MARTIN ENGINEERING

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To improve the understanding of both the behavior of bulk materials and the performance of the equipment systems that handle those materials, Martin Engineering opened a new corporate research center, the Center for Bulk Materials Handling Innovation (CFI).

Housed in a new 2,100-square-meter (22,600-square-foot) building at Martin’s headquarters campus in Neponset, Illinois, CFI is a $5 million USD facility with the goals of innovation, collaboration, and education to improve bulk-materials handling.

The Center for Innovation holds the promise of improved productivity and profitability in industrial operations where clean, efficient handling of bulk material is essential. Martin’s new corporate research center is focused on improving the handling of bulk materials in industries such as coal-fired power generation, coal and hard-rock mining, sand and gravel production, pulp and paper, and cement.

**Basic Science Meets Product Development**

Part pure-science research laboratory and part industrial product-development center, CFI collaborates with partners including corporations, industry associations, and universities for practical research to solve the common problems associated with the handling of bulk materials. These problems lead to added maintenance expenses and reduced productivity.

The full-time CFI staff, including scientists, engineers, and technicians, is dedicated to advancing the understanding of the behavior of bulk materials and the performance of material handling systems.

CFI has both the scientific instruments and the full-scale materials handling equipment, including a three-part recirculating conveyor system, to test bulk materials and prototype components under simulated operating conditions.
Laboratories for Specialized Research

Focused laboratories allow for the analysis and testing of characteristics and performance of metals, polymers, and bulk materials, as well as the accelerated testing of components under a variety of harsh environments.

“The Center forBulk Materials Handling Innovation represents a major commitment to the industries we serve.”

– Edwin H. Peterson
Chairman

Martin Engineering is the first in the industry to take this basic science-first approach to improving the handling of bulk materials. According to Martin’s Chairman Edwin H. Peterson, “The Center for Bulk Materials Handling Innovation represents a major commitment to the industries we serve. Our research partners will benefit from a better understanding of the characteristics of the bulk materials they use and how they should be handled. This will lead to new technologies that make materials handling cleaner, safer, and more productive.”

A Resource for Education

CFI offers dedicated training and education resources, including a state-of-the art, 44-seat training room and a video conference center.

CFI also includes a re-circulating three-conveyor process simulation loop. An observation deck allows visitors to view the process simulation loop, through window, or via closed circuit video cameras.

Leadership for Industry

The Center for Innovation will help Martin maintain its position as the leading innovator of systems to make bulk-materials handling cleaner, safer, and more productive.
Martin Engineering’s Foundations™ Educational Programs teach “old hands” and “new hires” alike about the operation of belt conveyors used to handle bulk materials.

These non-commercial educational programs present information on preventing damage, controlling fugitive material, reducing maintenance costs, increasing safety, and improving operating efficiency. They are suited for anyone interested in improving the safety, working conditions, performance, and profitability of operations where belt conveyors are a key to success.

Meeting Your Needs, On Your Schedule

Program sessions can be scheduled at your convenience at your facility, a neutral site, or a conference or trade show; as part of a company meeting; or in a focused training session. They can be delivered to—and focused on—personnel from one plant, or they can be arranged to benefit multiple-locations from one company or personnel from several conveniently-located operations. Small class sizes keep the presentations informal and encourage discussion of specific problems.

Foundations™ Educational Programs include opportunities to discuss your facility and specific conveyor problems. By prior arrangement, a workshop at your facility can be preceded by a site survey to document conditions and evaluate equipment. Digital photography from the survey will then be included in the workshop, with discussions centered on specific problems and possible solutions.

Certification

These classes can qualify for Professional Development Hours (PDHs). Certificates of completion are provided to everyone who attends a program. All seminars have a companion “open-book” test to verify understanding of the information presented.

Program Instructors

The Foundations™ Educational Programs are taught by certified Martin personnel who have spent years working on and around belt conveyors.

These experienced professionals have both a theoretical understanding of conveyor principles and practical, “hands-on” experience in operating and troubleshooting belt conveyors. Instructors have seen conveyors handling a variety of materials all over the world, and they have provided innovative solutions to resolve problems and upgrade efficiency.

Workshop instructors draw on an array of training materials and use an interactive style that keeps the sessions lively and interesting.

For More Information

For information on scheduling, registration fees, and the program’s money-back guarantee, contact Martin or email workshops@martin-eng.com.
**Coming Soon: 3 Levels of the Foundations™ Conveyor Programs**

<table>
<thead>
<tr>
<th>Level 1: FOUNDATIONS™ BASIC WORKSHOP</th>
<th>Level 2: FOUNDATIONS™ OPERATIONS &amp; MAINTENANCE SEMINAR</th>
<th>Level 3: FOUNDATIONS™ ADVANCED CONVEYOR SEMINAR</th>
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</thead>
<tbody>
<tr>
<td><strong>Audience</strong></td>
<td><strong>Audience</strong></td>
<td><strong>Audience</strong></td>
</tr>
<tr>
<td>New hires with little or no knowl-</td>
<td>Operations and Maintenance Personnel, Supervisors, and</td>
<td>Conveyor Designers, Plant Engineers, and Plant</td>
</tr>
<tr>
<td>edge of belt conveyors</td>
<td>Production and Maintenance Managers</td>
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<tr>
<td><strong>Length</strong></td>
<td><strong>Length</strong></td>
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<td>1 day or less</td>
<td>Multi-day</td>
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<tr>
<td><strong>Emphasis</strong></td>
<td><strong>Emphasis</strong></td>
<td><strong>Emphasis</strong></td>
</tr>
<tr>
<td>Basic conveyor concepts, safe</td>
<td>Practical, problem-and-solution approach to the</td>
<td>Technical and commercial aspects of conveyor</td>
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<tr>
<td>work practices, and fundamental</td>
<td>difficult problems faced by those involved in the</td>
<td>operations: Topics covered include power</td>
</tr>
<tr>
<td>Foundations™ principals for clean,</td>
<td>hands-on conveyor operations</td>
<td>requirements, transfer-point design, and return</td>
</tr>
<tr>
<td>safe, and productive conveyor</td>
<td></td>
<td>on investment (ROI) calculations</td>
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<tr>
<td>operations</td>
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<tr>
<td><strong>Presentation</strong></td>
<td><strong>Presentation</strong></td>
<td><strong>Presentation</strong></td>
</tr>
<tr>
<td>This is a packaged program using</td>
<td>This seminar typically involves a minimum of a</td>
<td>The Operations &amp; Maintenance Seminar is</td>
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<tr>
<td>a computer presentation with notes,</td>
<td>one-day, on-site survey of the local condition and</td>
<td>generally considered a prerequisite to this</td>
</tr>
<tr>
<td>allowing the course to be taught</td>
<td>a one-day classroom discussion lead by a Martin</td>
<td>seminar. The advanced Foundations™ seminar</td>
</tr>
<tr>
<td>by in-house personnel or a Martin</td>
<td>subject-matter expert. This discussion focuses on</td>
<td>is taught by a Martin subject-matter expert</td>
</tr>
<tr>
<td>Engineering subject-matter expert.</td>
<td>problems and solutions in areas such as controlling</td>
<td>who is a qualified engineer and generally lasts</td>
</tr>
<tr>
<td>Concepts are taught in a manner</td>
<td>fugitive materials, belt damage, mistracking, impact,</td>
<td>1-5 days, depending on the areas of interest</td>
</tr>
<tr>
<td>that makes it easy to understand</td>
<td>wear, belt cleaning, dust control, and transfer-point</td>
<td>and certification requirements.</td>
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<tr>
<td>across languages. Depending upon</td>
<td>construction and maintenance.</td>
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<td>the needs of the audience, the</td>
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<td>basic workshop can be presented in</td>
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<td>augment site-specific training</td>
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<td>programs.</td>
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MARTIN ENGINEERING: FOCUSED ON IMPROVING THE HANDLING OF BULK MATERIALS

For more than 65 years, Martin Engineering has focused on solving problems in the handling of bulk materials, in all industries around the world. Martin has developed innovative technologies to improve the handling of bulk materials—that boost flow, that reduce dust and spillage, that extend component life and reduce downtime, that improve the operating environment and the bottom line—and backs them all with an Absolutely, Positively, No Excuses Guarantee.

Areas of Expertise

Field Services  Resources to Improve Operations in Plants Handling Bulk Materials

To solve problems in operating plants, Martin offers a comprehensive array of services focused on improving material handling. Service specialists—certified, skilled, and experienced—will help make a critical difference in the performance of your plant's material-handling systems.

- Equipment Installation
- Specialized Maintenance
- Process Improvement
  - Site Survey
  - Equipment Census
  - Bulk-Material Testing
  - Carryback Analysis
  - Dust Monitoring
  - Flow Modeling (DEM)
  - Laser Surveying
  - Silo, Bin, and Bunker Cleaning
  - Air-Cannon Maintenance
  - On-Line Asset Library

Personnel Training  Instruction in Why and How to Improve Bulk-Materials Handling

Through its industry-leading Foundations™ books and its educational programs, Martin helps industry personnel understand the critical importance of bulk-materials handling. The client-driven programs will help new hires; plant operations and maintenance personnel and their managers; and conveyor designers, engineers, and plant managers control the variables that affect the critical factors of conveyor performance. Tailored to meet your needs, on your schedule, programs are provided on-site or at a mutually agreed upon location.

- Conveyor Safety Training
- Foundations™ Educational Programs (3 Levels)
- Certified Conveyor Technician (CCT) Certification Program
# MARTIN ENGINEERING: PRODUCT OFFERINGS

## Conveyor Products

**Systems to Improve Belt Conveyors and Control Fugitive Material**

Belt conveyors provide reliable, safe, and effective systems that are capable of moving thousands of tons of material per day. However, problems arise that lead to issues with system performance, component life, operating schedules, and regulatory compliance. Martin Engineering offers solutions designed to help operations where the conveying of bulk materials is a key to overall productivity and profitability.

- Belt-Cleaning Systems
- Tail Pulley-Protection Plows
- Belt-Training Devices
- Dust-Management Systems
  - Passive Containment Devices
  - Insertable Dust Collectors
  - Dust-Suppression Systems
    - (Fog, Foam, and Water-Spray)
- Transfer-Point Technologies
  - Belt-Support Cradles
  - Chutewall and Wear-Liner Systems
  - Skirtboard-Sealing Systems
- Leading-Edge Conveyor Technologies
  - Engineered Transfer Systems
  - Air-Supported Belt Conveyors
  - Modern Conveyor Architecture

## Flow Aid Products

**Systems to Improve the Flow of Bulk Materials from Storage and through Industrial Processes**

Martin was born when the company’s founder invented the Vibrolator® Ball Vibrator to improve the recovery of molding sand from foundry hoppers. Today, Martin continues its emphasis on the development of systems that enhance the movement of bulk materials from storage bins, hoppers, and silos, and through chutes, screens, feeders, and conveyors.

- Railcar Unloading Systems
- Railcar Unloading Vibrators
- Railcar Connector Boots
- Engineered Vibration Systems
- Pneumatic Rotary Vibrators
- Pneumatic Linear Vibrators
- Rotary Electric Vibrators
- Hopper Gate Openers
- Air-Cannon Systems
  - Stand-Alone Air Cannons
  - Multiple-Port Air-Cannon Systems
  - Air Cannons for High-Temperature Applications

## Maintenance Management

**Resources to Improve the Maintenance Program in Bulk-Materials Handling Operations**

MartinPLUS® Data Manager program is an on-line library of component information. Custom-built for a belt conveyor system, this digital resource can improve maintenance productivity and reduce costs.
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REFERENCES


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Möller, J.J. (September 1985). *Protect Your Conveyor Belt Investment*. Presentation to BELTCON 3 International Material Handling Conference, Johannesburg, South Africa.


Ontario Natural Resources Safety Association. *Safety Reminder*, newsletter. P.O. Box 2040, 690 McKewn Avenue, North Bay Ontario, B1B 9P1 Telephone: (705) 474-SAFE.


Project Management Institute (PMI). Additional information about project management and the accreditation program for project managers is available from PMI on the organization’s website: http://www.pmi.org


Roberts, A.W.; Ooms, M.; and Bennett, D. Conveyor Belt Cleaning – A Bulk Solid/Belt Surface Interaction Problem. University of Newcastle, Australia: Department of Mechanical Engineering.


Spraying Systems Company (http://www.spray.com) contains a variety of useful material on the basics and options available in spray nozzles.


APPENDIX B

GLOSSARY

• GLOSSARY .................................................................................. 532
• MEASUREMENT ABBREVIATIONS ........................................... 542
This is a list of belt conveyor-related terms, as they are used in this edition of *FOUNDATIONS™*. It does not pretend to be a complete compendium of all terms used in describing belting, conveyors, and/or systems for handling bulk materials. If a phrase is not shown, first break it down into its component words. Also consider consulting with other references, such as *CEMA Publication #102, Conveyor Terms and Definitions*, as well as the publications and terminologies used by suppliers of specific components.

### A

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>abrasion</td>
<td>Wearing away by friction, as by rubbing or scraping.</td>
</tr>
<tr>
<td>access door</td>
<td>Point of entry into an enclosed area, typically with a method of closure.</td>
</tr>
<tr>
<td>active dust collection</td>
<td>See dust-collection system.</td>
</tr>
<tr>
<td>adhesion</td>
<td>The bonding strength between two materials.</td>
</tr>
<tr>
<td>aeration device</td>
<td>Device mounted inside a vessel that adds low pressure/high-volume air to materials that have become compacted and hard to allow them to flow efficiently again, sometimes called aeration diffusers, pads, or nozzles.</td>
</tr>
<tr>
<td>agglomeration</td>
<td>Process or act of gathering into a mass; creating larger, heavier groupings of particles.</td>
</tr>
<tr>
<td>aging</td>
<td>The exposure to an environment for a period of time.</td>
</tr>
<tr>
<td>air cannon</td>
<td>A device that uses periodic blasts of compressed air to clear away material buildup inside pipes or transfer chutes.</td>
</tr>
<tr>
<td>air knife</td>
<td>Belt-cleaning system that directs a stream of air to shear off carryback.</td>
</tr>
<tr>
<td>air-supported conveyor</td>
<td>A conveyor that uses a conventional belt, pulleys, and drive but is supported on its carrying side by a thin film of air instead of idlers.</td>
</tr>
<tr>
<td>air-to-media ratio</td>
<td>Used to describe dust-collection filters, the air-to-media ratio is the flow of air in cubic meters per second (m³/min) divided by the area of filtration media in square meters (m²).</td>
</tr>
<tr>
<td>amplitude</td>
<td>Half the extent of a vibration, oscillation, or wave; the measurement above or below the base or centerline.</td>
</tr>
<tr>
<td>anemometer</td>
<td>Device used to measure air velocity.</td>
</tr>
<tr>
<td>angle of attack</td>
<td>The angle at which a cleaning blade is placed against the belt.</td>
</tr>
<tr>
<td>angle of repose</td>
<td>The angle or slope that a conveyed material will assume when discharged onto an open pile.</td>
</tr>
<tr>
<td>ANSI</td>
<td>Acronym for American National Standards Institute.</td>
</tr>
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### B

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>apron feeder</td>
<td>A series of overlapping metal plates mounted on a rotating chain that are used to transport heavy, lumpy or abrasive materials.</td>
</tr>
<tr>
<td>AR plate</td>
<td>Abrasion-resistant steel plate commonly used for wear liner at transfer points.</td>
</tr>
<tr>
<td>aramid fibers</td>
<td>A class of strong, heat-resistant synthetic fibers used in aerospace and military applications, as well as in the carcass of conveyor belting.</td>
</tr>
<tr>
<td>arc of contact</td>
<td>The circumferential portion of a pulley engaged by a belt.</td>
</tr>
<tr>
<td>ASME</td>
<td>Acronym for American Society of Mechanical Engineers.</td>
</tr>
<tr>
<td>aspect ratio</td>
<td>A ratio comparing the thickness of the top and bottom covers of a belt.</td>
</tr>
<tr>
<td>backstop</td>
<td>A mechanical or electric braking device used to prevent a loaded, inclined conveyor belt from rolling backwards if the motor stops. Also referred to as a “holdback clutch” or “clutch brake.”</td>
</tr>
<tr>
<td>back welding</td>
<td>A method of welding in which at each weld, the bead is drawn back toward the welded end.</td>
</tr>
<tr>
<td>backstep welding</td>
<td>A weld applied to the back side of the joint; commonly called back welding.</td>
</tr>
<tr>
<td>baghouse</td>
<td>A closed structure that contains a set of filter bags to capture airborne dust.</td>
</tr>
<tr>
<td>beater bar</td>
<td>A device (usually a roller device with an external bar) which strikes another object with the object of removing material accumulation.</td>
</tr>
<tr>
<td>bed</td>
<td>Some variety of low-friction bars or other flat surface to support the belt profile instead of using an idler’s rolling “cans.”</td>
</tr>
<tr>
<td>belt clamp</td>
<td>Beams or metal plates secured transversely across both belt ends to hold them in a desired position.</td>
</tr>
<tr>
<td>belt cleaner</td>
<td>A device that uses one or more tensioned blades mounted on a supporting structure to remove material that clings to the carrying surface of a conveyor belt beyond the normal discharge point.</td>
</tr>
<tr>
<td>belt-cleaner effect</td>
<td>Where the pressure of a sealing system against the belt removes residual material from the belt surface, as when the tail seal removes material from the belt where it enters the loading zone.</td>
</tr>
<tr>
<td>belt-cleaning system</td>
<td>A belt cleaner, or a group of belt cleaners and associated equipment (such as mounts and tensioners), as located on one conveyor.</td>
</tr>
<tr>
<td>belt conveyor</td>
<td>A flexible rubber endless belt, looped over a framework of rollers and pulleys, that is used to transport material from a load zone to a discharge point.</td>
</tr>
<tr>
<td>belt fastener</td>
<td>A mechanical device for holding two ends of a conveyor belt together.</td>
</tr>
<tr>
<td>belt feeder</td>
<td>A short, flat, variable-speed conveyor belt used to transfer, or “feed,” material from one component to another in a material transport system. The material feed rate can be adjusted by speeding up or slowing down the belt.</td>
</tr>
<tr>
<td>belt flap</td>
<td>An up and down oscillation of a belt between idlers.</td>
</tr>
<tr>
<td>belt grade</td>
<td>A classification of belt cover based on its properties, designed to provide a reference for end users as to what belts to use in different applications.</td>
</tr>
<tr>
<td>belt modulus</td>
<td>The force per unit width of belt required to produce a stated percentage of elongation.</td>
</tr>
<tr>
<td>belt profile</td>
<td>The shape of the belt, particularly its upper (carrying) surface.</td>
</tr>
<tr>
<td>belt runout</td>
<td>A condition where a conveyor belt moves too far to either side of its properly-centered path; also referred to as belt “mistracking” or “wander.”</td>
</tr>
<tr>
<td>belt sag</td>
<td>The vertical deflection of a conveyor belt from a straight line between idlers, usually expressed as a percentage of the center spacing of the idlers.</td>
</tr>
<tr>
<td>belt slip</td>
<td>The speed differential between the belt and the pulley surface.</td>
</tr>
</tbody>
</table>
belt slip switch | A switch that shuts down a conveyor drive motor when it senses the belt moving at a slower speed than the drive pulley.

belt stretch | The increase in belt length that takes place when tension is imposed. Elastic stretch is a temporary change in length that varies directly with the pull. Permanent stretch is the residual change in length after tension has been removed; it generally accumulates over a period of time.

belt-support cradles | A method of belt support without rolling components, using slider or impact beds.

belt-support system | The components below the carrying side of the belt that support the weight of belt and cargo.

belt tracking | The actions a person takes to get the belt to track consistently.

belt training | The actions a person takes to get the belt to track consistently.

belt-cleaner blade | The element of a belt cleaner that comes into contact with the belt.

bend pulley | A pulley used to change the direction of (or “bend”) a conveyor belt.

bias cut | A cut of the belt ends made diagonally, that is at an angle less than 90 degrees (usually 22⁰) to the longitudinal axis.

blockout | A safety procedure involving the prevention of a system from moving by physically holding it in position.

boilover | A problem where material overflows the chute, caused by chute blockages.

booster drive | Used in some long conveyors to reduce the power/tension at the drive pulley.

bottom cover | The non-carrying belt side towards the pulleys.

boundary friction | See interface friction.

bow | A concave curve of the belt.

breaker; breaker fabric | An extra ply incorporated in the belt carcass for shock-absorption.

brush cleaner | A belt-cleaning device that uses a rotating brush to clean carryback material from the return run of a conveyor belt.

capacity | The maximum material load on the belt, cargo, or throughput.

capture velocity | The amount of air speed required to gather an airborne dust particle into a dust-collection system.

carcass | The fabric, cord and/or metal reinforcing section of a belt, as distinguished from the rubber cover.

CARP | Acronym for “Constant Angle Radial Pressure,” a belt-cleaning blade design concept to maintain cleaning angle as the blade wears.

carryback | Conveyed material that clings to the surface of a belt past the nominal discharge point. If not removed by a belt-cleaning system, these particles become dislodged along the return run and pile up beneath the belt.

carrying idler | Any type of idler that supports the load-carrying run of a conveyor belt.

carrying run | The upper run of a conveyor belt used to transport material from a load zone to a discharge point.

carrying side | The side of the conveyor or belting that would contact the material cargo.

catenary idler | A flexible idler set where the rollers are suspended on a flexible link, rope, or chain structure and the ends are supported in pivoted stands. The tube or rollers sag to form the trough. Also called a Garland idler.

CEMA | Acronym for Conveyor Equipment Manufacturers Association.

center-to-center | The distance between the center of two pulleys or idlers. Sometimes also called centers or center distance.

ceramic-faced wear liner | A lining using ceramic blocks or tiles for improved resistance to abrasion.

CFM or cfm | Abbreviation for “cubic feet-per-minute” in airflow calculations.

chamfer | To cut at an angle, as a bevel.

chatter; blade chatter | The rapid vibration of a belt cleaner that is not aligned properly with a conveyor belt.

chevron, chevron belt | A V-shaped ridge on the carrying side of a belt to keep material from rolling down an incline.

chute, chutework | An enclosure that is used to contain material as it is transferred from one piece of equipment to another.

chute wall | The walls of the loading chute and sometimes the transfer-point skirtboard.

chutewall | See skirtboard.

classifier | A piece of equipment used to sort and separate material by size.

cleaner | A device for removing adherent material from the belt.

cleat, cleated belt | Objects on or raised sections of a conveyor belt, used to stabilize material carried up an incline.

CMMS | Acronym for computerized maintenance-management system, a system that tracks maintenance work and its costs.

coefficient of friction | The ratio of the force required to slide two surfaces to the force pressing them together; equal to the tangent of the interface friction angle.

cohesion | A material’s internal strength.

cold splice | A type of belt splice in which the layers of a conveyor belt are overlapped and bonded together with an adhesive compound.

concave | Curved inward; bow is a concave curve in the belt.

confined space | A potentially hazardous enclosed area; access is usually controlled by safety regulations.

consolidated bulk density | The density of a body of a bulk material after it has been subjected to a compressive force (F) or vibratory energy, sometimes called vibrated bulk density.

convex | Curved outward; camber is a convex curve of the belt.

conveyor | A piece of equipment designed to carry material from one point to another along a predetermined path.

conveyor belt | A length of flexible rubber belt that is stretched over a framework of rollers and pulleys and then made into a single piece by splicing its two ends together.

counterweight | The weight applied to a conveyor belt gravity take-up assembly to maintain proper belt tension.

cover | The outer layer of belting. Also, the lid or roofing structure to protect conveyor and materials from exposure to elements and limit release of material.

creep | The action of a belt alternately losing speed on the driving pulley and gaining speed on the driven pulley.

creeper drive | An auxiliary motor and gearbox that is designed to operate a piece of equipment at a very slow speed. Also referred to as a “pony drive.”
crown^2 | The difference between the diameter of a pulley at its center and at its rims.
crowned pulley^1 | A pulley with a greater diameter at the center, or other points, than at the edges.
crusher^2 | A piece of equipment used to crush or shatter larger pieces of material into smaller ones.
crust breaker | A cleaning edge installed on the head pulley just below the material trajectory so it is close to, but does not touch, the belt; serves as a doctor blade to limit the amount of material that gets through to the conventional pre-cleaner installed just below.
cupping^2 | The action of the edges of a belt curving upward on the carrying run and downward on the return run. Also referred to as belt “curl.”
cut edge^1 | The uncovered edge of a belt, created by slitting the desired width from wider belting.
cyclone^2 | A high-velocity “whirlwind”-type device that uses centrifugal force to separate dust particles from the air.

dBA | Acronym for decibel A scale, a measurement of sound intensity.
deck, decking^2, deck plate | A barrier plate located between the conveyor’s stringers to prevent material from spilling off the running belt onto the return run. Also referred to as “belt pans.”
deflector wear liner | A liner installed inside the skirtboard that incorporates a bend toward the center of the belt, which channels material away from the belt edge and sealing system.
deflector^2 | A metal plate installed in a transfer point to change the trajectory of material flow.
delamination^1 | The separation of layers of material.
DEM | Acronym for Discrete Element Modeling, a computer-based technique to analyze and demonstrate the movement of individual particles in or through a structure.
density^1 | The ratio of the mass of a body to its volume or the mass per unit volume of the substance. For practical purposes, density and specific gravity may be regarded as equivalent.
diagonal plow^2 | A device placed at an angle across the surface of a conveyor belt to deflect material off to one side.

dIN | Acronym for Deutsches Institut für Normung, the German Institute for Standardization, which develops norms and standards for industry. DIN standards are used internationally, but still most commonly in Europe.
discharge^3 | The point where material exits from a conveyor or other component in a material handling system.
disk idler^2 | An idler that uses a series of cushioned disks to support a conveyor belt.
displaced air | The air that is pushed out of the chute when the chute is loaded, equal to the volume of materials placed into the chute.
diversion plow^2 | A retractable plow that can be lowered to the carrying surface of a belt to divert material off of a conveyor ahead of the normal discharge point.
downstream | In the direction of the places that the belt has not yet reached, or toward the discharge of the conveyor or system.
drag conveyor | Material-handling system using bars or plates on a chain to pull the cargo to the discharge point.
dribble chute^2 | An angled chute positioned under the head end of a conveyor belt to catch any material that may fall off the return side and drop it into the discharge stream.
drive^2 | An arrangement of electrical and mechanical components that provide motive power to a conveyor or other piece of equipment.
drive pulley^2 | The pulley connected to the drive mechanism of a conveyor belt.
drum pulley^2 | A pulley that is of uniform diameter from side to side.
durometer | A device that measures the hardness of a flexible material (such as an elastomer), accomplished by measuring the resistance to the penetration of an indenter point.
dust bags^2 | Specially designed air-permeable filter bags that trap and collect airborne dust from a material handling system.
dust-collection system(s) | A mechanical system used to remove dust from the air in a material transport system.
dust curtains^2 | Segmented rubber or plastic curtains (baffles) suspended inside an enclosed duct that are used to slow down airflow and allow airborne dust to settle back into the material stream on a conveyor belt before it exits its load zone.
dust-suppression system(s) | A dust-control system using water or enhanced water to reduce the escape of airborne particulates.
dynamometer^1 | An apparatus capable of inducing various loads for evaluation of dynamic belting properties.

e | edge damage^3 | Tears and rips in the fabric of a conveyor belt.

e | edge distance | Dimension between the outside of the skirtboard and the edge of the belt.
edge sealing | See seal.
edge-sealing strip(s) | See sealing strips.
effective belt width | The measurement of the horizontal width of a troughed conveyor belt that is measured across the dimension parallel to the bottom roller.
effluent | The outflow of water (with material solids) exiting a belt-washing system.
elastomer | A polymer having elastic properties resembling natural rubber; typically rubbers or urethanes.
electrical conductivity^1 | A measure of how well a material accommodates the transport of electric charge, measured in Ohm (Ω).
elongation | An increase in length, usually expressed as a percentage of initial length.
end stop^2 | A clamp equipped with a set screw that is used to secure blades in position on a belt-cleaner mainframe.
entrainment damage^2 | A groove worn into the surface of a belt by material trapped between the moving belt and the skirtboard and/or sealing system.
entrainment point(s) | A point where the belt becomes wedged.
entry, entry point^2 | The point beyond the tail pulley where a conveyor belt passes into the load zone.
EPA | Acronym for Environmental Protection Agency, a branch of the United States government.
exit, exit point^2 | The area of a load zone where the skirtboards come to an end and the main carrying run of the conveyor begins.

F

fatigue^1 | The weakening of a material occurring when repeated application of stress causes permanent strain.
flop gate | A pivoted metal plate that can be moved or “flopped” to feed material to either of two different discharge points.

flight conveyor | A type of conveyor that uses spaced cleats or scrapers (flights) to move material from one point to another through a channeled chute.

flat belt | A conveyor belt that carries its cargo without being troughed.

flat idler | An idler where the supported belt is flat.

flat roller | See flat idler.

flex cracking | A cracking of the surface resulting from repeated flexing or bending.

flight conveyor | A type of conveyor that uses spaced cleats or scrapers (flights) to move material from one point to another through a channeled chute.

flood gate | A pivoted metal plate that can be moved or “flopped” to feed material to either of two different discharge points.

flow aid | Device or method to promote the flow of materials through chutes, including both linear and rotary vibrators, air cannons, aeration systems, chute linings, and soft chute designs.

flush, flush-through | An uncontrolled surge of material through a material handling system component.

footprint | Projected or actual area occupied on the ground.

free-belt edge distance | The non-load carrying portion of the belt’s width, toward the belt edges, typically where the skirtboard-scaling system is applied.

friction | The resistance to motion due to the contact of surfaces.

fugitive material | Any stray material that escapes from a material handling system at a place other than its normal discharge point, might originate as carryback, spillage, or airborne dust or from other causes.

full-trough pulley | A tail pulley installed so its top is inline with the top of the center rolls on the first fully-troughed idlers.

g | The amount of material flow that is being transferred on a conveyor at any given time, usually expressed in “tons per hour” (t/h or st/h).

generator | A device that regulates the flow of material from a bin or storage hopper to a conveyor or other piece of equipment.

feeder belt | A belt that discharges material onto another conveyor belt.

field-trimmed | Cut to the proper size at the point of application (as opposed to being cut at the factory).

fines | Small particles of material.

finger splice | A joint of the belt where the two ends are cut into a number of narrow triangular “fingers” which are interlaced.

flanged pulley | A pulley with a raised rim at the edges for the purpose of keeping the belt contained.

flat belt | A conveyor belt that carries its cargo without being troughed.

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impact resistance | The relative ability of a conveyor belt assembly to absorb impact loading without damage to the belt.

induced air | Air pulled into the voids created as the material stream expands as it leaves the head pulley.

insertable, insertable dust collector, insertable dust filter | A dust-collection system composed of filters designed to be incorporated inside the enclosure of a transfer point or other dust source.

interface friction (Ω) | The friction between the bulk material and the surface(s) that will be in contact with it (e.g. chutewall and belt); can be determined with a shear cell and a sample of the actual interface material; sometimes referred to as wall friction or boundary friction.

intermediate idlers | Idlers placed between impact beds or slider beds to support a conveyor belt when material is not being loaded.

internal friction angle | The angle at which the particles within a bulk material slide over one another within a pile, or failure due to shearing.

ISO | A universal short form of the name of the International Organization for Standardization adopted from the Greek word “isos,” meaning equal.

J

jog switch | A manual start switch located near the discharge end of a conveyor used to “jog” or “bump” the belt for short distances for testing purposes or to gradually empty the belt of overloaded material.

joint | The connection of two belt ends.

junction joint | The area between the wing roll and center roll on a set of troughing idlers.

junction-joint damage; junction-joint failure | A longitudinal splitting or cracking in a belt caused by insufficient transition distance between the tail pulley and the load zone for the type of belt being used and/or an idler-junction gap of more than 10 mm (0.4 in.) or twice the belt thickness.

K

kicker plate | Deflector to steer the flow of material after it leaves the first point of contact with the transfer chute.

knocking | The process of manually adjusting the cross-structure angle of conveyor belt idlers to train a belt to centerline, accomplished by moving one end of the idler slightly forward or back.

KPIs | Acronym for key performance indicators, performance measurements used as metrics to measure organizational success.

L

lading | A rubber, fabric, or ceramic covering applied to a pulley shell to improve belt traction against the pulley.

lateral misalignment | The offset of pulleys, idlers, or structure from a designated longitudinal reference line.

leakage | Material that has escaped from the material handling system, spilling from the sides or falling or expelled from openings.

lift | The vertical distance bulk material is moved on a conveyor; the change in height from one end of the conveyor to the other end.

limit switch | An electrical switch used to shut off the drive or actuator of a system component such as a flop gate once it reaches a predetermined set point.

linear tensioner | A type of tensioner that applies direct upward pressure to a belt cleaner.

liner | Material placed on the inside surfaces of an enclosure or vessel, usually to preserve the enclosure by reducing wear.

load out | Area at the discharge of a conveyor where material can be temporarily stored or loaded directly onto a device for transport to another destination.

load zone, loading zone | The receiving point where material is dropped or fed onto a conveyor.

loading chute | The enclosure that places the cargo onto the belt.

lockout | A safety precaution of placing a padlock or other control on stored energy sources, the power supply, or control circuit of a machine to prevent its premature resumption of operation or unexpected released energy.

longitudinal | In reference to a conveyor belt, a lengthwise direction that runs parallel with the centerline.

loose bulk density | The weight per unit volume of a bulk solid, measured when a sample is in a loose or non-compacted condition, \( \rho \).

LRR | Acronym for Low Rolling Resistance, a proprietary rubber formulation.

M

magnetic pulley | A pulley equipped with a permanent or electromagnet, used to remove tramp iron from the material cargo carried on or discharged from the conveyor.

magnetic separator | A device that uses magnetic attraction to pull metal scraps, known as “tramp iron,” out of the material stream on a conveyor.

mainframe | The main structural support of a belt cleaner upon which the blades are mounted.

mandrel | A central shaft used for mounting and lateral adjustment of a belt-cleaner mainframe.

manometer | A device used for measuring the pressure of gases or liquids; on conveyors, used for measuring air flow.

maximum tension | The highest tension occurring in any portion of the belt under operating conditions.

mechanical dust collection | Active dust-collection system, typically using fans pulling air through ductwork to a filtration system.

mechanical fastener | A system used to join the ends of belting, typically involving screws or rivets to attach plates connecting the two ends.

mechanical splice | A type of splice in which mechanical fasteners are used to connect the two ends of a belt.

minimum pulley diameter | The minimum pulley size (usually to prevent damage) for a particular belt as specified by the belting’s manufacturer.

misalignment switch | A limit switch mounted along the edge of a conveyor belt that will shut the drive motor down if the belt tracks too far to either side of its normal centered path.

mistracking | The off-center travel of a conveyor belt.

molded edge | A solid rubber belt edge formed in a mold, where the belt has been manufacturer to a specific width, rather than slit from a wider piece.

mooning | Uneven wear on a pre-cleaner blade that results from positioning the cleaner mainframe too far out from the head pulley.

MSHA | Mine Safety and Health Administration, a unit of the US Department of Labor.

N

negative rake | Cleaning blades inclined at an angle in the direction of belt travel; also known as the scraping orientation.
offset idlers | A troughing idler set where the wing rollers are in a vertical plane different from, but parallel to, the center roller. This permits the wing rollers to overlap the central roller, improving belt support; may also reduce the height of the idler set.

ioil resistant | Able to withstand any deterioration of physical properties arising from interaction with petroleum.

operating tension | The tension of a belt while running with a material load.

OSHA | Occupational Safety & Health Administration, in the United States an agency of the United States Department of Labor; the main federal agency charged with the enforcement of safety and health legislation.

outrigger | A projection extending laterally beyond the main structure of a vessel, aircraft, or machine, usually for added stability.

ozone cracking | Cracks in the belt surface caused by exposure to an atmosphere containing ozone.

particulates | Fine solid or liquid (other than water) particles found in the air, including dust, smoke, and pollen.

passive dust collection | A dust-collection system that minimizes dust by utilizing efficient transfer-point design and airflow control rather than mechanical devices.

peeling angle | When a cleaner blade is tilted in opposition to the direction of belt travel; also known as positive-rake angle.

pelletizer | A device to form pellets (small lumps) from fines or dust.

permanent stretch | A change in length of a belt seen after tension has been removed; this additional length generally accumulates over a period of time.

picking idlers | A type of troughing idler set with narrow wing rolls and a wide center roll. Idlers of this type are generally used for material that must be picked or sorted as it is conveyed.

pickup velocity | The speed at which air moving over a bed of a given material can pick up dust off the surface and carry it away, typically in the range of 1.0 to 1.25 meters per second (200 to 250 ft/min).

pillow block | A journal bearing enclosed in a bolt-on housing that is used to mount pulleys to a conveyor stringer.

pinch point | A point where a machine element moving inline meets a rotating element in such a manner it is possible to nip, or entrap, a person or object between the members.

pitot tubes | A pressure measurement instrument used to measure the velocity of fluid flow.

PIW | Abbreviation for Pounds per Inch Width, a measurement of a belt’s rated capacity for tension.

PLC | See programmable logic controller.

plenum | An enclosure in which pressurized air is distributed.

plow | A device stationed across the path of a conveyor to discharge or deflect material.

plug welding | A type of joint made by welding one part to another through a circular hole in the top part.

pluggage | The blocking of the discharge of a chute or hopper.

ply, plies | A layer of fabric used in the carcass of a belt.

pocket belt | A belt where pockets, formed by the addition of raised cleats and flexible sidewalls, are used to carry the cargo; commonly seen in high-angle applications.

positive pressure | The outward flow of air from the transfer point or other structure.

positive rake | In belt cleaning, a blade tilted in opposition to the direction of belt travel; also known as peeling angle.

pooling | Material that piles up on a belt at the load zone until it reaches belt speed and can be carried away.

PPEs | Personal protective equipment, equipment and attire such as a hard hat, safety glasses, hearing protection, respirators, and steel-toe shoes.

pre-cleaner | A belt cleaner installed on the face of a head pulley to shear off the bulk of any carryback clinging to the belt; primary cleaner.

press | A machine that applies pressure consistently across its surfaces, used for belt splices.

pressure roller | A roller installed to keep the belt in proper position, as above a belt cleaner.

primary, primary cleaner | A pre-cleaner; that is, a belt cleaner installed on the face of a head pulley below the material trajectory to shear off the bulk of any carryback material clinging to the belt. The primary cleaning position is on the face of the head pulley below the trajectory.

primary position | The area around the discharge pulley where primary belt cleaners are usually installed.

profile rip | A form of belt damage to the belt, with a rip running from the edge toward the center.

programmable logic controller (PLC) | A centralized computer system that controls a system’s operation and monitoring by communicating with remote input/output circuit boards for each individual system component.

pug mill | Industrial processing machine in which material is simultaneously ground and mixed with a liquid.

pull-cord stop switch | A cable running along the length of a conveyor, connected to one or more switches. In an emergency, a manual pull of the cable at any point will shut down the conveyor system.

pulley | A rotating cylinder mounted on a central shaft that is used to drive, change direction of, or maintain tension on a conveyor belt.

pulley-protection plow | A plow installed so the belt passes under it immediately before the belt enters a pulley (usually, the tail pulley). The plow removes material from the belt to prevent damage to the pulley and belt by entrapment of material between the two.

pulley wrap | The total area of contact where a belt wraps in an arc around the surface of a pulley.

pulverizer | A mechanical device used to grind material down to a fine powder consistency. A ball mill uses heavy steel balls that roll between counter rotating faces to crush the material.

PVC | Acronym for polystyrene, a material used in the construction of some conveyor belting.

radial tensioner | A tensioner that transmits torque through a pivoted extension or torsion spring to a belt cleaner.

rated tension | The minimum breaking strength of a belt in newtons per millimeter (N/mm) of belt width, as specified by the belting manufacturer. In the USA sometimes used as a term for the working tension.
reclaim system\textsuperscript{2} | A material handling system used to recover and transport material from a stockpile area to a point where it will be processed or consumed.

regenerative conveyor\textsuperscript{1} | A conveyor that discharges at a substantially lower altitude than the tail (so it conveys material downhill), producing electricity rather than consuming it.

relief | A mechanism that allows an item (a cleaner blade, for example) to move away from an obstruction (a mechanical splice, for example). These could include springs in the cleaning-system tensioner.

relieving angle | An incline or opening of surfaces that will allow material to be pulled free by the action of the belt, rather than surfaces that will allow material to be pulled from an obstruction (a mechanical splice, for example). These could include springs in the cleaning-system tensioner.

residual surfactant | A dust-suppression additive that will continue its agglomeration effect even after the moisture evaporates; also called a binder suppressant.

return idler\textsuperscript{2} | An idler used to support the empty, return side of a conveyor belt.

return run\textsuperscript{2}, return side | The side of a conveyor belt that does not carry cargo, after the discharge, as the belt returns to the loading zone.

reverse-jet | A method of cleaning filters in a baghouse; bags are cleaned by discharging a burst of compressed air into the bags at the top; the compressed-air burst flexes the bag wall and breaks the dust cake off so it falls into the collection hopper.

reversing conveyor\textsuperscript{2} | A type of conveyor that can carry material longitudinally in either direction.

ribs | See cleats.

rip detector\textsuperscript{2} | A system in which an electrical conductor is built into the plies of a conveyor belt that will shut the drive motor down if the belt becomes torn.

RMA | Acronym for Rubber Manufacturers Association, Inc.

rock box\textsuperscript{2} | A ledge or shelf inside a transfer chute where material is to accumulate. This allows subsequent material to impact on the accumulated material rather than against the chute, extending the life of the walls.

rock ladder\textsuperscript{2} | A series of rock boxes that slow down the velocity of material by cascading it back and forth between ledges.

Rockwell hardness (or scale) | A scale for evaluating the hardness scale of materials, as determined by measuring the depth of penetration of an indenter. Different scales are denoted by a single letter; “B” and “C” are the most common.

ROI | Return on investment or payback.

roll crusher\textsuperscript{2} | A mechanical device that uses a heavy, rotating metal drum equipped with teeth or cogs inside a screened enclosure to crush hard materials.

rollback\textsuperscript{2} | Stray pieces of material that roll and bounce backward down an inclined belt after material flow has been shut off. Or, the downhill motion of an inclined conveyor, running backward when the power is shut off while the belt is loaded.

rolling component(s) | The idlers and pulleys (and other rotating components) of a conveyor system.

ROM | Run-of-mine, the raw mined material that discharges at a substantially lower altitude than the tail (so it conveys material downhill) and is used for evaluating the hardness scale of material laid on a fabric but not forced into the weave.

screw conveyor\textsuperscript{2} | A type of conveyor that uses a rotating auger inside an enclosed tube to convey material from one point to another.

screw take-up\textsuperscript{1} | A mechanical take-up to apply tension to a conveyor belt in which movement of a pulley-bearing block is accomplished by means of a screw.

seal | Method to prevent spillage by containing the fines and dust at the edge of the skirtboard.

sealing strip(s) | The elastomer material installed between the skirtboard and the belt to prevent spillage.

sealing system | Elastomer seal and clamping mechanism at the edge of the skirtboard to contain dust and fines and prevent spillage.

secondary belt cleaner, secondary cleaner | A belt cleaner mounted beneath the return side of a conveyor belt to remove any remaining carryback fines that were not removed by the pre-cleaner blade.

secondary position | Position for a belt cleaner, between the point where the belt leaves the head pulley and where it contacts the first snub or bend pulley or return idler.

segregation | The accidental or undesired separation of a material by size.

self-aligning idlers\textsuperscript{2} | Idlers that can swivel to the left or right under the influence of the forces of the moving belt to keep the belt traveling on the centerline.

settling zone | An enlarged portion of the covered skirtboard area past the loading zone’s impact area; the extra volume designed to slow the airflow and allow airborne dust to return to the main material cargo and cleaner air to escape; also called a stilling zone.

shear cell test | Test to derive flow properties of a bulk material by measuring the force to shear the bulk material.

side-loading forces | Pressure resulting from the energy and weight of material pushing outward from the center.

side-support cradles | Belt support system using slider bars under the skirtboard, to provide a consistent and sealable surface for the sides of the belt.

skim coat | A thin layer of rubber material laid on a fabric but not forced into the weave.

skirtboard\textsuperscript{1} | The vertical or inclined plates extending out from a conveyor’s loading point and installed closely above the belt to confine the conveyed material.
skirtboard seal, skirting seal | The mechanism (often a strip of elastomer) installed along the bottom of the transfer point’s skirtboard to control spillage and keep material on the belt.

skirted area | The area of the transfer point that is enclosed within the skirtboard; the area of the transfer point from the load point through the exit.

skive2 | To remove some (or all) of a belt’s top cover to recess a mechanical splice; the process of countersinking the fasteners in a mechanical splice closer to the belt carcass to keep the top of the fasteners parallel with the surface of the belt.

slack-side tension2 | The area of least tension on a conveyor belt; the low-tension areas will vary on the location of the snub and take-up pulleys; they are completely dependent on the individual conveyor and must be identified for each application.

slider bar | A low-friction bar, typically used in the construction of a slider bed belt-support cradle.

slider bed2 | A series of longitudinal bars assembled in a cradle and placed beneath a conveyor load zone to provide a continuous surface for a loaded belt to ride on.

slider bed conveyor | A conveyor using some variety of low-friction bars or other flat surface, rather than idlers, to support the belt.

slip, slippage | The speed differential between the belt and the pulley surface.

snub, snub pulley2 | A small pulley used to increase the wrap area of a conveyor belt around a head or tail pulley for improved traction.

spillage | Lost material that has fallen from the side(s) of the conveyor belt; typically in the load zone, but can occur at any point along the conveyor; a general term for all fugitive material.

spiral-wrapped pulley2 | A wing pulley that is wrapped with a steel band in a spiral pattern to reduce belt vibration while still maintaining the self-cleaning function of the pulley.

splice | The joint where two ends or two pieces of belting are joined together to provide a continuous loop.

splice allowance1 | Additional belting required to allow a splice to be installed.

splice angle | The angle across the top of the belt at which two pieces of belt are joined.

spoon | A curved trough at the bottom of a transfer chute that directs the placement of the stream of material onto the receiving belt.

spring take-up2 | A mechanical device that utilizes a variable force spring or springs attached between the conveyor structure and the tail pulley mounting block to maintain tension on the belt.

squeegee blade | A soft urethane blade that wipes the belt to remove water from the belt.

stacker conveyor2 | A conveyor used to “stack” or drop material onto a stockpile or lowering well. A stacker conveyor can be “fixed,” to drop material into a single location, or “rotating,” to spread the material in a sweeping motion over a wider area.

stacker/reclaimer2 | A boom mounted conveyor equipped with a rotating bucket wheel that can “stack” or drop material onto a stockpile for storage or reverse direction and reclaim the material from the stockpile to another destination.

stackout system2 | A series of conveyors designed to carry material out onto a storage area.

Stahura Carryback Gauge | A method to measure carryback utilizing a collection pan with scraper blades held against the return side of a moving belt to capture residual material; developed by belt-cleaning pioneer Dick Stahura.

steering rolls2 | A set of rollers (or a set of troughed idlers) mounted on a pivot that can swivel left or right to steer a mistracking conveyor belt toward centerline.

stepped splice2 | A type of splice in multi-ply belting where the fabric plies on one end of the belt are removed so that it will butt together and overlap adjacent plies of fabric on the other end.

stilling zone | See settling zone.

stitch welding | A metal joining technique using a series of spaced welds, with intervals between the welds.

STP | Acronym for Standard Temperature and Pressure; 0°C/32°F, 1 atmosphere (101.325 kPa) (1 atmosphere of absolute pressure).

straight face pulley2 | A pulley with a flat surface with no crown.

stringer2 | The longitudinal supporting members of a conveyor structure, between the terminal pulleys.

surcharge angle | The angle to the horizontal which the surface of a body of material assumes while the material is at rest on a moving conveyor belt. This angle usually is 5° to 15° less than the angle of repose, though in some materials it may be as much as 20° less.

surfactant2 | A surface-acting agent. In dust suppression, this is an additive that is combined with water in a spray or fog to assist in the capture of airborne dust.

Swinderman Scale of Fugitive Materials | A scoring system that assigns values to a system’s performance in control of fugitive materials for dust, spillage, and carryback.

T

tagout | The placing of a name tag or other label or sign on a disabled power or control system, to identify that the system is “down” for maintenance and should not be restarted.

tailgate sealing box2 | An enclosure located at the tail end of a load zone to prevent material from leaking out onto the belt behind the chutework.

tail pulley2 | A pulley that turns the return run of a conveyor belt 180 degrees back into the carrying run.

take-up2 | A device used to remove slack from a conveyor belt and maintain tension. Gravity take-ups use a heavy counterweight to maintain belt tension; mechanical take-ups use a hydraulic device or screw adjustment to maintain tension.

take-up travel | The distance the take-up is able to move while the belt is running.

tension | The force along the belt line required to overcome the resistance of components and transport the load.

tensioner, tensioning device | A device used to maintain a belt cleaner’s cleaning pressure against the surface of the belt.

terminal pulley | The pulley at either end of the conveyor, the head and/or tail pulleys.

tertiary belt cleaners2, tertiary cleaner | Any additional cleaners added to a belt after the primary cleaner (pre-cleaner) and initial secondary cleaner; cleaner(s) installed further along the conveyor return than secondary position.

tertiary position | The area after the snub pulley for the installation of additional belt cleaners.

testout | Attempting to operate a device that has been presumably disabled by lockout / tagout / blockout procedures; used as a final safety precaution.
throughput | The amount of bulk material delivered by a material handling system; usually stated as tons per hour (st/h).

tie gum | A thin sheet of unvulcanized rubber inserted between plies in the assembly of a vulcanized belt splice.

tight side tension | The area of highest tension on a conveyor belt, usually located at the point where the belt approaches the drive pulley.

tilt switch | An electrical switch designed to shut off material flow from a conveyor when material backup at the discharge point forces it into a tilted position.

TLV | Threshold limit value, a level of dust to which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects; as expressed in parts per million parts of air (ppm) for gases and in milligrams per cubic meter (mg/m³) for particulates such as dust, smoke, and mist.

top cover | The carrying surface of the belt.

total material control | Success in containing spillage and carryback and controlling dust, where materials are kept on the belt and within the system.

TPH, tph | Abbreviation for “tons per hour;” a measure of capacity.

tracker, tracking device | A device used to steer a mistracking conveyor belt back to centerline.

tracking | See belt tracking.

training | See belt training.

training idler, trainer | An idler mounted on a pivot or otherwise adjustable base that, when actuated by the mistracking belt moving against it, will automatically adjust its position to steer the belt to the correct path.

trajectory | The arcing path made by conveyed material as it is discharged from the head end of a conveyor.

tramp iron | Pieces of scrap metal that may contaminate the material stream on a conveyor belt.

tramp iron detector | A system to detect the presence of tramp iron in a material stream and either remove the tramp iron or shut down the material handling system.

transfer point | The place (and associated equipment) where a belt conveyor is loaded or unloaded.

transition | The forming of the conveyor belt into a trough to receive its cargo; the area where this change takes place.

transition area | The area between the tail pulley of a conveyor and the start of the load zone where the belt transforms from flat to fully troughed or the area where the belt transforms from troughed onto the discharge pulley.

transition distance | The distance from the centerline of the terminal pulley to the first fully-troughed idler.

transition idlers | Idler sets between the tail pulley and the load zone that gradually transform the belt into the trough for loading.

transverse | The direction from side to side across a conveyor belt.

traveling plow | A plowing device that can be moved back and forth longitudinally over the carrying side of a conveyor belt to deflect material to alternate discharge points along its run.

tripper conveyor, tripper | A rail-mounted mechanism with a traveling take-up that can move the discharge end of a conveyor to multiple points along a straight line to fill individual hoppers or bins.

trough | The shape of a belt with the edges raised allowing it to carry more material.

trough angle | The angle (from horizontal) at which the belt edges are troughed to help center and contain its load.

troughing idlers | A set of carrying idlers consisting of a horizontal center roll with incline wing rolls on both sides that forms the carrying side of the belt into a trough.

tube conveyor | A conveyor where the belt is formed into a closed tube after it is loaded, typically used to prevent spillage and carry material vertically.

turnover | A system installed in a conveyor that inverts the belt, usually to control carryback by keeping the load-carrying (“dirty”) side of the belt up.

U

UHMW | Acronym for Ultra-High Molecular Weight polyethylene, a plastic material commonly used as a chute liner or low-friction belt-support surface.

unidirectional conveyor | Conveyor that carries material in one direction.

upstream | In the direction of the places the belt has already passed, or back toward the loading point.

V

valley angle | The angle between two chute walls created by the side wall joining with the back wall.

vee roller | See V-return idlers.

vibrated bulk density | Also called consolidated bulk density (ρ), achieved by applying a compressive force (F) or vibratory energy to a body of material; used for determining the weight of material conveyed on the belt based on surcharge angle.

vibrating feeder | A type of feeder that uses a suspended or isolated trough with an attached vibrator to move material from a bin or hopper into a transfer chute.

viscosity | Resistance of a material to flow under stress.

V-plow | A “V” shaped device equipped with a rubber or urethane blade that rides atop the return run of a conveyor belt to deflect any stray material away from the tail pulley.

V-return idler | A return idler that incorporates two rolls in a “V” configuration to improve belt tracking on the return run.

vulcanized splice | A type of splice in which the layers of a belt are overlapped and bonded together, using heat and pressure (“hot vulcanization”) or a chemical bonding agent (“cold” vulcanization).

vulcanizer | A device to apply heat and pressure for curing a splice; also called a press.

W

wall friction angle | See interface friction.

wander | Mistracking.

warp | Lengthwise yarns in a woven fabric.

wash box | An enclosure containing a series of belt cleaners and water-spray nozzles for belt cleaning.

water tensioner | A type of belt cleaner tensioner that uses regulated water pressure to maintain tension on the cleaner blades.

wear liner | A layer of ceramic tiles, AR plate, or other abrasion-resistant material used to line the inside of a transfer chute or skirtboard to improve material flow and prevent abrasive wear and damage to the outer shell and structure.

weft | The crosswise yarns in a woven fabric.

weldment | A fabricated metal component held together by welded joint(s).
wing idler² | Either of the outer rollers in a troughed idler set, mounted at an angle to the central roll.

wing pulley², wing-type pulley | A type of self-cleaning pulley that supports the belt on individual vanes instead of a solid surface. The vanes are mounted on a central section that tapers down from inside to outside to direct stray material out of the pulley and off to the sides.

wing rollers | Rollers on the outside of a troughed idler set. See wing idler.

zero speed switch | Electrical switches used to detect the stoppage of a rotating shaft, such as on a conveyor drive motor.

zero rake | Belt cleaner angle of attack where blades are installed perpendicular (90 degrees) to the belt line.
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APPENDIX C
SAFETY LABELS
SAFETY LABELS

The following information and safety label recommendations are published with permission by the Conveyor Equipment Manufacturers Association (CEMA) and are available in CEMA Brochure 201. Labels may be purchased from the CEMA website (www.cemanet.org) or by writing the Conveyor Equipment Manufacturers Association, 6724 Loan Oak Boulevard, Naples, Florida 34109, Telephone 239-514-3441. They also can be obtained directly from many conveyor equipment manufacturers.

CEMA Safety Label Meanings

The CEMA Safety Label program uses color and specific signal words (words that designate a degree or level of hazard seriousness) to identify labels for three classifications of risk:

**DANGER LABEL**

Labels with “Danger” indicate an imminently hazardous situation, which, if not avoided, will result in death or serious injury. They are to be limited to the most extreme situations.

**WARNING LABEL**

Labels with “Warning” indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION LABEL**

Labels with “Caution” indicate a potentially hazardous situation which, if not avoided, may result in a minor or moderate injury. They may also be used to alert against unsafe practices.

**Note:** “Danger” or “Warning” should not be considered for property damage accidents unless personal injury risk appropriate to those levels is also involved. “Caution” is permitted for property-damage-only accidents.
DANGER LABELS

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

- Climb, sit, walk, or ride on conveyor at any time will cause severe injury or death. KEEP OFF.
- Hazardous voltage will cause severe injury or death. LOCK OUT POWER before servicing.
- Moving parts will cause severe injury. KEEP AWAY.
**WARNING LABELS**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION LABELS

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

- **CAUTION**
  - Do not enter
  - Hazardous Area
  - Authorized personnel only

- **CAUTION**
  - CAUTION
  - HOT SURFACE
  - Contact with skin may cause burns
  - DO NOT TOUCH

- **CAUTION**
  - Low Clearance
  - • Be Alert

- **CAUTION**
  - Insure Skirting System is properly adjusted
  - Failure to properly install, inspect, adjust and maintain this system may result in spillage, dust, downtime, equipment damage, or personal injury.

- **CAUTION**
  - Trip Hazard
  - • Be Alert
  - • Watch your step

- **CAUTION**
  - Hazardous environment
  - Respiratory protection required
  - Authorized personnel only

- **CAUTION**
  - Insure Impact Cradle is properly set
  - Failure to properly install, inspect, adjust and maintain this system may result in spillage, dust, downtime, equipment damage, or personal injury.

- **CAUTION**
  - Insure Belt is properly tracking and aligned
  - Failure to properly install, inspect, adjust and maintain this system may result in spillage, dust, downtime, equipment damage, or personal injury.

- **CAUTION**
  - Hazardous noise level
  - Ear protection required in this area

- **CAUTION**
  - Insure Belt is properly tracking and aligned
  - Failure to properly install, inspect, adjust and maintain this system may result in spillage, dust, downtime, equipment damage, or personal injury.

- **CAUTION**
  - Risk of Electrical Shock
  - More than one disconnect switch may be required to de-energize the equipment before servicing.
Safety Labels | Placement Guidelines

Product: Bulk Handling Equipment | Equipment: Bulk Belt Conveyors

A. To be placed on removable guards to warn that operation of the machinery with guards removed would expose chains, belts, gears, shafts, pulleys, couplings, etc. which create hazards.

B. Locate on inspection door(s). To be located on conveyors where there are exposed moving parts which must be unguarded to facilitate function, i.e. rollers, pulleys, shafts, chains, etc.

C. To be placed on removable guards to warn that operation of the machinery with guards removed would expose chains, belts, gears, shafts, pulleys, couplings, etc. which create hazards.

D. Locate at entrance to conveyor walkway. General warning to personnel that a conveyor’s moving parts, which operate unguarded by necessity of function, i.e. belts, rollers, terminal pulleys, etc., create hazards to be avoided; in particular, conveyors which stop and start by automatic control near operator work stations would use this label.

E. Space up to a maximum of 50 ft centers (walkway sides). To be placed up to a maximum of 50’ centers along the walkway side.

F. To be placed at entrances to enclosed areas which would expose personnel to operational or environmental hazards which should only be entered by trained and authorized personnel under specific conditions; Examples, lifting conveyors, transfer car aisleways, confined spaces, etc.
Product: **Bulk Handling Equipment** | Equipment: **Belt Conveyor Accessories**

These labels are to be placed on or near the maintained access for the following bulk belt conveyor accessories:
Bulk Handling Conveyors

Do Not Climb, Sit, Stand, Walk, Ride, or Touch the Conveyor at Any Time

Do Not Perform Maintenance on Conveyor Until Electrical, Air, Hydraulic and Gravity Energy Sources Have Been Locked Out and Blocked

Operate Equipment Only With All Approved Covers and Guards in Place

Lock Out All Power and Block Gravity Loads Before Servicing

Ensure That All Personnel Are Clear of Equipment Before Starting

Allow Only Authorized Personnel and Trained Personnel To Operate or Maintain Conveyors and Accessories

Keep Clothing, Body Parts, and Hair Away from Conveyors

Clean Up Spillage Around Tail Pulleys, Idlers, and Load Points Only When the Power Is Locked Out and Guards Are In Place

Do Not Modify or Misuse Conveyor Controls

Ensure That ALL Controls and Pull Cords are Visible and Accessible

Do Not Modify or Remove Controls, Guards, Interlocks, Warnings or other Safety Items without Manufacturer’s Approval

Report All Unsafe Conditions

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APPENDIX E
AUTHORS & ACKNOWLEDGMENTS
R. Todd Swinderman
Martin Engineering Corporate | Consultant

Todd Swinderman joined Martin Engineering in 1979 as Conveyor Products Engineer before becoming General Manager, President, and CEO. His vision and leadership have focused on developing innovative solutions for bulk-materials handling and expanding the company’s capabilities around the world. Swinderman has been active in CEMA as an officer, committee chair, and as the chief editor and driving force behind the updated sixth edition of *BELT CONVEYORS for BULK MATERIALS*.

Andrew D. Marti
Martin Engineering Corporate | Global Technical Writer

Andy Marti has more than 20 years of experience in writing about the problems and solutions in bulk-materials handling. He has served as coordinating author and editor for all four editions of *Martin’s Foundations™* books on improving the performance of belt conveyors and transfer points. Marti holds a B.A. in Journalism from Central Michigan University and an M.A. in Communications Media from the University of Northern Iowa.

Larry J. Goldbeck
Martin Engineering USA | Conveyor Technology Manager

Since joining Martin in 1981, Larry Goldbeck has traveled the world—from Indonesia to Iceland, from Duluth to Delhi—applying solutions to problems in the handling of bulk materials. He combines theoretical knowledge with 40 years of hands-on experience in the operation, maintenance, and troubleshooting of belt conveyor systems. Goldbeck is the developer and lead instructor of Martin’s Foundations™ Workshops on Operating and Maintaining Clean and Safe Belt Conveyors.

Daniel Marshall
Martin Engineering USA | Product Specialist

A self-described “numbers guy,” Daniel Marshall holds a B.S. in Mechanical Engineering from Northern Arizona University. He joined Martin in 2000 as a Research and Development Engineer. In his career at Martin, Marshall has worked with every conveyor product that Martin has to offer. He is currently instrumental in the design and application of dust-suppression and dust-collection systems.

Mark G. Strebel
Martin Engineering USA | Product Support Manager

Mark Strebel came to Martin after nine years experience as a test and results engineer and operations supervisor with a coal-fired public utility power plant. At Martin, he has focused on the development and application of technologies to improve bulk-materials handling in the positions of R & D Manager and Conveyor Products Manager, before assuming his current position. Strebel holds a B.S. in Mechanical Engineering and an M.B.A. from Bradley University.
There are always those individuals who, behind the scenes, quietly go about their job to get the task done. Oftentimes, those individuals, the unsung heroes, go unrecognized for the contributions they make to the process. Five individuals have consistently gone out of their way, some for almost two years, to bring the fourth edition *Foundations™, The Practical Resource for Cleaner, Safer, More Productive Dust & Material Control* to fruition.

Without the dedication, hard work, and insight of Martin employees Chelsea Blake, Seth Mercer, Jared Piacenti, and Bob Tellier and writing and proofreading consultant D. Michele Maki, PhD, the fourth edition of *Foundations™* would not have been possible.

This book could also not have been completed without the understanding and assistance of many outside resources and many Martin Engineering employees. These individuals have provided background information, technical expertise, “big-picture” and “detailed-picture” thinking, and “nuts-and-bolts” intricacies. We owe a debt to the following:

**Martin Engineering Corporate**
- Susan Coné, James Daly, Gina Darling, Harry Heath, Michele Ince, Chris Landers, Paul Mengnjoh, Travis Miller, Andrea Olson, Chris Schmelzer, Mark Stern, Kathy Swearingen, Terry Swearingen, Bonnie Thompson, Kathy Thumma, Jim Turner, Tina Usrey, and Ron Vick

**Martin Engineering Germany**
- Reiner Fertig, Michael Hengl, and Michael Tenzer

**Martin Engineering Brazil**
- Vanderlei Brunialti

**Outside Resources**
- Mike Braucher, Dave Gallagher, and Frank Hyclak, Goodyear Engineered Products
- Bob Reinfried, Executive Vice-President, CEMA
- Ed Walinski, Pneutech Engineering
- Darcy Winn, Winn Conveyor
- Ryan Buck and David Pratt, Wethersfield High School

---

**Martin Engineering USA**
- Bob Burke, Jim Burkhart, Jen DeClercq, Julie Derick, Robert Downs, Travis Grawe, Mark Huhn, Sonia Magalhaes, Kevin McKinley, Greg Milroy, Cheryl Osborne, Rachael Porter, Tracey Ramos, Wayne Roesner, Jim Roark, Becky Scott, Richard Shields, and Terry Vandemore

**Martin Engineering China**
- Eric Zheng

**Martin Engineering South Africa**
- Hannes Kotze

**Consultants**
- Paul Grisley, Grisley Conveyors
- Bob Law, Engineering Services & Supplies (ESS)
- Laurie Mueller

To all who lent a hand, thank you.

RTS, ADM, LJG, DM, MGS
Neponset, Illinois, USA, March 2009