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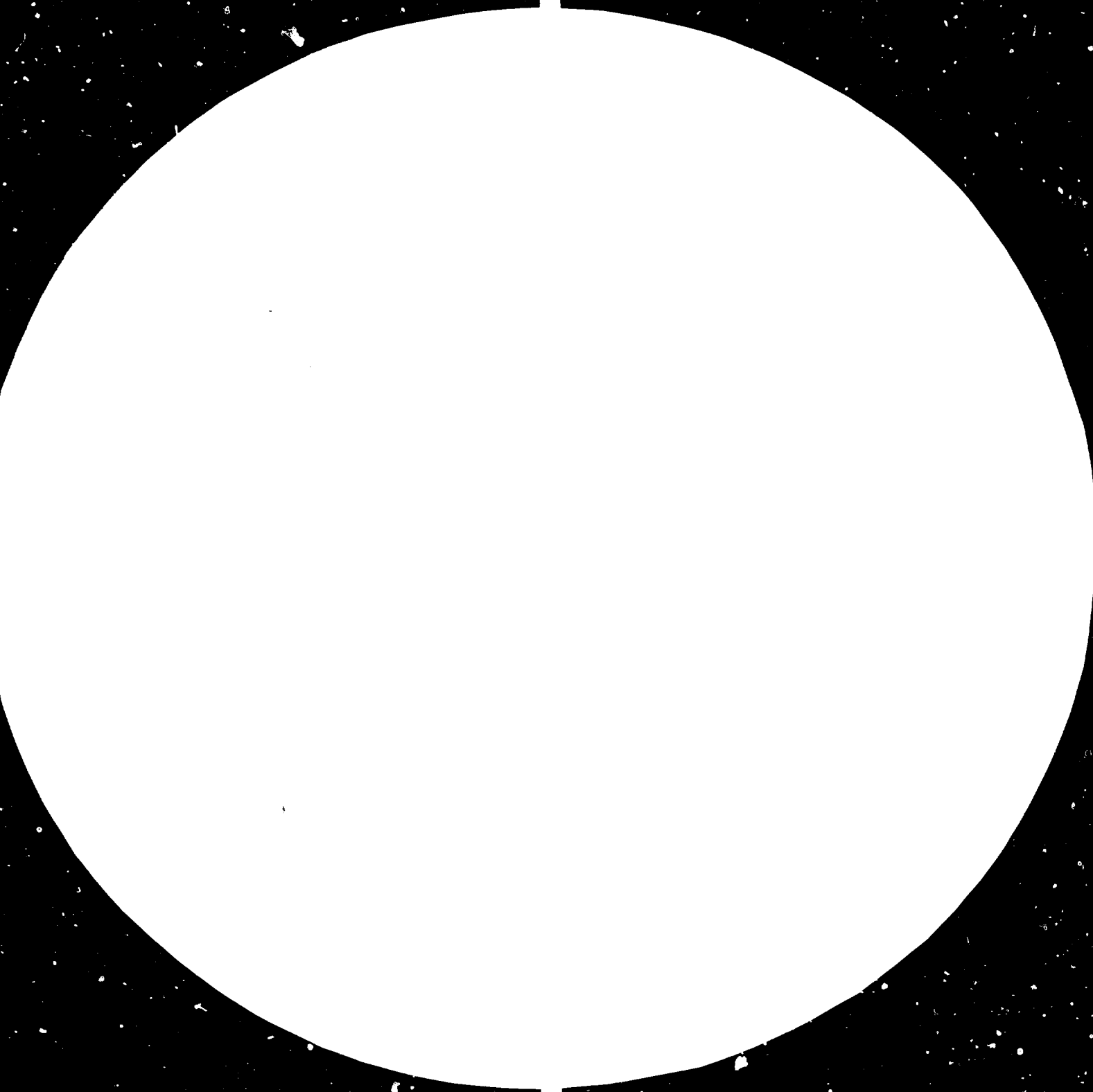
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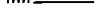
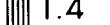
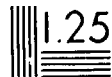
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Resolution Test Chart, NBS 1963-A, U.S. Government Printing Office, Washington, D.C.

Resolution Test Chart, NBS 1963-A, U.S. Government Printing Office, Washington, D.C.



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Seminar on Economic Criteria for the Selection
of Woodworking Machinery and Plant Systems

Hannover, Federal Republic of Germany, 19 May - 2 June 1981

SAFE OPERATION OF WOODWORKING MACHINES *

by

Messrs. Holz-Berufsgenossenschaft **

001017

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** Document originally in German and prepared for training in safe operation of woodworking machines by the Organization of Professionals for Safety in Wood Processing Industries (Holz-Berufsgenossenschaft, FRG).

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1. Introduction

This manual on "Safe Operations of Wood Processing Machines" was prepared by the German Organization of Professionals for Safety in the Industry. One of the 34 branches is the Organization of Professionals for Safety in the Wood Processing Industries (Holz-Berufsgenossenschaft). It is at the same time the Legal Accident Insurance Company. This organization is an autonomous body under public law. The board of directors and the committee of representatives are the executive and legislative bodies of the organization.

Supervising Duty: The professionals of the organization supervise and advise in accident prevention. Duties in the field of the inspectors (professionals) are:

- Consultation with member industries and their insured employees on subjects of operational safety;
- Control of accident prevention on the basis of the safety regulations in their member industries;
- Checking accidents to identify dangerous areas and taking the necessary steps to eliminate previously unknown hazards;
- Training of employees directly responsible for safety in the industry and those employees who should be aware of safety in wood processing industries (i.e. crane operators, fork lift operators, trainees, trainee supervisors, etc.);
- Evaluation of work processes in terms of accident and health hazards;
- Consultation with manufacturers on machines, equipment, plant systems and toolings;
- Co-ordination of committee work in preparing regulations for the control of technical equipment or for other technical reasons, as well as making contributions to committees establishing standards for accident prevention (safety) or supervising the enforcement of regulations;
- Co-operation with public safety authorities;
- Lecturing member companies and insured persons about accident prevention or advertising the idea of work protection.

Technical inspectors are located all over the country in different industry regions.

Safety regulations (accident preventing specifications): The accident prevention regulations cover minimum requirements for safety in the work place. They include obligations within legal standards which are the results agreed to in technical committees consisting of manufacturers, machinery users, industry managers and employees as well as experts and civil servants of government authorities and will be approved by the legislative body of the professional safety organization.

Membership and contribution: Every industry is by law required to be a member of the professional branch organization. The wood processing branch covers companies of wood harvesting and preliminary operations, primary and secondary wood processing, plastics, plastic covered items and similar products. The organization is supported by cash contributions from the industry.

Insured personnel: Insured personnel are those of the organization having a working, service or apprentice contract without any limit of age, sex or rate of income on short-term or permanent basis. This insurance covers, according to law, accidents both at the work place and on the way to and from there. It also covers any industrial (professional) sickness.

Provision for the insurance protection: The professional organization covers:

- Work accidents wherever the human body is injured by a working operation;
- Way accident whenever a human body is injured by an accident on the way to the work station;
- Industrial sickness wherever a person suffers or has a sickness caused by the influence of a specific industrial health hazard.

Benefit of the organization: Medical treatment, accident compensation, accident welfare work, professional assistance.

The Law on Safety Provisions for Workers and the obligations under this law is an interlinking of: The basic law, general rules and regulations, industrial legislation, constitution of insurance decree, law on technical equipment, industrial plant decree, and Law for the protection of youth.

The safety provisions are controlled by the organization of safety professionals in co-ordination with experts of governmental departments and consultants.

The regulation on noise emission: There are very specialized regulations available relating to occupational noise exposure. Protection against the effects of noise exposure must be provided when the level exceeds 85 dBA. A labourer working many years in a machining department under high noise level conditions would otherwise suffer loss of hearing.

2. Designation and operation symbols

General requirements

Machines and equipment must be clearly marked in a permanent manner with important details relating to their safe operation.

- Equipment designation
- Permitted safe operating limits

Special requirements

Machines for primary and secondary processing of wood and similar materials must be marked with the following:

- Manufacturer or supplier
- Type
- Product No.
- Year of manufacture

Other appropriate requirements for machine designations are also called for in other accident prevention and safety regulations

Labeling of tested and safety approved machines

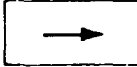

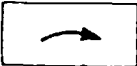
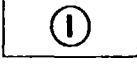
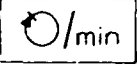

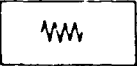



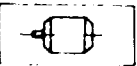

Example of German Test label



Various nominated test centres are authorised to issue labels as shown for machines conforming to safety requirements

Standardised control symbols

Control elements on machines must be positioned to afford easy access and be clearly and unambiguously marked

| | | | |
|---|--------------------------------------|---|-----------------------------------|
|  | Straight movement in arrow direction |  | Danger high voltage (under power) |
|  | Rotation in arrow direction |  | On |
|  | RPM indicator |  | Off |
|  | Feed |  | On-Off |
|  | Infinitely variable |  | Stepping control |
|  | Electric motor |  | Emergency stop (red) |

RPM calculation on belt drive

n_1 = Motor RPM

n_2 = Machine pulley RPM

d_1 = Motor pulley diameter

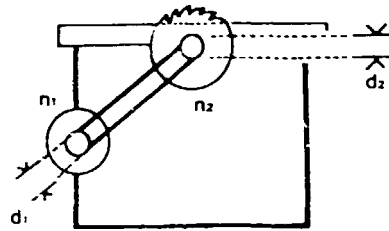
d_2 = Machine pulley diameter

$$n_2 = \frac{n_1 \cdot d_1}{d_2} \text{ RPM}$$

$$n_1 = \frac{d_2 \cdot n_2}{d_1} \text{ RPM}$$

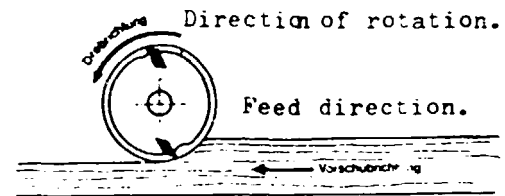
$$d_2 = \frac{d_1 \cdot n_1}{n_2} \text{ cm}$$

$$d_1 = \frac{d_2 \cdot n_2}{n_1} \text{ cm}$$

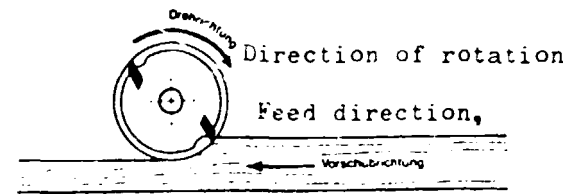


Direction of rotation and feed

Up milling Workpiece feed direction and cutting action opposed



Down milling Feed direction and cutting direction in the same direction
When down milling hand feed will not provide safe feeding of the work piece



3. Electrical Instalations

Working on electrical instalations

Only skilled electricians should undertake instalations, modifications maintenance or repairs to electrical parts of equipment

Skilled electricians

A skilled electrician must have adequate training and experience as well as a a good knowledge of the requisite regulations and be aware of the dangers and precautions in this field

Faulty and improper instalations

Electrical instalations and equipment must not be operated unless properly installed and conforming to all safety regulations in force. Any faults or defects must immediately be notified and rectified before reoperating the equipment

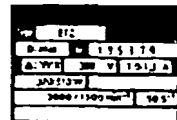
Electrical units

Electrical voltage U: 1 Volt = 1 V
Electrical current I: 1 Ampere = 1 A
Power P: 1 Watt = 1 W
Resistance R: 1 Ohm = 1 V/A
Frequency F: 1 Herz = 1 s⁻¹
Examples: multiples of units: 1000 Watt = 1 Kilowatt = 1 kW; 1000 Volt = 1 kV

Labeling of electrical drive equipment

Electrical drive equipment must carry a label of origin (name plate) giving power ratings and all relevant information for its safe operation. This label must be clearly visible when equipment is mounted on a machine

Type
Motor No.
Watts
RPM
Amps
Herz



Preventing electrical accidents

Use only well proven and safety tested equipment and make sure it is correctly and safely installed



The VDE test symbol is used only for electrical units

The GS test symbol "approved safety" is used for complete equipments

VDE
Organisation of
Electrical
Professionals

GS
Organisation of
safety professionals

Important safety precautions (Electrical equipment)

Safety precautions for un-earthed equipment

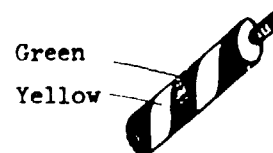
Safe approved low voltage level is 42 V this voltage level can be used for electrical equipment (as it does not constitute a serious shock hazard) except in explosion endangered areas.

PROTECTIVE ISOLATION: The feeder and equipment are isolated from the mains supply by means of an isolating transformer to avoid any return path through the body and earth. Only one unit of max 16 A can be connected.

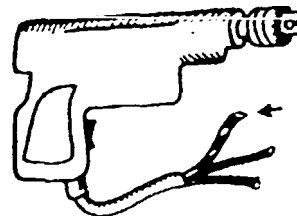


PROTECTIVE DOUBLE INSULATOR: Additional insulation is employed between the electrical part and the exposed casing to provide an additional measure of safety and avoids the casing becoming live to the mains in case of failure in the electrical part.

PROTECTION USING EARTH CONDUCTOR: The earth lead colour is yellow green and leads of this colour must not be used for any other wiring. In the case of a fault developing the current flowing in the earth lead interrupts the supply. Earthing conductors must not be interrupted due to faulty connectors or lack of extension leads or broken as this can be dangerous to life.



NEUTRAL: The equipment is provided with a neutral lead which is connected to the neutral of the supply line. In the case of fault the short circuit current will cause fuse failure. Testing and repairs must be left to skilled electricians.



FAULT CURRENT PROTECTION: A trip or cut-out device disconnects the supply to all leads within 0.2 sec of a fault current onset.

Only use equipment which is adequately protected for the job in hand. The level of protection must be indicated on the casing.

Examples:

Protection against water spray and dust deposits is indicated by the symbols: This is the usual level for equipment used in the wood working industry including exposed outdoor equipment.

IP 54

Protection against exposure to water jets and dust deposits symbols: Minimum protection level required for glue spreading machines.

IP 55

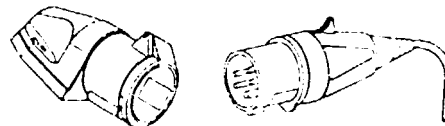
Protection for explosion endangered areas is indicated by the symbols: Extra safe is indicated in addition by: The choice depends upon intended use and must be decided by a skilled electrician. Explosion protected equipment is usually called for in lacquer coating and storage rooms.

Ex
"e"

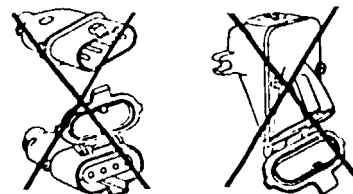
Light fittings with built in relay or remote switching device suitable for mounting within a safety distance of (35mm) of inflammable material (wood) are indicated by the symbol:



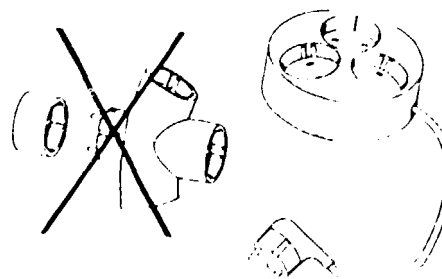
Connectors and cables
Standardised connectors for alternating current supplies. Only approved and tested multiconnectors should be used.



Flat multiconnectors are no longer approved for use.

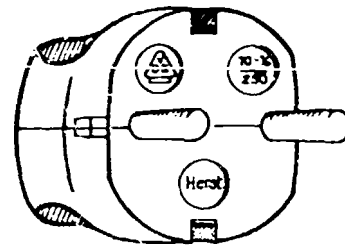


Other examples of multiconnectors



Care must be taken to ensure that the limits indicated on connectors such as voltage and current are not exceeded.

Connectors must never be tied together. This could strain the cable and in an emergency delay removing the plug to disconnect the mains. Do not pull on cables to withdraw plugs. Do not fit connectors or cable extensions. When using wound drum cable extensions unwind from drum to avoid possible overheating.



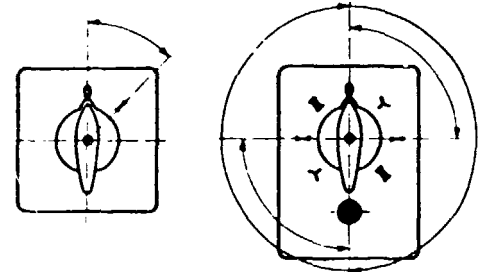
Variable speed controls

Machines with speed controls must always start from the slowest speed position.

Means should be provided to prevent the control inadvertently being turned in the wrong direction or to a higher speed position.

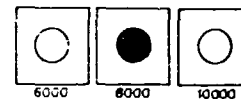
It should be possible to switch off the machine directly from any speed setting of the control.

The direction of rotation and speed setting should be clearly visible eg illuminated indicators.



Simple on-off switch

Pole switching motor control with safety high speed position stop



Illuminated indicators

Labeling of controls and switches

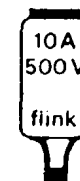
Controls and switches must be clearly marked and readily accessible to avoid any mistaking their purpose or use. They must in addition be positioned where safe access is at times possible yet protected if necessary to avoid accidental operation ie. recessed controls covered over foot controls.

Emergency stop controls must be clearly marked and readily recognisable (red colour) and within easy reach.

LIGHTING: Metal fixtures of lights must be electrically connected to the earth line. Good earthing practice is particularly important for equipment used outside and exposed to the weather. Only break proof armoured and safely insulated types "o" of hand held lights should be used.

FUSES:

Never bridge over blown fuses as this could lead to further damage or even fire hazards. Plain fuses should be used throughout as prescribed by the equipment manufacturers. Special delayed action types should only be used when and where approved by a skilled electrician.



Cutter materials and their reference symbols

UNALLOYED STEEL:

for boring bits and bandsaw blades



ALLOYED STEEL: (special steel) with upto 5% alloy content for circular and bandsaw blades, boring bits and mortice chains



HIGH ALLOY STEEL: (high tensile steel) with more than 5% alloy content for milling cutters



HIGH SPEED STEEL: with not more than 12% alloy content for milling cutters and planer knives



HIGH SPEED ALLOY STEEL: (high tensile high speed steel) with more than 12% alloy content for planer knives, milling cutters and compound cutters

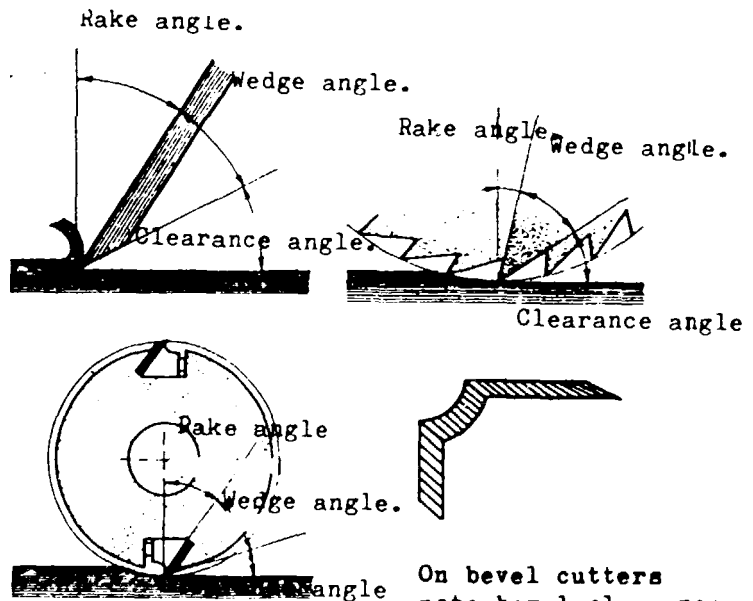


CARBIDE: (sintered tungsten carbon cobalt) for heavy cutting loads on tipped cutters and indexed blades



Hard alloyed steel for use as carbide **Stellit**

Designation of cutting angles



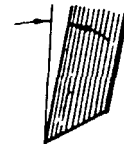
Incorrect cutting angles

CLEARANCE ANGLE TOO SMALL: Excessive friction on back of cutting edge, heat generated during cut, loss of sharpness, probable reduction of feed rate



Clearance Angle

RAKE ANGLE TOO SMALL: Poor chip generation, high pressure on cutter edge, higher feed force required with increased kickback danger



Rake Angle

WEDGE ANGLE TOO SMALL: Breakout on cutting edge reduced life of cutting edge



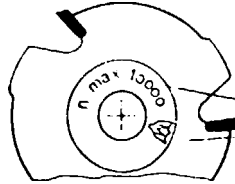
Wedge Angle

On bevel cutters note bevel clearance angle

Material and design

Cutting tools and bodies must be made of appropriate materials capable of withstanding the stresses imposed upon them in operation. The design should allow for safe operation and maintenance.

Markings

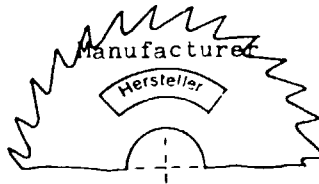


Rotating tools must be clearly and durably marked with the maximum allowable RPM and manufacturers name.

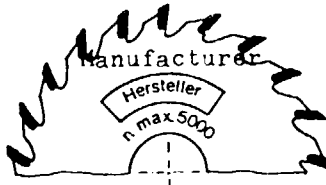


Planer heads and milling cutters for use with mechanical feed only must be clearly and durably marked "Mechanical Feed".

Circular saw markings

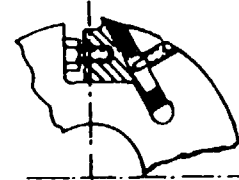
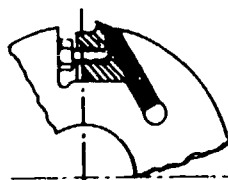


Data on solid steel circular saw blades

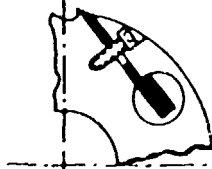


Data on carbide tipped circular saw blades

Clamping of knives

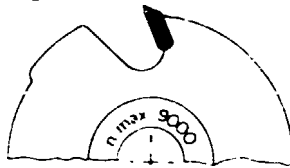


PRESSURE LOCKING JOINT: Change of knife position avoided by friction alone.



FORM LOCKING JOINT: The form and arrangement of the parts avoid any relative change in their position.

Maximum permitted RPM



Manufacturers stated maximum RPM on cutting tools must never be exceeded.

Cutting tools made before April 1954 where no maximum RPM is given must not be used above 4500 min⁻¹ or cutting speeds of 40 m/s.

HSS High speed high alloy steel saw blades



High speed high alloy steel saws must be clearly marked showing maximum RPM steel quality HSS and manufacturer.

When using HSS saw blades on circular saw benches note the following points:

1. Workpiece must be securely clamped
2. Feed part mechanical or mechanical
3. Rim speed must not exceed 40 m/s
4. Saw blade must be covered by a guard

Circular plate saw blades

Tooth shape for steel blades

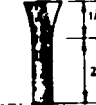
Tooth shape D for Rip sawing



Triangular tooth shape for cross cutting only



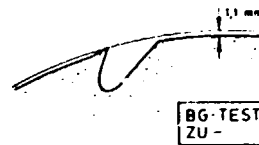
Tooth shape DX for cross cutting



Tooth shape HR for rip sawing



Anti kick back saw blade for hand feed

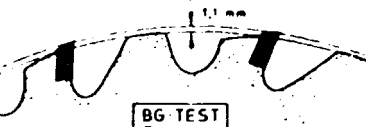


Hollow ground planer saw blade cross cutting only

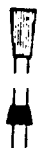


Carbide tipped (HM) circular saw blades

Tooth shape HR Carbide tipped



Carbide tipped saw blade chip gauge limited



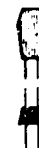
Flat face tooth for rip sawing



Hollow faced tooth for laminated panels



Alternate top bevel tooth for cross cutting



Trapeze tooth for cutting plastics

Maintenance of circular saw blades

Cracked or buckled saw blades must under no circumstances be used but must be disposed of.

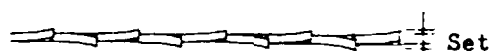
Circular saw blades must not be slowed down or brought to a stop after switching off by pressure on the sides.

Band saw blades

Band saw blade thickness: approx 1/1000 of saw wheel diameter

Blade width: depends upon application for rip cutting tennon cutting use wide blades for contour work narrow blades

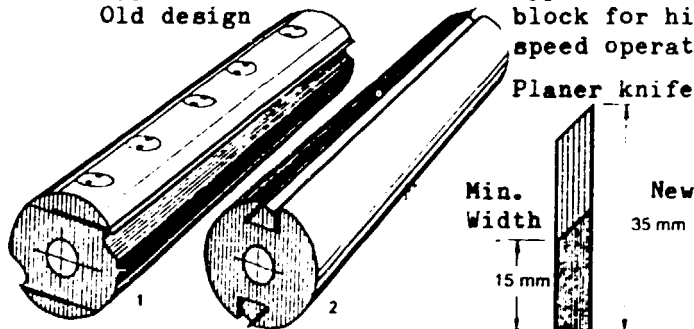
Tooth depth Tooth pitch Rounded gullet



Blunt saws tend to run out and tear

1. Circular clamp plate-type cutter block Old design

2. Wedge clamp type cutter block for high speed operation



3. Special type: Spiral cutter block reduces noise and gives better surface finish



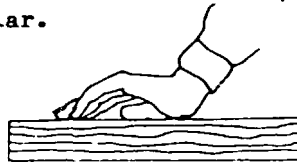
Clamping of knives

Locking bolts must only be tightened with the correct wrenches specified. Do not use extension leverage on wrench. Clean both the head and knife before assembly and tighten bolts starting from the centre outwards.

5. Milling Tools

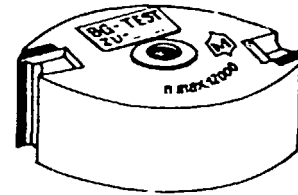
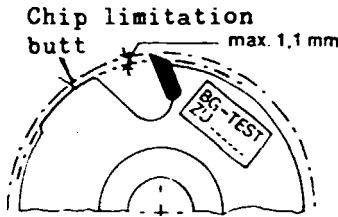
Hand feed

Manual loading and feeding of work pieces without using clamps or feed attachments for instance moulding along the fence without mechanical feed or shaping on a ball bearing collar.

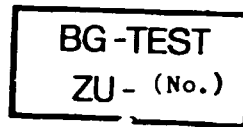


Tools intended for hand feed operation must have the following properties:

- Chip guage limitation maximum 1.1 mm
- Extensive circular form
- Narrow chip clearance gullet
- Kick back safe



In Germany these requirements are met by all tools carrying the test symbol BG-TEST

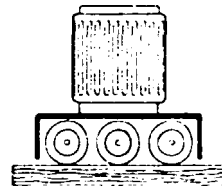


Partial mechanical feed (feed attachments)

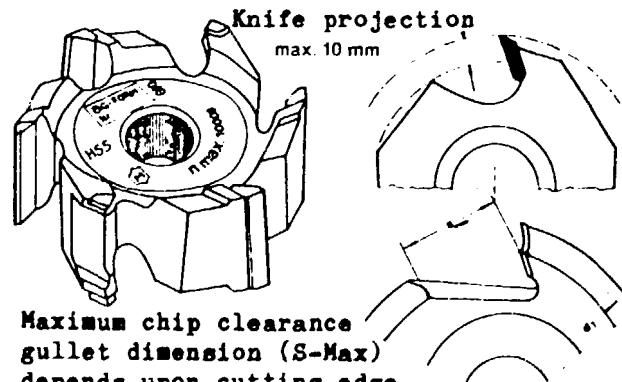
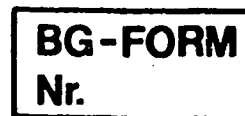
Manual loading and in feed of work pieces using built-in clamping infeeding devices such as feed attachments or sliding tables.

Constructional details of tools used on machines with partial mechanical feed

- Cutting edge projection maximum 10 mm
- Mainly closed circular form
- Limited width of chip clearance gullet
- No kick back danger



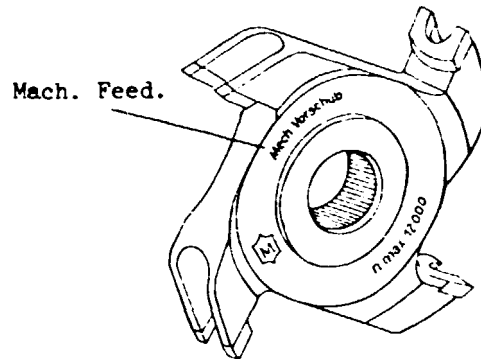
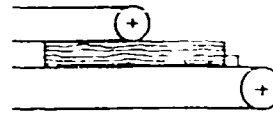
These requirements are all met by tools carrying th test symbol BG-FORM



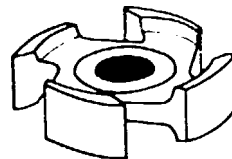
Mechanical feed

Loading and feeding of work pieces by means of power driven clamping and feed equipment, for example working with double - end tenoning machines

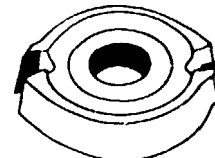
Tool requirements for use with mechanical feed systems: besides tools recommended for use with manual or partial mechanical feed other tools can also be used on machines with mechanical feed



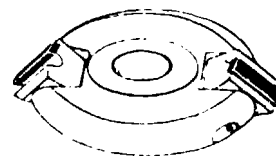
Standardised machining tool types



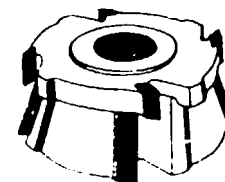
ONE PIECE TOOL
Tools without detachable parts tool body and cutting edge made from one piece



COMPOUND TOOL
(tipped tool)
Tools where the tips are joined to the body by an adhesive (for instance solder)



TOOLING ASSEMBLY
Tool where one or more knives are clamped in one body and can be adjusted or replaced



TOOLING SET
Tool made up of individual tools of afore mentioned types set together

Tooling spindles

Tooling spindles must be sturdy enough to stand up to the various loads applied during operation

Loose spindles must be at least 30 mm in diameter

Standard loose spindle



Diameter 30 mm useable lengths 80, 100 and 125

Diameter 40 mm useable lengths 100, 125 and 140 mm for use with larger diameter tools eg tenoning discs

Loose spindle with counter bearing shaft

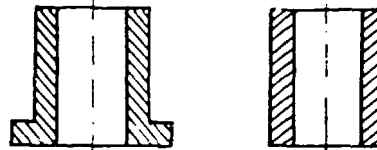


Diameter 30 mm useable length 160 mm

Loose spindles must be provided with spacer rings and securing nut. Loose spindles with counter bearing shaft must never be used without a counter bearing because of danger of spindle breakage

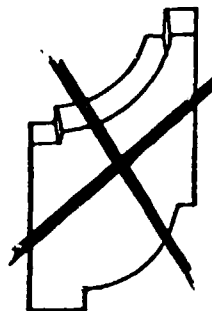
Spacer rings (Reducer bushes)

Spacer rings or reducer bushes must only be used on rotating tools when they accurately fit both the spindle and tool. The length of such pieces must not be less than 0.7 times or more than 0.9 times the bore of the tool



Multi-edge profile blades

Profile cutter blades with multiple cutting edges are no longer permitted by safety regulations



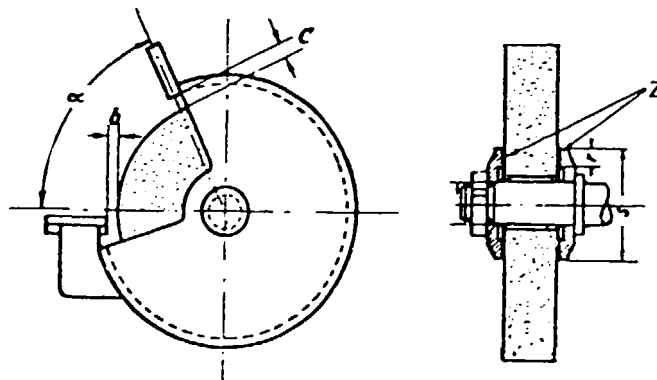
6. Maintenance and Reconditioning of tools

Tool maintenance:

- Blunt tools do not perform efficiently and are dangerous
- Damaged tools (worn threads, cracked etc.) must not be re-used
- Clean resinised tools
- Lay up tools on soft surfaces (wood)
- Always return tools to their place of storage after use

Reconditioning

- Reconditioning of assembled tools must be done only by skilled personnel
- The grinding wheel guard must be adjustable, maximum distance from wheel 5mm (c)
- The guard must adequately cover the wheel right up to the grinding aperture (max 65°) (d)
- The grinding support must be sufficiently large and adjustable to within 3 mm (b)
- The grinding wheel must be clamped between collars whose diameter is 1/3 at least that of the wheel (s)
- The collars must be of similar size and relieved
- Compressible packing pieces must be fitted between the wheel and collars



Grinding wheel markings

Grinding wheels must carry the following markings:

Manufacturer

Type of binder eg V = Ceramic, B = Resin bonded, R = Rubber bonded

Wheel dimensions

Permitted RPM of new wheel

Bonded mineral wheels must be marked with a white stripe. Wheels containing materials likely to be injurious to health must be marked in an appropriate manner

Other necessary data are:

Abrasive grit size, lower numbers = larger grit sizes higher numbers = finer grit sizes

Hardness indicating letters. Very soft E-G, Soft H-K, Medium L-O

Using grinding wheels

There are well defined safety regulations specified for the use of grinding wheels as set down by the metalworking industry covering the maximum permissible rim speed. Wheel mounting and fixing must be done by skilled personnel and the wheel must be given a ringing test to ensure there are no invisible cracks or defects. Only approved collars and packing pieces must be used. The wheel bore must match the spindle dimensions such that there is no noticeable play when the wheel is mounted by hand on the spindle before tightening.

After any adjustment to mounting or remounting of a wheel a test run of at least 5 min duration must be made ensuring that no one is within the danger zone. When using grinding wheels always use goggles or position the splinter proof shield on the machine. Only use wheels from manufacturers showing safety certification.

Band saw blades

1. Deresinising Use goggles and protection gloves
2. Setting with a setting device Set width $1/3$ of blade thickness per tooth. With wider settings leave the raker tooth straight. The set height should be $1/3$ to $1/2$ of tooth height.
3. Sharpening with a triangular file whose corners have been rounded off. File against root.

Circular saw blades

1. Deresinising Use goggles and protection gloves
2. Setting with setting pliers, lever operated setting device or automatic setter. The set must be checked with dial indicator. Unbalanced setting of the blade will cause drift.
3. Sharpening with a triangular file is outdated and seldom practised these days. With grinding wheel: first grind the wheel gullet then the back leaving burr facing front. On saws with expansion slots the relic tooth must be ground off where necessary.

Cutter knives

1. Grinding faults: a) Too small a grinding wheel (Diameter smaller than 140 mm) causes concave grinding giving too small a wedge angle, decreasing life of tool, cutting edge breaks.
b) Incorrect support on the grinder causes tipping in to the gap.
2. Grinding a) straight knives, use gauge or template.
b) Profile knives follow profile contour drawing.

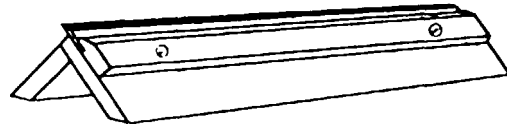
Check and maintain wedge angle and take care to maintain side relieve angle.

Cutting tools

Only use grinding machines with index adjustment for sharpening tools, do not alter cutter angles when re-sharpening.

Planer knives

1. Grinding faults:
 - a) Too heavy a pressure applied: knife turns blue and edge is distorted.
 - b) Incorrect alignment: width of knife uneven and unbalance in weight distribution.
2. Grinding:
 - a) Check knife width and weight; equalise difference during grinding. Do not reuse knives when less than 15 mm clamping width left after grinding.
 - b) Do not alter wedge angle (circular clamp plate type cutter block knives approx 52° , wedge clamp type cutter block knives approx 40°).
3. Jointing
Jointing of knives in jointing jig. Use oilstone.

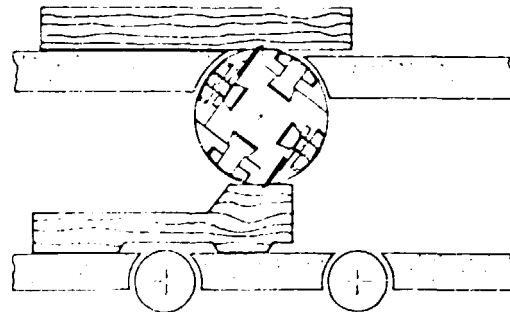


Planer knives

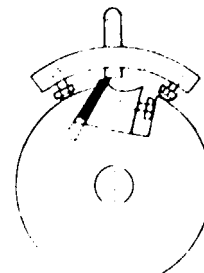
Replacing knives

Planing machine must be safeguarded against accidental switch on. Loosen securing bolts and remove knives. Clean knife clamp faces. Degrease new knives and mount.

Setting knife using wooden gauge block. Tighten locking bolts from centre outwards, test run then retighten locking bolts.



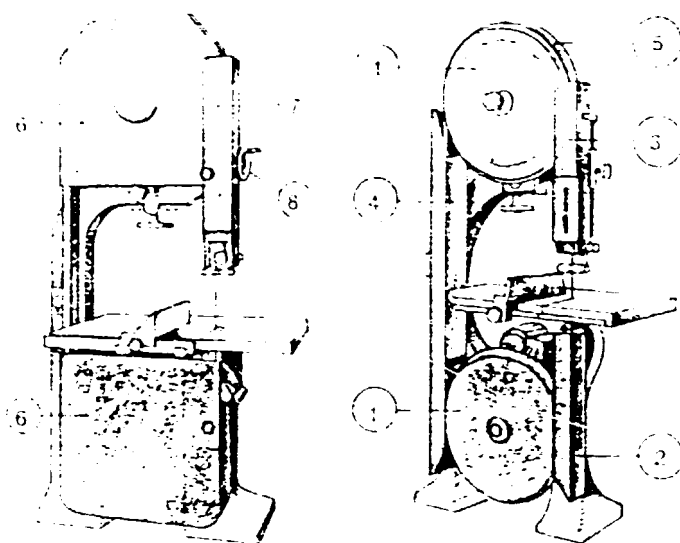
Setting knife using adjustable gauge or dial indicator. Tighten locking bolts from centre outwards, test run then retighten locking bolts.



7. Operating band saws

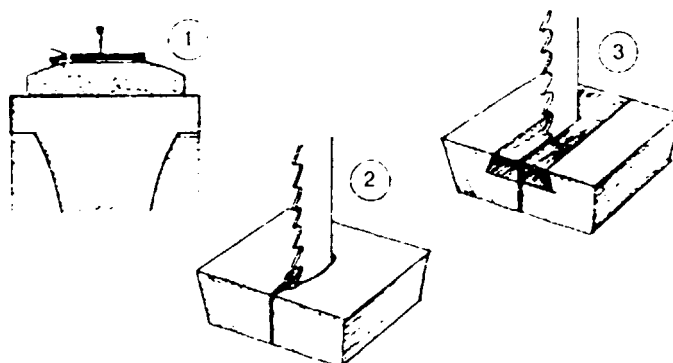
Constructional details
Designs upto 1979

- (1) Cover of wheel disc with spoked, fluted or punched cover (including rear).
- (2) Covering over down stroke part of band saw blade below table.
- (3) Height adjustable cover over down stroke part of band saw blade above table (cover can be positioned right down to cutting height).
- (4) Cover over up stroke part of band saw blade.
- (5) Metal ring to catch torn band saw blades.



Design features new machines (since 1980)

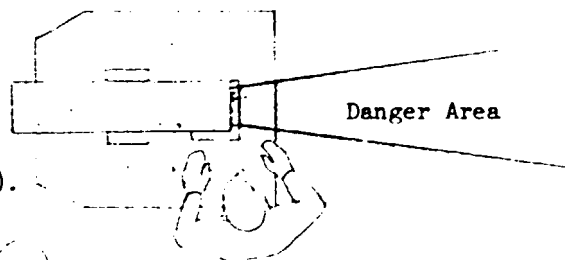
- (6) Enclosure of band saw wheels and up stroke part of blade.
- (7) Height adjustable saw blade front and side cover (setting adjustment to suit work piece height).
- (8) Adjustment control for setting top band saw guide (for machines with wheel diameters larger than 315 mm).



Wheel tyres and table inserts

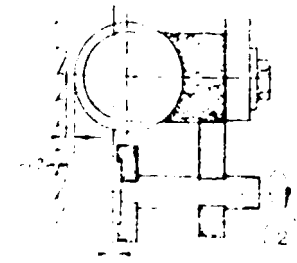
The material used and the shape of the tyres (1) ensure true running of the band saw and protect the tooth set.

(Tyre shape is usually slightly rounded Table inserts must be flush with the table top. Worn table inserts (2) must be replaced without delay, this is made easier where table inserts are provided with replaceable wear resistant parts (3).



Operation

- (1) Correct working position: operator in front of machine facing feed direction. Handling work pieces: keep hands away from cutting area place flat on work piece surface fingers and thumbs close together. Move work piece forward evenly following cut, do not pull backwards.
- (2) Adjustment of band saw blade guides: side guides set to some 2mm behind tooth gullets, band saw blade support roller guide must be positioned close behind the saw blade (approx 0.5 mm so that it rotates only when cutting pressure is applied to the band saw blade.

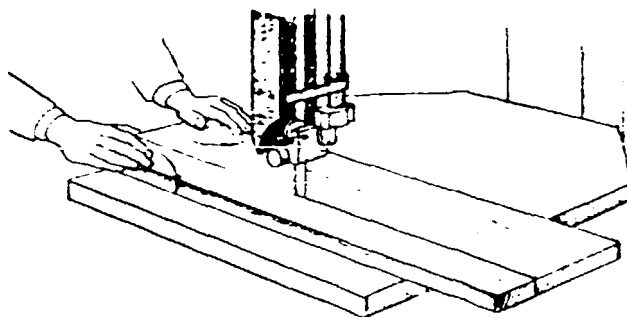


Rip sawing

Saw blade: use a wide sharp correctly set saw blade.

Work piece guidance: move work piece smoothly forward following scribed line. At end of cut move work piece parts as shown by arrows off the saw blade do not pull backwards.

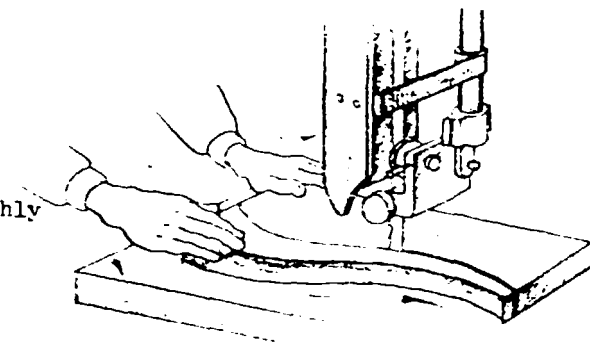
Application: for short runs only. When cutting longer work pieces a roller conveyor or table extension should be mounted behind the saw to avoid the work tipping.



Contour sawing

Saw blade: use a narrow sharp correctly set saw blade.

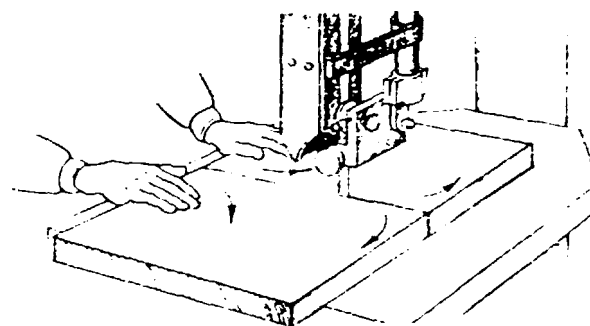
Work piece guidance: move work piece smoothly forward turning as required to follow the scribed contour. Do not withdraw or pull back as this could cause run out of the blade. On wide work pieces cut centre contour first.



Cross cutting, flat

Saw blade: use a wide sharp correctly set saw blade.

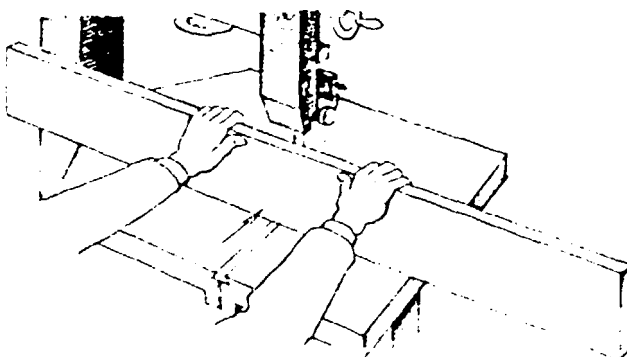
Work piece guidance: position hands as shown on work piece and feed smoothly applying pressure in directions shown by arrows to avoid any tendency of the kerf closing.



Cross cutting, upright

Saw blade: use a wide sharp correctly set saw blade.

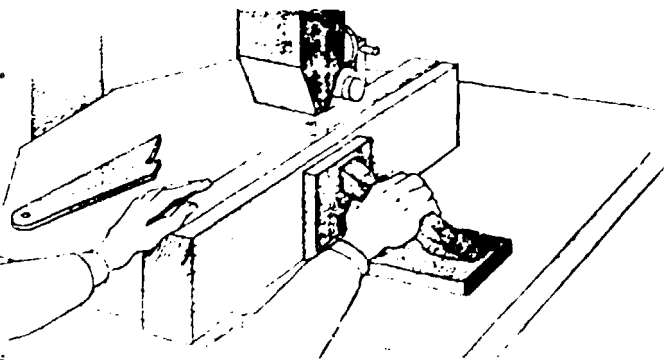
Work piece guidance: set height of cover and band saw guide as appropriate for work piece dimensions. Lean the work piece at left on the machine frame or the cover as shown and feed smoothly forward to cutting position. Very long pieces should be supported on table extension or rollers to avoid tipping when cut. Attention: Never feed in such that cutting starts at the top edge of work piece.



Resawing along scribed line

Saw blade: use a wide sharp correctly set saw blade.

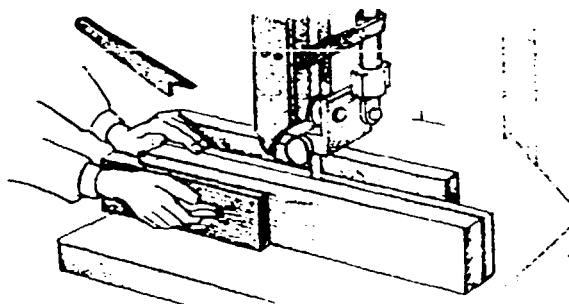
Work piece guidance: scribe cut required. Feed work piece smoothly forward in cut direction and guide by means of a right angled guide piece as shown by applying sideways pressure as necessary. Centre right angled guide slightly forward of saw blade (if positioned behind there is a tendency to close the kerf). Use a pushing stick to feed the last part through to keep hands safely away from saw blade. For longer pieces use supporting table extension or roller supports to avoid tipping.



Re-sawing along fence

Saw blade: use a wide sharp correctly set saw blade.

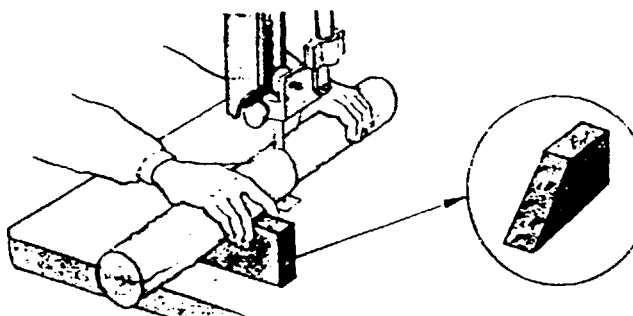
Work piece guidance: set the fence and align parallel to the saw blade. When re-sawing thin pieces always use a pushing stick and guiding block as shown for safety.



Cutting round stock

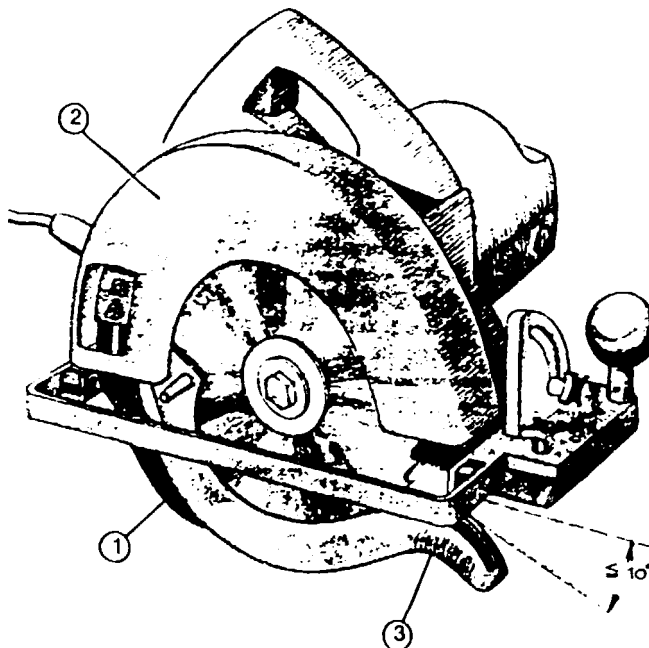
Saw blade: use a wide, sharp and correctly set saw blade.

Work piece guidance: use a special fixture to prevent work piece rotating. A simple wedge support like that shown is adequate to ensure round stock does not turn whilst sawing. For longer round an appropriately shaped wedge support to suit the work piece shape should be used.



8. Operating Circular Saws (hand held circular saws)

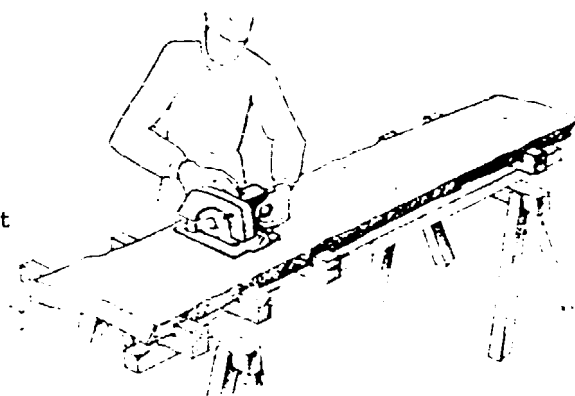
Hand held circular saws manufactured after 1975 must be equipped with a riving knife (1) when the maximum cutting depth exceeds 18 mm. The saw rim above the table must be protected by a solid enclosure (2). Protection in the cutting area is provided by a swivelling guard (3) which must have spring loaded return to the protected position where both sides of the saw rim are covered. This guard must be capable of being secured in position when the saw is at rest and not in use. Dip circular saws and those with a self adjusting swivel guard must have means of locking the guard. The distance between the saw rim and the riving knife must not exceed 5 mm.



Cross cutting lumber

Circular saw blade: chose a cross cutting circular saw blade for the operation shown.

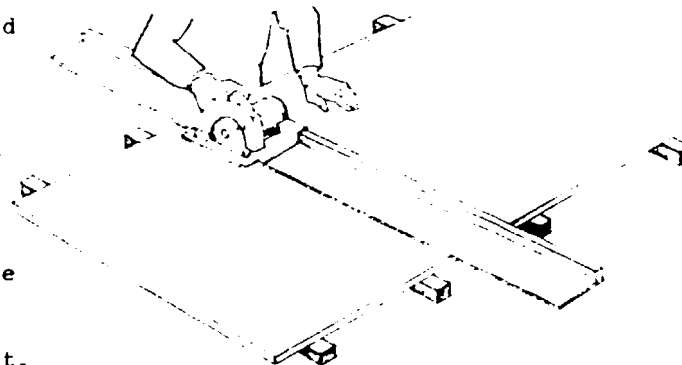
Procedure: check that the riving knife is correctly positioned and tightened. Set for correct cutting depth (allowing max 10 mm more than work piece thickness). Check electrical cable and plug, secure work piece in position such that feed pressure during sawing will not jam the kerf. Make sure there is plenty of clearance under the board for the saw blade. After cutting wait for the saw to come to a stop and ensure the swivel guard is secured in position before putting the saw away. Working layout and operator position as shown.



Sizing panel material

Circular saw blade: use a panel cutting saw (eg carbide tipped saw blade).

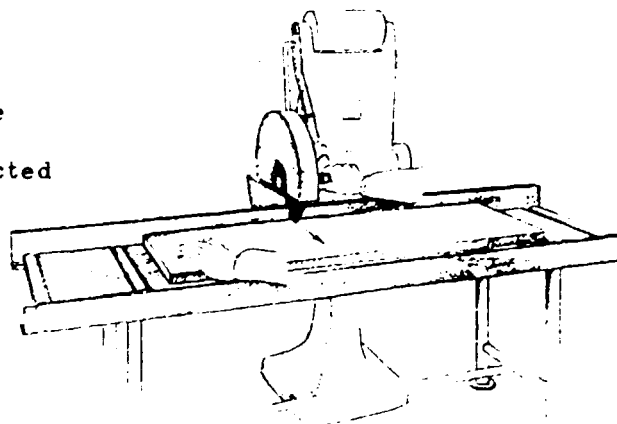
Procedure: check riving knife is correctly positioned and tight. Set for correct cutting depth. Ensure work piece is securely held in position so as not to move. Special guides or rails can be used to ensure a steady and straight cut. Working layout and operator position as shown.



9. Operating Pendulum Cross-Cutting Circular Saws

Constructional details

The saw blade must be fully enclosed right to the cutting aperture when at rest. The saw should return automatically to its safe rest position after use and be firmly held there. The fence must be solidly constructed extending to the saw opening slot. The end stop must ensure that the saw teeth do not extend beyond the table edge or else a protection cover should be provided to ensure the saw remains fully enclosed.



Operation

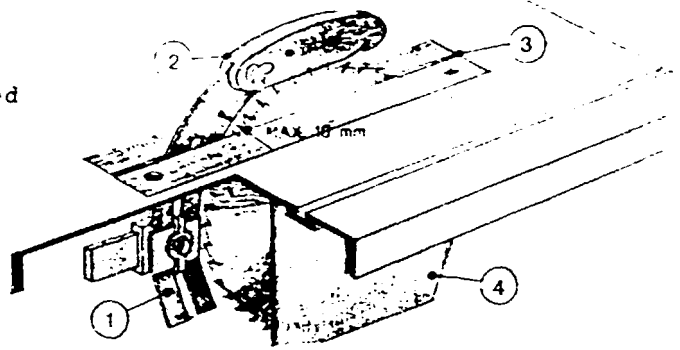
Saw blades: use a cross cut saw blade.

Procedure: stand to one side of cut.

Hold the work piece firmly against the fence with the left hand placed well away from the cutting area. After releasing the retaining lock with the right hand smoothly pull the saw forward to cut.

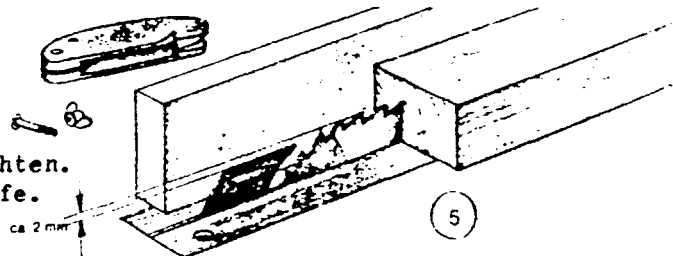
10. Operating panel sizing saws and saw benches
Constructional details machines
built up to 1979

- (1) The riving knife must be positioned within 10 mm of the blade and be adjustable both horizontally and vertically.
- (2) The top guard is attached to the riving knife and secured against tilting down onto the saw blade by a locking pin.
- (3) The table opening slot is kept as small as possible.
- (4) A cover is provided under the table to avoid any possibility of accidentally touching the blade.



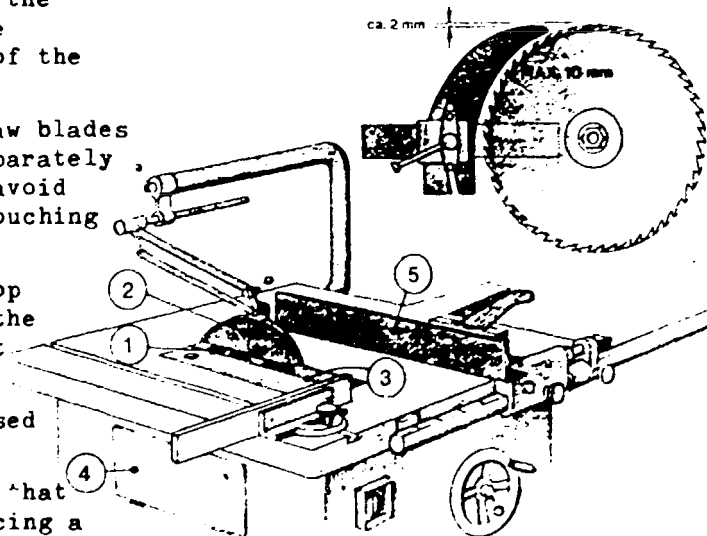
Setting up for blind (covered) sawing

Remove the top guard, reposition the riving knife so its top is some 2 mm below the top of the saw blade and tighten. Alternatively fit a shorter riving knife.



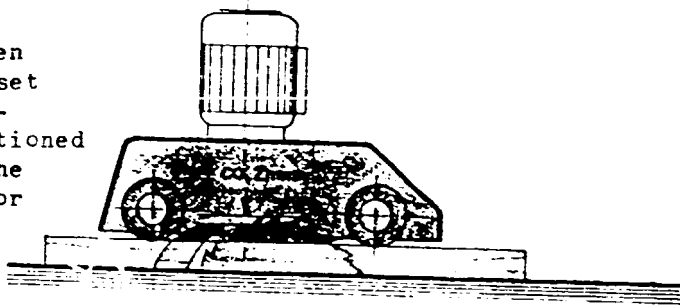
Constructional details machines
built after 1980

- (1) The riving knife can be adjusted both horizontally and vertically. It is secured against possibility of tilting and can be set to within 10 mm of the saw blade. Its top should never be positioned lower than the gullet of the uppermost saw tooth.
- (2) Machines built to take circular saw blades exceeding 250 mm in diameter a separately mounted top guard is provided to avoid any possibility of accidentally touching the blade.
- (3) The saw blade slot in the table top should be as narrow as possible (the gap on each side of the blade must not exceed 3 mm).
- (4) The saw blade must be fully enclosed below the table.
- (5) The fence must be adjustable such that its rear end can be positioned facing a point lying between the front of the blade and the blade centre. With tilting tables it should also be possible to position the fence on either side of the saw blade.



Feed attachments

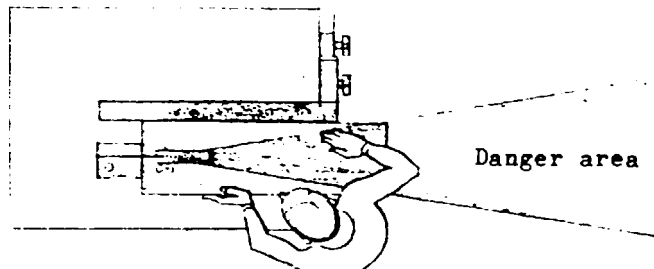
A riving knife should still be used even when using mechanical feeders (height set not lower than the gullet of the uppermost tooth). The feeder should be positioned so as to completely cover the top of the blade otherwise the protective cover for the saw blade must be used.



Operating circular saw benches

Circular saw blade: use only well sharpened even and correctly set blades.

Operation: set riving knife (not further than 10 mm from the blade) and tighten. Set the top cover over the blade at an appropriate height dependent upon work piece thickness. Operating position as shown stand clear of danger area.

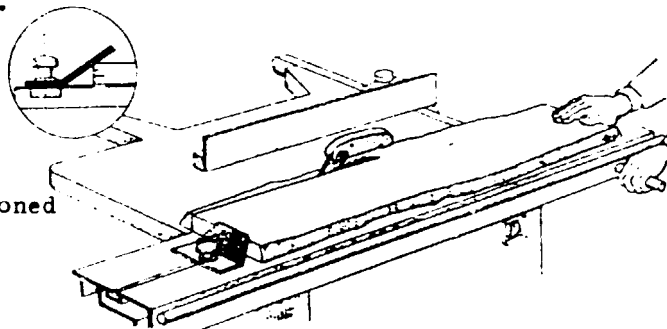


Sizing circular saw

Edging and ripping

Circular saw blade: use a rip saw blade.

Operation: set the end clamp to suit work piece length and push under clamp. Hold workpiece down with right hand and push the sliding table forward smoothly with the left hand as shown. Regularly check the setting of the riving knife and tighten always use top cover positioned correctly for work piece thickness.

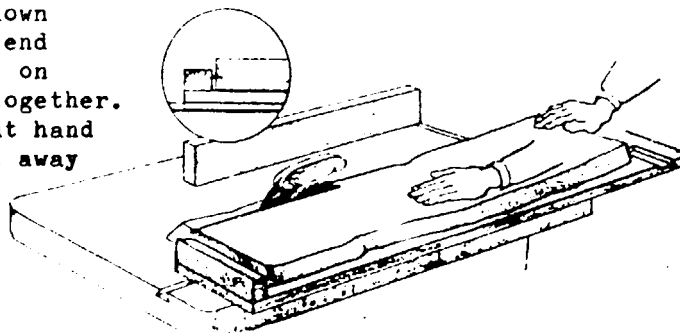


Circular saw bench

Edging and ripping

Circular saw blade: use a rip saw blade.

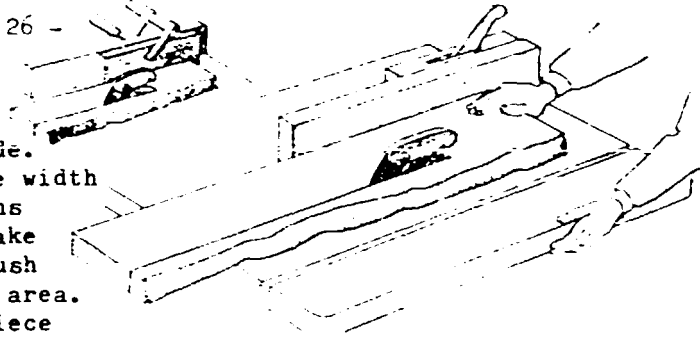
Operation: place the ripping board on the table engaging the runner in table slot. Place work piece on bed hollow side down if warped and push forward to engage end firmly in grip spikes. Lay hands flat on work piece fingers and thumbs close together. Push forward evenly with palm of right hand on end of work piece. Keep hands well away from cutting area.



Sawing wider work pieces

(Widths over 120 mm)

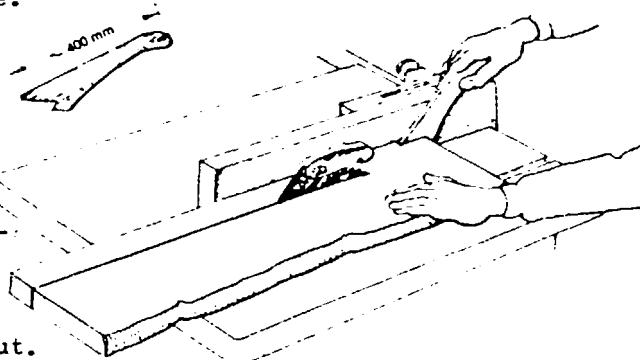
Circular saw blade: use a rip saw blade.
Operation: position the fence for the width of cut required. Should the cut widths entail narrow strips being cut off take care to keep hands clear and use a push stick in the vicinity of the cutting area. To avoid any tendency for the work piece to jam between the saw, riving knife and fence, position the fence so that its end does not extend beyond the centre of circular saw blade or use a shorter fence.



Sawing narrower work pieces

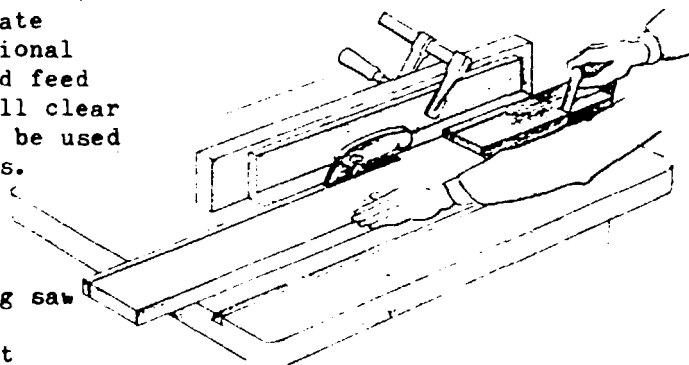
(Widths under 120 mm)

Circular saw blade: use a rip saw blade.
Operation: position the fence for width of cut required. Use both hands to guide and feed the work piece but near the cutting area always use a pushing stick to feed the work piece till well clear of the saw and riving knife. With shorter pieces use pushing stick from start of cut.



Sawing edges (lippings) and slats

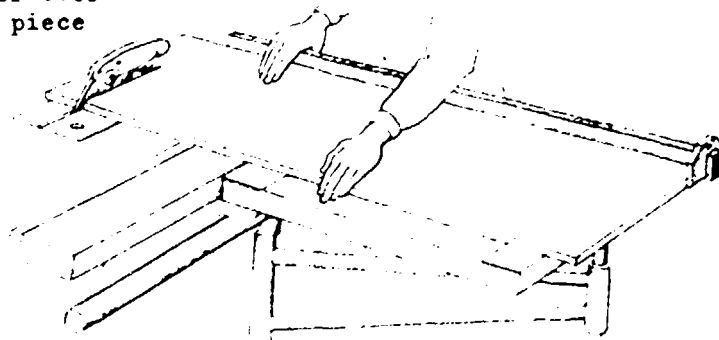
Circular saw blade: use a planer saw blade.
Operation: Position fence as appropriate with edge facing the saw or use additional right angled fence as shown. Guide and feed work piece with pushing block only till clear of the blade. Table extensions should be used to avoid tipping of longer work pieces.



Cross cutting wider work pieces

Circular saw blade: use a cross cutting saw blade.

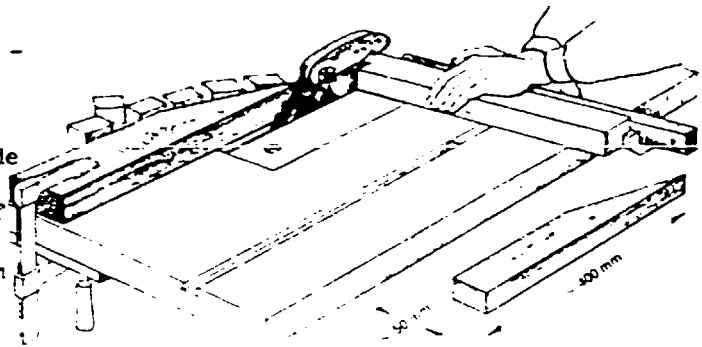
Operation: Position work piece against cross cut stop use left hand to press piece against fence whilst feeding. When using a ruled cross cut fence tilt this up before returning it to starting position and to off-set work piece or take off work piece at the end of saw blade rim. Regularly check riving knife position and make sure it is tight. Keep top guard or cover over saw blade positioned to clear work piece thickness.



Cross cutting

narrower work pieces

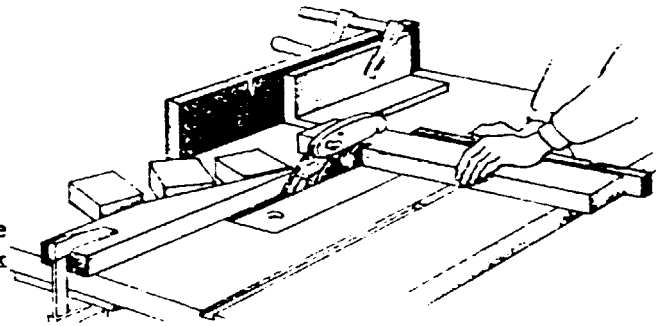
Circular saw blade: use a planer saw blade
Operation: position deflector as shown to deflect sawn pieces away from rear of saw blade. Use a cross cut fence. Do not use fingers to remove any piece from table near the blade.



Cross cutting

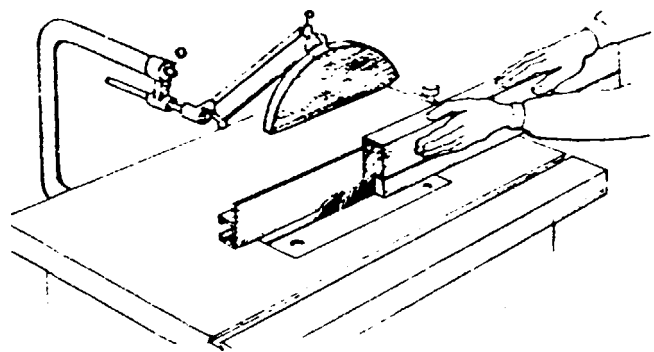
short work pieces

Circular saw blade: use a planer saw blade.
Operation: position a clearance fence to guide work pieces as far as the front of the blade (start of cut). Use a cross cut fence and a deflector appropriately positioned near the riving knife.



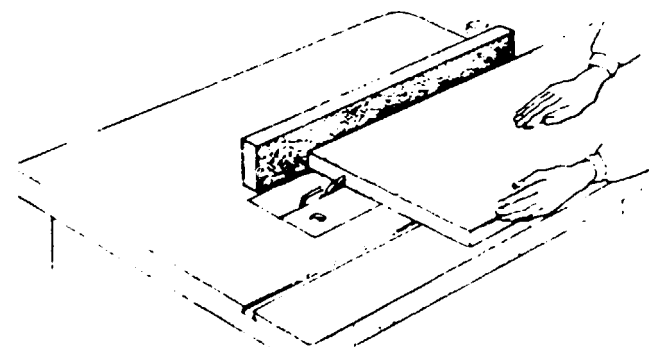
Blind (covered) sawing rebating

Circular saw blade: use a planer saw blade
Operation: when rebating position the work piece along the fence such that the sawn piece falls on the opposite side of the blade to that of the fence. Remove fixed top guard or raise adjustable top guard and lower riving knife for rebating and blind covered sawing.



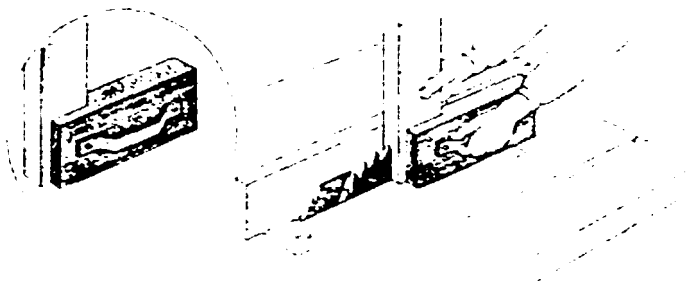
Blind (covered) sawing, grooving

Operation: lower riving knife. When feeding press work piece firmly down on to table top to avoid jump grooving. When grooving across grain on narrower pieces use cross cut fence. When using special grooving tools fit appropriate slot lining insert to table which allows sufficient tool clearance on both sides.



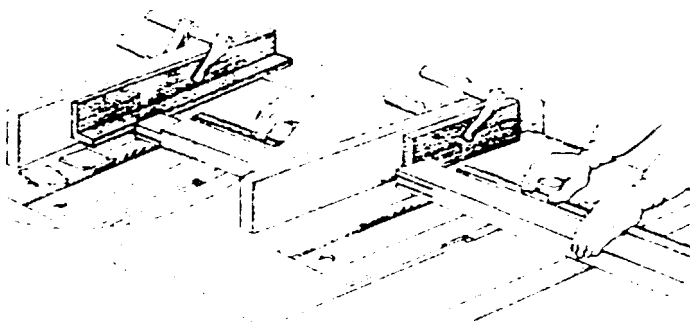
Blind (covered) sawing tenoning

Operation: lower riving knife and tighten. Position and tighten fence for correct tenon size. Use pushing block to feed and the right hand to steady the work piece. Keep fingers away from leading side. Withdraw together backwards both work piece and pushing block after sawing. Pushing block dimensions: 120 mm x 250 mm rebate according to work piece size.



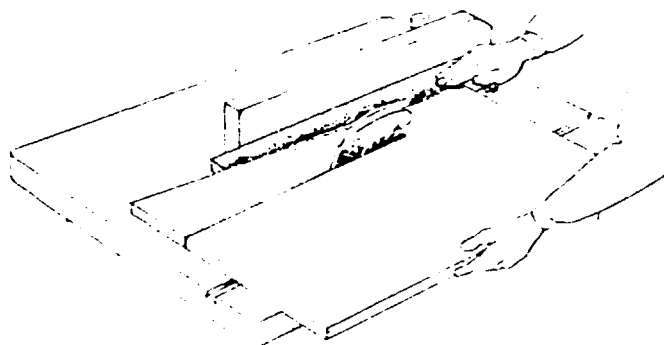
Sawing tenon shoulders

Circular saw blade: use planer saw blade. Operation: move fence back or clamp a shorter block on to avoid sawn off pieces getting caught against blade and fence. Alternatively a right angled guide clamped firmly to the fence can be used. This should be positioned slightly above the piece to be cut off but such as guide on the tenon. Always feed the work piece right past the blade to the riving knife.



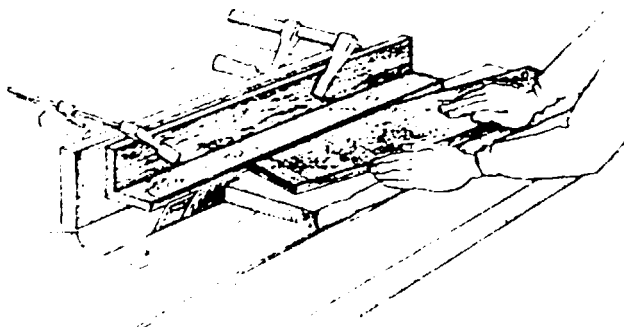
Sawing using a template

Circular saw blade: use planer saw blade. Operation: set the fence allowing for template. Ensure work piece is held against template during whole sawing period. Use left hand to guide work and right hand to feed. Check setting of riving knife and top guard and make sure both are tight. Set height of top guard to suit work piece thickness.



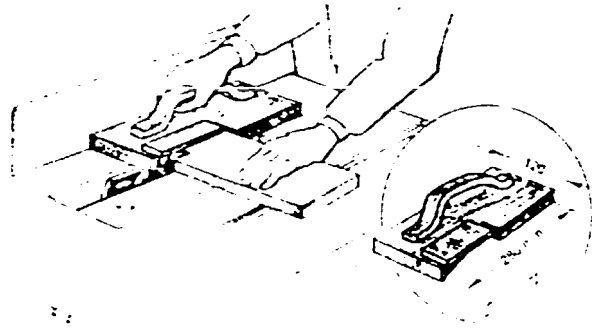
Sawing using a spiked template

Circular saw blade: Use planer saw blade. Operation: firmly clamp right angled piece to fence so that underside is clear of the saw blade yet such that it will accurately mate with and guide the template. Press work piece and template together ensuring spikes firmly bite into work piece. Feed work piece and template firmly pressed to guide edge and advance to cut. Make sure and loose pieces sawn off do not remain under right angled guide piece.



Sawing wedges

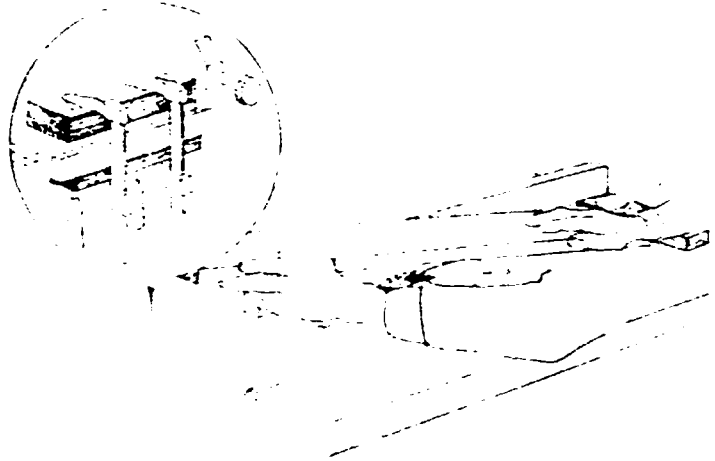
Circular saw blade: use planer saw blade. Operation: keep table slot opening on either side of the blade to a minimum. Push work piece with wedge jig through till clear of the riving knife before removing the sawn wedge. Use only good fitting jigs that feed and guide work piece smoothly across table. Use guard over blade or over the entire travel of the wedge jig.



Stopped slotting (grooving)

Shorter work pieces

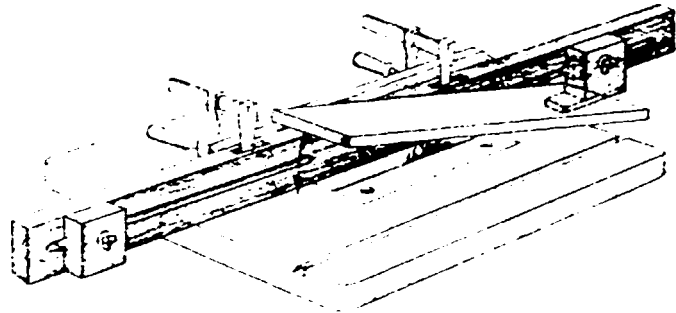
Operation: remove top guard riving clamp knife secure riving knife clamp. Position an end stop and clamp using a backing block on underside of table. Place work piece against end stop and drop down smoothly to table and feed to scribe or second stop, lift up smoothly after sawing.



Stopped slotting (grooving)

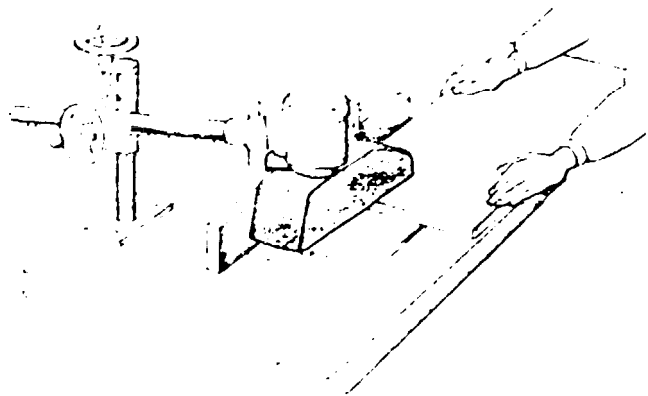
Longer work pieces

Operation: remove top guard and riving knife. Firmly clamp jig to fence. Set and lock kick back stop and end stop to determine start and stop length of cut required. Place work piece firmly on kick back stop and press against stop. Drop work piece down smoothly to cut and feed into limiting end stop. Always remember to replace riving knife and top guard after slot cutting work is completed.



Working with feed attachment

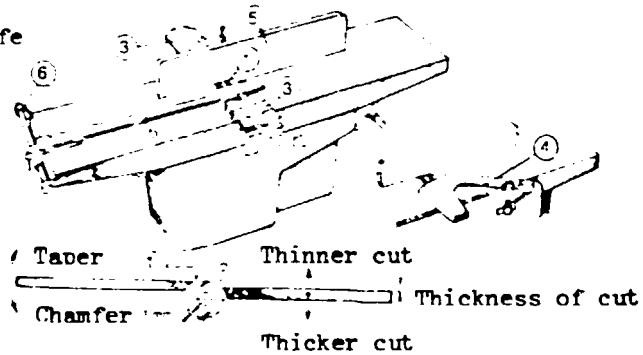
Operation: set riving knife as kick back stop. Position feeder so that it holds work piece firmly against the fence whilst sawing. Make sure fence is firmly clamped in position. Place work piece against fence and smoothly feed in till it engages with the feeder rollers and the cut commences



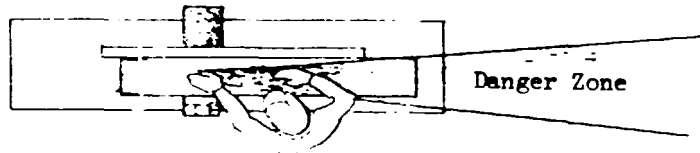
11. Operating Surfacers and Jointers

Constructional details

- (1) Round cutter block with knife projection not more than 1.1 mm above block circumference.
- (2) Clearance between table lips and knife edge circumference as small as possible (maximum of 5 mm).
- (3) Protective cover over cutter block and table slot both in front and behind the fence, i.e. bridge guard or folding cover.
- (4) Swivel guard in front of fence.
- (5) Jointing fence.
- (6) Adjustable guide bar (the guide bar keeps work piece pressed against the fence and covers the exposed cutter block area).

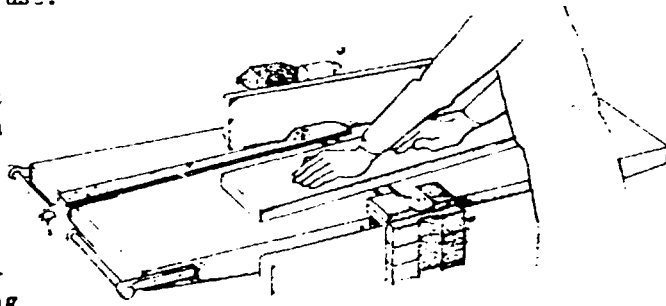


Operation: Always keep the unused parts of the cutter block covered and protected (hinged cover, flexible cover, guide bar) operator position as shown. Position of hands: place both hands firmly on the work piece fingers and thumbs close together and well clear of edges. For stopped planing align both tables firmly secure, kick back stop on infeed table and reset outfeed table after use.



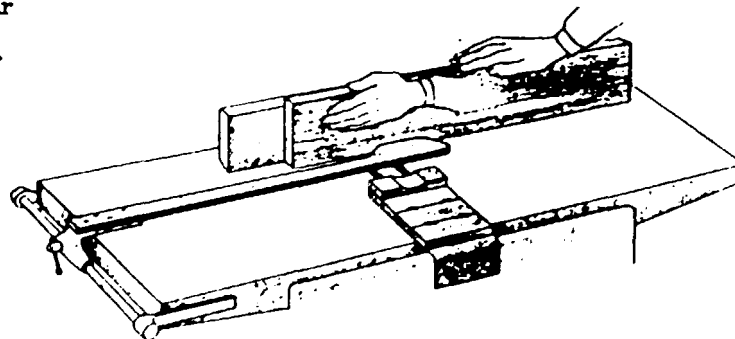
Surfacing wider work pieces

Operation: check table setting, set for correct cutting depth. On rough work piece surfaces always start with a low removal rate. Cover the exposed parts of the cutter block both in front and behind the fence. Feed work smoothly forward maintaining pressure down onto table standing to one side as shown.



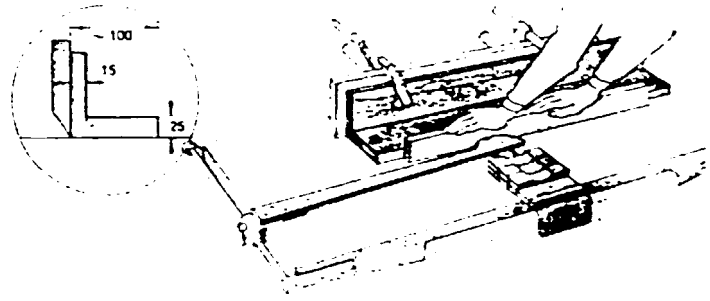
Jointing wider work pieces

Operation: check table and fence settings ensure fence is well tightened. Set the adjustable guide bar to maintain work piece against fence. Cover over unused parts of cutter block. Feed work piece smoothly forward firmly pressing down on table.



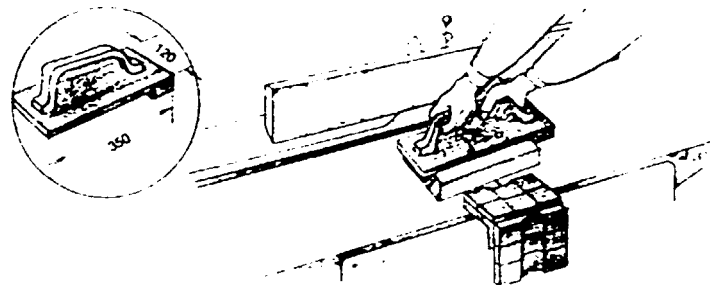
Trueing up and jointing narrower work pieces.

Operation: secure a right angled guide to the fence. Use correctly positioned adjustable guide bar. Make sure unused parts of cutter block are covered.



Trueing up shorter work pieces.

Operation: check setting of machine table and adjust for low removal depth of cut. Fit work piece in feeder block and holding the block with both hands firmly at an angle of some 20° to direction of feed smoothly to cutter. Slotted end perforated table lips help reduce noise level in the work environment.



12. Operating Thicknessers

Construction details:

- (1) Cutter block: knives set no more than 1.1 mm above cutting block circumference.
- (2) Kickback fingers with restricted turning angle (width 8.15 mm spacing between stops not to be more than half their width).
- (3) Chip ejector opening: the opening should be constructed or positioned such as to avoid access to the cutter.
- (4) Pressure bars.
- (5) Infeed roller.
- (6) Outfeed roller.

Dimension a: the kickback fingers should be at rest at least 3 mm below the cutter knife circumference.

Alternative design for kickback stops

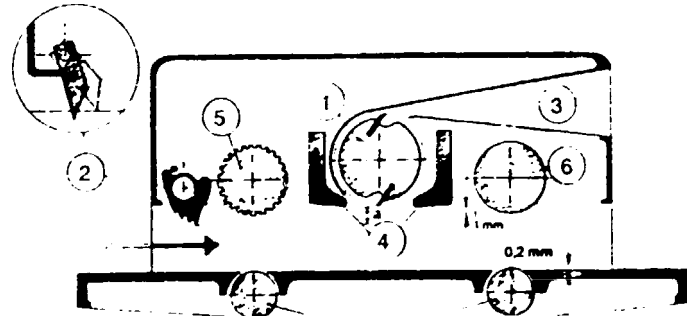


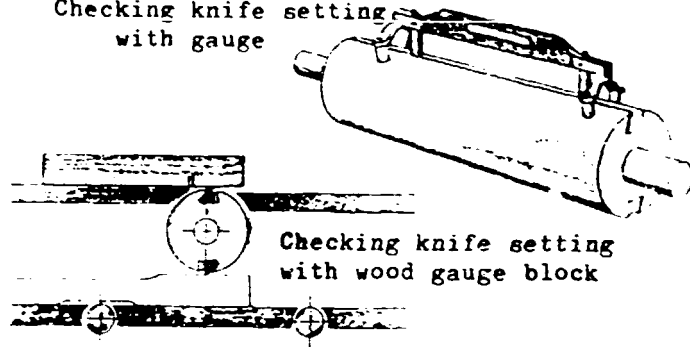
Table Rollers
(Dimensions shown for guidance only)

1. Cutter block
2. Kickback fingers
3. Chip ejector opening
4. Pressure bars
5. Infeed roller
6. Outfeed roller

Changing and setting planer knives

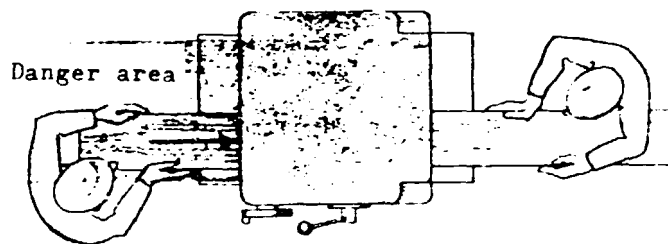
Make sure machine cannot accidentally be switched on. Loosen securing bolts and remove knife. Clean out mounting slot and degrease new knife and assemble. Set knife height by means of a setting block or gauge (maximum projection 1.1 mm). Follow manufacturers instructions for setting retaining and lock screws or alternatively start from the centre and work outwards to ends. After any change of knife or adjustments always test run and then retighten lock bolts again.

Checking knife setting with gauge



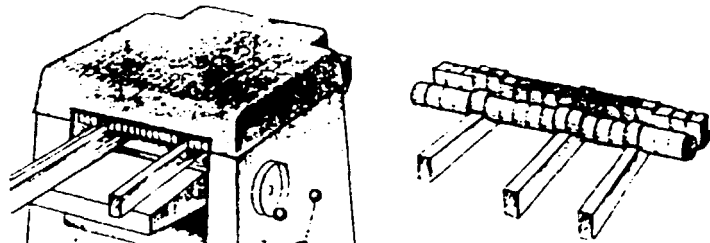
Operation

Wait for cutter block to attain full operating speed before use. Should any blockage or fault occur switch off feed units immediately. Do not try to remove any chips or splinters from the table whilst the machine is still running. Avoid surfacing very short pieces. Surface a longer piece for preference and then cut down to smaller sizes required. Operator position as shown.



Thickening narrower work pieces

Set table height for work piece thickness required. Choose and set appropriate feed speed. Always feed in two pieces together on machines having fixed infeed rollers and back pressure bars (position work pieces one near each end as shown). When machine is equipped with sectional top infeed rollers and sectional pressure bars more pieces can be fed in simultaneously.

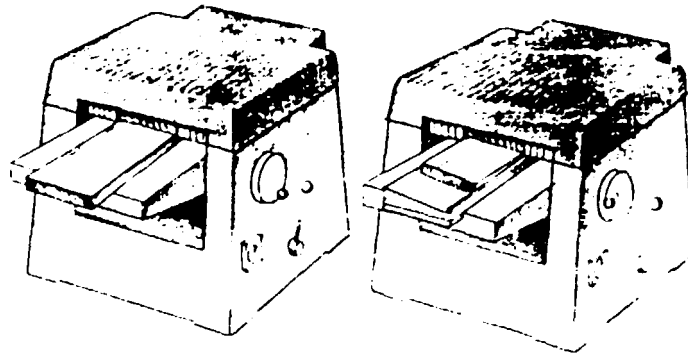


Action of sectional infeed rollers and sectional pressure bars

Kick back stop necessary in addition

Thickening wider work pieces

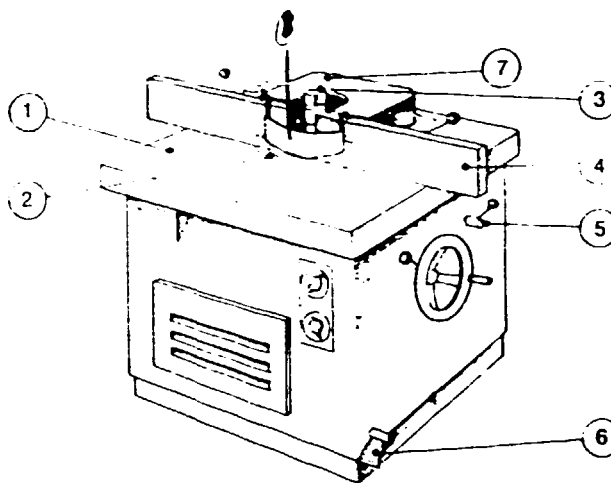
Set table height and feed speed. Remove any loose chips or knots before use. When thickening wedge shaped pieces ensure that the template used is safe and appropriate for the work piece concerned. Always begin with a low rate of removal.



13. Operating Spindle Moulders (shapers)

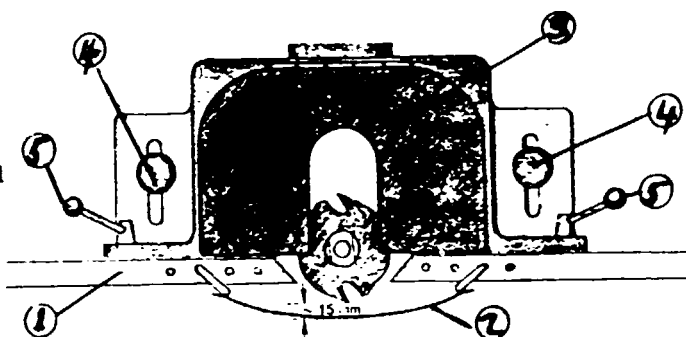
Constructional details

- (1) Adequate table surface
- (2) Inset rings to match table opening to cutter diameter (always keep opening as small as possible)
- (3) Spindle fitted with spacer rings and lock nut
- (4) Fence (make sure it can be securely locked in position)
- (5) Lever to lock spindle for tool change
- (6) Brake pedal to slow down and stop spindle
- (7) Rear safety hood cover
- (8) Front hand guard (deflector)



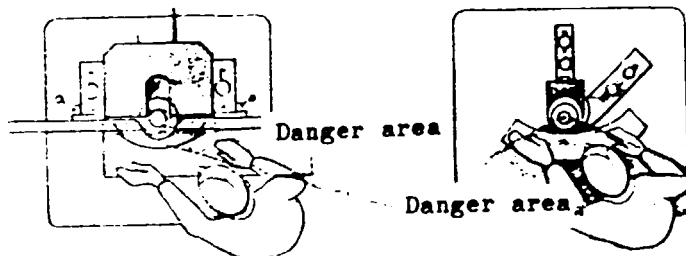
The fence

- (1) Fence parts bored with a series of holes for setting the front guard deflector adjusted according to tool diameter
- (2) Front hand guard deflector positioned as shown
- (4) Securing knobs to allow positioning and securing of fence to table
- (5) Securing levers to allow positioning of fence parts



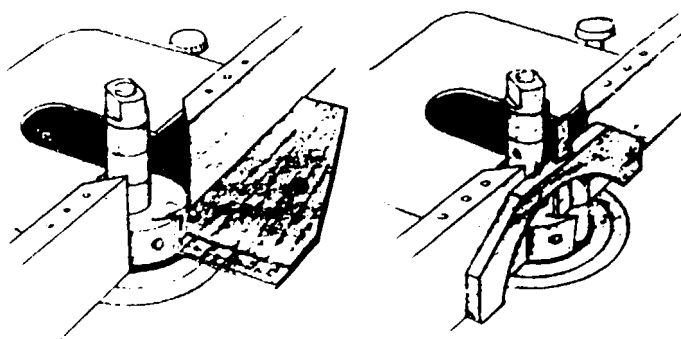
Operation

For straight feeding set the fence as in upper drawing. Make sure fence is securely clamped to avoid any danger of movement during cutting. Position fence parts as near as possible to the tool and lock. Lower the front hand guard deflector to work piece thickness. When contour shaping always cover over top of tool. Operator position and position of hands as shown.



Setting up the spindle moulder

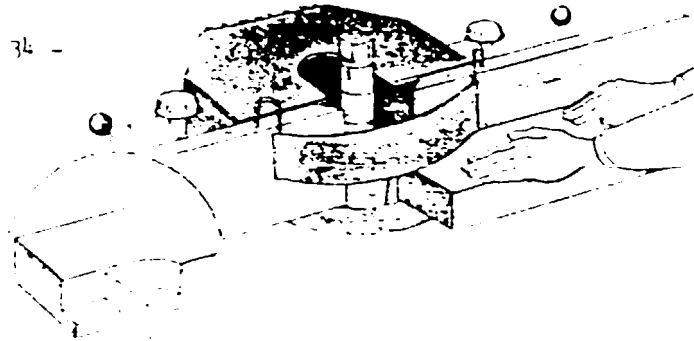
Make adjustments only on stopped machine. Use a measuring jig or gauge. Set depth of cut to suit the work. Close down table opening with insert rings to suit tool diameter. Position front hand guard deflector and close rear cover hood.



Moulding straight edges

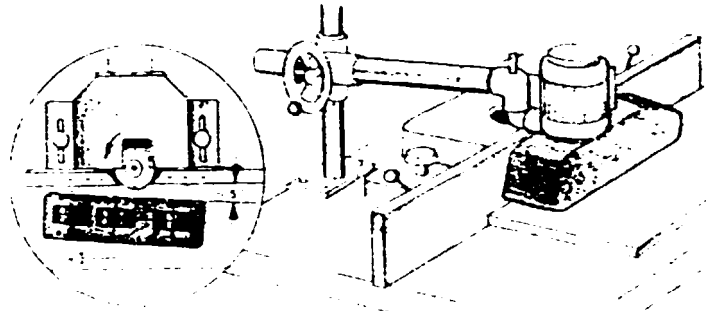
Cutting tool: choose appropriate chip gauge limited tool for hand feed.

Operation: use a sufficiently long piece for trial cuts and always start cutting from end of work piece. Avoid stopped recess cutting or fit a kick back stop appropriate to work piece. Never adjust fence position with machine running. Keep work piece firmly pressed against fence. Position hands to avoid necessity of changing hand position during cut.



Moulding with partial mechanical feed (feed attachment)

Cutting tool: choose appropriate tool for hand feed or partial mechanical feed. Operation: position and secure fence. Mount feed attachment slightly inclined to direction of feed towards the fence to ensure work piece is kept pressed against fence. Keep fence gap to a minimum. Keep mechanical feed attachment mounted close to the tool even when shaping wider work pieces as it acts as a protective cover. Make cutting test run also with the feed attachment.



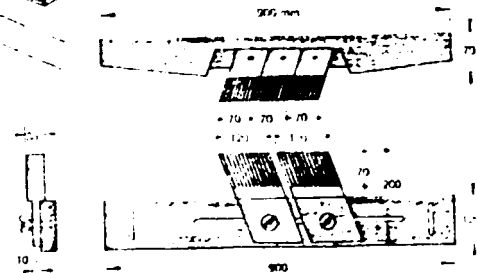
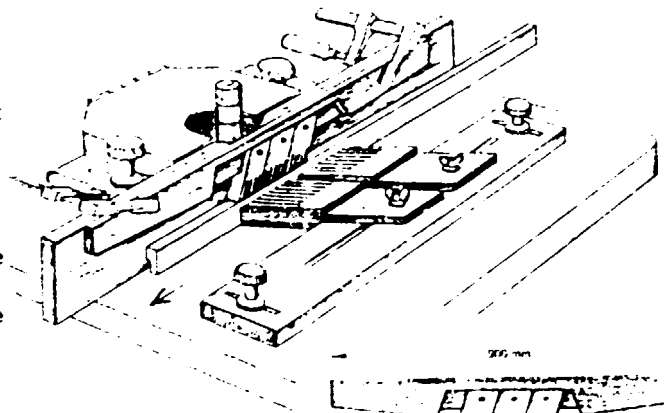
Moulding narrower work pieces

Cutting tool: choose appropriate tool for hand feed.

Operation: Adjust the tool and position fence as appropriate. Position and clamp comb guide fingers in place where they will firmly hold and guide work piece against cutting pressure.

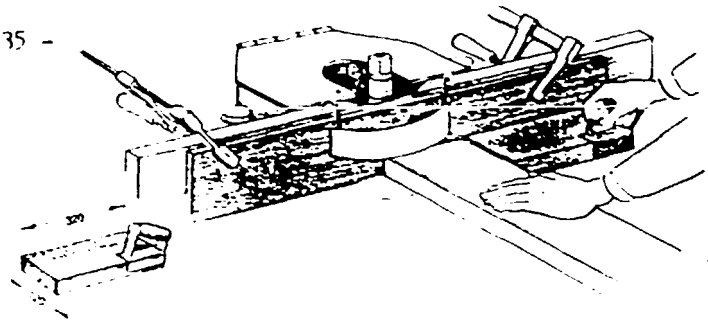
Always position comb pressure fingers where they will also act as an effective protection cover over the cutting area. When correctly mounted the comb pressure fingers will hinder the work piece being kicked back (in direction against arrow).

Comb: the comb can be made of hard wood the teeth are cut parallel to the direction of grip. Angle of teeth to work piece edge approx 70°.



Moulding ends
thinner work pieces

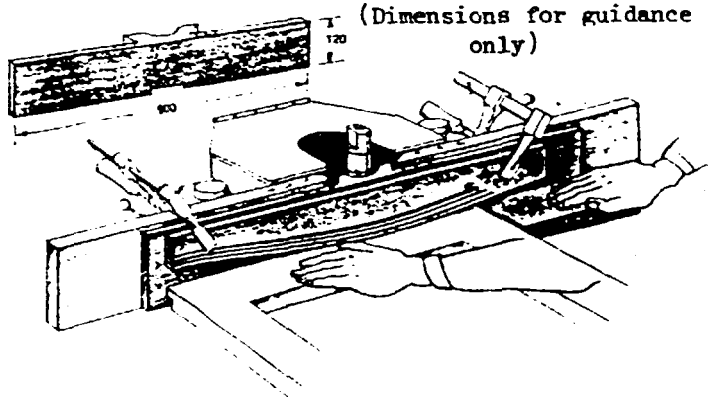
Cutting tool: choose an appropriate tool for hand feed operation.
Operation: attach an auxiliary guide block to the fence with dove tail slot in fence gap area. Position front cover deflector or bent pressure spring. Cut clearance in the auxiliary guide block stop, machine and set accurately for depth of cut required. Always use a pusher block to feed work piece and support larger pieces to avoid tipping.



(Dimensions for guidance only)

Moulding frames

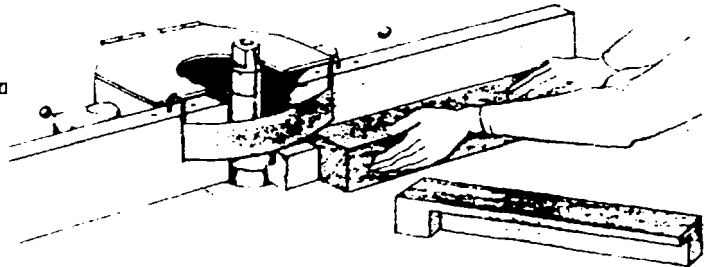
Cutting tool: choose an appropriate tool for hand feed operation.
Operation: attach an auxiliary guide block to fence. Use an arched pressure spring for preference as a front guard or else position front guard deflector to cover top of cutting area. Feed in using pusher block to avoid tear out. Provide a support for longer frames which extend beyond the table.



(Dimensions for guidance only)

Moulding of work pieces with small cross section

Cutting tool: choose an appropriate tool for hand feed operation.
Operation: with machine stopped position fence parts as close as possible to the tool. Feed work piece only with a pusher block long enough to ensure proper grip for work piece. Pusher should be so proportioned to ensure it firmly holds the work piece against the table and fence whilst machining.



Setting up the spindle moulder

Careful preparation and setting up of machine saves time in the end and is an essential for safe operation.

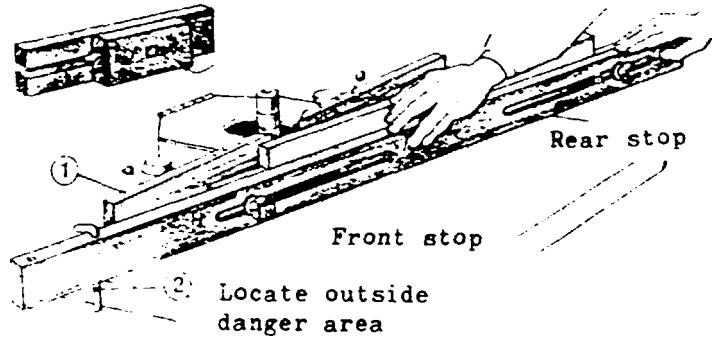
- (1) When choosing tool consider (feed method, work piece material etc).
- (2) Check tool, make sure it is tight on the spindle (also ensure that knife faces are clean and no damage to cutting edges, etc.).
- (3) Set RPM to suit tool and work piece.
- (4) Set cutting height and depth with stopped machine.

- (5) Position and tighten fence parts and protection covers to suit work to be done.
- (6) To ensure safe operation check and tighten all connecting parts fixing knobs, levers (fence, protection covers, accessories, table extensions etc).
- (7) Do not test run without protection covers in position. Always fit a kick back stop for recess cutting.
- (8) Use ear muffs to protect ears in noisy areas.

Stopped cutting
shorter work pieces

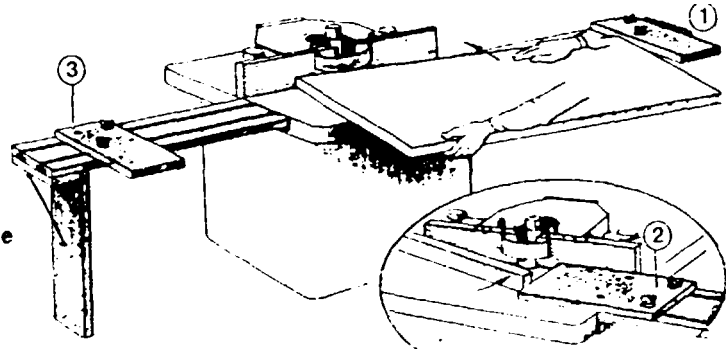
Cutting tool: choose an appropriate tool for hand feed.
Operation: set up the spindle moulder, use front hand guard deflector when cutting narrower pieces.
Fit work piece into appropriately dimensioned recessed pusher block. Set the pre-set stops in jig for correct length and position of cut. Make sure work piece is securely held in pusher block (steel spikes firmly imbedded in work piece). Position pusher block against left hand fence (1). Make sure securing pivot (2) of jig is firmly located, swing jig into position ensure both hands are kept well clear on the right hand side of the cutter as shown.

Adjustable stop to locate work piece



Stopped cutting
longer work pieces

Cutting tool: choose appropriate tool for hand feed.
Operation: set up the spindle moulder use front hand guard deflector and table extension. Position right angled stops for start and finish positions of cut (1) and (3). Position work piece as shown and drop in to cut.

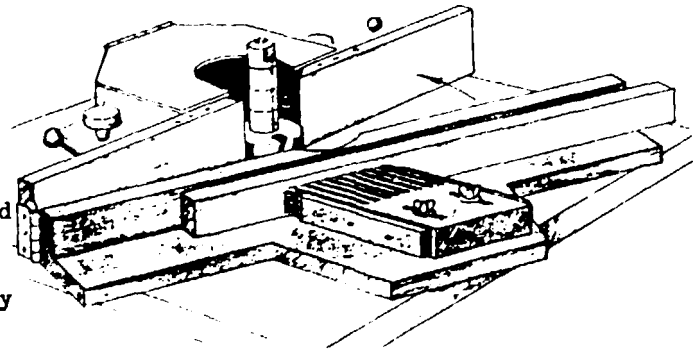


Fitting right angled stops to table extensions.

- (1) Position for longer work pieces.
- (2) Position for shorter work pieces.

Stopped cutting
longer thinner work pieces

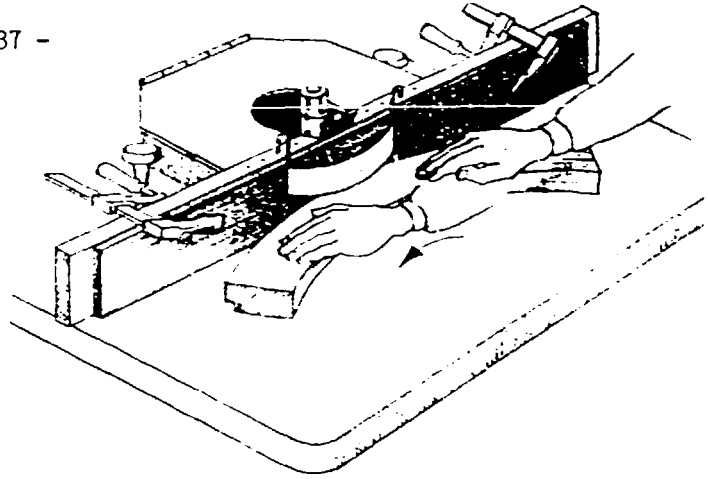
Cutting tool: choose appropriate tool for hand feed.
Operation: set up the spindle moulder and the hinged jig, mark the cutting centre on the jig arm and on work piece. Position work piece as shown with jig arm swung out, align cutting marks, swing jig arm in to cut, feed work piece forward to end of cut required then swing jig arm out again to remove work piece. Ensure jig is firmly held at hinge. The pressure comb must securely hold the work piece in position whilst cutting without danger of slipping. Use a comb with steel springs on ends.



Outside contour shaping

Cutting tool: choose appropriate tool for hand feed.

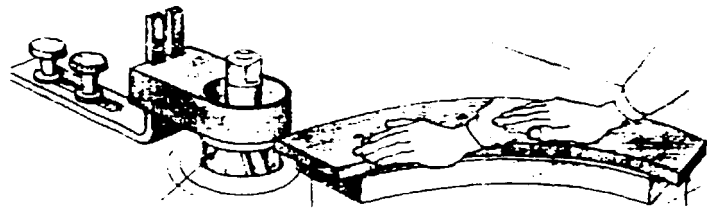
Operation: set up spindle moulder, fit auxiliary guide board to fence and clamp firmly in position, fit front deflector. Mark the centre of deepest cut on the auxiliary board to keep work piece pressed to this point whilst cutting.



Contour shaping using a template

Cutting tool: choose appropriate tool for hand feed.

Operation: fix a guide roller on top of the tool where it will safely guide the template. Fix a ring guard with a sturdy bracket firmly above and centred over the guide roller. The ring guard should extend some 15 mm beyond the tool circumference. Place the template overhang end against shaping collar and slowly approach beginning of cut then feed steadily on round cut pressing and guiding on the collar. When cutting against the grain proceed by turn over.



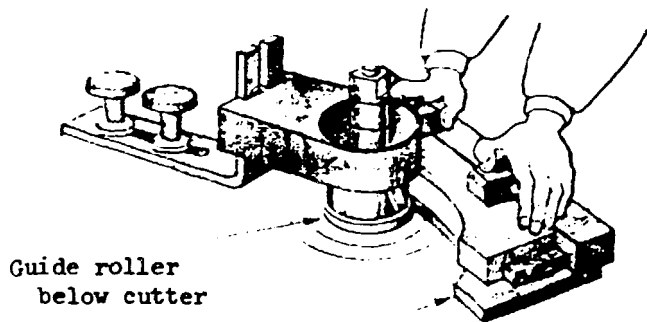
Guide troller on top of cutter

Template Overhang

Contour shaping using a clamping template

Cutting tool: choose appropriate tool for hand feed.

Operation: fit guide roller below the tool. Position suitable size of ring guard over tool securely. Set work piece in the template and clamp securely. Bring template overhang to bear on roller and feed in to cut steadily. Turn work piece over when cutting against grain. Place hands on the template well away from the cutting area. When template is needed for long runs it can be fitted with quick release toggle clamps for securing work pieces.



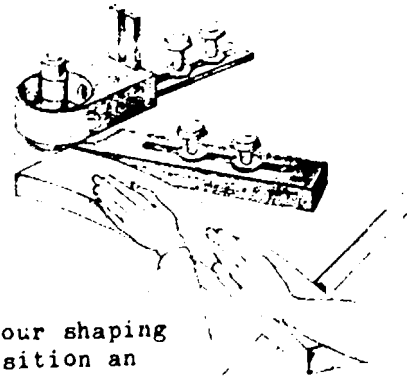
Guide roller below cutter

Template Overhang

Contour shaping (work piece guided on guide ring)

Cutting tool: choose appropriate tool for hand feed.

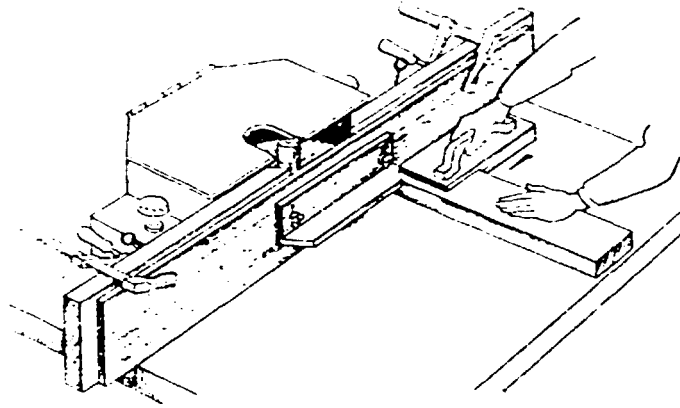
Operation: firmly position turn locked guard ring over tool. Position guide block with two bolts and with its point bearing on the guide ring stopping it turning. Feed work piece along guide block to guide ring and start cut firmly keeping work piece pressed against ring.



When contour shaping always position an adequate protection over tool. Use additional ring guard if necessary.

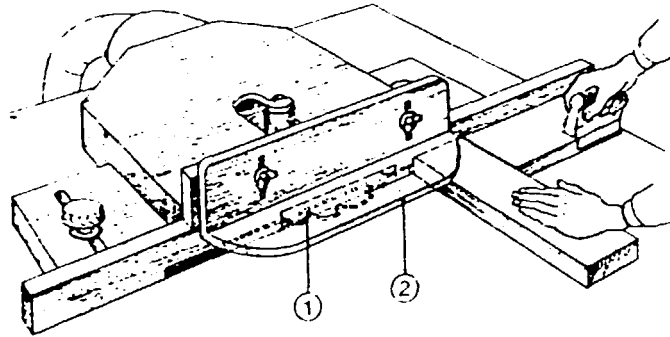
Tenoning with saw blade

Cutting tool: choose a saw blade with wide tooth pitch preferably with chip gauge limitation.
Operation: position a guide board along fence firmly clamped and also a suitable front guard deflector or a right angled guard whose height can be adjusted as shown. Use a pusher block to feed work piece and apply pressure on to table.
The guide board along the fence must provide continuous guidance.



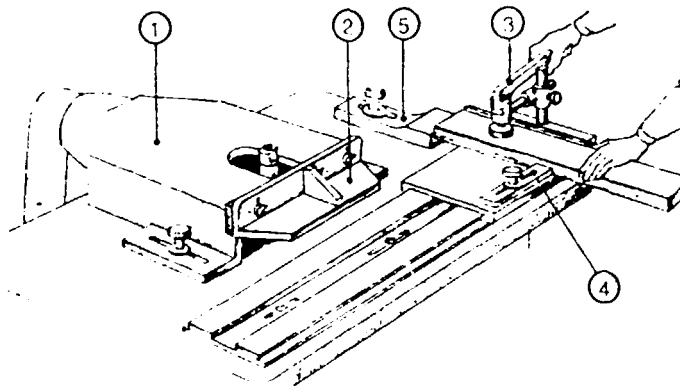
Tenoning with saw blade

Cutting tool: choose a saw blade with wide tooth pitch preferably with chip gauge limitation.
Operation: fix appropriate protection cover for larger saw blades as shown. The fence or guide on the safety box must provide continuous guidance. This can be by means of a lower guide rail (1) Mount an angle piece (2) as front guard and set to appropriate height for work piece thickness.



Tenoning with tenoning disc

Cutting tool: choose a tool designed for hand feed or partial mechanical feed.
Operation: the work piece should be firmly clamped on work piece slide (partial mechanical feed). The tool carrying spindle must be sturdy (loose spindle diam 40 mm or with counter bearing 30 mm diameter). Fix appropriate cover hood for cutting tool (1), with angle guide (2). Firmly clamp (3) work piece using a side stop (4) against turning. Keep hands on clamp lever during cut to prevent accidental loosening. Mount block (5) on table to correctly position work piece before clamping.

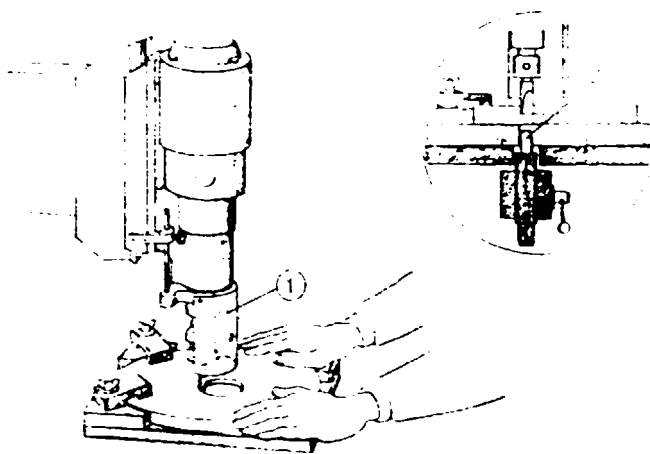


14. Operating routers

Safety attachments

Correctly position protection covers (deflector, brush ring, spring loaded ring) (1) Protection covers which also protect the cutting area whilst machining are much to be preferred.

Feed work piece or template against pre-positioned guide or the copying pin (2) which should be set to suit template thickness. Set protection cover to template height. Switch on and lower router to cutting position, avoid up milling when feeding. Hold work piece or template firmly keeping hands clear of cutting area.



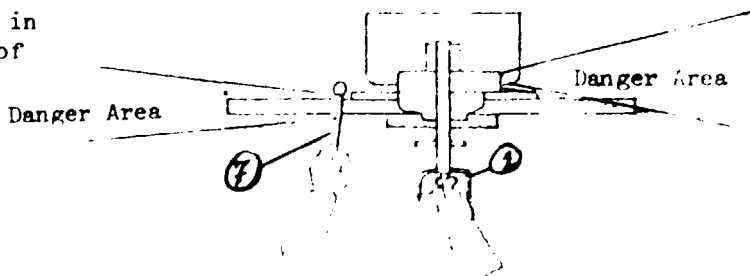
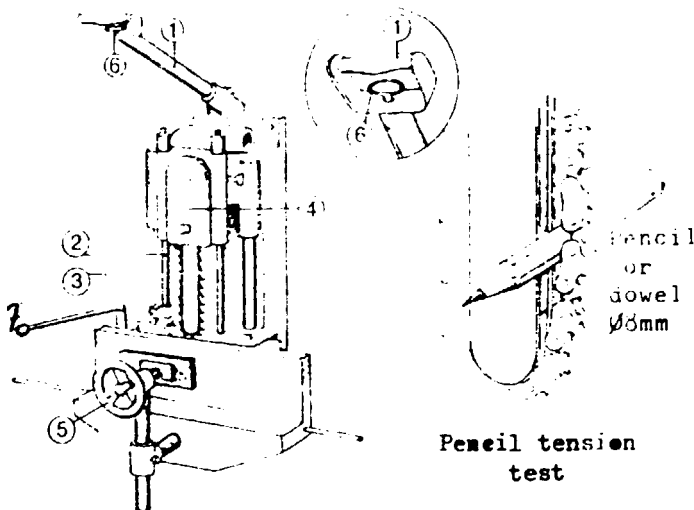
15. Operating chain mortising machines

Constructional details

- (1) Lever for lowering mortising head
- (2) Adjustable protection rods with chip breaker (3) mounted on rod on chip throwing side
- (4) Enclosure over chain drive head
- (5) Work piece clamp
- (6) Safety switch to avoid unintentional start when lever (1) is used to maintain operation.
- (7) Slide lever

Operation:

Check chain tension. (see picture). Firmly clamp work piece in position. Check to see that protection rods move freely and set them for work piece height. With right hand on lever handle (1) lower to cut and feed work piece with left hand as required with lever (7). When machine is in operation keep hands well clear of work piece.



16. Operating Belt Sanders

Constructional details

Machines built upto 1979

The outside parts of pulley rims must be covered and spoked wheels enclosed. Table travel must be restricted to ensure guide hand rail remains clear of belt edges at the full extremity of table travel.

Dust exhaust facilities must be provided.

Machines built after 1980

The sanding belt is fully enclosed its return length and over the pulleys right up to the working area.

Attachments must be fitted or provision made to avoid any danger of injury from the belt edges (limited travel of table, pressure pad, sanding pad guide). Dust exhaust facilities must be provided.

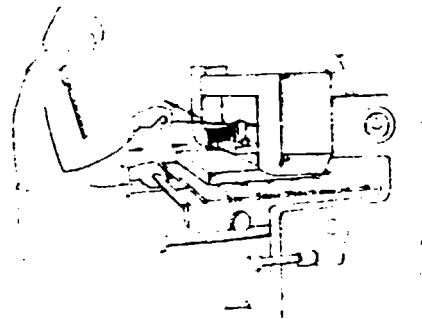
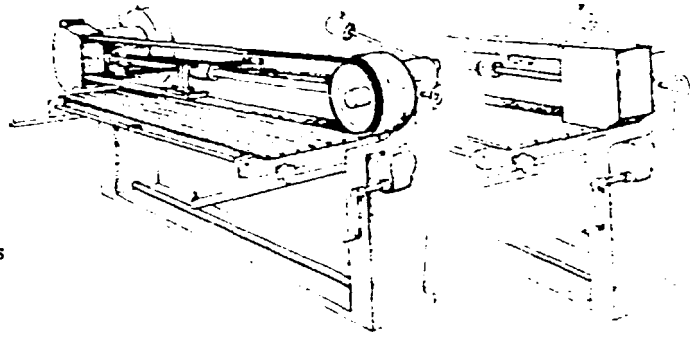
Operation

Position table height for thickness of work piece to be sanded.

Sand preferentially near the dust collector end whenever possible particularly with short pieces.

Remove and replace damaged sanding belts without delay.

Regularly check belt tension. Clean out regularly any accumulated dust from machine.



17. Operating Cross Cut Saws

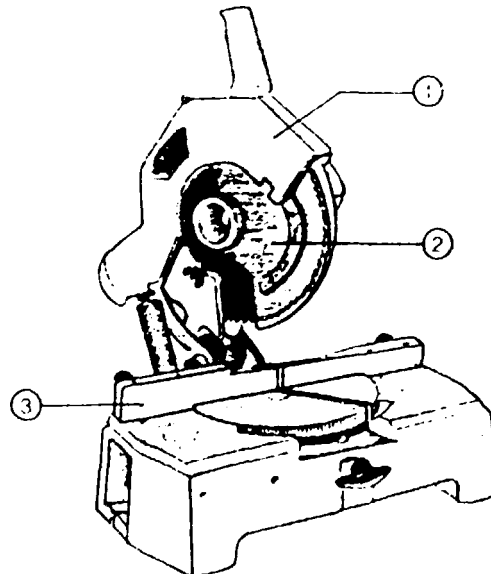
Constructional details

- (1) Integral enclosure of unit and saw blade up to its maximum cutting depth.
- (2) Sliding saw blade guard with safety catch to secure guard in rest position.

Machines produced after 1980 should be provided with means of automatic return of saw head to its rest position after use where it is locked.

Operation

Check and set fence parts (3) open to smallest possible safe clearance particularly when cutting strips or battens. Set mitre angle place work piece firmly against fence, hold with right hand well clear of cutting area firmly against table and fence and lower saw unit into cutting position with the left.



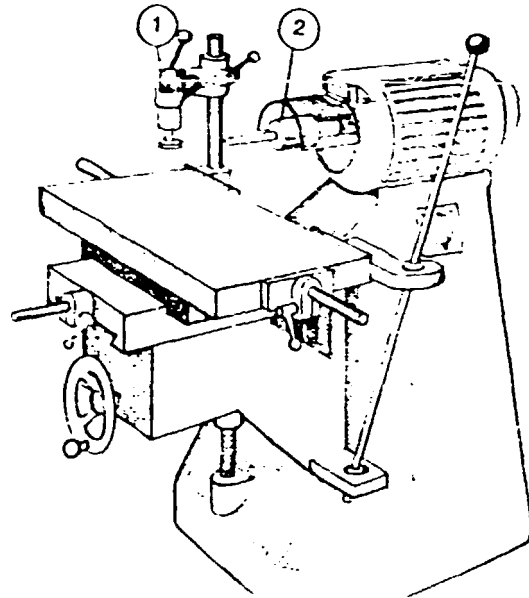
18. Operating boring machines

Constructional details of slot mortising machines

- (1) Work piece clamping attachment
- (2) Hinged flap cover for chuck

Operation

Clamp work piece securely
Adjust table height and limit stops for table movement
Adjust boring depth on machines with travelling boring unit
Bore smoothly step depth by step depth



Drill press

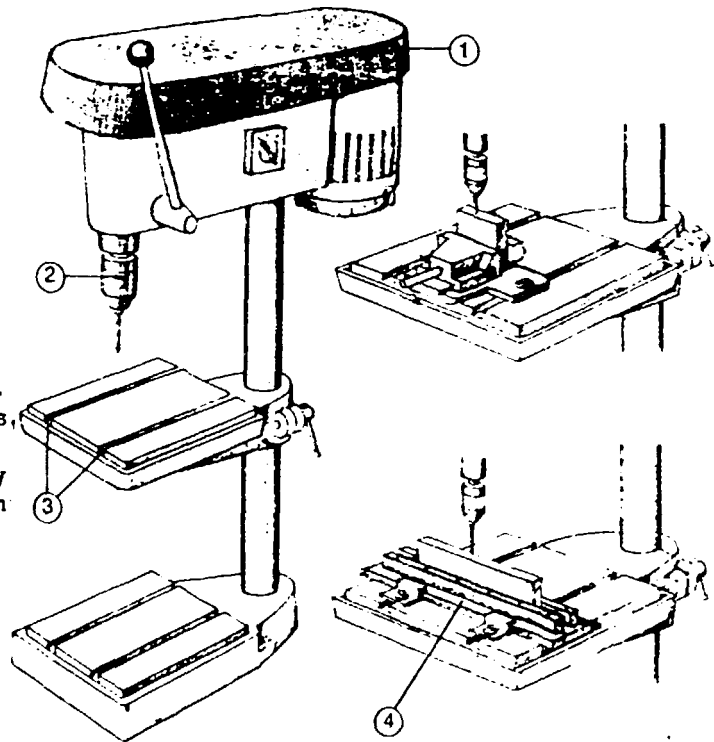
- (1) Drive mechanism enclosure
- (2) Drill chuck (quill) Tool chucks with protruding parts must be equipped with additional slots or other covers.

The work table must be equipped with means for mounting and securing work pieces (3).

Large open pulleys and drive belts (on older machines) must be enclosed with additional protection covers.

Operation

Place work piece on table and firmly secure against turning. Smaller pieces can be held in machine vice (secure vice to table with at least two bolts). For the drilling of a series of holes in line use drill template firmly clamped to table (4). Remove rings, wristwatches from hands, wear close fitting clothing. Wear a cap or hair net to keep hair safely away from any danger of getting caught up in rotating parts. When drilling brittle material use goggles.



19. Operating power tools

Constructional details

Power tools must be provided with means for rapid switch off without need to release hand grip.

Operation

Check cable and plug. Lay cable clear of any obstructions or danger of damage and where it is not likely to be tripped over.

Position work piece firmly on suitable support ensuring it will not move about when working pressure is applied.

Check any safety and switching provisions before use.

Use both hands whenever possible to hold and guide machine. Where appropriate fix extra handle (provided for the purpose on many power drills).

Switch on machine only in work position, before placing machine aside disconnect from mains.

Use only the machines own on-off switch and never the plug as a switching device. After use switch off immediately, wait for the machine to come to a complete stop, place it securely aside where there is no danger of its tilting over or falling. Make sure machine is disconnected from mains before changing tools, servicing, maintenance or setting up machine accessories.

All hand held machines should be regularly checked and maintained by skilled technicians.

The proper protection covers etc designed specifically for the purpose must in all cases be fitted to machines in accordance with the use they are intended for (drilling, boring, sawing, routing).

Hand held machines when used as stationary machines (built in or mounted on stands or tables etc) should be equipped with the recommended safety measures appropriate to stationary machines.

Sabre saws(jig saws)

Constructional details

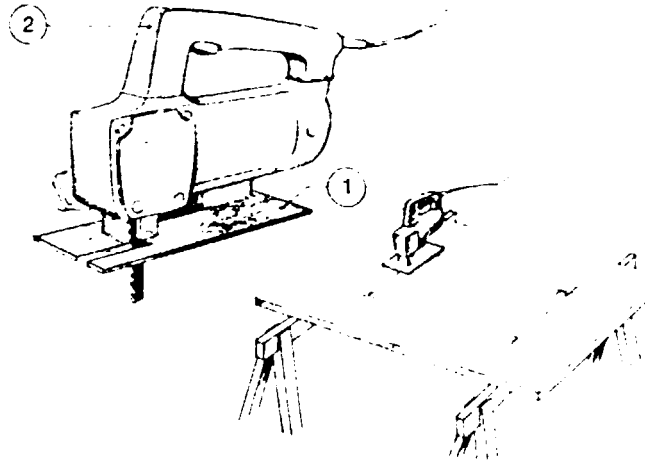
- (1) Large substantial guide plate
- (2) Hand grip with on-off trigger

Operation

Position work piece and secure against movement during cutting. For inset cuts a starting hole should preferably be drilled in advance.

Do not hold work piece near cutting area

Position machine in starting position before switching on.



Hand router

Constructional details

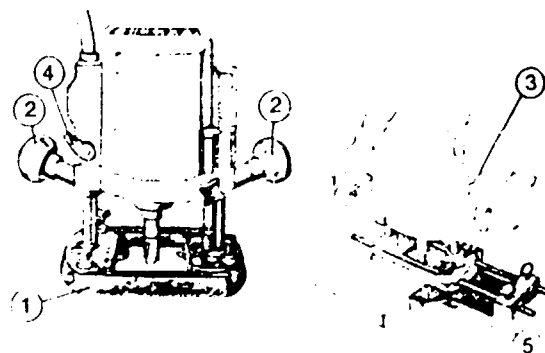
- (1) Machine guide frame
- (2) Hand grips
- (3) On-off switch within easy reach of grip
- (4) Release lever automatic safety catch for guide frame

Operation

Choose and fit appropriate bits and set depth of cut.

Use a jig to guide the machine safely (5).

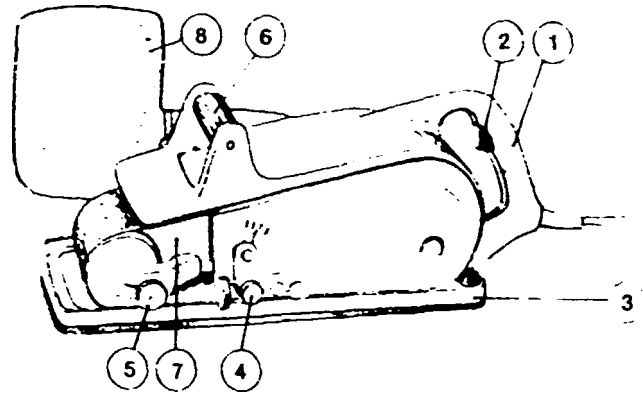
Position work piece conveniently for routing and clamp securely. When using a template secure it firmly.



Hand held belt sanders

Constructional details

- (1) Hand grip with built in on-off switch (2)
- (3) Machine frame with brush rim
- (4) Sanding belt tensioner
- (5) Roller guide adjustment to centre sanding belt run
- (6) Guiding grip
- (7) Belt protection cover
- (8) Dust collecting bag

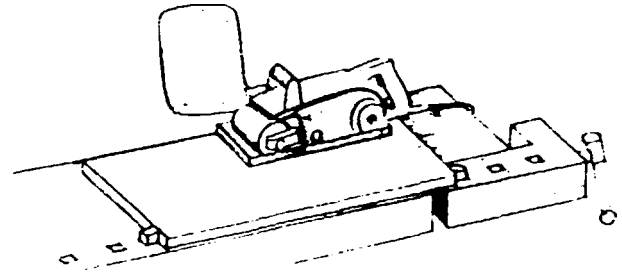


Operation

Check electrical cable and fittings.
Check sanding belt tension and true running.

Use both hands to hold and guide machine.

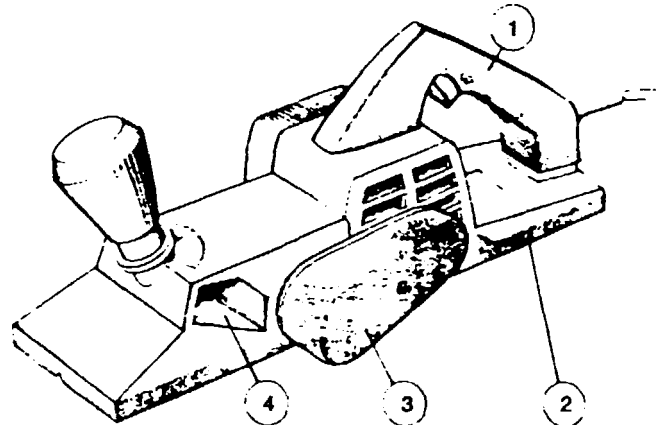
Ensure work piece is securely held in position before using machine.



Hand held planer

Constructional details

- (1) Hand grip with built in on-off switch.
 - (2) Machine guide plates with lips (maximum lip gap to cutter knife circumference 5 mm)
 - (3) Drive mechanism enclosure.
 - (4) Chip ejector exit
- On machines built after 1980 the chip ejector exit must be secure to inadvertant access (fingers, Touch).

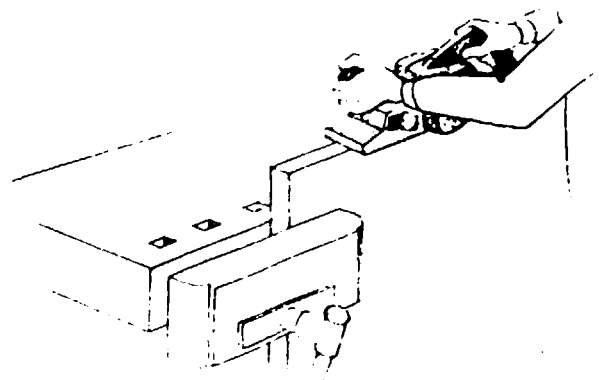


Operation

Check and set the table position for cutting depth required. Securely clamp work piece.

Position machine on work piece before switching on.

Immediately after use switch off machine
Make sure machine comes to a complete stop before putting aside.



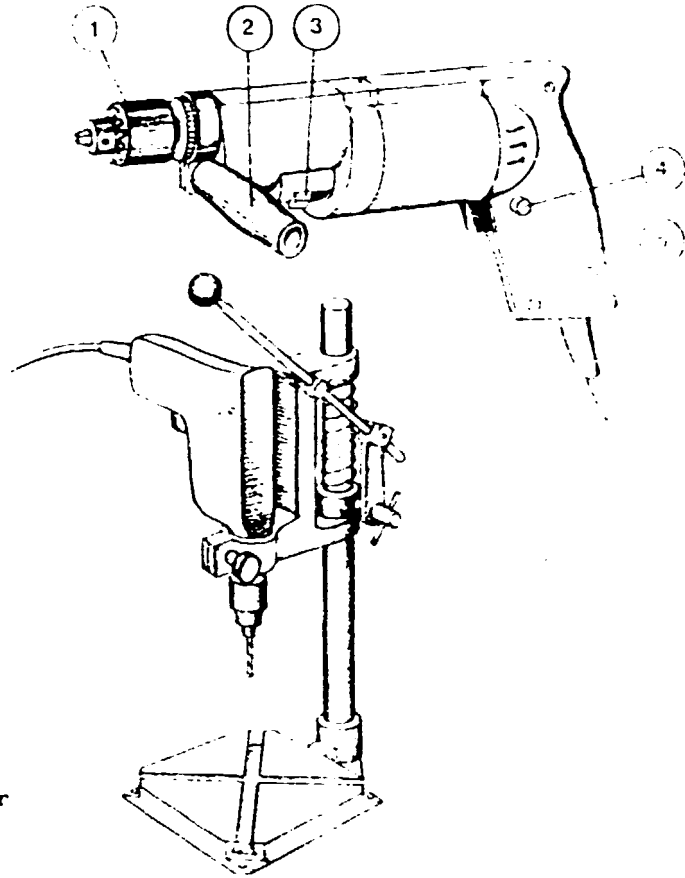
Power drills

Constructional details

- (1) Chuck. Chucks used on hand held machines must not have any protrusions
- (2) Steadying grip (positionable to suit application)
- (3) Speed setting knob
- (4) Trigger lock
- (5) Trigger

Operation

Choose appropriate bit to suit material of work piece.
When working on brittle materials or overhead always use goggles.
Position grip (2) to suit working conditions.
Secure or clamp smaller work pieces before drilling against turning.
Whenever possible use a fixed depth bore stop (stops mounted on the chuck rotating with the drill can cause additional reel effect).
Use drill stand for preference whenever possible.



20. Precautions against danger near moving machine parts or work pieces.

Dangerously exposed parts on power driven machines can cause squeeze, sheer, cut press, push, catch, crush, etc. effects. To minimize the risks of any accidental contact with such parts of machines they must be enclosed or covered where possible or guarded so as to avoid risk of inadvertently touching them.

General principles

Machine tools and other power driven machine parts must be protected from the risk of accidental contact by means of enclosures, covers, guards, deflectors or automatic switch off facilities.

Enclosure

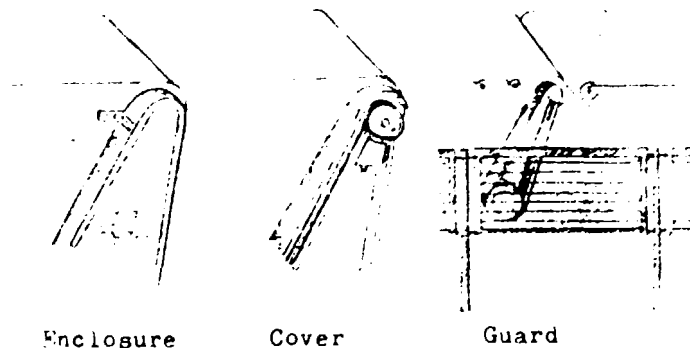
Safety enclosure device positioned directly over the dangerous area which on its own or with other parts completely encloses the dangerous area closing it off from reach.

Cover

Safety device positioned directly over the dangerous area and which covers off the dangerous area from reach from the side covered.

Guard

Safety device provided in the form of a fence or railings to close off dangerous parts from reach.



Enclosure

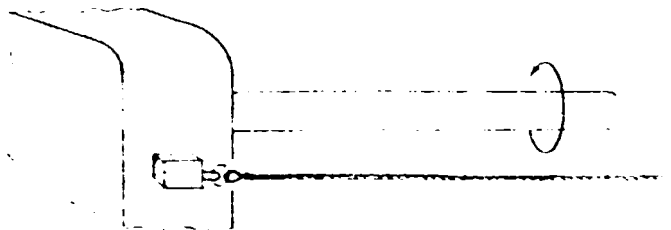
Cover

Guard

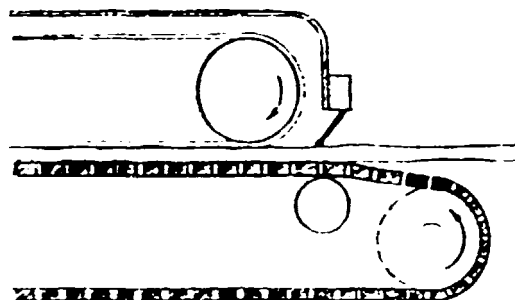
Protection devices on in feed units

Where none of the previously mentioned and illustrated methods can be applied means should be provided to stop the moving parts before one can approach too closely. examples

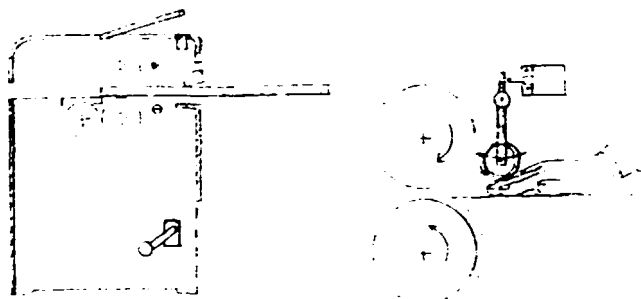
Danger trip switch fitted with rip cord and positioned in front of drive shaft of multi-purpose machines. The emergency trip switch must switch machine off whenever the rip cord is either extended or broken. The rip cord must be so positioned as to effectively protect the entire length of the danger zone.



Trip switch fitted to infeed side of mechanical systems.



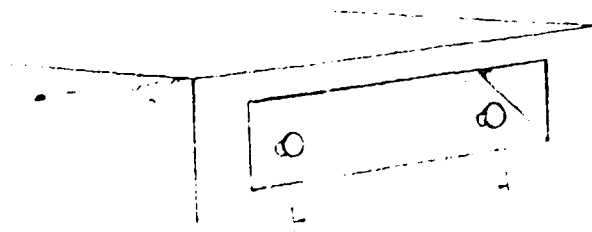
Trip bar extending the full length of infeed position on spreading machines. The trip is actuated only when any unusual movement or intrusion pushes against it, it will then immediately switch off machine. Once the trip is operated it will not be possible to restart the machine by just removing the obstacle or resetting the trip alone.

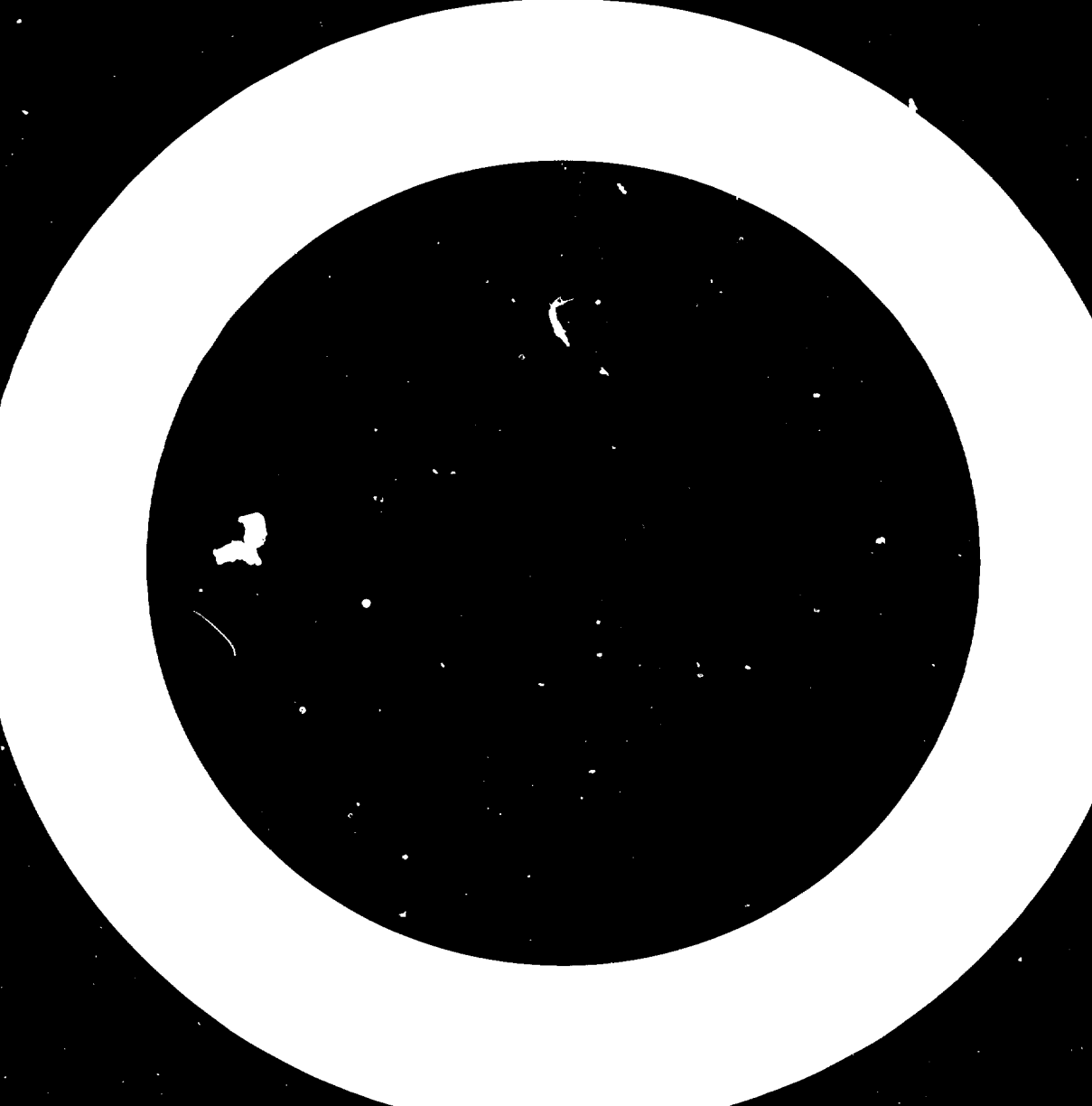


Safety two hand operated controls

In specific cases, where a danger to the operator still exists despite other safety measures, additional safety can be achieved by using two hand controls. This requires that both hands are on the controls to start the machine thus ensuring that they are clear of any danger area.

Two hand controls must meet the following conditions:
The control buttons must be positioned well clear of the danger area and be of a non latching self release type.
They should also be spaced far enough apart to make sure that both hands are used.
Should either button be released the machine should be temporarily switched off.
To switch on again both control buttons must first be returned to their rest position.

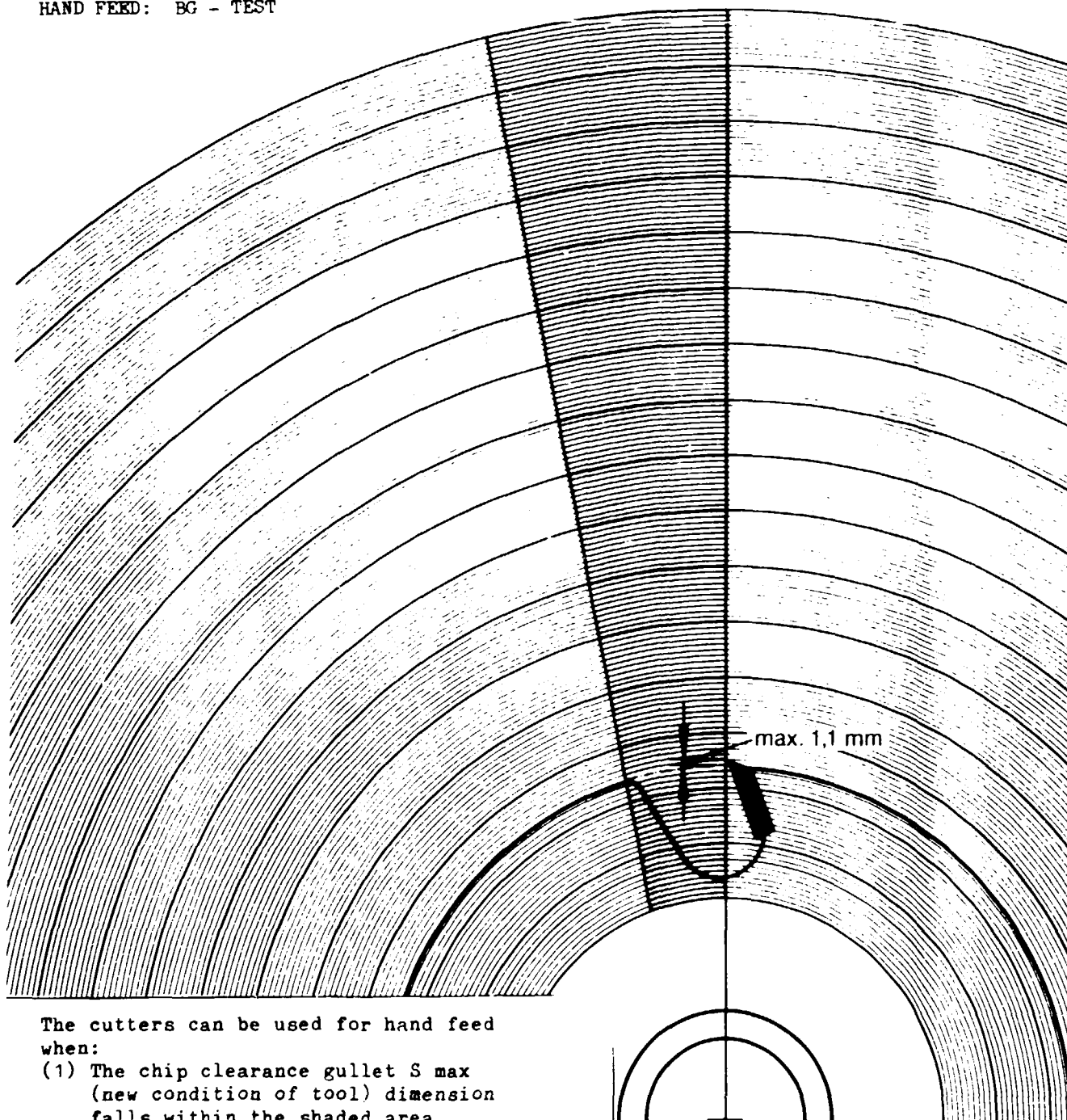




Template for Checking Milling Tools

ANNEX 1

HAND FEED: BG - TEST

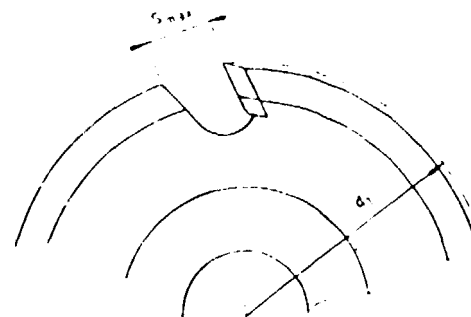


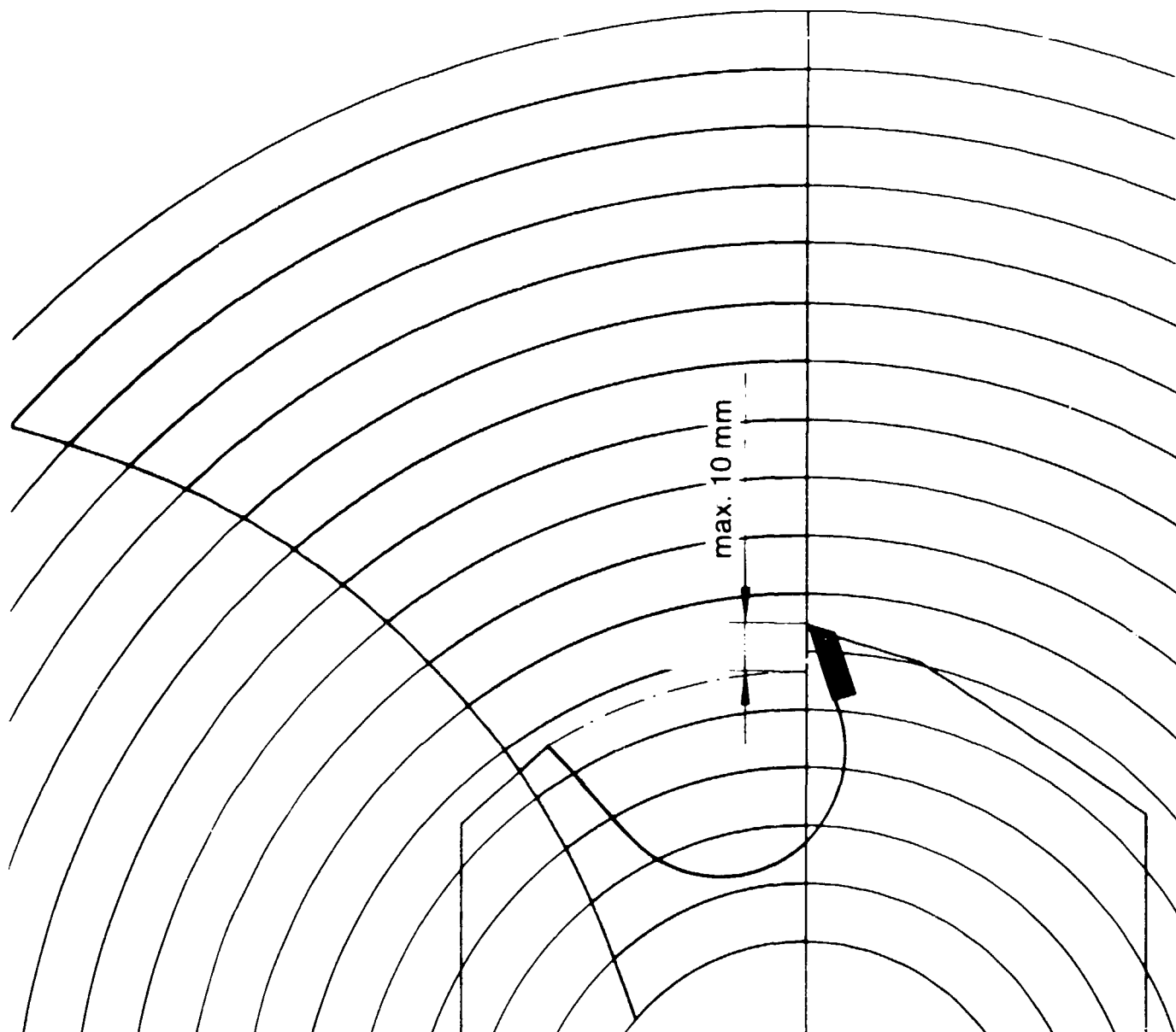
The cutters can be used for hand feed when:

- (1) The chip clearance gullet S_{max} (new condition of tool) dimension falls within the shaded area and:
- (2) The cutting edge protrusion does not exceed 1.1 mm beyond the tool diameter.

Cutting tools exceeding these limits must only be used with mechanical feeders or if appropriate with partial mechanical feed attachments.

Note: The S_{max} dimension of the gullet on profiled tools is measured from the largest cutting diameter d_1 as shown.





The cutters can be used for partial mechanical feed (with feed attachment on slide, etc.) when:

- (1) The chip clearance gullet S_{max} (new condition of tool) dimension falls inside the shaded area and;
- (2) The cutting edge protrusion does not exceed 10 mm beyond the tool body diameter.

Cutting tools exceeding these limits must only be used with mechanical systems.

Note: The S_{max} dimension of the gullet on profiled tools is measured from the smallest cutting diameter d_1 as shown.

