cpi confederation of paper industries

MULTIPOINT GLUERS GUARDING STANDARDS

GUIDANCE DOCUMENT

MAY 2005

Multipoint Gluers Guarding Standards

1. Foreword

This Confederation of Paper Industries – Corrugated Sector Body guide dealing with machinery safety issues at folding box gluers will, if applied by the industry, help to reduce the unnecessary injuries that occur every year at such machines.

The guide has benefited from being written following a study of folding box gluers in the workplace. It has allowed the authors to address activities and hazards observed during the study and which might otherwise be missed. Consequently the safety guide is able to provide practical help in both the risk assessment process and in determining the appropriate control measures needed to ensure these machines are set, operated, adjusted and maintained safely.

For all involved with folding box gluers and whatever your level of experience it provides a benchmark tool to help find gaps or shortcomings with existing safeguards across the full range of activities performed at these machines.

A logic flow chart is included which both adds to the practical nature of the guide and will help with determining the guarding requirements for each section of the machine. It will ensure you look at what your employees do at each section of the machine and then design the safeguards and safe work procedures to address actual working practices.

Chris Flint
HSE's Manufacturing Sector

2. Introduction

This guide has been prepared by the Health and Safety Committee of the Confederation of Paper Industries (CPI) – Corrugated Sector Body following a survey of a sample of multi point folding box gluers in use in the UK in 2004. It is intended as an aid for those who own, operate or maintain folding box gluers.

The guide contains practical advice to aid the risk assessment process and help decide the control measures needed to ensure these machines are set, operated, adjusted and maintained safely.

Although the guide was prepared following a survey of *multipoin*t gluing machines used in the corrugated packaging industry, the principles apply equally to *straight line* gluers and similar machines used in carton making and other related industries.

3. Scope

The guide applies specifically to folding box-gluing machines. These are machines fed with blanks that have been previously creased and/or slotted and which fold and glue the blanks to form flat packed cases or trays. The scope includes single and multipoint gluing machines.

The guide is limited in application to types of machines in common use at December 2004. It does not apply to types of machines that may be developed after that date. However, every effort has been made to ensure that the guidance is compatible with pr EN 1010 – Part 5 (Safety of machinery – Safety requirements for the design and construction of printing and paper converting machines – Part 5: Machines for the production of corrugated board and machines for the conversion of flat and corrugated board) the provisions of which are expected to form the EN safety standard covering this type of machine.

The scope is limited to machinery safety issues i.e. preventing physical injury from dangerous moving parts. Other health and safety issues such as electrical safety, noise and manual handling are outside the scope of this document.

The scope also excludes any ancillary equipment such as prefeeders and (semi)-automatic stackers. *See note under Emergency Stop Devices 10.3.7 regarding one aspect of safety related to this type of equipment.*

4. Logic flow chart

A logic flow chart has been included at Appendix I as an aid to assessing the risks associated with tasks that could potentially involve approach to dangerous moving machine parts and to help decide the most appropriate safeguarding methods to be applied in each case.

5. Definitions

Multi-point gluer – normally a machine with the capability to apply glue at one up to a maximum of six positions in one pass

Straight-line gluer – a machine that applies single glue line normally for the manufacture of a regular case, and can include multi-point gluers used for this process

Prefeeder – equipment that automatically feeds blanks into the feed hopper of the gluing machine

(Semi)-automatic stackers – equipment used for collating bundles of finished blanks and stacking them on to pallets or ready for palletisation

Electro Sensitive Protection Equipment (ESPE) – Electrosensitive equipment (e.g. photo-electric beam or curtain) that stops the dangerous moving parts before any part of a person’s body can reach the danger zone

Slow crawl control – a system that controls the linear speed of the machine to 1 meter per minute and is under the control of the person at risk (the person who is exposed to a danger point whilst carrying out required activity on the machine). This control could be provided by a hold–to-run control; or a two hand control device

Hold-to-run control device - where the actuator automatically returns to the start position when released and where machine operation is started and maintained only as long as the actuator is held depressed. Probably with the use of a wander lead, remote control or buttons on the machine frame

Emergency stop device – A device that stops the dangerous parts moving in accordance with ISO 13850: 1996 Safety of machinery – Emergency stop – principles for design. The devices may be buttons, or trip devices including trip wire or antennae etc.

6. Dangerous Parts

Folding box gluers have a number of moving parts with the potential to cause entanglement, trapping, shearing, crushing, striking and piercing injuries. These include the following.

- Rotating shafts.
- In running nips between belts and rollers.
- Moving back fold arms, otherwise known as rotating, rotary or folding hooks.
- Reciprocating kicker plates.
- Trapping points between moving carriage units and side frame.

This list is neither exclusive nor exhaustive and users of these machines may identify other moving parts, with the potential to cause injury, when conducting their risk assessments.

7. Principles of Risk Reduction

As well as helping machine users to assess the risks this guidance is also designed to help them complete the following steps.

1. Eliminate machinery hazards where possible (e.g. by design). An example being the inrunning nips between upper and lower roller tracks or folding belt which can be safeguarded by a deflection of the first roller in the roller track of at least 25mm under a contact force of 70 N maximum and fixed guards on following rollers on the track.
2. Eliminate, or if this is not possible, minimise the need for people to approach dangerous moving parts of machinery.
3. Ensure that any moving dangerous parts that could potentially be approached are properly safeguarded with the guards and safety devices properly maintained and inspected.
4. Ensure that any residual risks remaining are properly controlled by providing and maintaining safe systems of work.

Tasks that could potentially lead to the need for close approach to moving parts include the following.

- Setting.
- Checking settings.

- Performing adjustments.
- Clearing blockages.
- Viewing or inspecting operating parts of the machine or product passing through it.
- Cleaning.
- Faultfinding.
- Maintenance.

Note: more than one person can undertake some of these tasks at the same time, the communication between the two people and operation of start / stop controls needs to be fully considered when undertaking the risk assessment.

8. Measures for eliminating and reducing the need for close approach to dangerous parts

The need for close approach to dangerous moving parts of the machine should be eliminated, or where this is not possible, minimised. The following is a list of measures that should be considered and applied where reasonably practicable in the individual circumstances.

- Install automatic (motorised) adjustment devices.
- Modify manual adjustment devices so that they can be operated from safe positions outside the machine frame.
- Install automatic glue detection systems.
- Provide guards with clear panels that allow a good view of the working parts of the machine from outside.
- Install Internal lighting inside the guard enclosure.
- Install CCTV cameras and monitors that allow the working parts of the machine to be viewed from outside the guard enclosure.
- Provide arrangements to ensure that as many as possible of the operations that could potentially involve approach to dangerous moving parts are carried out with the machine stationary and isolated from the power supply.

9. General Approaches to Safeguarding of Dangerous Parts

There are a number of reasonably practicable measures that can be taken to safeguard dangerous parts of folding box gluers. It is common practice to use a combination of measures chosen from the following.

- Fixed guards – including perimeter fencing, enclosing guards fitted in close proximity to the individual dangerous parts of the machine, use of the machine side frame as a barrier and localised close nip guards.
- Interlocking guards (which are commonly incorporated into perimeter fencing) – where the interlocks ensure that the machine cannot be run with the door or gate open other than under specified slow crawl control.
- Adjustable guards – these can be adjusted during machine setting but remain fixed during machine operation e.g. telescopic, bellows type, roller blinds etc.

- Trip devices – that stop the dangerous moving parts before any part of a person's body can reach the danger zone and prevent the machine from being run, other than under specified slow crawl control, while the presence of the person close to the danger zone is detected. These devices include:
    a) pressure sensitive mats; and
    b) Electro Sensitive Protection Equipment (ESPE) e.g. photo-electric (light beam) devices etc

Guards should be designed and installed in accordance with current best practice and adopting the requirements of British and European standards in an appropriate way to achieve best practice. For example BSEN 294 "Safety of Machinery – safe distances to prevent danger zones being reached by upper limbs" specifies the correct positioning of fixed guards.
The "Sources of Further Information & Guidance" at Appendix III, provides a list of the main standards current at the time of publication.

10. Machine controls, power isolation devices and emergency stop devices

This section provides checklists of questions to help users determine if the machine controls, power isolation devices and emergency stop systems meet required standards. Where the answer to any question is "No" remedial action is required. Machine users should prepare and implement an action plan to deal with the shortcomings.

10.1. Slow Crawl Control
A slow crawl control should be provided to reduce the risk of injury during tasks that could potentially involve close approach to dangerous parts (see sections 6 and 7 above). A slow crawl speed may reduce the risk of being injured. But operating the machine at slow crawl speed does not guarantee that the person involved will be safe. The risks associated with each task must be assessed. A safe system of work must be provided and maintained in each case. Employees must be carefully trained in the safe systems of work and adequate supervision and monitoring must be provided to ensure that the safe systems of work are followed in practice. The answers to questions 10.1.3. to 10.1.6. should always be "Yes".

Questions to help determine if control system is adequate.	**Yes**	**No**
10.1.1. Is the maximum achievable linear crawl speed limited to **1 metre/min**?		If no, answer to question 10.1.2 must be Yes
10.1.2. If the answer to question 10.1.1. is "No", are all dangerous parts to which the person performing the task under slow crawl control could potentially gain access properly safeguarded, e.g. by close fitting guards for the individual dangerous parts, ESPE or pressure mats?		
10.1.3. Is the slow crawl achieved only by a hold-to-run control button or a two-hand control device?		
10.1.4. Is the slow crawl control operable only by the person who is performing the task/potentially at risk?		
10.1.5. Does the slow crawl control bypass only the individual interlocked guard or ESPE through which the person performing the task/potentially at risk has to gain access?		
10.1.6. Do all other fixed guards; interlocked guards and ESPE remain in place and fully operational and effective when the slow crawl control is in use?		

Note: Though not seen on any of the machines surveyed it would be possible to provide a safeguard by means of a hold-to-run device with a displacement limited to a maximum of 25mm (a true inch device)		
10.2. Pre start warning devices Unless the machine is very small such that the person starting it, whether to run it at production or slow crawl speed, has a clear view of every position around and inside the machine, a pre start warning device must be provided. You can use the following questions to help you decide if the pre start warning system is adequate. For the system to be adequate the answers to *all* questions should be "Yes".		
Questions to help determine if control system is adequate.	**Yes**	**No**
10.2.1. Does the pre start warning operate when *any* of the start control buttons are operated?		
10.2.2. Does the pre-start warning device include a self-monitoring system within the control circuit?		
10.2.3. Does the self-monitoring system comply with BS EN 954-1 Category 2? *(This states that; safety related parts of control systems should be designed, constructed, selected, assembled and combined in accordance with relevant standards using well-tried safety principles. In addition the safety related parts should be designed so that their functions are checked by the control system. The periodicity of this checking is described within EN954-1)*		
10.2.4. Does the pre-start warning system incorporate an audible signal that can be heard clearly from all working positions in and around the machine?		
10.2.5. If the ambient background noise level is high does the pre-start warning system also incorporate a flashing warning light that is visible from all positions around the machine?		
10.2.6. Does the audible signal and, where applicable the visible signal, last for between one and two seconds?		
10.2.7. Does the pre-start warning device ensure that a waiting time of at least three seconds passes before the machine can then be started by repeated operation of the same or a different start control button?		
10.2.8. Does the device ensure that after the waiting time has elapsed, or after a preceding operation in slow crawl mode, the start control button must be operated within a further period of up to 12 seconds (the release time) to successfully start the machine without a further warning signal?		
10.2.9. Does the device ensure that if the start button is not operated within the release time the warning signal will sound again and the system will require the whole warning and starting sequence to be started again?		
10.2.10. Does the device ensure that after operation of a stop control, or the emergency stop, the machine can only be restarted after repeating the whole pre-start sequence?		

10.3. Emergency stop devices

The machine must be provided with an emergency stop system. You can use the following questions to help you decide if the emergency stop system fitted to the machine is adequate. For the system to be adequate the answers to all questions should be "Yes".

Questions to help determine if control system is adequate.	**Yes**	**No**
10.3.1. Does the emergency stop system comply with recognised standards? *(For example does it meet all the specific functional requirements listed in BS EN 418?)*		
10.3.2. Are the emergency stop devices located within easy reach of any position in which an operator or assistant may be working?		
10.3.3. Are the emergency stop devices located within 15 metres of any point on the machine?		
10.3.4. Are emergency stop devices provided along the normal operating side of the machine?		
10.3.5. Are emergency stop devices provided along the drive side of the machine?		
10.3.6. Are emergency stop devices provided where they will be readily accessible from places at which access is required for the activities identified in paragraph 7 (Principles of risk reduction)?		

10.3.7. Where ancillary equipment (note: dealt with in the main body of this guidance) is fitted all e-stops should be designed and fitted so that when activated they stop the whole machine, including the ancillary equipment.

10.4. Electro Sensitive Protection Equipment (ESPE)

ESPE devices, such as photoelectric curtains, may be installed to safeguard dangerous parts of the machine. The installation must satisfy the requirements of Provision and Use of Work Equipment Regulations 1998 (PUWER). New machines fitted with ESPE devices must also satisfy the requirements of the Supply of Machinery Regulations 1992 (SMR). Compliance requires effective exchange of information between those involved in designing, manufacturing, supplying and using the ESPE devices to ensure the integrity of the machine's overall protective systems. An inadequately installed ESPE can adversely affect the overall standard of protection and control. You can use the following questions to help you decide if the ESPE devices on your machine are adequate. For you to have confidence that the ESPE devices are adequate the answers to all questions should be "Yes".

Questions to help determine if control system is adequate.	**Yes**	**No**
10.4.1. Where ESPE equipment has been fitted to an existing machine, have you obtained from the supplier of the ESPE comprehensive documentation setting out the capability and limitations of the equipment?		
10.4.2. Have you confirmed that the person installing the ESPE equipment has obtained this documentation and used it when installing the ESPE on your machine?		

10.4.3. Have you confirmed that the person installing the ESPE equipment was competent to do so?		
10.4.4. Did you obtain an assurance from the person installing the ESPE equipment that the machine's overall safety and control systems have not been adversely affected by the installation of the ESPE equipment?		
10.4.5. In the case of a new machine already fitted with ESPE devices have you obtained the documentation mentioned in 10.4.1 above from the machine manufacturer or supplier?		
10.4.6. Have you obtained written instructions from the supplier explaining how the safeguarding system is intended to operate, how to operate, maintain and test it and the action to be taken if it fails to operate correctly?		
10.4.7. Have you trained and instructed your employees to understand how the ESPE devices are intended to operate, how to operate, maintain and test them and what action to take if they fail to operate correctly?		
10.4.8. Have you put in place a formal system under which functional checks on all ESPE devices are carried out every day or every shift?		
10.4.9. Have you put in place a formal system under which a competent person carries out periodic inspections and tests on ESPE devices in addition to the functional checks carried out every day or every shift?		
10.4.10. Have you taken effective steps to ensure that access to the dangerous parts of the machine from any direction not protected by an ESPE device is prevented?		
10.4.11. Have you taken effective steps to prevent anyone remaining between ESPE and the dangerous parts of the machine or, alternatively, to detect a person who is present in that area and prevent the machine operating while they remain in there (unless they are operating the machine under slow crawl control and in accordance with **section 10.1. Slow crawl control** above)?		
10.4.12. Have you confirmed that the ESPE devices are positioned in accordance with BS EN 999 to ensure that they provide the protection required for the approach speeds of parts of the human body specified in that standard? See Appendix II		
10.5. Remote control devices A remote control device may be used for the start and slow crawl functions of the machine. If you have a remote control device you can use the following questions to help you decide if the device is adequate. For the device to be adequate the answers to all questions should be "yes".		
Questions to help determine if control system is adequate.	**Yes**	**No**
10.6.1. Have you confirmed that the device has been designed in accordance with the principles set out in BS EN 60204 –1: 1993?		
10.6.2. Have you confirmed that the maximum range of the device is as short as is reasonably practicable? *(For example limit the range so that the radius of the operating envelope is half the length of the machine.)*		

10.6.3. Have you carried out a thorough risk assessment of all tasks that involve using the remote control device?		
10.6.4. Did your risk assessment take full account of foreseeable misuse of the device?		
10.6.5. Have you provided a safe system of work specifying how the remote control device must be used?		
10.6.6. Have you provided effective arrangements for supervising the safe use of the remote control device?		
10.6.7. Have you trained employees how to use the device safely and in a manner that will not jeopardize safety?		

11. Commonly Encountered Hazards

(Compiled from observed activities and hazards during the research into this guidance)

Hazard	**Possible Control**	**Control suitable and sufficient?**		
		Yes	**No**	**Action**
Circumventing interlocked access gates, e.g. persons closing the gate with another person inside the enclosure	All rotating shafts nip or shear points close guarded. Exchange Key systems, locking off procedures for main isolators. Pressure sensitive devices, electro sensitive protection equipment.			
Person able to stand behind electro sensitive protection equipment enabling machine to be started.	No room for a person to stand behind a electro sensitive protection equipment (i.e. between the curtain and dangerous moving parts that the device protects) or, if there is then effective safeguards have been provided to prevent the machine being run with a person in that position unless that person is operating a slow crawl control that meets the requirements specified above.			

Hazard	Possible Control	Control suitable and sufficient?		
		Yes	No	Action
Safeguards for setting, adjustment and other activities that may require approach to dangerous moving parts				
Persons have to approach machine whilst it is operating.	Interlocked guards or photo-electric device prevents the machine from operating other than in slow crawl mode (max 1m/min). Slow crawl control is made available and can be operated only by the person at risk i.e. the person who has to approach the dangerous moving part. *The slow crawl control is achieved via a "hold-to-run" button e.g. on a wander lead or remote control. See slow crawl hazards and control above.*			
The slow crawl speed of the machine is greater than 1 meter per minute, because of operational setting requirements and person needs to approach the machine whilst it is operating.	All the accessible dangerous parts that can foreseeably be approached are fitted with individual close-fitting guards that prevent access to the danger zone, in which case the maximum permissible speed is the lowest practicable slow crawl speed. Safeguarding of nip points between upper and lower roller tracks or folding points may also be provided by a deflection of the first roller and then fixed guards for following rollers			

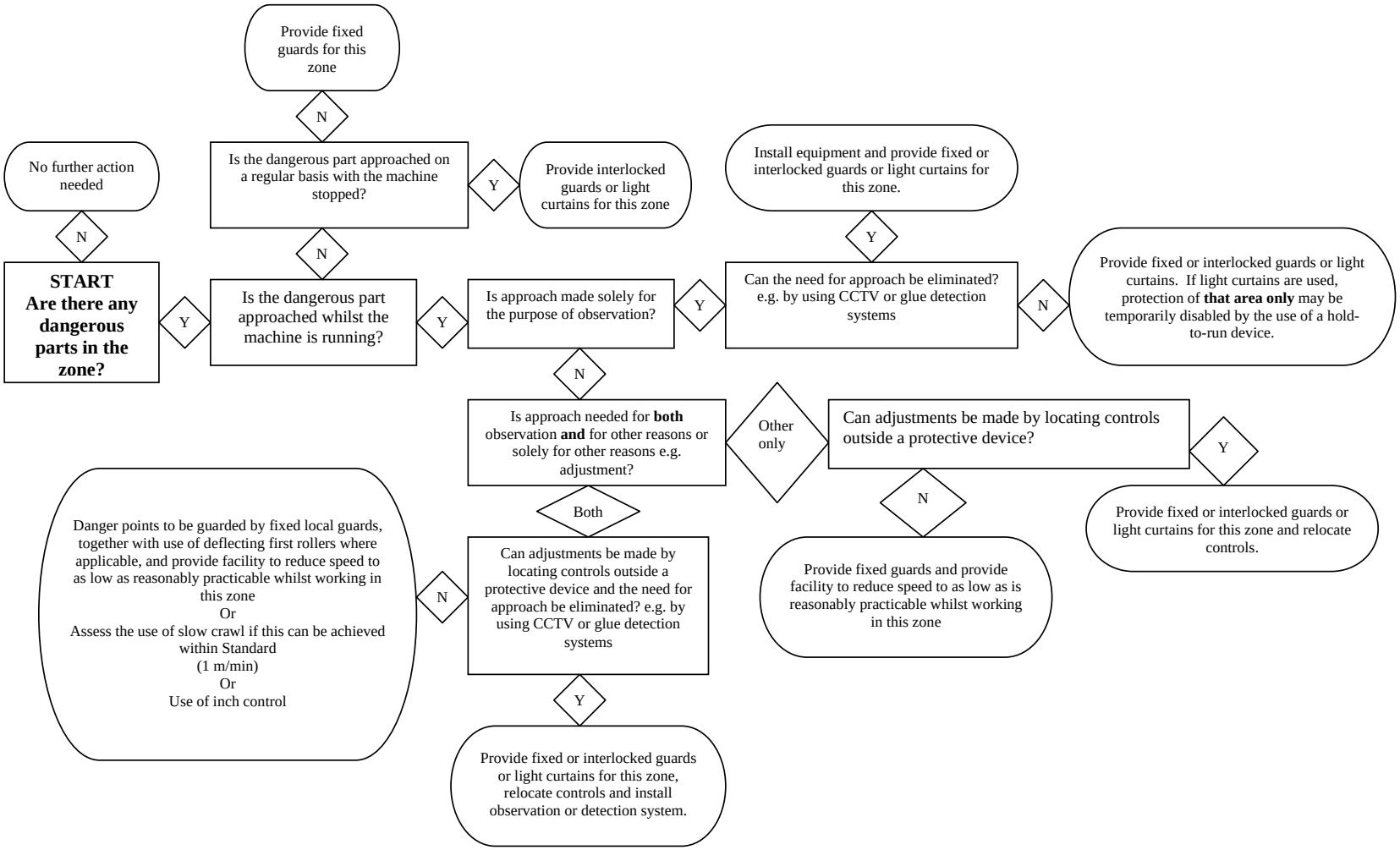
Hazard	Possible Control	Control suitable and sufficient?		
		Yes	No	Action
Slow crawl control system is not under control of the person at risk.	Slow crawl devices override only the interlock for the access gate opened or the ESPE interrupted and not other safeguards, which would allow access to other sections of the machine. Any remote control device is designed in accordance with the principles set out in BSEN 60204 –1:1993. The installer of the remote control system has ensured that its range is as short as reasonably practicable. The person responsible for machine operation has ensured that appropriate safe systems of work, supervision and training are implemented to ensure that the remote control is used in a manner, which would not jeopardise safety.			
The person operating the slow crawl device loses control of the machine.	The slow crawl device cannot be overridden and only operates as long as the control is depressed, once released the machine stops and has to go through a re-start routine.			
Tripping hazard if control device is on wander lead.	The lead is kept off the floor e.g. the lead is a helical “tidy” lead suspended from an overhead catenary.			

12. Maintenance and Inspection of Safety Devices

Hazard	Possible Control	Control suitable and sufficient?		
		Yes	No	Action
Deterioration of safety devices and machine parts leading to significant risk.	Documented and monitored planned maintenance programme operated to timescales that address likely deterioration of controls, guards and safety devices.			
Safety devices and guards loose, missing or not working properly.	Daily safety checks completed and recorded by the machine operators and rectification arranged and tracked.			
Faults and defects not rectified.	Regular monitoring by managers / supervisors of daily checks with procedure established to identify delay in rectifying any faults recorded.			
More complex controls and safety devices faulty.	Periodic (monthly?) safety inspections and checks carried out by the maintenance staff.			
Maintenance and inspection programmes not implemented to policy.	Management review process confirms policy being operated to required standard.			

Appendix I

Flow chart to help determine the guarding requirements for each section of the machine



Flow chart to help determine the guarding requirements for each section of the machine

Introduction

1. The flow chart is a tool to help you decide the appropriate *method* of safeguarding to use at each section of the gluing machine. The standards required for those safeguards are described in section 9 - General Approaches to Safeguarding of Dangerous Parts - *of* this guide.

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How to use the flow chart

2. Start by going to the feed point on the machine. Look at the moving parts of the machine accessible from this point. Now turn to the flow chart. Beginning at the start point on the chart ask yourself the questions in the rectangular decision boxes. Answer each question as either “yes” (Y) or “no” (N). Follow the flow chart until you come to a stop. The oval box where you come to a stop indicates what is likely to be the most appropriate method of safeguarding for the circumstances.

3. Go to the next downstream section of the machine and repeat the above procedure.

4. Repeat the procedure at each section of the machine down as far as, and including, the delivery point.

5. On most machines the sections to be checked in this way include the following but if your machine has an additional section the flow chart can be applied to it in exactly the same way.

    a. The feed
    b. The prebreaker section
    c. The combi folder section
    d. The glue application section
    e. The nip section
    f. The trombone section
    g. The delivery

EXTRACT FROM IEC TS 62046 "SAFETY OF MACHINERY – APPLICATION OF PRESENCE SENSING PROTECTIVE EQUIPMENT TO MACHINERY (ESPE)"

DISTANCE TO A HAZARD

Where ESPE is used, it shall be positioned at a sufficient distance from the machine hazards to ensure the machine can stop or otherwise reach a safe condition before any part of an approaching person can reach the hazardous zone. The separation distance shall be maintained for all foreseeable directions of approach.

This distance shall take into account:

a) ESPE detection capability in relation to human characteristics including:

- Approach speed;
- Body part penetration/encroachment;
- Possibility of circumvention, and

b) the overall system stopping performance;

In the case of moving parts of machines the separation distance used shall apply from the moving part towards the direction of approach. The minimum distance of the trip device from the machine hazard (danger zone) shall be calculated by using the general formula below, which is taken from ISO 13855/EN 999:

$$S = (K \times T) + C$$

Where:

S is the minimum distance, in millimeters, from the machine hazard (danger zone) to the detection point, line, plane or zone;

K is a parameter, having the following values K: walking speed; 1600 mm/sec, upper limbs; 2000 mm/sec.

T is the overall system stopping performance in seconds;

C is an additional distance, in millimeters, having the following values:

Upper limbs; $C = 8(d - 14)$ where d is the detection capability and is ≤40mm
$C = 850$ when the detection capability is >40mm

Lower limbs; $C = 1200 – 0.4 * H$ where H is the height of the detection zone
$H \leq 15 (d – 50)$ where d is the detection capability

Whole body; C = 1200 when the protective equipment is at floor level
C = 1200 – 0.4 * H where H is the height of the detection zone at the point furthest from the hazard
(The value of 1200mm used for C when considering ground-level trip devices includes an allowance for the first stride of a person stepping into the sensing zone of the trip device.)

STOPPING PERFORMANCE

The overall system stopping performance used for calculation of the separation distance shall include:

a) the response time of the protective equipment;
b) the maximum time under worst-case conditions, for example maximum load, maximum speed, etc. for the machine to stop or otherwise reach a safe condition after receiving the output signal from the protective equipment;
c) factors which can lead to a deterioration in performance of pneumatic, electrical and mechanical components, for example wear,
Ageing, temperature;
d) an allowance for the accumulation of such factors as variations in stopping performance, installation tolerances, time measurement accuracy, etc.
(The total allowance for deterioration in performance and variation in stopping performance, etc.under c) and d), should be a minimum of 10%.)

SUPPLEMENTARY PROTECTIVE MEASURES

Supplementary protective measures shall be provided as necessary to ensure that:

- the hazardous zone of the machine can be approached only through the detection zone of the trip device;
- unexpected start-up of the machine is not possible after a person has passed through the detection zone of the trip device to the hazardous zone of the machine.

These supplementary protective measures can include, for example:

- barriers to ensure that a person cannot approach the machine hazard from directions not protected by the protective equipment
- provision of a restart interlock
- provision of a presence sensing device;
- measures to prevent a person being present between the protective equipment and the hazardous zone,

If additional measures (e.g. obstacles) are used to prevent a person being present between the ESPE and the hazardous zone, and the additional means is designed to be removed, it shall be interlocked with the safety-related control system so that hazardous machine movement is not possible if the additional means is not present.

It shall not be possible to create an additional hazardous situation after any person has passed through the detection zone of an ESPE.

Appendix III

Sources of Further Guidance

Managing Health & Safety

INDG163(rev1)	Five steps to risk assessment leaflet

Work Equipment

PUWER 1998	Provision and Use of Work Equipment Regulations 1998

Machinery Standards

The current EN Standards give specifications for new machines. However, some of the precautions may be relevant to existing machines when it is reasonably practicable to fit them.

TYPE A STANDARDS

TC 114 - SAFETY OF MACHINERY

BS EN 292: Part 1: 1991	Safety of machinery - Basic concepts, general principles for design Part 1. Basic terminology, methodology (ISO TR 12100-1)
BS EN 292: Part 2: 1991 AMD: 1997	Safety of machinery - Basic concepts, general principles for design Part 2. Technical principles and specifications (ISO TR 12100-2)
BS EN 1050: 1997	Safety of machinery - Principles for risk assessment (ISO 14121: 1999)

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TYPE B STANDARDS

TC 114 - SAFETY OF MACHINERY

BS EN 294: 1992	Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs (ISO 13852: 1996)
BS EN 349: 1993	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body (ISO 13854: 1996)
BS EN 414: 2000	Safety of machinery - Rules for the drafting and presentation of safety standards

BS EN 418: 1992	Safety of machinery - Emergency stop equipment, functional aspects - principles for design (Revised as ISO 13850: 1996 Safety of machinery - Emergency stop - principles for design)
BS EN 574: 1997	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design (ISO 13851: 1997)
BS EN 626-1: 1995	Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery Part 1. Principles and specifications for machinery manufacturers (ISO 14123-1: 1998)
BS EN 626-2: 1996	Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery Part 2. Methodology leading to verification procedures (ISO 14123-2: 1998)
BS EN 811: 1997	Safety of machinery - Safety distances to prevent danger zones being reached by the lower limbs (ISO 13853: 1998)
BS EN 953: 1998	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120)
BS EN 954-1: 1997	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1: 1999)
BS EN 982: 1996	Safety of machinery - Safety requirements for fluid power systems and their components – Hydraulics
BS EN 983: 1996	Safety of machinery - Safety requirements for fluid power systems and their components – Pneumatics
BS EN 999: 1999	Safety of machinery - The positioning of protective equipment in respect of approach speeds of parts of the human body (ISO 13855)
BS EN 1037: 1996	Safety of machinery - Prevention of unexpected start-up (ISO 14118: 1997)
BS EN 1070: 1998	Safety of machinery – Terminology
BS EN 1088: 1996	Safety of machinery - Interlocking devices associated with guards - principles for design and selection (ISO 14119: 1998)

Standard currently awaiting publication

PrEN 1010-5	Safety of machinery – Safety requirements for the design and construction of printing and paper converting machines – Part 5: Machines for the production of corrugated board and machines for the conversion of flat and corrugated board.