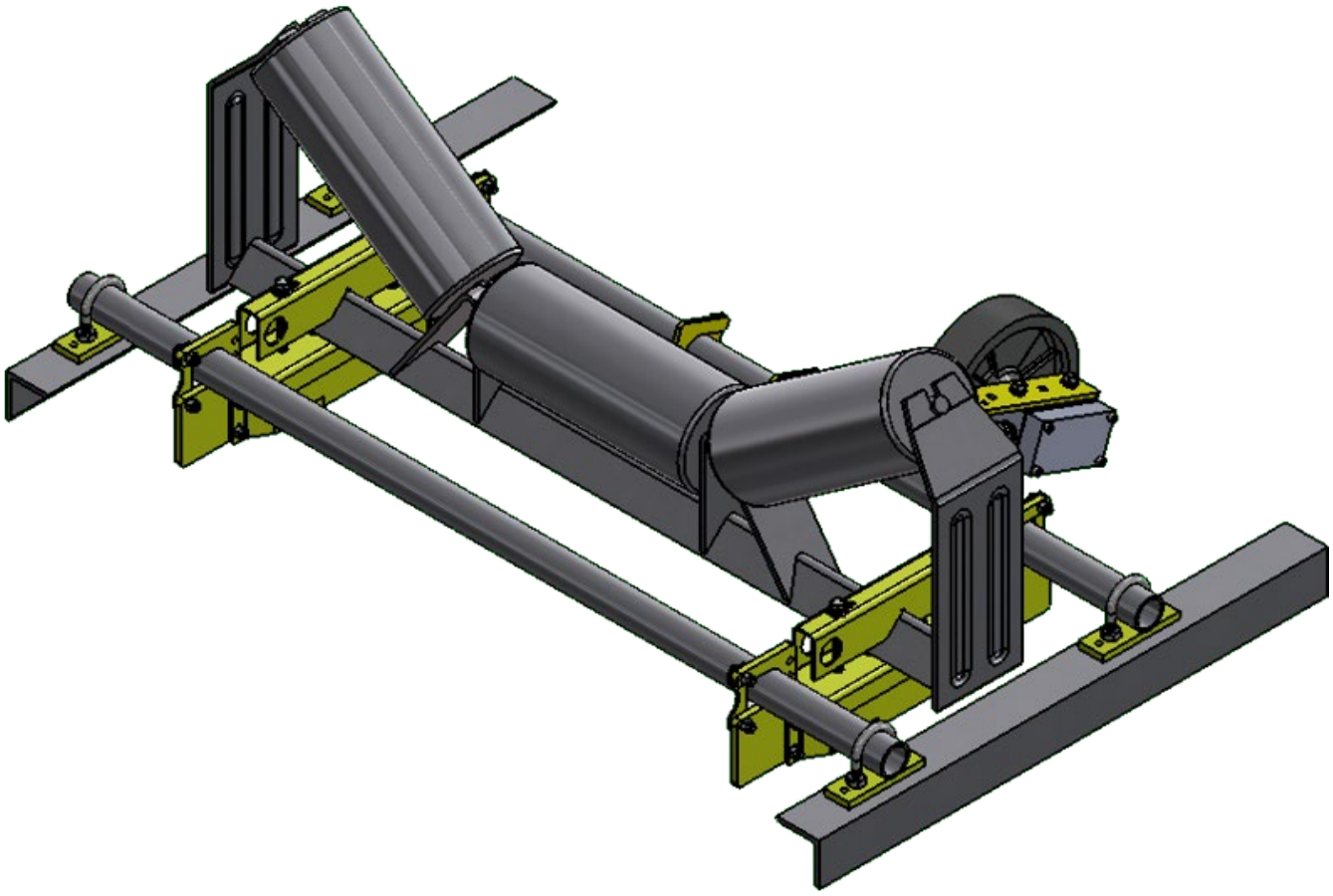
2.1. Idler Types and Parts Identification



1	Impact Idlers support belt under feed hopper.
2	All idlers are aligned with rollers flush across the top.
3	Top of the center roller min. ½" higher than crown of the head & tail pulley.
4	Scale must be placed a minimum of 1 idler from the feed point and 1 idler from last roller before transition roller.
5	Belt Scrapers on both sides of the belt prevent excessive material build-up.
6	When using the standard speed sensor wheel, the point of contact on the return belt should be between return rollers to insure tracking.
7	A gravity take-up provides automatic belt tensioning.

NOTE: All (or some) of the scale components can be painted to match the needs of the client. See Appendix I: Paint System Data Sheet for exa

2.2. Trough Roller Converted to a Scale Idler



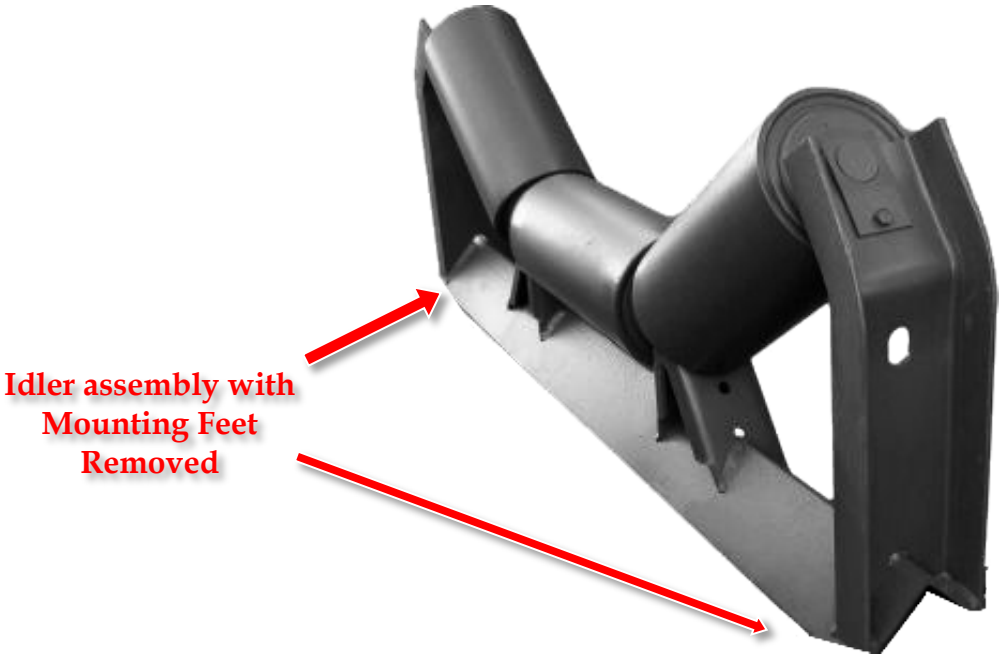
Cut Idler foot off at a 45º angle and make sure the idler is still strong mechanically and not flimsy.

Potential Idler Conditions (Weighbridge Area):

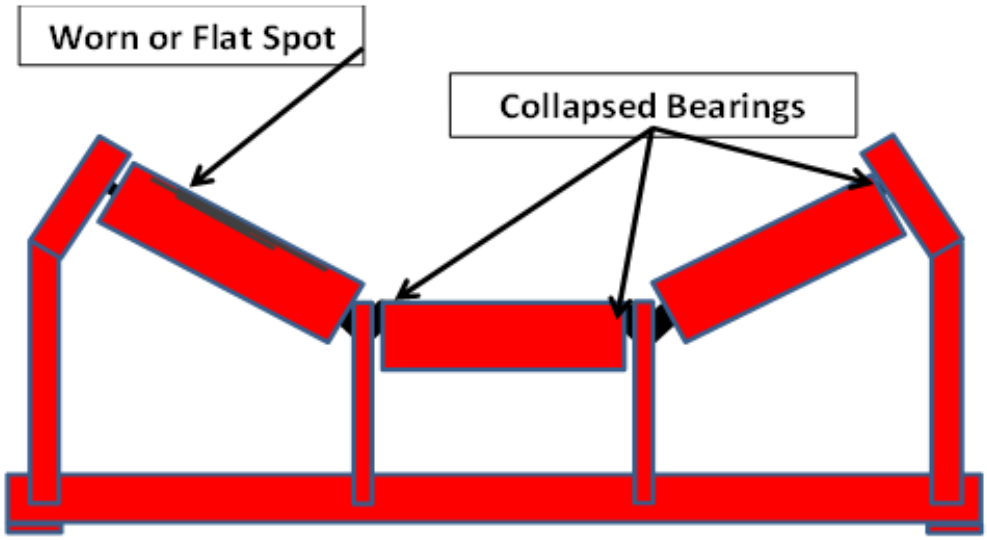
- Incorrect Type and Angle
- Collapsed or seized bearings
- Seized Rollers
- Twisted Idlers
- Weak or Flimsy Idlers

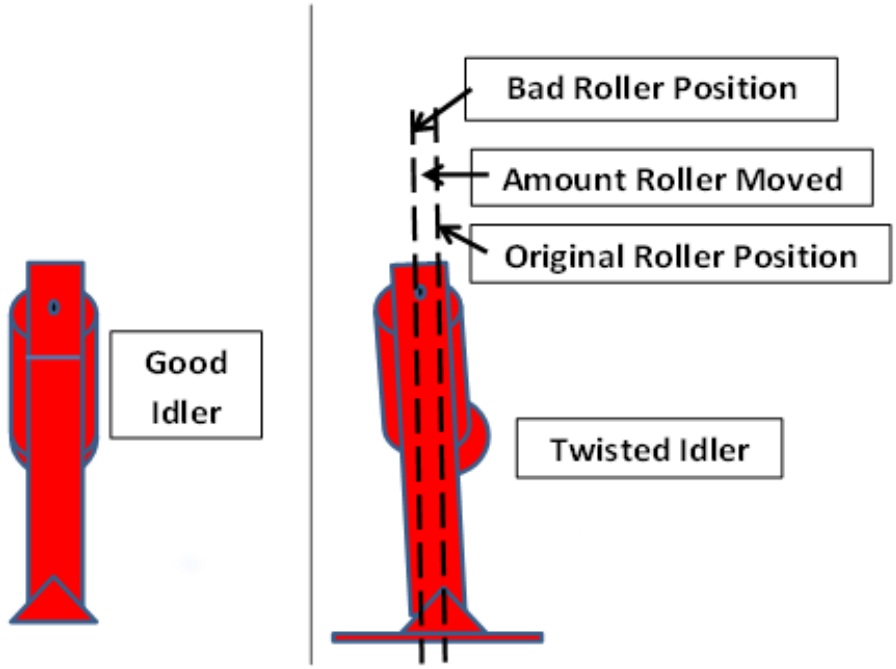
Potential Scale Issues:

- The mechanical alignment and Belt Tension will change.
- Unbalanced loading across the scale.
- Flat spots on the idler roller causing slapping, vibration, and erratic scale readings.
- Twisted or weak idlers cause excessive vibration and torque on the scale
- There are many different styles of idlers. The idler is the complete unit that usually has 3 rollers (2 Wing and 1 Center Roller).



2.3. Troughing Idlers





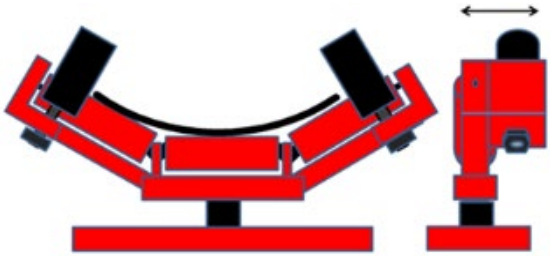
2.4. Idler Types

Precision Idlers

Scale Quality Idlers look identical to standard Idlers. But they are manufactured with concentric rollers, precision trough angles, and higher quality bearings to eliminate the effect of mechanical inconsistency.

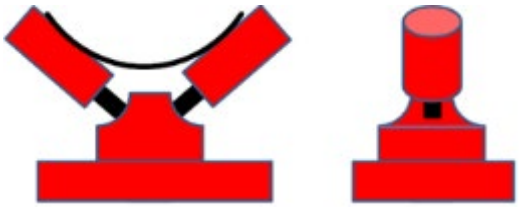
Belt Tracking Idlers

Aids in belt alignment. **NOTE**: These idlers should not be mounted within 20 feet from the weighing area.



V-Shaped Idlers

Rigidity of the belt is increased, increasing the margin of error.



Flat Idlers

Frequently used on weigh belt feeders. Flat belts lack the rigidity of troughed belts, therefore are excellent for high accuracy applications.

Catenary Idlers

Weighing Elements are attached to each end of the roller assembly measuring the tension on the idler rather than direct gravimetric force of the material.

2.5. Conveyor Parts

2.5.1. Belting

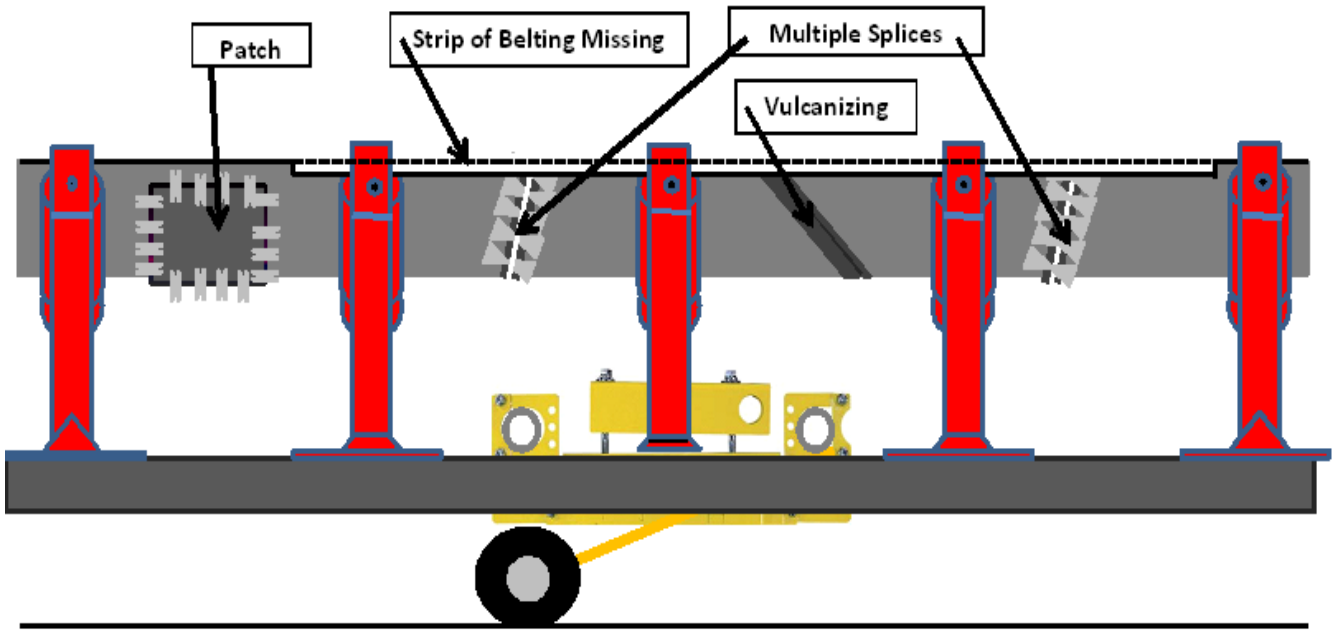
Conveyor belting is available in a variety of thicknesses and grades. It is typically joined together with saddle clips or is vulcanized. The clips are made from steel. Vulcanizing is a melted or glued joint. Some conveyors have multiple splices.

Potential Belting conditions:

- Multiple belt splices and bad patch repairs.
- Patches or saddles that are from different thickness belting.
- Damaged belting with sections missing off the edge.

Potential Scale Issues are:

- Increased mechanical inconsistency resulting in high vibration in the weigh area
- Material loss from the belt due to holes or inconsistent belt edge
- Damaged mechanical spices may cause impact shock on the scale idler.



2.5.2. Tail Pulley

The tail pulley is the pulley at the start of the conveyor. This is usually the pulley at the point where the material is fed onto the belt.

Potential tail pulley Issues:

- Tail pulley misalignment causes bad belt tracking which may result in uneven belt loading.
- Excessively worn pulley may result in slippage potential.

2.5.3. Head Pulley

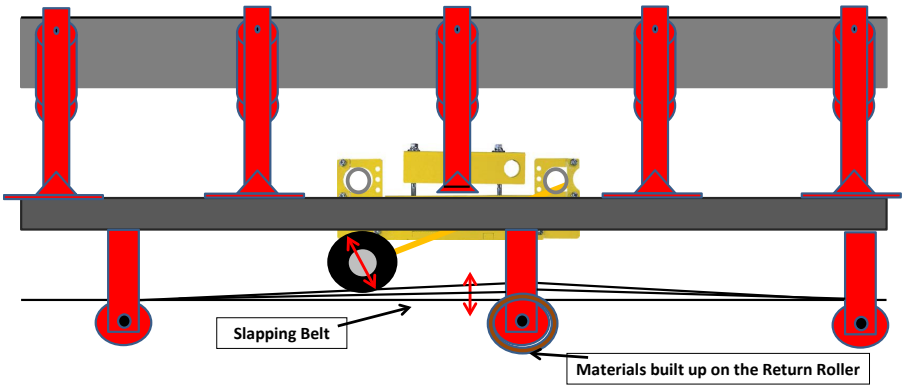
The head pulley is located at the top of the conveyor where material is discharged.

Potential head pulley issues:

- Bearing problems that can cause belt tracking issues.

2.5.4. Return Idler (just 1 Flat Roller)

The return rollers are mounted on the underside of the conveyor frame to support the return belt. These rollers should be kept free of material build-up, which may result in increased vibration. If the return idlers cause the speed sensor to hop off of the belt, move the mounting arm to the other pipe, or mount the speed sensor on a separate 1-1/4" galvanized schedule 40 pipe anchored to the conveyor frame with standard U-Bolts.



Material build up on the return roller makes the belt slap up and down causing the speed wheel to jump off the belt. This causes the belt to lose contact with the belt and cause erratic speed readings

2.5.5. Belt Tensioners

1. **Gravity Take-Up Pulley System**

   The gravity take up pulley system is a gravity type tensioning device. It typically consists of 3 pulleys and a concrete block. The top 2 pulleys are attached to the frame and the 3rd pulley is suspended on the belt acting like a jockey pulley. The 3rd pulley is pulled down by the concrete block to maintain consistent belt tension.

   Potential Take-Up Pulley Conditions And Issues.

   - If the counterweight for the take up system is striking the ground the belt tension will be affected. The belt tension will fluctuate, and the scale will sense the tension changes as changes in the load on the conveyor belt.

2. **Manual Tension Adjusters**

   These adjusters are mounted and incorporated as part of the conveyor frame. There are 2 tensioners - 1 on each side of the conveyor located at the Tail Pulley.

   These adjusters do a few things:

   - They adjust the tension of the belt by adjusting the tail pulley forwards or backwards.
   - Because they adjust independently, they can be used to correct belt tracking problems.

   Potential Belt Tensioner's Conditions and issues are:

   Belt tension is critical because it is related to how the load flows across the belt.

   - If the tensioners are not adjusted evenly the belt will not track correctly.

Belt Tension Issues:

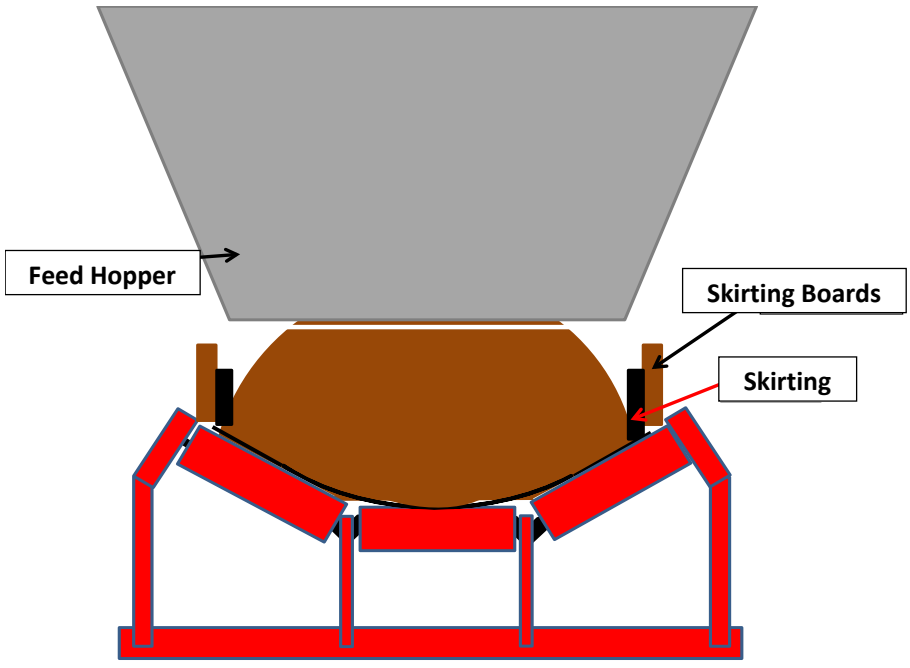
- If too high, the belt will be too stiff, and the scale will not sense the load correctly.
- If too loose, the conveyor belt may slip and not be able to carry the load.

2.5.6. Skirting

- **Skirting Boards**: Placed on both sides of the belt at the point where material is fed onto the belt. They help guide and stabilize the loaded material as it starts its journey up the conveyor belt.
- **Skirting**: Pieces of rubber material that are attached to the Skirting Boards and mounted in such a way that they just touch the top of the conveyor belting to prevent material spillage at the loading point.

Possible Issues:

- **Skirting Boards**: Generally, do not cause issues if attached securely
- **Skirting**: Incorrectly installed skirting can press on the belt, and the scale will sense this additional pressure, and assume it is material as well as and restrict its movement. If it is too loose, it can allow material to be jammed between the skirting and the conveyor belt causing the same affects as if it were too tight.



Material Belt loading issues

Any scale works best when it is measuring material 60-100% of its rated capacity. If the material is being trickled onto the conveyor, the scale will not have enough deflection to calculate the weight correctly. The same goes for if the material is loaded more onto one side versus the other.

2.5.7. Impact Rollers (Belt Loading Zone)

This is where the material is fed onto the belt. The impact rollers are mounted and spaced very close together to help absorb the impact from material that is hitting the conveyor belt. This helps the material being loaded to stabilize quicker and also prevents damage to the conveyor belting.

2.5.8. Other Factors

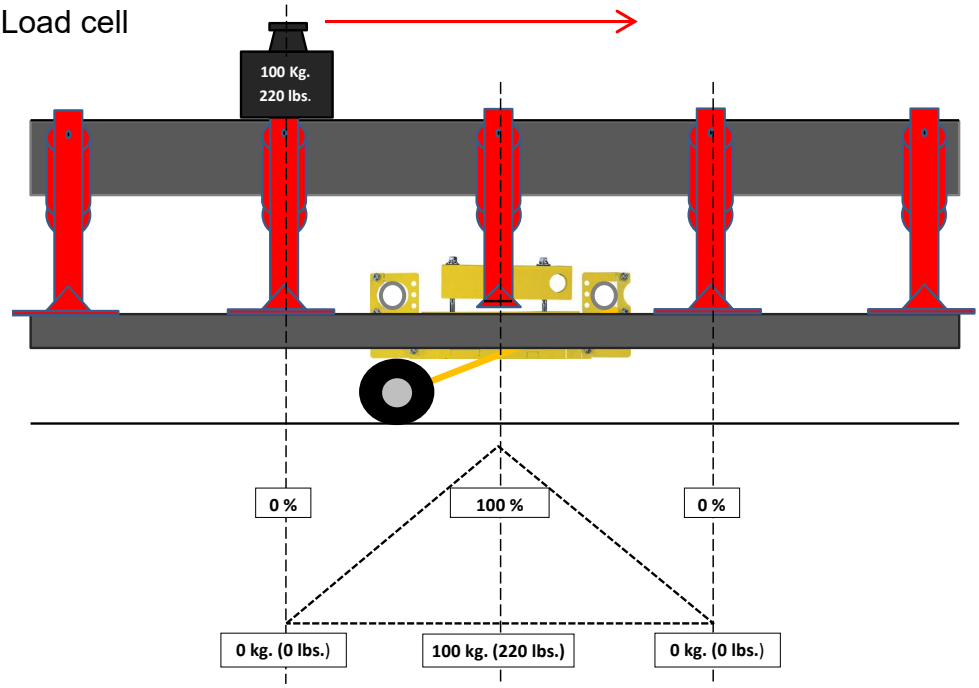
- **Belt Scrapers -** Belt scrapers keep the belt clean, which in turn prevents material build up on the return rollers.
- **Conveyor Stability issues -** The stability of the conveyor is very important. A conveyor that is under designed for the application is more susceptible to flexing and vibration, which will affect the scale's mechanical alignment and accuracy.
- **Vibration issues -** Excessive vibration on the conveyor can affect the alignment of scale and in extreme cases cause noise interference.
- **Wind -** Wind is a common problem on Conveyors with very light material and loading. In situations like these it is best to install guarding on the conveyor.

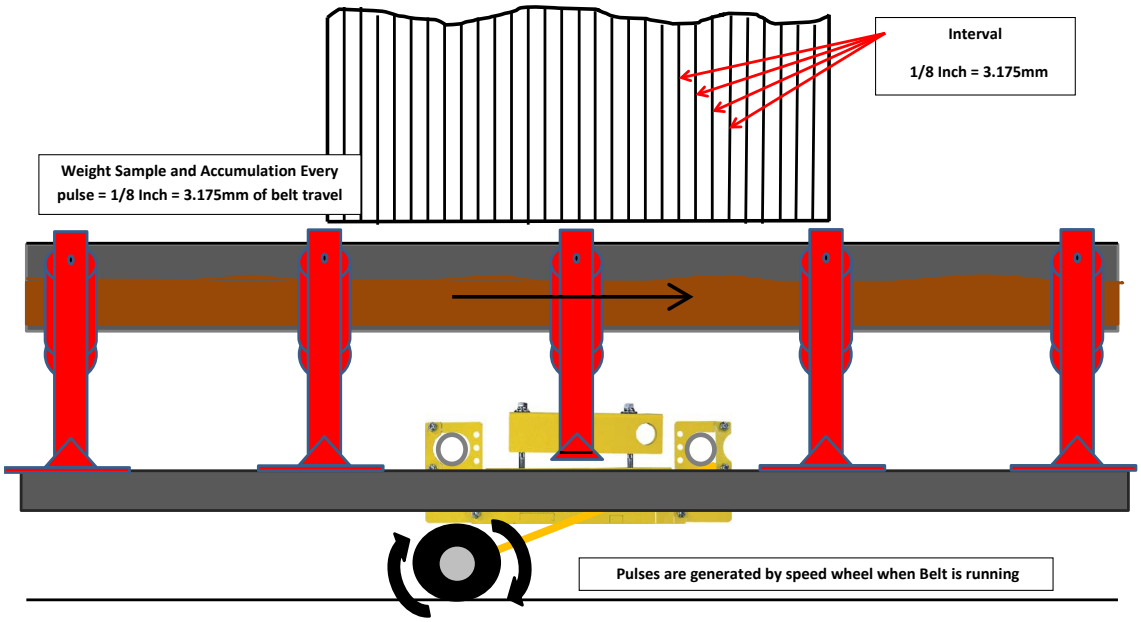
Section 3: Basic Weighing Principles and Scale Operation

3.1. Weighing Theory

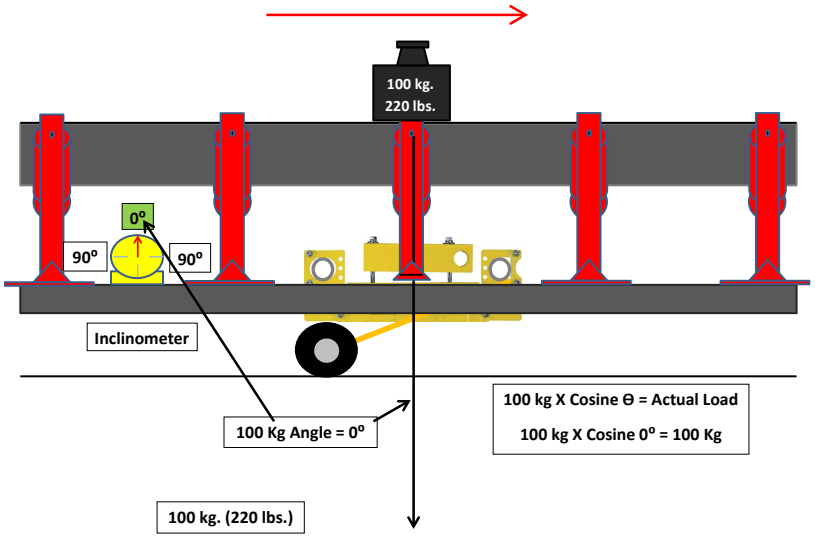
Types of scales available in order of popularity

1. Strain Gauge Load cell
2. LVDT
3. Volumetric
4. Nuclear

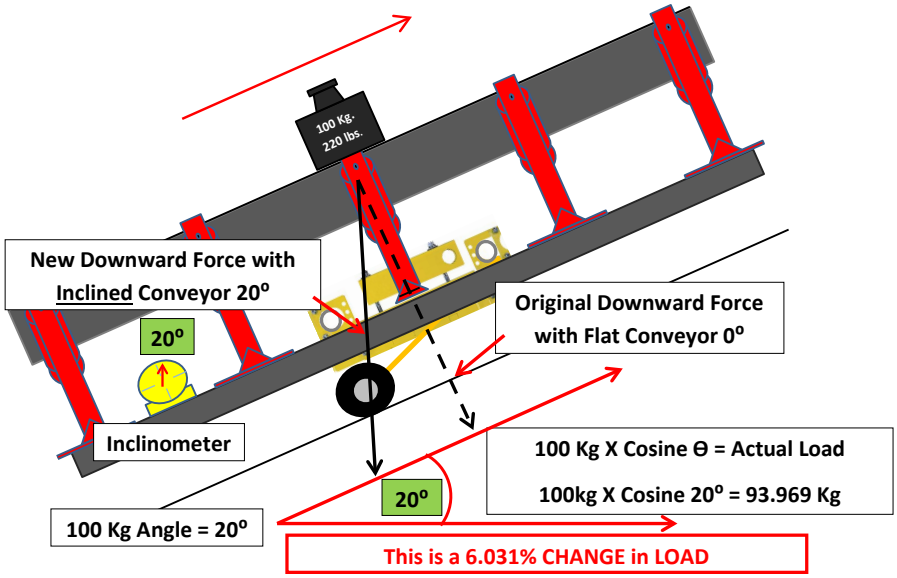




Conveyor Angle of 0º



Conveyor with angle of 20º

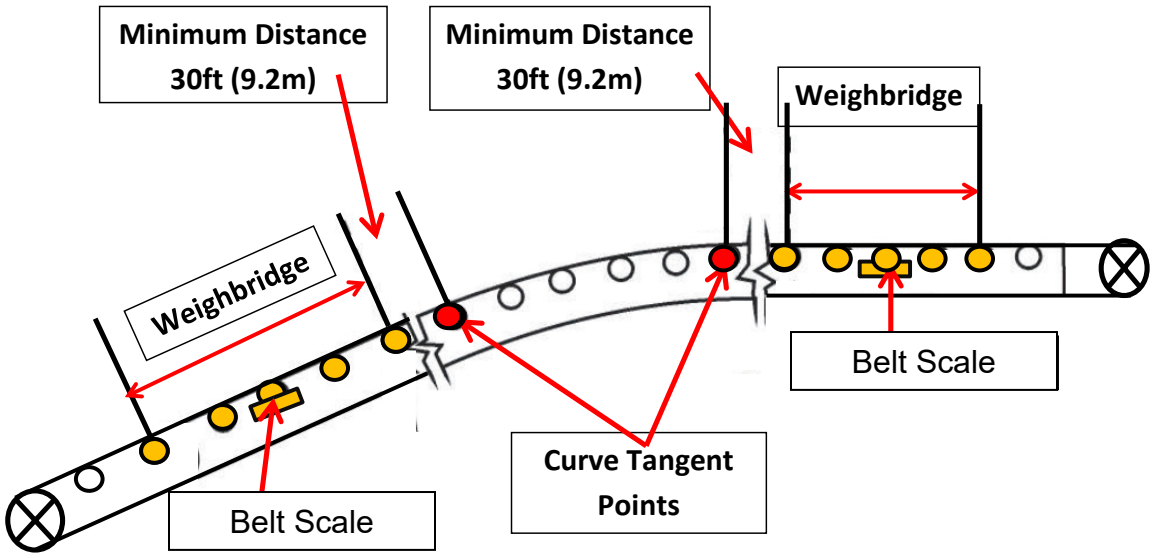


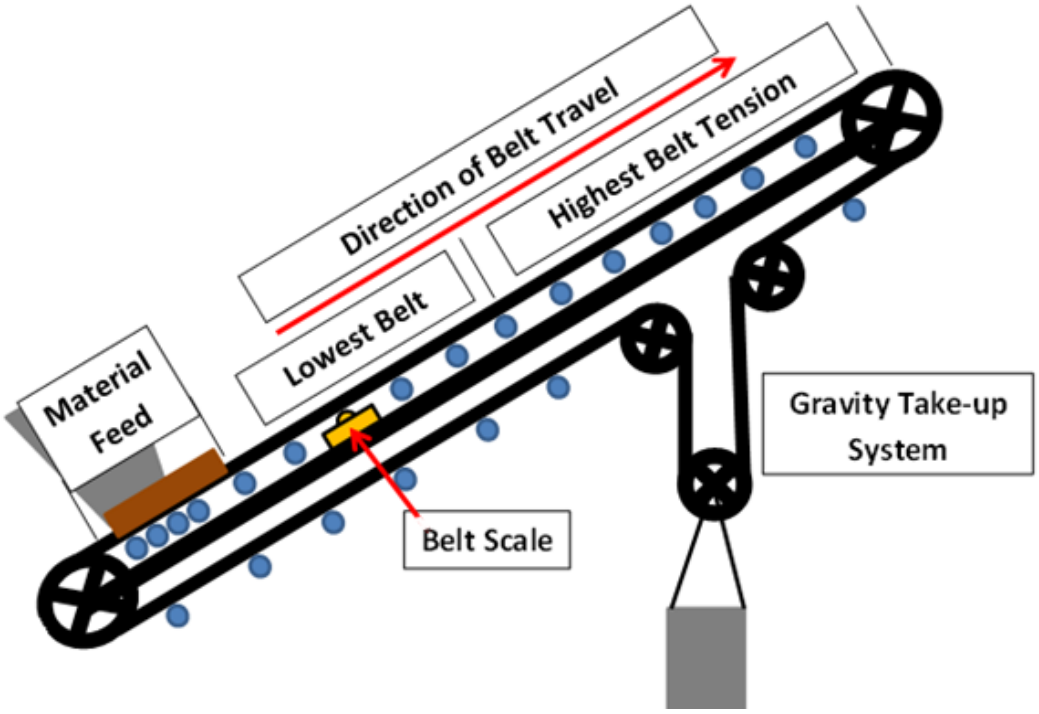
3.2. Weighbridge

Weighbridge - Critical Items to be done with 100% accuracy:

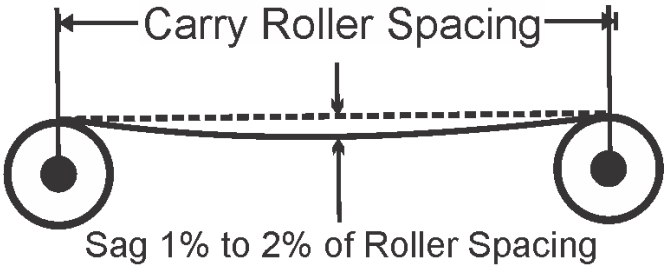
1. The idlers & Rollers in the weighbridge must be in excellent condition.
2. The idlers must be square with the conveyor frame.
3. The idlers must be square with each other and string lined and shimmed.
4. All load cell assemblies must be level with each other and the conveyor frame.
5. Tighten the V-blocks bolts until the split, lock washer is compressed flat.
6. Please DO NOT over tighten. (Load cell readings can be affected).
7. The V-Blocks must be tightened down evenly.
8. The angle sensor must be mounted on the conveyor frame.
9. The idler spacing should be the same on both sides. +/- 1⁄16 Inch (1.5875mm)
10. The scale must be installed per the instruction manual.
11. The pipes MUST be centered in the holes on the load cell assembly hanger brackets.
12. All MEASUREMENTS must be EXACT. **DO NOT GUESS OR ASSUME MEASUREMENTS**.
13. After the installation, the scale must be 'free floating' and not 'jammed' to ensure accuracy and eliminate false readings.

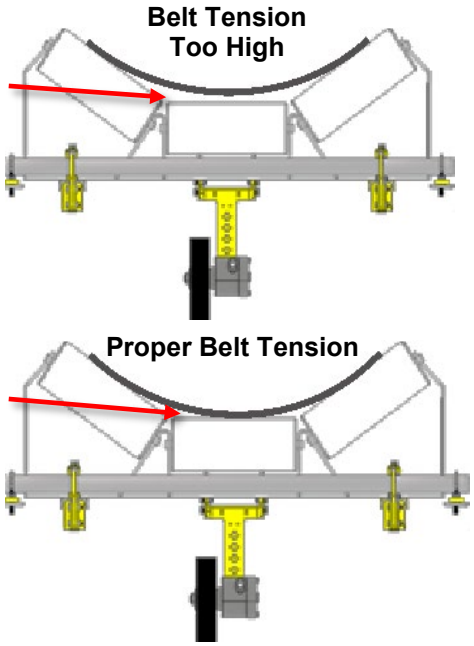
Weighbridge Location Guide for Curved Conveyors





NOTE: Proper Belt Tension results in sag between carry rollers of 1% to 2% of spacing. For example, Idler spacing of 48" center to center produces belt deflection of approximately ½" to 1".





Section 4: Conveyor Types and Typical Scale Operation

4.1. Radial Stackers

Radial Stacker Conveyors require an Automatic Angle Compensator to eliminate the need for re-calibration when changing the angle of elevation of the conveyor.

4.2. Curved Conveyors with a Vertical Curve

This type of conveyor is **NOT** ideal or recommended for a scale installation.

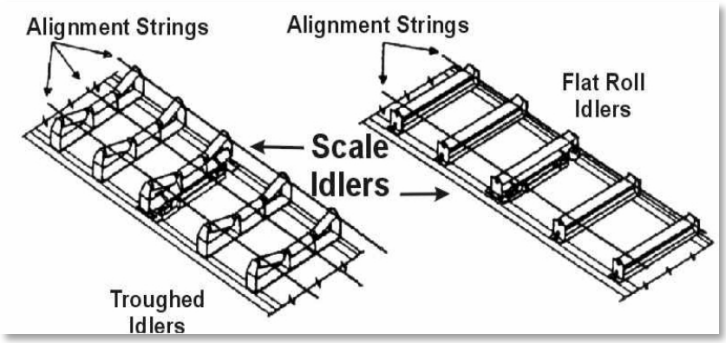
You must check for proper belt and idler contact under the following conditions before deciding to install the scale on this type of conveyor.

1. Conveyor STOPPED – NO Material
2. Conveyor RUNNING – NO Material
3. Conveyor RUNNING – WITH Material

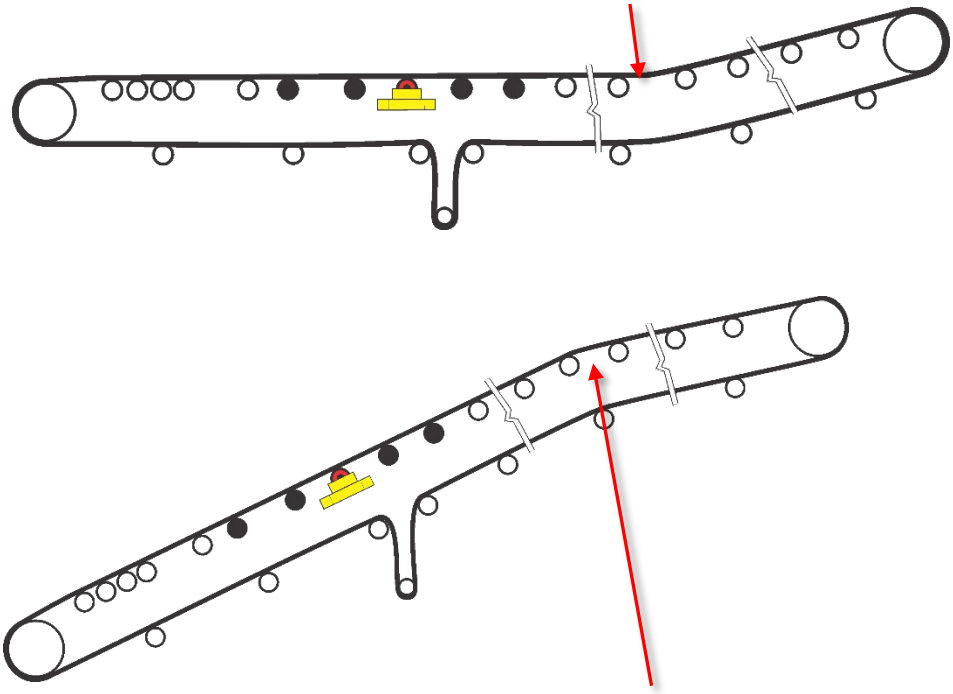
Items to check:

A. Belt contact in weighing zone (minimum of 2 idlers before and 2 idlers after the scale).

B. Belt Tracking.



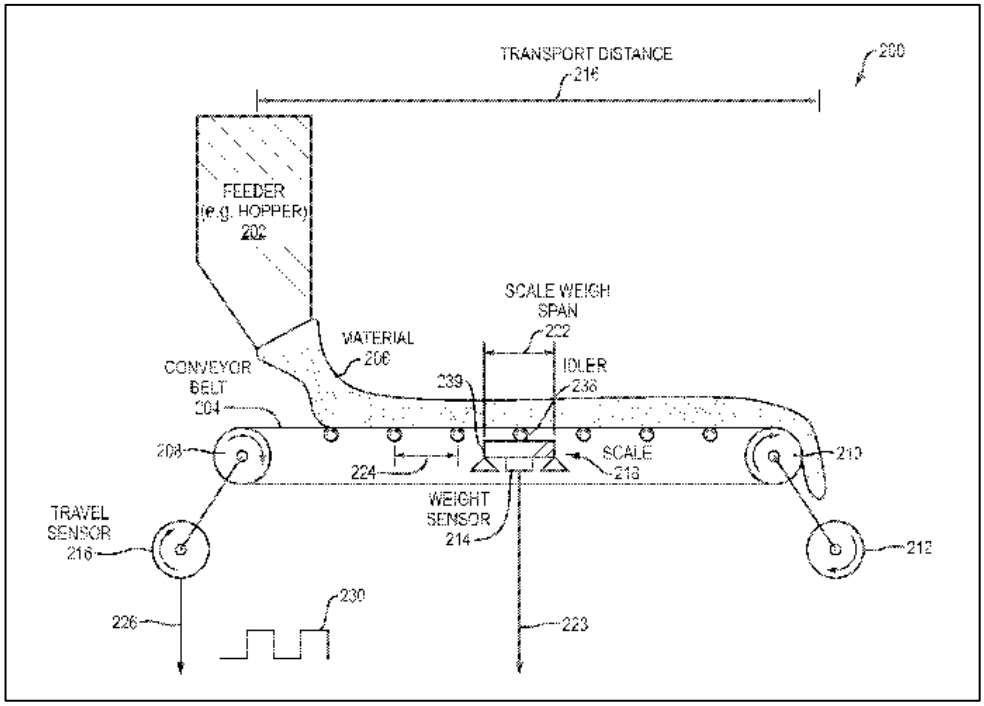
Concave Curve Minimum 40 ft. from Tangent Point of Curve.



Concave Curve Minimum 40 ft. from Tangent Point of Curve.

4.3. Belt Feeders

These belts travel very slow speed and the idlers are very close together.



4.4. Portable Conveyors

These Conveyors are moved from time to time as jobs require.

4.5. Mobile Machine Crushers

Calibrations are done more frequently on these machines because are they move regularly in a single day.

4.6. Portable Trans-Loaders

Calibrations are done more frequently on these machines because are they move regularly in a single day.

Section 5: Weighbridge Alignment

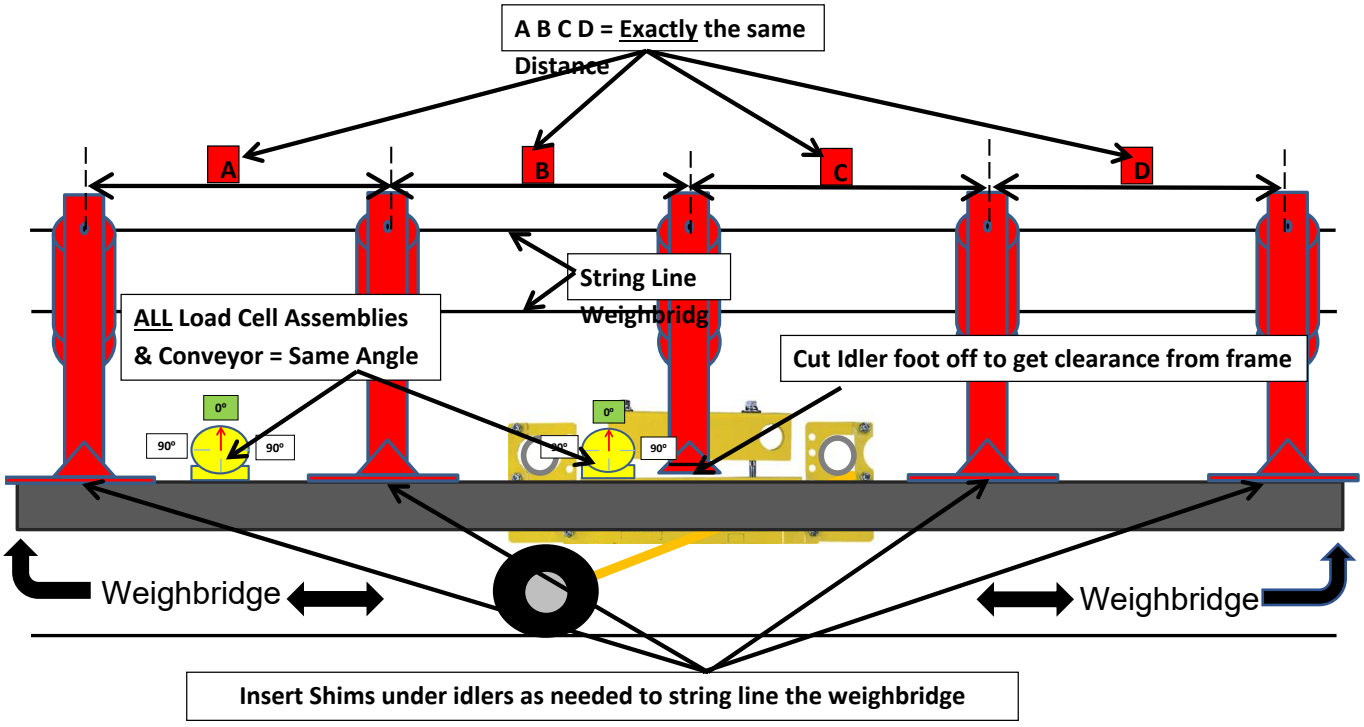
5.1. Connecting the Weighbridge -Checklist

Critical Items to be done with 100% accuracy:

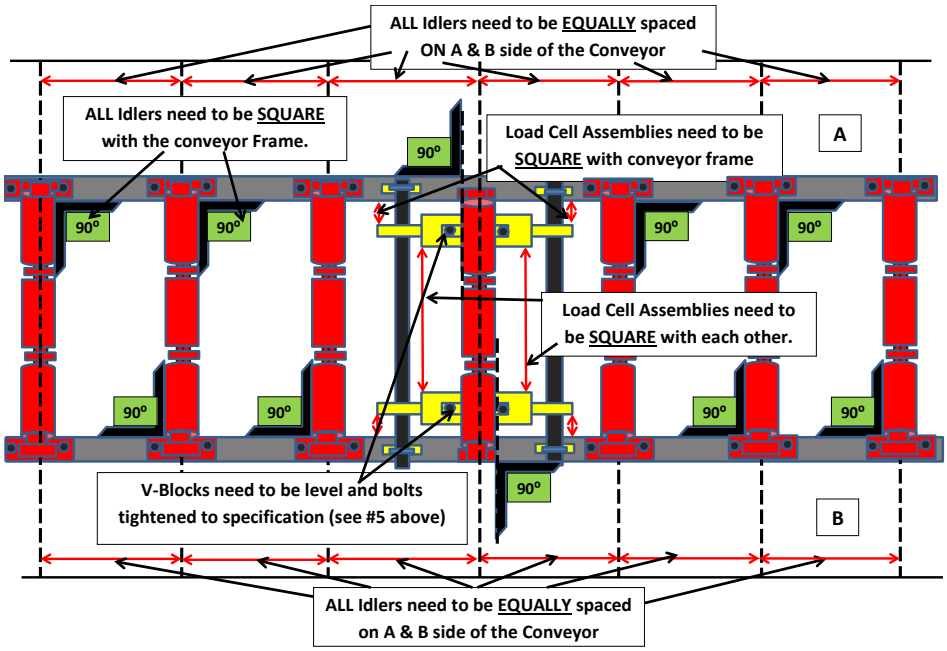
1. The idlers & Rollers in the weighbridge must be in excellent condition.
2. The idlers must be square with the conveyor frame.
3. The idlers must be string lined and shimmed.
4. Tighten the V-block bolts until the split, lock washer, is compressed flat.
   DO NOT over tighten. (Load cell readings can be affected).
5. The angle sensor must be mounted on the conveyor frame.
6. The pipes MUST be centered on the holes on the load cell assemblies.
7. All MEASUREMENTS must be EXACT. **DO NOT GUESS OR ASSUME MEASUREMENTS**

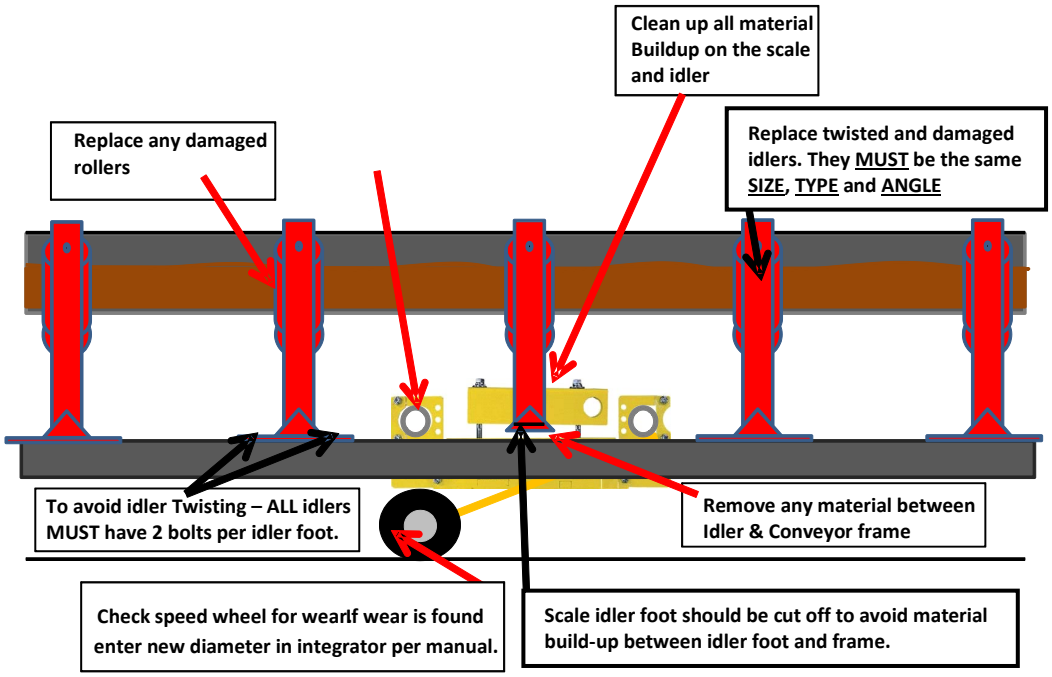
CRITICAL WEGHBRIDGE POINTS = 100% ACCURACY REQUIRED

5.2. Weighbridge Installation Diagram



5.3. Proper Setup and Maintenance Diagrams





Section 6: Calibration

6.1. Routine Calibrations

Routine calibrations consist of conducting:

- ZERO Calibration 2-3 times / day or when needed based on stability of empty belt weight over time
- Span Calibration with test weights (when needed)
- Material tests (when needed)

6.2. Physical & Mathematical Verification Using Tests Weights

A. Pre checks / measurements

- Measure ACTUAL belt speed. (be very accurate) **meters/minute ____ m/min (ft/m)**
- Measure ACTUAL Weigh Span (be very accurate) **meters or feet _____m or Ft**
- Measure ACTUAL Test weight on a LAB scale (be very accurate)**kg or pounds ____Kg or Lbs.**

B. How to Calculate Actual Belt Speed without a Tachometer Using a Stop Watch

a. Mark the belt at 1 point
b. On the conveyor mark 2 reference points A & B (20 meters apart) **20 meters**
c. Start and run the belt empty
d. Time in seconds how long it takes the mark from point A to B.
   D = _____seconds
e. Time in seconds how long it takes the mark on the belt to do 1 rev.
   E = _____seconds
   Used if you cannot see the belt from where the integrator is mounted for "set Zero"

This formula is the same for Feet (ft) just use Feet instead

Calculate belt speed by using the following formula

Belt Speed (m/min) = 20 meters .

Time from A to B in seconds X 60 Seconds

C. Verify the scale Span & Test weight setting reads the same as Actual Measured in #1

a. Press **F1**
   Make sure the weigh span matches **ACTUAL** measured span.
   Make sure the Test weight matches **ACTUAL** measured Test Weight.
b. (optional) Correct if needed.
c. Press **WEIGHT RATE**.

D. Verify the scale belt speed reads the same as Actual Measured belt speed in #1

Make sure Belt speed is the same as Measured belt speed in #1

If belt speed is not the same adjust as follows:

a. Press **F3** twice. Then, press the **Select** button until the arrow appears next to pulley diameter. Use small up and down arrow keys & adjust pulley size until speed matches.
b. Press **Select**, and then press **WEIGHT RATE**.
c. **SW1** position 1 must be **ON** to change the diameter. **SW1** position 4 must be **ON** or the diameter will return to default value on re-boot.

E. Calculate the TPH using ACTUAL MEASUREMENTS from conveyor

d. **USE MEASURED VALUES FROM STEP #1**
e. USE the following formula to calculate what rate you should be running after calibration.

METRIC

CALCULATED Tons per Hour = Test weight in (kg)

(Z x Weigh Span) (m) X 60 Minutes X Belt Speed (m/min)

1000

POUNDS

CALCULATED Tons per Hour = Test weight in (lbs)

(Z x Weigh Span) (ft) X 60 Minutes X Belt Speed (ft/min)

2000

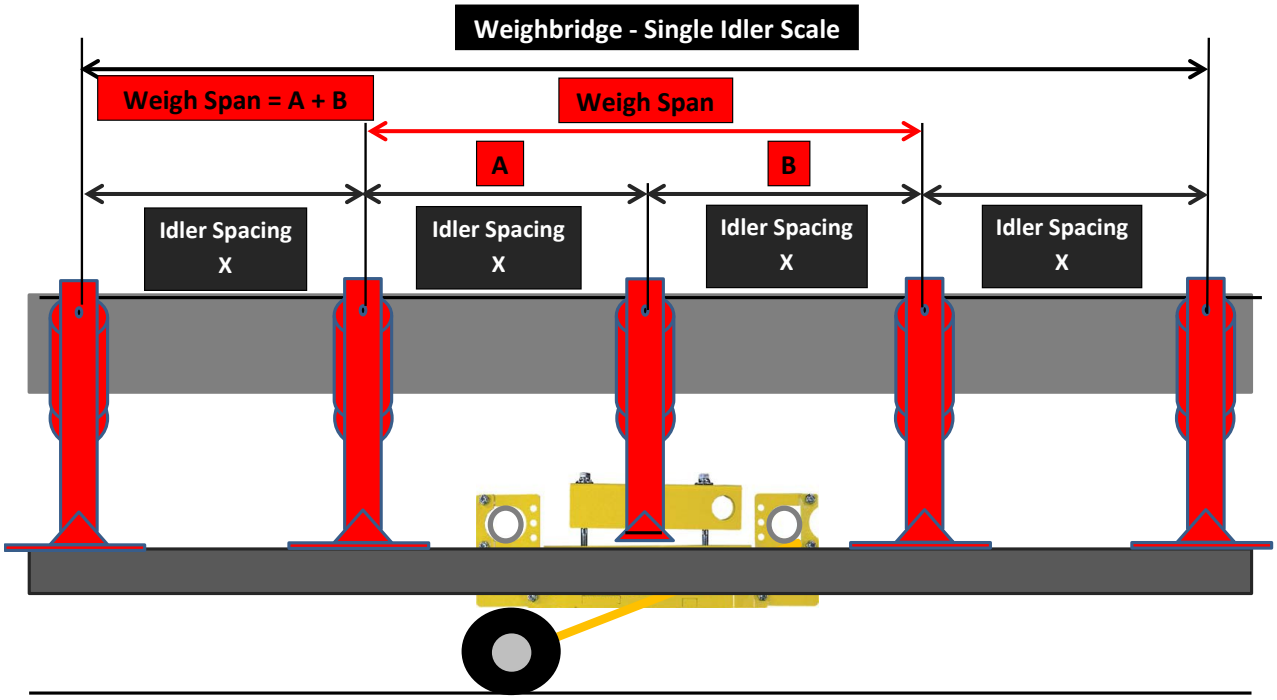
Substitute (Z) and Weigh Span depending on the type of scale you have.

Type of Scale	Value to use for (Z)	Weigh Span Formula Pg20 & 21
Single Idler Scale	½	A + B
Dual Idler Scale	½	A + (Bx2) + C
Triple Idler Scale	½	A + (Bx2) + (Cx2) + D
Quad Idler Scale	½	A + (Bx2) + (Cx2) + (Dx2) + E

6.3. Calculating a Single Idler Scale

The size spacing (X) is different from one conveyor to another.

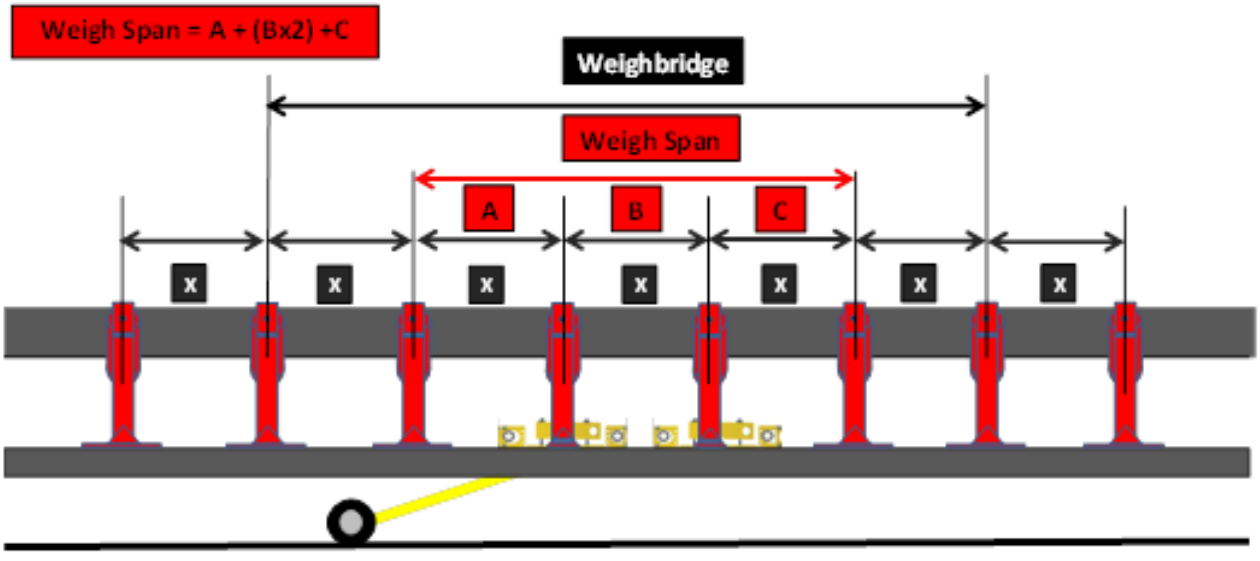
It is important that the Idler spacing X is exactly the same.



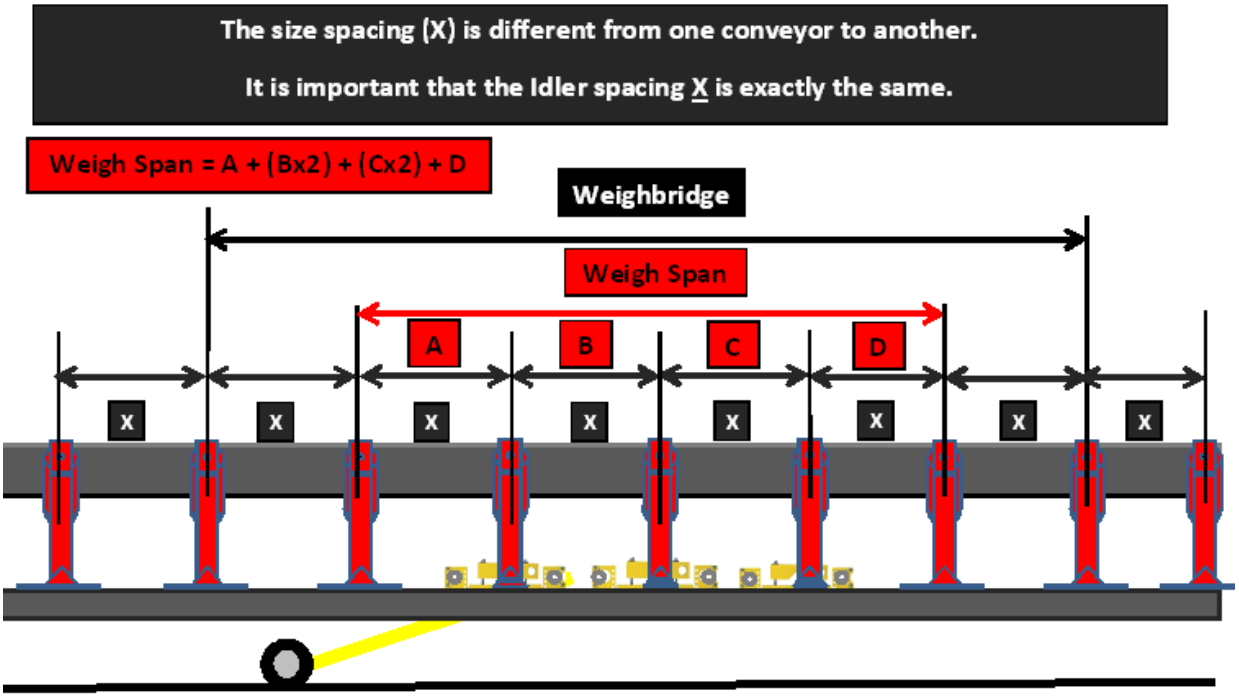
6.4. Calculating a Dual Idler Scale

The size spacing (X) is different from one conveyor to another.

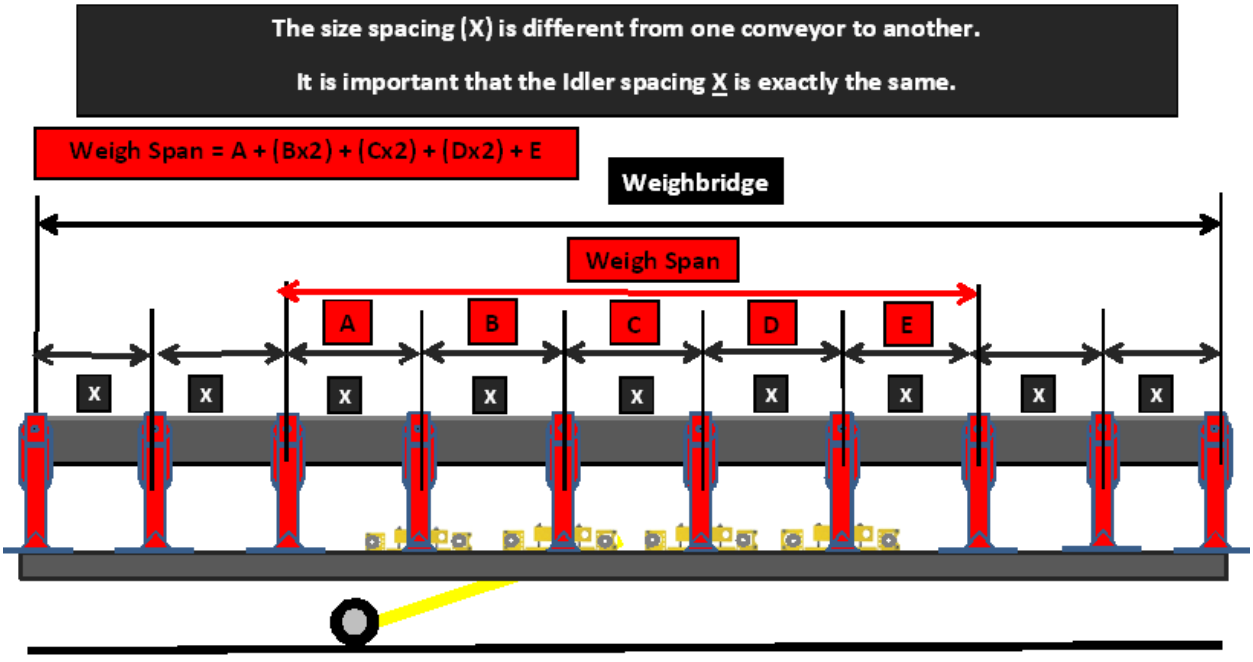
It is important that the Idler spacing X is exactly the same.



6.5. Calculating a Triple Idler Scale



6.6. Calculating a Quad Idler Scale



Conveyor Belt Scale Application Guide

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