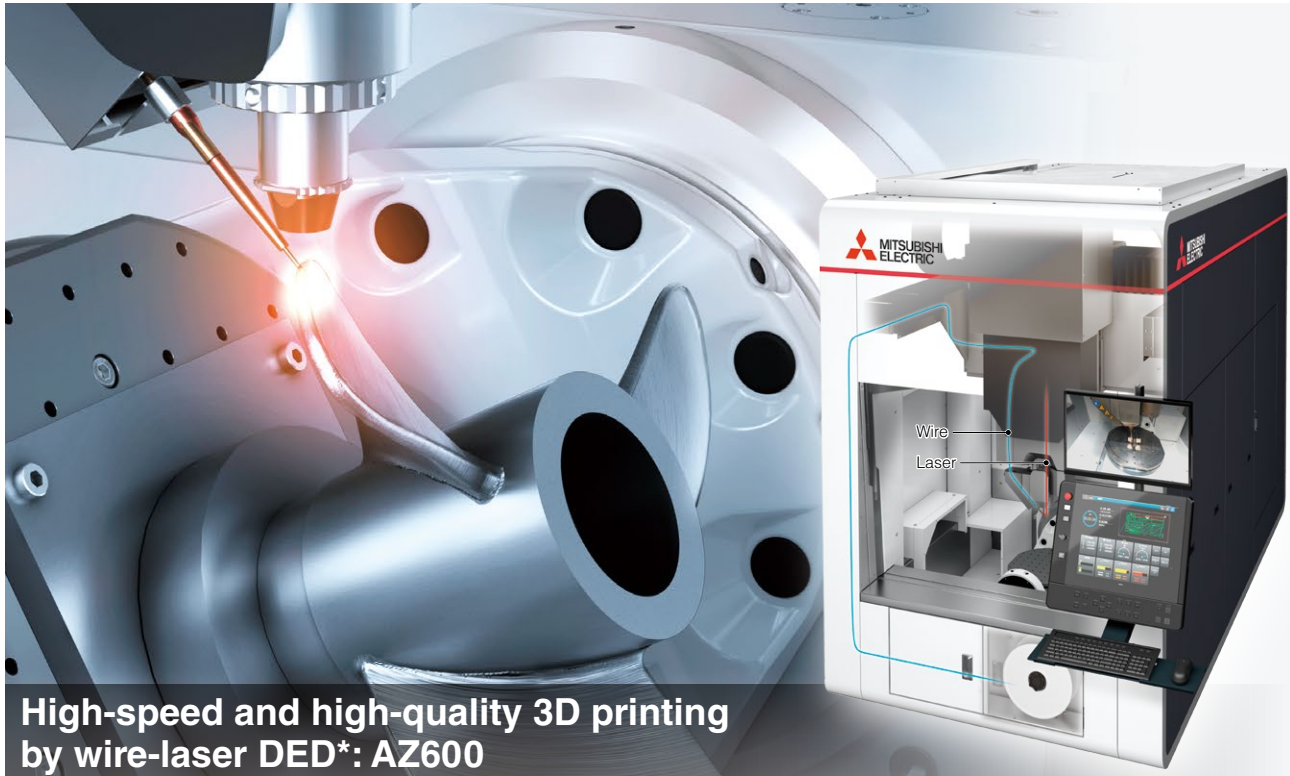


FACTORY AUTOMATION

Wire-Laser Metal 3D Printer AZ600



New imagination opens the future.



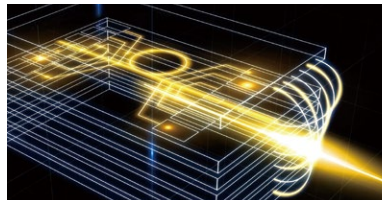
*Directed Energy Deposition

Additive Manufacturing(AM) integrated with Mitsubishi Electric's technology



Wire feeding

Inherits the "wire feeding technology" from our EDM machine technology. A stable wire feeding system enables stable 3D printing.



Laser output control

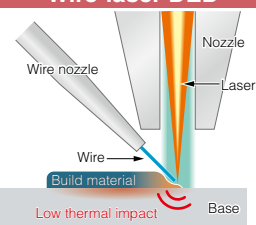
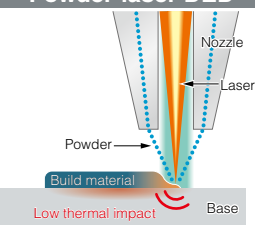
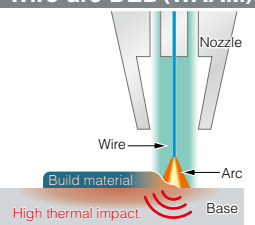
A Mitsubishi in-house fiber laser oscillator is used for our heat source. It ensures high output stability and long-term reliability, hence reads to a high-quality modeling.



CNC

AZ600 is equipped with an in-house 5-Axis CNC. Process conditions are detected by sensors to optimally control axis moves, wire feed rate, and laser output.

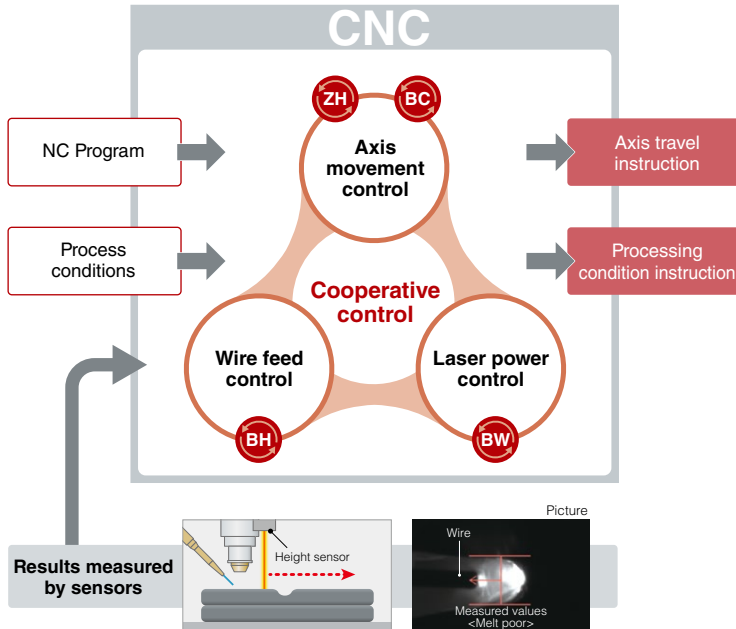
Features

	Wire-laser DED	Powder-laser DED	Wire-arc DED (WAAM)
			
Cost	Low price	Expensive price	Low price
Contribution ratio	Almost 100%	60 ~ 90 % ^{*1}	95 % or more ^{*1}
Storage	Easy(safe)	Needs to be managed	Easy(safe)
Quality	Stable (Dense)	Vacancy risk exists ^{*1}	Heat affected
Molding accuracy	~±1mm ^{*2}	~±0.2mm ^{*2}	~±2mm ^{*2}

*1: Varies depending on material manufacturer, modeling content, etc. *2: Varies depending on the shape of the molding, materials, etc. The above are typical values.

AM process control

Coordinated control that automatically compensates in real time automatically compensates for axis movement, wire supply volume, and laser output based on information from various sensors.



What's 4 kinds AM process control? *

ZH Z height tracing control

Control target: AM processing head (Z axis) [mm]
Height sensor measures molded surface before each layer's processing. The distance between wire tip and the object is accurately adjusted.

BH Bead height control

Control target: Wire feed [mm/min]
Height sensor measures molded surface before each layer's processing. The wire supply volume is automatically adjusted evenly, to prevent unevenness and achieve a uniform height.

BW Bead width control

Control target: Laser [W]
Camera monitors the width of the melt pool. The result is automatic adjustment of laser output to ensure constant bead width.

BC XY tracing control

Control target: AM processing head (XY axis) [mm]
Camera monitors the width of the melt pool. Automatically adjusts bead positions that are about to be displaced due to uneven temperature distribution, etc.

*Select ON or OFF control depending on the processing details.

Machine structure

High rigid structure / Compact design

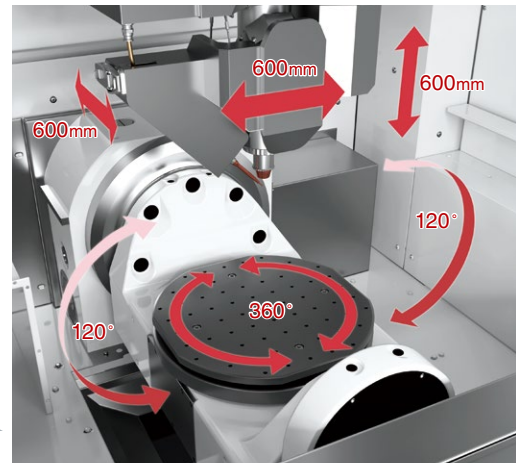
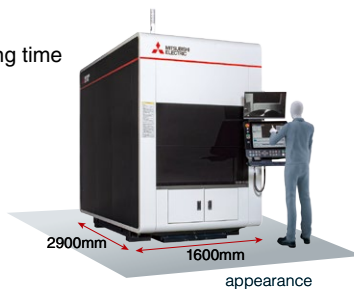
The machine structure specification is a five-axis mechanism. The design of the processing machine integrates the functions necessary for modeling in a space-saving manner.

Axial feed performance

- A gantry structure provides rigidity
- High-speed operation reduces machining time

MAX
<Feed speed> 50 m/min

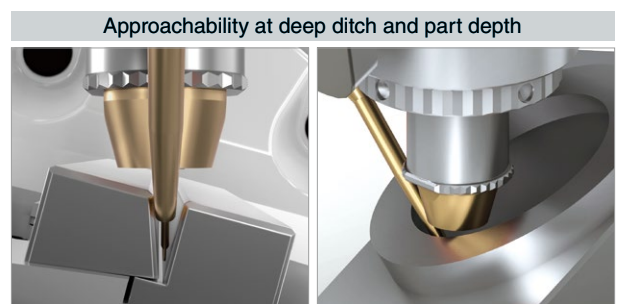
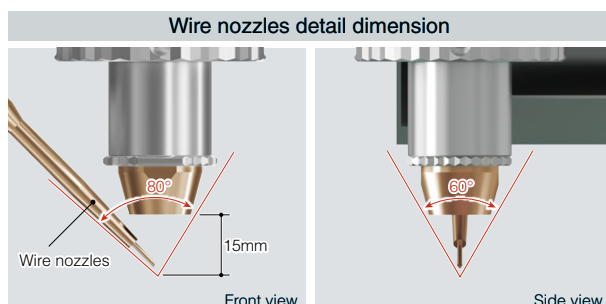
MAX
<Acceleration> 1G



stroke

Side wire method processing head

Compact AM processing head tip structure enables molding of narrow bevels and deep grooves.



Processing Examples

Additive (Near net shape)

Metal 3D printers improve production efficiency by limiting 3D printing to the necessary areas and manufacturing by cutting.



Marine propeller

Time : 8h 47min.
Size : Ø300(11.8)
× L120(4.7)mm(inch)
Substrate: Stainless steel(SS) 304
Wire : Stainless steel(SS) 17-4PH

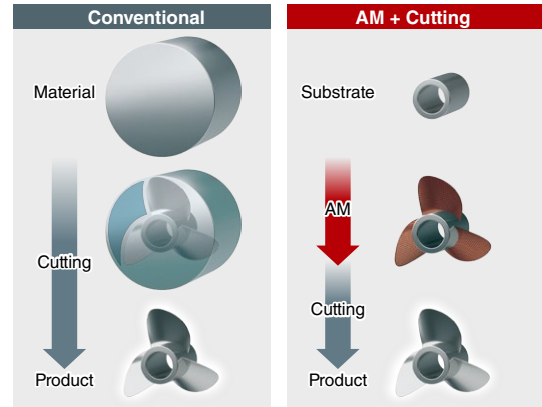
Conventional(Only cutting)

188 h.

AM+ Cutting

40 h.

About 80% reduction



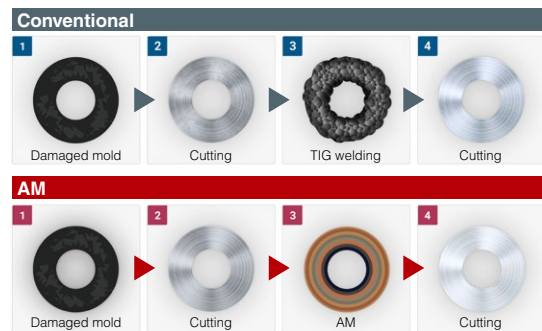
Repair

Traditionally, skilled workers repair molds by welding. Metal 3D printers automate the repair process and stabilize quality.



Die casting dies

Time : 10min.
Size : W57(2.2) × D50(2.0)
× H52(2.0)mm(inch)
Substrate: H13 Tool steel(TS)
Wire : DHW™



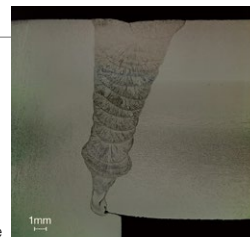
Welding

Wire laser DED "AZ600" realizes mechanization of the welding process that used to be handled by skilled workers.

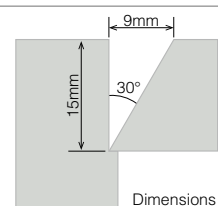


Groove weld

Time : 10min.
Size : L200(7.9)mm(inch)
Substrate: Stainless steel(SS) 304
Wire : Stainless steel(SS) 308L



Cross-section picture



Dimensions

Dissimilar Material Deposition (Coating)

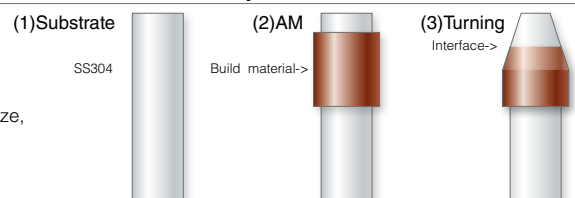
Dissimilar metal modeling increases the degree of freedom in product design and creates new added value.



Coating

Time : 3~9min. par layer
Size : Ø20~30mm
Ø0.79~1.2 inch
Substrate: Stainless steel(SS) 304
Wire : Stellite® 6, Aluminum bronze,
Alloy HX

How to make samples



Processing Examples

Additive manufacturing



Marine propeller

Time : 6h 30min.
Size : $\varnothing 300(11.8) \times L120(4.7)$ mm(inch)
Substrate: Stainless steel(SS) 304
Wire : Aluminum bronze



Rocket Engine Nozzle

Time : 15h 40min.
Size : $\varnothing 210(8.2) \times H280(11)$ mm(inch)
Substrate: Stainless steel(SS) 304
Wire : Alloy 718



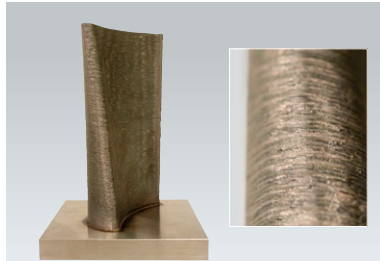
Open impeller

Time : 15h 24min.
Size : $\varnothing 244(9.6) \times H103(4.1)$ mm(inch)
Substrate: Stainless steel(SS) 304
Wire : Stainless steel(SS) 17-4PH



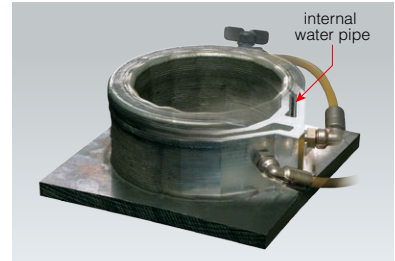
Branching Pipe

Time : 10h 20min.
Size : $\varnothing 40(1.6) \times H90(3.5)$ mm(inch)
Substrate: Stainless steel(SS) 304
Wire : Alloy HX



Turbine Blade

Time : 4h
Size : $W120(4.7) \times H200(7.9)$ mm(inch)
Substrate: Stainless steel(SS) 304
Wire : WASPALOY™



Water Jacket for Drive Motor

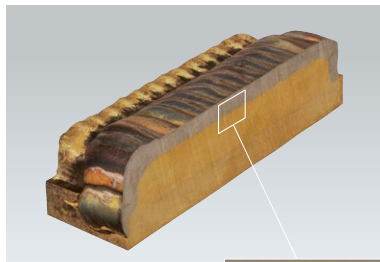
Time : 8h 44min.
Size : $\varnothing 120(4.7) \times H60(2.4)$ mm(inch)
Substrate: Aluminum alloy A5083
Wire : Aluminum alloy A5183



Wear resistance
M2 High-speed steel(HSS)
Low-cost material
Substrate : SKD61

Hot forging die

Time : 6min.
Size : $\varnothing 50(2.0) \times H30(1.2)$ mm(inch)
Substrate: H13 Tool steel(TS)
Wire : M2 High-speed steel(HSS)



High hardness
H13 Tool steel(TS)
High Thermal conductivity
Aluminum bronze

High Performance Molds

Size : $\varnothing 50(2.0) \times H30(1.2)$ mm(inch)
Substrate: Aluminum bronze
Wire : H13 Tool steel(TS)



Wear resistance
Ni b/ carbide 2.2mm thick
Heat-resistance
Alloy 718 14.5mm thick

Mining drill bit

Time : 1h 35min.
12mins. (Ni base(b)/ carbide building)
Size : $\varnothing 130(5.1) \times H200(7.9)$ mm(inch)
Substrate: Stainless steel(SS) 304

Wire list

- Iron : Mild Steel, Maraging Steel(18Ni), H13 TS, M2 HSS, DHW™
- Stainless : SS 308L, SS 316L, SS17-4PH, SS 420J2
- Nickel : WASPALOY™, Alloy 718, Alloy 625, Alloy HX
- Copper : Aluminum Bronze, Cupronickel

- Cobalt : Stellite® 6, Stellite® 21
- Titanium : Ti-6Al-4V
- Aluminum : A5000(A5183, A5356)
(Additional option: special wire feeder for aluminum alloy, is needed)

Options

Special wire feeder for aluminum alloy

Additional wire feeder unit would be able to be equipped with a second type of wire spool in addition to the standard wire spool.

- Used in modeling low-rigidity wires such as aluminum alloys.
- Improves work efficiency by using different types of wire.

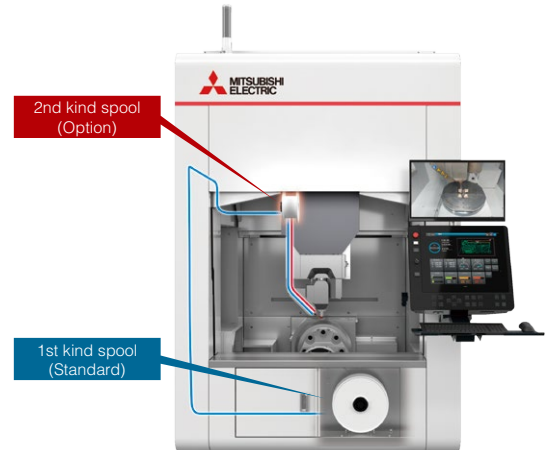


Motor parts mock-up

Time : 6h 40 min.
Size : $\varnothing 65(2.6) \times H75(3.0)$ mm(inch)
Substrate: Aluminum alloy A5052
Wire : Aluminum alloy A5356



*Sustainable motor(RF-SR type)
Designed by Mitsubishi Electric Corporation



Automatic slide covers



Automatic top slide cover

This option enables the suspension of heavy objects such as jigs.

- Fixed ceiling cover is replaced with an automatic sliding cover.
- Improved setup work efficiency.



Automatic side slide cover

Responding to factory automation needs*

- Fixed side cover for the left and right side is replaced with automatic sliding cover.

*Individual specification discussions are required for the details of automation support.

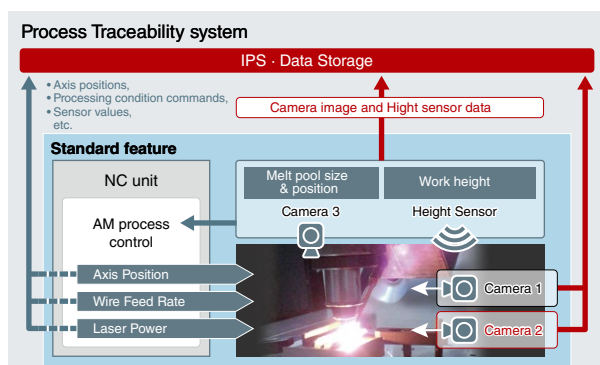
AM process data logging function (Process Traceability System)

Under development

This option realizes storage of machining logs and time-series synchronized display.

The storage of processing logs ensures traceability of the molding process.

Quality assurance of molding parts is realized.



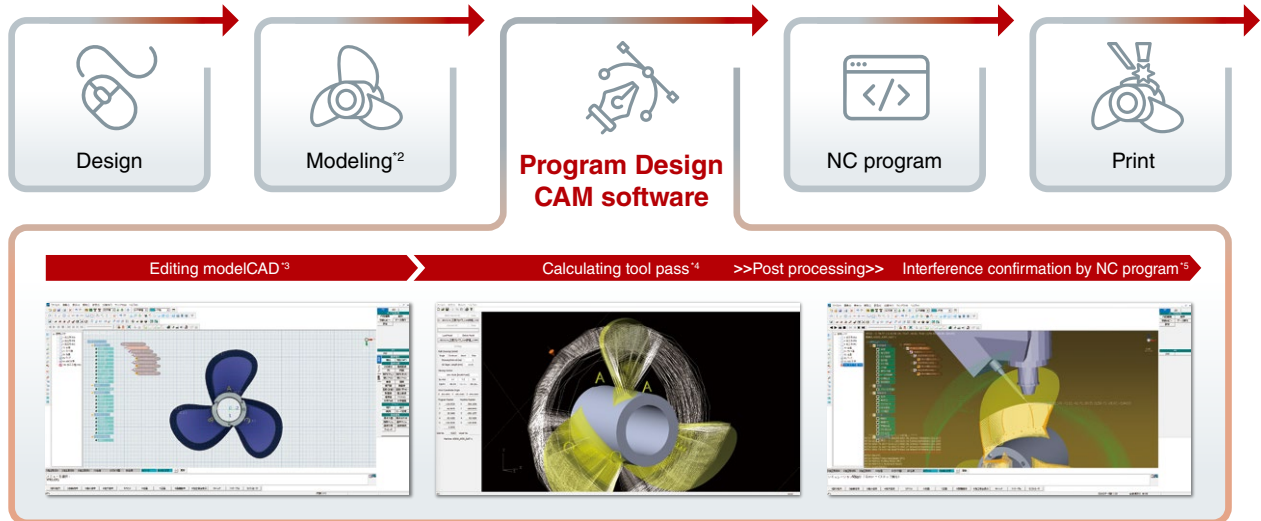
Display example



- Displayed on an additional display using Viewer software
- Processing logs are stored in storage

CAM software:MZ^{*1}

CAM software: MZ, is compatible with our original AM process control.
The simulation function enables confirmation of the molding path and machine axis movement.
Contributes to highly reliable manufacturing through prior verification (simulation) up to the start of molding.



*1 : CAM software:MZ is a product of Mitsubishi Electric Software Corporation and is software to be installed on an external PC.

*2 : The 3D model is created by the customer's own 3D CAD software.

*3 : 3D IGES files and Parasolid files can be read in with the standard CAM specifications. Support for reading other files is optional.

*4 : Toolpaths are data calculated and generated by the language used in CAM. NC programs are generated through post-processing.

*5 : Indicates data in a format that can be read by the machine. Translated with DeepL.com (free version)

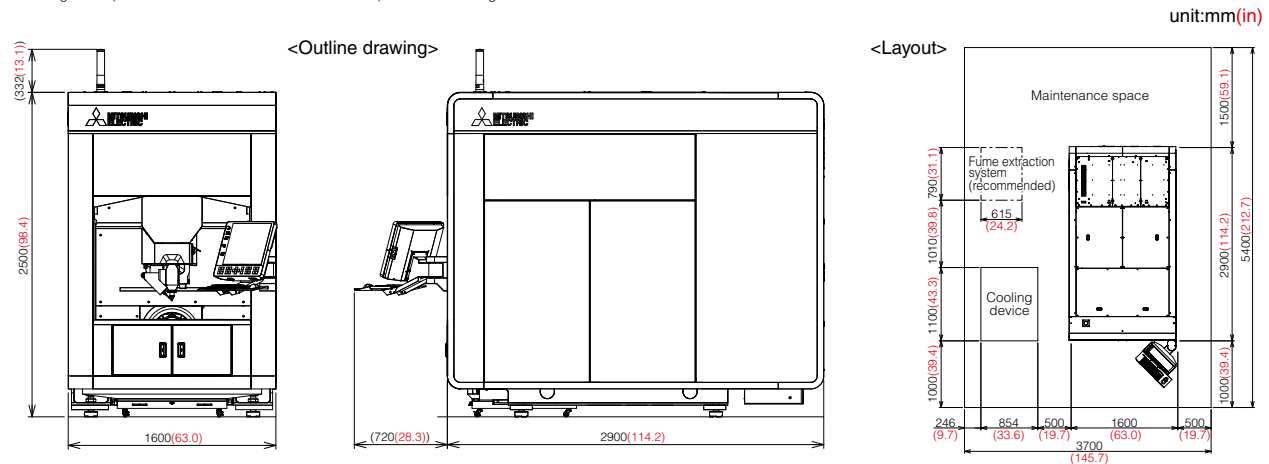
Specifications

Model	AZ600-F20	AZ600-F40
Stroke (X x Y x Z) [mm(in)]	600(23.6) x 600(23.6) x 600(23.6)	
Maximum workpiece size [mm(in)]	Ø500(19.7) x 500(19.7)	
Maximum load capacity [kg(lb)]	500(1100)	
Laser output power [kW]	2	4
Main standard equipment ^{*6}	Wire feeding system(Wire diameter: 1.2mm), Processing head(Laser diameter Ø3.0mm), Magnetic damage reduction function, Height sensor Cartridge type protective glass holder, Shielding gas NC control, Camera for processing chamber, Signal tower, 2-axis rotary table BC axis ^{*7} , Table size Ø385 mm, Automatic slide cover (Front door)	
Main options	2-axis rotary table AC axis ^{*8} , 2-axis rotary table BC offset(100/200/285mm offset to left), Table size Ø500mm, Automatic side and top cover, Special wire feeder for aluminum alloy (Additional wire feeder unit specification), AM process data logging function(Additional dedicated software and hardware)	

*6 : A fume extraction system and a cooling system does not include among standard accessories.

*7 : Tilting axis B (left-right tilt viewed from the front) ±120° and rotating axis C 360° are used.

*8 : Tilting axis A (front-back direction tilt viewed from the front) ±120° and rotating axis C 360° are used.





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NAGOYA WORKS: 1-14, YADA-MINAMI, 5-CHOME, HIGASHI-KU, NAGOYA 461-8670, JAPAN

- * Not all the models are supported in all the countries and regions.
- * The machine specifications differ according to the countries and regions. Please check with your dealer.
- * The processing data provided in this brochure is for reference only.