ASME B20.1-2003
(Revision of ASME B20.1-2000)

SAFETY STANDARD FOR CONVEYORS AND RELATED EQUIPMENT

AN AMERICAN NATIONAL STANDARD



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The next edition of this Standard is scheduled for publication in 2006. There will be no addenda issued to this edition.

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FOREWORD

The first edition of the Safety Standard for Conveyors, Cableways, and Related Equipment was sponsored by the National Conservation Bureau and the American Society of Mechanical Engineers. It was approved by the American Standards Association (now known as the American National Standards Institute, Inc.) as American Standard B20.1-1947.

In 1950, the Sectional Committee B20 was reorganized under the sponsorship of the Accident Prevention Department of the Association of Casualty and Surety Companies and the American Society of Mechanical Engineers. Four Subcommittees were formed to make specific recommendations for revisions. These were:

Subcommittee No. 1 — Scope and Intent
Subcommittee No. 2 — Nomenclature and Definitions
Subcommittee No. 3 — Portable Conveyors
Subcommittee No. 4 — Conveyors in General

Section 5, Definitions, was based on the conveyor industry dictionary, Conveyor Terms and Definitions, as prepared by the Technical Committee (now the Engineering Conference) of the Conveyor Equipment Manufacturers Association (CEMA).

The second edition of this Standard, dated April 1955, was submitted in draft form to the Sectional Committee for approval and distributed to industry in general for criticism and comment. Approval was then given by the Sectional Committee, the sponsors, and the American Standards Association. The Standard was designated as American Standard B20.1-1957 on December 4, 1957.

In 1967, the third edition of the Safety Standard for Conveyors and Related Equipment was submitted in draft form to representatives of industry for comment. It was subsequently approved by the Sectional Committee, the sponsors, and the American National Standards Institute for issuance as American National Standard B20.1-1972 on February 17, 1972.

The fourth edition of the Safety Standard for Conveyors and Related Equipment was undertaken in 1973 to assist the Office of Safety and Health Standards, U.S. Department of Labor, which indicated interest in the Standard.

A change in format from a specification standard to a performance standard was deemed necessary. Simply stated, the Standard describes what end result should be achieved without the limiting specification usually given by a design and without the inclusion of finite material selection or dimensions.

The fourth edition was subsequently approved by the B20 American National Standards Committee, the Secretariat, and the American National Standards Institute for issuance as American National Standard B20.1-1976 on June 14, 1976.

In accordance with the policy of the American National Standards Institute, Inc., the B20 Committee began working on a revision of B20.1-1976 in February 1980. The fifth edition was approved by the B20 Committee, the sponsor (ASME), and the American National Standards Institute for issuance as American National Standard B20.1-1984 on March 13, 1984.

Per the procedures outlined and implemented in the fifth edition, the sixth edition was approved by the B20 Committee, the sponsor (ASME), and the American National Standards Institute for issuance as American National Standard B20.1-1987 on March 11, 1987. The seventh edition was approved for issuance as an American National Standard on March 26, 1990. The eighth edition was approved for issuance as an American National Standard on August 9, 1993.

The ninth edition was a compilation of changes occurring in the 1993 edition, B20.1a-1994, and B20.1b-1995. It was approved for issuance as an American National Standard on May 23, 1997.

The 2000 edition was a compilation of changes from the B20.1a-1997 and B20.1b-1998 addenda. It was approved for issuance as an American National Standard on December 14, 2000.

Following approval by the B20 Committee and ASME, and after public review, ASME B20.1-2003 was approved by the American National Standards Institute on October 9, 2003. The 2003 edition is a revision to the B20.1-2000. This Standard shall become effective one year from the date of issuance.

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Safety standards for mechanical power apparatus are published in ANSI/ASME B15.1-1996 (Safety Standard for Mechanical Power Transmission Apparatus). Safety standards for lockout and tagout procedures are published in ANSI Z244.1-1982 (R1993) (Safety Requirements for Lock Out/Tag Out of Energy Sources) and OSHA Standard Number 29 CFR 1910.147 "The Control of Hazardous Energy (Lockout/ Tagout)." The use of recommendations and guidelines as published by the Conveyor Equipment Manufacturer's Association (CEMA) "Safety Label Brochure No. 201" and "Guidelines for Vertical Reciprocating Conveyors" published by the Conveyor Product Section of The Material Handling Institute in conjunction with ASME B20.1 is encouraged, as are the above mentioned standards.

The values stated within the Standard are in both SI and U.S. customary units, with the latter placed in parentheses. These units are essentially interchangeable and, depending on the country, as well as industry preferences, the user will determine which values are to be regarded as the standard.

Safety codes and standards are intended to enhance public safety. Revisions result from committee consideration of factors such as technological advances, new data, and changing environmental and industry needs. Revisions do not imply that previous editions were inadequate.

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ASME STANDARDS COMMITTEE B20
Safety Standard for Conveyors and Related Equipment

(The following is a roster of the Committee at the time of publication of this Standard.)

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ASME B20.1-2003
SUMMARY OF CHANGES

Following approval by the ASME B20 Committee and ASME, and after public review, ASME B20.1-2003 was approved by the American National Standards Institute on Month XX, 2003.

ASME B20.1-2003 includes the following changes identified by a margin note, **(03)**.

Page	*Location*	*Change*
iv	Foreword	(1) Penultimate paragraph added (2) Last paragraph revised
1	3	Editorially revised
3, 6	4	Definitions of *conveyor, tow* and *tow pin* revised
8	5.11.2(b)(2)	Editorially revised
8	5.12(a)	Editorially revised
13	6.17	(1) Title revised (2) New para. 6.17.1 added and subsequent paragraphs redesignated (3) Para. 6.17.2 redesignated as 6.17.1.2 (4) New paras. 6.17.2, 6.17.2.1, and 6.17.2.2 added

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SAFETY STANDARD FOR CONVEYORS AND RELATED EQUIPMENT

INTRODUCTION

Accidents resulting from the manual handling of materials have been reduced by the use of conveying and other forms of mechanical handling equipment. A further reduction in the accident rate can be gained by following safe practices in the design, construction, installation, operation, and maintenance of such equipment.

The design and installation of conveyors and conveyor systems should be supervised by qualified engineers. Likewise, the operation and maintenance of conveyors and systems should be supervised by trained personnel.

The purpose of this Standard is to present certain guides for the design, construction, installation, operation, and maintenance of conveyors and related equipment.

Those portions of this Standard relating to maintenance and operation procedures are fully as important as those relating to design and installation. The best design features may be negated by faulty maintenance and operating practices. It is important that operating and maintenance personnel be instructed in recognizing hazards and pertinent safety precautions.

1 SCOPE

This Standard applies to the design, construction, installation, maintenance, inspection, and operation of conveyors and conveying systems in relation to hazards. The conveyors may be of the bulk material, package, or unit handling types where the installation is designed for permanent, temporary, or portable operation.

This Standard shall apply, with the exceptions noted below, to all conveyor installations.

This Standard specifically excludes any conveyor designed for, installed for, or used primarily for the movement of human beings. This Standard does, however, apply to certain conveying devices that incorporate within their supporting structure work stations or operator's stations specifically designed for authorized operating personnel.

This Standard does not apply to conveyors such as underground mine conveyors for which specific standards are already in effect, or to equipment such as industrial trucks, tractors, trailers, automatic guided vehicles, tiering machines (except pallet load tierers), cranes, hoists, power shovels, power scoops, bucket drag lines, trenchers, platform elevators designed to carry passengers or an operator, manlifts, moving walks, moving stairways (escalators), highway or railroad vehicles, cableways, tramways, dumbwaiters, pneumatic conveyors, robots, or integral machine transfer devices. Some of the foregoing have specific standards.

The provisions of this Standard shall apply to equipment installed one year after the date of issuance.

2 REFERENCE TO OTHER CODES

Certain other codes and standards have been cited as references in this Standard. Reference to them does not constitute inclusion of the complete text of such codes or standards as a part of this Standard.

This Safety Standard for conveyors is supplementary to any law or code covering fire or health regulations.

3 INTENT (03)

The intent of this Standard is to provide for safe operation and maintenance of conveying equipment.

Suggestions for improvement of this Standard may be submitted to the Secretary of the B20 Committee, ASME, Three Park Avenue, New York, NY 10016-5990.

Proposals should be written in accordance with the following format:

(a) Specify page and paragraph designation of the pertinent Standard.

(b) Indicate suggested change (addition, deletion, revision, etc.).

(c) Briefly state reason and/or evidence for suggested change.

(d) Separately submit suggested changes if more than one paragraph is affected.

The B20 Committee will consider each suggested change at its first meeting after receipt of the suggested change(s).

The B20 Committee will render an interpretation of any requirement of the Standard. Interpretations will be rendered only in response to a written request sent to the Secretary of the B20 Committee, ASME International, Three Park Avenue, New York, NY 10016-5990.

The request for interpretation shall be in the following format:

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Subject: Cite the applicable paragraph number(s) and provide a concise description.

Edition: Cite the applicable edition of the standard for which the interpretation is being requested.

Question: Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME committee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

4 DEFINITIONS[1]

actuator: a device that initiates the action of controls or controllers and is mannually operated. The actuator may be a push button, toggle switch, foot pedal, hand lever, hand-set timer, or any other device that performs the described function.

antirunaway: a safety device to stop a declining conveyor and thus prevent moving away in the event of a mechanical or electrical failure.

apron pan: one of a series of overlapping or interlocking plates or shapes that, together with others, form the conveyor bed.

automatically controlled: describes the operation be the action of a mechanism that is initiated by some impersonal influence, such as a conveyor that is started by a low level bin indicator.

backstop: a mechanical device to prevent reversal of a loaded conveyor under action of gravity when forward travel is interrupted.

bed

(a): that part of a conveyor upon which the load or carrying medium rests or slides while being conveyed

(b): in bulk material conveyors, the mass of material being conveyed

belt idler: a roller or series of rollers that supports the belt of a belt conveyor.

belt tripper: a device incorporating a system of pulleys that causes the conveyor belt to discharge material at one or more points along the length of the conveyor.

boom: a cantilevered member or structure that may be hinged, fixed, or pivoted.

brake: a friction device for slowing down conveyor components, bringing conveyor equipment to a controlled stop, holding traveling or traversing equipment in a selected location, preventing reverse travel, and controlling overspeed due to the action of gravity.

bunker: a large bin or compartment for storage of bulk materials.

car unloader: a type of conveyor characterized by a shallow, horizontal loading section that enables it to receive and unload material from hopper bottom cars without requiring a pit or other excavation.

carrier

(a): a device attached to or hung from trolleys to support the load

(b): the receptacle in which objects are placed for transmittal through a conveying system

(c): the moving part of a vertical or inclined reciprocating conveyor that supports the load

chain: a series of links pivotally joined together to form a medium for conveying or transmitting motion or power. General classes of chain common to conveyors are detachable, pintle, combination, roller, rivetless, coil, inverted tooth, and bar link chains.

chute: a trough through which bulk materials or objects are directed and lowered by gravity. The trough may be open or enclosed, straight of curved.

control: the system governing the starting, stopping, direction of motion, acceleration, speed, retardation, identification, and function of the moving member in a predetermined manner.

controller: an electromechanical device or assembly of devices for starting, stopping, accelerating, or decelerating a drive, or serving to govern in some predetermined manner the power delivered to the drive.

conveying medium: that portion of a conveyor that moves or carries materials, packages, or objects.

conveyor: a horizontal, inclined, or vertical device for moving or transporting bulk material, packages, or objects, in a path predetermined by the design of the device, and having points of loading and discharge, fixed or selective. Included are skip hoists and vertical reciprocating and inclined reciprocating conveyors. Typical exceptions are those devices known as industrial trucks, tractors, trailers, tiering machines (except pallet load tierers), cranes, hoists, power shovels, power scoops, bucket drag lines, trenchers, platform elevators designed to carry passengers or an operator, manlifts, moving walks, moving stairways (escalators), highway

[1] Many definitions were extracted from the latest revision of Conveyor Terms and Definitions, Book No. 102, prepared by the Engineering Conference of the Conveyor Equipment Manufacturers Association, Washington, DC 20850. For definitions of terms other than those defined in Section 4, refer to this publication.

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or railway vehicles, cableways, tramways, dumbwaiters, pneumatic conveyors, robots, or integral machine transfer devices.

conveyor belt: a belt used to carry materials and transmit the power required to move the load being conveyed.

conveyor screw: the material propelling medium of a screw conveyor generally consisting of an assembly of helical flights mounted on a rotating pipe or shaft.

conveyor, apron: a conveyor in which a series of apron pans forms a moving bed.

conveyor, belt: an endless fabric, rubber, plastic, leather, or metal belt operating over suitable drive, tail end, and bend terminals and over belt idlers or slider bed for handling bulk materials, packages, or objects placed directly upon the belt.

conveyor, bucket: any type of conveyor in which the material is carried in a series of buckets.

conveyor, chain: any type of conveyor in which one or more chains act as the conveying medium; a British term for trolley conveyor.

conveyor, declining: a conveyor transporting down a slope.

conveyor, electrified monorail: a conveyor consisting of a network of tracks or guide rails that may be installed horizontally, vertically, inclined, or in combination with one or more self-propelled cars or trolleys that move independently under automatic control from one point to another within the track network, carrying material in containers or by devices suspended from or attached to the cars or trolleys.

conveyor, en masse: a conveyor, comprised of a series of skeleton or solid flights on an endless chain or other linkage, that operates in horizontal, inclined, or vertical paths within a closely fitted casing for the carrying run. Bulk material is conveyed and elevated in a substantially continuous stream with a full cross section of the casing.

conveyor, extendable: a conveyor that may be lengthened or shortened to suit operating needs.

conveyor, flight: a type of conveyor comprised of one or more endless propelling media, such as chain, to which flights are attached, and a trough through which material is pushed by the flights.

conveyor, horizontal reciprocating: a conveyor that progressively advances material by a back-and-forth motion of its conveying medium. It may be equipped with hinged flights or tilting dogs or pushers. These units operate generally in the range of 0 degrees to 30 degrees from the horizontal.

conveyor, inclined reciprocating: a reciprocating power or gravity actuated unit (not designed to carry passengers or an operator) that receives objects on a carrier. These units operate on inclines generally in the range of 30 degrees to 70 degrees from the horizontal.

conveyor, live roller: a series of rollers over which objects are moved by the application of power to all or some of the rollers. The power transmitting medium is usually belting or chain.

conveyor, mobile: conveyor, supported on a structure, which is movable under its own power and includes, but is not limited to, radial stackers, winged stackers, reclaiming conveyors, and shiploaders. These conveyors normally handle bulk material.

conveyor, oscillating: a type of vibrating conveyor having a relatively low frequency and large amplitude of motion, usually powered by a rotating eccentric.

conveyor, overland: a single or series of belt conveyors designed to carry bulk material across country, usually following the general contour of the land.

conveyor, portable: a transportable conveyor that is not self-propelled, usually having supports that provide mobility.

conveyor, power and free: a conveying system wherein the load is carried on a trolley or trolleys that are mechanically propelled through part of the system and may be gravity or mannually propelled through another part. This arrangement provides a means of switching the free trolleys into and out of adjacent lines. The spur or subsidiary lines may or may not be powered.

conveyor, pusher bar: two endless chains cross-connected at intervals by bars or rotatable pushers that propel the load along the bed or trough of the conveyor.

conveyor, reciprocating: a conveyor where the carrier or pusher moves forward and back, or up and down, in the same plane.

conveyor, roller: a series of rollers supported in a frame over which objects are advanced manually, by gravity, or by power.

conveyor, roller slat: a slat conveyor using rollers for slats.

conveyor, screw: a conveyor screw revolving in a suitably shaped stationary trough or casing fitted with hangers, trough ends, and other auxiliary accessories.

conveyor, shuttle: any conveyor such as a belt, chain, apron, screw, etc., in a self-contained structure, movable in a defined path parallel to the flow of the material.

conveyor, slat: a conveyor employing one or more endless chains to which non-overlapping, non-interlocking spaced slats are attached.

conveyor, suspended tray: a vertical conveyor, having one or more endless chains with suitable pendant trays, cars, or carriers, that receives objects at one elevation and delivers them to another elevation.

conveyor, tow: an endless belt or cable driven system, or chain supported by trolleys from an overhead track or (03)

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running in a track with means for towing floor-supported or rail-guided trucks, dollies, or carts.

conveyor, trolley: a series of trolleys supported from or within an overhead track and connected by endless propelling means, such as chain, cable, or other linkage, with loads usually suspended from the trolleys.

conveyor, vertical articulated: a type of vertical conveyor in which sections of articulated slat conveyor apron form rigid carriers for vertical movement in continuous flow. The carriers are flexible in but one direction, and they assume a vertical position on the noncarrying run to minimize space requirements.

conveyor, vertical chain, opposed shelf type: two or more vertical elevating-conveying units opposed to each other. Each unit consists of one or more endless chains whose adjacent facing runs operate in parallel paths. Thus each pair of opposing shelves or brackets receives objects (usually dish trays) and delivers them to any number of stations.

conveyor, vertical reciprocating: a reciprocating power or gravity actuated unit (not designed to carry passengers or an operator) that receives objects on a carrier and transmits these objects vertically between two or more levels.

conveyor, vibrating: a trough, tube, or other device flexibly supported and vibrated at a relatively high frequency and small amplitude to convey bulk material or objects; usually powered by an electrical or pneumatic impulse.

conveyor, wheel: a series of wheels supported in a frame over which objects are moved mannually or by gravity.

deflector

(a): a device across the path of a conveyor placed at an angle and designed to deflect objects

(b): a plate inserted in the trajectory of a bulk material discharge to change direction

drive: an assembly of the necessary structural, mechanical, and electrical parts that provide the motive power for a conveyor.

drum: a cylindrical or polygonal rim type of wheel around which cable, chain, belt, or other linkage may be wrapped. A drum may be drive or driving. The face may be smooth, grooved, fluted, or flanged.

dumbwaiter: a type of material lifting device specifically limited to a platform area of 0.8 m^2 (9 ft^2) or less, and inside car height of 1.2 m (4 ft) or less, and a hoistway door height of 1.24 m (4 ft 1 in.) or less.[2]

emergency stop: a stop arising from a sudden and unexpected need, and not as a part of the normal operation.

emergency stop device: a device that can be actuated in an emergency situation to stop a conveyor.

enclosed: describes guarding of moving parts in such a manner that inadvertent physical contact by parts of the body is precluded as long as the guard or enclosure remains in place. The guarding may make use of hinged, sliding, or removable doors for inspection or service.

flight

(a): plain or shaped plates suitably made for attachment to the propelling medium of a flight conveyor.

(b): a term applied to any section of a conveyor in a tandem series.

gate: a device or structure by means of which the flow of material may be stopped or regulated; also, a section of conveyor equipped with a hinge mechanism for movable service, often called a hinged section.

grating

(a): a coarse screen made of parallel or crossed bars to prevent passage of oversize material

(b): a series of parallel and crossed bars used as platform or walkway floors, or as coverings for pits and trenches over which traffic may pass. Generally removable to permit access to conveying equipment for servicing

(c): a series of parallel or cross bar units, or both, fastened to or propelled by the conveying medium, used for carrying large lump-sized bulk material or objects. Generally used to permit passage of air for cooling or heat to maintain temperature

guard

(a): a covering, barricade, grating, fence, or other form of barrier used to prevent inadvertent physical contact with operating components such as gears, sprockets, chains, and belts

(b): a structure mounted below an overhead mounted conveyor to protect personnel from falling materials

guarded: shielded, fenced, enclosed, or otherwise protected by means of suitable enclosure, covers, casing, shields, troughs, railings, or by nature of location so as to reduce risk of personal injury.

guarded by location: describes moving parts so protected by their remoteness from the floor, platform, walkway, or other working level, or by their location with reference to frame, foundation, or structure as to reduce risk of accidental contact by persons or objects. Remoteness from regular or frequent presence of public or employed personnel may, in reasonable circumstances, constitute guarding by location.

hopper: a box having a funnel-shaped bottom, or a bottom reduced in size, narrowed, or necked to receive material and direct it to a conveyor, feeder, or chute.

inactive controls: those controls that are not a part of, or do not contribute to, the present or future contemplated use of the conveyor or system as presently installed and wired.

[2] See ASME A17.1 for dumbwaiter safety requirements.

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integral machine transfer device: a part of a machine that loads, unloads, or transfers material (parts) from one location to another within the machine, during processing of the material, and without which the machine could not perform its function. Typically, both the machine and transfer device are supplied together and share the power and control systems.

limit switch: an electrical device by which the movement of a conveyor and allied equipment may be controlled within predetermined limits.

nip point: a point at which a machine element moving in line meets a rotating element in such a manner that it is possible to nip, pinch, squeeze, or entrap a person or objects coming into contact with one of the two members. The same definition holds for the similar point with respect to two rotating parts or two converging parts in linear movement.

operator's station: location at which actuators are placed for the purpose of starting, stopping, reversing, or otherwise controlling the conveyor or system of conveyors in the course of normal operation.

overload device: a mechanical or electrical device designed to disconnect the driven equipment from the driving equipment in event of an overload on the conveyor.

platform: a working space for persons, elevated above the surrounding floor or ground (such as a balcony) for the operation of machinery and equipment.

prevent: when used in a context such as prevent access or prevent physical contact, means to impede or block; when used in the context such as prevent injury, means to reduce the chances of, but does not imply that an injury cannot occur.

qualified person: a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve problems relating to the subject matter and work.

rail

(a): one of the longtitudinal members in a conveyor frame

(b): the supporting surface under the wheels or rollers of a chain conveyor

(c): the supporting track for equipment mounted on wheels, such as belt tripper, weigh larry, etc

(d): the vertical members that guide the pendant trays, cars, or carriers in a suspended vertical tray conveyor

rail clamp: an attachment or device for clamping a mobile conveyor or belt tripper to the rail to hold it in a fixed location.

rail stop: a stop mounted on the conveyor rails to limit the travel of traversing machinery.

railing guard (guardrail): a structure consisting of rails and posts, including top rail, post, and, where required, toeboards.

rated capacity: the capacity at the rated speed, as established by the manufacturer or a qualified person, at which safe and satisfactory service can be expected.

rated speed: the speed of the conveyor, as established by the manufacturer or a qualified person, at which safe and satisfactory service can be expected.

remote control: any system of controls in which the actuator is situated in a remote location.

remote location: any location, with respect to the conveyor, from which the presence or position of personnel relative to the conveyor cannot be readily determined from the operator's station.

roller

(a): a revolving cylinder or wheel over which something is moved. The face may be straight, tapered, crowned, concave, or flanged; corrugated, ribbed, or fluted

(b): a component part or a roller chain in which it may serve only to reduce frictional loss occurring as the chain passes over the sprockets. Rollers may also serve as the rolling support for the chain and the load being conveyed

(c): the rotating element upon which a conveyor belt or chain or the object being transported is carried

roller turn: a series of vertical rollers mounted in a frame to guide conveyor chain around a horizontal curve.

safety device: a mechanism or an arrangement placed in use for the specific purposes of preventing an unsafe condition, preventing the continuation of an unsafe condition, warning of an unsafe condition, or limiting or eliminating the unsafe effects of a possible condition.

shall: as used in the context of a provision of this Standard, indicated that the provision is mandatory and must be followed.

shear point or line: the point at which, or the line along which, a moving part meets or passes close enough to a stationary or moving part or object so that part of the human body can be caught, trapped, or pinched between them.

shield guard: a full or partial enclosure or cover, either framed or solid, made from material sufficiently rigid to prevent accidental contact with moving parts.

should: as used in the context of a provision of this Standard, indicates a recommendation, the advisability of which depends on the facts in a particular situation.

skip bucket: the tub or bucket used for containing the material conveyed by a skip hoist.

skip hoist: a bucket or car operating up and down a defined path receiving, elevating, and discharging bulk materials.

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slat: a member supported between chains in a slat conveyor; the series of slats form the conveying medium.

snub roller: any pulley used to increase the arc contact between a belt and drive or trail pulley.

spill guard: a stationary device of sufficient strength and capacity to catch, retain, and contain any reasonably foreseeable spillage from a conveyor passing overhead that might cause personal injury.

stacker: a conveyor adapted to piling or stacking bulk materials, packages, or objects.

switch

(a): a device for connecting two or more continuous package conveyor lines

(b): an electrical control device

(c): a mechanism that transfers a trolley, carrier, or truck from one track to another at a converging or diverging section

switch, slack cable: a device installed to automatically shut off the power supply when the hoisting cable becomes slack or has slack due to accident or jamming.

take-up: the assembly of the necessary structural and mechanical parts that provides the means to adjust the length of belts, cables, chains, etc., to compensate for stretch, shrinkage, or wear, and to maintain proper tension.

terminal: a term normally applied to the extreme ends of a belt system, i.e., head and tail pulleys.

tow pin: a moveable or fixed member on a truck, dolly, or cart used to engage the power system on a tow conveyor.

tracks: the beams, shapes, or formed section on which trolleys, rollers, shoes, or wheels roll or slide while being propelled.

transfer car: any wheeled device used for transferring loads from one conveyor line to another; may be mannually or automatically operated.

transfer mechanism: any mechanism that transfers objects onto or off a conveyor line or from one conveyor line to another.

tray: a car, carrier, or pallet, usually suspended from the moving element of the conveyor, used to carry conveyed loads.

tread plate: a plate of suitable size fitted between conveyor rollers to permit persons to use it as a working or walking surface.

trolley: an assembly of wheels, bearings, and brackets used for supporting and moving suspended loads or for carrying load connecting and conveying elements such as chain, cable, or other linkage.

truck (also known as cart)

(a): an assembly that supports another unit in either a fixed or adjustable position and that provides mobility

(b): a wheeled vehicle that can be detached from a conveying medium (usually chain) and pushed by hand

walkway: an elevated passageway for persons above the surrounding floor or ground level, including catwalks, footwalks, runways, and elevated walkways.

work station: a physical location where a person is normally positioned, which is located by design and supported with facilities necessary for a person to perform prescribed work duties. This position would not apply to maintenance location.

5 GENERAL SAFETY STANDARDS[3]

5.1 Application

Conveyor equipment shall be used to convey only the specified commodities or materials within the rated capacity and the rated speed. Where special use is not indicated, or ratings are not available, good industry practice shall be used.

5.2 Maintenance (Repair)

(a) Maintenance and service shall be performed by qualified and trained personnel.

(b) Where lack of maintenance and service would cause a hazardous condition, the user shall establish a maintenance program to ensure that conveyor components are maintained in a condition that does not constitute a hazard to personnel.

(c) No maintenance or service shall be performed when a conveyor is in operation except as provided in paras. 5.3 and 5.4.

(d) When a conveyor is stopped for maintenance or service, the starting devices, prime movers, or powered accessories shall be locked or tagged out in accordance with a formalized procedure designed to protect all persons or groups involved with the conveyor against an unexpected restart. Personnel should be alerted to the hazard of stored energy, with may exist after the power source is locked out. Refer to ANSI Z244.1-1982, American National Standard for Personnel Protection — Lockout/Tagout of Energy Sources — Minimum Safety Requirements, and OSHA Standard 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)."

(e) All safety devices and guards shall be replaced before starting equipment for normal operation.

5.3 Lubrication

(a) Conveyors shall not be lubricated while in operation unless it is impractical to shut them down for lubrication. Only trained and qualified personnel who are aware of the hazards of the conveyor in motion shall be allowed to lubricate a conveyor that is operating.

[3] IMPORTANT: The general safety standards in Section 5 form a part of, and must be used with, the specific standards in Section 6.

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(b) Where the drip of lubricants or process liquids on the floor constitutes a hazard, drip pans or other means of eliminating the hazard shall be provided.

5.4 Adjustment or Maintenance During Operation

When adjustment or maintenance must be done while equipment is in operation, only trained and qualified personnel who are aware of the hazard of the conveyor in motion shall be allowed to make adjustment or perform the maintenance or service.

5.5 Backstops and Breaks

Antirunaway, brake, or backstop devices shall be provided on all incline, decline, or vertical conveyors, where the effect of gravity will allow uncontrolled lowering of the load and where this load will cause a hazard to personnel.

5.6 Overload Protection

Where overload conditions would cause damage to equipment that could result in a personal injury, overload devices or suitable warning means shall be provided.

5.7 Gates and Switches

(a) Power positioned gate and switch sections shall be provided with devices that will prevent these sections from falling in case of power failure.

(b) Means shall be provided on all gate and switch sections to prevent conveyed material from discharging into the open area, created by lifting of the gate or switch.

5.8 Counterweights

When counterweights are supported by belts, cables, chains, and similar means, weights shall be confined in an enclosure to prevent the presence of personnel beneath the counterweight. As an alternative the arrangement shall provide a means to restrain the falling weight in case of failure of the normal counterweight support.

5.9 Guards and Guarding

5.9.1 General Requirements of Guarding

5.9.1.1 Guarding. Where necessary for the protection of personnel from hazards, all exposed moving machinery parts that present a hazard to personnel at work stations or operator's stations shall be mechanically or electrically guarded, or guarded by location or position.

5.9.1.2 Interfacing of Equipment. When two or more pieces of equipment are interfaced, special attention shall be given to the interfaced area to ensure the presence of adequate guarding and safety devices.

5.9.1.3 Guarding Exceptions. Wherever conditions prevail that would require guarding under this Standard but such guarding would render to conveyor unusable, prominent warning means, such as signs or warning lights, shall be provided in the area or on the equipment in lieu of guarding.

5.9.1.4 Maintenance of Guards and Safety Devices. Guards and safety devices shall be maintained in a serviceable and operational condition. Warning signs provided in accordance with para. 5.9.1.3 shall be maintained in a legible/operational condition.

5.9.2 Guarding by Location or Position

(a) Remoteness from frequent presence of public or employed personnel shall constitute guarding by location.

(b) Overhead conveyors, such as trolley conveyors and hanger-suspended tray conveyors, for which guarding would render the conveyor unusable or would be impracticable, shall have prominent and legible warnings posted in the area or on the equipment and, where feasible, lines shall be painted on the floor delineating the danger area.

(c) When a conveyor passes over a walkway, roadway, or work station, it is considered guarded by location if all moving parts are at least 2.44 m (8 ft) above the floor or walking surface or are otherwise located so that personnel cannot inadvertently come in contact with hazardous moving parts.

(d) Although overhead conveyors may be guarded by location, spill guards, pan guards, or equivalent shall be provided if material may fall off the conveyor and endanger personnel.

5.9.3 Guarding of Nip and Shear Points. In general, nip and shear points shall be guarded unless other means to ensure safety are provided. See Section 6 for specific conveyors.

5.10 Headroom

(a) When conveyors are installed above exit passageways, aisles, or corridors, there shall be provided a minimum clearance of 2.00 m (6 ft 8 in.) measured vertically from the floor or walking surface to the lowest part of the conveyor or guards.

(b) Where system function will be impaired by providing the minimum clearance of 2.00 m (6 ft 8 in.) through an emergency exit, alternate passageways shall be provided.

(c) It is permissible to allow passage under conveyors with less than 2.00 m (6 ft 8 in.) clearance from the floor for other than emergency exits if a suitable warning indicates low headroom.

5.11 Controls

5.11.1 Electrical Code. All electrical installations and wiring shall conform to the National Electrical Code (Article 670 and other applicable articles) as published by the National Fire Protection Association and as

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approved by the American National Standards Institute, Inc.

5.11.2 Control Station

(a) Control stations should be so arranged and located that the operation of the affected equipment is visible from them. Control stations shall be clearly marked or labeled to indicate the function controlled.

(b) A conveyor that would cause injury when started shall not be started until personnel in the area are alerted by a signal or by a designated person that the conveyor is about to start.

(1) When a conveyor that would cause injury when started is automatically controlled or must be controlled from a remote location, an audible device or devices shall be provided that can be clearly heard at all hazardous points along the conveyor where personnel may be present. The audible warning shall be actuated by the controller device starting the conveyor and shall continue for a required period of time before the conveyor starts. A flashing light or similar visual warning may be used in conjunction with, or in place of, the audible device if a visual warning is more effective.

(03) *(2)* Where system function would be seriously hindered or adversely affected by the required time delay, or where the intent of the warning may be misinterpreted (i.e., a work area with many different conveyors and allied devices), a clear, concise, and legible warning sign shall be provided. The warning sign shall indicate that conveyors and allied equipment may be started at any time, that danger exists, and that personnel must keep clear. These warning signs shall be provided along the conveyor at areas not guarded by position or location.

(c) Remotely and automatically controlled conveyors and conveyors where operator stations are not manned or are beyond voice or visual contact from drive areas, loading areas, transfer points, and other potentially hazardous locations on the conveyor path not guarded by location, position, or guards shall be furnished with emergency stop buttons, pull cords, limit switches, or similar emergency stop devices.

(1) All such emergency stop devices shall be easily identifiable in the immediate vicinity of such locations unless guarded by location, position, or guards. Where the design, function, and operation of such conveyor clearly is not hazardous to personnel, an emergency stop device is not required.

(2) The emergency stop device shall act directly on the control of the conveyor concerned and shall not depend on the stopping of any other equipment. The emergency stop devices shall be installed so that they cannot be overriden from other locations.

(d) Inactive and unused actuators, controllers, and wiring should be removed from control stations and panel boards, together with obsolete diagrams, indicators, control labels, and other material that might confuse the operator.

5.11.3 Safety Devices. All safety devices, including wiring of electrical safety devices, shall be arranged to operate such that a power failure or failure of the device itself will not result in a hazardous condition.

5.11.4 Emergency Stops and Restarts. Conveyor controls shall be so arranged that, in case of emergency stop, manual reset or start at the location where the emergency stop was initiated shall be required for the conveyor(s) and associated equipment to resume operation.

Before restarting a conveyor that has been stopped because of an emergency, an inspection of the conveyor shall be made and the cause of the stoppage determined. The starting device shall be locked or tagged out before any attempt is made to remove the cause of the stoppage, unless operation is necessary to determine the cause or to safely remove the stoppage. Refer to ANSI Z244.1-1982, American National Standard for Personnel Protection — Lockout/Tagout of Energy Sources — Minimum Safety Requirements, and OSHA Standard Number 29 CFR 1910.147 "The Control of Hazardous Energy (Lockout/Tagout)."

5.12 Operation

(a) Only a trained person shall be permitted to operate a conveyor. Training shall include instruction in operation under normal conditions and emergency situations. This provision does not apply to the interface of the public with conveyors indended for public use, such as at checkout counters. (03)

(b) Where safety is dependent upon stopping devices or starting devices or both, they shall be kept free of obstructions to permit ready access.

(c) The area around loading and unloading points shall be kept clear of obstructions that could endanger personnel.

(d) No person shall ride on a conveyor, except on a slow-moving assembly conveyor 0.4 m/s (80 ft/min) maximum or on a conveyor that incorporates a station specifically designed for operating personnel.

(e) Personnel working on or near a conveyor shall be instructed as to the location and operation of pertinent stopping devices.

(f) A conveyor shall be used to transport only loads it is designed to handle safely.

(g) Under no circumstances shall the safety characteristics of the conveyor be altered if such alterations would endanger personnel.

(h) Routine inspections and corrective maintenance measures shall be conducted to ensure that all guards and safety features are retained and function properly.

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(i) Personnel should be alerted to the potential hazard of entanglement in conveyors caused by items such as long hair, loose clothing, and jewelry.

(j) Conveyors shall not be maintained or serviced while in operation unless proper maintenance or service requires the conveyor to be in motion. In this case, personnel shall be made aware of the hazards and how the task may be safely accomplished.

5.13 Transfer, Loading, and Discharge Points

(a) At transfer, loading, and discharge points where unconfined and uncontrolled free fall of material can result from flooding, ricocheting, overloading, trajectory, leakage, or a combination thereof, such unconfined and uncontrolled free fall of material shall be prevented if it would create a hazard to personnel.

(b) In the absence of a guard or barrier specifically erected to protect personnel, warnings shall be provided to restrict unauthorized personnel from entering hazardous loading, unloading, and transfer areas.

5.14 Hoppers and Chutes

(a) All openings to hoppers and chutes shall be guarded to prevent personnel from accidentally falling or stepping into them or allowing any part of their body to make contact with conveyors below them. Where guards are not practical, warning signs shall be posted. If the hopper or chute is equipped with a grating to protect against contacting the conveyors below, such grating will be considered as sufficient guarding provided that one dimension of the opening does not exceed 50 mm (2 in.).

(b) Dump hoppers having the hopper flush with the floor and which by their use cannot be guarded shall be equipped with grating having a maximum opening of 50 mm (2 in.) and shall be heavy enough to withstand any load of personnel or trucks, etc., that may be imposed on it. If the openings in the grating are larger or if no grating is provided, temporary railing guard shall be placed around ground level hoppers when dumping operations are not in progress. During dumping operations, warning signs shall be placed in conspicuous locations warning personnel of an open pit. If there is a need to give operators of trucks, loaders, or bulldozers a reference to the hopper location, guide posts shall be used.

5.15 Fire Safety

This Standard is not intended to address fire-related considerations. Applicable national, state, and local codes should be complied with.

6 SPECIFIC SAFETY STANDARDS[3]

6.1 Belt Conveyors — Fixed in Place

6.1.1 Safety Considerations

(a) Nip and shear points shall be guarded. Typical locations are:

(1) at terminals, drives, take-ups, pulleys, and snub rollers where the belt changes direction

(2) where belts wrap around pulleys

(3) at the discharge end of a belt conveyor

(4) on transfers and deflectors used with belt conveyors

(5) at take-ups

(b) It is not the intent of this requirement to provide guarding along the conveyor length where the belt rides on the carrying or return rollers.

(c) Take-up mechanisms may be guarded as an entity by placing standard railings or fencing around the area with suitable warning signs, as an alternative to guarding individual nip and shear points.

(d) On overland conveyors, audible or visual (or both) signalling devices for warning conveyor initiation shall be required only at the transfer, loading, and discharge points, or at those points where personnel are normally stationed.

(e) On long overland belt conveyors where a pedestrian overpass or underpass is required, they shall be installed at intervals consistent with usage, normally not to exceed 300 m (1,000 ft).

6.1.2 Operation and Maintenance

(a) Only trained personnel shall track a conveyor belt, which must be done while the conveyor is operating.

(b) The practice of applying a belt dressing or other foreign material to a rotating drive pulley or a conveyor belt is hazardous and should be avoided.

(c) The use of portable emergency stop controllers in lieu of permanently installed pull cords, push button stations, etc., shall be permitted for maintenance personnel who patrol overland conveyors. At those points where personnel are normally stationed, the conveyors shall be equipped with permanently installed pull cords or similar stop controllers.

6.2 Bucket Conveyors

6.2.1 Guarding

(a) Guards shall be provided at points where personnel could come in contact with cables, chains, belts, and runways of exposed bucket conveyors.

(b) Inspection doors or maintenance doors or both should include signs warning of possible danger if opened or removed while the conveyor is in operation.

6.3 Chain Conveyors

6.3.1 Safety Considerations

(a) Chain conveyors, by necessity, have moving chains that cannot be enclosed without impairing the function. They shall be provided with warning signs or personnel barriers, unless guarded by location.

(b) Where a chain conveyor is raised and lowered as a transfer mechanism, mounted within another conveyor,

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and where enclosure would impair the function, warning signs or personnel barriers shall be provided, unless guarded by location.

6.4 En Masse Conveyors

6.4.1 Safety Considerations. En masse conveyors are not considered as free standing and are to be braced at intervals indicated by the manufacturer. Eccentric platform loads or other lateral loads may require lateral bracing or other bracing or both.

6.4.2 Guarding. Inspection doors or maintenance doors or both should include signs warning of possible danger if opened or removed while conveyor is in operation.

6.4.3 Operation and Maintenance

(a) Where flight cleaning or casing cleaning or both are required, they shall be performed by trained personnel, with conveyor power supply locked out. Special attention may be required at feed and discharge points.

(b) When coupling or uncoupling the en masse conveyor line, the line shall be restrained to prevent injury through the uncontrolled travel of the broken line.

6.5 Flight and Apron Conveyors — Bulk Material

6.5.1 Safety Considerations. Inclined apron conveyors shall be equipped with lifting blades when the conveyor inclination exceeds the angle of slide of the design material.

6.5.2 Operation and Maintenance. At installation, flight and apron conveyors should be "jogged" or hand run through at least one complete revolution to check design clearances prior to running under automatic power.

Flight and apron conveyors handling sticky materials, which tend to build up, shall be cleaned as often as required for safe operation.

6.6 Inclined Reciprocating Conveyors

6.6.1 Safety Considerations

(a) Means shall be provided to prevent hazard to personnel in the event of mechanical or electrical failure. The carrier must be equipped with backstop devices sufficient to stop and to hold the carrier and load.

(b) Overtravel devices shall be provided where necessary to minimize potential for injury to personnel.

(c) Riding the conveyor shall be forbidden to all personnel. Warning signs to this effect shall be prominently posted at each point of access and each point of operation.

6.6.2 Guarding

(a) The conveyor shall be guarded so as to prevent injury from inadvertent physical contact.

(b) The conveyor housing shall be equipped with doors or an equivalent means at each manual loading and unloading station, interlocked so that they can be opened only when the carrier has stopped at that level and such that the carrier cannot be actuated until they are closed.

(c) Inclined reciprocating conveyors that automatically receive and discharge material may have interlocked doors as in (b) above or, as an alternative, may be guarded by a suitable enclosure extending from the path of the moving carrier.

(d) Where the application requires that personnel walk onto the carrier to load or unload material the carrier shall be provided with standard railings, snap chains, or equivalent, across the loading/unloading side(s). Snap chains shall be at least 39 in. at their lowest point.

(e) Controls shall be installed or located so they cannot be actuated by a person on the carrier.

6.7 Live Roller Conveyors — Belt or Chain Driven

6.7.1 Safety Considerations

(a) Nip points occur between chain and sprockets on chain driven live roller conveyors.

(b) Nip points can occur between belt and carrier rollers on belt driven live roller conveyors.

(c) Nip points occur at terminals, drives, take-ups, idlers, and snub rollers where the belt changes direction. A return belt idler does not require guarding.

(d) Nip points occur on transfers and deflectors used with live roller conveyors.

(e) Shear points occur at automatic take-ups; they shall be guarded.

6.7.2 Guarding

(a) On chain driven live roller conveyors, unless guarded by location or position, the nip point between chains and sprockets shall be enclosed, to prevent entry of hands, fingers, or other parts of the body into a point of hazard by reaching through, over, under, or around the guard.

(b) On belt driven live roller conveyors, nip points between the belt and roller may be considered guarded if the load carrying rollers are spaced so as to prevent access, if plates or rods are placed between rollers, if pop-out rollers are used as load carrying rollers, or if other suitable guarding is used, such as guarding by location.

6.8 Mobile Conveyors

6.8.1 Safety Considerations

(a) Mobile conveyors shall be provided with a brake, rail clamp, or other position locking device for each motion, such as, but not limited to, luffing, slewing, and traversing, where movement would present a hazard.

(b) Limit switches shall be provided on rail mounted mobile conveyors to limit the travel within design limits. Rail stops shall be provided beyond the design travel

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limits to physically stop the mobile conveyor in case of overtravel.

(c) Sweeps shall be provided on all rail mounted mobile conveyors to deflect objects ahead of the nip points between wheels and rails where a hazard to personnel would result without the sweep.

(d) A mobile conveyor shall be designed to be stable against runaway or overturning under normal conditions of operation. Resting a portion of a mobile conveyor on the ground, a pile, or on any other support shall not cause instability of the machine.

6.8.2 Guarding

(a) Where power to electrically powered mobile conveyors is provided by trolley or rail, these conductors shall be guarded in such a manner as to prevent accidental contact by personnel.

(b) Access stairways, ladders, and platforms shall be designed and located so as to avoid hazardous shear or nip points between sections of structures that in operation move relative to each other.

6.8.3 Operation and Maintenance

(a) When a mobile conveyor exposed to high wind conditions creates a hazard to personnel, normal operation shall cease and, if necessary, the conveyor shall be moved to a parking position and secured.

(b) When an operator is required on a mobile conveyor, a platform or cab shall be constructed for his protection. The conveyor shall be designed so that, when the operator is on the platform engaged in the normal performance of his duties, he will be protected from injury.

(c) Where operation is such that there is danger of movement of the mobile conveyor into the stockpile or any other obstacle, a detector shall be provided to stop the conveyor movement.

6.9 Portable Conveyors, Extendible Belt Conveyors, and Car Unloaders

6.9.1 Safety Considerations

(a) The raising and lowering mechanism for the boom of a portable conveyor shall include in its design, or be provided with, a safety device that will hold the boom at any rated angle of inclination.

(b) A powered extendible conveyor shall be equipped with a device located on the outermost boom end that shall stop extension of the conveyor when contact is made with the device as may be required to protect personnel.

(c) An extendible conveyor shall be equipped with momentary contact push buttons without holding circuits to activate powered booms.

(d) Portable conveyors shall be stable when used within the manufacturer's rating so that the conveyor will not topple when in use or when being moved in the manner for which it was intended. When the portable conveyor must be lashed to prevent movement or overturning in high winds, a warning sign indicating the necessity shall be clearly posted.

(e) Guarding by location shall be determined with the boom in its lowest position.

6.10 Pusher Bar Conveyors

6.10.1 Safety Considerations

(a) If a hazard exists where the bar passes through the bed at the discharge end, suitable guards or warnings shall be provided at this point.

(b) Loads on the incline shall have pushers of adequate height above the bed or have top restraining members.

(c) All chains shall be guarded by suitable means, including warning signs, to prevent accidental contact with the moving chain.

(d) In a pusher bar conveyor having a roller bed, where the relationship between the height of the bar and the spacing of the rollers creates a hazard, adequate guarding shall be provided.

(e) When a shear point exists between the return pusher bar and a frame member, guarding shall be provided.

(f) When the conveyor is automatically loaded, an automatic spacer shall be provided to ensure feeding the loads ahead of the pusher bars where a hazard to personnel could exist.

(g) When a pusher bar conveyor discharges to another conveyor, means shall be provided to stop the pusher bar conveyor in the event the receiving conveyor cannot accept another load.

6.11 Roller and Wheel Conveyors

6.11.1 Safety Considerations

(a) Unit or package speeds that could create a safety hazard shall be avoided by limiting the length of the pitched run or by using speed retarders, brakes, or other means that effectively provide the control needed.

(b) Personnel shall not be allowed to walk or step on free turning rollers or wheels. Suitable means, such as tread plates, can be used between the rollers as a walking surface for designated operators in the performance of their duties.

6.11.2 Operation and Maintenance. Rollers and wheels shall be free running to prevent unintentional diverting of units being conveyed when such a diverted unit could create a hazard to personnel.

6.12 Screw Conveyors

6.12.1 Safety Considerations

(a) Screw conveyors shall not be operated unless the conveyor housing completely encloses the conveyor moving elements, and power transmission guards are in place, except as provided in (b) and (c) below.

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(b) If the conveyor must have an open housing as a condition of its use and application, the entire conveyor is then to be guarded by a railing or fence, unless guarded by location.

(c) Feed openings for shovel, front end loader, or other manual or mechanical equipment shall be constructed in such a way that the conveyor screw is covered by grating. If the nature of the material is such that a grating cannot be used, then the exposed section of the conveyor is to be guarded by a railing and there shall be warning signs posted.

6.13 Shuttle Conveyors, Belt Trippers, and Transfer Cars

6.13.1 Safety Considerations

(a) These conveyors shall be provided with a brake, rail clamp, or other position locking device.

(b) Means shall be provided to limit travel. Stops shall be provided beyond the normal travel limits to stop the conveyor in case of overtravel.

(c) When the conveyor and its path are obstructed from view of the controlling operator, the conveyor shall have a device to warn of its movement or provide other means to ensure personnel safety in the area.

(d) Sweeps shall be provided for all moving cars, trippers, or shuttles to deflect objects ahead of pinch points between wheels and rails, where a hazard to personnel would result without the sweep.

(e) Although all nip and shear points shall be guarded, it is not the intent of this requirement to provide guards where the belt rides on the idlers.

(f) Trippers or shuttles may discharge into silo or bunker openings, with or without seals. In either case, openings shall be provided with grating to suit the material being handled, and the width of the openings shall not be large enough to permit personnel to fall through. Where material size requires openings that would permit personnel to fall through, the openings shall be protected by other means.

(g) Where power is electrically provided via trolley or rail, these power conductors shall be guarded in such a manner as to prevent accidental contact by personnel. In explosive areas, explosion-proof equipment and cable reels shall be used instead of trolley and rail.

(h) When a person is required to move with the shuttle, tripper, or transfer car, a work station shall be provided for his/her protection.

6.14 Skip Hoists — Bulk Materials

6.14.1 Safety Considerations

(a) Limit switches shall be provided to establish limits of travel of the skip bucket. Additional switches shall be provided to interrupt the power supply and actuate the hoist brake whenever the skip bucket, through failure of the design travel limit switches or for any other reason, exceeds the design travel limit by a predetermined safe distance.

(b) Slack cable switches shall be provided and so arranged that whenever the skip hoisting rope or the counterweight hoisting rope develops slack or loses tension due to sticking in the guides, overtravel, or for any other reason, power to the drive will be cut off and the brake will be set.

(c) Riding the skip bucket by personnel shall be forbidden.

6.14.2 Guarding

(a) All sheaves shall be fitted with sheave guards to prevent the wire rope from coming off the sheaves under a slack cable or similar condition.

(b) The guarding of the wire rope and drum on the hoist is normally not practical due to fleet angle requirements. If the hoist unit is located in an area that is generally accessible, then a complete wire mesh or similar guard shall be placed around the hoist. This guard is not required when guarded by location.

6.14.3 Operation and Maintenance

(a) The following wearing parts should be regularly and frequently inspected by qualified maintenance personnel and should be maintained regularly or replaced when the degree of wear indicates possibility of failure before the next inspection:

(1) brake shoes and brake operating parts
(2) hoisting ropes, clamps, and attachments
(3) sheaves, particularly head sheaves
(4) tracks, wheels, and mechanisms
(5) limit switches and slack cable device

(b) Whenever the brake or any parts of the drive train between the brake and the drum shaft are being repaired or replaced, the skip bucket and counterweight shall be blocked in their guides.

6.15 Slat Conveyors and Roller Slat Conveyors

6.15.1 Safety Considerations. A slat conveyor can present a shear point when the gap between the slats is great enough to permit access to cross members below the slats. At these points all members should be a safe distance away from the slats, or a continuous pan under the slats should be provided.

6.15.2 Guarding. A hazard exists at the tail end of a slat conveyor in which the slats are above the center line of the chain. The gap between slats closes when the slats reach the top surface of the conveyor. This area should be guarded. If the material flow enters over the tail sprocket, making guards impractical, a warning sign should identify the hazard.

6.16 Suspended Vertical Tray Conveyors

6.16.1 Safety Considerations

(a) Means shall be provided to sense overloads where these loads could cause failure and injury to personnel.

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(b) Automatic loading and unloading devices are recommended to prevent placing of any parts of the human body into the path of vertically traveling carriers.

6.16.2 Guarding

(a) The conveyor shall be installed in an enclosed shaftway or housing to prevent injury from inadvertent physical contact with moving parts of the equipment. Access doors to the shaftway or housing shall be secured so that only authorized service personnel may enter.

(b) For suspended vertical tray conveyors designed so that the pendant tray, car, or carrier comes to a stop during manual loading or unloading, the conveyor housing should be equipped with interlocked doors or equivalent safety barriers at each manual loading and unloading station. The doors shall be mechanically or electrically interlocked to the operation of the conveyor so that they can be opened only when the pendant tray, car, or carrier has stopped, and so that the pendant tray, car, or carrier cannot be moved until they are closed.

(c) Suspended vertical tray conveyors designed to automatically receive and discharge material may have interlocked doors as in (b) above or, as an alternative, may be guarded by a suitable enclosure extending on all sides a safe distance from the path of the moving pendant trays, cars, or carriers.

(03) ### 6.17 Tow Conveyors

6.17.1 Tow Conveyors — In the Floor/Overhead

6.17.1.1 Safety Considerations

(a) A clearance space for personnel shall be provided between the side of a cart, or between any load overhanging the side of a cart, and any fixed or moving object.

(b) The cart path shall be identified by a floor stripe parallel to the cart path, one line on each side, located a safe distance from the edge of the cart or overhanging load.

(c) Where wall openings or other conditions do not permit a safe clearance, the reduced clearance area shall be marked with appropriate warnings.

(d) Where a cart may change its direction without warning, such as switching off the main line into a transfer conveyor or a spur, this area shall be marked with an appropriate warning such as diagonal stripes on the floor within the clearance lines.

(e) Where carts start automatically, a warning is required.

(f) Means shall be provided to allow the operator to disengage the tow pin from the conveyor pusher without being in front of the cart.

6.17.1.2 Guarding

(a) Provisions shall be made to prevent runaway carts from exiting the ramp zone and entering work areas.

(b) Ramps with traffic aisles shall have a barrier of sufficient strength and height to prevent a runaway cart from entering the traffic aisle.

(c) Ramps without traffic aisles shall have warning signs to warn personnel not to enter.

(d) Means shall be provided to maintain the stopped position of a ramp conveyor or carts under maximum rated load condition.

(e) Where there is a projection above the floor, the projection and adjacent area shall be identified by appropriate diagonal stripes or warning signs, or both. This identification shall particularly apply to devices that project intermittently at unpredictable times.

6.17.2 Tow Conveyors — Public Use Intended

6.17.2.1 Safety Considerations

(a) Means shall be provided to sense overloads where these loads could cause injury.

(b) Loading and unloading areas shall be provided with means to detect personnel on or in unauthorized proximity to the conveyor and automatically stop or prevent motion.

(c) Means shall be provided to physically restrict people from the path of the towed vehicle.

(d) Riding or walking on the conveyor or towed vehicle shall be forbidden. Warning signs to this effect shall be prominently posted at each point of access and each control station.

6.17.2.2 Guarding. Where a parted chain, cable, belt, tow pin, or other linkage would permit a runaway condition on an incline or decline, antirunaway/backstop devices shall be provided.

6.18 Trolley Conveyors and Power and Free Conveyors

6.18.1 Safety Considerations

(a) In areas where the parted chain, cable, or other linkage would permit a runaway condition on an inclined or declined section, and where personnel are present, antirunaway devices shall be provided. The conveyor path may be arranged so that travel of the uncontrolled conveyor will be arrested before it enters an area where personnel are present.

(b) In areas where personnel perform work on the load of a moving conveyor, and guards would impair the workers' performance, the load shall be cradled, hooked, bolted, or otherwise attached to the carrier.

6.18.2 Guarding

(a) Nip points occur at traction wheels, sprockets, caterpillar drives, and roller turns, and shall be guarded unless guarded by location.

(b) The telltale effect of the moving conveyor components serves as a warning device and permits unguarded nip or shear points at heights of less than 2.44 m (8 ft).

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(c) Automatic stops or closures shall prevent a trolley or trolleys from moving off the track during the portion of a cycle when any track end is not aligned with its mating member.

(d) Hoisting equipment for lift sections or drop sections or both shall stop or control the vertical motion in the event of power failure.

(e) On inclined or declined conveyors or sections, where personnel are present and there may be an occurrence of uncontrolled movement of a free trolley, arresting devices shall be provided. A rigid pusher dog on the power chain with positive carrier engagement shall be considered an acceptable means, or the conveyor path may be arranged so that travel of the uncontrolled free trolley, carrier, or load, or combination thereof, will be arrested before it enters the personnel area.

(f) Guards shall be provided to restrict unauthorized personnel from entering hazardous loading, unloading, and transfer areas. When guarding is not feasible, clear and legible warnings shall be provided.

(g) Access to lift or drop sections shall be guarded to prevent unauthorized personnel from entering the area. Warning signs shall be posted where guarding is not feasible, unless access to lift or drop sections is guarded by location.

(h) Where conveyors are located above personnel and the possibility exists that the transported product may fall off from any cause, guards (spill guards) shall be provided.

6.19 Vertical Articulated Conveyors

6.19.1 Safety Considerations

(a) Control system shall include means to prevent jamming or spilling objects if the absence of such controls could produce a hazards to personnel.

(b) Means shall be provided to stop the conveyor in the event a jam occurs where injury to personnel would otherwise result.

6.19.2 Guarding

(a) The conveyor shall be enclosed to prevent injury from inadvertent physical contact with the moving parts of the equipment.

(b) The entry and exit openings in the enclosure shall be guarded by extending the enclosure side guards a safe distance from the path of the vertically moving carrier. A top cover shall be provided to form a tunnel, if practical.

6.20 Vertical Chain Opposed Shelf Type Conveyors

6.20.1 Safety Considerations. Overload devices shall be furnished to stop the conveyor in the event a jam occurs where injury to personnel would otherwise result.

6.20.2 Guarding

(a) The conveyor shall be housed so as to prevent injury from inadvertent physical contact with the moving parts of the equipment.

(b) The conveyor housing should be equipped with doors or equivalent device at each manual loading and unloading station, interlocked so that they can be opened only when the carrier has stopped and the carrier cannot be actuated until they are closed.

(c) Vertical chain opposed shelf conveyors that automatically receive and discharge material may have interlocked doors as in (b) above or, as an alternative, may be guarded by a suitable enclosure extending from the path of the moving carrier platform.

6.21 Vertical Reciprocating Conveyors

6.21.1 Safety Considerations

(a) Means shall be provided to prevent hazard to personnel in the event of mechanical or electrical failure. The carrier must be equipped with backstop devices sufficient to stop and to hold the carrier and load.

(b) Overtravel device(s) shall be provided where necessary to minimize potential for injury to personnel.

(c) Riding the conveyor shall be forbidden to all personnel. Warning signs to this effect shall be prominently posted at each point of access and each point of operation.

6.21.2 Guarding

(a) The conveyor shall be guarded so as to prevent injury from inadvertent physical contact.

(b) The conveyor housing shall be equipped with doors or an equivalent means at each mannual loading and unloading station, interlocked so that they can be opened only when the carrier has stopped at that level and such that the carrier cannot be actuated until they are closed.

(c) Vertical reciprocating conveyors designed to automatically receive and discharge material may have interlocked doors as in (b) above or, as an alternative, may be guarded by a suitable enclosure extending from the path of the moving carrier.

(d) Where the application requires that personnel walk onto the carrier to load or unload material, the carriers shall be provided with standard railings, snap chains, or equivalent across the loading/unloading side(s). Snap chains shall be at least 39 in. at their lowest point.

(e) Controls shall be installed or located so they cannot be actuated by a person on the carrier.

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ASME B20.1-2003 INTERPRETATIONS

Replies to Technical Inquiries
December 2001 through May 2003

FOREWORD

This publication includes all of the written replies issued between the indicated dates by the Secretary, speaking for the ASME B20 Standards Committee, Safety Standard for Conveyors and Related Equipment, to inquiries concerning interpretations of technical aspects of ASME B20.1, Safety Standard for Conveyors and Related Equipment.

These replies are taken verbatim from the original letters except for a few typographical corrections and some minor editorial corrections made for the purpose of improved clarity. In some few instances, a review of the interpretation revealed a need for corrections of a technical nature; in these cases, a corrected interpretation follows immediately after the original reply.

These interpretations were prepared in accordance with the accredited ASME procedures. ASME procedures provide for reconsideration of these interpretations when or if additional information is available that the inquirer believes might affect the interpretation. Further, persons aggrieved by this interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

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Interpretation: 20-17

Subject: ASME B20.1a-1997

Date Issued: December 17, 2001

Question: Section 9-5.6.2 Inspection Records states that "Where system function would be seriously hindered or adversely affected by the required time delay, or where the intent of the warning may be misinterpreted, a clear, concise, and legible warning sign shall be provided. The warning sign shall indicate that conveyors and allied equipment may be started at any time, that danger exists, and that personnel must keep clear." Does the use of these signs, in a case where the facility has a Lockout — Tagout policy, relieves of the code requirements to have audible or visual warning prior to equipment startup?

Reply: ASME and its Committees do not "approve, rate, or endorse any item, construction, proprietary device, or activity." However, with regard to Section 5.11 and specifically paragraphs 5.11.2(b)(1) and 5.11.2(b)(2), the following should be clarified.

The requirements of 5.11.2(b) only apply to conveyors that, when started, would cause injury to a person doing her/his normal job function, for example a person working in and out of the path of an automotive assembly line. That requirement is not intended to apply to automated conveyor systems that start/stop on a regular basis usually governed by material flow criteria. Personnel are protected from such automated systems by following the other applicable General Safety Standards of Sections 5 and 6. For persons involved in "service or maintenance" related to conveyors and related equipment/systems, the control of hazardous energy is governed by Section 5.11.4, which references the OSHA regulation.

Interpretation: 20-18

Subject: ASME B20.1-1996, Paragraphs 5.9.3 and 6.1.1(b)

Date Issued: October 23, 2002

Question: When a belt conveyor (that is fixed in place) is passing over a walkway below 8 ft (ex: 7 ft), and that conveyor has carrying and return rollers, do those carrying and return rollers need to be guarded?

It seems that Article 6.1.1(b) says that these do not need to be guarded, however, it seems that because they can be considered a nip point under Article 5.9.3 and can therefore form a hazard, Article 5.9.3 says they should be guarded. Articles 6.1.1(b) and 5.9.3 would therefore contradict each other.

Reply: Paragraph 5.9.3 is part of "General Safety Standards" section; it is prefaced by "In general" and tempered by "unless other means to assure safety are provided. See Section 6 for specific conveyors." This wording is consistent with the B20 Standard's intent of being a performance rather than design Standard.

Paragraph 6.1.1(b) simply recognizes that many belt conveyors have "carrying and return rollers" that present no danger by their very nature/design. However, in any application where a return belt could present a dangerous condition, means should be provided for safe operation to all persons involved. The Standard does not require such locations to be guarded just because a belt is passing over a roller.

With regard to the specific conveyor configuration you describe in your question, please note: "ASME does not 'approve,' 'rate,' or 'endorse' any item, construction, proprietary device, or activity." Therefore, the Committee is limited in its response to addressing the B20 Standard and makes no attempt to apply or interpret the Standard as it may apply to specific installations.

The Committee does not feel these provisions contradict each other. However, suggestions for improvement of the B20 Standard are always welcomed and may be submitted to the Secretary in accordance with Section 3.

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Interpretation: 20-19

Subject: ASME B20.1b-1998, Paragraph 5.11.2(b)

Date Issued: May 27, 2003

Question: Section 5.11.2(b)(1) states that "when a conveyor that would cause injury when started is automatically controlled or must be controlled from a remote location, an audible device or devices shall be provided that can be clearly heard at all hazardous points along the conveyor where personnel may be present. The audible warning shall be actuated by the controller device starting the conveyor and shall continue for a required period of time before the conveyor starts..."

(a) If a conveyor has guarding installed in accordance to the B20.1 standard, are the "hazardous points" protected, thereby removing the need to provide the audible warning, if the remainder of the conveyor (such as the discharge location) can be seen from the control location?

(b) Does this requirement apply during maintenance and service of the machine where guards may be removed to access certain components?

Reply: (a) Section 5.11.2(b)(1) addresses that unique conveyor system where, even though the other provisions of Sections 5 and 6 are met, there remains a concern that a person who normally is in the area may be injured if not alerted prior to the conveyor startup/movement. A common example is an automotive assembly conveyor where, if not alerted, a worker could be injured when the conveyor is started.

The phrase "conveyor that would cause injury when started" applies to both conveyors "controlled from a remote location" and "automatically controlled" conveyors.

It is not the intent of the Standard that all conveyors "controlled from a remote location" and "automatically controlled" conveyors be equipped with warning devices. This provision is an exception to the norm and does not require prior to the starting of automatically controlled/sequenced conveyors that a warning be sounded every time a conveyor is started.

The term "hazardous points along the conveyor where personnel may be present" must be read in the context of Paragraph 5.11.2(b)(1). In the assembly conveyor example, the warning device must alert anyone along the line who could be injured. This use of "hazardous points" does not refer to those hazards requiring the guarding detailed in Section 5.9.

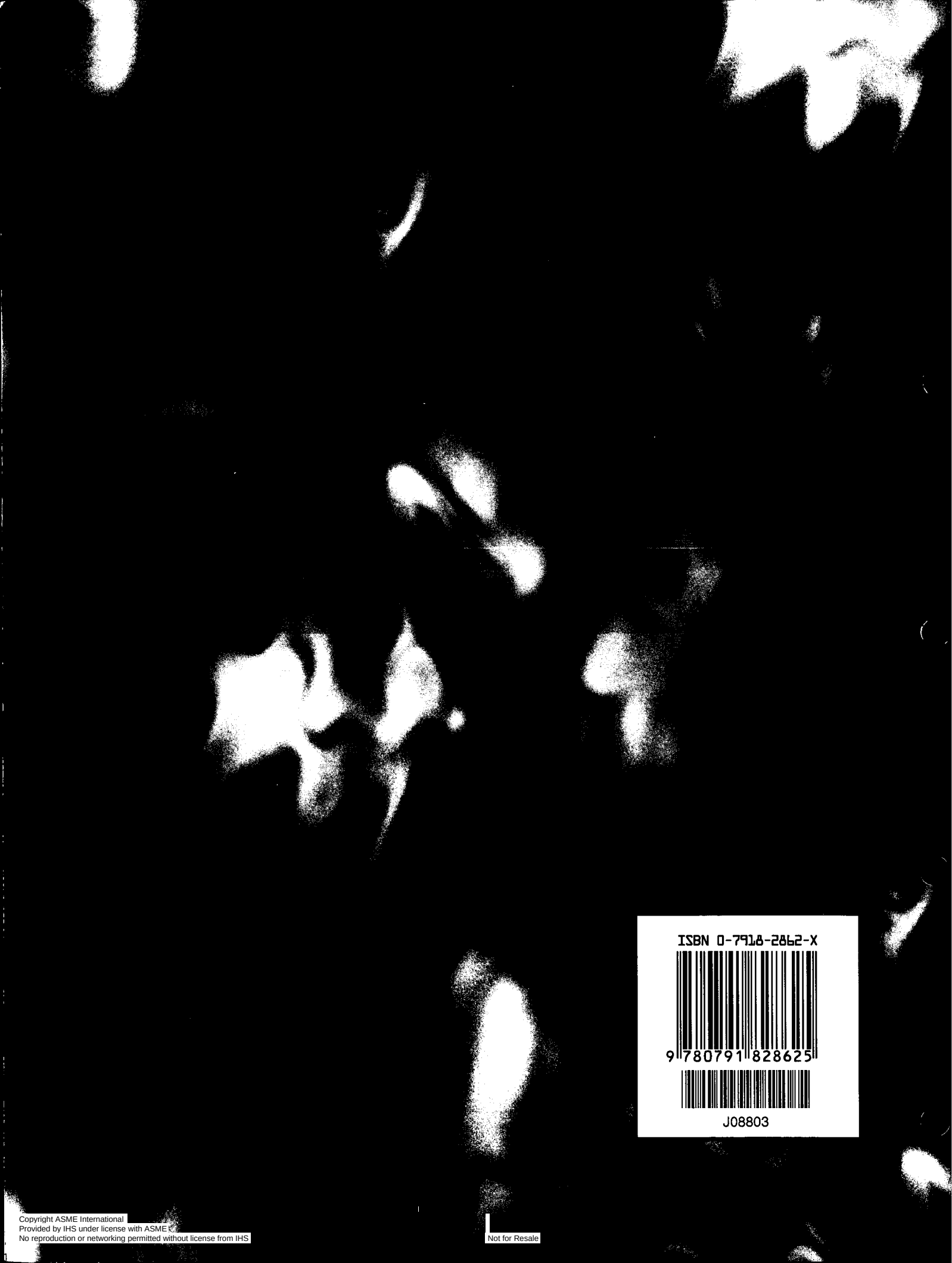
While a conveyor that is guarded in accordance with Sections 5.9 and 6 would not normally require a warning device, neither does having a warning signal negate the need to meet other guarding requirements of Sections 5 and 6.

(b) Section 5.11.2(b) has no applicability to maintenance and servicing activities, which are addressed in Section 5.2.

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