Packaging machinery: Safeguarding thermoform, fill and seal machines

Food Information Sheet No 26

Introduction

Thermoform, fill and seal (TFFS) machines are used in a wide range of industries and the guidance in this document will be of use to anyone using these machines.

The guidance gives advice on safeguarding for both existing and new machinery and is based on European and British Standard BS EN 415-3: 2000 *Safety of packaging machines - Part 3: Form, fill and seal machines*. This standard also covers horizontal and vertical form, fill and seal machines, bag fill and seal machines and carton erect/form, fill and seal/close machines.

Injury history

HSE investigated nearly 50 serious accidents on TFFS machines between 1997 and 2001, they were the biggest cause of investigated packaging machinery injuries for that period. A third of these were major injury accidents involving amputation and broken bones.

Hazards

Around 50% of injuries are caused by failures in guarding at the two main hazard areas:

- the forming dies; and
- the cutters that separate the continuous packaging into individual packs.

Other injuries occur at the sealing dies, fillers, web-grippers, transmission machinery and film-rollers.

Analysis of the investigated accidents reveals the major causative factors to be:

- 36% guards removed, failed or inadequate;
- 19% guarding not provided or fallen into disuse;
- 17% unsafe systems of work, especially during maintenance.

Injury occurs most commonly on manually loaded, horizontal, short bed machines, which have insufficient space between the forming dies and sealing dies to fit tunnel guards complying with the separation distances required by BS EN 294: 1992 *Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs* (Table 4). Operators fill the formed pockets with product in the loading area, between the forming and sealing dies.

New machinery

The full range of hazards on new TFFS machines should be safeguarded using the techniques described in BS EN 415-3. Purchasers should specify in the purchase contract that, as a minimum, the machinery meets the requirements of this standard and should check on delivery that the Declaration of Conformity confirms this.

Safeguarding against the major hazards accessible from a loading area can be achieved by the following means:

- tunnel guards over the forming and sealing dies should have reach distances in accord with BS EN 294, Table 4;
- where the depth of the opening exceeds 120 mm, as well as the guard extending 850 mm, a pictogram should be attached warning operators of the hazard of reaching into the machine;
- if it is not possible to achieve the required reach distances for the guards, then the following options should be considered (depending on the assessment of risk and what is technically possible):
  - trip guard;
  - trip guard with deterring device;
  - trip guard with photoelectric device;
  - light-sensitive trip device;
  - linked automatic guarding; and
  - automatic guard.

Details of the minimum safety distances associated with these options for different depth of opening are given in Table 1 (taken from BS EN 415-3).

Note: BS EN 415-3 outlines the minimum acceptable levels of safety within the state of the art. HSE does not consider deviations below these minima to be acceptable for new machines.

Table 1 Minimum safety distances for safeguards (dimensions in millimetres)

Bed depth	>20-30	>30-40	>40-60	>60-120	>120-220	>220
Safeguarding options	**Safety reach distance**					
B Fixed tunnel guard	230	550	850	850	850*	850*
C Trip guard	230	350	450	550	850	850
D Trip guard with deterring device	230	300	350	450	550	550
E Trip guard with photoelectric device	230	250	300	400	500	550
F Light-sensitive trip device	230	230	230	230	230	230
G Linked automatic guard	230	230	230	230	230	230
H Automatic guard	5	5	5	5	5	5

NOTE: Dimension B (from Table 4 of BS EN294: 1992) should be used wherever possible. Dimensions C-H only apply to TFFS machines where it is impossible to comply with dimension B.

* A label or pictogram should be fitted to warn of the hazard of reaching into the aperture

Existing machinery

Existing machinery is subject to the Provision and Use of Work Equipment Regulations (PUWER) 1998 and should be suitable for its purpose, properly maintained and safe to use and clean.

Users should use the safeguarding options for new TFFS machines as a benchmark for existing machines. Where the standard of safeguarding is found to be lower than for new machines, a risk assessment should be carried out to see if it is reasonably practicable to upgrade the guarding.

Improvement may be needed in basic hardware, systems of work and in training and supervisory procedures.

All improvements should form an integrated package since improved guarding alone may lead to tampering if there is a significant increase in the difficulty of carrying out production and maintenance tasks.

Modifications to existing machines may require the following:

- extension of tunnel guards over the dies;
- reduction of bed depth by use of a false base;
- fitting of a photoelectric safety device;
- full enclosure of the loading station and a change to automatic loading;
- fitting of automatic guarding.

Where improved safeguarding is required, particularly on short bed machines, this should be carried out as soon as possible. Until then, such machines should only be used under safe systems of work (see following section), arrived at by risk assessment that deals with the risks arising from the safeguarding deficiencies.

It may not be possible to provide adequate safeguarding on older short bed machines, in which case they will need to be replaced.

Safe systems of work

There should be properly assessed systems of work, especially for higher-risk production activities such as package-depth-changing, film-threading and clearing blockages and for maintenance tasks such as die-changing and troubleshooting.

People who operate or maintain the machines should be competent to do so and be provided with suitable instruction, information and training.

The level of supervision required will depend on the competence of the worker and the risks of injury identified by the risk assessment.

Management should monitor that the systems of work and training standards are being adhered to and are still valid.

Advice on training may be available from the supplier or manufacturer of the machine.

Maintenance and troubleshooting

During these procedures the machine should be suitably electrically isolated and other energy sources, such as compressed air, should be dumped. Electrical power and other energy sources should be locked off to prevent unintentional start up. There should be tight control of any override keys to prevent powered movement while guards are defeated or removed. A risk assessment should be carried out for maintenance and troubleshooting which should consider whether any additional safeguards are needed, such as the use of a permit-to-work system.

Powered movement of the unguarded dangerous parts of a TFFS machine should be allowed only when no other ways of working are possible and when other suitable safeguards are in place, for example:

- the minimum unguarded area should be exposed;
- the minimum number of people should be within the hazard area;
- precautions should be taken to prevent entanglement (no loose clothing, ties etc);
- information on the risks, the safe system of work and emergency procedures must be given to people in the hazard area.

Further information may be available from manufacturers or suppliers and any manuals should be consulted for process or technical information. Changes or modifications should be recorded and kept with any machine-related documents.

Regular maintenance is essential and should be as recommended by the manufacturer or supplier, otherwise the maintenance schedule should be determined by a risk assessment.

Maintaining machinery safeguards

Regular supervisory checks should be made to ensure that the safeguarding is in place and working effectively. Intervals will be based on experience and any relevant manufacturer or supplier information.

Operator checks should establish that there are no obvious faults, that the guards are in place, and that photoelectric devices and emergency stops are not patently defective. Functional tests may be included in daily operator checks or in routine/periodic maintenance, depending on the risk.

People carrying out checks should be competent to do so. Suitable checks on safeguarding should be carried out during the installation and commissioning of the machine before handover to production.

Further reading

BSI publications

BS EN 415-3:2000 *Safety of packaging machines - Part 3: Form, fill and seal machines*

BS EN 294:1992 *Safety of machinery: Safety distances to prevent danger zones being reached by the upper limbs*

HSE publications

Supplying new machinery Leaflet INDG270 HSE Books 1998 (single copy free or priced packs of 15 ISBN 0 7176 1560 X)

Buying new machinery Leaflet INDG271 HSE Books 1998 (single copy free or priced packs of 15 ISBN 0 7176 1559 6)

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

Five steps to risk assessment Leaflet INDG163(rev1) HSE Books 1998 (single copy free or priced packs of 10 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 (Second edition) HSE Books 1998 ISBN 0 7176 1626 6

Application of electrosensitive protective equipment using light curtains and light beam devices to machinery HSG180 HSE Books 1999 ISBN 07176 1550 2

Other publications

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 The Stationery Office 1992 ISBN 0 11 025719 7

Supply of Machinery (Safety) (Amendment) Regulations 1994 SI No 2063 The 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

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.)

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

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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