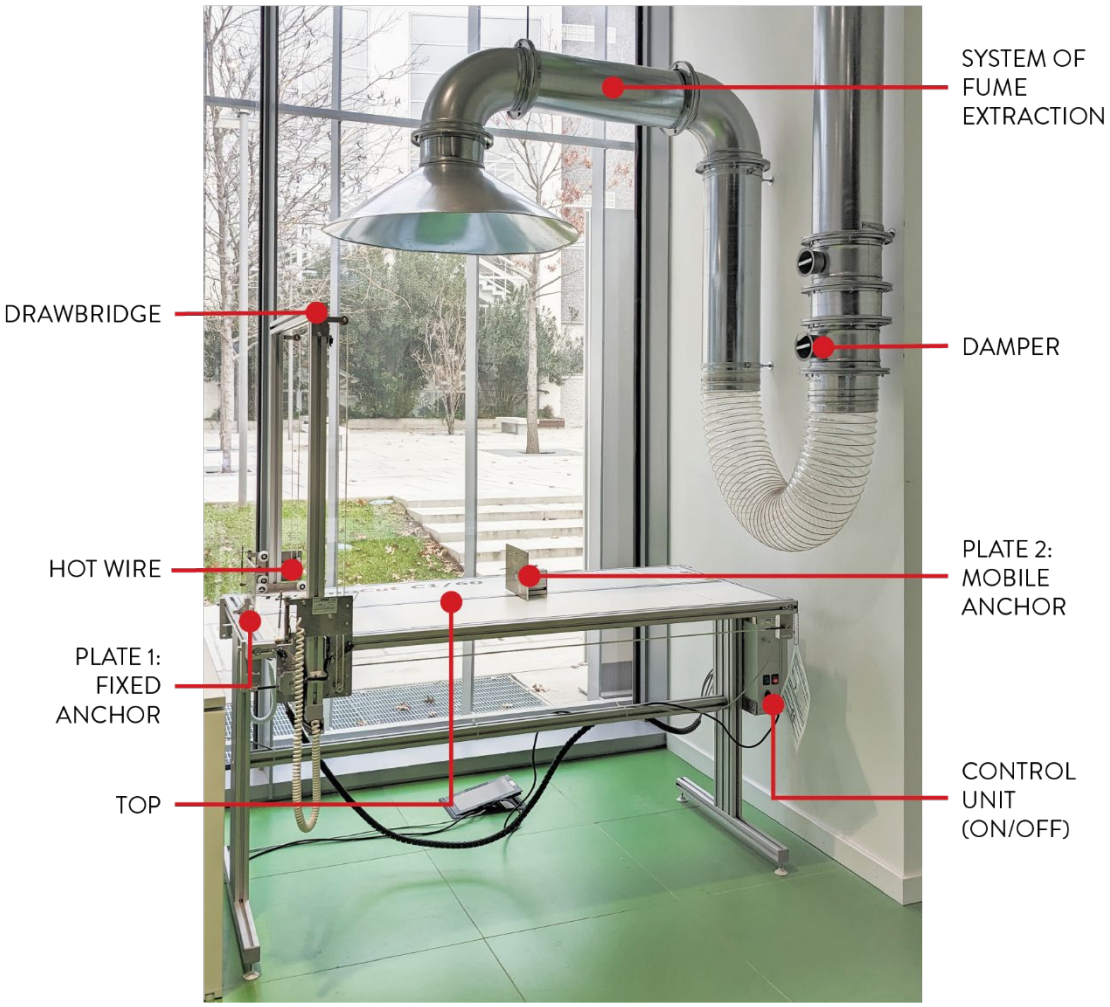
LABORA
POLITECNICO MILANO 1863

LAB.
CNC
CNC LAB.

tutorial for using the hot wire plotter



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index

1. turning on the plotter

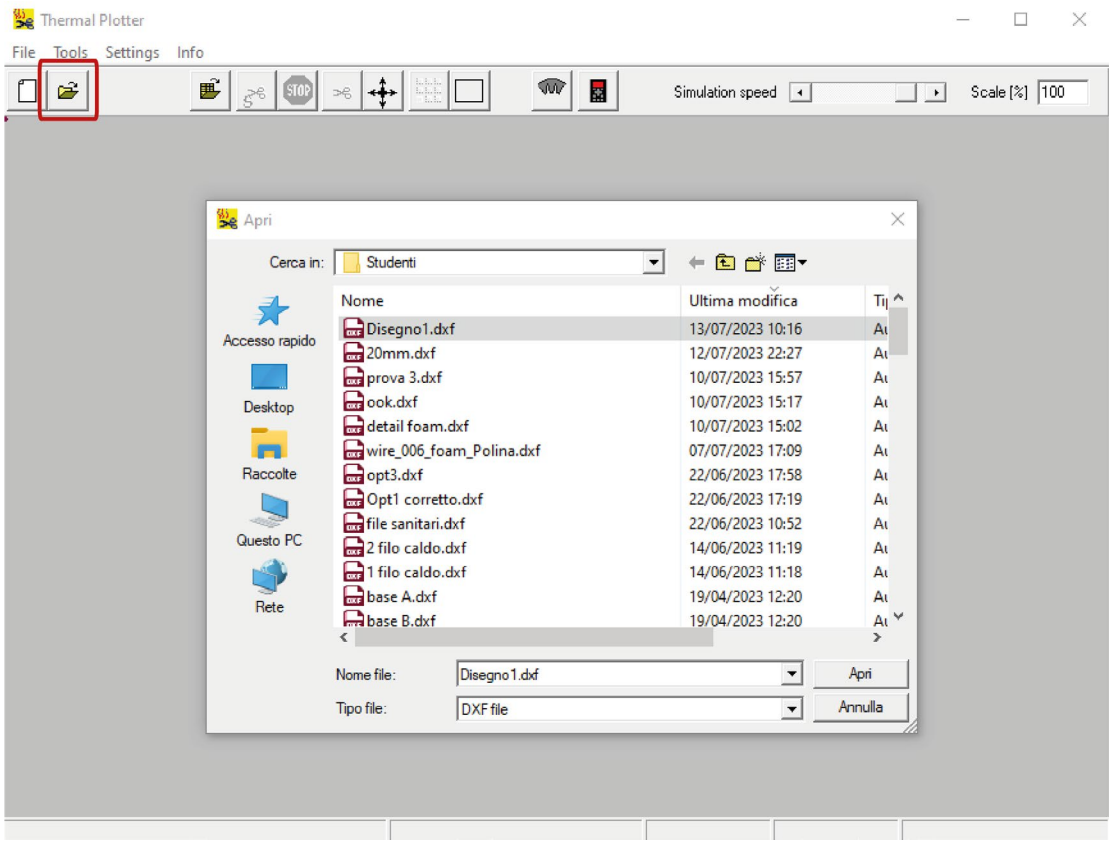
Press both switches on the control unit on the right side of the machine: red turns on the machine, green heats up the wire.

2. checking the cutting file

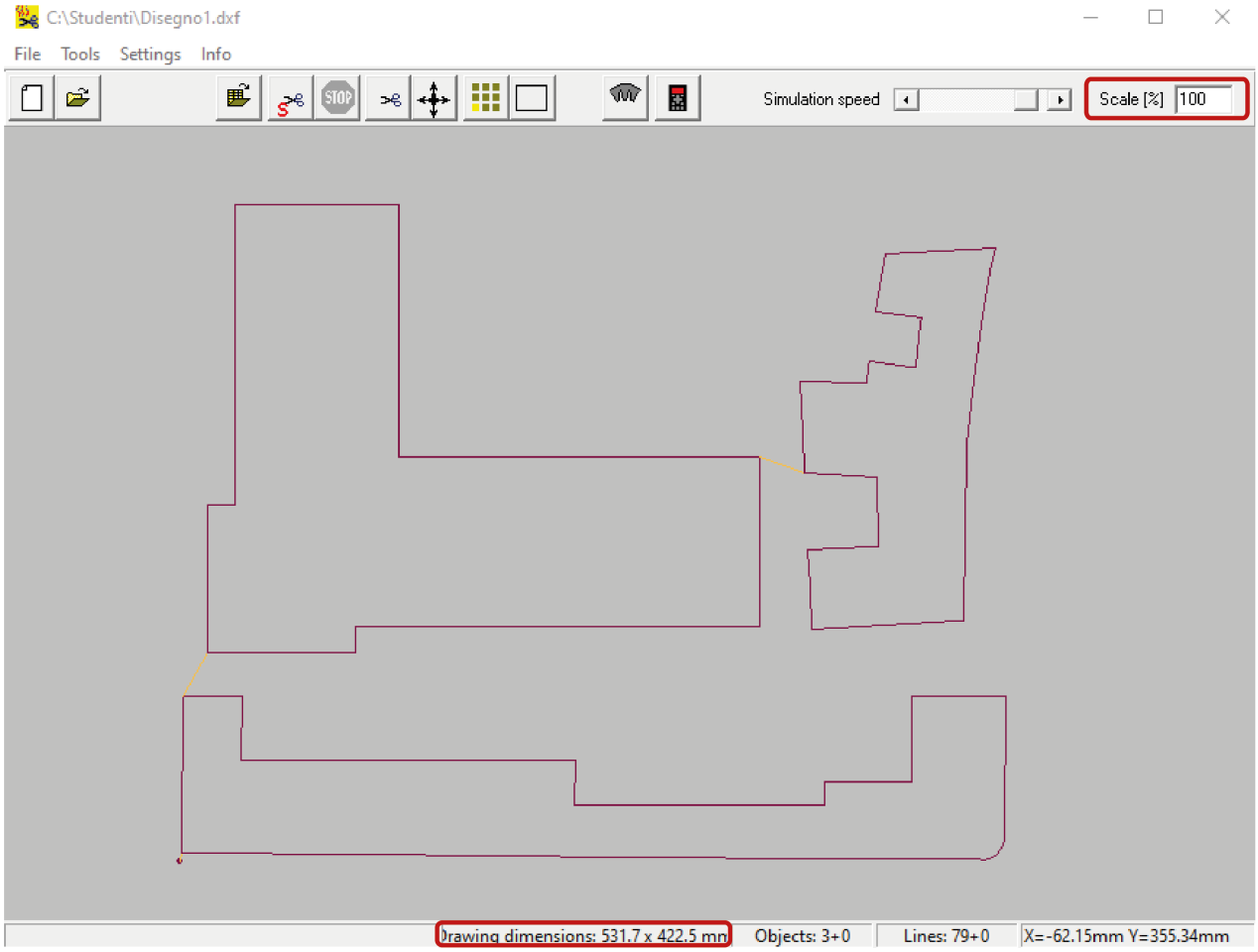
Open the **software *Softcut*** by clicking on the icon:

The cad **file** must be saved in **.dxf 2000 format**, making sure that **there are no overlapping lines** and other lines or figures that shouldn't be cut (see *file set up for hot wire plotter* form).

Open the file **.dxf** in the software *Softcut* by clicking on the icon:

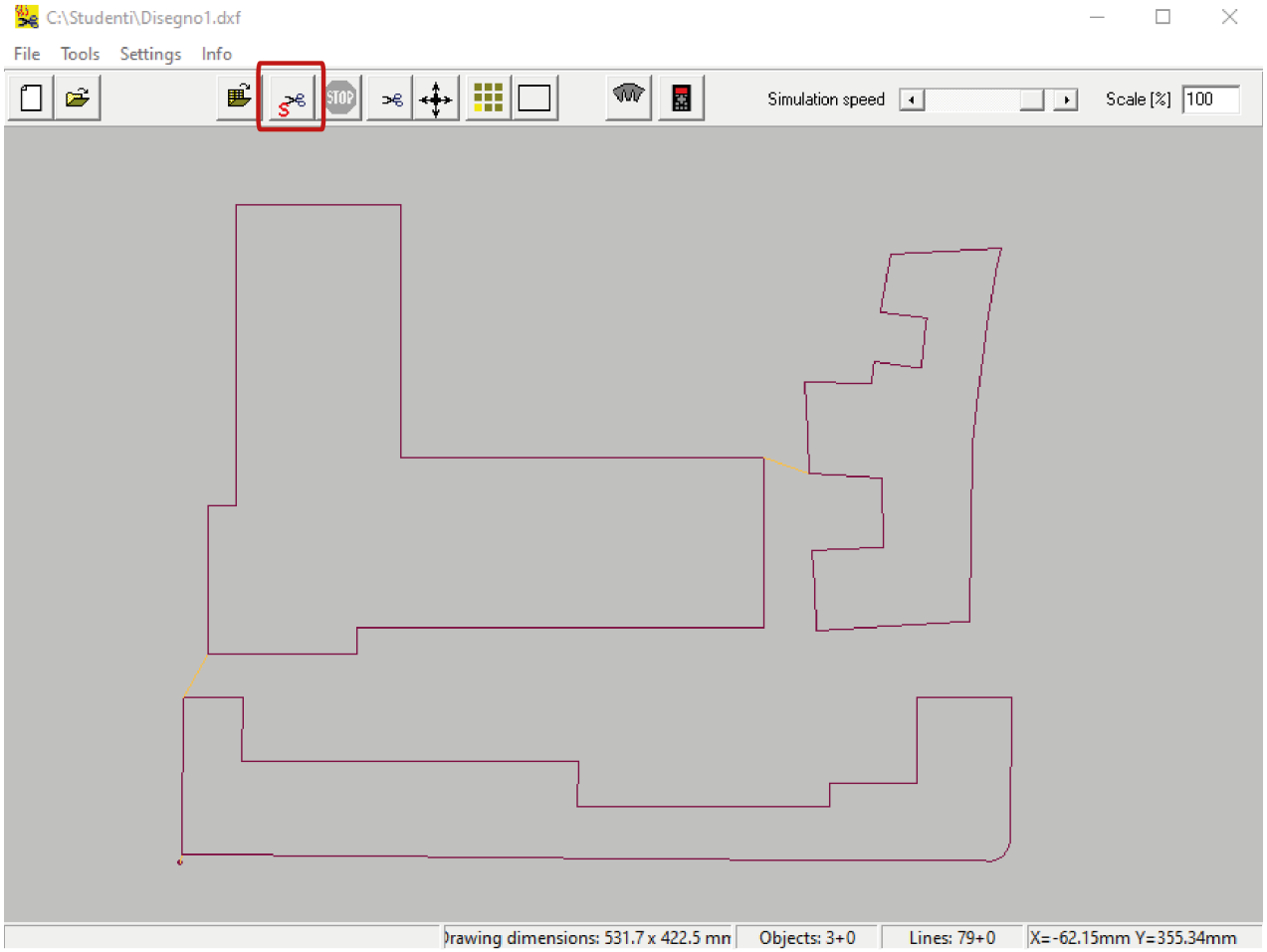


Make sure that the **dimensions shown in the bottom bar** *Drawing dimensions* **correspond to the size of the total dimension of the** desired **pieces**; if not, change the scale in the designated box *Scale (%)* on the top right.

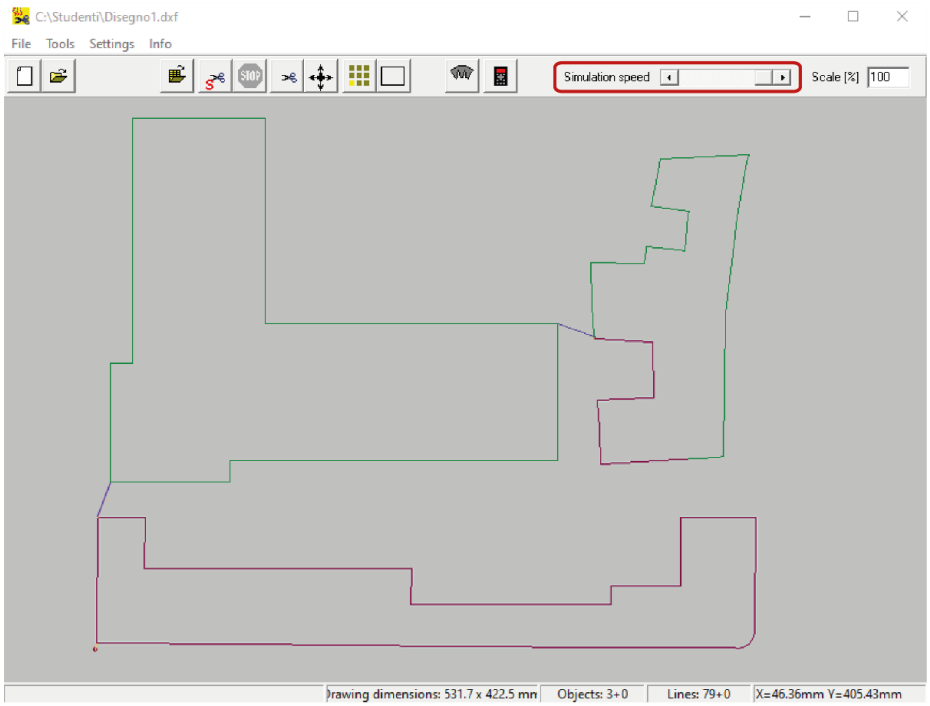


3. checking the cutting path

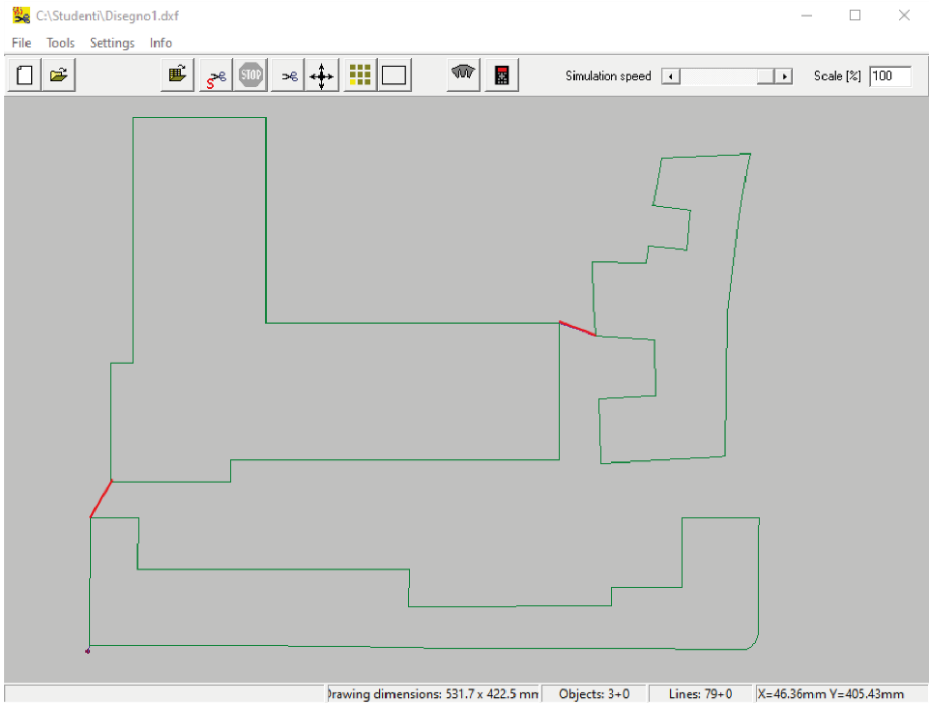
Click on the ***Cutting Simulation*** icon:



During the simulation, the movement of the wire is represented by the progress of a blue line. If necessary, **adjust the speed** by changing the parameters in the designated box ***Simulation speed*** on the top right, even during the simulation.



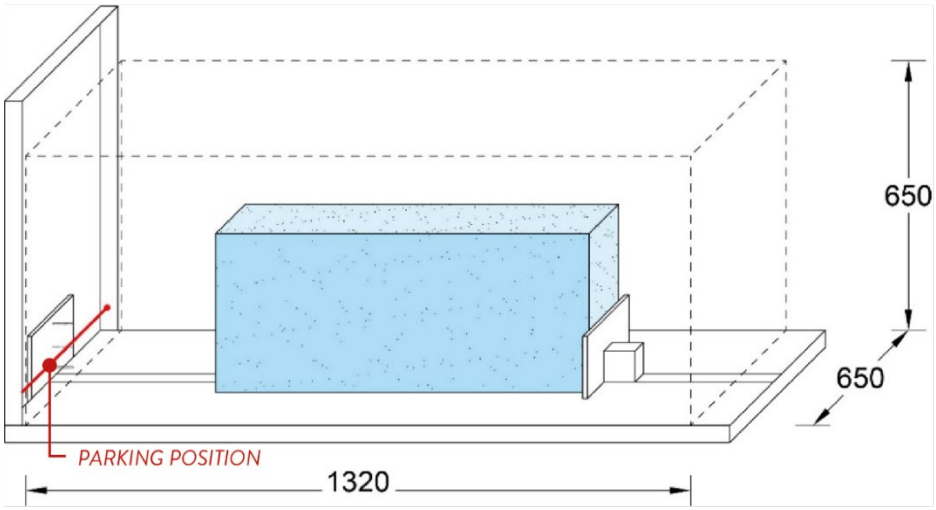
The preview of the cutting path allows you to **verify that there are not multiple passes on the same line** that would increase the thickness of the cut. If this error occurs, ask for staff support.



The connecting lines between the different shapes (blue line in the previous picture) are automatically generated by the software *Softcut* and can be retraced several times.

4. preliminary operations

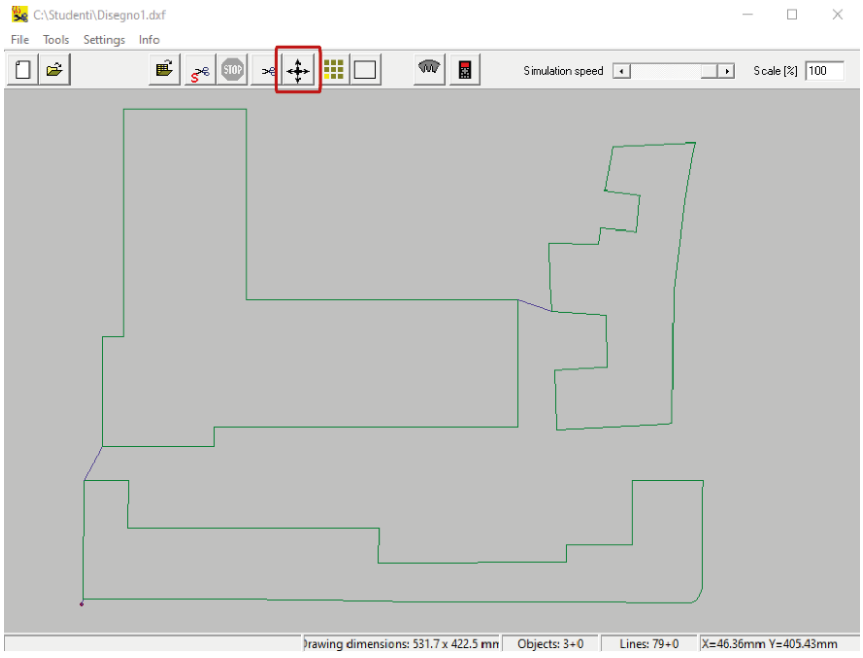
Make sure that the **wire** is in the **parking position**. The parking position is at the bottom left of the axes of movement of the wire.



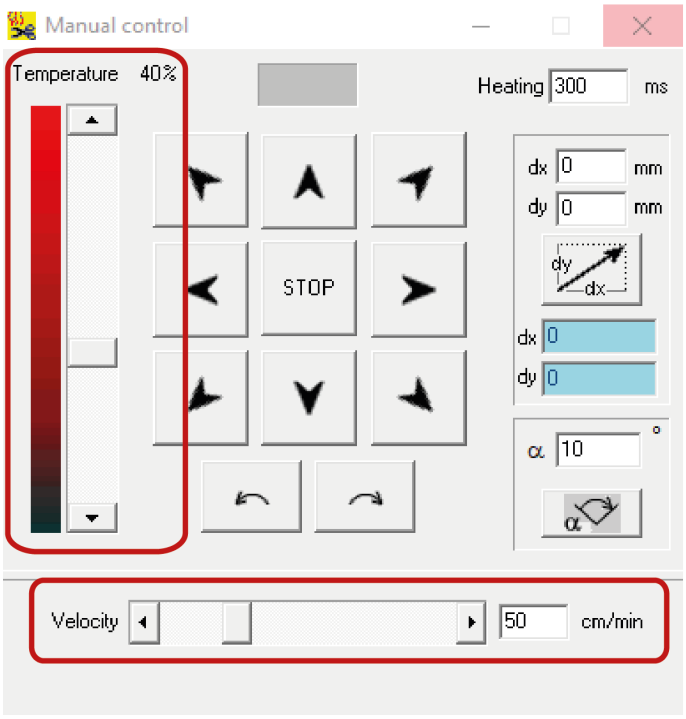
5. moving the wire

In order to move the wire in the material it's necessary to **verify the specific parameters of *Temperature* and *Speed*** for the chosen material, to do this select from the drop-down menu on the top left *Setting* → *Parametres Material* and take note of the parameters.

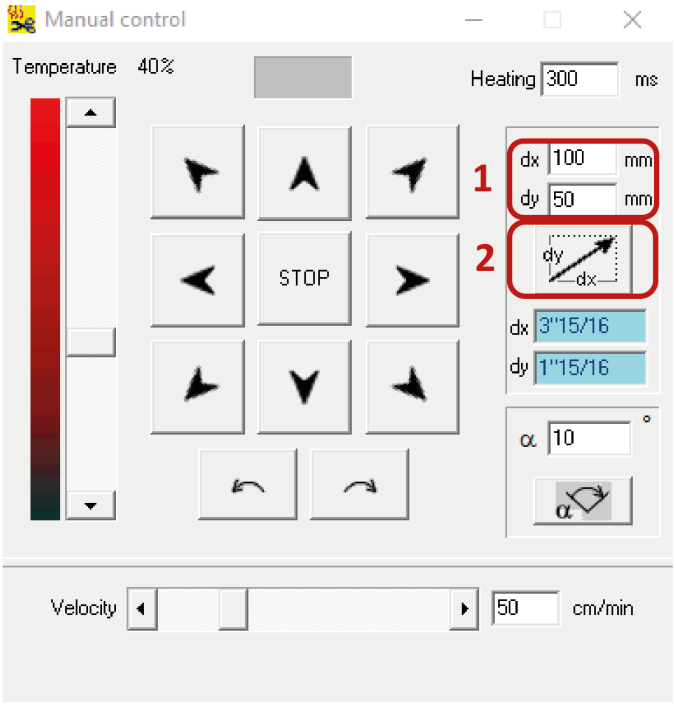
To move the wire click on the icon ***Manual control* window**:



Fill in the parameters of ***Temperature*** and ***Speed,*** as previously noted, inside the *Manual control* panel.



How to use the directional arrows: **press and hold the left mouse button on the arrow** until the desired position is reached, **or right click on the arrow once**, in this way the wire will move independently until the end of the travel.



During this automatic movement it's possible to stop the progress of the wire by pressing the *STOP* button.

If you allow the limit to be reached automatically, you will still need to **press the *STOP* button to make the machine operational again.**

If you want to **move the wire of a defined measure**, indicate its value in the **dx and dy boxes** (1) then confirm with the button (2).

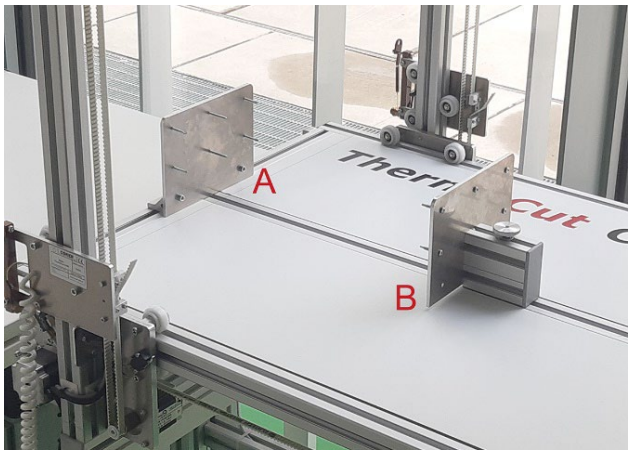
Insert positive values to move the wire up and to the right; negative values to move the wire down and to the left.

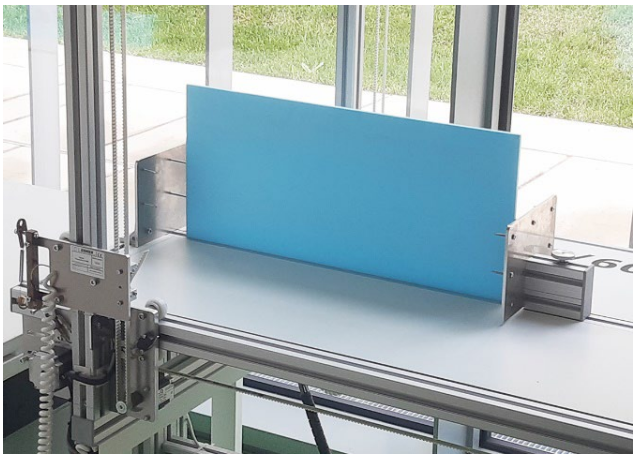
The end of the travel, downwards on the vertical axis, is 1 cm from the plane of the machine.

6. securing the material

The **maximum cutting area is 1320 mm x 650 x 650 h**. Check that the material size doesn't exceed these measurements.

Place the **foam material** on the machine surface and **secure it to one or both of the anchoring plates** *A* and *B*. If the plate has a thickness of less than 30 mm it's necessary to attach it to both plates to ensure its stability during cutting.

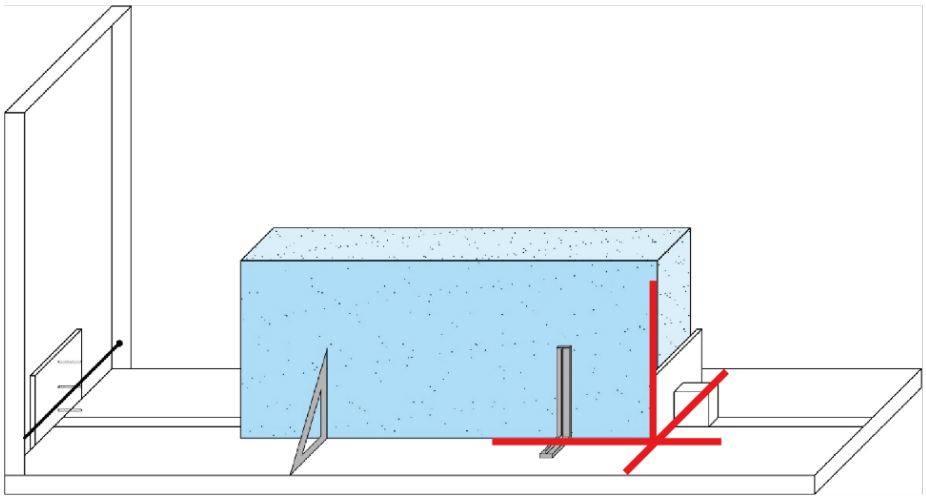




To obtain a good anchorage, insert the screws for at least 5-10 mm inside the block/slab.

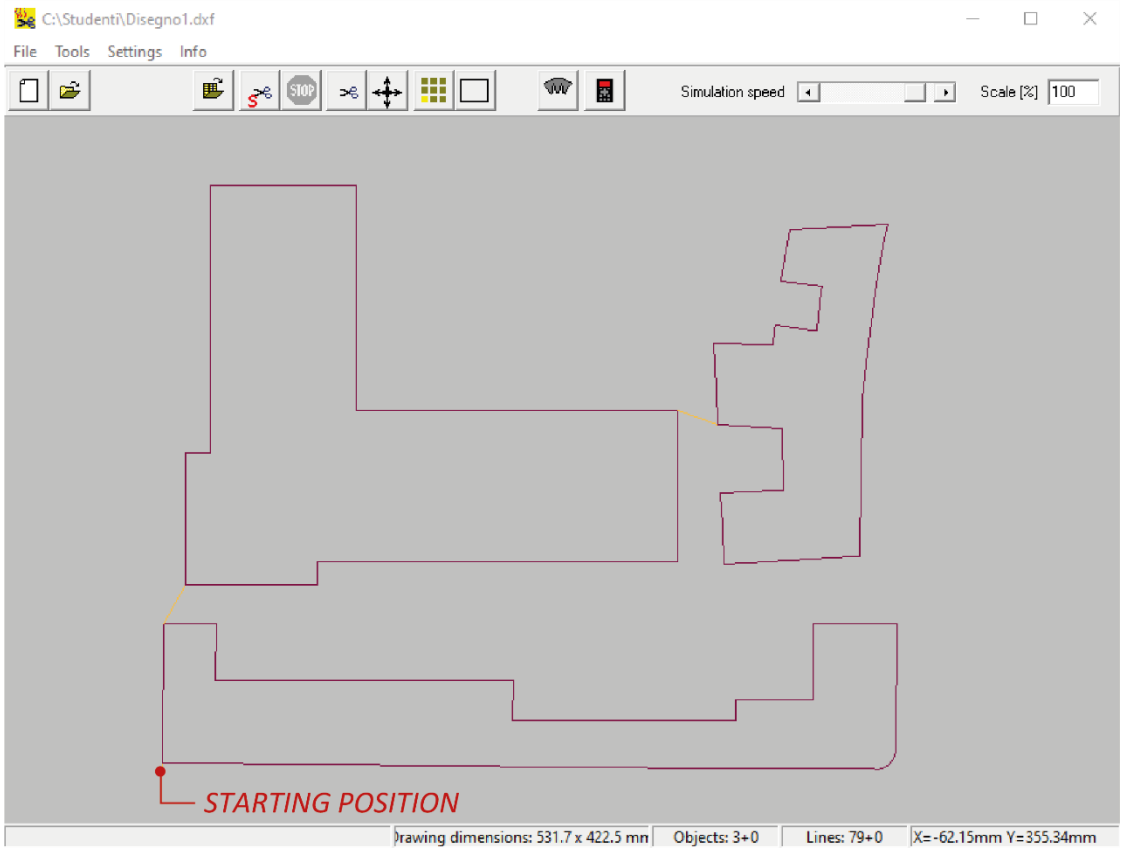
The left plate *A* is unmovable, the right plate *B* can slide horizontally along the plane of the machine, so it can be adapted to the size of the material. To move the anchor plate *B*, it's necessary to loosen the screw placed on the support of the plate and, once you find the optimal position, tighten again. If the material has a thickness of ≥ 30 mm, it can be anchored only to the right plate *B*.

Anchor the **sheet** of material to the plate/plates checking that it's **perfectly perpendicular to the plane** of the machine and **parallel to the edges of the plane**. To do this, use "L" metal squares or set squares; **remove them before cutting**.



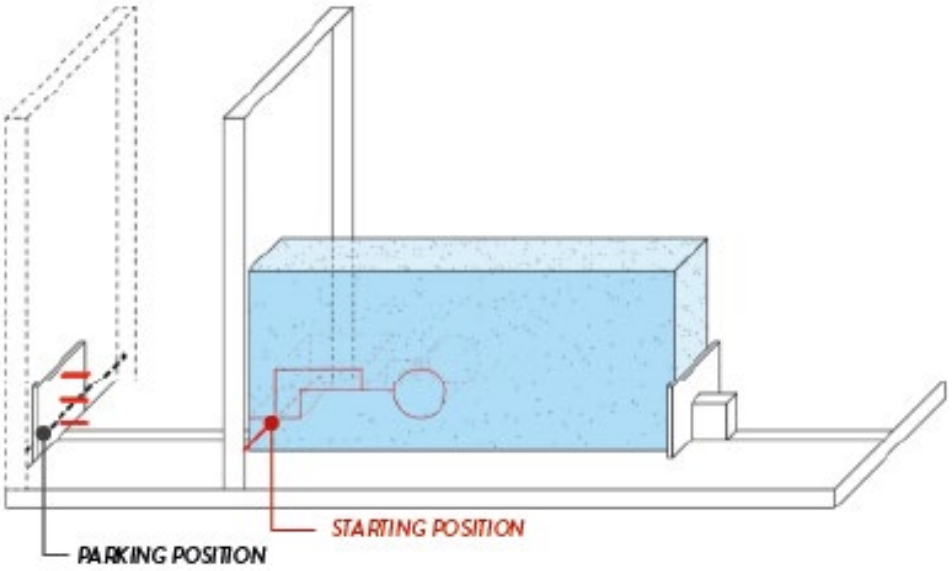
7. starting position of the wire

The **starting position** of the cutting path automatically generated by the software is at the **bottom left**.



From the parking position make the **first movement only horizontally** for at least 20 mm, so that the wire doesn't collide with the screws of the anchor plate.

If the plate is fixed to the right plate only, continue with the advance of the wire, always horizontally, until it enters the material by about 5 mm.

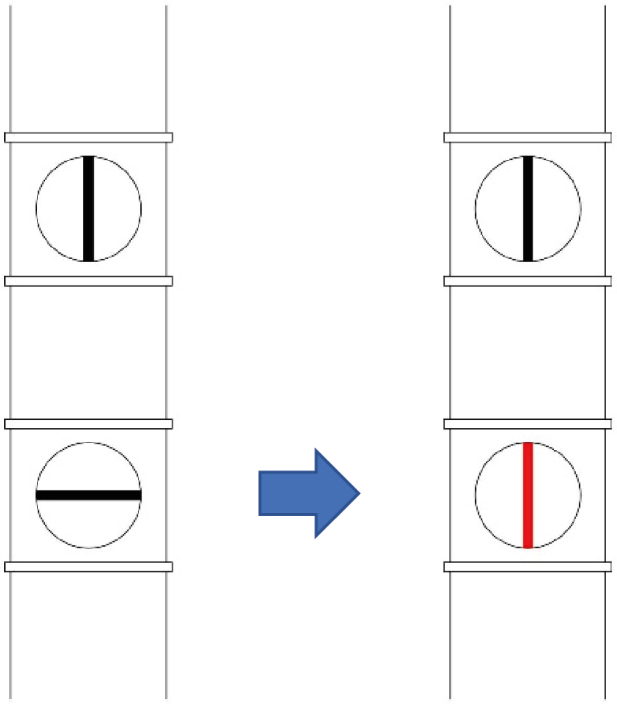


8. turning on the smoke aspiration system

Before starting the cutting operations turn on the smoke extraction system or check that it is already turned on and open the suction damper of the hood above the hot wire cutter.

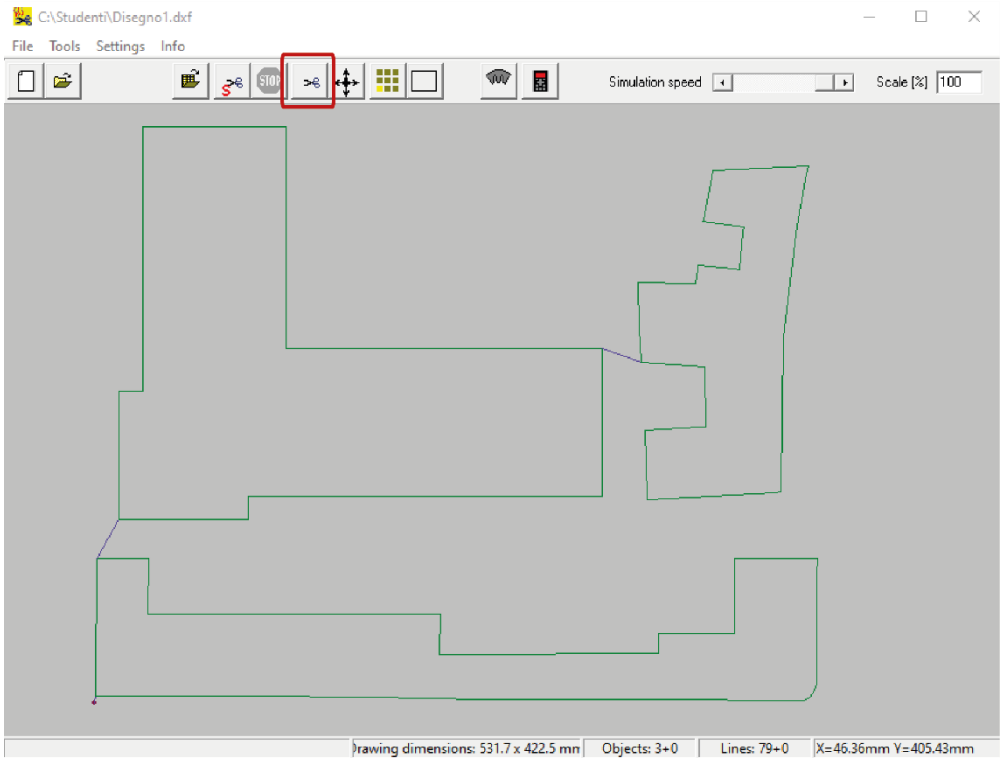
Press in position **I** the two switches on the right of the CNC LAB door.

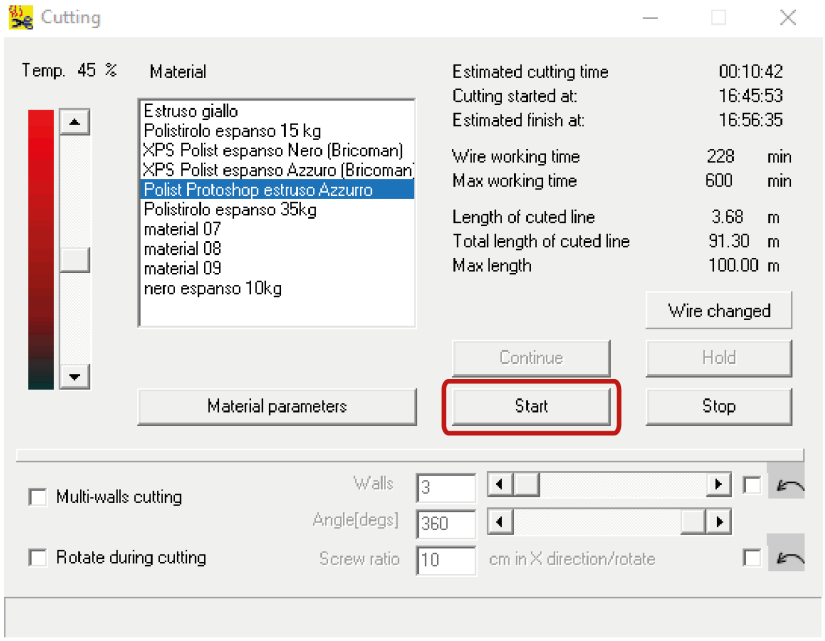
The **wire plotter** is equipped with a **suction hood**, to open the conduit **turn only the lower damper** placed on the exhaust pipe to the left of the entrance door, putting it in a vertical position.



9. cutting process

Click on the ***Cutting*** icon: 





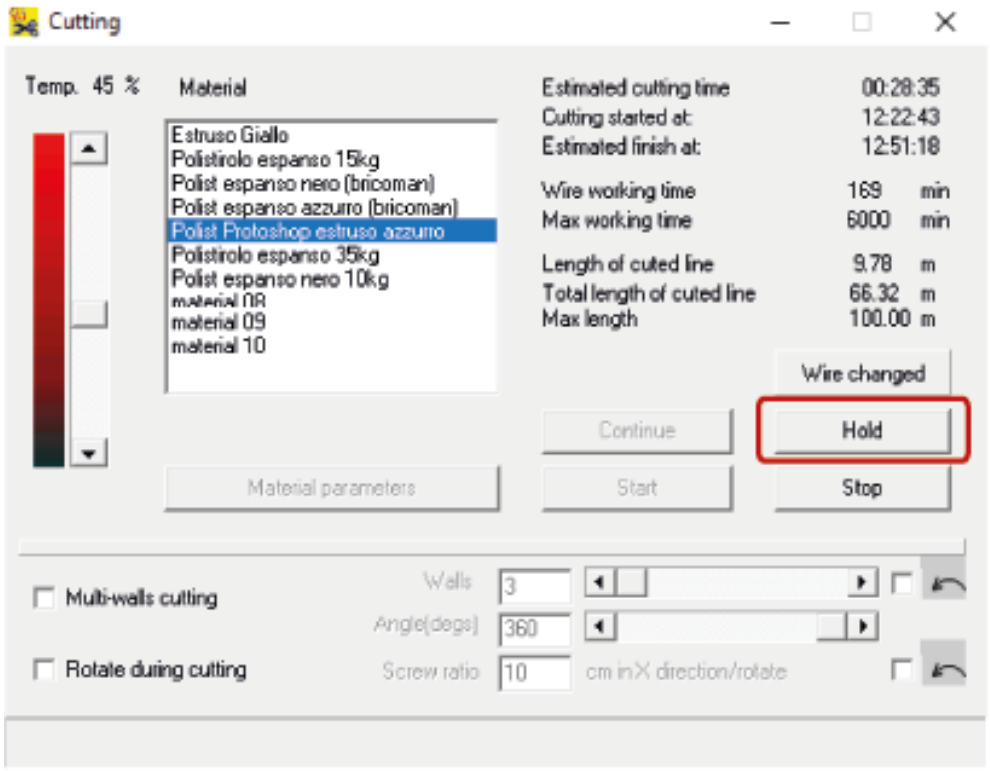
In the window *Cutting* **select the material** to cut in the ***Material* column**.

If the material to be cut isn't present in the library, ask the staff for support.

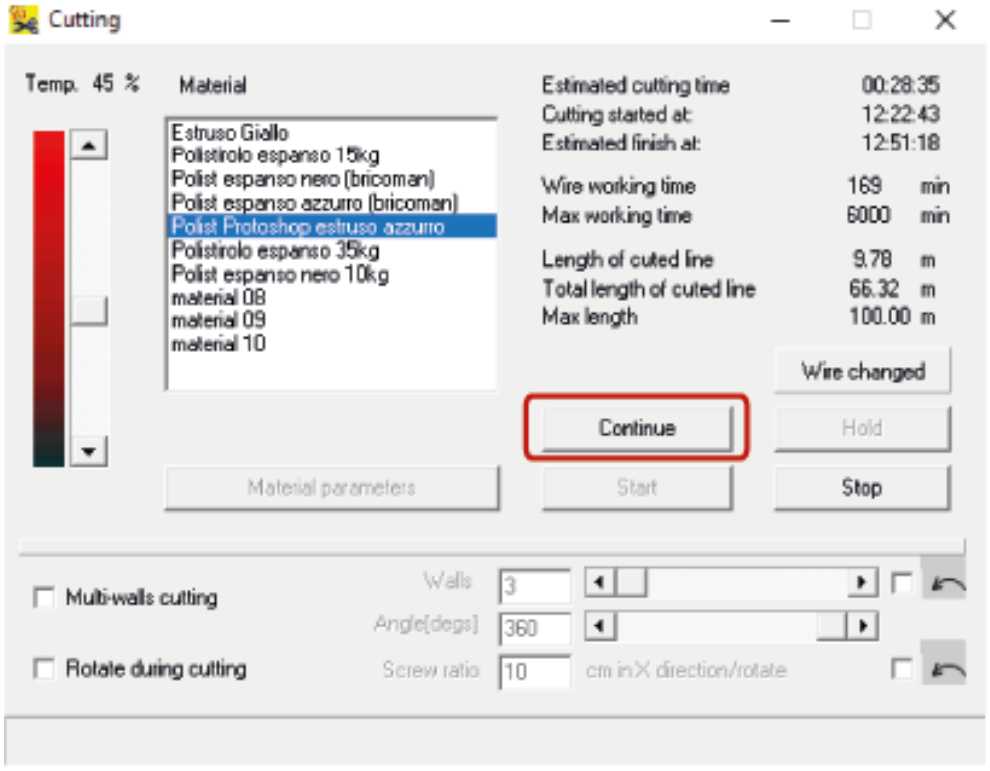
Click ***Start*** **to start the cut**.

DURING CUTTING REMAIN CLOSE TO THE MACHINE TO MONITOR ITS CORRECT OPERATION.

If you need to pause the machine during the cutting phase, click the ***Hold*** button in the *Cutting* window.



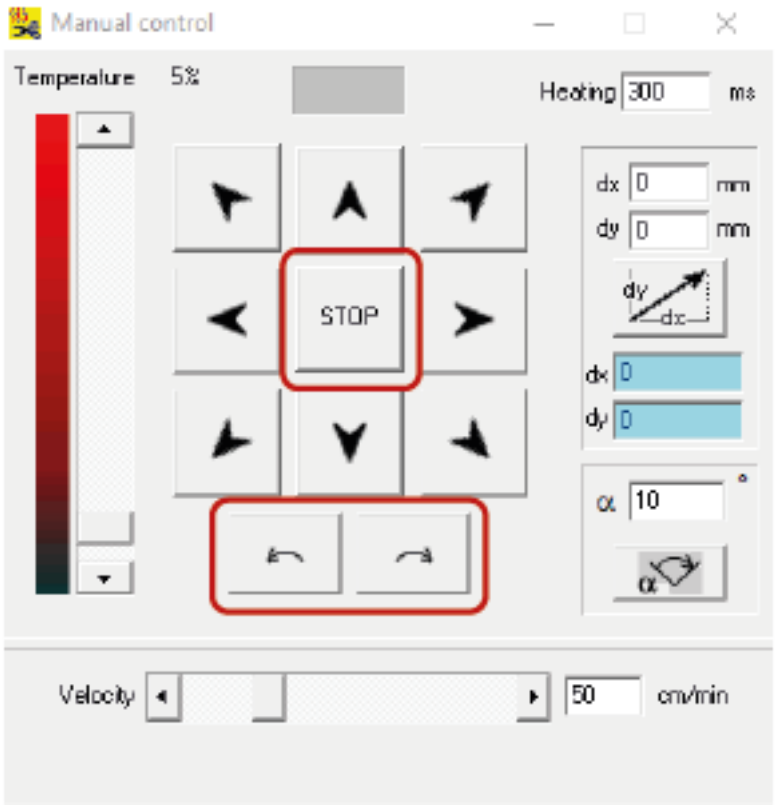
To resume cutting, click the ***Continue*** button.



10. at the end of the cut

Return the wire to the parking position, making sure **not to collide with the screws of the anchor plates**.

WIRE CLEANING: open the Manual Control window and set the **temperature** to **5%**. **Heat the wire by right-clicking on the arrows highlighted** in the image below and wipe it with a piece of paper towel, then **press** the ***STOP*** button once cleaning is complete.

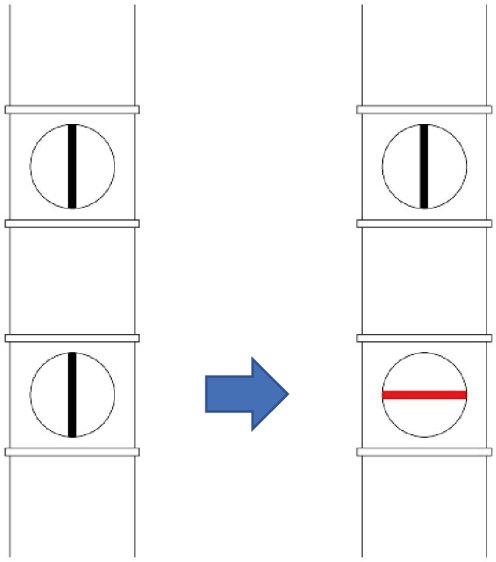


TOP CLEANING: remove residues from the top.

TURNING OFF THE MACHINE: press both switches on the control unit on the right side of the machine (as for turning on).

CLOSING THE DAMPER: close the lower damper placed on the exhaust pipe, returning them to a horizontal position.

SWITCHING OFF THE ASPIRATION SYSTEM: press in position **O** the two switches on the right of the CNC LAB door.



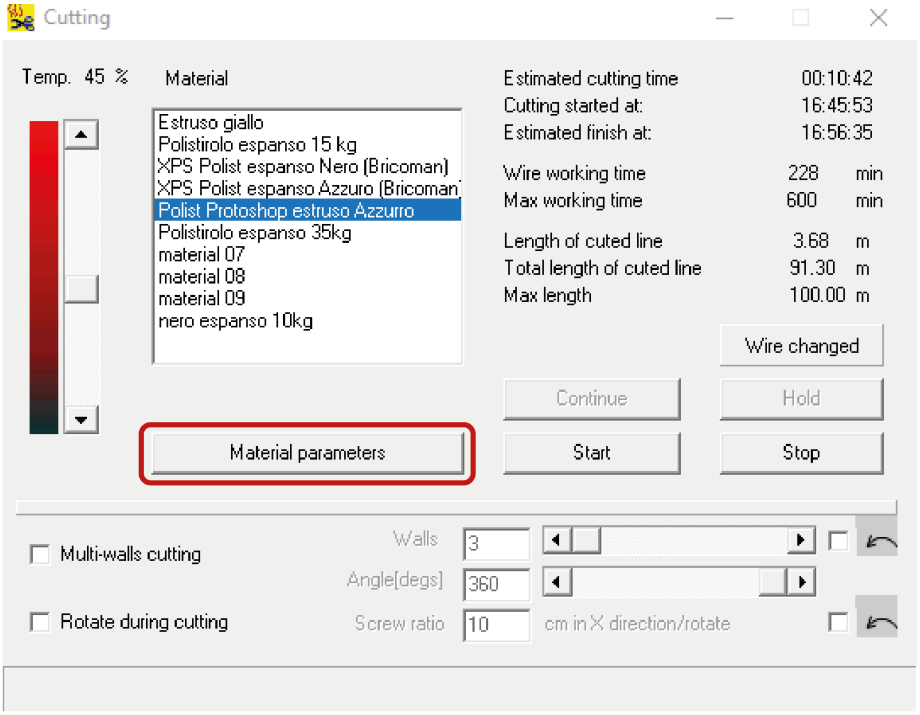
LEAVE THE SYSTEM TURNED ON BOTH SWITCHES IN POSITION "I" IF THERE ARE LASER PLOTTERS IN OPERATION IN THE CNC ROOM.

IN THE EVENT OF MACHINERY MALFUNCTIONING OR BREAKAGE OF THE WIRE TURN THE MACHINE OFF AND CALL THE STAFF.

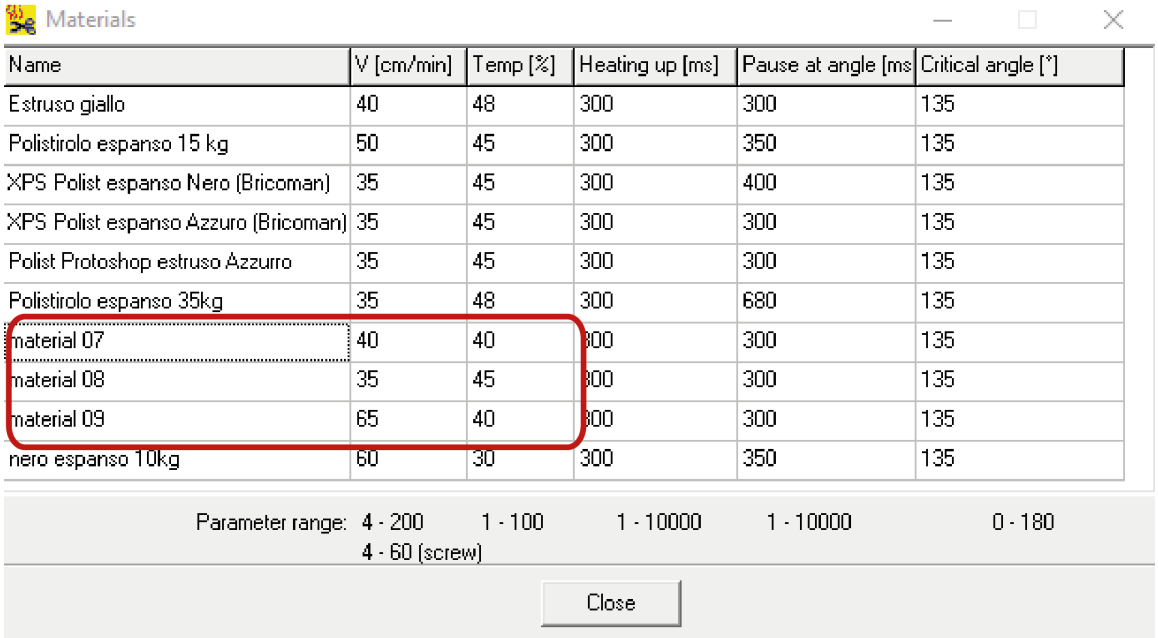
11. advanced settings – staff operators only

a. defining material cutting parameters

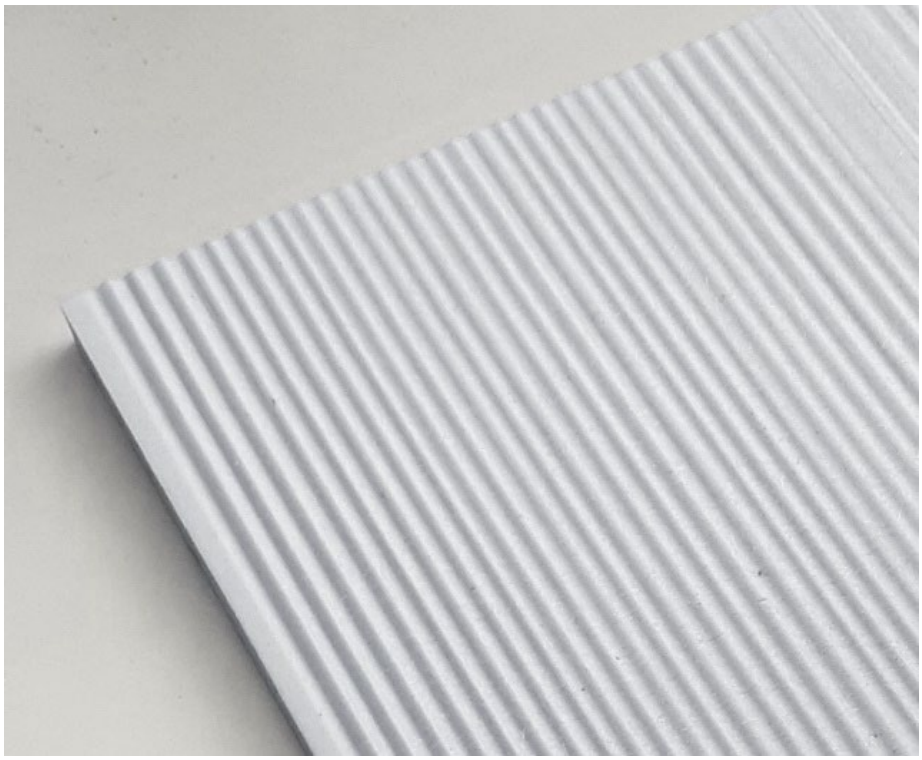
If the **material** to be cut **is not present in the library**, click on ***Material parameters*** in the ***Cutting*** **window**.



Select a generic material from the table and rename it, then **change** its ***Velocità*** *V (cm/min)* and ***Temperatura*** Temp *(%)* parameters according to its density. The denser the material, the higher the temperature and the slower the speed.

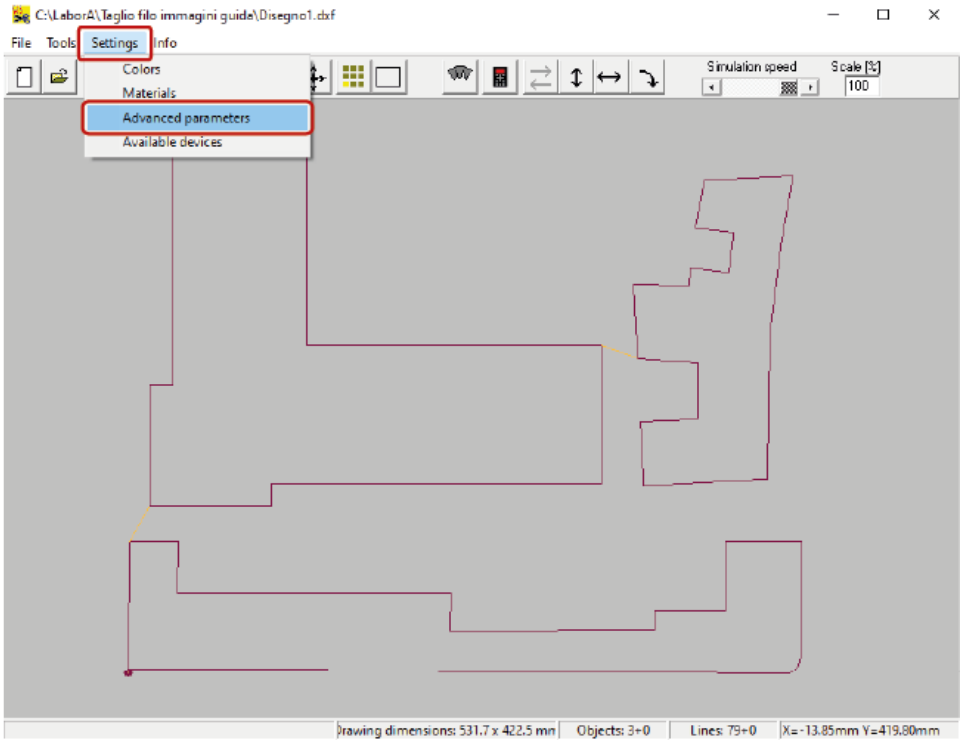


- If, during cutting, the **wire does not remain taut**, the assigned cutting parameters are not correct for that type of material: try **decreasing the speed and/or increasing the temperature**;
- if, on the other hand, you notice that the **cutting lines are too thick** (≥ 1 mm), you should **decrease the temperature and/or increase the speed**;
- if the **edges appear rounded**, you can increase the ***Pause at angle*** **parameter**, which is set by default on 300 ms;
- if the ***Pause at angle*** **parameter is too high**, an excessively long pause in the corner **creates a circular hole**.
- if the material is of poor quality, it could have one or more directions in which the inconsistency of density generates a **wavy cut** instead of a straight one; in this case try to **rotate the material by 90°**.

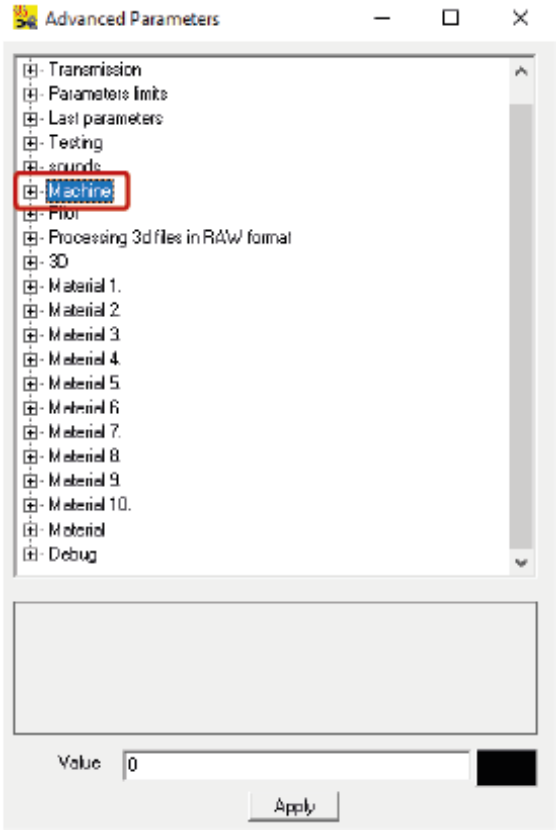


b. configurating software parameters

Select ***Setting*** > ***Advanced Parameters*** from the main menu:



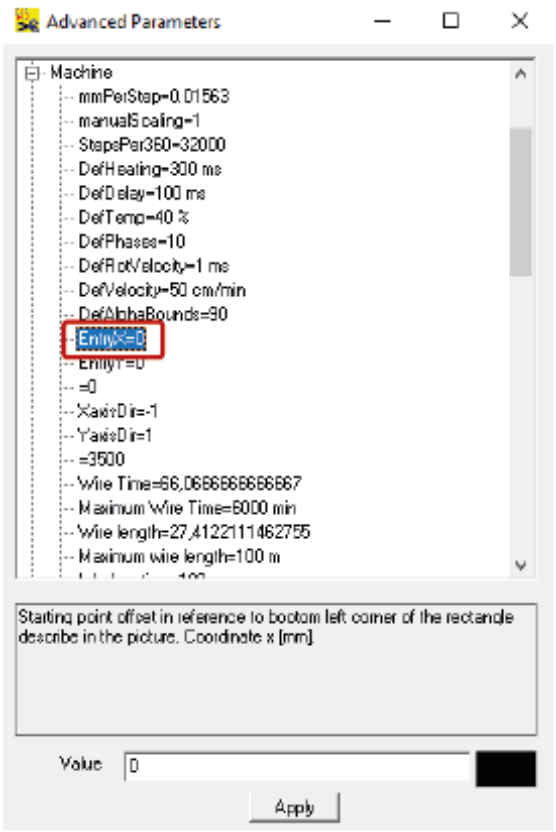
In the window choose the voice ***Machine***



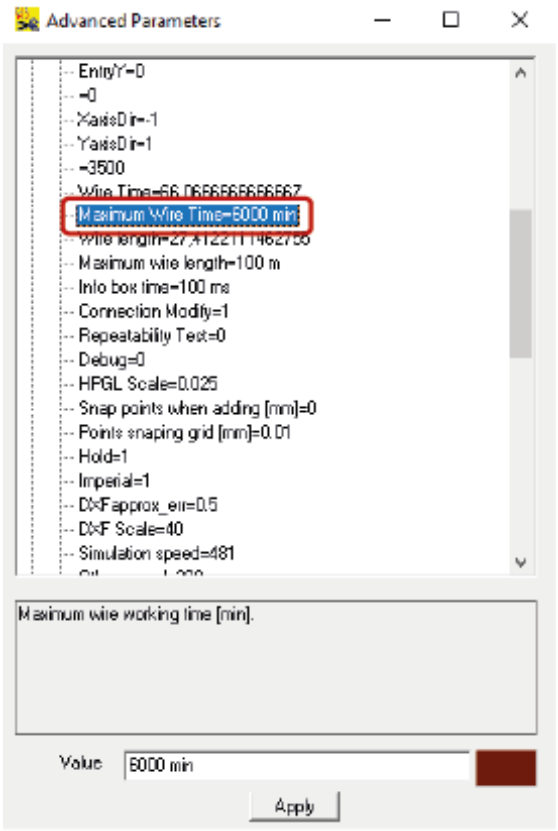
The **starting point of the wire in relation to the imported drawing** is managed with the **variables *Entry x*** and ***Entry y***.

If these variables are ***= 0*** the **starting point** of the wire is at the **lower left corner of the** imported **drawing**.

In order to **move the starting point relative to the drawing**, it is possible to **assign a negative value to both *Entry x*** and ***Entry y***, for example, assigning the values of Entry x=-20 and -Entry y=0, the cut will begin at a distance of 20 mm from the drawing.

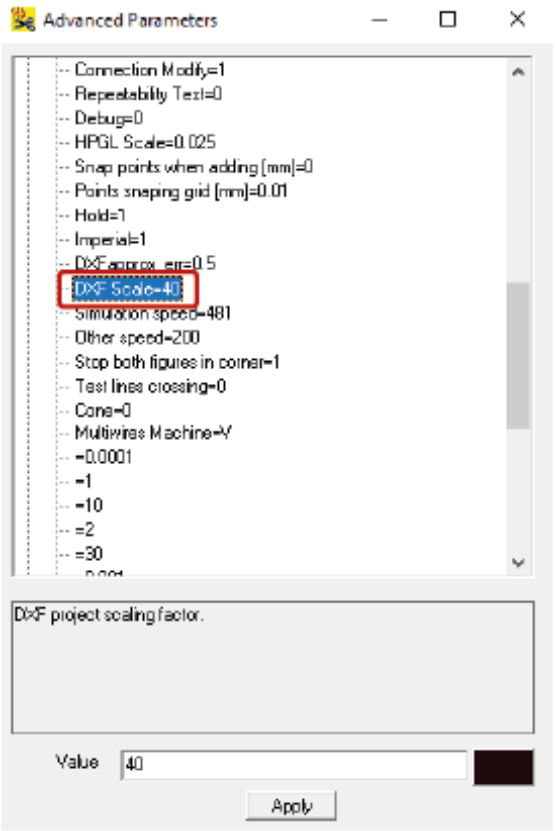


The **maximum wire usage time in minutes** is managed by the **variable *Maximum Wire Time***. When this time expires, the software will display an alert window requesting the wire to be replaced.



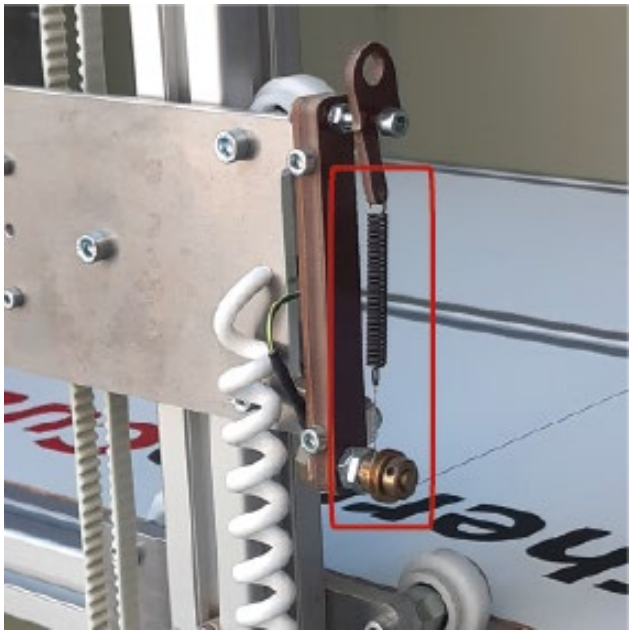
The **scale for importing DXF files** is managed by the **variable *DXF Scale***.

To import **drawings at the correct scale in millimetre** units, this scale must be ***=40***



c. replacing the wire

When the **wire is very worn**, it acquires a **whitish colour** and **must be replaced**.
The **spool of wire** is located in the **CS1 drawer in the CNC Lab**, dismantle the deteriorated wire by untying it from both spring eyelets and use it as a measure to determine the length of the new wire.



Tie the wire to the eyelet of the first spring, pass it through the slots of the two circular brass guides and **hook it to the eyelet of the second spring, holding it taut**.

d. changing the end stop of the wire on the x-axis

The **end stop** of the wire **on the x-axis of the bridge** to which the wire is anchored to, is **determined by a physical stop** placed on the bridge's sliding track.

It is therefore possible to change the parking position of the wire by loosening the Allen screw and moving the stop.

12. prohibitions and regulations

HOT WIRE PLOTTER

IT IS FORBIDDEN TO USE THE HOT WIRE PLOTTER UNLESS YOU HAVE BEEN TRAINED TO DO SO BY LABORATORY STAFF AND ARE EXPLICITLY AUTHORISED

Use this machine **only to cut foamed plastics**:
- polyurethane foam
- polystyrene
- foamed polystyrene

BURNING HAZARD

Never touch the wire when it is moving

When using this machine it is mandatory to **switch on the smoke aspiration system and open the damper**

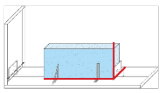
If the wire breaks or in case of other incidents turn off the machine right away and alert the laboratory staff

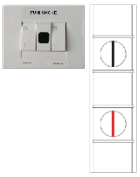
During use it is recommended to protect your airways with a mask

HOT WIRE PLOTTER

Use this machine **only to cut foamed plastics**:
- polyurethane foam
- polystyrene
- foamed polystyrene

Before cutting:
- turn on the hot wire plotter
- place the material on the machine table by attaching it to one or both anchor plates
- check that the material is parallel to the edges of the table and perpendicular to it
- switch on the SMOKE aspiration system
- open the aspiration damper connected to the machine





Cutting phase:
- from the computer press the ***Cutting*** command in the ***Softcut*** programme

At the end of the work:
- turn off the machine
- remove any material waste from the work surface
- close the aspiration damper

13. machine sheet

POLITECNICO MILANO 1863

LaborA modellistica fisica e virtuale
Campus Bonardi - building 16A
via Ampère, 2 - 20133 Milano

EQUIPMENT IDENTIFICATION						
Name	Description	Model	Manufacturer	Serial n°	Year	Supplier
ThermoCut	Cutting plotter	Series C1/60	Coner	18202L	2020	MGF

TECHNICAL SPECIFICATIONS						
Power	Weight					
150 Watt	Kg 90					

Notes: hot wire cutter for expanded plastic materials - cutting surface dimensions 1200 x 600 mm - maximum height from cutting surface 600 mm

IMAGE	OPERATING INSTRUCTIONS
	1 - Only cut sheets or blocks of expanded plastic materials: styrofoam, extruded or expanded polystyrene, EPS, XPS
	2 - DO NOT CUT materials such as expanded polyurethane and rigid plastic sheets
	3 - Turn on the machine with the green button
	4 - Heat up the wire with the red button
	5 - Start the aspiration system and open the damper placed above the machine
	6 - Place the workpiece on the cutting surface securing it with the designated anchoring plates
	7 - Start the cut from the software
	8 - Remove the workpiece from the surface when you hear the buzzer
	9 - Remove any leftovers from the surface
	10 - Turn off the wire and the machine
	11 - Clean the machine and clear from any leftovers
	12 - In case of malfunctioning or incidents turn off the machine by disconnecting the power supply

AUTHORISED MACHINE OPERATORS
Laboratory staff or collaborators adequately educated and trained for use

PPE - PERSONAL PROTECTION EQUIPMENT	
No PPE requested	

POTENTIAL DANGERS	
Fire hazard	 
Burn hazard	

PROHIBITIONS	
Forbidden to remove protective devices	 
Forbidden to perform maintenance with moving parts	

AUTHORISED MAINTENANCE OPERATORS	
ORDINARY	Laboratory staff adequately educated and trained
EXTRAORDINARY	Specialised external personnel