

ROBOTS

# ROBOTS

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**SHELL-O-MATIC**

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# FANUC M-2000iA™ SERIES

## HEAVY CAPACITY ROBOT SYSTEMS

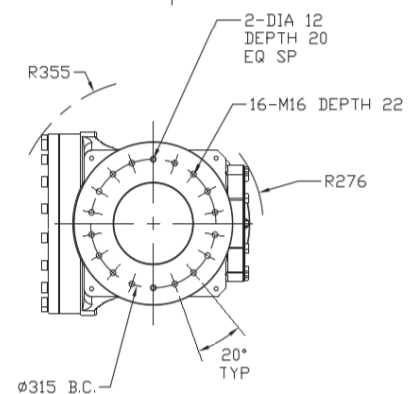
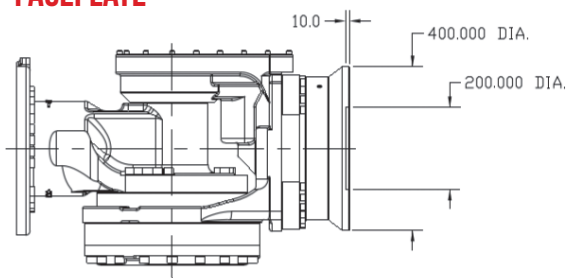
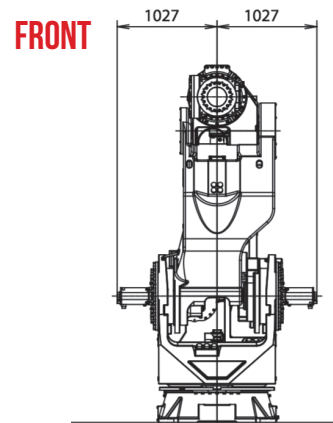
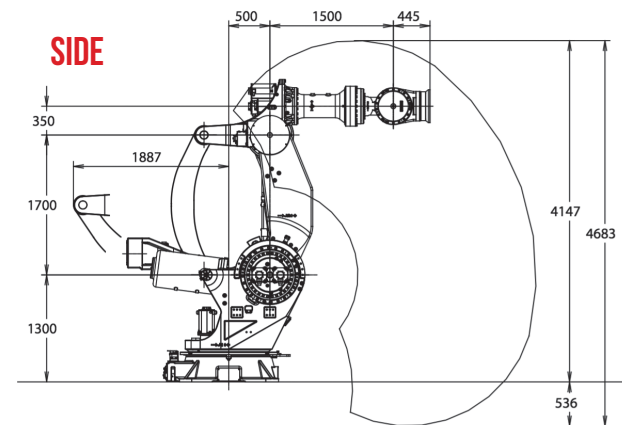
WHEN SHELL-O-MATIC CREATED ITS ROBOT PRODUCT LINE, WE INCLUDED A MODEL WITH A PAYLOAD UP TO 2300 KG/5070 LBS.

FANUC Robotics' M-2000iA series robot is engineered for applications that cannot be handled by traditional robots due to work piece size or distances they must be moved. The world's leading supplier of robots has now greatly expanded robot applications with the M-2000iA series. The M-2000iA series is the world's largest and strongest six-axis, modular construction, electric servo-driven family of robots designed for a variety of manufacturing and systems processes.



## SPECIFICATIONS

ITEMS		M-2000iA/ 1200	M-2000iA/ 900L	M-2000iA/ 1700	M-2000iA/ 2300
Axes		6	6	6	6
Payload - Wrist (kg)		1200	900	1700	2300
Reach (mm)		3734	4638	4683	3734
Repeatability (mm)		±0.3	±0.5	±0.27	±0.18
Motion range (degrees)	J1	330 (±165)		330	
	J2	160 (+100/-60)		160	
	J3	165 (+35/-130)		165	
	J4	720 (+/-360)		720	
	J5	240 (+/-120)		240	
	J6	720 (+/-360)		720	
Motion speed (degrees/s)	J1	45		20	
	J2	30		14	
	J3	30		14	
	J4	50		18	
	J5	50		18	
	J6	70		40	
Wrist moments N-m (kgf-m)	J4	14700(1500)		29400	
	J5	14700(1500)		29400	
	J6	4900(500)		8520	
Wrist load inertia (kg-m²)	J4	2989		7500	
	J5	2989		7500	
	J6	2195		5500	
Mechanical brakes		All Axes	All Axes	All Axes	All Axes
Mechanical weight (kg)		8600	9600	12500	11000
Mounting method <sup>(1)</sup>		Floor	Floor	Floor	Floor
Installation environment		0 to 45		0 to 45	
Ambient temperature (°C)					
Humidity		Normally: 75% or less Short term (within a month): 95% or less No condensation (No dew or frost)			
Vibration (m/s²)		4.9 or less (0.5G or less)			
IP rating(s)		Wrist IP67, rest IP54			



# IRB 8700

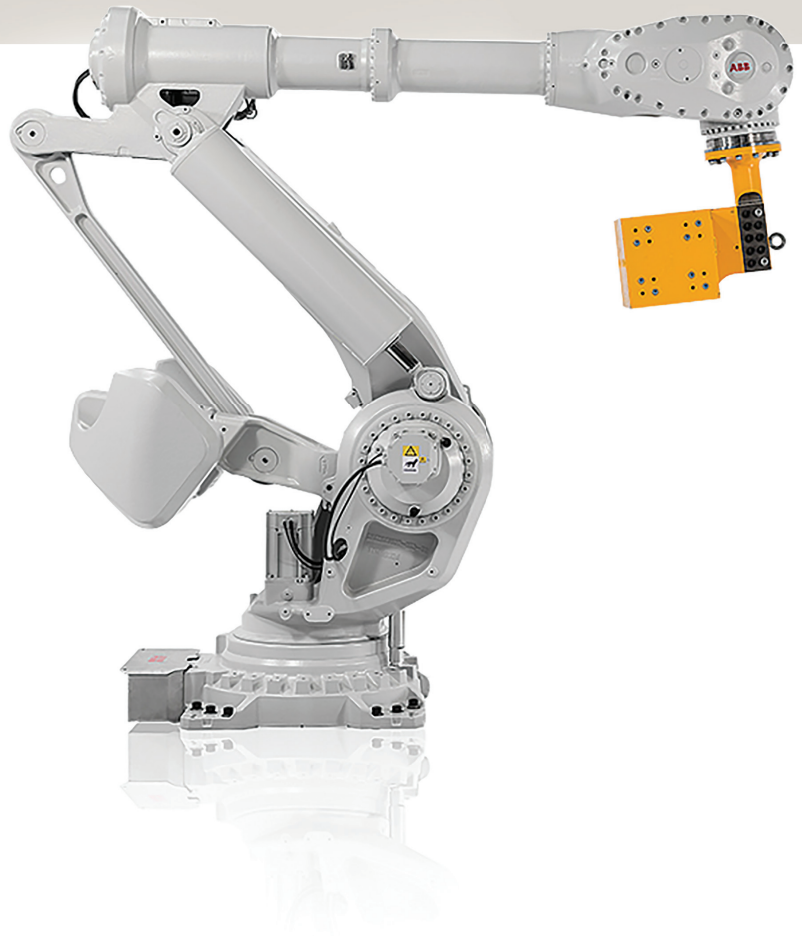
## THE LARGEST ROBOT ABB HAS EVER MADE.

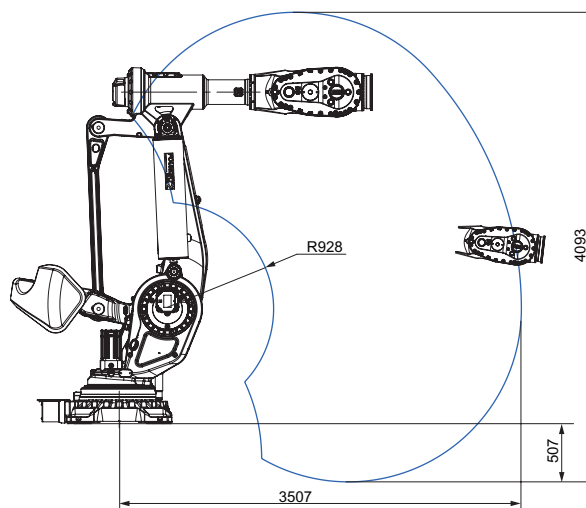
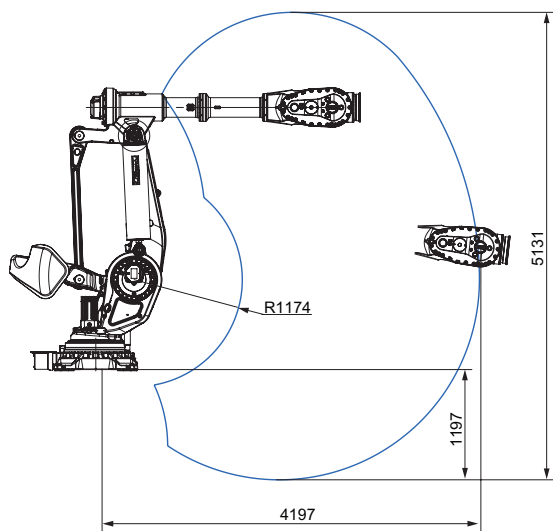
In designing the IRB 8700, the focus was on delivering a very reliable robot with a low total cost of ownership. Through a combination of robust design elements, including simpler parts configurations where possible, ABB Robotics applied decades of engineering experience to combine the high performance that customers require with low overall maintenance needs.

**IN ADDITION, THE IRB 8700 DELIVERS 25% FASTER SPEEDS THAN ANY OTHER ROBOT IN THIS CLASS SIZE.**

Features and benefits:

- » High payloads up to 1000 kg with the wrist down
- » 25% faster speeds than other robots in this size class
- » Highly reliable with simplified design and Foundry Plus 2 protection standard
- » Built around LeanID for reduced wear on dress packs and ease of simulation
- » Built using non-hazardous materials





### SPECIFICATION

ROBOT VERSIONS	REACH	HANDLING CAPACITY	CENTER OF GRAVITY	WRIST TORQUE
<b>Without Lean ID</b>				
IRB 8700-800/3.50	3.50 m	800 kg	460 mm	6043 Nm
IRB 8700-550/4.20	4.20 m	550 kg	460 mm	5279 Nm
<b>With Lean ID</b>				
IRB 8700-800/3.50	3.50 m	630 kg	460 mm	6043 Nm
IRB 8700-550/4.20	4.20 m	475 kg	460 mm	5279 Nm
Extra loads can be mounted on all variants. 50 kg on upper arm and 500 kg on frame of axis 1.				
Number of axes		6		
Protection		Complete robot IP67		
Mounting		Floor mounted		
IRC5 Controller variants		Single cabinet		

### PERFORMANCE

	IRB 8700-800/3.50	IRB 8700-550/4.20
Pos. repeatability RP	0.05 mm	0.08 mm
Path repeatability RT	0.07 mm	0.14 mm

### MAXIMUM AXIS SPEED

	AXIS 1	AXIS 2	AXIS 3	AXIS 4	AXIS 5	AXIS 6
IRB 8700-800/3.50	75°/s	60°/s	60°/s	85°/s	85°/s	115°/s
IRB 8700-550/4.20	75°/s	60°/s	60°/s	85°/s	85°/s	115°/s

### ELECTRICAL CONNECTIONS

Supply voltage	200-600 V, 50/60 Hz
Energy consumption ISO-Cube	3.93 kW

### PHYSICAL

Dimensions robot base	1175 x 920 mm
Weight	4527 - 4575 kg

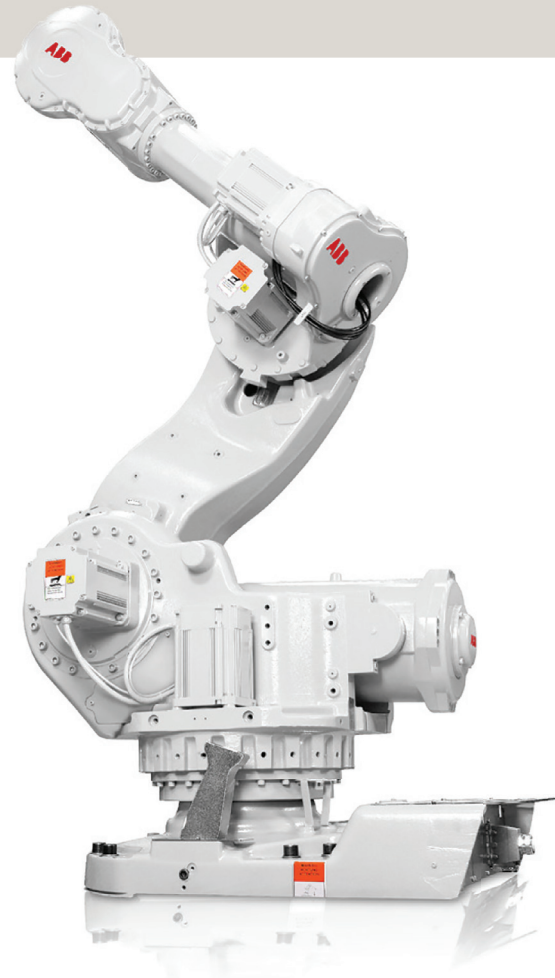


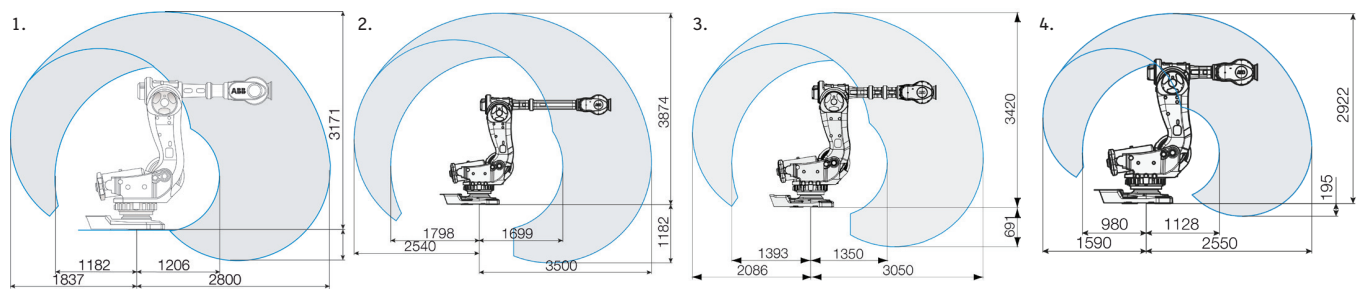
# **IRB 7600**

## **A NEW WORLD OF POSSIBILITIES OPENS UP WITH ABB'S POWER ROBOT FAMILY.**

It comes in several variants, up to 630 kg handling capacities. The IRB 7600 is ideal for weighty applications, regardless of industry. Characteristics such as high available torque and inertia capability, rigid design and powerful acceleration have earned this market leader its “Power Robot” title.

- » Reliable - High production up time
- » Security - A safe investment
- » Fast - Short cycle times
- » Accurate - Consistent parts quality
- » Strong - Maximized utilization
- » Robust - Harsh production environment
- » Versatile - Flexible integration and production





1. IRB 7600-340/2.8 | 2. IRB 7600-150/3.5 | 3. IRB 7600-325/3.1 | 4. IRB 7600-400/2.55/IRB 7600-500/2.55

SPECIFICATION				
ROBOT VERSIONS	REACH	HANDLING CAPACITY	CENTER OF GRAVITY	MAX WRIST TORQUE
<b>IRB</b>				
IRB 7600-500	2.55 m	500 kg	360 mm	3010 Nm
IRB 7600-400	2.55 m	400 kg	512 mm	3010 Nm
IRB 7600-340	2.8 m	340 kg	360 mm	2750 Nm
IRB 7600-325	3.1 m	325 kg	360 mm	2680 Nm
IRB 7600-150	3.5 m	150 kg	360 mm	1880 Nm
(IRB 7600-150 loaded with 100 kg 1660 mm)				
Extra loads can be mounted on all variants 50 kg on upper arm and 550 kg on frame of axis 1.				
Number of axes		6		
IRC5 Controller variants		Single cabinet, PMC		

ENVIRONMENT	
AMBIENT TEMPERATURE FOR MECHANICAL UNIT	
During operation	+5 °C (41 °F) up to +50 °C (122 °F)
During transportation & storage for short periods (max 24 h)	-25 °C (13 °F) up to +55 °C (131 °F) up to +70 °C (158 °F)
Relative humidity	Max 95%
Degree of protection	
Manipulator	Standard: IP67, Option: Foundry Plus 2
Controller	Air cooled
Noise level	Max 73 dB (A)
Safety	Double circuits with supervision, emergency stops and safety functions, 3-positions enable device.
Emission	EMC/EMI-shielded

PERFORMANCE				
AXIS WORKING RANGE				
Axis 1 Rotation	+180° to -180°			
Axis 2 Arm	+85° to -60°			
Axis 3 Arm	+60° to -180°			
Axis 4 Wrist	+300° to -300°			
Axis 5 Bend	+100° to -100°			
Axis 6 Turn	+360° to -360°			
AXIS MAX SPEED				
	325/500 KG	400 KG	340 KG	150 KG
Axis 1	75°/s	75°/s	75°/s	100°/s
Axis 2	50°/s	60°/s	60°/s	60°/s
Axis 3	55°/s	60°/s	60°/s	60°/s
Axis 4	100°/s	100°/s	100°/s	100°/s
Axis 5	100°/s	100°/s	100°/s	100°/s
Axis 6	160°/s	160°/s	160°/s	190°/s

ELECTRICAL CONNECTIONS	
Supply voltage	200-600 V, 50/60 Hz
PHYSICAL	
Dimensions robot base	1206.5 x 791 mm
Weight	2.400-2.450 kg

# IRB 6700

**THE IRB 6700 FAMILY OF ROBOTS IS A NATURAL EVOLUTION FOLLOWING 40 YEARS OF LARGE ROBOT HERITAGE AT ABB.**

This 7th generation of large ABB robots features a multitude of next generation improvements derived from intimate customer relationships and exhaustive engineering studies. The IRB 6700 is more robust than its predecessor and maintenance has been simplified, making it the highest performing robot for the lowest total cost of ownership in the 150-300 kg class.

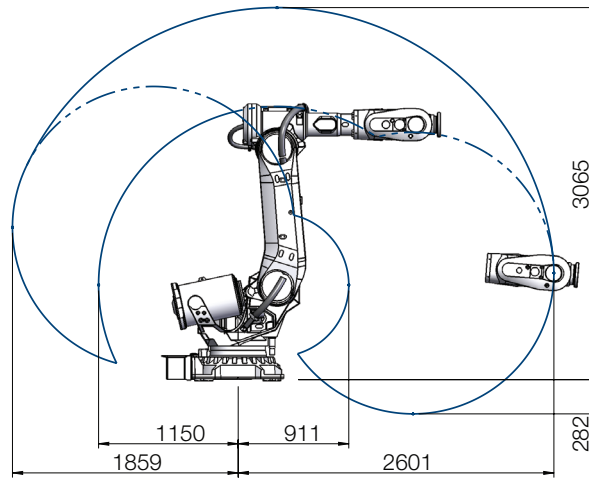
#### Features and benefits:

- » Increased service intervals and decreased service times
- » Longer uptime—mean time between failures: 400,000 hours
- » Available with Lean ID for cost, effectively increasing dress pack lifetimes
- » More robust with a rigid structure and a new generation of motors and compact gearboxes
- » Increased speed and shorter cycle times—on average 5 percent faster
- » Improved accuracy and higher payloads
- » Built to operate in the harshest environments—available with Foundry Plus 2 package
- » 15% lower power consumption





IRB 6700-200/2.60



SPECIFICATION WITHOUT LEANID					SPECIFICATION WITH LEANID				
ROBOT VERSIONS	REACH	HANDLING CAPACITY	CENTER OF GRAVITY	WRIST TORQUE	ROBOT VERSIONS	REACH	HANDLING CAPACITY	CENTER OF GRAVITY	WRIST TORQUE
<b>IRB</b>					<b>IRB</b>				
6700-200	2.60 m	200 kg	300 mm	981 Nm	6700-200	2.60 m	175 kg	300 mm	981 Nm
6700-155	2.85 m	155 kg	300 mm	927 Nm	6700-155	2.85 m	140 kg	300 mm	927 Nm
6700-235	2.65 m	235 kg	300 mm	1324 Nm	6700-235	2.65 m	220 kg	300 mm	1324 Nm
6700-205	2.80 m	205 kg	300 mm	1263 Nm	6700-205	2.80 m	200 kg	300 mm	1263 Nm
6700-175	3.05 m	175 kg	300 mm	1179 Nm	6700-175	3.05 m	155 kg	300 mm	1179 Nm
6700-150	3.20 m	150 kg	300 mm	1135 Nm	6700-150	3.20 m	145 kg	300 mm	1135 Nm
6700-300	2.70 m	300 kg	300 mm	1825 Nm	6700-300	2.70 m	270 kg	300 mm	1825 Nm
6700-245	3.00 m	245 kg	300 mm	1693 Nm	6700-245	3.00 m	220 kg	300 mm	1693 Nm
Extra loads can be mounted on all variants 50 kg on upper arm and 250 kg on frame of axis 1.					Extra loads can be mounted on all variants 50 kg on upper arm and 250 kg on frame of axis 1.				
Number of axes		6			Number of axes		6		
Protection		Complete robot IP67			Protection		Complete robot IP67		
Mounting		Floor mounted			Mounting		Floor mounted		
IRC5 Controller variants		Single cabinet, panel mounted controller			IRC5 Controller variants		Single cabinet, panel mounted controller		

**PERFORMANCE**

	6700-200	6700-155	6700-235	6700-245	6700-205	6700-175	6700-150	6700-300
Pos. repeatability RP (mm)	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Path repeatability RT (mm)	0.06	0.12	0.08	0.12	0.08	0.12	0.14	0.07

# SHELL-O-MATIC-TYPE ROBOTS

## HEAVY DUTY DIPPING ROBOT

**SHELL-O-MATIC-TYPE ROBOTS HAVE BEEN DESIGNED SPECIFICALLY FOR THE SHELL-BUILDING PROCESS AND ARE ESPECIALLY SUITED FOR HEAVY LOADS, UP TO 1500 LBS / 675 KG.**

Before the era of the articulated robot, Shell-O-Matic was the first to introduce electrically driven robots in the investment casting industry back in 1973. These robots were designed and built by Shell-O-Matic specifically for the industry needs.

This design has now evolved for more than 40 years and has proven its benefits to our clients with over 250 robots installed so far all over the globe. Those robots are still selected by our clients today due to their ease of maintenance, simplicity and reliability. Furthermore, their construction is perfectly suited for heavy weight lifting capacity where they are more cost effective than articulated robots.

The product line includes:

- » 3 robot models respectively suited for 205 Kg, 365 Kg and 680 Kg.
- » Embedded Shell-O-Matic traverse axis with length design to suit your process complexity.
- » Simple and convenient manual control mode or fully automatic mode.
- » Smooth and fast motion.
- » Made from standard industrial components available worldwide.

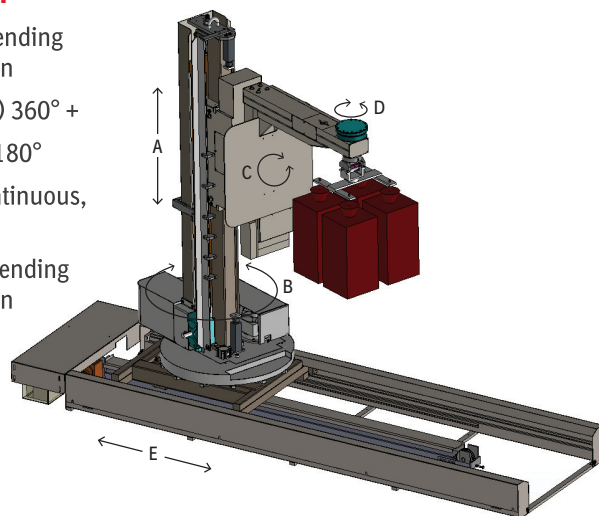


With these robots we also deliver turnkey systems including:

- » Multi robot integration to maximize your factory throughput.
- » Industry-renowned gripper systems selected for or adapted to your needs. Proven designs with many grippers having more than 25 years of continuous operation.
- » Integration of the robot with the surrounding process equipment (including existing equipment used in your factory).
- » Simple human-machine interface in the language of your choice.
- » Robot cell safety system matching your local safety codes.
- » Worldwide training and support by Shell-O-Matic investment casting robotic experts.

## THE SHELL-O-MATIC DIPPING ROBOT

- A Vertical, depending on application
- B Index (swing)  $360^\circ$  +
- C Tilt  $-30^\circ$  to  $+180^\circ$
- D Rotation, continuous, reversible
- E Traverse, depending on application

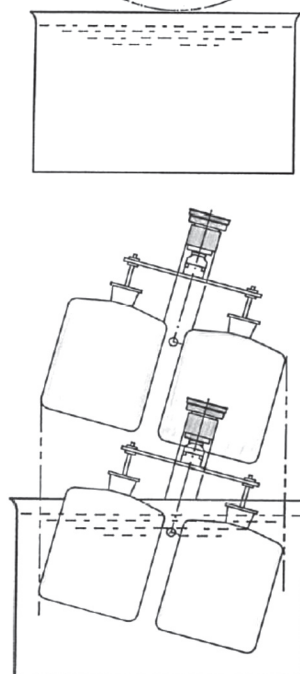
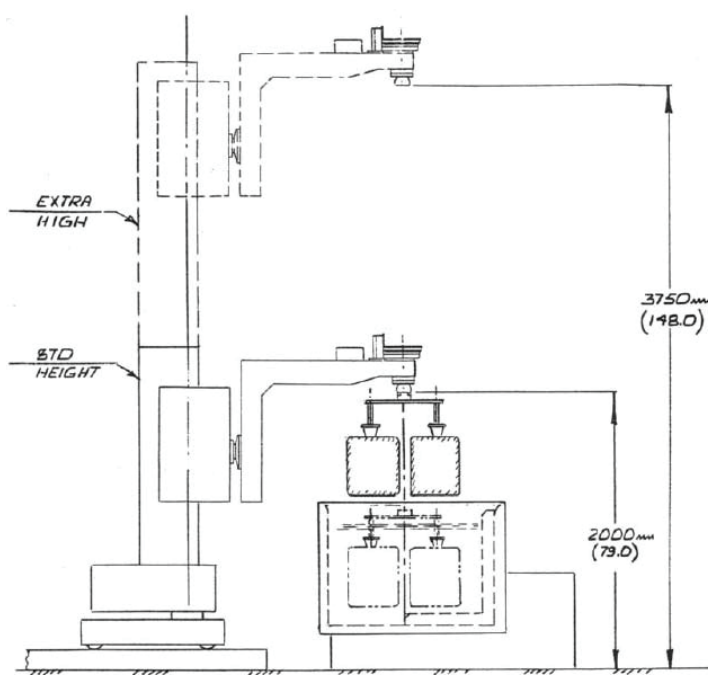
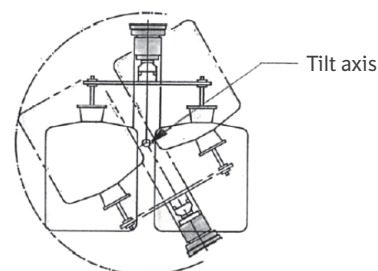


## THE SHELL-O-MATIC SYSTEM

The unique Shell-O-Matic tilt axis makes it possible to rotate the parts directly over the tank - without complex programming.

The same simple movement helps to manipulate the molds inside a rainfall sander in an easy way.

The straight linear vertical motion makes it easy to follow the wall of the tanks - all without complex programming.



# OTTO ROBOT

## A SELF-DRIVING VEHICLE

In partnership with Clearpath Robotics, Shell-O-Matic presents the Otto robot, a self-driving vehicle that combines the flexibility of a labour force with the efficiency of conveyors and the safety of automated guided vehicles (AGVs).

The Otto is available in a range of weight-bearing capacities and can be fitted with various load-carrying implements, adapted for the material it will transport, making it ideal for a variety of tasks in the factory, including:

- » Carrying wax trees or shells with standard Shell-O-Matic couplings
- » Moving items from the wax room to the shell room
- » De-waxing equipment automatically
- » Loading wax patterns/molds in the proper orientation
- » Manipulating molds/patterns to control quality or clean them

### GUIDANCE

The Otto robot has a laser vision system that allows it to “see” its environment, enabling it to guide itself through the factory.

During commissioning, one Otto robot is manually “walked” through the factory and fed, via Wi-Fi, the factory geometry that it “sees.” This allows the Otto to create a factory map, which is then used to configure the system and teach the Otto fleet various navigational constraints, including:

- » Low-speed zones
- » One-way traffic areas
- » Stop signs
- » Any other traffic considerations present in the factory



The Otto robots' central management system uses the factory map to decide on the Ottos' best delivery paths. Should the Ottos encounter obstacles, they will “see” them and automatically find new paths to achieve their goals. The Otto robot is robust, and its active suspension system means it can adapt to imperfect floors and even cross over small objects (up to 22 mm high).

## EFFICIENCY

In operation, the Ottos are assigned pick-up and drop-off jobs from a central Wi-Fi-controlled fleet management system, which is connected to the facility's MES to control material handling. The central system also automatically manages the battery charging of the Ottos to maintain and optimize the fleet's operational efficiency.

## SAFETY

Once assigned a task, the Otto automatically finds the best path across the factory to perform material delivery. In operation, the Otto interacts perfectly with any humans or other Ottos moving around it. The Otto slows down when it detects nearby movement and creates real-time avoidance trajectories that allow it to interact safely with its environment.

## VERSATILITY

Shell-O-Matic can install an articulated robot or manipulator on the Otto, which shares the Otto's battery to power its implements. An advantage of this pairing is that it allows the Otto to facilitate the exchange of material between two separate stations.

This flexibility gives further versatility to the system and enhances its adaptability to the evolving material handling needs the factory may experience, including:

- » Raw material package change
- » Produced-part geometry change
- » Addition of new cells in the factory

