



Safeguarding flat belt conveyors in the food and drink industries

Food Information Sheet No 25

Introduction

This information sheet gives guidance on conveyor safeguarding options for new and existing flat belt conveyors used in the food and drink industries. It also covers safeguard maintenance and checking procedures. The guidance will assist in ensuring compliance with the Supply of Machinery (Safety) Regulations 1992 (SMR) and the Provision and Use of Work Equipment Regulations 1998 (PUWER 98).

Flat belt conveyors include smooth, slatted, mesh and woven belt types but not bucket, troughed, roller, screw and rotating table type conveyors.

The principal hazard areas (in-running nip points and transmission parts) have traditionally been safeguarded by fixed guards. However, analysis of injury figures indicates that relying on fixed guarding alone is not effective and alternative precautions are required. If fixed guards are used, they need to be designed to allow safe cleaning of the machine without guard removal. Alternatively, as a new approach, **guards can be interlocked where daily access is required**. This new standard has been agreed with the industry through a liaison committee comprising food equipment supplier and user trade associations.

Hazards and risks

An analysis of injuries caused by machinery in the food and drink industries over a ten-year period has shown conveyors to be the cause of 30% of injuries investigated by HSE - more than any other class of machine.

The analysis showed that 90% of conveyor injuries occurred on belt conveyors; and 90% of the injuries involved well known hazards such as in-running nips, transmission parts and trapping points between moving and fixed parts.

Also, 90% of accidents occurred during normal operations - production activities, clearing blockages and cleaning; all foreseeable activities in food processing.

Belt conveyors used in the food and drink industries present unique safeguarding problems due to access for cleaning. Additionally, cleaning fluids, water and food product can cause problems due to ingress of liquids into sensitive parts and by chemical reactivity.

Safeguarding: legal requirements

All new machines, including own-build, substantially refurbished machines from within the European Economic Area (EEA) and second-hand machines from outside the EEA, should comply with the relevant 'essential health and safety requirements' (EHSRs) set out in SMR. These Regulations enact the Machinery Directive in the UK and require machine suppliers (or users who make their own machines or import into the EEA themselves) to comply with the EHSRs and affix the CE mark to safe machinery. Where existing conveyors are integrated with new machinery or conveyors which then operates as an integrated whole, CE marking is needed.

Even when a machine is supplied CE marked, and is then claiming to comply with the law, users should not assume that it does so and is therefore safe. Users should check for themselves that all relevant EHSRs are met and that the machine supplied is, in fact, safe.

European standards are being drafted on conveyor systems (for all industries) to guide makers on how to meet the EHSRs. The main standards relevant to flat belt conveyors will be BS EN 619 *Continuous handling equipment and systems. Safety requirements for equipment for mechanical handling of unit loads* and BS EN 620 *Continuous handling equipment and systems. Safety requirements for fixed belt conveyors for bulk materials*.

Advice on design criteria to meet the additional risks of food hygiene is given in BS EN 1672-2: 1997 *Food processing machines. Safety and hygiene requirements: basic concepts. Part 2. Hygiene requirements*.

Advice on safeguarding options particular to food machinery is currently in draft as prEN 1672-1: *Food processing machines. Safety and hygiene requirements: basic concepts. Part 1. Safety requirements*.

In addition to the above, PUWER 98 imposes duties on employers to ensure that work equipment (including conveyors):

- is suitable for the purpose for which it is used;
- is maintained in an efficient state, in efficient working order and in good repair;
- is safe to use and able to be safely cleaned and maintained; and
- if new machinery, is able to meet the requirements of SMR.

If a conveyor is repositioned in the workplace, the user will need to ensure the conveyor still complies with PUWER 98 and may need to reassess the risks.

Design considerations for safeguarding new conveyors

General safeguards (including in-use cleaning)

The following hierarchy of safeguarding measures should be considered for new conveyors. Materials used should be suitably robust and meet hygiene requirements where necessary (eg stainless steel).

Safety by design

Eliminate in-running nips and other trapping points by design, for example by the use of lift-out rollers and by guarding which is permanent (eg welded in place or part of the structure). Permanent guarding is the best option so long as it prevents the risk of injury and allows cleaning and the safe clearing of product.

For example, close-fitting, permanent guarding is suitable for in-running nips created between the belt and end rollers. Further information on safeguarding is given in BS 5667: 1980 Part 19 *Specification for continuous mechanical handling equipment - safety requirements. Belt conveyors - examples for guarding of nip points.*

Fixed guarding

Fixed guarding (ie guarding which can be removed for maintenance and is secured using hand tools by screws, nuts, bolts etc) can be used if the guard will not have to be removed frequently. Guards should either enclose the danger area or prevent access by ensuring a suitable distance to any danger area. See BS EN 294: 1992 *Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs* (Table 4).

The disadvantage of fixed guards is that they may not be replaced - or if replaced, may not be properly secured. Access for cleaning may be restricted.

Where access is required more than once a month to transmission parts for adjustment or lubrication, the guard should be designed so that this is possible without having to remove it.

Interlocking guards

Interlocking guards (eg guards fitted with coded, magnetic interlock switches to prevent the machine running when open) have some advantages and some disadvantages compared with fixed guards. Advantages include easy access for cleaning and maintenance; disadvantages include the need to maintain the interlocks in good condition, especially when subject to cleaning fluids etc.

This method of guarding should be used **where guards may need to be removed frequently**, eg once a day, for cleaning or clearing blockages etc. As with fixed guards, interlocking guards should safeguard the danger area.

Interlocking should be of a hygienic design and resistant to ingress of water and chemical attack from either the food product or suitable cleaning chemicals. Suitable cleaning chemicals should be specified in the instruction handbook. This will probably mean the use of coded, magnetic or proximity-interlocking switches. The control system and interlocking integrity should be to a minimum of Category 1 as stated in BS EN 954-1: 1997 *Safety of machinery. Safety related parts of control systems - general principles for design.*

Control guards (ie guards which start the machine when they are closed) can be used to reduce downtime. However, this is only if the operator cannot be trapped between the danger zone and guard when closed, interlocking is to the highest possible reliability and there is no hazard from rundown time when the guard is opened.

Tripping devices

Tripping devices, either mechanically actuated (eg trip bars, safety mats) or electrosensitive devices (eg photoelectric) are another safeguarding option. Tripping devices should stop the machine automatically before an operator, or part of an operator, enters the danger zone. Tripping devices should only be considered where it is not practicable to safeguard by other means. Hygiene and environmental requirements need to be taken into account when selecting tripping devices which may be subjected to food contamination or cleaning chemicals.

The integrity of the mechanically actuated tripping devices should be to a minimum of Category 1 and electrosensitive devices' integrity should be to a minimum of Category 2 as stated in EN 954-1: 1997.

Two-hand control

Two-hand control is not considered a suitable method for safeguarding conveyors because it does not offer protection to others who may be in the vicinity.

Other design issues

The design of all belt conveyors should take into account:

- safe methods of clearing blockages and in-use cleaning, eg using automatic systems (spray nozzles etc);
- safety at conveyor start-up. In larger conveyor systems it may not be practicable to see from the control panel all positions where people could be at risk. In such cases an automatic start-up warning

alarm should be provided which would allow a person sufficient time to operate an emergency stop control before the conveyor system starts (alternatively mirrors or other viewing aids should be considered);

- suitable selection of belt materials - smooth belts can have different levels of grip (due to different materials or coatings) which can increase/reduce the risk of being drawn in, especially where conveyors with different levels of grip are installed adjacent to one another;
- the need for trays and drainage to capture drips from belt lubricants;
- suitable enclosure/protection for motors, switches etc to prevent ingress of water, cleaning chemicals etc;
- including guidance in the instruction handbook on safe methods of work, suitable cleaning chemicals/methods etc.

Deep cleaning safeguards

Deep cleaning (periodic thorough cleaning) often involves an element of dismantling. Where cleaning cannot be achieved with the 'normal' safeguards in place, the following hierarchy should be considered.

Unpowered option

It may be possible to clean some conveyors by using a safe system of work involving disconnecting the conveyor from the power supply. This may involve unplugging the conveyor (lockable plug covers are available for industrial plugs) or locking off the isolator. The use of this method is normally limited to easily cleaned conveyors, probably in lightly soiled situations with low-risk foodstuffs.

For heavily soiled conveyors and high-risk foodstuffs, intensive cleaning of the belt surface is required which may involve incremental movement of the belt as part of the cleaning regime. In such cases manual movement of the belt may be an option. However, this option should not be used if an excessive effort is required. Any special tools required should be provided and easy to use.

Manual powered control

This should be used where it is not practicable to clean the conveyor either with the normal safeguards in place or using the unpowered option.

In this case guards which need to be removed frequently (eg daily) should be interlocking. A cleaning mode should only allow powered movement with interlocking guards open by means of a hold-to-run control device

(which should stop the conveyor when released) and limited movement (eg the conveyor operating at reduced speed or reduced power).

In addition to the engineering safeguards, the cleaning regime needs to be carried out in accordance with a safe system of work. Emergency stop devices should be suitably located (eg trip wires, push buttons etc).

Safeguarding existing conveyors

Safeguarding on existing conveyors should be assessed against the standards for new conveyors outlined earlier. If the standard of safeguarding is lower than that indicated, a risk assessment should be carried out. The risk assessment will indicate whether the conveyor safeguarding needs to be upgraded. If upgrading of safeguarding is not reasonably practicable, the control of residual safety risks could be achieved by other means such as safe systems of work, increased effective supervision and additional training.

Maintenance on conveyors

Maintenance aspects should have been considered at the design stage of new conveyors. For example, where inspection and adjustment needs to be undertaken with the conveyor in motion, it should be possible to do it safely without removing the safeguards.

Maintenance requiring the removal of safeguards should be undertaken with the conveyor suitably isolated from energy sources (eg locked off from the power supply).

On older conveyors, where dangerous moving parts must be exposed to carry out maintenance procedures, additional safeguards and safe systems of work must be in place to prevent injury.

The conveyor manufacturer's instructions for safe maintenance should be followed.

Checking conveyor safeguards

Operator checks

These should be frequent and should be used to establish that:

- safeguards are in place (eg daily visual checks);
- guards etc are fitted correctly (eg not distorted, no obvious incorrect gaps);
- all fixings are present (eg bolts);
- interlocks and emergency stops are not obviously defective (eg missing, hanging off, visibly broken); and
- dependent upon the risk, interlocks are working as intended.

Operators should be trained in:

- how to carry out operator checks safely;
- what to do when a defect is spotted; and
- safe methods of working during normal production, including clearing blockages and cleaning.

Routine inspections

These should be carried out at regular intervals, the frequency of which will be dependent on a risk assessment, taking account of experience and manufacturer's information. Routine inspections should be carried out by a person (in-house) who is trained and competent.

People undertaking inspections should have sufficient training and knowledge to understand the safeguarding methods, how to spot defects, how to undertake the work safely and know what action to take. They should also be aware of the risk of being drawn in when two conveyors operating at different speeds are placed end-to-end.

Periodic maintenance

This may cover many things in addition to safety issues and should be carried out as recommended by the conveyor manufacturer. If maintenance information is not available for the conveyor, maintenance requirements should be established by a suitable risk assessment.

The correct positioning, security and operation of safeguards should be checked **after any maintenance or deep cleaning operation**.

Additional safeguard checking

This should include the functional testing of interlocks, measurement of gaps (eg on close-fitting, in-running nip guards), checking the tightness of fixings (eg on fixed guards) etc. These checks may be included in operator checks, routine inspections or periodic maintenance based upon the risk.

Further reading

Supplying new machinery INDG270 HSE Books 1998
Single copies free, multiple copies in priced packs
ISBN 0 7176 1560 X

Buying new machinery INDG271 HSE Books 1998
Single copies free, multiple copies in priced packs
ISBN 0 7176 1559 6

Effective purchasing procedures for equipment in the food and drink industries Free leaflet INDG323
HSE Books 2000

Five steps to risk assessment INDG163(rev1) HSE Books 1998 Single copies free, multiple copies in priced packs ISBN 0 7176 1565 0

Provision and use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and Guidance L22 HSE Books 1998
ISBN 0 7176 1626 6

Product standards: Supply of machinery 98/644 (Explanatory booklet on the Supply of Machinery (Safety) Regulations 1992. Available from DTI Hotline Tel: 0870 150 2500)

Supply of Machinery (Safety) Regulations 1992 SI No 3073 Stationery Office 1992 ISBN 0 11 025719 7

Supply of Machinery (Safety) (Amendment) Regulations 1994 SI No 2063 Stationery Office 1994
ISBN 0 11 045063 9

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

Further information

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995 Website: www.hsebooks.co.uk (HSE priced publications are also available from bookshops.)

For information about health and safety ring HSE's InfoLine Tel: 08701 545500 Fax: 02920 859260 e-mail: hseinformationservices@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG. You can also visit HSE's website: www.hse.gov.uk

British Standards are available from BSI Customer Services, 389 Chiswick High Road, London W4 4AL Tel: 020 8996 9001 Fax: 020 8996 7001 Website: www.bsi-global.com

The Stationery Office (formerly HMSO) publications are available from The Publications Centre, PO Box 276, London SW8 5DT Tel: 0870 600 5522 Fax: 0870 600 5533 Website: www.clicktso.com (They are also available from bookshops.)

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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