

**KOBELCO**

WELDING ROBOT

# **ARC MAN™**

**STRUCTURAL STEEL WELDING ROBOT SYSTEM**



**KOBE STEEL, LTD.**

# Welding robot systems for structural steel from Japan's leading welding company "KOBELCO"

Kobe Steel, the only welding solutions company that develops all of its own original welding robots, welding power supplies and welding wires aims to be your No.1 partner for structural steel fabrication.

## ASSURING

Through our in-depth understanding of the welding process, our aim is to make a system that fabricators can trust and use with confidence

- We provide robot systems that contribute to the quality and control of the production process
- We also support new processes and new standards

## TRUSTWORTHY

We continually pursue the optimization of structural steel welding

- We aim for the best welding quality that meet certification standards and type approval for architectural structural steel
- We provide support for a wide range of structural steel welding technologies and production processes

## EFFICIENT

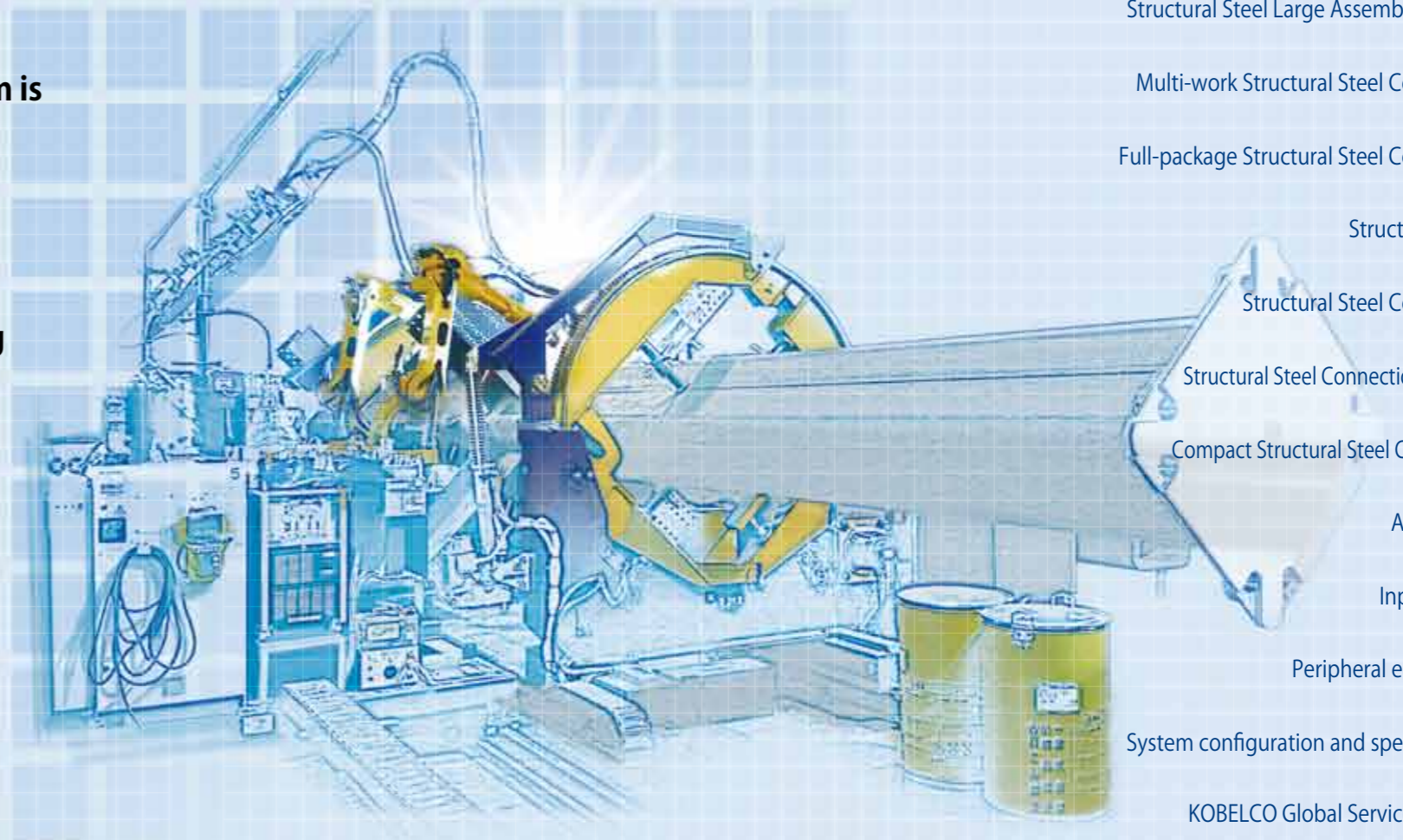
Contributing to cost reduction through fast and high efficiency welding

- By raising the percentage of welding automation, we aim to increase the number of weld that can be robot-welded
- Our robot is adaptable to numerous applications thus increasing the rate of return on its investment

## EASY

Our welding robot system is user friendly such that anyone can operate it from day one of its installation

- Our aim is to supply a robot system that requires minimum pre-operation setting up
- Minimal data input and simple operation lessen the work load of the operator



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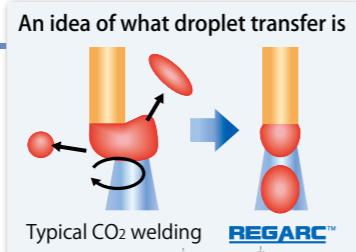
KOBELCO Global Service Network 21

# REGARC™ Structural Steel Welding Robot Systems

The advantages of REGARC™ welding and constant voltage welding combined to give high quality welding.

## What is REGARC™ ?

The REGARC™ process featuring our new power supply SENSARC™ AB500 achieves systematic and smooth droplet transfer for global transfer through our original current/voltage wave form controller (patented)



## Wire for REGARC™

- Optimized to reduce slag volume and slag removal for carbon dioxide multi-pass welding.
- Superior conductivity, adherence resistivity and wire feedability made possible through REGARC™'s unique waveform control.
- Compatible with conventional constant voltage welding. 490MPa level (YGW11): FAMILIARC™ MG-50R(N) 550MPa level (YGW18): FAMILIARC™ MG-56R(N)



## System characteristics

### 1 Reduces production time

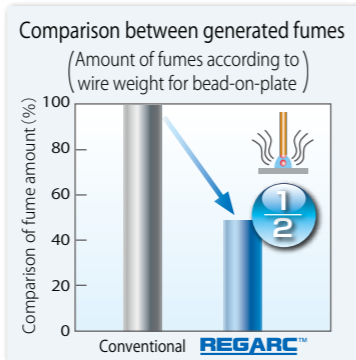
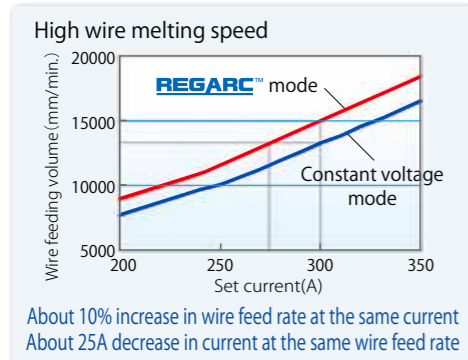
Low spatter means less frequent cleaning and because of reduction in spatter adhering to the work, the robot operation time and post-treatment time can be significantly reduced. Combined with the reduction in air cut time as a result of the new software, robot operation time reduction up to 20% can be expected for a column plate thickness of 22mm/0.87in, 400mm/15.75in diameter (compared to our competitors). \*Time reductions may vary due to plate thickness or diameter. In addition, an automated contact chip changer is supplied as standard so chip changes are carried out automatically during operation resulting in increased continuous operability. \*Space saving type welding robot systems do not come standard with a chip changer.

### 2 High quality welding

Since the average current can be reduced as a result of the faster wire melting rate in the REGARC™ welding process, the maximum heat input can be minimized. In addition, by switching between REGARC™ welding and constant voltage welding for each weld pass or during welding, each part can be welded appropriately.

### 3 Environment friendly and energy saving welding

Even whilst the wire melting rate is being increased, with our proprietary process, the average current can be lowered thereby reducing the energy consumption compared to conventional constant voltage welding (a 5% reduction in power consumption can be achieved for the same wire feed rate). Furthermore, by reducing the over-heat time for melting, the amount of fumes generated can be reduced.



### 2-ARC welding robot system for steel core connection



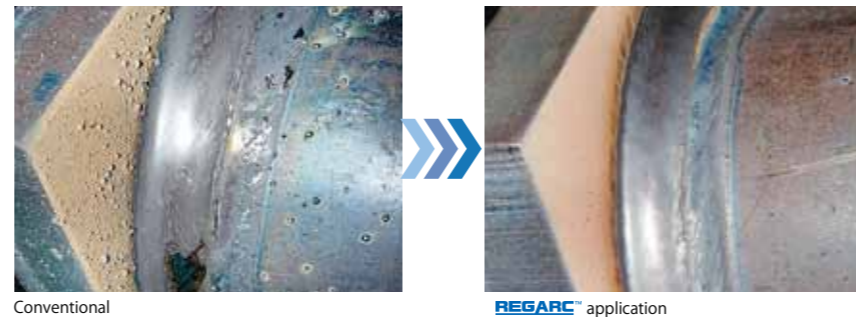
### Spatter on nozzle

— Spatter comparison test

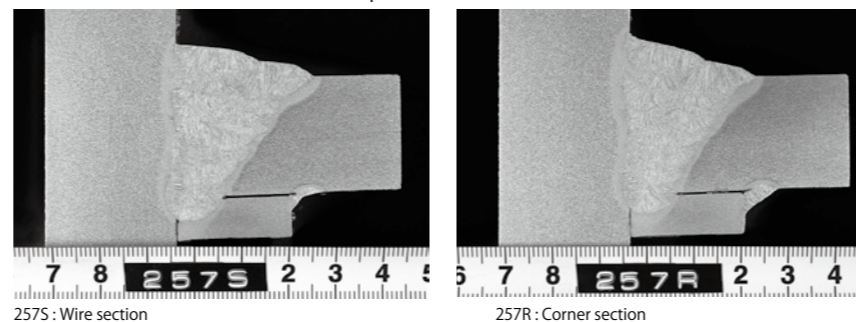


### State of spatter adhesion and fume generation after welding

— FAMILIARC™ MG-56R(N)



### Cross section of weld bead and weld penetration



## The technology behind REGARC™

- Specialized welding equipment
- Specialized welding material
- Chip changer



## Systems installed

- Structural Steel Large Assembly "2-ARC" Welding Robot System



- Structural Steel Large Assembly Welding Robot System



## Scope of application

Types of REGARC™ Welding Robot Systems				
System	Compact Structural Steel Connection Welding Robot System	Structural Steel Connection Welding Robot System	Structural Steel Large Assembly Welding Robot System	Multi-work Structural Steel Connection Welding Robot System
Robot base	Single welding only	Single/ 2-ARC	Single/ 2-ARC	Single welding only
Wire weight	MAX 650 kg / 1433lb MAX 1000 kg / 2205lb	MAX 2000 kg / 4409lb MAX 3000 kg / 6614lb MAX 4000 kg / 8818lb	MAX 10000 kg / 22046lb MAX 15000 kg / 33069lb MAX 20000 kg / 44092lb MAX 30000 kg / 66139lb	MAX 3000 kg / 6614lb
Other	Chip changer not included		Chip changer included	

## REGARC™ Optimal plate thickness

### ©HSS-Column welding

Plate thickness 9~40mm / 0.35~1.57in

### ©Round pipe welding

Plate thickness 9~40mm / 0.35~1.57in

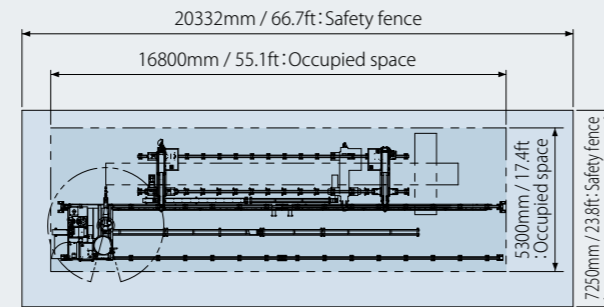
\*The conventional constant voltage mode can be used for applications other than the above

# Structural Steel Large Assembly Welding Robot System

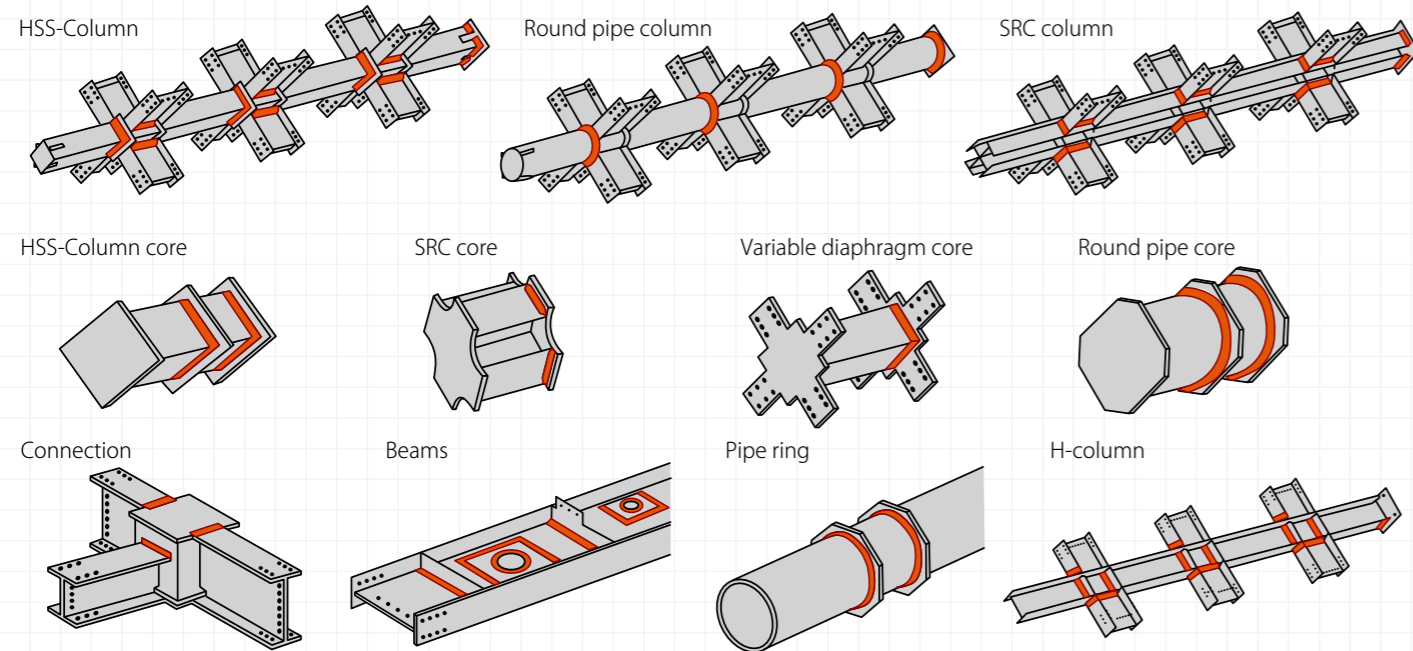
- Enhanced functionality and expandability —



● Reference layout plan



## Welding points



● Example of column large assembly system connection process



● Example of column large assembly system beam process



● Example of cut-out base process



● Example of horizontal process (bead external view)



## Features

### 1 Feature to realize unobserved operation for extended periods

- Nozzle cleaner, nozzle auto changer, wire cutter, chip changer (available for REGARC™ only) come as standard
- The arc start pre-check function and crater – arc start combination feature reduces arc start errors
- The slow-down start feature and wire stick removal feature control arc ON/OFF time stoppages
- Slag automated removal equipment can be installed (option)

### 2 Applicable to a wide variety of work, increased plant operation rate

- S-form column, SRC column (H-column), round pipe column, box column can all be handled
- Applicable also to column body fabrication method (non-bracket fabrication method)
- Applicable also to bracket welding (horizontal welding) for column through-box column, SR column (H-column)
- Applicable also to core connector welding, connection welding

### 3 High quality welding

- Bead appearance corresponding to JASS6 and heat control conditions, in-pass temperature management, handling feature and robot model certification are also applicable
- The automatic measurement of corner radius and corner gap means that even work with variations can be welded appropriately

### 4 Simple operation

- Easy-to-understand input screen makes it easy to create data
- The home automatic measurement feature allows the robot to automatically measure the column position

### 5 Existing delivered systems can be upgraded to 2 arcs (robots)

- Adding a robot and slider to an existing column large assembly system can upgrade the system to a 2-ARC welding system

## Some variations of Structural Steel Large Assembly System



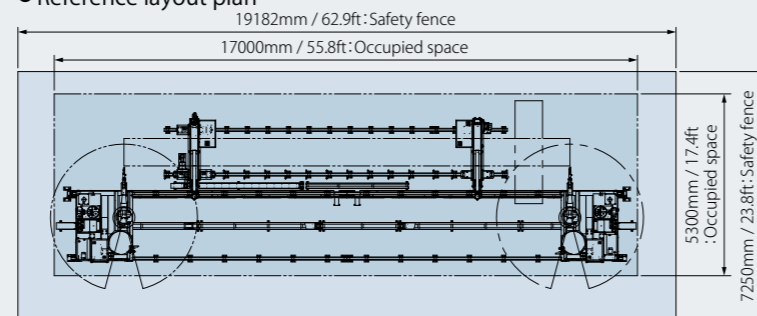
# Structural Steel Large Assembly "2-ARC" Welding Robot System

- Significant increase in productivity per unit area —

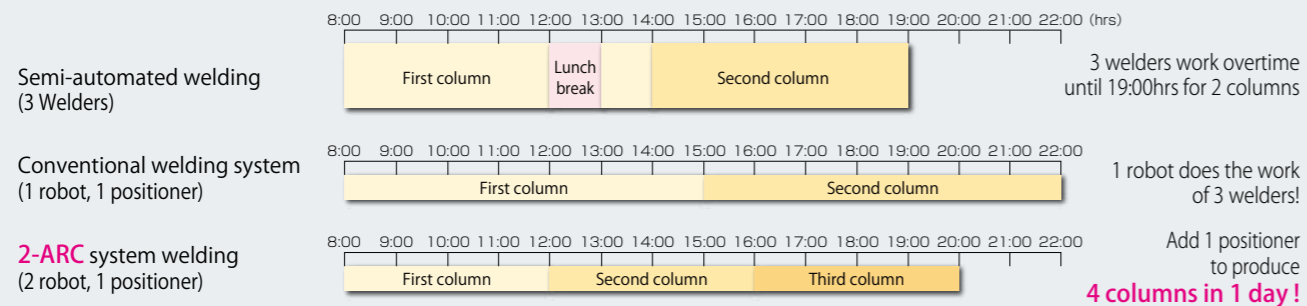


Central diaphragm is simultaneously welded.

## ● Reference layout plan



## Benefits of automatic welding (for a S-form column 400mm/15.75in core, 22t/0.87in, 6 joint, semi-automated arc generation rate of 30%)



## Applicable range

System type	10T-800MP2	15T-1000MP2	20T-1000MP2	30T-1000MP2
HSS-Column diameter	250~800mm / 9.84~31.5in	250~1000mm / 9.84~39.37in	250~1000mm / 9.84~39.37in	250~1000mm / 9.84~39.37in
Pipe diameter	250~813mm / 9.84~32.01in	250~1016mm / 9.84~40in	250~1016mm / 9.84~40in	250~1200mm / 9.84~47.24in
Column maximum weight, welding applicable range	10t•13m/42.7ft	15t•13m/42.7ft	20t•13m/42.7ft	30t•13m/42.7ft
Joint number	Maximum 4-joint and base plate			
Applicable Column plate thickness	9, 12, 16, 19, 22, 25, 28, 32, 36, 40mm / Min 0.35in Max 1.57in			
Applicable Round pipe thickness	9, 12, 16, 19, 22, 25, 28, 32, 36, 40, 45, 50, 55, 60mm / Min 0.35in Max 2.36in			
Applicable SRC thickness	9~32mm (in 1mm pitches), 35, 40, 45, 50, 60mm / Min 0.35in Max 2.36in			
Application to column plate thickness (option)	45, 50mm / 1.77, 1.97in			
Gap range	4~10mm / 0.16~0.39in			
Gap difference tolerance for 2 weld joints	Maximum 6mm / 0.24in (a single pass may apply depending on the configuration)			
Combined joint	2-ARC welding combination selection is automatically set			

(Note 1) HSS-Column diameter, column maximum weight, welding range, etc. are all within the applicable range of the "column large assembly welding system" (see p6).  
(Note 2) See p3 for the appropriate plate thickness of columns and round pipes for REGARC.

## Features

### 1 Welding time halved

- Welding time is halved compared to Single ARC welding systems.
- In addition to welding, wire cut, sensing function and slag removal is automatically executed by 2 robots at the same time.

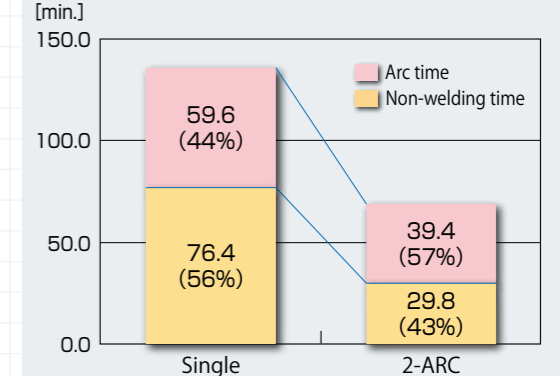


Sensing



Slag removal

### Plate thickness, 9mm/0.35in, 250mm/9.84in square, 6 joint worktime comparison [min.]



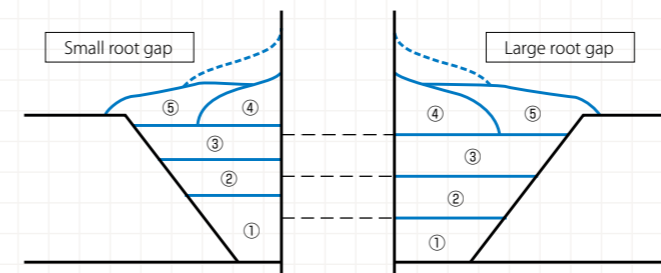
Effect on thin plate (effect on 2-ARC thin plate)

### 2 Welding different route gaps

- To weld different initial cross-sections within the same welding time, the welding amperage, arc voltage and welding speed are automatically calculated.

**Handles gaps up to 6mm/0.24in! \***

\*A single pass may apply depending on the configuration



### 3 Applicable also for columns with different plate thickness or diameter

- Different sizes (plate thickness, diameter) can be welded simultaneously with 2-ARC welding system.

\*Same diameter, same plate thickness only possible with REGARC.



Columns with different plate thickness/diameter (image of mock-up)

### 4 Applicable to a variety of work with improved operational efficiency



Round pipe 2-ARC welding



SRC 2-ARC welding



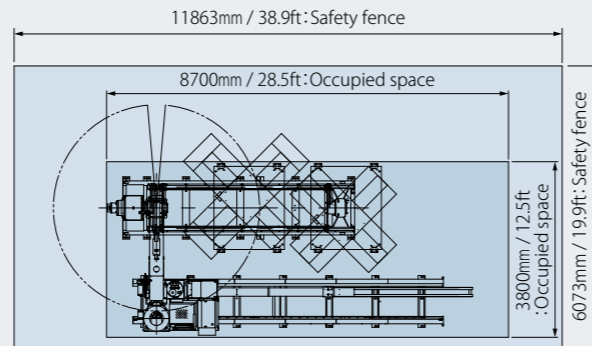
2-ARC welding joining HSS-column core

# Multi-work Structural Steel Connection Welding Robot System

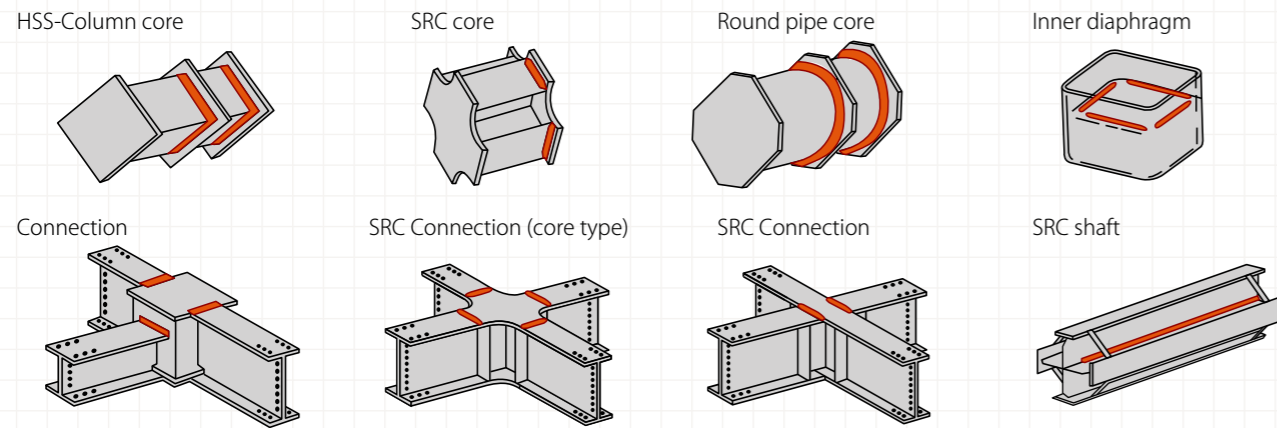
- Multi-purpose for high operational efficiency —



## ● Reference layout plan



## Welding points



## Features

### 1 Multi-purpose and operational efficiency achieved

- Applicable to respective types of core, connection, inner diaphragm and SRC shaft
- Due to continuous operation of differing types or multiple works, long operation times would be possible.

### 2 Simple input of data for each type of work

- A simple interactive input screen not just for cores but also for all connections, inner diaphragms and SRC shafts
- Work measurement and tiresome inputs are lessened to reduce time and prevent input errors.

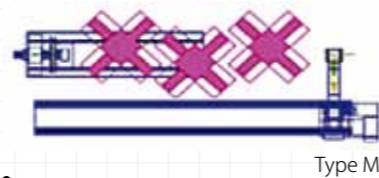
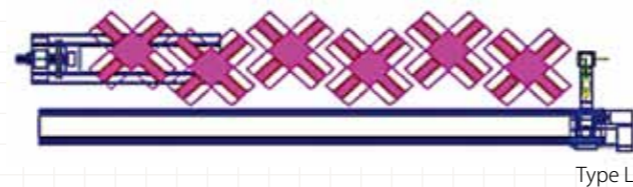
### 3 Continuous operation for various works

- Using the reserved operation function, numerous works of different types can be set at once, allowing for continuous operation.

### ● Reference installation points for each type of connection and inner diaphragm and corresponding image

Type	Occupied space	Connection work (note 1)	Inner diameter (note 2)
S	W8700mm × D3800mm × H3420mm (W28.5ft × D12.5ft × H11.2ft)	2units	4units
M	W11000mm × D3800mm × H3420mm (W36.1ft × D12.5ft × H11.2ft)	3units	6units
L	W17000mm × D3800mm × H3420mm (W55.8ft × D12.5ft × H11.2ft)	6units	13units

(Note 1) Maximum case - work with connection length of 2400mm installed in 2 rows  
(Note 2) Maximum case - work with column diameter of 500mm installed



## Application example

### 1 Core welding

- Measurement time is eliminated for corner radius sensing, increasing quality.



### 2 Connection welding

- Depending on the matching of the back plate, welding parameters are automatically adjusted to prevent burnt through.



### 3 Inner diaphragm welding

- Applicable to a depth of 300mm/11.81in from the upper surface of the core to the lower surface of the diaphragm (inside metal surface)



### 4 SRC shaft welding

- Interference between the robot and flange is automatically avoided based on the shape of the work entered and sensing.



## Applicable range

### ● Core

Type	Diameter	Applicable plate thickness	Applicable to thick plates (option)	Length
HSS-Column	250~800mm / 9.84~31.5in	9, 12, 16, 19, 22, 25, 28, 32, 36, 40mm / Min 0.35in Max 1.57in	45, 50mm / 1.77, 1.97in	300~3500mm / 11.81~137.8in
Round pipe	250~813mm / 9.84~32.01in	9, 12, 16, 19, 22, 25, 28, 32, 36, 40, 45, 50, 55, 60mm / Min 0.35in Max 2.36in		
SRC	250~800mm / 9.84~31.5in	9~32 (in 1mm Pitches), 36, 40, 45, 50, 55, 60mm / Min 0.35in Max 2.36in		

(Note 1) Applicable for columns and round pipes with special specifications up to columns 1000mm/39.37in square  
(Note 2) See p3 for the appropriate plate thickness of columns and round pipes for REGARC™.

### ● Connection

Type	Diaphragm dimensions	Flange width	Flange thickness	Beam structure	Connection step
S-Connection	250~1100mm / 9.84~43.31in	100~400mm / 3.94~15.75in	9~32mm (in 1mm Pitches) 36, 40, 45, 50mm / Min 0.35in Max 1.97in	300~1000mm / 11.81~39.37in	Over 120mm / 4.72in
SRC-Connection			1mm Pitches for 9~32mm / 0.35~1.26in	700~1000mm / 27.56~39.37in	

### ● Inner diaphragm

Type	Column core internal diameter	Inner diaphragm depth	Inner diaphragm thickness	Column core height
Inner diaphragm	200~1000mm / 7.87~39.37in Column inner diameter 175mm / 6.89in	Within 300mm / 11.81in	9~32mm (in 1mm Pitches) 36, 40, 45, 50mm / Min 0.35in Max 1.97in 1mm Pitches for 9~32mm / 0.35~1.26in	Below 1000mm / 39.37in

### ● SRC shaft

Type	Flange width	Flange/web thickness	Shaft length	Flange gap separation	Flange aperture
SRC shaft	100~400mm / 3.94~15.75in	6~25mm / 0.24~0.98in	1000~3000mm / 39.37~118.11in	Within 800mm / 31.5in	Within 100mm / 3.94in

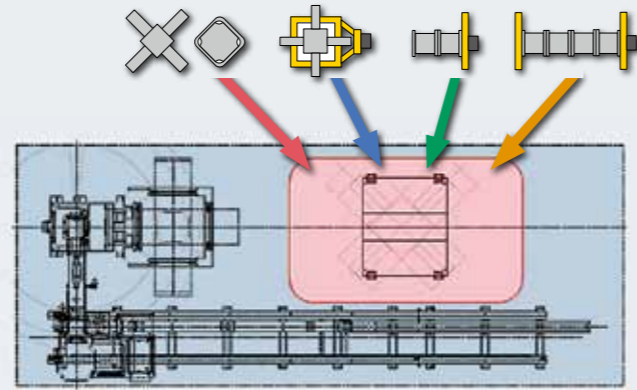
(Note 1) the flange aperture requires more than 140mm when using slag automatic removal equipment.

# Full-package Structural Steel Connection Welding Robot System

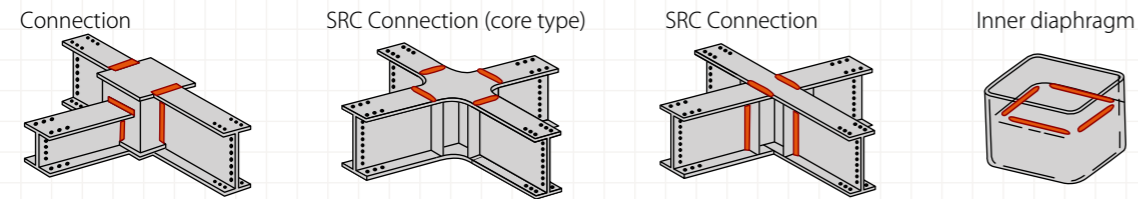
●Connections are "fully" finished by "one set"! —



● With the addition of various positioners, a variety of work can be handled



## Welding points



## Features

### 1 Connections are fully completed in one set

- A crane is not required for work reversal
- Diaphragm X beam flange (inside/outside) and beam web edge material welding is carried out continuously

### 2 Simple operation

- The only inputs are diameter, flange thickness and leg length
- Flange thickness and attachment point do not need to be entered



## Applicable range

Item	Specifications
Connection height	300~800mm / 11.81~31.5in
Size	Below 2400mm / 94.49in
Diaphragm diameter	240~650mm / 9.45~25.59in
Beam flange width	100~400mm / 3.94~15.75in
Step dimension	Diaphragm top surface - beam flange top surface - t 19 / 0.75in : over 100mm / 3.94in t 22 / 0.87in - : Diaphragm thickness + over 120mm / 4.72in
Mass	Below 2.0t / 4409lb

\*SRC connections are also applicable  
\*for ground installation, the applicable range increases.  
See the applicable range "connection" table on p10.

## Application example

### ● Outside flange welding



### ● Inside flange welding

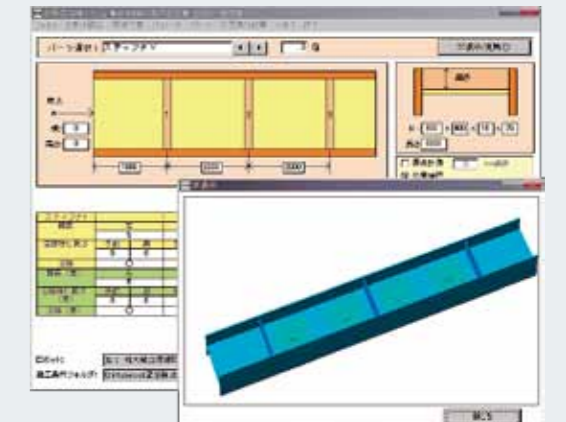


### ● Web welding

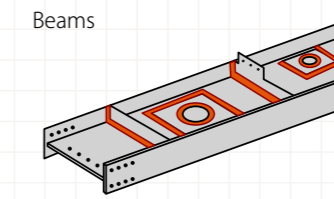


# Structural Beam Welding Robot System

●Automation of beam welding is achieved —



## Welding points



## Features

### 1 Turn welding

- The flange terminal and scallop interior are sensed and the positional accuracy of the angles are detected to ensure quality turn welding



Turn welding bead

### 2 Positioner for beams

- In order to weld stiffener and flange, the beam is rotated by the positioner, and the robot approaches the beam from directly above to reduce residual welding.
- Rotating the beam from front to back does not require a crane thus reducing time.

### 3 Alternate welding function

- Stiffener welding is done alternately on the front and rear, reducing warping due to the thermal strain of welding.

### 4 Rotation correction function

- If a part is attached at an angle, the deviation in rotation will be accounted for during welding
- After detecting the terminal position of the component part by sensing, a welding program for the part is made to enable real-time corrections to be made during welding by arc tracking.

## Introduction merit (operation time) Stiffener SP X 3 sheets X both sides + support plate PL X 3 sheets X single side

Beam	SP	PL	Operation time	Arc time (%)	Semi-automatic (%)
1200mm X 500mm X 19mm X 32mm / 47.24in X 19.69in X 0.75in X 1.26in	16t / 0.63in	16t / 0.63in	04:14:24	03:05:24 (72.9%)	10:17:54 (30.0%)
1000mm X 400mm X 16mm X 28mm / 39.37in X 15.75in X 0.63in X 1.1in	14t / 0.55in	14t / 0.55in	03:07:54	01:58:54 (63.3%)	06:36:12 (30.0%)
800mm X 300mm X 14mm X 26mm / 31.5in X 11.81in X 0.55in X 1.02in	12t / 0.47in	12t / 0.47in	02:35:30	01:26:30 (55.6%)	04:48:12 (30.0%)

\*Operation time, arc time and semi-automation are shown in units of time (HH:MM:SS)

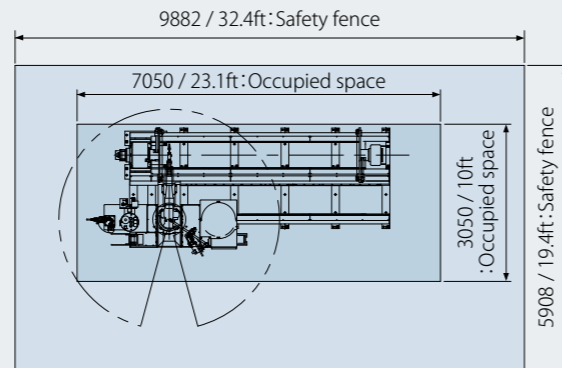
## Applicable range

Applicable points	Size
Beam web X stiffener	Handles beams up to 400~800mm/15.75~31.5in and beam floor position of 1400mm/55.12in.
Beam flange X stiffener	Includes turn welding (positioner used)
Beam web X reinforcement plate	Separation between beam flange from 50mm/1.97in upwards
Beam web X reinforcement plate/through hole	Through hole diameter 100~600mm/3.94~23.62in
Beam web X reinforcement (round type) plate	Separation between beam flange from 350mm/13.78in upwards

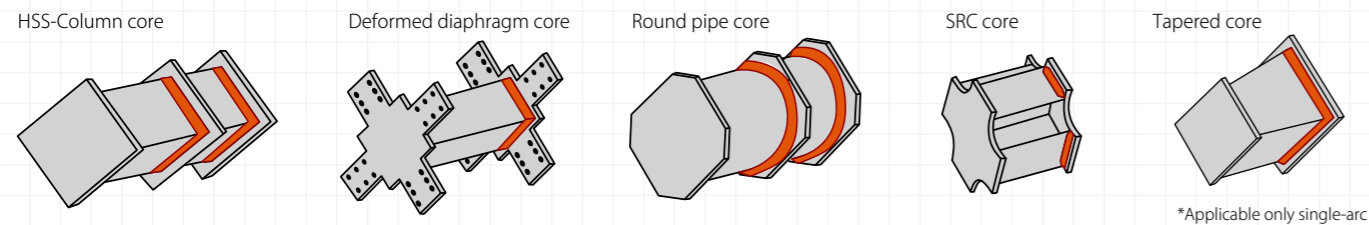
# Structural Steel Connection Welding Robot System



● Reference layout plan



## Welding points



## Features

### 1 Realizing unobserved operation for extended periods

- A maximum of 18 fixtures can be welded continuously
- Nozzle cleaner, nozzle auto-changer, wire cutter, chip changer (**REGARC™** only) come as standard
- The arc start pre-check function and crater-arc start combination feature reduce arc start errors
- The slow-down start feature and wire stick removal feature control arc ON/OFF time stoppages
- Automatic slag removal equipment can be installed (option)

### 2 Applicable to a variety of work, improved operational efficiency

- Optimal for round pipe, SRC or other types of core

### 3 High quality welding

- Bead appearance corresponding to JASS6, heating management conditions, applicable to in-pass temperature management and robot model certification
- The automatic measurement of corner radius and corner gap means that work with variations can be welded appropriately

### 4 Simple operation

- Easy-to-understand input screen makes it easy to create data

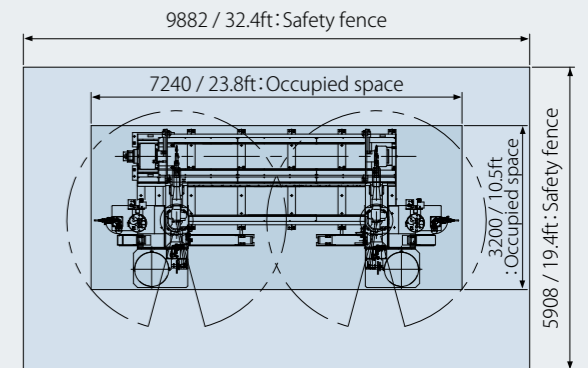
### 5 Existing delivered systems can be upgraded to a 2-ARC welding system

- 2-ARC welding is possible by adding a robot and slider to an existing core connector welding system

# Structural Steel Connection "2-ARC" Welding Robot System



● Reference layout plan



## Features

### 1 Welding time halved

- Similar to the 2-ARC of the column large assembly system, the time of a conventional system can be halved.
- Apart for welding, wire cut and sensing related work or slag removal is also executed by 2 robots simultaneously.

### 2 High efficiency and space saving

- The welding time of the core can be significantly reduced with just the occupied space of a Single ARC system.

### 3 Welding different root gap

- A welding current to weld different groove cross-sections within the same amount of welding time.

### 4 Applicable to different column plate thicknesses or diameters

- Different sizes (plate thickness, diameter) can be welded simultaneously with 2-ARC welding system.

### 5 Core connection clamp with counter-strain feature

- The connection jig for conventional clamp surface plate is improved and prevents diaphragm bevels breaking (patented)



## Applicable range

System type	2t specification	3t specification	4t specification
HSS-Column diameter	200~800mm / 7.87~31.5in	250~800mm / 9.84~31.5in	250~1000mm / 9.84~39.37in
Pipe diameter	200~813mm / 7.87~32.01in	250~813mm / 9.84~32.01in	250~1016mm / 9.84~40in
Length/connection points	300~3000mm / 11.81~118.11in / maximum of 9 (18joints)		
Applicable plate thickness	Column	9,12,16,19,22,25,28,32,36,40mm / Min 0.35in Max 1.57in	
	Round pipe	9,12,16,19,22,25,28,32,36,40,45,50,55,60mm / Min 0.35in Max 2.36in	
	SRC	9~32 (in 1mm Pitches), 36,40,45,50,55,60mm / Min 0.35in Max 2.36in	
Column plate thickness handled (option)	45, 50mm / 1.77, 1.97in		

(Note 1) Core connection clamp (required as a separate option). (Note 2) Attachment jig for core attachments other than square diaphragms will be required additionally. (Note 3) See p3 for the appropriate plate thickness of columns and round pipes for **REGARC™**.

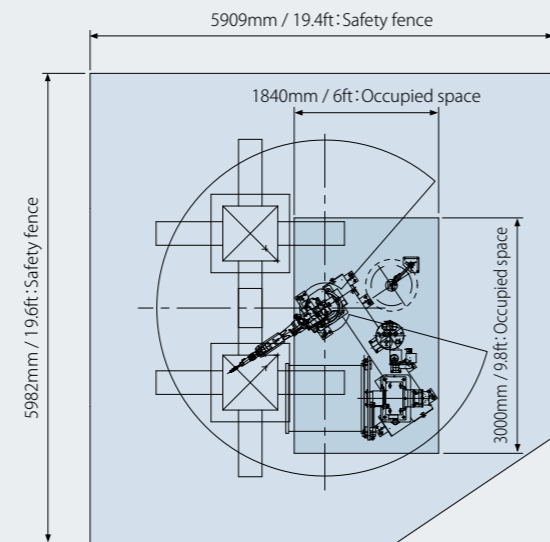


# Compact Structural Steel Connection Welding Robot System

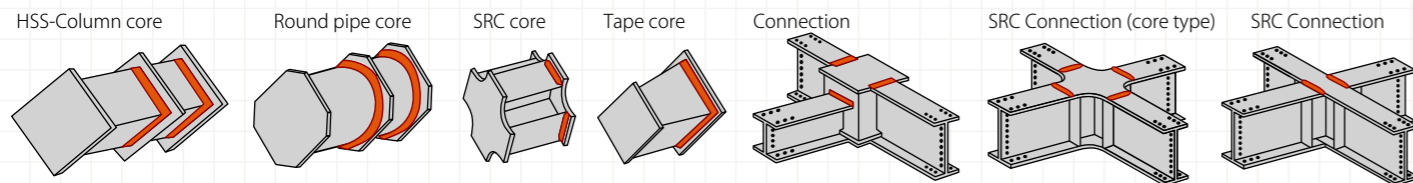
● Small space, big effect ! —



● Reference layout plan



## Welding points



## Features

### 1 Space saving and easy operation

- The equipment only occupies 1.8m × 3.0m / 6ft × 9.8ft!
- The robot automatically measures the outer radius of 4 corners by the corner radius sensing function thus eliminating time for measurement and improves quality.
- Easy-to-understand input screen makes it easy to create data

### 2 High quality welding

- Bead appearance corresponding to JASS6 and heat control conditions, in-pass temperature management, handling feature and robot model certification are also applicable
- The automatic measurement of corner radius and corner gap means that work with variations can be welded appropriately

### 3 Connection data can be input easily

- Since the input of detailed dimensions is not needed, production time including set-up time can be significantly reduced
- Burn through prevention function, surface step applicability function and round-trip multi-pass welding function reduces time and effort during assembly and negate the need for repair welding after robot welding.

### 4 Realizing unobserved operation for extended periods

- Nozzle cleaner, Nozzle auto changer and wire cutter come as standard
- Welding of core connection is also possible
- The arc start pre-check function and crater – arc start combination feature reduces arc start errors
- The slow-down start feature and wire stick removal feature control arc ON/OFF time stoppages
- 2 connections positioned to make continuous operation possible

### 5 Applicable to a variety of work, improving operational efficiency.

- Optimal for round pipe, SRC or other types of core
- Connection flange welding can also be applied for step connections

## Application example

### ● Core connection welding



### ● Round pipe core welding



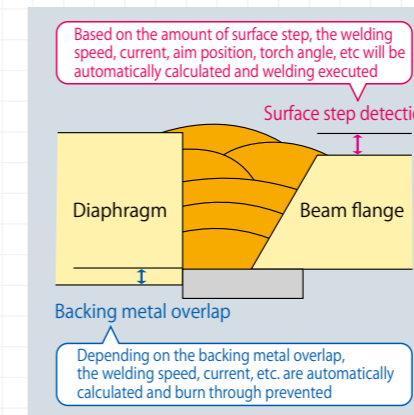
### ● SRC core welding



### ● Connection welding



### ● Surface step sensing and burn through prevention function



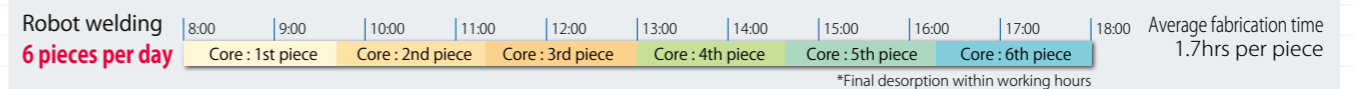
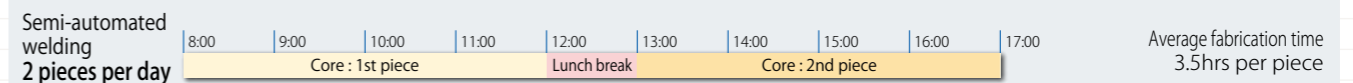
### ● Burn through prevention function



### ● Surface step handling function



## Benefits of automating Subject work : S-form column (400mm / 15.75in core, 16t / 0.75in)



## Applicable core, connection shape/dimensions

### ● Core

Type	Diameter	Plate thickness	Length
HSS-Column	200~800mm / 7.87~31.5in	9, 12, 16, 19, 22, 25, 28, 32, 36, 40mm / Min 0.35in Max 1.57in Plate thickness handling : 45, 50mm (option) / 1.77, 1.97in	274~1000mm / 10.79~39.37in
Round pipe	200~813mm / 7.87~32.01in	9, 12, 16, 19, 22, 25, 28, 32mm / Min 0.35in Max 2.36in Plate thickness handling : 36, 40, 45, 50, 55, 60mm / Min 1.42in Max 2.36in	
Tape (option)	250~800mm / 9.84~31.5in	9, 12, 16, 19, 22, 25, 28, 32mm / 0.35in~1.26in	
SRC form	Cross section dimensions : 250~700mm / 9.84~27.56in Flange width : 100~400mm / 3.94~15.75in	Flange thickness : 9, 12, 16, 19, 22, 25, 28, 32mm / Min 0.35in Max 2.36in Plate thickness handling : 36, 40, 45, 50, 55, 60mm / Min 1.42in Max 2.36in	

(Note 1) Core connection clamp (required as a separate option). (Note 2) Attachment jig for core attachments other than square diaphragms will be required additionally  
(Note 3) See p3 for the appropriate plate thickness of columns and round pipes for REGARC.

### ● Connection

Type	Diaphragm dimensions	Flange width	Flange thickness	Beam structure	Connection step
S form connection, SRC form connection, 2 connections placed	240~700mm / 9.45~27.56in	100~400mm / 3.94~15.75in	9~32mm (in 1mm Pitches) 36, 40, 45, 50mm / Min 0.35in Max 1.97in 1mm Pitches for 9~32mm / 0.35~1.26in	300~1000mm / 11.81~39.37in (Butt connection) 700~880mm / 27.56~34.65in (Step connection)	Over 120mm / 4.72in

### 1 Structural Steel Navigation

Useful for checking production progress and aiding planning and making quotes

- Checking production progress : Management of robot welding progress and improving the process prior to welding  
Displays robot operation progress. Production progress can be checked both on the shop floor as well as from the office through a network connection.
- Estimate calculation feature : Eliminates wastage and enables high precision process planning to be made  
Apart from tact time, wire usage etc. can be calculated to enable high precision process planning and cut down production wastage

The screenshot shows a software interface for steel production navigation. It includes a Gantt chart with columns representing different workpieces and rows representing welding passes. Callouts identify 'Work name/Column number', 'Welding order', 'Remaining pass number', and 'Current pass'. A data table on the right lists 'List of possible input data' categorized into 'Column management', 'Joint management', 'Progress', and 'Other'. The table includes items like 'Work name, Column number', 'Start/end times, Required time', 'Arc generation time', 'Wire usage (kg)', 'Calculated welding length (m)', 'Gas used (L)', 'Column diameter, plate thickness', 'Gap width', 'Column corner internal radius', 'Maximum input heat per joint', 'Current time, elapsed time, Estimated completion time', 'Current joint name, pass number', 'Welding order', 'Remaining wire alarm', and 'Part replacement alarm'.

### 2 Process report software (option)

Management of input can be executed for the entire welding line thus increasing reliability.

- The welding current, arc voltage and welding speed are fed back through the robot during welding and can be displayed real-time on the PC monitor. After welding, the heat input can be calculated based on the data stored in the PC and a report can be generated.

\*The software and equipment are not calibrated measurement devices. Exact measurements should be made with separate measuring equipment.

The diagram illustrates the process report software system. It shows a 'Controller' connected to a 'Welding power supply SENSARC AB500' and a 'Sensor unit' on the robot. 'Digital communication' links the controller to the sensor unit. The sensor unit sends data to the controller, which is then displayed on a PC monitor. A callout states: 'The obtained data is collected under the job name and a process report is made'. Another callout says: 'The process report function can be used in combination with welding power supply SENSARC AB500 and ARCMAN MP.' A table below shows a sample process report with columns for 'パス', '距離', '溶接電流(A)', 'アーク電圧(V)', '溶接速度(cm/min)', '溶接入力(kJ/cm)', and '入力温度(°C)'. The table contains 6 rows of data for different passes.

### 3 ARCMAN™ call function (option)

During unmanned operation, the robot's finishing schedule, error messages and operation information can be sent to a designated email address.

### 4 BCP325T-NBFW method software (option)

To weld a cold press steel plate (BCP325T) with increased toughness, a lamination method known as NBFW (Non-Brittle Fracture Welding) shown below is necessary. In addition, with this method, the use of a YGW18 welding wire is necessary and the heat input for the U bead/T bead must be limited to 15 - 22/15 - 25KJ/cm

The block contains two images. The left image is a diagram of the 'NBFW lamination pattern' showing a T bead and a U bead with dimensions: '8mm以下' for the T bead and '5~12mm' for the U bead. The right image is a photo of a weld joint labeled 'BCP325T-NBFW software (R part bead appearance of a plate thickness of 36mm)'.

### 5 Error skip function (option)

When an error such as an arc defect is detected, a skip operation is initiated and then the next joint is welded.

### 6 Applicable software for maximum input heat 30KJ/cm, 40KJ/cm

Welding conditions according to the input heat are automatically generated to match the work.

### 7 Input heat/pass temperature management software

A split function is provided for easy management of inter-pass temperature. Applicable also during 2-ARC welding.

### 8 Corner radius sensing feature

The robot automatically measures the outer radius of 4 corners by the corner radius sensing function thus eliminating time for measurement and improves quality.

### 9 Corner gap sensing function

The welding quality can be improved by measuring the gap of the corner parts which are prone to variations from machining process.

### 10 Arc start pre-check function

Before welding, the robot automatically checks whether or not the arc can start as to prevent arc start error.

### 11 Crater – arc start combined function

For circumference welding, the corrected information of the sensor position information for the terminal part the arc is reflected in the position of the next pass to improve the appearance of the bead.

### 12 Wire stick release function

When the wire is stuck during the treatment of craters, the robot automatically re-arcs to dislodge the wire thus facilitating the robots continuous operation.

### 13 Arc retry function

If the arc does not appear due to surface slag or impurities, the start position is changed and arc start initiation is repeated.

### 14 Slow down start function

Arc starting is improved by smoothly feeding the wire at arc start

### 15 Scheduled operation function

Even if there are several wires, the data for the next wire can be input into the computer during welding to reduce the robot idle time after welding. In addition, when there are multiple positioners, welding can be carried out on 2 workpieces with just 1 start operation

### 16 Origin auto-measurement function

For column large assembly system, the column installation position is automatically measured thus reducing personnel measurement work.

### 17 Throat thickness height adjustment function

Throat thickness height target value can be slightly adjusted when necessary.

### Software quick-glance table

Software name	Large assembly		Multi-work		Full-package		Connections		Compact	
	REGARC™	Constant voltage	REGARC™	Constant voltage	REGARC™	Constant voltage	REGARC™	Constant voltage	REGARC™	Constant voltage
REGARC™ HSS-Column welding	○		○		◎※		○		○	
REGARC™ pipe welding	○		○		◎※		○		○	
REGARC™ NBFW method	◎		◎		◎※		◎		◎	
HSS-Column welding	○	○	○	○	◎※	◎※	○	○	○	○
Pipe welding	○	○	○	○	◎※	◎※	○	○	○	○
Connecting welding	◎	◎	○	○	○	○	○	○	○	○
SRC core welding	◎	◎	○	○	◎※	◎※	◎	◎	◎	◎
Inner diaphragm welding			○	○	○	○				
NBFW method	◎	◎	◎	◎	◎※	◎※	◎	◎	◎	◎
Beam welding	◎	◎			Beam welding	Beam welding				
Taper core welding (only for Single ARC)							◎	◎	◎	◎
Connecting web welding	○	○			○	○				
SRC shaft welding			○	○	◎※	◎※				
Column through column (horizontal) welding	◎	◎								
Pipe ring welding	◎	◎								
HSS-Column welding plate thickness increased (45, 50mm)			◎	◎			◎	◎		◎
NBFW plate thickness increase (45, 50mm)			◎	◎			◎	◎		◎
Pass split function	○	○	○	○	○	○	○	○	○	○
Weld overlay adjustment function	○	○	○	○	○	○	○	○	○	○
2-ARC weld function	◎	◎					◎	◎		
Error skip function	◎	◎								
Structural Steel navigation	○	○	○	○	○	○	○	○	○	○
Process reporting software										

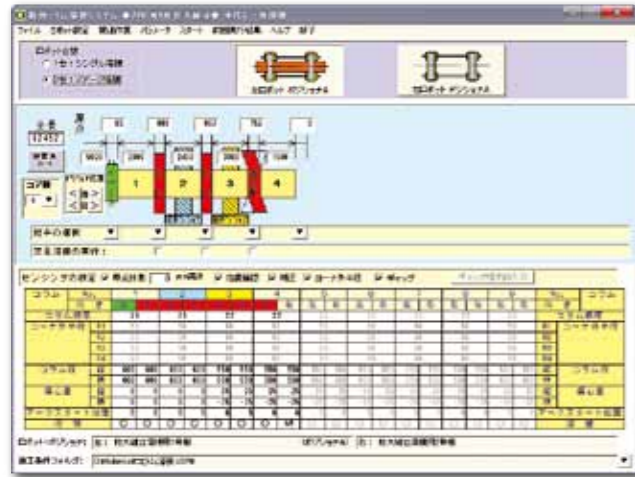
◎ Only compatible with welding power supply AB500  
※=Applicable through installation of various additional positioners ○=Standard specification ◎=Option

Allows for simple operation

# Input Screen

All work data can be easily viewed in diagram form while inputting

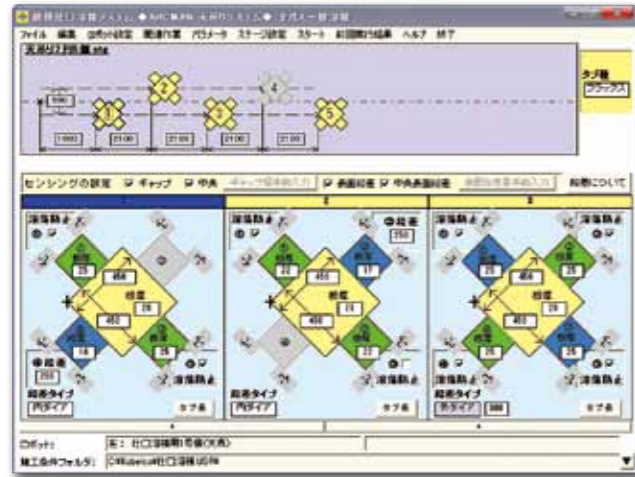
## 1 Column large assembly welding (Corresponding system : Large assembly 2-ARC/Single ARC)



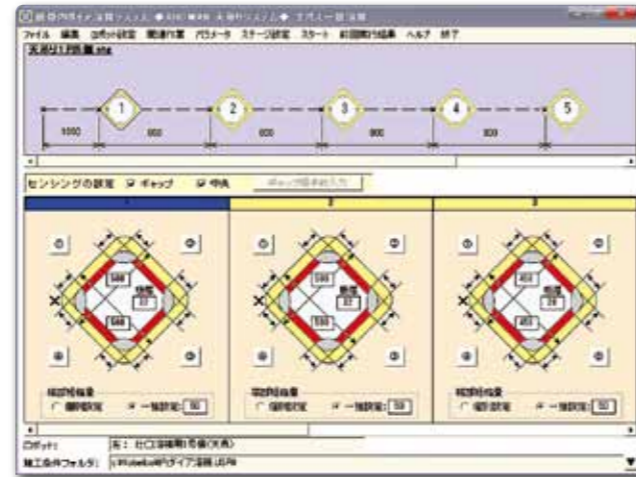
## 2 Core welding (Corresponding system : Large assembly 2-ARC/Single ARC, Core connection 2-ARC/Single ARC, Full-package multi, Compact)



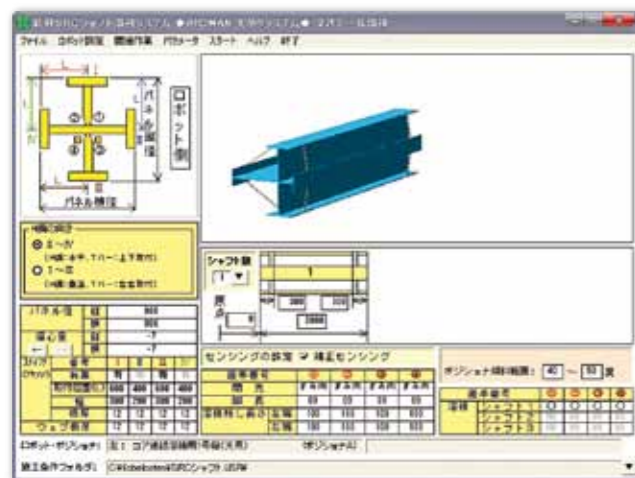
## 3 Connection welding (Corresponding system : column large assembly, Full-package multi, Compact)



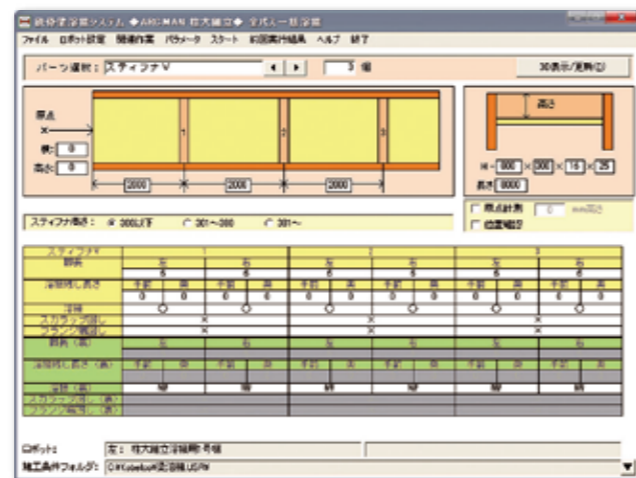
## 4 Inner diaphragm welding (Corresponding system : Full-package multi)



## 5 SRC shaft welding (Corresponding system : Multi)



## 6 Beam welding (Corresponding system : Large assembly, Beam)



Supporting stable operation

# Peripheral equipment

## Peripheral equipment for continuous un-supervised operation

### Nozzle auto changer



By using 2-types of nozzle lengths, long and short, welding quality can be improved and weld defects due to wind can be prevented.

### Nozzle cleaner



Spatter on the nozzle is automatically cleaned preventing defects such as blow holes.

### Wire cutter



Improved sensing accuracy improves welding quality

### Chip changer



Chips are changed at the optimal timing to enable extended operation of REGARC™.

### Slag automatic clearing equipment



The robot automatically removes slags, which improves continuous operation as well as prevents failures.

### Core connector clamp



Since many cores can be welded continuously, continuous operation time is increased.

## Welding power supply **SENSARC™** series

### **SENSARC™** AB500(for robot welding only)

- Minimum spatter CO2 welding process **REGARC™** equipped
- Automated switching between **REGARC™** and constant voltage
- Improved maintainability through digital control

**SENSARC™** AB500(for robot welding only)



### **SENSARC™** CS500MK2

(high performance CO2 MAG welding power supply)

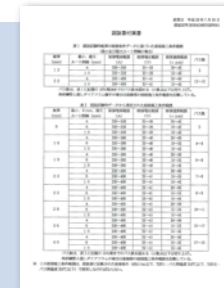
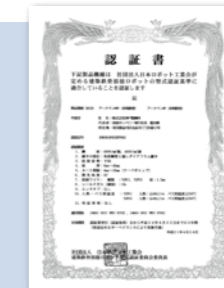
- Excellent instant arc start-up
- Superior high speed welding
- Steady arc from low to high currents

CS500MK2



## Certified robot type

Kobe Steel, Ltd.'s structural steel welding system for all equipment has obtained the Japanese Robot Association's certification of Architectural steel welding robot and therefore officially approved for industrial use.



## Robot specific solid wire **FAMILIARC™** MG-R series

As an overall manufacturer of welding products, Kobe Steel, Ltd. develops and produces specific wires for robots.

With superior sensing ability compared to normal wire, slags reduction in contribute to superior re-arcng. This is the perfect solid wire for robots.

(MG-R series : MG-50R, MG-55R, MG-56R, MG-50R(N), MG-56R(N))



# System configuration and specifications

Welding equipment	<b>SENSARC™</b> AB500	<b>SENSARC™</b> CS500MK2
Welding mode	<b>REGARC™</b> mode/ set voltage mode	set voltage mode
Utilization rate	Using 450A-100% water cooled torch	Using 500A-100% water cooled torch

## ① Structural Steel Large Assembly “2-ARC” Welding Robot System

System type	10 ton specifications	15 ton specifications	20 ton specifications	30 ton specifications
Robot	6-axis multi-joint welding robot <b>ARCMAN™</b> MP			
Robot transfer equipment	Stroke: left-right 13.0m / 42.7ft, front back 1.15m / 3.8ft			Please contact KOBELCO
Occupied space (Safety fence range)	2-ARC: 5.3m×17.0m / 17.4ft×42.7ft (7.3m×19.2m / 3.8ft×63ft) / Single ARC: 5.3m×16.8m / 17.4ft×55.1ft (7.3m×20.3m / 3.8ft×66.6ft)			

## ② Multi-work Structural Steel Connection Welding Robot System

System type	Type S	Type M	Type L
Robot	6-axis multi-joint welding robot <b>ARCMAN™</b> MP		
Positioner	Both grip 1 axis, possible load 3000kg / 6614lb		
Robot transfer equipment	Left-right stroke 5.7m / 18.7ft	Left-right stroke 8.0m / 26.2ft	Left-right stroke 14.0m / 45.9ft
Occupied space (Safety fence range)	3.8m×8.8m / 12.5ft×28.9ft (6.1m×12.0m / 20ft×39.4ft)	3.8m×11.1m / 12.5ft×36.4ft (6.1m×14.2m / 20ft×46.6ft)	3.8m×17.1m / 12.5ft×56.1ft (6.1m×20.2m / 20ft×66.3ft)

## ③ Full-package Structural Steel Connection Welding Robot System

System type	Reverse Positioner and floor placement type
Robot	6-axis multi-joint welding robot <b>ARCMAN™</b> MP
Positioner	Single grip 1 axis, possible load 2000kg / 4409lb
Robot transfer equipment	Left-right stroke 8.0m / 26.2ft
Occupied space (Safety fence range)	4.4m / 14.4ft Deep × 10.7m / 35.1ft Wide (6.1m / 20ft Deep × 14.2m / 46.6ft Wide)

## ④ Structural Beam Welding Robot System

System type	Beam specific system
Robot	6-axis multi-joint welding robot <b>ARCMAN™</b> MP
Positioner	Both grip 1 axis, possible load 3000kg / 6614lb
Robot transfer equipment	Left-right stroke 14.0m / 45.9ft
Occupied space (Safety fence range)	3.9m×17.0m / 12.8ft×42.7ft (6.3m×20.2m / 20.7ft×66.3ft)

## ⑤ Structural Steel Connection Welding Robot System

System type	2 ton specifications	3 ton specifications	4 ton specifications
Robot	6-axis multi-joint welding robot <b>ARCMAN™</b> MP		
Positioner	Both grip 1 axis, possible load 2000kg / 4409lb, 3000kg / 6614lb, 4000kg / 8818lb		
Robot transfer equipment	Left-right stroke 3.0m / 9.8ft		
Occupied space (Safety fence range)	2-ARC: 3.5m×7.2m / 11.5ft×23.6ft (5.9m×9.9m / 19.4ft×32.5ft) / Single ARC: 3.1m×7.1m / 10.2ft×23.3ft (5.9m×9.9m / 19.4ft×32.5ft)		

## ⑥ Compact Structural Steel Connection Welding Robot System

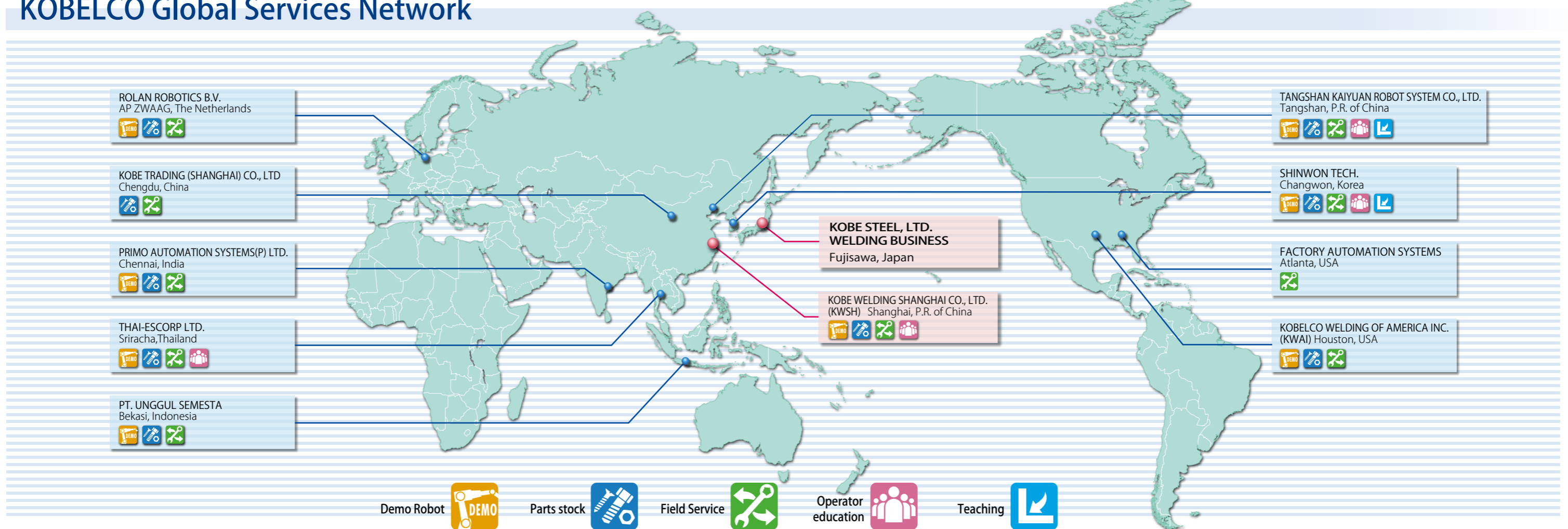
System type	Standard specifications (650kg / 1433lb)	1 ton specifications
Robot	6-axis multi-joint welding robot <b>ARCMAN™</b> MP	
Positioner	Single grip 1 axis, possible load 650kg / 1433lb, 1000kg / 2205lb	
Occupied space (Safety fence range)	1.8m×3.0m / 5.9ft×9.8ft (6.0m×5.9m / 19.7ft×19.4ft)	

### • Peripheral equipment, welding specifications (① - ⑥ common)

Peripheral equipment	Nozzle cleaner, air cleaner, wire cutter (air drive type), nozzle auto-changer (with wire brush cleaning feature), Computerized slag auto-removal equipment, chip changer (not space saving type, <b>REGARC™</b> powered series)
Welding specifications	Welding wire: solid wire <b>FAMILIARC™</b> MG-50R, MG-50R(N), MG-55R, MG-55, MG-56R, MG-56R(N), MG-56, MG-400FR 1.2mmφ Shield gas: CO <sub>2</sub> 100% Welding posture: Column large assembly... downward, horizontal fillet, level, ceiling... downward, horizontal fillet, downward fillet, core connection/space saving type core/joint combined... downward

(Note 1) The installation method for the safety fence mentioned above is given in JIS B 9707 (Machine safety - Safety distances for preventing upper limbs reaching dangerous areas-)  
(Note 2) Safety fence specifications: 1800mm/70.87in or more from the floor level

# KOBELCO Global Services Network





WELDING ROBOT  
**ARCMAN™**  
STRUCTURAL STEEL  
WELDING ROBOT SYSTEM

## **KOBE STEEL, LTD.**

WELDING BUSINESS

<http://www.kobelco.co.jp/english/welding/>

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# **KOBELCO**

WELDING ROBOT

# **ARCMAN™**

STRUCTURAL STEEL WELDING ROBOT SYSTEM



**KOBE STEEL, LTD.**