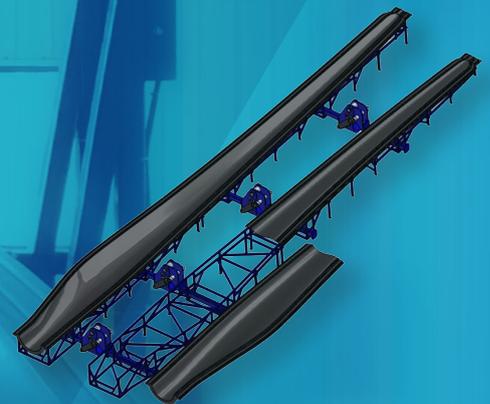


# COMPOSITE TOOLING & MANUFACTURING AUTOMATION





# COMPOSITE TOOLING FOR WIND TURBINE BLADES

Gurit Tooling is the largest independent manufacturer of plugs and molds for wind turbine blades worldwide. Its scope of activity reaches beyond wind turbine blade molds and also blade production assisting equipment, including automated devices. Gurit Tooling also makes highly engineered molds for other industries like marine and such.

With over 520 skilled employees worldwide dedicated to the design, engineering, manufacture, and service of composite tooling, Gurit is a prime engineering and sourcing partner for quality molds, wind blade production equipment, and global services delivered to client specification in short lead times and at very competitive prices.

A comprehensive solution:

- Design and manufacturing of master plugs and molds
- Modular automatic mold turning system, also known as hinges
- Hydraulic mold clamping and alignment systems
- Modulated heating and process monitoring systems for blade processing, both in PCB and/or PLC format
- Wind blade production assisting equipment – jigs and fixtures
- Global maintenance services for global locations of our customers

## MANUFACTURING AUTOMATION

Gurit leads the industry in blade manufacturing automation, providing consistent efficiency and reliability, making it the preferred choice for manufacturers of high-quality wind turbine blades.

Our vast experience working with blade manufacturers, worldwide, has given us specialized insight that helps blade builders solve their particular problems. Our services include:

### ■ Engineering Services

- Mechanical design (3D CAD)
- Structural analysis (FEA)
- Hydraulic system design
- Automation (PLC and Micro Controller)

### ■ Manufacturing Services

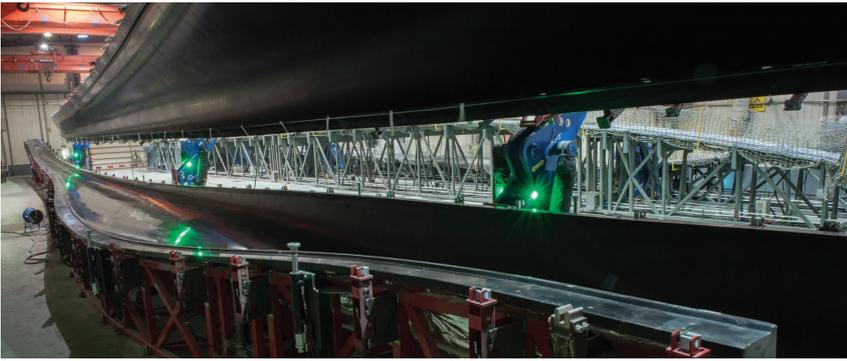
- Welding of large and small components
- CNC machining

### ■ Technical Services

- Installation and commissioning
- Operator and maintenance training
- Contracted maintenance services for mold system and related equipment



# COMPOSITE TOOLING



Composite materials open new avenues for the manufacture of lightweight, strong and durable structures of almost any conceivable form and shape. Independent of the chosen composite manufacturing process, plugs - a three-dimensional model of final part - and molds - the forms used to actually manufacture a final part - define the accuracy of composite components. Gurit is globally the largest independent, fully integrated and highly specialised mold maker for large structures.

Established in 2007 as Red Maple, in Taicang, China, Gurit Tooling has made a name for itself as the leading manufacturer of plugs and molds for wind turbine blades. In 2016, Gurit opened an assembly and support facility in Poland as a European hub for our clients. In Montreal, Canada, Gurit operates a competence centre for hinges (PH Automation) and automation solutions.

Dedicated to the design, engineering, manufacture and service of composite tooling, Gurit is globally a prime engineering and sourcing partner for quality molds, wind blade production equipment, and global services, delivered to client specification in short lead times and at very competitive prices - worldwide.



## SHORT LEAD TIMES

Gurit has the ability to manufacture large scale mold sets. International blade manufacturers worldwide choose Gurit as their primary supplier for prototyping and serial mold production.

As a highly specialized, industrial plug and mold maker with the latest technology at hand, Gurit controls the complete vertical production process. This allows Gurit to offer quality tools at unbeatable prices and even more importantly at very short lead-times - shipment, installation and commissioning included.

## COVERING THE COMPLETE MOLD PRODUCTION PROCESS

Gurit's tooling makes a perfect match with the Group's other core offerings of structural design, composite materials manufacturing, composite processing know-how and composite component fabrication. This pairing enables fully industrialized, innovative, and cost-effective solutions for wind energy, marine, transport, and architectural markets. Gurit has specialized CNC engineers, operating 5-axis CNC machines, to build master plugs with extreme accuracy and speed. Gurit's plugs have successfully been used to make up to more than 25 perfect molds. This means that all components, shear webs, spar caps and root inserts fit every time without costly adjustments or use of fillers. Gurit equips its molds with hydraulic turn-over, closing and clamping systems, jigs and fixtures, and offers a choice of software controlled electric or liquid mold heating systems depending on the production process or the targeted precision.

## WELDED PLUGS, MOLDS AND BLADE LIFTING SYSTEMS, JIGS AND FIXTURES

Gurit's plug and mold surfaces are held by a very rigid steel support structure to ensure a tight, stable surface geometrical tolerance. All welding is done in-house following ISO standards, with CE certified welders and International Welding Engineers on-site, to ensure high levels of quality and safety. Over the past several years Gurit has worked with many high profile clients to design, develop, and manufacture key metal structures and tools to aid in the blade turning and turbine assembly process with high efficiency and accuracy. Whether it is new design, concept, build to print design, or prototypes, Gurit can work through all the phases of a project from design conception, design & validation, manufacturing, to delivery of the final parts with a competitive cost and time without compromise to quality.

# MANUFACTURING AUTOMATION FOR CYCLE TIME REDUCTION

**Gurit Tooling leads its class for blade manufacturing automation, providing consistent efficiency and reliability, making it the preferred choice for manufacturers of high-quality wind turbine blades.**

Our vast experience working with blade manufacturers, worldwide, has given us specialized insight that helps blade builders solve their particular problems. Our aim is to be a full system provider for our wind blade manufacturers.



# BLADE MANUFACTURING TURNKEY AUTOMATION

## MOLD TURNING

Gurit offers a full range of hinges with different capacities and arm sizes catered to blade mold sizes from 50 to 150m. The turning system can precisely close the two halves of the mold and control angular positions.

Gurit's hinge portfolio includes arms with sizes and torque capacities ranging from 550 to 750 kNm. Latest hinge generations are modular what enables a fast and low-cost installation, providing the ability to expand and reconfigure the system.

### ■ Hinge portfolio:

- GT7: Advanced sensing enabling industry 4.0 solutions
- GT7 / GTT200: Widest used hinge in molds <110M long
- GTT-258: Hinge of choice for molds >=110M long



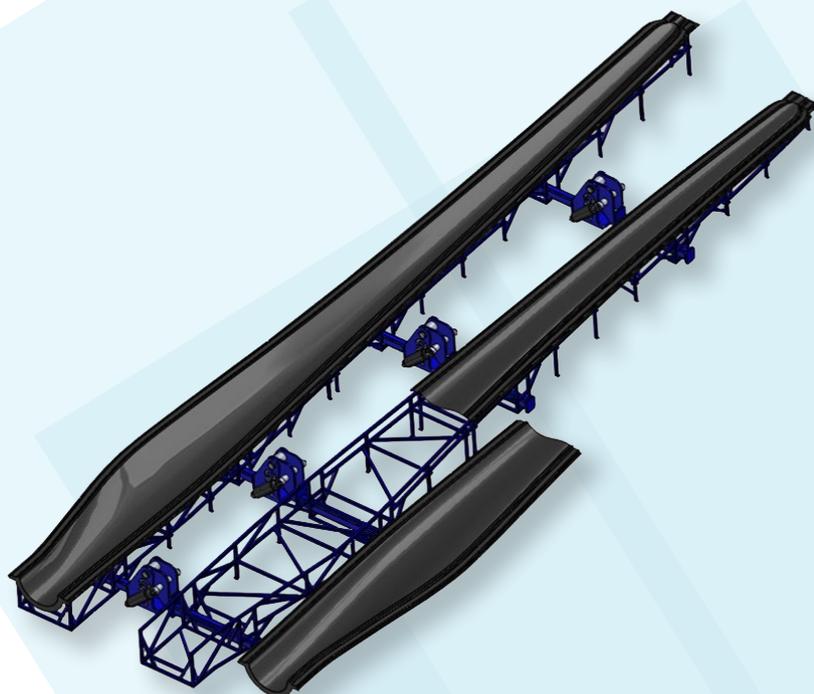
SPECIFICATION	GTT200	GT7	GTT258	UNITS
Voltage	340-480			V (3ph)
Frequency	50/60			Hz
Torque capacity per hinge	550	690	750	kNm
Weight capacity per hinge	13.8	17.3	18.8	Ton
Number of hinges per mold	Acc. to spec.			
Hinge Maximum working pressure	320	320	320	Bar
Rotation time	6.5	5.5	8	Min
Number of jacks	Acc. to spec.			
Jack maximum lifting force per jack	198	198	198	kN
Jack maximum working pressure	320	320	320	Bar

## MODULAR MOLD

Modular mold for wind turbine blades is a cutting-edge reconfigurable mold structure tailored for the mass production and customization of large-scale wind turbine blades, the core component of wind power equipment. This design perfectly adapts to the “separated manufacturing, on-site assembly” production mode of large wind turbine blade mold and has become a mainstream technical solution for the wind power mold industry driven by global energy transformation and cost reduction demands.

### Main features of modular mold:

1. Modular and recyclable mold system platform for various large wind turbine blade mold
2. Maximum reuse of existing equipment/components for ultimate sustainability goals
3. Interchangeable upper composite shell sets allow blade series converting
4. Retrofittable wind blade mold frame structure brings onsite modification possibility for other projects
5. Independent mold shell shipment with rigid composite shell construction
6. Significant wind blade mold transportation saving



## MOLD HEATING

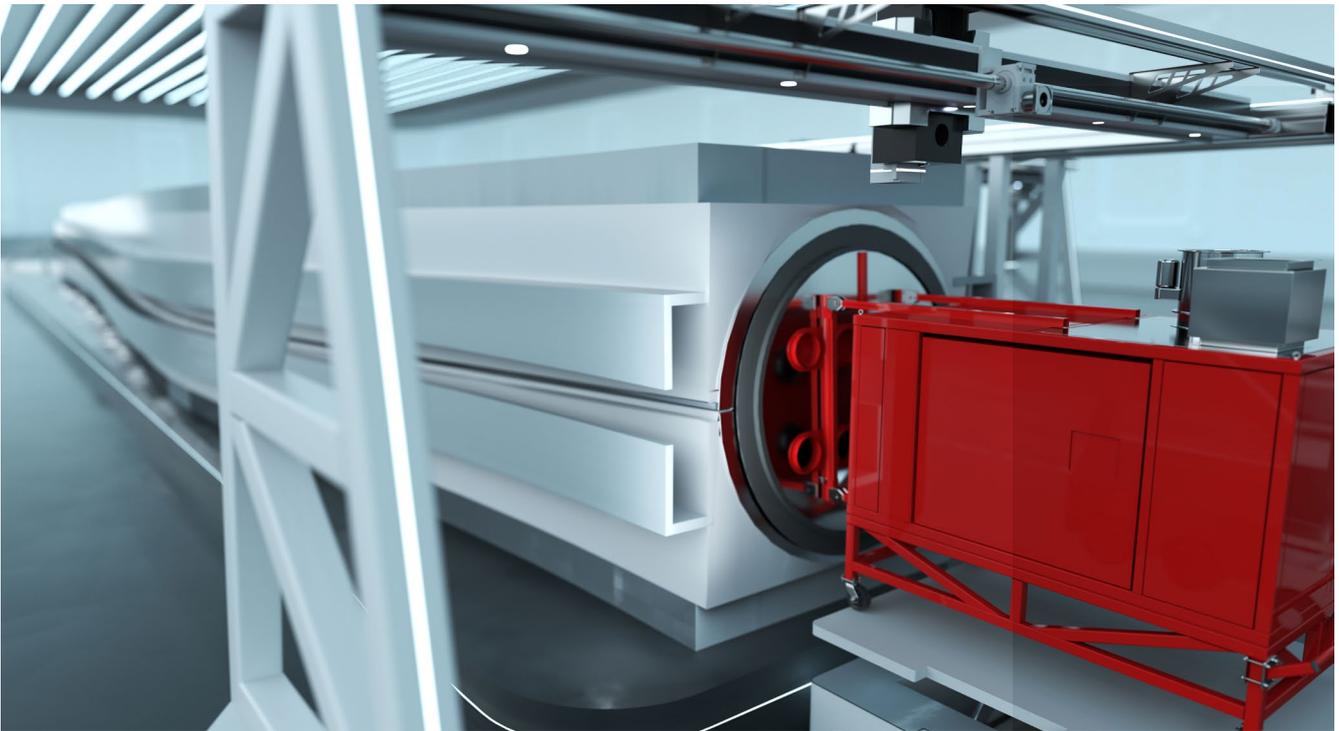
Gurit Tooling offers the following various operation purposes for its mold heating system:

The mold heating system used by Gurit is customized for each mold. Gurit offers two types of heating systems with an option of different types of controllers.

### ■ Electric heating system:

The wind blade mold is normally divided up to 300 zones depending upon the blade structure design. Each zone includes two temperature sensors, two overheating safety switches and one heating resistance.

- PLC Heating System
- Vacuum Monitoring System
- Surface Laminate Sensor (Temperature sensing)
- Auxiliary system includes cavity heating and liquid heating
- Cooling systems capable of reducing cycle times by up to 60 minutes through cooling ramps of up to 0.4 C/min

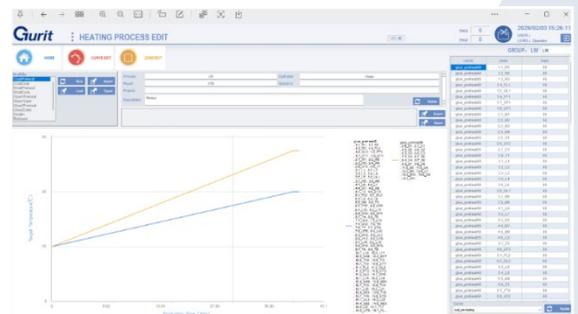


### Cavity heating and cooler, with chiller function

The in-house developed software package provides full intuitive control and supervision over an Ethernet network. It is also available with an integrated touch screen computer system to simplify the heating control system.

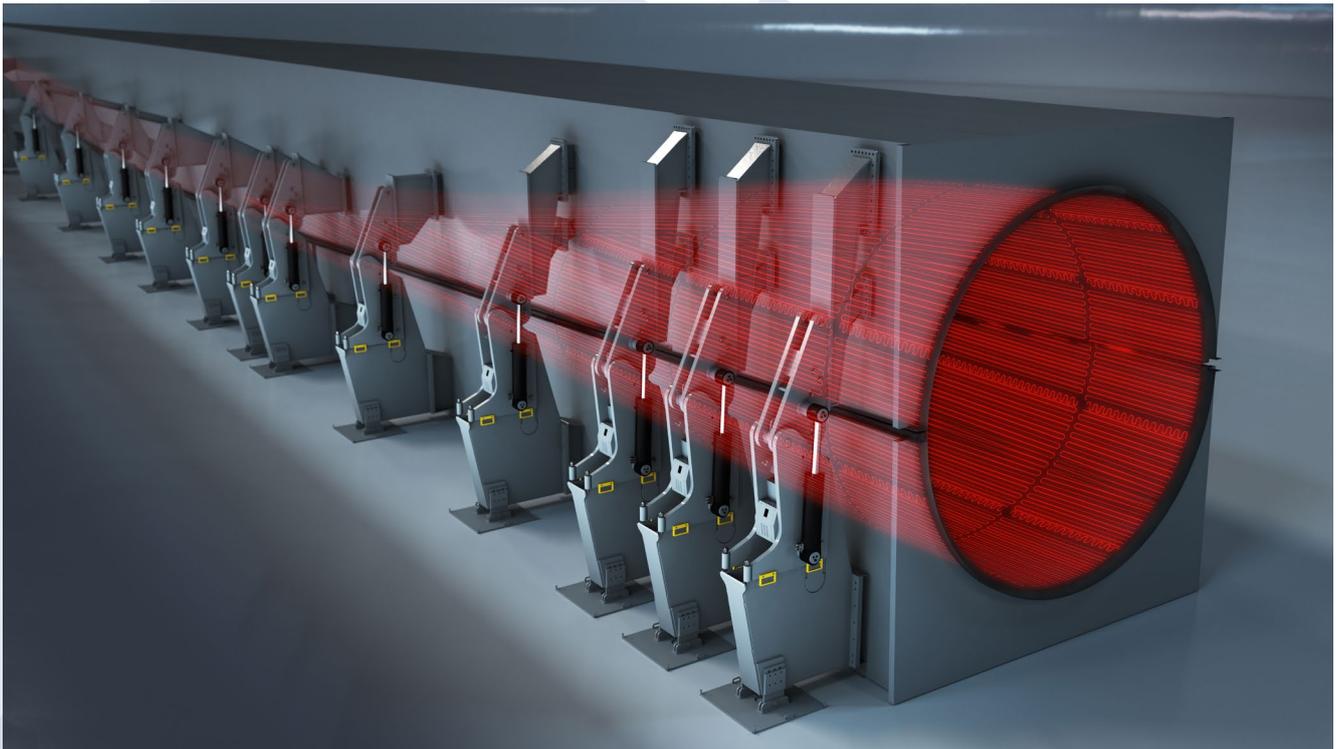
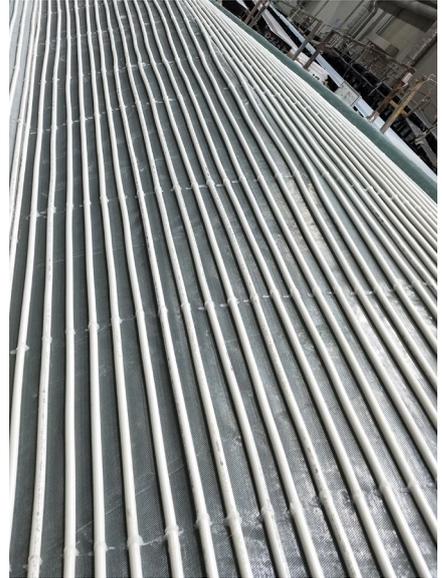
### Key System Features:

1. Various of blade process heating recipes setup and configured processing control
2. Surface vacuum interface with automatic drop tests and vacuum level control
3. Surface thermocouple interface with reporting and automatic TG test.
  - Critical areas of the part are monitored to estimate their cure percentage.
4. Customizable quality control reports
5. RFID controlled access
6. Online curing profile adjustment
7. Remote / central data warehouse
8. Customizable quality control reports



■ **Liquid heating system:**

The liquid heating systems from Gurit are designed for further purpose in mold or relevant accessories such as root plate. Advantages include easy maintenance when compared to electric heating, quick replacement equipment change-out, surface cooling, and ability to use prepreg materials.

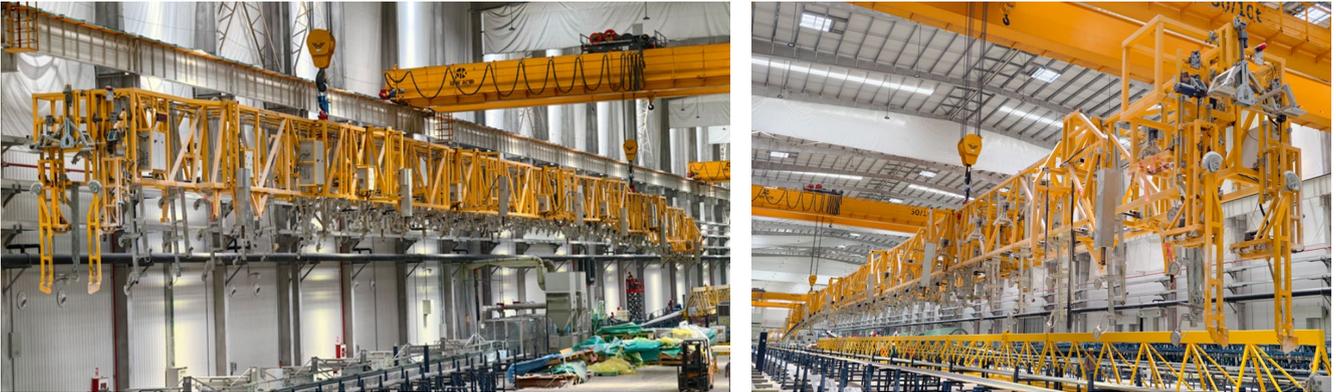


## MODULAR WEBS POSITIONING DEVICE GANTRY (“GALACTICA”)

The webs gantry system allows for easy lifting, bonding and positioning of the webs parts during blade assembly. The system includes a loading station for the gantry structure. The gantry is positioned on the mold’s suction or pressure sides without requiring external actuators other than Gurit’s mold jacks & clamps.

The webs gantry system main truss is modularized and of variable height to minimize overhead gantry hook height requirements. The main truss can be disassembled into segments and fully containerized for efficient transportation. The gantry system minimizes capital investment by using the hydraulic lifting and clamping system already available in the mold. The system’s operation time is minimized with most mounted components having full rough adjustment possibility.

The system includes an automated vacuum system with suction cups. The truss frame is built with seamless pipe that acts as an accumulator to aid in the holding force in the instance of any leaks or short duration power loss. Electro clamps or UPS for the vacuum pump are available as upgrades.



SAMPLE CONFIGURATION	MODULAR TRUSS	ADJ. LEGS	SWING ARMS	END CLAMPS	SUCTION CUPS	ALIGN DEVICES	LOAD STATION
Featured	✓	✓	✓	✓	✓	✓	✓
Vacuum pump	According to requirement						
Suction cups	According to requirement						
Power outage protection option 1	Manual lifting slings						
Power outage protection option 2	Automatic mechanical clamp						
Power outage protection option 3	Vacuum beam accumulator						
Power outage protection option 4	UPS						
Support legs	Fitted to mold hydraulic jack & clamp system or Shear web alignment & lifting up / lowering down system (3.5T electrical actuator)						
Alignment devices	Mating metal blocks fitted to the mold frame						
Weight	According to actual project requirement						
WLL	According to actual project requirement						
Crane requirement	Max. 2x 20000 Kg. overhead cranes						
Min. Crane hook height	8M						
Sample process flow	#1: Load from station #2: Place on mold #3: Dry fit #4: Bond webs #5: Disengage from mold #6: Park						

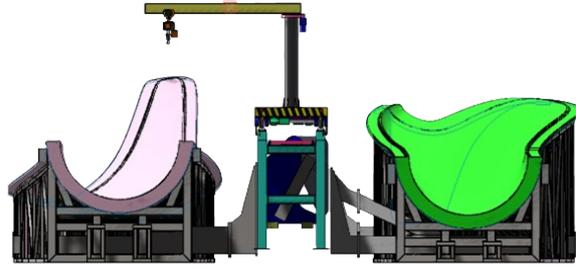
## CENTRAL RAIL & AGV PLATFORM SYSTEM - A SMARTER WAY TO MOVE MATERIALS IN THE BLADE MOLD AREA

### A Smarter Way to Move Materials in the Blade Mold Area

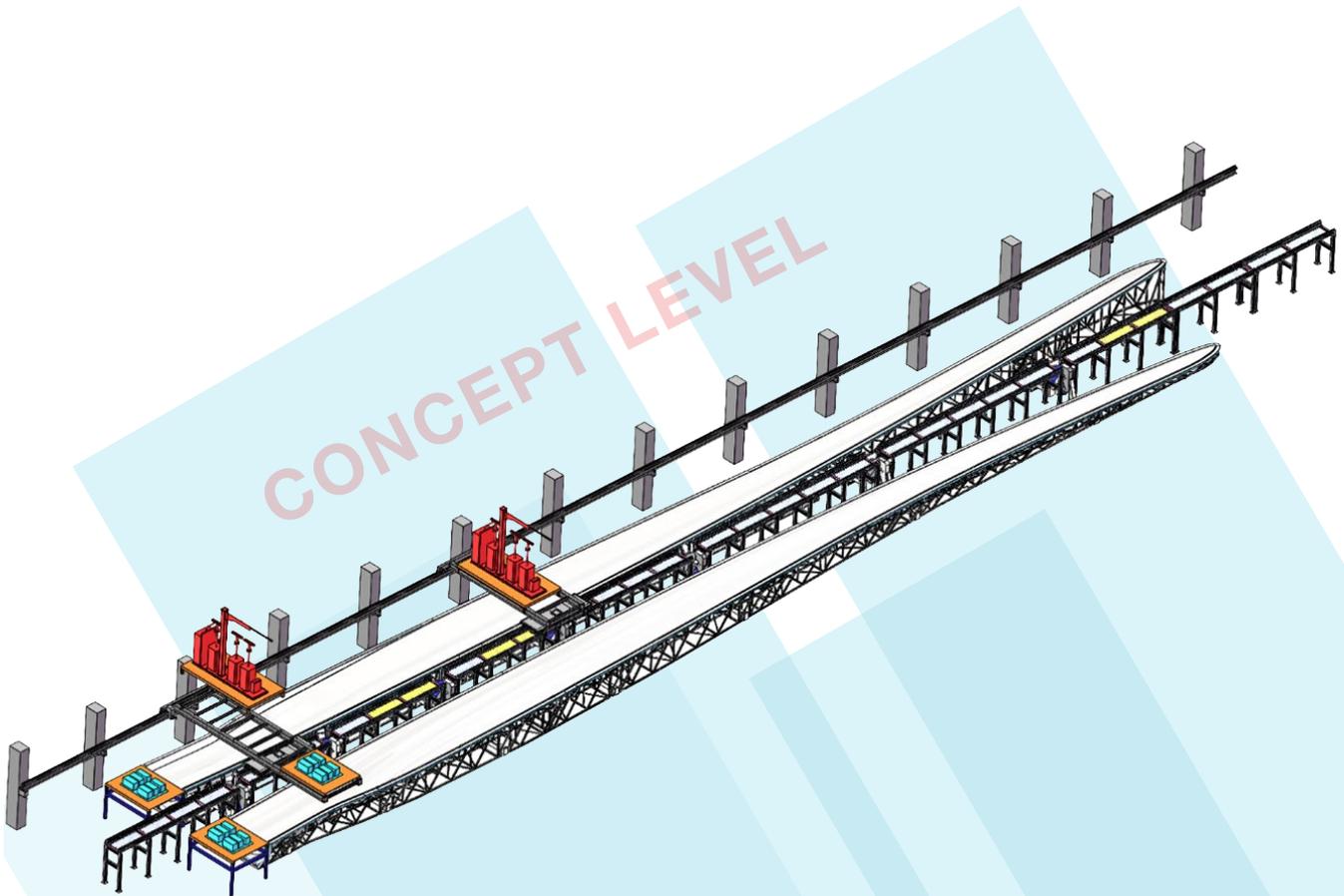
Our Middle Rail System is engineered to optimize material handling from root to tip, ensuring smoother operations and reducing manual workload.

#### Key System Features:

1. Integrated sub rail solution
2. High-capacity rigid platform
3. Efficient material flow
4. Optimized glue application workflow
5. Designed for future expansion



The system is scalable and can be extended with additional functions, automation options, or handling tools as production needs evolve.





## AUTOMATED HIGH-PERFORMANCE GRINDING SOLUTION

Precision, Power, and Productivity for Modern Blade Manufacturing. Our next-generation grinding solution is engineered to deliver unmatched efficiency, reliability, and consistent quality, purpose-built for the demanding requirements of large composite blade production. With industry-leading design enhancements and proprietary control technology, our system reduces operational costs while maximizing output.

Our system features an industry-exclusive 1000mm grinding head, significantly wider than the conventional 800mm heads used by most competitors. This creates a 25% larger grinding surface, and when combined with our higher operating speed, the result is an overall productivity increase.

Designed for low maintenance and maximum uptime. Built for long life and minimal service interruptions, our equipment incorporates:

- One-piece linear guide design with no hydraulic system, dramatically reducing failure points
- Four heavy-duty bottom rollers engineered for exceptional durability and resistance to wear

Our machine's grinding head can swing  $\pm 80^\circ$ , enabling smooth, controlled grinding even in challenging areas such as blade leading and trailing edges.

With an extended arm length of 2.3 - 2.7 meters longer than the typical 2-meter reach of most competitors, our system offers superior coverage and is perfectly suited for large-scale blade production.

GM-061C (Full-Automatic)

**Clean Operation with Low Dust Emission.** Operator safety and workplace cleanliness are elevated through our advanced dust-suction port design. This proprietary structure captures dust efficiently during wide-surface grinding, reducing airborne particles and improving the overall working environment.

**Lower Consumable Costs.** Our 1000mm grinding strips cost nearly the same as standard 800 mm strips but provide 25% more grinding surface area. This gives customers a minimum 20% reduction in overall consumable usage, delivering long-term budget savings without compromising performance.



ITEM	GM-061C (FULL-AUTOMATIC)
Dimension (LxWxH)	4m×2m×5.6m Two - stage telescopic structure
Weight	9 ton
Sanding Range (Height)	0.8-8 m
Extended Arm (length)	2.7 m
Power Supply	3Ph+N+PE 380VAC 50Hz
Power Rating	≈30kW Load rate <60% cosφ≥0.8
Air Consumption	240L/min
Sanding Efficiency	>250 m <sup>2</sup> /h It can achieve grinding of the main surface, leading edge, trailing edge, and the tips
Sanding Quality	a. Glossiness ≤ 5 GU b. Paint Adhesion≥6Mpa
Dust removal efficiency	≥98%
Remarks	1. The AGV moves automatically and sanding automatically. 2. It has a two - stage lifting structure. The sanding height can reach even higher, and it can move freely in an old factory building with a 6-meter-high door.

## LAMINATING CART SOLUTION

As blade lengths continue to increase, manual laminating has become increasingly difficult, time-consuming, and inefficient. Traditional manual handling not only slows down production, it also requires crane support, adding complexity and unnecessary cost to your workflow.

Our innovative laminating cart is designed to replace manual work entirely and eliminate the dependency on cranes.

This results in:

- Higher efficiency
- Safer and smoother operations
- Consistent, high-quality lamination
- Significantly reduced labor effort

1st Generation



2nd Generation



3rd Generation



Upgrade your production process with a smart, purpose-built laminating solution that keeps pace with modern blade manufacturing demands.

## BLADE WEIGHING SYSTEM

Ensure every blade meets the highest standards of quality and balance with our advanced Blade Weighing System. Engineered for precision and designed for seamless integration, this system gives you full control over blade measurement and data traceability.

**High-Accuracy Load Cells.** Each system is equipped with four load cells on both the root and tip weighing stations. These industrial-grade sensors deliver precise and stable weight measurements, ensuring full confidence in blade mass distribution and structural balance.

All load cell data is collected through a centralized weighing instrument, installed safely within the control cabinet. This device processes weight inputs in real time, guaranteeing consistent and accurate readings for every blade.

Our dedicated weighing software communicates directly with the weighing instrument to capture and record all key data points.

**Enhance Your Production Quality.** With complete digital documentation, you gain full traceability, improved quality control, and a streamlined workflow.



- 1 Root weighing device
- 2 Control cabinet
- 3 Tip weighing device

## INTELLIGENT END FACE MILLING MACHINE (ROOT MILLER)

**Precision. Performance. Reliability.** For the Next Generation of Wind Blades. Unlock higher productivity and superior blade-root quality with our Intelligent End Face Milling Machine, purpose-built for modern wind turbine blade manufacturing. Engineered to mill the end face of pre-embedded bolt sleeves with unmatched accuracy, this system delivers consistent, high-precision results every time.

**High-Precision Machining.** Advanced control and cutting technology ensure exceptional milling accuracy on every blade root, improving downstream assembly quality and blade-hub interface reliability.

**High Efficiency & Productivity.** Designed for fast, stable, and continuous operation, the machine significantly accelerates blade-root processing while maintaining consistent quality.

**Easy and Accurate Positioning.** User-friendly controls and intelligent positioning systems allow operators to set up and align blade roots quickly and confidently.

**Safety & Reliability Built In.** Robust machine construction, integrated protection systems, and ergonomic operation ensure safe, reliable performance in demanding production environments.

**A Proven Solution Trusted by Leading Blade Manufacturers.** This equipment addresses one of the most critical and challenging steps in blade-root processing. By improving milling accuracy and operational efficiency, it significantly enhances blade quality and reduces production bottlenecks.

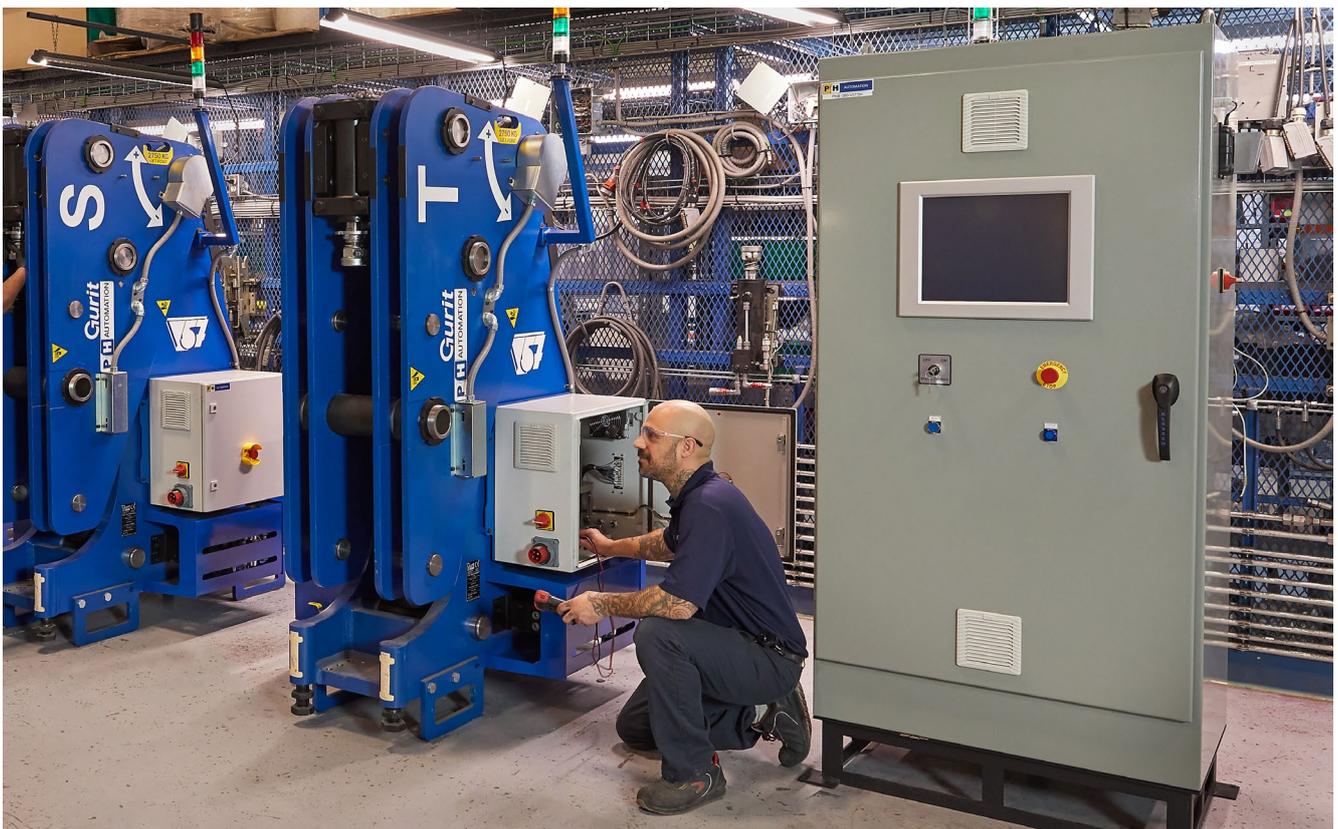
Manufacturers consistently praise its stability, convenience, and exceptional performance, making it the preferred choice for wind blade production lines worldwide.



## INSTALLATION SERVICE AND TECHNICAL SUPPORT

Gurit Tooling is the only company which provides local to local customer services globally. Our team is present in America, Europe and Asia, ready to provide fast support both on site, and on call. Our services include the commissioning and decommissioning of molds, periodical maintenance, and the training of operation and maintenance personnel.

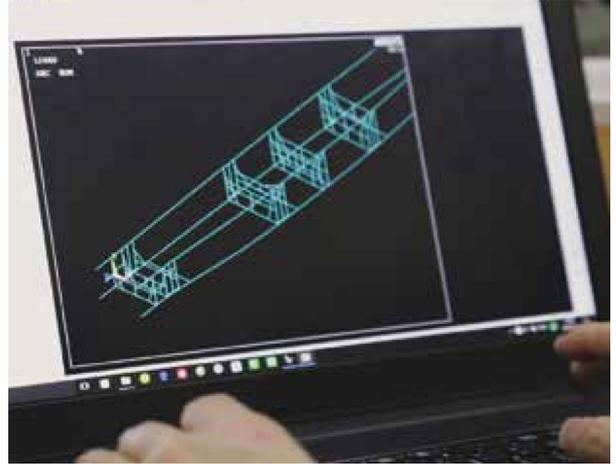
Our highly skilled team is always prepared to support customers with automation equipment, precision measurement with laser tracker, composite materials, welding, machining, and more.



## ENGINEERING DESIGN AND SUPPORT

Our engineering team has over a decade of experience in providing customers with complete design solutions, working closely with clients to fully understand their needs. We can quickly integrate our products with client's systems, as well as provide customized structural, mechanical, control and automation solutions.

Gurit brings decades of experience designing large composite structures for wind turbine blade tooling, the harshest marine and offshore conditions – expertise gained in race yachts, expedition vessels, and wind turbine blades. This background provides unique insight into the requirements of renewable and emerging technologies, including tidal, wave, and WASP projects.



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