

Australian Standard™

Wood processing machinery—Safety

**Part 5: Finishing machinery—Moulding
machines and routers with rotating tool**

This Australian Standard was prepared by Committee SF-007, Guarding of Woodworking Machinery. It was approved on behalf of the Council of Standards Australia on 14 August 2001 and published on 9 November 2001.

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Australian Chamber of Commerce and Industry
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Australian Woodworking Industry Suppliers Association
Construction, Forestry, Mining and Energy Union
Department for Administrative and Information Services South Australia
Department of Infrastructure, Energy and Resources (Tasmania)
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Australian Standard™

Wood processing machinery—Safety

Part 5: Finishing machinery—Moulding machines and routers with rotating tool

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PREFACE

This Standard was prepared by the Standards Australia Committee SF-007, Guarding of Woodworking Machinery as a revision, in part, of AS 1473—1991, *Guarding and safe use of woodworking machinery*.

The Standard is one of a series dealing with the safety of woodworking machinery, which has been developed following requests from regulatory authorities for a new edition of the Standard.

In common with many other Standards dealing with the safeguarding of machinery, the Committee agreed to base the series upon a number of drafts emanating from the European Community. This Standard is therefore based upon a number of drafts dealing with the various forms of moulding machines and routers which are available.

The Standard specifies the safety requirements which are unique to moulding machines and routers. Additional requirements which are common to all wood-processing finishing machines are given in AS 1473.2, *Wood processing machines—Safety, Part 2: Finishing machinery—Common requirements*. This Standard should be read in conjunction with AS 1473.2.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Wood processing machinery—Safety

Part 5: Finishing machinery—
Moulding machines and routers with rotating tool

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies particular requirements for the design, manufacture, guarding and use of moulding and routing machines with an interchangeable rotating tool used in the manufacture of components for furniture, joinery and the like. It is to be read in conjunction with AS 1473.2, which contains general requirements.

1.2 OBJECTIVE

The objective of this Standard is to provide designers, manufacturers, suppliers and users of moulding machines with the means of minimizing the risks to the health and safety of persons working with them.

1.3 REFERENCED DOCUMENTS

The following documents are referenced in this Standard.

AS

- 1473 Wood processing machinery—Safety
- 1473.2 Part 2: Finishing machinery—Common requirements
- 4024 Safeguarding of machinery
- 4024.1 Part 1: General principles
- 4024.2 Part 2: Installation and commissioning requirements for electro-sensitive systems—Optoelectronic devices
- 4024.3 Part 3: Manufacturing and testing requirements for electro-sensitive systems—Optoelectronic devices
- 4024.4 Part 4: Installation and commissioning requirements for electro-sensitive systems—Pressure-sensitive devices
- 4024.5 Part 5: Manufacturing and testing requirements for electro-sensitive systems—Pressure-sensitive devices

ISO

- 7009 Woodworking machines—Single spindle moulding machines—Nomenclature and acceptance conditions

IEC

- 60204 Electrical equipment of industrial machines
- 60204-1 Part 1: General requirements

NOHSC

- 1003 National Exposure Standards for Atmospheric Contaminants in the Occupational Environment

1.4 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.4.1 Anti-kickback device

A device which either reduces the possibility of kickback or arrests the motion during kickback of the workpiece.

1.4.2 Complete enclosure

Combination of fixed and moveable guards which when closed, completely encloses the machine and prevent parts of the workpiece, e.g. dust and shavings, from flying outside the machine.

1.4.3 Confirmation

Statement, sales literature, leaflet or other where a manufacturer (supplier) declares either the characteristics or the compliance of the material or product to a relevant Standard.

1.4.4 Curved work

Machining of a curved workpiece with one side in contact with the table (or if held in a jig with the jig in contact with the table) and the other in contact with the vertical reference of a steady or ring guide when using a jig (see Figure 1.1).

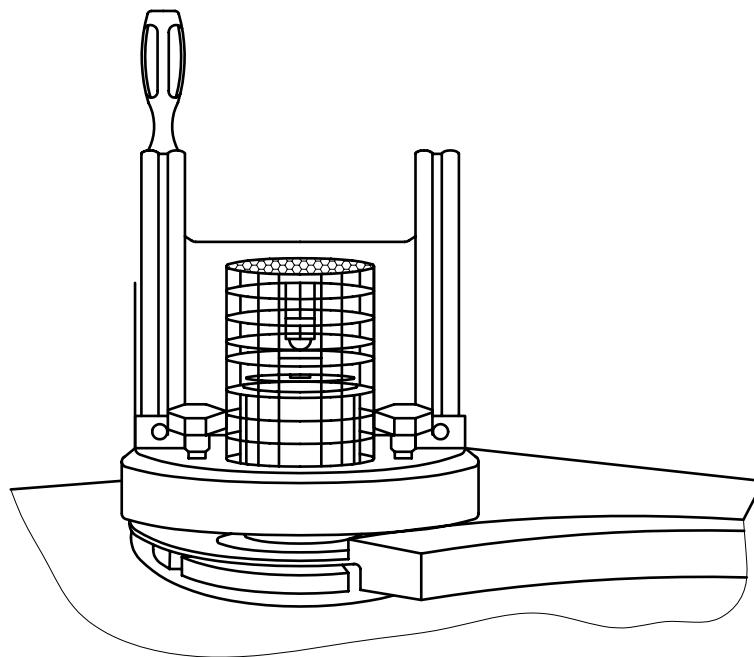


FIGURE 1.1 CURVED WORK

1.4.5 Demountable power feed unit

A feed mechanism which is mounted on the machine so that it can be moved from the working position without the use of a spanner or similar additional device.

1.4.6 Ejection

Unexpected movement of the workpiece or parts of it, or part of the machine, from the machine during processing.

1.4.7 Four sided moulding machines

A machine where the workpiece once loaded manually or by magazine moves by an integrated feed mechanism. The machine has at least four work units, one on each side, with rotating planing or moulding tools. The tool spindles have horizontal and/or vertical axes which can be adjusted manually or by power.

The machine can be fitted with additional work units such as universal spindles or glass bead saw units.

1.4.8 Glass bead saw unit

A work unit fitted with a saw blade to cut out a glass bead from the machined profile.

1.4.9 Hand feed

Manual holding or guiding of the workpiece or of a machine element incorporating a tool. Hand feed includes the use of a hand operated carriage on which the workpiece is placed manually or clamped and the use of a demountable power feed unit.

1.4.10 Hydraulic tool fixing device

A device for clamping the tool to the spindle by hydraulic pressure.

1.4.11 Integrated feed

Feed mechanism for the workpiece or tool which is integrated with the machine and where the workpiece or machine element with incorporated tool are held and controlled mechanically during the machining operation.

1.4.12 Kickback

Particular form of ejection describing the unexpected movement of the workpiece or parts of it, or parts of the machine.

1.4.13 Loading the machine

Manual or automatic placing of the workpiece on to a carriage, magazine, lift, hopper, moveable bed, conveyor or the presentation of the workpiece to an integrated feed device.

1.4.14 Machine actuator

Power mechanism used to effect motion of the machine.

1.4.15 Machine setting mode of operation

The setting, programming, fault finding, program verification, testing and manual (under power) non-sequential operation of the machine.

1.4.16 Machining mode of operation

The automatic, programmed, sequential operation of the machine with the facility for manual or automatic loading/unloading of workpieces.

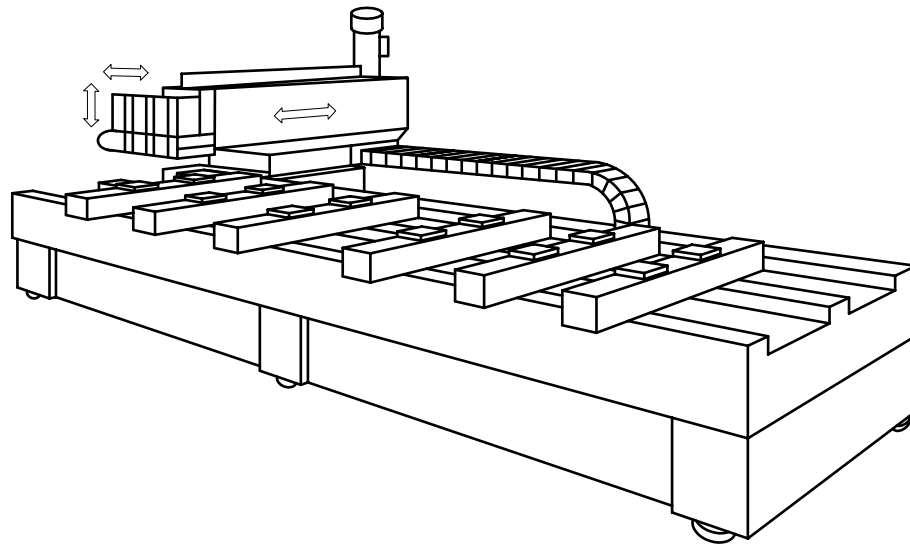
1.4.17 Numerical control (NC) boring and routing machines (machining centres)

Integrated fed machines designed for the machining of workpieces by the use of milling or boring tools. The machines have at least two square programmable axes (X,Y) for positioning or machining. The axes operate according to a NC work programme.

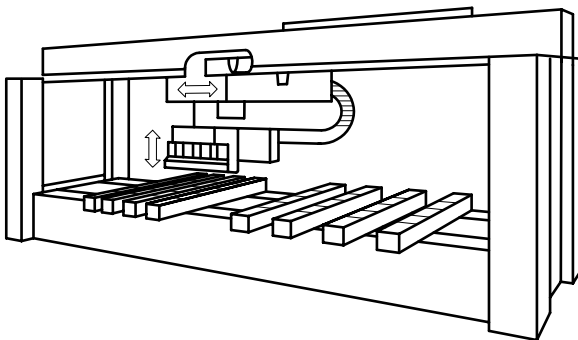
Typical machines are shown in Figure 1.2.

The machine may have—

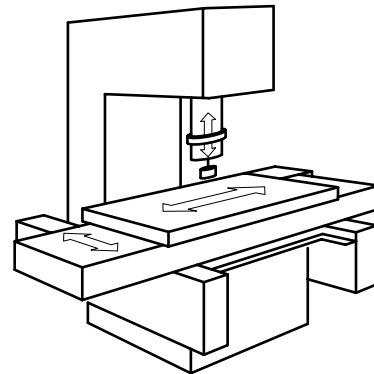
- (a) additional units for sawing, sanding, and the like.;
- (b) fixed or movable workpiece support;
- (c) mechanical, pneumatic, hydraulic or vacuum clamping of the workpiece; or
- (d) automatic tool change facilities.



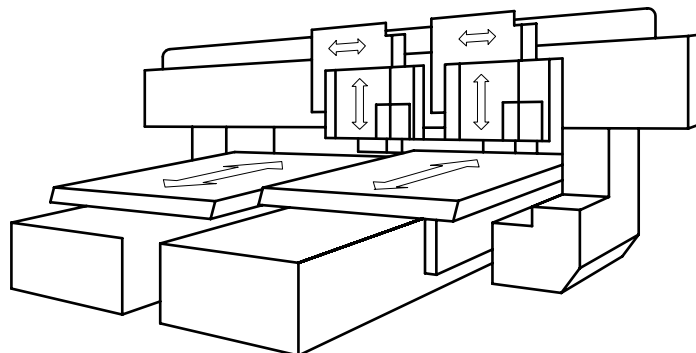
(a) A 'C' frame machine (fixed table, movable head)



(b) Portable frame machine (fixed portal, fixed table, moving head)

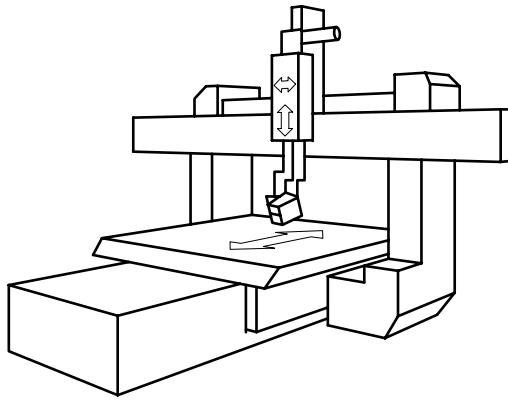


(c) Overhead router (moving table)

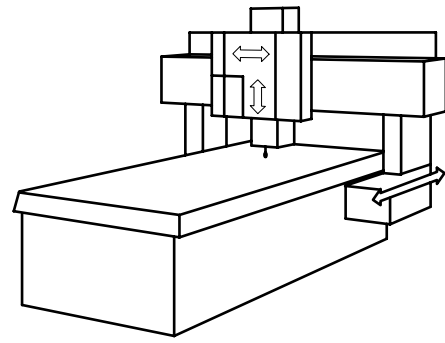


(d) Overhead router (moving tables, fixed portal, moving heads)

FIGURE 1.2 (in part) NC BORING AND ROUTING MACHINES



(e) Machining centre (moving table, fixed portal, moving head)



(f) Overhead router (fixed table, moving head)

FIGURE 1.2 (in part) NC BORING AND ROUTING MACHINES

1.4.18 Numerical control (NC) computerized numerical control (CNC)

Automatic control of process performed by a device that makes use of numerical data introduced while the operation is in progress.

1.4.19 Operational stop

Control whereby the machine can be brought to stop and where once the machine or the dangerous parts have stopped the energy supply to the actuators need not be cut off (e.g. cycle stop).

1.4.20 Partial enclosure

Combination of fixed and moveable guards which when closed, encloses the defined machine danger area. It may or may not have apertures or a ceiling.

1.4.21 Removable spindle

Spindle capable of being changed without removing the bearings.

1.4.22 Routing machines (manual feed)

'C' frame type machine for moulding of workpieces by means of either of the following:

- (a) One tool spindle located above or below the table and running at a variable high speed of up to 40 000 rpm. The work head is adjustable and may be tiltable, but is fixed during cutting.
- (b) A table to support the workpiece or jig. The table may be tiltable or movable in X and Y direction or adjustable round a C axis.

The spindle may be moved up and down during machining manually or by means of hydraulic or pneumatic devices. Workpiece feeding may be manual or by means of integrated feed systems.

1.4.23 Shaped work

Curved machining at the edge or on the surface of a workpiece.

1.4.24 Single spindle vertical moulding machine

Hand fed machine fitted with a single vertical spindle (fixed or removable) the position of which is fixed during machining and a horizontal table, all or part of which is fixed during operation. The spindle passes through the table and its drive motor is situated beneath the table. The machine may have any of the following features:

- (a) The facility for the spindle to be raised and lowered through the table.
- (b) The facility to tilt the spindle.
- (c) Fitted with an additional manually operated travelling table.

1.4.25 Speed range

Speed within which the tool spindle or tool is designed to operate. It may be expressed in revolutions per minute (rpm) or a surface speed.

1.4.26 Splinter catching fingers

Splinter catching fingers are devices designed to minimize the ejection of splinters or parts of the workpiece.

1.4.27 Stopped straight work

Machining of only a part of the workpiece's length (see Figure 1.3).

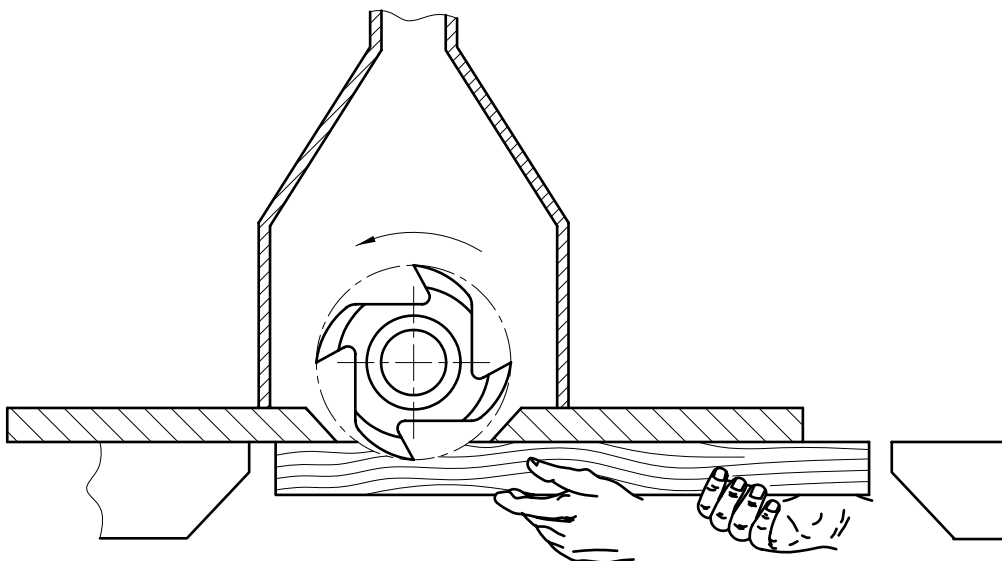


FIGURE 1.3 STOPPED STRAIGHT WORK

1.4.28 Straight work

Shaping of a straight workpiece with two faces in contact with the table and the fence respectively, and where the work starts at one end of the workpiece and continues through to the other end of the workpiece (see Figure 1.4).

1.4.29 Tenoning

Machining of the ends of the workpiece to facilitate joining one workpiece to another.

1.4.30 Throat capacity

Minimum distance between centre-line of the spindle and the column.

1.4.31 Universal spindle

A work unit the position of which can be changed manually or by power to allow it to work at different positions around the workpiece.

1.5 TERMINOLOGY

The major components of single spindle vertical moulding machines and the terminology relating to the components are shown in Figure 1.5.

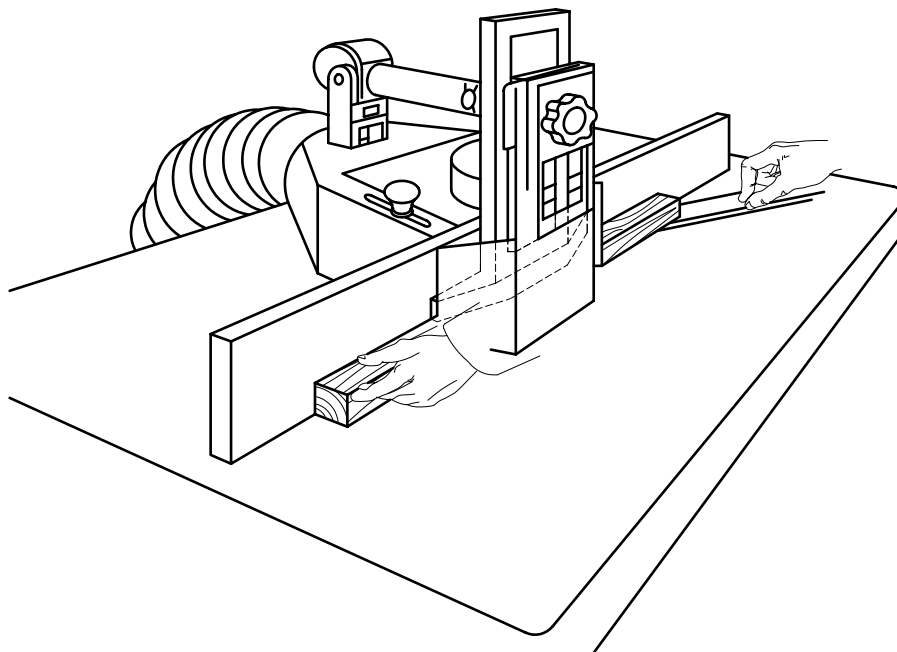


FIGURE 1.4 STRAIGHT WORK

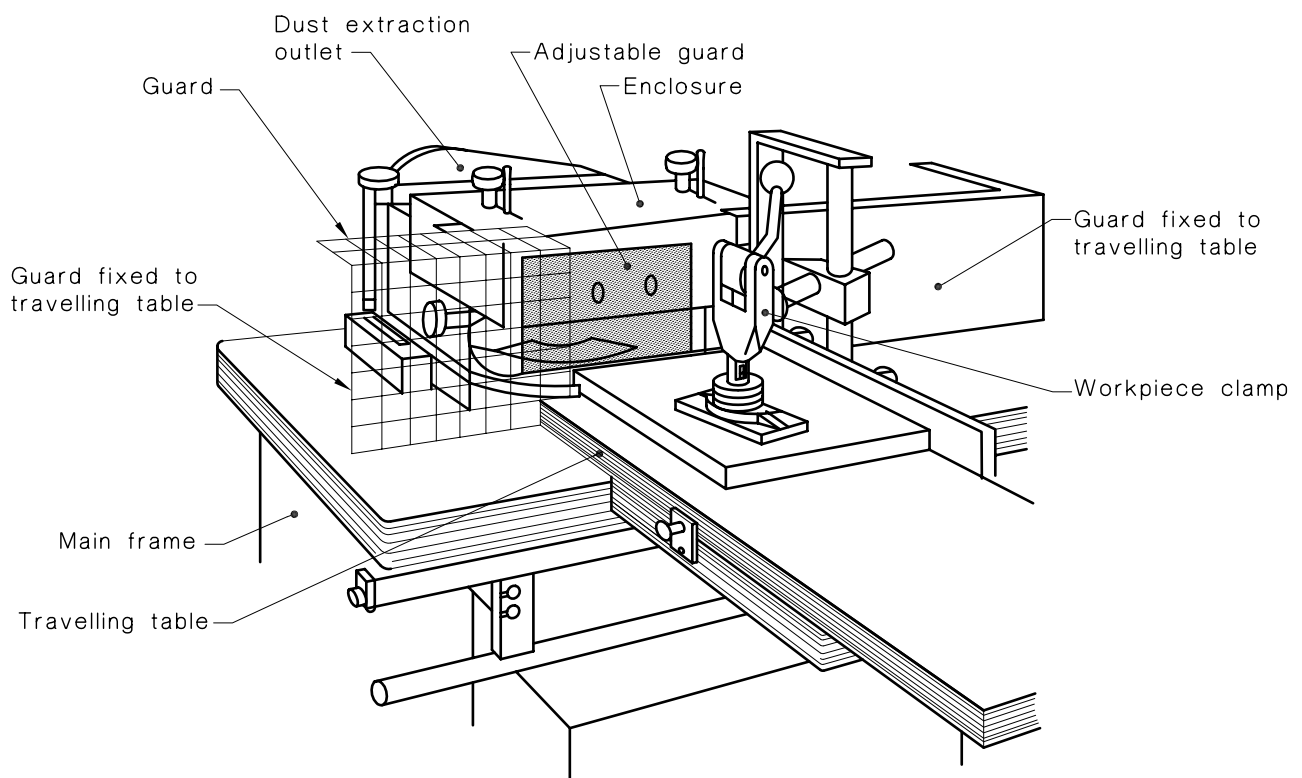
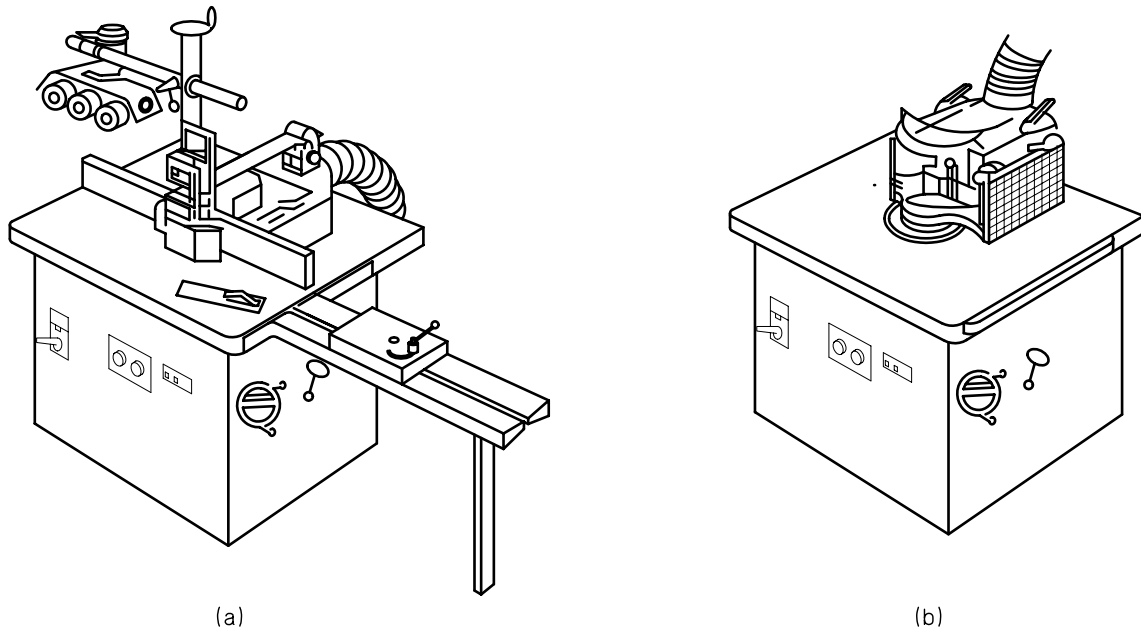


FIGURE 1.5 SINGLE SPINDLE MOULDING MACHINES

SECTION 2 REQUIREMENTS FOR SINGLE SPINDLE MOULDING MACHINES

2.1 SCOPE OF SECTION

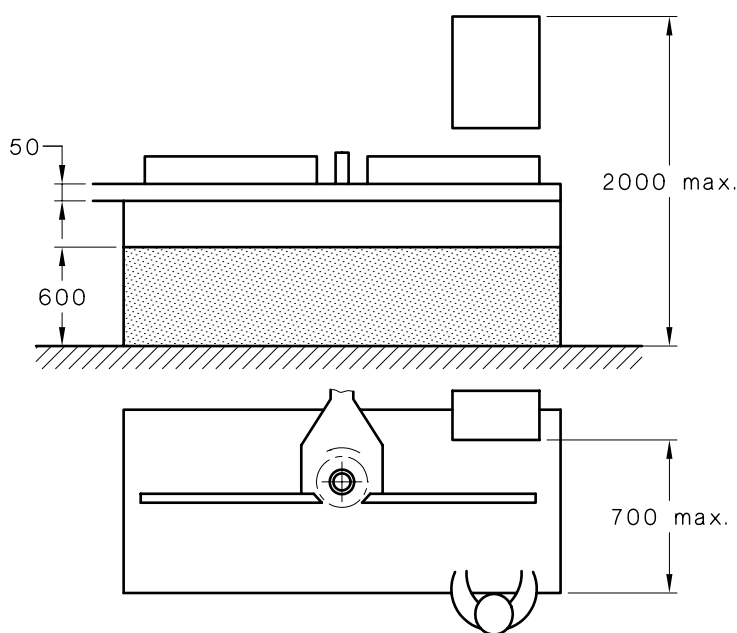
This Section sets out the specific requirements for single spindle moulding machines.

2.2 CONTROLS

2.2.1 Position of controls (see also Figure 2.1)

The main electrical control devices, that is, for starting, normal stopping, emergency stop (if required), spindle adjustment, direction of rotation and mode selection (if required) for the machine, shall be located either—

- (a) below the table in a band located 50 mm under the table and 600 mm above the floor; or
- (b) on a fixed pendant at a maximum height to the top of the pendant of 2000 mm, and a maximum of 700 mm from the front of the machine.



DIMENSIONS IN MILLIMETRES

FIGURE 2.1 LOCATION OF CONTROLS

2.2.2 Starting

Mechanical controls shall be located below the table and not at the rear of the machine.

2.2.3 Normal stopping

2.2.3.1 General

When operated, the stop control shall disconnect power from all the machines actuators and operate the automatic brake (if provided).

When initiated, the stopping sequence shall be—

- (a) stop the demountable power feed unit (if provided);
- (b) stop any powered movement of the spindle;
- (c) stop any rotation of the spindle;
- (d) release the guard locking after stopping the tool e.g. by using a time delay; and
- (e) cut power to the machine actuator.

The machine shall stop directly from each speed.

If the machine is fitted with a mechanical brake, the normal stop shall be of category 0 in accordance with IEC 60204-1.

If the machine is fitted with an electrical brake or a power operated clamping device, the normal stop shall be category 1 in accordance with IEC 60204-1.

For machines with electronic pre-set numerical control the normal stop shall be category 2 in accordance with IEC 60204-1. Power shall remain only to the electronic equipment.

Machines fitted with side travelling table shall be provided with additional normal or emergency stop control on the travelling table or its support.

Machines need not be fitted with a separate normal stop control if they are fitted with an emergency stop control which also performs the same function.

2.2.3.2 Emergency stop

Machines with more than one machine actuator shall be fitted with an emergency stop control. When operated, the emergency stop control shall stop all actuators.

For the position of an emergency stop control, see Clause 2.2.1. Where a front extension support is provided it shall be fitted with an emergency stop control.

The emergency stop shall be category 0 in accordance with IEC 60204-1, for machine fitted with a mechanical brake and category 1 in accordance with IEC 60204-1 for machines fitted with an electrical brake.

The emergency stop shall not cause the workpiece to be unclamped unless the travelling table is stationary at the rest position or all motors have come to rest.

2.2.4 Speed limiting

Machines designed to be fitted with a travelling table for tenoning which are capable of spindle speeds in excess of 3600 rpm, and which can be fitted with tools of a diameter greater than 250 mm, or with maximum speed in excess of 8000 rpm shall have a speed limiting device which will prevent the spindle rotating faster than 8000 rpm whilst tenoning with tooling of a diameter greater than 250 mm. This can be achieved by interlocking the guarding system described in Clause 2.9.4.3 with the machine drive.

2.3 SPINDLE ADJUSTMENT

2.3.1 Height adjustment

The spindle shall be adjustable in height. The adjustment device shall be self locking (e.g. by rack and pinion). The machine shall be equipped with an indicator to show incremental vertical movement of the spindle.

The height of the spindle shall not change by more than 0.5 mm when a force of 300 N is applied to the spindle in the direction of the axis.

2.3.2 Inclination adjustment

Where the spindle is capable of being inclined relative to the table, the machine shall be equipped with an indicator to show the amount of inclination with respect to the table. The adjustment device shall be self locking.

The inclination of the spindle shall not change by more than 1 degree when a force of 300 N is applied to the spindle axis at the top of the spindle, with the inclination set at 90 degrees.

2.3.3 Motor driven adjustment

Where the spindle is capable of power driven vertical adjustment during rotation, this adjustment shall be carried out by means of a hold to run control. The start command for this adjustment shall be hardwired when this adjustment is controlled by NC.

Where the spindle is capable of power driven inclination, this shall only be possible when the spindle is not rotating.

2.4 SPINDLE LOCKING

If it is necessary to hold the spindle stationary e.g. for tool changing, a spindle holding device shall be provided e.g. a double spanner arrangement or an integral locking bar inserted through the spindle.

This device shall prevent the spindle from rotating if the spindle motor is inadvertently switched on.

2.5 DIRECTION OF ROTATION

Single direction of rotation machines shall always run anti-clockwise (as viewed from above see Figure 2.2).

Where the machine is also designed to run in the clockwise direction of rotation, the following additional requirements shall be met:

- (a) A direction of rotation selection device shall be fitted at the machine's normal operating position which shall be designed so that the movement of the control is consistent with its effect.
- (b) This device shall be held in the anti-clockwise direction position by a blocking device and selection of clockwise direction shall only be possible following manual override of the blocking device.
- (c) As soon as the spindle stops anti-clockwise rotation, the direction of rotation selection device shall stay in anticlockwise position with the blocking device effective and restart of the spindle shall only be possible after manually selecting the direction of rotation.
- (d) As soon as the spindle stops clockwise rotation, the direction of rotation selection device shall automatically return to a neutral position.
- (e) A visible warning device shall inform the machine operator when clockwise rotation is selected.

NOTE: The visible warning device may be supplemented by an audible one.

- (f) The selector actuator shall not initiate spindle start up.

2.6 TOOL FIXING DEVICE

The spindle shall be fitted with a tool fixing device which may be—

- (a) a locknut and a separate or integral spindle ring which ensures a positive connection between the ring and the spindle; or
- (b) a locknut and a spindle which ensures a positive connection between the tool and the spindle, see Figure 2.3.

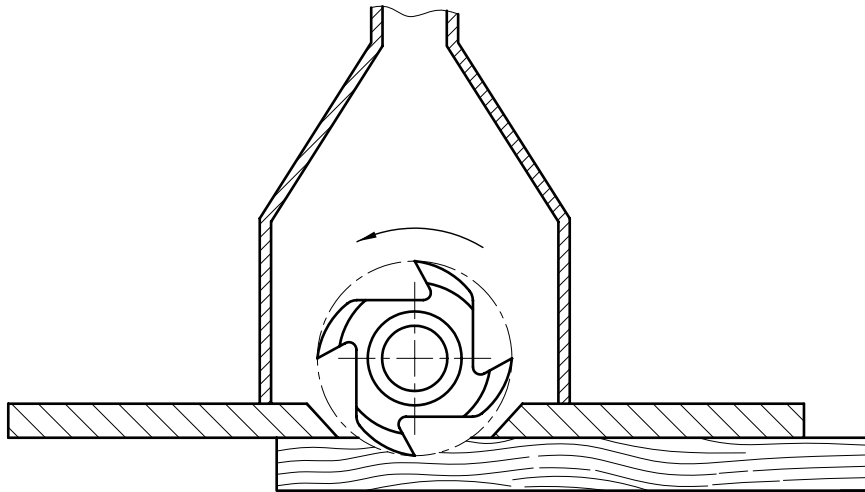


FIGURE 2.2 DIRECTION OF ROTATION

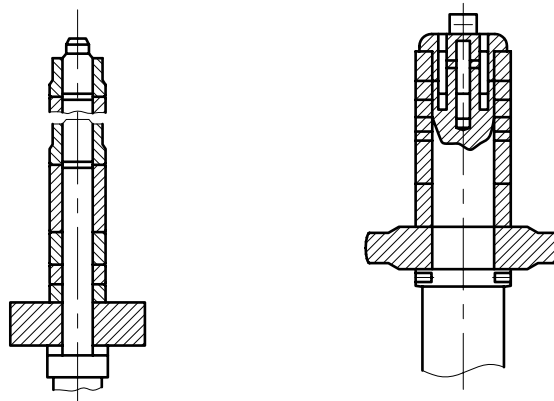


FIGURE 2.3 TOOL FIXING DEVICES

2.7 DEVICES TO MINIMIZE THE POSSIBILITY OR MINIMIZE THE EFFECT OF EJECTION

Provision shall be made for the fixing (e.g. fixing holes) of anti-kickback devices (e.g. adjustable end stops) to the fence plates, or to the extension table (see also Clause 2.11).

2.8 WORKPIECE SUPPORTS AND GUIDES

2.8.1 Table

2.8.1.1 Table dimensions

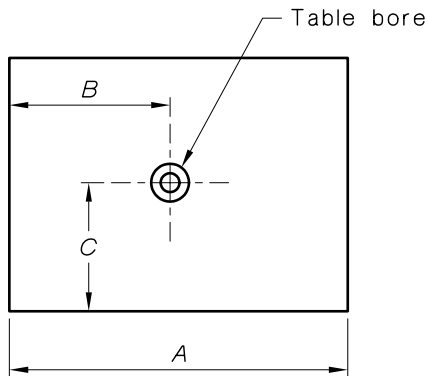
The machine table dimensions shall be as shown in Figure 2.4(a).

The table shall not be tiltable.

2.8.1.2 Table rings

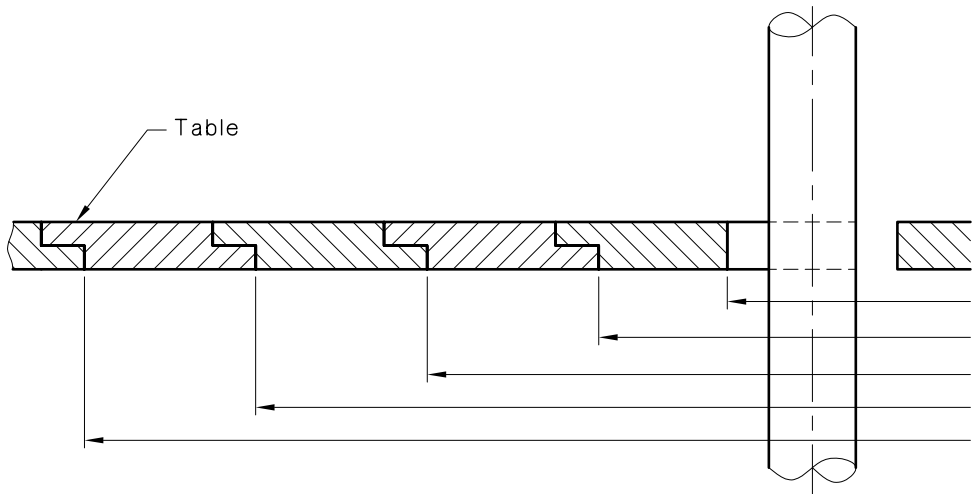
The table shall be equipped with a set of table rings with internal diameters as shown in Figure 2.4(b).

For table bore diameters in excess of 300 mm, a fifth table ring shall be provided.



millimetres			
Table bore diameter	Maximum table length <i>A</i> min.	<i>B</i>	<i>C</i>
≤190	600	$250 < B \leq A/2$	350 ±100
≥190	1000	$450 < B \leq A/2$	350 ±100

(a) Table dimensions



Ranges of internal diameter of table ring	65 —75*	105 —115	145 —160	200 —225
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* For machines fitted with removable spindle.

(b) Table rings

DIMENSIONS IN MILLIMETRES

FIGURE 2.4 TABLE DIMENSIONS

2.8.2 Workpiece guiding for straight work

2.8.2.1 Fence plates dimensions

In order to ensure vertical stability of the workpieces, the machine shall be equipped with fence plates which—

- (a) have a minimum height of—
 - (i) for table bore diameters of less than or equal to 190 mm.....120 mm;
 - (ii) for table bore diameters over 190 mm.....150 mm;
- (b) have a minimum length of—
 - (i) the table length (for the two fences);
 - (ii) for table bore diameters less than or equal to 190 mm 300 mm for each fence;
 - (iii) for table bore diameters over 190 mm.....450 mm for each fence; and
- (c) satisfy the requirements given in test G4 of ISO 7009.

2.8.2.2 Fence adjustment

Adjustment for the fence shall be as follows:

- (a) The fence assembly shall be capable of being fixed securely to the table and shall be adjustable in order to take account of the tool diameter and the position of the spindle.
- (b) When transverse adjustments are carried out, the fence plates shall remain integral with their support.
- (c) The lateral adjustment of the fence plates shall allow any necessary opening for the tool to be reduced to a minimum. The fence plates shall either be fitted with a device ensuring continuity between the fence plates, or shall be equipped with fixing arrangements which would permit such a device, e.g. a false fence to be fitted.
- (d) A fine adjustment control for transverse movement of the outfeed fence plate with respect to the infeed fence plate shall be provided.

When moved in this way the fence plate shall remain parallel to the fixed fence plate, and their re-alignment shall be checked by a method given by the manufacturer in the instruction handbook.

- (e) The part of the fence plates close to the tool shall be made of light alloy, plastic, wood or similar material.
- (f) All adjustments except those to fix and to adjust a device for ensuring continuity between the fence plates shall be capable of being made without the aid of a tool.

2.8.2.3 Workpiece guiding for curved work

Where provided a workpiece guiding device suitable for curved work (see Figure 2.5) shall be either of the following:

- (a) A guiding steady—
 - (i) the shape or adjustment of which shall allow for progressive penetration of the tool in the workpiece;
 - (ii) that shall support and guide the workpiece during machining;
 - (iii) upon which the tangency point where the depth of cut is measured shall be clearly marked;