E-FCS

User Manual

TOPFIBRA

EFFECTIVE FILAMENT WINDING® PIONEERS

E-FCS

USER MANUAL

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1. INTRODUCTION

The purpose of these service instructions is to get to know the machine and use its applications as planned.

The service instructions have important information for using the machine in a safe, adequate and economical way. It is strongly recommended for the operator of the machine respect all the existing security laws in the country as far as the security and health of the worker as well as environmental protection are concerned.

The service instructions must always be available near the machine. Any person who may perform jobs with the machine must first read the basic instructions and the following tasks:

- Complete operation, preparation, repair of breakdowns, conservation, and management of additional materials.
- Conservation (inspection, maintenance, tuning, repair).
- Transport handling and starting-up.

The service instructions are for an expert in ancillary machinery who does not need basic information. This training can be acquired initially consisting of several days, provided by Topfibra.

Topfibra's after-sale service is at your disposal for any information you may need or any questions you may have.

The operating instructions and the list of spare parts are mentioned with the serial number of the machine. The operating instructions are not instructions for performing major repairs; these repairs should be performed by Topfibra or by a specialized company.

The guarantee of Topfibra will not be in vigour in the following cases:

- When the compulsory maintenance works are not carried out (those that affect the safety), by the technical service personnel of Topfibra or by any workshop authorized by Topfibra. The above-mentioned works must be documented and should be filed in the maintenance Dossier of the machine.
- When the machine is used under abnormal conditions, damage or defects are caused due to improper, inadequate or negligent use.

- When the machine has not been used in agreement with the usage instructions, wherein the normal conditions of operation are mentioned, the nominal values of tension and frequency of electrical power and the characteristics that must have auxiliary installations.
- When the reason for failure or malfunction is a consequence of an inadequate repair or alteration caused by persons not authorized by Topfibra
- Due to natural phenomena not linked to the company like earthquakes, floods, fires, electrical discharges, beams, terrorist attacks, etc.

2. BASIC SECURITY INSTRUCTIONS

2.1. Warning signals and symbols

The following instructions use the following names and symbols corresponding to indications of special importance.

Norms and safety measures are planned for the protection of operators and other people in order to avoid the danger of death, injury and suffering substantial material damages.

Warnings and safety measures are planned to avoid possible damage to materials or machine.

THE SUPPLIED MACHINE IS TO BE APPLIED JUST FOR CUTTING GRP BLANKS OR PIPES. THE LOADING AND UNLOADING OF THE GRP PIPES OR BLANKS AT THE WORKING PLACE OF THE MACHINE AND ITS SURROUNDING WILL BE UNDER THE RULES OF THE

WORKPLACE RISKS PREVENTION PLAN IN FORCE OF THE COMPANY. THEREFORE, TOPFIBRA SHALL NOT HAVE ANY RESPONSIBILITY OF THE GRP MANIPULATION.

2.2. General information for the safety of the operator and the machine

The most basic safety rule is that you cannot access the machinery or any part of it unless all its moving parts are stopped.

Access to the safety working area of the machinery and the operation of electromechanical, electrical, electronic, hydraulic, etc. parts is restricted unless the machinery is out of power.

You must not cancel or put out of service the safety parts of the machinery, particularly movement limit switches.

The machine must be operated by qualified staff with perfect knowledge of working procedures and safety rules necessary for his protection or for the protection of other people.

Topfibra cannot be held responsible for any damages to people, goods and premises due to wrong or inadequate use of the machinery, lack of skill of the operator or maintenance staff, or the non-adherence of safety rules at work.

Noncompliance of the working methods and operations that are explained in this manual could entail the cancellation of the guarantee by the manufacturer of the machine.

Any damaged wire or defective component of the machine must be substituted with an original piece without any delay.

No welding operation with a voltaic arch must be carried out on the machine or near the machine unless it is totally powered off. Be sure you have a good ground connection for the machine, taking into consideration that power should not flow through any structural element or cables of the machine.

3. DESCRIPTION AND CHARACTERISTICS

3.1. Description of the machine

The FCS machine is composed of a gantry structure sustained by two mobile columns that move over tracks fixed into the very foundation.

The bridge structure is composed of two columns and a beam linking them. The two carriages, the left one and the right one move vertically on these two columns. These carriages are used for holding the main pulley on the right and the tensioning pulley on the left.

In the following pages, you can find diagrams of the different parts of the machine:

3.1.1. Diagram 1: Frontal view

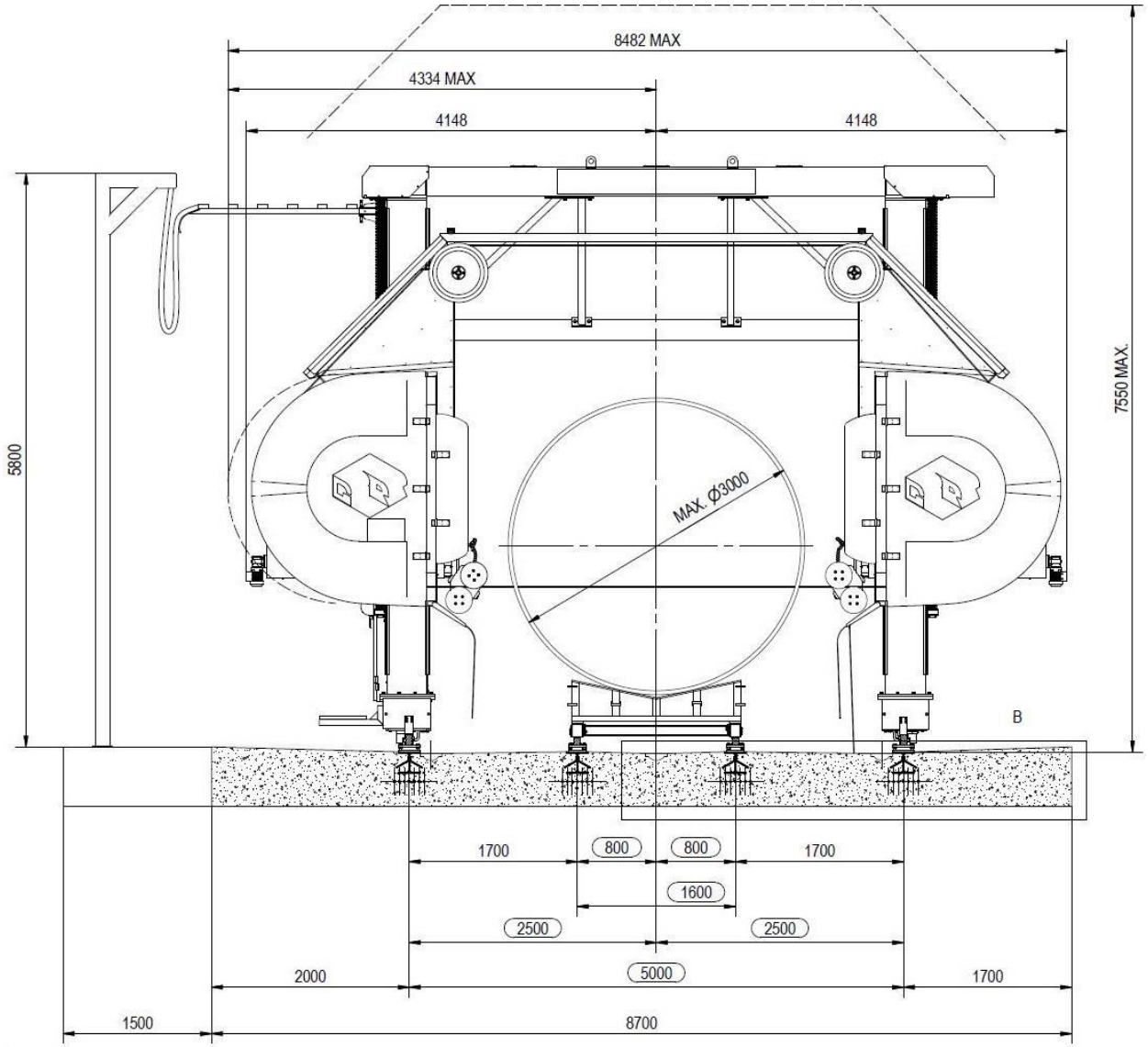


Figure 1: Frontal view

3.1.2. Diagram 2: Right Lateral view

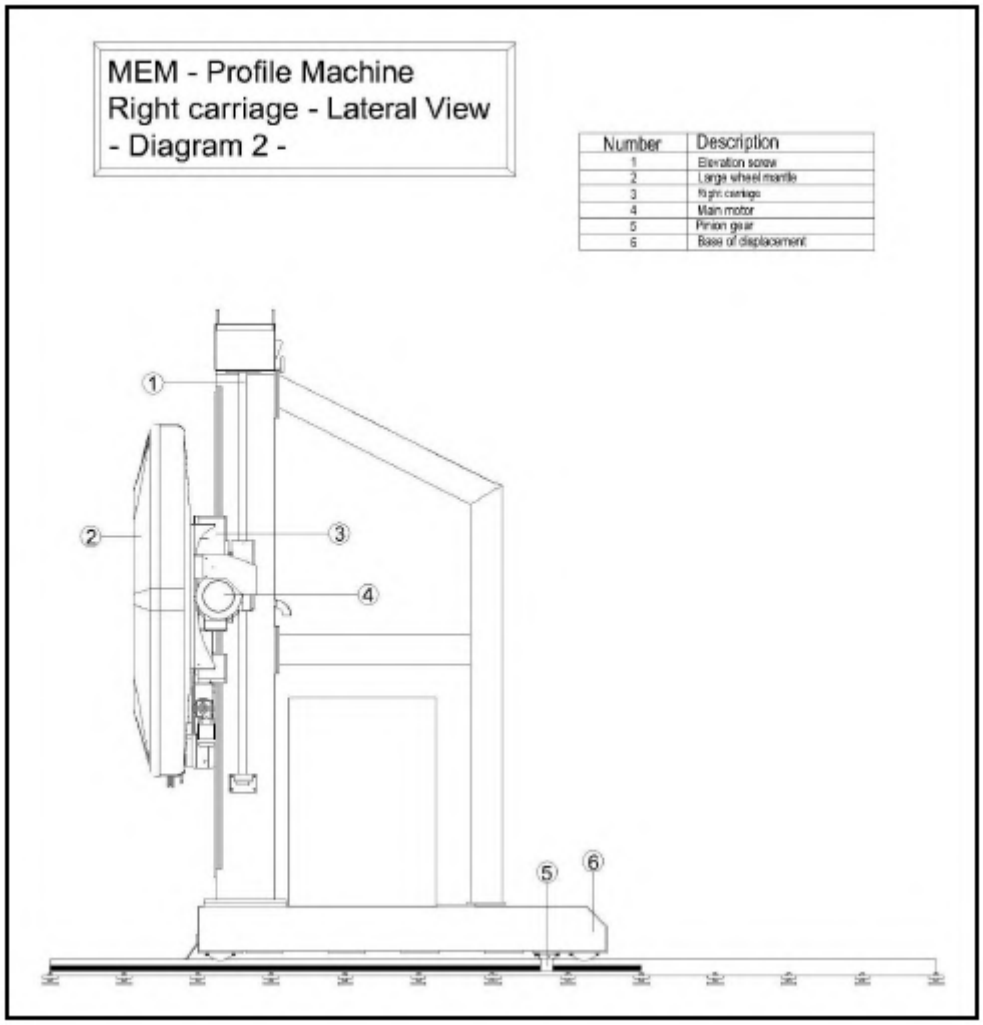


Figure 2: Right Lateral view

3.1.3. Diagram 3: Left Lateral View

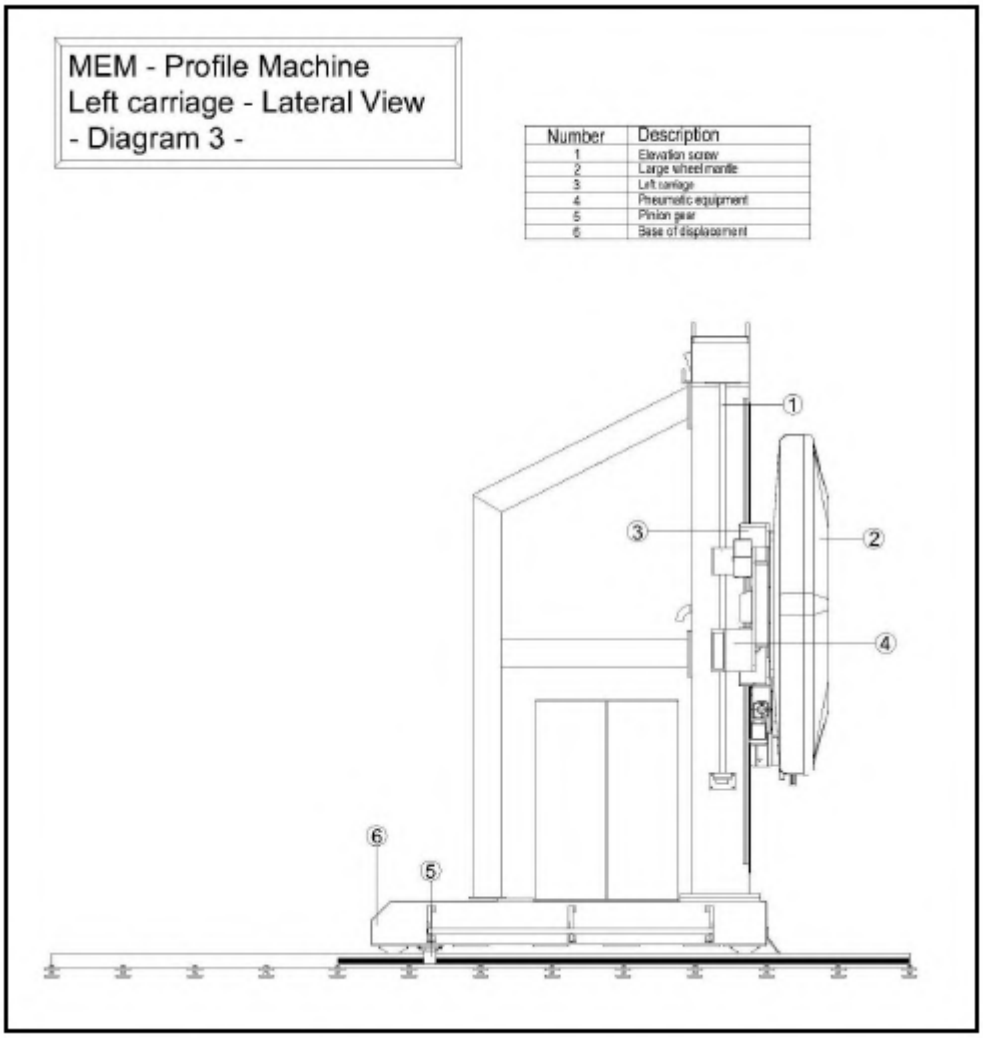


Figure 3: Left Lateral view

3.1.4. Control Panel

Figure 4: Control Panel

MARK	DENOMINATION	MARK	DENOMINATION
1	START Cycle	12	Tense / Untense wire
2	STOP Cycle	13	Speed of axis movement
3	Emergency stop	14	Axis X
4	Extra axis	15	Axis Y
5	Wire stop	16	Reset
6	Wire start	17	Reset waiting time
7	Peripherical speed regulation of wire	18	Right guide pulleys out
8	Restart of machine	19	Right guide pulleys in
9	Tighten wire	20	Left guide pulleys out
10	Cooling water open	21	Left guide pulleys in
11	External light switch		

3.2. Technical characteristic

Structure: Bridge structure constructed in arc welded steel, with all working surfaces smoothed guaranteeing high precision in working surfaces and cut pieces.

Variable speed: System for regulating the linear speed of the diamond wire by electronic control, reaching cutting speed from 0 to 40 m/s. This variation will allow the cutting of any kind of material like GRP, BRP etc.

Tension: Automatic tensioning of the wire, with detection of "wire breakage". The pneumatic cylinder will keep the working tension constant.

Rubber liners: All pulleys (drive, guide and tensioning pulleys) have rubber liners to protect them and to achieve the necessary traction of the wire.

Guide pulleys: It has two guide pulleys of the wire in its entry towards the block to be cut. These steering wheels have an electrical system of approximation to the stone so that the arrow formed in the wire is minimal.

Cooling: Automatic cooling system of the diamond wire, with constant water pressure measurement which will stop the machine in case of water shortage on the wire.

Control panel: The main control panel includes all the necessary items for the start-up of the machine, as well as the required indications for its safeguard. It has a second mobile pendant control that can also be used to run the machine. The electrical equipment is mounted in an air-conditioned cabinet.

Movements: The movements are controlled by servomotors and are guided on a calibrated rail track.

Approaching system: Motorized system of approaching the guiding wheels which allows adjusting the width to cut with the diamond wire and to increase the speed of the same.

Numeric control: Numeric control, with options for programming directly on the machine or by means of CAD-CAM software programs. The control is capable of performing all cutting functions in two interpolated axes.

CAD drawing software program to design the profile job. Simulation of the wire trajectory on the screen generating the cutting paths to be followed.

Graphic presentation of the programmed profile job on the CNC screen.

Serial communication port RS-232 for PC.

3.2.1. Technical data

Maximum cutting height	3000 mm
Power of the main motor	15 kW
Power of the elevation motor	1.3 kW
Wire length	19,80 m
Wire-speed	0 – 40 m/s
Speed of vertical movement	0 – 675 mm/min
Speed of longitudinal movement	0 – 3000 mm/min
Diameter of the main pulleys	2000 mm
Diameter of guide pulleys	250/600 mm
Number of axes controlled by CNC	2
Total length occupied (approx.)	RAILS + 2000 mm
Total width occupied (approx.)	9200 mm
Total height of the machine (approx.)	7600 mm
Total installed power	22 kW
Total weight of the machine (approx.)	9000 kg

Information about the sound levels produced by the machine.

Operators of the machine are informed that the level of Acoustic Pressure, Continuous Equivalent Measure A, emission is **68.3dB (A).**

Likewise, the Instantaneous Acoustic Pressure, Measure C is **125.2 dB.**

3.3. Dimensions

Erection of the machine:

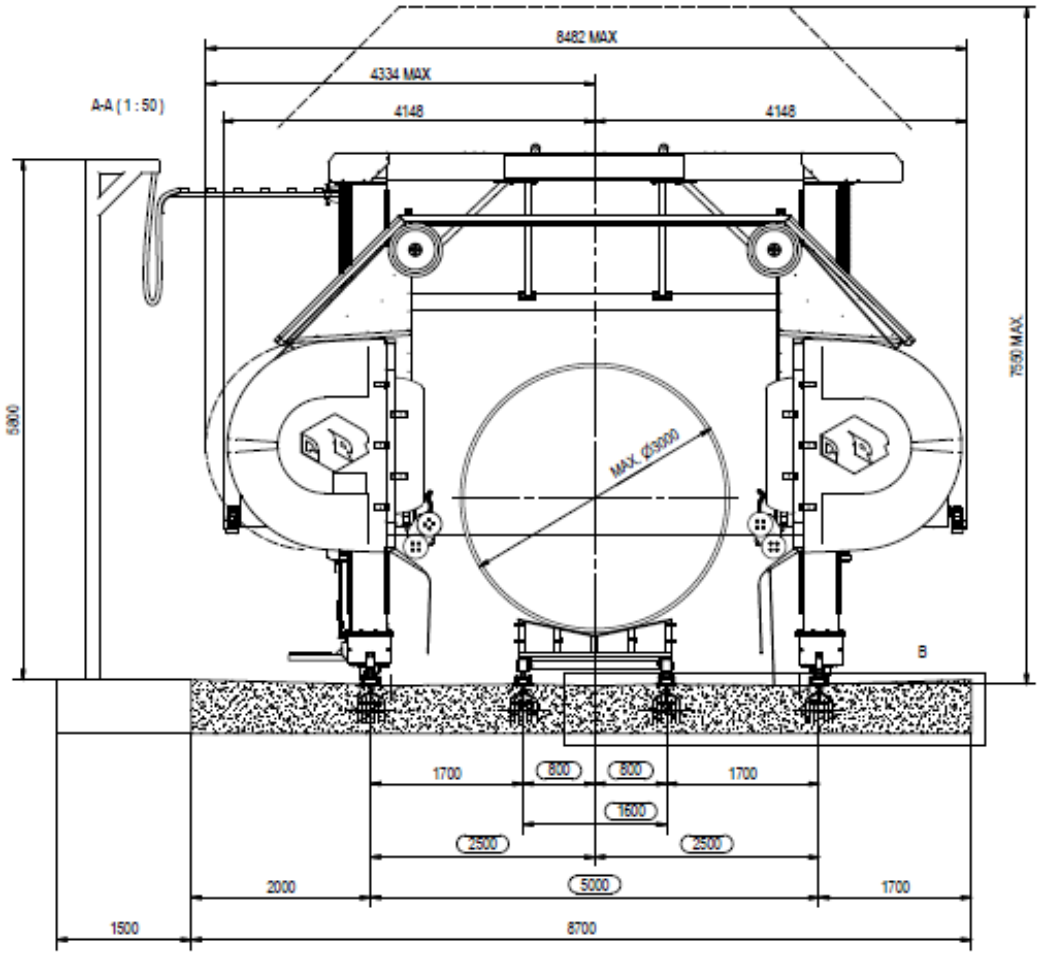


Figure 5

Lateral view:

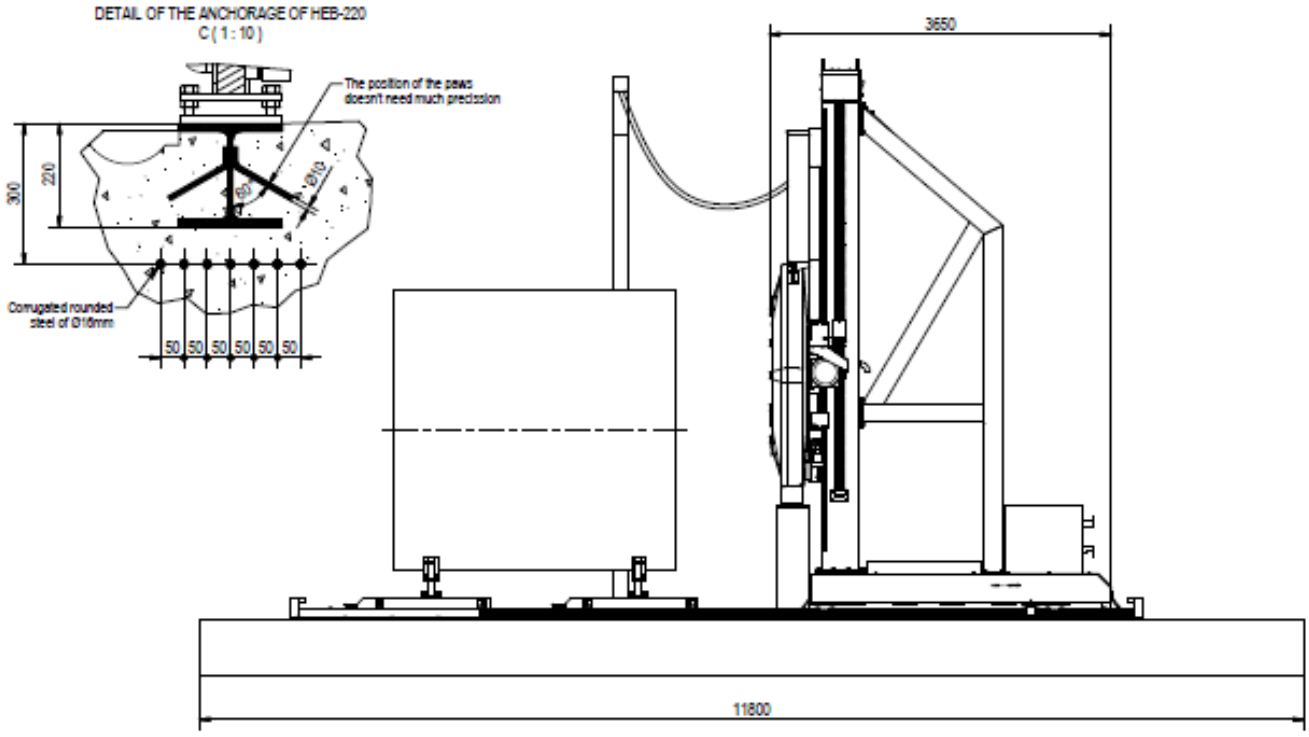


Figure 6

4. USAGE CONDITIONS

The machine must be used only in the perfect technical state and as per prevision. The operator has to be aware of the dangers, following these instructions, taking into account that those breakdowns that may affect functional safety must be repaired immediately.

The machine and its accessories are exclusively for the following uses:

Cutting stone blocks with the following specifications.

Maximum height of Stone block	3000 mm
Maximum weight of the GRP pipe	6000 kg

The wire speed must not exceed 40 m/s.

Under normal usage conditions as described in this manual, the operator of the machine must position himself out of the “Danger Area or Safety Area”:

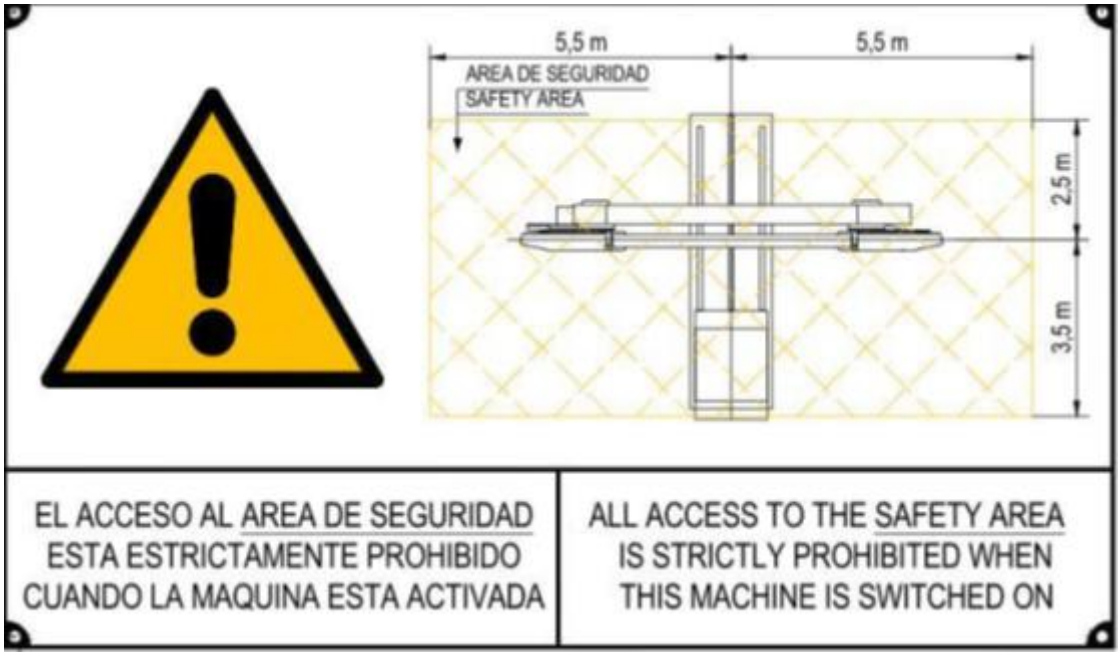


Figure 7

The characteristics of the threads used for this machine model are:

- Diamond Wire with 5 mm steel cable with 1960 N/mm² of resistance.
- Diamond beads with diameters 8, 9 or 11mm.

The range of stones that can be cut with this machine and these wires are:

- Any kind of stone with compression resistance lower than 200 N/mm².

Any incorrect use of the machine such as:

- For the lifting of loads or people, etc.

INCORRECT USE.

Any incorrect use of the machine can cause serious dangers for the staff or any other person or cause serious damage.

The manufacturer/ supplier will not be responsible for any damage resulting from the incorrect use of the machine. The risk shall lie exclusively on the operator.

5. INSTRUCTIONS FOR TRANSPORT, HANDLING AND PACKING

5.1. Conditions for movement and elevation

The machine is provided in the following subgroups:

Nine meters of rails	Weight: 790 kg/ud.
Machine	Weight: 9000 kg.

5.1.1. Installation and assembly

One will be due to make, previously to the assembly, the foundation that we specified in drawing F-210702.

The initial assembly will be made by **Topfibra** personnel or authorized partners. Any other installation, in another place, will have to be reviewed by **Topfibra**.

6. STARTING UP AND RUNNING OF THE MACHINE

6.1. Instructions for installing and operating the diamond wire

6.1.1. The diamond wire as a cutting tool (General aspects)

The diamond wire is a cutting tool that requires special care in order to get a high performance along with good cutting quality.

The wire should be cut only in the direction indicated by the manufacturer. If there is no sign indicating the cutting direction, put it in such a way as the comet that forms the metallic material sustains diamond crystals that hold the diamonds.

Always consider that the wear of the beads that compose the wire must be concentric, in order to get a high performance of the tool. During the life of the tool, should you note abnormal wear of the wire of some or all the beads, cut the wire, give the wire one more twist for a linear meter of wire and make a joint.

In order not to damage the motor of the machine, it is important to start the main motor, which is the motor moving the wire, with the wire out of the stone block.

Once the wire has entered the cut, check the correct position of the cooling devices, taking special care to position one of them at the entry of the wire in the stone. The tank has to be large enough to avoid a shortage of water at any point during the cut.

The recommended lineal speeds of the wire according to the kind of stone are as follows:

MATERIAL TO CUT	SPEED OF THE WIRE (m/s)
Marble	28 – 33
Granite class II	25
Granite class III	22 – 24
Granite class IV, V	20 – 22
Limestone	28 – 30
Sandstone	28 – 30

For the GRP pipes use Sandstone speed

These may vary according to the manufacturer of the wire.

When you start to cut with a new wire, the speed shall be one or two meters under the recommended speed. Shall the wire vibrate a lot or shall the beads suffer conical wear, increase the linear speed of the wire in order to correct this defect.

Sometimes, the wire may vibrate, reducing the life of the steel cable and the joints. This is because of a mechanical resonance phenomenon. To stop these vibrations, you only have to slightly modify the lineal speed of the wire.

The lengths of the wire to be used will be 19,80 m. It shall be looped and the diameter of the beads shall be 11mm.

6.1.2. Process of mounting the diamond wire

1. Bring down the vertical trolleys of the machine to have easier access to the whole perimeter of the wheels.
2. Open the shells of the wheels check the state of the rubber protection and change them in case of deterioration.
3. Totally extend the wire and check the cutting direction indicated by the manufacturer.
4. For open wires, both ends shall be jointed and mounted on the wheels taking into account the above-mentioned instructions.
5. Move the tension wheel towards the left, the wire will be automatically tensioned.
6. Close the shells of the wheels.
7. With the hand, check that the wire is running with a helical movement. Normally, it should twist once on the length between both guiding wheels. This checking shall be made with the machine turned off.
8. The working pressure of the pneumatic cylinder of the tension of the wire is indicated on a manometer. It may be between 6 and 7 bars.

Ø PLUNGUER = 125 mm		
PRESSURE (bar)	STRENGHT (kN)	WIRE TENSION (kg)
1	1,104	56,3
2	2,209	112,7
3	3,313	169,0
4	4,417	225,4
5	5,552	283,3
6	6,626	338,1
7	7,731	394,4
8	8,835	450,8
9	9,94	507,1
10	11,044	563,5

6.1.3. Wire changing process due to breakage during a cut

Due to the breakage of the wire, the mechanizing cycle gets interrupted and the machine temporarily stops. The wire broken warning is shown.

1. Press stop the mechanizing cycle.
2. Release machine tension.
3. Message shown “Wire tension”.
4. Tension the wire again.
5. Message shown “Wire OK, press cycle”.
6. Press mechanizing cycle start.

6.1.4. Procedure for electrical connection

The electrical distribution board, where the machine will be connected shall have the following characteristics:

Tension	380 V + Earth + Neutral
Required power	22 kW

Differential switcher	300 mA
Basic output model	380 V Tripolar + Earth + Neutral 125 A

6.2. Machine operational controls

See Manual Fagor CNC for operators.

7. SAFETY MEASURES

7.1. Common safety measures

It is necessary to define a working guideline before operating the machine.

To maintain order and cleanliness of the working area, leaving the area free from any obstacle that might obstruct work likewise maintain regular cleaning of the machine for the inspection of its controls and signals.

Establish the danger area of the machine with appropriate markers and put signs of the restricted area of entry to non-authorized persons except for the operator in the working area.

Inform the operator as well as other workers who might work near the machine of the potential risks.

7.2. Individual safety measures

The operator and his assistants will have to wear the following "Individual Protection Gear".

- Safety helmet.
- Boots or safety shoes.
- Gloves.

It is recommended to wear loose-fit clothes, not to leave hair loose neither to wear any hanging objects.

7.3. Information on residual risks

The following residual risks are present during the use, assembly, dismantling, handling and maintenance of this machine:

Risk of being trapped, during normal use, for any worker accessing the "Danger Area", and introducing any part of the body between the wire and the pulleys.

Risk of impact to any worker who might be present within the "Safety Area".

8. MAINTENANCE INSTRUCTIONS

8.1. Operations, adjustments, lubrication, cleaning and servicing to be made for the correct functioning of the machine

THESE OPERATIONS HAVE TO BE CARRIED OUT WHEN THE MACHINE IS STOPPED.

Rubber liners for pulleys: Check the correct status of the rubber liners of the main pulleys as well as the guide pulleys.

Always keep rubber liners in your spare.

The rubber liner model for the pulleys is Vulkollan with a size 42x8 mm. Change of rubber liner is very easy, it is done by keeping the pulley fixed and inserting the rubber liner centred all around the pulley. Push using a non-sharp device (ex. a screwdriver) in the centre of the rubber liner in order to press it and introduce it progressively in the V-groove of the wheel. The rubber liner must be laterally well adjusted onto the wheel or else the rubber liner will wear out in a few hours. Similarly, cut the rubber when you finish assembling and always cut it a little longer so that the rubber is well compressed on both extremes. It is recommended to check the status of the rubber liner when you change the work job.

The rubber liner model for guide pulleys is Rubber Liner Ø180mm. In order to change them, you will have to unscrew the lid of the wheel, and once you take out the lid, remove the worn-out rubber liner and replace it with the new one and fix the screws back.

Vertical Movement Screw rods: (number 1, fig.2 y fig.3). The vertical displacement screw rods are protected and they have to be lubricated manually every 500 hours of operation. The above-mentioned greasing will be done with oil SAE 90.

The air filter of the control panel: (number 8 fig.3). According to the amount of dust level in the working area, it is advised to regularly take out and clean the air filter to remove the maximum amount of dust possible. Change the filter if required.

Greasing: The following parts of the machine will have to be manually greased regularly:

- **Wheel movement bearings and their pulleys**: For the greasing of these bearings the lids are at either side of the movement bases. Once the lids are opened you can see on each side of the wheels two greasing devices.

- **Tensioning guides**: The tensioning guides have a central lubricating system situated on the back side of the tensioning pulley carriage. This greasing has to be done weekly.

Figure 8

The bearings of the axis must be greased every 150 working hours, and the bearings of the slewing ring every 400 hours.

As a basic norm, greases with different base oils must not be mixed, nor greases with different oil thicknesses.

However, if different greases must be mixed, please select at least those with the same base oil thickness.

Guide pulleys with approximation: The maintenance of the guiding wheels system with an approximation is as follows:

- Greasing:
- Weekly greasing of the sleeves.
- Weekly greasing of the screw nut.

For greasing the nuts the wheels must be completely apart.

For greasing use grease (no oil) with a lithium soap base.

- Greasing of the screw rod and cleaning (weekly):
- Open the outer lid, unscrewing the fixing screws.
- Clean the spilling grease present and the old grease of the screw.
- Apply grease to the length of the screw rod.
- Close the lid by fixing the screws back.

Clean the pulleys, mantles (inside and outside) as well as cutting area daily with water pressure.

Check the status of the elevation screws every week.

Monitor every year the oil level of the gear units.

8.2. Types and frequencies of inspections

Maintenance of the machine, as well as a registry of follow-up of this board, are compulsory for honouring the guarantee. Likewise, it is also compulsory to fill out the maintenance chart to fulfil the guarantee contract.

HOURS	100	200	300	400	500	600	700	800	900	1000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										
HOURS	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										

HOURS	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										
HOURS	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										

HOURS	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										
HOURS	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										

HOURS	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										
HOURS	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										

HOURS	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										
HOURS	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
Rubber liners of pulleys										
Vertical mov. Screw rods.										
Control panel air filter										
Greasing of bearings										
Tensioning guides										
Guide pulleys approximation										
(The spaces allotted must be filled with the dates of every check up)										

8.3. Repair

Complicated mechanical repairs which might be required like the replacement of the main pulley, a gear unit or any electronic component of the control panel should be done only by Topfibra technicians or by authorized technical personnel.

8.4. Troubleshooting

Excessive wire vibration. In this case, the rubber liners of the guide pulleys and/or main pulleys must be replaced immediately.

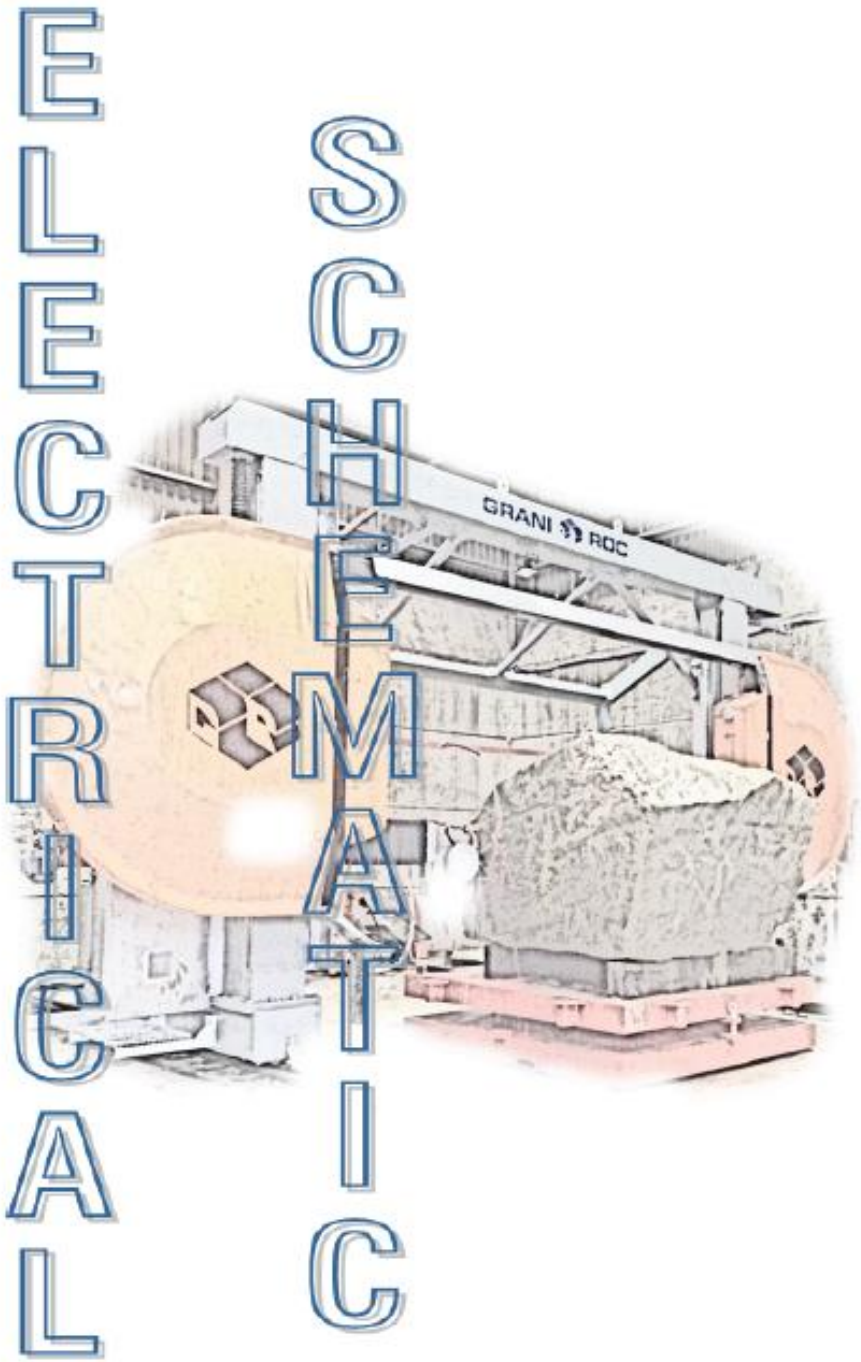
The machine does not make any movement: Emergency Stop pressed, door open or failure of the relay in the control panel.

The main motor does not start: Emergency Stop pressed, end limit switch pressed, failure of the main motor, failure of the main inverter (see chart for possible breakdowns).

The machine does not move: Breakage of the gear unit, failure of the advancement motor, and failure of the inverter (see chart for possible breakdowns).

8.5. Electrical diagrams

Consult the wiring diagrams.



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