CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION

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www.cemanet.org

2023 CEMA ENGINEERING CONFERENCE
UNIT HANDLING SAFETY SUBCOMMITTEE MEETING
Naples Grande Beach Resort, Naples, FL
Monday, June 12, 2023 – 10:45 am

AGENDA

1. Call to order.

2. Attendance and Introductions.

3. Approval of Minutes of November 8, 2022 – Minutes were approved.

4. ASME B20.1 updates.

5. Old business
   a) **CEMA SBP-001 Design and Safe Application of Conveyor Crossovers for Unit Handling Conveyors** – Updates.
   Subcommittee: Troy Uahinui & Greg Pollitt, Honeywell Intelligrated; Boyce Bonham, Hytrol Conveyor Co. Inc.; Dan Modzeleski, Dematic Corp.; Ray Weidenfeller, Sunhill America, LLC.

   Draft 10 was created and sent out again to the attendees for review and approval. However, some edits and comments received are in the process of being captured. It was noted that the current CEMA SBP-001 document does not address characteristics of the intermediate step plate required for crossing conveyors that are greater than 36 inches.

   The paragraph above Section 5.1 and the Crossover Selection Chart need to be reviewed because. The chart suggests that a step across a distance less than or equal to 36 inches is tolerable and it was mentioned that this might be a little further than the values promoted by other standards (i.e., EN 619 Standard shows 31-1/2 inches but it's not a requirement).

   EN 619 Standard does not mandate the implementation of the handrail spanning the width of the conveyor, therefore CEMA is questioning the need to align with them. CEMA SBP-001 indicates that this handrail is not optional. The idea is to offer more clarity regarding this. Troy agreed to obtain input from ergonomic experts to discuss the appropriate step across distance. Furthermore, it was pointed out that some figures were still needed to help communicate the intent of the message in this paragraph.

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The distance mentioned in section 7 must be updated with the ergonomic expert's recommendation.

Additionally, the second bullet point in Section 8.1 should be restored to its original verbiage, however, it was suggested that we consider adding some diagrams/figures to better communicate the objectives. The subcommittee agreed to add elements or diagrams to the document to ease understanding and move forward with the document.

b) **Safety Best Practices, Conveyor Drives Research** – Updates.
Subcommittee: Todd Swinderman, RToddS Engineering LLC; Bryan Gauger, Cisco-Eagle; Matt Anderson, Bunting; Pat Knapke, Pulseroller.

The idea is to see if there was a best practice for using a belt conveyor's drive motor to aid in threading a new belt onto a conveyor instead of just pulling by hand or using a powered industrial vehicle.

There was a concern expressed about the practice of using the conveyor drive to string a new belt onto a conveyor because it goes against the lock-out/tag-out requirements. There were concerns about CEMA endorsing such a practice.

The Unit Handling Safety Subcommittee agreed to table this topic until further notice. Additionally, it was suggested that this should be brought to the attention of the "Appendix D – Installation Standard" subcommittee in the CEMA's Bulk Belt Systems and Emerging Technologies Committee to be included because it is common practice.

c) **CEMA White Paper Topics** – Volunteers needed.
- Use of wireless pendant for operating conveyors
- E-Stop span of control.
- How to best utilize servo motors with a Safe Torque Off function
- Hard guard enhancements

d) **Unit Handling Book (Chapter 21) vs. CEMA SBP-003 (2022).**
The CEMA Unit Handling Book, Chapter 21, has contradictory information to the SBP document regarding the height requirement for netting in Example 5. 2/3 max load height compared to 40 inches.

Additionally, was noted the difference between the images in both publications. Mark Corsmeier, Honeywell Intelligrated; will reach out to Chris Maines, Honeywell

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Intelligrated, regarding the history of these images and provide feedback to this subcommittee.

6. New Business
   a) **CEMA SBP-003 - 2023 "Design and Application of Spill Guarding for Unit Handling Conveyors" Review** – Updates.
   The 2022 version was sent to the Official Representatives (ORs) for approval and was approved with comments. The comments received will be part of the new revision of the document for the 2023 version.

7. Next Meeting – November 7, 2023, Virtual CEMA Fall Engineering Conference.

8. Adjourn.

Troy Uahinui, Chair

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2022 CEMA FALL ENGINEERING CONFERENCE
UNIT HANDLING SAFETY SUBCOMMITTEE MEETING
Cisco Webex Meetings
Tuesday, November 8, 2022

MINUTES

1. Call to order
   Dan Modzeleski, Dematic; Acting Chair, called the meeting to order at 1:03 pm.

2. Attendance and Introductions – Roll call attached.

3. Approval of Minutes of June 13, 2022 – Minutes were approved.

4. Old business
   a) **CEMA SBP-001 Design and Safe Application of Conveyor Crossovers for Unit Handling Conveyors** – Updates.
   Subcommittee: Troy Uahinui & Greg Pollitt, Honeywell Intelligrated; Boyce Bonham, Hytrol Conveyor Co. Inc.; Dan Modzeleski, Dematic Corp.; Ray Weidenfeller, Sunhill America, LLC.

   Draft 10 was created and sent out again to the attendees for review and approval. However, some edits and comments received are in the process of being captured.

   It was noted that the current CEMA SBP-001 document does not address characteristics of the intermediate step plate required for crossing conveyors that are greater than 36 inches.

   The paragraph above Section 5.1 and the Crossover Selection Chart need to be reviewed because. The chart suggests that a step across a distance less than or equal to 36 inches is tolerable and it was mentioned that this might be a little further than the values promoted by other standards (i.e., EN 619 Standard shows 31 ½ inches but it's not a requirement).

   EN 619 Standard does not mandate the implementation of the handrail spanning the width of the conveyor, therefore CEMA is questioning the need to align with them. CEMA SBP-001 indicates that this handrail is not optional. The idea is to offer more clarity regarding this. Troy agreed to obtain input from ergonomic experts to discuss the appropriate step across distance. Furthermore, it was pointed out that some figures were still needed to help communicate the intent of the message in this paragraph.

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Additionally, the second bullet point in Section 8.1 should be restored to its original verbiage, however, it was suggested that we consider adding some diagrams/figures to better communicate the objectives. The subcommittee agreed to add elements or diagrams to the document to ease understanding and move forward with the document.

b) **CEMA SBP-003 (2022) "Design and Application of Spill Guarding for Unit Handling Conveyors" Approval** – Updates.
Subcommittee: Troy Uahinui & Greg Pollitt, Honeywell Intelligrated; Glen Langstaff, Ralph-Pugh Co., Inc.; Boyce Bonham, Hytrol Conveyor Co. Inc.

The document was sent to the Official Representatives (ORs) for approval and was approved with comments. The comments received will be part of the new revision of the document for the 2023 version.

c) **Safety Best Practices, Conveyor Drives Research** – Updates.
Subcommittee: Todd Swinderman, RToddS Engineering LLC; Bryan Gauger, Cisco-Eagle; Matt Anderson, Bunting; Pat Knapke, Pulseroller.

The idea is to see if there was a best practice for using a belt conveyor's drive motor to aid in threading a new belt onto a conveyor instead of just pulling by hand or using a powered industrial vehicle.

There was a concern expressed about the practice of using the conveyor drive to string a new belt onto a conveyor because it goes against the lock-out/tag-out requirements. There were concerns about CEMA endorsing such a practice.

The Unit Handling Safety Subcommittee agreed to table this topic until further notice. Additionally, It was suggested that this should be brought to the attention of the "Appendix D – Installation Standard" subcommittee in the CEMA's Bulk Belt Systems and Emerging Technologies Committee to be included because it is common practice.

d) **CEMA SBP-002 "E-Stop Application Guide for Unit and Bulk Material Handling Conveyor Systems"** – Updates.
This committee requested that the Conveyor Controls Committee develop a list of factors to be considered in creating a risk assessment to help make this determination.

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Mitch Burkert, Dematic Corp.; volunteered to represent this committee in the conveyor controls subcommittee created to review the CEMA SBP-002. No further actions are required from this subcommittee. (This topic can be removed from Old Business on subsequent meeting agenda)

e) **Review of Best Practices for Implementation of Fire and Explosion Preventive Measures** (From the CEMA's Bulk Handling Safety Subcommittee) – Updates.
Todd Swinderman, Chair of the Bulk Handling Safety Subcommittee, mentioned that on his subcommittee, the document was approved to be sent to the Bulk Handling Safety Subcommittee Meeting Attendees and then to the CEMA Official Representatives (ORs) defining in the opening paragraph that the current document is for Bulk Handling Conveyors. No further actions are required from this subcommittee. (This topic can be removed from Old Business on subsequent meeting agenda)

f) **CEMA White Paper Topics** – Volunteers needed.
- Use of wireless pendant for operating conveyors
- E-Stop span of control
- How to best utilize servo motors with a Safe Torque Off function
- Hard guard enhancements

No volunteers at this time.

g) **ASME B20.1 Changes** – Updates
Minor changes were incorporated in the September 2022 edition. No further actions are required from this subcommittee.

h) **CEMA Safety Videos** – Updates
CEMA is developing a safety video streaming option. Hopefully, this will be ready in 2023.

i) **Unit Handling Book (Chapter 21) vs. CEMA SBP-003 (2022).**
The CEMA Unit Handling Book, Chapter 21, has contradicting information to the SBP document regarding the height requirement for netting in Example 5. 2/3 max load height compared to 40 inches.

Additionally, was noted the difference between the images in both publications. Mark Corsmeier, Honeywell Intelligrated; will reach out to Chris Maines, Honeywell Intelligrated, regarding the history of these images and provide feedback to this subcommittee.

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5. New Business – No new business was discussed at this meeting.

6. Next Meeting – June 12, 2023, LaPlaya Beach & Golf Resort, Naples, FL.

7. Meeting was adjourned at 2:02 pm.

Dan Modzeleski, Acting Chair

CONVEYOR EQUIPMENT
MANUFACTURERS ASSOCIATION

CEMA Safety Guide - 01 (2023)
Revision of CEMA SBP-001 - 2012
Approved: XXXXXX

CEMA Safety Guide - 01 - Draft 11

Design and Safe Application of Conveyor Crossovers for Unit Handling Conveyors

Conveyor Equipment Manufacturers Association, Inc.

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The information provided herein is advisory only.

These recommendations provided by CEMA are general in nature and are not intended as a substitute for professional advice. Users should seek the advice, supervision, and/or consultation of qualified engineers, safety consultants, and other qualified professionals.

Any use of this publication, or any information contained herein, or any other CEMA publication is made with the agreement and understanding that the user and the user's company assume full responsibility for the designs, safety, specifications, suitability, and adequacy of any conveyor system, a system component, a mechanical or electrical device designed or manufactured using this information.

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Conveyor Equipment Manufacturers Association, Inc. (CEMA)
www.cemanet.org

SAFETY NOTICE

The Conveyor Equipment Manufacturers Association has developed Industry Standard Safety Labels for use on the conveying equipment of its member companies.

The purpose of the labels is to identify common and uncommon hazards, conditions, and unsafe practices which can injure, or cause the death of the unwary or inattentive person who is working at or around conveying equipment.

The labels are available for sale to member companies and non-member companies.

A full description of the labels, their purpose, and guidelines on where to place the labels on typical equipment has been published in CEMA Brochure No. 201, Safety Label Brochure. The Brochure is available for purchase by members and non-members of the Association. CEMA Safety Information and Safety Label Placement Guidelines are available to review on the CEMA website at: **www.cemanet.org**

Please Note: Should any of the safety labels supplied by the equipment manufacturer become unreadable for any reason, the equipment USER is then responsible for the replacement and location of these safety labels.

Replacement labels and placement guidelines can be obtained by contacting your equipment supplier or CEMA.

FOREWORD

In this 2004 version, in response to many inquiries, we added the citation in the California Code of Regulations that Cal/OSHA uses to limit the types of allowable crossovers to the note at the bottom of the General Application Guide Chart to allow people to find the reference.

In 2012, the Unit Handling Safety Committee approved removing verbiage banning type 1 and type 2 crossover in the state of California. It was suggested to add verbiage to check state and local regulations for applicable standards.

The 2023 version updates Standard and Regulatory references, addressed the use of handrails and increased the stopover distance on Type 1 & 3 crossovers, and clarifies ladder characteristics when used on Type 1 crossovers to avoid foot interference.

TABLE OF CONTENTS

1. PURPOSE

The purpose of this document is to outline a standardized approach to the devices and items routinely provided to allow personnel to cross-unit handling material handling conveyors used in a typical warehouse or manufacturing facility.

These approaches flow from the collective experience of the member companies of the Unit Handling Section of the Conveyor Equipment Manufacturers Association (CEMA). They have been collected herein to offer considerations for the selection and use of crossovers as one means of creating a safer operating environment for people working with unit-handling conveyor systems.

Specific conditions will vary from application to application, as will the purposes and experience level of the personnel expected to use the crossovers. These varying conditions, purposes, and experience levels will affect the selection of the type and design of the equipment provided in any given situation.

The interests of practicality, utility, and safety are of prime concern in evaluating any proposed design.

2. DEFINITIONS

The definitions of terms used within this standard will conform to those identified in ANSI/CEMA Standard No. 102 “Conveyor Terms & Definitions” except as redefined within this section. Additional terms not currently found in ANSI/CEMA Standard No. 102 are defined here.

Conveyor Crossover: a device used to allow personnel to cross conveyors at designated and approved locations.

~~Fill-in Plates: Closely fitted plates positioned between the rollers, wheels, or chains of powered or non-powered conveyors. These plates may be intended to be used as portions of a walkway, to provide a “steadying” or “resting” place, and/or to prevent access to potential injury-producing catch points.~~

Ladder Crossover: a conveyor crossing device, with a slope greater than 50 degrees, consisting of one or more ladders with support railings and, possibly, a platform that traverses the conveyor path. (See Types 1 & 3).

Landing: a step or platform intended to allow someone to stand at that location while resting or waiting for a passageway to clear.

Rung Extension Plate: a plate, bar or other device added to the edge of ladder’s rung that bridges the gap between the edge of the rung and the edge of the conveyor.

Ship’s Ladder ~~Stair~~: a steep stairway equipped with treads and stair rails with a slope of 50 to 70 degrees. It is sometimes referred to as a “ship’s stair ~~ladder~~”.

Stair Crossover: a conveyor crossing device, with a slope of less than 50 degrees, consisting of one or more stair step assemblies ~~which~~ that may be joined together across the conveying surface by railing or railings and a platform or walkaway. (See Types 2 & 4).

Step Plates: closely fitted plates positioned between the rollers, wheels, or chains of powered or non-powered conveyors. These plates may be intended to be used as portions of a walkway, to provide a “steadying” or

"resting" place, and or to prevent access to potential injury-producing catch points.

Step–to–Step Distance: the distance between two steps measured from the trailing edge of the departure step to the leading edge of the arrival step.

Stile: a generic term used to denote any crossing or "passing" device, sometimes used to denote a conveyor crossover.

3. HUMAN FACTOR CONSIDERATIONS

People and their observed tendencies are the reason that CEMA has found it necessary to address the need for crossovers. In operations areas where personnel are familiar with the conveying equipment, and their duties or routes of travel can require movement across conveyor paths, there is a great potential for abuse of the most basic safety rules. Temptations for this personnel to cross-running and/or temporarily stopped conveyors are very strong. Experience has shown that accidents are inevitable under these conditions. Continuous analysis of worker requirements for movement and access in the conveyor operating areas is necessary. Proper application of crossovers at the "most needed" locations can go a long way towards promoting workplace safety when conditions would otherwise present the temptation to cross the conveyors in an unsafe manner.

4. GENERAL DESIGN PARAMETERS

There are two different types of elevated conveyor crossovers commonly used in industrial applications. These are the ladder and stair types. Each of these can be sub-categorized by whether they allow crossing at conveyor height or provide for crossing at an elevation that clears both the conveying surface and the highest item expected to be conveyed. All four designs should be lagged to the floor for safety and stability.

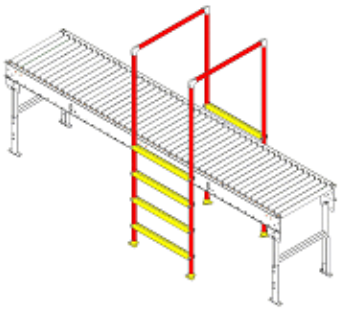
When designing these crossovers, reference should be made, among others, to the following documents:

- ANSI/ASSP ~~Standard~~ A1264.1 – "Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace, Floor, Wall and Roof Openings; Stairs and Guardrail/Handrail Systems" www.ansi.org
- OSHA's 29 CFR ~~1910.24~~ 1910.25 – "~~Fixed Industrial~~ Stairs" www.osha.gov
- OSHA's 29 CFR ~~1910.27~~ 1910.23(d) – "Fixed Ladders" www.osha.gov

4.1. Crossovers at Conveyor's Height

- Ladder – At Conveying Height (Type 1 Access Method): this Crossover typically uses vertical ladders on both sides of the conveyor, and handrails (without middle rail) traversing the conveyor; an angled ship's ladder may also be used. This type requires the least floor and over-the-conveyor space and is the easiest to install.

  The use of both hands is required while climbing the ladder and ~~while~~ crossing the conveyor. To ensure stability and safe crossing of personnel, the connecting handrail is required.



Type 1 Access Method

  This type of crossover is typically used by trained personnel for access to maintenance and for other operational purposes.

- Stair – At Conveyor Height (Type 2 Access Method): this type of stair crossover brings the walking surface height only up to the conveying surface height, or slightly above. ~~There should be handrails on both sides of the stairs and crossing area.~~ To ensure stability and safe crossing of personnel, the connecting handrail is required. The crossing area will usually not have an intermediate rail, allowing for clearance for the conveyable to pass under the handrail.

Type 2 Access Method

This type of stair crossover improves on the vertical space requirements of Type 3 (see below) but may not meet fire code egress requirements in all areas.

These units can be applied in lower ceiling heights and head clearance areas than is possible with full decked crossovers. They are easier to build and apply and can be more easily moved when there are changes in conveyor or personnel travel paths. This is the most convenient type of crossover to use, since often a package can easily be carried in one hand, and there are few steps to negotiate.

For both Type 1 & Type 2 Crossovers: Personnel should be cautioned to cross only when conveyable are not present or immediately approaching the conveyor. This is not unlike crossing the street or fork truck aisle, except the "traffic" is much slower, comes from only one direction, and the "pedestrian" has one or more handrails available the entire way across. In some instances, there will be no opportunity to step on the conveyor surface. In these instances, it will be necessary to step completely across the conveyor. On wider (and some narrow) applications, surfaces suitable for walking or stepping will be provided. On a wide belt or slat conveyor, this will be accomplished by stopping the conveyor during passage and using the conveying surface itself as a walkway if necessary. In these instances, the control of the conveyor motion must be at the location of the passage. Those controls should be operated only by the person seeking passage.

4.2. Crossover Above the Conveyor

- Ladder – Over the Conveyable (Type 3 Access Method): the most elaborate type of ladder crossover clears both the conveyor and the conveyable. This type has a ship's ladder (shown on the drawing) supporting both sides of a standard deck, with standard toe boards and railings. The ladders may be straight or angled as shown. If angled, there should also be handrails on each side of the ladder for increased stability.

Type 3 Access Method

These crossovers save floor space over the stair-type unit while retaining the over-the-load capability.

The disadvantages of this type of crossover are the same as with stair Type 4 (see below), except that ladder requires both hands to use ~~safety~~ safely. Both take up a lot of vertical space to provide both adequate package clearance with the crossover deck, and head clearance with the building or other structure. Ladders require that personnel have both hands free. Disabled persons missing a limb or several fingers on the same hand will find it difficult to use this type of crossover.

- Stair – Over the Conveyable (Type 4 Access Method): this type of crossover is one method of providing access for the public, and approved access to workstations for operational personnel. Such devices are routinely required to have a solid deck crossover with toe boards, standard stair treads, and standard hand railings on both sides of both the top deck and stairways. When used as part of an approved route of egress in case of fire, the width and strength of the structure must conform to the published requirements for the egress traffic expected for that location. This structure must also be of sufficient strength to support the maximum expected load safely.

Type 4 Access Method

The main disadvantages of this type of crossover are the vertical and horizontal space requirements and the limitations it places on the height of packages that can be conveyed beneath it. ~~They are the less portable than the other three types of crossovers.~~

5. APPLICATION

The application of crossovers must be evaluated on an individual basis. There are many factors that must be considered and weighed against each other. The general guidelines for application are these:

- Type 1 - Ladder-type crossovers at the conveyor surface are useful in operations areas where space is at a premium and traffic is expected to be occasional.

- Type 2 - Stair type crossovers at the conveyor surface should be used in operations areas (where room permits), where items might be carried, and where traffic may be light or occasional.

- Type 3 - Ladder type crossovers above the conveyor surface are appropriate where the horizontal room is at a premium, and traffic is expected to be light. Non-fire exit access by anyone who is able-bodied is appropriate with this design.

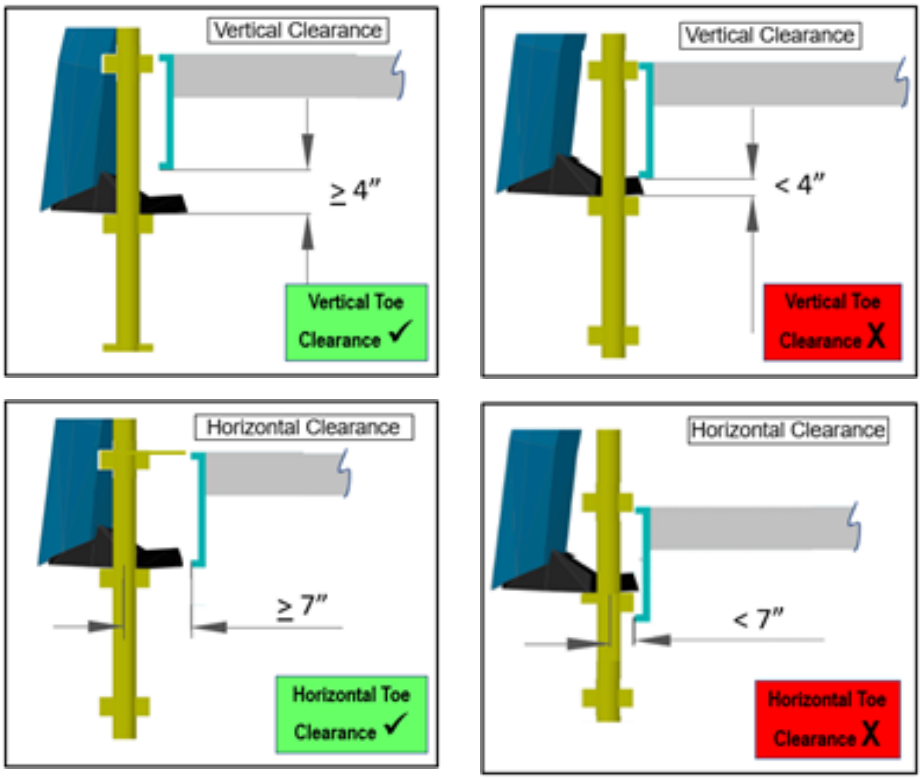
- Type 4 - Full stairway over the conveyable type crossovers ~~should~~ must be used when the general public is expected to be crossing the conveyor, or when ~~operator work stations are using them as part of a primary route of egress~~ International Building Codes requirements for stairways are applicable if stairs are accessed by the general public or if they are part of an egress route. The units ~~should~~ must be equipped with standard handrails, decking, and toe boards. Stair tread and riser design ~~should~~ must also conform to accepted standards. Strength and width requirements outlined in the appropriate industrial standards for egress ~~should~~ must be observed.

- Type 1 and Type 2 - Ladder and stair-type crossover designs without decking at or near conveyor heights are the most convenient. This is because the climbing requirement is reduced to a minimum. For this reason, they have the greatest capacity to reduce accident potential in many cases. In these situations, the step across distances, railings, conveyor type, and control of the conveyors must be carefully evaluated.

- Type 1 and Type 3
  - Ladder type crossovers are more appropriate when ~~portability and~~ floor space economy ~~are~~ is a factor. Personnel using the devices should always be familiar with the area and their use.

  - For ladder-type crossovers, there are potential interferences with the side frame of the conveyor or other obstruction, and to reduce the potential for tripping, the top rung or rung extension plate must be level with or just above the top of the conveying surface.

    Additionally, the next rung down must be a least 4 inches below the bottom of the frame or other obstruction to allow room for the climber's shoe. If this is not possible, the distance between the conveyor's frame, and the centerline of the rung must be 7 inches to allow room for the foot. An extension must be added to the top rung to bridge the gap.



5.1. General Application Guide Chart

The following chart is a general application guideline for types of conveyors and associated crossover designs.

Crossover Selection Chart

	Conveyor Type	BELT		ROLLER		CHAIN	
	Step to Step Distance	36 inches or less	Greater than 36 inches	36 inches or less	Greater than 36 inches	36 inches or less	Greater than 36 inches
Type 1	Access	O - IAP	O - IAP	O - IAP	O - IAP	O - IAP	O - IAP
	Method	Step Across	Step on Stopped Belt	Step Across	Step on Plates	Step on Plates or Across	Step on Plates
Type 2	Access	O - E	O - E	O - E	O - E	O - E	O - E
	Method	Step Across	Step on Stopped Belt	Step Across	Step on Plates	Step Across	Step on Plates
Type 3	Access	O~~P~~ - E	O~~P~~ - E	O~~P~~ - E	O~~P~~ - E	O~~P~~ - E	O~~P~~ - E
	Method	Walk on Deck	Walk on Deck	Walk on Deck	Walk on Deck	Walk on Deck	Walk on Deck
Type 4	Access	P - E	P - E	P - E	P - E	P - E	P - E
	Method	Walk on Deck	Walk on Deck	Walk on Deck	Walk on Deck	Walk on Deck	Walk on Deck

Legend:

Occasional (O) = not for heavy traffic or the only access to a workstation.
Primary (P) = primary route of egress capable
IAP = Informed Authorized Personnel
Employee (E) = Employee or others accompanied by an employee

Note: Be sure to consult state and local regulations before applying crossovers.

6. MECHANICAL SAFETY CONSIDERATIONS

At conveyor level crossovers where the conveyor is wider than 36 inches, an intermediate step plate or plates of some kind should be considered. This is often possible on roller and chain conveyors, but not on the belt or slat-type conveyors. The purpose of these step plates is to provide a solid intermediate point for personnel to step while crossing the conveyor. Such plates will necessarily be slightly below the conveying surface. Care should be taken that the top steps on either side of the conveyor must be level with or just above the top of the conveying surface ~~are no more than a few inches above the conveyor surface in these instances~~.

~~Across the conveyor handrails should be evaluated on an installation-by-installation basis when conveyor height crossovers are employed. In most instances a handrail on each side of the travel path is the best option. When the conveyor is expected to be running when someone is crossing, the size and mass of the potential load should be evaluated with respect to potential injury involving the downstream handrail. Stopping the conveyor while crossing is in process is also an option.~~

7. CONTROLS

Certain types of conveyors and conveying situations make it advisable to tie the conveyor control circuit into the conveyor crossing event. High-speed conveyors, particularly those conveying heavy packages, should be considered for this option. Although the distance across the conveyor may be an easy step (36 inches or less) accidentally stepping on a running high-speed conveyor may cause someone to ~~loose~~ lose their balance, even when holding two handrails. For this reason, it might be advisable to provide a conveyor control switch on each side of the crossover to stop the conveyor prior to personnel crossing.

Other situations which warrant this measure are Belt and slat conveyors over ~~33~~ 36 inches wide. On this equipment, crossing the conveyor requires a step where no step is possible. Stopping the conveyor provides that step.

Other situations which might indicate the need to shut down the conveyor prior to crossing would be solid, heavy bulky loads that might injure personnel. Another instance might be an expected very high number of loads moving on a wide conveyor, making finding a break to pass through “on the fly” difficult or impossible.

In all of these situations, the exact control sequence should be evaluated closely. Unexpected start-up of the conveyor, while the personnel is crossing, is unacceptable. Any control scheme should be closely evaluated under every conceivable situation for this possibility.

To help determine the level of control and reliability for the control system, one should refer to ISO 13849-1 “Safety of Machinery – Safety Related Parts of Control Systems” - Part 1 a~~nd 100~~.

8. ADDITIONAL CONFIGURATIONS

8.1. Multiple Conveyors and Platforms

Where Type 1 and 2 crossovers are utilized to cross multiple conveyors without returning to the walking/working surface, a landing or step of full width and a minimum of eight (8) inches deep will be provided between conveyors. Suitable rails or grab handles will be provided on both sides of the landing if continuous handrails across the conveyors and landings are not installed. Multiple conveyors separated by gaps greater than twelve (12) inches will require that crossover railing systems comply with the kick plate and intermediate rail requirements of OSHA 29CFR ~~1910.27~~ 1910.23 and ~~ASME~~ ANSI/ASSP A1264.1 if the elevation of the crossing surface exceeds four (40 feet. Obviously, this is necessary only at the locations where the deck or step transverses the clear distance between the conveyors.

Ladder ways for ascending or descending to/from the conveyor elevation shall conform to the provisions of OSHA 29CFR ~~1910.27~~ 1910.23 and ~~ASME~~ ANSI/ASSP A1264.1.

Crossover ladderways descending onto platforms that are 4 feet or more above the next walking-working surface shall employ one of the following fall arrest features:

- A landing extending at least 50 inches past the ladder base at right angles to the ladder rungs.
- An elevated backstop railing system such that 50 inches or greater radius from vertical to horizontal radiating from the top step of the ladder will contact the backstop. Such a backstop will conform to standard guard rail strength construction and strength requirements except that there shall be no opening larger than 10 inches by 10 inches. The backstop shall extend to one (1) foot six (6) inches or more to each side of the ladder width and have a total width not less than five (5) feet six (6) inches. Structural members of the backstop shall conform to the twenty (20) inches vertical by 8 feet maximum

open hole dimensions of the handrail design. Lesser members of suitable strength may be used to reduce the openings to 10 inches x 10 inches or smaller.

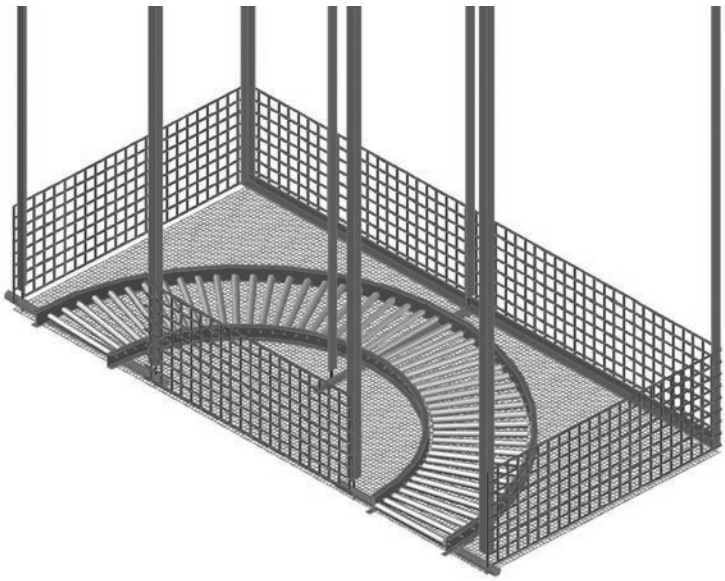
- ~~A standard ladder cage as prescribed in OSHA 29 CFR 1910.27~~. A fixed ladder meeting the requirements of OSHA 29CFR 1910.23.

CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION

CEMA Safety Guide - 03 (2023)
Revision of CEMA SBP-003 - 2022
Approved: XXXXXXX

CEMA Safety Guide - 03 - Draft 1

Design and Application of Spill Guarding for Unit Handling Conveyors



Conveyor Equipment Manufacturers Association, Inc.

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Conveyor Equipment Manufacturers Association, Inc. (CEMA)
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FOREWORD

In the 2022 version, the Unit Handling Safety Subcommittee added consideration for transporting packages with an anon-centered center-of-gravity or the ability to change their center-of-gravity, (liquids, sand, etc.), concerning how high the side rails should be, (typical side rails are 2/3 the height of the package)..

In 2023, the designation of the publication was changed to CEMA Safety Guide per CEMA's Board of Director decision.

TABLE OF CONTENTS

1. PURPOSE

The purpose of this document is to outline a standardized approach to the selection and application of common guard rail, safety netting, and accessories used to contain loads (cartons and totes excluding stacked loads) transported on unit handling conveyors.

Figure 1. Plastic Tote Pan

These approaches flow from the collective experience of the member companies of the Unit Handling Section of the Conveyor Equipment Manufacturers Association (CEMA). Their recommendations have been compiled herein to help ensure a safe operating environment for personnel working next to or below unit handling conveyors.

It should be noted that a risk assessment should be performed on a case-by-case basis to determine needs. The risk assessment should consider how the area is defined, the number of employees in that surrounding area, and its means of usage. The risk assessment should determine if netting should be applied after reviewing where the application falls in regard to means of egress.

The types of loads being handled, and the location of the conveyor equipment will affect the selection of containment devices. Particular attention must be given to overhead conveyors that pass over aisleways and work zones. These areas usually require additional safeguards to protect personnel from falling objects caused by jamming loads. Plastic tote pans commonly used to transport loose items are especially vulnerable to jam-induced ejection from the conveyor because of their tapered sides and low coefficient of friction.

Safety should always be the primary concern when determining the necessary precautions for any situation.

2. DEFINITIONS

The definitions of terms used within this standard will conform to those identified in ANSI/CEMA Standard No.102 “Conveyor Terms and Definitions” except as redefined within this section. Additional terms not currently found in ANSI/CEMA Standard No. 102 are defined here. The term guide or guard rail represents the same meaning in this document.

2/3 Rule – The rule of thumb adopted by the unit handling industry requires the height of the guide rail to be at least 2/3 the height of the tallest load on the conveyor. This applies to conveying surfaces 8 ft and higher above the floor except as determined by risk assessment.

Notes:

- During the risk assessment, the height of the center of gravity must be taken into consideration to ensure 2/3rds is adequate.

Factors that influence load stability should be considered during a risk assessment:

- Center of gravity - In the center of the load or lower, additional caution is needed if the load’s center of gravity is above 2/3 height.
- Conveyed material stability – Loose material can shift the center of gravity, for example, liquids or small loose solids (ball bearings, fine gravel)
- Weight

- Load form factor (shape)
- Loose straps, cord, tape, labels, excess glue, open flaps, irregular sides, and bottoms
- Totes, cartons, trays draft, and lips

Content spillage and minimum load height should be considered when space is required between the bottom of the guide rail and the top of the side rail

2.1. Adjustable ~~Guard~~ Guide Rail

~~Guard~~ Guide rail attached to the conveyor frame with adjustable mounting brackets that allow horizontal and vertical adjustment. The adjustable guide rail is typically available in single (one rail) or double high (two rails) configurations.

Figure 2 – Adjustable Guide Rail

2.2. Fixed ~~Guard~~ Guide Rail

~~Guard~~ Guide rail attached directly to the conveyor frame (no adjustment). The guide rail can be spaced up for photo eyes or load viewing. The guide rail is available in high (channel) or low (angle) configurations.

Figure 3 – High (Channel) Fixed Guide Rail
(shown without spacers)

Figure 4 – Low (Angle) Fixed Guide Rail
(shown with spacers)

2.3. Safety Netting

Nylon or wire mesh used to construct a screen guard for overhead conveyors. Netting can be hung from conveyor or overhead building structure.

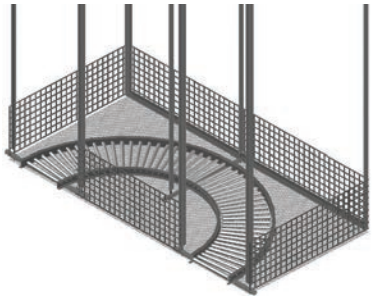


Figure 5 – Safety Netting

3. HUMAN FACTOR CONSIDERATIONS

People and their observed tendencies are the reasons that CEMA has found it necessary to address this topic when dealing with netting. In operations areas where personnel are familiar with the conveying equipment, their duties and designated routes of travel have the propensity to shortcut the designated routes into non-designated areas.

There is a great potential for abuse of the most basic safety rules. Temptations for personnel to shortcut designated routes often occur when traveling to or from break rooms, restrooms, ingress, and egress to workstations, and adjacent work areas. Continuous analysis of worker requirements for movement and access in the conveyor operating areas is necessary.

Proper application and training concerning the use of designated pathways throughout the operations areas are essential. Whenever changes or movement of equipment are made, an evaluation of the overhead equipment ~~and whether safety netting is required~~, should be performed. The application of netting at the needed locations, along with proper training in the use of designated pathways, can go a long way toward promoting workplace safety.

4. DESIGN

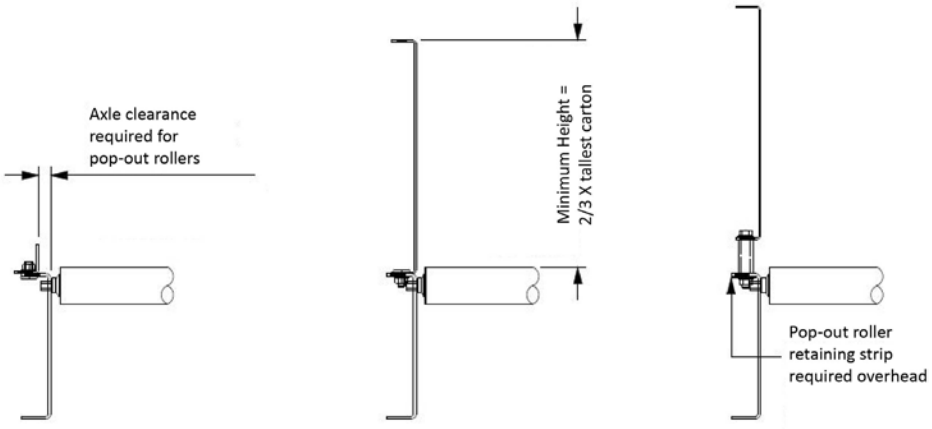
The two most commonly used items to contain products on unit handling conveyors are ~~guard~~ guide rails and safety netting.

4.1. ~~Guard~~ Guide Rail

The guide rail is generally attached directly to the conveyor side frame and can be fixed position or adjustable.

4.2. Fixed ~~Guard~~ Guide Rail

The fixed ~~guard~~ guide rail can be low (angle type) or high (channel type). The low ~~guard~~ guide rail is generally used in loading or picking areas and is not recommended for overhead applications except in the case of inner lanes of the multi-lane conveyor where safety netting is also used. The high ~~guard~~ guide rail is recommended for all conveying surfaces 8 ft and higher above the floor or platform. The ~~guard~~ guide rail height should be at least two-thirds the height of the tallest load on the conveyor. This rule of thumb is commonly referred to as the 2/3 Rule. Loads with a high center of gravity may require a higher ~~guard~~ guide rail to prevent spillage.



Angle ~~Guard~~ Guide Rail
Not recommended for overhead applications without safety netting

Channel ~~Guard~~ Guide Rail

Channel ~~Guard~~ Guide Rail with Spacers

Figure 6 – Fixed Guide Rail

4.3. Adjustable ~~Guard~~ Guide Rail

The adjustable ~~guard~~ guide rail can be adjusted both horizontally and vertically from the conveyor side frame for varying load widths and heights. Typically, the ~~guard~~ guide rail is clamped to support rods that in turn are clamped to the conveyor side frame. Adjustments are made by loosening the clamps, re-positioning the ~~guard~~ guide rail or support rods, and then re-tightening the clamps. Small channels in a single or double high configuration are generally used for adjustable ~~guard~~ guide rails. The ~~guard~~ guide rail(s) must be vertically positioned to contain the shortest and tallest loads on the conveyor. In some cases, it may be necessary to add a center ~~guard~~ guide rail to prevent certain loads from passing between the top and bottom ~~guard~~ guide rails.

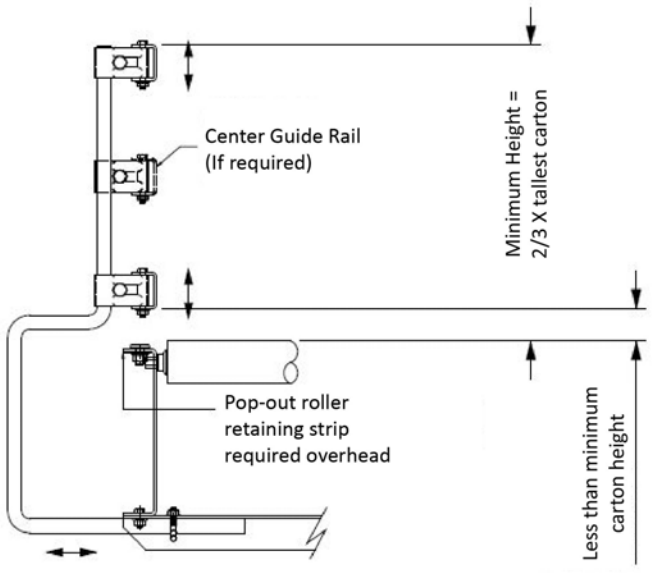


Figure 7 – Adjustable Guide Rail

4.4. Safety Netting

The application of safety netting must be evaluated for each specific area of a conveyor system. Careful consideration should be given to conveyors over worker access areas and walkways.

A combination of high ~~guard~~ guide rail and safety netting may be required in these areas, particularly when there is a possibility for load jams on the conveyor. Spillage from load jams generally occurs when loads continue to be driven into a jammed or stopped condition downstream.

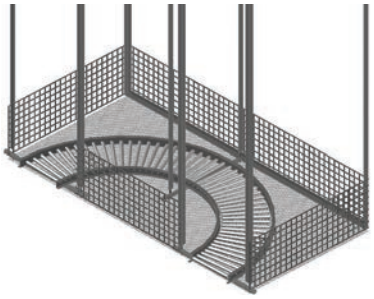


Figure 8 – Safety Netting

Curves, spurs, transfers, and merge areas downstream of belt conveyors are particularly vulnerable to load jams and should be appropriately safeguarded against spillage. Load spillage presents a particular hazard to personnel around and below the affected area.

~~Netting systems should be designed with fireproof materials whenever possible. Common netting materials often used by manufacturers are as follows:~~

The design of netting systems is based upon the following parameters: Use fireproof materials whenever possible.

Common netting materials examples:

- Braided Nylon
- Polyethylene
- Wire
- Heavy gage construction grade plastic woven into a mesh pattern. Light gage plastic is not acceptable.

Mesh Size	Material	Capacity	Cord Strength	Fire Retardant
1 in x 1 in	Nylon	1,000 ft-lb	190 lbs	X

4.5. Load Size and Weight

Netting must be able to withstand the impact of the maximum load weight falling from the top of the ~~guard~~ guide rail to the netting elevation. The capacity value from the catalog must be greater than the impact generated by the maximum load falling the maximum distance to the netting.

Capacity > Maximum Carton Weight x Maximum Fall Distance

4.6. Netting Height

The design must allow for sufficient space for several loads collecting in the netting area. The height of the netting needs to ~~be 2/3 the height of the tallest load which is often higher than~~ extend at least 40” above the height of the guide rail.

4.7. Mesh Size

Net mesh size is determined by the smallest item to be contained.

Netting mesh size should be small enough not to allow loads or conveyor rollers to pass through the netting. Recommended mesh size is typically 1 inch x 1 inch. This size will not allow any loose 1.9 inches diameter rollers to pass through the netting. Small items in totes or cartons need to be reviewed for the ability to pass through netting mesh.

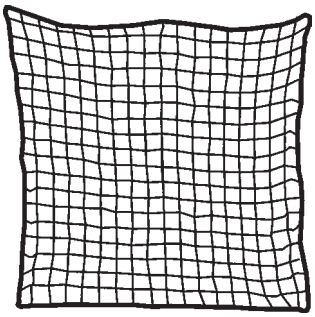


Figure 9 – Netting Mesh

4.8. Spacing of Supports

Spacing of supports for netting should minimize sag when loaded and allow for an ample number of connection points to prevent failure of netting at maximum loading. Aircraft cable-style mounting is recommended to distribute the loading of netting at connection points. Connections should be made with snap hooks.

However, connections made to the conveyor are typically made with plastic wire ties. Consideration should be made when selecting the wire tie size and number of connection points to assure its ability to handle the capacity of the load that could occur with the netting. The number and spacing of connections should be reviewed with netting manufacturers to obtain the full strength of the netting.

Figure 10 – Safety Sign Used in Netting Systems

4.9. Signage

The safety netting system, including the netting and related hardware, is not designed to support personnel. Installations should provide signage warning personnel to keep off the safety netting.

4.10. Design Considerations

- Design the netting to support the heaviest product loads.
- Vertical netting can be used above the ~~guard~~ guide rail as an alternative to sheet metal.
- Netting must be removable for cleanout.
- Solid pans can be used for under guarding.
- Avoid the sharp edge commonly produced by cutting the plastic net.
- When using plastic netting as under guarding as well a spill guarding consider that the plastic material can be deflected, allowing access to moving machinery, and may not be considered an effective guard. A risk assessment should be performed to evaluate. One method of mitigation could be to minimize deflection by using fasteners at shorter intervals.
-

5. EXAMPLE OF SPILL GUARDING CONFIGURATIONS

These are not intended to exclude other methods.

5.1. Single Line

- ~~The space between conveyor side frame and netting must be equal to or greater than the conveyor between frame (B.F.) dimension.~~
- The vertical netting must extend above the conveyor ~~guard~~ guide rail a minimum of 2/3 the maximum load height.

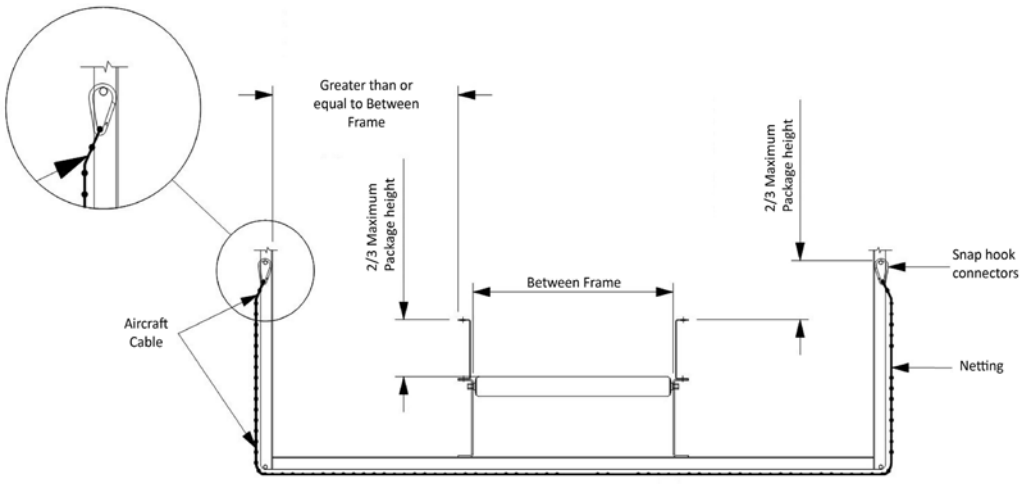


Figure 11 – Single Line Spill Guarding Configuration

5.2. Multiple Lines

- The spacing between parallel lines should be less than the minimum load size.
- ~~The space between the conveyor outer side frame and the netting must be equal to or greater than the conveyor between frame (B.F.) dimension.~~
- The vertical netting must extend above the conveyor ~~guard~~ guide rail a minimum of ~~2/3 the maximum load height~~ 40 inches.

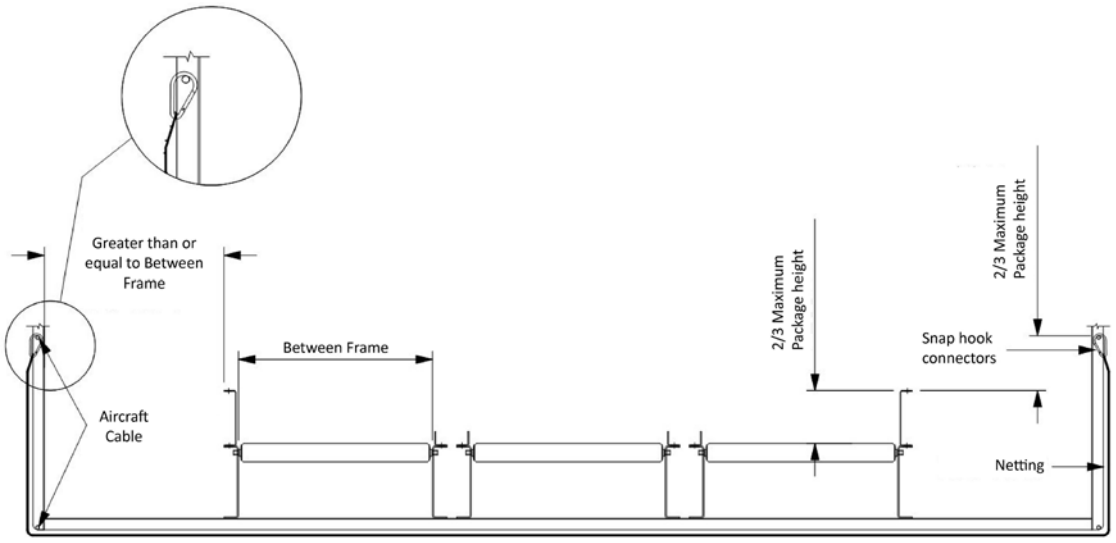


Figure 12 – Multiple Line Spill Guarding Configuration

5.3. ~~Lines Supported of Platforms~~ Multiple Lines with Catwalk

A ~~platform~~ catwalk may serve as spill guarding if it properly protects the areas below. Vertical netting shall be installed ~~on the handrail~~ between the conveyor frame and the catwalk to contain spilled loads. If the smallest load can fit between the bottom of the conveyor frame and the catwalk. As always, a risk assessment should be conducted when reviewing each application for spillage.

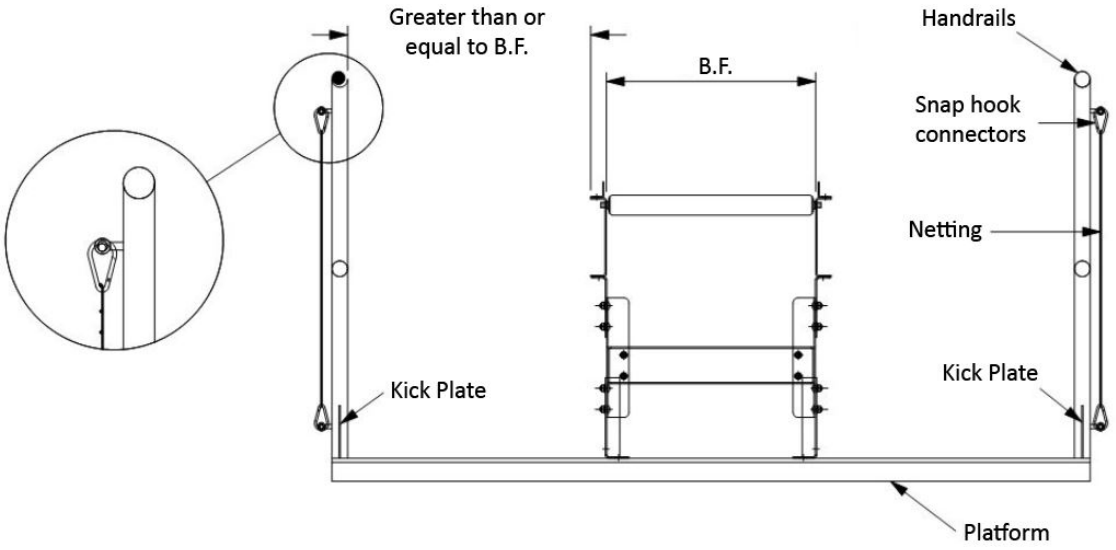


Figure 13 – ~~Lines Supported on Platforms~~ Multiple Lines with Catwalk

5.4. ~~Lines Parallel to Catwalk~~ Single Line with Catwalk

A catwalk may serve as spill guarding if it properly protects the areas below. Vertical netting may be installed on the handrail or between the conveyor frame and catwalk to contain spilled loads. Vertical netting may be installed between the conveyor frame and catwalk to contain spilled loads when it is determined that the smallest packages can fit between these openings. As always, a risk assessment should be conducted when reviewing each application for spillage.

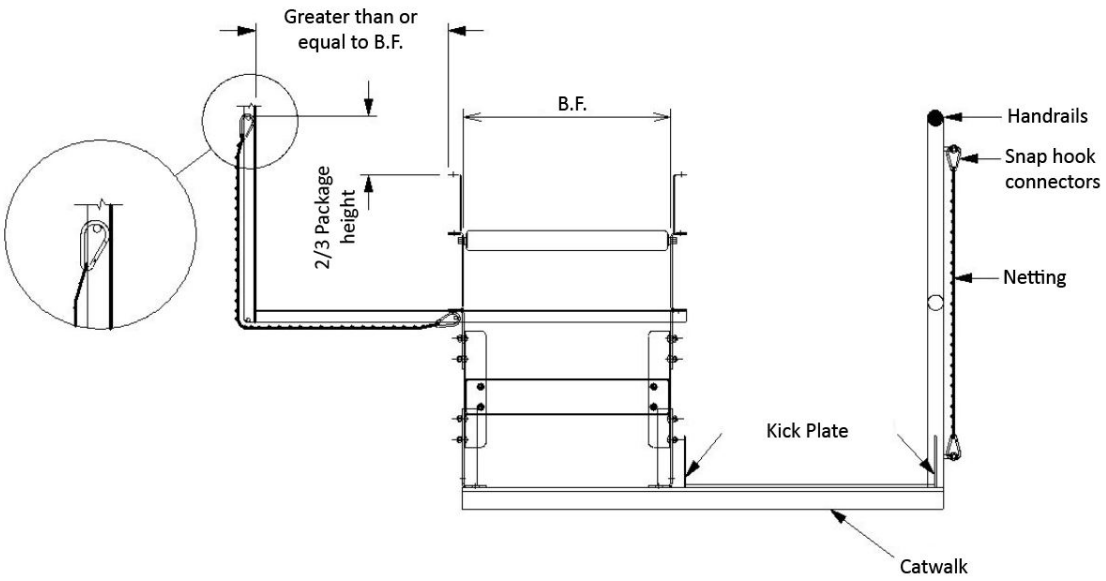


Figure 14 – ~~Lines Parallel to Catwalks~~ Single Line with Catwalk

5.5. 90° Transfers and Merges

- Transfers and merges are more susceptible to load jams due to causes such as variations in load integrity, changes in direction of travel, and timing of conveyor equipment.
- The volume of loads that can be collected in these areas must be considered in the design of the netting system. The use of jam-detection devices in such areas is recommended in addition to spill guarding.

5.6. Platforms

A platform with a conveyor can serve as spill guarding if it properly protects the areas below. However, vertical netting may need to be installed on the handrail or between the conveyor frame to contain spilled loads. This is applied when it is determined that the smallest packages can fit between these openings and the location of the conveyor is near the edge of the deck or cut-out opening. As always, a risk assessment should be conducted when reviewing each application for spillage.

5.7. Testing

1. Determine where the weakest area(s) of the spill guarding is located. (There may be several such points in the netting system).
2. Assemble a test load that simulates the maximum carton or load to be handled by the conveyor equipment.
3. Drop the load from the maximum height. Inspect the netting and connection points. The netting should return to its original shape. There must be no tears or fretting.

6. INSPECTION/MAINTENANCE

To avoid overloading the netting system, remove the spilled product immediately and inspect for damage to the netting system. Yearly inspections are necessary. Inspect all cabling and fasteners to make sure they are tight and secure. Inspections are also required any time work is performed in the area that requires removing or modifying the netting. Particular attention is required if welding or grinding is performed in the area.