SISTEMI MAGNETICI ELETTROPERMANENTI
Divisione ancoraggio macchine utensili - serie rettifica e fresatura

PERMANENT-ELECTRO MAGNETIC SYSTEMS
Clamping Tool Machines Division - Systems for grinding and milling operations

SYSTÈMES MAGNÉTIQUES ÉLECTROPERMANENTS
Section serrage machines-outils - série rectification et fraisage

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Manuale uso e manutenzione
Instruction and maintenance manual
Manuel d'utilisation et d'entretien
Betriebs- und Wartungsanleitung
Manual de uso y mantenimiento
Drift- och underhållsmanual

Nr. 50 100 7816

TECNOMAGNETE®

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ENGLISH

1 GENERAL NOTES

Thank you for purchasing one of the many products manufactured by **TECNOMAGNETE S.p.A.**

This manual is designed to help you become familiar with your new system and must therefore be carefully read and followed.

Should you require any further information regarding the system, please contact the **TECNOMAGNETE** service department.

The descriptions and illustrations provided in this manual are for reference only.

While guaranteeing the basic features specified for each type of equipment, **TECNOMAGNETE S.p.A.** reserves the right to change at any time and without notice the parts, details and accessories that it deems necessary for engineering or commercial reasons or in order to improve the product. The necessary updates, if required, shall be supplied as attachments.

This manual is property of **TECNOMAGNETE S.p.A.** and cannot be copied (in part or in whole) or made available to third parties without the written consent of the manufacturer. Should the products be amended and/or updated, upon authorization of **TECNOMAGNETE S.p.A.,** the manufacturer shall integrate the existing manual by providing the text explaining the use of the modified/integrated component along with a description of potential residual risks.

1.1 Overview of the company

TECNOMAGNETE started its activities in 1972 as manufacturer of permanent-electro magnetic systems designed to ensure power, flexibility and maximum safety. Its state-of-the-art technologies and the patents developed over the years have enabled the company to become a leading supplier in several international markets.
The permanent-electro magnetic systems manufactured by TECNOMAGNETE are able to produce all the magnetic force required for both clamping and lifting parts, thus eliminating the need of using electric power during machining.

Its main fields of activity include:

CLAMPING SYSTEMS FOR TOOL MACHINES

- **Grinders**
- **Millers**
- **Lathes**
- **Systems for the machining of rails**

MOLDING SYSTEMS

- **Systems designed to clamp the molds onto presses**

LIFTING SYSTEMS FOR LIGHT LOADS

- **Manual lifters**
- **Battery operated lifters**

LIFTING SYSTEMS FOR HEAVY LOADS

- **Magnetic lifters**
- **Fixed crossbeams to support magnetic modules**
- **Telescopic crossbeams to support magnetic modules**

TECNOMAGNETE has installed approximately 50,000 units in over twenty years, thanks mainly to its wide range of products, its flexibility to meet customers' requirements and its efficient post-sales service.

1.2 Importance of the manual

A copy of this manual must always be made available to the operators responsible for the installation, operation and maintenance of the system in order to allow them to carry out all the required operations in compliance with the instructions provided in the manual.

A full compliance with the instructions provided in this manual is an essential requirement to be able to correctly use the equipment and ensure the safety of operators and other people.

The manual forms an integral part of the system. Therefore, all reproduction and divulgation rights related to the manual or its attachments are reserved.

The manual must always be transferred to the new owner of the system if the latter is sold.

1.3 Storing the manual

It is severely forbidden to remove parts, tear pages or alter this manual.

The manual should always be carefully preserved so that it is not damaged.

Always protect the manual from excessive humidity and heat and store it in a location where it can be easily accessed by operators in case of need.

1.4 Conventions

To simplify consultation, the manual has been divided into the following hierarchical order so that each phase is described in detail:

1 Section 1 of the manual

1.1 Chapter 1 of Section 1 of the manual

1.1.1 Paragraph 1 of Chapter 1 of Section 1 of the manual

1.1.1.1 Subparagraph 1 of paragraph 1 of Chapter 1 of Section 1 of the manual

Some chapters and/or sections contain bulleted lists to allow operators to follow the operation described step by step.

Parts that require specific attention are highlighted with symbols.

Units of measure, including decimal values, have been indicated using the international system of units.

1.5 Definition of symbols

All information related to safety is highlighted in bold.
All warnings that draw the attention of operators on operations that may be hazardous in terms of safety or health or that may cause physical injuries, if the applicable instructions are not followed, are highlighted in bold and marked with the following symbol:

All warnings related to operations that have to be carried out by skilled and qualified personnel are highlighted in bold and marked with the following symbol:

1.6 Personnel responsible for the operation of the system

Some operations, as stated in this manual, can only be performed by qualified and skilled personnel. The qualification level is described by means of the following standard definitions:

- Qualified personnel are personnel with specific technical knowledge and/or the experience necessary to avoid potential risks originating from power and/or mechanical components (engineers and technicians).
- Trained staff is personnel that operates following the instructions and/or under the supervision of qualified personnel, who is responsible for verifying that they are not exposed to potential hazards resulting from the contact with power and/or mechanical moving parts (personnel responsible for operation and maintenance). .
- Before using the system, users shall always have to verify with authorized personnel that:
  1. All personnel have received a copy, have read and understood the content of the instruction manual
  2. All personnel have agreed to follow the instructions provided

1.7 Trained personnel

- OPERATORS: workers who, after receiving the necessary instructions, have been authorized by the owner to operate the system. Workers with this qualification must be thoroughly familiar with the content of this manual.
- PERSONNEL RESPONSIBLE FOR HANDLING OPERATIONS: personnel working in this role must possess specific skills (that must sometimes be acquired by following special training courses, if required by current laws) and be familiar with the operation of lifting equipment and methods, types of slinging and procedures to safely handle loads. This qualification implies having a perfect knowledge and full familiarity with the content of section 2.2.
- MECHANICAL MAINTENANCE TECHNICIAN: these workers must be thoroughly familiar with installation, adjustment, maintenance, cleaning and/or reparation procedures. This qualification implies having a perfect knowledge and full familiarity with the content of this manual.
- ELECTRIC MAINTENANCE TECHNICIAN (ref. EN60204 paragraph 3.45): this qualification is assigned to all personnel specifically trained to perform operation on electric components, which include connections, adjustments, maintenance and/or reparations, and to personnel who is qualified to perform operations inside electric cubicles and boards. This qualification implies having a perfect knowledge and full familiarity with the content of this manual.

1.8 Individual protection means

All personnel listed above must wear suitable clothing to protect them from potential industrial accidents.

In particular, personnel must always wear industrial shoes along with ear protection, helmets and goggles, if required.

All personnel should refrain from wearing loose clothing that could get tangled with moving components.

1.9 General safety precautions

The instructions and recommendations provided below comply with current safety regulations and imply the obligation of complying with applicable provisions.

TECNOMAGNETE S.p.A. shall not be responsible for damages caused to people or equipment originating from the failure to follow applicable safety provisions and to comply with the instructions given below.

All operators are therefore expected to follow the instructions below and to thoroughly comply with the safety procedures concerning the installation and use of the equipment applicable in the country in which the system is used.

All ordinary and extraordinary maintenance operations must be performed when the system is idle and after it has been disconnected from the power supply, if possible.

To prevent the system from being accidentally started during maintenance operations, it is always advisable to place onto the control panel a sign with the following warning:

ATTENTION! CONTROL DISABLED DUE TO MAINTENANCE

Before connecting the power cable to the terminal box on the main board, it is essential to verify that the line voltage complies with the one shown on the nameplate of the board.

All transportation, installation, ordinary and extraordinary maintenance operations performed on the system must be carried out only by personnel with the qualifications stated in paragraph 1.6.

The system can be used only for the applications specified in operating instructions and only in combination with the equipment and components recommended by TECNOMAGNETE S.p.A.

1.10 Behavior during emergency situations

In the event of emergency, it is always advisable to follow the procedures outlined in the operation and maintenance manual of the machine on which the system is installed.

In the event of fire, always use the extinguishing means provided being careful not to use water to extinguish fires on electric parts.

1.11 Improper or non permitted use

The system is not designed to be used in explosive environments.

An improper use may:
- **Cause injuries to personnel**
- **Damage the system or other equipment**
- **Reduce the reliability and performance of the system**

The system must always be used for the applications for which it has been designed and manufactured. Therefore, customers should:
- **Always use suitable working parameters**
- **Carry out the required maintenance in accordance with he instructions provided**
- **Use appropriate materials**
- **Comply with all the instructions provided**
- **Safely and firmly fix the system and all its parts**
- **Contact TECNOMAGNETE S.p.A. in case of doubt to determine whether a specific operation is permitted**

The clamping of special materials, other than those referred to in this manual, must be preventively authorized in writing by the TECNOMAGNETE S.p.A.

1.12 Nameplate

Magnetic chucks are fitted with a nameplate that provides information on the manufacturer, in compliance with current law requirements.

The nameplate should never be removed even if the system is resold.

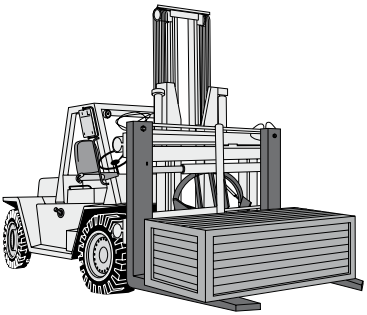
If the nameplate is damaged or has been removed, it is necessary to contact TECNOMAGNETE S.p.A. to order a duplicate.

Always quote the model printed on the nameplate in all communications with TECNOMAGNETE S.p.A.

Failure to comply with the above instructions shall entitle TECNOMAGNETE S.p.A. to disclaim any responsibility for injuries to personnel and damage to equipment, making the user fully responsible before competent authorities.

2 TRANSPORTATION AND HANDLING

MILLERS and GRINDERS can be transported in wooden crates and mounted onto a pallet to simplify handling.



ENGLISH

2.1 Receipt

All systems are carefully inspected before shipping. Upon receipt, customers should verify that the packaging and the material inside it has not been damaged (unless otherwise instructed by TECNOMAGNETE S.p.A.) in order to ensure that the system has not been damaged during transport and that the material supplied complies with order specifications. Visible transport damages should be immediately reported to TECNOMAGNETE S.p.A. and the forwarding agent.

ATTENTION
All faults and defects must be reported **within ten days** from receiving the goods.

2.2 Handling

ATTENTION
All personnel involved in handling loads should wear protective gloves and shoes.
The customer will always have to verify that all handling operations are carried out in accordance with applicable safety requirements.

ATTENTION
When lifting or handling the system, always make sure that the surrounding area is clear and free from obstacles, and that the recommended safety distances are maintained, in order to prevent causing injuries to people and animals or damage to equipment present near the system.
The system is designed to be lifted and handled with appropriate lifting equipment with characteristics and capacity suitable for the weight to be handled.

Handling operations must always be performed very carefully in order to avoid potential impacts that could damage the system parts and prevent them from operating correctly.

When using fork lifters, always verify that speed and inclinations are within recommended values. Do not leave lifting equipment unattended when the load is suspended.

ATTENTION
Always verify that the system is disconnected from energy supplies and that all moving parts are firmly fixed in place when transporting, handling and storing the system.

ATTENTION
Do not handle lifting systems with electromagnetic lifters.

ATTENTION
Read all the instructions on the packaging before opening it.
Always keep the original packaging so that it can be used to transport the system if needed.

2.3 Transportation

In order to transport the system, it is sometimes necessary to disassemble some of its parts. These parts will later be reassembled and reconnected during the installation phase by the service technicians of TECNOMAGNETE S.p.A. or of the customer under the supervision of TECNOMAGNETE S.p.A personnel.

The system should always be transported within the following environmental limits: temperature ranging from –10°C to +55°C, with temperature increase up to 70°C for a maximum of 24 hours.

If the system requires the use of specific transportation means (by sea or air), special provisions shall

have to be adopted in order to protect it from damages caused by potential impacts. In order to protect the system from atmospheric agents, lubricate it with anti-corrosion oils and place hygroscopic salts in the box. All parts that cannot be permanently fixed in place must be removed.

2.4 Storage

Before removing the system from service or storing it for long periods of time, always thoroughly clean it in order to remove machining scraps and protect all visible metal parts with protective oils or greases to prevent the surfaces from oxidizing.

Disconnect the controller from the magnetic chuck and from the power supply.

It is generally advisable to cover the system with a waterproof sheet and store it in dry and safe place.
The temperature of the storage area should range between 0°C (32°F) and 55°C (131°F).

Relative humidity should be between 30% and 90%, non condensing.

The atmosphere should be clean, free from acids, corrosive gases, salts, etc.

Always restart the system in accordance with the instructions provided in Chapter 6.

3 DESCRIPTION OF THE SYSTEM

3.1 Advantages

The best possible clamping conditions that a tooling machine can offer are as follows:

1) Firmly fix the part that has to be machined
2) Verify that the tool is able to access the surfaces that have to be machined.

Magnetic clamping systems offer the advantage of combining the best of these two operating conditions:

1) The clamping forces generated by magnetic systems are evenly distributed along all contact surfaces, in addition to having an intrinsic strength.
2) The part that has to be machined is clamped only along the contact surface, so that the remaining surfaces can be accessed by the tool.

The substantial difference in distribution of the clamping forces account for the greater performances offered by magnetic systems as compared to traditional mechanical systems. Some of the main advantages include:

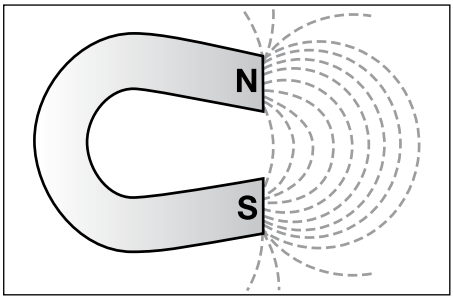
a) The high clamping force of magnetic systems is consistently distributed on all surface of the part to being clamp. This can be particularly useful when clamping sensitive parts like those with a small thickness or that tend to deform easily.
b) The working principle of magnetic systems offers the unparalleled advantage of significantly reducing vibrations created by machining. This means that it is possible to remove materials at greater speed and perform more accurate machining operations.

European standards concerning the safety of work places and electromagnetic compatibility clearly emphasize the superiority of permanent-electro magnetic systems as compared to electromagnetic ones, because they do not require a continuous source of external energy, except for the clamping and release phases, and do not affect the operation of other equipment as they do not return any form of energy to the network.

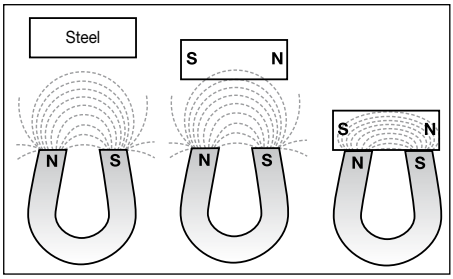
Magnetic clamping systems ensure a continuous air flow. The system is not dependant on external energy sources while the tool machining is in progress, which means that if a power failure occurs, the clamping forces are not affected and are therefore able to continue clamping the part.

3.2 Main principles concerning the clamping of parts

The magnetic force lines close between the northern and southern pole of the magnetic chuck.



This flow can be used to attract and clamp ferrous parts. A steel part exposed to a magnetic field is attracted by the opposed polarity of the field towards the magnet, until contact is achieved.

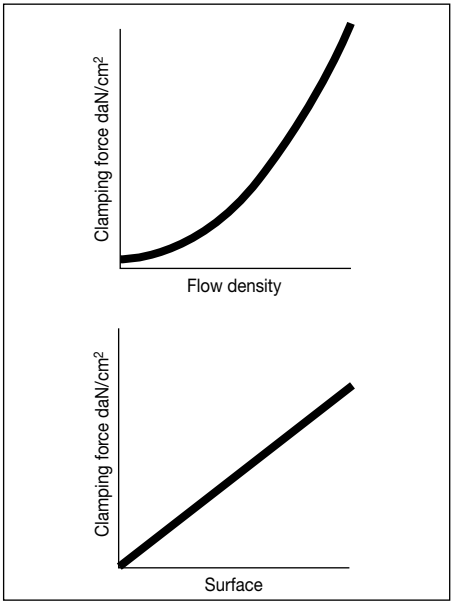


The flow produced by the steel varies according to the material it contains, its dimensions, the level of contact achieved between the part to clamp and the magnetic chuck, and the easiness with which the flow passes through the steel.

3.3 Factors that influence magnetic forces

The amount of magnetic flow applied to the part is the factor that most influences the clamping force. To achieve an optimum clamping force, it is necessary to apply the greatest possible magnetic flow to the part being machined. If the part has a simple design, it is sufficient to correctly position it on the northern and southern poles of the magnetic chuck. The clamping force is proportional to:

1) The square of the density of the magnetic flow present on the surface that is in contact with the part
2) The area of the part that is in contact with the magnetic chuck up to maximum saturation point.

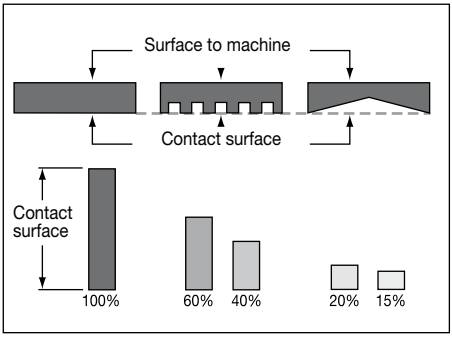


Doubling the contact area means doubling the clamping force. A 10% reduction in the flow density reduces by 19% the clamping force. If the flow density is halved, the clamping force is reduced by 75%. The flow density tends to reduce when the flow encounters a magnetic resistance (reluctance). A typical example of this type of situation is represented by air gaps (where an air gap represents the average contact distance between the part to machine and the magnetic chuck) and the elements that form the material of the part being clamped. The main factors that influence the flow density and clamping force applied to a part of any dimension are described below.

3.3.1 Contact surface

The condition that provides the highest resistance to the forces generated during machining is achieved when air gaps are reduced to a minimum and therefore the contact between the surfaces is continuous. The worst results are achieved with an air gap and a minimum contact.

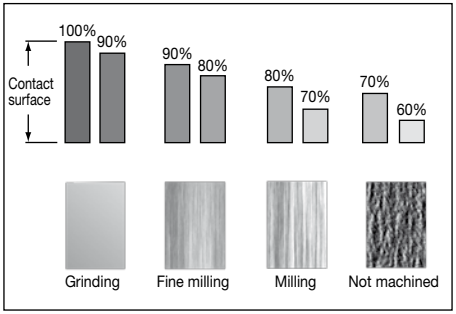
100% = Optimum clamping
60% = Very good clamping
40% = Satisfactory for some operations
20% = Sometimes sufficient for light grinding operations



3.3.2 Superficial finish

The machining operation is also influenced by the superficial roughness of the part to machine. A good contact surface with the magnetic chuck significantly reduces air gaps and thus ensures a consistent clamping force.

100% = Grinding
90 ÷ 80% = Fine milling
80 ÷ 70% = Milling
70 ÷ 60% = Not machined



3.3.3 Material used

Always check the material of the part that has to be machined in order to verify that it is magnetically conductible. The most conductive material is mild steel. The following reduction factors apply to other materials:

100%	Mild steel
70 ÷ 80%	Alloyed steel
50%	Cast iron
20%	Nickel
0%	Non magnetic stainless steel, brass and aluminum

3.3.4 Conditions of the part surface

Superficial heat treatments change the physical structure of surfaces and consequently also influence their capacity of absorbing magnetic flows. Annealed materials provide higher performances. Tempered materials are unable to satisfactorily absorb the magnetic flow and tend to maintain a certain degree of magnetism even after the chuck has been disabled (DEMAG), to the point that it is sometimes difficult to detach the part from the magnetic chuck. Residual (or absorbed) magnetism can be removed by using a demagnetizer.

3.3.5 Thickness of the part

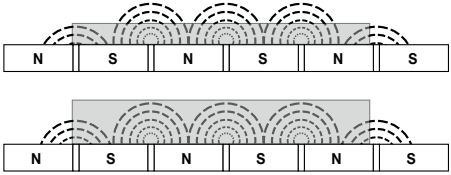
The flow follows a semicircular path inside the part, which originates from the center of the pole, moves towards the magnetic chuck and reaches the center of the subsequent one.
If the part is smaller than this radius, the part of the flow that it is output may disperse and cannot therefore be used to clamp the part. Consequently, the resulting attraction will be smaller than the one achieved when you machine a part with a thickness that is able to absorb the whole flow.

1) Always check the thickness of the part to machine.
If the thickness is insufficient, you will notice residual magnetism on the surface opposite the contact one, along with lower performances. The whole flow output from the magnetically anchored part is dispersed.

The depth of the magnetic flow varies according to the model of magnetic chuck.
However, as a general rule parts with a small thickness require the use of poles with a smaller section.

The magnetic clamping section of a system with square poles is equivalent to one fourth (1/4) of the side of pole (if the part covers at least 4 poles arranged in alternate configuration, to the side of the pole (if the part covers at least 2 poles in sequence)

and to the smaller side of the pole (for systems for parallel poles). The clamping force for smaller thickness values is inversely proportional to the ratio between the thickness (S) of the part and the theoretical magnetic clamping section (L), as described above. Consequently, the flow reduction factor (Fr) will be equivalent to (Fr) = S/L



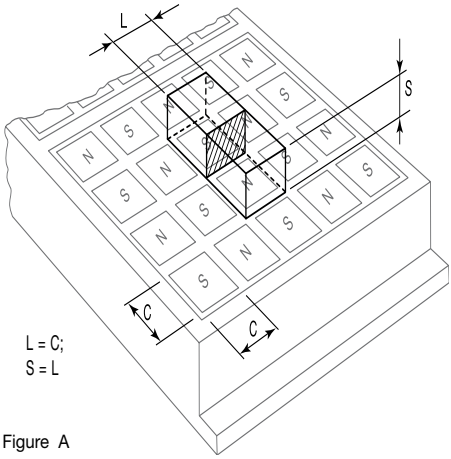


Figure A

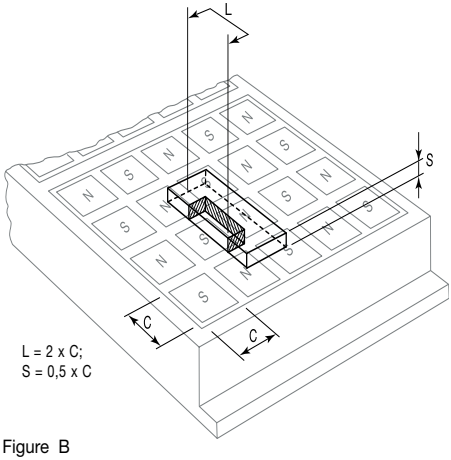


Figure B

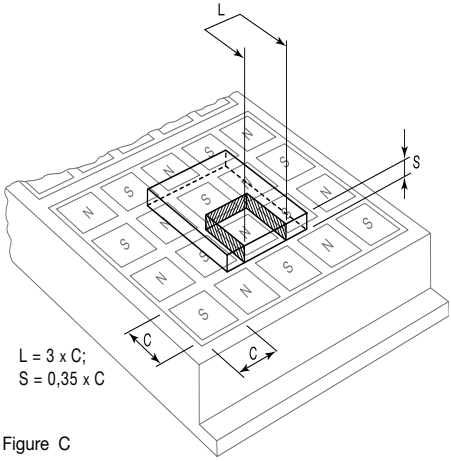


Figure C

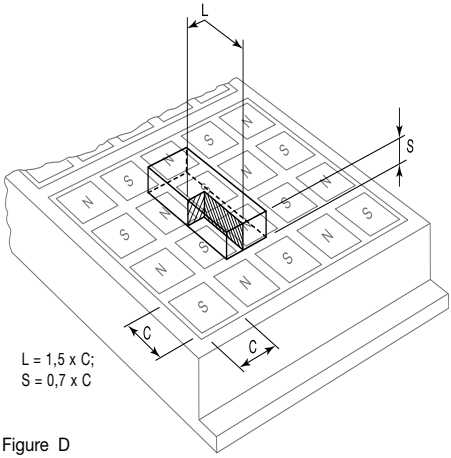


Figure D

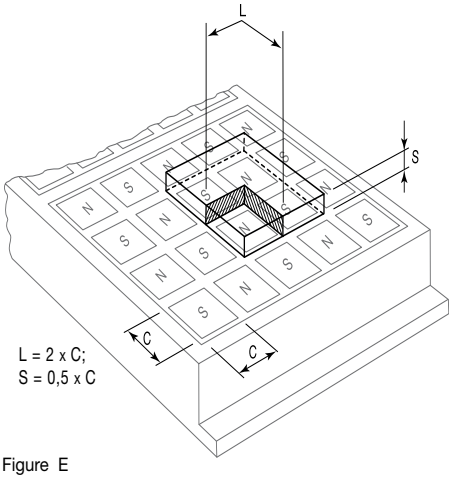


Figure E

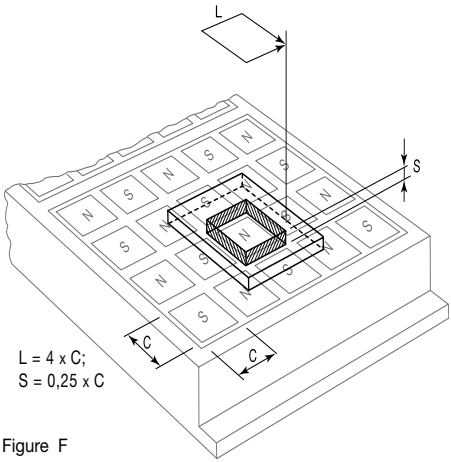


Figure F

3.3.6 Magnetic force

This manual applies to two types of clamping systems:

- Systems for milling operations
- Systems for grinding operations.

The circuits of these two types of systems are obviously different due to the fact that the forces used differ and are generally higher for milling operations.

The default circuit of systems for milling operations comprises a reversible magnet, placed below the flow conductor (pole), and a static magnet that surrounds the pole. When the reversible magnet works in parallel with the static one, the two forces are combined.

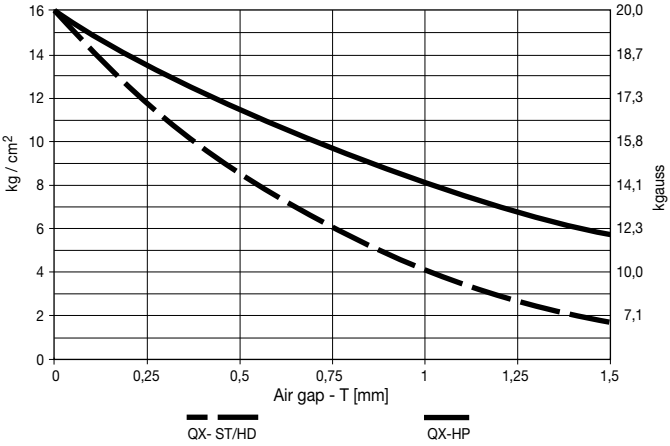
The default circuit of systems for grinding operations includes a single magnet that is placed under the flow conductor.
Consequently, the clamping forces and enabling/disabling principle are different.

On systems for milling operations, the polarity of the magnet under the pole is inverted by the solenoid that surrounds it, while on systems for grinding operations, the magnet is magnetized and demagnetized by the solenoid.
In the circuit of systems for milling operations all north and south poles are alternated. Consequently, the crown (or frame) is neutral and is therefore called “neutral crown”. On systems for grinding operations (with one magnet, all poles have the same polarity (north by default) and the magnet is closed by the frame (which is called “active crown”).
Consequently, the forces involved are significantly different because the amount of magnetic flow is clearly much higher in systems for milling operations.

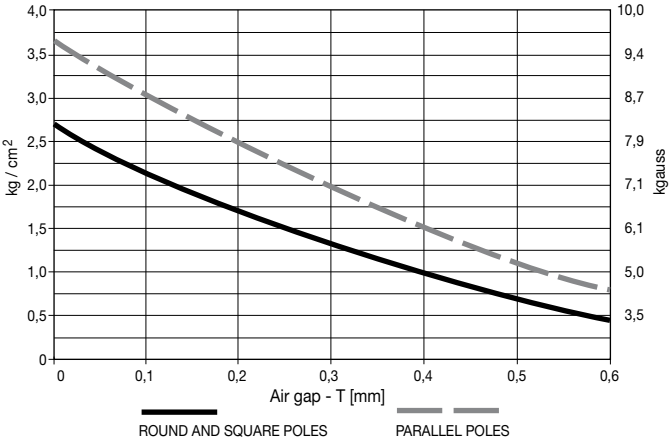
The magnetic clamping force is represented by means of the following curves that have been calculated in the following operating conditions:

- Part to clamp in mild steel
- Thickness suitable to contain the magnetic flow
- Consistent and level contact surface.

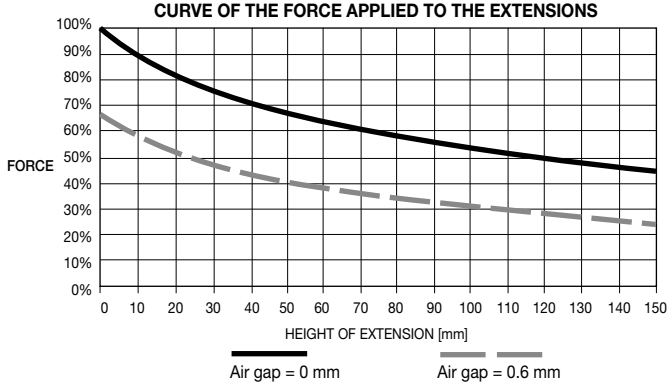
SYSTEMS FOR MILLING OPERATIONS



SYSTEMS FOR GRINDING OPERATIONS



CURVE OF THE FORCE APPLIED TO THE EXTENSIONS



Note: the diagrams are general and are provided for information only.

4 AVAILABLE MODELS

The permanent-electro magnetic systems for milling and grinding operations described in this manual can be divided into the following categories:

MAGNETIC CHUCKS WITH SQUARE POLES
Series: **QX and SQ/ST; HD; HP; CUBOTEC; QX/HN; QG**

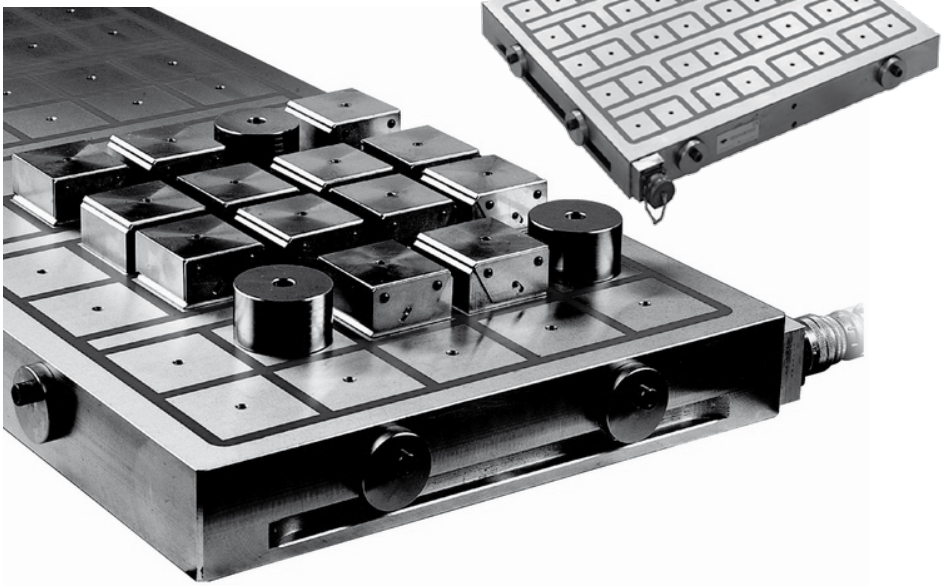
MAGNETIC CHUCKS WITH PARALLEL POLES
Series: **SGL; PRL; TFP1; TFP0; TPF; MDS**

MAGNETIC CHUCKS WITH ROUND POLE
Series: **RPC**

4.1 Magnetic chucks with square poles

4.1.1 Series QX and SQ/ST

Models with a low density of poles that are particularly suitable for medium and large magnetic chucks. These models are constituted by magnetic sectors formed by “islands” of poles, that produce a clamping force proportional to the dimensions of the parts to machine. These models are particularly suitable to machine medium and large parts.

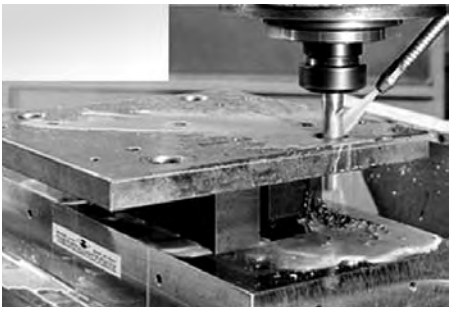


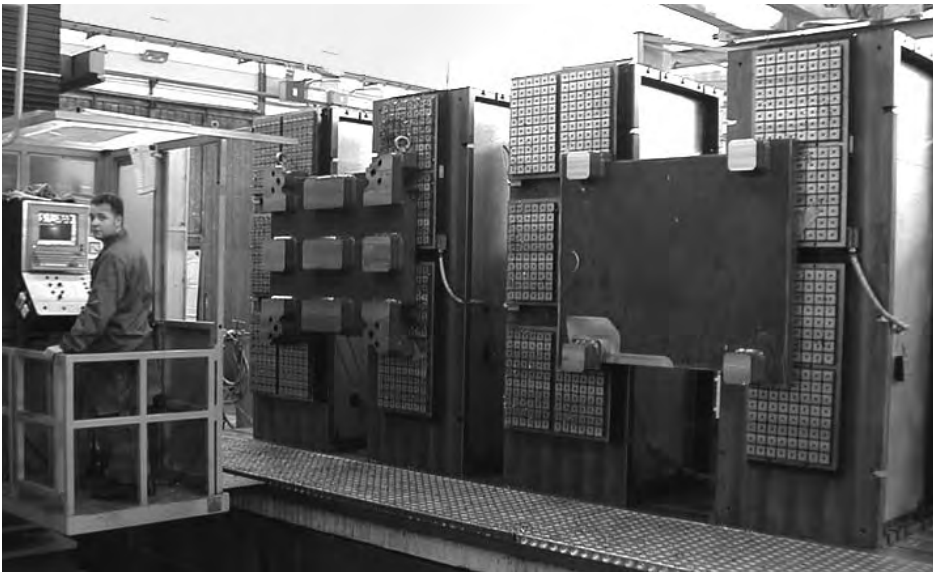
4.1.2 Series QX and SQ/HD

Systems with high density poles suitable for small/ medium magnetic chucks. These models have large magnetic surfaces and can therefore be used to clamp parts with small and medium dimensions.

4.1.3 Series QX and SQ/HP

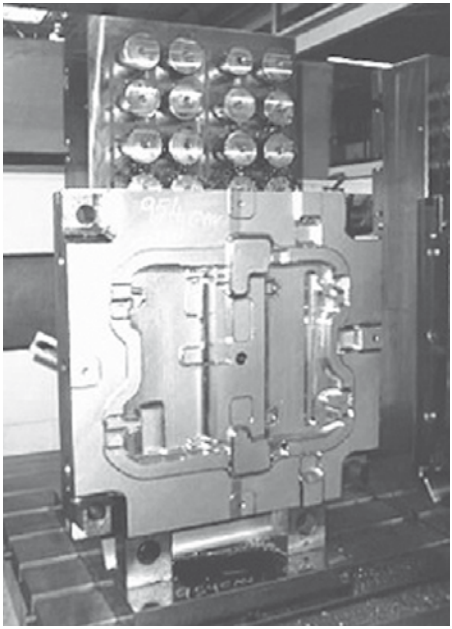
These systems, which can be configured in version ST or HD, offer the power required to machine parts with discontinuous surfaces. They are ideal to rough non machined or forged parts because of the combination of a high clamping force and wide-ranging magnetic field.

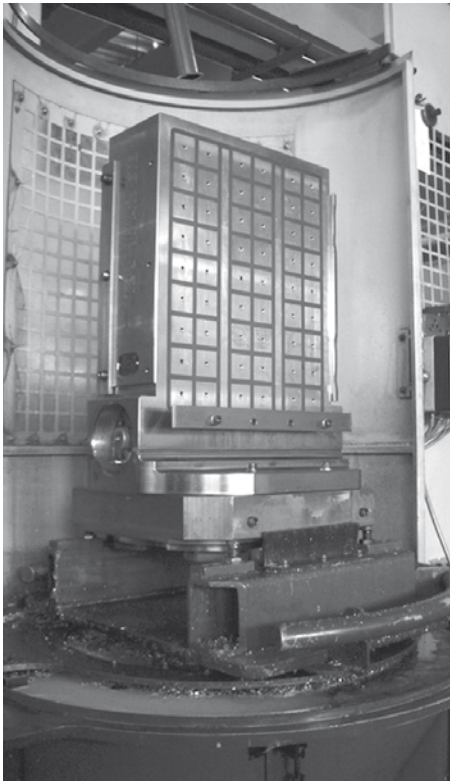




4.1.4 CUBOTEC

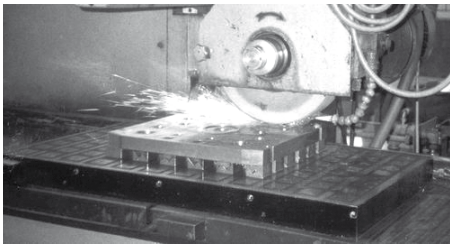
This system consists of a series of QX and SQ blocks arranged in vertical single bloc units, in the shape of shoulders and magnetic cubes. It is ideally suited for horizontal machining centers and FMS systems. The system provides a supporting surface that can be fixed onto machine workbenches and a second surface to support parts with large dimensions and weights.

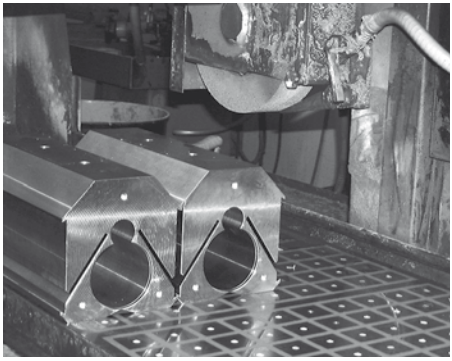




4.1.5 Series QX/HN, QXG and QG

These systems have a square pole, like models QX and SQ, but are designed with a special technology that allows them to be used with high speed grinders and millers for the machining of alloyed steels.





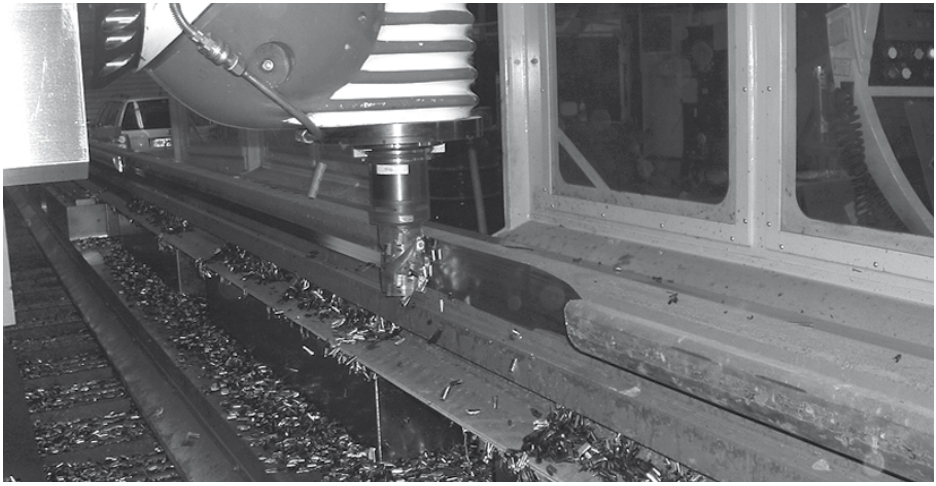
4.2 Magnetic chucks with parallel poles

4.2.1 Series SGL

Magnetic chucks for milling operations, based on the same technology of QX and SQ, models, but with poles arranged in a parallel configuration. These systems are ideal to machine parts like profiles, rails, bulb plates, etc.

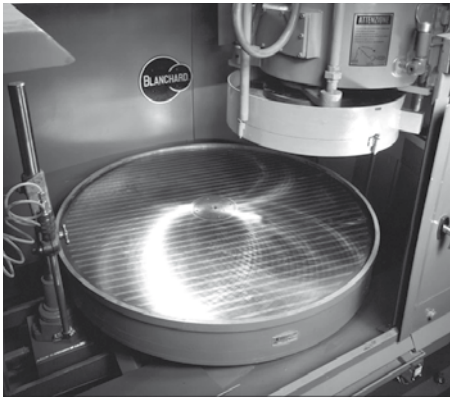
4.2.2 Series PRL

Magnetic chucks for grinding and milling operations, based on the typical technologies of MILLERS and GRINDERS, with poles arranged in a parallel configuration. Even these chucks are specifically designed for the machining of parts, like models SGL, but require the integration of dedicated technologies when used for grinding operations.



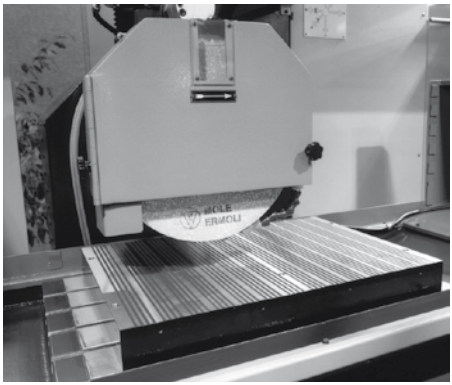
4.2.3 Series TFP1

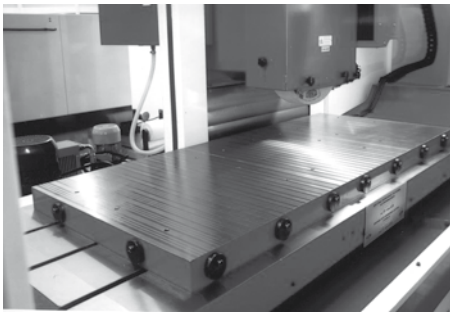
Permanent-electro magnetic systems for GRINDING operations, specifically designed for high precision grinding.
These systems have parallel poles and a magnetic surface entirely coated in metal.



4.2.4 Series TFP0

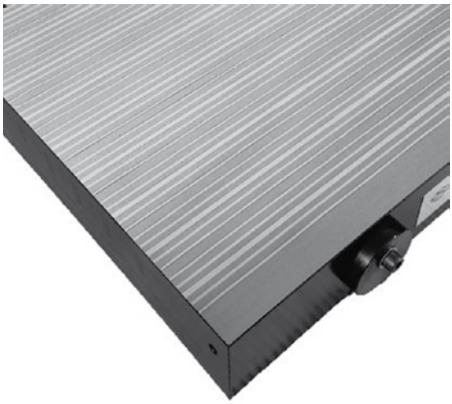
Permanent-electro magnetic systems for GRINDING operations, specifically designed for high precision grinding. These systems differ from model TFP1 because the magnetic surface is coated with a mix of steel/resin.

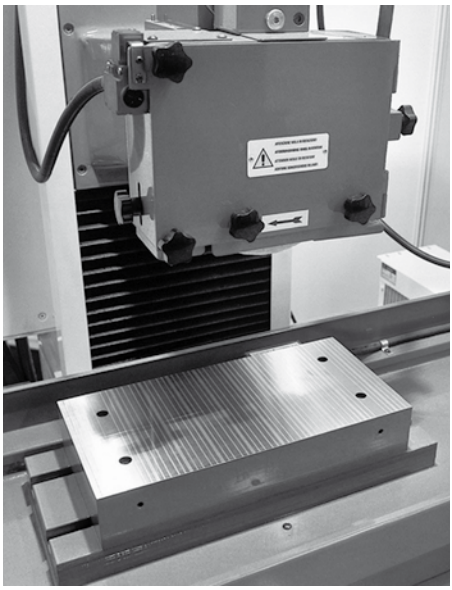




4.2.5 Series TPF

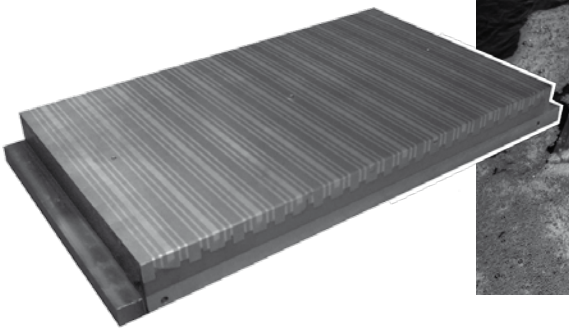
Permanent-electro magnetic systems for GRINDING operations, specifically designed for high precision grinding. These systems have the same characteristics of model TFP1, but have a higher polar pitch that allows the machining of parts with a small thickness.

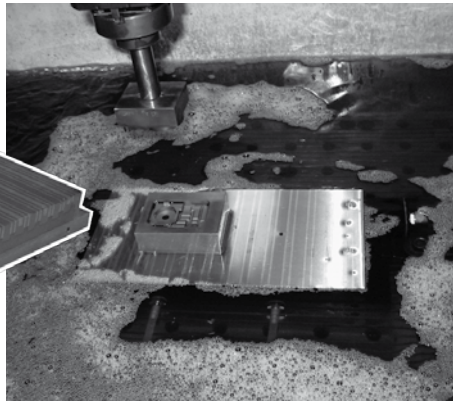


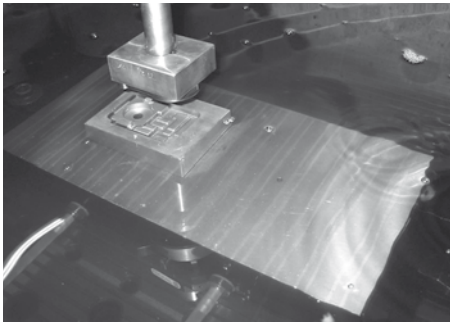


4.2.6 Series MDS

Permanent-electro magnetic systems that have the same technology and configuration of model TPF, which is also applied to EDM systems.



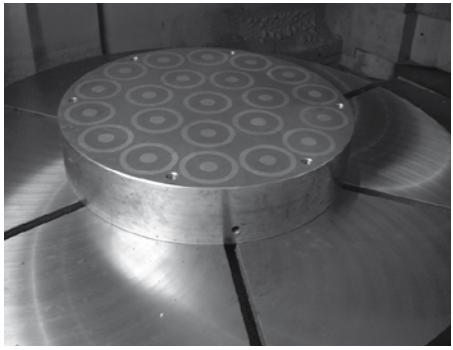




4.3 Magnetic chucks with round poles

4.3.1 RPC

Permanent-electro magnetic systems for GRINDING operations, specifically designed for high precision grinding of parts with medium dimensions and thickness. These systems can be fitted with a shapeable over-plate fully coated in metal. Poles are arranged in a circular configuration.



5 GENERAL DESCRIPTION OF THE SYSTEM

5.1 Systems for milling operations

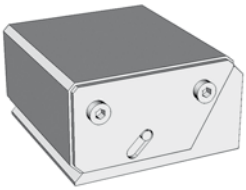
The system described in the manual comprises:
- One or two magnetic chucks
- Accessories (fixed and mobile polar extensions).

5.1.1 Accessories for milling

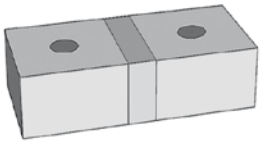
In order to be able to machine parts with small dimensions or discontinuous supporting surfaces, it is possible to separately purchase the following accessories, which include fixed and mobile extensions with stop:
- Fixed extension
- Mobile extension
- Double fixed extension
- Fixed extension with stop
- Round mobile extension

TECNOMAGNETE S.p.A. is also able to supply on request special and custom accessories.

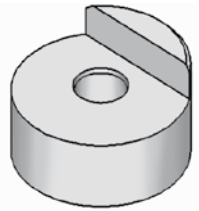
Fixed extension



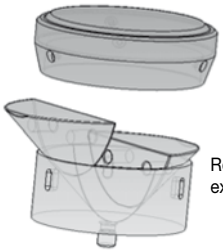
Mobile extension



Double fixed extension



Fixed extension with stop



Round mobile extension

5.2 Systems for grinding operations

The system described in the manual comprises:
- One or more magnetic chucks.

5.2.1 Accessories for grinding

To able to machine parts with shaped supporting surfaces, it is possible to separately purchase shapeable over-plates that reproduce the polar pitch of the chuck on which they are fitted.

TECNOMAGNETE S.p.A. can however be contacted at any time for specific requests or assistance.

6 INSTALLATION

6.1 Warnings

Before fitting the magnetic chuck onto the machine for which it is designed, always perform the following operations:

- Verify that the system is installed so that it is possible to access all components for ordinary and extraordinary maintenance purposes, remembering to leave the required spaces (approximately 1 m along each side of the system).
- Verify that the lighting of the site of installation guarantees a perfect view of all the production cycles from all four sides of the machine.
- Verify that all the main chucks are perfectly aligned using a spirit level and perform the required adjustments by inserting shims under the supporting points.

The system is designed to work under the following conditions:

Operating temperature:	-10°C÷+80°C (14°F÷176°F)
Humidity:	<50% at 40°C (104°F)

6.2 Preparation

- Clean all the parts with a clean and dry cloth in order to remove the residuals of anti-corrosion coating.
- Verify that all the mobile parts are correctly positioned and aligned.

6.3 Mechanical installation

TECNOMAGNETE guarantees, for all the models described in this manual, a parallelism tolerance of +/- 0.05/1000 between the magnetic surface and the resting one on the machine bench (or a verticalness tolerance for CUBOTEC systems or for systems used to form MAGNETIC SQUARES). After completing installation, TECNOMAGNETE advises to finish the magnetic surface with a miller fitted with a scraping insert or a grinder.

Customers who decide to install directly the magnetic system, must specifically refer to the instructions provided in this manual. If additional fixing holes are required, always remember to drill them on the housing that encloses the magnetic circuit. If necessary, it is also possible to drill on these surfaces positioning and reference holes for the parts to machine (the holes on the poles are provided for this purpose). TECNOMAGNETE S.p.A. can be contacted at any time for special requirements concerning the areas that can be drilled and machined.

The following tables provide the axial pre-charge value **P** and the corresponding torque values **M** that have to be applied to the screws used to assemble the chuck onto the tool machine. The values in the table apply to screws with hex head type UNI 5737-65 and to socket head screws type UNI 5931-67. The friction coefficient was considered equivalent to 0.14, which is the value that generally applies to blackened and lubricated surfaces. The torque must be applied gradually using dynamometric wrenches.

Threading	Resistance class = 8.8	
	P (N)	M (Nm)
M 6 x 1	9000	10,4
M 8 x 1,25	16400	24,6
M 10 x 1,5	26000	50,1
M 12 x 1,75	37800	84,8
M 14 x 2	51500	135,0
M 16 x 2	70300	205,0
M 18 x 2,5	86000	283,0
M 20 x 2,5	110000	400,0
M 22 x 2,5	136000	532,0
M 24 x 3	158000	691,0
M 27 x 3	206000	1010,0
M 30 x 3,5	251000	1370,0

6.4 Electric connections

All wiring instructions are provided in the operation and maintenance manual of the controller supplied with the magnetic chuck. This manual therefore provides basic information only.

6.5 Useful technical information

Electric safety can be guaranteed only if the electrical system is correctly connected to a grounding system in good working order, as foreseen by current laws concerning electrical safety. Therefore, it is essential to always verify these safety requirements before starting the system and have the distribution system carefully inspected by qualified personnel in case of doubt.

TECNOMAGNETE S.p.A. shall not be responsible for damages originating from the failure to connect the system to an appropriate grounding system.
Users shall have to make sure that the system is protected with a differential magnetothermal switch suitable to withstand the rated current used by the system. It is therefore necessary to install a suitable protection with magnetothermal switch (curve C) with a I_n value compliant with nameplate data.

TECNOMAGNETE systems are permanent-electro systems, which means that they need to be powered only during the short cycle phases. This configuration is designed to ensure maximum safety in the event of power failure.
TECNOMAGNETE controllers use the power supply by means of a sophisticated partializing process, which means that they can be operated only when the machine is idle and that they require a rated current that is normally lower than the one required to operate the machine on which the magnetic system being controlled is installed.

ATTENTION
Do not perform repeated MAGNETIZATION/DEMAGNETIZATION CYCLES

TECNOMAGNETE systems are constituted by permanent magnets and use electric power only to enable/disable the operating section. Therefore, they can be regarded as “COLD” magnetic clamping systems.

The frequent repetition of magnetization/demagnetization cycles over short intervals of time may increase the temperature of the magnetic chuck.

It is therefore advisable to run cycles only when necessary.
The connection of the magnetic chuck to the power supply must be carried out by qualified personnel only.
Check the supply voltage and frequency.

7 ASSESSMENT OF RESIDUAL RISKS

In designing the chuck, the manufacturer has taken into account specific manufacturing criteria and all applicable and current safety requirements, which do not however eliminate other potential residual risks.

This chapter provides a description of the potential risks that could arise in specific situations.

- **As the chuck is designed to be fitted onto tool machines, it is essential to make sure that operators have read and understood the instructions contained in this manual, along with those of the machine where the magnetic chuck will be installed, and that they are therefore aware of he residual risks of this machine as well.**
- **The individual protection means that have to be used when working with the chuck are the same ones required for the use of the tool machine on which the module is installed.**
- **As for the potential residual risks originating from the exposure to electromagnetic fields, specific precautions should be taken by pregnant women; users suffering from specific pathologies; users with pacemakers or other prosthesis with electronic circuits including hearing aids, intracranial metal implants (or any other implant situated next to vital anatomic structures), vascular clips or chips in ferromagnetic material. It is useful to remember that:**
  1. **TECNOMAGNETE magnetic systems are stationary systems and do not generate electric fields.**
  2. **The V/m (Volt/meter) value generated during operation is equivalent to 0 (ZERO).**
  3. **The electromagnetic emissions generated during the enabling/disabling phase does not exceed 100 Gauss at a distance of 100 mm from the system.**

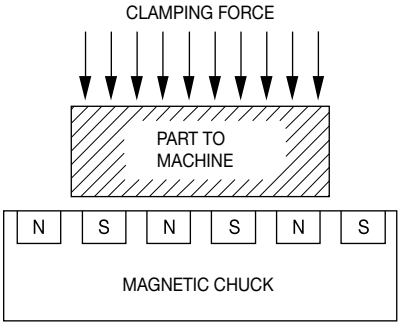
8 ORDINARY USE OF THE SYSTEM

The following section describes the basic operating procedure to follow in order to use the magnetic chuck.

8.1 Clamping force

The clamping force of the system is directly proportional to the working magnetic surface, the type of material being machined and the general conditions of the surface.

- Material to machine (mild and alloyed metal, cast iron.....)
- Superficial conditions of the part (roughness, linearity.....)
- Contact surface between the part and chuck (i.e. the surface in contact with the poles)



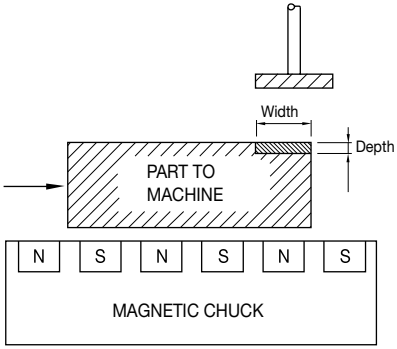
The clamping force is distributed consistently.

The magnetic clamping force is always applied towards the surface of the magnetic chuck.

8.2 Cutting force

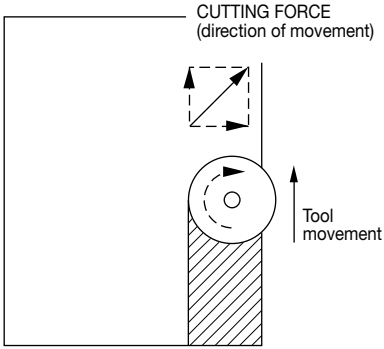
The cutting force during all types of machining operations always depends on the operating conditions of the tool (depth, direction of movement, revolutions per minute) and on the hardness of the material that has to be machined.

The cutting force applied by a tool includes a component that tends to slide the part being machined along the surface of the magnetic chuck.



The horizontal component is influenced by the geometry and direction of movement of the tool. Therefore, the clamping force must necessarily be greater than the cutting force, which is distributed in all directions, in order to guarantee safe clamping of the part.

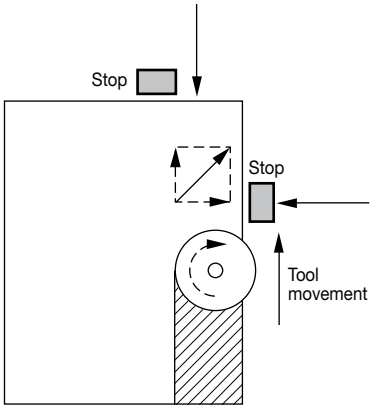
It is therefore very important to make sure that the clamping force, applied in a straight line as compared to the magnetic chuck, is reduced by one fifth (1/5) in order to be able to contrast the tangential force, which tends to slide the part.



Example: cutting force of 1000 daN
Clamping force of 4000 daN
Clamping force = 4000 N/5 = 800 N
Therefore: clamping force of 800 daN < Cutting force 1000 daN (resulting in an insufficient clamping force)

If mechanical stops are installed to offset tangential forces and thus allow for the fact that the part to be machined may slide on the magnetic contact surface, changes in the forces in action can be observed.

Clamping force of 4000 daN > Cutting force of 1000 daN (resulting in a sufficient clamping force)



In other words, the installation of mechanical stops offsets the tangential forces that cause the part being machined to slide, thus guaranteeing maximum safety.

Correctly positioning the mechanical stops is very important, in particular when the contact surface between the part and magnetic chuck is small (the same concept also applies to the clamping force).

The mechanical stop can also be used as reference, that is as zero point for the system.

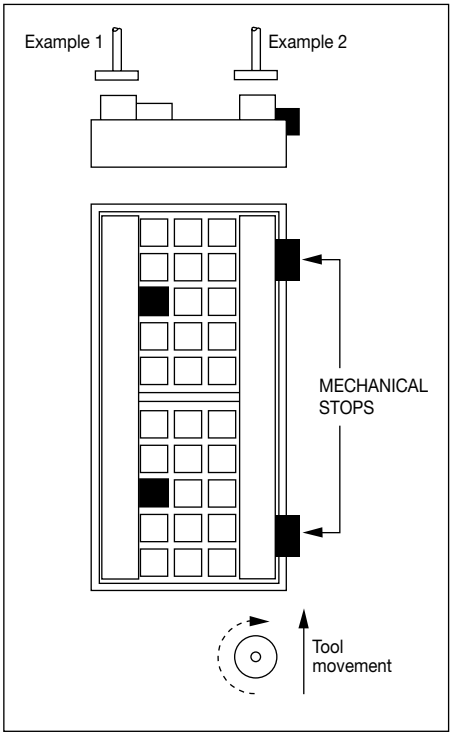
It is particularly important to pay attention to very long parts with a small thickness, because the torque applied by the cutting force generated by the tool may rotate the part during machining.

In this case, it is sufficient to place two mechanical stops along the longest side of the part (in the opposite direction as compared to that of the cutting force of the tool). See Example 2

If the lateral section, which is in contact with the mechanical stops, has already been machined (and has therefore a flat surface), it is also possible to use a magnetically clamped bracket as side stop.

Alternatively, it is also possible to use fixed polar extensions as mechanical stops. See Example 1

The magnetically clamped bar or fixed polar extensions enable to use the system both as mechanical support and for magnetic clamping purposes. Both systems are in fact able to conduct the magnetic flow.



8.3 Positioning the parts onto extensions

To be able to mill a part and obtain a level and parallel surface when a magnetic clamping system is not available, it is generally necessary to fit the supporting surface with shims.

This operation must be performed manually, requires longer set-up times and must be performed by skilled operators for satisfactory results.

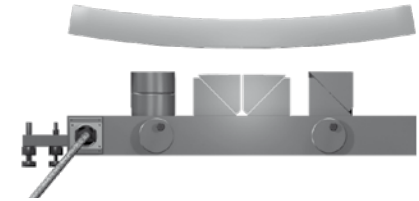
The use of mobile polar extensions allow the part to be quickly shimmed to the machine automatically. Operation is based on the following principle:

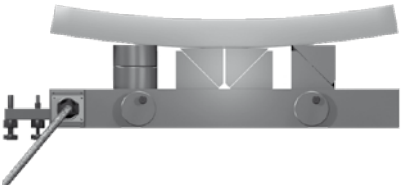
A - Create a plane by defining three fixed clamping points (using fixed polar extensions F), in order to obtain a working surface that intersects three points.

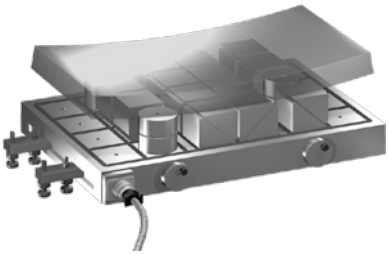
B - The remaining surface will have to be covered with mobile polar extensions (M) that will adapt to the irregularities of the surface and guarantee a continuous magnetic flow between the chuck and part to machine.

It is very important to install the highest number of mobile polar extensions, as the actual clamp-

ing force applied to the part is directly related to the number of available extensions.



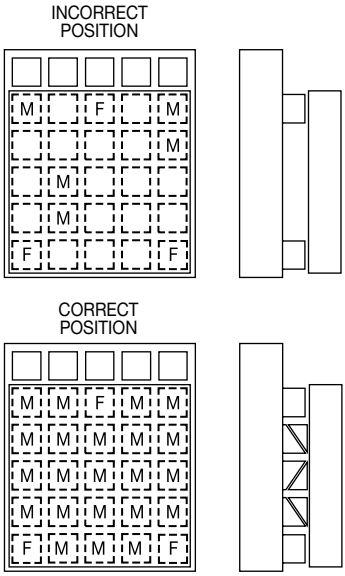




ATTENTION! The holes on the poles are provided to simplify the positioning of accessories like polar extensions (see page 59, section 5). It is useful to remember that these accessories act as conductors and do not need therefore to be excessively clamped.

Recommended driving torque M = 15 Nm.

Max. driving torque M = 23 Nm.



Use the polar extensions (for milling operations) to verify that all the surface of the part to machine is covered with the polar extensions.

The clamping force is directly proportional to the surface in contact with the part to clamp (and thus to the number of polar extensions).

The greater the number and the higher the clamping force

Verify that the polar extensions are correctly positioned, checking also the magnetic balancing (number of poles with SOUTH polarity = NORTH polarity).

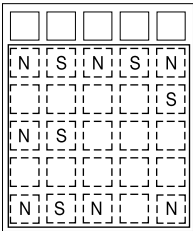
In other words, if it is not possible to use the whole surface of the part for magnetic clamping, it is possible to use polar extensions to verify that the extensions present meet the following conditions:

a) The number of extensions with North (N) polarity must be equivalent to the number of extensions with South (S) polarity. It is generally sufficient to arrange the extensions so that they face one another, as this configuration ensures a correct alternation between north and south.

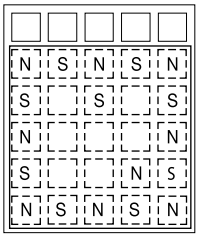
b) The polar extensions that are in contact with the part should be placed, when possible, along the whole length of the part. This ensures that the clamping force is able to effectively offset the cutting force.

c) The mobile polar extensions must also be correctly positioned in order to guarantee an efficient use of the automatic shimming system. Mobile extensions must also be alternated.

INCORRECT POSITION

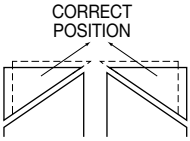


CORRECT POSITION



The mobile parts of polar extensions must move away or forward when sliding along the vertical plane. This means that their movement should never be equivalent or parallel (this does not apply to round mobile extensions).

CORRECT POSITION



8.4 How to calculate the clamping force

The magnetic clamping force is very easy to calculate, because it is determined by:

- The surface of the magnetic chuck in contact with the part to clamp
- The conditions of the contact surface of the part to clamp
- The technical characteristics of the material of the part to machine
- The type of magnetic chuck used

8.5 Example of how to calculate the clamping force of a magnetic chuck

Contact surface = 200 cm^2 (*)

- Conditions of the part surface = Not machined (Taverage = 0.6 mm)
- Type of material to machine = C40
- Model of magnetic chuck = **Magnetic chuck model - For milling operations, with square poles, series QX or SQ/ST and series QX or SQ/HD**
- Clamping force per cm^2 = 6 kg/cm^2 (see page 51 in paragraph 3.3.6 - Chart for MILLERS)

Taking into consideration the information provided above, the clamping force can be calculated by means of the following formula:

Total clamping force = 6 kg/cm^2 x 200 cm^2 = 12000 kg

This is an example and theoretical calculation that does not take into account all possible variables that may occur during actual machining operations (non homogenous material with hard points in some sections, surface with deformations that prevent a perfect contact between the part and extensions, non linear surface that prevents the removal of consistent quantities of materials, etc.). Therefore, it is generally advisable to consider also a safety factor (Fa) = 0.5:

Thus, the calculation described in the example above would yield to the following result:

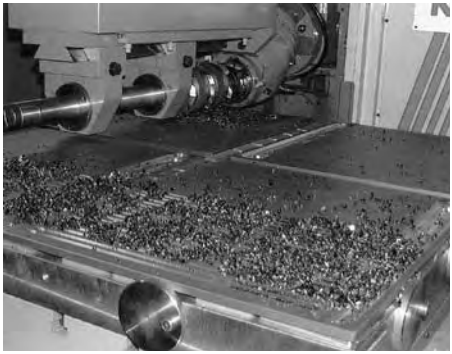
12000 x 0.5 = 6000 kg

(*) In order to quickly calculate the contact surface (cm^2), count the number of working poles and multiply it by the system value of cm^2 of the pole.
Example: pole with dimensions of 50x50 mm = 25 cm^2; pole 70x70 = 49 cm^2)

ENGLISH

8.6 Instructions on how to clamp parts for traditional machining operations

8.6.1 Flattening - Part clamped directly onto the magnetic chuck



Magnetic chucks can be typically used to flatten sheets. After cleaning the sheet and having removed the burrs, which may increase the air gap and thus decrease the clamping force (see paragraph 4.3), position the part to be machined and manually perform the shimming operation.

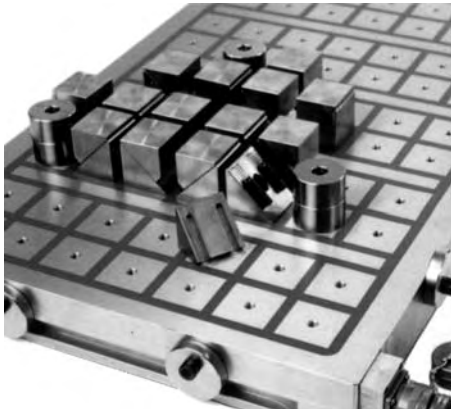
This operation limits the deformations caused by the system's magnetic attraction forces and the vibrations produced during machining.

This type of machining offers the advantage of being able to position the part directly onto the magnetic chuck, but does not enable allow machining operations like contouring, drilling and threading operations. In addition, the degree of levelness depends on the ability of the person performing the operation.

To optimize the clamping action applied to the part (section 4.3) and positioning, it is possible to use mechanical stops (paragraph 8.2) in order to offset the tangential forces that tends to slide the part and have a reliable reference point.

8.6.2 Flattening - Clamping the part onto the extensions

To further enhance the performances of the magnetic chuck and obtain, for example, a good degree of levelness, it is possible to use mobile polar extensions that are also supplied as accessories by TECNOMAGNETE (paragraph 5.1.1).



These extensions can be used to automatically and consistently shim the sheets to machine with a quick and accurate procedure. The correct use of these accessories and of the fixed polar extensions enable to obtain high levelness and parallelism tolerances even during the initial milling operation, in addition to superior final finishes. These accessories also enable too reduce the vibrations that may occur when the clamping forces are not consistently distributed and consequently also the premature wear of tools.

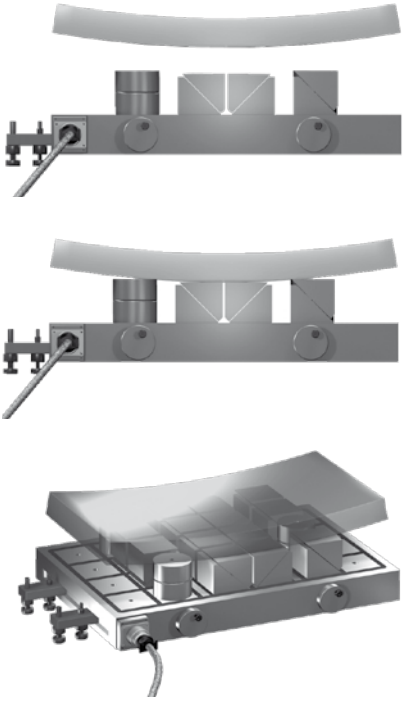
Place the three fixed polar extensions under the sheet to machine (paragraph 8.3) and add the mobile polar extension to strengthen the support surface.

If the thickness of the sheet causes it to bend, use five fixed polar extensions, placing four along the sides and one in the center.

STEP ONE – Place the part to machine onto the extensions and start the magnetization cycle (you will notice that the mobile polar extensions will adapt to the sheet profile), then perform the roughing operation on the upper surface.

STEP TWO – Start the demagnetization cycle and turn the sheet so that the roughed side is in contact with the extensions. Rough and contour the second surface. Before finishing the roughed surface, it is necessary to perform another magnetization cycle. The sheet, which has been deformed by the yield and heating of the material, releases the internal stress and adapts to the new position. At this point it is necessary to perform a new magnetization cycle so that the mobile polar extensions readapt to the contact surface and then finish the upper surface.

STEP THREE - Start the demagnetization cycle and turn the sheet so that the finished side is in contact with the extensions. At this point it is possible to finish the surface roughed in “step one”.



8.6.3 Threading machining – Clamping the part on mobile extensions

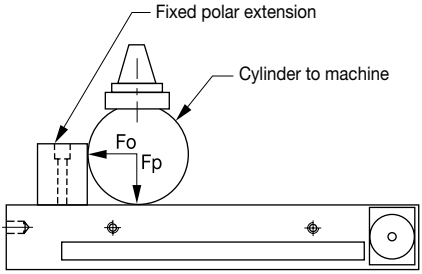
To be able to perform threading operations, it is essential to lift the part being machined in order to allow the tool to exit without damaging the surface of the magnetic chuck. The accessories available include fixed polar extensions (paragraph 5.1.1) that are designed to enhance the circulation of the magnetic flow and machining. Fix the extensions on the poles using the screws supplied, then mill them in order to obtain a supporting surface that is parallel and aligned with the surface of the magnetic chuck. The purpose of polar extensions (section 8.3) is to transfer the magnetic flow from the part to machine, while limiting the loss of force.

ATTENTION! Carefully check the position of all extensions! The magnetic clamping force is directly proportional to the number of extensions that are in contact with the part, but also to the balancing of the north and south poles (paragraph 8.3).

ATTENTION! Always verify that the extensions do not come into contact with one another, as this condition could short-circuit the magnetic flow and prevent it from reaching the part to machine.

8.6.4 Machining cylindrical parts

To be able to machine parts with a cylindrical shape or an irregular surface, it is necessary to place the part directly onto the magnetic chuck and rest it onto the fixed polar extensions. These extensions prevent the part from rolling off, but also conduct the magnetic flow, thus enhancing the clamping of the part. Machine the part so that the cutting forces resulting from the machining are not applied in direction of the extensions.



8.6.5 Serial machining

In order to machine parts in series or with an irregular profile, it is generally advisable to use polar extensions or use top-plates. To configure the top-plates, use polar extensions with the same section of the poles and join them with non magnetic material (stainless steel, aluminum, etc.). Always remember to take into account the polar pitch of the magnetic chuck both as regards the dimensions of the polar extensions, which must be equivalent to those of the poles, and the distances between the poles. At this point, it is possible to shape the over-plate in order to obtain a positioning template. The frame of the chuck that surrounds the magnetic “islands” (with the only exception of the area where the discharge cable is connected) can be drilled to allow the insertion of plugs to aid positioning and removal. The magnetic chuck can also be used to clamp vices, partition and part-holding elements in order to be able to machine parts that are difficult to clamp or are made of non magnetic material.

8.7 Machining examples

8.7.1 Flattening

Part to machine	Machining	Accessories required	Recommended chuck	Machining example
Plate or block (lateral dimension of the part below 150 mm)	Flattening (parallel surfaces)	Not required	**QX and SQ/HD** (recommended pole: 50÷62)	Plate dimensions: 120x120x20 Material: Fe - Miller: Ø 80 mm Number of inserts: 5 - Geometry: 45° - Feeding: 300 mm/min - Speed: 800 rpm Machining depth: 1.40 mm
Plate or block (part dimensions below 150 mm)	Flattening (planar and parallel surfaces)	The part is too small for the use of mobile extensions. Manual Shimming recommended.	**QX and SQ/HD** (recommended pole: 50÷62)	Plate dimensions: 120x120x20 Material: Fe - Miller: Ø 80 mm Number of inserts: 5 Geometry: 45° Feeding: 300 mm/min Speed: 800 rpm Max. machining depth: 1.40 mm Reduce depending on air gap
Drawn plate (part dimensions above 150 mm)	Flattening (parallel surfaces)	Not required	**QX and SQ/ST, SQ HD, SQ HP**	Plate dimensions: 250x250x50 Material: C40 - Miller: Ø 100 mm Number of inserts: 7 Geometry: 45° Feeding: 1000 mm/min Speed: 600 rpm Machining depth: 1.40 mm (models ST) 2.10 mm (models HD) 2.80 mm (models HP)
Drawn plate (part dimensions above 150 mm)	Flattening (planar and parallel surfaces)	Mobile extensions	**QX and SQ/ST, SQ HD, SQ HP**	Plate dimensions: 400x400x50 Material: C40 - Miller: Ø 100 mm Number of inserts: 7 Geometry: 45° Feeding: 1000 mm/min Speed: 600 rpm Machining depth: 2.30 mm (models ST) 3.50 mm (models HD) 4.20 mm (models HP)
Forged plate (part dimensions above 150 mm)	Flattening (parallel surfaces)	Mobile extensions. Always recommended due to the irregular surface.	**QX and SQ/HP** (recommended pole: 70÷80)	Plate dimensions: 400x400x50 Material: C40 - Miller: Ø 100 mm Number of inserts: 7 Geometry: 45° Feeding: 1000 mm/min Speed: 600 rpm Depth: 3.00 mm (models HP)
Forged plate (part dimensions above 150 mm)	Flattening (planar surfaces)	Mobile extensions	**QX and SQ/HP** (recommended pole: 70÷80)	Plate dimensions: 400x400x50 Material: C40 Miller: Ø 100 mm Number of inserts: 7 Geometry: 45° Feeding: 1000 mm/min Speed: 600 rpm Depth: 3.00 mm (models HP)

8.7.2 Contouring

Part to machine	Machining	Accessories required	Recommended chuck	Machining example
Plate or block (later dimensions of part below 150 mm)	Contouring must necessarily performed in two steps	Mechanical stops on two sides	**QX and SQ/HD** (recommended pole: 50÷62)	Plate dimensions: 120x120x60 Material: Fe Miller: Ø 25 mm Number of inserts: 3 Geometry: 90° Feeding: 800 mm/min Speed: 1500 rpm Machining depth: 3.00 mm Machining depth: 10.00 mm
Drawn plate (part dimensions above 150 mm)	Full contouring in one step	Fixed or mobile extensions	**QX and SQ/ST, SQ/HD, SQ/HP**	Plate dimensions: 400x400x50 Material: C40 Miller: Ø 25 mm Number of inserts: 3 Geometry: 90° Feeding: 1000 mm/min Speed: 1500 rpm Machining depth: 10.00 mm Machining depth: 5,00 mm (models ST) 10.00x8.00 mm (models HD) 10.00 mm (models HP)
Forged plate (part dimensions above 150 mm)	Full contouring in one step	Fixed or mobile extensions	**QX and SQ/ST**, **SQ/HD, SQ/HP**	Plate dimensions: 250x250x50 Material: C40 Miller: Ø 100 mm Number of inserts: 7 Geometry: 45° Feeding: 1000 mm/min Speed: 600 rpm Machining depth: 1.40 mm (models ST) 2.10 mm (models HD) 2.80 mm (models HP)
Drawn plate (part dimensions above 150 mm)	Full contouring in one step	Fixed or mobile extensions	**QX and SQ/ST**, **SQ/HD**, **SQ/HP**	Plate dimensions: 400x400x50 Hardening and tempering material Miller: Ø 25 mm Number of inserts: 3 Geometry: 90° Feeding: 1000 mm/min Speed: 1500 rpm Machining depth: 10.00 mm Machining depth: 3,00 mm (models ST) 10.00x5.00 mm (models HD) 10.00x6.00 mm (models HP)

8.7.3 Drilling and tapping

Part to machine	Machining	Accessories required	Recommended chuck	Machining example
Plate or block (part dimensions below 150 mm)	Drilling and blind tapping	Mechanical stops on two sides	**QX and SQ/HD** (recommended pole: 50÷62)	Part dimensions: 120x120x60 Material: Fe Drill: Ø 12 mm Feeding: 0.18 mm/rev Speed: 1200 rpm
Plate or block (part dimensions above 150 mm)	Drilling and blind tapping	Mechanical stops on two sides and fixed polar extensions to lift the part. Pre-drill if the extension cannot be removed.	**QX and SQ/HD** (recommended pole: 50÷62)	Part dimensions: 120x120x60 Material: Fe Drill: Ø 12 mm Feeding: 0.18 mm/rev Speed: 1200 rpm
Drawn plate (part dimensions above 150 mm)	Drilling and blind tapping	Not required	**QX and SQ/ST, SQ/HD, SQ/HP**	Plate dimensions: 250x250x50 Material: C40 Drill: Ø 30 mm Number of inserts: 2 Feeding: 0.06 mm/rev Speed: 1500 rpm
Drawn plate (part dimensions above 150 mm)	Drilling and reeving tapping	Fixed polar extensions to lift the part. Pre-drill if the extension cannot be removed.	**QX and SQ/ST, SQ/HD, SQ/HP**	Plate dimensions: 250x250x50 Material: C40 Drill: Ø 30 mm Number of inserts: 2 Feeding: 0,06 mm/rev Speed: 1500 rpm
Forged plate (part dimensions above 150 mm)	Drilling and blind tapping	Not required	**QX and SQ/ST, SQ/HD, SQ/HP**	Plate dimensions: 250x250x50 Hardened and tempered material Drill: Ø 30 mm Number of inserts: 2 Feeding: 0.06 mm/rev Speed: 1600 rpm
Forged plate (part dimensions above 150 mm)	Drilling and reeving tapping	Fixed polar extensions to lift the part. Pre-drill if the extension cannot be removed.	**QX and SQ/ST, SQ/HD, SQ/HP**	Plate dimensions: 250x250x50 Hardened and tempered material Drill: Ø 30 mm Number of inserts: 2 Feeding: 0,06 mm/rev Speed: 1600 rpm

8.7.4 Machining of series or parts with special shapes

Machining	Accessories required	Recommended chuck	Machining example
Flattening Contouring Drilling Tapping	Shaped over-plate	**QX and SQ/ST, SQ/HD, SQ/HP**	Same as above, but adapted to the dimensions of the part, the material and depth of the over-plate

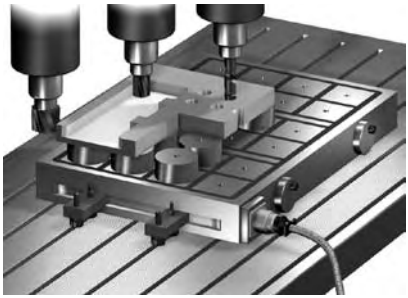


Figure 8.7A - Flattening, drilling and formation of imprints

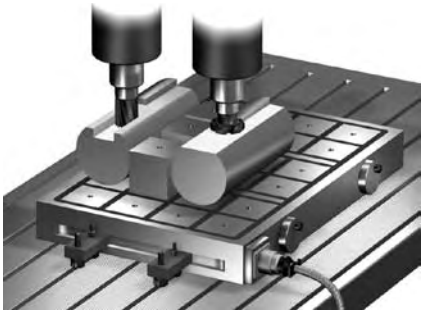


Figure 8.7B - Facing of strappers and creation of key slots

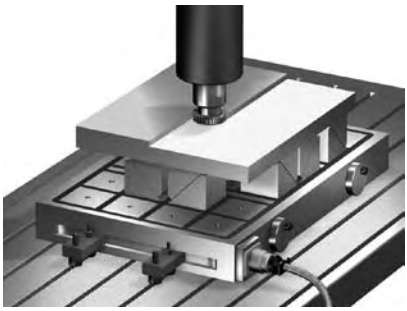


Figure 8.7C - Surface roughing

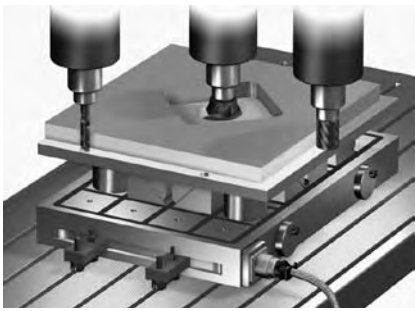


Figure 8.7D - Tilting, roughing, release of stress and finishing of second surface

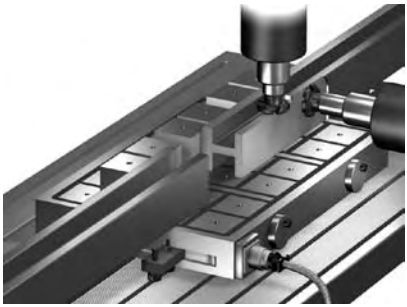


Figure 8.7E - Flattening and butting of profiles

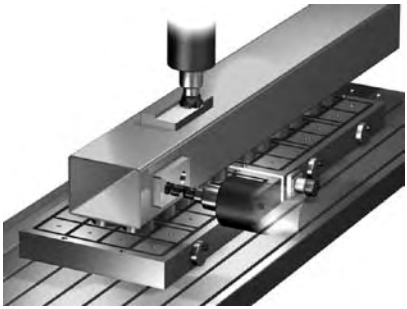


Figure 8.7F - Butting and drilling of tubular sections

Figure 8.7G - Profiling of blades and chiseling of sheets

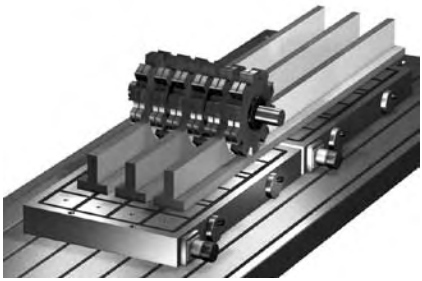


Figure 8.7H - Profiling of multiple joined guides

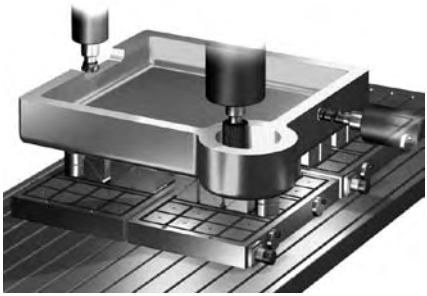


Figure 8.7I - Flattening and contouring of cast and molded parts

Figure 8.7L - Flattening, contouring and boring of cast iron parts

Figure 8.7M - 3D machining

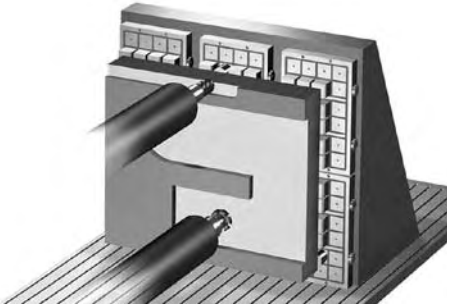


Figure 8.7N - Machining of plates with horizontal axis

9 MAINTENANCE

9.1 Premise

A correct maintenance significantly influences the life cycle of the system, ensures a high performance and fault-free operation, along with maximum functional safety.

9.2 Safety precautions applicable to maintenance

ATTENTION

Always verify that all maintenance operations are carried out by qualified and trained personnel (paragraph 1.7).

While performing maintenance operations, always take into account the following:

- All maintenance operations should be performed when the system is idle and disconnected from the power supply.
- All reparations on electric systems must be performed after disconnecting the system from the power supply and enabling the emergency button. All personnel responsible for the operation, maintenance and cleaning of the system shall have to thoroughly follow the safety instructions applicable to the country of installation.
- Always wear safety glasses and shoes and any other type of PPE required including overalls that cover as much of the body as possible.
- Do not wear rings, watches, chains, bracelets, loose clothing, etc. during maintenance work.
- Stand on a rubber insulating mat (if possible) when doing maintenance work.
- Avoid working on wet floors or under very damp conditions.
- Always perform maintenance operation according to schedule.
- Always replace components with original spare parts in order to guarantee maximum performance.
- When performing cleaning operations, avoid using grinders or abrasive, corrosive or solvent material that could cause the removal and/or make numbers, initials or information printed on the system illegible.
- Protect all electric and electronic equipment from water.

- Clean all electric parts with a vacuum system only, not with compressed air.

9.3 Daily maintenance

These operations must be performed at the end of the daily shifts by the operator or personnel responsible for cleaning operations:

- General cleaning of system.

9.4 Weekly maintenance

These operations, which have to be carried out by the operator at the end of the week, include:

- Inspection of signaling lamps (refer to the operation and maintenance manual supplied with the controller).
- Inspection of buttons (refer to the operation and maintenance manual supplied with the controller).

9.5 Monthly maintenance

These operations, which must be performed once a month for daily working shift of 8-10 hours and must be performed by qualified and skilled personnel, include:

- Visual inspection of the magnetic plates.
- Tightening of all the screws of the magnetic chucks.
- Removal of rough surfaces and rust.
- Inspection of the surfaces of magnetic chucks.
- Visual inspection of the terminal boards of magnetic chucks and of the controller.

9.6 Maintenance operations required every six months

These operations, which are based on a daily working shift of 8-10 hours and must be performed by qualified and skilled personnel, include:

- Disconnection of the discharge cables of the magnetic chucks from the connection boxes.
- Measurement of the resistance and insulation values at 500 V.
- Passing a steel sheet over the surface of the poles to detect potential signs of residual magnetism.
- Reconnection of the discharge cables of the magnetic chucks to the connection boxes.

9.7 Extraordinary maintenance

Maintenance operations not specifically described in this manual are considered extraordinary maintenance and must be carried out by qualified personnel specifically authorized by TECNOMAGNETE S.p.A.

9.8 Information on extraordinary reparation and maintenance operations

To allow users to quickly perform troubleshooting operations, the manual includes also the following documents:

- Layout and assembly instructions for the chuck used.

The wiring diagrams are included in the operation and maintenance manual of the controller.

TECNOMAGNETE S.p.A. can be contacted at any time for further information or queries regarding the operation and maintenance of the magnetic chuck.

10 TROUBLESHOOTING AND CORRECTIVE ACTIONS

This section provides information designed to help operators to troubleshoot and correct the problems that may arise during the use of the equipment.

It is particularly important to correctly calculate the clamping forces, as specified in previous paragraphs and to carefully determine the safety factors to be used for the calculation of these forces.

Always verify that the parts cannot come loose or be ejected during machining, specifically if the machining forces are above the clamping ones.

For information on how to troubleshoot electric issues, refer the enclosed diagrams and the operation and maintenance manuals supplied with the controller.

All reparation on electric components must be carried out only after disconnecting the system from the power supply and enabling the emergency button. All personnel responsible for reparation operations must thoroughly follow the accident prevention procedures in force in the country of installation of the system.

11 SPARE PARTS

All permanent-electro systems for grinding and milling operations are supplied with a list of spare parts that is attached to the manual.

12 DECOMMISSIONING AND DISPOSAL

12.1 Decommissioning

To decommission the system, disconnect it from the power supply, place it out of service, disassemble it from the tool machine and remove the controller and all mobile parts.

12.2 Disposal

The user is responsible for the demolition, dismantling and disposal of the materials/components that are part of the system. Said operations shall have to be carried out in accordance with UE directives or with the laws in force in the country of use.

Dismantling operations must always be carried out with utmost care to ensure maximum safety and prevent potential industrial accidents. Specific care should be taken when:

- Disassembling the system in the installation site.
- Transporting and handling of the system.
- Dismantling the system.
- Separating the materials/components that are part of the system.

Demolition and disposal operations should be carried out in compliance with appropriate regulations in order to protect the health of workers and the environment. In particular all separation, recycling and disposal operations must be compliant with the provisions stated in the national or regional laws concerning the disposal of solid industrial and toxic and dangerous waste. Said provisions specify in particular that:

- Sleeves, flexible ducts and plastic or non metal parts must be disposed of as special waste.
- Electric components such as switches, transformers, sockets, etc. must be disassembled so that they can be reused, if in good conditions, or inspected and recycled.

13 WARRANTY AND TECHNICAL SUPPORT

13.1 Warranty terms and conditions

TECNOMAGNETE products are guaranteed for 36 months from the invoice date except where otherwise indicated in writing. Said warranty covers all defects of materials and workmanship. Faulty parts shall be replaced or repaired by the manufacturer in his workshops.

All material to be repaired must be sent CARRIAGE PAID.

After reparation, the controller shall be sent CARRIAGE FORWARD to the customer.

The warranty does not cover expenses relating to our engineers visiting the installation site nor machine dismantling. If on-site assistance is required, labor cost shall be invoiced at current prices, along with transfer and travel expenses.

The manufacturer shall not be responsible for direct or indirect damages caused to people or property by this controller or by reparations carried out by the purchaser or third parties.

Reparations under warranty shall not affect the duration of the warranty period.

This warranty does not cover:

- Damages originating from ordinary wear resulting from the use of the system
- Faults caused by improper use or assembly
- Damages originating from the use of spare parts other than those recommended
- Damages caused by incrustation

13.2 Warranty invalidity

The warranty shall not apply in the following cases:

- If the customer fails to make the payments at due time or fulfill contractual obligations.
- In the event of unauthorized reparations or changes.
- If the serial number has been tampered with or deleted
- If the damage originates from improper operations or use; for example improper maintenance, impacts and other causes that cannot be attributed to ordinary operating conditions.
- If the controller has been disassembled, tampered with or repaired without the written authorization of TECNOMAGNETE S.p.A.

All controversies originating from this warranty shall be settled by the Court of Milan.

For help or further information, contact our technical services department at the following address:

TECHNICAL SUPPORT SERVICE

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15 ATTACHMENTS

This manual includes the following attachments:

a) Dimensional drawing

b) Installation chart

c) List of spare parts

15.1 Declaration of conformity

TECNOMAGNETE S.p.A. hereby declares that the equipment is compliant with the main requirements and any other applicable provision specified in directives:

2004/108/EC and 2006/95/EC.

The EC declaration of conformity is available for reference at the following Web page:

http://www.tecnomagnete.com/engcecertificate.htm

To view the declaration of conformity, open the Web page and click the name of the purchased product.

• IT
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