EDAF2/3

H.E.A.T.

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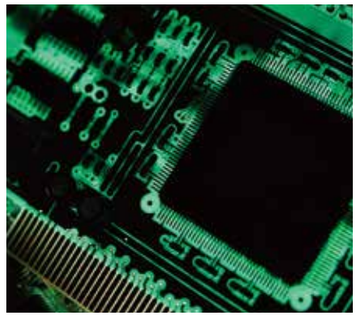
H296Ea 1811 (SJ-T)

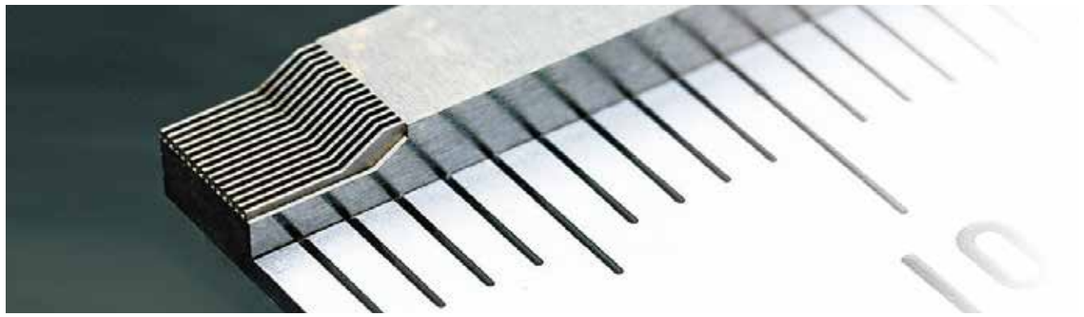
MAKINO

EDAF2/3

Abundant achievements in die/mold machining of electronic parts

Electronic parts used for smartphones and personal computers are required to be smaller and more reliable. EDAF 2/3 meet even higher demands such as minimal in-corner R, uniform and fine surface finish and good mold release characteristics for mold injection.



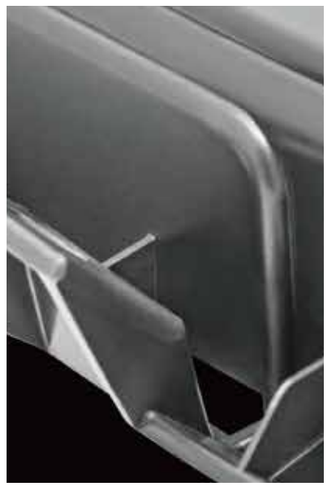


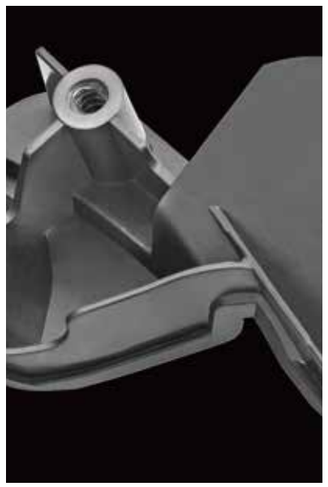
Productivity improvement of plastic mold and die-casting mold

H.E.A.T. Technology

- Discharge control technology Hyper-Cut
- Super Spark
- High speed jump HS-Rib

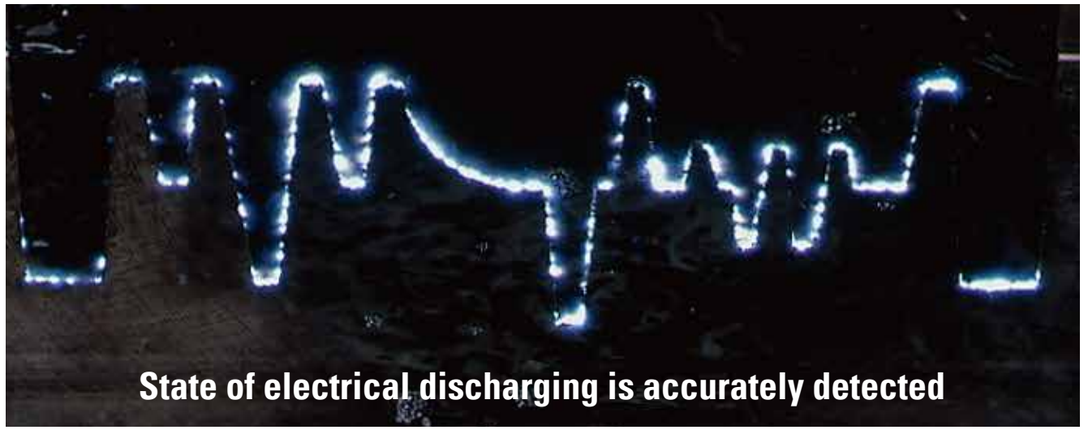
Thanks to H.E.A.T. technology, high-speed and low-wear machining of various shapes are realized.



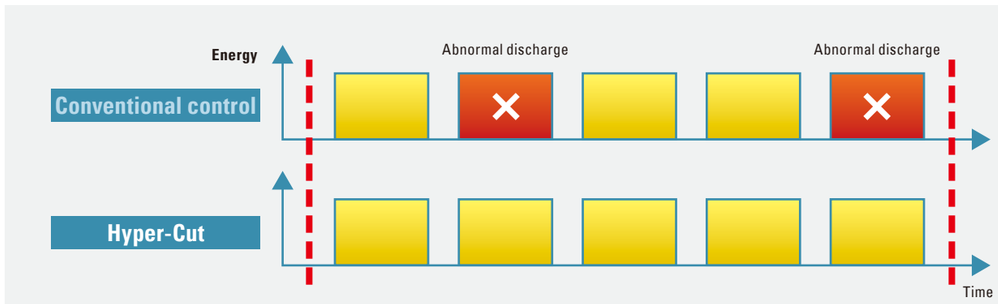


Injection-molded plastic parts are getting thinner and more complicated.

Hyper-Cut

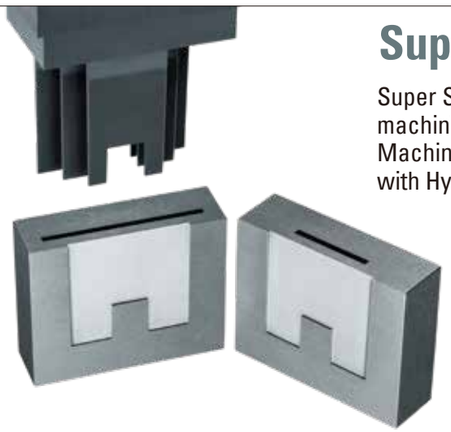


Hyper-Cut is a control technology that increases electrical discharge energy per unit time.
By accurately detecting discharge state, occurrence rate of abnormal electrical discharge is decreased.



- **Machining time is shortened by 30%**
- **Wear of graphite electrode is reduced to 1/10**

(Comparison to the conventional generator <MGH 5 generator>)



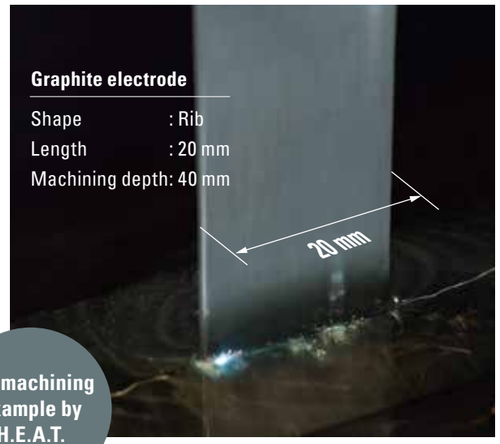
Super Spark

Super Spark is a control technology which shortens rough machining time regardless of electrode and workpiece material. Machining time can be further shortened by combination use with Hyper-Cut.

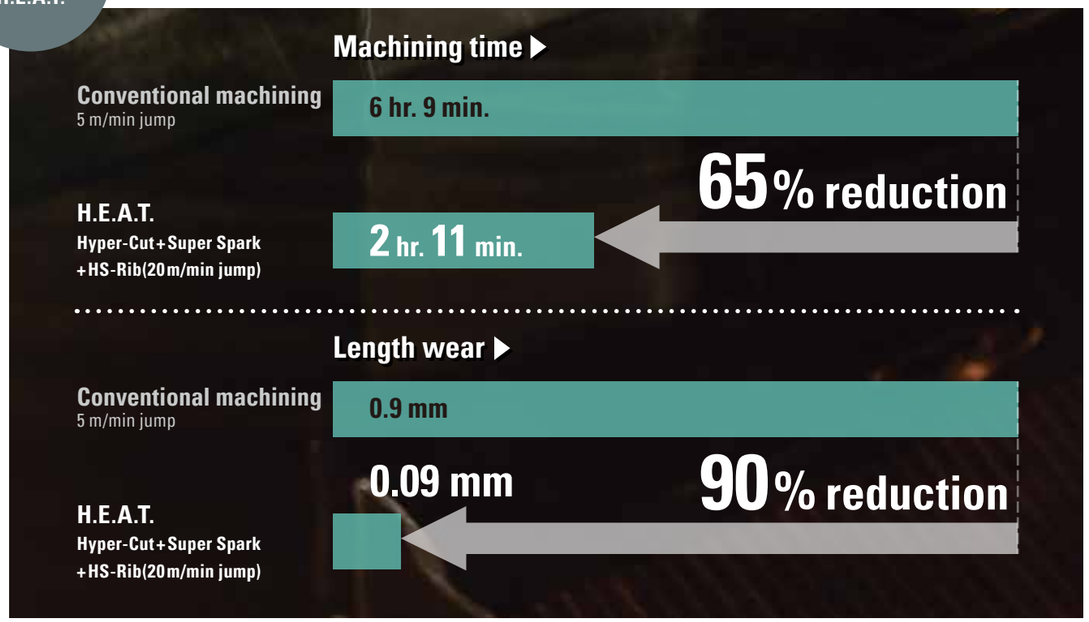
HS-Rib

In order to realize high-speed rib machining, the Z-axis jump function has been enhanced. Machining chip is discharged efficiently and machining time is drastically shortened. It is particularly effective in machining plastic molds with many rib-shapes and pin-gates.

Jump speed 20m/min



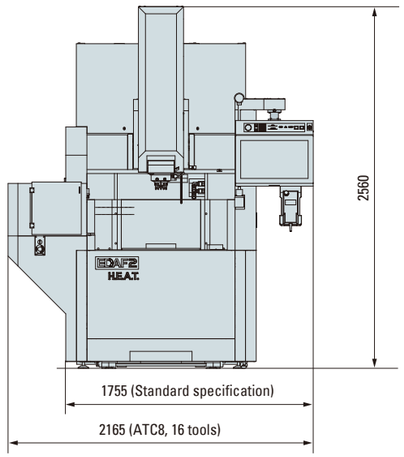
Rib machining example by H.E.A.T.



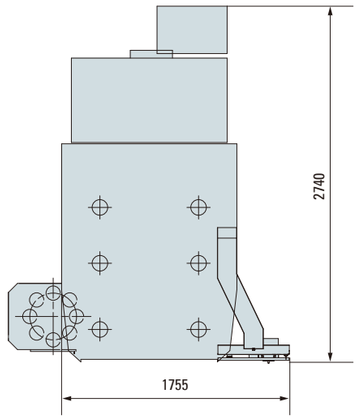
EDAF2

Axis travels (X × Y × Z) : 350×250×250 mm
Table working area (W × D) : 550×350 mm
Maximum payload : 500 kg
Maximum electrode weight : 50 kg

Front view



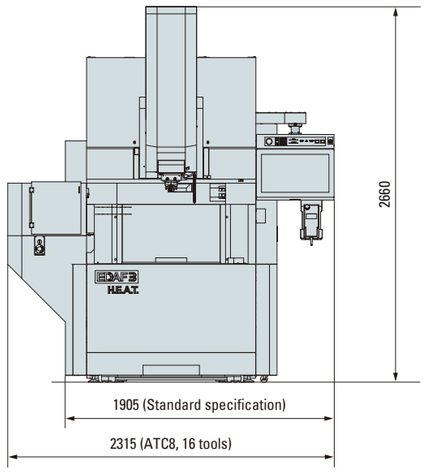
Layout



EDAF3

Axis travels (X × Y × Z) : 450 × 350 × 350 mm
Table working area (W × D) : 700 × 500 mm
Maximum payload : 800 kg
Maximum electrode weight : 75 kg

Front view



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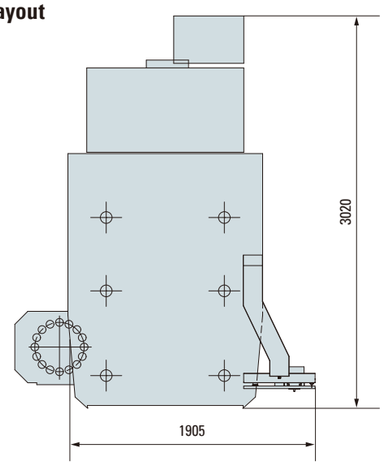


Hyper *i*

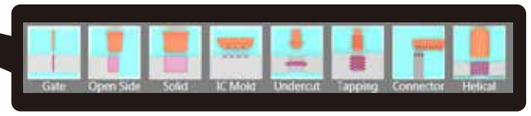
*i*ntuitive | *i*ntelligent | *i*nteractive

Applying the latest interface technologies used for smartphones and tablets, Makino's Hyper*i* provides operators with simple and natural way of operation.

Easy programming

Machining program can be created easily on the user-friendly graphical screen.

Machining type menu



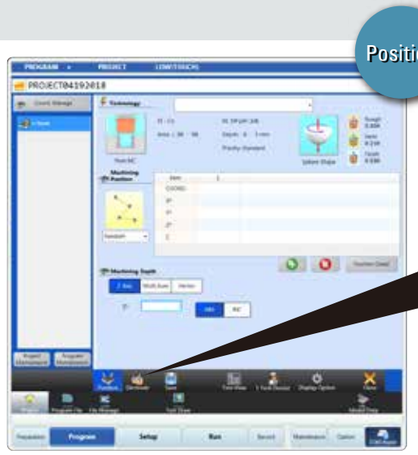
Proper machining condition is automatically determined by selecting machining shape on the menu and inputting workpiece material and electrode material etc.

Program

Orbit

Orbit pattern / Electrode dimension reduction

Three types of orbit patterns, Circle/Square/Sphere, are equipped. Each type has 2D and 3D motion patterns to create optimal programs for machining various shapes.



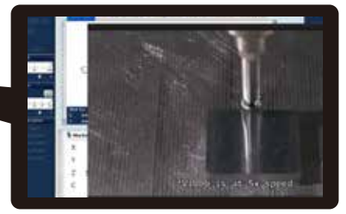
Screen for position and depth

Electrode setting

Screen for tool pot number and order of machining

Setup

Setup screens such as Plate center, Hole center, Corner, Edge Find, 3 Points Find, CenterHoles, Measuring Angle, etc. help operators operate intuitively.

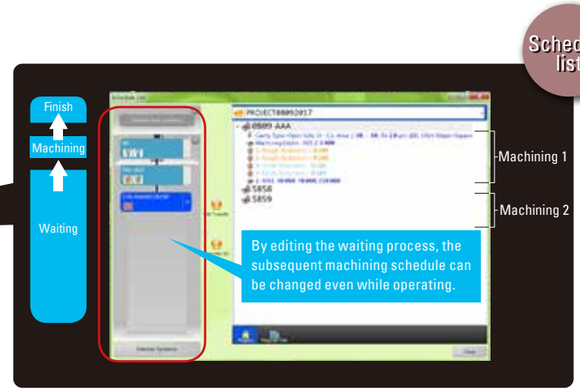


EDM Assist

Explanation movies are available.

Schedule-run

Continuous operation of multiple programs can be easily done.



E-Tech doctor

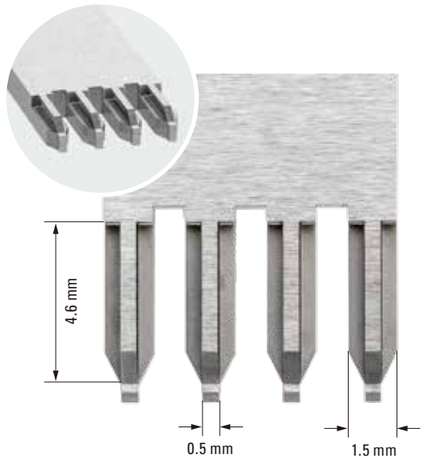
E-Tech doctor is an advanced help function that suggests ways to improve various problems interactively.

Example: "Since the discharge state is bad, I want to know how to improve."

Machining example

High accuracy and high speed machining of connector mold

Electrode wear and machining speed are improved with new machining conditions for connectors



	Conventional condition	New condition
Machining time	2 hr. 7 min.	1 hr. 40 min.
Smallest corner radius	24 µm	15 µm
Surface finish	Rz 1.5 µm (Ra 0.2 µm)	

Connector mold

Workpiece material: Carbon steel (SKD11)
Electrode : Oxygen-free copper
Electrode reduction: 0.05 mm/one side
Machining depth : 0.5 mm

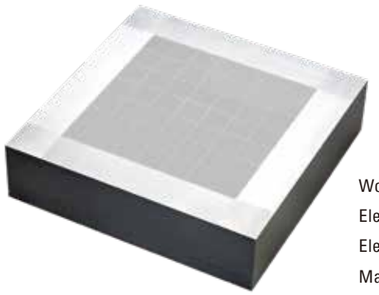
Project screen (connector)

By selecting priority for machining between "Quality", "Standard" and "Speed", suitable machining program for connector can be generated.

Stable depth accuracy

Difference in height is within ±2.5 µm

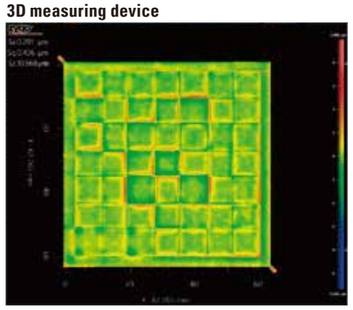
By the machine structure with minimized thermal distortion, positioning accuracy is kept stable in machining with automatic tool changing.



Workpiece material: Stainless steel (STAVAX)
Electrode : Oxygen-free copper
Electrode reduction: 0.2 mm/one side
Machining depth : 0.02 mm

Forty-nine parts of top face are machined, targeting to the height of grinded surface on edge.

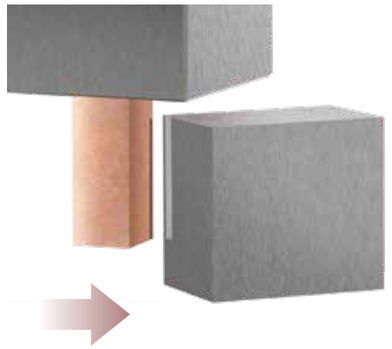
Measured results obtained with a non-contact 3D measuring device



Measuring device: Zygo Newview

Open side machining

Rough machining time is shortened by **30%** with high speed jump in the direction of X-axis and Y-axis.



High rigid machine body structure realizes higher speed jump

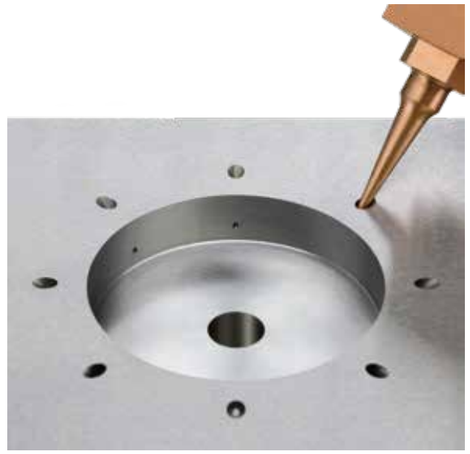
Open side machining

Workpiece material : Carbon steel (SKD61)
Electrode : Oxygen-free copper
Electrode reduction : 0.07 mm/one side
Machining amount in X axis direction: 1 mm
Machining amount in Z axis direction: 20 mm

Submarine gate machining

Rough machining time is shortened by **50%** with new machining conditions for submarine gate and high speed jump.

Pin gate with uniform outlet hole shape can be machined at high speed.
On dedicated input screen, positioning of submarine gate electrode requiring C-axis indexing can be performed easily.



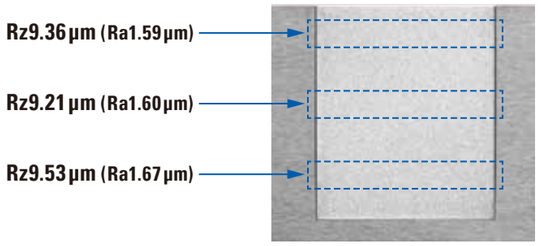
Project screen (gate)

Submarine gate

Workpiece material : 8407 (Equivalent to SKD61)
Electrode : Oxygen-free copper
Electrode reduction : 0.15 mm/one side
Taper angle : 5.8 deg.
Machining depth : 10 mm
Gate incidence angle: 45 deg.
Surface finish : Rz 5 µm (Ra 0.8 µm)

Good mold release characteristics of rib-shaped mold

New technology of control and low electrode wear drastically brings uniform machined surface.



Thin rib machining

Workpiece material:	Stainless steel (STAVAX)
Electrode	: Graphite (ISO-63)
Rib length	: 25 mm
Rib width	: 1 mm
Electrode reduction:	0.15 mm / one side
Machining depth	: 30 mm

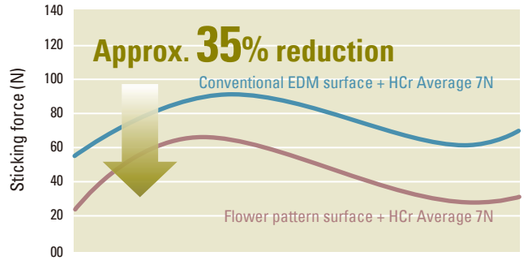
Surface of good mold release characteristics

Sticking force is reduced by 35%.

Standard machining condition

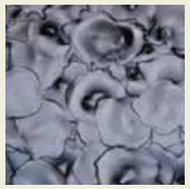
Flower pattern

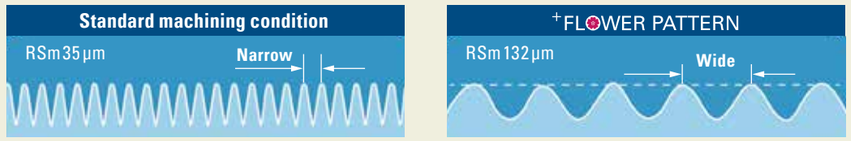
Workpiece material: ASP23 (VANADIS23) Size: 20 × 20 mm Surface finish: Rz10 µm (Ra1.5 µm)



Molding resin : Halogen free epoxy resin A
Molding machine: MTEX MATSUMURA made ATOM-F1
Number of shots : 1000 times

+FLOWER PATTERN





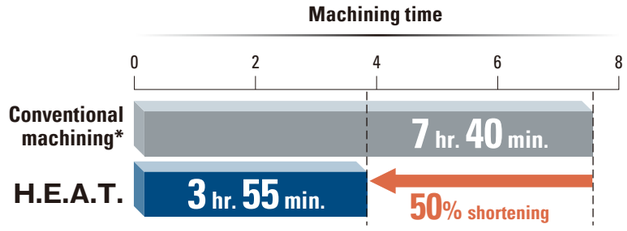
FLOWER PATTERN is an optimum machining condition for semiconductor package and narrow rib machining which is hard to polish. Surface finish with uniform Rz (Ra) value and large RSm value has been pursued. Its good mold release characteristics and maintenance ease contribute to high productivity.

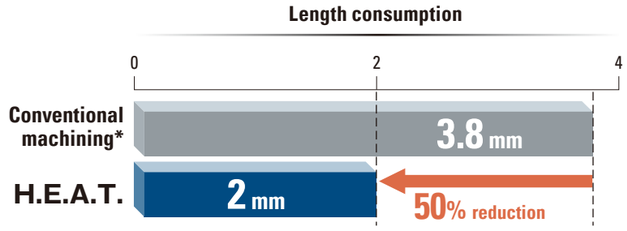
Machining of beryllium copper

H.E.A.T. shortens machining time by **50%** and reduces electrode wear by **50%**

Radial rib

Workpiece material	: Beryllium copper (MoldMAX HH)
Electrode	: Graphite (ISO-63)
Number of electrodes	: 3 (Conventional: 4 at least)
Electrode reduction	: 0.15 mm / one side
Machining depth	: 30 mm
Machined surface finish:	Rz10 µm (Ra1.6 µm)





*Comparison with previous MGH 5 generator, 30 A specification, and machine without HS-Rib.
Rough / Semi / Finishing: Total

Beryllium copper

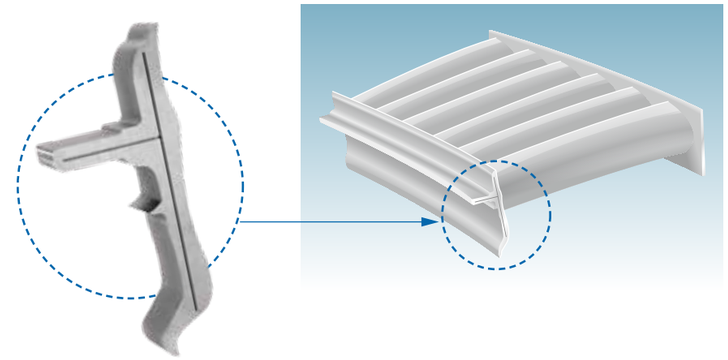
It is used for injection molds and mold insert parts, because it has excellent cooling efficiency as the thermal conductivity is ten times as high as that of steel, two times that of aluminum. It is effective in preventing molding defects and shortening cycle time by good mold release characteristic.

Parts machining of hard-to-cut material

Hyper-Cut shortens machining time by **35%** and reduces electrode wear by **45%**

Seal slot (aerospace engine part)

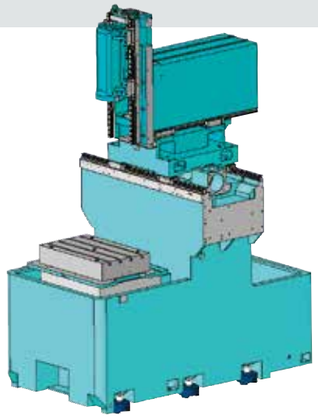
Workpiece material:	Inconel (718)
Electrode	: Graphite (ISO-63)
Machining depth	: 3.3 mm
Machining time	: 15 min.

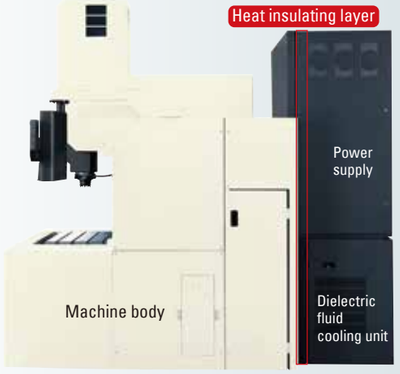


Machine structure / Stability against thermal distortion

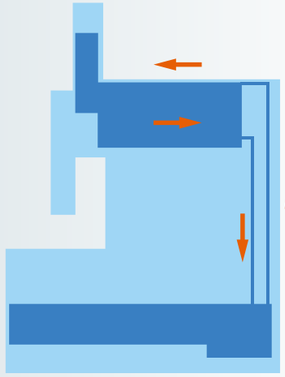
Reliability in long hour continuous operation

The symmetrical machine design is combined with various mechanisms for suppressing thermal distortion. Change of machine posture due to heat is minimized even in long-hour continuous machining. Its high accuracy enables automation.



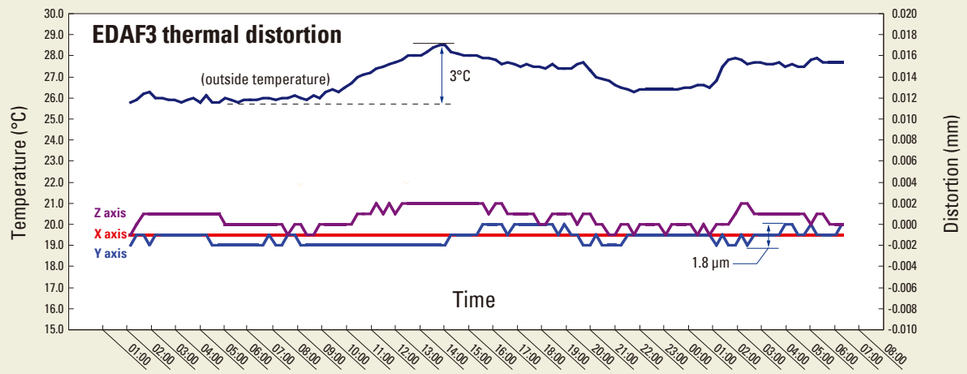


Equipment such as NC power supply unit, dielectric fluid cooling unit and pumps is placed behind the machine main body. Insulating plate and air-layer between the main body and the equipment prevent heat transfer.



Temperature-adjusted dielectric fluid circulates in the casting of Y-axis and Z-axis for suppressing thermal distortion.

Unaffected by ambient temperature change

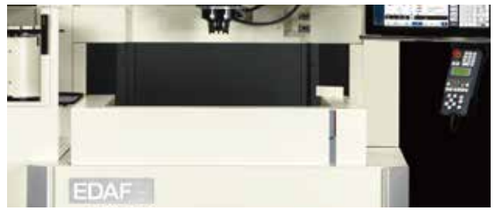


Deformation is minimized to 0.6µm/°C even under the unstable temperature condition.

Useful functions for machining

Accessibility and operating ease

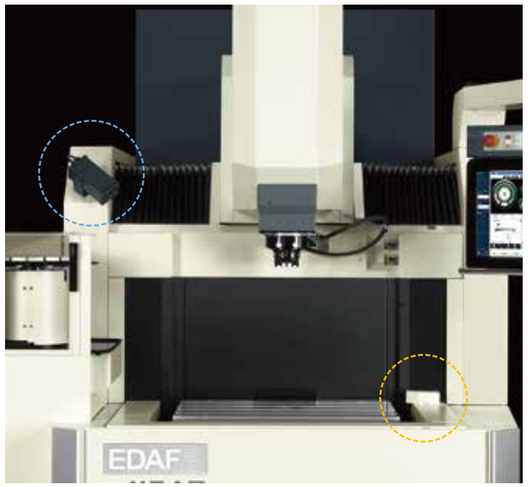
Operator can access close to the table and perform setting work easily.



The height of the work tank can be adjusted to the workpiece. Visibility is excellent.

For safety and maintenance

Safety unit



Automatic fire extinguisher

When heat (60°C) is detected, extinguishing agent is flushed.

Flame sensor (optional equipment)

When flame is detected, machine stops instantly. (Required for automation system)

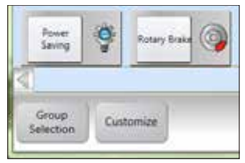
Consumables manage screen

When time of replacement of consumables such as dielectric fluid filter, battery, etc. comes, colors of the cells are changed to notify operator.

Energy saving

Energy saving power supply unit

The newly developed energy saving power supply unit, which has average power capacity of 80A (100 at peak), is equipped as standard specification. Its productivity is much higher than conventional one.



Power saving function

Dielectric fluid cooling unit, pumps, fans, etc. stop during idle time.

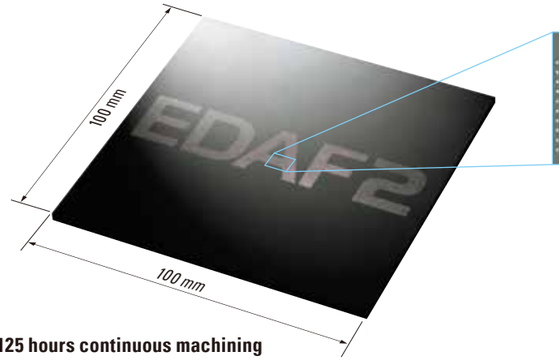
Programmable flushing control

Flow rate of machining fluid can be freely set with M-code. It is possible to set different rates for rough machining and finish machining, and to change them automatically.

Fine hole machining specification

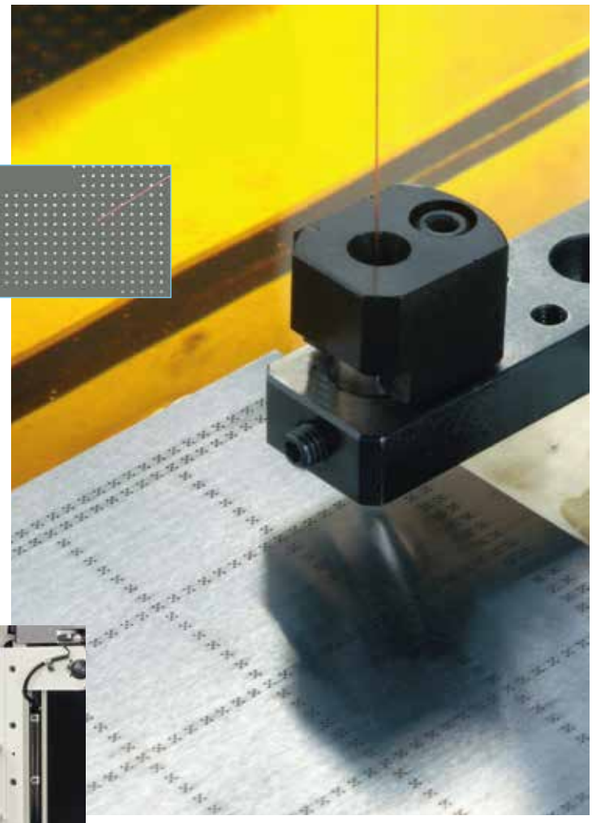
This specification has been specially developed for high accuracy fine hole machining. But, the guide arm is removable and conventional EDM machining is also possible.

· Usable electrode diameter: 0.02 - 3.0 mm



125 hours continuous machining with 80 µm diameter electrode

Workpiece material: Tungsten carbide (G5) Workpiece thickness: 0.5mm
Electrode : Copper (0.08 mm dia.) Number of electrode : 32



Removal type guide arm

It is easy to switch to conventional EDM machining.

Automatic electrode changer
(optional specification)

Automatically changeable electrode diameter: 0.08 - 3.0 mm

***Automatic electrode exchange is possible only with W-axis NC positioning specification.**

Middle guide

Stability can be kept during machining by suppressing deflection of the middle part of pipe or solid electrode. In automatic electrode changing, it helps electrode go into the electrode guide.

Accessories of fine hole specification
(Common to W axis NC positioning specification, W axis manual positioning specification)

· MA head for fine hole machining
· Electrode guide: 2 pieces
· High pressure flushing fluid supply unit
· High pressure flushing automatic selecting function
· Collision prevention antenna

Fine hole machining specification: Optional specification/Optional equipment

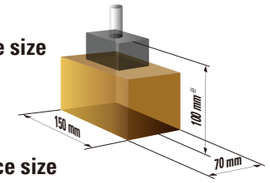
· Shaped electrode macro
· Ultra high pressure pump specification (10 MPa)
· Additional electrode holder
· Small-diameter electrode holder
· Collet chuck, sub collet chuck

Automation

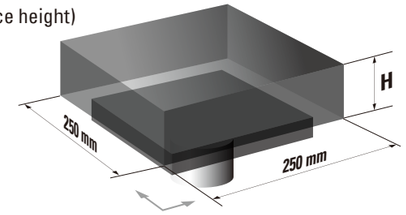
E/W Changer 300

E/W Changer 300 is space-saving electrode and workpiece changer with multilevel storage.

● **Maximum electrode size**
(*: Including holder)



● **Maximum workpiece size**
(H: Workpiece height)



Machine axis directions

		Table chuck position (standard specification)		Table chuck position (33 mm lower specification)	
Chuck type		EROWA	system3R	EROWA	system3R
H	Work pallet	72 mm	52 mm	105 mm	105 mm
	Magnet pallet	62 mm	42 mm	95 mm	95 mm

System examples

EDAF is compatible with various robots and transfer machines.

Automatic workpiece changer

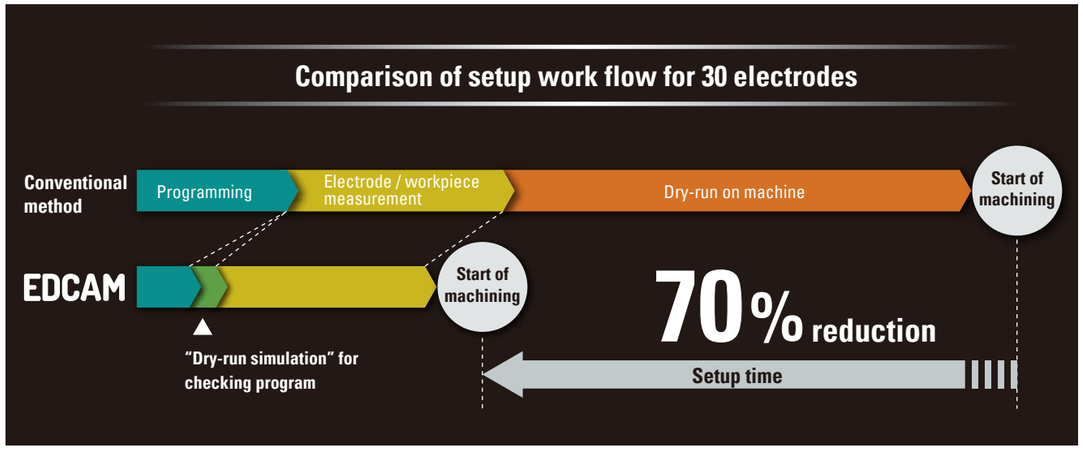
Vertical Machining Center V22 | Transfer machine | NC Electrical Discharge Machine EDAF2

Automatic electrode and workpiece changer

CAM system for EDM machines

EDCAM (Software, sold separately)

Less setup time - dry-run can be skipped



The epoch-making CAM system which eliminates manual input and on machine dry-run.

Dry-run simulation

Dry-run is performed on PC. It is possible to check machining position, electrode shape, interference between electrode and workpiece, etc.

Easy programming

Data necessary for machining can be read directly from CAD. Mistakes caused by manual input is totally eliminated. Furthermore, proper machining condition can be automatically selected based on machining area. As the user interface is as same as that of machine controller, operator can use EDCAM easily.

For efficient electrode machining


V22

Vertical Machining Center
V22 • V22 GRAPHITE
Axis travels (X × Y × Z) : 320 × 280 × 300 mm
Maximum payload : 100 kg

Vertical Machining Center
V33i • V33i GRAPHITE
Axis travels (X × Y × Z) : 650 × 450 × 350 mm
Maximum payload : 300 kg

5-Axis Vertical Machining Center
D200Z • D200Z GRAPHITE
Axis travels (X × Y × Z) : 350 × 300 × 250 mm
(B / C) : 91 deg. (0 deg. to +91 deg.) / 360 deg. (cont.)
Maximum payload : 75 kg

Machine Specifications

	EDAF2	EDAF3
Axis travels X × Y × Z	350 × 250 × 250 mm	450 × 350 × 350 mm
Work tank inner dimensions W × D × H	700 × 500 × 300 mm	850 × 650 × 400 mm
Maximum fluid height	250 mm	350 mm
Table working area W × D	550 × 350 mm	700 × 500 mm
Rapid traverse	5000 mm / min	5000 mm / min
Maximum electrode weight	50 kg	75 kg
Maximum payload	500 kg	800 kg
Z-axis bottom point (Distance from electrode mounting plate to table)	250 mm	250 mm
Height to table top surface	850 mm	850 mm
Electrode mounting plate dimensions	160 mm diameter	160 mm diameter
Table T-slots width × number	10 mm × 4, pitch 80 mm	14 mm × 4, pitch 110 mm
Machine size W × D × H	1755 × 2740 × 2560 mm	1905 × 3020 × 2660 mm
Floor space W × D	2250 × 3170 mm	2400 × 3450 mm
Machine weight	3768 kg	4868 kg

Dielectric Fluid Supply Unit

Type		Integrated with machine	Integrated with machine
Dielectric fluid volume		300 L	450 L
Dielectric fluid filtration system	Type	Internal pressure-type paper filter	Internal pressure-type paper filter
	Number of filter elements	2	2
Number of dielectric fluid ports	Suction	1	1
	Flushing	1	1

Standard Specifications

- ES200A power supply unit 80A
- HS-Rib
- Drop tank design with three-side opening
- Set of centering / measuring probes
- Portable control panel (FPB2)
- Ethernet (1000BASE-T/100BASE-TX/10BASE-T) Compliant
- Dielectric fluid cooling unit (0.75kw)
- Automatic fire extinguisher
- Automatic power shutoff
- Power supply rear layout
- Super Surface
- Super Edge
- Super Spark IV
- NC program memory 10GB
- Anti-virus software
- EDM Explorer
- HyperConnect (including Email notification function)

Optional Specifications (not retrofittable)

- ATC : 8, 16 or 32 tools
- MA head (spindle rotation type)
- Mi head
- MR head
- Thermal chamber specification*1
- Fine-hole machining specification*2
- Special customer-specified machine colors
- EW Changer 300*3
- EW Changer 300 (with WSS)*3
- HQSF*4
- Sludge separator*5
- High accuracy (EDAF2 only)
- Wire EDM attachment (5kg wire reel type)
- Operation panel left side layout

Optional Equipment

- Robot interface (E/W Changer, REROWA, or 3R type)
- Power supply line filter
- Flame sensor*6
- Carbide machining circuit
- Ultra-fine machining circuit / Carbide machining circuit package*7
- DD circuit
- Super Spark Gr.
- Super Surface Gr. (including ultra-fine machining circuit / carbide machining circuit)
- Work light (1 LED light)
- Signal tower (1, 2 or 3 lamps)
- Vibration sensor
- EPX (Electrode Position eXecutor) (Required separately PC)
- MEL Machine kit*8

*1 Fine-hole machining, wire EDM attachment and carbide booster are not selectable.
*2 HQSF, thermal chamber, carbide booster, dielectric fluid distributor unit, E/W Changer and wire EDM attachment are not selectable. Z axis travel, workpiece limit and machine height etc. are changed. Please contact our sales staff for details.
*3 Table chuck (EROWA or 3R), head chuck, pallet and flame sensor are required. ATC, fine-hole machining, sludge separator and HQSF are not selectable.
*4 Requires DD circuit.
*5 When HQSF is required.
*6 When carbide booster and E/W Changer are equipped.
*7 Super Surface Gr. is not selectable.
*8 EDM 3D shape measuring function is not selectable.

Spindle indexing/Rotation unit specification

	Indexing accuracy (arc/sec)	Rotation speed (rpm)
MA head	±0.00417 deg.	10 - 1000
MR head	±0.00417 deg.	1 - 10
Mi head	±0.00055 deg.	1 - 10