



Corrugated Sector



# **CORRUGATOR GUARDING STANDARDS AND SAFE WORKING PRACTICES**

## **GUIDANCE DOCUMENT**

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## **Corrugator Guarding Standards and Safe Working Practices**

This inspection checklist is designed for member companies to use as a guide/aid to assess the adequacy of Machinery Guarding standards and safe working practices on their Corrugator.

### **Forward by Health and Safety Executive**

This document will provide you with a useful and practical tool that you can use as a course filter for checking the safeguards of your corrugating machine. I welcome this CPI Corrugated Sector development and encourage you to make full use of the checklist. As well as helping you to find any gaps or shortcomings with existing safeguards and safety devices, it should assist 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.

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### **Introduction by the CPI Corrugated Sector**

As an immediate practical tool, to assist the industry to address corrugator safety, the Corrugated Sector Health and Safety Committee has produced this Guarding Standards and Safe Working Practices Checklist. It is intended for use as an inspection checklist to help audit corrugating machines. This process is expected to lead on to the conducting of Risk Assessment, which identify controls that deliver hazard reduction, and from the assessments the production of Safe Systems of Work; it does not replace these requirements. The Corrugated Sector Safety Recommendations (Pink Booklets) can provide guidance on hazard reducing controls, which need to be prioritised and approved through the appropriate budgeting processes. The Safe Systems of Work need to be easily understood by operators and produced for each unit or station of the machine. Finally the work undertaken needs to be translated into effective operator training that ensures the safe operation of the machine.

## The various types of machine guard available include:

- Fixed guards – these are intended to prevent any part of the body coming into contact with dangerous parts. Fixed guards have no moving parts and are kept in place by welding or fasteners – it should only be possible to remove them by using a tool.
- Distance guards – these are barriers sited at appropriate distances away from danger areas. Instead of completely enclosing danger areas, they place the danger areas out of normal reach.
- Adjustable guards – these are guards, which are adjustable as a whole, or fixed with adjustable elements. The adjustment is made to suit the particular operation being carried out and remains fixed until it is completed. Operators should be trained in how to adjust them correctly so that maximum protection is gained.
- Self-adjusting guards – these are fixed or movable guards which adjust automatically to accommodate the passage of material.
- Fixed enclosing guards – these enclose the whole area of the dangerous machine so that the person is totally removed from the danger area. Openings in the guard exist so that work can be fed – automatically or manually – into the machine's process.
- Interlocking guards – these are guards, which are moveable or have moveable parts, whose movements is interconnected with the power or control system of the machine. The guard should be connected to these controls in two ways; firstly, until the guard is closed the power is shut off to prevent the machine from working. And secondly, the guard remains locked until the risk of injury has passed – or opening the guard eliminates the hazard, perhaps by shutting down the machine.
- Electrosensitive Protection Equipment (ESPE) – trip systems that can be used as an alternative of interlocking guards.

## The hazards

Dangerous parts of the machinery can cause a wide variety of injuries including:

- Contact – serious injuries/amputation of limbs can occur after contact with rotating shafts/cylinders, e.g. Slitter Scorer unit or the Rotary Chop Unit and burns following contact with pre-heater/pre-conditioner rollers.
- Entanglement – where clothes and hair or limbs can become entangled in unguarded revolving shafts, pulleys – causing serious injury.
- In Running nip points – serious injuries/amputation of limbs can occur, e.g. between corrugator rolls and pressure rolls.
- Impact – some parts of the corrugator can cause severe injury if an individual gets in the way when the machine is running at high speed.
- The term 'dangerous part of machinery' is a well known one and the Health and Safety Executive has classified certain parts of machinery as inherently dangerous. These parts include revolving shafts, spindles, stock bars and abrasive wheels.
- In view of this it is essential that we assess and remove the risks posed by these dangerous parts so that they do not cause injury.

When assessing the need to guard one area it is important that you consider the type of guarding carefully, to ensure that the new guarding selected does not create another risk (e.g. ergonomically in the same area or risk further along the production process).

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Reel stands	While reels of paper are being loaded on and off the reel stands or when paper is being spliced in, is there effective guarding or suitable systems around the reel stands/Splicers, to prevent persons coming into contact with the reel or other moving parts? Electrosensitive Protection Equipment (ESPE) is a possible solution.		
Reel Stands	Are there any exposed chains/sprockets, drive belts or rotating shafts, which are unguarded and have trap potential?		
Reel Stands	Is there a safe system of work in case cores become jammed in the stand arm chucks to allow safe removal of reel?		
Splicers	Are there any rotating parts within upper limb reach, which present an entanglement/nip hazard?		
Splicers	Are there moving parts that can be a "struck by" or "shear " hazard. Are control measures in place to eliminate or minimise the risk? If so what are they?		
Splicers	Where fixed guarding has been installed by the manufacturer, are all these guards securely fixed and in place? Are other guards securely fixed?		
Sound Proof Acoustic Enclosures	Ensure all door catches on the unit have been fitted and are working? Are operators leaving doors open while the single Facer is running?  Are all the doors and acoustic panels on the enclosures in place? Have any been damaged? It is critical to ensure that noise does not escape through any openings and drastically reduce the effectiveness of the enclosure. Is correct signage in place?		
Hearing Protection	Is suitable and effective hearing protection issued and the wearing made mandatory? Are mandatory warning notices displayed reinforcing the need to wear hearing protection around the corrugator? Has a noise assessment been conducted? Have any additional noise reduction measures been taken as a result of the noise assessment to reduce the levels?		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Pre Heater	Are fixed guards or proximity guards fixed as appropriate? If interlocked gates are required do these reduce the machine to crawl speed or stop as appropriate?		
Single Facer	Are control measures in place for threading paper through the single facer?  Are procedures documented in a safe system of work and are operatives suitably trained and the training recorded?		
Single Facer	Are drive shafts and other dangerous rotating parts fully guarded at the drive side of the Facer?  Is this guarding suitable and sufficient to prevent anyone being able to reach in or climb over the guard? (A guard which is 2 metres in height with an interlocking access gate connected to the power/control unit or fixed guard)		
Pre Heater/Single Facer	Do operators wear special gloves and sleeves to protect themselves from contact with heated rollers/cylinders?		
Single Facer	Are there panels covering all dangerous rotating parts? How are these panels secured? (Locks/padlocks or are they interlocked to the single Facer or ideally, interlocked to the power/control panel)		
Single Facer	If operators walk through the single Facer unit between the corrugator rolls/pressure rolls and the pre heater while the machine is running at greater than crawl speed – are suitable proximity guards in place?  What guarding arrangements are there in place around the corrugator roller and pressure roller, to protect persons from the serious in running nip point?  Possibly interlocking gates at either end preventing persons from being able to access the rollers while the machine is running at speed. Access through only allowed while threading paper through when the machine is at crawl speed. (5 linear metres per minute)		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Single Facer	Prior to conducting any cleaning tasks within the single facer, have suitable and sufficient risk assessments been prepared outlining existing control measures? Are the control measures documented in safe systems of work? Is there a defined cooling down period, prior to cleaning down heated rollers and cylinders?		
Single Facer	Working at height. See note under other issues on last page  During engineering or cleaning maintenance, is there a requirement to work at height (above 2 metres), if so what control measures are in place to protect persons? E.g. a suitable working platform securely fenced on the open sides and accessible by fixed steps or ladder or, as a last resort lanyard and harness.		
Single Facer	Are all steam pipes lagged to prevent burn hazards and to save heat?		
Single Facer	Is there adequate drainage around the single facer to allow effective run off of water, to eliminate STF hazards?		
Wrap Arms – within the single facer – ground and gantry level	Is there any guarding around these wrap arms to prevent persons being entangled with the cylinders?		
Overhead Gantry Between single facers and gantry to the double backer	Does the gantry have the required guard rails, mid point rails and toe boards fitted along the full length of the machine?  Is every section of the platform secure with no loose boarding or gaps in it?		
Overhead Gantry	Are there any STF hazards on the platform?		
Overhead Gantry	Is the area under the transfer section where the paper is travelling through boarded out to ensure no risk of anyone falling through the web to the floor area below?		
Gantry/transfer sections between single Facer's/double backer	Are there any exposed rollers/shafts/belts or any in running nip points along the overhead section where persons could get entangled?  Are operators allowed to be on the gantry while the machine is running at greater than crawl speed (9 linear meters per minute)? If so, what precautions are in place?		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Gantry	Is there a safe system of work for clearing/removing single face web from the gantry?		
Fixed stairs or ladders to the overhead gantry	Are these stairs or ladders firmly secured to the floor and gantry? Do they have any handrails on them?		
Double Backer – Pre Heater	Is the pre heater section/wrap arms fully guarded around the Double Backer unit with a 2 metre fixed guard with an interlocking sliding gate at the front and a further gate at the side of the unit on both sides of the machine to prevent access into the unit while the machine is running at greater than crawl speed. The side gate to be interlocked so the gate will not open until the machine speed is a 9 linear meters per minute (Crawl Speed) to thread paper through only?		
Double Backer	If there is a panel which covers/guards exposed dangerous rotating parts at this point, is this panel firmly secured? How is it secured?  Locked or interlocked?		
Overhead Gantry above the Double Backer	If there is a walkway/platform above the unit, is this walkway fully guarded with guard rails, mid point rails and toe boards and meshed or boarded underneath to prevent anyone falling from the platform into the double backer/glue unit and being carried forward into the blanket section?		
Gantry feeding the Web to the Glue Unit	Is there suitable provision for feeding the single face web from the gantry to the glue unit?  Is the walkway/platform adequate to ensure safe working at height?  Has suitable access to this area been provided?		
Tessa Tape Unit	Normally the tape is inserted from the drive side. Does it move in safely without obstruction that could cause it to jam, skew or stop suddenly? Is there a safe method for feeding Tessa tape into the web? Is there any requirement for persons to work at height (e.g. to change tape)?		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Tessa Tape Unit	What impact does the insertion of the unit have on any gates and interlocking provided between the glue unit and the blanket section?		
Glue Unit/entry to blanket section or short press depending on the machine	<p>Is there a suitable access gate on both sides of the machine at this point, interlocked to the machine and incapable of being opened unless the machine speed has fallen to a crawl speed of 5 linear meters per minute? This gate to be a minimum of 2 metres in height.</p> <p>The in running nip point on entry to the blanket section must be fully guarded and protected.</p>		
Blanket Section/ Shortpress	<p>Is the blanket section guarded on both sides of the machine?</p> <p>Are the actual panels at the side and below the unit secured? How are they secured? Fixed or interlocked?</p> <p>Or</p> <p>Is there perimeter fencing running the entire length of the machine on both sides, keeping persons away from the unit while it is operational?</p> <p>If there is perimeter fencing, does this guarding incorporate an interlocking access gate with a key exchange system in place?</p> <p>Or</p> <p>Is there ESPE (light guarding) preventing access to the blanket section and under the unit while the machine is running</p>		
Blanket Section/Shortpress	<p>What safe operating procedures do you have in place for :-</p> <ol style="list-style-type: none"> <li>1. Getting up on the Blanket section for cleaning or maintenance</li> <li>2. Cleaning the Short press units?</li> </ol> <p>What method of access on and off the blanket section is provided? Do these procedures include the method and requirements for isolation?</p>		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Rotary Shear Unit	<p>Is the drive roller adequately guarded on both sides of the machine?</p> <p>Has access been prevented to stop a person climbing over the drive roller to gain access to the blanket?</p> <p>Are there any exposed shafts; belts within easy upper limb reach either side of the drive roller?</p>		
Rotary Shear Unit	<p>Where reject board is being discharged into a trolley/cage, is there an interlocking access gate in front of the unit to prevent access into the unit while the machine is running?</p> <p>This gate can only be opened when the machine is not chopping out waste board.</p> <p>Alternatively has a chute been installed that diverts the reject board into a trolley cage that is located under a non-hazardous part of the machine?</p>		
Ripper Tape Unit	<p>Where the Ripper Tape applicator is positioned is there a safe working platform to stand on while attending to the process?</p> <p>Does this safe working platform have guard rails, mid point rails toe boards and is it fully in filled to prevent anyone falling off the unit onto the web, which would carry a person to the slitter scorer unit?</p>		
Rotary Shear Unit leading to the Slitter Scorer Unit	<p>What level of guarding is in place between these units?</p> <p>Is there easy access to any dangerous moving parts?</p> <p>Can a person walk under the unit, crossing from one side of the machine to the other?</p> <p>Ideally both sides of this section should have fixed guarding, 2 metres in height with an interlocking access gate on both sides, if necessary</p>		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Slitter Scorer Unit	<p>Is the entry point to the slitter scorer unit adequately guarded on both sides of the machine, preventing persons from being able to reach into the slitter/creaser shafts?</p> <p>Is the area immediately in front of the shafts guarded the full width of the unit/machine?</p> <p>Is there a gate at this point, providing entry to the unit for clearing jam-ups or adjustments?</p> <p>If so, how is this gate secured? This gate should be interlocked to the machine with a key exchange system in place</p>		
Slitter Scorer Unit	<p>Is there a pit under the slitter scorer unit?</p> <p>Where are the access points to this pit?</p> <p>Are the access points, (gates, trap doors) interlocked to the machine?</p> <p>Is access to the pit restricted to authorised persons only?</p> <p>Are there safe operating procedures or SSoW in place for entering the pit and working on the unit?</p> <p>Is the area defined as a confined space?</p> <p>If it is a confined space area, are permits to work used?</p>		
Slitter Scorer Unit	<p>Is there any other dangerous part on the unit where access is easily obtained and there is no guarding in place to protect persons from the exposed parts?</p>		
Slitter/Scorer Unit	<p>Is the discharge area from the unit adequately guarded on both sides of the machine?</p>		
Slitter Scorer Unit leading to the Rotary Chop Unit	<p>Is the transfer section guarded on both sides of the machine, preventing access under the unit?</p> <p>Are there any finger/hand traps on the transfer section?</p> <p>Can access be obtained on to the web?</p> <p>Could a person enter on to the web and be carried forward into the rotary chop unit?</p> <p>Is there an interlocking access gate, preventing persons getting on to the web while the machine is running?</p>		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Rotary Chop Unit	<p>Is the entry point to the unit (rotating shaft/knife) adequately guarded the full width of the machine? How is this unit guarded?</p> <p>Are there safe systems of work in place for performing engineering work on the unit and are there safe procedures to be followed when clearing jam ups? Is access into this unit controlled via a permit to work system?</p>		
Rotary Chop Unit	<p>Is the discharge point from the unit adequately guarded?</p> <p>Can a person reach back into the unit and make contact with the rotating shaft/knife?</p>		
Top Stacker transfer section	<p>Can persons walk on and off the transfer conveyor belt freely at any time? If so what procedures are in place?</p> <p>Are appropriate emergency stop trip wires provided and set at an effective height? Is the section securely fenced on both sides?</p> <p>Is there a gate (entry point) onto the conveyor line, which is interlocked restricting access when the machine is running at greater than crawl speed?</p> <p>If the operator has to lean over to take samples are suitable hand rests for supporting the arm provided?</p> <p>Is there a safe working platform or bridge across the machine for persons to stand on?</p>		
Top/Bottom Stacker transfer section	<p>Are there any exposed in running nip points along the section?</p> <p>Are there any exposed shafts/rollers/chains along the section?</p>		
Top/Bottom Stacker transfer section	<p>Is access prevented from under the belt section while belts are operational?</p> <p>Are there any exposed shafts/rollers where a person could get entangled?</p> <p>Is this area fenced off or adequately guarded?</p>		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
Stacker Lift Tables	<p>Is the area around the lift tables fully guarded, the height, width and length of the unit, completely preventing persons from being under the lift table while it is operational?</p> <p>Are locking off pins always used when access under the stacker for engineering or cleaning maintenance is required? These pins securing the lift table in the event of hydraulic failure.</p> <p>Is there a safe system of work in place for entering under the stacker lift tables?</p> <p>Does this system of work require a check to be performed to confirm that the locking off pins have been put in place before entry under the stacker unit is allowed?</p>		
Delivery Conveyor	<p>Are there any exposed shafts/rollers/chains along the section?</p> <p>Are there any in running nip points along the section that are unguarded?</p> <p>Either in running nip points in powered conveyors or stack tracking?</p> <p>Is the out feed line split into sections?</p> <p>Can each section be individually driven in both directions to bring stacks of board together?</p> <p>Can this line operate in manual and automatic mode?</p> <p>Are persons allowed on the unit, when the rollers/track are operating in manual/automatic mode?</p> <p>Are there procedures to ensure that the line is isolated prior to persons walking on the line, to attend to stacks fallen over etc?</p> <p>What method of isolation is used for this task?</p> <p>Does the operator walk on to the line to insert identification tickets or can this task be carried out, without the need for a person to have to go on to the line?</p>		

<b>Component:</b>	<b>Hazard/Issue Identified:</b>	<b>Findings:</b>	<b>Action Required:</b>
<b>OTHER ISSUES</b>			
Electrical – throughout the machine	<p>How many start positions are there on the machine?  Where are these located?  Can the machine be re-set from all these positions?  Does re-setting the machine, involve the use of a key?  Are keys removed from the reset buttons so no person is able to reset the machine whilst individuals are in a potentially harmful position  Is there a unique key at each re set position?  Are there authorised persons who have the responsibility for re setting the machine?  Is the isolation procedure defined and understood by all persons?  Are there different levels of isolation depending on what tasks/activities are being carried out?  Does the machine operate with a key exchange system?  Do all the emergency stops/interlocks on the machine fail to safe?  Are emergency stops on a dual circuit system  Is the electrical relay system fitted to the machine of a switch type (e.g. Pilz Relay)?  Are all emergency stops and interlocking guards checked on a regular basis?  Have these safety checks been defined specifying what must be checked/inspected, every shift, daily, weekly etc?</p>		
Hydraulic oil tanks/pipe work	<p>Are there any oil leaks on any of the tanks?   Are the tanks and pipe work regularly inspected?</p>		
Working at height (throughout the machine)	<p>Have controls been put in place that adhere to the Work at Height hierarchy?  These are: 1. Avoid work at height where possible, 2. use work equipment or other measures to prevent falls where cannot avoid working at height 3. where a fall cannot be eliminated use work equipment or other measures to minimise potential distance and consequence of a fall.</p>		

## Corrugator Guarding



Blanket Press 1  
Fence with interlocked gates



Double Backer Glue Unit 1  
Fence with interlocked gates



Double Backer Glue Unit 2  
Interlocked Gates



Double Backer Glue Unit to  
Blanket Press



Double Backer 1  
Guarding all entry points



Blanket Press 2  
Fence with interlocked gates



ESPE on Reel Stand 1



ESPE on Reel Stand 2

## Corrugator Guarding



ESPE on Reel Stand 3



ESPE on Reel Stand 4



ESPE Reel on Stand 5



ESPE on Reel Stand 6



Rotary Shear 1, Conveyor diverting reject board to cage



Rotary Shear 2, Conveyor diverting reject board to cage (different angle)



Rotary Shear 3  
Interlocked guarding for cage



Rotary Shear 4  
Interlocked guarding