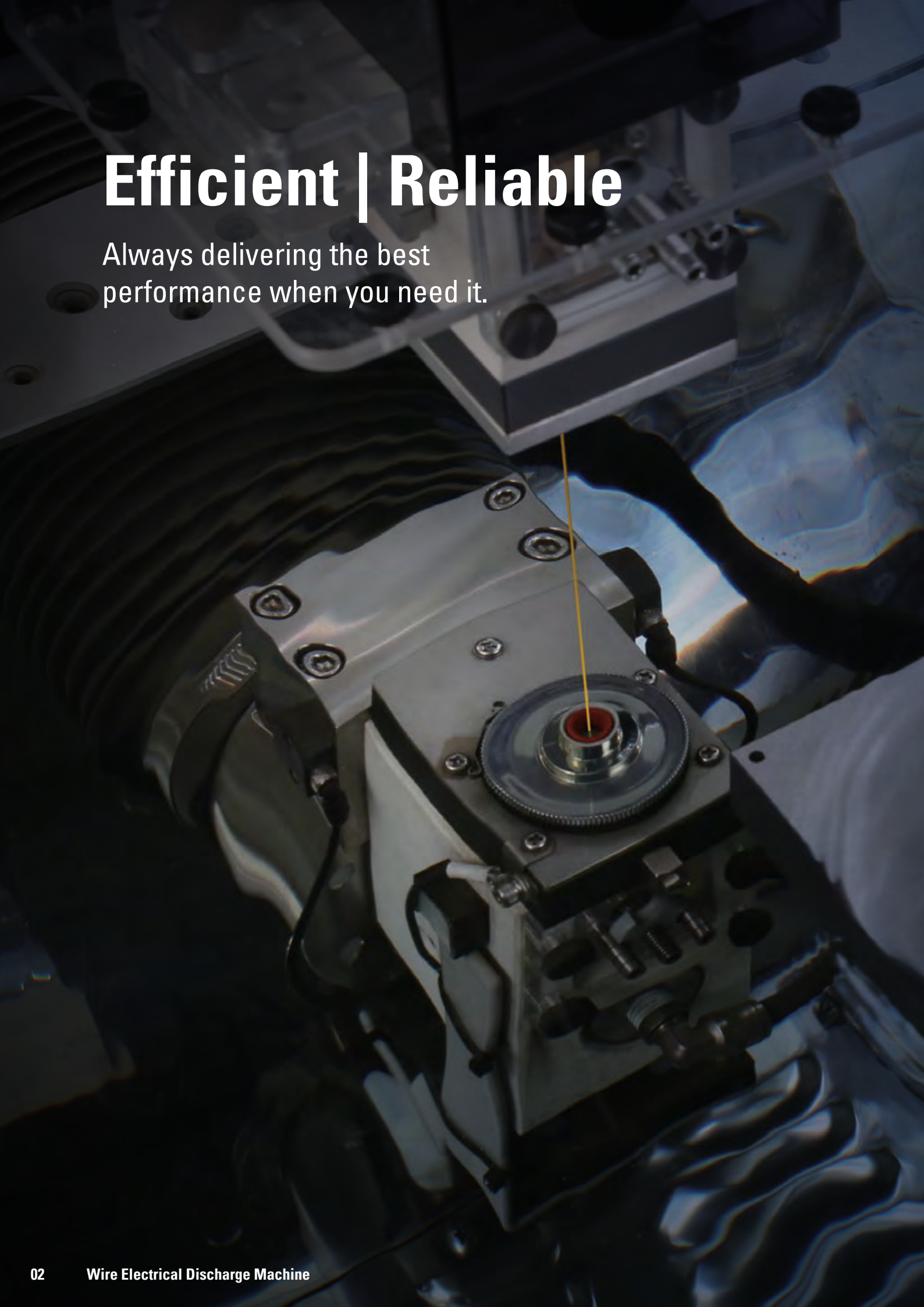
U SERIES

U3 U6 | U3H.E.A.T. U6H.E.A.T.

Wire Electrical Discharge Machine

MAKINO



Efficient | Reliable

Always delivering the best
performance when you need it.

Makino U Series

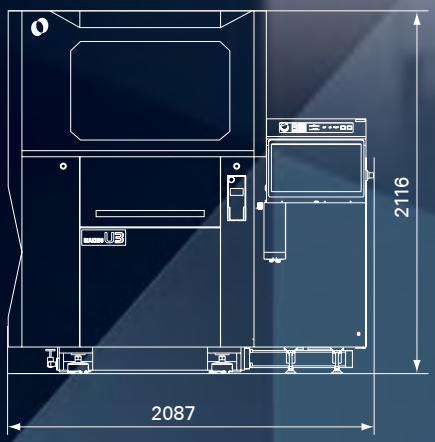
Wire EDM machines that cut parts while cutting costs!

Makino's new U series was designed and built to produce your parts to run continuously with minimal operator intervention. Makino EDM's have been recognized as setting the bar for low operating costs, reduced maintenance as well as the lowest wire consumption in the EDM industry.

Our key technologies such as **H.E.A.T.** (High Energy Applied Technology) and the newly developed **Hyper-Cut** guarantee the fastest machining possible while maintaining accuracy and desired surface finish. Having brought the EDM industry superior mechanical and electrical technologies, Makino EDM debut's the next generation in EDM control's "**Hyper i**". Minimal operator knowledge is required as the Hyper i control has built in features that are intuitive and easy to use.

U3 U3 H.E.A.T.

Compact design

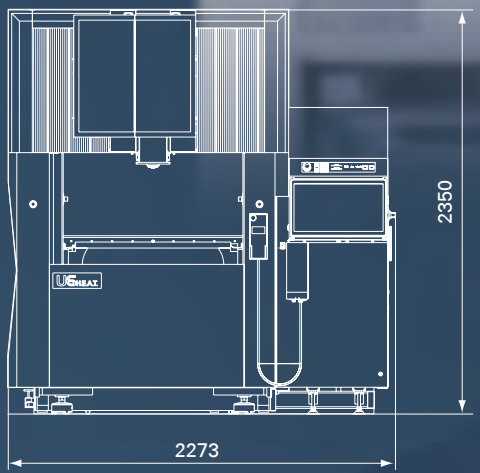


		U3 / U3 H.E.A.T.
Axis travels (X x Y x Z)	mm	370 x 270 x 220
Axis travels (U x V)	mm	±50 x ±50
Maximum workpiece size (L x W x H)	mm	770 x 590 x 220
Maximum dielectric fluid height	mm	260
Maximum workpiece weight	kg	600
Height to table surface	mm	950
Machine Weight	kg	3400
Wire electrode diameter	mm	0.1, 0.15, 0.2, 0.25, 0.3

U6 U6 H.E.A.T.

*Additional 2nd screen, keyboard and mouse are optional

Compact design



		U6 / U6 H.E.A.T.
Axis travels (X x Y x Z)	mm	650 x 450 x 420
Axis travels (U x V)	mm	±75 x ±75
Maximum workpiece size (L x W x H)	mm	1000 x 800 x 400
Maximum dielectric fluid height	mm	455
Maximum workpiece weight	kg	1500
Height to table surface	mm	1000
Machine Weight	kg	5200 / 5300
Wire electrode diameter	mm	0.1, 0.15, 0.2, 0.25, 0.3

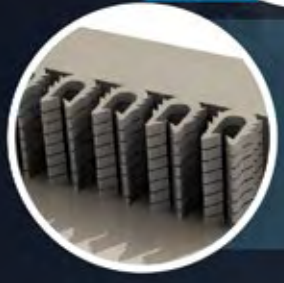
Solutions for every Industry

The Makino U Series will provide a Universal approach to a wide range of applications sure to address the most demanding needs of Die/Mold, Job Shop, and Production Machining industries.

Medical Guide Plate

Medical Surgical Instrument: Guide Plate

- 420 Stainless Steel, 50mm thick
- H.E.A.T. improves the productivity of Index & Burn operations
- Cost efficient manufacturing with (3) parts stack process
- Rotary table used to machine multiple parts and part details in a single setup



Medical Implant: Staple Production

- Titanium Alloy - 6Al4V, 9mm thick
- Parts Production using dia. 0.100mm Brass Wire and a rotary table
- Minimal recast layer and without any "Bluing" effect
- Machining time: 5min 30 sec per part (when machining 40 parts)

Stamping Die Punch
- Tool Steel, 100mm thick
- Hyper-Cut Technology achieves a superior surface finish of 3,5 µm (0.42 µm Ra) in just 3 cuts
- Straightness: 2 µm (one side)

Stamping Die Punch
- Carbide (G3) , 100mm thick
- To address all requirements a wide range of machining conditions are available as standard Fine surface finish of 1µmRz (0.14 µmRa) is achieved in just 5 cuts

Stamping Die Plate
- Tool Steel, 20mm thick
- Makino Pico guides cut small Micro tapers with the highest possible accuracies and ensure successful wire threading into small holes.

Production of Gear
- 420 Stainless Steel , 50mm thick
- H.E.A.T. Technology provide outstanding high-speed machining of 128 mm2/min in the most difficult flushing conditions with nozzles detached from the work piece.
- Surface finish down to 4.8 µmRz (0.6 µm Ra) is achieved in just 3 passes

Plastic injection cavity for car dashboard
- Tool Steel, 200mm thick
- Fast and accurate machining is realized even with work pieces containing complex thickness transitions
- Eliminate post-process hand polishing

Power Generation Insert
- Inconel - high nickel alloy , 150mm thick
- H.E.A.T. technology provide high speed machining in the most difficult flushing conditions using 0.3mm wire Hard Brass

Aerospace Hinge
- Titanium Alloy - 6Al4V, 120mm thick
- Wire Type: 0.300mm Hard Brass
- Achievable straightness to 5 µm in just one pass
- High Tolerance Metallurgical Integrity and Less Recast Layer

Medical Surgical Tool
- Tool Steel (2.3mm Dia.)
- Machine extremely fine details with wire dia. 0.1mm and Wire EDM Turning at 800rpm

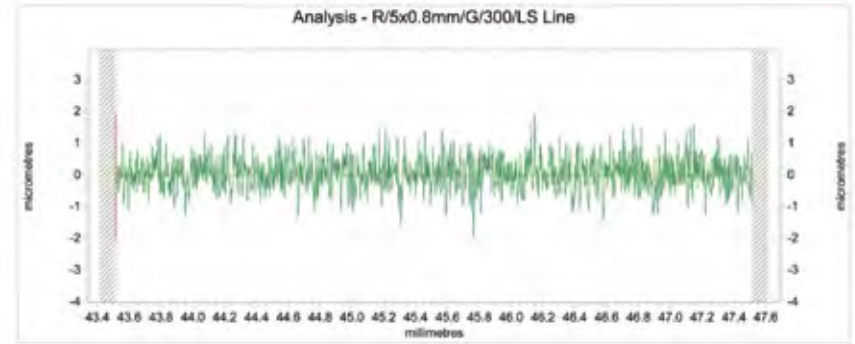
Hyper-Cut

Hyper-Cut Technology addresses the demanding need to deliver a superior surface finish while reducing trim cuts.

Hyper-Cut was specifically developed for the precision stamping die building industry.

Competitive results are achieved in a wide range of applications using different wire type, wire size diameters, workpiece thickness and materials.

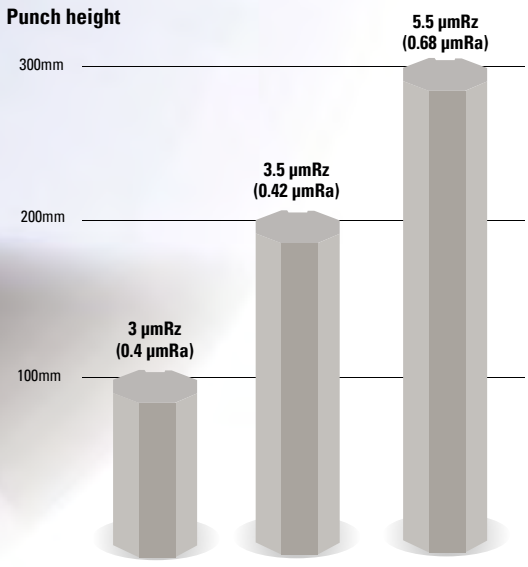
3 µmRz/3 Pass Machining on Steel



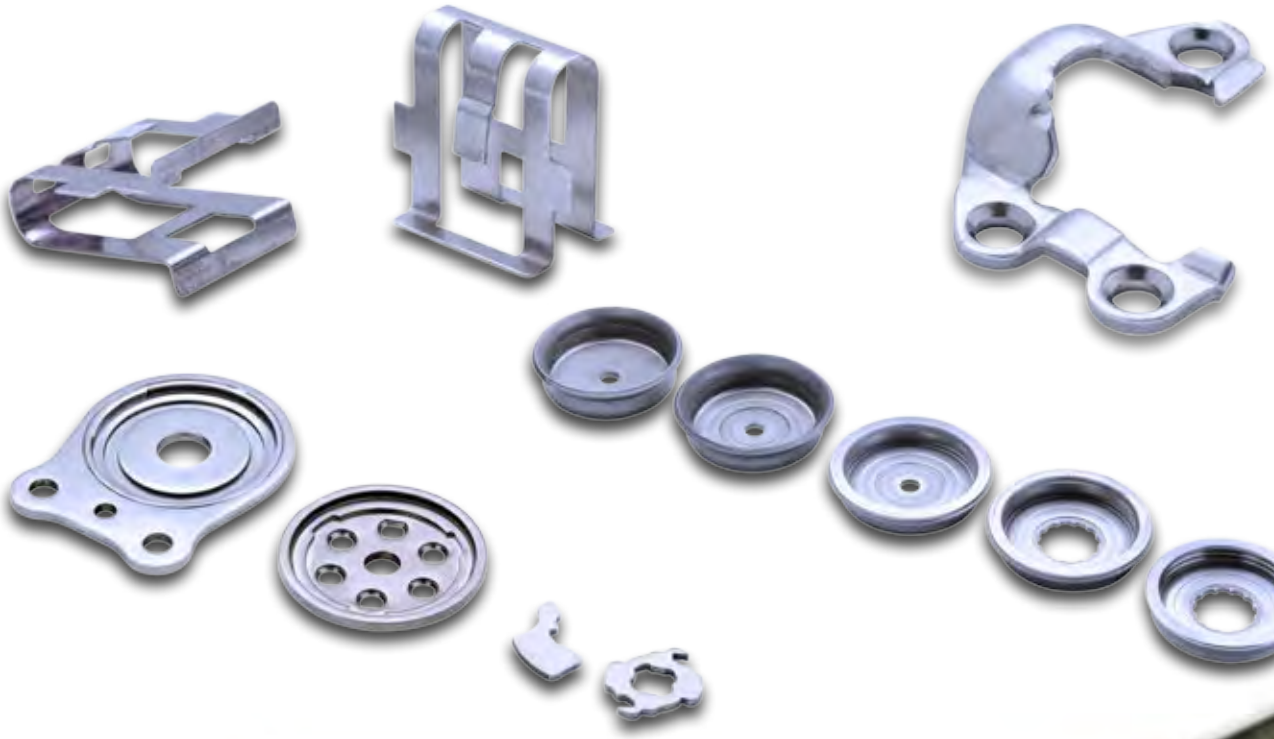
Workpiece Material:	Steel (SKD-11)
Wire Used:	0.25mm dia. Brass Wire
Material Thickness:	80mm
Surface Finish:	3 µmRz (0.4 µmRa)

Surface finish down to 2.5 µm Rz (0.34 µmRa) can be realize as well using only 4 Pass Machining (Steel, 80mm Thick).

Superior surface finishing even in the tallest workpiece applications

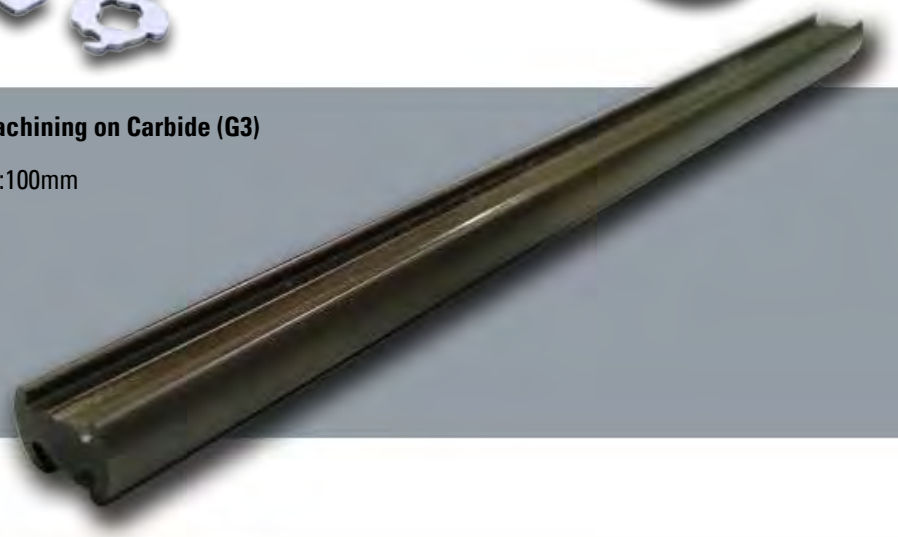


Surface finishing with just 3 cuts machining:Steel



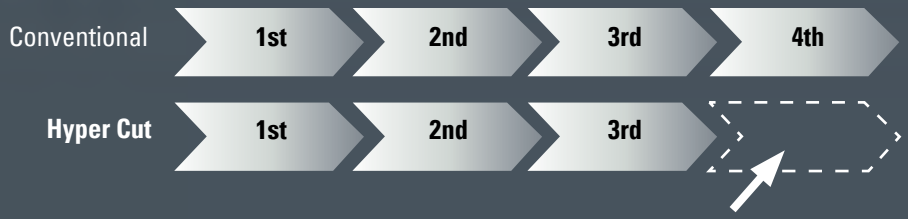
2,5 µmRz/3 Pass Machining on Carbide (G3)

Material Thickness:100mm



Cut fast with less wire

Comparison of machining time with surface finish is 3 µmRz (Ra0.4 µm)

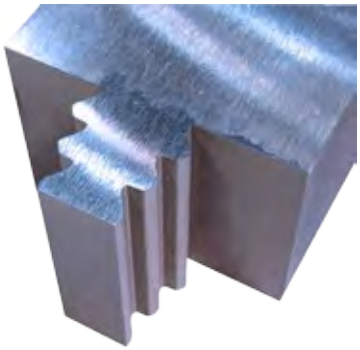


The elimination of the 4th Skim Cut provides a **20%** Reduction of Cycle Time and an additional **14%** reduction in Wire Consumption.

Hyper-Cut address the most demanding needs of every Industry

Aerospace – Fir Tree

410 Stainless Steel, 38mm thick
Machining Time: 1 hr 17min
Surface finish: 3 µmRz (0.4 µmRa)

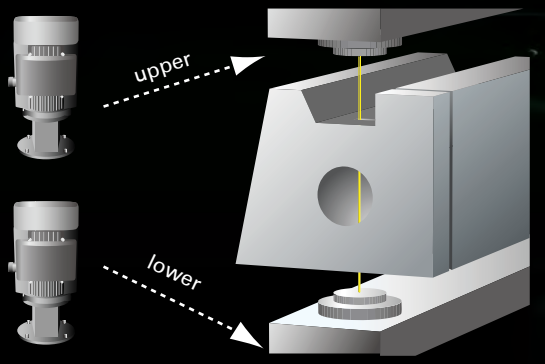


H.E.A.T.

High Energy Applied Technology

Fastest both nozzle away machining in the world

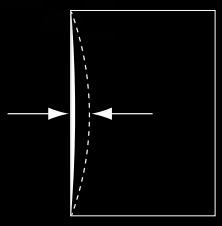
In EDM, the most difficult cuts are when the nozzles are detached from the workpiece. Makino **H.E.A.T.** Technology uses a combination of flushing enhancements and special generator upgrades that greatly increase cutting speed. As a result, Makino H.E.A.T. Technology delivers a part to the customer with minimal operator intervention, fast, accurate and with superior surface finishes. This combination is unmatched in the EDM industry.

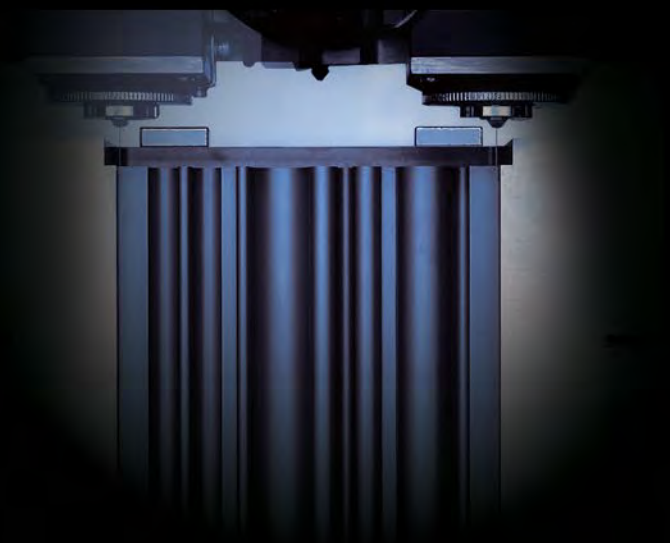


H.E.A.T. Technologies unique flushing capability is a result of our High Capacity Digitally Controlled Dual Flushing pumps.

Workpiece material : S55C (steel)
Wire used : Dia. 0.25 mm Brass wire
Plate thickness: 150 mm
No. of passes: 1
Machining nozzle position: Top and bottom separated by 8 mm
Machining length: 353.8 mm

Straightness Improved by **58%**
12 µm ➔ 5 µm on one side

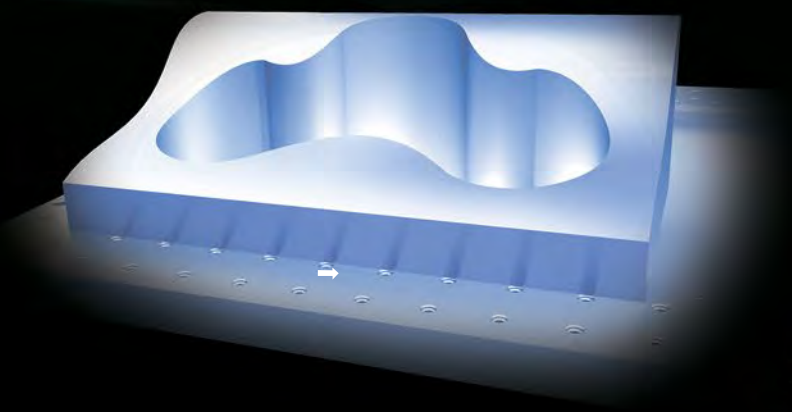


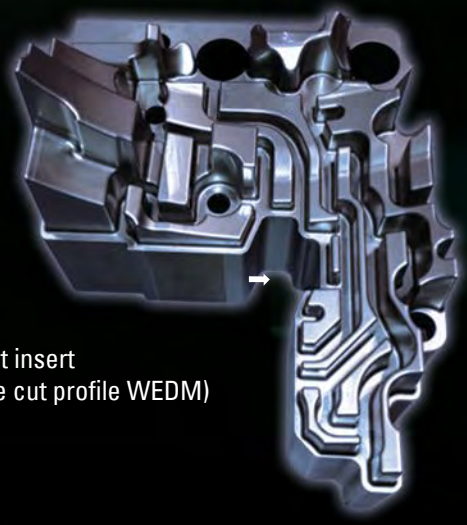


Machining speeds improved by **75%**
49,50 mm² / min ➔ 87,00 mm² / min

Machining time reduced by **43%**
17 ore 52 min. ➔ 10 ore 10 min

Plastic injection cavity
for car dashboard

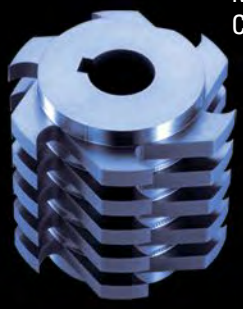




Die cast insert
(outside cut profile WEDM)

Medical Instrument

Mechanical
Component

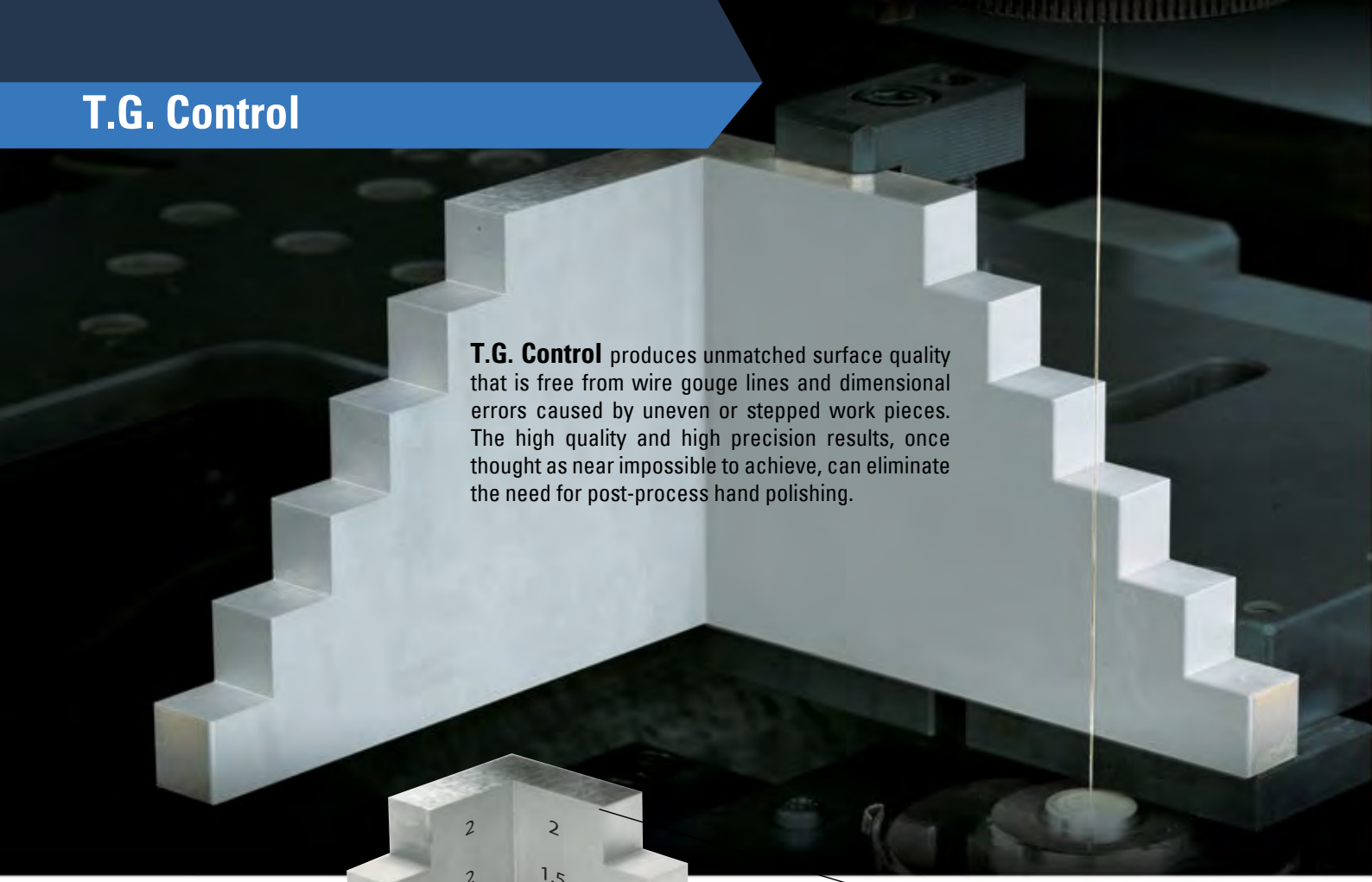


H.E.A.T. 3pass machining

Surfaces finishes down to Rz 5µm can be achieved using just three passes using H.E.A.T. Technology.

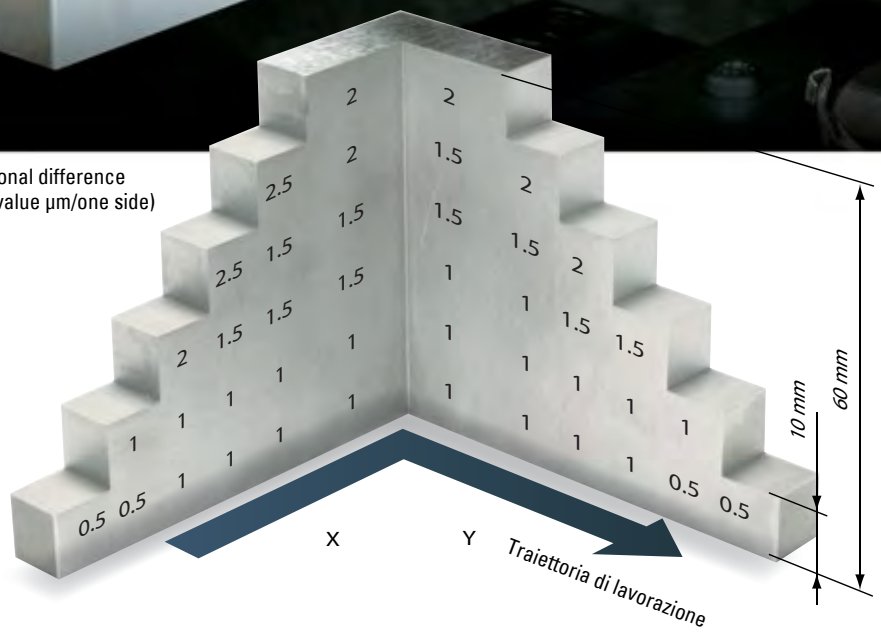
Workpiece material:	STAVAX (stainless steel)
Wire used:	Dia. 0.25 mm (BS)
Plate thickness:	60~100 mm
No. of machining passes:	3
Machining speed:	1st 1.9-1.3 mm / min
	2nd 7.8 mm / min
	3rd 8 mm / min
Surface finish:	Rz 5 µm (Ra 0.68 µm)

T.G. Control



T.G. Control produces unmatched surface quality that is free from wire gouge lines and dimensional errors caused by uneven or stepped work pieces. The high quality and high precision results, once thought as near impossible to achieve, can eliminate the need for post-process hand polishing.

Dimensional difference
(Actual value µm/one side)



Workpiece material	:SKD-11(steel)
Wire used	: Dia. 0.2mm(BS)
Plate thickness	: 10-60mm
No. of machining passes	: 2
Surface finish	: Rz 10µm(Ra 1.4µm)

There are a wide range of material thickness variation conditions with available second and third machining pass settings. Compatible wire diameters: Dia. 0.200, 0.250, and 0.300mm

No difference in part straightness and surface finishes even in opposite machining directions.

- Machining from the higher to lower levels of a workpiece.
- Machining from the lower to higher levels of a workpiece.
- Machining in different axis directions, such as X and Y.

Machining Conditions:

- ► 5 ~ 20mm plate thickness
- ► 10 ~ 60mm plate thickness
- ► 40 ~ 100mm plate thickness
- ► 80 ~ 150mm plate thickness

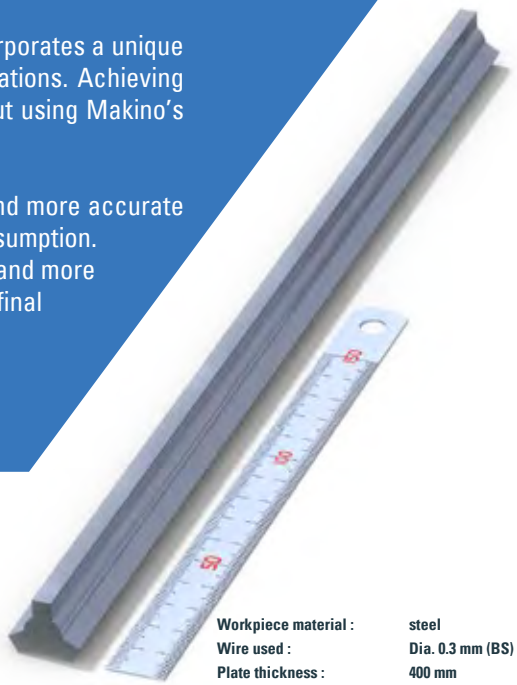
Surface finishes down to Rz 4µm (Ra 0.5µm) can be realized using only 3 Pass Machining.

Extrusion dies with TG - Control

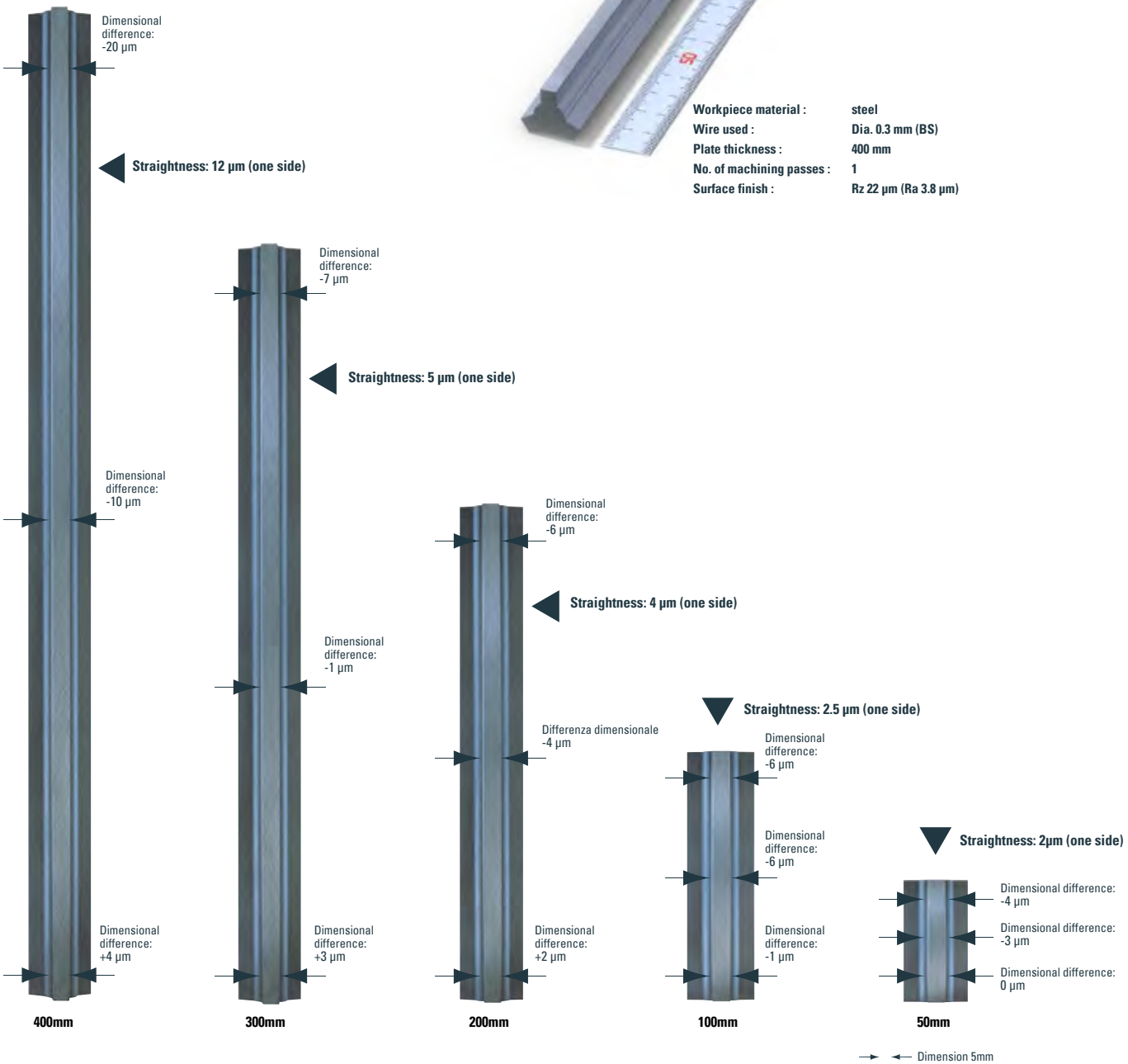
Incredible straightness

Makino's proven technology **GS-Cut (BellyWIZARD)** incorporates a unique approach to part straightness in the tallest workpiece applications. Achieving tolerances of 5 µm over 300mm are realized using only one cut using Makino's Belly Wizard Technology.

This efficiency-enhancing technology produces a straighter and more accurate work piece during the Rough Cut while also reducing wire consumption. From this improved precision, Finishing Passes are also faster and more accurate by having to remove less material and error from the final work piece.



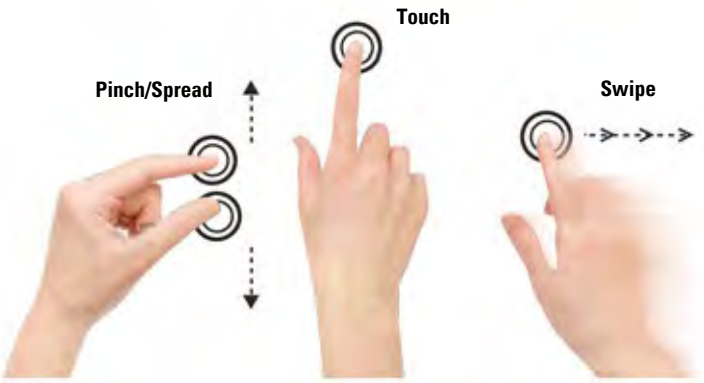
Workpiece material :	**steel**
Wire used :	**Dia. 0.3 mm (BS)**
Plate thickness :	**400 mm**
No. of machining passes :	**1**
Surface finish :	**Rz 22 µm (Ra 3.8 µm)**



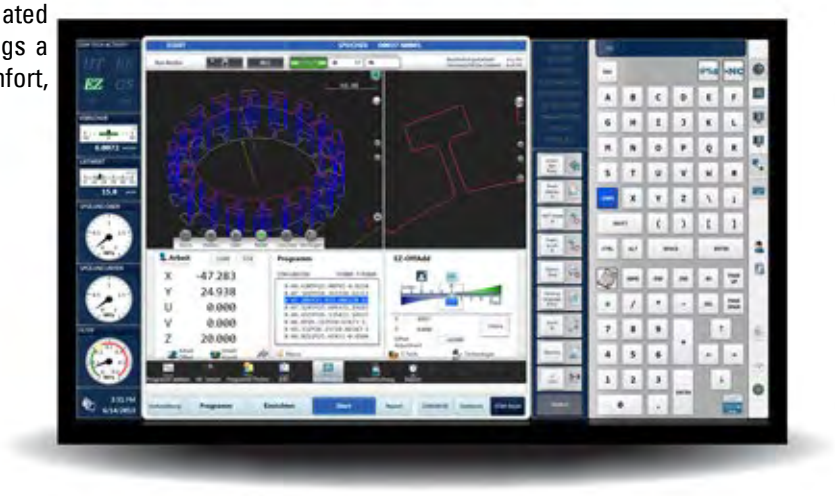
*i*ntuitive | *i*ntelligent | *i*nteractive

Makino's new **Hyper i** control revolutionizes the interface between the operator and the machine. Using the most current interface technologies used by SmartPhones and Tablets, Makino's Hyper i Control makes use of Pinch, Swipe and Spread functions that provide the operator with a simple and natural feel that is comfortable and extremely efficient. The user friendliness of the Hyper i Control is further enhanced with the integration of on-board digital manuals, intelligent help functions, and e-Learning training system.

Any operator with a basic knowledge of machining can learn Makino's Hyper i Control. Operators quickly learn and appreciate the technology and power that the Hyper i Control provides, and most operators are able to produce sophisticated part details on the first day of installation. Hyper i brings a completely new level of user-friendliness, operator comfort, and efficiency to the shop floor.



Gesture Control is the natural way to interact with the machine

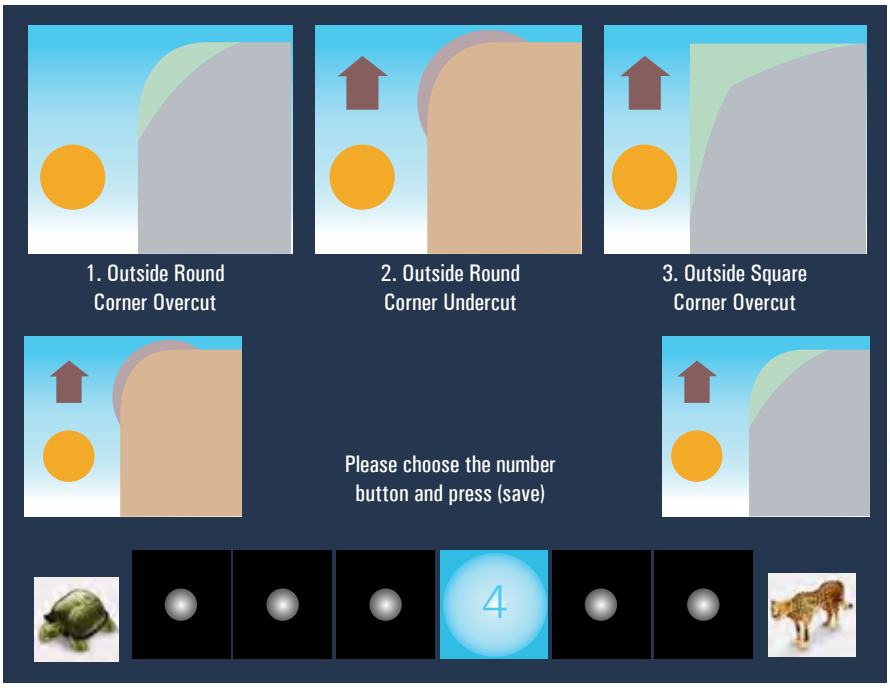


High Definition Screen

E-Tech Doctor can help you to achieve your perfect cut! E-Tech Doctor is a revolutionary method of adjusting machining conditions to create the desirable result.

E-Tech Doctor can make improvements in these 3 areas.

- ► **Corner Accuracy**
- ► **Straightness**
- ► **Flatness of Lead/Entry Point**

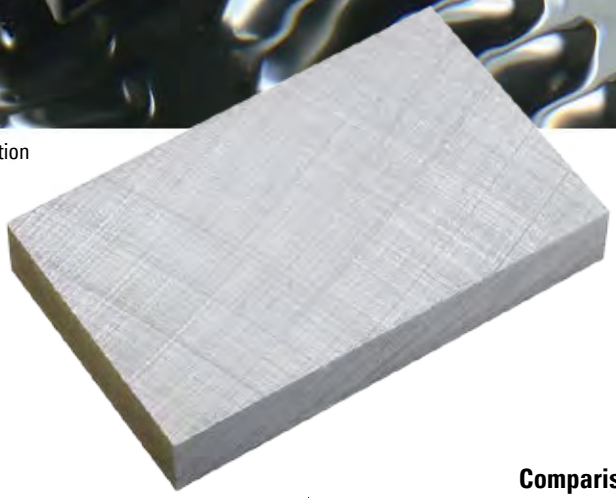


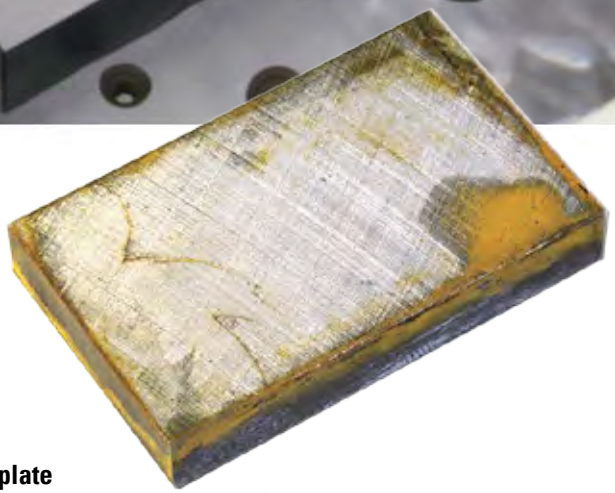
ProTech

ProTech* Technology is a proprietary enhancement to the U series that protect the work piece against rust. No need for harmful additives that may effect resin life as well as unpleasant side effects.

Benefits are effective on several kind of materials such as: Steel, Carbide and Aluminum

*Option

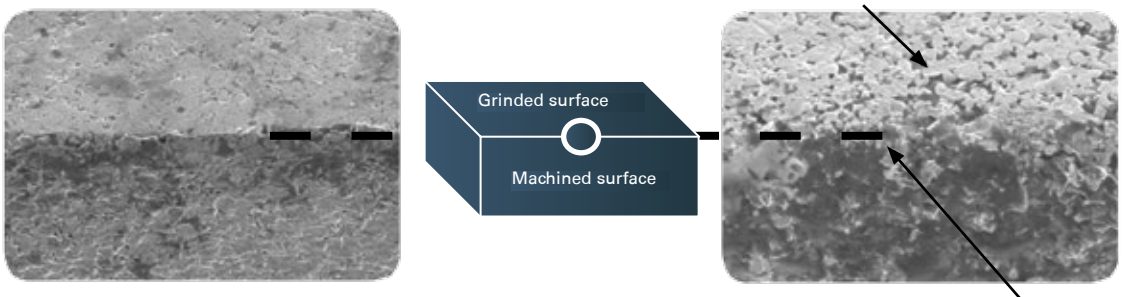




Comparison of a Steel plate
Condition: parts are submerged for 24 hours
Water conductivity: 15 µS / cm
Material: Steel S55C

With ProTech

Without ProTech



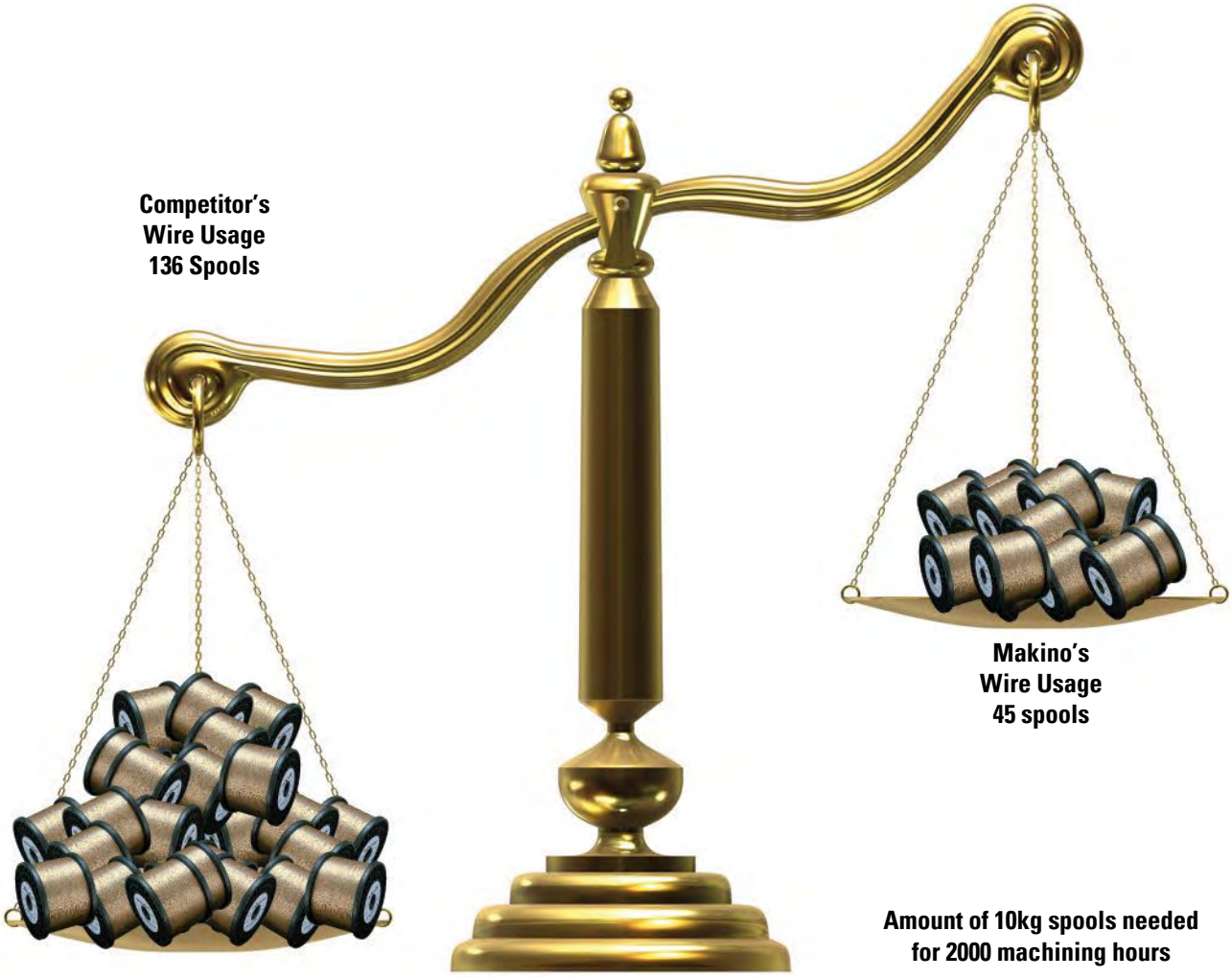
Comparison of a Tungsten Carbide
Condition: parts are submerged for 24 hours
Water conductivity: 15 µS / cm

Low Wire Consumption

Cut Fast, Cut Accurate, and Save Money!

The biggest expense in operating a Wire EDM machine is the consumed wire, and Makino has been the industry leader in low wire consumption technologies. There are no special settings or "part-time" buttons an operator has to enable to save on wire costs; every cutting condition, including sealed and poor flush applications, is automatically optimized and designed from the ground-up on the Makino for low wire consumption. Optimum Machining Performance is the ideal mix of Machining Speed, Part Accuracy, and Wire Consumption for the best combined efficiency, throughput, and cost. Only Makino can provide all 3 for every condition and application!

Up to 60% savings in wire costs



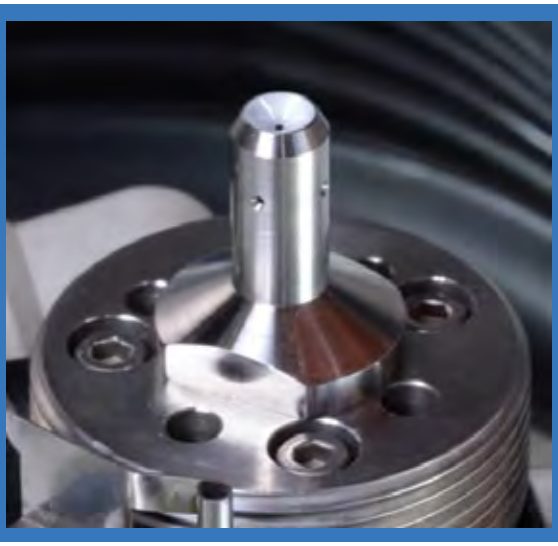
Amount of 10kg spools needed for 2000 machining hours

Dual Guide Option

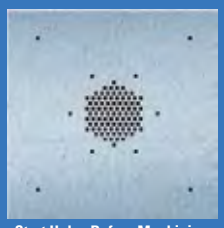
PICO Precision Guide system

Wire diameter: Dia. 0.1, 0.15, 0.2, 0.25, 0.3 mm

Pico Precision Guide System offers an innovative approach to closed round guides with high precision. Our Pico guides are specifically designed to cut Micro tapers with the highest possible accuracies. Initial start holes as low as 0.3mm are automatically threaded without failure. These guides also are able to successfully thread small holes located in very tight pitch locations.

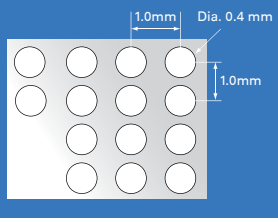


Automatic wire threading through 0.4mm diameter start holes in close proximity at a 1mm pitch.



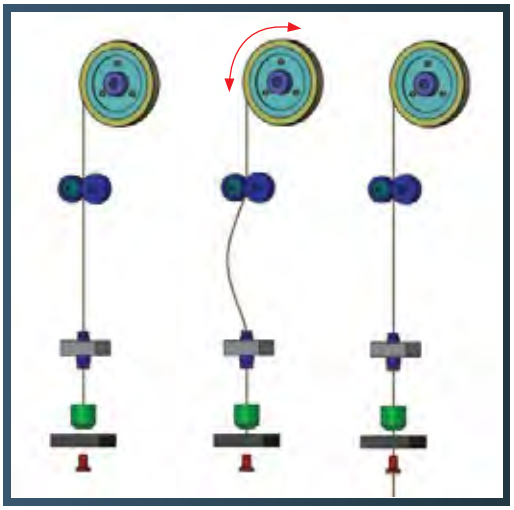
Start Holes Before Machining

After Machining

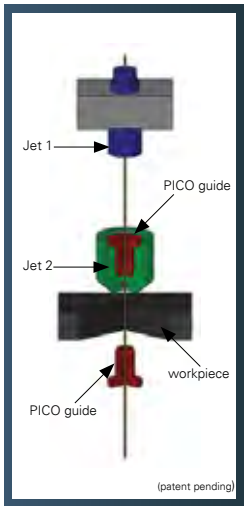


The wire is thread automatically through 0.4mm diameter start holes in close proximity at a 1mm pitch. The optimum fluid jet diameter can be selected to match the workpiece thickness and start hole diameter. Fluid jets are easy to replace and available in diameters of 0.5, 0.7 and 1.2mm

PECKING FEED SYSTEM



TWIN JET SYSTEM



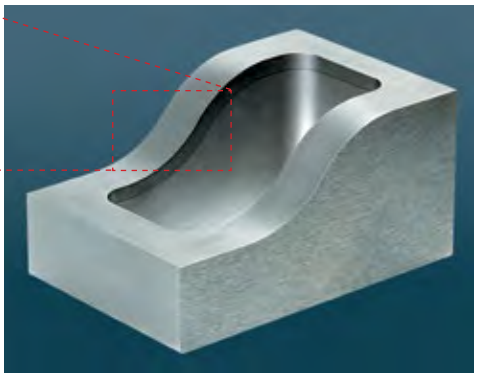
High performance twin-jet automatic wire threading system

Pico Precision Guides use a unique twin-jet system that can form a small diameter jet to assure pin point accuracy for reliable Automatic Wire Threading. The additional feature of our pecking system add further assurance of successful unattended operation. The design of the Guide Assembly allows quick exchanging of the wire guide diameter without the need to square or vertically align the wire.

Micro taper machining

The PICO guide system facilitates high-accuracy machining of micro tapers. This new guide system, combined with precise servo control, produces uniform machining along the entire length of the cut detail.

Workpiece Material: S55C (tool steel)
Wire Used: Dia. 0.2mm Hard Brass
Process: 3 Pass Machining
Operation: 4-Axis Machining of Trim Die
Geometry: 2.0mm Straight Land with 1° Back Taper Relief over 3D Contour

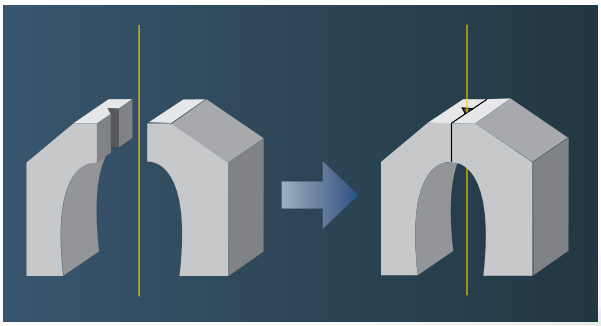


Split Precision Guide system

Wire diameter: Dia. 0.1, 0.15, 0.2, 0.25, 0.3 mm

Split Precision Guides use two separate PCD components mounted to ceramics. The Split Precision guides open during threading cycles, assuring AWT reliability at any height. This low maintenance system also reduces operator intervention, and provides extremely long guide life. Split Precision guides are offered in V-Flat and C-Type configurations. The Split Precision V-guide system is perfect for high production applications, while the Split Precision C-Guides are the best solution for high taper angle machining.

AWT to 300 or 400mm-thick workpiece



Split Precision guides perform reliable threading cycles in thick work pieces as a result of a larger target area while the guides are open.

Maximum plate thickness capable of automatic threading

Machine	Plate Thickness
U3	200mm
U6	400mm

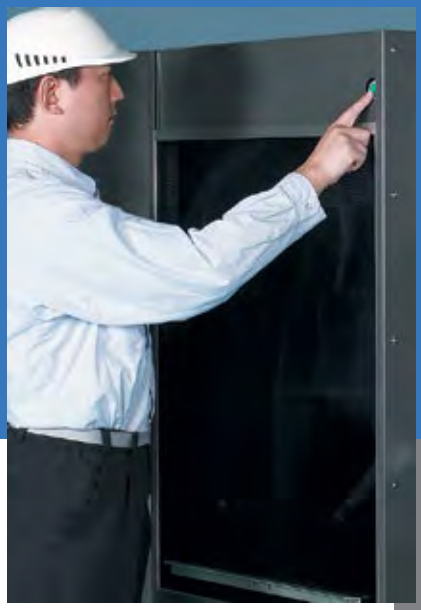
Common to Split Precision and PICO High Speed AWT to 10 seconds

The optimal threading cycle can be selected according to the process or application, such as hole diameter size, plate thickness, or wire type used. These threading options will increase the reliability and speed cycle of the Auto Wire Threading process, and are vital in supporting the reliable wire threading of special high-speed coated wires.

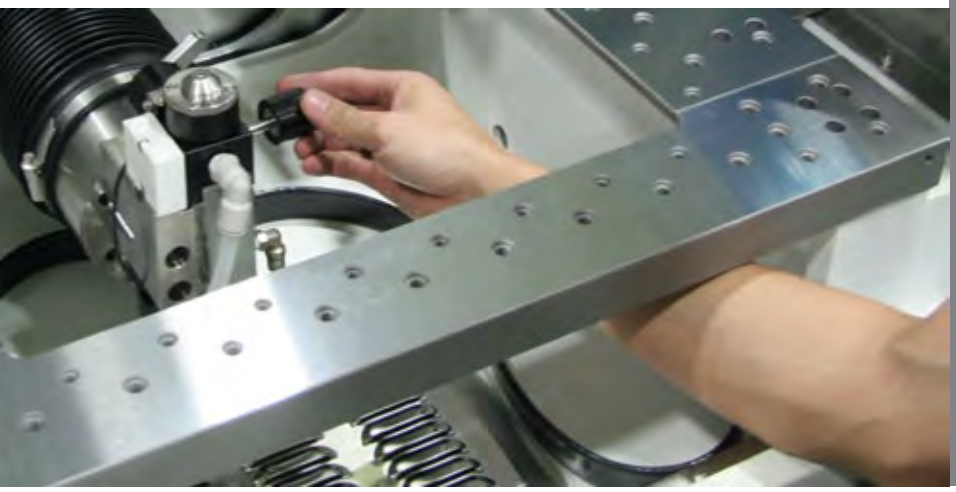
Maintenance

Filter change is a breeze

The main di-electric filters are conveniently located in a non-submerged cabinet that allows for fast and simple replacement. To make filter replacement easier and safer, an integrated Filter Air Purge system is used to drain excess water from the filters. Operators will find this feature extremely helpful as it will make handling the filters much less weight intensive, and it also minimizes the water and slip hazards on the floor that are common during filter replacement. 4 Filter System are standard in case of H.E.A.T. configuration.



Air is blown by pressing the button. This blows moisture captured in the filter.

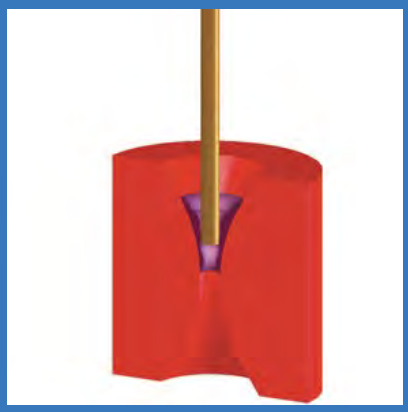


Maintenance of the Energizing plate

Adequate space is provided to access the lower head, allowing adjustment of the energizing plate even if a workpiece is mounted. Indexing of the energizing plate is accomplished without the need of tools or cumbersome measuring devises. Loosening of the spring-loaded repositioning which is further simplified by a “one click” / one rotation indexing design.

Guide Cleaning

After sludge Removal



Removal of sludge

As a result of our Pico Guide being a closed round system, sludge can become an issue for maintenance. Makino has developed a special twin jet system that aids in the continuous removal of sludge each and every time a thread occurs. This design extends the guide maintenance interval, and provides greater machine reliability.

Makino's Split Guide system is the ultimate solution in decreased maintenance as a result of the open architecture design. At the touch of a button or wire threading cycle the guides open for ease of maintenance.

Consumable monitoring by Hyper i

Dedicated Maintenance screens provide the operator with a convenient access to consumable item status, part descriptions and maintenance procedures.

Easy Operation

Load workpiece with crane

Machine head can be moved all the way in without obstructing loading large workpiece by crane

Accessibility

The automated front Drop Door design allows easy loading / unloading of large work piece's on the table. The drop door also travels below the work table level, allowing for excellent access underneath the work table for maintenance and machine operation purposes. Additionally, operators can use mechanical work holding lifters directly in front of the machine.

Intermediate Door

A unique door system (only available on the U6 and U6 H.E.A.T.) allows door operation to an intermediate level for convenient viewing and access to the workpiece.

Portable multifunction control panel

Makino provides “as standard” a multi-function Handbox with digital readout. This advanced and portable hand box offers a wide range of features that provide operators with convenient and time-saving functions during set up and operation of the machine.

Wire disposal box with wheels

The need for a Wire Chopping Unit is eliminated as a result of Makino’s unique Wire Cleaning and Wire Drying system. The wire coils up neatly and cleanly in the wire collection bin as a result of being completely dry before passing through the pinch rollers, and this design reduces maintenance requirements while boosting machine reliability. The large capacity wire collection bin allows easy removal of spent wire, and is mounted on wheels for effortless movement.

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