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1 INTRODUCTION

1.1 MACHINE DESCRIPTION

Vertical single shaft milling machine, for machining wooden pieces by chip removal with rotary tool installed on the shaft.

The machine has manual feeding, with a single vertical shaft, which can be fixed or interchangeable, with fixed position during the machining and a horizontal supporting plane, fixed during the machining. The shaft passes through the plane, and the driving motor is positioned below. The machine can have one or more of the following configurations:

- the possibility of choosing up to 5 rotation speeds for the tools depending on their diameter and type of machining to be made;
- the possibility of adjusting the shaft in vertical position through the plane;
- the possibility of increasing the supporting surface by adding additional planes;
- motor direct starting by push button;
- the reversal of the shaft rotation direction;
- possibility of installing the interchangeable spindle.

1.2 CONFORMITY

The machine has been planned and built according to the norms ANSI 01.1: April 1991 SAFETY REQUIREMENTS FOR WOODWORKING MACHINERY.
1.3 MACHINE IDENTIFICATION

1.3.1 Machine identification

The machine is identified by the writings shown on the plate (Fig. 1) placed on the basement as indicated in Fig. 2.

Fig. 1: Machine identification plate.

Fig. 2: Position of the identification plate

1.3.2 Correspondence

When communicating with the Dealer or the Technical Service Center or the Manufacturer, for any reason concerning the machine, always refer to the following data:
• Machine model
• Machine serial number
• Manufacturing year

1.3.3 Service recommendations

When preparing this instruction handbook, all the operations involved in the routine maintenance have been considered.

We recommend you not to make any repair or intervention not indicated in this handbook.

All the operations needing to remove some parts must be carried out by qualified and/or authorized technical staff.

Only skilled and trained staff is authorized, after having read this handbook, to use the machine and to carry out the maintenance operations.

As for technical problems for the Service, give the following information as well:

• Connection voltage
• Frequency
• Purchase date
• Detailed information on the possible found failure
• Detailed information on the special machining to be made
• Use period / operating hours
1.3.4 Final test report

The factors for the final test of the machine geometry are referred to the norm ISO 7009, and particularly:

<table>
<thead>
<tr>
<th>Machining table flatness</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal (A)</td>
<td>0.15 mm</td>
</tr>
<tr>
<td>Diagonal (A)</td>
<td>0.25 mm</td>
</tr>
<tr>
<td>Transversal (B)</td>
<td>0.15 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Longitudinal rectilinearity of the machining guide shoulders</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>0.40 mm</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.15 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parallelism of the machining guide shoulder planes</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>0.20 mm</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.05 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perpendicularity of the machining guide shoulders to the machining table</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood a=</td>
<td>0.20 mm</td>
</tr>
<tr>
<td>Aluminum a=</td>
<td>0.10 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radial swinging of the tool-holding shaft</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;pos.: a; 6000 min⁻¹</td>
<td>0.020 mm</td>
</tr>
<tr>
<td>&gt;pos.: b; 6000 min⁻¹</td>
<td>0.030 mm</td>
</tr>
<tr>
<td>$A_{\text{max}} = 200$ mm</td>
<td></td>
</tr>
<tr>
<td>Flatness of the tool supporting surface</td>
<td>Tolerance</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Perpendicularity of the tool-holding shaft to the machining table</td>
<td>Tolerance</td>
</tr>
<tr>
<td>Flatness of the spacer supporting plane</td>
<td>Tolerance</td>
</tr>
</tbody>
</table>

Seller's/dealer's stamp
2 WORKING SAFETY

2.1 GENERAL SAFETY RULES

The machine operator and the person in charge must read this instruction handbook carefully and completely before executing any operation on the machine.

Keep this handbook close to the machine.

The manufacturer is continuously improving the products, so some machine components may possibly change.

All the technical information in this handbook are exclusive property of the manufacturer and are strictly confidential.

Thus, it is forbidden to reproduce and disclose them, even partially, without a written authorization by the manufacturer.

It is also forbidden to use this handbook for purposes other than those strictly connected with the installation, use and maintenance.

For detailing shortly and clearly the operation, adjustments and other, some figures may show the machine without safety guards. DO NOT USE the system under these conditions, and in case of maintenance or repair interventions follow the indications in the chapter: MAINTENANCE.

2.1.1 Operator training

It is extremely important that all the operators are suitably trained in the use, adjustment and utilization of the machine.

Above all:

a) the principles for adjusting and using the machine, including a correct use and adjustment of the devices for guiding and holding the piece, guards and tools.

b) The tool correct selection for each operation.

c) The position of the hands with respect to the tool.
d) The safe piece handling while machining, following the recommendations for using templates and similar devices:
   • to use roller devices or extension tables when long pieces are machined.

e) The safe storage of pieces before and after the machining.

f) The correct adjustment of the safety devices.

g) To start the machining only when the tools have reached the operating speed.

h) The use of personal protections for the ears, eyes and lower limbs.

This machine has been designed and manufactured to give the user a suitable safety but, like all machines provided with cutting systems, it may cause dangerous situations due to incorrect use of the machine, lack of experience or tampering with the safety devices of the machine; therefore the operators should take these remarks into account and carefully follow the instructions given in this handbook about safety.

2.1.2 Safety plates

On the machine (Fig. 3) some safety plates, Table 1 have been installed to warn the operator about the residual risks on the machine, the suitable use of the working equipment and the safety measures that must be followed during the maintenance interventions.

![Fig. 3: Position of the safety plates](image)

Safety plates in English have been positioned on the machine. Plates in Spanish are supplied as well, to be positioned on the machine in case of need for the operator.
2.1.3 Symbols

Table 1: Safety plates

To point out the handbook sections concerning personal safety, the following symbols have been used in the USE AND MAINTENANCE operations of the machine:

**ATTENTION**
Information or procedure that, if not carefully followed, could cause death or serious personal injuries.

**CAUTION**
Information or procedure that, if not carefully followed, could cause light personal injuries or machine damages.

**ELECTRIC DANGER**
Information or procedure that, if not carefully followed, could cause death or serious personal injuries.

**WARNING**
Information or procedure that aids the operator in the best use of the machine or equipment, to lengthen their life, avoid damages or programming losses, optimize the work in compliance with safety norms.
NOTE
*Important information or procedure*

It is recommended to use the personal protection devices for the eyes.

It is recommended to use the personal protection devices for the ears.

It is recommended to use the personal protection devices for the hands.

It is recommended to use the personal protection devices for the lower limbs against the squeezing due to falling pieces during the operation.

### 2.2 MACHINE CORRECT AND IMPROPER USE

The machine can carry out milling operations (profiling and tenoning) on deadwood, veneered wood, plastic materials with features similar to wood.

Any other use or machining on a material other than the indicated ones (for example metals or materials with similar features) is forbidden, as it can be risky for the operator.

The manufacturer will not be responsible for damages or injuries to people and/or things caused by a use non-complying with the norms. The risk will exclusively be at the user’s charge.

This machine cannot operate in explosive environments.

### 2.2.1 Number and position of the working places

For a correct and safe use of the machine a single operator is expected, whose working place is located in front of the guard for the guide machining.
2.3 INDIVIDUAL RISK FACTORS

Some clothes or accessories worn by the operator can cause accidents. It is advisable to avoid wearing dangerous objects, such as: rings, watches, bracelets, large-sleeved overalls, not perfectly fastened belts, ties and, generally, anything sticking out of the person that may be grasped by a moving part of the machine during its operation: people with long hair should keep it gathered on the back of the neck, and possibly wear a cap.

People not belonging to the work place shall absolutely stay far off the operating machine.

2.4 ENVIRONMENTAL RISK FACTORS

The place of work must be properly illuminated.

The operations performed by the machine produce dust and, in general, the machine is in a place where other machines spread dust in the environment; to avoid dangerous dust concentrations it is necessary:

- to make a correct connection with the suction system;
- to periodically carry out the maintenance on the suction system filters;
- further, as the dust deposited on the floor generates danger conditions, it is necessary to carefully clean the place of work close to the machine periodically.

2.5 RISK FACTORS CONNECTED WITH THE MACHINE USE

- When the machine is connected to the mains, check the correspondence between the electrical features of the machine and those of the mains; it is also
advisable to check the correct grounding of the machine; these steps must be recalled to the specialized technician carrying out the electrical connection.

- Before carrying out any maintenance on the machine, switch and cut it off from power sources, set the main switch on zero and lock it.
- Machining pieces that are too small or too big for the machine capacity may cause a dangerous situation for the operator or the people near the machine; always compare the sizes of the pieces being machined with the max. and min. dimensions that the machine can work.
- Do not remove or change the protection devices to change the operating capacity of the machine.
- Be very careful when choosing and maintaining the tools.
- Never use cracked, strained or excessively worn tools, as their utilization impairs the machining quality and can involve risks for the people nearby the machine, as well as further increase the machine noise.
- Always wear gloves when handling the tools; refer to the data in the handbook for the knife locking and projecting, as well as for the best adjustment of the knife locking screws.
- A correct maintenance will ensure higher working safety as well as a constant quality level of the machining.
- The protection devices must be regularly checked for their operation, for example before every working shift.

2.6 PROTECTION AND SAFETY DEVICES

The machine is equipped with the following protection and safety devices:
Fig. 5: Protection and safety devices

a) emergency push button
b) lockable main switch
c) self-braking motor with intervention lower than 10 s;
d) interlocked front cover; it stops the spindle rotation when opened
e) guard interlock micro-switch
f) machining guide
g) guard - chip conveyor for the guide machining
h) machining guide upper cover
i) front guard for the guide machining
j) upper cover locking pin
k) adjustable shoulders for the machining guide.

It is important to check the correct operation of the safety and protection devices as indicated in § 5.1.1.
2.7 RESIDUAL RISKS

Even with the guards installed and operating correctly, the machine can originate the following residual risks:

- breaking of a tool while machining;
- breaking of the piece being machined;
- electric shock;
- noise exposure, above all if the indicated personal protection devices are not used;
- emission of dust, above all if the suction system is not correctly connected and maintained.

2.8 ENVIRONMENTAL SAFETY

2.8.1 Noise emission

The operating conditions for measuring the noise meet the enclosure D of ISO 7960: 1995.

The acoustic power levels have been measured according to the measuring method using the developed surface shown in EN ISO 3746: 1995.

The acoustic emission pressure level at the operator's seat has been measured according to EN ISO 11202: 1996.

<table>
<thead>
<tr>
<th></th>
<th>T120C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Empty without suction</td>
</tr>
<tr>
<td></td>
<td>Operating with suction</td>
</tr>
<tr>
<td>Emitted acoustic power</td>
<td>86.1</td>
</tr>
<tr>
<td>level dB(A)</td>
<td>90.0</td>
</tr>
<tr>
<td>Acoustic pressure level</td>
<td>74.7</td>
</tr>
<tr>
<td>in the working place dB(A)</td>
<td>80.0</td>
</tr>
</tbody>
</table>

Inaccuracy constant of the measurement \( K = 4 \) dB.

The reported noise levels are referred to "free field" conditions, in compliance with the test methods expected in the reference norm, EN 848-1: 1998.

The reported noise levels are emission levels and do not represent safe operation levels. Although there is a relation between emission levels and exposure levels, this cannot be reliable for stating whether further precautions are needed or not. The factors determining the exposure level of the work staff include exposure time, features of the working place, other noise sources, etc…, i.e. the number of machines and other adjacent processes. The allowed exposure levels may be different depending on the country, too. However, this information will allow the machine operator to better evaluate the danger and the risk.

Some factors reducing the exposure to noise are:
• correct choice of the tool
• correct choice of the feeding speed
• maintenance on the tools and on the machine
• correct use of the personal protection devices

2.8.2 Dust emission levels

The dust emission level in the place of work is $0.17 \text{(mg/m}^3 \text{ of air)}$.

2.8.3 Machine removal and demolition

For removing the machine, disconnect it from the power sources (e.g. electric system), clean it carefully and cover the machining tables and the tool-holding shafts with anti-rust agent. Do not store the machine in wet environment and protect it against weather agents.

2.8.4 Emergencies

In case of flooding of the room where the machine is located, immediately cut the power supply off. Before starting the work again, have the machine checked by a specialized technician.

In case of fire, immediately cut the machine off and intervene using suitable fire extinguishers, aiming the jets at the flame bottom. Even if the machine is not apparently damaged, before starting the work again, have the machine checked by a specialized technician.
3 MACHINE INSTALLATION

3.1 HANDLING - TRANSPORT - STORAGE

<table>
<thead>
<tr>
<th>Model</th>
<th>T120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight kg</td>
<td>550</td>
</tr>
</tbody>
</table>

*Table 2: Machine weight*

3.1.1 Lifting method

Use lifting means with min. capacity of 1,000 kg.

![Machine lifting with lift truck.](image)

*Fig. 6: Machine lifting with lift truck.*

*When using the lift truck, place some anti-slip material between the forks and the machine basement.*
When using lifting belts or ropes, they must have a suitable capacity and being positioned as indicated in Fig. 7; the machine parts touching the lifting means must be protected. The max. use load of a lifting rope, belt or chain corresponds to the max. lifting load only if the lifting means are perfectly vertical; in case of inclination, the max. lifting load is reduced according to the indications of Table 3.

<table>
<thead>
<tr>
<th>Angle $\alpha$</th>
<th>Load reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>- 15%</td>
</tr>
<tr>
<td>45°</td>
<td>- 30%</td>
</tr>
<tr>
<td>60°</td>
<td>- 50%</td>
</tr>
</tbody>
</table>

Table 3: Lifting load reduction

When the machine moves, do not stay in the manoeuvring area.

3.1.2 Storage

Do not leave the machine under bad weather conditions and grease all oxidizable parts if a long storage is expected, which must be in a dry place and at temperatures between 0°C and 50°C.
3.2 POSITIONING

3.2.1 Positioning and foundations

Place the machine on a reinforced concrete board with a thickness of about 150 mm, properly levelled and sized a little larger than the machine overall dimensions. It is not necessary to fasten the machine to the floor.

Make the machine stable by levelling it to the floor; in this way, it can be operated efficiently and accurately.

3.2.2 Min. spaces for a safe use

Before placing the machine check if the working area has a sufficient space for enabling its correct utilization.

Leave the area around the machine free from objects that may hinder the operator’s activity, for example scaffoldings or other fixed structures.

Fig. 8: Machine positioning

3.3 MACHINE PREPARATION FOR THE START-UP

3.3.1 Check of the machine possible damages

At the machine delivery check that there are no damages due to the transport; if there are any damages, immediately inform the forwarder or contact directly the seller and/or the manufacturer.
### 3.3.2 Machine installation

The machine is delivered with some details removed; they must be installed before starting the machine up:

- the upper cover (52) of the machining guard (57) at the guide; remove the supports (58) and fit them in the cover side pins, then fasten the supports together with the cover to the guard (57);
- the machining guard to the guide (57) must be fastened to the machine plane in the suitable holes by the levers (36 - 37);
- the shoulders supplied (27 - 28) with the guide: for each shoulder fit the pin (29) in one of the arranged holes and then in the slot on the guide, then tighten the release lever (23 - 24) on the pin and lock in the working position;
- the vertical pressing devices (59) positioned on the guide: fit the pin (60) in the support (61) and fasten by a screw;
- the horizontal pressing devices (62) positioned on the machine plane;
- fit the front guard (63) in the holes made in the shoulders (27 - 28);
- the suction conveyor (64), under the plane, to the base;

**Fig. 9: Installation of the removed parts**
3.3.3 Machine cleaning

Before starting to work, degrease carefully the working areas and the guards with a suitable and safe thinner.

3.4 MACHINE CONNECTION WITH THE POWER SOURCES

3.4.1 Connection with the electric system

All the operations concerning the electrical connection must be made by skilled personnel in compliance with the regulations in force.

Before any electrical connection, make sure the electric line is sized so as to stand the machine power, and check if the mains voltage and frequency correspond to the machine plate data (Fig. 6).

The machine can suit operating voltages included in a tolerance range of ± 5%, outside of which it is necessary to adjust the supply voltage.

To improve the electrical safety it is necessary to install a lockable switch with fast intervention fuses upstream the machine.

Refer to Table 4 for choosing the lead and fuse sizes to be used for the machine connection. If the machine distance from the power supply point is long, it is advisable to increase the lead section to reduce the voltage drops along the feeding line.

<table>
<thead>
<tr>
<th>Absorbed current (A)</th>
<th>Cable section (3 + T) mm²</th>
<th>Fuses Type AM</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 10</td>
<td>AWG 12</td>
<td>12 A</td>
</tr>
<tr>
<td>&gt; 10 ÷ 14</td>
<td>AWG 10</td>
<td>16 A</td>
</tr>
<tr>
<td>&gt; 14 ÷ 18</td>
<td>AWG 10</td>
<td>20 A</td>
</tr>
<tr>
<td>&gt; 18 ÷ 22</td>
<td>AWG 10</td>
<td>25 A</td>
</tr>
<tr>
<td>&gt; 22 ÷ 28</td>
<td>AWG 10</td>
<td>32 A</td>
</tr>
<tr>
<td>&gt; 28 ÷ 36</td>
<td>AWG 8</td>
<td>40 A</td>
</tr>
</tbody>
</table>

Table 4: Cable section and fuse size

Connect the three electric cables (phases) to the terminals L1, L2 L3, Fig. 10.

Connect the yellow/green cable (ground lead) to the terminal PE and the neutral cable, if present, to the terminal N.

Use AWG type cable for the multipole supply cable.

Carefully tighten the cable holder and close the terminal board.
3.4.2 Check of the rotating direction

Check the rotating direction of the spindle shaft starting the machine as described in § 4.7.1 (the shaft must rotate in the direction opposite the piece feeding).

If the shaft does not turn in the correct direction, it is necessary:

- to cut the line off;
- to revert two phases of the supply in the terminal board;
- to try again the rotating direction

3.4.3 Connection with the suction system

*It is indispensable to connect the machine to a suction system to eliminate the risks from inhaling dust and to ensure a safe use and a proper machine operation.*

Fig. 11 shows the positions of the suction inlets under the table and of the protecting device for working at the guide.

Always operate with the suction system on.
The suction pipes, if in plastic, must be fire retardant.

The dust emission in the environment can be reduced by:

- maintaining the tools and the machine;
- maintaining the suction system keeping the filters efficient;

**Fig. 11: Suction inlets**

<table>
<thead>
<tr>
<th>Features of the suction inlets supplied with the machine</th>
<th>Ø (mm)</th>
<th>Capacity (m³/h)</th>
<th>Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testo centrato cella tabella italiano</td>
<td>140</td>
<td>1100</td>
<td>100</td>
</tr>
<tr>
<td>Suction inlet on the tool protecting device for working at the guide</td>
<td>140</td>
<td>1100</td>
<td>190</td>
</tr>
<tr>
<td>Suction inlet on the protecting device for working at the shaft</td>
<td>120</td>
<td>820</td>
<td>100</td>
</tr>
</tbody>
</table>

The data are given for an air suction speed of 20 m/s valid for dry chips and, in case of wet chips (humidity content 18%) for an air suction speed of 28 m/s.
4 MACHINE START-UP AND USE

4.1 CONTROL LIST AND FUNCTIONS

*Fig. 12: Machine controls*

1. handwheel for the spindle vertical adjustment;
2. retractable folding lever;
3. indicator for the vertical incremental position of the shaft;
4 motor brake IN/OUT switch;
5 emergency stop push button;
6 overload cutout main switch;
7 spindle motor standard stop push button;
8 push button for enabling the shaft rotation direction reversal;
9 rotary switch for selecting the spindle rotation direction;
12 locking lever for the vertical movement of the spindle turret;
13 spindle rotation locking lever;
14 spindle motor start push button;
15 motor support locking return lever for belt tensioning;
16 motor support lever for belt tensioning;
17 lockable device;
18 main switch knob.

4.2 SPINDLE POSITIONING

Rotate the lever (12) (Fig. 12) counterclockwise to clear the spindle-holding turret, then act on handwheel (1) using lever (2) for the vertical positioning; rotate the lever (12) clockwise to lock the position of the spindle-holding turret. It is advisable to position the spindle always upwards for a correct value reading.

4.3 PREVENTIVE CHECKS

Before starting the spindle:

- check if the installed tool is suitable for the machining to be made;
- position the belts so as to get the correct speed for the tool to be used;
- check if the guards are correctly seated;
- check if the spindle value corresponds to the expected tool use.

4.4 TOOLS

4.4.1 Features of the tools that can be installed

The tool is the most dangerous element of a single-shaft vertical milling machine, so it is necessary to use only tools corresponding to the European norms EN 847-1: 1997, following the use instructions indicated below.
For safety reasons, each tool is suitable for working at a max. speed; this value is indicated by the manufacturer on the tool surface and indicates the max. revolution number the tool can follow.

When purchasing the tools the carpenter must ask his tool supplier for tools with the following features:

- for the tools in a single piece, for the composed tools and for the bodies of complex tools use a balancing level of G16 according to ISO 1940/1;
- for the complex tools, a level of G40 according to ISO 1940/1.
- The tool building features can be detected in Fig. 13.

**Fig. 13: Tool hole features**

- For the tool installation and locking refer to the recommendations by CEN/TC 142/WG 8. The torque applied for locking the cutting parts must be the one specified by the tool manufacturer.
- To ensure a safe and effective machining, the tool to be used must be suitable for the material to be machined.
- The tools must be correctly sharpened and installed on supports, as well as carefully balanced.

### 4.4.2 Tool handling

**Always wear gloves when handling the tools.**

Clean the tool always using suitable commercial products; never use dangerous products (flammable liquids, etc...) or products that can damage the environment. The cleaning is necessary for two main reasons:

- the resin in the wood being machined sticks to the cutting edges of the tool and reduces its cutting capacity;
- the wood resin sticks also to the tool body, causing, in the time, a tool unbalancing with serious risk for the user.
Should the tool be damaged, balance it immediately.

4.5 INITIAL ADJUSTMENTS AND OUTFIT

4.5.1 Installation of the interchangeable spindle

To install the interchangeable spindle, operate as follows:

- by the handwheel (1) lift the spindle completely and lock the spindle-holding shaft rotating the knob (13) in the position A (Fig. 14);

![Diagram of spindle installation](image)

Fig. 14: Shaft rotation lock/release

- check if the splining cones and the threads of the spindle (19), of the spindle-holding shaft (20) and of the ring nut (21) are perfectly free and bump-free;
- tighten the locking ring nut (21) on the tool holding spindle, leaving about 3 mm between ring nut and flange of the spindle (Fig. 15);
Fig. 15: Interchangeable spindle

- fit the locking cone of the spindle (19) in the corresponding seat of the spindle-holding shaft (20) and tighten the locking ring nut (21) rotating it clockwise together with the spindle;
- using the supplied wrench (22) tighten the ring nut (21) checking the distances indicated in Fig. 15 are kept;
- fit the tools, § 4.5.3;
- release the spindle-holding shaft rotating the knob (13) in position B (Fig. 14).

4.5.2 Removal of the interchangeable spindle

The removal must be made with the shaft cold; thus, after the machine has been turned off, wait at least 30 minutes so that the tool-holding shaft cools down, then operate as follows:

- by the handwheel (1) lift the spindle completely and lock the spindle-holding shaft rotating the knob (13) in the position A (Fig. 14);
- remove the tools, see § 4.5.3;
- using the supplied wrench (22) (Fig. 15) loosen the ring nut (21) completely rotating the wrench in counterclockwise direction, and rotate simultaneously also the spindle (19);
- pull the spindle (19) out and loosen the ring nut (21) to use it on another spindle;
- clean the splining cones and the spindle threads before storing it;
- to install another spindle operate as indicated in par. § 4.5.1.
4.5.3 Tool installation on the spindle

This operation must be made every time the tools are to be installed or replaced on the spindle shaft:

- by the handwheel (1) lift the spindle completely and lock the spindle-holding shaft rotating the knob (13) in the position A (Fig. 14);
- check if the tool-holding shaft is clean, as well as the spacers, the tool sleeve and all the supporting planes;
- leave on the machine plane the reduction ring reducing the distance between tool and plane as much as possible;
- fit the tools on the shaft, checking if the supplied spacers are arranged as in (Fig. 16);

Always use the supplied spacers to locate the cutters in the correct position and to ensure their correct support.

fit the anti-rotation spacer (25) so that the supporting plane of the nut (26) projects above the thread discharge on the spindle top for a distance between 1 and 5 mm; while in the spindle with the top screw the distance between the surface of the last spacer (31) and the spindle bottom must be between 12 and 16 mm.

the max. height of the cutter pack must not exceed the distance between the supporting plane at the base of the spindle shaft and the anti-rotation spacer positioned according to the instructions in the previous point; for a better understanding we enclose the following table according to the provisions of EN 848-1:

<table>
<thead>
<tr>
<th>Shaft diameter</th>
<th>Max. length that can be used from the shoulder.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single-piece shaft</td>
</tr>
<tr>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>30</td>
<td>140</td>
</tr>
<tr>
<td>40</td>
<td>180</td>
</tr>
<tr>
<td>50</td>
<td>220</td>
</tr>
</tbody>
</table>
Fig. 16: Tool installation

- tighten the nut (26) effectively by the supplied wrench (30);
- release the spindle-holding shaft rotating the knob (13) in position B (Fig. 14).
4.5.4 Selection of the tool rotating speed

The tool max. speed must be lower than the max. one allowed by the manufacturer, and anyway not lower than 35 m/s, to avoid the risk of piece rejection, and not higher than 80 m/s, to avoid the danger of tool damaging.

A plate (32 - Fig. 17) inside the belt protection cover and showing the Table 1 aids choosing the best operating speed considering the used diameters and the machine revolution number.

---

**Fig. 17:** Position of the plates for choosing the speed and belt position
**Table 5: Selection of the tool rotating speed**

Use example of Table 5:

Miller diameter = 200 mm

Available speeds: 3000, 4500, 6000, 8000, 10000 min⁻¹;

To define the operating speed intersect the line indicating the cutter diameter with the spindle rotation speed column, in this case the choice is between 4500 and 6000 min⁻¹; 3000 min⁻¹ is too low (surface speed lower than 35 m/s), 8000 min⁻¹ is too high (surface speed higher than 80 m/s); the correct choice is 4500 min⁻¹ to reduce the machine noise as much as possible.

After having chosen the tool rotation speed according to the indications of Table 5 it is necessary to position the belt in the pulley race, whose correct position can be found in the plate (33 - Fig. 17), inside the belt protection cover, showing the plate of Fig. 18.
4.5.4.1 Belt positioning on the races, Fig. 19

- release the motor support rotating the lever (15) counterclockwise and loosen the belt operating the lever (16) rightwards;
- position the belts on the chosen race, referring to Fig. 18;
- rotate the lever (16) leftwards to tension the belt; the belt tension is correct pressing in the middle of the belt with a movement of about 3.9 mm a load of about 22 N is obtained;
- rotate the lever (15) clockwise to lock the position of the motor support.

Fig. 18: Belt position and revolution number.
4.6 SAFETY OPERATING PROCEDURES

4.6.1 Dimensions of the pieces being machined

The max. dimensions of the pieces being machined (Table 6) relate to the piece balanced on the roller plane before, during and after the machining; always check this condition, both for profiling and tenoning operations, so as to avoid sudden piece movements due to instability.

<table>
<thead>
<tr>
<th></th>
<th>MU</th>
<th>T120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. length</td>
<td>mm</td>
<td>900</td>
</tr>
<tr>
<td>Min. length</td>
<td>mm</td>
<td>500</td>
</tr>
<tr>
<td>Max. width</td>
<td>mm</td>
<td>750</td>
</tr>
<tr>
<td>Min. width</td>
<td>mm</td>
<td>8</td>
</tr>
<tr>
<td>Max. height</td>
<td>mm</td>
<td>105</td>
</tr>
<tr>
<td>Min. height</td>
<td>mm</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 6: Dimensions of the pieces being machined

If the dimensions exceed the range of value indicated in the Table 6, it is possible to machine the pieces, but it is necessary to use suitable working instruments, and above all: templates or jigs for machining the small pieces and table extensions to support larger pieces.
For non-rectilinear pieces, as well, use templates to support and machine them with full safety.

4.6.2 Machine adjustment and installation

Before any adjustment or maintenance the machine must be cut off.

4.6.3 Tool adjustment on the machine

Templates and guides must be used for positioning the tools on the machine to ensure accuracy and reduce the need for adjusting the machine. Use the table reduction rings to reduce the distance between table and shaft and/or tools as much as possible.

4.6.4 Guide adjustment

a) A guide must always be used for the guide machining, so as to avoid piece sliding and swinging.
b) A dummy guide must be used as much as possible.
c) A feeder must be used as much as possible.
d) In the manual feeding an end passage pusher must be used against the guide to reduce the risks for the operator.
e) Extension roller devices or tables must be used to support long pieces.

4.6.5 Rotating directions

The tool must absolutely rotate in the correct direction. The operator must ensure that the machine is switched to operate in the wished rotation direction and that the material is fed in the direction opposite the shaft rotation.

4.6.6 Speed selection

The operator must make sure that the suitable rotation speed has been selected, according to the tool used on the machine.

4.6.7 Machine operation, guard choice and adjustments

As there is a wide range of machining types that can be performed by vertical shapers using different shafts, tool-holders and cutters, a single protecting device cannot be effective for all these machining types.
Each machining must be separately considered and the most practical guard for the peculiar machining must be selected.

The min. hole in the table, too, shall depend on the kind of tool, on the blade projection and on the height of the cutter positioning.

The supplied reduction rings are very useful for getting a hole as small as possible. This is to prevent the piece from swinging and being stuck in the blades while passing on the hole.

The guard must wind up as much as possible the cutter depending on the type of machining.

The shaper with straight guide is equipped with a movable feeder that can be used for covering the cutters on the longest length, and often is the best protection for the machine.

These feeders can be easily adjusted for suiting the piece dimensions, and must not originate entangling risks.

If a feeder is not used, some pressing devices forming a tunnel where the piece can be introduced are adapted for the guide machining and for the whole piece length, if they are used with a dummy guide or other means reducing the distance between the guides.

### 4.6.8 Guide machining with cutting through all the piece length

A machining of this kind is carried out using a straight guide in most of the cases, as the pieces have a rectangular section through all their length.

The pieces can be guided by the angle formed by table and guide.

The horizontal and vertical pressing devices can be arranged to form a tunnel through which the piece can be guided.

The next piece can be used for pushing the previous one, and the last piece will be machined using a pusher.

For machining thin panels only the pressing device apex can be used, if its thickness is suitable.

Special slides must be used according to the piece length.

On a vertical shaft shaper the distance between the two halves of the straight guide must be sufficiently wide to leave the necessary space for the cutter.

This causes a useless exposure of the blades, the cutter and the shaft; further, the piece end can touch the outfeed guide edge.

These risks are eliminated by using a dummy guide or with the alternative of a device having the same features and closing the distance between the guides.

It is recommended to carry out the tool passage through the dummy guide by a screw adjustment and not by pushing the guides towards the tool.

### 4.6.9 Interrupted machining

Guide machining where the cutting never involves the whole piece length.

A machining of this kind is called interrupted, the cutter must penetrate in one side instead of starting from one piece end and/or interrupting the machining before the piece end.
A template is therefore necessary, as well as a protecting device repairing the cutter as much as possible. Two retainers must also be used at the two ends. The template must enable a piece fast and accurate positioning, as well as being tightly hold. The most practical method for locking the piece is using fast locks operating with levers or cams. Some front and rear retainers fastened on the guides or on the table enable a better template control; the loading/unloading can be made by a second template fastened on the first one.

4.6.10 Shaft machining

A template must be always used when machining with the shafts, unless the operation type does not enable it; that is, when the piece is so large that adding a template makes the machining impossible, or when the piece is so small or so complicated that it cannot be safely held in the template. For most of the shaft machining a template is used for the finished piece contour. The finished shape is achieved by keeping the template against a roller bearing, while the piece meets the tool.

4.6.11 Simultaneous machining

It is absolutely recommended not to operate with simultaneous machining because the rejection risk increases.

4.6.12 Other machinings

When other types of machinings are made, such as tenoning and butting, suitable templates or supports can be used for reducing the risk of accidents. The following accessories can be used for aiding the operator during the machining:

- templates
- pushers
- movable feeders
- extension tables
- retainers and rip fences.

4.6.13 Noise reduction

- The tool conditions are very useful for reducing the noise level.
- The materials and the positions of the protecting devices must aid in reducing the noise level.
- The tool speed must be chosen so as to reduce the noise level.
- The use of personal protections must integrate the use of those mentioned above.
4.7 OPERATING CYCLE

4.7.1 Spindle start

To start the spindle, operate as follows:

- Carry out the checks indicated at § 4.3;
- power the machine turning the knob (18);
- set the switch (4) in brake release position;
- the machine is equipped with spindle shaft rotation inverter: select the spindle rotating direction acting on the switch (9), the position F corresponds to the counterclockwise rotation direction, while the position R corresponds to the clockwise rotation direction.
  It is not possible to start the spindle if a rotating direction has not been selected before.
  The machine stops immediately if the rotating direction switch is operated while working.
- To choose the clockwise rotating direction or the simultaneous machining direction [position R of the switch (9)] keep the light push button (8) pressed while starting the spindle; the relevant pilot light switches on.
  Do not operate with simultaneous machining because the rejection risk increases.
- Press the push button (14) to start the spindle motor.
- Press the push button (7) to stop the spindle motor.

4.7.2 Use of the machining guide

- A protecting device must always be used for the guide machining, so as to avoid piece sliding and swinging.
A dummy guide must be used as often as possible for reducing the distance between cutter and guides: a sample is supplied together with the machine. Fig. 21 gives the dimensions of a dummy guide, a sample of which is supplied together with the machine.

**Fig. 21: Dummy guide.**

- Fig. 22 gives the instructions for a correct installation: position A open the two guides and approach the dummy guide to the spindle, position B when the dummy guide lays on the rear guard, close the two guides on the dummy guide and lock their position.

**Fig. 22: Dummy guide installation**

- Always use a pusher, Fig. 23, at the passage end against the guide to reduce the risks for the operator.
Fig. 23: Pusher

4.7.2.1 Guide adjustment

Fig. 24: Guide machining guard
23 - Infeed guide locking lever
24 - Outfeed guide locking lever
27 - Infeed guide
28 - Outfeed guide
34 - Infeed guide shoulder locking lever
35 - Outfeed guide shoulder locking lever
36 - Infeed guard locking lever
37 - Outfeed guard locking lever
38 - Infeed shoulder adjustment handwheel
39 - Outfeed shoulder adjustment handwheel
40 - Upper cover locking pin
52 - Upper cover
57 - Guide machining guard
59 - Vertical pressing device
60 - Vertical pressing device pin
61 - Vertical pressing device pin support
62 - Horizontal pressing device
63 - Front guard
65 - Horizontal pressing device support
66 - Horizontal pressing device locking screw
67 - Vertical pressing device pin locking screw
68 - Vertical pressing device support
69 - Vertical pressing device locking screw

a) To move the whole protection device manually loosen the levers (36) and (37).
b) Adjust micrometrically the infeed guide (27) to the outfeed guide (28) according to the removal depth:
   • loosen the lever (34);
   • rotate the handwheel (38), (clockwise rotation: the guide approaches the tool; counterclockwise rotation: the guide goes far from the tool).
c) To adjust the outfeed guide (28) micrometrically to the infeed guide (27):
   • loosen the lever (35);
   • rotate the handwheel (39), (clockwise rotation: the guide approaches the tool; counterclockwise rotation: the guide goes far from the tool).
d) Act on the levers (23 and 24) to position the guides according to the tool diameter.

After each adjustment, strongly tighten the device locking levers, and namely: (23-34-36) and (24-35-37).

4.7.3 Pressing device use for the guide machining

The system is made up of two sets of pressing devices: the horizontal ones are fastened to the machining table; the vertical ones are installed on a support fastened on each infeed and outfeed shoulders of the machining guide, and of a front guard (63) fit on the shoulders (27 and 28).

To ensure the pressing device operation of the material being machined, the horizontal and vertical pressing devices must be adjusted according to the dimensions of the piece being machined following this procedure:
a) adjust the horizontal pressing device (62) on the piece width, acting on the screw (66), so as to squeeze it against the guides (27 and 28; Fig. 25).
b) Adjust the vertical pressing device (59) on the piece height, acting on the screw (69), and outside the tool cutting circumference, acting on the screw (67) and lock it in position.

c) Adjust the front protection (63) as for its height making it slide vertically; and according to the tool diameter placing it inside the holes made on the shoulders (27-28).

The pressure made must not be too strong, the wood to be machined must slide smoothly and evenly.

4.7.4 Use of the machining guide with three positions (optional)

The machining guide with three positions enables to adjust both shoulders micrometrically and reciprocally.

Fig. 25: Three-position machining guide guard

23 - Infeed guide locking lever
24 - Outfeed guide locking lever
27 - Infeed guide
As for the general use of a machining guide and of its protecting device, refer to § 4.7.2 and to § 4.7.3.

**Fig. 26: Adjustment of the machining guide in the three positions**

a) To move the whole protection device manually loosen the levers (36) and (37).

b) Micrometric adjustment of the outfeed guide (28), **position A**:
   - loosen the lever (37);
   - lock the lever (36);
   - rotate the handwheel (39), (clockwise rotation: the guide moves forwards; counterclockwise rotation: the guide moves backwards).

c) Micrometric adjustment of the infeed guide (27), **position B**:
• lock the lever (37);
• loosen the lever (36);
• rotate the handwheel (39), (clockwise rotation: the guide moves backwards, counterclockwise rotation: the guide moves forwards).

d) Simultaneous micrometric adjustment of the infeed guides (27) and outfeed guides (28), position C:
• loosen the lever (37);
• lock the lever (36);
• rotate the handwheel (38), (clockwise rotation: the guides move forwards, counterclockwise rotation: the guides move backwards).

e) Act on the levers (23 and 24) to position the guides according to the tool diameter.

After each adjustment, strongly tighten the device locking levers, and namely: (23-36), and (24-37).

4.8 GUIDE MACHINING PROCEDURES

While machining, the operator must use accessories, Fig. 14, suitable to operate in safety conditions, such as:

• templates;
• pushers;
• movable feeders;
• extension tables;
• retainers and rip fences.

Before each machining check if the piece is free from inclusions, such as steel nails, that could damage the tool.

After adjusting the guides according to the tool outer diameter, and passage depth:

• adjust the horizontal pressing device according to the width of the wood to be machined;
• adjust the vertical pressing device according to the height of the wood being machine.

IMPORTANT: after having made the adjustments, check if the tool touches the guards or the machine fix parts.
4.8.1 Guide machining with cutting through all the piece length

Such a machining is made using a straight guide in most of the cases; the pieces have a rectangular section through all their length.

The pieces can be guided by the angle formed by table and guide. The vertical and horizontal pressing devices are arranged for forming a tunnel through which the piece can be guided; follow the indications of § 4.7.2 and of § 4.7.3.

The next piece can be used for pushing the previous piece, and at the end the last piece will be machined using a pusher (Fig. 23) passing under the side pressing device.

For machining thin panels the pressing device apex can be used, but its thickness must be suitable.

Special slides must be used according to the piece dimensions. If possible, use a dummy guide to close the clearance between the two guides, as shown in Fig. 21.

Before starting the spindle select the correct speed for using the tool as indicated in § 4.6.6.

4.8.2 Interrupted machining

The machining is interrupted when:

a) the cutter penetrates in one side instead of starting from one end, and/or
b) the cutter stops the machining before the piece end.

It is absolutely necessary to use a template together with a protecting device shielding the cutter as much as possible, and some retainers must be used at the ends.

The template must allow the piece to be quickly and accurately positioned, and to be strongly held in position (examples in Fig. 32).

4.9 SHAFT MACHINING PROCEDURES

4.9.1 Milling with the curved guide

The sequence of the steps to be made refers to the number sequence inside the following figures.
Fig. 27: Installation of a guard for machining with curved guide

1 - Install the cutter on the cutter-holding spindle;
2 - choose the guide plate with shape (a) or (b) and screw it on the support plate;
3 - install the multi-curve servo-cutter on the cutter-holding spindle choosing the spacing rings between cutter and servo-cutter so that the cutter can freely rotate, and tighten completely the nut or the locking screw of the cutter on the spindle;
4 - adjust the cutter diameter on the scale of the curved guide. If necessary, move the guide plate according to the milling depth and tighten the screw carefully. The vertical positioning of the curved guide occurs according to the cutter vertical positioning;
5 - fit the casing in the guides of the curved guide;
6 - fasten the casing on the machine table;
Fig. 28: Protecting device for the shaft machining

7 - loosen the thumbscrews on both sides;
8 - move the casing upper part forwards until it sufficiently covers the cutter (c: position for manual infeed milling, d: position for feeder infeed milling);
9 - fasten the guard brushes;
10 - connect the suction pipe;
11 - loosen the thumbscrews and adjust the protection cover at the cutter height; make
the two cover guide components descend, so as to get the wished pressure against the piece, and tighten the thumbscrews carefully;

12 - to aid the piece guide, install a two-roller pressing device (optional);
13 - position the guard brushes so that they cover the movement area of the curved piece.

Fig. 29: Machining examples

Machining examples:
14 - Piece inner milling.
15 - Piece milling using a feeder.
16 - Piece inner milling using a feeder.
17 - Milling of a ring piece with the feeder.
4.9.2 Milling with inlet ring

The sequence of the steps to be made refers to the number sequence inside the following figures.

Fig. 30: Installation of a guard for machining with inlet ring

1 - Install and fasten the wished cutter and the corresponding inlet ring on the cutter-holding spindle;
2 - fasten the casing on the machine table to cover the cutter;
3 - loosen the thumbscrew until you can push the infeed strip, rotating it by 90° backwards;
4 - position the infeed strip at the height of the inlet ring, pressing it against the inlet ring, and tighten the thumbscrew carefully. Later on proceed as indicated from point 11 to 17 of previous paragraph.

**Fig. 31: Machining examples**

Machining examples:
5 - Milling of a ring piece without feeder.
6 - Milling of a ring piece with feeder.
Fig. 32: Accessories for the guide machining
4.10 Tenoning procedure with sliding table

4.10.1 Tenoning sliding table

Fig. 33:

1. Sliding table locking device
2. Vise
3. Vise operating lever
4. Vise vertical locking lever
5. Vise horizontal locking lever
6. Piece sloping rest
7. Rest locking lever
The square enables straight tenoning or tenoning sloped from -60° to +60°.

To prevent splinters from forming while tenoning -- which is always transversal to the wood fibers -- it is necessary to use a splinter-proof insert installed on the rule; Fig. 34 shows the dimensions of the splinter-proof device according to the used rule profile; it must be carried out in wood (e.g. spruce, beech, etc...) or other material not damaging the tool if touching it.
For using the sliding table operate the device 1 pulling the relevant knob downwards.

4.10.2 Adjustment of the protecting device for tenoning operations

**Fig. 35:**

a) Remove the vertical and horizontal pushers;
b) release the guides 26 and 27 and open them;
c) open the guard 25 acting on the safety pin 24 to release it;
d) install the tenoning tool;
e) adjust the horizontal position of the protecting device 28 by the levers 4 and 5; the guide edge must be at about 5 mm from the min. cutting circumference;
f) adjust the guides 26 and 27 leaving a distance not higher than 5 mm from the end and the tool largest diameter, lock them in position by the levers 1 and 8;
g) adjust the position of the vertical guide 23 leaving a distance not higher than 5 mm between it and the machining piece;
h) at the end of the adjustments make sure that the levers and the knobs are well tightened.
4.10.3 Tenoning of straight pieces

a) Follow the indications of par. 4.10.2;
b) position the belt at the lowest speed;
c) position the spindle vertically;
d) then, referring to Fig. 33 proceed as follows:
e) lay the wooden piece on the guide 14;
f) adjust the position of the reference ledges 11 to determine the tenoning depth;
g) loosen the vise 2 by the lever 4 until the cap touches the piece and lock in this position; the cap must be positioned as near as possible to the piece part being machined;
h) rotate the lever 3 in the direction indicated by the arrow to lock the piece to the table;
i) start the spindle;
j) make the piece touch the tool by pushing the sliding table with the hands as shown in Fig. 33;
k) at the end of the machining switch the spindle motor off.

4.10.4 Tenoning of sloped pieces

a) Follow the steps indicated in par. 4.10.2;
b) position the belt at the lowest speed;
c) position the spindle vertically;
d) then, referring to Fig. 36 proceed as follows:
e) release the rest 6 and rotate it according to the wished sloping, then lock it in its position by the lever 7;
f) lay the wooden piece on the guide 14;
g) adjust the position of the reference ledges 11 to determine the tenoning depth;
h) loosen the vise 2 by the lever 4 until the cap touches the piece and lock in this position; the cap must be positioned as near as possible to the piece part being machined;
i) start the spindle;

j) make the piece touch the tool by pushing the sliding table with the hands as shown;

k) at the end of the machining switch the spindle motor off.

Fig. 36:
5 MAINTENANCE

5.1 MAINTENANCE AND SAFETY

A careful maintenance makes the machine life longer and keeps the machining features unchanged. An important safety factor for the machine and the operator is a general accurate cleaning of the machine and the surrounding area; in the evening, at the end of the works, it is advisable to clean by means of a vacuum-cleaner.

The parts to be lubricated are:

a) upper bearing of the spindle turret, use the suitable grease nipple (fig. 37) with grease BEACON 326 by Esso, do not use different grease; if it is difficult to find, ask the manufacturer for it, provide for the lubrication every 500 working hours using not more than 15 g of grease;

b) spindle turret, clean the spindle turret at least once a week with products which are not dangerous or harmful for the environment or the people; then, lubricate with medium viscosity mineral oil.

Fig. 37: Spindle shaft bearing greasing
Do not use the machine if the protection and/or safety devices are not efficient.

Before any maintenance intervention, set the main switch to zero and warn about the machine stop by a sign.

5.1.1 Safety measures

Periodically press the emergency push button to make sure it is efficient.

Check if the motor brake stops the shaft for a max. time of 10 s; otherwise, to adjust it, refer to § 5.3.

5.1.2 Tool maintenance

a) Keep the tools always cleaned to get the best working conditions.

b) Resin deposits mixed with wooden dust and small chips must be removed by a hard bristle brush dipped in a suitable and safe thinner.

c) Do not use any other product, nor synthetic thinners of any kind.

d) By a jet of compressed air, remove every dirt residue and dry every part.

e) Clean the working table with a dry cloth.

Use gloves when handling the tools.

5.2 ELECTRIC SYSTEM MAINTENANCE

The maintenance of the electric parts must be performed by skilled personnel, with the machine stopped, under authorization of the person in charge with the safety.

Before any intervention, it is indispensable to cut the machine electric supply out rotating the lockable main switch on “0”, than disconnect it electrically from the mains.

It’s not possible to perform any preventive intervention on the electrical system, but you can only intervene when an element is damaged providing for its replacement; however it is possible to improve the reliability of the electrical parts following some provisions:

- all the motors are supplied with overload cutout, calibrated on the motor rated current; avoid starting and stopping several times consecutively, as this causes a motor overheating and make the overload cutout ineffective;
- do not remove material required a power higher than the installed one;
- replace the faulty components with others having the same features;
- calibrate the overload cutouts at the rated current indicated on the motor plate.
5.3 SELF-BRAKING MOTOR

Every 2 months or 200 stops, periodically check and adjust the braking electro-magnetic device, as the motor braking time must be kept under 10 s. Detecting longer braking times it is necessary to adjust the entrefer or replace the brake friction material.

5.3.1 Entrefer adjustment

The distance between the electro-magnet case and the movable core (Fig. 38), with the brake not supplied, is called entrefer and is adjusted when manufacturing the device and, depending on the size of the installed motor and brake type, it ranges between the values shown in Table 7:

<table>
<thead>
<tr>
<th>Motor size</th>
<th>MU</th>
<th>Entrefer</th>
<th>Min. thickness of the friction material</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMS 90 – 100 – 112 - 132</td>
<td>mm</td>
<td>0.2 ± 0.5</td>
<td>2</td>
</tr>
<tr>
<td>HFV 90</td>
<td>mm</td>
<td>0.25 ± 0.5</td>
<td>1</td>
</tr>
<tr>
<td>HFV 100</td>
<td>mm</td>
<td>0.3 ± 0.55</td>
<td>1</td>
</tr>
<tr>
<td>HFV 112</td>
<td>mm</td>
<td>0.35 ± 0.6</td>
<td>1</td>
</tr>
<tr>
<td>HFV 132</td>
<td>mm</td>
<td>0.35 ± 0.6</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 7: Entrefer and friction material**

The entrefer increase depends on the consumption of the friction material (B); this changes the brake performance, such as: noise increase, decrease of the braking capacity with following longer braking time, problems for the brake electric release.

When the entrefer reaches a value higher than the max. allowed one, it is absolutely necessary to take this value back to the min. allowed one according to the type of motor installed on the machine.

For adjusting the entrefer, remove the air conveyor (18), then act on the locknut (16) till reaching the suggested entrefer, measuring it by a feeler gauge.

While adjusting, check the wear condition of the friction material; if the wear is too much, it is necessary to replace the movable anchor - brake disk (12).

The correct brake operation cannot be ensured when operating in oily environments or under extreme temperatures, if the proper guards are not used.
5.3.2 Replacement of the movable anchor - brake disk (12)

- Remove the air conveyor (18);
- loosen the locknut (16) for adjusting the braking torque;
- remove the washer (15);
- pull the cooling and braking fan (13) out;
- loosen the three screws (C) fastening the electro-magnet;
- remove the movable anchor-brake disk (12) and replace it;
- install again all the components following the reverse order, adjusting the en-
trefer value as explained in § 5.3.1.
5.3.3 Replacing the electro-magnet (11)

- Open the terminal board cover (7) and disconnect the electro-magnet (11) from the feeder-rectifier (8);
- remove the air conveyor (18);
- loosen the locknut (16) for adjusting the braking torque;
- remove the washer (15);
- pull the cooling and braking fan (13) out;
- loosen the three screws (C) fastening the electro-magnet;
- remove the electro-magnet (11) and the movable anchor-brake disk (12) and replace them;
- install again all the components following the reverse order, adjusting the entrance value as explained in § 5.3.1.
6 WHAT YOU MUST DO IF...

6.1 FOREWORD

The machine transport, unloading and positioning, an incorrect use or a poor maintenance may result in problems that can be solved according to the following points.

Symbol key:
- ■ Interventions that the user can do.
- ● Interventions that must be made by the skilled technical staff of the (inner or outer) service.

6.1.1 The spindle overload cutout does not reset

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check the power supply</td>
<td>Check that the power supply mains to which the machine is connected supplies current ■</td>
</tr>
<tr>
<td>One of the protection switches of the transformer has intervened</td>
<td>Reset it ■</td>
</tr>
<tr>
<td>You try to connect it with the star/delta starter not on 0</td>
<td>Rotate the star/delta starter on 0 ■</td>
</tr>
<tr>
<td>Pressed emergency push button</td>
<td>Rotate the emergency push button to reset it ■</td>
</tr>
<tr>
<td>Overload</td>
<td>Wait 10-30 seconds before resetting it ■</td>
</tr>
<tr>
<td>Overload cutout faulty</td>
<td>Replace it ■</td>
</tr>
</tbody>
</table>

6.1.2 The spindle motor rotates always braked

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>The brake coil is faulty</td>
<td>Replace it ●</td>
</tr>
<tr>
<td>The brake rectifier is faulty</td>
<td>Replace it ●</td>
</tr>
</tbody>
</table>
6.1.3 The spindle motor overload cutout has intervened at the switching-on

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>The clockwise rotation speed has been selected</td>
<td>Press the push button to enable the clockwise rotation before starting the spindle</td>
</tr>
<tr>
<td>Open front cover</td>
<td>Close the cover</td>
</tr>
</tbody>
</table>

6.1.4 The overload cutout of the spindle motor has intervened

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload due to too much removal</td>
<td>Reduce the removal depth</td>
</tr>
<tr>
<td>Overload due to an excessive feeding speed</td>
<td>Reduce the feeding speed</td>
</tr>
<tr>
<td>Overload due to the tools</td>
<td>Sharpen the tools or change the plates</td>
</tr>
</tbody>
</table>

6.1.5 Piece surface being machined not smooth

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worn tools</td>
<td>Sharpen the tools or change the plates</td>
</tr>
</tbody>
</table>
# TECHNICAL AND ENVIRONMENTAL DATA

## 7.1 TECHNICAL DATA

<table>
<thead>
<tr>
<th>STANDARD FEATURES</th>
<th>MU</th>
<th>T120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spindle start direct remote starter with push button</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Motor magneto-thermal protection</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Automatic motor brake</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Speed reversal</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Grooving on table</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Spindle rotation speed</td>
<td>No.</td>
<td>5</td>
</tr>
<tr>
<td>Rings on table</td>
<td>No.</td>
<td>5</td>
</tr>
<tr>
<td>Front handwheel for shaft vertical positioning</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Indication of the vertical incremental position of the shaft</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Protection for the guide machining with suction hood</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Manufacturing guide (protection) with 2 adjustments: entry front drive only exit front drive only</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Shaft locking knob on front control panel</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Suction hoods</td>
<td>No.</td>
<td>2</td>
</tr>
<tr>
<td>Electro-welded sheet basement</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Casing for tenons with suction hood, inlet Ø 140 mm and with emergency push button</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Machining table dimensions:</th>
<th>mm</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>1300</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Machining table height</td>
<td>mm</td>
<td>903</td>
</tr>
<tr>
<td>Fixed spindle shaft diameter and Shaft length (EN 848-1)</td>
<td>inch</td>
<td>1” 1/4”</td>
</tr>
<tr>
<td></td>
<td>mm</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>MU</td>
<td>T120</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----</td>
<td>---------------</td>
</tr>
<tr>
<td>Fixed spindle shaft vertical stroke</td>
<td>mm</td>
<td>170</td>
</tr>
<tr>
<td>Distance between fixed shaft stop and machining table</td>
<td>mm</td>
<td>-1 -171</td>
</tr>
<tr>
<td>Inner diameter of the rings on the table</td>
<td>mm</td>
<td>72 - 108 - 152 - 224 - 270</td>
</tr>
<tr>
<td>Max. diameter of the tools for profiling</td>
<td>mm</td>
<td>250</td>
</tr>
<tr>
<td>Max. dimensions of the tool retracting under the table</td>
<td>mm</td>
<td>330 x 90</td>
</tr>
<tr>
<td>Shaft rotation speed</td>
<td>mm⁻¹</td>
<td>3000-4500 -6000-800 0-10000</td>
</tr>
<tr>
<td>Suction inlet diameter on the machining guide</td>
<td>mm</td>
<td>140</td>
</tr>
<tr>
<td>Rear suction inlet diameter under the table</td>
<td>mm</td>
<td>140</td>
</tr>
<tr>
<td>PACKING – TRANSPORT</td>
<td>MU</td>
<td>T120</td>
</tr>
<tr>
<td>---------------------</td>
<td>----</td>
<td>------</td>
</tr>
<tr>
<td>Overall dimensions for the transport:</td>
<td>Width</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>Length</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>mm</td>
</tr>
<tr>
<td>Case packing dimensions:</td>
<td>Width</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>Length</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>mm</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>550</td>
</tr>
<tr>
<td>Weight with package</td>
<td>kg</td>
<td>620</td>
</tr>
</tbody>
</table>

**ELECTRICAL DATA**

| Spindle motor power | kW/ HP | 6.6 / 9 |
| Three-phase voltage | V | 220/400 |
| Connection voltage | V | 220 |
| Frequency | Hz | 60 |
| Current |  |  |
| Low voltage circuit with transformer | V | 110 |

**SUCTION DATA**

| Suction air min. speed: | for dry chips | m/s | 20 |
| | for wet chips (humidity ≥ 18%) | m/s | 28 |
| Capacity | m³/h | 1,800 |
| Vacuum | mm H₂O | 720 |

**ENVIRONMENTAL DATA**

| Storage temperature | °C | 0° + 50° |
| Operating temperature | °C | 5° + 40° |
| Max. relative humidity |  | 90% |
| Elevation | m | 1,000 |

**STANDARD ACCESSORIES**

- Use and maintenance handbook
- Wiring diagram
- Spare part catalogue
- Set of wrenches for the maintenance

**ACCESSORIES upon REQUEST**

- Interchangeable shaft MK5
<table>
<thead>
<tr>
<th>MU</th>
<th>T120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional interchangeable spindle MK5</td>
<td>■</td>
</tr>
<tr>
<td>Table extension, with emergency push button, up to:</td>
<td>■</td>
</tr>
<tr>
<td>1750</td>
<td></td>
</tr>
<tr>
<td>Table extension, with emergency push button, up to:</td>
<td>■</td>
</tr>
<tr>
<td>2400</td>
<td></td>
</tr>
<tr>
<td>Aluminum shoulder for machining guide</td>
<td>■</td>
</tr>
<tr>
<td>Machining guide (guard) with 3 adjustments:</td>
<td>■</td>
</tr>
<tr>
<td>simultaneous drive of the 2 shoulders;</td>
<td></td>
</tr>
<tr>
<td>drive of the entry shoulder only;</td>
<td></td>
</tr>
<tr>
<td>drive of the exit shoulder only</td>
<td></td>
</tr>
<tr>
<td>Table widening front extension up to:</td>
<td>■</td>
</tr>
<tr>
<td>mm</td>
<td>1100</td>
</tr>
<tr>
<td>Interchangeable spindle shaft diameter and</td>
<td>inch</td>
</tr>
<tr>
<td>Shaft length (EN 848-1)</td>
<td>mm</td>
</tr>
<tr>
<td>mm</td>
<td>140</td>
</tr>
<tr>
<td>Interchangeable spindle shaft vertical stroke</td>
<td>mm</td>
</tr>
<tr>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Distance between fixed shaft stop and machining table</td>
<td>mm</td>
</tr>
<tr>
<td>mm</td>
<td>+72</td>
</tr>
<tr>
<td>mm</td>
<td>-98</td>
</tr>
</tbody>
</table>

Key: ○ = Standard  ■ = Optional
7.2 OVERALL DIMENSIONS

Fig. 39: Overall dimensions