

Australian Standard™

Conveyors—Safety requirements



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Australian Standard™

Conveyors— Safety requirements

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PREFACE

This Standard is the result of consensus among representatives of the Standards Australia Committee SF/25, Guarding of Conveyors and Joint Standards Australia/Standards New Zealand Committee EL/23, Electrical Equipment in Coal Mines to prepare it as an Australian Standard. It supersedes AS 1755—1986, Conveyors—Design, construction, installation and operation—Safety requirements. It contains the safety measures to be implemented for the installation and operation of conveyors and conveyor systems, both above ground and underground and sets out the necessary personal protective measures against hazards experienced by operators of such plant.

The changes included in this Standard cover the general safety requirements for large and small conveyors and conveyor systems, and in particular the details for conveyor control and motor drive isolation. Technical and editorial amendments have been incorporated in line with available ISO documentation for mechanical handling equipment.

Major changes made in this edition include—

- (a) clarification that the Standard is applicable to both above ground and underground conveyor systems;
- (b) adding a Section dealing with requirements for specific applications, notably underground coal mines; and
- (c) adding, as an appendix, ergonomic data.

The term ‘normative’ has been used in this Standard to define the application of the appendix to which they apply. A normative appendix is an integral Part of a Standard.

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STANDARDS AUSTRALIA

Australian Standard

Conveyors—Safety requirements

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out the minimum safety requirements for the design, installation and guarding of conveyors and conveyor systems. It includes requirements for users and providers of inspection, maintenance, training and implementation of safe work practices for such equipment. Particular emphasis is given to operational safety and the protection afforded to operators, maintenance personnel or other persons who may be exposed to risks to health and safety associated with conveyors or conveyor systems.

This Standard includes requirements for—

- (a) specific locations such as hazardous areas, confined spaces and coal mines; and
- (b) specific types such as belt conveyors and mobile or transportable conveyors.

The Standard is not intended to apply to platform elevators, moving stairways or conveyors specifically designed for the conveyance of people.

A glossary of conveyor terms is provided in Appendix A.

1.2 OBJECTIVE

The objective of this Standard is to enable designers, manufacturers, suppliers, employers and users of conveyors and conveyor systems to minimize the risks to health and safety where conveyors are used.

1.3 APPLICATION

The requirements of this Standard are intended to be used by designers, manufacturers, suppliers, installers, users and owners of conveyors or conveyor systems.

The requirements of this Standard shall apply to all conveyors or conveyor systems installed or reinstalled following the publication date of this Standard. This provision need not apply where a contract for the supply and installation of a conveyor or conveyor system has been entered into prior to that time.

Where a risk assessment is required by this Standard, the requirements of AS 4024.1, AS/NZS 3931 and AS/NZS 4360 or equivalent Standards shall be followed.

Alternative methods of providing safety based on risk assessment in accordance with AS 4024.1, AS/NZS 3931 and AS/NZS 4360 may be used provided that the level of safety offered by the alternatives is at least equivalent to that provided by the methods given in this Standard.

In addition to the requirements of this Standard, there may be other requirements set by the regulatory authority. Users of this Standard should therefore make themselves aware of any specific requirements in the jurisdiction where the conveyor or conveyor system will be used.

1.4 SECTION REQUIREMENTS

Conveyors and conveyor systems shall comply with the requirements provided for in each relevant section of this Standard.

1.5 REFERENCED DOCUMENTS

A list of the documents referred to in this Standard is given in Appendix B.

1.6 DEFINITIONS

For the purpose of this Standard the definitions below apply.

1.6.1 Competent person

A person who has, through a combination of training, education and experience, acquired knowledge and skills enabling that person to perform correctly a specified task.

1.6.2 Control circuit isolation

The interruption of the control circuitry of the drive motor(s) of a conveyor system(s).

1.6.3 Conveyor

Apparatus or equipment operated by any power other than manual, by which loads are raised, lowered or transported or are capable of being raised, lowered, transported or continuously driven by—

- (a) an endless belt, rope or chain or other similar means;
- (b) buckets, trays or other containers or fittings moved by an endless belt, rope, chain or other similar means;
- (c) a rotating screw;
- (d) a vibrating or walking beam; or
- (e) rollers

It includes the supporting structure and auxiliary equipment used in connection with the conveyor.

1.6.4 Conveyor system

An installation comprising one conveyor, or multiple conveyors whose control is integrated.

1.6.5 Danger zone

Any zone in or around a conveyor or conveyor system in which a person is subject to a risk to health or safety.

1.6.6 Emergency stop

A manual or automatically operated system designed to stop a conveyor system in the shortest practicable time in an emergency.

1.6.7 Energy-isolating device

Any device that physically prevents the transmission or release of energy. These may include, but are not limited to, electrical isolators, disconnect switches, line valves and blocks.

1.6.8 Fail safe

The principle of failure to safety, which is any failure of the machinery, its associated safeguards, control circuits or its power supply that leaves the machinery in a safe condition.

1.6.9 Fixed guarding

Guarding which can only be removed by the use of tools.

1.6.10 Guarded

Shielded, fenced, enclosed or otherwise protected by means of suitable enclosures, covers, casing, shield guards, trough guards or railing guards which removes foreseeable risk of personal injury being caused by accidental contact or approach, and for an under guard, removes any additional foreseeable risk of personal injury caused by contact with, or spillage of, material from the conveyor.

1.6.11 Guarded by location or position

Moving parts which are protected by their remoteness from the floor, platform, walkway or other working level or which by their location with reference to frame, foundation, or structure remove the foreseeable risk of accidental contact by people or objects.

1.6.12 Mining

A system of obtaining and processing minerals or coal, including quarrying.

NOTE: Where the general provisions of this Standard have been varied for mining applications the following has been assumed:

- (a) Access to all conveyors by the general public is effectively controlled.
- (b) Access to all conveyors is limited to persons trained in the hazards that may be associated with the conveyors.

1.6.13 Mobile conveyor

A conveyor whose location may be moved during its operation (see Figure 3.3).

1.6.14 Nip point

That point at which a moving conveyor element meets a fixed or moving element so that it is possible to nip, pinch, squeeze or entrap parts of the human body coming into contact with one of the two elements.

1.6.15 Normal stop

A manual or automatically operated system designed to stop the conveyor under normal operating conditions.

1.6.16 Protective stop control

A stop control provided for the protection of the conveyor or personnel from a hazard which, when activated, stops the conveyor and includes emergency stop controls.

1.6.17 Pull wire

A wire connected to a device, normally provided for emergency stop control which, when pulled, activates the device.

1.6.18 Regulatory authority

A Minister of the Crown, a government department or other public authority having power to issue regulations, orders or other instructions having the force of law in respect of any subject covered by this Standard.

1.6.19 Runaway

Uncontrolled movement of the conveyor in either direction.

1.6.20 Sequence

A control system designed to stop or start a conveyor, depending upon the state of other equipment.

1.6.21 Shall

Indicates that a statement is mandatory.

1.6.22 Shear point

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

1.6.23 Should

Indicates a recommendation.

1.6.24 Start

A manual or automatically operated control system designed to start the conveyor under normal operating conditions.

1.6.25 Transportable conveyor

A conveyor which is not a mobile conveyor that can be moved as a unit from one location to another.

SECTION 2 REQUIREMENTS FOR DESIGN AND CONSTRUCTION

2.1 GENERAL

In addition to the requirements of this Standard, conveyors and conveyor systems shall be designed and constructed consistent with the relevant requirements of AS 4024.1 and other relevant Standards.

Safety features necessary for the safe operation of the conveyors and conveyor systems shall be included at the design stage.

2.2 DESIGN AND CONSTRUCTION

2.2.1 Selection of materials

All materials used in the manufacture of conveyors shall comply with the relevant Australian Standards. In the absence of an Australian Standard, appropriate International or overseas Standards may be used.

2.2.2 Design requirements

The design and construction of a conveyor shall take into full account the magnitude, incidence, conditions and manner of all loading and forces likely to be applied to the conveyor.

The slope and characteristics of the conveying system shall be designed to prevent hazardous unintentional sliding of the conveyed material under operating conditions.

2.2.3 Stopping devices

2.2.3.1 Safe stopping

Conveyors shall be designed to ensure that they will stop in the shortest practicable time consistent with safety when the driving energy is disconnected, and remain stopped until the energy is restored.

2.2.3.2 Anti-runaway device

Any conveyor which can run away due to the effect of gravity shall be provided with device(s) which will automatically prevent run away. Where a belt, chain drive, fluid coupling or similar device is interposed between the motor and the driven shaft, the anti-runaway device shall be installed to prevent runaway in the event of a failure of the interposing device. More than one anti-runaway device may be required on a chain conveyor.

Where a hazard to people exists from the failure of an anti-runaway device then two automatically operated devices shall be provided to prevent run away. Each device shall be capable of holding the load independently. These devices should be monitored for wear and effective operation.

Each anti-runaway device shall be rated to stop and hold at least 150% of the maximum load applied by the conveyor.

NOTE: These devices include but are not limited to brakes, anti-runback or holdbacks.

2.2.3.3 *Prevention of hazardous movement*

Where an electromechanical brake is provided on a conveyor which may run away or run back, and a non-direct drive is used, e.g. a fluid coupling, brakes shall not be released until the torque has been applied to the main driving shaft of the conveyor. They shall be applied automatically if the power fails or the operating control is returned to the 'off' or 'stopped' position. See also AS 4024.1.

2.2.3.4 *Controlled speed of descent*

Brakes which are manually released and applied by the movement of operating devices shall be designed so that if the power is interrupted with the brakes in the release position, the load can descend only at a controlled speed.

2.2.4 **Lubrication points**

Where bearings or other parts are inaccessible or are in a danger zone and require lubrication, the lubrication point should be located in a position which is both accessible and outside the danger zone. The lubrication points should be located outside the alignment of the carrying mechanism of the conveyor and should be accessible without the removal of any guard.

2.2.5 **Take-ups and counterweights**

2.2.5.1 *Take-ups*

All components of a take-up which can move during operation shall be guarded.

Where a take-up device can operate automatically, fixed distance guarding should be provided to prevent access to all components of the tension carriage or balance weight.

Where there is access at the bottom of the gravity take-up, protection shall be provided to eliminate the hazard from descent of the weight due to failure of a component. Provision for the removal or disposal of spillage in this area shall be provided.

Suitably worded signs warning of the stored energy hazard of the take-up system, shall be visible at each point of access to the take-up system and rope system. Such signs should comply with the requirements of AS 1319.

2.2.5.2 *Access to take-up*

Means of access to the take-up for repair and maintenance purposes, together with provision for releasing or securing the stored energy shall be incorporated in the design of the system.

2.2.5.3 *Control of take-up*

The manual control for the take-up shall be accessible from outside the guarded area.

Where automatic control of the take-up is provided, then isolation of the automatic operation and selection of a manual operation should be provided.

Manually operated tension devices shall not be capable of free wheeling under any condition.

Where take-ups are remote or on a different level from the main drive, an emergency stop facility complying with Clause 2.7.7 shall be provided at the take-up.

2.2.5.4 *Wire ropes for take-ups and counterweights*

All wire ropes used for take-ups and counterweights of conveyors shall have a minimum safety factor of 4.5, relevant to the maximum static load that can be applied by the tension system. The minimum dynamic factor of safety should be 2.25.

2.2.6 Hinged section

2.2.6.1 General

Hinged sections of a conveyor or conveyor system used for the purpose of creating a passageway shall be designed so that when the hinged section is opened while the conveyor is in operation, it need only stop the adjacent upstream conveyor. The conveyor may be restarted automatically upon closure of the hinged section provided that compliance with the requirements of Clause 2.7.8.2 is assured.

2.2.6.2 Manually operated

Manually operated hinged sections shall be self-locking in the open position or counterbalanced and shall be designed so that the maximum effort required to open or close the hinged section does not exceed 150 N.

2.2.6.3 Power operated

Power-operated hinged sections shall be provided with mechanical safety devices which restrict their closing to a safe speed and prevent them from falling in the event of a power failure.

2.2.7 Raising and lowering systems

Conveyors which include an articulated or mobile part which is raised and lowered, shall be fitted with devices for automatically immobilizing these parts in the event of loss of power.

The raising or lowering system shall be designed to prevent accidental movement or kickback when operated.

The system controls shall be located so their operation is clear of the underneath of the conveyor.

Stops or limiting devices shall be provided to prevent movement of the articulated or mobile part beyond its designed limits.

2.2.8 Dust generation and control

Where dusts are present or may be generated due to the operation of a conveyor, measures shall be taken to minimize the generation and control the presence of dust. The following recommendations should apply:

- (a) Scrapers should be provided where material may be drawn into a pulley to the belting contact area. The scraper should divert the material clear of the contact area.
- (b) Means should be provided at the discharge point of a conveyor to minimize carry back of material.
- (c) For areas of a conveyor which may generate significant dust, (e.g. transfer points or areas of high air velocity) means should be provided to collect or suppress the dust. These means may include, but are not limited to, the following:
 - (i) Water sprays.
 - (ii) Dust cover hoods.
 - (iii) Dust collections systems.
- (d) Horizontal areas on which dust can accumulate should be minimized.

2.3 ACCESS TO CONVEYORS

2.3.1 General

Means of access to the conveyor and its controls for the purpose of working, operating, inspecting or servicing shall be provided. Where fixed platforms, walkways, stairways or ladders are used for providing access, they shall comply with the requirements of AS 1657. Operation of the conveyor shall be from floors or platforms, not from stairways or ladders. Regular work or servicing should not be undertaken from ladders.

In the design of access provided for the operation and maintenance of the conveyor or conveyor system, alternative means of exit shall be provided for personnel in the case of fire.

2.3.2 Crossovers for aisles and passageways

Where access to either side of the conveyor is required, crossovers or underpasses shall be provided at appropriate intervals including at the head and tail end, at the drive and other transfer points along the conveyor.

Where a conveyor crosses a walkway, aisle or passageway and the lowest part of the conveyor or material or attachment is less than 2.1 m above the floor or walkway surface, a crossover or underpass as appropriate shall be provided.

NOTE: For underground mining applications, the underpass may be a crawlway.

2.3.3 Working clearance

Where access is required along an operating conveyor, a minimum working clearance of 600 mm coupled with a minimum headroom of 2.1 m shall be provided down one side of the conveyor. The non-walk side of the conveyor should have sufficient clearance to allow any spillage of material to fall clear of the conveyor. Adequate clearance shall be provided between the material being conveyed and the roof.

The provision for a minimum headroom of 2.1 m need not apply to underground mines.

2.4 OPERATING CLEARANCE

Adequate clearance shall be provided to prevent inadvertent contact between the conveyed material and any part of the conveyor system, including installed equipment or structures. Where it is possible to manually overload a conveyor to a point where adequate load clearance is not maintained, a load gauge should be installed at the loading points.

2.5 LIGHTING

2.5.1 General

Suitable permanent or mobile lighting shall be provided for conveyors or conveyor systems appropriate to their location in accordance with AS 1680.2.1.

For underground mining, a cap lamp or other portable light is acceptable for locations other than transfers and drive heads.

2.5.2 Emergency lighting

Emergency lighting should be provided to allow for safe egress.

2.6 ELECTRICAL REQUIREMENTS

The electrical installation, components and associated equipment of conveyors or conveyor systems shall comply with AS/NZS 3000 and other relevant standards appropriate to the specific location or type of conveyor as provided for in this Standard.

2.7 CONVEYOR CONTROL AND ISOLATION FACILITIES

2.7.1 General

Control and isolation facilities required in this Standard for conveyors and conveyor systems shall be adequately rated.

2.7.2 System integrity

Design errors which compromise the intended integrity of a system can occur during any phase of the design process (see Figure 2.1).

The system shall be designed in a manner that will reduce the possibility of errors being introduced. It should be checked during all phases to confirm freedom from error. The higher the level of integrity required and the more complex the system, the greater will be the extent of the check. This applies both to systems where the logic is entirely determined by permanent connections, e.g. a hard-wired electrical relay logic system, and to software or other programmable systems. However, the increasing complexity of typical programmable electronic systems highlights the difficulties faced by the designer who needs to assure system integrity.

Programmable systems shall provide a level of performance at least equal to that afforded by conventional hard-wired safety systems

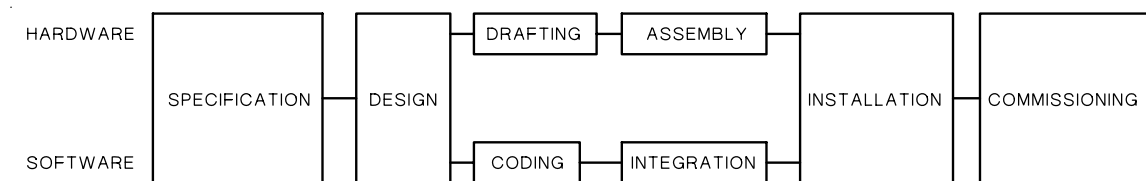


FIGURE 2.1 PHASES IN THE DESIGN PROCESS

2.7.3 Main isolating device

An energy isolating device shall be installed to completely isolate the sources of drive energy from the conveyor or conveyor system. This device shall be capable of being locked in the isolating position, be of the manual reset type and be suitable for direct manual operation. The main isolating device shall not be capable of being locked in the 'on' position. Suitable facilities shall be provided to clearly indicate the operated state of the device.

2.7.4 Remote isolating device

Where it is required to isolate the conveyor remotely, an energy isolating device conforming with the following shall be provided for this purpose:

- (a) The device shall be lockable in the isolated position and be of the manual reset type.
- (b) The device shall isolate the source of energy from the drive system by either—
 - (i) direct isolation of the energy source, or
 - (ii) indirect isolation of the energy source via a control system.

- (c) Where indirect isolation of the energy source via a control system is used, the following shall apply:
 - (i) The remote isolating device shall cause the isolation of the drive energy from the conveyor via at least two independent means to assure system integrity.
 - (ii) A system shall be provided to indicate at the remote isolation device, that the drive energy has been isolated.
- (d) A prestart warning in accordance with Clause 2.7.5 shall be provided.

2.7.5 Prestart warning systems

Where an otherwise uncontrolled hazard may arise when a conveyor or conveyor system starts, an automatically operated prestart warning system shall alert people to the fact that the conveyor is commencing operation and a potential danger exists. The system shall be in the form of an appropriately timed visual or audible warning given prior to the conveyor starting.

Where auditory or visual warnings are provided they shall not be a substitute for physical safeguards. Auditory or visual warnings shall be duplicated or overlapping and shall be monitored or inspected periodically to ensure adequate levels of safety.

2.7.6 Protective stop control

The output from a protective stop control shall cause the conveyor to stop by the operation of the energy isolating device. Activation of such control shall be by one of the following methods:

- (a) Direct operation.
- (b) A non-reprogrammable interposing device (e.g. relays, including electronic relays).
- (c) A programmable interposing device for other than emergency stop controls.

The defeat of protective devices which may endanger personnel shall not be permitted.

Facilities should be provided for testing the operation of protective stop controls.

NOTES:

- 1 Where appropriate, warning of the impending operation, status and record of operation of protective devices should be included in the design of the conveyor or conveyor system, e.g. belt tracking.
- 2 Blocked chute, bin full and transfer overfull are typical of the stop facilities provided for the purpose.
- 3 For mining applications see Clause 4.6.8.
- 4 Programming requires a change in function, operational logic or purpose. A change of address or identification does not constitute reprogramming.

2.7.7 Emergency stop controls

Controls shall be provided to stop the conveyor or conveyor system in an emergency. These stop controls shall be of the manually operated, automatic lock-off manual reset type. The circuit in which emergency stopping controls are provided shall be designed fail safe and otherwise protected from faults that may defeat the operation of the facility.

Emergency stop controls shall be capable of being operated with minimal effort without danger to the operator and shall be provided where the operating control is clearly visible and readily accessible even for inaccessible conveyors.

Emergency stop controls shall be provided as follows:

- (a) For conveyors not greater than 2.5 m in length and located less than 2.5 m above the floor, walkway or platform, a single stop control at the middle of the conveyor.

- (b) For conveyors greater than 2.5 m in length and located less than 2.5 m above the floor, walkway or platform, at the head, tail, drive and at intervals not exceeding 30 m along the length of the conveyor.
- (c) For conveyors positioned more than 2.5 m from the floor, walkways or platforms, at accessible locations at intervals not exceeding 100 m along the length of the conveyor.
- (d) At positions adjacent to the conveyor at which the conveyor can be started.
- (e) At every permanent working station.

Provision of a pull wire activated device is considered adequate for the purposes described above.

2.7.8 Stop/Start controls

2.7.8.1 General

Except for conveyors at mines, resetting of any normal stop control or emergency stop control shall not restart the conveyor without the actuation of a start control (see Clause 4.5.2).

Where practical, all stop/start controls and emergency stop facilities should be uniform throughout the conveyor or conveyor system.

Where an otherwise uncontrolled hazard could exist at a loading, unloading or transfer point in a conveyor system, the conveyor system shall be designed to operate in sequence and be provided with automatic stop controls which are designed to prevent the hazard from arising.

2.7.8.2 Automatic stop controls

Automatic stop controls provided for conveyor systems for other than safety purposes, e.g. overdimensional load, tension mechanism overtravel, and temperature limit controls, should not prevent the restarting of the system after resetting, provided that—

- (a) the stopping device is labelled to indicate that the conveyor will restart upon resetting the device; and
- (b) where this control is in a position from which the whole of the system cannot be viewed and there is a possibility of accidents arising from the starting of the conveyor, a warning signal in accordance with Clause 2.7.5 shall be provided.

NOTE: This stop control may be wired into electronic control equipment.

2.7.9 Pull wire requirements

2.7.9.1 General

Pull wires shall not be used as substitutes for guards. Where used as an emergency stop control a pull wire activated device shall comply with following requirements:

- (a) Breaking, slackening or removal of the pull wire shall activate the device.
- (b) Where electrical continuity is monitored in the pull wire—
 - (i) the slackening requirement of Item (a) need not apply; and
 - (ii) the conveyor shall stop in the event of the pull wire being broken or removed.
- (c) The force required to operate the pull wire activated device shall not exceed 70 N when applied midway between supports and at right angles to the axis of a pull wire with less than 300 mm movement and 230 N along the axis of the wire.
- (d) The design and distance between pull wire supports shall be such that the wire moves freely when pulled and does not become disengaged from the support.

NOTE: A maximum spacing of 6 m should apply.

- (e) Materials used for pull wires shall be of adequate strength, be protected against environmental conditions and be suitable for handling without the need for additional protection being worn by operators.

NOTE: Where more than one switch is used in a pull wire system, a visual indicator should be provided to indicate which switch has been activated.

- (f) The switch shall be activated when the pull wire is pulled in any direction. (See Figure 2.2).

Where an electric pull wire is used, it shall be installed as shown in Figure 2.2(c).

2.7.9.2 Location of pull wires

Pull wires should be located in such a manner that they are—

- (a) clearly visible;
- (b) readily accessible from all areas of access to the conveyor;
- (c) located external to the vertical line of any nip or shear point and no further than 1 m from the nip or shear points;
- (d) at least 900 mm above the access floor;
- (e) generally not more than 1500 mm above the access floor;
- (f) where all nip or shear points are greater than 1500 mm above the access floor the pull wire requirement of Item (e) may be raised provided the pull wire is lower than all nip or shear points; and
- (g) where it is possible for a person to be inadvertently on a moving conveyor, an emergency stop should be provided and be located no closer to the conveyor discharge than the maximum stopping distance of the conveyor. The emergency stop should be accessible from the conveyor.

See Figure 2.3 for the preferred location of pull wires.

NOTES:

- 1 The requirements of Clause 2.7.9 relating to pull wires may be replaced by an alternative emergency stop system providing an equivalent level of safety.
- 2 Pull wires are not an alternative to guarding.

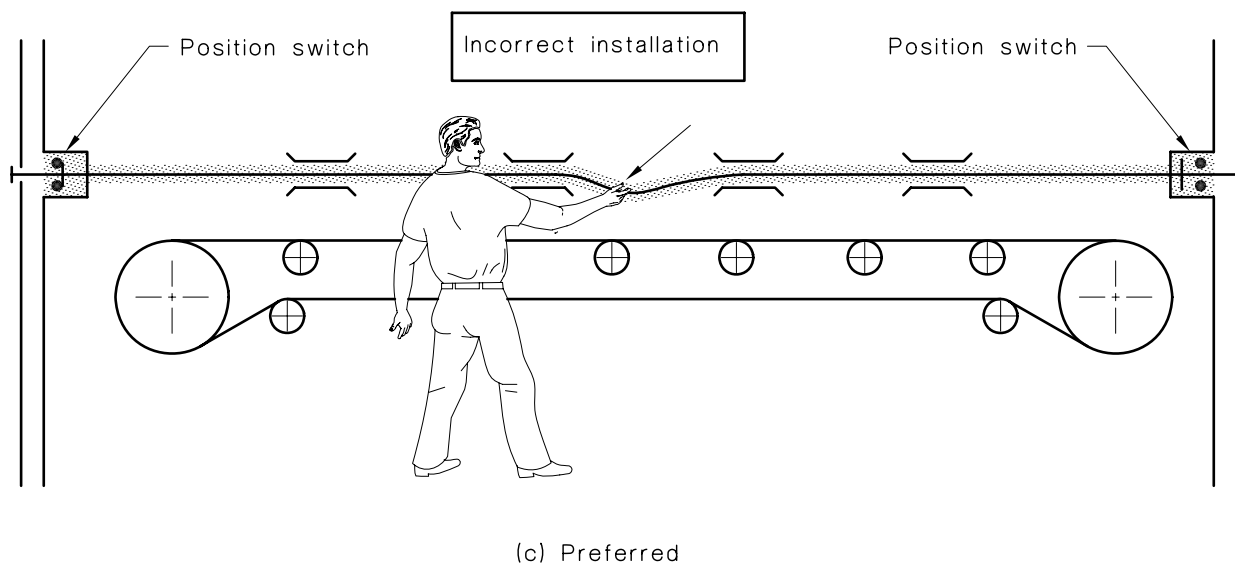
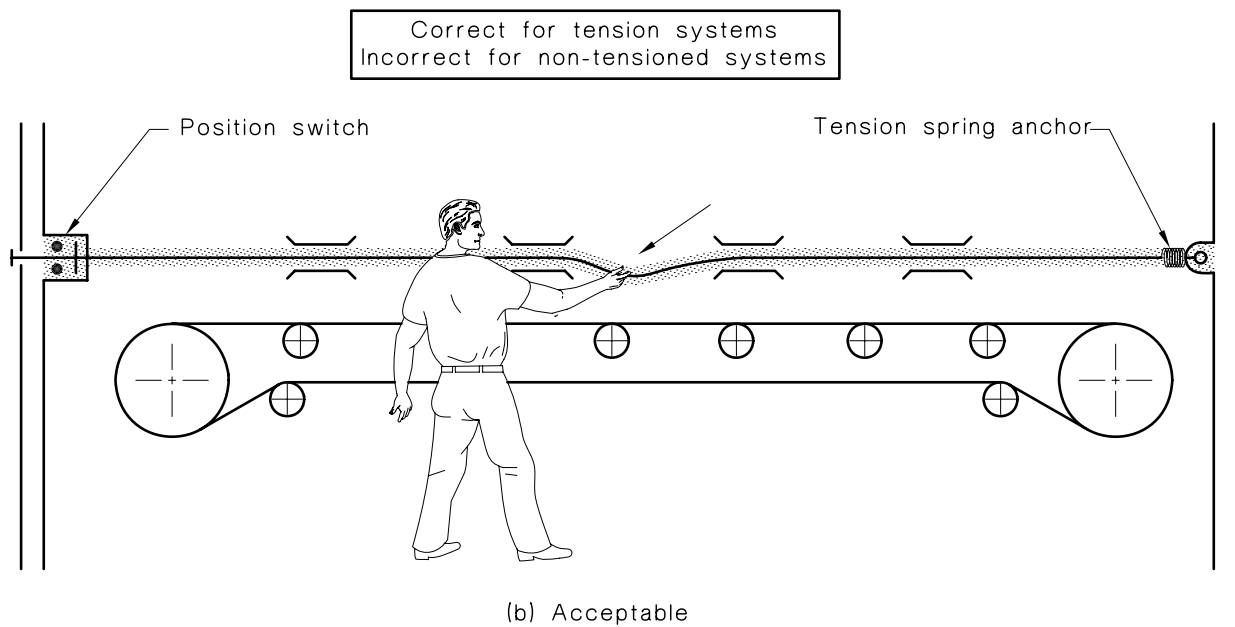
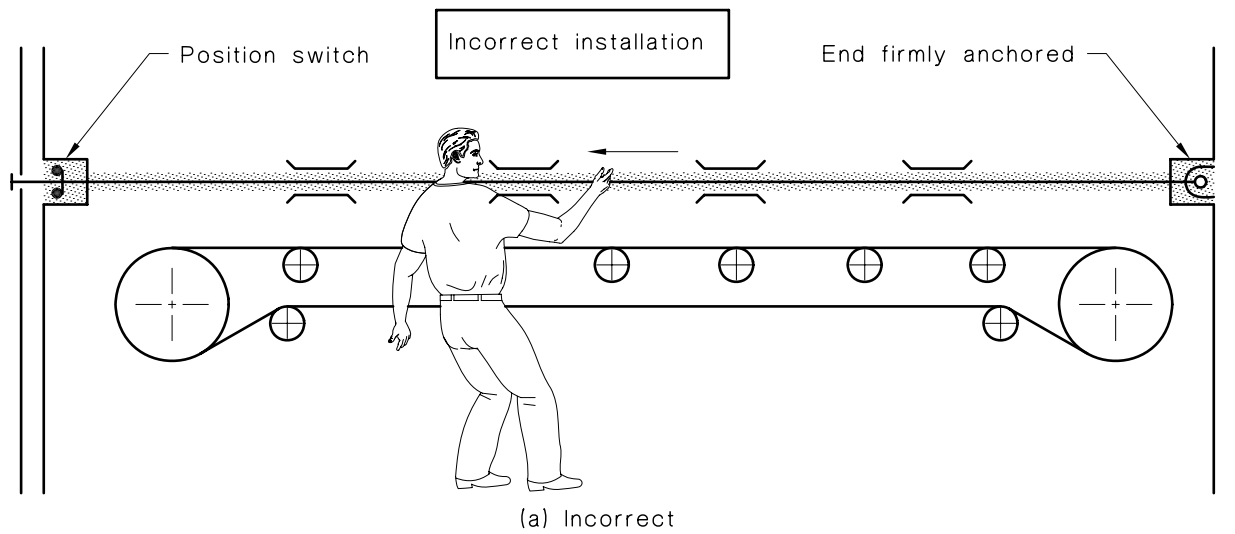
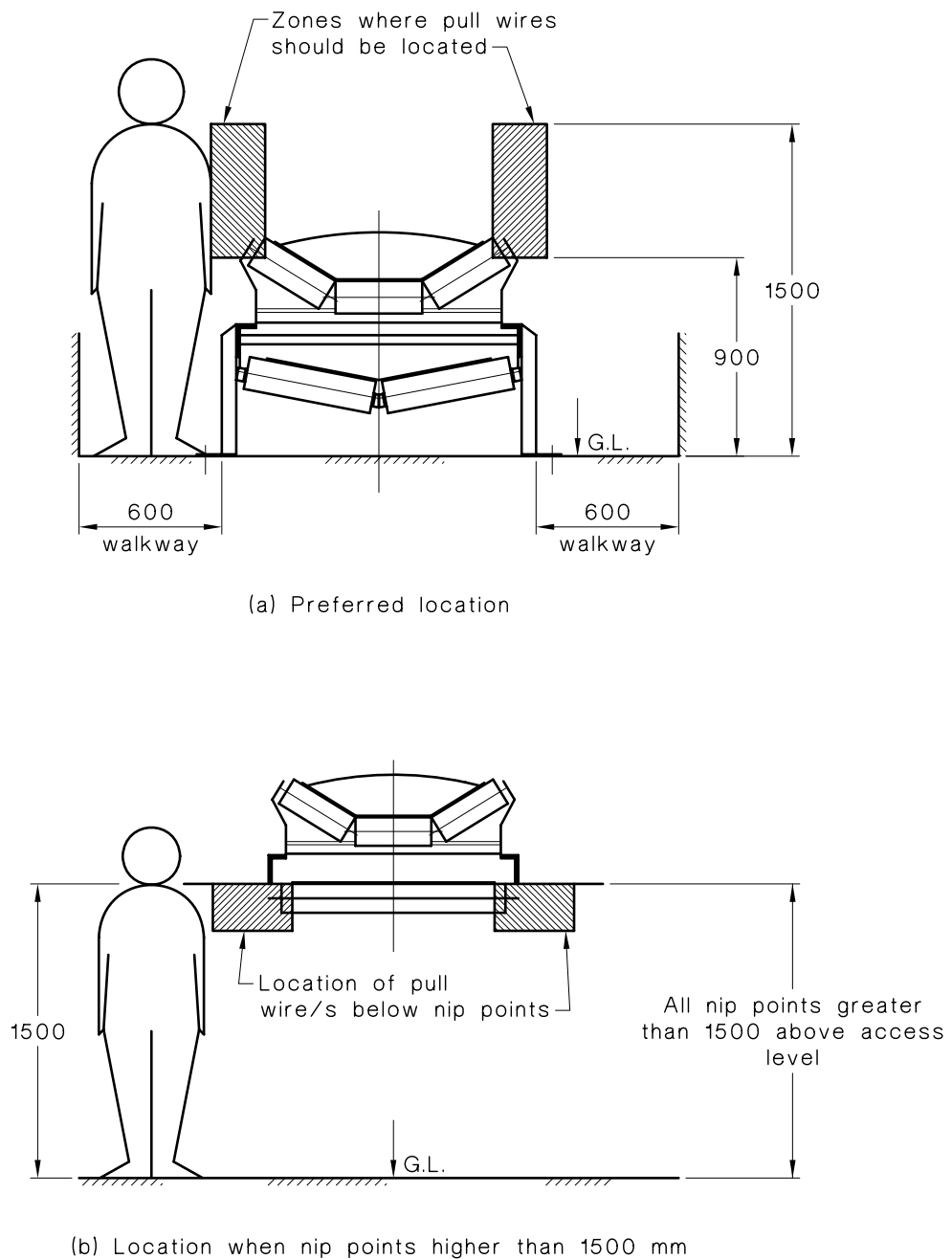


FIGURE 2.2 EMERGENCY STOP PULL WIRE—OPERATING DIRECTION REQUIREMENTS



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FIGURE 2.3 LOCATION OF PULL WIRES

2.7.10 Protection of controls

Where any hazard may exist due to inadvertent or unauthorized operation of any control, then facilities shall be incorporated in the design of the controls to prevent such operation. Typical facilities provided for this purpose include covers over controls, locked enclosures and key operated switches.

2.7.11 Protection from overload

Overloading of a conveyor or conveyor system shall be prevented by provision of suitable energy limiting devices. These devices include but are not limited to—

- (a) electrical overload limiters;
- (b) fluid couplings;
- (c) shear pins; and
- (d) pressure relief valves.

Where a shear pin is used, a description of the size and type of material of the shear pin shall be placed at an appropriate point on the conveyor to facilitate proper replacement.

All fluid couplings shall be protected from overpressure and over-temperature.

2.8 FIRE PROTECTION

2.8.1 Firefighting facilities

Where a fire hazard exists on a conveyor or conveyor system, firefighting facilities appropriate to the risk shall be provided.

2.8.2 Fire risk

Where the operation of a conveyor or conveyor system could create a fire hazard, the design of the conveyor or conveyor system shall include items to minimize the risk.

2.8.3 Fire detection

Where a hazard may be created by not detecting a fire on a conveyor or conveyor system, fire detection facilities should be incorporated in the design.

2.8.4 Lubricants

Oils and lubricants should be effectively contained.

Accumulated spilled oils and lubricants should be controlled sufficiently to minimize any potential fire hazards.

2.8.5 Accumulation of combustible materials

The accumulation of combustible material resulting from the operations of a conveyor shall be controlled to prevent contact with the moving parts of the conveyor. This may be achieved by the installation of easily maintained scrapers, loading point skirting, shedder plates and self-shedding covers over components located beneath the conveyor.

In addition, sufficient space shall be provided under moving parts for the removal of accumulated material. Generally, for bulk materials handling belt conveyors, not less than 300 mm should be provided for this purpose but, in no case shall this clearance be less than 150 mm.

2.9 MARKINGS, SIGNS AND IDENTIFICATION

2.9.1 General

Where appropriate, permanent markings, signs and identification plates shall be in accordance with AS 1318 and AS 1319. Where a hazard could exist from the misinterpretation of a symbol the meaning of the symbol shall be clarified in writing. Markings, signs and labels shall be of durable corrosion resistant construction and be permanently attached. Markings, signs and labels shall be installed or positioned so that they are clearly visible and do not become obscured while in service.

2.9.2 Information plates

Where appropriate, each conveyor should be provided with an information plate located at the drive and detailing the following:

- (a) The manufacturer's and suppliers's name, trade name or mark.
- (b) An identification number.
- (c) Year of manufacture.

2.9.3 Safe working load

The safe working load of a unit handling conveyor should be exhibited at each loading point. For overhead chain type conveyors the safe working load shall be indicated as mass per attachments and total mass per structure.

The load capacity of bulk handling conveyors should be exhibited on the conveyor.

2.9.4 Marking of control devices

Each manually operated stop, start or other function control shall be identified with markings, signs or labels in writing clearly indicating the purpose of the control. Not withstanding the generality of this requirement, the following shall also apply:

- (a) Emergency stop devices shall be indicated by a sign.
- (b) Actuators of knock-off emergency stop devices shall be coloured red.
- (c) Signs shall be provided at each end and every 30 m along a conveyor where a pull wire is used e.g. emergency stop.
- (d) Signs shall be provided at the isolating devices provided for in Clauses 2.7.3 and 2.7.4 which clearly indicate the function and purpose of the device. See Clause 6.3.3 for specific requirements for remote isolating devices.

SECTION 3 REQUIREMENTS FOR GUARDING

3.1 GENERAL

Guards shall be designed and provided to prevent access to danger zones unless the danger zone is guarded by location or position. Guards shall be included in the design of the conveyor or conveyor system and shall not in themselves create a hazard.

Particular attention is drawn to the mass of guards which may need to be manually lifted into place. Guidance on manual handling is provided in NOHSC:1001 (1990).

All guards shall be secured in position so that they cannot be removed without the use of tools unless an interlocking device is provided to automatically stop the conveyor in the event of the removal of the guard.

For mining applications complying with Clause 4.5, guards may be of the lift-off design not incorporating the interlocking device.

Guards should be designed so that it is not necessary to remove them for servicing or inspection purposes.

NOTE: For example, interlocking may be achieved by a pull wire operated stop switch in accordance with Clause 2.7.9, which operates automatically when the guards are removed.

3.2 DESIGN AND CONSTRUCTION OF GUARDS

3.2.1 General

Unless otherwise specified guards shall be designed and located in accordance with the requirements of AS 4024.1. Guards shall be designed to prevent—

- (a) persons reaching into the danger zone;
- (b) clothes and hair or other body parts becoming caught;
- (c) conveyed materials accidentally falling or being projected onto persons;
- (d) the hazard from the failure of a component;
- (e) inadvertent contact with a danger point on the conveyor; or
- (f) inadvertent contact with hot or hazardous fluids from fluid couplings or torque converters.

3.2.2 Materials

Guards shall be made of solid material, mesh or equivalent construction. Sheet metal guards should not be less than 1.5 mm thick. Mesh guards should not be less than 1.5 mm wire gauge, or 3 mm wire gauge for 50 mm square mesh and above.

3.2.3 Strength

The safety distances specified in Clause 3.2.4 shall be maintained when loads are applied as follows:

- (a) A force of 450 N at a point on the guard applied over a square area of 50 mm × 50 mm.
- (b) For guards which can be climbed or rested upon, a mass of 90 kg placed on the guard and a simultaneous horizontal force of 220 N applied to points selected to establish the strength of the guard. The required clearances from the danger zone shall be maintained when a force of 450 N is applied at point on a guard over a square area of 50 mm × 50 mm.

3.2.4 Reach dimensions and guard placement

Except where stated elsewhere the design and construction of guards and their subsequent location shall be such that the safety distance from any nip point or shear point to the nearest point of access is in accordance with Appendix C.

Typically the safety distances are as follows:

- (a) For square mesh with opening size up to and including 9 mm, guards shall be at least 25 mm from the nip or shear point.
- (b) For square mesh with opening above 10 mm and up to 50 mm, guards shall be at least 200 mm from the nip or shear point.
- (c) For fence type guards the maximum distance between the underside of the fence and the floor shall be 200 mm. The location of the nip or shear point may reduce this dimension.

3.2.5 Types of guards

3.2.5.1 General

Guards are normally provided in the form of—

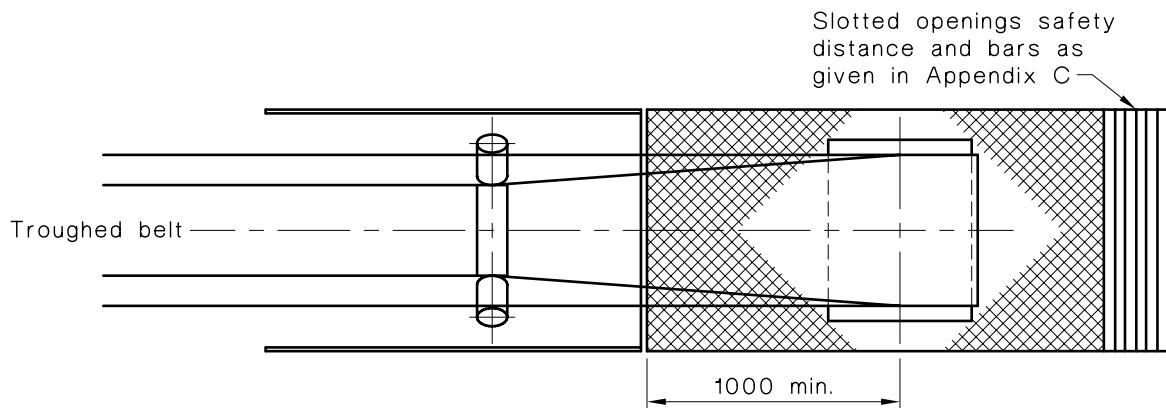
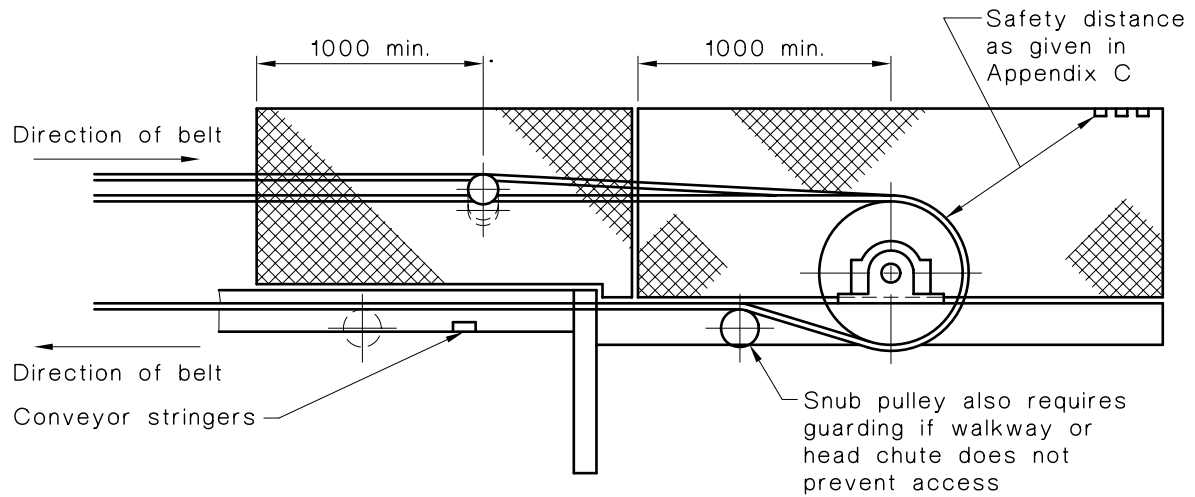
- (a) fixed enclosure guards see Figure 3.1;
- (b) fixed distance guards see Figure 3.2; or
- (c) nip guards where shear hazards are not present see Figure 3.3.

3.2.5.2 Fixed enclosure guard

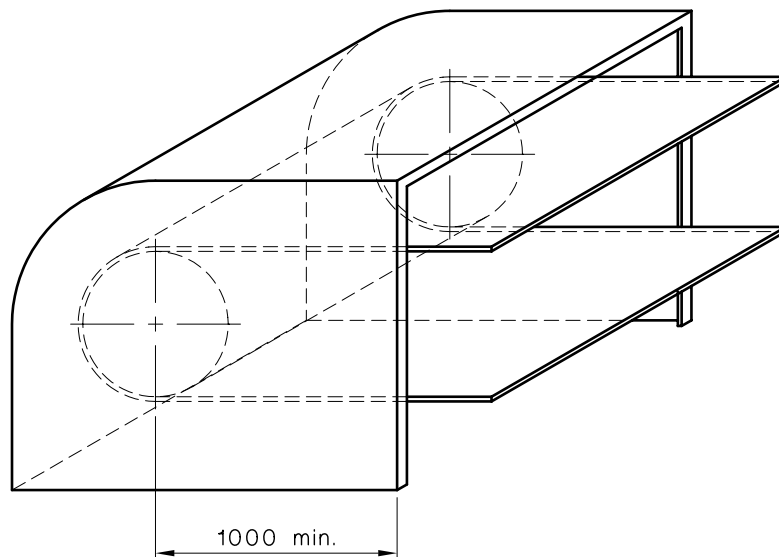
A fixed enclosure guard is a guard which, when in position, prevents access to a hazard or area by enclosure. It encloses the hazard to prevent access, so far as is practicable, consistent with the passage of the conveyor, materials and spillage.

Where an opening exists for the passage of the conveyor, the guard at the opening should extend for a minimum distance of 1000 mm from the hazard (see Figure 3.1). This distance shall be increased to 1150 mm when the pulley diameter is greater than 1000 mm. Where fixed enclosure guards cannot be used, fixed distance guards or nip guards shall be installed.

Guarding of idler sets where required should be provided on the approach side and should extend for 1000 mm from the nip point. On the out-running side the guard should extend for at least 1000 mm beyond the nip point (see Figure 3.4).



(a) Head pulley



(b) Tail pulley

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FIGURE 3.1 FIXED ENCLOSURE GUARD

3.2.5.3 *Fixed distance guards*

A fixed distance guard does not completely enclose a hazard but reduces access by virtue of its physical dimensions and its distance from the hazard. It shall be designed and constructed with the object of preventing any part of the body from reaching a hazard. It may take the form of a fixed barrier or fence designed to such a height so as to prevent normal access to the danger zone, although climbing over this type of safeguard cannot be entirely eliminated. (See Figure 3.2.)

Where fence type guards are used they shall ensure that—

- (a) the access to any fenced area includes a system to automatically stop the conveyor before access is obtained to the danger zone; and
- (b) a sign shall be provided at every access point through the fenced off area stating ‘DANGER—Isolate drive energy’.

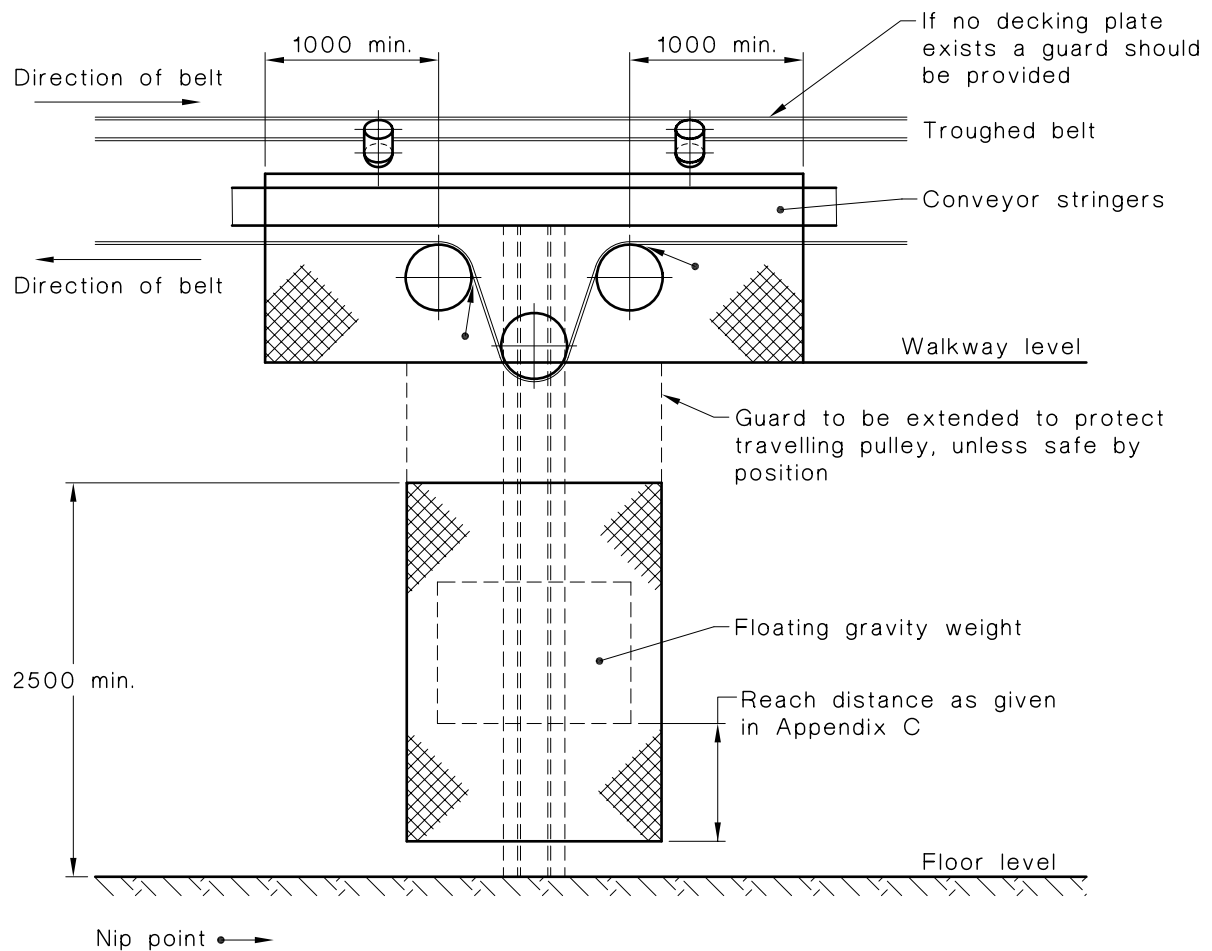
3.2.5.4 *Nip guards*

Nip guards shall extend for a minimum of 150 mm from the nip point and across the width of the belt for the full length of the idler or pulley and shall be closely fitted to follow the belt line and idler or pulley periphery approaching the nip, with gap not exceeding 4 mm. See Figure 3.3(a) and 3.3(b).

NOTE: Nip guards may not provide adequate protection from injury due to entrapment of hair, skin or clothes.

The principle of nip guards is shown in Figure 3.3(c). Examples of typical arrangements for nip guards at tail pulleys are shown in Figures 3.3(e) and 3.3(f).

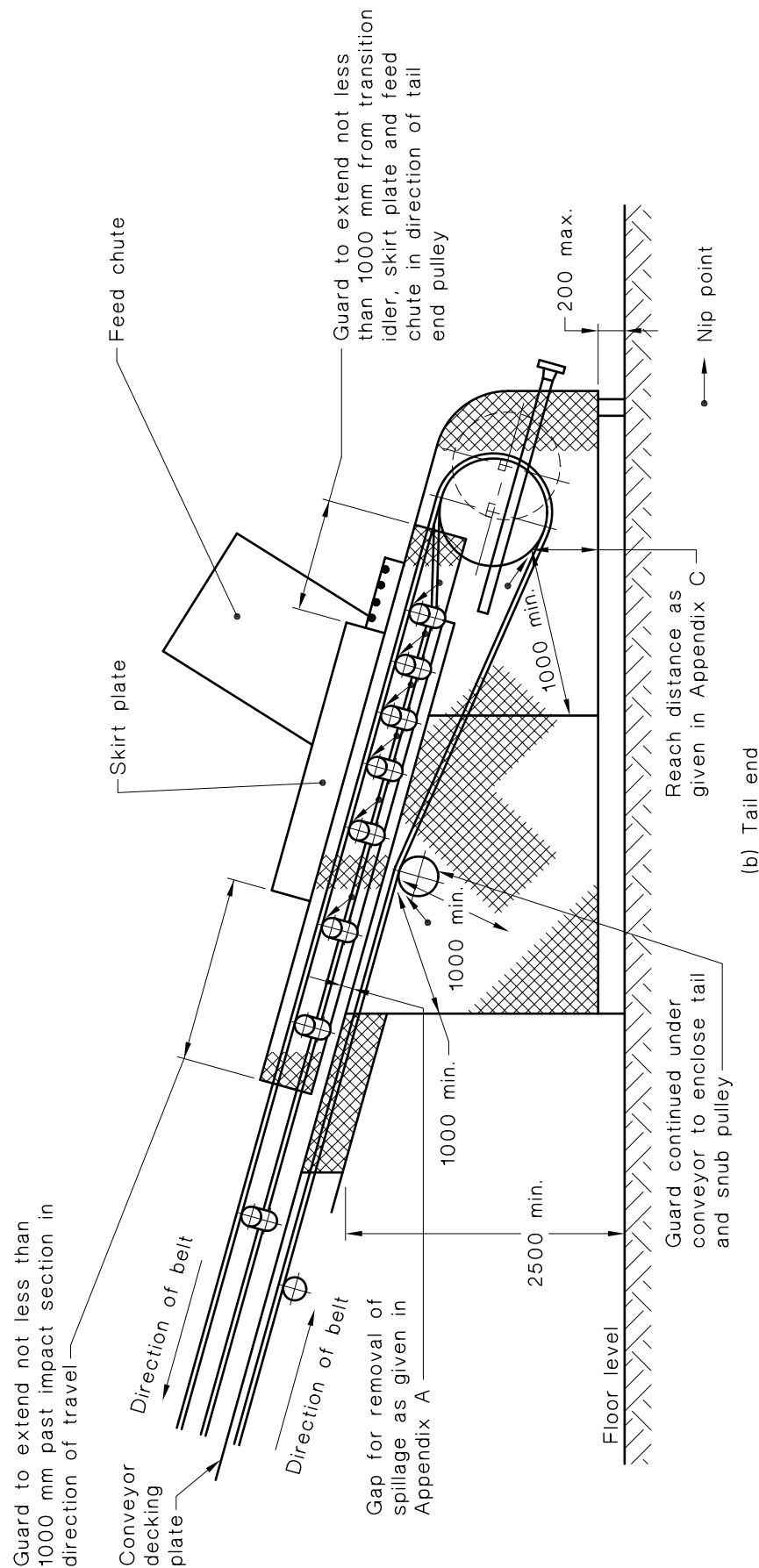
Where nip guards of alternative designs are used, which do not provide adequate protection, they should be fitted in association with fixed enclosure guards or fixed distance guards.



(a) Gravity take up

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FIGURE 3.2 (in part) FIXED DISTANCE GUARD



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FIGURE 3.2 (in part) FIXED DISTANCE GUARD