



Safe use of vertical spindle moulding machines

Woodworking Information Sheet No 18 (Revised)

Introduction

This information sheet is one of a series prepared by HSE's Woodworking National Interest Group. Vertical spindle moulding machines are primarily used for moulding, rebating and grooving of straight and curved materials. They can, however, be used for a variety of other operations requiring a range of cutters, attachments and jigs. This sheet advises employers and machinists of the basic safe working practices associated with straight, stopped and curved work.

The main legal requirements covering the use of these machines are contained in the Provision and Use of Work Equipment Regulations 1998 (PUWER 98) and the supporting Approved Code of Practice (ACOP), *Safe use of woodworking machinery*.^{1,2}

It is vital that machine operators are properly trained to carry out the work they are expected to do. Only operators who have been authorised, ideally in writing, as properly trained and competent, should be allowed to operate machines. Adequate instruction and supervision are also important.

When purchasing a new vertical spindle moulding machine, it should be supplied with a declaration of conformity and have a CE mark.³ As a minimum, it should be designed and constructed to meet BS EN 848-1.⁴ New tooling should meet BS EN 847-1.⁵

Accidents

Operations at vertical spindle moulding machines have a history of serious accidents, frequently involving the loss of several fingers.

Accidents are caused by contact with the cutters, often as a result of cutters snatching and workpiece kick-back. This is usually because initial contact with the wood is too fierce or is due to a knot or irregular grain. Kick-back may result in the machinist's leading or following hand dropping onto the cutters, particularly if the machinist has difficulty in maintaining control of the workpiece at the beginning or end of a cut.

In an HSE survey of 1000 woodworking accidents, 14% occurred on vertical spindle moulding machines. Of these, 42% occurred on straight through work, 34% on stopped work and 15% on curved work.⁶

The straight work accidents were largely a failure to use false fences and pressure pads (Shaw guards), which would provide adequate enclosure of the cutter.

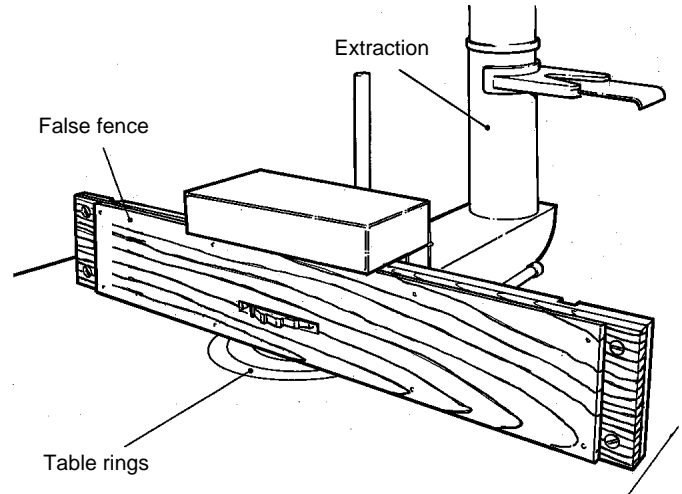


Figure 1 The false fence greatly reduces the exposure of dangerous parts

The stopped and curved work accidents were mainly the result of failing to use backstops and jigs or workpiece holders.

General safeguarding

To reduce the risk of contact with the cutter block during rundown, machines should be fitted with a **braking** device that brings the block to rest within 10 seconds. Unless already fitted with a manual or foot-operated brake, vertical spindle moulding machines with a rundown time greater than 10 seconds should be fitted with a braking device by 5 December 2005.^{2,7}

The type of tooling in use and the height at which it is set will determine the size of the hole in the table (ie the gap between spindle and table). Use **table rings** to close the gap to a minimum (see Figure 1). This reduces the risk of the workpiece dipping and catching the edge as it passes over the gap.

For most work, the cutters on vertical spindle moulding machines can be guarded to a high standard. Where this is not possible, use jigs or work holders and stops.

No single type of guard or safety device can deal adequately with the variety of work which can be done on these machines. You must assess each job carefully and provide the best protection to suit the particular circumstances.

Backcutting or **climbcutting** is a highly dangerous operation. This is because the machinist cannot exert any force to resist the sudden forward movement of the workpiece if the cutter snatches. It should be

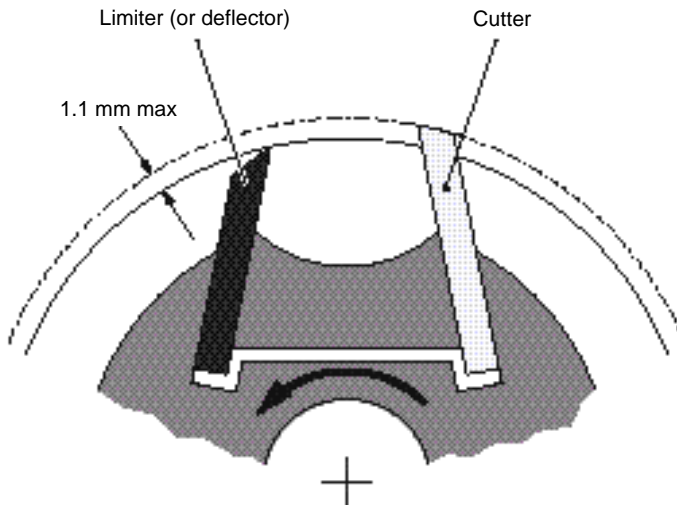


Figure 2 Example of limited cutter projection tooling

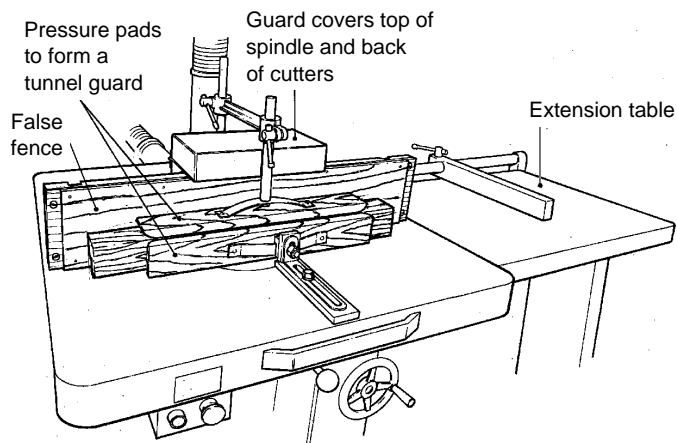


Figure 3 Vertical spindle moulding machine fitted with two Shaw guards forming a tunnel. The dimensions of the pressure pads prevent access by the operator to the cutters when the workpiece is removed

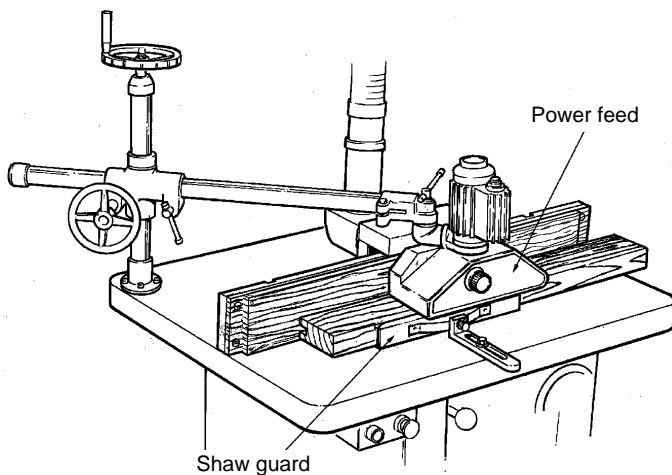


Figure 4 Use of power feed and side pressure pad for straight work

discouraged even if a jig or work holder is used. Wherever possible, feed the workpiece to the tool against the direction of spindle rotation.

Tooling

Where possible, use only limited cutter projection tooling.² A changeover to limited cutter projection tooling should be made when replacement tooling is obtained, or by 5 December 2003, whichever is the sooner. This type of tooling (see Figure 2) reduces the risk of kick-back and the severity of injury (ie should the operator's hand contact the tool). Such tooling should be designed to BS EN 847-1.⁵ Detailed guidance is provided in Woodworking Information Sheet WIS37.⁸

Detachable cutters and limiters (deflectors) should be the correct thickness for the cutter block in which they are used. They should be capable of being mounted in such a way to prevent them being ejected. It is essential that the selected rotational speed of the machine is appropriate for the tooling being used (the designed speed range should be marked on the cutter block).

Only tools marked 'MAN' (meaning hand-feed) should be used on vertical spindle moulders, even if a demountable power feed unit is to be used.

On new (CE-marked) machines, the spindle should not be supplied with a slot for inserting cutter blades (known as a French or slotted spindle). On old (ie pre-CE-marked) machines, the use of such spindles is not recommended and in any case they should be phased out by 5 December 2003.

Straight work

This includes work where the moulding extends over the full length of the workpiece and stopped work where the cut extends over part of the length of the workpiece. The cutters, cutter block and spindle behind the fence should be fully enclosed by a suitably designed guard which allows for the connection of dust exhaust outlets (see Figure 3).

Before machining starts, the gap between the outfeed and infeed fences must be closed by the attachment of a false fence (see Figure 1), allowing only that part of the cutter which is cutting to be exposed. It also provides good workpiece support and prevents the workpiece from 'dipping in' between fences. It may be necessary to fit a different false fence for every job.

Before the cutter is broken through the false fence, the area where the cutter will break through must be protected by top and side pressure pads big enough to prevent access to the cutters. Breaking in is then achieved by either pushing/adjusting the fence assembly back onto the cutter, or by raising the cutter up into the false fence (the method used will depend on the type of tooling in use).

To provide workpiece support for long lengths of timber, use extension tables or roller trestles (see Figure 3).

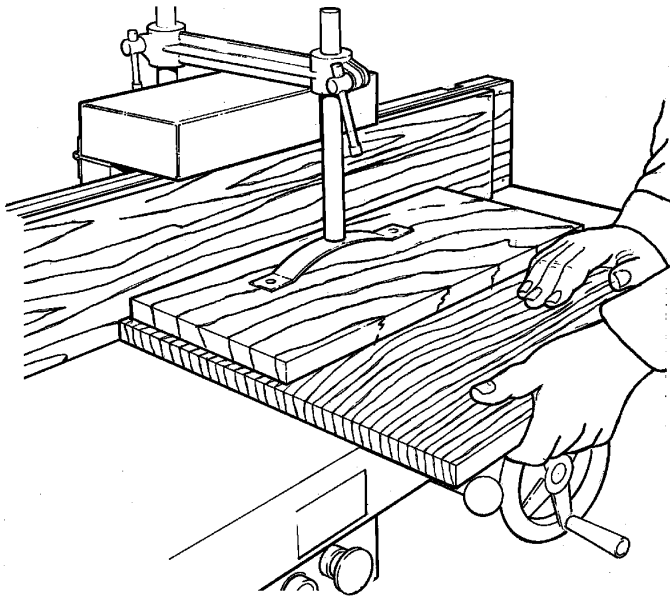


Figure 5 Straight work with only the top pressure pad in use

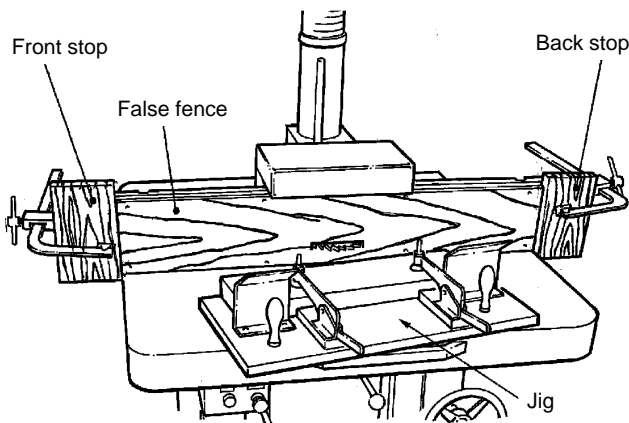


Figure 6 Jig (note toggle clamps and handles) and back/front stops for producing stopped work

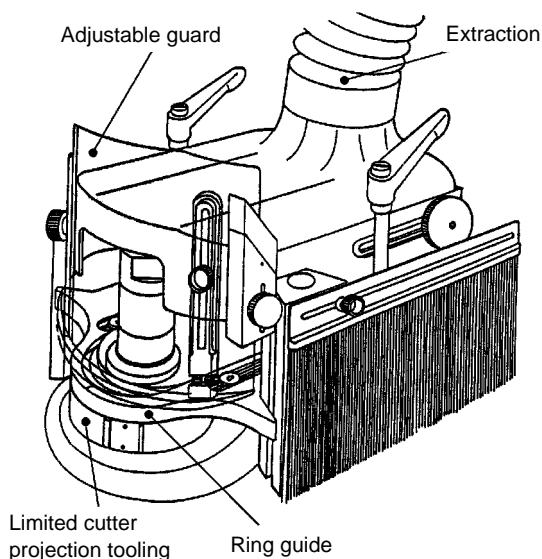


Figure 7 Example of guard and guiding device for curved work
(source BS EN 848-1: 1999)

Full length straight cuts

Where possible a demountable power feed unit should be used for straight cuts. This should be easily adjustable to suit different sizes of workpiece and should not, in itself, create a trapping hazard. Used in conjunction with a side pressure pad, a power feed unit often represents the best method of guarding (see Figure 4).

Where a demountable power feed unit cannot be used, the cutting area should be enclosed by vertical and horizontal spring-loaded pressure pads. These pads form a tunnel through which the workpiece can be safely fed with the use of a pushstick (see Figure 3).

The top and side pressure pads should be made of hardwood (those supplied with some new machines may also be plastic or light alloy) and be the same width and depth as the workpiece. They must also be long enough to prevent operators' hands from reaching the cutters. Pads of various lengths and widths will be necessary to accommodate a range of workpiece sizes.

Machining of thin panels may only require use of a top pressure pad (see Figure 5).

When a wide or heavy cut is made, especially on thin material, the fence may not give adequate support to the moulded section of wood. Adequate support can be provided by fixing a packing piece, which is a mirror image of the moulding, to the out-feed side of the fence.

Straight work with stopped cut

The cutters may have to break into the solid face, instead of starting the cut at the beginning of the workpiece and/or have to break out before reaching the end. Because a guard cannot be used which is fully effective in preventing contact with the cutters (except on thin workpieces) jigs should be used. Access to the cutter from the top can, however, be prevented by using a top pressure pad.

Stops allow for greater control of the jig, allow greater stability of the workpiece and prevent kick-back when 'dropping on'. Typically, the jig containing the workpiece is placed against a backstop, fed slowly onto the cutters to break in, then fed forward against the false fence to the front stop and the jig taken off (see Figure 6).

In cases where it is not practicable to hold the workpiece in a jig or holder (eg large window frames, doors etc), the operator's hands need to be safely positioned well away from the cutters. In these circumstances, stops need to be robust enough to provide a firm support for the workpiece.

Shaped or curved work

When setting up for shaped or curved work, the straight fence is removed and a guiding device (ie a ring fence or ring guide), together with an adjustable guard (traditionally a 'bonnet' guard), is fitted to enclose as much of the spindle and cutter block as possible (see Figure 7).

Use jigs incorporating a template for all curved work. The template determines the outline of the finished shape and is held against a ring guide as the workpiece is moved past the cutter. The ring guide determines the line of cut - where possible it should be set above the cutters (though for some operations it may have to be below). It is used both as a lead-in and guide to the template or workpiece.

Large, small or complex workpieces

In general it is possible to use a jig unless the workpiece is so large that a jig would make the job unmanageable or the workpiece is so small or complicated that it cannot be held securely in a jig.

Small and complex shapes may require you to use a spike or pushstick. Alternatively a lead-in device fixed to the machine table may facilitate safe feeding of the workpiece.

Design of jigs and work holders

The use of jigs and work holders is necessary for all stopped and curved work, unless the nature of the operation makes it impracticable. Even if workpieces are irregularly shaped and limited production runs are involved, jigs should be used.

The design of jigs and work holders is determined by the work to be done and they are typically made of hardwood and plywood. They should allow quick and accurate location of the workpiece which should be held firmly in position. Jigs should have secure handles and wide bases, so that machinists have a firm grasp at a safe distance from the cutters. The workpiece should be clamped or secured within the jig. The most convenient method of holding the workpiece in the jig is to use manually operated quick-acting clamps which work with either a toggle or a cam action. Hand shields in front of operators' hands provide additional protection (see Figure 6).

With curved work, a combined template and jig helps ensure that work is held firmly and correctly to produce the required shape and finish. Box jigs are particularly useful as they allow better control of the workpiece, reduce or prevent breakout. The template should also be extended horizontally, beyond the nose and tail of the work to provide lead-in and lead-out control, for safe working (see Figure 8).

References and further reading

1 *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance L22* HSE Books 1998 ISBN 0 7176 1626 6

2 *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 0 7176 1630 4

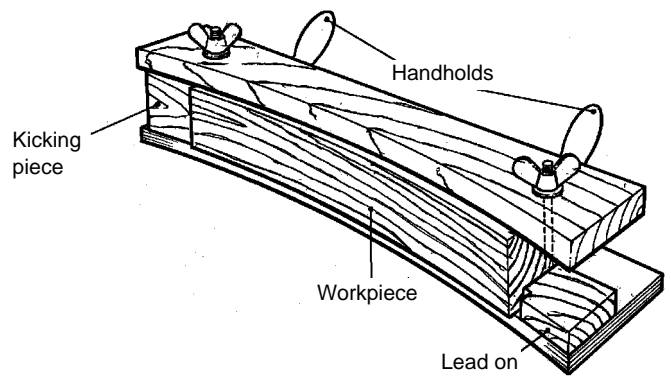


Figure 8 Box jig

3 *Buying new machinery: A short guide to the law and some information on what to do for anyone buying new machinery for use at work* INDG271 HSE Books 1998

4 BS EN 848-1: 1999 *Safety of woodworking machines. One side moulding machines with rotating tool. Part 1: Single spindle vertical moulding machines*

5 BS EN 847-1 *Tools for woodworking. Safety requirements. Part 1: Milling tools and circular saw blades*

6 *Accidents at woodworking machines* WIS7(rev) HSE Books 1999

7 *POWER 98: Retrofitting of braking to woodworking machines* WIS38 HSE Books 1998

8 *POWER 98: Selection of tooling for use with hand-fed woodworking machines* WIS37 HSE Books 1998

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

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