# Safety at compression moulding machines

## HSE information sheet

**Plastics Processing Sheet No 9 (Revision 1)**

## Introduction

This information sheet is one of a series produced by HSE's manufacturing sector and gives practical advice for owners and users of compression moulding machines. It gives information on commonly accepted and practicable safeguards for significant hazards on compression moulding machines *supplied before* the publication of BS EN 289:1994. This standard was replaced by BS EN 289:2014[1] and represents 'state of the art' for these machines. This guidance can be used as a check for machines manufactured after 1994 to make sure that they meet the minimum levels of protection required.

The main UK legal requirements covering the safe use of compression moulding machines are the Provision and Use of Work Equipment Regulations 1998.[2]

Since 1995, all new machinery has been subject to the European Machinery Directive, which requires machines to be safe by design and construction. When first placed on the market or first put into service, machinery must meet all relevant Essential Health and Safety Requirements (EHSRs) in the Directive. The machine should be designed to the 'state of the art', and be accompanied by user instructions, a Declaration of Conformity, and bear a CE marking. Further guidance on the Directive and the UK Supply of Machinery (Safety) Regulations is available from HSE's website and in *Buying new machinery*.[3]

## Guarding standards for production

The tables below list practical safeguards that can be applied. Current standards are quoted to illustrate acceptable levels of safety. Where the publication date of standards is after the machine manufacturing date you should ensure that standards that were current at the time of manufacturing are met. For pre-1995 machinery, safeguards that meet PD 5304:2005[4] are acceptable alternatives to the more recent BS ENs quoted.

**Table 1** Hazards and principal safeguards for window frame manufacturing machines

| Hazard | Safeguard |
|---|---|
| **Traps between the moving platens/ moulds from operator's position** | *Either*:<br>■ dual-channel interlocking with cross-monitoring, with the first channel having two guard position sensors acting on the control circuit and the second channel having a device which directly or indirectly interrupts a power medium when the guard is open; *or*<br>■ guard-inhibited power interlocking; *or*<br>■ dual-channel interlocking with cross monitoring, with one position sensor for each channel; *or*<br>■ photoelectric systems (positioned to protect all hazards in the area and to prevent a person standing on the danger side with the machine operating); *or*<br>■ on smaller machines, two-hand control with additional fixed guards to prevent the possibility of access by another person. |
| **Traps in the core and ejector mechanism** | Prevent access to the dangerous parts *either* by interlocking them with the front operator's guard, *or* by using localised fixed guards. |

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|---|---|
| **Traps between platens/moulds as a result of gravity fall (where applicable)** | To prevent trapping between the moulds on downstroking presses some form of physical restraint.<br><br>*Either*:<br><br>■ one or more scotches, capable of supporting the weight of the ram, platen and tool, inserted when the platen has returned to the top of its stroke. On large machines (>800 mm in any platen dimension and >500 mm maximum stroke) engagement of the scotch should be automatic; on small machines (<800 mm in any platen dimension and <500 mm maximum stroke) the scotch may be manually engaged if it is interlocked with the guard; *or*<br>■ where a scotch operates in conjunction with an interlocked guard, the guard should not be able to open until the scotch is in place; *or*<br>■ where a scotch operates in conjunction with an electro-sensitive device, scotches should be capable of arresting the closing stroke at any point at which trapping can occur; *or*<br>■ a pilot-operated check valve and counterbalance valve assembly connected to the lower end of the hydraulic cylinder. |
| **Traps between the platens and presses where full-body access is possible** | Where operators can walk into the area between the platens (usually when the machine bed is at floor level or below), a person-sensing device should be provided which will not allow the platens to close if an operator is present in the danger area. Relevant technologies include different forms of electro-sensitive devices, such as photo-electrics and scanning devices. |
| **Traps between the moving platens/ moulds at the rear of machines** | If the machine can be operated from the rear, safeguarding there should be to the same standard as that at the operator's position described above. If access is for setting or maintenance only, *either:*<br><br>■ a fixed guard and robust lock-off procedure; *or*<br>■ an interlocked guard which positively interrupts the control signal initiating a dangerous movement and blocks any energy accumulator. |
| **Traps between the platens on multi-daylight presses** | The guard should be interlocked with the platens so that it remains closed if a platen fails to open during an opening stroke. |
| **Dangerous moving parts at loading/unloading mechanisms** | Fixed guards can be used if access is only for maintenance. If access is required for other tasks, eg setting up, then interlocked guards with two position sensors and cross-monitoring should be provided. |
| **Burns at hot surfaces** | Hot parts above 80 °C should be protected against accidental contact using guards or insulation. Where hot parts are necessarily exposed (eg moulds) warning signs are required. When accessing or working near hot parts, safe systems of work should be agreed and followed; this may include the use of personal protective equipment . |

## Safety during mould change

Accidents have occurred during setting because safe systems of work are not followed and interlocks are overriden. You should provide a written safe system of work for your setters based on the following.

***Before mould change***

- If downstroking, chock/scotch the top platen in the fully raised position.
- Isolate and lock off the power source to any ejection mechanism before access to them is attempted.
- Make suitable lifting equipment available for the removal and insertion of heavy moulds.
- Place a sign/barrier on the machine controls stating that tool setting is in progress.

***Mould changing with guards/interlocks in use (preferred method)***

- No mould changing, setting or try-out operation should be undertaken without first checking on the function of the machine's safety devices for the mould area.
- If any bodily access is required between the platens, use the emergency stop control (despite

the fact that all the guards and interlocks are operational). Note that this is in addition to the steps outlined above.

- If powered movement of the platen is required with the guards open, only permit such operations if suitable override facilities have been built in to the machine controls. To be suitable, such facilities should include low pressure together with two-hand control and slow speed (10 mm or less) or limited movement (inch), all of which should be engaged automatically on selection of the override mode.
- If there are prolonged periods during the setting procedure when powered movement of the presses is not required, isolate the machine from its power supply, lock off and dissipate any stored energy.

***Mould changing with guards/interlocks removed (only if essential)***

- If any of the guards or interlocks have to be removed, isolate the machine from its power supply, lock off and dissipate any stored energy.
- If powered movement of the press tool is necessary with the guards removed, this should only be possible through the use of a lockable mode selector key which automatically engages limited movement (inch) or low-pressure movement under the control of a hold-to-run device or a two-hand control.

***After mould change***

- When the guards/interlocks are reinstated, and before returning the machine to the operator, carry out relevant checks from the monthly maintenance list to prove the guards are functioning properly.
- Ensure that the mechanical restraint is correctly adjusted.
- The operator should conduct the operational checks independently before starting production on the machine.

## Operator safety checklist

Regular checks by the operator are a good way of identifying problems as well as making sure machinery is safe for use. It is recommended that operator checks are carried out at regular intervals, as a suggestion daily or after mould changes. Table 2 contains the recommended minimum checks the operator should carry out on a regular basis. You may also want to consult the manufacturer's instructions to see if the operator should carry out any additional checks.

**Table 2** Recommended checks for the operator to carry out

| **The answer to all questions should be 'yes' or action needs to be taken** | **Yes** | **No** |
|---|---|---|
| Are all fixed and interlocked guards in place, in good condition and secure? | | |
| Are all interlocking devices correctly aligned and securely attached to guards? | | |
| Does opening an interlocked guard immediately stop the parts it protects? | | |
| When an interlocked guard is open do all dangerous parts remain stationary if a start control is pressed? | | |
| Where time-delay interlocks are fitted do they prevent access until rotation of dangerous parts has stopped? | | |
| Are fixed guards held in place with fastenings that require a tool to undo them? | | |
| Where pressure-sensitive mats are fitted does the pressure-sensitive mat indicator work when the mat is stepped on? | | |
| Do any trip devices function correctly? | | |
| Are all control unit enclosures closed, locked and the keys removed? | | |
| Where two-hand controls are provided do both buttons have to be pressed together for the machine to operate? | | |
| Where hold-to-run controls are provided if you release the button does the machine stop? | | |

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| Where fitted, are adjustable guards adjusted correctly? | | |
| Are safety devices, interlocks and guards free from evidence of being tampered with? | | |
| When the machine front guard is open, does the machine remain stationary when a start control is pressed? | | |
| *Weekly check:* Are the mould-securing bolts tight? | | |

## Monthly machine inspections

It is recommended that monthly machine inspections are carried out. The checklist in Table 3 provides a suggested minimum list of checks to do but you should also consult the manufacturer's instruction manual to see if any additional maintenance inspections should be carried out.

**Table 3** Suggested minimum checklist

| **The answer to all questions should be 'yes' or action needs to be taken** | **Yes** | **No** |
|---|---|---|
| Are all fixed guards held in place with fastenings that need a tool to undo them? | | |
| Are all interlocking devices correctly aligned and securely attached to guards? | | |
| Does opening an interlocked guard immediately stop the parts it protects? | | |
| When an interlocked guard is open do all dangerous parts remain stationary if a start control is pressed? | | |
| Where time-delay interlocks are fitted do they prevent access until rotation of dangerous parts has stopped? | | |
| When an emergency stop button is pressed does it stop all movement of the machine? | | |
| Once an emergency stop button has been pressed does all machine movement remain stopped until the button has been reset? | | |
| Do any trip wires stop the machinery almost instantaneously? | | |
| Are control unit enclosures closed, locked and the keys removed and retained by a designated person? | | |
| From a visual inspection, is any electrical wiring in good condition and free from damage? | | |
| Are safety devices, interlocks and guards free from evidence of being tampered with? | | |
| Where two-hand controls are provided do both buttons have to be pressed together for the machine to operate? | | |
| Where hold-to-run controls are provided if you release the button does the machine stop? | | |
| Does the movement of the interlocked guards actuate the sensors of the associated hydraulic, pneumatic or electrical mechanisms? (Visual check) | | |
| Are all pressurised flexible hoses in good condition and their fastenings secured in place? | | |

## References and further reading

***References***

1 BS EN 289 *Plastics and rubber machines. Compression moulding machines and transfer moulding machines. Safety*
British Standards Institution

2 *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance* L22 (Fourth edition) HSE Books 2014 www.hse.gov.uk/pubns/books/l22.htm

3 *Buying new machinery: A short guide to the law and your responsibilities when buying new machinery for use at work* Leaflet INDG271(rev1) HSE Books 2011 www.hse.gov.uk/pubns/indg271.htm

4 PD 5304 *Guidance on safe use of machinery*
British Standards Institution

***Further reading***

For health and safety in plastics manufacturing premises see HSE's plastics webpages www.hse.gov.uk/plastics/

For PUWER and CE marking see HSE's work equipment/machinery webpages www.hse.gov.uk/work-equipment-machinery/

## Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

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