



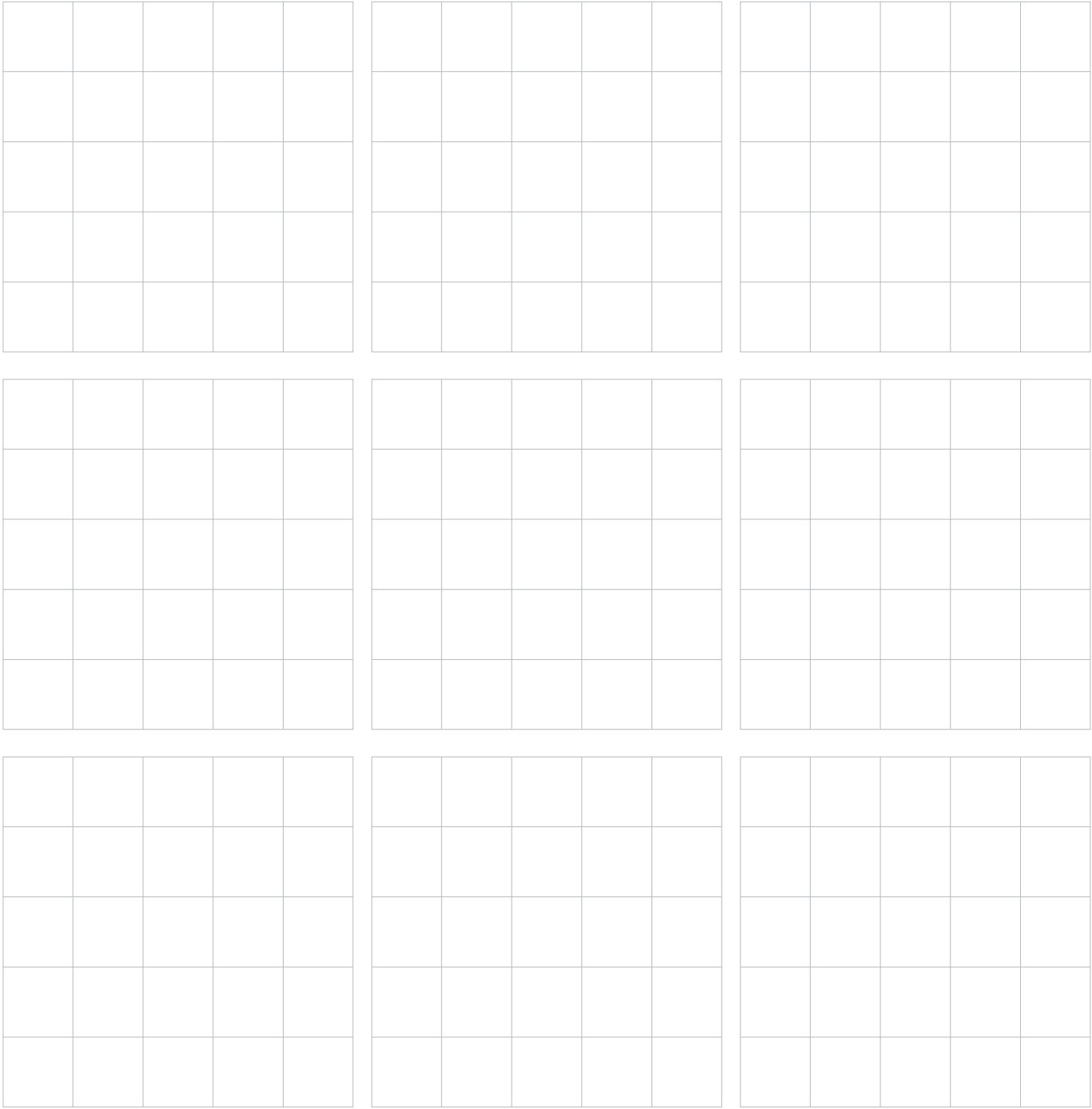
**BENTELER**   
makes it happen

Technical Glass

Machines and systems  
for glass processing

# PARTNER FOR

# PERFECT GLASS

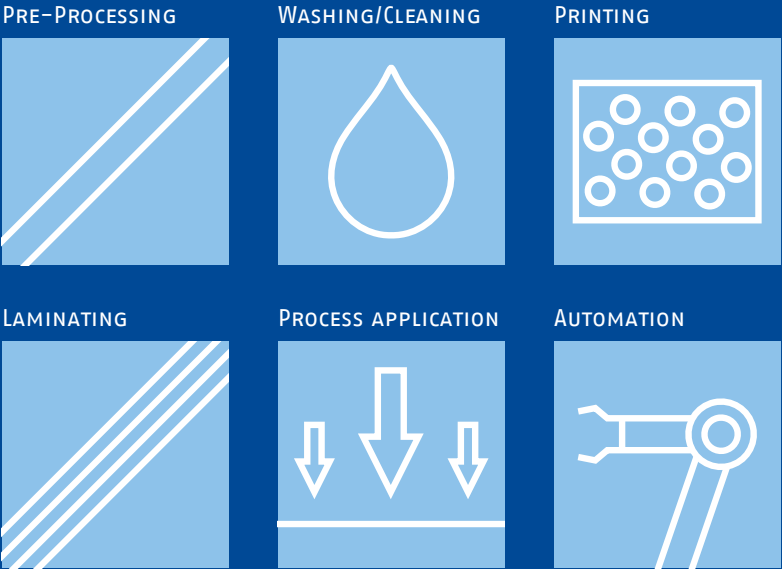


PERFECT GLASS IS WHAT DRIVES US AND HAS BEEN  
OUR MOTIVATION FOR MORE THAN 60 YEARS.

**ON YOUR SIDE**  
We support our customers  
worldwide with innovative  
solutions and services as  
partners on an equal level.



BENTELER develops and  
commercializes innovative  
solutions for Architectural,  
Automotive and Technical  
Glass.



**QUALITY                      FLEXIBILITY                      EFFICIENCY**

We have a high performance claim. For ourselves, for our machines and for our services. Our experience and conscientiousness form the basis for the highest quality.

We focus on your specific requirements to ensure that we supply you with machines that are exactly what you need. Your requirements set the standard from which we develop our solutions.

We are right behind you in your pursuit of technical progress and optimal processes. Our machines and services will allow you to increase productivity rates and achieve sustainable cost reductions.

We combine the functions you need into complete modular processing lines – for perfectly interlocking processes and short throughput times during glass processing.





## CUTTING MACHINE

COATED AND UNCOATED GLASS, THIN GLASS APPLICATIONS

Your solution for a fully automatic and highly accurate CNC cutting process. The robust and precise machine concept assures the highest process stability even for thin glass.



### TECHNICAL DATA

**Glass size:** max. 2,600 x 2,600 mm  
**Glass thickness:** 0.4 - 6 mm  
**Cutting accuracy:** up to +/- 0.05 mm

### ADVANTAGES

#### Quality

- ▶ Servo-driven CNC cutting bridge
- ▶ Gentle cutting and breaking technology guarantees optimal edge quality
- ▶ Cutting table made from granite
- ▶ Specially designed cutting head

#### Flexibility

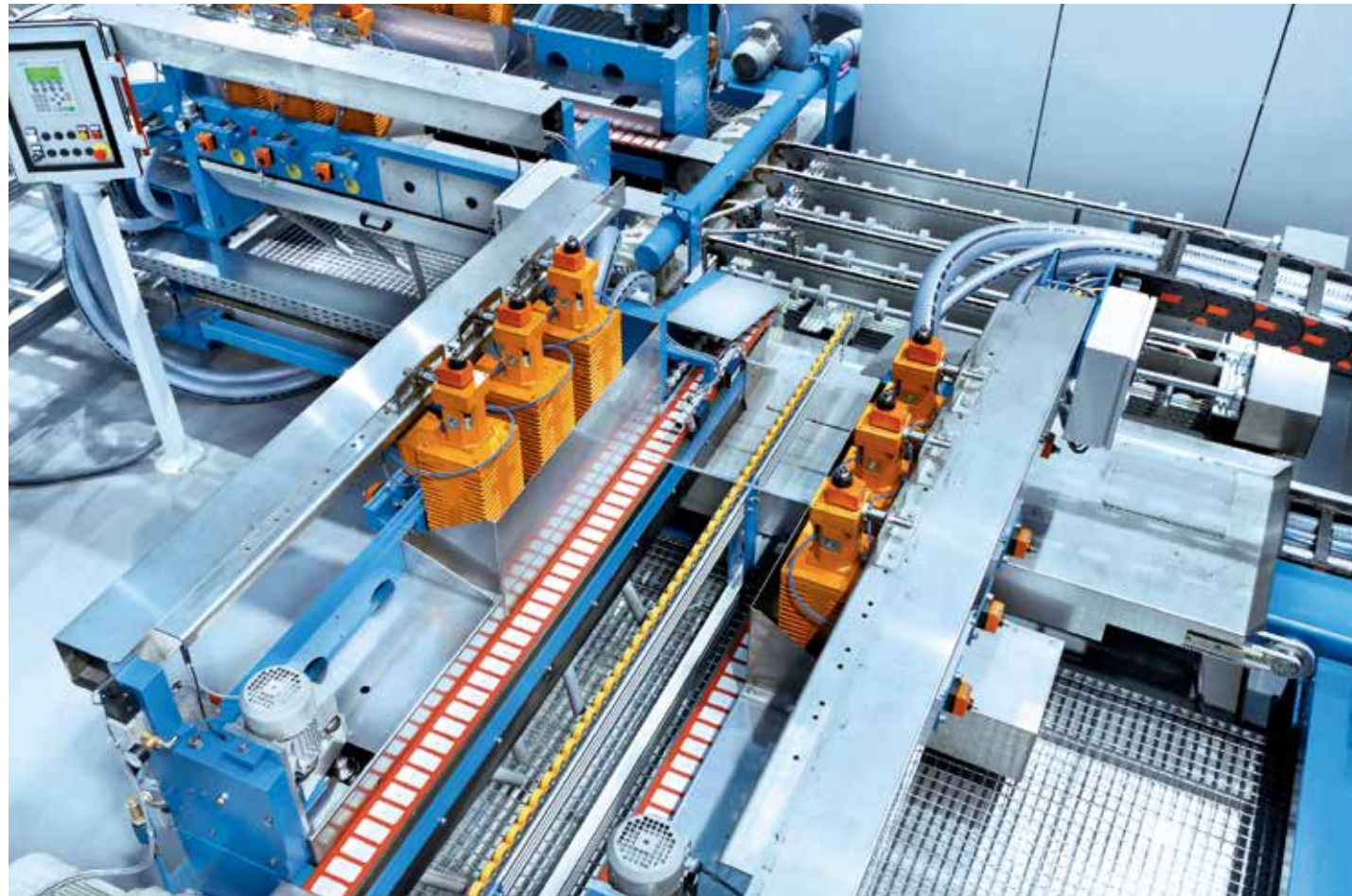
- ▶ Cutting pressure adjustable
- ▶ Quick change of cutting wheels

#### Efficiency

- ▶ Fast and precise cutting with optimised uptime and yield
- ▶ Especially made for integration in glass processing lines







## PENCIL-EDGE GRINDING MACHINE

COATED AND UNCOATED GLASS, FLOAT GLASS, STRUCTURED GLASS

The BENTELER standard C-Edge Grinding Lines convince by optimal grinding results. The very robust design warrants precision and process reliability.



### HIGHLY PROFITABLE

Designed for low-maintenance operation, our systems support your profitability with high availability.

### TECHNICAL DATA

**Glass size:** max. 9,000 mm  
**Glass thickness:** 1.1 – 8 mm  
**Finished glass tolerance (1.000 mm × 1.000 mm):** +/- 0.2 mm  
**Operating speed:** max. 15 m/min

### ADVANTAGES

#### Quality

- ▶ Precise grinding results also for large raw glass tolerances
- ▶ Patented, completely encapsulated high-precision grinding spindles with long service life in wet and abrasive environments
- ▶ Stable design for low vibration glass processing

#### Flexibility

- ▶ Up to 5 grinding spindles per side
- ▶ Design with vacuum instead of pressure belts also available for glass processing without touching the top glass surface

#### Efficiency

- ▶ Fast and precise width adjustment with fully automatic support bars
- ▶ Automatic side and angle alignment to prevent unground glass edges and burns







## 2nd GEN GRINDING MACHINE

COATED AND UNCOATED GLASS, FLOAT GLASS,  
STRUCTURED GLASS, THIN GLASS

This patented machine stands out by extremely high availability. With simple handling and high automation, the tool change and setting is carried out in just a few minutes.



### TECHNICAL DATA

**Glass size:** max. 3,200 × 3,200 mm  
**Glass thickness:** 0.5 – 6 mm  
**Operating speed:** max. 16 m/min  
**45° corner cut:** 2 – 5 mm  
**Finished glass tolerance**  
**(1,000 × 1,000 mm):** +/- 0.2 mm

### ADVANTAGES

#### Quality

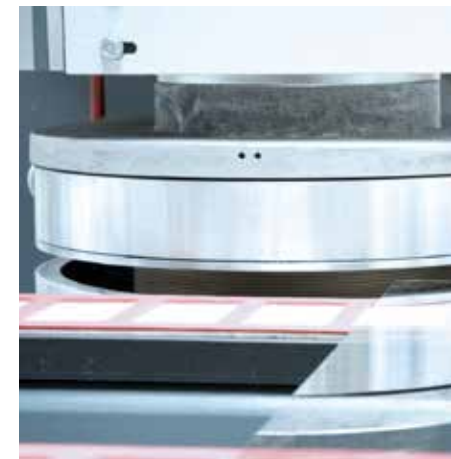
- ▶ No touching of the top glass surface by means of vacuum belts
- ▶ Absence of cooling water on the glass surface due to patented cooling water extraction
- ▶ Automatic tool adjustment and wear compensation

#### Flexibility

- ▶ Designed for mass production with a wide range of glass dimensions and even very thin glass thicknesses
- ▶ One or two grinding spindles per side

#### Efficiency

- ▶ Optimisation of yield due to automatic tool sharpening and wear compensation
- ▶ Very high uptime due to reduction of tool change-, maintenance- and cleaning times
- ▶ Same processing tool for glass edge and corner
- ▶ Quick tool change with hydraulic clamp





## CNC Processing Center

HIGHEST FLEXIBILITY, FULLY AUTOMATIC SOLUTION

Your solution for complex glass shapes. With the vast array of working widths, this machine can be used across many platforms of production.

PRE-PROCESSING



### TECHNICAL DATA

**Glass size:** max. 3,300 × 20,000 mm  
**Grinding and milling rotational speed:** 12,000 U/min  
**Milling speed:** max. 2 m/min  
**Speed of operation:** 20 m/min  
**Drill diameter:** 4 – 70 mm



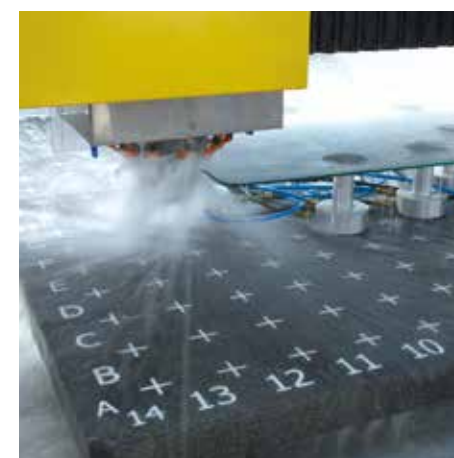
### ADVANTAGES

#### Quality

- ▶ Processing on stationary workpiece warrants accurate final products
- ▶ High-frequency motor spindle for all types of machining

#### Flexibility

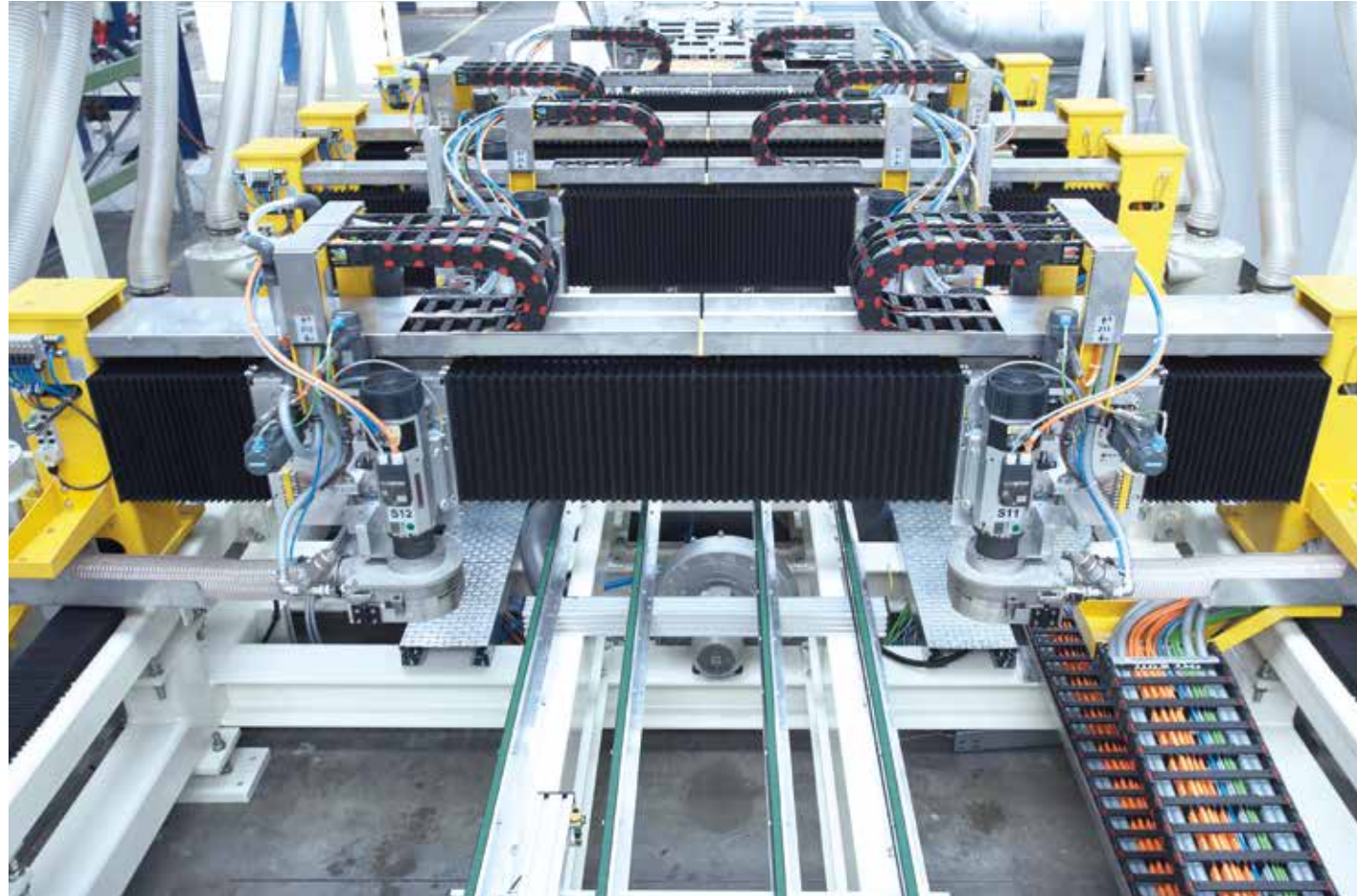
- ▶ CNC glass processing with up to 5-axis machining
- ▶ Fully automatic set-up for product change
- ▶ Gantry construction allows separate grinding and milling tools access to complete working width of the glass sheet
- ▶ Customised processing of different widths possible



#### Efficiency

- ▶ Especially made for integration in glass processing lines
- ▶ Highest level of automation: drilling, grinding and milling operations in one machine with automatic glass loading and positioning saves time and improves quality





**EXTREMELY THIN, FLEXIBLE AND SCRATCH-RESISTANT, DISPLAY GLASSES FIT INTO MODERN MONITORS OF VARIOUS FORMATS. WITH EXCELLENT HAPTICS FOR A SMOOTH OPERATIONAL EXPERIENCE.**

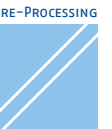
#### TECHNICAL DATA

**Glass size:** max. Gen 10.5  
**Glass thickness:** 0.3 – 1.1 mm  
**Operating speed:** max. 12 m/min  
**Dimensional accuracy:** +/- 0.05 mm

## SUBSTRATE GLASS GRINDER

COATED AND UNCOATED GLASS, THIN GLASS APPLICATIONS

This machine combines high automation with accurate grinding results and outstanding glass edge quality. The proven extraction system assures a clean and dry process with a long lifetime in a 24/7 operation.



### ADVANTAGES

#### Quality

- ▶ Patented BENTELER coolant extraction system for dry grinding and polishing process
- ▶ Extremely precise CNC-controlled process allows minimum stock removal for maximum edge quality
- ▶ Smooth glass handling utilising air-float and point-contact belts

#### Flexibility

- ▶ Machines for different glass sizes available
- ▶ Multiple corner cut designs
- ▶ MES integration

#### Efficiency

- ▶ Stock removal down to 0.15 mm per side with 3 stations
- ▶ 24/7 operation
- ▶ Optimisation of yield

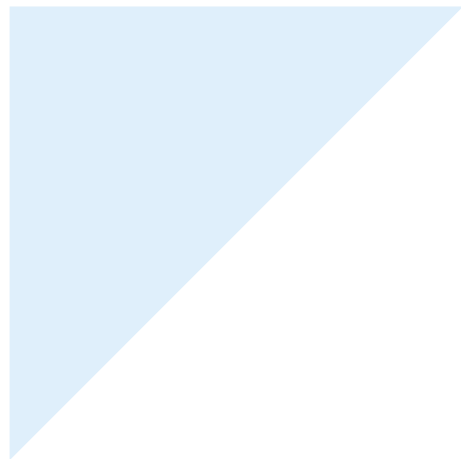




# MULTISPINDLE DRILLING MACHINE

COATED AND UNCOATED GLASS, FLOAT GLASS, STRUCTURED GLASS

The BENTELER CNC-Controlled Multispindle Drilling Machine is a very process-reliable and flexible solution for your drilling requirements. The CNC-controlled axes warrant a high repeatability with minimal set-up time.



## TECHNICAL DATA

**Glass size:** max. 1,300 × 2,300 mm  
**Glass thickness:** 2 – 19 mm  
**Repeatability of the borehole placement:** +/- 0.2 mm  
**Speed of positioning:** 40 m/min  
**Number of drill spindle pairs per machine:** 1 – 7



## ADVANTAGES

### Quality

- ▶ Patented BENTELER drilling spindle for a long service life even in wet and abrasive environments
- ▶ Machine frame and components of especially stable design warrant low vibration drilling with high precision and repeatability
- ▶ Cooling water extraction system to protect the glass surface

### Flexibility

- ▶ The drilling machine can be equipped with up to 7 spindle pairs
- ▶ Simple upgrade of additional drilling spindles
- ▶ Large variety of drilling patterns with optimised cycle time
- ▶ CNC-controlled processing in X, Y and Z direction

### Efficiency

- ▶ Designed for high-capacity in-line operation
- ▶ Automatic measuring and calibrating system for fully automatic and precise positioning of the drilling tools
- ▶ Automatic and fast tool change as well as tool sharpening







# SCREEN PRINTING MACHINE

AUTOMATED SOLUTION, HIGHEST PRECISION

The BENTELER Screen Printing Machine provides innovative features for high performance requirements. Your solution for screen printing in a fast production line and 24/7 operation.



## TECHNICAL DATA

**Glass size:** max. 2,600 × 1,600 mm  
**Glass thickness:** min. 0.5 mm  
**Screen size:** max. 3,350 × 2,150 mm  
**Cycle time:** 9 secs.  
**Repeatability:** +/- 0.1 mm

## HIGHLY RELIABLE

Smooth integration, a wide range of automation functions as well as high failure safety in the three-shift operation



## ADVANTAGES

### Quality

- ▶ Printing up to the glass edge possible to avoid shiners
- ▶ No risk of displacement of adjusted position
- ▶ Accurate and reproducible glass transport

### Flexibility

- ▶ Recipe memory for up to 500 models
- ▶ Moving screen frame

### Efficiency

- ▶ Alignment by laser projection
- ▶ Refitting with just one person





## tecWasher compact

COMPACT DESIGN, EASY OPERATION

The tecWasher compact is a high-quality washing machine for small and medium-sized formats.



### TECHNICAL DATA

**Working width:** 600–1,600 mm  
**Glass thickness:** 0.5–12 mm  
**Operating speed:** 3–13 m/min  
**Glass length:** min. 148 mm  
**Glass width:** min. 50 mm



### ADVANTAGES

#### Quality

- ▶ Excellent washing and drying quality
- ▶ Stainless steel AISI 304 or 316L
- ▶ Long lifetime also in rough environments

#### Flexibility

- ▶ Tailor-made polishing and cleaning configurations can be integrated
- ▶ Recipe control
- ▶ Motorised glass thickness adjustment
- ▶ Continuously adjustable transport speed

#### Efficiency

- ▶ Water-saving cascade system
- ▶ Simple operation and easy maintenance
- ▶ Compact design with ventilator located on platform





## tecWasher F

STANDARDISED DESIGN, LOW INVEST COSTS

The tecWasher F is a standardised, modular concept for all glass formats.



### TECHNICAL DATA

**Working width:** 2,000 – 3,300 mm  
**Glass thickness:** 1.5 – 21 mm  
**Operating speed:** 3 – 13 m/min  
**Glass length:** min. 280/350 mm

### ADVANTAGES

#### Quality

- ▶ Excellent washing and drying quality
- ▶ Proven BENTELER quality

#### Flexibility

- ▶ Different configurations available due to modular design
- ▶ Detergent dosing and glass polishing available
- ▶ Easy operation and maintenance

#### Efficiency

- ▶ Compact footprint
- ▶ Energy-saving design
- ▶ Blower and switch cabinet located on top of the machine





## LABWasher

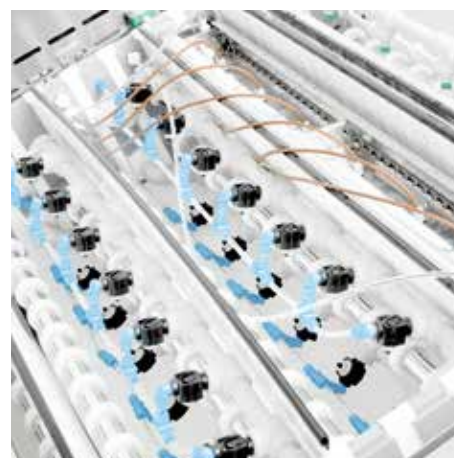
CLEANROOM ENVIRONMENTS, PREPARATION FOR VARIOUS COATING APPLICATIONS, RESEARCH LABORATORIES

The BENTELER LABWasher is designed for challenging cleaning and surface preparation requirements. Its modular design provides highest flexibility for various applications.



### TECHNICAL DATA

**Working width:** 1,000 – 1,600 mm  
**Glass thickness:** 0.4 – 8 mm  
**Operating speed:** 0.5 – 8 m/min  
**Glass length:** min. 80 mm



### ADVANTAGES

#### Quality

- ▶ Double housing to prevent introduction of machine-induced particles
- ▶ Air filtering up to EU 13
- ▶ Spraying zones with up to 140 bar
- ▶ Ionizing bar
- ▶ Ultrasonic cleaning with up to 950 kHz
- ▶ Cylindrical brushes with carbon-free bristle

#### Flexibility

- ▶ Highly customised configurations by modular design
- ▶ Easy machine upgrade e. g. with corona unit for surface tension adjustment
- ▶ Integration of process monitoring of every single station possible
- ▶ Designed for integration into production line

#### Efficiency

- ▶ Premium glass cleaning up to submicron cleaning quality
- ▶ Encapsulated design with extraction system for cleanroom environment







## COATING WASHER

USED IN PRODUCTION LINES WITH CONTINUOUS  
SURFACE COATING PROCESSES

The BENTELER Coating Washer optimally prepares the glass for the following coating process. The Washer achieves constantly high cleaning results through a combination of high-performance polishing, cleaning and rinsing zones.

WASHING/  
CLEANING

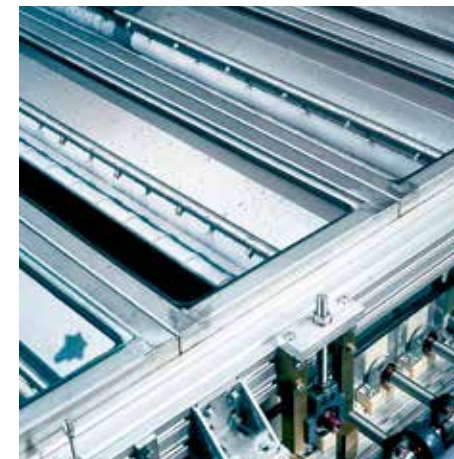


### TECHNICAL DATA

**Working width:** up to 3,360 mm  
**Glass thickness:** 0.7 – 50 mm  
**Operating speed:** 1 – 25 m/min  
**Glass lengths:** min. 280/350 mm



### ADVANTAGES



#### Quality

- ▶ Glass surface preparation for various coating applications
- ▶ Oscillating disc-type brushes reliably detach soiling and oxide coatings from the glass surface
- ▶ Air filtering up to EU 13
- ▶ Robust design and quality materials
- ▶ Effective separation of polishing and cleaning zones
- ▶ Automatic measurement and correction of the water conductivity

#### Flexibility

- ▶ Customisable configurations through modular design
- ▶ Motorised glass thickness adjustment
- ▶ Integration into production lines
- ▶ Cylindrical brushes with various bristle types

#### Efficiency

- ▶ Water-conserving cascade system
- ▶ Simple operation and easy maintenance





## EDGE SEALING

HIGHEST PRECISION AND FAST WORKING SPEED FOR  
THIN-FILM AND CRYSTALLINE SOLAR MODULES

With outstanding process reliability, the BENTELER Edge Sealing System creates a precise seam made of butyl hotmelt.



## TECHNICAL DATA

**Cycle time:** < 25 secs.  
**Tolerance of sealing seam thickness:** +/- 0.07 mm  
Corner configuration freely selectable  
(overlapping, joint, seamless)  
Double drum loader for continuous operation



## ADVANTAGES

### Quality

- ▶ Maximum process reliability based on very robust design
- ▶ Accurate and repeatable sealing quality
- ▶ Laser measurement system for process control

### Flexibility

- ▶ Modular design for simple integration into existing production lines
- ▶ Adjustable butyl bead geometrie
- ▶ MES linkage

### Efficiency

- ▶ Extremely high operating speed
- ▶ Optimised uptime by high quality components and 24/7 uninterrupted buthyl supply
- ▶ Maximum yield by accurate process control







## FOIL MANAGEMENT

HIGH REPEATABILITY AND EXACT POSITIONING FOR FULLY AUTOMATIC PROCESSING OF LAMINATING AND COVER FOIL

The BENTELER Foil Management stands out with its extremely high repeatability for cutting and positioning of the foil as well as its maximised availability. The machine is individually adapted to the characteristics of the respective foil.



### TECHNICAL DATA

**Cycle time:** < 25 secs.  
**Positioning precision:** +/- 0.2 mm  
**Cutting speed:** 190 m/min



### ADVANTAGES



#### Quality

- ▶ Mature design as a result of decades of experience in laminated glass production
- ▶ Foil cutting table with high precision servo drives
- ▶ Smooth foil cutting and handling without tension and stress

#### Flexibility

- ▶ Optional cover glass positioning for glass-glass modules
- ▶ Easy integration into existing production lines
- ▶ MES linkage

#### Efficiency

- ▶ Fully automatic non-stop operation in production lines
- ▶ Integrated foil punching device for the bus bars
- ▶ Automatic roll change and foil start
- ▶ Automatic wind-up device for interleave foil





## AUTOMATIC TRIMMING/ SEAMING UNIT

FLEXIBLE SOLUTION FOR TRIMMING OF LAMINATED GLASS MODULES

This machine design combines high flexibility, exceptional uptime and process stability. Efficient trimming solutions for PVB foil, EVA or even butyl.



### TECHNICAL DATA

**Module size:** max. 3,200 × 6,000 mm  
(optional other dimensions)

**Type of material:** PVB, EVA, butyl



### ADVANTAGES

#### Quality

- ▶ Trimming/Seaming spindles with linear adjustable rotor for smooth trimming/seaming
- ▶ To ensure proper wear compensation, the Y and Z axes are automatically adjusted via the HMI

#### Flexibility

- ▶ Trimming by metal brushes or seaming by grinding wheels
- ▶ Integration of vacuum extraction system to remove foil or butyl particles generated by the trimming process
- ▶ Cooling water extraction for seaming process

#### Efficiency

- ▶ High yield due to accurate wear compensation
- ▶ Optimised uptime by short set-up times
- ▶ Clean environment and safe operation by safe extraction systems





## AUTOMATIC FRAMING OR RAIL BONDING UNIT

FULLY AUTOMATED SOLUTIONS FOR THE PRODUCTION  
OF SOLAR MODULES

BENTELER offers various plant conceptions for framing or rail bonding of solar modules. No matter whether a simple tape-based adhesive technology, 1K or 2K adhesive or a combination of both is desired, BENTELER has an appropriate solution for a continuous 24/7 production line.



**GOOD SOLAR GLASS ALLOWS ENERGY-RICH  
SUNSHINE TO PENETRATE UNIMPEDED. AT THE  
SAME TIME, IT DEFIES HAIL AND SNOW LOAD  
BY MEANS OF ITS MECHANICAL STABILITY.**

### TECHNICAL DATA

**Module size:** max. 1,000 × 2,000 mm  
(optional other dimensions)  
**Cycle time:** 60 secs.

### ADVANTAGES

#### Quality

- ▶ High repeatability and reliability
- ▶ Monitoring of all relevant process parameters guarantees stable processes

#### Flexibility

- ▶ Process adjustable to customer needs
- ▶ Simple integration into existing production lines
- ▶ Application of tape, 1K or 2K adhesives

#### Efficiency

- ▶ 24/7 continuous operation
- ▶ Small footprint
- ▶ Easy maintenance







## PAPER AND FOIL APPLICATION

### FULLY AUTOMATIC GLASS PACKING FOR PROTECTION OF SENSITIVE GLASS SURFACES

The BENTELER Paper and Foil Application ensures reliable results for paper and foil applications onto sensitive glass surfaces. The combination with a fully automatic unloading system reduces the risk of damage to a minimum.



### TECHNICAL DATA

**Glass size:** max. 2,600 × 2,600 mm  
**Glass thickness:** 0.5 – 12 mm  
**Operating speed:** adjustable to line speed



### ADVANTAGES

#### Quality

- ▶ Reliable adhesion of paper on the glass
- ▶ Precise positioning of paper and/or foil
- ▶ Reliable 24/7 operation

#### Flexibility

- ▶ Unloading with automatic foil application on top and/or bottom side of the glass
- ▶ Different glass sizes and paper/foil thicknesses
- ▶ Integration into existing production lines

#### Efficiency

- ▶ Paper and foil application in one station possible
- ▶ Fast operation for maximum output
- ▶ High uptime through automatic paper roll exchange



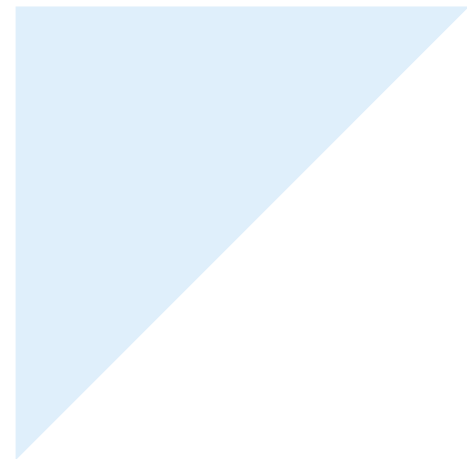




# LOADING, UNLOADING AND HANDLING

HIGHLY AUTOMATED AND CUSTOMER SPECIFIC SOLUTIONS  
FOR ALL TYPES OF GLASS

BENTELER offers various solutions for glass handling systems. Whether to automatically load or unload or to connect several kinds of equipment, BENTELER has the right solution.



## TECHNICAL DATA

**Glass size:** max. up to 3,200 × 6,000 mm  
**Glass thickness:** 0.4 – 19 mm  
**Cycle times:** adjustable to customer needs



## ADVANTAGES

### Quality

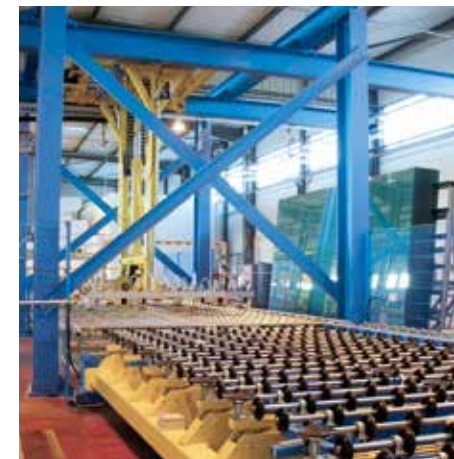
- ▶ Scratch-free glass transport and positioning
- ▶ Glass handling solutions without marks on glass surface

### Flexibility

- ▶ Any kind of glass handling solution available (robot, gantry stacker, shuttle systems)
- ▶ Glass separation with automatic paper, cord or powder application
- ▶ Loading with automatic paper removal

### Efficiency

- ▶ Cycle time optimised turnkey solutions
- ▶ Reliable systems with high accuracy and repeatability
- ▶ Innovative solutions with combined functions







# MIRROR COATING LINES

## HIGHLY AUTOMATED TURNKEY SOLUTIONS

Your solution for efficient mirror production lines with optimised uptime and yield.



## TECHNICAL DATA

**Glass width:** up to 3,600 mm  
**Glass length:** up to 6,000 mm  
**Line speed:** up to 11 m/min  
**Yield:** up to 98 %



## ADVANTAGES

### Quality

- ▶ Almost the entire production line manufactured and delivered out of one hand
- ▶ High-quality machines and solutions to warrant stable mirror quality
- ▶ Engineering performance based on long-term experience

### Flexibility

- ▶ Turnkey lines as well as upgrade and replacement solutions
- ▶ CSP or indoor application, copperless or copper process
- ▶ Electric and gas furnaces

### Efficiency

- ▶ High uptime due to advanced automation technologies
- ▶ Solutions for most competitive optimisation of yield





## PRODUCTION LINES FOR ACID-ETCHED GLASS

### HIGHLY AUTOMATED TURNKEY SOLUTIONS

No matter whether etched glass for windows, partitions, shower doors or other applications, BENTELER supplies complete lines for high-quality acid etching of glass. The design of BENTELER etching lines is based on detailed know-how in glass processing and process application.



### TECHNICAL DATA

**Glass width:** up to 3,300 mm  
**Glass length:** up to 6,000 mm

### ADVANTAGES

- ▶ Entire line out of one hand
- ▶ Clear interfaces and fast ramp-up of the line
- ▶ Worldwide experienced assembly and commissioning teams
- ▶ Engineering competence also for the main building requirements

#### Scope of supply

- ▶ Glass handling
- ▶ Glass cleaning
- ▶ Various acid application processes
- ▶ Glass inspection



# OUR SERVICE

## PLANNING, DEVELOPMENT AND MAINTENANCE

BENTELER will accompany you with a fast and flexible service through each stage of your project: We will plan your new system, which will leave our premises as a turnkey solution ready for you to use. We take responsibility for the development stages to allow for a smooth commissioning process. We are there for you over the entire life cycle of your system, i. e. we will be there for you right from the initial use of your system and we will always ensure the availability of all spare parts.



## OUR SPECIALISTS ARE AVAILABLE FOR YOU WORLDWIDE.



# BENTELER GROUP

## 140-YEAR SUCCESS STORY



### About BENTELER

BENTELER is a leading global company that develops, produces and sells products, systems and services for the automotive, energy and engineering sectors. We are a family-owned firm now in the fourth generation. Our 30,000 employees at 153 locations in 40 countries are passionate about excellence in manufacturing and distribution – in close proximity and collaboration with our customers. Sales in 2016 amounted to 7,423 Million Euros. The three Business Divisions BENTELER Automotive, BENTELER Steel/Tube and BENTELER Distribution are organized under the strategic management holding company BENTELER International AG in Salzburg, Austria. With our technological expertise and strong focus on successful implementation, we develop solutions that make the difference – for customers, employees and society. And we make them happen.

**BENTELER. The family of driven professionals. Since 1876.**  
[www.benteler.com](http://www.benteler.com)





Intelligent designs  
and machines for:

Technical Glass  
Architectural Glass  
Automotive Glass

## About BENTELER Glass Processing Equipment

BENTELER Glass Processing Equipment develops and implements glass processing in the fields of architecture, automotive as well as technical glasses. With more than 3,000 successfully delivered machines in more than 50 countries, we support our customers with innovative solutions and as partner on eye level.

BENTELER Maschinenbau GmbH  
Frachtstraße 10 – 16  
33602 Bielefeld  
Germany

telephone: +49 521 542-0  
fax: +49 521 542-229

glass-processing@benteler.com  
[www.benteler-glass.com](http://www.benteler-glass.com)