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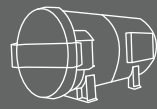
DESIGN  
MANUFACTURING  
UPGRADING  
INSTALLATION SUPERVISION  
INSTALLATION  
SERVICE  
TRAINING  
SPARE PARTS SALES

## INDUSTRIAL AUTOCLAVES AND FURNACES

Composite  
moulding

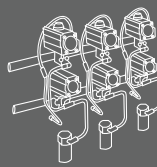


## AUTOCLAVE FOR COMPOSITE MATERIALS



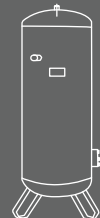
### CYLINDRICAL VESSEL

Heat-insulated pressurised cylindrical vessel with a quick-acting bayonet catch. Hermetically sealed door prevents leakage and depressurisation.



### VACUUM PLANT

A vacuum plant to create vacuum in special bags the moulding pills are placed into. The plant includes vacuum pumps, a receiver and a pipeline system with valves and sensors.



### COMPRESSED GAS SUPPLY SYSTEM

A compressed gas (air or nitrogen) supply system consisting of a compressor, a receiver, a nitrogen plant, a reducer, etc. Autoclave moulding involves pill de-aeration in a special bag where the moulded material is compacted by the gas pressure on the vacuum bag, binder gets cured and the product obtains its final shape.



### HEATING/COOLING SYSTEM

The autoclave features an electric heating system with easy access to the heating elements for maintenance or replacement. The system includes a fan intended to create a uniform heat pattern in the autoclave, which fan is driven by an adjustable-frequency drive in a cooled protective casing. The cooling system includes a heat exchanger inside the autoclave and a coolant circulation and cooling system (cooling tower, chiller, etc.) for controlled reduction of temperature.



Polymer composite structural materials (PCM) based on continuous reinforcement fibre (glass, carbon, organic) and thermoreactive binders (epoxy, polyether, etc.) are gaining popularity in producing critical articles for various industries: aerospace, automotive, construction, shipbuilding, defence, sports gear production, etc. High-tech autoclaves by Volna provide PCMs with high stress-strain properties while keeping density as low as possible.

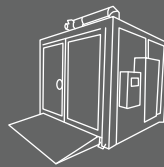
Diameter	300 to 3 500 mm or larger
Length	300 to 16 000 mm or larger
Effective pressure	Max 3 MPa or higher *
Effective temperature	Max 250 °C or higher *
Adjustable rate of heating/cooling	0,1 - 10 °C/min
Temperature increment	0,1 - 10 °C/min
Temperature pattern deviation within the treatment zone	Max +/- 2,5 °C

**Automated control system.** The autoclave moulding process is completely automatic. The control system (CS) reads the temperature and pressure sensors and commands the executive elements to ensure keeping to the pre-set conditions with appropriate accuracy. Special software developed by Volna Automation is used to keep the actual conditions as close to the pre-set ones as possible. The CS allows to create a fully automatic process with remote access to control and monitor it and automatic generation of treatment mode protocols.

Every autoclave is tailored to specific customer's needs with particular focus on the heating rate and temperature uniformity.

\* Can be tailored to customer's specific needs

# FURNACE FOR COMPOSITE MATERIALS



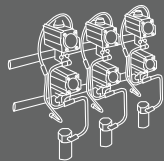
## DEAD-END OR TUNNEL CHAMBER

Casing made from construction carbon steel, internal space lined with sheet steel with heat-resistant and corrosion-resistant coating. Optional modular design



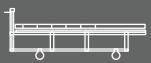
## HEATING/COOLING SYSTEM

Adjustable heating and cooling rates  
Support of any number of temperature sensors both at the product and in the vacuum bag with easy connection in the chamber and readings displayed at the operator's touch screen



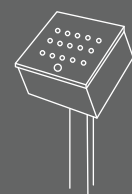
## VACUUM SYSTEM

Vacuum bag connecting inlets, vacuum plant and infusion module (option)



## TRANSPORTATION SYSTEM

Easy-to-use loading system based on a rail track mounted inside and outside the chamber, or a flat-bed chamber with a material handling trolley



## CONTROL SYSTEM

Adaptive control system tailored to the customer's needs respecting its functions and interface. The control system supports integration with the infusion module under common control  
SCADA-based control system for remote condition monitoring with the possibility to generate process charts and protocols as required



Volna furnaces can be used for a wide range of applications. The most common task is binder polymerisation for producing light high-strength articles by the vacuum infusion process. The furnaces are commonly used for thermal post-treatment of finished goods, to dry materials, to warm up moulds, for other purposes. This equipment provides such a major advantage as uniform temperature distribution within the chamber ensured by the effective air recirculation system, which significantly reduces the time required to reach the desired temperature in the furnace.

Dimensions	On demand
Effective temperature	Max 250 °C or higher*
Temperature pattern deviation within the treatment zone	Max +/- 2,5 °C
Adjustable rate of heating/cooling	0,1 to 10 °C/min
Temperature increment	0,1 °C/min

The furnace can be provided with a vacuum system and/or infusion system as an option.

Volna designs and produces furnaces according to the customer's needs respecting their dimensions, specifications and scope of supply. Large furnaces are made as a kit of individual modules for on-site assembly. Such a design can include a movable partition so that the customer may use not the entire system as a whole, but only modules that are actually needed, thus reducing power consumption. Therefore, the customer shall have a furnace with adjustable useful space.

\* Option – Explosion proof furnace or individual components

\* Can be tailored to customer's specific needs