Safety at window frame manufacturing machines

HSE information sheet

Plastics Processing Sheet No 8 (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 machinery used for manufacturing window frames. It gives information on commonly accepted and practicable safeguards for significant hazards on both new and second-hand window manufacturing machinery. This guidance can be used as a check for machines manufactured after the relevant European Standards to make sure that they meet the minimum levels of protection required.

The main UK legal requirements covering the safe use of window frame manufacturing machines are the Provision and Use of Work Equipment Regulations 1998.[1]

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*.[2]

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[3] are acceptable alternatives to the more recent BS ENs quoted.

Table 1 Hazards and principal safeguards for window frame manufacturing machines

Hazard	Safeguard
Accessible powered clamps (all types of machinery)	Either restricted stroke (6 mm or less), two-hand control, guarding of the clamps or low-pressure approach to within 6 mm of the work-piece: in this case, the clamp should retract if an obstruction is detected during descent. The approach pressure on the clamp should not be adjustable by the user.
Work-piece movement	Where practicable, clamping or other means of restraint if there is a risk of the work-piece moving and causing injury during machining, particularly at saws (including bead saws), routers/slotters and end millers. Where sequencing is automatic, the blade/cutter should be interlocked with the clamping mechanism so that blade/cutter cannot be presented to the work-piece until it is clamped.

Contact with the blades of the following types of saw: pivoting single- and double-head mitre, cut-off/pull-up, cross-cut/draw, bead and snip	Fixed guarding (eg a tunnel guard) which encloses the saw blade in both its cutting and retracted position (see BS EN 953[4]). Where this is not practicable, the teeth of the saw blades should be fully enclosed by a self-adjusting guard (with mechanical linkages, not reliant on gravity alone) when in the rest position. Where cutting is automatically initiated, and the blades not fully enclosed during the cutting process, this should be by controls which require the operator to use both hands. Where it is not practicable to fit a self-adjusting guard (as described above) then a fixed or gravity-operated adjustable guard should be provided with a hold-to-run button or trigger switch on the operating handle. The button or switch should be arranged so that, when the button is released, power to the saw blade spindle is removed. Where it is possible to stand between the powered movable saw-blade carriages and there is a risk of crushing, hold-to-run operating controls should be located in a position which prevents the operator being injured. There should be a clear view of the working area from the operator's position.
Contact with mitre saw blades where blade movement is lateral	*Either:* ■ fixed or interlocked guards which prevent access to the blades in their cutting and retracted positions; *or* ■ automatic blade guards which move into the forward position in advance of the blades and cover the blade to the greatest extent practicable during the cutting process. In their retracted position the blades should be fully enclosed in their housing. Neither of these options may be practicable on some older machines. In these cases, the minimum acceptable standard for the cutting/clamping risk is the provision of hold-to-run controls which require the operator to use both hands. In their retracted position the blades should still be fully enclosed in their housing. Where it is possible to stand between the powered movable saw-blade carriages and there is a risk of crushing, hold-to-run operating controls should be located in a position which prevents the operator being injured. There should be a clear view of the working area from the operator's position.
Contact with saw blades at v-notch and bench circular saws	For v-notch saws, an adjustable bridge guard over the blade(s) should be provided to enclose as much of the blade(s) as possible when cutting. It should be strong, not easily deflected to expose the blade(s) during cutting, wide enough to prevent access to the blade from the sides and easily adjustable without the use of a tool. Circular saw benches should be guarded below the table so as to completely enclose the blade. Above the table, an adjustable guard should be provided; the bottom should be not more than 12 mm above the work-piece. Means should also be provided to prevent the need for the operator's hand to pass close to the blade when feeding.
Contact on tools with multiple-cutter machinery (eg routers/ slotters/drilling machines)	These machines should be fitted with controls which require the operator to use both hands on separate hold-to-run devices (eg push buttons or trigger grips). Removing either hand from the control should bring the cutters to rest promptly. Where a prompt rundown time is not practicable, there should be an adjustable guard which covers the tools in the retracted position.
Contact with hot parts (welding plates) at welding machines and/or trapping as plates move on both single and in-line machines	*Either:* ■ fixed guards or automatic guards that move into position before welding; *or* ■ two-hand controls. Where clamping initiates an automatic sequence, not requiring the continuous use of the two-hand control, fixed or automatic guards should be provided.

Contact with knives and cutters at cabinet enclosed corner cleaning machines and transom grooving machines	Fixed or distance guards at the front of the machine should prevent access to the knives and cutters. Side or rear doors giving access for cutter block changing should be interlocked so that the cutter spindle motion stops when the door is opened. If run-down time exceeds the time needed to gain access, then guard locking or time-delay interlocking will be needed.
Contact with cutters at end milling machines	Access to the cutters through the feed opening should be prevented by restricting the size of the opening (including by the use of spring-loaded/lever-operated self-adjusting guards) or by interlocked guarding.
Machine centres (eg cutting and welding centres)	Fixed guarding or perimeter fencing. Access doors in the perimeter fencing should be interlocked to machine operation. Presence-sensing devices, limited movement devices and/or other appropriate safeguards should be deployed within the perimeter fencing if access is needed with the machine under power.

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?		
Where fitted, are adjustable guards adjusted correctly?		

Are safety devices, interlocks and guards free from evidence of being tampered with?		
Do self-adjusting (eg saw-blade) guards move freely and fully enclose the blade or other dangerous part?		
Does the adjustable part of the guard enclose all the blade on return to the rest position?		
Do return springs on saw-blade guards and at end millers work effectively? (ie do they return adjustable or movable guards to a position where the dangerous parts are fully enclosed?)		
Are the safety devices at clamps working correctly?		
Are circular saw-blade guards set to no more than 12 mm above the height of the material being cut?		
Are push-sticks provided at circular saws?		
Are hot surfaces on in-line welders protected by two-hand controls or fixed guards?		
Where applicable, is movement of dangerous parts prevented while either a test piece is between the electro-sensitive curtain or a weight is applied to a pressure-sensitive mat?		

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?		
Where there are dual-channel interlocking systems, is each channel in good working order and is each independently able to stop the dangerous parts it protects?		
If fitted, does the trip device on the leading edge of the power-operated guard operate when activated?		
Are the high-tensile steel bolts (holding top mould to platen) in good condition?		
If fitted, is the mechanical restraint sound, properly secured and adjusted, and functioning correctly?		
Is any heat insulation provided in place and in good condition and are hot surface warning signs in place?		
If fitted, are any presence-sensing devices in the mould area working correctly?		

References and further reading

References

1 *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

2 *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

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

4 BS EN 953 *Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards* British Standards Institution

Further reading

Safety at manually-fed pivoting-head metal-cutting circular saws Engineering Information Sheet EIS12 HSE Books 1998 www.hse.gov.uk/pubns/engindex.htm

Circular saw benches. Safe working practices HSE Woodworking Information Sheet WIS16(rev2) HSE Books 2011 www.hse.gov.uk/pubns/woodworking/wis.htm

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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