Sistema magnetico elettropermanente di ancoraggio

Permanent electromagnetic clamping system

ENGLISH

RADIAL POLE

Manuale uso e manutenzione

Operation and Maintenance Manual

Nr. 50 100 7816

TECNOMAGNETE®

CONTENTS

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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: 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.

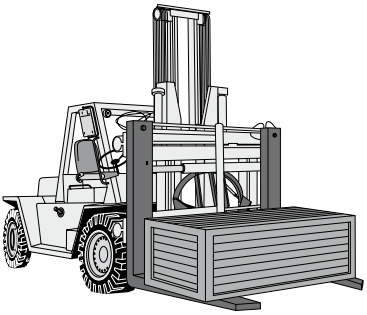
If the nameplate is damaged or has been removed, it is necessary to contact TECNOMAGNETE S.p.A. to order a duplicate.

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

RADIAL POLE PRS & PRH systems can be transported in wooden crates and mounted onto a pallet to simplify handling.



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:

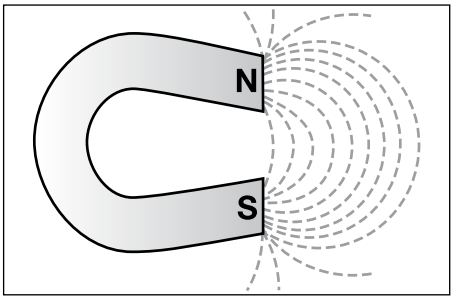
a) The high clamping force of magnetic systems is consistently distributed on all surface of the part to being clamp. This can be particularly useful when clamping sensitive parts like those with a small thickness or that tend to deform easily.
b) The working principle of magnetic systems offers the 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.

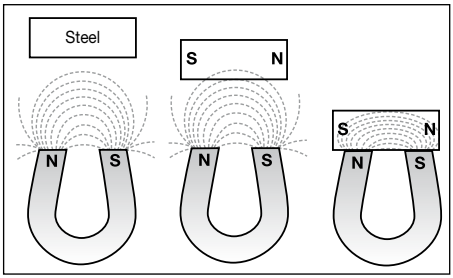
Magnetic clamping systems ensure a continuous air flow. The system is not dependant on external energy sources while the tool machining is in progress, which means that if a power failure occurs, the clamping forces are not affected and are therefore able to continue clamping the part..

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.

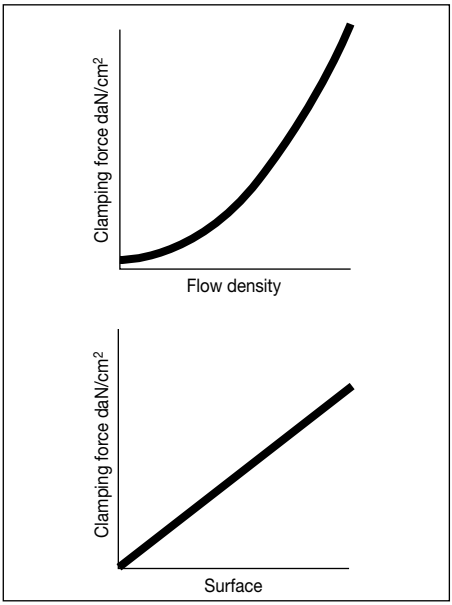


The flow produced by the steel varies according to the material it contains, its dimensions, the level of contact achieved between the part to clamp and the magnetic chuck, and the easiness with which the flow passes through the steel.

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.

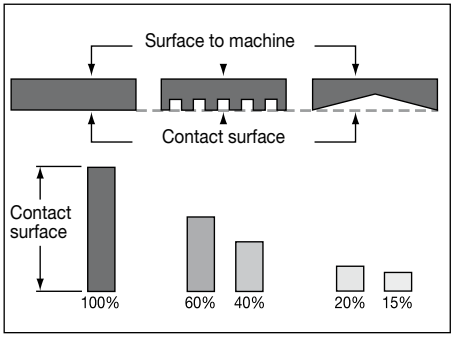


Doubling the contact area means doubling the clamping force. A 10% reduction in the flow density reduces by 19% the clamping force. If the flow density is halved, the clamping force is reduced by 75%. The flow density tends to reduce when the flow encounters a magnetic resistance (reluctance). A typical 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.

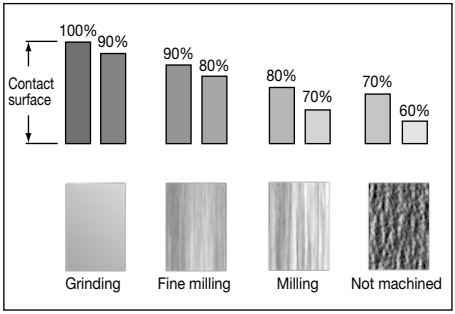
100% = Optimum clamping
60% = Very good clamping
40% = Satisfactory for some operations
20% = Sometimes sufficient for light grinding operations



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

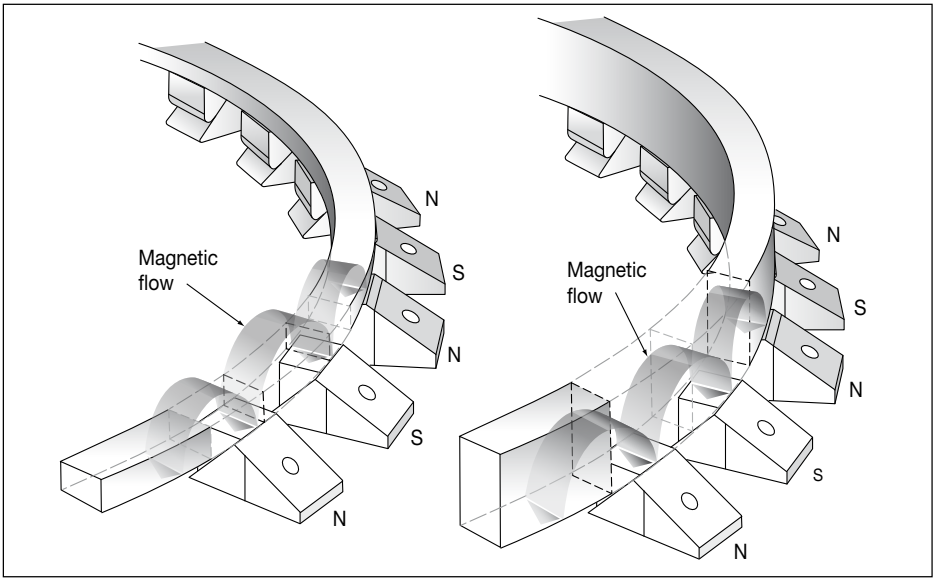
3.3.4 Conditions of the part surface

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 Part thickness

The flow path inside the part is constituted by a semicircle that starts from the center of a pole of the magnetic chuck and ends in the center of the next one.

If the thickness of the part is smaller than the radius, the output flow is scattered and cannot be used for clamping purposes. The resulting attraction will be smaller than the one that results when all the flow is absorbed by a part with a thickness that can contain it. Therefore, THE THICKNESS OF PART TO BE CLAMPED MUST BE EQUIVALENT OR GREATER THAN HALF THE WIDTH OF THE POLE.



3.3.6 Performances of PRH systems

This manual applies to two types of clamping systems:

- Systems for light machining operations (grinding and turning) - Mod. PRS
- Systems for heavy machining operations (turning) - Mod. PRH

The circuits of these two types of systems are obviously different due to the different forces used.

PHR circuits comprise 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.
PRS circuits include a single magnet that is placed under the flow conductor.
Consequently, the clamping forces and enabling/disabling principle are different.

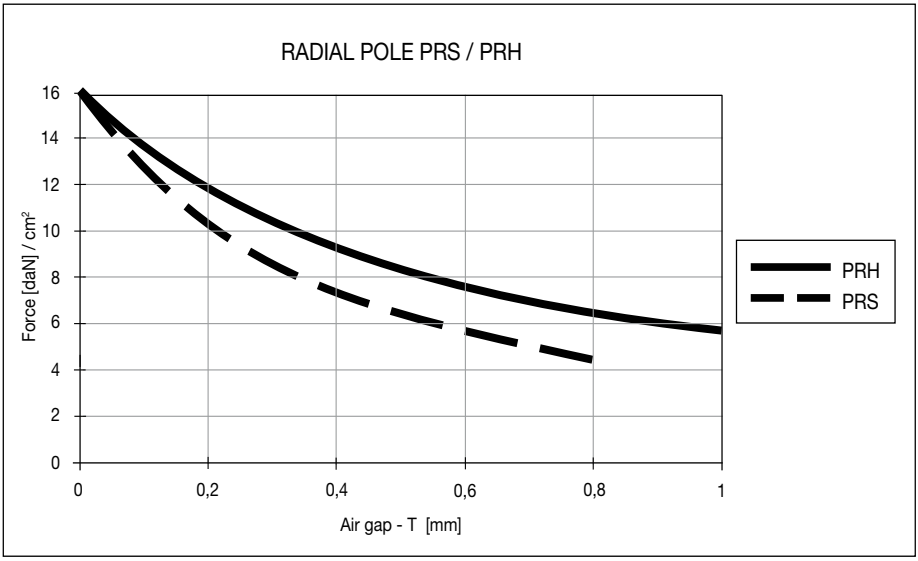
On PRH systems, the polarity of the magnet under the pole is inverted by the solenoid that surrounds it, while on PRS systems, the magnet is magnetized and demagnetized by the solenoid.
Consequently, the forces involved are significantly different because the amount of magnetic flow is clearly much higher in PRH systems.

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

The force curve shows that even if the magnetic field crosses both magnetic and non magnetic bodies (air, dust or generally ferrous materials), the maximum efficiency can be attained when the poles (or the pole extensions) are in close contact with the surface of the part that has to be clamped.

The force curve shows that the clamping forces “F” (daN) tend to decrease as the air gap T (mm), generated by “unexpected elements” (magnet, foreign bodies, depressions, peaks, etc.) between the flow conductors and the surface of the part that has to be clamped.



4 AVAILABLE MODELS

There are two families of Radial Pole magnetic chucks. Both use the same permanent-electro technology, but have different configurations of magnets and offer specific performances.

- **PRS /CR model** - Permanent electromagnetic system for turning), with quick-fitting connector, for light machining operations (grinding and turning).
- **PRS /SC model -** Permanent electromagnetic system for turning), with sliding contacts, for light machining operations (grinding and turning).
- **PRH /CR model -** Permanent electromagnetic system for turning), with quick-fitting connector, for heavy machining operations (turning).
- **PRS /SC model -** Permanent electromagnetic system for turning), with sliding contacts, for heavy machining operations (turning).

4.1 PRS - Chuck with radial poles for light grinding and milling

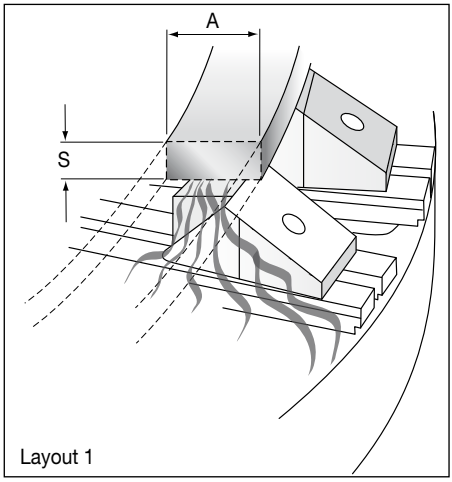
The PRS magnetic chuck is **suitable to hold alloy steel parts and bearings** and is also **particularly suitable to clamp rings,** especially if the thickness of the part enables the magnetic flow to be concentrated, thus allowing the part to be subjected to all the necessary processes.

As the total holding force in this case varies according to the contact surfaces between the poles and the parts, the concentration of the magnetic flow guarantees the maximum clamping force (expressed in daN/cm2).

These chucks are typically used to clamp bearings when performing light grinding or milling operations.

If the magnetic flow cannot be concentrated because of the thickness of and the size of the part or because the part to be clamped is in alloy steel or steel for bearings, it is preferable to use a PRS magnetic chuck, which optimizes the flow concentration thanks to the pole extension.

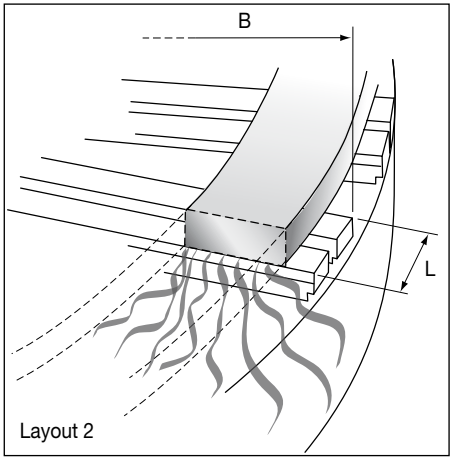
In this case the magnetic flow can be concentrated and the maximum clamping force can be applied only to the contact surface between the pole extension and the part (layout 1).



Layout 1

The use of pole extensions is recommended when the strip of the ring ("A" on layout 1) is 30% above the total length of the pole ("B" on layout 2).

This magnetic chuck is not the ideal solution when the poles of the chuck are fully or almost fully covered (very large contact are between the chuck and the part, layout 2). Summarizing, it is possible to state that the increase of the contact area significantly reduces the clamping force.



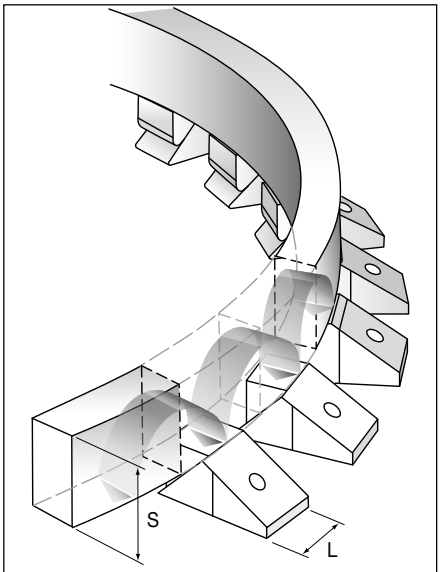
Layout 2

4.2 PRH - Chuck with high power radial poles for heavy duty turning

PRH chucks are magnetic clamping systems that use the “polarity reversal” technology to guarantee the availability of a maximum clamping force with all geometrical forms. However, these types of chucks do not offer a good demagnetization when used with alloy steel or steel for bearings.

Even in this case the total clamping force varies according to the contact surface between the poles and the pole extensions of the part.

Parts with a small thickness (smaller than the width of the pole) enable the same clamping force to be used both on PRS and PRH chucks. For parts with a greater thickness (thickness above the width of the pole), it is preferable to use a PRH system with double magnet.



S = Thickness
L = pole width

PRH - Chuck with high power radial poles for heavy turning

5 GENERAL DESCRIPTION OF THE SYSTEM

5.1 Standard configuration of "RADIAL-POLE"

The standard configuration includes:

- "RADIAL-POLE" chuck with quick waterproof connector
- Controller with cable to connect the magnetic chuck/controller
- Remote push-button panel with connection cable
- Interface contact to start the machine.

5.2 Optional accessories of "RADIAL-POLE"

The supply also includes the following optional accessories:

- Rotating Mercotac manifold or sliding contacts for fixed installations
- Stationary or mobile pole extensions.

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. 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 12 x 1.75	3780	8.5
M 12 x 1.25	4130	9.6
M 14 x 2	5150	13.5
M 14 x 1.5	5600	14.3
M 16 x 2	7030	20.5
M 16 x 1.5	7480	21.4
M 18 x 2.5	8600	28.3
M 20 x 2.5	11000	40
M 20 x 1.5	12200	43.1
M 22 x 2.5	13600	53.1
M 22 x 1.5	14900	57.1
M 24 x 3	15800	69.1
M 24 x 3	17200	73.1

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

8.1 Performance of magnetic chucks

The clamping force of a magnetic system is always influenced by two main variables: magnetic induction (expressed in Gauss) and pole contact surface (expressed in cm^2).

8.2 Magnetic induction

The relation between the specific clamping force (daN/cm^2) and magnetic induction (Gauss) is quadratic. Therefore, it is very important to maximize the value of induction in order to increase the performance of clamping.

kGauss	daN/cm^2
1	0.04
5	1
10	4
15	9
20	16

8.3 Contact surface

If the value of magnetic induction is equivalent, the greater the contact surface, the higher the total clamping force. For example, if the system guarantees a magnetic induction of 20 kGauss (16 daN/cm^2), the increase of the contact surface will yield to the following results:

cm^2	daN
10	160
20	320
30	480
40	640
50	800
60	960
70	1120

Therefore, it is very important to use the maximum magnetic induction value, then increase the contact surface.

8.4 Performance of PRS chucks

The following indications are provided for information only, because performances are influenced by the type of machining, the type of material and the type of machine on which the chuck is installed, and obviously by the degree of familiarity with the process and the experience in the use of the machine of operators. It is useful to remember that all processes must be compliant with safety regulations, which must be attached to this manual and made available to all operators.

The method for calculating the maximum chips removal rate varies according to the model and size of the magnetic chucks designed by TECNOMAGNETE.

8.4.1 Example 1: how to calculate clamping force with pole extensions covered by the part

Fully covering the strip that supports the part (a) guarantees the availability of a specific pole contact surface.

Data:

If you are using pole extensions with a working surface of (L x A) 50 mm x 50 mm

Then: 50 mm x 50 mm = 2500 mm^2 = 25 cm^2

If the number of covered poles is = 14

Then: 25 cm^2 x 14 poles = 350 cm^2

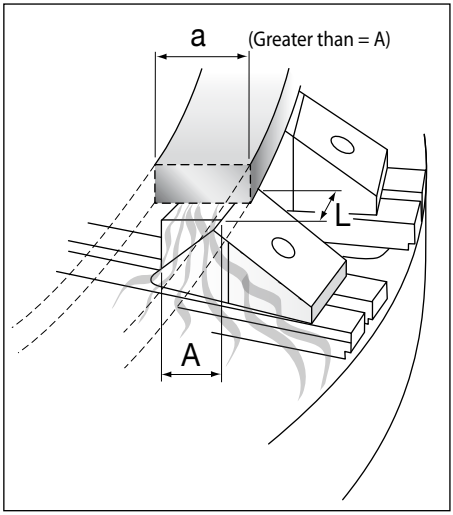
Therefore, if you are machining a steel part for bearings and you have set the parameters in order to attain an induction of 20 kGauss and this magnetic induction corresponds to a specific clamping force, which is equivalent to 16 daN/cm2, it is easy to calculate the actual magnetic clamping force of the chuck with radial poles.

- Magnetic induction on the part: 20 kGauss - 16 daN/cm^2
- Pole extensions fully covered by the part 350 cm^2

AVAILABLE CLAMPING FORCE:

Clamping force (daN) = Total contact surface (cm^2) x Magnetic induction value (daN/cm^2), then:

350 x 16 = 5600 daN



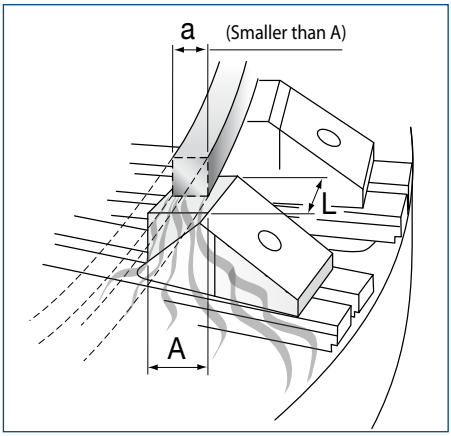
8.4.2 Example 2: pole extensions not fully covered by the part

If the strip that supports the part (a) does not fully cover the pole extensions, it is more complex to calculate the contact surface. However, this can be done by using the following factors:

Contact surface for each pole extension S = (L x a)

Total contact surface S tot. = S x number of poles

Clamping force (daN) = Total surface contact x magnetic induction value (Gauss)



The factors described above enable to calculate the clamping force in all conditions and for all types of parts.

8.4.3 Example 2: machining without pole extensions

If the supporting strip does not exceed 30% of the pole surface, it is necessary to follow the instructions applicable to the case in which the part covers the whole pole extension (example 1).

If the part covers more than 30% of the pole surface of the PRS chuck, it is advisable to contact the technicians of TECNOMAGNETE S.p.A.

8.5 Considerations on cutting forces

The cutting force during all processes varies according to the operating conditions of the tool (depth, feeding length, revolutions per minute) and the hardness of the material that has to be machined.

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

The horizontal component originates from the geometry and the feeding length of the tool. For the part to be safely clamped, the clamping force must necessarily be greater than the cutting strength that splits in all directions.

The horizontal component of the clamping force required to contrast the tangential force that tends to slide the piece, is influenced by the friction coefficient (μ) (due to the nature of the material in contact with the system, the friction coefficient is μ = 0.15÷0.30), assuming that the machining operation is carried out on a piece with the following characteristics:

contact surface = optimum (1 - see chapter 3.2, paragraph 1, multiplication coefficient = 1);

degree of roughness = fine milling (μ 0,20).

In this case, the calculation is the following:

5600 x 1 x 0,2 = 1120 daN

Attention: the cutting force of a process must be below the calculated "CLAMPING FORCE". TECNOMAGNETE suggests that you downgrade the theoretically calculated force by about 20%,

If you introduce mechanical stops to oppose the tangential component and prevent the part being machined from sliding along the magnetic chuck, the result is:

5600 x 1 = 5600 daN

In other words the introduction of mechanical stops eliminates the tangential component, which causes the part to slide, thus guaranteeing maximum safety.

The correct position of the mechanical stops is very important, especially when the contact surface between the part and the magnetic chuck surface is limited (the same concept applies to the clamping force).

It is useful to remember that it is always necessary to verify that the machining parameters are compliant with those supplied by the manufacturer of the machine on which the chuck is fitted.

9 MAINTENANCE

9.1 Premise

An adequate maintenance maintains the machine in good operating order, guarantees excellent performances and ensures the utmost safety in functional terms.

9.2 Safety precautions to be followed during maintenance

ATTENTION

All maintenance operations should be performed by qualified personnel only (chapter 1.7).

The main precautions that should be adopted during maintenance operations are:

- All maintenance operations should be carried out when the machine is idle and possibly disconnected from the power supply;
- Reparations on electric systems should be performed when the machine is not powered and when the emergency button is pressed. Al personnel responsible for the maintenance, cleaning, etc. must thoroughly follow the accident prevention regulations in force in the country in which the machine is used;
- Always use protective gloves and reinforced shoes, and any other individual protection means to protect as much as possible all parts of the body;
- Do not wear rings, watches, chains, bracelets and loose clothing during maintenance operations;
- Place an insulated rubber mat (when available) under your feet before starting maintenance operations;
- Avoid performing maintenance operations on wet floors or in very damp areas;
- Perform the maintenance operations at the recommended schedules;
- To ensure a correct operation of the machine, it is very important to replace faulty or worn parts with original spare parts only;
- While cleaning the machine, it is very important to use the utmost care before using grinding wheels, abrasive, corrosive or solvent material that could remove and/or make numbers, tags or information illegible;
- Avoid wetting electric and electronic parts;
- Clean electric parts with an aspirator, not with compressed air.

9.3 Daily maintenance

These operations have to be carried out at the end of day by the operator or personnel responsible for cleaning operations:

- General cleaning of equipment.

9.4 Weekly maintenance

These operations must be carried out at the end of the week by operations:

- Inspection of signalling 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 must be carried out once a month if the machine is used for shifts of 8÷10 hours per day by qualified and competent operators:

- Visual inspection of the status of magnetic chucks;
- Inspection of the torque of the screws of magnetic chucks;
- Removal of asperities and roughness;
- Inspection of the surfaces of magnetic chucks;
- Visual inspection of terminal boards both of magnetic chucks and controllers.

9.6 Six-month maintenance

These operations must be carried out every six months if the machine is used for work cycles of 8÷10 hours per day by qualified and competent operators:

- Disconnection of the discharge cables from the junction boxes on the magnetic chucks;
- Measurement of the resistance and insulation values at 500 V;
- Rubbing a steel part on the surface of the chucks to verify the existence of areas with magnetic halos;
- Reconnection of the discharge cables to the junction boxes on the magnetic chucks.

9.7 Extraordinary maintenance

Maintenance operations that are not specifically described in this manual fall within extraordinary maintenance and must therefore be carried out by qualified technicians of TECNOMAGNETE S.p.A.

9.8 Information on reparation and extraordinary maintenance operations

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

- Dimensional layout and assembly instructions, depending on magnetic chuck model.

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 information on the operation and maintenance of magnetic chucks.

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 magnetic systems series “RADIAL POLE” 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

14.1 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

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

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