Safety Guidelines

Warning notices must be observed to ensure personal safety as well as that of others, and to protect the product and the connected equipment. These warning notices are accompanied by a clarification of the level of caution to be observed.

Qualified Personnel

This device/system may only be set up and operated in conjunction with this manual. Qualified personnel are only authorized to install and operate this equipment in accordance with established safety practices and standards.

Warning: This product can only function properly and safely if it is correctly transported, stored, installed, set up, operated, and maintained.

Note: Always use product in accordance with specifications.
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Preface

Although this instruction manual was originally written to support the MSI belt scale, it can also be used as a reference for models MMI and MUS, or belt scale weighing in general.

Note: All diagrams are specific to the MSI belt scale. When applying this manual to other belt scale models, use diagrams as examples only.

Please refer to the appropriate belt scale instruction manual for full specifications, and installation and calibration procedures. Manuals can be downloaded from the Siemens Milltronics web site at www.siemens-milltronics.com.

Belt scale design and manufacture allow for greater accuracy to be achieved when installed and applied according to the guidelines. To help the user maintain the accuracy and performance of the belt scale, this manual provides recommendations for the proper application of belt scales under specific conveyor and environmental conditions.
Belt Conveyor Terminology

Idler Detail
Locating the Scale

Belt Tension

Belt tension varies in relation to material tonnage, belt speed, conveyor length and the height that the material must be raised. The larger these values, the greater the tension and the greater the resulting effect on the scale.

Recommendation

Install the scale close to the tail section where tension and tension variations from no load to full load are minimal.

Material Turbulence

Material leaving the area of the feed point and associated skirtboards will be turbulent and will require a distance of belt to settle. Do not attempt to weigh the material before it settles completely. Locating the scale also depends on the conveyor belt speed and the characteristics of the material.
Recommendation

Locate the scale no less than one idler space beyond the point where turbulence stops. If that cannot be determined, refer to the following chart:

<table>
<thead>
<tr>
<th>Belt Speeds</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 1.5 m/sec (300 fpm)</td>
<td>2 m (6 ft)</td>
</tr>
<tr>
<td>up to 2.5 m/sec (500 fpm)</td>
<td>3 m (10 ft)</td>
</tr>
<tr>
<td>over 2.5 m/sec (500 fpm)</td>
<td>5 m (15 ft)</td>
</tr>
</tbody>
</table>

Curved Conveyors

Vertical curvature in the conveyor design can create difficulties with belt scales. Both concave and convex curvatures will disturb the idler alignment if the belt scale is installed in the area of the curve. The concave curvature is more difficult to manage because it may lift an empty belt off the idlers around the curve, preventing a good empty belt zero balance for the scale. The diagrams below illustrate the minimum distance the belt scale should be from the curvature to obtain accurate results.

Concave

Convex
Belt Ploughs

The use of belt ploughs or any conveyor or material control device that changes the profile of the carrying belt in or near the scale area is not recommended. These devices have a negative effect on the belt scale idler alignment and may create drag on the belt which the scale may sense as a material force or load.

Recommendation

Do not install the belt scale within 9 m (30 ft) of belt ploughs or similar devices that change the profile of the material or belt.

Stacker Conveyors

Any conveyor that is not a permanent structure or that varies in its incline, elevation or profile is not considered a good installation for an accurate belt scale. For applications where a belt scale can be used effectively with a conveyor of this type, please consult your Siemens Milltronics representative.

Conveyor Trippers

A conveyor with a tripper is not as common as a conveyor with fixed curvature, but it can have a similar effect on belt scales. A tripper can cause varying belt tension and can cause lifting of the belt in the scale area if the belt scale is not located in the best position.

Recommendation

On a conveyor with a tripper, locate the scale according to the recommendations for fixed curves, but with the tripper in its fully retracted position.
Conveyor Considerations

Belt Scale Take-up Device

A variety of conveyor belt take-ups can control conveyor belt tension. Of the three basic types, (screw, horizontal gravity and vertical gravity), the vertical gravity take-up is the most reliable because it can react to changes in belt tension and maintain relatively uniform tension. Using a vertical gravity take-up greatly reduces the influence of belt tension on the scale and improves accuracy.

Recommendation

For the best accuracy, use a vertical gravity take-up. If that is not practical or possible, use a horizontal gravity take-up. The use of the screw type take-up should be limited to conveyors with pulley centers of less than 18 m (60 ft).

Material Feed Point

Some conveyor systems require that multiple feed points be in use at the same time. Belt tension can vary considerably depending upon the combination of feeds points in use at any given time.

Recommendation

Whenever possible, install the scale on a conveyor that has only one feed point.

Material Loading

Various methods are used to feed material to the belt. Often, the flow of material from the pre-feeder to the belt is not uniform and at speeds different from the conveyor belt speed. These influences may reduce accuracy.
Without Control Gate

Recommendation

Ensure steady and uniform material loading to the conveyor belt at or near the same speed as the belt. Install a material feed control gate or similar device to enhance the uniform flow of material.

With Control Gate

Material Roll Back

Material roll back (sometimes referred to as material slip) occurs on a conveyor belt when the material, due to its size and shape, rolls back on itself even though the general direction is forward. It may be the result of a conveyor with a steep incline, an inequality between material feed velocity and belt speed, or poorly selected or installed rubber or
chain curtains at the infeed, where the curtain momentarily holds back the material on the top of the pile causing it to slow down in comparison with the rest of the pile.

**Recommendation**

Make a close inspection of the installation to determine if the proper speed to feed and incline versus material roll back relationships are in use.

**Conveyor Belting**

The variations in the number of belt plies, the cover thickness and the type and quantity of splices in a given conveyor belt causes considerable variation in the weight per length of that belt. During the course of zero balancing, most belt scales average the weight of the belt over one complete circuit of the belt.

The amount of the deviation (+ or -) from that average, if great enough, can make it difficult to obtain a good zero reference and subsequent scale accuracy.

**Belt Stiffness**

A belt that is over-rated for its intended use may be so stiff that it cannot flex enough to properly trough in the idlers. When this happens (especially in 35° and 45° idlers), the belt arches across the idler and neither a good zero of the belt nor a good span calibration can be obtained.

![belt too stiff](image1.png) ![good belt flexion](image2.png)

**Recommendation**

When replacing worn sections of belting, ensure that it is the same as the existing belting. When choosing a new belt, select one that suits the application. Avoid selecting an over-rated belt.
Idlers

Of the variety of idlers available, only certain types are permitted for use with a belt scale. Use of the proper idlers is necessary to achieve good idler alignment in and around the scale area.

Recommendations

a. Do not use wire rope type, 2 roll “V” type, or catenary type idlers on or near scale. Offset type may be acceptable in some installations (consult Siemens Milltronics regarding their use). The only truly acceptable types are the troughed 3 roll in-line type or single roll flat type idlers.

b. The most common troughed idlers are 20° and 35°. 45° troughed idlers may be used but accuracy may suffer. The deeper trough angle tends to magnify the effect that belt tension and belt stiffness have upon the scale, increasing the importance of good idler alignment.

c. Select idlers that have the same dimensions, that have rolls that are concentric within 0.5 mm (.020"), and that have troughs that match within 3 mm (0.12"), when compared to a template. All idlers chosen for scale installation must be of the same manufacture and properly lubricated (in some cases, idlers having “Lube-for-life” bearings are required).

d. Keep all idler rolls clean, free from material build-up, and free spinning without over-greasing. Neglecting this may result in misalignment and poor belt tracking. Replace all idlers that have stiff, stopped or eccentric rolls.
Idler Alignment

The proper and accurate alignment of idlers in the scale area is critical for belt scale function and accuracy. Refer to the installation procedure in the appropriate belt scale manual.

Recommendation

Properly align the scale idlers and at least two (preferably three) idlers on each side of the scale. See diagram on page 2 (Idler Detail) for an example of correct idler alignment.

Head Pulley

Be cautious when installing a scale in a short conveyor or in conditions where the scale must be located in the area near the head pulley. Head pulleys are essentially flat faced with a slight crown. When using troughed idlers, the belt profile must change from the troughed to flat in a short space. To accommodate this, the conveyor manufacturer designs a built-in vertical displacement of the head pulley above the top of the center roll of the adjacent idler. To further aid this transition, idlers of decreasing trough angles are inserted between the head pulley and the normal run of idlers.

If these adjustments are not made, a considerable amount of stress is exerted on the belt edges and the idlers adjacent to the head pulley and, ultimately, these undesired forces are applied to the scale.

Recommendation

a. On conveyors with 20° trough idlers, a minimum of two fixed 20° idlers must be located between the belt scale and the head pulley.
b. On conveyors with 35° trough idlers, a minimum of two 35° and one 20° retreat idlers must be located between the scale and the head pulley.

c. On conveyors with 45° trough idlers, a minimum of two 45°, one 35° and one 20° retreat idlers must be located between the scale and the head pulley.

d. The vertical displacement of the head pulley relative to the adjacent retreat idler is normally in excess of what is acceptable for belt scale installations.
When locating a scale close to the head pulley, maintain a maximum of 13 mm (1/2") vertical displacement between the top of the head pulley and the top of the center roll of the adjacent idler by making the following adjustments:

1. Lower the head pulley on its mounting until the vertical displacement measured from the top of the head pulley does not exceed 13 mm (0.5") above the top of the center roll of the adjacent idler.

   or

2. Shim all the retreat idlers between the head pulley and the scale, the scale idlers and at least two approach idlers to accomplish the same end result mentioned in option 1.

Tail Pulley

Usually, the space reserved for the infeed suppresses any effect the tail pulley might have upon the scale. A problem could occur if the tail pulley is the self-cleaning type with slats or beater paddles, often called a wing pulley. The beating action of this pulley may create oscillations that could be transmitted through the belt to the scale.

Recommendation

If possible, avoid the use of wing type pulleys. Use solid face welded steel pulleys.

Conveyor Rigidity

The conveyor stringers in the scale area should be strong enough to limit relative deflection to 1.6 mm (1/16") or less with supports 2.4 m (8 ft) apart throughout the range of conveyor loading. Stringers should also be straight so that the belt has a better chance of tracking centrally on the conveyor.

Vibration

A belt scale is an inherently sensitive device and should be isolated from equipment that can induce harmful or disturbing vibration. Equipment such as crushers, vibratory feeding equipment, bins subject to hammering, and hammer mills should be avoided.

Conveyor Covers

Covers are required for outdoor installations involving belt scales.

Recommendation

Ensure that the covers do not interfere with the operation of the scale. Install additional shielding to counteract the adverse effects of the elements (wind in particular). The amount of shielding will depend on the geographical area, but typical dimensions are 9 m (30 ft) before and after the center of the scale and 1 to 1.2 m (3 to 4 ft) above and below the carrying belt line.
Belt Tracking and Troughing

A combination of factors determine whether or not the conveyor belt will properly track (i.e. keep its position on the conveyor and idler centerline) and trough (i.e. lay in the idler trough and make good contact with all three idler rolls as intended).

First, consider the belt:
- ensure sufficient ply rating to support the load without being overrated
- ensure that rubber covers are of the proper thickness
- ensure that splices are properly selected and installed

Second, ensure that the conveyor take-up is the right type for the application and that it is properly adjusted and working properly.

Third, consider the idlers:
- ensure the idlers are square to the conveyor and located centrally on the frame
- ensure that all idler rolls turn on their axis
- ensure that training idlers or idlers with guide rollers (if used) are not installed closer than 9 m (30 ft) from a scale idler

Skirtboards and Sealing Strips

In some applications it is necessary to extend the infeed skirtboards and sealing strips the full length of the conveyor. Problems in weighing accuracy can result from the force the sealing strips exert on the belt, and indirectly on the idlers, especially when pinching occurs. Obtaining accurate zero balance and span calibrations under these circumstances is difficult.
Recommendation

Remove the sealing strips or raise them sufficiently to eliminate their effect upon the belt and idlers.
Maintenance and Modifications

Maintenance

Once the conveyor is fitted with a belt scale, it requires more attention as it is now part of the weighing system. To ensure accurate weighing, take good care of the scale and the surrounding area. Perform the following maintenance for proper scale operation:

- lubrication of all pulleys and idlers
- proper belt tracking and training
- proper belt cleaning and scraping
- proper belt take-up operation
- proper material and spillage control

Maintenance Precautions:

- When welding near the scale, do not allow current to pass through the belt scale.
- Reset the shipping stops to reduce physical shock to the load cells during maintenance.

Modifications

Any changes to the conveyor and/or related equipment could have a profound effect upon the operation and resulting accuracy of the belt scale.

Recommendation

Consult your Siemens Milltronics representative for advice regarding belt scale installation in a modified conveyor system.

Material Build-up

Keep the conveyor belt and associated equipment as clean as possible, so that the scale measures only the loads intended and not the added load due to material sticking to the belt. To remove materials that stick to the belt and conveyor equipment, use good quality belt cleaning equipment such as belt scrapers, rotary brushes, vibrating cleaners, shakers, and ploughs. Although scales can be frequently and automatically recalibrated at no load (zero), it is not a good practice to allow material build-up to remain on the belt.

Material Spills

General good housekeeping is always important. Material spillage results in lost production and can also adversely affect scale operation when spilled material wedges between dynamic parts preventing proper scale deflection. In addition, the build-up affects the zero balance of the scale.

Recommendation

Do not overload the conveyor. As a precaution, install deflectors to keep spills from reaching the scale.