

Safe use of power-operated cross-cut saws

HSE information sheet

Information Sheet No 35 (Revision 1)

Introduction

Power-operated cross-cut saws are versatile but dangerous machines which have caused many serious accidents. This information sheet has been produced by HSE in consultation with the woodworking industry. It provides practical advice for both users and suppliers about guarding and safe use of these machines. It also summarises the key requirements of the latest British and European standards which represent 'best practice'.

What are power-operated cross-cut saws?

There are a wide range of designs and saws can be either automatic or semi-automatic. This means that the saw blade is moved through the workpiece under power (usually hydraulic or pneumatic) and the saw can therefore cycle without the operator initiating the stroke. As the operator does not have direct control of the blade movement, unlike on a manual cross-cut, high standards of safeguarding are necessary. Manual cross-cut saws, where the saw unit is pulled through the workpiece by hand, are covered in WIS36.¹

Note: The term *safeguarding* includes *guards, interlocks, two-hand controls etc.* The *safeguards* used must keep the operator out of the danger area during the cutting stroke.

Types of saw

There are two main saw categories, depending on where the saw blade is mounted, either above the table or below the table (up-cutting). Most machines have only one saw unit, but this sheet is also relevant to machines with two or more units.

All saws can have either:

Semi-automatic feed This has an integrated feed which is started manually. The workpiece can be either positioned manually or a positioning mechanism can be used for cutting it to length.

Automatic feed

This has an integrated feed which is started automatically. The workpiece is manually loaded and/or unloaded but is automatically positioned for cutting to pre-selected lengths.

Assess the risks

Once you have identified which type of machine you have, you need to assess the risks and decide whether they are adequately controlled. Each type of machine requires a different set of safeguards that will also depend on how the machine is being used. Although standards of guarding have greatly improved in recent years, many older machines are poorly guarded. A thorough risk assessment of existing guarding and how the machine is used is the only way to make sure your machine is safe.

Your assessment should include the following areas:

- **Guarding** – Do the guards actually prevent access, eg do they extend far enough and is the current safeguarding adequate or could you do more?
- **Training and machine use** – Compare how the machine should be used with how it is actually used. Do operators take short cuts? What training or instruction have they had? Do they fully understand how the machine operates?
- **Intervention by operators** – Look at reasons why an operator might need to intervene, such as adjusting settings, clearing blockages/misfeeds or removing dust/off-cuts and make sure they are trained to do this safely.
- **Two-man operation** – Where the risk assessment identifies that there is a risk to a person other than the operator, especially where someone is 'taking off', you will need to consider if existing safeguarding is adequate, even where two-hand controls are fitted.

The risk assessment should also identify which is the best machine available to undertake a particular job.

Safe working practices for all machines

Operator training

The best way to control risks is by physical safeguards. However, operator training is equally important. Training should include not just normal operation of the machine but also how to deal with events such as blockages, breakdowns etc. Many accidents have been caused by the operator using unsafe working practices during an intervention, with the saw blade still under power or running down. In some circumstances, intervention can be done safely using a long-handled tool but generally before attempting such work the saw blade should be stationary. Depending on the process safe isolation may also be necessary.

Safe isolation

Safe electrical isolation is the most reliable way of preventing an unexpected start-up during a machine intervention. However, this is dependent on there being suitable means to ensure accidental reconnection is prevented. One means of achieving this is breaking the 3-phase by mechanical means and a locking-off facility.

Jigs/push-sticks etc

In most cases, correct safeguarding of the machine will prevent accidents, but suitable appliances to allow feeding and removal of short or twisted workpieces may also be necessary, for example long-handled tools and/or push-sticks. This is particularly important when guards do not meet the requirements of Table 4 of BS EN 13857:2008² (referred to as 'Table 4' from now on). This sets out the minimum dimensions for guards to prevent operators reaching the dangerous parts. The use of a suitable jig is essential for jobs such as stake pointing as this will provide workpiece stability, minimises the risk of kickback and keeps hands away from the saw blade.

Causes of accidents

Cross-cut saws can be difficult machines to make safe because physical guarding alone cannot eliminate all the risks completely and those which remain have to be managed by a safe working practice. Lack of training is a significant factor in many accidents and adequate training, instruction, authorisation and supervision of the operator must be in place.

Semi-automatic machines – where the saw blade stroke is initiated by the operator. Most accidents are caused by unintentional operation of this 'start' control, usually an old style foot pedal or treadle, leading the blade to stroke and/or clamps to operate.

Accidents have occurred even where pedals are shrouded.

Automatic machines – where the saw blade stroke is started in another way, usually by the workpiece striking a sensor. Most accidents are caused when the sensor (stop) is triggered while the operator's hand is in the danger zone, generally because the machine is not properly safeguarded or has not been isolated. Up-stroking saws in particular have caused a number of partial or complete amputations.

Common problems on both *semi-automatic* and *automatic* machines include:

- guarding and/or machine dimensions are insufficient to prevent operators putting their hands into the danger zone;
- safeguards have no interlocks or ones that can be easily removed or defeated;
- single-hand controls; and
- un-shrouded foot pedals.

Other accidents have been caused by unsuitable use of the machine and poor maintenance of machine guards.

General safeguarding

Most accidents can be avoided by keeping the operator's hands away from the danger zone during workpiece clamping (where fitted) and/or the saw blade cutting stroke. This can be achieved by applying one or more of the following measures:

- Prevent (or restrict) access to the danger zone with appropriate guards.
- Provide a two-hand control device to start the saw blade stroke and workpiece clamping.
- Make sure the controls are fixed in a position where the operator cannot start the saw blade stroke and/or powered clamping while being able to reach into the danger zone.

Machines operated by a foot pedal or treadle, or a single-button control, which have not been modified to two-hand control operation, will require extra safeguarding.

Access to the danger zone can be controlled by fitting fixed or moveable (hinged) interlocked tunnel guards, ie interlocked with the saw spindle drive motor to stop the blade. These should extend across the full width of the machine table on each side of the cutting line.

Where possible, tunnel guards should prevent access to the danger zone. For example, they should be designed to meet the requirements of Table 4.

Any crushing or shearing hazard at the rear of either semi-automatic or automatic machines created by the saw on its return stroke should be prevented by fixed guards, and any openings must comply with the Table 4 safety distances.

Specific safeguarding for machines with saw spindle above the machine table

Horizontal-cutting (travelling head/radial arm) sawing machines (Figure 1)

This is the most common type of power-operated cross-cut saw. The saw blade moves horizontally forward on an arm in a straight line during the cutting stroke and then back to its rest position. The arm can rotate relative to the centre line of its vertical support (pivoting) and the saw unit can 'cant' relative to a horizontal line in the direction of the arm.

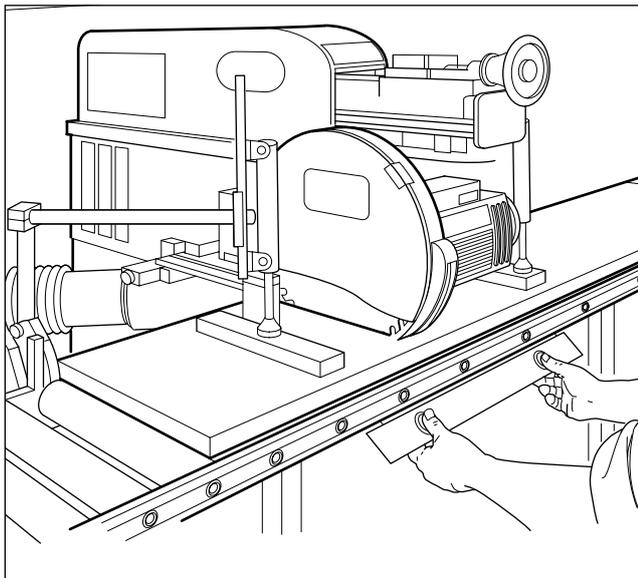


Figure 1 Horizontal-cutting semi-automatic cross-cut saw operated by two-hand control device

Guarding for horizontal-cutting semi-automatic machines

The upper, non-cutting part of the saw blade should be fitted with a fixed guard covering the saw blade, at least down to the saw spindle. Guards which need to be removed for blade changing should be hinged and require a tool to do so.

When the saw unit is in its rest position, access to the cutting area of the saw blade should be prevented by:

- fixed guards, any openings in which meet the requirements of the safety distances in Table 4;
- self-closing power-operated guards interlocked with the position of the saw unit; or

- a combination of fixed guards and self-closing power-operated guards.

The cutting stroke of the saw unit should be controlled by a two-hand control device that conforms to BS EN 574³ and, when this control is released, the saw unit should return to the safe rest position within 1.5 seconds.

The braked run-down time should be less than 10 seconds or, where the run up exceeds 10 seconds, be less than the run-up time, but should not exceed 30 seconds.

Work table

The table should extend at least 250 mm on either side of the cutting area and be fitted with a fence. When the saw blade is at the most forward position of its stroke, none of the saw teeth should project beyond the front edge of the machine table. The table may need to be widened at the saw line to achieve this (see Figure 2).

Down-cutting sawing machines (Figure 2)

The saw blade moves down through the workpiece during the cut in a similar way to a manually-operated machine.

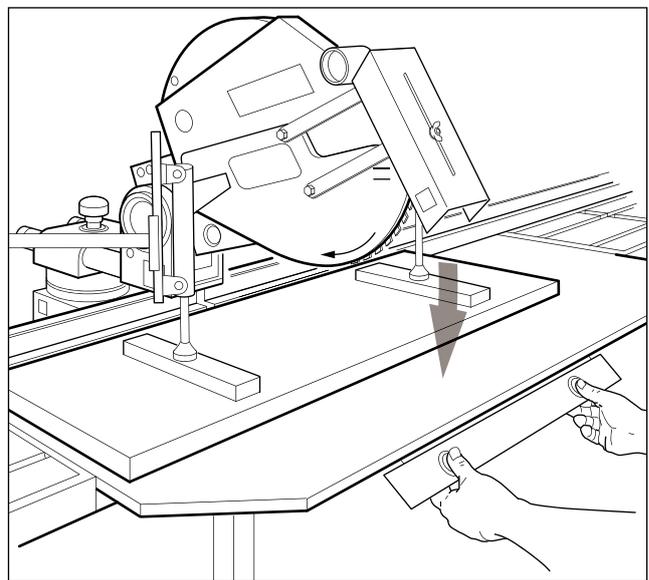


Figure 2 Down-cutting machine with self-closing guard

Guarding for down-cutting semi-automatic machines

Access to the non-cutting part of the saw blade should be prevented by a fixed guard that extends to the lowest point on the periphery of the saw flange. Any access in the guard for blade changing must be hinged and require a tool to open it.

Access to the cutting area of the saw blade should be prevented either by:

- a self-closing guard, covering both sides of the saw teeth, that extends beyond the blade periphery and opens when it makes contact with the workpiece or fence; or
- a self-closing guard, covering at least the periphery of the saw blade and both sides of the saw teeth, that is completely closed in the rest position and opens progressively as the saw blade lowers.

Both of these options require the addition of a two-hand control.

An alternative option is to guard as for an automatic machine (see section on guarding for automatic horizontal, down-cutting and pendulum machines on following page).

The braked run-down time should be less than 10 seconds.

Work table

Semi-automatic machines with a blade less than 315 mm should have a table that extends at least 500 mm on either side of the cutting line. For blades over 315 mm then it should be at least 1.0 m either side. Automatic machine tables should extend 250 mm either side of the cutting line. In all cases, the measurement should take into account the blade's ability to cant and, if the workpiece is held manually, then there should also be a fence.

Pendulum cross-cut sawing machines (Figure 3)

These are saws where the blade moves either in a straight line or an arc through the workpiece then returns to its rest position.

Guarding of the saw blade and saw unit on pendulum semi-automatic machines

Prevent access to the non-cutting area of the saw blade by a fixed guard that extends to the lowest point on the periphery of the saw flange. Any access in the guard for blade changing must be hinged and require a tool to open it.

You should prevent access to the saw blade in the rest position:

- in the non-cutting area of the saw blade by the measures described above; and
- in the cutting area of the saw blade by:
 - a fixed guard, any openings in which meet the safety distances of Table 4;

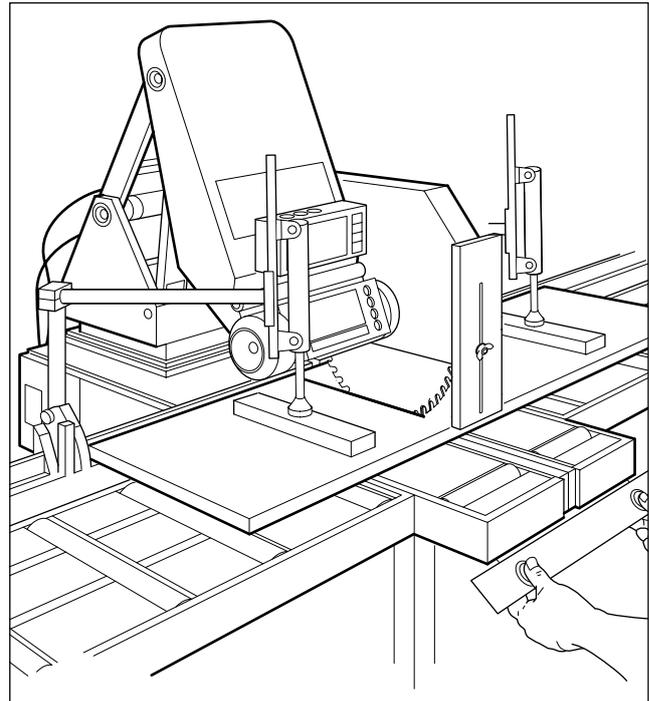


Figure 3 Example of pendulum cross-cut sawing machine

- self-closing power-operated guards interlocked with the position of the saw unit; or
- a combination of fixed and self-closing power-operated guards.

The cutting stroke of the saw unit should be controlled by a two-hand control device that conforms to BS EN 574.³ When released the saw should return to its rest position within 1.5 seconds

An automatic brake should be provided for the saw spindle where the unbraked run-down time exceeds 10 seconds. The braked run-down time should be less than 10 seconds but, if the run-up time exceeds 10 seconds, then the run-down time must be less than the run-up time, but in no case should it exceed 30 seconds.

Work table

Semi-automatic machines should have a table that extends at least 1.0 m either side of the cutting line. Automatic machine tables should extend 250 mm either side of the cutting line. These measurements should take into account any ability to rotate the saw unit. As with the horizontal cross cut, when the saw blade is at the most forward position of its stroke, none of the saw teeth should project beyond the front edge of the machine table. The table may need to be widened at the saw line to achieve this. A fence should also be fitted to either side of the cutting line.

Guarding and braking for horizontal, down-cutting and pendulum automatic machines

Prevent access to the saw blade by fixed guards. Where access is needed for maintenance or saw blade changing, it should be via interlocked guards with guard locking (ie the machine cannot be operated before the saw blade has stopped rotating). Details of the type of interlocking required are given in the relevant standard for each machine.^{4,5,6}

Any openings in these fixed guards, eg for workpiece loading and unloading, should meet the safety distances of Table 4.

For horizontal and pendulum automatic machines an automatic brake should be provided for the tool spindles where the unbraked run-down time exceeds 40 seconds to reduce braking to below this time.

For down-cutting automatic machines the braked run-down time should be less than 10 seconds.

Machines where the saw spindle is below the table

Up-cutting cross-cutting sawing machines

The saw blade is located below the 'table' when in the rest position. From the rest position the blade moves upwards and sometimes also horizontally through the workpiece during the cut (see Figure 4).

When 'resting' access to the blade should be prevented by fixed guards for both semi-automatic and automatic machines and any openings should meet the requirements of Table 4. Any access for blade changing, adjustment or maintenance should be via a moveable interlocked guard with guard locking.

Guarding of the saw blade on up-cutting automatic machines

Access to the cutting area of the saw blade should be prevented by either:

- fixed guards, with any openings meeting the requirements of Table 4. Any access door for saw blade changing, adjustment or maintenance should be interlocked with guard locking that ensures that the door remains locked until the saw blade has returned to the rest position;
- pressure-sensitive mats; or
- light barriers.

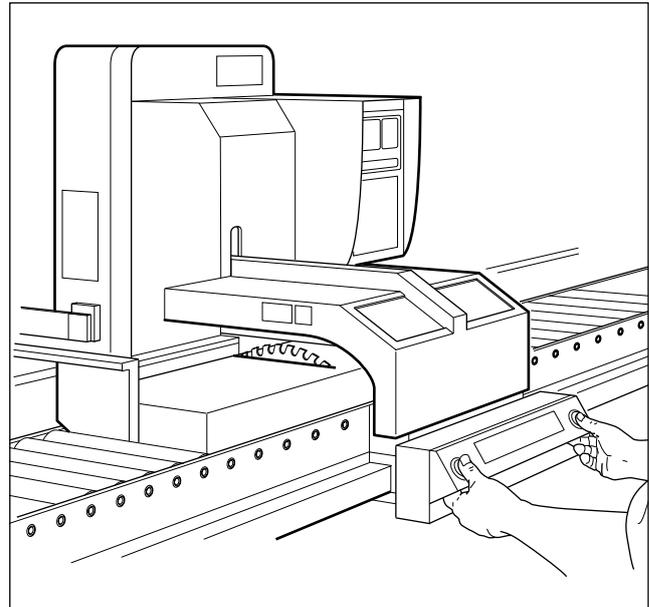


Figure 4 Up-stroking semi-automatic cross-cut saw with two-hand control and short tunnel guard

Guarding of the saw blade on up-cutting semi-automatic machines

Access to the cutting area of the saw blade for semi-automatic machines can be prevented as per automatic machines or by fixed or moveable guards. These can also be used in combination with pressure mats.

Specific requirements for all of these safeguarding options are covered in BS EN 1870-10:2003.⁷

Automatic braking should be fitted if the un-braked rundown time of the saw spindle exceeds 60 seconds to reduce it below this time.

Work table

The machine table should extend 1.0 m either side of the saw cutting line, when 90° to the fence. On the outfeed side the table can be designed to allow off-cuts to fall beneath the table but this must not allow access to the saw blade. If there is no clamping then the table must also be fitted with a fence on both sides of the saw line.

Clamping devices

Power-operated workpiece-clamping should always be provided for all semi-automatic and automatic horizontal, down-cutting and pendulum machines. It is optional on up-cutting machines.

Where the crushing hazards from clamping have not been prevented by any of the general or machine specific safeguards then the following options are available:

- two-stage clamping, with a maximum of 50 N force for the first stage, followed by the full clamping force actuated by manual control;
- reduce the gap between the clamp and the workpiece to 6 mm or less by a manually adjustable device and also limit the stroke to a maximum of 10 mm;
- limit the clamp closing speed to 10 mm/s or less; or
- prevent access to the clamp by a guard fixed to the clamping device to reduce the gap between the workpiece and the guard to 6 mm or less. The maximum extension of the clamp outside the guard should not be more than 6 mm.

Workpiece positioning mechanism

There may be other trapping, drawing in or shearing risks from the workpiece positioning mechanism (where fitted). If this is not stopped by the safeguards preventing access to the saw blade, then additional safeguards will be required, as detailed in the relevant standard for the machine.

Other hazards

Noise

These machines may emit high levels of noise. When fitting new or improved safeguarding, you should favour modifications that are likely to reduce noise emission levels.

Dust

All woodworking machines should be fitted with suitable dust extraction equipment to reduce the exposure to wood dust to a minimum.

Further information on training, dust and noise can be found on the HSE website: www.hse.gov.uk.

References and further reading

- 1 *Safe use of manually operated cross-cut saws* Woodworking Information Sheet WIS36 HSE Books 2011 www.hse.gov.uk/pubns/wis36.pdf
- 2 BS EN ISO 13857:2008 *Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs* British Standards Institution
- 3 BS EN 574:1996 *Safety of machinery. Two-hand control devices. Functional aspects. Principles for design* British Standards Institution
- 4 BS EN 1870-3:2001 + A1:2009 *Safety of woodworking machines. Circular sawing machines. Down cutting cross-cut saws and dual purpose down cutting cross-cut saws/circular saw benches* British Standards Institution
- 5 BS EN 1870-11:2003 + A1:2009 *Safety of woodworking machines. Circular sawing machines. Semi-automatic and automatic horizontal cross-cut sawing machines with one saw unit (radial arm saws)* British Standards Institution
- 6 BS EN 1870-12:2003 + A1:2009 *Safety of woodworking machines. Circular sawing machines. Pendulum cross-cut sawing machines* British Standards Institution
- 7 BS EN 1870-10:2003 + A1:2009 *Safety of woodworking machines. Circular sawing machines. Single blade automatic and semi-automatic up-cutting cross-cut sawing machines* British Standards Institution
- 8 BS EN 1870-9:2000 + A1:2009 *Safety of woodworking machines. Circular sawing machines. Double blade circular sawing machines for cross-cutting with integrated feed and with manual loading and/or unloading* British Standards Institution
- 9 *Machinery: Guidance notes on the UK Regulations (September 2009)* BIS URN 09/P86. View online at www.berr.gov.uk/files/file52968.pdf
- 10 *Safe use of woodworking machinery. Provision and Use of Work Equipment Regulations 1998 as applied to woodworking machinery. Approved Code of Practice and guidance L114* HSE Books 1998 ISBN 978 0 7176 1630 5

Further information

Further information on health and safety for woodworking can be found on HSE's woodworking website: www.hse.gov.uk/woodworking/

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