WAZER

The most powerful cutting in an affordable waterjet.

Wazer Pro

Review

Engineer's Report - March 2025 - INTERNAL USE ONLY

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I. Introduction - claims

The **WAZER Pro** is a small-format waterjet cutter designed and produced by **WAZER,** a New York-based company founded in 2015. The founders were four university coursemates who began the research and water cutter project during their undergraduate course while studying at Penn Engineering. The company now provides the world's most affordable and compact waterjet cutters to customers around the globe.

The company's first product, WAZER Desktop, has been an enormous success since its release in 2018 and has therefore progressed to provide an improved iteration. The WAZER Pro is the latest addition to their portfolio being released on June 4 2024 ,with the goal of providing desktop waterjet cutting of all materials to all engineers. The WAZER Pro is designed to provide ease of maintenance through ease to disassembly and repair as well as facilitate the workflow through the in-depth instruction manual easing the learning curve.

The machine operates at a pressure of around 7,400 psi with a maximum allowable working pressure of 8600 psi, which is double that of the original WAZER Desktop and is advertised to cut any material with respect to thickness ranges and properties. In this review, the focus will be on the usability and performance of this machine on a range of different materials and applications, as well as the support available and ease of repair.

Features:

- Same footprint as the Desktop version
- 7,400 psi operating pressure
- Interactive LCD control screen
- Collects used abrasive during cutting
- Underwater cutting for quiet operation
- Abrasive collection and Filter system
- Sturdy aluminum frame
- Continuous cutting: 90 Min
- Backflow cut-out sensor

Specifications:

- Cutting

- Waterjet working pressure: 7,400 psi
- Orifice material: Ruby or Sapphire
- Orifice diameter: 0.51mm
- Kerf (width of cut) 1.1mm
- Abrasive rate: 0.15kg/min
- Cutting thickness - material dependent
- Gantry Max speed: 1,500mm/min

- Mechanical and Dimensions

- Cutting dimensions: 305mm x 460mm (12” x 18”)
- Machine dimensions:
    - 856 x 648 x 1400 mm (34” x 26” x 55”)
- Machine weight (filled) 360 kg, (Empty) 170 kg
- Abrasive Hopper Capacity: 19.1 kg

- Software and Electrical

- Software: WAM online cloud based
- Power: 220V / (50Hz or 60Hz), 16.1A, 3700W
- Hydraulic Power: 2,088 W 2.8 HP
- SD card
- Supported (OS): Any with browser and wifi connectivity

II. Packaging

1. Unboxing

Typically, we assess the ease of unboxing for new users and highlight any flaws. However the **WAZER PRO** was already unpacked and on display at the SolidPrint Office. Therefore, we will do an inspection based on the user manual's unboxing process found online. It should be noted that these machines are hand-assembled by the production staff in WAZER's own factory in Shenzhen, China and undergo dozens of separate quality tests before being shipped out.

The device appears to be packaged on a large pallet with the contents packed within a plywood crate similar to WAZER Desktop. Inside this crate are all the contents which are neatly stacked up which prevents parts from falling off when the crate walls are being removed. The WAZER Pro itself was encased in a polyester zip-up bag. Cardboard is also used to split the segments and provide extra help in protecting the contents.

Fig.1: Unboxing manual image

Inside the crate, there are a number of smaller sections containing each of the different parts of the WAZER Pro. This includes 2 buckets of abrasive, a water filter, an accessories box, 4 replacement beds, and the WAZER Pro cutter.

To remove the 170 kg machine from the palette, WAZER have placed a feature using slanted wooden beams on a crate panel, which can be used as a ramp for the pallet jack. However, it is still suggested that help from another person is used to ensure safety of dismounting the machine.

Fig.2: Unboxing manual image

The unboxing process alone is said to take around 30 minutes to complete. The tools required mentioned in the manual are T20 Torx screwdriver, pallet jack, a slotted screwdriver, hammer, pliers, gloves and a friend to assist.

Overall, the unboxing process is made easy given that the manual provides clear images and instructions of the process. WAZER have also packaged the machine well, allowing for adequate protection of the internals which also ensures the device arrived to the new owners in the state that it was initially shipped.

2. Kit contents

WAZER has revamped their package contents through splitting accessories into three boxes: Setup, workflow and maintenance. This separates the uses of these into three segments for the desired usage. It should be noted that WAZER take users' feedback into consideration to amend the accessories provided and implement new content accordingly.

Setup Accessories

Fig.3: Initial set-up box

Initial Setup Box		
• Sprayer Kit x 1	• WAZER Pro Power Receptacle x 1	• Wall Mount x 1
• Water Leak Alarm x 2	• Magnetic Drain Filters x 2	• Adhesive Hose Tie down
• SD card x 1	• Abrasive Fill Cup x 1	• Cable Ties
• Orange Tap Adapter x 1	• Plumbing Kit x 1	• Tool Tray kit x 1

Tab. 1 - Initial Setup Box Contents

To set up the WAZER, an individual starter kit is provided, containing all the components listed in Table 1. Wall mounts are included to secure the machine to a structure, preventing accidental movement, even though the machine's weight itself provides stability.

Optional water leak alarms serve as a fail-safe against flooding. Placed around the machine, they quickly trigger alerts in case of leaks or overflow.

Additionally, the included plumbing kit simplifies the connection to the water supply and drainage system, ensuring a smooth installation process.

Workflow Accessories

Fig.4: Workflow Box

Black Tool case		
• File x 1	• Needle Nose Pliers x 1	• Deburring Tool x 1
• Nozzle Height Gauge x 1	• 6A 24V DC Type I Fuse x 2	• Phillips screwdriver x 1
• Vernier Caliper x 1	• Seamer Pliers x 1	• Abrasive Hose Ends x 2
• Nozzle Guard x 1	• Spare Backflow sensors x 3	• Abrasive Hose x 1
• Abrasive Hose End O-ring x 4	• Short Bed Anchoring Screws x 10	• Long Cut Bed Anchoring Screws x 10
• Cut Bed Bolt Tool (T Hex Driver 6mm) x 1	• Spare Pro Orifice x 1	

Tab. 2 - Workflow Box Contents

The WAZER Pro workflow accessories are designed to streamline operation, enhance efficiency, and improve the overall user experience. To support troubleshooting, users are provided with essential tools for resolving issues and replacing expendable parts, ensuring minimal disruption.

Included in the toolkit is a spare orifice, allowing users to quickly replace the worn component in the nozzle assembly. This not only extends the machine's usability but also reduces downtime, as users can continue operating while ordering a replacement. The provided accessories ensure an optimal experience, maintaining performance and reliability.

Other	
• Cart Kit	• Used Abrasive Sand Bag x 10

Tab. 3 - Other Workflow Box Contents

The cart kit is provided to facilitate the maneuvering of heavy abrasive buckets and other items. This uses roller wheels to allow ease of movement.

Maintenance Accessories

Fig.5: Maintenance Box

Maintenance Setup Box		
• Pump Oil x 1	• Oil Pan x 1	• Spare Nozzle Kit
• Input Water Filter Canister Wrench x 1	• Oil Replacement Funnel and hose x 1	• Full Span Absolute Locating JIg x 1

Tab. 4 - Maintenance Box Contents

The oil and oil pan provided with the WAZER Pro are essential for maintaining the high-pressure pump system. The oil lubricates the pump's internal components, reducing wear and ensuring smooth operation under extreme pressures. Regular oil changes help prevent overheating, extend the pump's lifespan, and maintain cutting efficiency.

The oil pan is included to make the oil change process cleaner and more convenient, allowing users to properly drain and dispose of old oil without spills. Proper lubrication is crucial for the pump's performance, and following the recommended maintenance schedule helps avoid costly downtime or damage.

Additional contents

- **1x spare cut beds.** The beds of this machine are sacrificial, so as you cut pieces, the bed dampens the flow of water, protecting the machine. The bed also secures the pieces being cut during use.
- **2x buckets of abrasive.** The abrasive is the medium that cuts the material and the WAZER uses 0.15 kg/min
- **Misc/spare parts.** This kit contains spare washers, taps, and other parts that may fail during the lifetime of the WAZER's use.
- **A user manual.** This is one of the most comprehensive we have seen, almost any problem you have can be addressed by reading this manual.

III. Hardware

1. Architecture

The WAZER Pro uses three stepper motors that run on steel rods to control movement. Two on either side of the X-axis in the frame of the machine control the Y-movements. A stepper motor inside the water jet module controls the X-axis movements. This is exactly the same for the Desktop version.

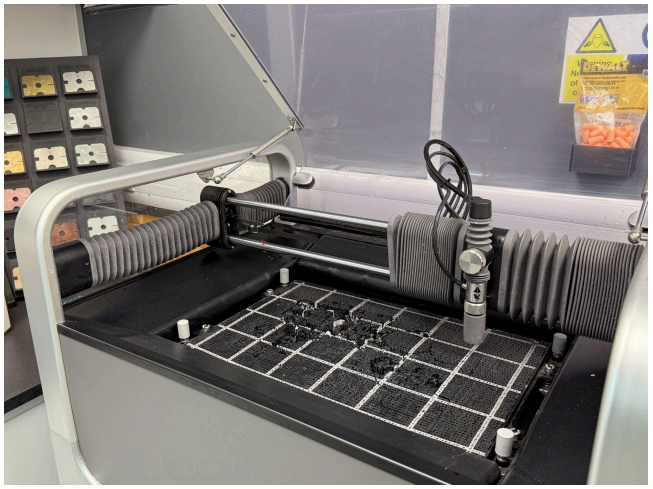

Fig.6: Wazer Pro Gantry

Fig.7: Bed leveling

Accuracy is maintained at a high level due to the dual stepper motors driving the Y-axis. The single stepper motor within the water jet module is expected to be of high quality, ensuring precise cuts along the X-axis. Since the gantry does not operate at high speeds during cutting, high-speed stepper motors are unnecessary; instead, minimizing gear play is crucial for maintaining precision.

The bed leveling system consists of four springs secured by bolts. To calibrate the nozzle, the gantry can be moved to the four corners of the bed, where the offset is measured using the Banjo bolt cap, which sets a 2 mm clearance between the nozzle tip and the bed. Each respective screw is tightened until the nozzle clearance is uniform across all points.

The machine enclosure is designed to protect the user and contain splashback during cutting. The WAZER Pro cannot operate with the lid open, ensuring safety through embedded magnets in the lid and frame. When cutting begins, water is jetted onto the material, creating significant ricochet until the material is pierced. Once piercing is complete, the process becomes quieter as the machine follows the programmed cut path. The housing effectively contains sprayed water and abrasive, but 1.5 cm-wide slits at the corners allow some splashback onto surrounding surfaces during material piercing.

These slits allow for air circulation which significantly lowers humidity and heat in the cutting area during the cut. This allows you to see more of the cut happening. With that said, WAZER confirms that in its next batch of machines, machines will come with small frontal seals to remove potential misting through these gaps towards the user.

2. Components

a. Frame

The main body of the WAZER Pro is made from both steel and aluminum extrusions with some plastic casings around the internals of the tank. Powder-coated steel panels are used to conceal the electrical components of the device, however, these can be easily removed for easy maintenance purposes as some sit on hooks.

The machine has a sleek, tidy look and can be almost completely disassembled for repair and maintenance, similar to an industrial system. The main frame of the machine is made from aluminum extrusion and contains the control screen and emergency stop button. This makes the machine sturdy for sustained, reliable use and facilitates moving the system, thanks to the cutouts.

Fig.8: Frame

A new addition to the WAZER pro not seen on the desktop version is the water hose used to clean off debris from the part upon completion of cutting.

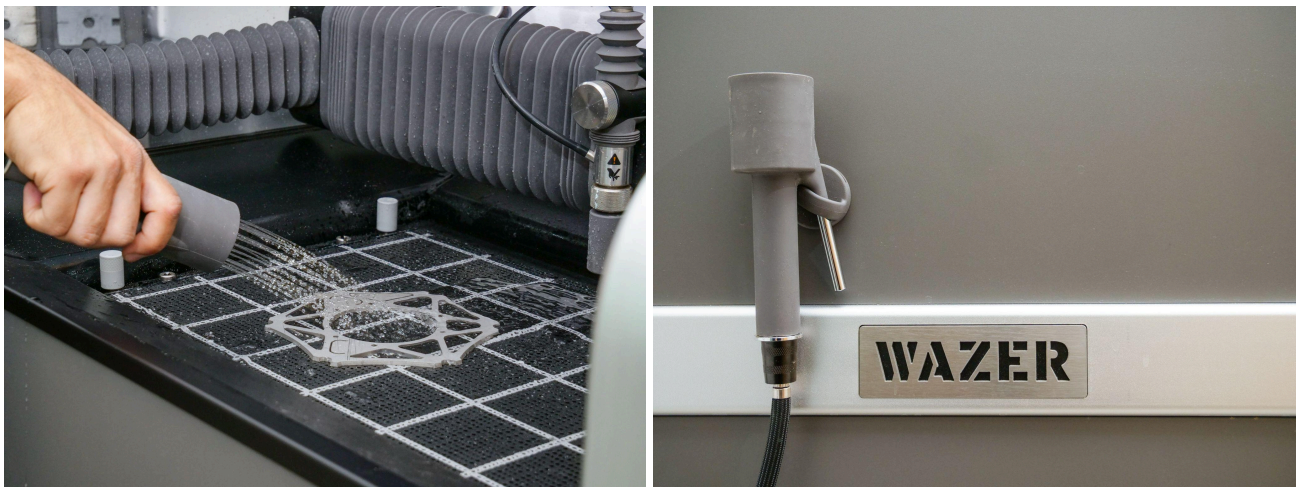

Fig.9: Hose

Figure 9 illustrates the hose in use and how it is attached to the device side using a magnet attachment for ease of relocation. This makes the collection of cuts tidier as any cutting debris or abrasive can be easily washed off the parts, avoiding making an external mess.

b. Water Jet Nozzle

The WAZER Pro nozzle is a critical assembly that enables precise cutting by combining high-pressure water flow with vacuum-fed 80 mesh garnet abrasive. With a 0.51 mm diameter, the orifice highly concentrates the water jet, maximizing cutting efficiency. As water exits the orifice, it creates negative pressure, drawing abrasive from a lateral feed tube into the stream. This process ensures thorough mixing of the abrasive with the water inside the 1.1mm diameter mixing tube before ejection, enhancing cutting capability.

The nozzle assembly is Z-axis adjustable to maintain an optimal cutting distance from the workpiece. A banjo bolt cap with a 2 mm lip serves as a reference for proper clearance, while a hand-turnable knob allows easy height adjustments.

Precision is key to the nozzle's design, as it directly impacts cutting accuracy. The orifice is crafted from ruby or sapphire, and the mixing tube is made of tungsten carbide, ensuring durability and maintaining a consistent, high-quality jet stream.

Fig.10: Water jet nozzle

The entire nozzle assembly is considered to be a consumable; the part is said to last 300 hours before needing replacement. However, this can vary. We appreciate WAZER's parts design for maintenance; performing changes to parts has been made easy.

c. Machine Compartments

The WAZER Pro features a fully integrated pump, eliminating the need for a separate pump box and stand. This redesign makes the machine more compact and easier to manage and improve workspace efficiency. The pump is housed within the bottom compartment below the tank, effectively lowering the center of mass and enhancing stability during operation.

Compared to its predecessor, the WAZER Pro's pump is significantly more powerful. It delivers a hydraulic power output of 2,088 W and achieves an operating pressure of 7,400 psi (510 bar), enabling faster and more efficient cutting. Although the power is increased, the operating noise level is slightly lower due to being enclosed within the frame, reaching 85.4 dB, whereas the Desktop has a 1.6 dB increase.

A substantial portion of this noise comes from the pump pressurizing water before delivering it to the cutting nozzle. Despite the increased volume, the integrated design helps contain some of the operational noise, making it more manageable in a workshop setting. Proper water filtration and maintenance are essential to prevent clogging and wear, especially given the high pressures involved.

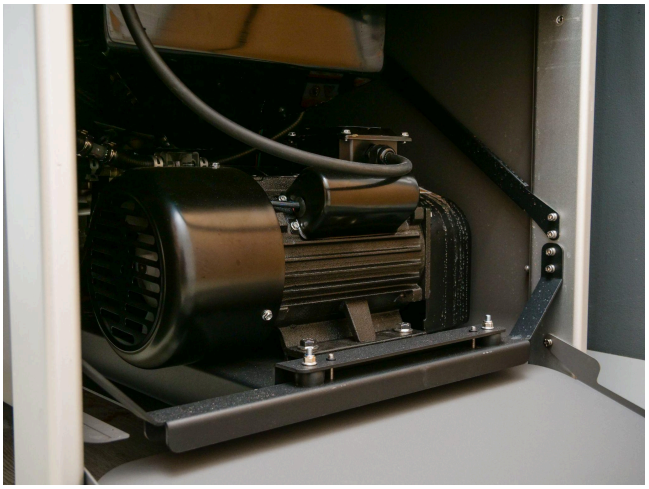

Fig.11: Pump compartment

Just above the pump compartment sits the Control box, high-pressure inline filter, damper valve and various other important hardware components. Just below the control box is a togglable switch which is used to activate the submerged cutting feature; however, it was noticed that there was no signage or labelling to indicate what the switch specifically does. Therefore, we are uncertain whether the mode is in submerge mode or not; the only way to tell is by checking the orientation of the manual. It would be great to see a label added just above the switch.

Fig.12: Pump compartment

d. Device stand

The WAZER Pro no longer requires any additional stands as it is fully built as an integrated unit, containing all that the desktop has separately. The Pro is significantly higher than the desktop version since the tank is a lot larger. The footprint is exactly the same as the desktop model, meaning that the device can still be suitably placed in small rooms.

Fig.13: Device stand alone

e. Base

The WAZER Pro comes with a pre-installed cut bed, along with four additional spare beds included in the package we received. The cut bed is made from corrugated polypropylene, a lightweight yet durable material designed to withstand prolonged exposure to high-pressure water and abrasive particles. However, these beds are consumable and will degrade over time.

The lifespan of a single cut bed varies between 20 to 40 hours, depending on factors such as cutting patterns, material hardness, and frequency of use. To maximize longevity, the bed can be flipped over, as the bottom side typically remains intact.

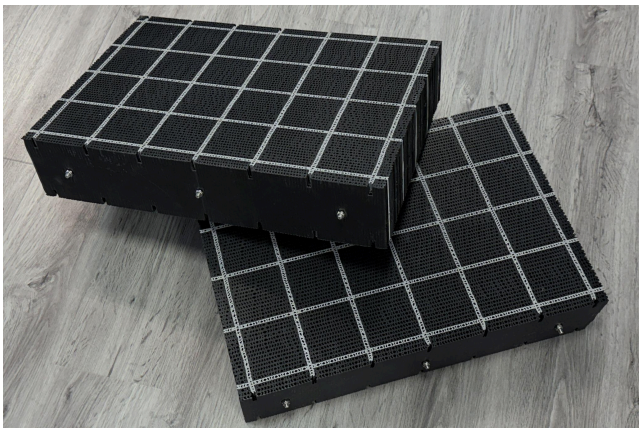

Fig.14: Sacrificial base

Beneath the cut bed, the machine's base features a protective aluminum plate. This plate acts as a failsafe barrier, preventing stray water jets from puncturing the plastic underside of the WAZER and ensuring long-term durability. Regular inspection and timely replacement of the cut bed are essential for maintaining cutting precision and preventing excessive water pooling, which could affect performance.

f. Abrasive Collection System

The abrasive collection system on the Pro model is significantly improved from the collection system on the Desktop machine. This system actively collects used abrasive material while operating through low-pressure pumps positioned at the bottom of the tank, directing the material into catch buckets located at the front of the machine. Figure 15 illustrates the abrasive collection tanks, which are secured in place by turning the holding rail forward. These tanks are easily removable for emptying facilitating the maintenance procedures.

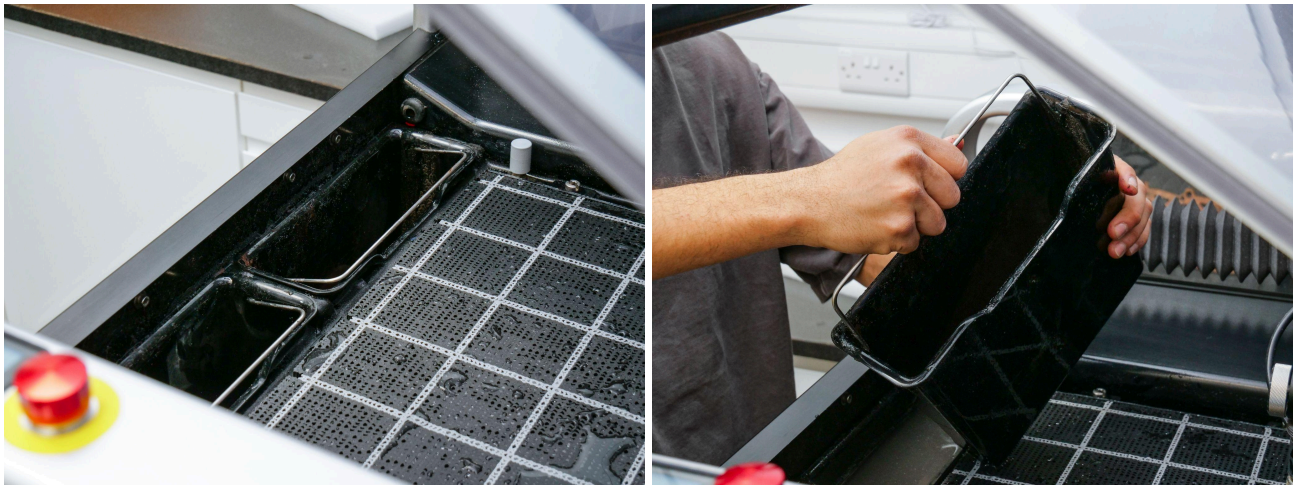

Fig.15: Abrasive collection tanks

Although abrasive collection is present on the Desktop model, it doesn't work optimally which can lead to clogging from abrasive buildup at the bottom of the tank. Clearing used abrasive from the Desktop machine requires the user to first remove the bed, drain the water, and manually scoop out the material from the bottom of the tank. The Pro model offers a significantly more efficient solution, eliminating the need to drain the tank or remove the cut bed, thereby enhancing workflow efficiency. The Pro consumes approximately 9 kg of abrasive per hour of operation, so users simply need to monitor the collection buckets after each hour of use.

During testing, we noticed the left abrasive collection port to not dispense any water, therefore indicating a clog, which could be due to a large debris segment. The blockage was cleared by blowing compressed air into the abrasive collection port to effectively creating a burst of air with the hopes of dislodging the debris. This attempt worked well, and water was able to flow again using the low-pressure pumps.

Although the "abrasive collection" setting includes a backflow feature which pausing the flow every 30 seconds to inject water through the venturis and disturb settled abrasive at the bottom of the tank, we found an older technique to be surprisingly effective. By simply covering the dispensing hole with a thumb while the water pump is running, a manual backflow is created that instantly agitates the settled abrasive, allowing for quicker and more efficient recollection.

g. Absolute Locating Jig

An **absolute locating jig** is a precision-engineered fixture that enables consistent, repeatable placement of material on a CNC cutting platform. In the context of waterjet systems like the **WAZER Pro**, this jig is particularly advantageous for operations requiring high repeatability and accuracy such as double-sided cuts, rework of partially processed stock, or high-volume batch production. It also plays a critical role in workflows involving pre-machined components or externally marked materials, where positional integrity is essential.

To support these applications, **WAZER provides a downloadable DXF file** of a purpose-designed absolute locating jig via their official support portal. This allows users to cut the jig directly using their WAZER Pro unit, using the 4 mm-thick aluminum plate that comes mounted to the Cut Bed with the precision locating holes already cut out. These locating-holes fit around locating pins that are rigidly mounted to the tank, ensuring a rigid and stable setup that does not depend on the Cut Bed, which can swell and move around over time. Additionally, the jig includes pre-defined **divots spaced at 60 mm intervals**, which are intended for the installation of hold-down screws. These screw points provide flexible clamping options for a variety of stock sizes and shapes, contributing to material stability during cutting operations.

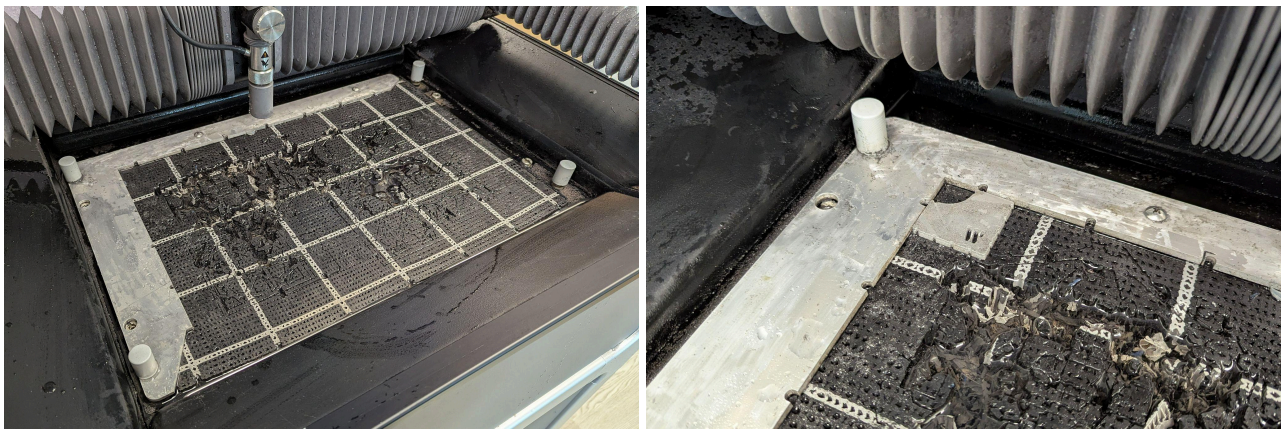

Fig.16: WAZER Pro Absolute Locating Jig

The jig establishes a fixed machine datum at **X = 20 mm, Y = 20 mm**, which serves as the physical reference point for material alignment. By positioning the top-left corner of the stock against this fixture edge, users can confidently set their digital design origin in the **WAZER CAM (WAM) software** to **X = 25 mm, Y = 25 mm**. This accounts for a 5 mm fixture offset and ensures precise registration between the digital toolpath and the actual material placement on the bed.

In practical terms, the use of this locating jig significantly reduces setup time and minimizes alignment errors. Operators can bypass manual edge-finding or guesswork typically associated with defining workpiece boundaries. Instead, the jig offers a **repeatable reference system**, ideal for rapid part changeovers, nested cutting jobs, or multi-step fabrication workflows.

Overall, the WAZER Pro's absolute locating jig is a highly effective tool that enhances precision, efficiency, and repeatability in waterjet cutting operations. It's particularly valuable for engineering environments where time, material conservation, and dimensional accuracy are key production drivers.

h. Gauge Block

The WAZER Gauge Block is a precision accessory engineered to work in conjunction with the WAZER Pro's Absolute Locating Jig and cut from the same included 4mm-thick aluminum plate. Its primary purpose is to facilitate accurate, repeatable offsets of the material from the jig's reference edge either by 13 mm or 25 mm. This enables users to reposition stock away from worn or damaged areas of the cut bed or to accommodate unique cutting requirements, all while preserving a consistent coordinate system within the WAZER software. By using the Gauge Block, operators can quickly align material without manual

measurement, improving both setup efficiency and cutting accuracy.

IV. Cutting software

1. WAM

WAM is the software that is used with the WAZER. It is accessed through the browser on your computer. This has its drawbacks such as requiring access to wifi, but it is easy and simple for both the user and the company to manage.

a. Landing Page

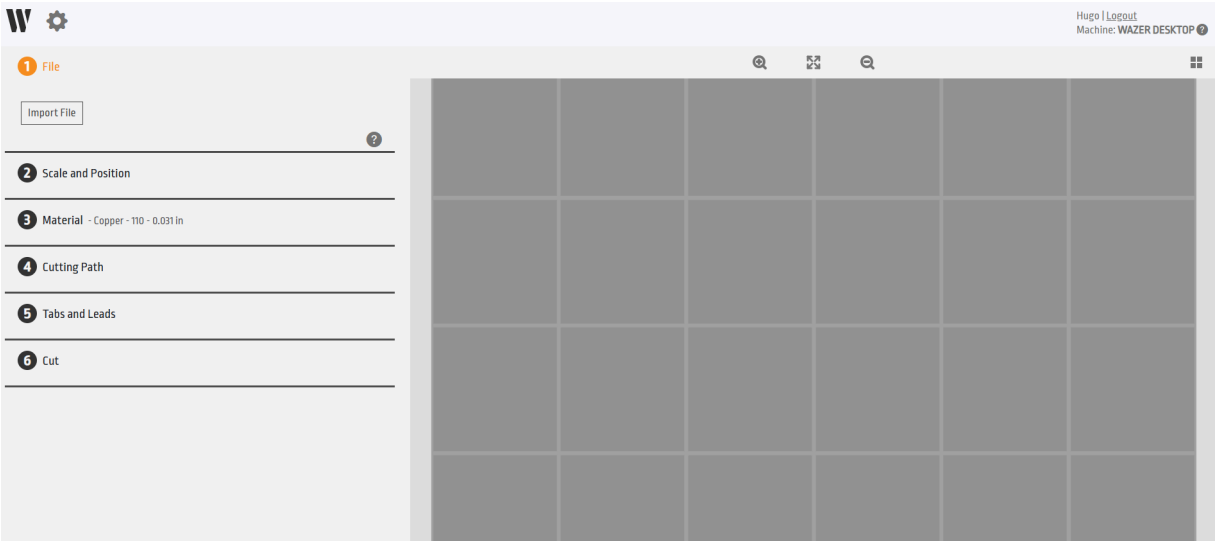

Fig.17: Landing Page WAM software

The WAM landing page is simply intuitive with very few superficial options and neatly staged processes as seen in Figure 17. The processes are labelled 1 to 6, making the workflow of the software usage straightforward whilst minimizing the learning curve for fast overcome.

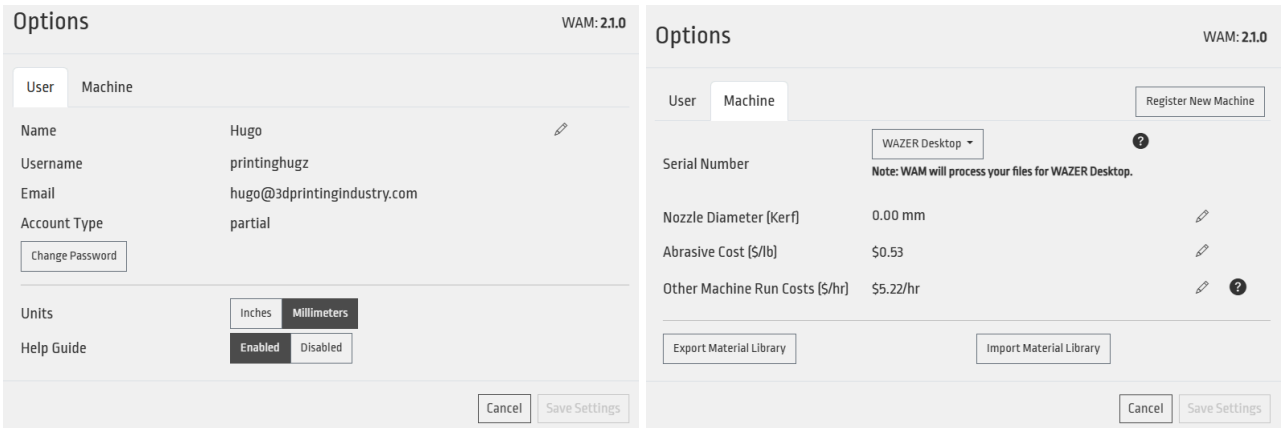

Fig.18: Settings WAM software

The landing page is where users can access the available settings shown in Figure 18. It is important that users select the correct machine before continuing the workflow. Through the use of the settings, users can enter the costs of abrasives and other expendables, which would estimate the total running costs at the end of generating a G-code for the machine.

b. Import Files

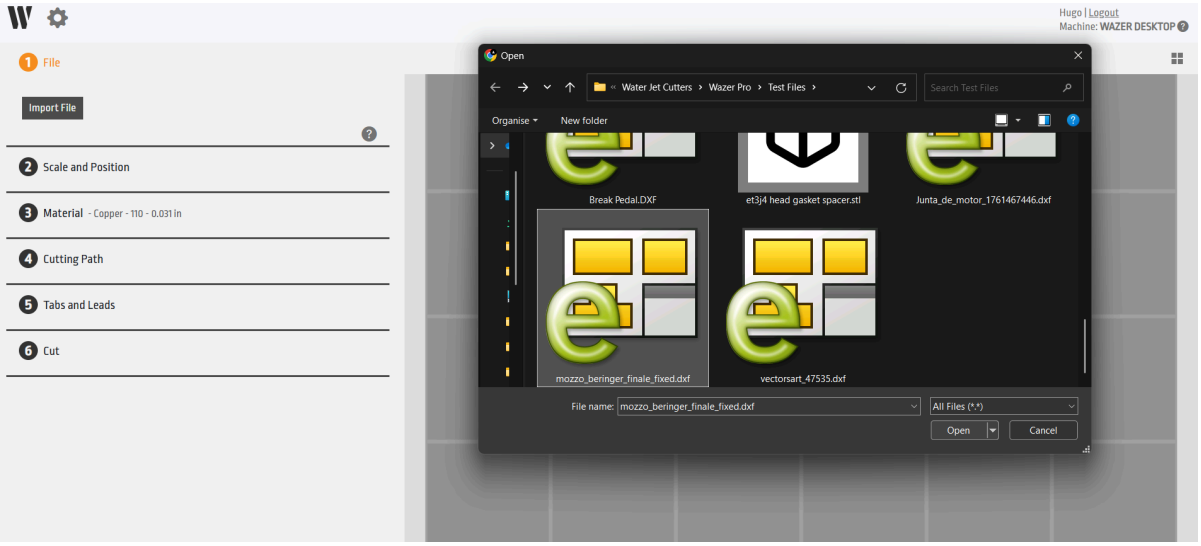

Fig.19: Import files WAM software

The first option you are prompted with when using WAM is "**Import File**" as seen in Figure 19, this essentially accesses the local files on your machine for upload. The file types that can be imported are .svg and .dxf, as these are both vector file types.

c. Scale and Position

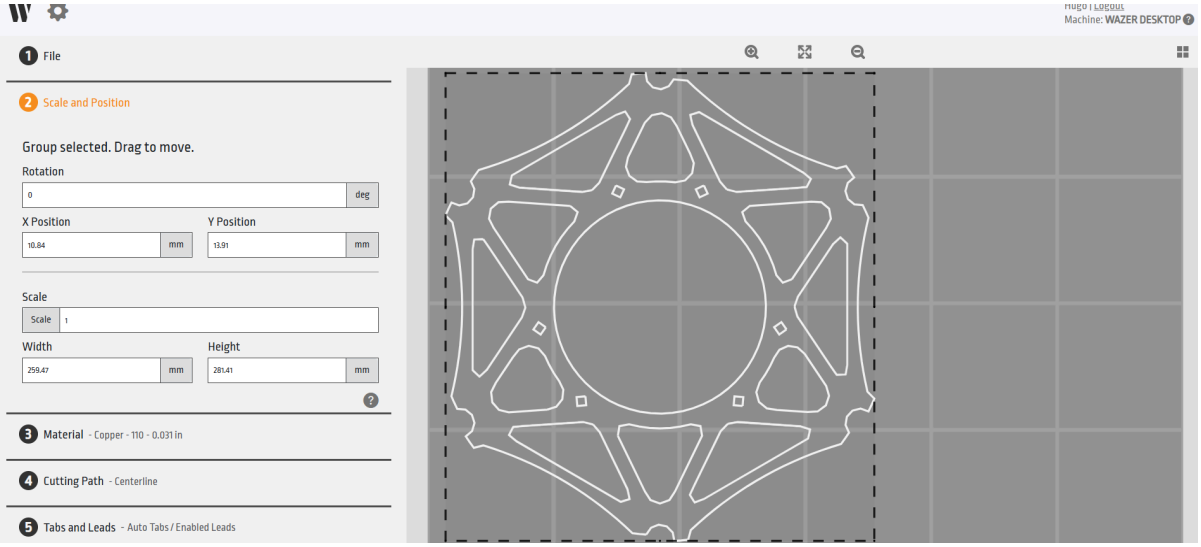

Fig.20: Scale and position

Scale and position is the second step of the workflow, this requires the user to check the coordinates of where the vector file is placed, inspect measurements and scale. There are no nodes that you can drag or reposition in this software. The user must enter the positioning and scale in the menu on the left. This works, but it would be nice to see more levels of control here, including extra amending tools such as split or cut.

It would also be great to have additional tools such as a vector editor tool, where we could perform section cuts or any alteration tools. This would make the amendment more convenient as it would reduce the need to travel back and forth from CAD software.

d. Material

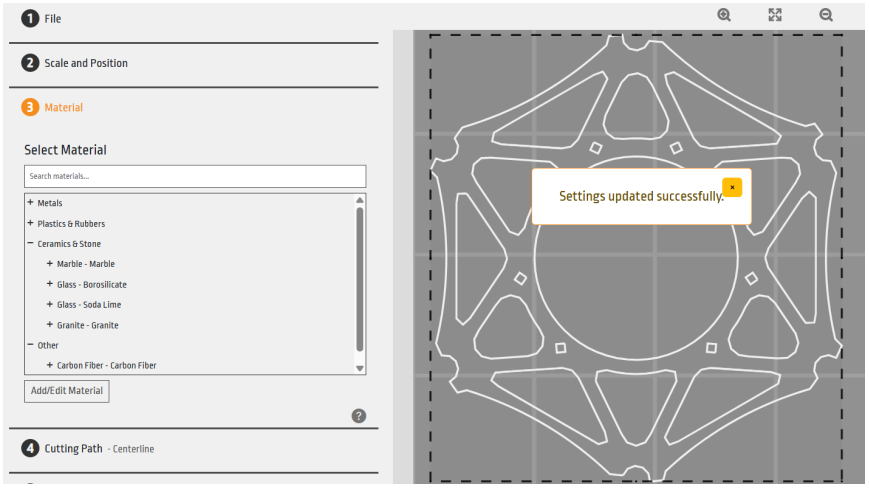

Fig.21: Material menu

The third step to the workflow is selecting the **Material** that will be cut. This menu provides users with already preset, pre-tested material profiles containing the optimal cutting parameters for it with respect to thickness. However, in the event that the desired material to cut is not available, there is also an option to create a custom profile for it as well as specifying the thickness you are cutting. The general materials are listed into four separate categories: metals, plastics and rubbers, ceramics and stone, and others.

e. Cutting Path

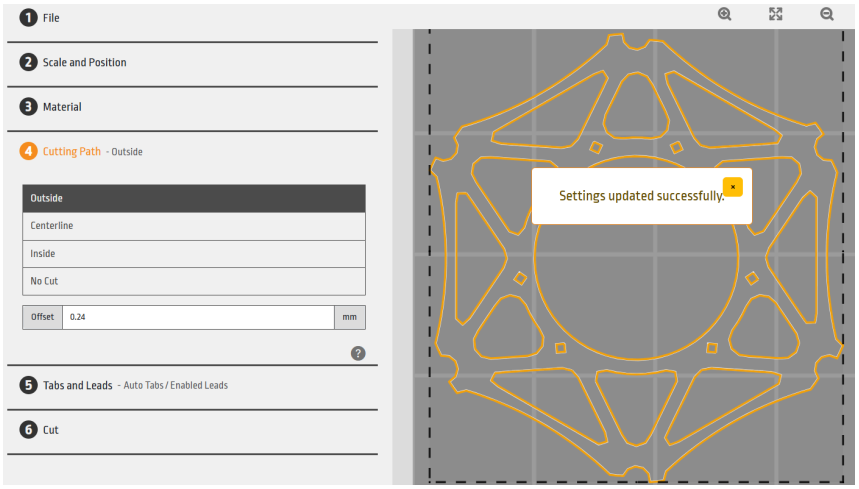

Fig.22: Cutting path outside

The next option in the software is the Cutting Path, a crucial setting that determines how the cut aligns with the design vector. Since the WAZER Pro has a kerf width of 1.1 mm, the material will be removed along the cut path, making this choice essential for maintaining design accuracy. The software provides three cutting path options:

- **Outside Cut** – Positions the kerf outside the vector line, preserving the exact dimensions of the design.
- **Centerline Cut** – Places the kerf directly on the vector, meaning half of the 1.1 mm kerf width is removed from both sides of the line.
- **Inside Cut** – Positions the kerf within the vector, ensuring the outer dimensions remain intact but removing material inside the shape.

These options allow users to control where material loss occurs, ensuring precise cuts and maintaining intended part dimensions. Understanding the 1.1 mm kerf width is critical, as incorrect placement can result in undersized or oversized final parts.

f. Tabs and Leads

Fig.23: Tabs menu

This menu allows users to add tabs to the design, either manually or automatically. A tab is the point that is left connected to the waste material essentially keeping it from being debris. For optimal results, tabs should be placed on straight edges as they are easier to remove and smooth out during post-processing.

Additionally, leads determine the piercing location and the entry path of the cut. The water jet starts at the lead point, creating a slightly larger hole in the waste material before transitioning into the cutting path. This approach minimizes defects on the final part, ensuring a smoother edge finish.

g. Cut

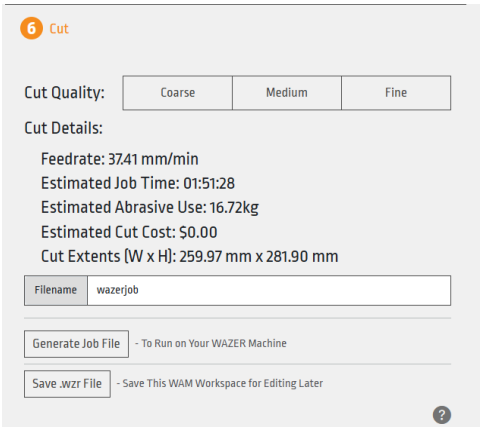

Fig.24: Export cut file

This is the final menu option, where the user selects one of three cut quality levels: Coarse, Medium, or Fine. These options impact the gantry's cutting speed and, consequently, the overall cutting time. The Coarse setting allows for faster gantry movement, while the Fine setting moves more slowly to achieve a smoother finish. Since the abrasive flow rate remains constant at 0.15 kg/min, Coarse cuts consume less abrasive than Fine cuts, as they are completed more quickly. However, the water pressure remains the same across all cut quality settings. In terms of cut quality:

- Coarse cuts may leave excess material on the back of the part, requiring post-processing to remove.
- Fine cuts ensure a clean, fully-through cut, leaving only the tab connection at the edges.

The appropriate setting depends on the material, required precision, and post-processing considerations.

V. Control Panel

The WAZER can be operated via a small **LCD screen** located on the right-hand side of the unit, this is controlled by four directional buttons surrounding a central **select** button. Below this is a **Start/Stop** button used when cutting. There is also an **E-stop** button above this that can be used to emergency stop the cutter. This is the exact same interface found on the Desktop model.

Fig.25: WAZER control panel

1. Cut

To start a cut on the WAZER, you first need to follow the steps above to prepare the file using WAM. Once you have your file on an SD card, this can be inserted into the machine just below the screen.

This is the home screen of the WAZER and has two options: **Select Cut File** and **Setup & Maintenance**. These two options contain all the necessary tools to allow you to complete a successful cut. If you have done a cut previously, you may need to go into maintenance and “collect abrasive” or do a “tank clean”. If this is your first cut or you are running a clean system, select **“cut file”** and the machine will guide you through the steps.

Fig.26: WAZER home screen

1. Select Cut File

The first step is to select the cut file; to do this, press this option on the home screen and select your chosen .gcode file in the next menu. If there are folders on the SD card, you can use the arrow buttons to navigate to them.

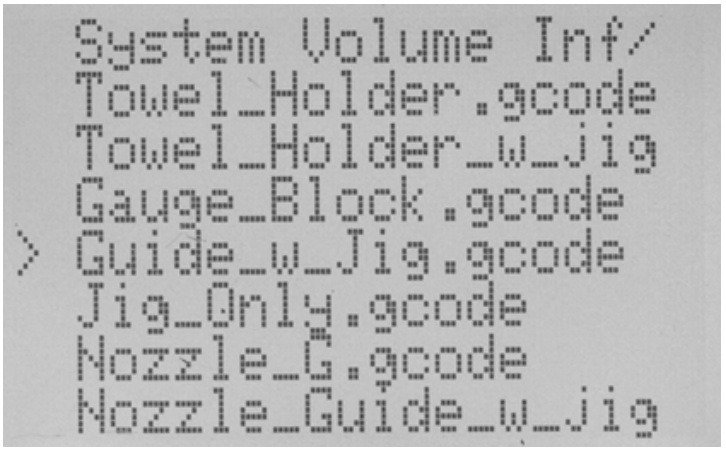

Fig. 27: WAZER file select menu

Once your part .gcode is selected, the WAZER will take you through the checks to make sure you have filled the abrasive hoppers and emptied the abrasive catch tanks, as well as set the Z-offset between the material and nozzle. The offset can of the nozzle can be checked only once the sheet of material is secured into place using the screws.

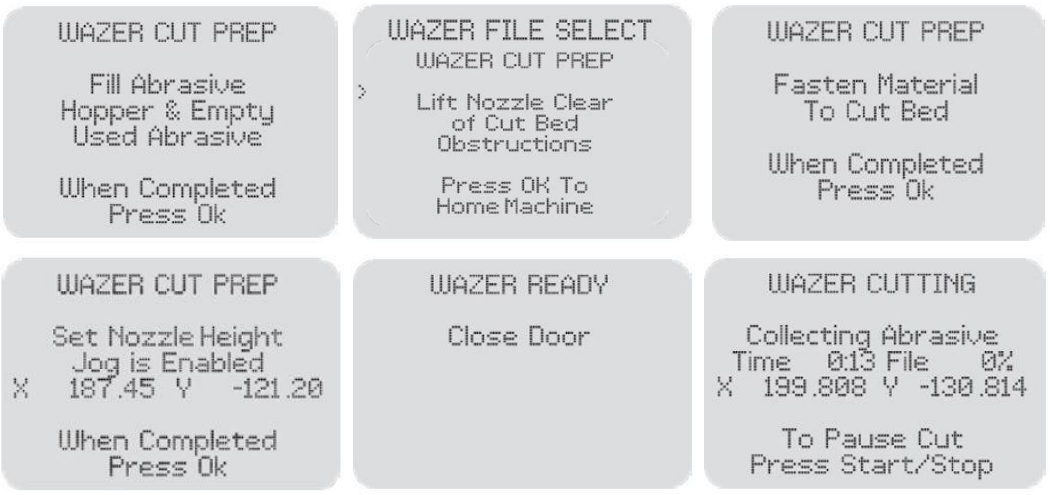

Fig.28: WAZER cut prep screens.

Once all the checks followed on the UI are completed and confirmed the user can begin cutting simply by closing the door triggered by the interlock switches and pressing the Start Button. This will begin by cutting the smallest features of the part first and work its way towards the larger cuts.

2. Maintenance

Illustrated in Figure 26 the home screen of the WAZER has two options: **Select Cut File** and **Setup & Maintenance**.

Between cuts, it is good practice to clean the machine and purge the water reservoir of any left-over abrasive. This is where the maintenance option comes in handy as it has many different options and settings to activate certain parts of the machine to check that all is working as it should. If cutting metal it's always ideal to check the two magnetic filters located on the rear tank of the machine; these should be cleared to avoid any debris from interrupting the process.

1. Setup and Maintenance menu

This menu gives the user the option to carry out multiple checks regarding different parts of the machine and offers step-by-step guidance on doing so, which is a nice addition.

Fig.29: Maintenance menu

- **Maintenance** will open up another sub-section for cleaning the machine during cuts.
- **Input/Output** check allows the testing of components. Listed below are the inputs:
    - Door switch
    - Water level sensor
    - Service sensor
    - SD card
    - Limit switch

  Outputs
    - Low-pressure pump
    - Dump valve
    - Vibration motors
    - High-pressure pump
    - Jog
- **Jog** allows the user to move the nozzle to any point on the cut bed using either their hand or the buttons on the control pad.
- **Cut Rate testing** has four options to run a test cut to gauge how a new material will react.
    - General cut - if you have no idea how the material will react
    - Fast cut - if you know the material leans towards the faster side
    - Medium cut - if you know the material is in the middle of the spectrum
    - Slow cut - if you know the material is going to be hard to pierce and cut.
- **Firmware Version** lets the user check that their WAZER is up to date with the latest bug fixes and improvements.

2. Maintenance Menu

The maintenance menu is accessed through the **Maintenance** option listed above. This menu contains various options that are regularly used to keep the WAZER performing well. These options are listed below

- **Used Abrasive Collect**

This feature turns on the low-pressure system of the WAZER to collect used abrasive from the bottom of the tank and deposit it in the used abrasive tanks.

- **Nozzle Purge**

This feature turns on the high-pressure system of the WAZER to purge the nozzle of any contaminants or pressure if the machine is going to be turned off/moved.

- **Abrasive Flow Rate**

This feature turns on the abrasive system for a pre-set duration to aid the user in measuring the abrasive flow rate.

- **Tank Cleaning**

This feature cleans the tank by stirring up used abrasive from the bottom of the machine by strategically using the high-pressure water from the nozzle to manoeuvre around many points on the work area. The low-pressure system is also engaged to deposit any abrasive into the used abrasive hoppers.

- **Abrasive Pickup Cleaning**

This is a similar feature to tank cleaning, but it only stirs up the abrasive located around the four abrasive pickup filters. This also turns on the low-pressure system to collect abrasive from the tank.

- **Water Level Setup**

This engages both the high and low-pressure systems to raise or lower the water level to the appropriate depth for cutting.

Fig.30: Maintenance menu

3. Customer Service/Helpline

WAZER has a very close relationship with its customers. The company has extensive support for any users in a bid to help them with any problems they may have while using the WAZER product.

WAZER relies on resellers to help reach customers around the world. In the UK, a company called **SolidPrint3D** is in charge of distribution. WAZER's authorized distributors have trained members of staff who can help customers plumb in the machine and assist with setup and installation.

WAZER also offers excellent in-house after-sales support if customers are in need.

WAZER is a company built by engineers and is aimed at a similar target market of makers and small businesses. This means that most customers will have some hands-on skills and can repair their machines with some help from the WAZER support staff.

The first way that a customer can get help is through the WAZER website (support.wazer.com). Where there are extensive resources and links that can be accessed to help the user. These menus explain the potential issues and why they may occur so the user can identify what is wrong with their machine.

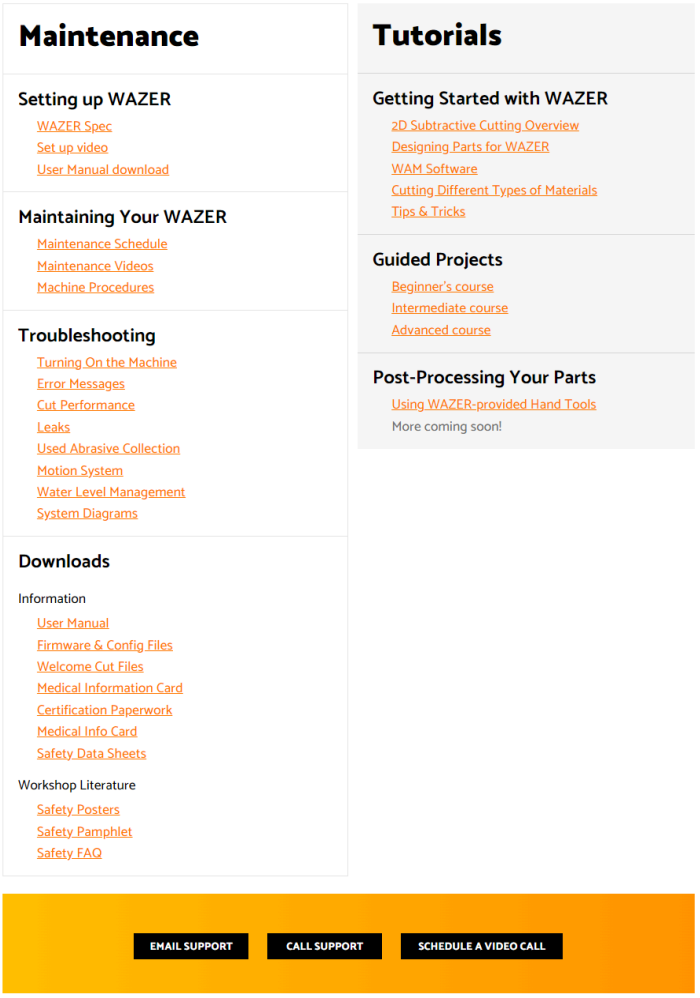

Fig.31: WAZER website support section

If the user cannot identify or fix their problem using the online resources, then the support team is there to assist.

First contact can be made by email, phone, or by submitting a ticket online. If this is not enough to solve your problem, a video call can be arranged to help the user directly.

The team in charge of these calls has excellent knowledge of the machine and can help the user with any of their problems. The on-call engineers have props in front of them to help show the customer which part they are talking about and use this as an aid when explaining the problem.

During our experience with the WAZER team, the member of staff we talked to was very friendly and spoke in a kind and informative manner. He had great expertise in the product and explained the most common issues and their fixes in a clear and concise manner.

WAZER is very honest with its customers and openly accounts for any shortcomings with its product openly. An example of this is the orifice on the nozzle. This piece has very tight tolerances and so needs to be replaced more regularly than other components. WAZER is very upfront about this and even included a spare in the original sale of the machine.

To improve their machine, the staff created a list of the most common issues that are presented to them on the helpline in hopes that the engineering team can look into this further and implement a fix on the next machines being produced.

Wazer Test file

This is the first test we carried out on the WAZER Pro to simply get a grasp of the machine's use and the way it functions. The cut was done using a test model file provided by WAZER in Ceramic using the Fine cut mode, which provides the smoothest edge cuts but costs slightly more time. The WAZER test file is designed to showcase some cutting geometries and how well the device is able to perform them.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Disabled	Fine	Ceramic Tile	10 mm	4 Min

Tab.5: Ceramic Tile cut parameters

Fig.32: WAZER test model results

Our first test cut was a success, clearly showcasing all the cut geometries with smooth edges. However, we observed that the initial piercing process was completed quickly, but there was a delay before the nozzle began moving. To optimize this, we increased the cutting speed to 150%, as the material appeared softer than expected.

We used the Tile Ceramic material preset, which is configured for a thickness of 7.5 mm, 2.5 mm less than the actual tile thickness. Fortunately, this discrepancy was not an issue, as the material proved to be much softer than anticipated.

To test the cutting of thin, delicate features, we added "3DPI" text to the part, requiring precise, sharp corner cuts. These features were successfully executed, as shown in Figure 32. However, a small discrepancy was noted in the "D" character, where the center piece was missing. This was due to manual handling—being extremely delicate, the piece snapped off upon contact.

VI. Dimensional Accuracy Test

Objective: To verify the accuracy and precision of the Wazer Pro, we will set the device to cut basic geometries such as the **square and circle,** from a 1 mm aluminum sheet 12 times for the squares. These will then be measured for dimension accuracy using a digital vernier caliper. The results will then be compared against the actual dimensions and record deviations. The **Pass Criteria** will be set to ±0.1mm tolerance.

1. Squares

This test is used to gauge the capability of the WAZER Pro to produce multiple parts with the same tolerances and dimensions. For this, we produced 24 small rectangles measuring 20 x 15 mm from 1 mm aluminium, as it is a soft and easy-to-cut material, to simulate a batch production situation since most users will be using the machine to cut sheet metal.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Enabled	Fine	Aluminum	1.5mm	5 Min

Tab.6: Aluminum Squares cut parameters

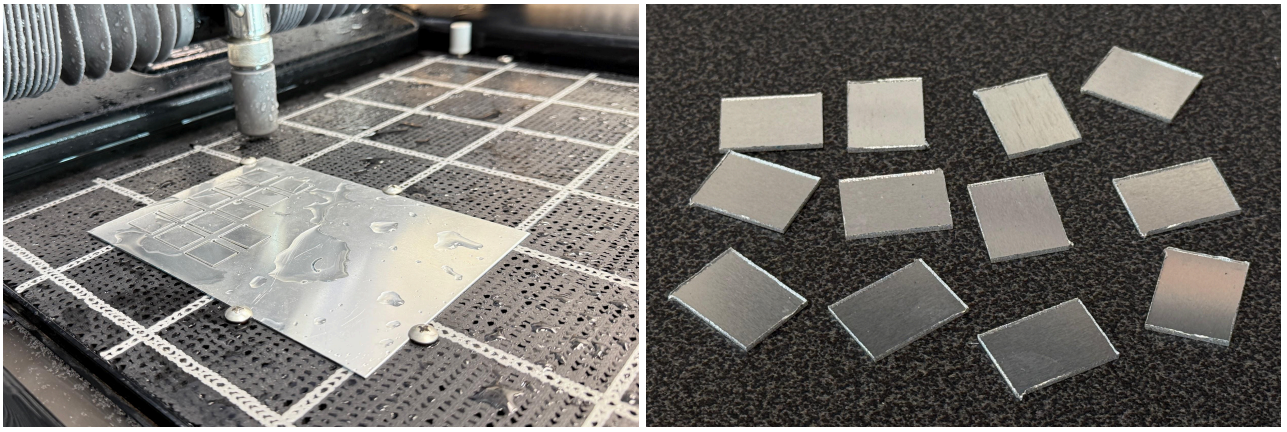

Fig.33: Acrylic repeatability results

The cuts came out well, and all the pieces look clean and visually similar. Tabs were also enabled and set to an optimal thickness of 1.5 mm to allow for ease of removal. We appreciate how tabs can be adjusted on the software. These then had to be filed off for measurement so as not to interfere with the callipers. Figure 33 illustrates the faint lip on the squares from the cutting sand, essentially folding some of the material behind the main body. This sharp edge was easily removed through sanding deburring and other post-processing procedures.

Squares	X-Axis	Y-Axis
Reference	*20*	*15*
Cut 1	20.020	15.020
Cut 2	20.030	15.020
Cut 3	20.020	15.010
Cut 4	20.030	15.030
Cut 5	20.030	15.010
Cut 6	20.030	15.030
Cut 7	20.010	15.030
Cut 8	20.030	14.990
Cut 9	20.020	15.000
Cut 10	20.020	15.010
Cut 11	20.030	14.990
Cut 12	20.020	14.990
Average of deviations	0.024	0.016
Average of real values	20.024	15.011
Standard deviation (σ)	0.007	0.016
Estim. stand.dev. (s)	0.007	0.016
Mean + 3.σ	20.044	15.058
Mean - 3.σ	20.004	14.964

Tab.7: Repeatability table results

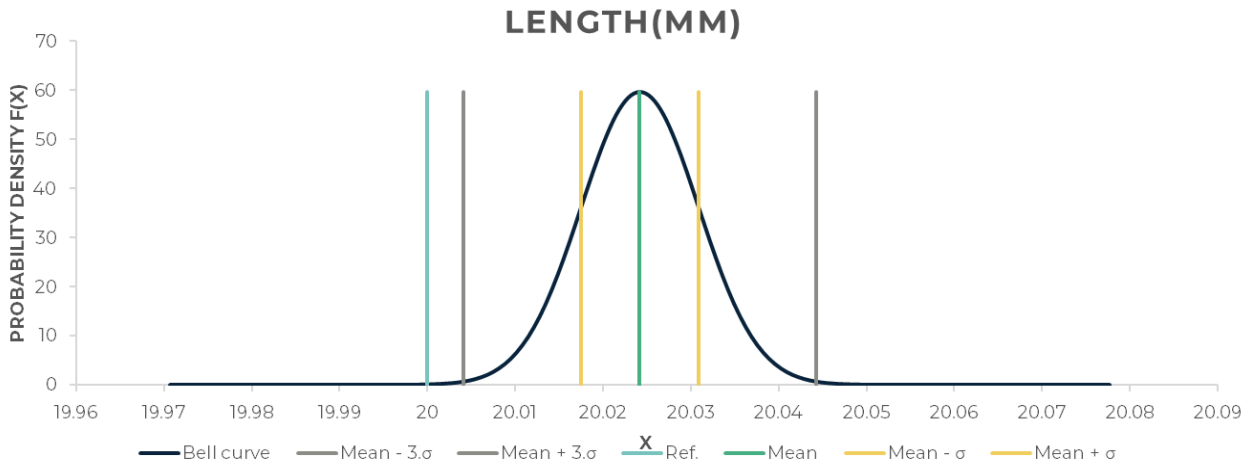

Fig.34: Normal distribution on the length

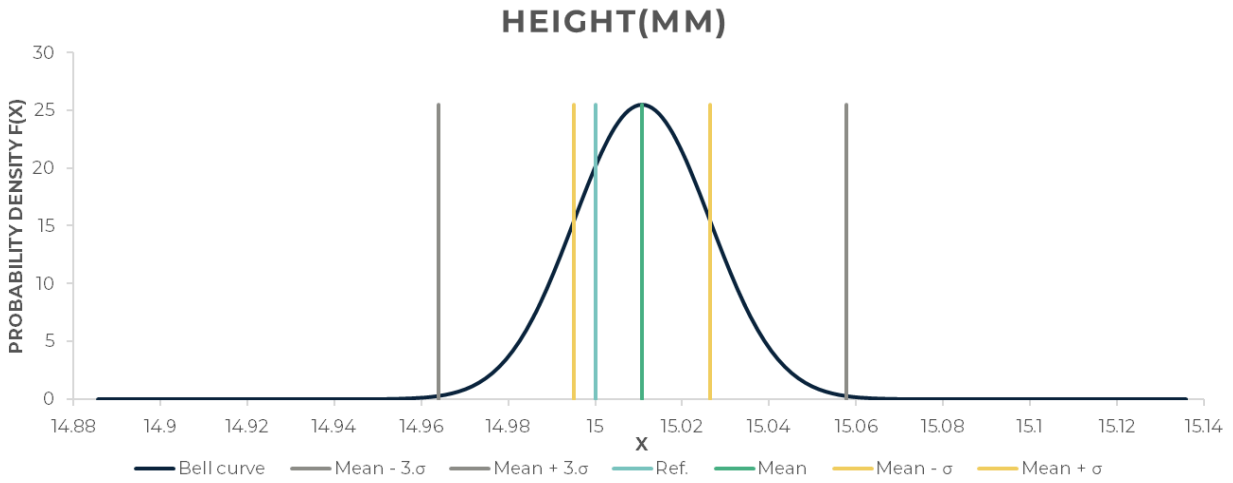

Fig.35: Normal distribution of height

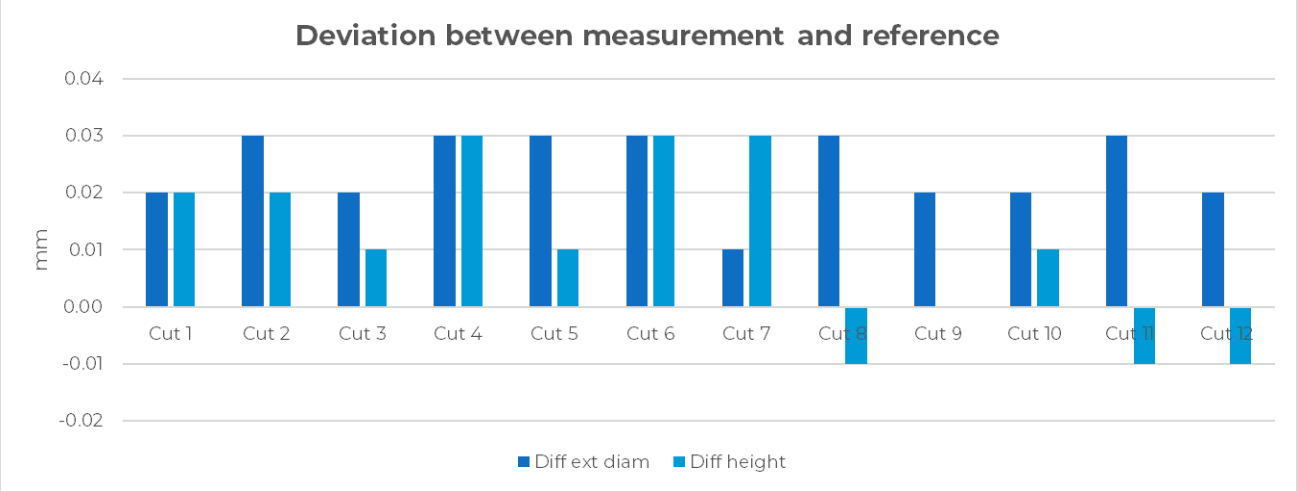

Fig.36: Difference between measurement and reference

The squares repeatability test demonstrated a significant improvement in accuracy compared to the desktop machine. Most measured dimensions were slightly over the reference, averaging a deviation of just 0.02 mm, an insignificant discrepancy. The greatest variations in dimensional accuracy were observed along the X-axis, with an average deviation of **0.024 mm**, while the Y-axis showed a smaller deviation of **0.016 mm**.

In terms of repeatability, the **overall mean difference across all tests** was **0.02** mm, well below the 0.1 mm tolerance threshold, indicating excellent accuracy. The s**tandard deviation for both axes** was **0.011 mm**, significantly lower than the 0.05 mm benchmark, demonstrating outstanding precision. For a waterjet system at this price point, a good result is typically around ±0.15 mm. However, the WAZER Pro far exceeded this, proving its ability to deliver highly accurate cuts.

Overall, there are no significant concerns, as the waterjet cutter successfully met all target criteria. The repeatability tests confirm that this machine is highly capable of producing high-tolerance cuts.

Users should note that dimensional accuracy may be affected over time due to wear and tear. Regular maintenance is essential, including nozzle replacements approximately every 300 hours, to ensure optimal machine performance.

2. Circular Trajectory

At 3DPI, we perform this test on all belt-driven systems we review. It helps identify small discrepancies between the X and Y axes, which are particularly common in Cartesian belt systems.

In these systems, each axis is individually controlled by a sinusoidal function, which has "dead points" where the speed momentarily drops to zero. Due to system inertia, the water jet machine may lose accuracy during rapid acceleration or deceleration. This issue is more pronounced when using low-quality stepper motors or when the G-code lacks commands to minimize sudden jolts. A common solution is to implement gradual deceleration before stopping, ensuring smoother motion and improved accuracy. However, due to the device not requiring the movement of a high-speed gantry, it is unlikely that inertia can cause issues.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Enabled	Fine	Aluminum	1.5mm	12 Min

Tab.8: Aluminum *cut parameters*

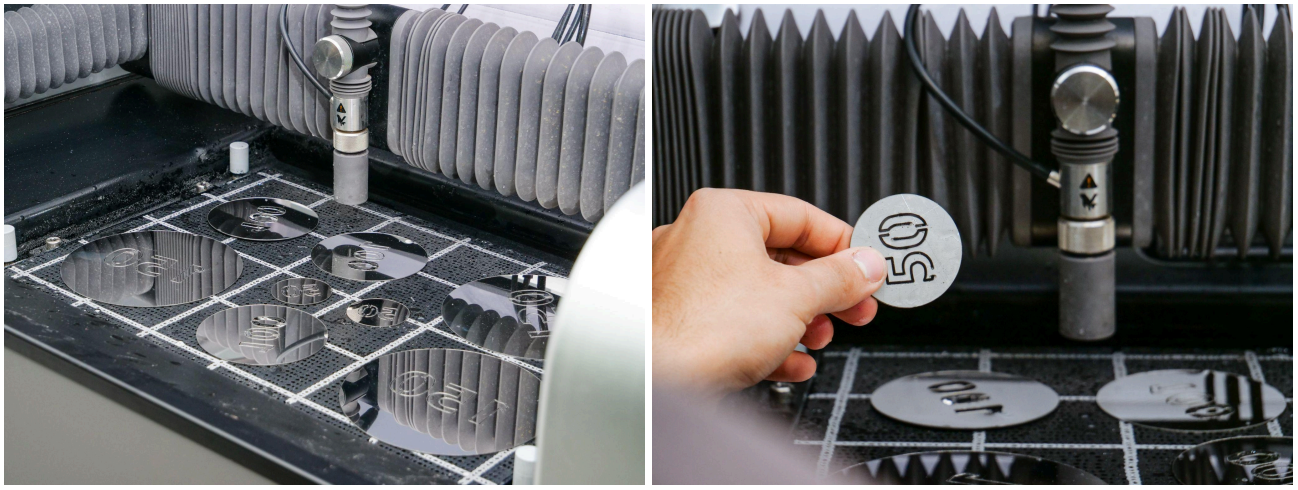

Fig.37: Aluminum *circular trajectory results*

With regards to cut quality, the WAZER Pro has done well, leaving behind no visible defects. All circles were cut out of a single sheet of aluminium, using tabs to prevent the circles from bouncing off the bed and sinking to the bottom of the tank. Leads were used to eliminate the piercing hole effect from the main body.

CIRCULAR TRAJECTORY	Circle 1 (mm)		Circle 2 (mm)		Circle 3 (mm)	
Reference	*50*		*100*		*150*	
Axis	X	Y	X	Y	X	Y
Cut 1	50.05	50.03	100.05	100.05	149.89	149.91
Cut 2	50.03	50.06	99.98	100.09	149.91	149.90
Cut 3	49.98	50.04	100.05	99.99	149.91	149.94
Average of deviations	0.033	0.043333	0.045	0.050	0.097	0.083
Average of real values	50.020	50.04333	100.032	100.043	149.903	149.917
Standard deviation (σ)	0.032	0.014	0.042	0.045	0.010	0.019
Estim. stand.dev. (s)	0.035	0.015	0.046	0.049	0.011	0.020
Mean + 3.σ	50.117	50.084	100.157	100.178	149.934	149.973
Mean - 3.σ	49.923	50.002	99.907	99.908	149.872	149.861

Tab.9: Circular trajectory data

The figure above illustrates the measurement results for nine circles with diameters of 50 mm, 100 mm, and 150 mm. Each was measured on a flat surface using vernier callipers with an accuracy of ±0.01 mm.

Mean of the difference for X-Axis	0.06
Mean of the difference for Y-axis	0.059
Mean of the difference for all test	0.059
Mean of the standard deviation	0.031

Tab.10: Circular trajectory data

The mean difference between the X and Y axes was just 0.001 mm, highlighting the WAZER Pro's excellent build quality and its ability to produce near-perfect circles. This also indicates a well-balanced quality between the stepper motors on each axis. No specific circle showed significantly higher inaccuracies. As shown in Table 10, the mean deviation across all tests was 0.059 mm, well below the 0.1 mm tolerance threshold, while the mean standard deviation was 0.031 mm, staying within the 0.05 mm benchmark.

Measured deviations increased slightly with larger circles, suggesting the machine has more difficulty with broader arcing movements than with small, precise cuts. This is a known characteristic of belt-driven systems.

It's important to note that water jet cutters will never achieve the same level of accuracy as laser cutters due to the nature of the cutting process and the evolving cut bed to which parts are fastened. However, for most applications, this level of deviation is well within an acceptable range and should not impact usability.

Overall, these results confirm the WAZER Pro's ability to deliver high-quality cuts with excellent dimensional accuracy and smooth edges. The lack of discrepancies between the axes further supports its precision in producing circular cuts. Compared to the desktop WAZER, the Pro demonstrated significantly improved dimensional accuracy, likely due to the upgraded water pump, as the axis motors and gantry remain unchanged.

5. Material Compatibility and Application Use Test

In this section, we will evaluate the WAZER Pro's performance across different materials and thicknesses by assessing the quality of its cuts. The machine is specified to cut a wide range of materials, including titanium, carbon fibre, copper, HDPE, glass, and more. While the material range is said to be virtually unlimited, thickness remains a key limitation.

Some of our test cuts will simulate real-world use cases, allowing us to assess factors such as taper angle and overall cut quality. The evaluation criteria include achieving clean cuts with minimal taper while ensuring a smooth and efficient workflow with minimal issues.

3. 3D Printing Industry stencil

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Enabled	Fine	PC	3 mm	8 Min

Tab.11: HDPE cut parameters

Fig.38: Spray Paint stencil of 3DPI logo result

During the cutting of the PC sheet, we encountered a backflow clog caused by a character cut breaking free from its tabs and getting trapped under the nozzle. The backflow sensor accurately detected the issue and automatically paused the machine. To resolve this, we disconnected the hose at both ends and used compressed air to clear out moisture particles. Once the hose was reconnected and the cut chamber lid closed, we resumed the cutting process, achieving the results shown in Figure 38.

The stencil's cut quality met expectations, featuring smooth outlines with no significant defects, aside from some faint piercing dots. The manually set 1 mm tabs were easily removable, though they lacked sufficient strength, as a few broke off during cutting.

Overall, we were pleased with the waterjet's performance on the PC sheet. Unlike traditional laser cutters, which cause PC to melt at the contact point and leave surface defects, the waterjet cutter, when set to fine mode, produced clean cuts with no residual artefacts, making it a viable manufacturing solution.

The Coarse mode, in contrast, serves as a quick and efficient cutting option that sacrifices refinement for speed. It requires less time and consumes less abrasive material than the fine preset but may necessitate post-processing to remove parts from the material body. This mode is ideal for rapid prototyping where quality of edges is not required to be fine.

4. Yamaha MT03 Head Gasket

Copper is a highly versatile metal, but its reflective nature makes it challenging to cut with a laser, often resulting in surface discolouration or thermal distortion. This makes water jet cutting an ideal solution, as it allows for precise and clean cuts without heat-affected zones, preserving the material's original finish. The WAZER Pro excels in this application, producing intricate designs with sharp edges while preventing warping or damage to delicate features due to it being a cold-cutting process.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Disabled	Fine	110 Copper	1.5 mm	19 Min

Tab.12: Copper cut parameters

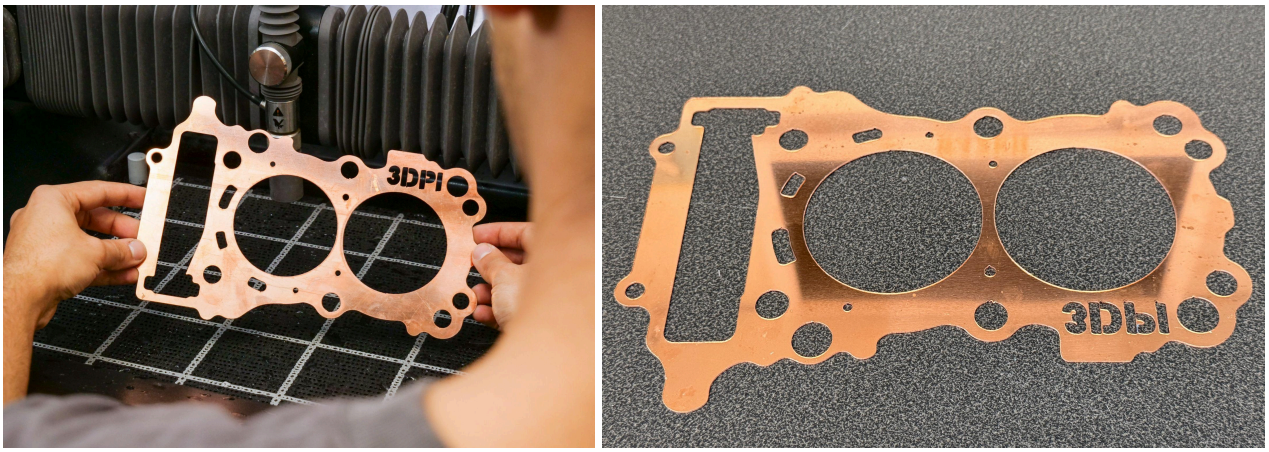

Fig.39: Copper gasket result

For the copper gasket cut, both leads and tabs were disabled. While this is not ideal, since debris can become trapped beneath the nozzle, potentially causing backflow, it increases efficiency by minimizing excess material. This made it a high-risk cut, but fortunately, no issues occurred during the process.

The resulting copper gasket exhibited excellent surface quality and precise cut definition, exceeding our expectations. However, some post-processing was required, as the back side of the cut bent slightly inward, creating a thin lip along the edges. This is a common occurrence when cutting metal with a water jet. Fortunately, the lip was easily removed through standard deburring and sanding, resulting in a smooth, clean finish.

Water jet cutting is particularly well-suited for copper, as it eliminates the risk of thermal distortion or oxidation commonly associated with laser cutting. By using a cold-cutting method, the WAZER Pro maintained the material’s integrity, ensuring sharp edges and a pristine surface.

Overall, this test cut was a success, demonstrating that the WAZER Pro can produce functional, high-precision copper parts with minimal post-processing. This reinforces its capability as a reliable solution for intricate gasket manufacturing and other high-tolerance copper applications.

5. KTM bracket in aluminium

This test piece, made from thicker aluminium, serves as a great evaluation of the WAZER Pro's precision when cutting denser materials. Cutting thicker parts with a water jet can introduce challenges, such as stream lag, where the water stream slightly bends backwards as the nozzle moves, resulting in a textured rather than perfectly vertical cut. However, since aluminium is a relatively soft metal, we expect minimal to no stream lag in this case, allowing for a clean and accurate cut.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Enabled	Fine	Aluminum	3 mm	15 Min

Tab.13: Aluminum cut parameters

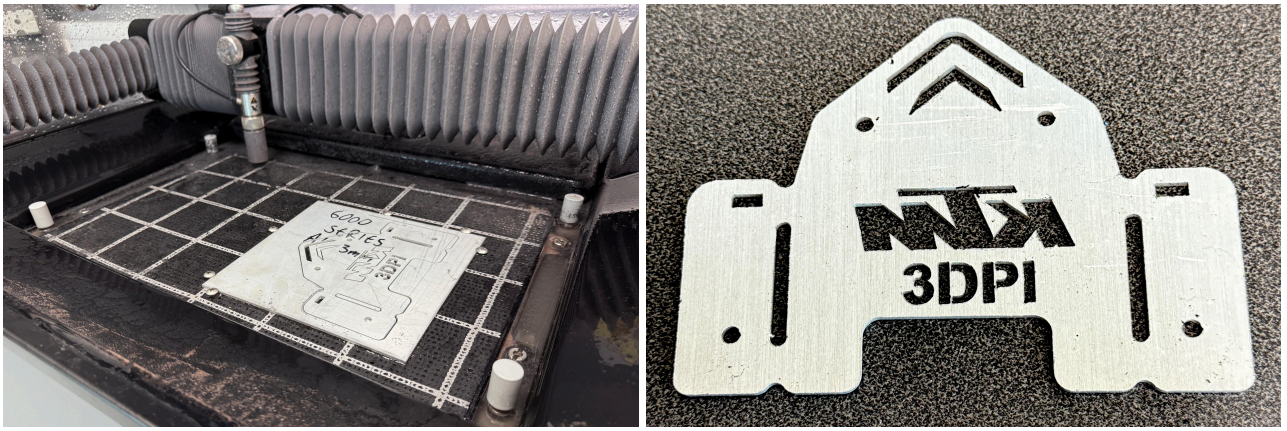

Fig.40: Aluminum Bracket result.

The WAZER Pro performed exceptionally well in cutting a 3 mm-thick aluminium sheet to create a custom tail bracket for a KTM motorcycle. The machine delivered precise and clean cuts, maintaining excellent edge quality with minimal taper.

To ensure success rate and accuracy, we utilized tabs and leads, which were successfully generated without any issues. The tabs held the part securely in place during cutting, preventing unwanted movement, while the leads provided a smooth entry point, minimizing edge imperfections.

Overall, the WAZER Pro proved to be a highly effective solution for fabricating motorcycle components, offering a combination of accuracy, reliability, and efficiency. The finished tail bracket required little to no post-processing, making it a practical and efficient manufacturing method for custom aluminium parts.

6. Bottom Bracket (BB) mount in titanium

The WAZER Pro's performance in cutting **1 mm thick titanium sheet** will be evaluated based on several key factors. Precision and dimensional accuracy are crucial, ensuring that the final cut matches the intended design with minimal deviation. Edge quality will be assessed, with a focus on smoothness, absence of burrs, and minimal taper, as titanium's hardness can sometimes lead to rougher edges. The effectiveness of the waterjet in preventing material warping or discoloration, which is common with heat-based cutting methods, will also be considered. Additionally, the machine's ability to maintain a stable cutting process without excessive nozzle clogging, stream deflection, or material shifting will play a critical role.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Inside	Disabled	Fine	Titanium Grade 2	1 mm	12 Min

Tab.14: Titanium cut parameters

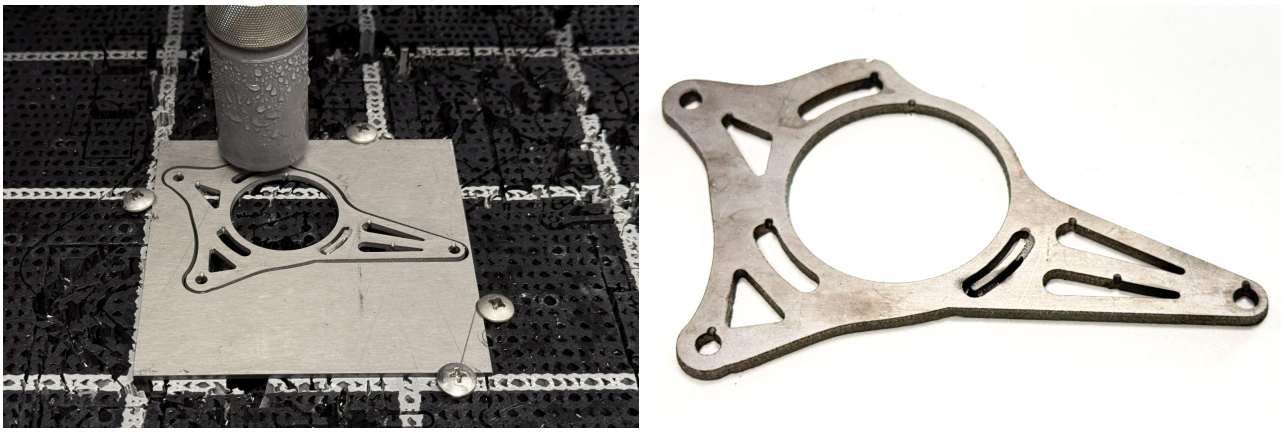

Fig.41: MTB chainring bracket result

The titanium sheet was securely fastened onto the cutting bed using four screws, positioned at each corner to act as pivots. This setup effectively prevented material shifting during cutting, as the high-pressure process can sometimes cause distortion.

Once the G-code was generated in WAM, we exported it to a microSD card and loaded it into the WAZER Pro for cutting. The cutout extents were easily repositioned directly above the part using the relocating arrows and jog feature. With the setup complete, the cutting process began.

At the start of the cut, we observed significant splashback and sparks coming off the material. However, it became evident that the initial pierce did not occur, as the tool head began moving before penetration was achieved. To resolve this, we reduced the cutting speed to 80%, allowing the abrasive to properly pierce the material and continue cutting as intended. However due to the initial speeds, we result in having an incomplete cut out portion. While post-processing may correct this defect, it is not the ideal outcome, as in its current state, the part is unusable. Therefore it is suggested that users run a cut rate test which can be found in the maintenance section of the UI and can help identify the proper pierce time and cut rate parameters. Once precisely tuned we can expect optimal results.

The 80% workflow performed optimally, producing well-defined outlines with sharp cavities and smooth, grain-free cut surfaces. Splashback was minimal, primarily occurring during the piercing process, which is expected. The machine functioned well overall, with no backflow issues in this instance. Due to being limited on material we did not get a chance to run a cut rate test which would have definitely refined results.

7. Stained glass window decor

This test will involve cutting and assembling two distinct materials to create a stained glass window decoration. The selected materials include two shades of stained glass, which will form the decorative elements, and a sheet of acrylic for the main frame. Acrylic was chosen for its ease of manipulation, allowing for precise adjustments to ensure a proper fit with the glass components.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Centreline	Disabled	Fine	Stained Glass	1 mm	4 Min
Inside	Disabled	Fine	Acrylic	2.5 mm	4 Min

Tab.15: Stained Glass and Acrylic Sheet Cut Parameters

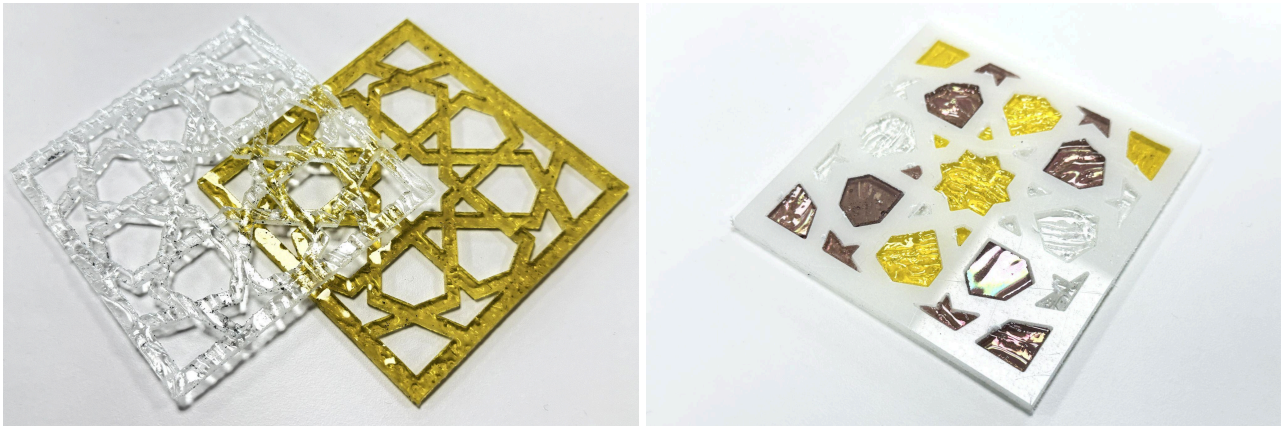

Fig.42: Stained glass frame and assembled frame result

The intricate geometries on the three stained glass sheets were cut with impressive precision. Water jet cutting, which applies no mechanical force to the glass, significantly reduces the risk of cracks, chips, or breakage, making it the optimal method for this material. Additionally, because water jet cutting does not generate heat, it prevents thermal stress and microfractures that could weaken the glass over time. This method is versatile and capable of cutting a wide range of glass types, including laminated, and stained glass, which are often difficult to cut with conventional techniques.

The same high-quality results were observed with the acrylic surround sheet. No defects were present, and all components were cut cleanly without the need for leads or tabs. While using no tabs is typically a more risky approach, in this case, it was successful.

Both materials were assembled seamlessly with minimal effort, allowing the small glass pieces to sit neatly in the frame. The stained glass was cut using an outline tool path, while the plastic frame was cut using the centerline tool, ensuring a 0.5 mm gap at each end when pressed into place.

Overall, both materials were cut successfully with no complications, and the cuts featured remarkably smooth surfaces. This indicates that the material presets used were well-suited for this design. We were particularly impressed with the WAZER Pro's ability to cut sharp turns in glass without defects. Another notable advantage is the efficiency of the water jet cutting process: as an automated system, it reduces material waste and increases repeatability, making it ideal for both custom one-off designs and high-volume production. Since the process involves no direct contact with the material, it eliminates tooling wear, lowering maintenance costs and ensuring long-term reliability.

8. Steel Rotor Centrepiece

The water jet cutting process for manufacturing a 3 mm thick steel centrepiece disc rotor on the WAZER Pro must prioritize precision, durability, and efficiency. The cutting parameters should ensure clean, burr-free edges to minimize post-processing while maintaining tight tolerances for proper fitment with other motorcycle components.

A consistent cutting speed, optimized abrasive flow rate, and appropriate water pressure must be maintained to prevent excessive kerf width and ensure a uniform cut throughout the steel. The process should avoid overheating or microstructural damage to preserve the material's mechanical integrity. Lead-in and lead-out strategies must be carefully planned to avoid overcutting or creating stress points that could compromise the rotor's strength.

The overall efficiency of the WAZER Pro should be considered, ensuring that the process minimizes material waste while maintaining repeatability for multiple rotor production. The machine's ability to execute sharp corners and fine details without defects will be crucial to achieving a high-performance rotor suitable for motorcycle applications.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Inside	Enabled	Fine	Steel	3 mm	1 Hour 12 Min

Tab.16: Steel settings and parameters

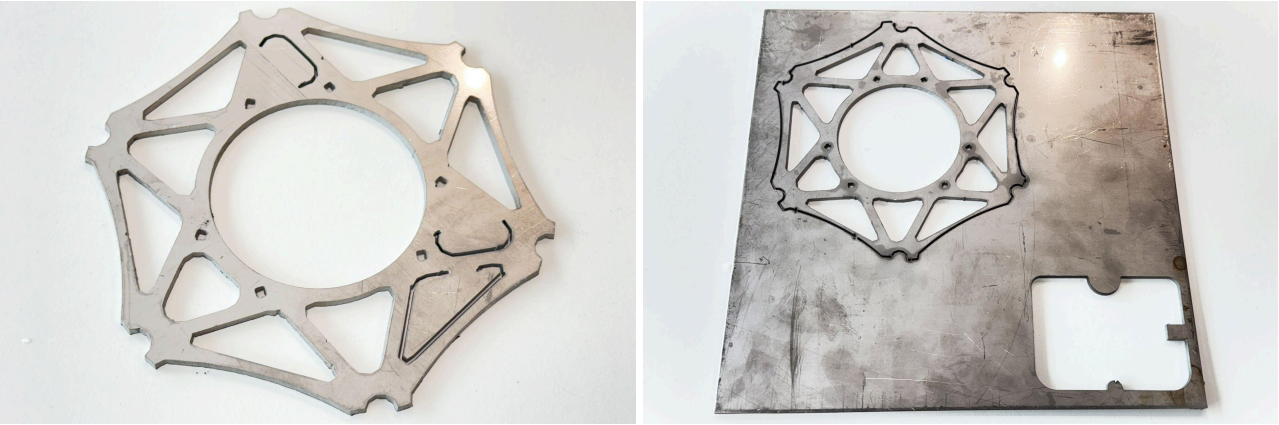

Fig.43: Centre piece steel rotor result

The material was first well secured onto the bed to prevent any movement or vibration during cutting, ensuring accuracy in the rotor's intricate design features, including mounting holes and ventilation slots. Tabs and leads were also enabled to reduce the risk of waste clogging the cutting nozzle and eliminate the markings of pierced holes. However, the tabs did not function optimally since the thickness was adjusted to 1.5 mm, deeming them weak for the purpose. This caused plenty of issues with backflow as they would sometimes break off and become trapped.

Once again, the same steps of removing the hose and blowing compressed air into the hose were done, however, this time it did not seem to clear the moisture out completely. The hose was reconnected and resumed, which, after 20 seconds, triggered the sensor again. This cycle was repeated 4 times. The cause was potentially due to the trapped moisture bridging a signal between the wires, triggering the effect.

Unfortunately, the end result was not what was expected; each time the backflow sensor was triggered and then cleared to resume, a tab would be present on the part as the g.code does not track back enough to resume from a point where the cut can be smoother.

The steel test conducted doesn't go to say that the WAZER Pro is unable to do cuts on such materials. The test would have been feasible if the tabs had been left at the automatic size, preventing debris material from bouncing off the part and causing backflow.

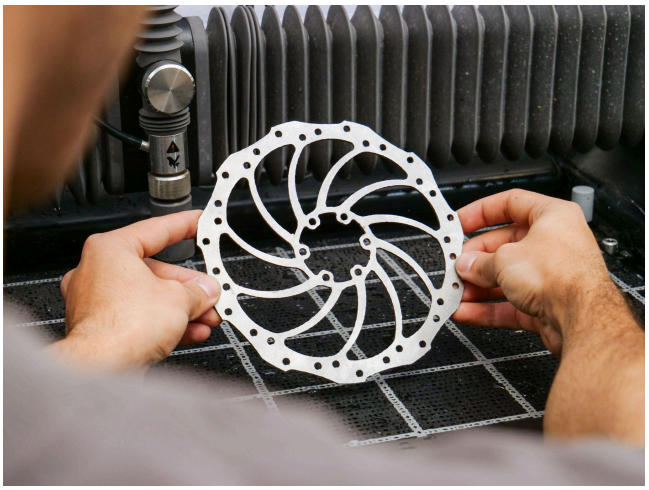

Fig.44: Bicycle disc rotor result

Here we have a cut of 2 mm steel produced by SolidPrint, this is an excellent representation of WAZER Pro's abilities. This bicycle disk rotor cut-out was excellently rendered, representing each cavity to a high standard. This shows the true abilities of the WAZER Pro when using thicker tabs to prevent failure. Thicker tabs are harder to remove but with the correct tooling and post processing techniques the optimal outcome can be achieved.

9. Drone Frame

This test is to determine the capability of the WAZER Pro when working with hardened composite materials. Therefore the material chosen for this is carbon fiber sheeting with a thickness of 2 mm. The model selected is a drone frame, which is a typical application use for drone frame manufacturers who require all the properties of the Carbon fibre material as well as the intricate cut-out of the frame.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Disabled	Fine	Carbon Fiber	2 mm	22 Min

Tab.17: Carbon fibre cut parameters

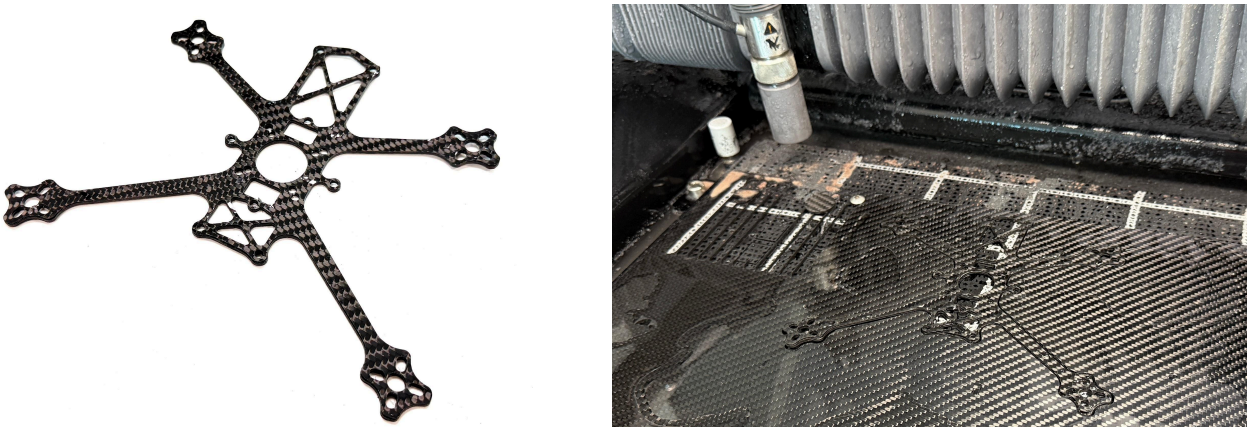

Fig.45: Carbon fibre drone plate results

All cut-out geometries, including small circles, were produced with exceptional precision. By initiating leads on the waste material, pierce holes were entirely eliminated.

Despite correctly positioning the carbon fibre sheet in the WAZER Pro, some layers delaminated due to water seeping between the carbon and resin layers. This issue may stem from a material defect that allowed water ingress when cutting small holes, weakening the bonds and causing separation rather than a machine issue. The quality of the carbon fibre sheet plays a crucial role in water jet cutting, as lower-grade materials are susceptible to this issue.

WAZER has acknowledged that delamination can occur on the top side of laminate materials. Waterjets introduce stress during piercing, which can be particularly challenging for laminates. They also noted that material suppliers using multiple lamination processes may create weaker interlayer bonds, making delamination more likely. Some users have resolved consistent delamination problems simply by switching to a different material supplier, even while using the same cut file.

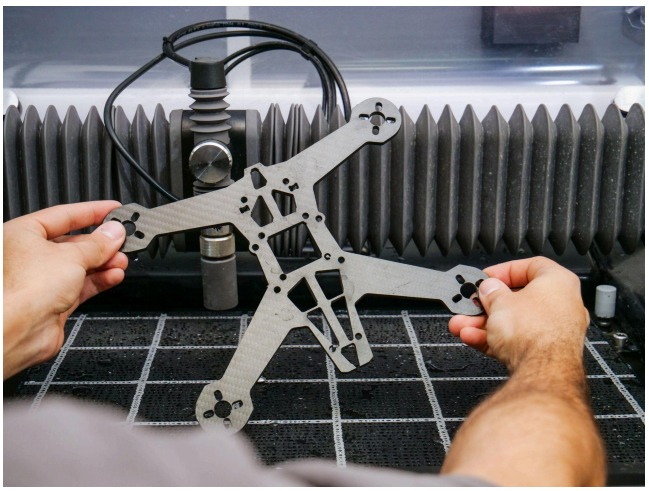

Fig.46: Carbon fibre drone plate results

Here we have another part cut by SolidPrint using a higher-quality carbon fibre sheet allowing for the optimal cut of the part free from all defects. This is an excellent representation of what the WAZER Pro can achieve when using the correct quality material. Overall, we can confirm that WAZER's claim that the machine is capable of handling carbon fibre is valid.

10. Chainring cover

In this test, we will be cutting an HDPE sheet to create a bicycle chainring cover designed to protect the rider from sharp chainring teeth and prevent loose objects such as laces or trouser legs from getting caught. To meet the required standards, the cut must be of high quality, free from defects, and precisely shaped for proper fitment.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Disabled	Fine	HDPE	2 mm	7 Min

Tab.18: HDPE cut parameters

Fig.47: Chainring cover results

As seen in Figure 47, the HDPE chainring cover was precisely cut, demonstrating accurate geometry and a well-defined outline. While some post-processing, such as light sanding, would further refine the edge quality, the result is impressive, especially considering that no tabs were used. Since waterjet cutting plastic typically requires some post-processing, this outcome aligns with standard expectations.

The total cutting time was just 7 minutes, highlighting the significant speed advantage of the WAZER Pro over the Desktop version. This improvement is largely due to the larger water pump and increased cutting pressure, which enhance overall efficiency.

In conclusion, the WAZER Pro successfully delivers clean, precise plastic cutouts while maintaining excellent accuracy, validating its effectiveness for HDPE applications. The resulting chainring cover is fit for use, further demonstrating the machine's capability in producing functional, high-quality parts.

11. Brass seal

For this test, we will be water jet cutting a 1mm thick brass sheet to produce a precision performance seal, primarily composed of small circular features. Since metal gaskets require exceptional accuracy to function effectively, the WAZER Pro must achieve highly precise dimensional tolerances, ensuring clean cuts, minimal edge taper, and no distortion. The final brass seal should meet strict fitment and sealing requirements, demonstrating the machine's capability for fine-detail metal cutting.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Disabled	Fine	Brass	1 mm	9 Min

Tab.19: Brass cut parameters

Fig.48: Brass gasket result

As illustrated in Figure 48, the brass gasket was precisely cut on the WAZER Pro with no defects. While the standard cutting lip common in waterjet-cut metals was present, it was easily removed using a rotary sanding tool, resulting in a clean and functional final part.

Once again, the WAZER Pro demonstrated impressive efficiency, completing the gasket in just nine minutes. This reinforces its capability to produce functional parts in a matter of minutes. Overall, we are highly satisfied with the outcome, as the cut was executed flawlessly—even without the use of tabs—without any issues to report.

12. Foam tool organiser cutout

As we have already seen the machine be able to cut tough materials such as metal, ceramics, glass and plastic, it would be interesting to test the machine's capabilities in cutting softer materials. This test will consist of cutting out a foam piece measuring 25 mm in thickness being the maximum specified thickness for the machine. The model selected for the foam will be a caliper cutout as part of a foam storage system for a toolbox.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Disabled	Fine	Foam	25 mm	3 Min

Tab.20: Foam cut parameters

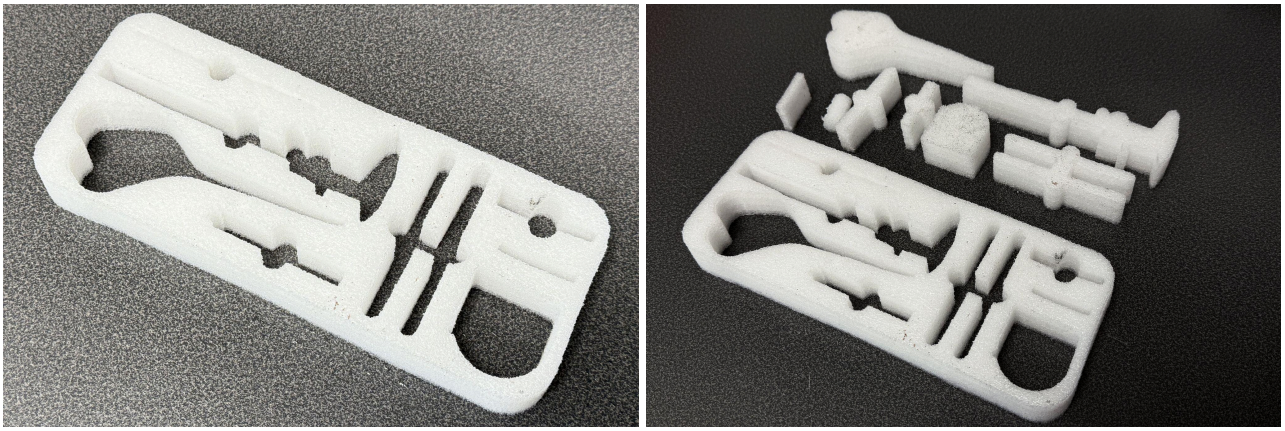

Fig.49: Foam calliper stand results

Since the foam is a soft material, we disconnected the abrasive hose and relied solely on water pressure to make the cuts shown above. Even without abrasives, the WAZER Pro easily cut through the 25mm thick foam, producing a clean, uninterrupted edge with no visible defects. The negative piece from the cut highlights the precision and smooth lines the WAZER is capable of achieving.

During the test, we observed that the abrasive dispensing system was still activating despite the hose being disconnected. A dedicated feature to disable abrasive dispensing when not needed would be beneficial, preventing unnecessary mess and improving user control.

Overall, the test successfully validated the WAZER Pro's capability to cut foam effectively. This opens up a wide range of potential applications, from precision-cut storage solutions to protective packaging, making the WAZER a versatile tool throughout a product's lifecycle.

Another excellent result from the WAZER Pro.

1 Inch Thick Aluminium Part

The objective of this test is to assess the WAZER Pro waterjet cutter's performance in processing a 1-inch (25.4 mm) thick aluminum plate for the purpose of fabricating a flange component. This test will evaluate the system's ability to produce dimensionally accurate, clean-edged, and repeatable cuts on thick non-ferrous metal stock using standard WAZER settings and tooling.

Cutting Path	Tab Placement	Cut Quality	Material	Thickness	Time predicted
Outside	Disabled	Fine	Aluminium	1 Inch	2 hours 50 mins

Tab.21: Flange cut parameters

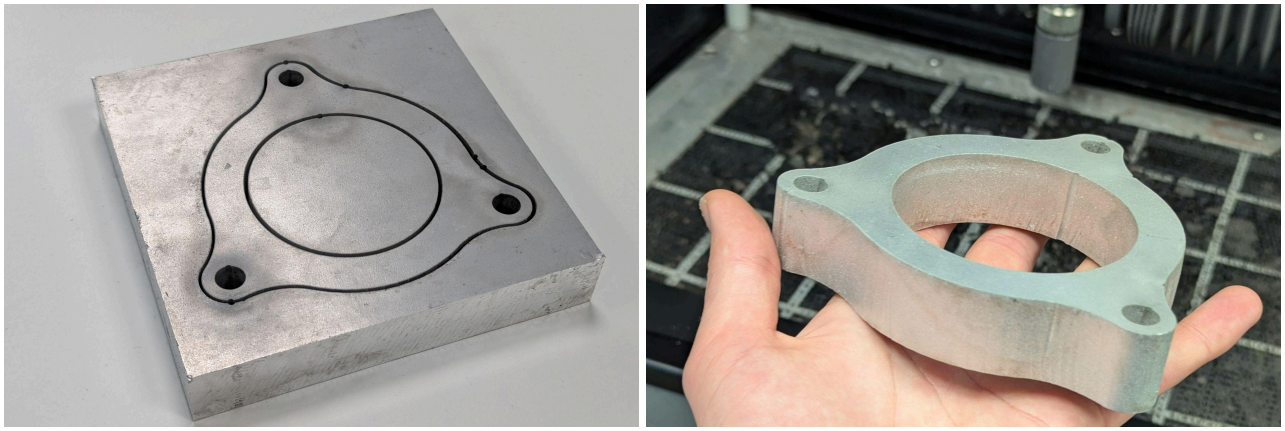

Fig.50: Flange cut result

The WAZER Pro was able to successfully complete the flange cut out in a time of 2 hours 50 minutes which is around 25.4 kg of abrasive consumed. The hoppers can only carry 19.1kg of abrasive 80 mesh alluvial garnet wherefore requires one refill. Abrasive buckets actively catch the used abrasive therefore it is important to clear these out and check these when adding more abrasive as it is likely to overfill.

Six distinct pierce marks were observed on the part surface. These defects were caused by the machine interrupting the cut cycle to reload abrasives. Each time the abrasive feed was paused and resumed, the WAZER reinitiated a pierce operation at the paused location, resulting in localized over-penetration and pitting. These marks not only impact visual quality but also contribute to dimensional inaccuracies around critical features. While not catastrophic for all use cases, these interruptions highlight a limitation of the WAZER Pro when cutting thicker stock continuously. It would be great to have a feature which allows the nozzle to shift to the waste material area when performing the pierce again and travel into position, this would minimise the causes of these marks.

Overall, the test demonstrated that while the WAZER Pro is technically capable of cutting 1-inch aluminum, **cut quality degrades toward the bottom of the material**, and **machine interruptions** can introduce flaws if not managed. These findings suggest that for mission-critical flanges or high-finish parts, either post-processing or process refinement is required to meet high-precision standards.

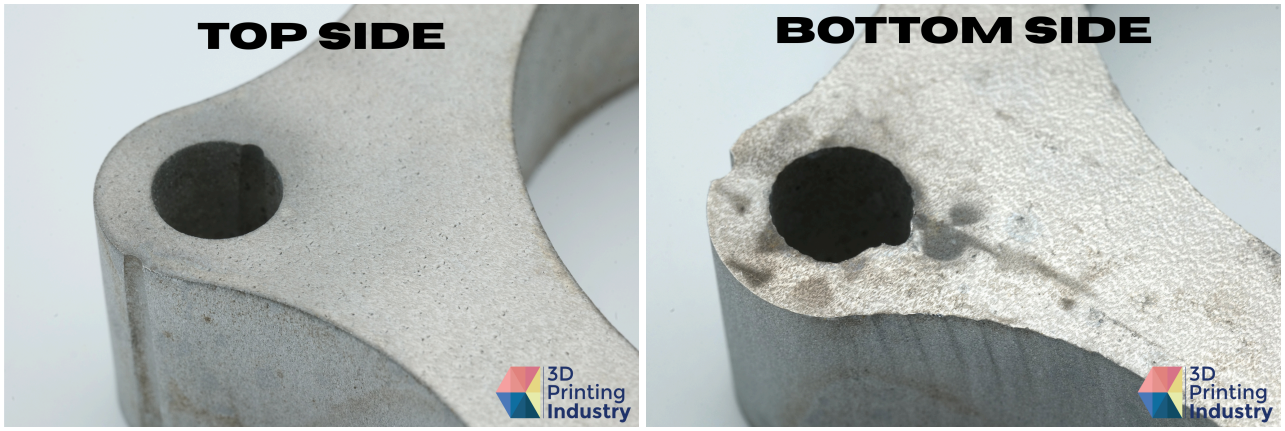

Fig.51: Surface quality of edges

The cutting test of the 1-inch thick aluminum flange on the WAZER Pro yielded a part with generally acceptable performance on the top face, but notable quality issues on the underside. The top edges of the flange were relatively smooth and consistent, demonstrating good surface finish and contour fidelity where the abrasive jet first entered the material. This suggests the initial jet performance and nozzle alignment were effective, and that the machine is capable of handling the upper portion of thick aluminum cuts with precision.

However, once the part was flipped over for inspection, it became clear that the bottom edges exhibited roughness, jaggedness, and taper-related inconsistencies. This is a typical artifact of thick-section abrasive waterjet cutting, where the energy of the jet diminishes as it travels deeper into the material. The loss of jet focus and cutting force near the bottom surface leads to visible striation marks and uneven edge quality, especially along curves and narrow geometries. This condition could require post-processing such as grinding or milling, particularly if the flange is intended for sealing or mating applications.

Hole	Reference	Measured Top	Measured Bottom	Deviance	Kerf Angle
	mm				°
1	*10*	10.21	9.89	0.32	0.36
2		10.06	9.87	0.19	0.21
3		10.03	9.74	0.29	0.33
4	*75*	75.12	74.95	0.17	0.19
Averages				**0.24**	**0.27**

Tab.22: Flange measured holes

As part of our evaluation, we performed dimensional inspection of the three flange mounting holes and the central clearance hole to assess the geometric accuracy and identify any inconsistencies introduced during the cutting process. The measurements taken from the top surface of the part revealed deviations above the nominal (reference) diameter, most notably at **Hole 1**, where the presence of a **pierce initiation point** resulted in an oversized diameter of **10.21 mm**, exceeding the design specification. This localized overcutting is attributed to the dwell time and material disruption caused during the initial abrasive piercing phase.

Measurements taken from the **underside** of the part showed consistently **undersized hole diameters**, as expected due to the **kerf taper** inherent in abrasive waterjet cutting. The energy loss and jet divergence as the cut progresses through the 1-inch (25.4 mm) thick aluminum results in a narrowing of the cut path at the exit surface. It is important to note that the exit holes were **not consistently circular**, likely due to striation-induced edge roughness and inconsistent material removal near the end of the cut path. As a result, underside measurements were approximated based on the best-fit circle method, introducing some degree of uncertainty.

The data, summarized in Table 22, clearly demonstrates that cutting thicker materials such as 1-inch aluminum significantly increases dimensional deviation compared to thinner stock. WAZER's own data claims that 95% of parts maintain a dimensional tolerance within ±0.1 mm when cutting 2 mm-thick aluminum. However, it is clear that cutting 1 1-inch-thick aluminum increases average deviation significantly, as we scored ±0.24 mm for this test cut, being more than double the nominal tolerance. This deviation is consistent with expectations for high-thickness cuts, where jet deflection, taper, and abrasive flow inconsistencies are more pronounced.

Additionally, the **kerf angle**, derived from the difference in hole diameters between the top and bottom surfaces, was calculated to have an average of **0.27°**. While this taper is relatively minor and may be acceptable for non-critical features, it should be considered in any applications requiring tight tolerances, mating fits, or circularity-dependent geometries.

In summary, while the WAZER Pro is capable of cutting through 1-inch aluminum, users should anticipate reduced geometric fidelity, particularly around features requiring high precision. These deviations reinforce the importance of design allowances, post-process verification, and possibly secondary machining for functional parts.

VII. Conclusion

Strengths

To conclude this report, this section highlights key observations from our work with the WAZER Pro waterjet cutter.

- **Maintenance**

The WAZER Pro is designed for ease of maintenance, allowing users to quickly replace key components such as the jet cutting nozzle, which lasts approximately 300 hours, and the sacrificial cutting bed, which serves between 20 to 40 hours before needing replacement.

Fig.52: Maintenance

Regular maintenance is straightforward, with abrasive catch buckets requiring inspection and emptying every two hours of cutting to prevent buildup of abrasive on the bottom of the tank. Similarly, the machine's filters—located at the back—should be checked periodically. The WAZER Pro includes additional features that streamline maintenance, slightly reducing the amount of hands-on work required compared to previous models.

- **WAM Software**

WAM is WAZER's proprietary G-code generation software, responsible for converting designs into precise cutting commands. It runs on a web-based interface and follows an intuitive six-step workflow, making it easy to learn within the same day.

The software simplifies the process of importing, processing, and exporting G-code files. It includes a comprehensive material library covering a wide range of cutting applications. Additionally, users have the flexibility to input custom parameters, allowing for fine-tuned control when working with specialized materials.

- **Machine Controls & Usability**

The control panel, located on the right-hand side, is housed within the aluminium frame and features:

- Emergency stop button
- D-pad with a central select button
- Start/stop button
- Small LCD screen
- SD card slot for loading files

The interface is clean and well-organized, prioritizing frequently used options for efficient navigation. Fastening materials is simple, using low-tech screws to secure them to the bed, and bed levelling is achieved

through four spring-supported bolts positioned at each corner.

- **Customer Support**

WAZER's customer support is exceptional, providing timely and knowledgeable assistance. Additionally, SolidPrint's reseller support team is highly responsive, offering expert guidance and fast response times. This level of support has been among the best we have encountered, ensuring a smooth experience for users.

- **Cutting Performance & Accuracy**

Most of our functional parts tests were completed successfully, though there is a learning curve for optimizing cuts and post-processing. Once users understand best practices, cut success rates improve significantly. Compared to the WAZER Desktop, the WAZER Pro demonstrated noticeably better dimensional accuracy, particularly in square and circular cutouts marking a significant improvement over the previous model.

- **Backflow Sensor**

A new feature in the WAZER Pro, the backflow sensor helps prevent issues by detecting water intrusion in the abrasive tube. The system consists of two wires positioned 2 inches apart inside the abrasive hose. If water backflows, the connection triggers a pause in cutting, notifying the user. This is an excellent preventative measure, though adding an app notification system would further improve usability by alerting users remotely.

- **Submerge cutting**

When activated, this feature fully submerges the part by filling the tank until the water level is just above the nozzle compressor tube. This serves multiple benefits, starting with noise reduction, as the water acts as a natural sound dampener, significantly quieting the cutting process. Additionally, it enhances cutting quality by containing the abrasive stream and minimizing heat buildup, resulting in cleaner, more precise cuts, particularly for delicate materials such as glass and thin metals. The submerged cutting process also improves safety by preventing water and abrasive particles from splashing out, ensuring a cleaner and more controlled cutting environment.

- **The absolute locating jig**

An **absolute locating jig** provides a significant benefit in enhancing the precision, repeatability, and efficiency of cutting operations on machines like the WAZER Pro. By establishing a fixed and known datum point on the cutting bed, the jig allows users to reliably position materials in the exact same location for every job. This is especially valuable for operations such as double-sided cuts, part rework, or batch production, where consistent alignment is critical. It eliminates the need to repeatedly re-zero or manually measure the material's position, reducing setup time and minimizing user error. Furthermore, the jig supports streamlined digital-to-physical alignment users can confidently set their design origin in the WAZER software to match the jig's fixed offset, ensuring that the cut geometry aligns perfectly with the intended part layout every time. Ultimately, it contributes to improved workflow, tighter tolerances, and higher quality results, especially when dealing with pre-machined materials or complex multi-step cutting processes.

Weaknesses & Areas for Improvement

While the WAZER Pro excels in many areas, some aspects could be refined in future updates to improve workflow and functionality.

- **Backflow Sensor Sensitivity**

While the backflow sensor effectively detects water intrusion, we encountered false triggers after resuming cutting. Even after clearing moisture from the abrasive hose, the sensor remained active, likely due to residual moisture on the connectors or over-sensitivity.

Suggested Improvement:

Reduce sensor sensitivity or introduce a temporary bypass option to disable detection for three minutes after clearing moisture.

- **WAM Software Customization & Cloud Features**

While WAM is intuitive and well-suited for beginners, it lacks the customization and advanced editing features found in other CNC software like LightBurn (commonly used for laser cutters).

Suggested Improvements:

Expand editing tools to allow minor DXF file adjustments without switching to third-party software.
Introduce cloud-based functionality for wireless device connection, remote control, and file transfers.

- **Automatic Tab Generation**

Currently, WAM systematically generates tabs width based of the material type and thickness so that it can securely hold waste material while also enabling the user to remove the waste off the raw part when applying a 10N force. However we found it to be a little tough.

Suggested Improvement:

No suggestions. Users already have the option to manually adjust the tabs thickness.

- **Abrasive Dispensing Control**

When cutting soft materials like foam, abrasive is still dispensed despite not being necessary.

Suggested Improvement:

Add a toggle option to disable abrasive dispensing for materials that only require high-pressure water.

- **Backflow Pause & Resume Logic**

Currently, when resuming after a backflow pause, the WAZER Pro does not rewind the toolpath enough, leading to large unwanted tabs at the resume point.

Suggested Improvement:

Modify the resume logic to rewind slightly further back in the G-code, allowing the abrasive to fully catch up before continuing at the original position.

- **Quality in cutting 1 inch thick aluminium**

Although the WAZER Pro is able to cut 1 inch thick aluminium successfully, the quality can be said to be sub-optimal as it leaves rough edges on the underside of the part. This would then require post processing for perfecting. Users should keep this in mind as dimensional accuracy can be affected.

1. Overall feeling

The WAZER Pro showcases significant advancements in cutting accuracy, usability, and maintenance, making it an excellent choice for users seeking a compact yet high-performance waterjet cutter. While certain workflow refinements and software enhancements could further improve the user experience, the machine's strengths far outweigh its limitations, delivering high-quality, repeatable results across a wide range of materials.

Priced at $18,999 per unit, with the option to trade in the Desktop version for a discount, the WAZER Pro is a cost-effective solution, especially compared to its closest competitor, which exceeds $50,000. This pricing makes it an appealing choice for professionals who don't require a large-format industrial waterjet cutter but still need precision and versatility.

One of the most notable upgrades is the water pump, capable of producing 2.1 kW of hydraulic power, a significant improvement over the previous model. This enhancement expands the machine's cutting capabilities, allowing it to handle a broader range of materials and cut thicker sections with greater efficiency. Another major improvement is the integration of hardware within the machine's frame, eliminating the need for a separate pump unit, which enhances both workspace efficiency and build quality. Maintenance has also been made straightforward, with easy access to replaceable components.

The workflow is intuitive, requiring minimal training, and this extends to the WAM software, which allows users to manually input custom material profiles after optimizing cutting settings. WAZER follows a continuous improvement philosophy, frequently updating software and firmware to refine the machine's capabilities. However, there is room for further software enhancements, particularly to accommodate more advanced users by expanding available tools and customization options.

Several key features stand out, including the upgraded water pump, submerged cutting feature, backflow sensor, improved water hose system, and self-cleaning functions, all of which reduce hands-on maintenance. The submersible cutting option effectively reduces noise, enhances cut quality, and improves safety, making it an excellent addition. While the backflow sensor has both advantages and minor drawbacks, it remains a valuable feature with room for improvement.

The WAZER Pro has demonstrated outstanding repeatability, as seen in our precision testing. Repeatability square tests yielded a mean difference of just 0.02 mm and a standard deviation of 0.011 mm, both well below the acceptable limit, highlighting the machine's exceptional accuracy and precision. The circular trajectory test further confirmed optimal belt tensioning, with no significant deviations across either axis. The only slight discrepancy was observed in dimensional accuracy on larger parts, with smaller circles performing more consistently.

Overall, the WAZER Pro is a substantial improvement over its predecessor, the WAZER Desktop. Its affordable price positions it as a high-value alternative to expensive industrial waterjet cutters, making it an ideal choice for professionals and workshops that require precision cutting without the footprint or cost of a full-sized system.

In terms of usability, WAZER has done an excellent job in streamlining the workflow, allowing users to learn the process within a single day, resulting in a smooth and satisfying learning curve. Our application tests further reinforce the machine's versatility, cutting a variety of materials and thicknesses that laser cutters simply cannot handle. The engineering behind the WAZER Pro is highly impressive, and it's easy to see why it has become such a successful and well-regarded product.