Corrugated Sector

CASEMAKER / FLEXO FOLDER GLUER GUARDING AND SAFE WORKING PRACTICES

GUIDANCE DOCUMENT

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1. Foreword

The Confederation of Paper Industries acknowledges the support of the Health and Safety Executive in producing this guidance.

Disclaimer

Nothing in this guidance constitutes legal or other professional advice and no warranty is given nor liability accepted (to the fullest extent permitted under law) for any loss or damage suffered or incurred as a consequence of reliance on this guide. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action.

The guidance is not a substitute for duty holder and/or safety professional's judgment. Notwithstanding the good practice contained in this guidance, duty holders are responsible for ensuring they have adequate procedures in place for verifying and evaluating their organisations compliance with health and safety or other law.

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2. Introduction

This guide has been prepared by the Paper and Board Industry Advisory Committee (PABIAC) Corrugated Sector Delivery Committee following a review of industry specific guidance which dated from 1978 to 1992 and a study of Casemaker machines in the workplace.

The guidance is designed to help users of Casemakers (inline converting machines including Flexo Folder Gluers) in undertaking machinery and task related risk assessments. The guide is a checklist for users and managers in organisations that operate these machines supplied before the publication of the European Standards BS EN 1010-1:2004 and BS EN 1010-5:2005. This guidance may also help those purchasing, using and maintaining machinery manufactured after these dates but you should ensure you refer back to the relevant standard in place for your machine as well. Its purpose is to help the industry to achieve further reductions in the number of avoidable injuries that occur every year on such machines.

The main legal requirements covering the safe use of Casemakers are the Provision and Use of Work Equipment Regulations 1998. Further guidance on these regulations can be found in 'Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance.

All new machinery since 1995 has been subject to the European Machinery Directive which requires safety by design and construction. Machinery when first placed on the market, or first put into service, must meet all relevant essential health and safety requirements to the "state of the art", and be accompanied by Instructions, a Declaration of conformity, and bear CE marking. Further guidance on the Directive and the UK Supply of Machinery (Safety) Regulations is available from HSE's website and in the free leaflet '*Buying new machinery'* which can be found at http://www.hse.gov.uk/pubns/indg271.htm For more information on British Standards please consult the British Standards Institution website (www.bsigroup.com).

The layout of the guidance is designed in a checklist format, which will enable users to cross check their existing safety standards against this new guidance There are a number of columns that have already been partially completed to help you. Work your way through the checklist using the photographs, hazard and minimum control columns as a basis to benchmark your machine against. Once you have done this, you can then complete the 'findings' and 'corrective action' columns to record what the standards are on your machine and what needs to be done. The checklist will help you to find any gaps or shortcomings with existing safeguards and safety devices and help you to identify some routine and non-routine tasks, such as threading up, cleaning, carrying out adjustments, engineering maintenance, clearing blockages and jams that have the potential for bringing operators and other staff into close proximity with moving parts of your machine. You should then carry out a detailed risk assessment for each of these activities and use the results to ensure that the relevant guards, safety devices and systems of work are designed in such a way as to ensure that the task will be carried out safely. Find out where your employees need to work on the machine, understand what it is they need to do when they are there and design the safeguards and procedures accordingly.

The guide is broken down into machine sections for ease of use as below:

Directory:	**Section**	**Component**
	A	Feed unit
	B	Print unit
	C	Slotting / creasing unit
	D	Rotary die cutting unit
	E	Waste system
	F	In-line gluing machines (where provided)
	G	Folding section
	H	In-line stitching / taping machines (where provided)
	I	Counter ejector / transfer section

The age, make and design of your machine, may mean that not all hazards and controls are identified within this guidance. Consequently, control measures not listed in here may also be identified as alternative means of safeguarding. Your risk assessment will determine what if any additional controls should be applied.

3. Accident Analysis

An analysis of accident data supplied by CPI corrugated sector members between 2009 to 2012 identified that one third of all machinery accidents reported in the corrugated sector were on Casemakers. Additionally 17.5% of all reported slip, trip and fall accidents also occurred on these machines. An analysis of machinery related RIDDOR reportable accidents occurring on Casemakers identified the following accident types:

Accident type	**Proportion of total**	**Machinery parts involved**
Setting machine	50%	Print rollers accounted for 80% of these accidents

Clearing jam	25%	
Maintenance (fault diagnosis)	17%	Including: running without guard & hand moving belts
Taking sample	8%	

This analysis can help in identifying areas and tasks for reviewing your current safeguarding arrangements against this new guidance and then prioritising actions.

The guidance contains practical advice to help you with your risk assessments and in deciding the control measures needed to ensure that operators and other personnel who may come into contact with the equipment are not exposed to hazards.

4. Scope

The guide applies specifically to Casemakers. These are machines that are fed with blanks that may have previously been rib scored and will then involve some or all of the following operations: pre-feed, feed, print, rotary die cut, score and slot, then close (most commonly glued, but can also be stitched or taped) and folded to form flat packed cases; bundled, stacked and palletised.

You may find parts of this guide useful in risk assessing other related converting machinery these are:

- Printer Slotters – feed, printing & slotting sections
- Waste systems that are installed with other converting equipment
- Bundler tyers that can be used in conjunction with other converting equipment

Other safety issues such as isolation procedures, noise, manual handling, stored energy, slips & trips and working at heights are outside the scope of this document. Additional information in these areas is available via the CPI website: www.paper.org.uk and the HSE website http://www.hse.gov.uk/

5. Definitions for terminology used in this guide

Hold-to-run control device
control device which initiates and maintains machine functions only as long as the manual control (actuator) is actuated

Limited movement control device (jogging/inching)
control device, a single actuation of which, together with the control system of the machine, permits only a limited amount of travel of a machine element

Tracking
the movement of a unit or units of the machine under power or manually, this can be “in-line” (along the direction of the machine operation) or “side” (the unit moving out at right angles to the line of the machine)

Tampers/Tamper Plates
side aligning or pushing devices on the feed unit and counter ejector

Kicker feed
a reciprocating feeder bar that presents one board at a time from the bottom of the stack to the in feed pull rollers

Stereos
printing plates, printing dies.

Fixed print units
units that cannot be “tracked” but can be raised and lowered within the confines of the machine for setting purposes

ESPE
electro-sensitive protective equipment

6. Dangerous parts

Casemakers have a number of moving parts with the potential to cause injury. Examples include the following:

- In-running nips between rollers
- In-running nips between belts and rollers
- Crushing between tamper plates and the machine or material being processed
- Trapping points between moving side frames
- Trapping crushing points between tracking units and fixed points
- Sharps, including blades and knives

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 your risk assessment, consideration should be given at least to the following tasks:

- Setting processes
- Performing adjustments
- Clearing blockages/jam ups
- Viewing or inspecting operating parts of the machine or product passing through it
- Cleaning
- Fault finding

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

7. Hierarchy of safeguarding measures

The Provision and Use of Work Equipment Regulations 1998 (PUWER) specifies the legal requirements for machinery and its uses. The regulations cover issues such as machinery guarding, controls, emergency controls, training and machine maintenance. More information on the full requirements of PUWER can be found in the PUWER Approved Code of Practice (ACoP).

PUWER outlines a hierarchy of safeguarding measures which should be used to prevent danger or injury from contact with dangerous parts of machinery. This hierarchy should be used when selecting safeguarding measures for machinery hazards.

Your risk assessment is the starting point for choosing safeguarding measures. Safeguarding measures fall into a hierarchy of four levels. You must consider each level in turn beginning with the highest level of protection first and then working your way down the hierarchy, making use of the measures as far as practicable. You may need to combine measures from more than one level to reduce the risk. However your preference should always be to adopt the highest level of safeguarding possible.

The three levels of the hierarchy are:

- fixed (enclosing) guards;
- other guards or protection devices, e.g. interlocking guards, nip guards, guard locking;
- protection appliances, e.g. trip nip bars which do not prevent access but stop the movement of the dangerous part before injury occurs and preferably before contact is made and hold-to-run control devices; and

the provision of information, instruction, training and supervision is an additional measure to the 3 levels of the hierarchy and complements each of them.

Safeguarding measures need to be carefully designed and provide the required protection without creating unnecessary difficulties for maintenance and production. See BS EN ISO 12100-1: 2010 and BS EN ISO 12100 –2: 2010 ‘Safety of machinery - General principles for design - Risk assessment and risk reduction’.

8. Carrying out Machine Interventions

Often workers in the corrugated sector are injured during machine interventions. Machine interventions include setting, cleaning, maintenance and trouble shooting. To prevent injuries during machine interventions the following should be adhered to:

- Wherever possible, carryout machine interventions with equipment isolated.
- If machinery needs to be running during interventions then do this with dangerous parts fully guarded.

- If guards have to be removed or disabled during machine interventions then additional safeguards must be put in place to prevent a person being injured. Additional safeguards may include:
    - Hold-to-run controls
    - Two-hand controls
    - Jogging/inching controls
    - Crawl speed

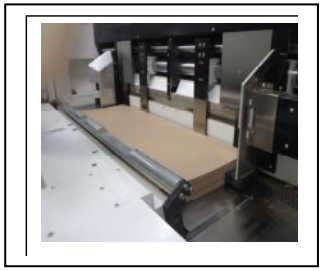
NB: Crawl speed is specified in BS EN 1010-1 for a number of different tasks you may be carrying out on the machine. Machines manufactured after the publication date of this standard (21 December 2004) should comply with the specified crawl speed for the majority of tasks which is 5m/min. Owners of machines manufactured before this date that may have a different crawl speed will need to demonstrate through your own risk assessment, the necessary safeguards that have been taken to minimise the risks and why it isn't possible to achieve 5m/min.

It should be noted that 5m/min is the maximum speed the machine should be operating and your own risk assessment may determine a slower speed is required for the tasks you are carrying out.

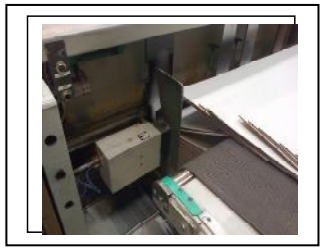
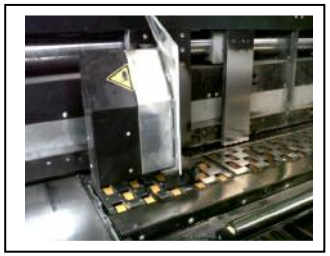
Machinery Checklist

Component	Hazard / Risk Identified	Control Measures - Minimum Requirements	Findings	Corrective action Required
A. Feed unit	**Comprised of the hopper, table, feed mechanism and draw or pull rollers. Maybe manually fed with blanks from a stack, often delivered on roller conveyor; or from an automatic feed system commonly referred to as a pre-feeder.**			
 	During tracking of the feed unit being struck by it, or trapped between the feed unit and the pre-feeder, extendo or palletised loads in the area. (Note: Consideration should be given to visibility limitations on the operator and drive side of the units.) Notes: 1. "Tracking" includes all movement of the feed unit. 2. Where the boards to be processed are delivered by fork lift truck there is a risk of the feed unit being struck by the truck causing a trapping or crush risk As a motorised feed unit opens or closes into the printer unit there is a trapping and crush risk between the units to:	Measures should be taken to prevent a person coming into contact with the tracking feed unit. When considering the measures to take, the hierarchy of safeguards outlined at the start of this guide should be followed. A combination of the following measures may be used to reduce the risks of the motorised opening and closing of units: • a hold to run control; • units with motorised tracking should move at a crawl speed, not faster than 5 m/m; • segregate area by use of a physical barrier and/or arranging a third party to monitor during movement; • an audible warning and/or a visual warning that activates prior to and during the unit being moved • the use of visibility aids such as cameras and mirrors		

	**A)** A person working between the units; **B)** The operator closing motorised unit	A) It should not be possible to trap a person between the motorised feed units. Safeguards to prevent this include: • an emergency stop/pull wire on the inside of the motorised print unit that stops the travelling function; • providing a “travel stop” button often on newer machines. When pressed this allows an operator to override and disengage the travelling mechanism on the unit they are working on so it will not move; • providing visibility aids e.g. mirrors so the unit operator can see if anybody is between the units before tracking; B) Measures should be taken to prevent the operator becoming trapped while closing the motorised unit. Safeguards to prevent this can include one or a combination of these methods: • Provide two hand hold to run controls; • Provide hold to run controls restricted to crawl speed with additional safeguards; • Locate the control box so the operator cannot contact the trapping point;		

	C) People working in the area if the feed unit is unintentionally moved as a result of being struck by a fork lift truck	C) Safeguards should be in place to prevent the units moving unintentionally e.g. as a result of pallets or forklift trucks striking them. One form of safeguard can include a physical means of preventing the unit from moving. Additional safeguards that can be used to prevent other hazards include: • Shrouded wheels to protect toe trapping; • Provide visual aids e.g. mirrors so the unit operator can see if anybody is between the units before tracking. • A safe system of work that provides for only one person closing the machine.		
	In-running nip created by the feed rollers/belt beneath the board on the feed table and potential crush injury from a "kicker" feed mechanism. .	In-running nips created by belts or rolls should be safeguarded. When considering safeguards to take, the hierarchy of safeguards outlined at the start of this guide should be followed. Guarding arrangements on feed mechanisms should be considered individually as each		

  		machine configuration is different. Solutions can include: • providing fixed guards to the rear of the feed mechanism to protect the shafts and guide runners of the moving mechanism; • providing fixed guarding on trapping/shearing points with guards that don't increase the risk; • interlocked guards into the area to ensure the machine is isolated before intervening; • guarding designed to move with the feed mechanism that protects hazardous areas; • ESPE. An example of a safeguard that can be used to protect against mechanical hazards at the feed point is a light operated last board device. This will interrupt the feeding device to change to single sheet feed mode and the feed mechanism will not restart until reset.		
	Crushing, trapping and shearing hazards from reaching through to the print cylinders.	It should not be possible to reach through to the rotating print cylinders. Examples of how to achieve this include: • A fixed guard extending the full length of the face of the machine securely, fixed to the feed unit side frames, that prevents a person reaching through (this would be positioned behind the feed mechanism adjustments). • A concertina guard that is designed to		

		move with the tamper unit that prevents access through to the print cylinder		
	Crushing and trapping by reaching through the board feed opening	Measures should be taken to protect the sheet feed area to the side of the tampers where reach distances through the gap to the print cylinders do not comply with BS EN ISO 13857. When considering the measures to take, the hierarchy of safeguards outlined at the start of this guide should be followed. A combination of the following measures may be used to reduce the risks: • The side feed tampers should be adjusted as close to the board as possible; and • Provide a guard e.g. a track or concertina that protects the exposed feed opening that remains on the outside of the tampers.		
	Crush or impact injury from manually adjusting tamper plate.	Maintain tracks and manually adjustable parts in this area to allow them to run freely.		
	Movement of the tamper plates to the pile creating a shearing or crushing hazard The danger points between the tamper plates and the blank pile in the hopper resulting in crush injuries	The danger point between the tamper plates and the fixed machine parts shall be safeguarded by guards or by a minimum reach distance of 120 mm. The tamper plate should be stopped before intervening in this area. A different mode of operation can be selected (feed interrupting		

		control) that stops the tamper unit operating prior to and during the intervention. To prevent injury, the force on the tamper plate should be minimised.		
	Trip hazard from raised tracks.	Protect tracks with covers where practical or as a minimum requirement highlight the tracks by painting them in a hi visibility colour		
	Crushing, shearing and drawing in hazards from moving dangerous parts underneath the feed table.	Measures should be taken to prevent access to dangerous moving parts underneath the feed table across the full width of the unit. When considering the measures to take, the hierarchy of safeguards outlined at the start of this guide should be followed.		

B. Print unit	Generally located immediately after the feed unit, a print unit is provided for each colour separation. The units are comprised of print and impression cylinders, an engraved (anilox) roll with associated inking roll and trough.			
  	During opening and closing of the print unit being struck or crushed between by or between the units. (Note: Consideration should be given to visibility limitations on the operator and drive side of the units.)	Rail tracks and wheels should be properly maintained and kept free of debris. Measures should be taken to prevent a person coming into contact with the moving unit. A) When considering the measures to take, the hierarchy of safeguards outlined at the start of this guide should be followed. A combination of the following measures may be used to reduce the risks of being struck during the motorised opening and closing of units: • a hold to run control; • using crawl speed during tracking units - not faster than 5 m/min; • segregating the area by the use of a physical barrier; • localised guards to prevent finger/ hand crush injury when operating the controls; • an audible warning and/or a visual warning that activates prior to and during the unit being moved; • the use of visibility aids such as cameras and mirrors. B) For manually opened and closed units, safeguards should be in place to prevent the units moving unintentionally e.g. as a result of pallets or forklift trucks striking them. Examples of safeguards include a physical means of preventing the unit from moving.		

	As a print unit opens and closes under motorised power there is a trapping and crush risk between the units to: A) A person working between the units; B) The operator closing the units;	A) It should not be possible to trap a person between the print units that are opening or closing under power. Safeguards to prevent this include: • An emergency stop/pull wire on the inside of the print unit that stops the travelling function. • a “travel stop” button that is sometimes provided on newer machines. When pressed this allows an operator to override and disengage the travelling mechanism on the unit they are working on so it will not move. • providing visibility aids e.g. mirrors or cameras etc. so the unit operator can see if anybody is between the units before tracking. B) Measures should be taken to prevent the operator becoming trapped while opening and closing the units under power. Safeguards to prevent this can include one or		

	C) Third parties entering the units.	a combination of these methods: • providing two hand hold to run controls; • providing hold to run controls and movement restricted to crawl speed (5m/min) with additional safeguards, if there is an assessment that a residual risk remains; • locating the control box so the operator cannot contact the trapping point. C) Measures should be taken to prevent third parties becoming trapped while opening and closing the units under power. For each of the situations above (A,B or C) additional safeguards that can be used to prevent other hazards include: • Shrouded wheels to protect toe trapping; • A safe system of work that provides for only one person opening or closing the machine and excludes others from the area.		
	Crush, impact and fatal injuries during the inserting or removing of individual print units into the print stack.	Measures should be taken to prevent people being injured during the inserting and removing of individual print units into the print stack. Examples of how this can be achieved include: A) Powered units: When considering the measures to take, the hierarchy of safeguards outlined at the start of this guide should be followed. A combination of the following measures may be used to reduce the risks: • movement of the single unit carried out under hold to run control;		

		• the unit operating no faster than crawl speed at 5 m/min; • a one person operation and no personnel should intervene during the process; • an audible warning and/or a visual warning that activates prior to the unit moving; • providing good visibility for the operator of the area they are moving the unit in; • maintaining and properly aligning the guidance system (e.g. rails, plates or tracks) and wheels; • ensuring side tracking wheels on units locate properly into floor rails when lowered; • providing side locating grooves in the floor where side tracking wheels are provided and a rail system is used; • setting the pressure correctly for pneumatically powered systems; • it is foreseeable that the unit could jam or come off the rails therefore; procedures should be in place to rectify the issue. It should take into consideration that the units are top heavy and if pushed at the top or rocked they are more likely to fall over. B) Manually moved units: When considering the measures to take, the hierarchy of safeguards outlined at the start of this guide should be followed. A combination of the following measures may be used to reduce the risks: • consideration should be given to changing manually moved units to being moved mechanically; • the person(s) moving the unit should have a good visibility of the area they are		

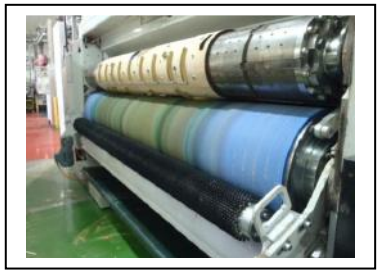
		moving the unit in; • if team pushing is used to move the unit then there should be agreed procedures and communication in place to ensure they work together, this may include nominating a lead person within the team to coordinate the move; • the guidance system (e.g. rails, plates or tracks) and wheels should be maintained, properly aligned; • side tracking wheels on units when lowered should correctly locate into the floor rails; • where side tracking wheels are provided and a rail system is used the floor should have side locating grooves; • it is foreseeable that the unit could jam or come off the rails therefore; procedures should be in place to rectify the issue. It should take into consideration that the units are top heavy and if pushed at the top or rocked they are more likely to fall over.		
	In-running nip and entanglement when contact is made with the anilox and ink rollers and drive elements.	Access to the rotating rollers, in-running nip and drive elements, including when the print units are in the open position, should be guarded. This can be achieved e.g. by: • Fixed guards • Interlocking guards		
	Cuts from contact with sharp chamber blades and doctor blades during setting and cleaning processes with the print units open.	Access to the printing plates and blades should not be possible while the rollers are moving. Use the hierarchy of safeguards in the introduction to identify controls. For cleaning operations:		

		• A fully guarded self-cleaning system is the preferred method of cleaning. • Where manual wash up is the only option then the print unit must be stopped and an appropriate cleaning tool with handle that keeps hands at safe distance from in-running nips, must be used (rags or other materials that can be drawn into the nip are not acceptable) • Cleaning doctor blades “on the run” must be prevented. • Mandatory wearing of cut resistant gloves during manual cleaning should be enforced and other forms of PPE should also be considered. Mandatory wearing of cut resistant gloves during any interventions in this area should be enforced and other forms of PPE should also be considered.		
	On fixed print units in-running nips, entrapment and entanglement from dangerous moving parts in the print unit when it is in its normal running position.	Access to the dangerous moving parts of machinery should not be possible while it is operating. This can be achieved e.g. by fixed guards or interlocking guards.		

	On print units in-running nips and entanglement in rotating print rollers during setting and attaching and removing stereos.	A separate “setting mode” should be provided for setting operations that prevents normal running of the machine. While setting, the print cylinder should not be rotating unless done manually or by a hold to run control) sometimes this is a shrouded foot pedal. In setting mode it is likely that the anilox and ink rollers will still be moving. These should be guarded so access is prevented; this may be required on both sides of the print unit if there is access. Where ink rollers need to keep running during set up, there should be enough clearance between the ink roller and platen cylinder to allow the stereo to be mounted without creating a frictional connection (stereo snatch) between ink roller and platen cylinder.		
	On fixed print units shearing and crushing injuries when lowering the print unit into the operating position.	Safeguards should be in place to prevent a person becoming trapped or injured in the lowering print unit mechanism. This can be achieved for example by: • providing two hand hold to run controls; • providing hold to run controls restricted to crawl speed, not faster than 5 m/m; • locating the control box so the operator cannot contact the trapping point; an audible warning and maybe a visual warning that activates prior to and during the unit being moved • a safe system of work combined with other safeguards that provides for only one person opening or closing the machine.		

	On fixed print units in-running nips and entanglement on the vacuum belts/ transport mechanism to the rear of the machine on the drive side.	Access to drive mechanisms and dangerous parts of machinery should be guarded. When choosing the guarding solution follow the hierarchy of safeguards outlined at the start of this guide.		

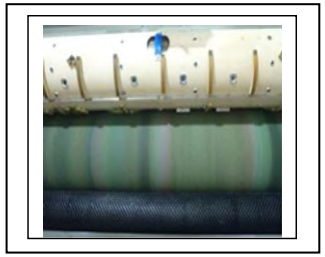
C. Slotting / creasing unit	Generally located after the last print unit, or the rotary die cut unit if provided, the unit comprises creasing and slotting heads and trim knives with associated pull rollers.			
 	Cutting or severing from contacting slotting and creasing tools. Trapping, crushing, cutting and entanglement as a result of contact with dangerous drive elements.	Access to the slotting and creasing tools and drive elements when the machine is operating should be guarded. This can be achieved e.g. by: • Fixed guards • Interlocking guards • ESPE Measures should also be taken to prevent injury from sharps. This can be achieved by e.g. using cut resistant hand protection combined with a safe system of work.		
	Crushing, cutting, trapping and entanglement in dangerous moving parts of slotter/creasing unit with automatic format setting.	Automatic format setting should only be possible with the print units closed. When units are in the open position, tool setting should be done by providing hold to run controls restricted to crawl speed, not faster than 5 m/m;		

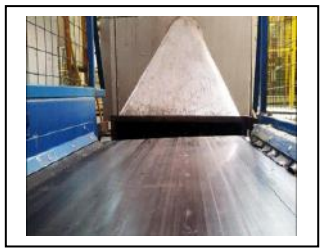
D. Rotary die cutting unit if fitted	Where included this unit is generally inserted after the print units and comprises anvil and cylinder to which cutting dies are attached, together with associated pull rollers.			
	During opening and closing of the rotary die cutter unit being struck or trapped between units.	Measures should be taken to prevent a person coming into contact with the moving unit. Motorised opening and closing of the units can be controlled by: • segregate area by use of a physical barrier and/or arranging a third party to monitor during movement • a hold to run control; • units with motorised tracking should move at a crawl speed, not faster than 5 m/m; • an audible warning and maybe a visual warning that activates prior to and during the unit being moved • the use of visual aids such as cameras and mirrors		
	As the rotary die cutter opens and closes under motorised power there is a trapping and crush risk between the units to: A) A person working between the units;	A) It should not be possible to trap a person between the units opening or closing under power. Safeguards to prevent this include: • an emergency stop/pull wire on the inside of the print unit that stops the travelling function. • a “travel stop” button sometimes provided on newer machines. When pressed this allows an operator to override and disengage the travelling mechanism on the unit they are working on so it will not move.		

	B) The operator closing the units.	• providing visibility aids e.g. mirrors or cameras etc. so the unit operator can see if anybody is between the units before tracking. B) Measures should be taken to prevent the operator becoming trapped while opening and closing the units under power. When considering the measures to take, the hierarchy of safeguards outlined at the start of this guide should be followed. A combination of the following measures may be used to reduce the risks: • providing fixed guards to protect trapping hazards; • providing two hand hold to run controls; • providing hold to run controls restricted to crawl speed with additional safeguards, if there is an assessment that a residual risk remains; • locating the control box so the operator cannot contact the trapping point; • shrouded wheels to protect toe trapping; • a safe system of work combined with other safeguards that provides for only one person opening or closing the machine.		
	Crush, impact and fatal injuries during the inserting or removing of the rotary die cutter unit.	Measures should be taken to prevent people being injured during the inserting and removing of the rotary die cutter unit. Examples of how this can be achieved include: A) Powered units: When considering the measures to take the hierarchy of safeguards outlined at the start of		

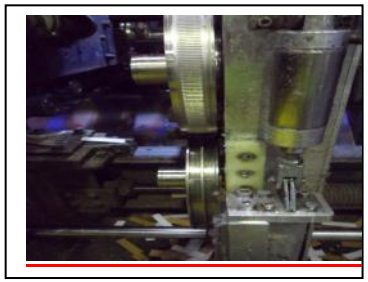
		this guide should be followed. A combination of the following measures may be used to reduce the risks: • movement of the unit should be carried out under hold to run control; • the unit should operate at a crawl speed, not faster than 5 m/m; • a one person operation and no personnel should intervene during the process; • an audible warning and/or a visual warning that activates prior to the unit moving; • the person moving the unit should have a good visibility of the area they are moving the unit in; • the guidance system (e.g. rails, plates or tracks) and wheels should be maintained, properly aligned; • side tracking wheels on units when lowered should correctly locate into the floor rails; • where side tracking wheels are provided and a rail system is used the floor should have side locating grooves; • if using pneumatically powered systems ensure that the air pressure is set correctly; • it is foreseeable that the unit could jam or come off the rails therefore; procedures should be in place to rectify the issue. It should take into consideration that the units are top heavy and if pushed at the top or rocked they are more likely to fall over. B) Manually moved units: • consideration should be given to changing manually moved units to being moved mechanically;		

		• the person(s) moving the unit should have a good visibility of the area they are moving the unit in; • if team pushing is used to move the unit then there should be agreed procedures and communication in place to ensure they work together, this may include nominating a lead person within the team to coordinate the move; • the guidance system (e.g. rails, plates or tracks) and wheels should be maintained, properly aligned; • side tracking wheels on units when lowered should correctly locate into the floor rails; • where side tracking wheels are provided and a rail system is used the floor should have side locating grooves; • it is foreseeable that the unit could jam or come off the rails therefore; procedures should be in place to rectify the issue. It should take into consideration that the units are top heavy and if pushed at the top or rocked they are more likely to fall over.		
	In-running nip, crushing, cutting and entanglement as a result of contacting dangerous parts of rotary die cutting unit.	Access to in-running nips and dangerous moving parts should be prevented. This can be achieved by e.g.: • Fixed guards • Interlocking guards		

 	Cutting, in-running nips, entanglement and crushing during securing the cutting forme to the die cutting cylinder.	Safeguards should be in place to prevent contact with dangerous moving parts. This can be achieved on machines pre-dating the BS EN 1010-1 and 1010-5 by e.g. • During securing the cutting forme to the die cutting cylinder where possible change rotation of the cylinder from in running to out running; AND • Operation of the cylinder when out running should be hold to run at crawl speed not faster than 5 m/m. OR • During securing the cutting forme to the die cutting cylinder where in-running nips cannot be eliminated the cylinder rotation should be limited to a rotation of 7.5 cm per actuation of the control (sometimes called jogging). Measures should also be taken to prevent injury from sharps. This can be achieved by e.g. using cut resistant hand / arm protection combined with a safe system of work.		

E. WASTE SYSTEM	**Located in a position to be able to remove trim falling from the slotting and /or rotary die cut units. A waste system generally comprises a conveyor system (belt, screw or air) that will remove the waste from under the machine, usually to an automated waste collection system.**			
  	Entanglement, amputation, crushing, shearing, drawing in, fall from height, impact injuries as a result of contacting the waste systems (belt, air conveying systems, rotary lock systems).	Each waste system is different in design and configuration. Therefore, you will need to use the hierarchy of safeguards described in the introduction to identify the correct safety precautions for your circumstances. The combination of controls should protect people from all the hazards listed. The hierarchy in the Work at Height Regulations (see further reading) should also be followed to prevent people falling into the waste transfer system. Examples of safeguards include: • linking the under-machine waste system with interlocked access gates so the conveyor stops when an access gate is opened. • guarding in-running nips and other machinery hazards (e.g. chain/sprocket drives, rotating shafts). • floor protection systems that prevent falls from height and access to dangerous machinery. Casemakers sometimes have covers over the waste system that move with the machine. When the machine is closed the waste can drop through to the waste transfer system. When the machine is opened the covers move with the machine to protect the danger zone and prevent people falling into the waste system. • fixed structures to prevent people falling into the pit or waste system.		

		Where access is needed into the waste system for maintenance, cleaning or troubleshooting (e.g. blockages) means should be provided to allow part of or the whole waste system to be isolated. Isolation should be carried out in conjunction with a safe system of work.		

F. In-line gluing machines (where provided)	The machine, located after the slotting unit, applies glue to the glue flap by means of a roller or injection system, prior to creased and slotted blanks being folded.			
 	Entanglement and drawing in hazards from in-running nips on moving parts on the glue wheel.	Access to the area of the glue wheel is located within the folding section. This area should be guarded in accordance with the hierarchy of safeguards outlined at the start of this guide. There is a residual risk when accessing this area as the glue wheel is likely to be idling at a much slower speed than under normal operating circumstances. In addition: • in-running nips on glue wheels should have nip guards; • the in-running nip between glue wheels and the glue duct should be guarded. The guarding may be provided by the glue duct if it is close fitting to the glue wheel and does not create an in-running nip. Any intervention with the glue wheels should be carried out with the wheels isolated.		

G. Folding section	**Located immediately following the glue machine (where provided) the section is comprised of a central conveyor with a series of (angled) belts, pulleys and plough bars and folds the blanks to form finished, flat pack, cases.**			
	Entanglement, crushing and drawing in hazards from in-running nips, folding belts, guide rollers and drive rollers positioned along the folding arms of the machine. Cuts and lacerations at the interface with the slotting/creasing or rotary die cut unit or tooling and the folding section.	Access to this area of the machine should be prevented by one or a combination of the following safeguards, taking into account machine run down times: • Fixed guards • Trapped-key interlocking device/guard locking device/ interlocking guards • ESPE Please note that whatever guarding combination is selected all moving parts should come to a complete stop prior to any intervention.		
H. Automatic In-line stitching and/or taping machines (where provided)	**Located after the folding unit and providing alternative closure to gluing for the finished case these machines apply stitches or tape, as applicable, to the blanks that have been pre-folded for this purpose.**			
	Entanglement risks on power driven shafts. Crushing, shearing and puncture injuries caused by mechanical movement of the stitching head and stapling unit. Crushing or shearing on in-running nips on taping machines.	Access to power driven shafts should be prevented by using fixed guards Access should be prevented to the stitching head and/or taping unit. This can be achieved e.g. by one or a combination of the following safeguards: • Fixed guards; • Interlocking guards; • Hold to run control for travel of the stitching unit; • ESPE. Changing and threading of the stitching or taping material should be carried out from a safe position with the machine stopped. This should be considered when installing guarding arrangements.		

I. Counter ejector / transfer section	The final section of the in line machine, receives flat pack cases from the previous section and corrects misaligned folding and arranges them in a pile prior to ejecting in predetermined quantities.			
  	Entanglement, crushing, drawing in, crushing and shearing hazards from in-running nips, belts, shafts, rollers and tamper plates. Note: These hazards may exist both on top and underneath the counter ejector unit and during the tracking of the unit.	Access to this area of the machine should be prevented by one or a combination of the following safeguards, taking into account machine run down times: • Fixed guards • Trapped-key interlocking device/guard locking device/ interlocking guards • ESPE The safeguards provided should take into account taking samples. If samples are taken from this section it will need to be while running at crawl speed or alternative safe sample collection points should be considered.		

Further Reading

1) Safe Use of Work Equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and Guidance http://www.hse.gov.uk/pubns/books/l22.htm
2) Working at Height Brief Guide http://www.hse.gov.uk/pubns/indg401.pdf
3) BS EN 1010-1:2004+A1:2010 Safety of machinery - Safety requirements for the design and construction of printing and paper converting machines – Part 1 Common requirements
4) BS EN 1010-5:2005 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
5) Manual Handling Assessments Charts (The MAC Tool) http://www.hse.gov.uk/pubns/indg383.pdf
6) CPI Corrugated Sector Advisory Note – Noise in a corrugator plant http://www.paper.org.uk/services/health_safety/occupational/Noise%20advisory%20note%20_2_.pdf
7) BS EN 415-4:1998 Safety of packaging machines. Palletisers and de-palletisers
8) BS EN 415-8:2008 Safety of packaging machines. Strapping machines.

Web pages with further information:

Safe maintenance (machinery) http://www.hse.gov.uk/safemaintenance/index.htm

Manual Handling http://www.hse.gov.uk/msd/manualhandling.htm

Assessment of Repetitive Tasks (ART) Tool http://www.hse.gov.uk/msd/uld/art/index.htm

Pushing/Pulling Guidance http://www.hse.gov.uk/msd/pushpull/index.htm

Noise at Work http://www.hse.gov.uk/noise/index.htm

Slips and trips http://www.hse.gov.uk/slips/

Falls from height http://www.hse.gov.uk/falls/

Appendix I

Casemaker Safe Operating and Guarding Standards

Use of ESPE

ESPE devices, such as photoelectric curtains, may be installed to safeguard dangerous parts of the equipment. The installation must satisfy the requirements of Provision and Use of Work Equipment Regulations 1998 (PUWER). New equipment fitted with ESPE devices must also satisfy the requirements of the Supply of Machinery Regulations 2008 (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 equipment's overall protective systems. An inadequately installed ESPE can adversely affect the overall standards of protection and control. You can use the following questions to help you decide if the ESPE devices 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**
1. Where ESPE devices have 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?		
2. Have you confirmed that the person installing the ESPE device(S) has obtained this documentation and used it when installing the ESPE on your machine?		
3. Have you confirmed the person installing the ESPE device(S) was competent to do so?		
4. Did you obtain an assurance from the person installing the ESPE that the machine's overall safety and control systems have not been adversely affected by the installation of the ESPE device(s)?		
5. In the case of a new machine already fitted with ESPE devices have you obtained the documentation mentioned In 1. above from the machine manufacturer or supplier?		
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 the devices fail to operate correctly?		
7. Have you trained and instructed you employees to understand how the ESPE device(S) are intended to operate, how to operate, maintain and test it; and the action to be taken if the devices fail to operate correctly?		
8. Have you put in place a formal system under which the functional checks on all ESPE devices are carried out every day or shift (as appropriate)?		
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 shift?		
10. Have you tasked effective steps to ensure that access to the dangerous parts of the machine from any direction, not protected by an ESPE device, is prevented? (e.g. by other guarding selected on		

a hierarchical basis)		
11. Have you taken effective steps to prevent anyone remaining between the ESPE and the dangerous part of the machine, following intervention (authorised or otherwise) and before the machine is operated?		
12. Have you confirmed that the ESPE devices are positioned in accordance with EN ISO 13855 to ensure that they provide the protection required for the approach speeds for the parts of the human body specified in that standard? (See guidance on validation in IEC TS 62046 - extract below)		

VALIDATION OF ESPE INSTALLATIONS

Extract from IEC TS 62046 “Safety of Machinery – Application of presence sensing equipment to machinery ESPE

DISTANCE TO 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 (by reach through beams (C_{RT}) and the possibility to reach over the top beam (C_{RO}))
   - Possibility of circumvention, and

b) The overall system stopping performance:

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

$$S = K (T1 = T2) + C$$

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

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

T1 is response time in seconds;

T2 is stopping time of hazardous moving parts in seconds;

C is an additional distance in millimetres, 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 ≤ 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 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 and 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:

a) The hazardous zone of the machine can be approached only through the detection zone of the trip device;

b) 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:

c) Barriers to ensure that a person cannot approach the machine hazard from directions not protected by the protective equipment;
d) Provision of a restart interlock;
e) Provision of a presence sensing device;
f) 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 II

Casemaker Safe Operating and Guarding Standards

Sources of Further Guidance

The standards included in this appendix are deemed relevant to this guidance the list is neither exclusive nor exhaustive

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

Basic Safety Standards

DIN EN ISO 12100 parts 1 & 2	Safety of machinery - Basic concepts, general principles for design part 1 - terminology, part 2 – technical principles (ISO TR 12100-1)
EN ISO 14121	Safety of machinery - risk assessment principles
BS EN 61508-2:2010	Functional safety of electrical/electronic/ programmable electronic safety-related systems

TYPE B STANDARDS

Safety Group Standards

BS EN 349: 1993+A1:2008	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body (ISO 13854: 1996)
BS EN 574: 1996+A1:2009	Safety of machinery - Two-hand control devices - Functional aspects - Principles for design

BS EN 953: 1998	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120)
BS EN 1037: 1996	Safety of machinery - Prevention of unexpected start-up (ISO 14118: 1997)
BS EN 1088: 1996	Safety of machinery - Interlocking devices associated with guards - principles for design and selection **NOTE:** *this will be replaced by BS EN ISO 14119 in 2013*
BS EN ISO 4413:2010	Safety of machinery - Safety requirements for fluid power systems and their components – Hydraulics
BS EN ISO 4414:2010	Safety of machinery - Safety requirements for fluid power systems and their components – Pneumatics
BS EN ISO 12100-1: 2003+A1:2009	Safety of machinery – Terminology
BS EN ISO 12100-2: 2003+A1:2009	Safety of machinery – Technical principles
BS EN ISO 13849-1:2008	Safety of machinery - Safety-related parts of control systems - Principles for design
BS EN ISO 13850:2008	Safety of machinery - Emergency stop, functional aspects - principles for design
BS EN ISO 13855:2010	Safety of machinery – Positioning of protective equipment in respect of approach speeds of parts of the human body
BS EN ISO 13857:2008	Safety distances to prevent danger zones being reached by the lower limbs

TYPE C STANDARDS

Machine Safety Standards	
BS EN 415 - 4: 1998	Safety of packaging machines - Palletizers and de-palletizers
	Standard not published in the UK and currently under review
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. (The ISO standards 12643-4 Graphic technology – Safety requirements for graphic technology equipment and systems – Part 4: Converting equipment and systems; and Part 5: Stand-alone platen presses. Are currently being developed and expected to form the model for the revised prEN 1010 Part 5)