DENTAL MACHINE s.r.l.
Automazione per il laboratorio odontotecnico
www.dentalmachine.it

INSTRUCTION MANUAL

A5 milling centre

English translation of the original Italian version

Serial number: from 1238 to XXX

Name	A5 Manual
Revision	Rev. 03
First issue	25 November 2015
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Prepared by	G. L. and L. L.
Signature	

DENTAL MACHINE SRL
Via d. artigianato 15 - 29022 Bobbio (PC)
C.F. - P. IVA 01607130331

USER'S GUIDE FOR USE AND MAINTENANCE OF A5 MILLING CENTER

1. GENERAL INFORMATIONS

1.1 Foreword

Thank you for choosing the A5 milling centre by Dental Machine.

We ask you to read carefully this manual and to keep in a safe place close to the machine itself, so it will be on hand when you need it.

1.2 Symbols

In the following manual, symbols have been used to highlight situations of RISK / DANGER / IMPORTANT INFORMATION. If they are not already familiar to you, please memorise them before to read the Manual.

This symbol highlights dangerous situations, which, if ignored may result in death or serious injury to people, to the machine or to the environment.

This symbol indicates the need to take specific care when performing the operation to avoid any injury or economic damages.

This symbol indicates technical notes or information, which, if ignored may result in damage to either the machine or the manufactured product

1.3 Definitions

PRODUCT = the involved A5 milling machine, whose serial number is shown on the CE label "CE" applied to it

MANUFACTURER = Dental Machine srl (see later)

CLIENT or **USER** = the person who uses directly the machine; is it uses it through an employee of his company and his in charge of security of the company, he may be defined **EMPLOYER**

OPERATOR = the machine who is using the machine in a specific moment or who has to take care of it; he must be properly trained

TRAINING = a specific training on how to use the machine, performed by the Manufacturer of by his deputy

MANUAL = both this manual and all documents supplied with the machine and/or during the training, on paper or digital support, which include:

1. User license of software CAM named "Millbox" produced by LAB srl from Cinisello Balsamo (MI, Italy) and licenced by CIMSystem di Cinisello Balsamo (MI, Italy) Via Monfalcone 3, Phone +39 02 61866330, delivered on a USB key;
2. Manual ISO Ns – Next Step – Machine interface manual, developed by Promax Srl, Via Newton, 5G – 50051 Castel Fiorentino (FI, Italy) - Phone +39 0571 684620, which explains user's interface to the machine and action that the operator can perform by touch-screen or keyboard plus mouse
3. Jäger spindle manual "High Frequency Spindle Manual" assembled on the specific machine (see § 8.3.5)
4. Declaration of Conformity to EU regulations
5. Declaration of application of the CE label, which in the specific machine, with its serial number

IMPORTANT NOTE

This Manual is the English translation of the original Italian Manual published by the machine Manufacturer.

it must be read carefully - both by the Employer and Operator – before starting the machine, end then it must be carefully stored in a place not far from the machine.

DANGER – ATTENTION

ATTENTION: *ISO-Ns is a software that uses a PC to drive a numerically controlled machine. According to its OpenSource philosophy, it accepts changes by the user. In case of changes, it is REALLY important to conserve the original version for future tests and an eventual renovation. The user is responsible of all the changes caused to the program.*

1.4 Product

Dental milling machine specifically designed for the production of dental prosthesis, named “A5” or “Milling center A5”. Improper use of this equipment hazards and cause damage to people and the environment. Please read carefully the following instructions and keep the close to the machine, in a place easy to reach.

1.5 Manufacturer

The machine is manufactured by:

Dental Machine s.r.l.
Registered office:
Piazza S. Francesco, 11
29022 BOBBIO (Piacenza) - Italy

Production plant:
Via dell’artigianato 15
29022 BOBBIO (Piacenza) - Italy
Phone +39 0523 936604 - fax: +39 0523 960478
email: info@dentalmachine.it

If any further assistance is required, or for clarifications regarding any part of this Manual, please contact the production plant and quote the serial number of the machine.

1.6 Certificate of Origin

This machine has been produced in **Italy**. On request, the manufacturer will provide the proper documentation.

1.7 Applied regulations

The machine is specifically designed for the production of dental prosthesis, named “A5”.

Since the machine may change tool automatically, the security regulation applicable is the **EN 12417 Machine tools – Safety – Machining centres**.

The above is a type C regulation, according to EN 292-1; thus it overrides type A and B regulations in case of conflict.

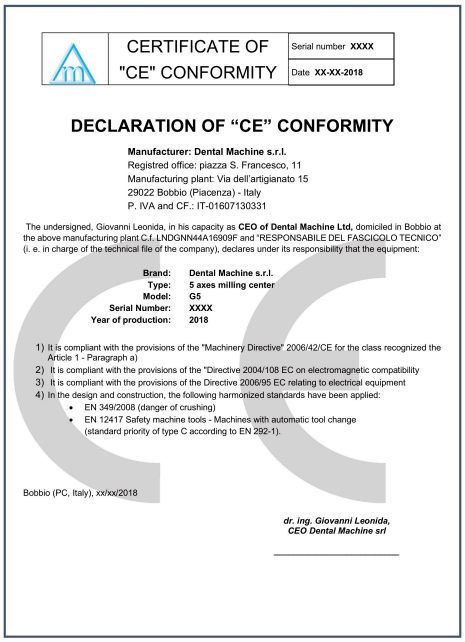
1.8 Labelling

The application of the above regulation is testified by the “CE label” applied (see figure) on the back of the machine and firmly riveted to a metal part of it.

Please take note of the serial number of your specific machine and always mention it in any contact with the service organization.

1.9 CE certificate

In addition to the above label applied on the machine, the Manufacturer delivers a declaration of conformity to applicable EU regulations, as shown in the sample picture.



CERTIFICATE OF "CE" CONFORMITY — Serial number XXXX — Date XX-XX-2018

DECLARATION OF “CE” CONFORMITY

Manufacturer: Dental Machine s.r.l.
Registred office: piazza S. Francesco, 11
Manufacturing plant: Via dell'artigianato 15
29022 Bobbio (Piacenza) - Italy
P. IVA and CF.: IT-01607130331

The undersigned, Giovanni Leonida, in his capacity as **CEO of Dental Machine Ltd**, domiciled in Bobbio at the above manufacturing plant C.f. LNDGNN44A16909F and “RESPONSABILE DEL FASCICOLO TECNICO” (i. e. in charge of the technical file of the company), declares under its responsibility that the equipment:

Brand: Dental Machine s.r.l.
Type: 5 axes milling center
Model: G5
Serial Number: XXXX
Year of production: 2018

1) It is compliant with the provisions of the "Machinery Directive" 2006/42/CE for the class recognized the Article 1 - Paragraph a)
2) It is compliant with the provisions of the "Directive 2004/108 EC on electromagnetic compatibility
3) It is compliant with the provisions of the Directive 2006/95 EC relating to electrical equipment
4) In the design and construction, the following harmonized standards have been applied:
   - EN 349/2008 (danger of crushing)
   - EN 12417 Safety machine tools - Machines with automatic tool change (standard priority of type C according to EN 292-1).

Bobbio (PC, Italy), xx/xx/2018

dr. ing. Giovanni Leonida,
CEO Dental Machine srl

1.10 Warranty

A5 milling machine is and industrial product (B2B), so the usual EU regulations for warranty of consumer products (B2C) are not applicable. The type and extension of warranty must be specified on the single sale contact or in a specific addition to it.

In any case, if present, warranty:

- is limited to the time specified in the contract (usually 365 calendar days from the date of its test at Dental Machine in the presence of the Client (or in their absence if the invitation is declined);
- is limited to failures due to bad assembly and / or bad components of the machine itself, and nothing else;
- does not include any liability for any other damage, loss of profit and non-fulfilment of client’s orders;
- does not refer to consumables (tools, disk, blocks, etc.);

- does not apply to the electrospindle, since it may be damaged by improper usage (e.g. not performing pre-heating before starting the work);
- does NOT include third party's supply (even if supplied and / or invoiced together with the machine itself) such as compressor, vacuum unit, tools, etc);
- is void in case of improper installation or usage of the machine different from what stated in this Manual.

CAUTION – WARNING

Any repairing on the machine not performed by the Manufacturer or a technician trained and approved by it makes the warranty null and void.

Any repair using non-original parts (including CAM software, unless approved in writing by the Manufacturer) makes the warranty null and void.

Warranty on the electrospindle is subjected to the assessment from the manufacturer (Jäger) – to be performed at his factory – that the failure is due to poor materials of poor assembly of them and not to other causes (e. g. not preheating it before actual work).

1.11 Needs for installation

The Client will provide a proper room for the installation of the machine and provide the needed electrical supply and air supply as well as (if required) vacuum system connection. Instructions were given to the client in the "PRE-INSTALLATION CHECKLIST "

1.12 Floor and building

The A5 is rather heavy; in normal working conditions its weight is 220 kg or 485 lb, and rests on an area of about 0.7 sqm or 7.5 sqft.

The Client must verify the maximum permissible load on the final position of the machine, as well as along the way selected to take the machine from the road to the final position, adding up the weight of the transport tool (e.g. forklift).

DANGER – ATTENTION

If the weight exceeds the maximum permissible load along the way and in the installation position, IT IS MANDATORY to change the way/position or find a system to distribute the weight on a broader surface because an over-loading may cause serious damages to the people involved in transport, the machine and the building.

1.13 Copyright

This Manual is property of the Manufacturer who own the copyright. The copyright of other components (ISO-Ns manual, etc.) belong to the specific company. It is for internal usage of the Client and his trained personnel.

No part of this manual will be disclosed to third parties unless specifically authorized in writing by the Manufacturer.

1.14 Use of A5

The A5 is intended for use only in dental CAD-CAM activity and only by professional people.

Professional" is someone that has a specific diploma either of "CAD-CAM extensive training" or of "CAD-CAM 5 axes milling training" issued by Dental machine of one of his delegate instructor at the end of training (see figure).

DANGER – ATTENTION

If the A5 machine is unattended for some time, avoid the access non-trained people to it.

2. THE A5 MILLING MACHINE

2.1 General description

The milling machine named 'A5' is a table machine designed to mill prostheses, abutments, surgical stents and similar items – typically produced by dental labs, obtained by soft materials in the shape of a disc (blank) as zirconium oxide, plastic (PMMA), wax and similar, as well as – occasionally - hard materials like lithium disilicate and similar.

With a proper accessory it can be used to mill, in alternative to the disks, of small blocks of lithium disilicate and similar, as well as finishing of pre-milled abutments.

2.2 Machine technical data

General data:

Type of machine:	**5 axes milling machine (milling centre)**
Model:	**A5**
Serial number:	***SEE THE LABEL ON THE MACHINE***
Year of manufacture:	***SEE THE LABEL ON THE MACHINE***

Size and weight (main body):

height	950 mm (37.4'')
front width	660 mm (26'')
depth	1000 mm (40'')
weight	200 kg max 220 in working conditions

Ground plane (not provided):

Minimum dimensions	same as the machine
Ergonomic height	900 mm
Minimum payload	250 kg

Electrical supply data:

Input voltage:	**230 V AC (alternate current) ± 10%**
Phases:	**single-phase (1P + N + ground)**
Frequency:	**50 Hz ± 1%**
Full load current:	**6.5 A**
Max. short-circuit current:	**3 kA**

Electrical supply: the machine is designed to operate with TT, TN and IT power supply systems. ***Before connecting the machine****, check for the presence of an efficient grounding system, and check the correct coordination of the differential protective devices with the grounding system; this will ensure the efficiency of systems that protect against indirect contact. This operation must be performed by properly trained personnel according to the specific regulations applicable in the country of installation, such as CEI 64-8 and similar.*

The nutrition from the electrical net is: monophasic tension 50 HZ, 230 Volt + Ground; maximal power absorbed: 1,5 kW; internal nutrition of the auxiliary: 24 V in direct current.

Compressed air supply data:

Rated pressure:	**7 bar ± 10%**
Nominal flow rate:	**30 litres/minute (minimum)**
Max. pressure:	**+ 15%**
Characteristics	**free from solids, oil and moisture (*)**

(*) Solids: filter grade at least 5 μm; oil: max content 1 mg/mc; moisture: dew point at max pressure +3 °C (ISO8573.1 standard)

Note: the machine has been designed to accomplish very long milling operations, therefore is recommended to use an oversized compressor, better if screw or blade type, designed to work 24 hours per day, with oil and moisture filters.

Environmental operating conditions:

Room temperature:	**between +5° and +30°C**
Relative humidity	**less than 90% at 20° C (50% at 40° C)**
Altitude:	**up to 1,000 m**

Environmental storage conditions:

Room temperature:	**between +5° and +40°C**
Relative humidity:	**less than 90% at 20° C (50% at 40° C)**
Altitude:	**up to 1,000 m**

Minimum IP rating of electric component case: IP54

The machine **must be protected against** exposure to strong radiation, both ionising and non-ionising and from contaminants such as gas, corrosive gas, powders, acids, oils, chemical products, detergents and any other product not specifically mentioned in this Manual.

The machine must be installed in a suitable environment (dental laboratory).

Classification of the machine and applicable regulations:

Classification: Milling machine A5 for dental technology laboratory.

The milling machine includes an automatic tool changer and has therefore been designed and built according to the applicable EU "machining centre" standards, i.e. UNI EN 12417:2009 Italian version (August 2010, which includes the errata dated March 2010).

The machine's electrical equipment has been designed and built according to EU standard CEI EN 60204-1: 2006.

Electromagnetic compatibility has been tested according to procedure of specifications EN 50370-1 and 50370-2.

The Declaration of Conformity to EU standards is delivered in a hard copy to the Client directly with the machine.

Properties of perishable materials, fluids and lubricants:

The machine is intended for dry milling of 'soft' materials for the production of dental prosthesis as PMMA, PEEK, wax, zirconium oxide partially pre-sintered and similar. It is recommended to use the parameters equipped by the manufacturer of the material itself.

For metal milling, the machine is equipped with a thank and a pump for liquid recirculation. The liquid has a double function: 1) reduce the friction between the tool and the machined part; 2) reduce temperature of the tool and if the machined part.

T

CAUTION – WARNING

The machine is designed to use an emulsion of water (tap water may be used if it has a low mineral salt content; demineralized water is preferable) and a cutting oil Castrol Alusol XT FF at about 5% in volume.

For use of different oil brands, please ask the Manufacturer.

3. RECIPIENTS OF THE MANUAL

A copy of this Manual, either on paper or on CD, delivered to the Client with the A5 machine will be given to the plant manager, who will make a copy to give to the machine Operator and maintenance technician. All of these figures must read this Manual in its entirety. A copy must be kept in a safe and easily accessible place – if possible close to the machine itself – and will be consulted in the case of need before performing any actions on or with the machine.

This Manual must be read in its entirety and in order and all “Attention” / “Caution” / “Important” notes must be carefully understood and memorised. Subsequently it will be sufficient to consult the sections of relevance; for this reason some items are repeated in the different sections.

4. PURPOSE

The information contained in this Manual refers to the use of the machine as stated by the design assumptions and its technical characteristics; provides instructions on transportation, handling, installation, adjustment and use, staff training, maintenance, ordering spare parts and residual risks related to its use.

IMPORTANT NOTE

The Manufacturer urges the Client to read this Manual IN ITS ENTIRETY upon receipt of the machine and STRICTLY before performing any actions on the machine.

5. MACHINE LIMITATIONS OF USE

This machine is intended **for professional use only** and this Manual is designed to provide instructions, indications and warnings necessary in order to know the machine, understand its operating principles and limits of operation and in order to be informed on how to safely use the machine.

These user instructions are to be considered an integral part of the machine and must be kept for future reference until the machine is decommissioned.

The Client is responsible for compliance with the instructions contained in this Manual, as well as any national and local regulations in the place of installation.

Should there be a conflict between the contents of this Manual and national / local legislation, the national / local legislation will prevail.

In such case, the Client is kindly requested to notify the Manufacturer about the conflict in order that the latter may verify and if necessary, correct the Manual.

It is understood that in no way can the Manufacturer be held responsible for any poor results of machined parts and / or broken tools and / or damaged blanks, insofar as the Client is responsible for the machine's use and results largely depend on the choice of material and milling strategies, which are beyond the control of the Manufacturer.

6. CONSERVING THE MANUAL

This Manual must be stored in a protected and dry place, away from dust and direct sunlight.

A copy of the Manual should be easily available for consultation in the proximity of the machine or at the request of anyone needing to work on the machine.

If the Manual is damaged or lost, the Client may request a replacement copy from the Manufacturer, quoting the serial number of the machine which is on the CE plate, riveted on the back of the machine.

7. UPDATES, ADDITIONS AND REPLACEMENT

This Manual reflects the state-of-the-art at the time of the machine's commercialisation and cannot be considered inadequate if it is later updated according to new knowledge.

The Manufacturer reserves the right to update production and the Manual without the obligation to update earlier production and manuals, except for exceptional cases relating to the health and safety of people and things.

The Client may contact the Manufacturer to request any updates or additions to the Manual, which shall be considered an integral part thereof.

If the Client wishes to receive further information or suggest improvements to this Manual, they must contact the Manufacturer directly and quote the serial number of the machine (CE label).

If the machine is sold, the Client is requested to notify the Manufacturer of the new owner's address in order to support the transmission of any changes and / or additions to the Manual to the new user.

IMPORTANT NOTE

The Manufacturer informs the Client that it is relieved from any liability for damages due to:

- **improper use of the machine;**
- **use contrary to the specific national / local rules in force ;**
- **incorrect installation;**
- **incorrect power supply, even due to sharp dips or spikes;**
- **serious maintenance deficiencies;**
- **modifications to the machine - including the use of CAM software - not expressly authorised in writing by the Manufacturer;**
- **use of spare parts (including blank holders) that are not original or not suitable for the model**
- **total or partial failure to observe the instructions of this Manual;**
- **exceptional events suffered by the machine, which may modify the mechanical and / or electrical and / or electronic settings, even to a marginal extent**

8. DESCRIPTION OF THE MACHINE

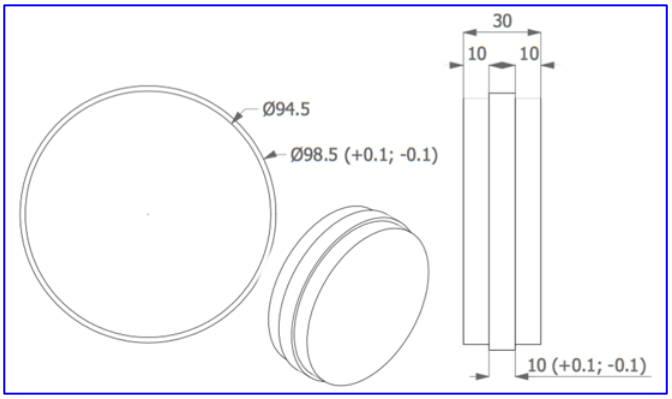
8.1 Machinable materials

The milling machine 'A5' model is designed to perform milling on standard discs used in dental sectors and grinding of blocks of special materials as lithium disilicate, etc. always for medical use.

8.1.1 Discs

The basic machine is fitted up to work on disks with diameter of 98.5 mm and height from 10 to 30 mm. The disks thicker than 10 mm must be equipped of:

- a border 10 mm high in the centre of the external border;
- a tapering above and below the border, up to a diameter no greater to 96.0 mm for the part exceeding the 10 mm (step).



It is very important that the 10 mm thick edge be positioned exactly in the median part of the thickness (figure above).

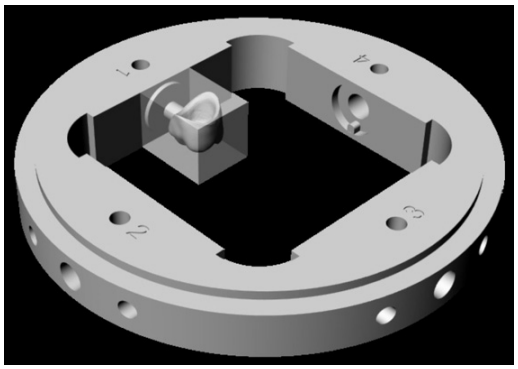
Attention: the dimension of the disks can change lightly from a manufacturer to another; always check that the disk will fit smoothly into the disk holder and that it can be lockable in position.

8.1.2 Other

On request, the machine A5 can be equipped with a piece holder for machining on different pieces

than the standard disk, such as blocks with cylindrical connection or screw connection (see figure below). Blocks are usable with a specific disk holder equipped of connections for blocks, which may be specific of the brand that you want to use.

examples of blocks



example of blank holder with attachment

DANGER – ATTENTION

The Client must not act as a makeshift machine manufacturer, inventing their own devices to mill forms other than the circular disc described above, as this may cause damage to the machine and people. Remember that any changes to the machine shall result in the loss of CE conformity and consequently the nullification of the warranty.

Similarly, the Client must not use the machine for tasks different to those for which it has been designed (milling/grinding materials in order to make prostheses, crowns, bridges, abutments, bars, surgical stents, etc. and similar items for the dental sector). Any other improper use will compromise the validity of the CE declaration of conformity and the warranty will be consequently void.

If required by the Client, the Manufacturer will do its best to find a safe and economical solution for any objects that need to be milled (for dental laboratories).

The milling/ grinding process is possible by:

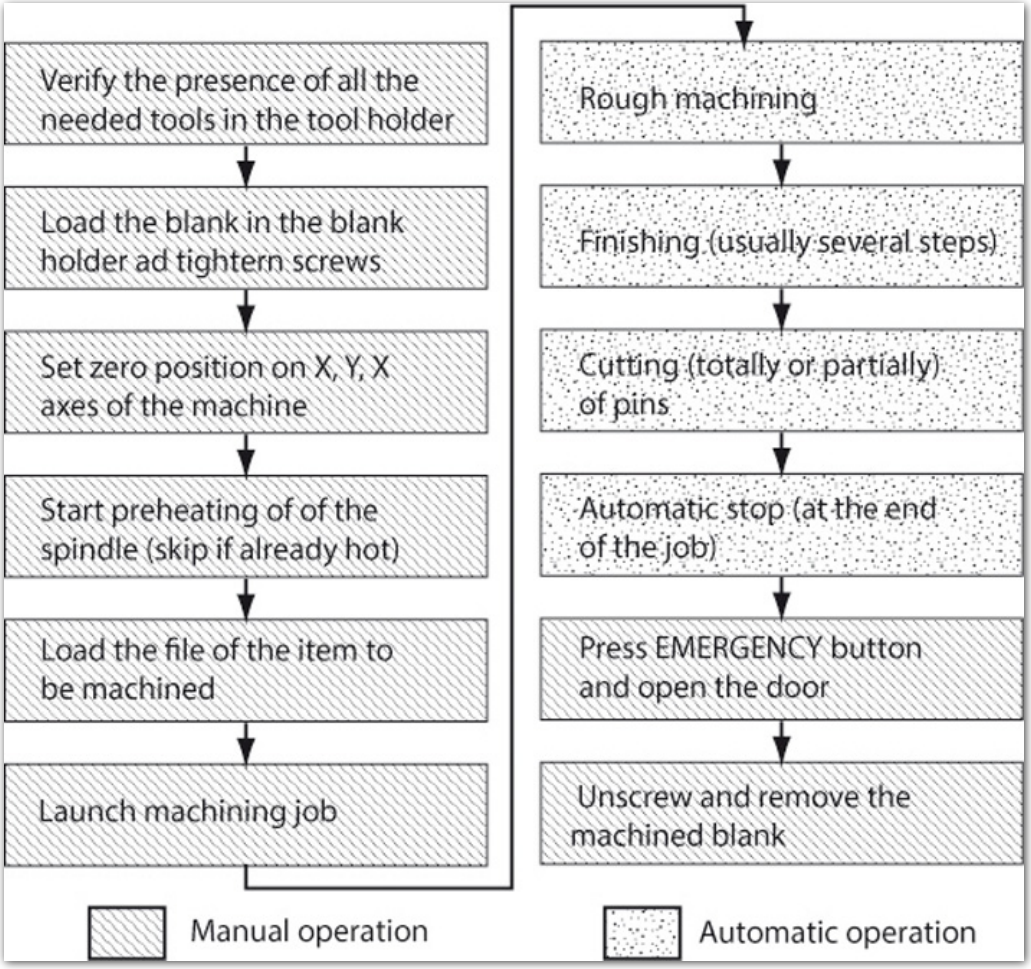
1. an electrospindle that rotates on its axis, fitted with a milling /grinding bit at its end;
2. a system for the translation of the electrospindle itself along three Cartesian axes (X, Y and Z);
3. a rotation system on two axes, one perpendicular to the other, to rotate the blank holder and therefore the piece support, (conventionally referred to as the A and C axes; angles of rotation: axis A = ± 25 °; C axis = 360 °).

The calculator electronically orders the movements through a file of tool pattern, achieved through a software CAM, by the ISO-G standards.

In order to accomplish the sequence of production of the desired part, the spindle should be able to use different types of mills, which depend also from the material on it must work and from the operation which has to be done.

For this reason, the machine is equipped with an automatic tool change, controlled by the numerical control of the machine, and – when needed – it changes the tool according to the type of milling required, as specified in the file stored in the computer which drives the machine.

8.2 Operating cycle



The following figure summarises the operating cycle, including both manual and automatic operations:

8.3 Components

The machine includes the following elements:

1. body;
2. side covers;
3. support for workable material (blank holder), with two rotation movements (axes A and C);
4. milling spindle (or electrospindle);
5. control computer;

6. cutting fluid unit (esternal);
7. font door and front panel;
8. electrical panel (internal);
9. back fixed cover
10. CAM software

8.3.1 Frame

The body of the machine is made of in painted steel, it holds the whole machine; on its turn it is supported by 4 small feet placed on the 4 corners of the machine. The framework, closed above and below, has different functions:

a) to support the mechanisms of the machine;
b) to support the back panel and the lateral panels of the machine, blocked by screws, to prevent the access in improper conditions;
c) to support the front dashboard, blocked by screws, to prevent the access in improper conditions;
d) to support the anterior glass of the machine, which can be opened to access to the machine;
e) to support all the internal movement body parts and also the electrical panel.

In conditions of normal use, the access to the machine for charging/ removing the disk into the blank holder or of the tools into the tool holder can take place only though the front door. For security, the opening is equipped with a sensor which stops the machine in case of accidental opening. It is always recommended to properly stop the machine from the governing PC / tablet of the machine. In case of emergency, press the button EMERGENCY on the front of the machine before opening the door.

8.3.2 Side covers

Both sides of the machine are closed with a fixed glass fiber panels, tightly connected to the body. They may be removed only by maintenance / repair personnel of the Manufacturer or duly authorized form him.

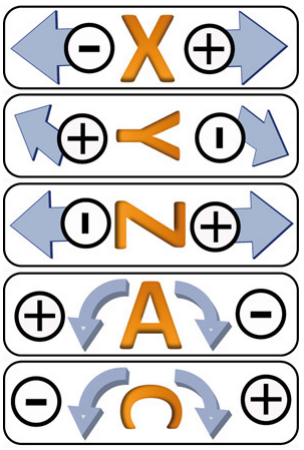
Side covers of this class of milling machines may be of different colours/shape or may bear images according to aesthetics and /or to the client's will.

8.3.3 Blank holder

This has a circular shape and a slot with a diameter of 98.5 mm in which the disk is inserted. This is then firmly secured to its support for machining by a circular flange, which is placed into position and secured to the support using special screws.

The support is assembled to allow 2 different movements around two perpendicular axes (usually named axis A and axis C).

8.3.4 Spindle movement group



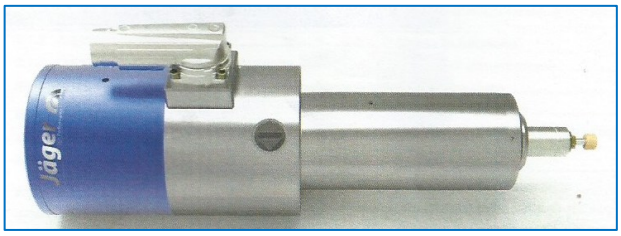
Allows the milling spindle to move in its designated space, horizontally along the two X and Y axes and vertically along the Z axis, thanks to a motor and worm-screws mechanism.

For all three axes, all mechanisms and slides are hidden by a sealed bellows to protect them from of zirconium oxide and other powders.

The name of the 3 axes is identified from specific labels which explain the sense of increase and decrease of the specific coordinates (see figure).

8.3.5 Milling electrospindle [or spindle]

This is the machine part that keeps the mill rotating during machining at a speed defined by the software, which depends entirely on the type of material being milled, the diameter of the tool and the type of machining being carried out.



The electrospindle is a precision tool insofar as it must be able to rotate at high speed without causing the spindle to vibrate and must be able to withstand vibrations caused by contact between the bits and the milled material.

Basically it is an engine which is governed by an electronic control, which manages the speed in function of what planned in the strategy of the CAM.

At the lower extremity it is equipped of a collet clutch for automatic tool changing.

As precision tool it has to be carefully handled and it is mandatory that it does not be subjected to impacts (e. g. trying to machine a disk with a higher thickness as stated to the CAM) and that its clutch is well cleaned only with compressed air, without using liquids or abrasives.

IMPORTANT NOTE

Caution: the failure to perform a pre-heating cycle prior to the start of any machining (unless immediately after a previous machining cycle) may cause damages to the ceramic bearings of the spindle with immediate breakage; and in any case it reduces the life of the spindle.

The spindle protects itself by a continuous flow of air toward outside. Avoid us of compressed air when cleaning it, since it may draw chips inside it. Also avoid any ultrasonic cleaning as well as any spaying on it.

The electrospindle installed on this machine is produced by:

Alfred Jäger GmbH
Siemensstrasse 8
D-61239 Ober Mörlen, Germany
Tel +49 (0) 6002 9121
info@alfredjaeger.de

Unless otherwise indicated in Appendix 2, the spindle model used is:

DentaDrive 60VLW S21

It is compliant to:

- machines directive 2006/42/EG
- lower tensions directive 2006/95/EG
- electromagnetic compatibility directive 2004/108/EG
- harmonized standard EN 14121 on the security of the machines and in particularly on the part 1 (guide lines for the definition of the risks).

The speed of the spindle is up to 60.000 turn/minute. For that reason, is mandatory use tools provided by the manufacturer, which are balanced for that speed.

The spindle is equipped with bearings in ceramic, highly sensible to dirt. For such reason, it protects itself with a continue flow of air, which prevents to the dust to come in and to reach the bearings. In lack of air (or pressure lower then 6 bar) the spindle will stop and machine will go in error.

8.3.6 Control computer (part of the machine)

The A5 control computer – which hold the file of the components to be machined and releases it in block to the numerical control of the machine – is a desktop or portable PC or even a tablet; it is connected to the machine by a standard Ethernet cable or Wi-Fi.

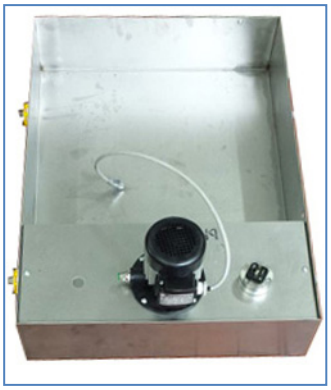
The operating system depends form the PC; usually is Windows 10 or his update.

This computer must be used according to the Manual ISO Ns – Next Step issued by Promax (§ 1.3).

As an alternative the portable PC may be replaced by an internal PC plus a *touch screen* monitor placed on the front door (see figure). Under proper conditions, the machine can also be operated by a remote operator through its Internet connection.

8.3.7 Cutting fluid unit

The unit consists in a pump and conduits that terminate with a nozzle near the tool, used to spray the fluid onto the piece being machined; the fluid is then collected into a bottom thank, placed on the floor under the machine, that also holds the recirculation pump.



Wet machining is necessary on most hard materials - in particular titanium and cobalt-chromium alloys - insofar as it cools both the tool and the machined piece using a recirculating coolant. If the coolant contains a portion of EMULSIFIABLE lubricating oil, it will also reduce the friction created by contact with the cutting edge, thereby reducing tool wear and minimising the generation of heat.

The same considerations can also be made when milling aluminium, lithium disilicate and similar products.

When milling soft plastic materials (e.g. PMMA and similar), the use of a coolant significantly improves both the texture of the milled part and its appearance, preventing the plastic from melting due to friction and giving the piece a "pasty" look.

The coolant and cutting fluid is determined by the Client based on the type of machining and is poured directly into the tray positioned on the floor under the machine.

If the selected strategy includes wet machining, the pump positioned in this tray will automatically start following a command by the CAM software and will pump the fluid. It is not possible to activate the pump unless its use has been contemplated by the strategy inserted into the CAM.

For the suggested cutting fluid see § 2.2.

DANGER – ATTENTION

Caution: some coolants may be toxic and/or flammable and/or irritating. Always carefully read and follow the precautions indicated on the coolant packaging.

Caution: some metals (e.g. titanium and his alloys, aluminium and his alloys, etc.) may produce flammable chips when milled. Use coolant for drilling of all metals, unless you are sure that there is no risk of flammability (such as with Co-Cr alloys).

Caution: avoid using products that have a boiling point under 100 °C since the heat generate by the working tip may generate flammable or toxic vapours.

If wet machining is not used for long periods of time (e.g. 2-3 weeks), the coolant oil may separate and form mould on the surface. In this case it will need to be completely replaced, disposing of the residue in accordance with the instructions of the oil producer.

8.3.8 Front door and front panel

The front side of the machine includes the following components:

(1) machine support (feet)
(2) support table
(3) machine side (may be different colors)
(4) LIGHT switch
(5) EMERGENCY button
(6) front glass with handle lo lift it for access to the machine

The “light” switch turns the light on and off.

The EMERGENCY button provokes the immediate safety arrest of the machine. To turn on again the machine, unblock it by rotating it in counter-clockwise for a quarter turn.

The front glass - partially transparent to allow the vision of the manufacturing - which may be opened (after switching off the machine) by pulling the handle toward the operator and upwards.

The hinges which support the glass are equipped by a balance piston which smooth the movement, counterbalance the weight of the glass itself and keeps it in positions when raised. The image of the front glass may change with time.

DANGER – ATTENTION

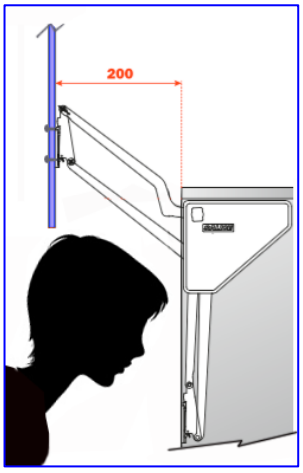
Any change on the hinges that support the glass has to be done by the manufacturer or from a skilled and using an original piston of the manufacture of the hinge or functionally equivalent.

CAUTION – WARNING

Opening the anterior glass to access at the blank holder, the glass raises but it also comes ahead toward the operator (about 200 mm, about 8").

Open it with a right posture and pay attention to the head.

When accessing to the opened machine, pay attention to the posture and to the movements, to escape to beat the head.

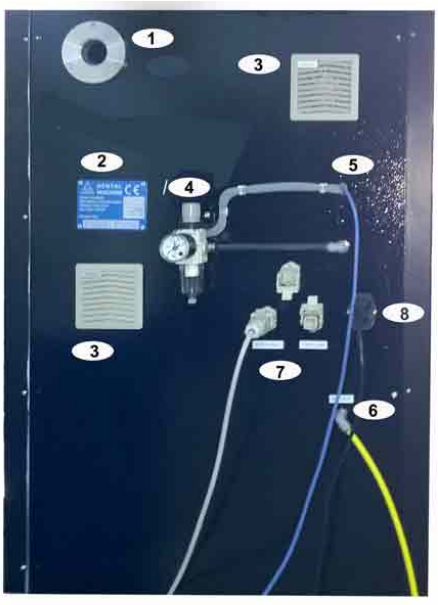


8.3.9 Electric panel

The electrical panel is totally internal to the machine and the access is reserved to the authorized technician.

For this reason, the machine must be preferably located in a relatively large room, making sure the maintenance technician has enough space to access the back and sides of the machine and completely open the electrical panel door to work inside.

The access is reserved to the technician authorized by the Manufacturer.



8.3.9 Back fixed cover

The back panel (fixed) of the machine includes several elements:

(1) Attachment for vacuum exhauster

(2) CE label with serial number

(3) Cooling air in/out

(4) Air pressure gauge and adjustment

(5) Ethernet cable

(6) Cutting liquid in

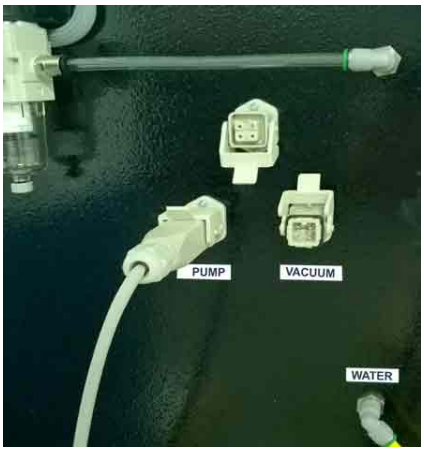
(7) Electric connections (see later)

(8) Connection to the main electric network.

All elements are self-explaining, except for electric connections:

Connection to the main electric network is performed by a plug IEC 320 C13 (F), quite popular in most countries, so the client can easily find the cable suitable for his type of plug.

Thus plug included a main switch on/off switch, which can be used as an alternative to the emergency button of the front. It should be turned off in the evening, at the end of the work day.



Other connections are made with a 4-pole CK plug, male-female to avoid confusion. They are:

a) Connection to the pump for cutting liquid

b) Connection to the vacuum exhauster (or to a valve onto the centralized vacuum system); by using this connection, the vacuum will activated immediately when there is generation ow dangerous powder (basically: dry milling of zirconia)

c) One open position for future needs.

8.3.10 CAM Software

The CAM Software receives the CAD project as a file representing the desired object (crown, bridge, etc.) in STL format, translates it into a series of paths that each single tool must complete to “carve” the desired object into the blank. The product is an “executable” file, which is normally transferred to the machine’s PC / tablet (see previous point) through a Wi-Fi connection.

When purchased, it is supplied on a USB key that constitutes an integral part of the machine, even if separate from the same, and can be used on any PC with Intel microprocessor and a Windows 7 or XP operating system.

One important characteristic of the CAM is that the 5 axes can also move / rotate simultaneously, if required by the machining strategy (continuous interpolation on 5 axes).

DANGER – ATTENTION

Caution: the machine has been designed and tested to work with a CAM software named "MillBox" by CIMSystem di Cinisello Balsamo.

The machine can also work with other CAM software if compatibility has been verified by the Manufacturer.

Use of CAM software that has not been checked and approved by the Manufacturer shall cause serious damage to the machine and to the operator and shall result in the nullification of the warranty.

8.3.11 Operator interface

Operator interface inputs / outputs / warnings / signals shown on the display are described in the “ISO-NS Operator Interface" manual, which forms an integral part of this Manual even if it is a

separate document, insofar as it is produced by a third party, Promax Srl - Via Newton, 5G - Castel Fiorentino (FI).

Programming instructions are also described in the "ISO-NS Programming Manual"; this too is a separate document insofar as it is produced by a third party (Promax Srl cited above).

9. REMARK ON ELECTRIC SUPPLY

The A5 machine is predisposed for connection to a stable electrical network, free of voltage variations (voltage dips and spikes outside the range of ±10% of the normal voltage of 220 V; frequency 50 Hz ±1%). The majority of energy suppliers are not able to guarantee this (most suppliers allow "various brief and long interruptions to voltage each day" on their network).

The standard CEI 0-21 (publication 2012-06) explicitly states that electrical energy providers can distribute energy with voltage variations of ± 30% of the rated voltage. This may damage:

- **Digital electronic process control devices or calculation machinery in general;**
- **Variable speed drives (power electronics).**

Therefore prior to installation, it is recommended to contact your energy provider to receive a guarantee on the quality of distribution and an assurance that the above-mentioned damage will not be incurred, or alternatively arrange for a technician to carry out the necessary tests.

In the absence of said guarantees, it will be necessary to install an on-line *Uninterruptible Power Supply* unit upstream of the machine, of approximately 10 kVA or higher if other devices are also connected to it (not included in the supply).

This strategy is also recommended to protect against any brief "voltage dips" that may occur on the network, even if they are generally so brief that they cannot be perceived by the human eye.

10. REMARK ON COMPRESSED AIR SUPPLY

When working, the A5 machine needs a continuous air supply, since the Jäger spindle is using air for two reasons:

1. protecting its ceramic bearing for the contact with chips, etc. that may damage them;
2. clamping of the tool by the collet.

In absence of a proper supply of air (quantity and pressure), the machine stops since it cannot due its job.

Please note the working A5 needs a CONTINUOUS flow of compressed air. The Manufacturer recommends the usage of a compressor specifically designed of continuous production (i.e. rotary

screw, rotary vane, etc.); if not available, a reciprocating compressor may be used, yet it must have a rating of 2-3 times the air need of the machine and an air reservoir of minimum 200 liters.

DANGER – ATTENTION

Like the electric, also compressed air fitting must be performed by an expert technician. And, after the fitting, plase check that, if the socket is not located immediately near the machine, or above it, the conduit must be properly fixed to avoid harm to people in case of breakage or detachment.

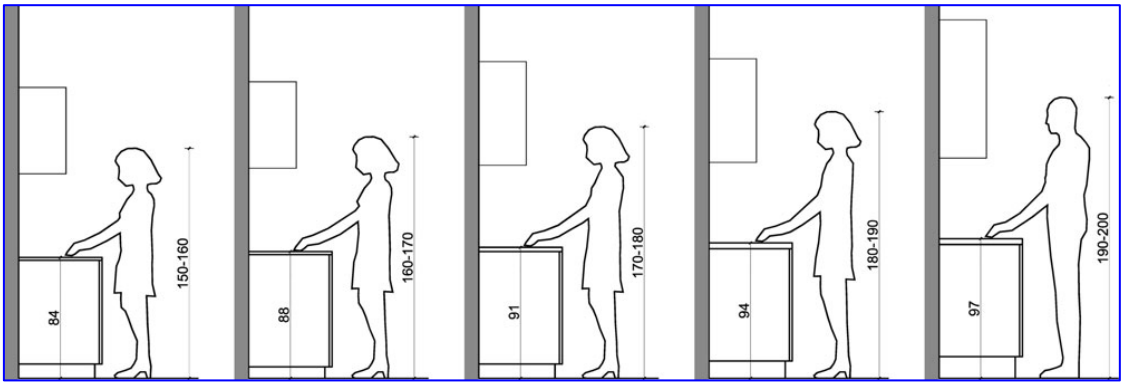
DANGER – ATTENTION

Remember that the air supply must be free of oil and moisture. The Manufacturer recommends the use of a good oil filter and a very good humidity filter (better if a condensing type unit).

11. OPERATOR'S STATION

For a secure and safe use of the machine, it has to be positioned on a table with suitable payload (minimum 300 kg) provided, at least, of 4 fixed supports.

The height of the table depends on ergonomics, so that the change of the discs results easy. Same considerations are applied for all standing jobs (figure below), taking account that the working zone of loading and unloading of the machine is circa 25 (10") cm above the base of support of the machine itself.



The loading and the unloading of the blank is an occasional operation, to be accomplish a few times per day, for that reason – for most operators - also a bad posture shouldn't cause particular inconvenience and a height of the table of circa 90 cm (35") is adequate for the majority of the operators.

It is opportune that the operator has enough free space from any obstacle, so that he has enough space to move and to escape in case of accident.

12. WORKING CONDITIONS

The A5 machine is designed to work in a close environment, not exposed to weather conditions and in “normal office condition”, i. e. a temperature from +10 to +30 °C with humidity not higher than 90%, at an altitude of 1,000 m on the sea level or less, on a floor not subject to vibrations and with a suitable ventilation of the place.

The machine must be installed on a proper stable table with a flat surface and its 4 legs properly adjusted.

In case of need for installation in other conditions, ask the Manufacturer.

13. OPERATOR

The machine is intended for professional use only. The operator in charge of running the machine must therefore be in possession of a "5-axes Milling Machine Operator" qualification issued by one of the Manufacturer's instructors or their delegate at the end of the "Training Course for 5-axes Milling Machine Operators" (see § 2.1).

Furthermore, the operator must have carefully read this Manual, which has been designed and prepared to provide the user with the instructions, indications and warnings necessary in order to know the machine, understand its operating principles and limits of operation and in order to be informed on how to safely use the machine.

The first time the Manual is read, it must be read in its entirety and in order, and all information and warnings must be understood and remembered.

In the case of any doubt regarding the interpretation of any phrases and/or terms, contact the Manufacturer.

The skills, training and psycho-physical condition of the machine operator must be such that they are able to completely understand and correctly apply the instructions contained in this Manual and displayed on the machine in the form of signs, symbols, pictograms and text.

The operator must not run the machine if they are under the effect of drugs, alcohol or any other substances that may compromise their normal level of attention, perception and reactivity.

14. TOOLS

14.1 Tool selection

For the first year, the Client must adopt only be tools provided from the Manufacturer or from approved companies because they have a plastic ring in a specific position, which is necessary for locking them on the tool holder (see figure).

The use of such tools is not mandatory, yet it is needed to make simpler and more affective the technical support from the Manufacturer and/or its Dealer.

14.2 Tool mounting

To prevent errors, every tool has a fixed position on the machine, which is stated according to the expected jobs of the Client. It's a restriction of 'good sense' to simplify the running of the machine and the support service. Such restriction can be removed by the Manufacturer if the Client prove to be an expert.

The access to the tools, for any reason, must be done at machine turned off, with the following procedure:

1. press the EMERGENCY button on the control console;
2. wait (if necessary) for the spindle to stop;
3. open the door and access the tool holder, position the new ones and/or check the position of the tools already present;
4. close the door;
5. release the EMERGENCY button on the console by turning it counter-clockwise.

DANGER – ATTENTION

Before starting any new job, pay maximum attention to ensure that the tools are exactly in the same position as the one stated in the CAM software. Incorrect use of a tool may lead to incorrect machining, causing damage to the piece being machined and the tool, and in worst case, damage to the machine itself.

Tools used in the A5 machine have a stem of 3 or 4 mm (depending on the client's choice) and must have a proper ring to keep them in place in the tool holder.

DANGER – ATTENTION

Caution: the tools used to mill prostheses or other dental elements are normally very small (bit diameter = 3 mm or less) and may therefore cause pricks if not handled with care.

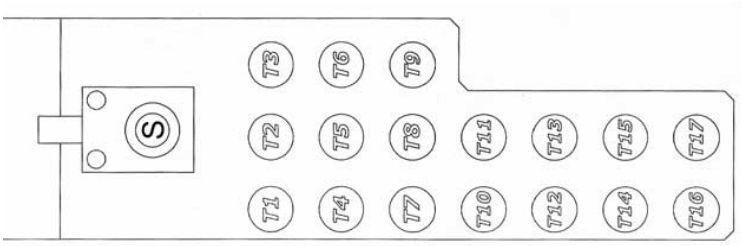
This can be avoided in two ways:

a) using suitably thick gloves to protect hands, which will however make the above-mentioned operations difficult;

b) taking care not to touch the thin part of the tool with your hands.

14.2 Tool holder position

The machine is fitted with a tool holder with 17 numbered positions (see figure).



Tool positions 1 to 14 are predefined when the machine is assembled and are reported in the CAM software as per the following table:

Position	Diameter mm	Use for	Shape	DM part number
T1	2	PMMA		FS122031
T2	1	PMMA		FS121031
T3	2	ZIRC		FS244120
T4	1	ZIRC		FS244110
T5	0,6	ZIRC/PMMA		FS120631
T6(*)	1	DISILIC	Grinding	FS244425
T7(*)	1	DISILIC	Grinding	FS244410
T8(*)	0,5	DISILIC	Grinding	FS244405
T9	2	METAL	Ball	FS124120
T10	1,5	METAL	Toroidal	FT244115
T11	1	METAL	Ball	FS144110
T12(*)	1,5	METAL	Flat	FP121541
T13(*)	2	METAL	Flat	FP122041
T14(*)	0,5	METAL	Flat	FP120541
T15				
T16				
T17				

Remarks:

1. *the above ma is the default one, and may be changed according to the client's needs*
2. *it includes tool for grinding of disilicate blocks and like*
3. *tools with (*) are optional*
4. *DM part number are used for re-ordering tool to Dental Machine*
5. *Empty positions may be defined with the client during installation*
6. *Empty position (and others) may be defined as back-up positions (they may have the tool as another position; if the tool brakes during the work, the machine automatically restart the bob with the back-up tool*
7. *The Client will take care of keeping an updated map of his specific tool map*
8. *That copy must be in a safe place and be accessible only to the machine operator*

DANGER – ATTENTION

Modifying tool positions (or mounting tools other than those indicated) without changing the tool description in the CAM software, may cause serious damage to the machine and pose a risk to the operator.

The change of the CAM software should be done by the Manufacturer or from a specialized technician.

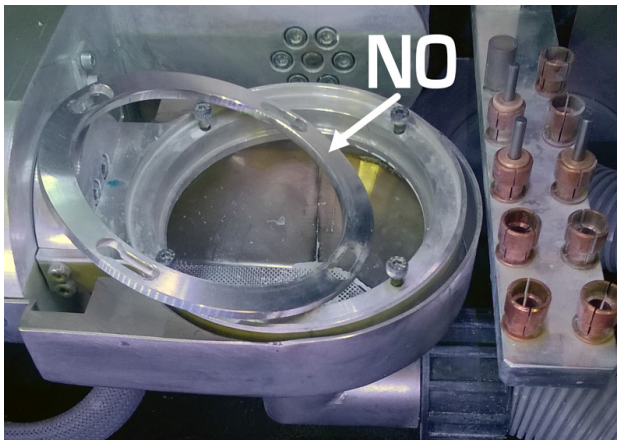
Any damage caused by not authorized changes from the CAM will not be covered by the machine warranty.

15. WORKING SEQUENCE

15.1 Morning start up

At the beginning of the work-day (or after a long interruption, of 1-2 hours) is necessary to execute the following process:

1. from the control tablet/PC, launch the process “SPINDLE WARM UP”;
2. **verify that any movable object is on the working area,** from the control tablet/PC and start the process “RESETTING AXES”;
3. At the end of these operations, go on with the current working process.



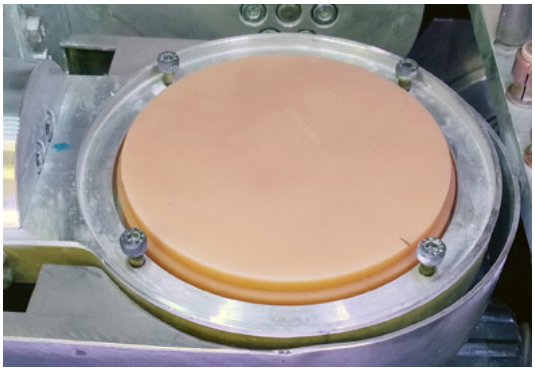
15. 2 Current Working

The sequence of operations that has to be performed to produce milled pieces is the following:

1. If at the beginning of the work, follow what explained at point 14.1;
2. press the EMERGENCY button on the console, and open the front door of the machine;
3. verify that on the tools holder that all the tools needed for the working process are present and that they are all in their correct position;

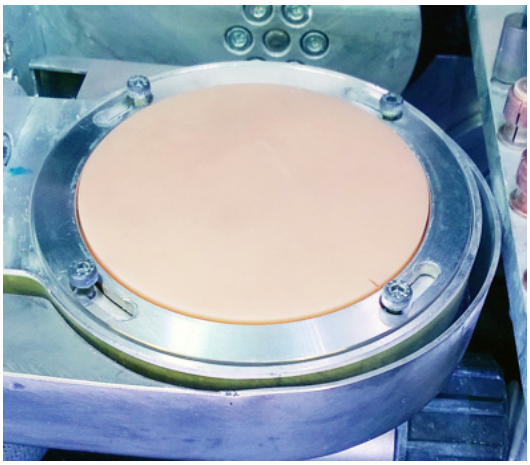
4. place the disk to be machined (disk) on the support (blank holder), inserting it in the correct position and securing it using the locking nuts; if is a used disc it has to be positioned in its “initial position”;

[in case of a new blank, it is recommended to make a permanent mark on the blank in a predefined position of your choice, providing it is always the same and visible from above, e.g. near the slit on the blank holder; this will make it easier to mount if it needs to be reused in the future in the same position as the initial one. In fact the CAM will keep in memory the already developed works on that disc exactly in connection to that position];



In the above figure, the reference is the bottom right screw.

5. insert the specific metal ring to block the disc in position and tighten the fixing screws with the screwdriver, part of the equipment;
6. close the door and release the EMERGENCY button;
7. by the control tablet / PC select the file to be machined and activate the job;
8. if the internal lights are turned on (button on the dashboard), the colour of the light will indicate the status of the machine (green = work in progress; blue = job finished; red = job sopped because of a problem);
9. at the end of machining, press the EMERGENCY button to stop the machine;



10. wait for the spindle to stop and open the door to access the job.

To execute the cycle, the machine will position itself at the starting point and start machining. All phases of the job can be seen on the display, step by step. A bar always displays an overview of the amount of the job completed and remaining ones on a horizontal scale.

16. CONTROL DEVICES

The machine is equipped with the following controls, arranged as follows:

1- **POWER** (on the back of the machine): is the general button, to switch off at the end of the working process and to switch on at the beginning;

2- **LIGHT** (green button on the dashboard): turns the light in the work area on and off; has no effect on machining; if switched on you can see the status of the machine “by sight” (green = work in progress; blue = job finished; red = job sopped because of a problem);

3- EMERGENCY (red button on dashboard): button for emergency stop; it is activated by simply pressing it down and it stays in that position until released by pulling it up from the console and turning counter-clockwise for a quarter turn; when pressed, it stops all machine movements as quickly as possible, bringing the machine into a safe condition. **CAUTION, DO NOT PRESS IT ACCIDENTALLY!**

The general switch located on the electrical panel on the back of the machine is another control device that can be used in emergencies, and which MUST be used for long idle periods, such as during the night and on weekends.

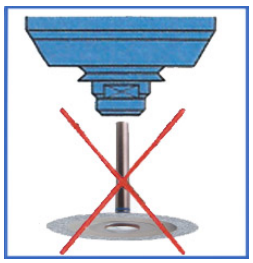
17. INCORRECT AND UNINTENDED USES

The machine must NOT be run with the safety devices dismantled, disconnected, not calibrated, or voluntarily removed and/or made inefficient, as this may give rise to electrical, thermal and mechanical risks.

DANGER – ATTENTION

The machine must NOT be used to machine elements in shapes and materials different to those intended by the Manufacturer, as this may damage both the machine and the product and be a source of danger to the operator.

In particular, it is prohibited to use tools that are not compatible with the characteristics required by the spindle and by the tool path file.



SPECIFICALLY, IT IS STRICTLY PROHIBITED to use a disc mill and/or facing tools. Even if these are included in the SUM3D manual, they are not suitable for machining with this machine.

In particular, the Manufacturer will not be liable for damage to persons and/or things and the warranty (if still valid) will be nullified:

DANGER – ATTENTION

- if the machine is used inappropriately or for uses other than those for which it is intended (production of dentures and surgical stents for dentistry);

- if any of the machine's operational parts have been modified in any way;

- if there are used spare parts that were not supplied or approved by the Manufacturer;

- if circuits, components and/or the system software has been modified in any way.

The information reported in this Manual must be strictly followed; and in the case of doubt, contact the Manufacturer.

Responsibility for the application of safety standards and rules of use belongs to the Client, which must ensure that authorised personnel:

- **is qualified to perform the requested activity;**
- **has the necessary knowledge;**
- **is in a normal psycho-physical state.**

IMPORTANT NOTE

Note that it is the explicit responsibility of the Employers to ensure their staff is suitably trained on workplace risks, safety devices and general accident prevention

rules in accordance with European Union directives or the legislation in the country where the machine is installed.

In any case, the machine is equipped with safety devices that protect the safety of operators and maintenance technicians during all stages of its life. These include:

- EMERGENCY stop button;
- emergency safety switch in the case opening of the door while the machine is running (this has the same effect as the EMERGENCY button);
- main electric switch (located on the electrical panel at the back of the machine);
- detailed information contained in this instruction Manual.

CAUTION – WARNING

Note that the machine is not fitted with a dust extraction system. When milling powdery materials, the Client must install a proper vacuum system which guarantee suitable extraction and filtering and safe air recirculation in the area where the machine is installed (see Appendix 1).

18. NOISE EMISSIONS AN VIBRATIONS

18.1 Noise

Even in heavy machining conditions, if the machine is properly installed (§ 12) it emits a sound level about 62 dB.

IMPORTANT NOTE

Any excessive or unusual noises – if not due to usage of worn out tools – must be a cause for concern: immediately turn off the machine off and call a maintenance technician.

The noise values measured at the operator workstation in intense operating conditions are reported in the following table.

5-axes milling machine, model: A5, power supply: 230 V AC 50 Hz, noise pressure at operator workstation, normal operation, maximum parameters.	
DISASSOCIATED DECLARATION OF NOISE EMISSION VALUES as per standard ISO 4871:2009	
Acoustic pressure $\mathbf{L_{pA}}$ *[dB(A)]* at operator workstation in decibels	**62.2 dB(A)**
Expanded uncertainty K_{pA} in decibels	± 4 dB
Peak acoustic pressure $\boldsymbol{L_{pC}}$ *[dB(C)]* at operator workstation in decibels	70.1 dB(C)
Expanded uncertainty $K_{cC,peak}$ in decibels	± 4 dB

Values determined in compliance with standard EN ISO 11202:2010. The sum of the measured emission values and the uncertainty value equals the maximum acoustic pressure value.

Caution: noise emission also depends on the material being milled and, to a large extent, the amount of worn out of the tool being used.

The quoted values are emission levels and are not necessarily safe operating levels.

Although there is a correlation between emission and exposure levels, this may not be a reliable basis on which to determine whether additional precautions are necessary. Factors that influence the actual exposure level of the workforce include workplace characteristics, other sources of noise, etc., the number of machines and other simultaneous processes.

The admissible exposure level may also vary from country to country. In any case, this information allows the machine user to evaluate the dangers and risks.

Caution: in many countries, there is a specific legislation concerning the risk assessment in a workplace, including noise: please check them and adopt – if necessary – the proper safety devices.

18.1 Vibrations

If properly installed (§ 12) and used correctly, there is no contact between the machine and the operator during machining. Therefore, there are no specific risks to the operator caused by vibrations produced by the machine.

19. TRANSPORTATION AND INSTALLATION

19.1 General information

The machine weigths approximately 240 kg (including the weight of packaging and accessories). The weight of the machine in operation is approximately 220 kg. Assuming that it will lay on a table of 30-40 kg weight and a free area of 25 cm (10”) all around it, a minimum floor loading capacity o 300 kg/sqm is recommended.

Except when the machine is delivered directly by the Manufacturer using their own truck, it is delivered completely assembled and carefully packaged to protect it against normal bumps and/or scratches during transportation.

Except in special cases, the machine is packaged in wooden crates, which can be moved into by a normal forklift.

For lifting, the machine may be taken either from the bottom, thanks to 30x30 mm square pipes placed close to the 4 feet, or from the top, by adding 4 male eyebolts (M16, max 100 mm length) like in the figure.

DANGER – ATTENTION

Lifting of heavy weights may cause damage to people. Please check local regulations and follow them.

19.2 Positioning, assembly, power connections

The position of installation is decided by the Client. The Client must accurately define the position of the machine, taking into account:

- the load-bearing capacity of the floor, which must support the weight of the machine and of the table (about 300 kg/sqm);
- the minimum spaces required to move the machine along the path to its final installation area,
- the load-bearing capacity of all paths from the public road to the final installation area, which must be able to support the weight of the machine, of the pallet truck (or fork lift) used to move it and at least one person;
- available space for the operator workstation;
- available space for the introduction and subsequent extraction of materials (which is the same as the operator space, given that this involves small hand movements);
- available space for routine and special maintenance on the machine, which includes in 100 cm on be back and on the left side.

The initial positioning and installation of the machine is always performed by the Manufacturer's personnel or by specifically trained delegates.

No equipment that may generate abnormal vibrations must be located near the machine.

After positioning the machine in its agreed location, perform the following checks:

- easy opening of the front glass door;
- easy opening of the rear panel and left side panel for possible maintenance works on the electrical panel;
- ergonomic and safe access by the operator.

To complete the machine's installation, electrical and pneumatic power connections must be made. They must be performed by skilled personnel in compliance with local current legislation.

IMPORTANT NOTE

The electric cable must have must be the right copper section according to:

- **its length**
- **protection for over-current installed on the wall plug**
- **protection for short-circuit installed on the wall plug or upstream**

- **local regulations**

In any case the MINIMUM section must be 2.5 mm^2 (0,004 in^2) or more, according to the above factors. The Manufacturer suggest a type H07RN-F or equivalent, with insulation 450/750 V or better.

19.3 Connection to Internet network

Although not mandatory for the machine's operation, the Manufacturer recommends to connect the machine to the internet network - either by cable or by a wireless connection - so that technicians can access the machine controller and check the machine status (with prior client authorisation).

This will allow the Manufacturer to provide technical assistance form a remote location, solving the majority of problems quickly and at low cost.

19.4 Moving the machine

When the machine needs to be moved, even to a room near its initial location, assistance from one of the Manufacturer's technicians should always be requested.

Moreover, after moving the machine is necessary to verify the entire machine, to ensure that it wasn't subjected to any damage e – if necessary – redo centring operation of the machine.

20. MACHINE OPERATOR

Please remind that the machine is intended *for **professional use only*** and must be used by persons who:

A. have followed the specific course to obtain the "*5-Axes Milling Machine Operator*" qualification, held by the Manufacturer, or rather trained and informed on how to use the machine safely, on residual risks, and risks that may be generated by incorrect or improper use;
B. have carefully read and understood this Manual in its entirety.

The machine must not be operated with the safety devices removed, disconnected, not calibrated, voluntarily removed or in any case inefficient, as this may generate a risk of contact with moving parts, entanglement, dragging and crushing.

The employer is responsible for ensuring employees do not tamper with safety devices to exclude them or prevent or limit their function. If safety devices or guards or any other part of the machine is damaged or malfunctioning, it is PROHIBITED to use the machine before the safety devices have been restored.

The machine is designed to run automatically; the operator needs only load the blank that will be milled, and unload the finished product. If the machine tool is broken or faulty, the machine will automatically stop; the error will be shown by the red lighting in the operating area a message on the control PC.

DANGER – ATTENTION

When in operation, the machine can be left unattended for short periods only. In any case, prior to leaving the machine, make sure that it will not cause any problems and in particular that daily maintenance has been properly performed.

Please apply carefully local regulation on machine safety.

21. MACHINE START UP

Commissioning must be performed by the Manufacturer or by delegated and properly trained personnel in compliance with this manual. During this phase, incorrect operations may cause serious damage to the machine or persons in certain cases.

Each machine is carefully inspected and its functions are all tested by the Manufacturer at the factory prior to its delivery.

In any case, like all precision machine tools, this machine is very sensitive to bumps or vibrations during its loading / transportation / unloading / final positioning.

IMPORTANT NOTE

Any machine can be damaged during transport and installation. During the first start-up it is therefore essential to check for abnormal operating conditions (such as irregular rotation, unusual noise, abnormal vibrations) and to notify the Manufacturer of any faults to ensure immediate action and repairs if necessary.

Before starting the machine and performing machining operations, check the characteristics of the electrical and pneumatic supply, fluids, levelling and the correct installation of the machine itself as indicated in the installation instructions (chapter 19).

If it becomes necessary to activate the emergency stop command, do so immediately and contact the Manufacturer to evaluate the causes and subsequently restart the machine.

22. OPERATION

The machine only works on files generated by the CAM (in this case Millbox), which computes all the paths that need to be executed in their correct sequence, and all the different tools that will be used.

This file must first be prepared on another computer and is recalled by the machine during the execution phase.

IMPORTANT NOTE

To start normal operation, it is necessary to carefully follow all the phases of execution indicated in the various screens that appear in the control panels on the computer screen where the procedures are illustrated.

If in doubt, in addition to this manual consult also the MillBox manual saved on the USB key of the CAM software user licence.

22.1 Operator interface

Instructions listed in the "Iso-Ns Operator Interface" manual must be carefully followed.

If it is necessary to activate the emergency stop command, do it immediately; then check if the possible fault is listed in chapter 26; if not, contact the Manufacturer to evaluate the causes and ask for instructions on how to restart the machine.

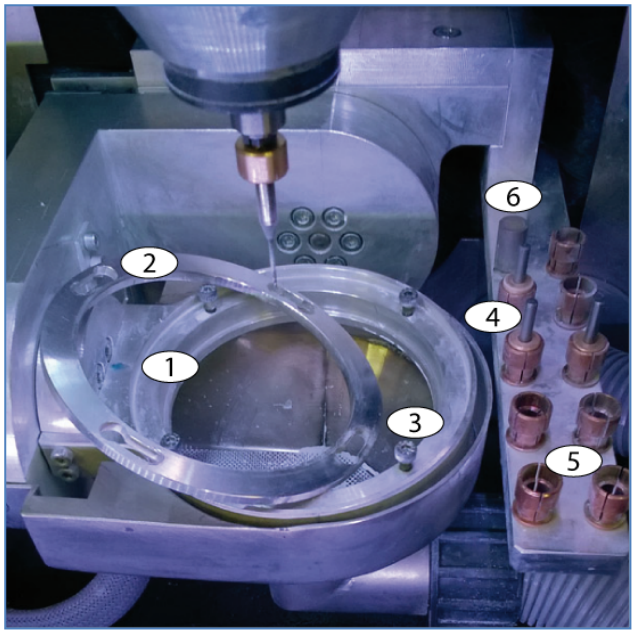
22.2 Loading blanks for machining

Remember that all loading and unloading operations both for new and machined blanks must be performed with the machine stopped. The same is valid for the loading and unloading of the tools.

DANGER – ATTENTION

The Client is kindly requested not to become upset if this creates a few extra minutes of work each day, and not to short-circuit the safety devices: they are designed to ensure your safety and that of your employees. Even the best of us can be unexpectedly distracted.

The working area is shown in the picture on the right:



(1) blank to be machined; (2) metal ring and screw to fix the blank; (3) blank holder; 3) locking screw of the metal ring; (4) bushing for keeping tools in position; (5) tool currently on the spindle; (6) spindle collet; (7) tool length measure sensor.

For changing the blank, follow the process indicated at § 15.2

Before loading the new disc is suggested to clean with a compressed air and the tool stems, as well as all bushings. Don’t blow air directly toward the spindle.

22.3 Tool check

Before starting any job, check that all the tool needed for it are present in the tool holder. If you are unsure of the integrity and position of all tools in the position stated in the software, check the position as per the instructions in § 14.1

DANGER – ATTENTION

The machine is designed to use only tools properly BALANCED for the speed of the electrospindle which - we remind - can reach 60.000 rpm.

The use of any other tool or equipment may create risks for workers and the machine, therefore resulting in the nullification of the machine warranty.

22.4 Execution of machining

To perform a certain machining process, the file generated by the CAM software must be recalled from the PC / tablet, which already includes the correct choice of tool depending on the operation being performed (rough-cutting, finishing, pin cut-off, etc.) and the details of all paths that must be executed by the same tool.

22.4.1 Resetting the axes

Using the PC / tablet, start the specific programme for this operation; wait for program completion and the axes will to be reset.

Instructions reported in the "Iso-Ns Operator Interface" manual must be carefully followed.

That operation has to be done with the working area free from any mobile object, including the metal ring of the disc holder (see point 15.1).

22.4.2 Pre-heating the electrospindle

Spindle pre-heating is activated using the PC and lasts approximately 2-5 minutes. The operation is complete when the spindle stops.

Remember that this operation is fundamental for the correct operation of the electrospindle, because it is a precision component that can generate power only when all its elements are correctly heated.

This can be avoided only if the electrospindle was already in operation (or: the new machining process begins at most 15 minutes after the end of the previous milling process).

CAUTION – WARNING

Failure to pre-heat the electrospindle may cause serious damage to the same and cause an important loss.

22.4.3 Launch and execution of machining

Using the control PC, the machining programme can be launched and the machine will perform it, including the necessary tool changes

Machining progress can be followed step by step *(see "Iso-Ns Operator Interface" manual)* on the machine's display.

22.5 Manual movements and resetting

Instructions reported in the "Iso-Ns Operator Interface" manual (§ 1.3) must be carefully followed.

22.6 Machine stop

The machine will automatically stop in the following cases:

1. intervention of motor thermal cut-off devices;
2. intervention of spindle inverter protection devices;
3. interruption to power supply (even if brief and not perceivable by people in the room; see point 10.3.11);
4. air pressure too low;
5. intervention of front door opening protection device;
6. end of execution of launched programme.

Point 6 represents a normal situation. To access the machining area, press the EMERGENCY button; once the spindle stops, open the door. When the door is open, the machine cannot be started.

In other causes, the cause of the error will need to be eliminated before the machine can be reactivated (see point 26).

To manually turn off the machine, perform the following operations on the PC /tablet:

1. push the button STOP on the control tablet/PC;
2. exit the machine's management programme
3. turn off the machine by the button ON-OFF (indicated I-O) on the back of the machine itself;
4. leave the control programme of the machine;
5. turn off the control computer.

If the interruption is for long periods (e. g. during night), it is recommended to turn off the machine by the main wall switch.

23 RISKS CONNECTED TO THE MACHINE USE

23.1 Risks when using the machine (residual risks) and Personal Protective Equipment (PPE)

Normal use of the machine does not pose any specific risks since during machining, the machine cannot be accessed. Door opening causes the stop of all movement of axes and of the feeding of the spindle; however the spindle may rotate for some time because of its inertia (anyway small, due to the size).

Furthermore, the small dimensions of the tools used (bits from 0.5 to 3 mm) may cause pricks if not handled with care.

This can be avoided in two ways:

a) using suitably thick gloves to protect hands, which will however make the above-mentioned operations difficult;

b) taking care not to touch the thin part of the tool with your hands.

Regardless of the type of machining performed, there is NO risk of the formation of a potentially explosive atmosphere inside the closed machining area, bacause:

- dry milled zirconium oxide is not flammable (the finished product will then be sintered in an oven at approximately 1,500 °C);
- chips of PMMA, PEEK and other materials have a very low (or even none) flame risk and the quantity are minimum, so that they cannot cause any danger for the operator;
- for all other materials, the operator must ensure that they don't create any danger by carefully reading the technical sheet of the material BEFORE he starts the milling process.

Remember that, in many countries, local legislation require the employer to assume responsibility for preventing damage to operator health, or rather for the implementation of all necessary measures - depending on the nature of the work, experience and techniques - to prevent or reduce professional risks and protect the health of workers, the population and the integrity of the environment

23.2 Risks due to improper / incorrect use of machine

The milling machine must not be made to operate with parameters different to those reported in the technical characteristics table and with products and/or materials with characteristics different to those described in § 27.2.

Always check these parameters prior to using the machine.

The milling machine has been designed and tested to use tool path and tool change files executed by the CAM software supplied with the machine (§ 8.3.11).

The use of patterns prepared using other CAM software - unless expressly authorised in writing by the Manufacturer - is to be considered improper and therefore potentially hazardous. The Manufacturer therefore denies formally any liability for the effects of said use.

23.3 Reasonably foreseeable risks of incorrect use

23.3.1 Operator

The machine is intended for professional use by an operator specifically trained to run the machine, who must be in possession of the *"5-axes Milling Machine Operator"* qualification issued by the Manufacturer (§ 1.13), which implies that he is familiar on how to safely use the machine, aware of the risks and consequences that may arise from incorrect use.

The most reasonably foreseeable incorrect use is use of the machine by non trained or poorly trained persons. The Manufacturer is powerless in this case.

It is therefore the responsibility of the Client or person in charge (in the role of "employer") to comply with all applicable laws and regulations related to health and safety of workplace and to ensure that access to the machine is limited only to properly trained persons.

23.3.2 Environment

The machine has been designed and built to operate in "normal" environmental conditions (§ 12).

The machine is therefore NOT intended to operate in the following environments:

- particularly dusty, regardless of the type of powder;
- in the presence of flammable gases or substances that may release flammable gases;
- in places where there are potentially explosive atmospheres;
- outdoors or in places without suitable protection against the weather elements, excessive humidity and temperatures exceeding the range specified by the Manufacturer for the correct operation and storage of the machine;
- in presence of high emission of electromagnetic;
- in any environments that do not reflect the environmental conditions described in the machine's technical data in this point.

23.3.3 Power supply

The machine has been designed and built to operate with "normal" grid voltage (§ 9). If the distribution network operator is not able to guarantee the quality of electricity and specifically a constant supply (§ 9) it is necessary to install - upstream of the machine - an *on-line Uninterruptible Power Supply* unit.

Eventual "voltage dips" (§ 9) that may occur on the grid may cause the total or partial loss of RAM (in the numerical control) contents and consequently unexpected machine behaviour, which may include:

a) stoppage in a blocked position;

b) continuation of the job inconsistent with the initial programming;

c) broken tools;

d) execution of movements causing collision between parts.

In these cases, the integrity of the machine may be at risk, however there is no risk to the operator even if they are located near the machine itself.

23.3.4 Air supply

A frequent reasonably foreseeable incorrect use is a drop in pressure in the compressed air supply network. The required air pressure is equal to 7 bar, with a tolerance of ±15%. In case of lower pressure, the machine arrest itself, without any risk.

In the case of overpressure beyond rated values, the machine's air transfer pipes may detach and subsequently flap uncontrollably, an occurrence which must be absolutely avoided.

Using secure fasteners, the compressed air transfer tubes must therefore be attached to a metal rod or similar element, which on its turn is properly attached to the wall/floor and the machine, so as to avoid hazards and/or damage due to the unexpected detachment of the compressed air.

Only use materials and tubes that conform to the local regulation applicable to pressure equipment.

23.3.5 Cutting liquid

Some machining strategy need the usage of the cutting liquid (§ 8.3.7). In case of low level of fluid, the milling / grinding operation will continue, yet results may be different from expected.

23.3.6 Powder

Another form of reasonably foreseeable incorrect use is the dry machining of powdery materials without connecting the machine to a local or centralised extraction system (not supplied with the machine, unless specifically requested).

We remind you that in the case of dry machining on powdery materials such as zirconium oxide (also known as zirconia), it is mandatory to avoid that the powders generated will not be dispersed into the environment, potentially causing damage to human health.

For this type of machining the machine must be connected to an extraction system (not included in the supply), whether centralised or local, fitted with a suitable micro-filter.

In this way, the internal part of the machine will be at a lower pressure than the surrounding environment, preventing the exit of powders that may damage the health of operators and other people close to the machine.

We remind you that for all materials, the effects of a compact material on the human body are very different to the effects of its powders. Even highly biocompatible materials (like wheat flour, wood, talcum, etc.) in their massive form may generate powders that are toxic for the human organism if they enter our airways (see for example appendix 1 for zirconium oxide).

24. DISMANTLING

DANGER – ATTENTION

The machine must be dismantled by the Manufacturer's personnel or persons properly trained by the Manufacturer, so they can properly sort materials for recycling and reducing environmental impact.

25. MACHINE ADJUSTMENT AND MAINTENANCE

People in charge of the machine's maintenance (including the operator) do not require any specific instructions or training other than the obligation to read and follow the contents of this Manual.

DANGER – ATTENTION

Before to perform any maintenance operation, be sure no tool is the spindle. If not, perform the tool discharge procedure as explained in the Iso-NS Manual.

When maintenance operations are performed on the machine, it mandatory to operate with power disconnected, both through the wall switch and the switch located on the back of the machine.

Similarly, the compressed air network must first be DISCONNECTED and the air inside pipes must be DISCHARGED. Also ensure that it is impossible for anybody to accidentally restore electrical or pneumatic power during maintenance works. It is recommended to display warning signs or to padlock the switches. Only at this point can maintenance works be performed on the machine, whatever the type.

NO MAINTENANCE WORKS MUST BE PERFORMED WITHOUT HAVING FIRST ISOLATED THE ELECTRICAL AND PNEUMATIC SUPPLY AND BEING SURE THAT THEY CANNOT BE RESTARTED.

Before to perform maintenance works on electrical parts, ensure that enough time has passed to discharge any residual energy (for example the terminal board of the inverter drives). The necessary discharge time is 60 seconds.

25.1 Daily maintenance

IMPORTANT NOTE

The machine does not contain any parts that need to be lubricated from the outside.

At the start of each working day (or at least every 24 operating hours), perform the following checks:

1. Check the efficiency of safety devices (switch on the front door);

2. Clean and inspect the spindle, specifically
   - **2.1** Check that all tool tapers are clean: perform the procedure to access the tool holder (point 13) and check visually that all tapers are clean; if there are impurities, clean them with a blow of air or soft cloth; **take care not to change the position of the tools);**
   - 2.2 Check that the spindle is clean in the taper clamping area; if needed, clean it with a soft cloth);
   - 2.3 Avoid using a blow of compressed air directly on the spindle, since it may damage it;
3. Check the level of the cutting fluid and adjust it if needed.

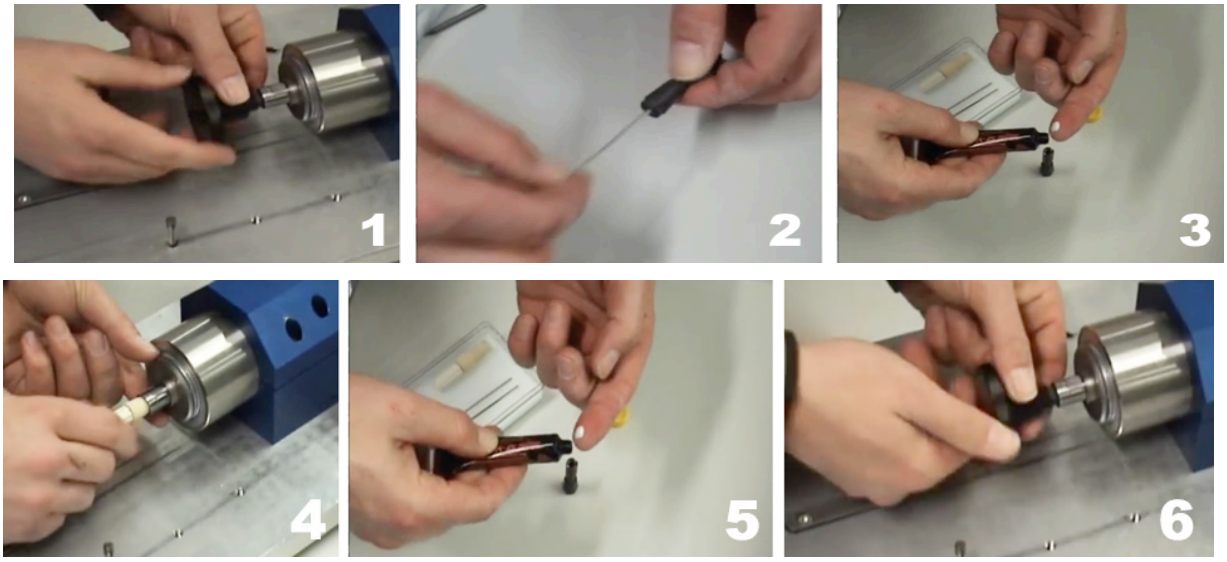
At the end of every working day (or at least every 24 operating hours), it is recommended to clean the machine all over by removing any milling residue. All residues must be disposed of in accordance with current local legislation.

25.2 Weekly maintenance

If the daily maintenance is properly performed, the weekly one is quite simple: basically it includes the cleaning of the collet of the spindle, according to the following procedure:

a. Unload the tool if it is in the spindle;
b. Disconnect the machine from the electric and air supply, as per § 25 and check if it is disconnected;
c. Wait at least for 60 seconds for the discharge of residual compressed air and electrostatic charges;
d. Open the front glass to get access to the spindle, and unscrew the collet with the proper tool, which is included in the maintenance kit;
e. Remove the dirt from the outside and inside of the collet with a soft cloth and the pipe cleaner included in the maintenance kit;
f. If not enough, use again the pipe cleaner after immersion of the collet in a proper solvent;
g. Dry perfectly the collet with compressed air;
h. Gently clean the collet seat with the conical tampon included in the maintenance kit;
i. Lie down e thin layer of grease - included in the maintenance kit – on the outside of the collet, and carefully remove any excess of it
j. Reload the collet in the spinlde by screwing it first by hand and – at the end – tighten it by the same tool used to unscrewing it;
k. Check that the assembled collet is open and ready to pick up a tool, and that the spindle rotates freely, without any effort.

Such sequence is illustrated in the following figure and is also explained on Youtube at the address https://www.youtube.com/watch?v=bhjidUzWzyo



IMPORTANT NOTE

If the collet show some kind of damages (scratches, wearing, etc.), replace it with a new one.

25.3 Monthly maintenance

Provided the cleaning operations and inspections described under daily maintenance are regularly performed, the machine does not require any monthly maintenance.

Monthly it is recommended to do a general cleaning inside the machine and removing with a vacuum cleaner all particles on bellows and on other visible parts.

Monthly it is recommended to check the efficiency of the electrospindle. As there is no cheap instrument to do it, this must be done empirically using the following methods:

1. listen to the sound of the spindle - after pre-heating - as it rotates and listen for any abnormal sounds (different to the initial sounds), above all at 30-60,000 rpm;
2. in the same operating conditions as above, place one hand on the chassis to feel for any abnormal vibrations (or different to the initial ones), above all at 30-60,000 rpm;
3. perform a standard machining process (e.g. a 10 x 10 x 10 mm cube) using a new tools and measure its precision.

25.4 Annual maintenance

Annual maintenance that can be performed by the client is limited to the replacement of the collet of the spindle with a new one during one routine cleaning operation (§ 25.2).

DANGER – ATTENTION

Except for that, annual and special maintenance must be carried out exclusively by the Manufacturer or by a specialised company indicated by the Manufacturer.

Caution: annual maintenance MUST include verification of the presence, correct operation and calibration of the machine's safety devices.

Annual maintenance requires the machine to be opened by dismantling the side panels, detaching the bellows and performing a visual inspection on the condition of the moving parts (guideways and worm-screws).

If necessary, the worm-screws and axis guideways must be lubricated by silicone grease Molykote Type 44 Medium (or equivalent).

The electrospindle is the heart of the machine and must be treated with maximum care. As previously mentioned, it must only be used with balanced tools, supplied by the Manufacturer or form approved supplier.

The electrospindle contains pairs of ceramic bearings which are lubricated for their entire lifecycle and therefore do not require periodic lubrication. It is also fitted with a pressurised collar that acts as a barrier against all impurities that may infiltrate and damage the bearings, and is kept under slight pressure by the compressed air to which the machine is connected.

Anyway, over time, repeated stresses on these bearings - which are in ceramic- may cause their collapse without prior warning, leading to the practical destruction of the spindle itself (but without danger to the operator). For this reason, it is recommended to have the Manufacturer (or the manufacturer of the electrospindle) inspecting the spindle condition every two years (or after 4,000 operating hours).

25.5 Special maintenance

The regularity of special maintenance depends on the extent to which the machine is used, the materials used and the environmental and operating conditions.

The verification of the presence, efficiency and calibration of the machine's safety devices depends on current legislation.

Caution: these operations must necessarily be performed by the Manufacturer or by personnel expressly authorised by the Manufacturer.

The operations deemed necessary shall then be performed by the maintenance technician. In all cases, the following operations are necessary:

Necessary operations	Frequency
Check if the spindle's ceramic bearings need to be replaced	Annually or each two years (*)
Check condition of electrospindle	Annually
Check presence, efficiency and calibration of machine's safety devices	Annually
Check condition of electric and pneumatic connections	Annually

(*) In the case of intense works (e.g. 2,000 hrs/year). For less intense works, this can be checked every two years. The operation must be carried out by the manufacturer of the spindle (Jäger, see point 8.3.5), normally at his premises.

25.6 Maintenance summary

Follow the maintenance summary table, which describes the necessary routine and preventive maintenance on the machine, to ensure correct and safe operation over time. Correct and timely machine maintenance will help keep the machine in perfect conditions of safety and operation.

The regularity of the following maintenance is jus a reference, and the actual need depends on the extent to which the machine is used, the materials used and the environmental and operating conditions. Heavy use of the machine, involving continuous and long operating cycles, may lead to the need for more frequent routine maintenance.

In any case, it is recommended not to reduce the maintenance beyond that indicated in the table.

Necessary operations	Minimum frequency
Spindle cleaning and inspection	Daily
General cleaning of residue and dust	Daily
Check efficiency of safety devices	Daily
Check wear of tools	Contact manufacturer (*)
Clean and apply grease in the collet and check proper operation of electrospindle	Weekly
Lubrication of worm-screws and guideways	Annually
Check condition of electric and pneumatic connections	Annually
Replacement of spindle collet	Annually
Check if the spindle's ceramic bearings need to be replaced	Annually or each two years

(*) Wear highly depends on the material of the tool and the machined product. **Caution: when the sound of the tool changes, it is probably worn out and must be replaced.**

During maintenance operations, any one must wear safety clothing and personal protective equipment, suitable for the operation being performed, such as gloves, protective visors, safety shoes, protective glasses, etc.

26. STANDARD REPAIRS, POSSIBLE FAULTS AND SOLUTIONS

DANGER – ATTENTION

All repair operations requiring access to the machine's internal parts must be exclusively performed by the Manufacturer or by a specialised company indicated by the Manufacturer. IT IS PROHIBITED to perform any maintenance operation before having turned off electric and air supply and waiting at least 60 seconds for discharging.

Fuses must be replaced **by specialised personnel using the same type of fuse with the rated current indicated by the Manufacturer** as these parameters guarantee the safety of the machine and its electrical equipment.

DANGER – ATTENTION

The changing of parts and fuses with an improper one may cause heavy damages as fires or electric shocks risks as well as irreversibly damage on circuits and devices of the machine.

In these cases, contact the Manufacturer who will provide instructions on which fuses to check; perform the recommended checks and/or replacements, or rather check their characteristics on the wiring diagrams and relative documentation.

All parts and devices, including electrical or pneumatic parts or devices must be replaced by a specialised technician according to the Manufacturer's instructions or using materials or devices that have the same characteristics as those being replaced.

DANGER – ATTENTION

IT IS PROHIBITED to replace any of the machine's parts or devices or its electrical or pneumatic equipment with any parts other than original spare parts with the same characteristics as those being replaced. Always contact the Manufacturer's technical service centre.

Following is a list of the machine's most common faults and errors, possible causes and solutions.

ERROR	POSSIBLE CAUSES	SOLUTIONS
The machine doesn't start.	The power cord is faulty	Check and if necessary replace the power cord.
	Faulty fuse/s	Eliminate the cause of the overload or short-circuit and then replace the fuse with one having identical characteristics and the same rated current.
	Faulty control circuit fuse	Eliminate the cause of the overload or short-circuit and then replace the fuse with one having identical characteristics and the same rated current.
	Remote control switch isn't activated	Contact the Dental Machine s.r.l. technical service centre
	EMERGENCY button pressed	Release (by lifting and turning) the EMERGENCY button

	No compressed air	Turn on the compressor and check that it works
The machine doesn't stop properly	Faulty contactor, welded contacts, etc..	Isolate the power supply using the proper device. Subsequently, contact the Manufacturer's technical service centre
MAIN switch doesn't turn on	No power	See the causes of "the machine doesn't start"
	General switch off	Turn it on (on the back of the machine)
Interface doesn't start	Network cable disconnected	Connect it
	Access point off	Turn it on
	Faulty access point	Replace it

For operating errors that appear on the control PC, consult the Iso-Ns - Next Step Manual (§ 1.3).

27. REASONABLY FORESEEABLE NORMAL, IMPROPER, INCORRECT / PROHIBITED / INCORRECT USE

27.1 Operator

The machine described in this Manual is designed to be run - during each work shift - **by one operator only,** who has been trained and informed about the residual risks by both the Client and the Manufacturer, as this is the responsibility of both parties.

It is the Client's specific responsibility (or in his role of "employer") to ensure that the operator interacting with the machine has the necessary characteristics.

In particular, he/she must:

1. be a legal adult;
2. be in a normal psycho-physical condition;
3. be physically and psychologically capable, in the Client's (or "employer's") opinion, of performing technical tasks;
4. be aware of the most important hygiene, accident prevention and technological standards;
5. have read and understood this Manual and in particular all safety precautions reported in this Manual; [*NOTE: we remind you that the term "this manual" implies this file and all other documents listed in point 2, which constitute an integral part of this Manual]*
6. have been previous informed and trained on residual risks:

a. the danger of injury or other damage that may arise from direct or indirect contact with common tools, milling tools, milled parts;

b. general hazards that may arise from working with electrical equipment;

c. general hazards that may arise from working with equipment that uses compressed air;

d. the danger of injury or other damage arising from the residual risks indicated in this user instruction manual and in particular those arising from contact with milling tools;

e. hazards arising from the inhalation of or contact with hazardous substances even if involuntary.

27.2 Normal use

Normal use is that described above, i. e. the milling of discs to produce dental prostheses or their parts, surgical stents to support dental surgery, as well as models and test elements of the same.

For this reason, the machine has been specifically optimised to mill specific materials. In particular, the machine has been tested for milling discs of the following materials (all for dental use):

- Co-Cr alloys
- Ti alloys
- Zirconium oxide (also known as *zirconia*)
- PEEK (polyetheretherketone)
- PMMA (polymethyl methacrylate) and similar resins
- Plaster, wax and soft materials in general

The machine is also tested for grinding hard materials blocks (for dental use) of:

- Lithium disilicate and similar hard material

To mill/grind materials other than those listed above, please contact the Manufacturer.

Every material must be milled according to the Manufacturer's instructions. The machine is built to operate in both in wet or dry mode, according to the strategy included in Millbox CAM.

27.3 Improper use

The machine must not be used **IMPROPERLY**; in particular:

1. the machine must not be used with materials featuring a different composition and/or format than those indicated (see points 10.1 and 27.2), nor may it be used with tools different to those intended (see point 13.2) and nor can tools be mounted in a way different to that indicated;
2. the machine has been designed and built specifically to perform machining processes for the production of dental prostheses, dental models and surgical stents for dental use; all other uses are prohibited unless previously authorised in writing by the Manufacturer;
3. all uses of the machine different to those indicated in the previous two points shall be considered inappropriate and unsafe; the Manufacturer therefore denies all responsibility;
4. all uses different to those indicated in previous points 1) and 2) of this chapter may cause damages and shall result in the nullification of the Manufacturer warranty if it is still valid;

5. the Client alone is responsible for damage resulting from the failure to comply with the prescriptions and instructions contained in this Manual.

27.4 Incorrect / prohibited / reasonably foreseeable incorrect use

The machine MUST ABSOLUTELY NOT BE USED INCORRECTLY.

IT IS PROHIBITED TO INSTALL THE MACHINE IN A ROOM WHERE THE FLOOR IS UNABLE TO SUPPORT THE MACHINE'S WEIGHT.

It is the Client's responsibility to check the compatibility of installation instructions in § 19 with the parameters of the building, either by consulting relevant documentation or performing an on-site technical survey.

Furthermore:

1. **it is strictly prohibited to use the machine with the safety micro-switches deactivated, and in general, with any safety and/or protection device (mechanical, electrical) deactivated and/or not working;**
2. **it is strictly prohibited to partially or totally neutralise, remove, modify or perform any action intended to make the safety micro-switches and danger signals inefficient;**
3. **it is strictly prohibited the use of the machine by untrained personnel (point 12);**
4. it is prohibited to leave the machine running and unattended for long periods of time without having first performed the daily maintenance described in point 25.1;
5. it is prohibited to use flammable, corrosive or harmful substances both in lubrication / cooling and cleaning operations;
6. it is prohibited to smoke or use devices with an open flame and/or handle incandescent materials near the machine, unless suitable safety measures have been adopted;
7. it is prohibited for anybody other than the trained operator to use the control PC / tablet while the machine is running;
8. it is prohibited to hang objects off the machine or place weights on the machine or its parts;
9. it is prohibited to use the machine in areas open to access by various people without suitable protection guards or with the guards open or not properly secured;
10. it is prohibited to use the machine unless the user has taken all necessary precautions to eliminate the residual risks indicated in this instruction Manual;
11. it is prohibited to use the machine for operations different to and/or in different ways and/or using different tools than those expressly indicated in this Manual (see previous chapters);
12. it is prohibited to use the machine in unsuitable environments and in areas not fit for the installation of a machine with these dimensions, unless suitable safety measures have been previously adopted;
13. it is prohibited for operators and maintenance technicians to access the inside of the machine or its parts to perform cleaning, lubrication, maintenance or other operations without having first placed the machine in safe conditions as described at the beginning of point 25;

14. it is prohibited to use the machine in unstable conditions, or with the machine positioned on surfaces that are not horizontal, not smooth, not stable, or which are not suitable to support the weight of the machine;
15. it is strictly prohibited to machine materials or products not expressly indicated in this Manual and to machine materials with sizes different to those indicated in previous paragraph 10.1;
16. it is strictly prohibited to perform machining using tools different to those indicated in chapter 13 or mounted in a way different to that specified in the same chapter;

Following is a list of reasonably foreseeable INCORRECT uses of the machine:

- Use of the machine before reading and understanding this Manual;
- Use of the machine with safety devices neutralised or removed;
- Use of the machine in unsuitable environmental conditions;
- Use of the machine with unsuitable materials or tools;
- Use of the machine by unauthorised, unsuitably trained and unsuitably informed personnel;
- Use of the machine in abnormal operating conditions or in the presence of obvious faults;
- Use of the machine to mill unsuitable or non-allowed materials;
- Use of the machine in places with a potentially explosive atmosphere or in the presence of ionising or non-ionising radiation outside the allowable range;
- Use of the machine in the presence of strong vibrations or noises.

Of course these are conditions that must be strictly avoided.

27.5 In the case of a machine blockage/fault

In the case of a machine blockage/fault, check the table of chapter 26 and act accordingly.

In the case of a blockage/fault not listed in said chapter: turn the machine off using the general switch located on the back of the machine, close off the compressed air connection, empty the circuit and contact the Manufacturer.

27.6 In the case of an accident...

The machine must be used in compliance with the instructions in this Manual. If the machine is used correctly, it is not possible to remain trapped or blocked inside. The operator should never come into contact with moving parts of the machine if it follows this Manual.

Minor accidents may occur by contact with the tools if the user does not wear protective equipment if the necessary precautions are not taken. Other accidents may occur during maintenance operations if safety precautions and the procedures explained in this Manual are not followed.

DANGER – ATTENTION

In the case of serious injury or the inhalation of dust, seek urgent medical attention and show to the doctor the data sheet on the product which may have caused the problem.

CAUTION – WARNING

Caution: Always store the technical data sheets of all materials and products used in a safe place (best solution: in a well-identified place near the machine) so that – in case of accident - anyone can give specific information to the medical personnel.

28. RESPONSIBILITIES

DANGER – ATTENTION

The Manufacturer cannot be considered responsible for any eventual faults caused by unreasonable, improper, incorrect, erroneous or prohibited use.

The Client (or the "Employer") is the sole responsible for compliance with safety standards regarding the installation and use of the machine.

The Client is the sole responsible for damage resulting from the failure to observe the specified conditions of use.

DANGER – ATTENTION

The Client (or the "Employer") is responsible for selecting a suitable location for the machine and for selecting the person/s in charge of running the machine, ensuring they are suitably trained to use the machine and equipped with the necessary personal protective equipment for the task, taking into account their state of health and anything they may be particularly sensitive to.

IMPORTANT NOTE

Given the high number of variables involved in milling (materials, tools, tool wear, strategies, etc.), while the Manufacturer guarantees that its product is suitable for the intended use, it cannot guarantee the precision of products machined by the Client, nor provide a guarantee for the eventual breakage of tools or materials that may occur during machining.

29. SPARE PARTS

Supply terms do not include any spare parts. If these are needed, contact the Manufacturer, specifying the serial number of the machine reported on its CE plate attached on the back of the machine.

To guarantee the machine's performance and safety characteristics considered by the Manufacturer during the design and construction of the machine, it is necessary to use spare parts with exactly the same characteristics as the original parts.

IMPORTANT NOTE

The use of UNSUITABLE spare parts or those with inferior or different characteristics than those considered by the Manufacturer may compromise the machine's safety characteristics.

DANGER – ATTENTION

It is therefore PROHIBITED to use non-original spare parts or spare parts not authorised by the Manufacturer. Parts used as spare parts or to replace safety devices, controls, protection devices, guards, electrical or pneumatic equipment must carry a CE MARKING when required and in compliance with applicable local legislation, and must be used exclusively for the specific application according to basic and exhaustively tested safety principles, taking into account actual operating conditions etc…

Parts and safety components, as well as the machine's command and control system parts must be EXHAUSTIVELY TESTED for their specific intended application on the machine and taking into account their safety function and operating conditions.

Contact for spare parts:

Dental Machine s.r.l.
Via del Lavoro, 18
29022 BOBBIO (Piacenza), Italy
Phone +39 0523 936604 - fax: +39 0523 960478
email: info@dentalmachine.it

29.1 Specifications of spare parts that may affect the health and safety of operators.

The following are the perishable materials and spare parts that may affect the health of workers:

- Front door safety system (glass): if this breaks, contact the Manufacturer by specifying the serial number (CE label in the back).

30. UPDATES TO MANUAL

The information, descriptions and illustrations contained in this manual reflect the state of knowledge at the time of the machine's sale. The Manufacturer reserves the right to make amendments to the equipment at any time for technical and/or commercial reasons.

Such changes shall not result in the Manufacturer's obligation to adapt equipment sold before that time, nor consider this publication as unsuitable.

Any integrations to this Manual deemed necessary and subsequently supplied by the Manufacturer must be filed together with this Manual and considered an integral part of the same.

Appendix 1 - Notes on zirconium oxide (or dioxide) (or zirconia)

FOREWORD

This appendix has no scientific basis, nor is it based on current literature on this subject. It simply represents an invitation to the user of theA5 milling machine to take maximum care, given that documentation on this subject is poor and conflicting.

ZIRCONIUM

Zirconium is the chemical element with atomic number 40 and the symbol **Zr**. In its pure form, it is a glossy whitish-grey metal, exceptionally resistant against corrosion. Zirconium is relatively similar to titanium, its superior counterpart in the periodic table.

Symbol	Ti	Zr
Atomic weight	22	40
Melting point (°C)	1,668	1,855
Density (g/cm3)	4.5	6.5
Hardness	6	5
Electrical conductivity (/m·ohm)	2.34×10^6	2.36×10^6
Thermal conductivity (W/m*K)	21.9	22.7

Both metals are relatively light and very resistant against corrosion in many environments, which is the reason they are commonly used in the chemical industry. Human tissue easily tolerates these two metals, which are therefore used for artificial joints and prostheses for implantation, as well as to develop structures for dental prostheses.

The name zirconium derives from the Arab *zarkûn,* "similar to gold". It is mainly used in a silicate or *zirconic* form ($ZrSiO_4$), and is a common component of many refractory and sand mixes used in foundries. Zirconium is also used in the jewellery sector due to its similarity to diamonds.

ZIRCONIUM OXIDE

Zirconium oxide (ZrO2) has various forms depending on its crystalline structure. In its impure form, it is also referred to as *zircon* and is used to manufacture laboratory crucibles able to withstand strong thermal shock, to line furnaces in the metalworking sector, and in the glass and ceramics industry as a refractory material.

In its cubic form (the so called cubic zirconia), it is a very hard material, normally colourless, with a melting point of 2,680 °C and characteristics very similar to those of a natural diamond, which is also why it is called a "synthetic diamond".

At room temperature, it is a white, odourless powder. It is a polymorphic crystalline substance: up to 1,170 °C it has a monoclinic crystalline structure, from 1,170 °C to 2,370 °C it has a tetragonal crystalline structure and over 2,370 °C it has a cubic crystalline structure.

The passage from the monoclinic phase (room temperature) to tetragonal phase (above 1,170 °C) involves a strong contraction of its volume, which is added to the volumetric contraction that the sintering process in itself involves; therefore, when the machined piece is sintered, it undergoes a

linear reduction of approx. 25% (i.e., to obtain 100 mm when finished, the raw piece must be approx. 125 mm).

During cooling, the reverse transformation should occur, with the volume increased again. This does not occur because the passage from the tetragonal structure to the monoclinic one (which would lead to the formation of cracks until breaking) is blocked by special additives (e.g. calcium, magnesium, yttrium oxide refractories) added by the manufacturer of the blank. The cooled material therefore remains in a semi-stable condition: it is not in a perfectly balanced state, but the change does not occur or occurs extremely slowly (a large part of common steels are in the same condition).

Zirconium oxide is also used to manufacture knife blades and other cutting tools. The internet is full of affirmations such as *"antibacterial and antiseptic blade, cuts like a scalpel and doesn't oxidise food, meats and vegetables"* which are in part true (it cuts well) and in part absolutely false (all the rest).

Its use in the dental industry dates back to 1998 thanks to studies performed at the dental clinic of the University of Zurich, which was searching for an alternative material to traditional metals for milling purposes. Given its high level of biocompatibility and good aesthetic features, today it is fast becoming the most commonly used material for dental reconstructions. Milling occurs beginning from a pre-sintered blank (or block), which can still be significantly machined by a tool, which is then sintered in the oven according to the cycle recommended by the producer.

There are varying and conflicting opinions on this material (also known as *zirconia*): from the most enthusiastic comments to the worst type of slander ("it's radioactive"; but then even our body is!). It is certainly not *"metal free"* as certain people like to imply, because it is composed of a metal oxide. The extent to which this is relevant for its contact with saliva and other body fluids is still being investigated, however this is beyond the scope of this appendix.

ZIRCONIUM OXIDE POWDERS

It is however worth noting that current literature contains scarce information on zirconium powder, with which machine operators may come into contact:

- if they don't handle the blank with gloves during loading, unloading, etc.;
- if the machine is not connected to an extraction system or if this doesn't work.

In general, zirconium oxide is classified as a "slightly hazardous material in the case of contact with skin (irritating), contact with eyes (irritating), ingestion, inhalation" or "the powder is irritating for the respiratory system and prolonged or repeated inhalation may cause chronic bronchitis or pulmonary fibrosis".

The unfortunate reality is that the toxicological properties of this substance have not been fully investigated and relatively few standards make any reference to it at all. We have found the following references in current literature:

a) REACH Regulation DSCL (EU)

This product is not classified according to European Union regulations.
S24/25 - Avoid contact with eyes and skin.
S28 - In the case of contact with skin, immediately rinse under running water.
S36/37/39 - Use protective garments and suitable gloves and protect the eyes / face.
Health hazards: 1

b) ECHA (European Chemicals Agency)

On 29th August 2011, began a public consultation on 20 potentially "extremely worrying" substances (ECHA/PR/11/20) including "Zirconium oxide and aluminosilicate refractory ceramic fibres (Zr-RCF)" as a

potentially carcinogenic agent.
But fibres are very different to powders...

b) OSHA IMIS (USA)

OSHA Permissible Exposure Limit (PEL):
General Industry: 5 mg/m^3 **Construction Industry:** 5 mg/m^3 TWA

American Conference of Governmental Industrial Hygienists (ACGIH)
Threshold Limit Value (TLV): 5 mg/m^3 TWA; 10 mg/m^3 STEL; Appendix A4 (Not Classifiable as a Human Carcinogen)
National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL): 5 mg/m^3 TWA; 10 mg/m^3 STEL

Health Factors
Potential Symptoms: Skin granulomas; In animals: X-ray evidence of retention in lungs; skin, mucous membrane irritation
Health Effects: Pneumoconiosis (HE10); Lung and skin granulomas (HE3)
Affected Organs: Respiratory system, skin
https://www.osha.gov/dts/chemicalsampling/data/CH_277200.html

Quite often, the producers of materials are very synthetic in their technical data sheets in relation to the hazards of their materials. One particularly complete data sheet is that prepared by DeguDent, the producer of the famous Cercon material, see (http://www.degudent.com/Communication_and_Service/Download2008/Safety_Data_Sheets/Safety_Data_Sheets/Cerconbasecolored.pdf). Extract from data sheet:

4. FIRST AID MEASURES Inhalation
In case product dust is released: Remove to fresh air.
Skin contact
In case product dust is released: Wash off with plenty of water.
Eye contact
In case product dust is released: Rinse thoroughly with plenty of water keeping eyelid open. If eye irritation persists, consult a specialist.
Ingestion
Have the mouth rinsed with water. In case of discomfort: Supply with medical care.

6. ACCIDENTAL RELEASE MEASURES Personal precautions, protective equipment and emergency procedures
In case product dust is released: Do not breathe dust.
Methods and material for containment and cleaning up
Use mechanical handling equipment. Dispose of absorbed material in accordance with the regulations.

7. HANDLING AND STORAGE Handling
Precautions for safe handling
In case product dust is released: Do not breathe dust. No particular measures required if used correctly. If dust occurs: Personal protective equipment

8. EXPOSURE CONTROLS/PERSONAL PROTECTION
Control parameters for Zirconium dioxide:

Control parameters	5 mg/m3	Time Weighted Average (TWA):(EH40 WEL)
Control parameters	10 mg/m3	Short Term Exposure Limit (STEL):(EH40 WEL)

Engineering measures
In case product dust is released: Local ventilation.

Personal protective equipment
Respiratory protection
In case product dust is released: Do not breathe dust. If maximum admissible concentration value at the workplace is exceeded, apply Dust mask.

Hand protection
No special protective equipment required.
Eye protection
Safety glasses with side-shields If dust occurs: basket-shaped glasses
Skin and body protection
No particular measures required.
Hygiene measures
Handle in accordance with good industrial hygiene and safety practices. When using, do not eat, drink or smoke. Wash face and/or hands before break and end of work.

So there is very little certainty regarding the long-term effects of zirconium oxide powders, except for the fact that they certainly do not have a positive effect. For this reason it is important to take all recommended precautions against its use and perhaps even more, because:

ALL POWDERS, IF INHALED, ARE POTENTIALLY VERY HAZARDOUS, EVEN WHEATMEAL, WOOD AND TALCUM POWDERS

Until new indications are released by the EU or the OHSA (which has recently confirmed the above-mentioned values, dating back to 1978), it is therefore important to make sure that the concentration of zirconium oxide powders in places commonly frequented by people does not exceed the TLV-TWA[1], and in places intermittently frequented by people, that it does not exceed the TLV-STEL[2]. For zirconium oxide powders, these limit values are:

- TWA = 5 mg/m3
- STEL = 10 mg/m3

We remind you that the TWA is the concentration limit calculated as a weighted average for a normal 8 hour working day and a 40 hour work week, while the STEL is the spot exposure limit defined as a maximum of 15 minutes that cannot be repeated more than 4 times per day, with at least 60 minutes between exposure periods.

In regards to the milling of zirconia (or zirconium oxide) blanks, powders can be avoided by wet milling. If the Dental Machine A5 milling machine is fitted with only one collection tray, there are two alternatives:

1. completely empty the collection tray, carefully wash it with potable water, fill it with potable water and start the pump for 2-3 minutes so as to clean the entire circuit; then empty it again and fill it with distilled and/or deionised and/or mineral water with a low mineral salt content[3];

[1] TLV-TWA = the time-weighted average concentration limit for a normal 8-hour workday and a 40-hour workweek weighted average concentration limit for a normal 8-hour workday and a 40-hour workweek

[2] TLV-STEL = spot exposure for a duration of 15 minutes, that cannot be repeated more than 4 times per day with at least 60 minutes between exposure periods

[3] Contact the producer of the material for information regarding tolerance against water impurities, which may cause variations in the colour of the material after sintering.

2. ask the Manufacturer to perform a modification on the machine, to use potable water or tank water after verifying the cost, the composition of the water and its compatibility with the milled material.

Note that wet milling the zirconia requires an additional drying cycle prior to the actual sintering process.

For this reason almost all users of the Dental Machine A5 milling machine prefer to dry mill this material. This may generate a risk of exposure to zirconium oxide powder by both the machine operator and anybody else that may be in the room where the machine is installed.

To avoid this risk, the machine:

A. Is fitted with a closing mechanism and relatively airtight seal on all doors, even those that can be opened only for maintenance;
B. When the machine is installed, it must be connected to an external extraction system, whether centralised or local, of a suitable size and equipped with air purification with micro-filter [this system is not included in the supply];
C. If the milling strategy does not require the use of fluid, when the numeric control starts, the valve connected to the external extraction system will automatically open;
D. In this way, the machine will be held in a vacuum with respect to the surrounding environment, preventing the spread of any powders;
E. It is implied that the Client must perform regular maintenance and check the correct operation of the centralised or local extraction system connected to the machine.

We remind you that the Client (in its capacity as "employer") is responsible for selecting the position of the machine in a suitable location, as well as for selecting the person/s in charge of running the machine, ensuring they are properly trained on how to use the machine, and if necessary, equipped with personal protective equipment suitable for the task.

The recommended precautions may be excessive, but it's better to take extra care when it comes to powders, because the effects may be manifested after many years and they may be terrible.

The case of Asbestos should be a lesson for all!

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