

# SOLUTION



Fiber Laser Welding System

# FLW ENSIS<sub>3</sub>

SERIES

Welding



あける

付ける

曲げる

The Engineering AMADA

切る

**FL**  
FIBER LASER

成形

研削



# A New Era of **Laser Welding**

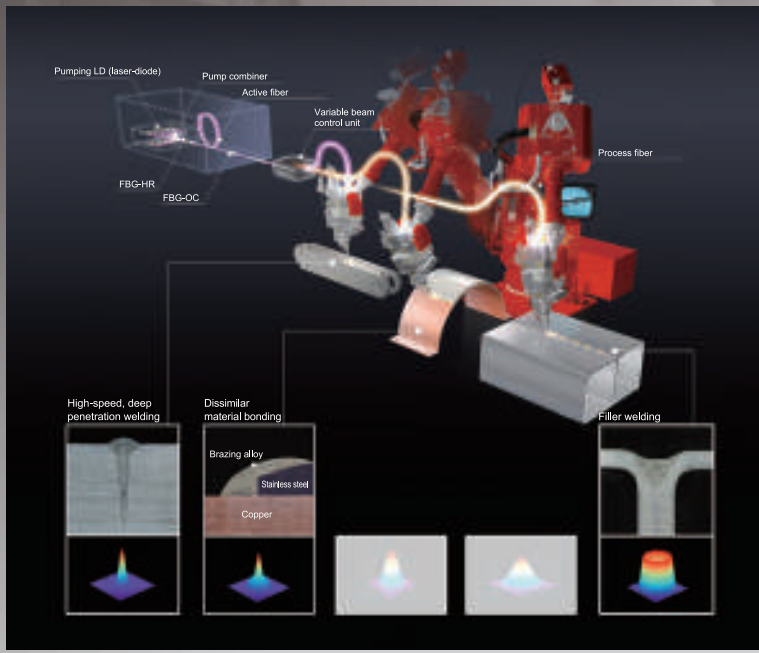
Equipped with an own-developed oscillator and the latest NC, high speed, high quality welding is achieved with the latest functions!

AMADA's fiber laser welding system provides high speed and high quality welding that is impossible with conventional machines.

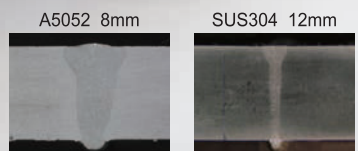
FLW-ENSISe is equipped with the newest "AMNC 4ie" for greatly improved operability. In addition, the newest correction system, using AI technologies, automates the correction work of robot programs and improves customers' work efficiency.

## Process range expansion with ENSIS Technology

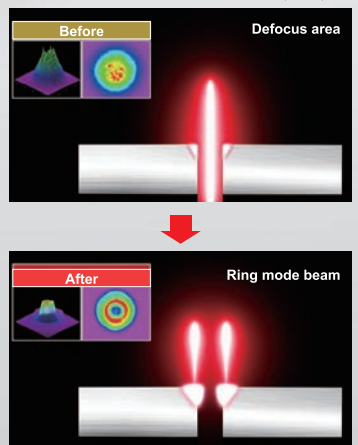
- ① 3kW or 6kW oscillators are available**  
 FLW-ENSISe - 3kW(ENSIS-3000) or 6kW(ENSIS-6000S) are available depending on the requirements of the customers' products.
- ② Beam control according to the application**  
 ENSIS Technology provides wider processing range from fine welds to gap bridging compared to conventional machines.  
 Optimum condition can be selected according to the application without replacing the lens or process fiber.



"Example of penetration depth by bead-on-plate"



\*Processed with FLW-6000ENSISe (6kW)



Fiber Laser Welding System

# FLW ENSIS SERIES

# Example of processing with representative samples

## Smooth back bead



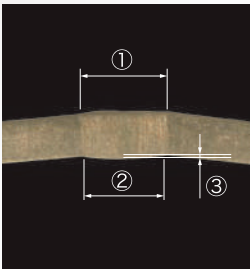
### Sample [Sanitary pipe]

3kW 6kW

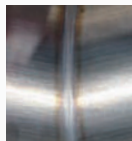


Material :SUS 316 L  
 Thickness :1.45mm (2.0 S)  
 :1.6mm (purchased)  
 Dimension :Φ50.8~74 × 215 mm  
 Purchased parts :Reducer, ferrule  
 Processing time :3 minutes 30 seconds

## Macro observation data (15 ° part)



① Surface width	3.05mm
② Back width	3.00mm
③ Back bead height	0.11mm



Enlarged photo of back bead inside the welded pipe

## Deep penetration weld with high power



### Sample [Flange tube]

6kW



Material :SUS 316 L  
 Thickness :Tube /5.0mm and flange /22mm  
 Dimension :Φ165.2 × 260 mm  
 Processing time :4 minutes 24 seconds

- ① High power x Ring mode x Weaving
- ② Deep and wide weld (Wine cup-shaped cross section)

Leg length: 5.67mm  
 Throat thickness: 4.19mm  
 Leg length: 5.04mm  
 Surface width: 4.05mm  
 Middle width: 1.68mm  
 Back width: 1.08mm

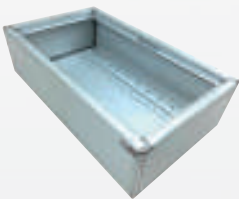
■ Long leg length created with a high power machine  
 ■ Welding without underfill by using filler wire

## Integrated spot welding process

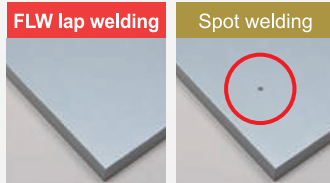


### Sample [Control box]

3kW 6kW



Material :SECC  
 Thickness :1.6 mm  
 Dimension :360 × 210 × 100 mm



With minimal thermal impact on the back surface

FLW-ENSISe	Work setting TAS (Correction)	Main weld	-0.48				
	Assembly Material handling Tack weld						
SPOT & TIG		Main weld		Post polishing	Rust prevention		
		Spot weld					

Lead time comparison

## Dissimilar material bonding



### Sample [Heat exchanger]

3kW 6kW



Material :SUS316+C1100  
 Thickness :1.0 mm+2.0 mm  
 Dimension :150 x 50 x 50 mm  
 Wire :Brazing wire for copper  
 Wire diameter :Φ1.6

Laser brazing

Dissimilar material bonding by FLW	SUS316+C1100						
	Design volume					-0.5	
Dissimilar material bonding by conventional process	Weight						
	Design volume						Machining
Laser brazing	Weight						



# FLW-ENSIS<sub>e</sub>

## 1 FLW-ENSIS<sub>e</sub> New Technology

### FLW-ENSIS<sub>e</sub> welding technology

#### AI-TAS\*

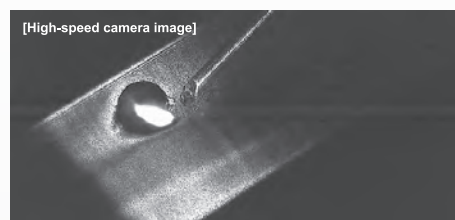
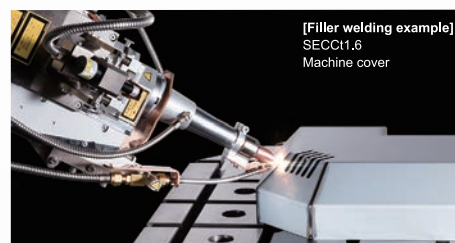
The conventional function "TAS (Teaching Assist System)" is enhanced!  
The robot-mounted "AI" automatically performs the correction work.  
The "AI" has learned different joint shapes and gap conditions to provide reliable corrections.  
Since the correction work is performed automatically, the operator can work on other jobs during this process, improving their work efficiency.  
\*Automatic correction may not be possible depending on the joint shape or material (surface scratches, etc.).



AI-TAS

#### Push-pull filler function

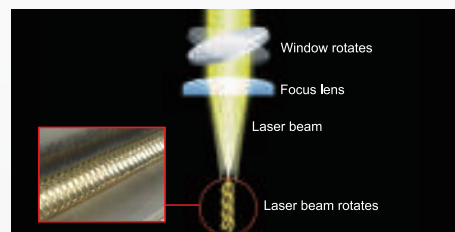
After finishing the filler welding, the filler wire is adjusted to the optimum position.  
This allows for welding of the next line smoothly, providing stable continuous processing.  
In addition, the change between fusion and filler welding can be performed by changing the process conditions, eliminating the need for a manual change.



Push-pull filler function

#### Beam weaving mechanism

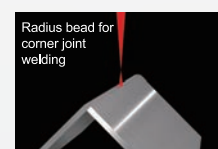
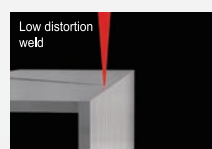
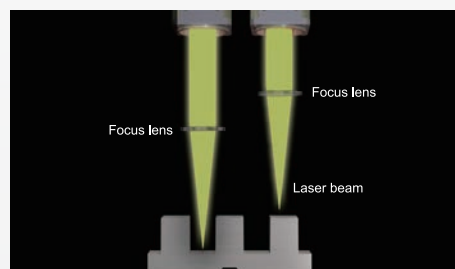
The laser beam is rotated at high speed to form a wide bead.  
A wide range of beads provides "improved ability for gap bridging" and "stable processing with filler wire."



Beam weaving mechanism

#### NC focus control

By moving the focus lens up and down inside the process head, there is no need to change the robot path within the same program including low distortion welding with focused beam and smooth welding with defocused beam.



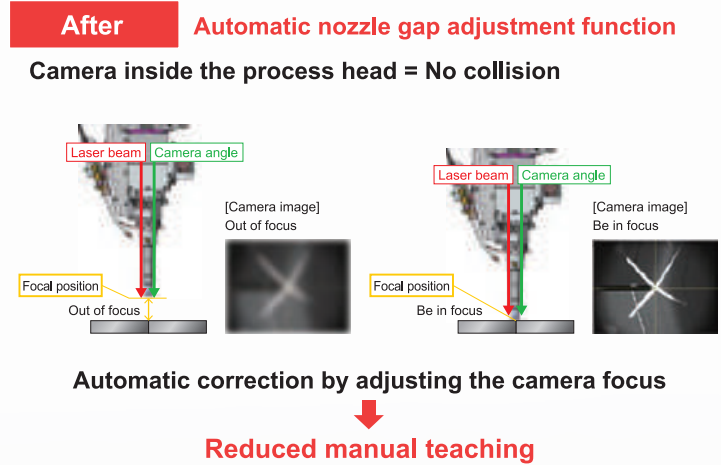
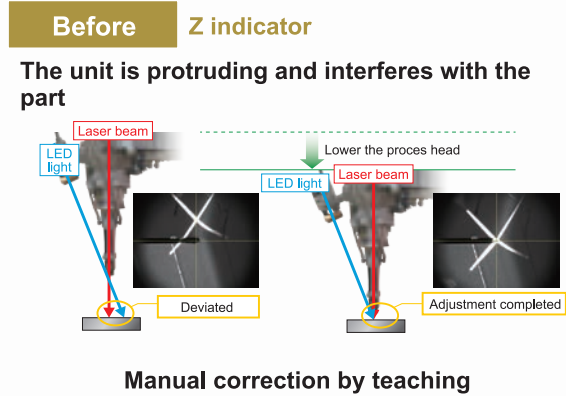
NC focus control

## Operation with easy setup

### Automatic nozzle gap adjustment function

Correction in the height direction of the teaching program is automatically performed by adjusting the focus of the camera image inside the process head.

No collision with the external unit occurs and the working hours are greatly reduced with automated correction.



### Setup navigation

The setup information from the created program can be viewed on the operation stand display.

For repeat production, the pictures showing the actual setup and notes can be saved with programs in addition to the data created by VPSS 4ie WELD. Registered setup information enables anyone to make the same setup, resulting in consistent and speedy manufacturing.



Setup navigation (AMNC 4ie)

### Processing condition file

Customers' own process condition files for each product can be created based on the standard conditions for each material type and thickness. Filler, weaving, and other settings can also be managed collectively on the process condition screen.



Control of welding conditions

### Protective glass dirt detection function

This system monitors for dirt and damage from spatter, dust, etc to the protective glass. Improving quality control and the process of welded products.



Protective glass dirt detection function



# FLW-ENSISe

## 2 Digitalization of the Welding Process

### Offline teaching

#### VPSS 4ie WELD ◆ Software for FLW-ENSISe

##### 1 Production Designer (PD)

Import 2D/3D CAD to create unfold drawings and programs. And add welding attributes such as joint shape during unfolding.

##### 2 VPSS 4ie WELD

~ Creating correct data with simulation functions ~

The robot posture data is automatically generated by allocating the welding lines and setting the process conditions based on the welding attributes added by PD. Collision check including jigs is performed during process simulation to create correct data.

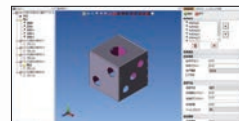
~ Improved productivity through offline teaching ~

The robot program can be created while the machine is under operation. The productivity of FLW-ENSISe is improved by creating programs for the next products without stopping the robot operation.

#### Flow of VPSS 4ie WELD

##### 1 PD

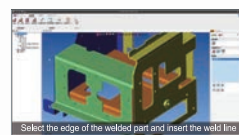
Add welding attributes to 3D model.



##### 2 VPSS 4ie WELD

###### (1) Select welding lines

Select welding lines and sequence, check welding attributes and select welding conditions.



###### (2) Collision check

Accurate collision check using registered jig data.



###### (3) Process simulation

After simulation, transfer data to the machine and start welding.



## 3 V-factory Compatible Machine

The FLW-ENSISe series can be connected to AMADA's IoT "V-factory" to visualize the machine operation and maintenance status. Operation management can be easily performed with data.



#### My V-factory

Visualize the operation status and machine condition.



#### AMNC 4ie

AMNC 4ie functions as a V-factory interface, supporting customers with high-performance NC equipment providing smartphone-like operation.



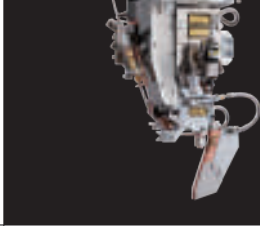
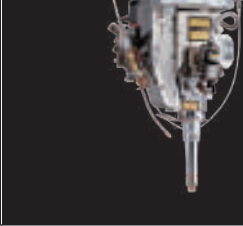
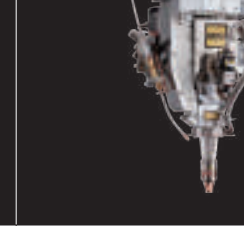
Display operation results and process history

Operating Stand by Planned Alarm

## 4 Other Functions (Including Options)

### Nozzle selected according to the application

\*For FLW-6000ENSIS<sup>e</sup>, water-cooled coaxial nozzle is required.

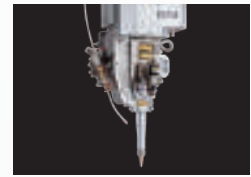
Name	Side nozzle	Fine nozzle	Water-cooled coaxial nozzle
Image			
Standard or Option	Standard	Standard	Option
Shielding effect	◎	○	○
Operability	△	◎	◎
Spatter durability	◎	△	◎
Filler welding	△	◎	◎

### Simple cutting torch • Option

Cutting can be performed by changing the nozzle and conditions. Cutting capability provides a wide range of applications, including additional process to 3D part and sudden design changes.



Cutting torch process example



Cutting torch

## 5 Lineup

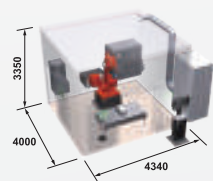
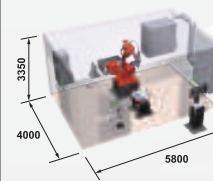
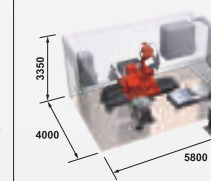
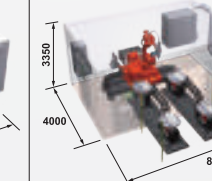
### Oscillator lineup



**3kW** FLW-3000ENSIS<sup>e</sup>  
Oscillator :ENSIS-3000 (3kW)

**6kW** FLW-6000ENSIS<sup>e</sup>  
Oscillator :ENSIS-6000S (6kW)

### Specifications selected according to the part size and lot

Model	Model 1	Model 2	Model 3	Model 5
Robot	●	●	●	●
Positioner table		●	●	●
Robot carriage			●	●
Shuttle specifications				●
Image				

\*M3: Robot carriage stroke length: 1.5m/3.0m/4.0m

\*M5: Robot carriage stroke length: 4.0m

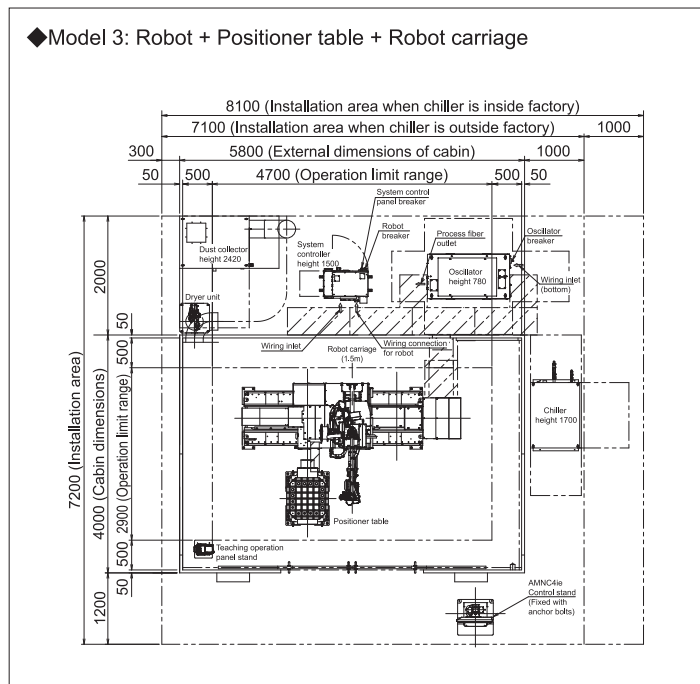
\*The above dimensions show the cabin size. The cabin height is 3750mm including duct.

\*The installation area of auxiliary equipment is separately required in addition to the cabin.



## ■Dimensions

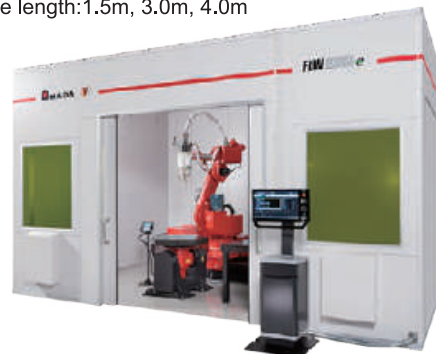
Unit : mm



## ■Lineup

The following lineup is available according to the part size, application and lot.

- ◆ FLW-3000ENSISe: Oscillator power 3kW  
FLW-6000ENSISe: Oscillator power 6kW
- ◆ Model 1: Robot-only  
Model 2: Robot + Positioner table  
Model 3: Robot + Robot carriage + Positioner table  
Model 5: Robot + Robot carriage + 2 Positioner tables with shuttle type
- ◆ Robot carriage specifications  
Stroke length: 1.5m, 3.0m, 4.0m



## ■Machine body specifications

Model name	FLW-6000ENSISe	FLW-3000ENSISe
Registered machine name	FLW6000ENE	FLW3000ENE
Oscillator/Chiller	*See below	
Robot	GA50 (made by YASKAWA)	
Robot controller	YRC1000 (made by YASKAWA)	
NC equipment	AMNC 4ie	
Process head	Made by AMADA	
Cabin	Full-covered cabin	
Dust collector	PXN-VIXA (made by SINTO)	

## ■Robot carriage specifications

Standard stroke length	m	1.5, 3.0, 4.0
Robot carriage speed	m/min	60
Positioning repeatability	mm	±0.1

## ■Positioner table specifications (with surface plate)

Passline height	mm	767
Loading capacity	kg	500
Rotation axis (angle)		±720°
Tilt axis (angle)		±90°

## ■Oscillator/Chiller specifications

Item		FLW-6000ENSISe	FLW-3000ENSISe
Oscillator model		ENSIS-6000S	ENSIS-3000
Rated output	W	6000	3000
Wavelength	μm	1.08	
Oscillator outline W×H×L	mm	750×780×1450	750×780×1450
Oscillator power requirements	kVA	20.4	10.1
Oscillator weight	kg	320	305
Chiller model		RKE7502B-VA-UP2BP	RKE5502B-VA-UP2BP
Cooling capacity	kW	18	13
Chiller dimensions W×H×L	mm	1100×1700×854	
Chiller weight *( ) during operation	kg	360 (470)	340 (450)
Chiller power requirements	kVA	11.4	9
Total power requirements (Model3) including dust collector	kVA	52.2	39.5

**!** To ensure safe and correct use, thoroughly read and understand the "Instruction Manual" before using the product.

- To operate the machine, a special cabin is required to prevent danger.
- This system requires a light shielding material dedicated to 1.08μm wavelength.
- When operating a robot in Japan, it is necessary to take the "special safety education related to work such as teaching" stipulated in Article 36, Item 31 of the Ordinance on Industrial Safety and Health.

\*The specifications and design are subject to change without notice.

\*Applications for the administration (installation notification, export, financing, etc.) of machines and devices described in this catalog are requested by the machine model name.

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**!** This laser product uses a class 4 invisible laser for processing, and a class 3R visible laser for checking the processing position.

- Class 4 invisible laser: Exposure to the eyes or skin of beams or scattered light is dangerous! Do not see or touch.
- Class 3R visible laser: Avoid direct eye-exposure

## AMADA CO., LTD.

200, Ishida, Isehara-shi, Kanagawa, 259-1196, Japan  
www.amada.co.jp

Inquiries



Product information  
FLW-ENSISe



E164-HQ01en

Jan. 2024