

Code of practice for

Safeguarding of the hazard points on troughed belt conveyors

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- Solids Handling and Processing Association

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Foreword

This British Standard has been prepared under the direction of the Mechanical Handling Standards Policy Committee.

When BS 2890 and BS 4531 covering troughed belt conveyors were revised Technical Committee MHE/9 decided to bring together the separate recommendations for safeguarding troughed belt conveyors in this single code of practice.

In the preparation of this standard cognizance has been taken of the revision of BS 5304.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard gives recommendations on the means of safeguarding of persons from injury by the use of safeguards, by protection from hazards due to necessary access to a troughed belt conveyor, from hazards from the moving sections of a troughed belt conveyor and by recommendations for emergency stopping and safe restarting. These recommendations apply to troughed belt conveyors complying with BS 2890 and BS 4531. It does not give recommendations for safe working procedures during maintenance of a troughed belt conveyor or during stoppages due to an emergency.

This standard does not apply to underground mine conveyors.

NOTE 1 This standard should be read in conjunction with BS 5304 which gives more general guidance on safeguarding machines.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard, the following definitions apply.

2.1

head of conveyor

the discharge end of the conveyor

2.2

tail of conveyor

the loading end of the conveyor

2.3

carrying idler

an idler which supports the loaded belt. An assembly of one or more carrying idlers comprises a carrying idler set

2.4

return idler

an idler which supports the empty side of the belt. An assembly of one or more return idlers comprises a return idler set

2.5

driving pulley

the pulley that drives the belt

2.6

take-up device

the device for taking up slack and applying tension to the belt

2.7

snub pulley

the pulley used to develop the necessary arc of contact (angle of wrap) of the belt on the driving pulley

2.8

bend pulley

the pulley used to change the direction of the belt

2.9

head pulley

the terminal pulley at the head of a conveyor

2.10

take-up pulley

the travelling pulley used in the take-up device

2.11

tail pulley

the terminal pulley at the tail of a conveyor

NOTE This may be a take-up pulley.

2.12

brake

a device for bringing the belting of the conveyor to rest and maintaining it at rest

2.13

tripper

a device usually comprising two or more pulleys, mounted either in a fixed position or on a travelling carriage, for discharging material from a belt conveyor at selected points or at any point along the length

2.14

shuttle conveyor

a unidirectional or reversible belt conveyor having overend discharge, the whole being mounted on a travelling carriage capable of being shuttled backwards and forwards along a track, giving a continuous distributed discharge

2.15

plough

a blade or blades mounted obliquely across the belt to discharge the material by deflecting it from the belt

2.16

anti-run-back

an automatic device for preventing a loaded elevating conveyor belting running backward when the power source is removed

2.17

hazard

a situation that may give rise to an injury or damage to health

2.18

safeguard

a guard or device designed to protect persons from danger

2.19**feed hopper**

a three or four sided extension to the feed boot, fitted to the conveyor or free standing, for receiving material in bulk from the loading device, e.g. a lorry, tractor, shovel

2.20**skirt plates**

an extension to the feed boot along the length of the conveyor for centralizing and/or retaining material on the belt

2.21**troughing idler**

an idler which supports the belt and maintains it in a troughed form

2.22**emergency stopping device**

a device which requires a deliberate action to bring a conveyor to rest for use when a dangerous condition is recognized

2.23**nip point**

the dangerous pinch point which occurs at the line of contact between the conveyor belt and rotating pulley and in certain cases between belt and idler roller

2.24**gravity take-up device**

a vertical weight operated device for taking up slack and applying tension to the belt

2.25**radial conveyor**

a conveyor which is pivoted vertically at or near its tail end and mounted on wheels or skids at a point along its length which permits it to be rotated horizontally

2.26**transition position**

the length of the conveyor at the head, tail or at an intermediate discharge pulley, where the belt profile changes from a troughed form to flat

2.27**transition distance**

the length of the conveyor occupied by the transition position

2.28**transition idlers**

the idlers supporting the belt over the transition distance. The geometry of the idlers varies over the transition distance to give the change from the troughed profile to flat

2.29**handing of conveyor**

the designation of the sides of a unidirectional conveyor, e.g. left or right when viewed from the tail to the head of the conveyor

2.30**chute**

a straight or curved, open topped or enclosed, smooth trough by which materials are directed and lowered by gravity

2.31**scraper**

a device fixed or flexibly mounted across the width of a belt or pulley of a conveyor, for removing adherent material

2.32**feed boot**

a three sided trough for feeding material centrally onto the belt

3 Hazard points and recommendations for safeguarding

3.1 Hazards and safeguards at nip points

3.1.1 Hazards

Hazards occur at in-running nips where belts wrap around the pulleys. They also occur at accessible carrying and return idlers at or near convex curves and other locations where the movement of the belt away from the idler may be restricted by means other than the load. It should be remembered that where a conveyor belt is designed to be reversed in direction there may be two in-running nips at each pulley. Hazardous nips may occur at the following locations shown in Figure 1:

- a) drive pulleys;
- b) terminal pulleys (head and tail trippers);
- c) bend and snub pulleys;
- d) take-up pulleys;
- e) transition troughed idlers adjacent to pulleys;
- f) carrying and return idlers at convex curves (brow position);
- g) carrying and return idlers beneath feed hoppers and skirt plates;
- h) carrying and return idlers at positions where the lift of the belt is restricted.

The greatest risk of injury occurs at head and tail pulleys particularly at the latter where there may be problems due to spillage and material inadvertently carried on the return side of the conveyor belt. The risk occurring at idler sets is usually less than at pulleys and this is reflected in the degree of safeguarding required.

3.1.2 Safeguards

Safeguarding should be provided at all accessible belt pulley in-running nips. These may take the form of fixed enclosure guards, distance guards or nip guards. Guards may also be used in conjunction with other items of plant, e.g. feed and discharge hoppers or chutes to achieve the prescribed standard of safeguarding.

3.1.3 Guards

3.1.3.1 Fixed enclosure guards

A fixed enclosure guard is a guard which, when in position, prevents access to a danger point or area by enclosure. It encloses the in-running nip points to prevent access so far as is practicable consistent with the passage of the belt, materials and spillage. Openings in guards should be as described in appendix A. When the opening required for the passage of belt and materials is in excess of that shown in appendix A, the guard at the opening should extend for a minimum distance of 1 000 mm from the nip point (see Figure 2). If access to the dangerous parts cannot be prevented by the use of a fixed enclosure guard then distance guards should be provided (see 3.1.3.2).

Examples of typical arrangements for guarding pulleys are shown in Figure 3 for head pulleys, Figure 4 for tail end pulleys and Figure 5 for gravity take-up devices.

3.1.3.2 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 is designed and constructed with the object of preventing any part of the body from reaching a danger point or area. 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 area, although climbing over this type of safeguard cannot be entirely eliminated.

Dimensions of fixed distance guards are given in appendix A.

3.1.3.3 Nip guards

Nip guards are inserted at danger points and protect these points directly. They also permit visual inspection during operation and need not be removed during repair and maintenance work.

The leading edge should be rigid and entered as deeply as possible into the in-running nip point.

A nip guard should follow the profile of the belt approaching the pulley nip. It should contain both edges of the belt to a minimum depth of 150 mm. Clearance between the nip guard and the pulley face, and between the side guard and the end faces of the pulley should not exceed 6 mm. The maximum dimension of 6 mm should always be maintained at adjustable pulleys. The principle of nip guards is shown in Figure 2 and Figure 6. Examples of typical arrangements for nip guards at head and tail pulleys are shown in Figure 7 and Figure 8.

NOTE Where nip guards of alternative designs are used (see Figure 9) which do not provide adequate protection on their own these may only be fitted in association with fixed enclosure guards or fixed distance guards as detailed in 3.1.3.1 and 3.1.3.2.

3.1.4 Safeguards at idlers and idler sets

3.1.4.1 Safeguards at transition troughed idler sets, and at idler sets at convex curve positions

Safeguards should be provided at accessible troughed idler sets at a transition position. It is usual that the belt edge is deflected at the ends of the wing rollers of a transition idler, in particular on the idler at the start of a transition distance. This will cause a force, the resultant of the belt tension, to be applied between the belt and idler rollers. Safeguards should be in the form of fixed distance side guards (see 3.1.4.2).

Examples of typical arrangements of fixed distance guards on a transition troughed idler set are shown in Figure 3.

3.1.4.2 Safeguards at carrying and return idler sets at convex curve position

Safeguards should be provided at accessible carrying and return idler sets at convex curves. These are where a belt changes direction in the form of a convex curve, i.e. at a "brow", causing an increase in the pressure between the belt and its supporting idlers. When this pressure restricts the upward movement of the edge of the belt safeguards should be provided. Safeguards should be in the form of fixed distance side guards, alternatively fixed enclosure guards or nip guards for return idlers (see 3.1.4.3).

3.1.4.3 Fixed distance guards for carrying and return idlers

Fixed distance guards should be located at the side of the conveyor.

Examples of typical arrangements of fixed distance guards at a bend of a conveyor are shown in Figure 10.

3.1.4.4 *Nip guards for return idlers*

Nip guards for return idlers should 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 and should be closely fitted to follow the belt line and idler periphery approaching the nip, with maximum gap not exceeding 6 mm (see Figure 11).

3.1.5 *Safeguards at idler sets beneath feed hoppers, skirts and fixed members*

3.1.5.1 *General*

Safeguards should be provided at positions where the requirement for access creates risk of trapping and crushing between the conveyor belt, where it passes over a carrying or return idler, and an adjacent feed hopper, skirt, structural bracing member, plough, or fixed surface. Similarly, safeguards should be provided if there is a risk of crushing between the belt and idler where the return idler is positioned close to a carrying idler immediately above it.

3.1.5.2 *Fixed enclosure guards for idler sets beneath feed hoppers, skirt plates and fixed members*

These should be provided generally in accordance with 3.1.3.1 and on the approach side should extend for 1 000 mm from the nip point. On the out-running side the guard should extend for at least 300 mm beyond the nip point.

3.2 *Access hazards*

3.2.1 *General*

Access hazards arise where access is allowed typically:

- a) under the conveyor;
- b) over the conveyor;
- c) around the terminals of the conveyor and where the material is discharged;
- d) at walkways;
- e) at working positions;
- f) passageways.

3.2.2 *Access under the conveyor*

Where the clear height of the conveyor is greater than 2 500 mm, unrestricted access beneath the conveyor may be permitted.

Where access under the conveyor is allowed at positions where the clear height is less than 2 500 mm, access ways should be guarded to prevent contact with moving parts of the conveyor. Safeguarding should take the form of fixed enclosure guards or fixed distance guards. Access ways should be defined by suitably placed guardrails. Access ways should be clearly marked.

A typical arrangement of safeguarding access under a conveyor is shown in Figure 12.

At other positions where there is no provision for access under the conveyor but where the clear height to the underside of the conveyor structure itself is between 700 mm and 2 500 mm there should be safeguards against unauthorized or inadvertent access. These may take the form of fixed distance guards or suitably placed guardrails.

Where the clear height to the underside of the conveyor structure is less than 700 mm other safeguards may be required in accordance with appendix A.

3.2.3 *Access over the conveyor*

Where access is required over the conveyor from one side to the other this should be catered for by the provision of purpose-built walkways incorporating guardrails and toeboards. There should be sufficient clearance between the walkways and ladders and the moving parts of the conveyor to prevent contact.

3.2.4 *Access at or around terminals of the conveyor and where material is discharged*

Where access is provided at or around terminals, safeguards should be provided to prevent contact with the moving parts of the conveyor and the material being discharged.

3.2.5 *Walkways and working platforms*

Walkways and working platforms should be provided at head pulleys, take-up devices to give safe access to locations where persons could fall more than 2 000 mm, these should be fitted with guardrails (1 000 mm above the level of the walkway), intermediate rails and with toeboards (150 mm deep) on both sides.

The surface of walkways and platforms should provide a firm foothold.

3.3 *Hazards at belt cleaning devices and other ancillary devices*

Where belt cleaning devices and other ancillary devices are installed, care should be taken that they do not constitute a hazard. Where such devices present a risk of injury suitable safeguards should be provided.

3.4 *Hazards at take-up devices, travelling trippers and at shuttle conveyors*

3.4.1 *Horizontal automatic take-up devices*

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

3.4.2 Vertical take-up devices

Safeguarding to a height of 2 500 mm above the walkway should be provided to prevent contact with moving parts of the conveyor. Safeguarding beyond this height is only required when access is provided, e.g. by means of a ladder, stairway or platform. Safeguarding should take the form of fixed enclosure guards or fixed distance guards. An example of safeguarding at a vertical take-up is shown in Figure 5.

Where there is access at the bottom of a gravity take-up, it is essential that protection be provided to check the descent of the weight should the belt break. Provision for the removal and disposal of spillage in this area is essential.

3.4.3 Fixed take-up devices

In the case of a locally adjusted fixed take-up device, e.g. screw type or winch type, where the movement of the carriage does not present a hazard, local safeguarding alone may be required for the in-running nip at the pulley.

3.4.4 Travelling trippers and shuttle conveyors

Where there would be a danger of trapping a person, there should be a minimum clearance in accordance with appendix A between a moving tripper, shuttle conveyor or radial conveyor and any fixed object other than its track. Safeguards should be provided to prevent any trapping between the travelling wheels and the rails. Where access is provided to, or across a travelling tripper, safeguards should be provided to prevent any trapping by or impact with a fixed object.

3.5 Transmission equipment

Hazards arise at rotating shafts and couplings, chains and chain wheels, gears and power transmission belts and pulleys. Safeguards should be by means of fixed enclosure guards and in accordance with appendix A.

The guarding of fluid couplings and similar devices which use fluid as a driving medium should be so designed to contain the discharge of hot fluid should this be released.

4 Guard construction

4.1 General

Guards may be of perforated or solid sheet construction and should be of adequate rigidity and strength for the situations in which they are employed. Guards of perforated construction are described in appendix A.

4.2 Openings in guards

The design of guards should enable spillage to be cleared without removal of guards. Where there is a requirement for the use of cleaning bars, scrapers, etc. rectangular slots may be provided in the guards for these purposes. Openings in guards should be suitably reinforced and should be in accordance with appendix A.

4.3 Fixing of guards

Guards should be securely fixed in position and should be capable of being removed with the aid of a tool and replaced without dismantling any other part. Where practical, captive type fastenings should be used.

4.4 Lubrication points

Lubrication points should be accessible from ground level, or from permanent gangways or platforms without removing the guards.

4.5 Interlocking

Where a moveable guard, cover, etc. is used as a safeguard, it should be so interlocked to the machine controls that:

- a) until the guard is closed the conveyor cannot operate; and
- b) the guard remains locked until any dangerous movement has ceased.

Where whole-body access to the danger area can be gained through an interlocked door a device which prevents inadvertent closing of the door should be provided. This can be achieved by, for example, a captive key bolt.

The interlocking system may be either mechanical, electrical, hydraulic, pneumatic or any combination of these. The type and mode of operation of the interlock should be considered in relation to the process to which it is applied.

The interlocking system should be designed to minimize failure to danger and should not be readily defeatable.

Further details on interlocking may be found in BS 5304.

5 Emergency stopping and safe restarting

5.1 General

Suitable means should be provided along the length of the conveyor for stopping it manually.

Consideration should be given also to automatic stopping of related items of plant which could cause hazards in the event of stopping a conveyor in an emergency.