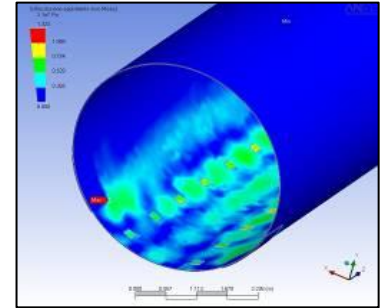
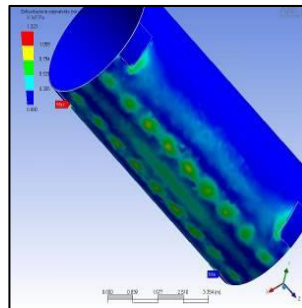
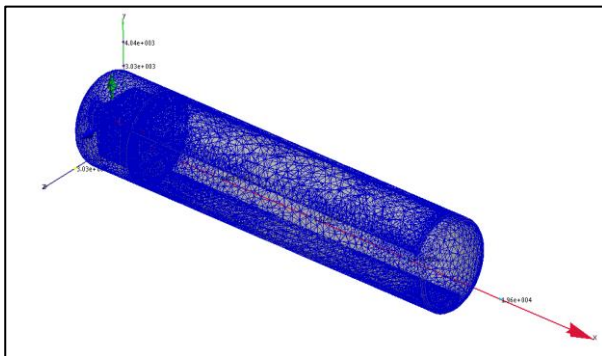




## Industrial and laboratory autoclaves «ITALMATIC» for polymer composites production

Autoclave is a pressure vessel, used for production of prepreg products, which is cured under vacuum bag, with temperature increase for polymerization, and over pressure created inside device. Starting from the perfect knowledge of the most part of calculation codes, our technicians find, on the basis of the Customer's requests, the best structural solution in the quality/price ratio.



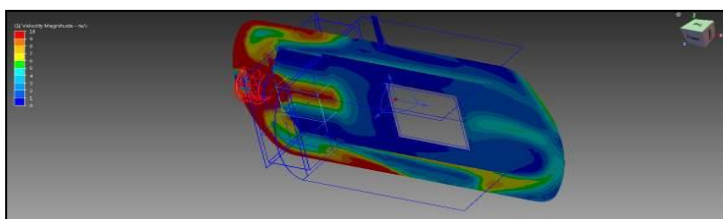
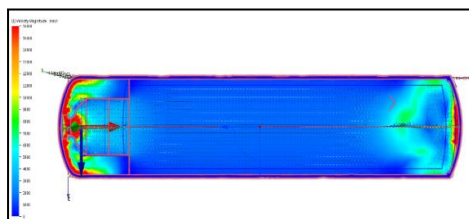
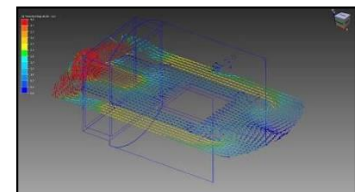
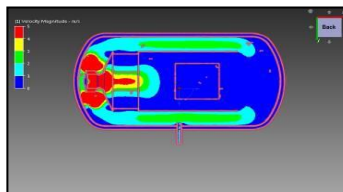
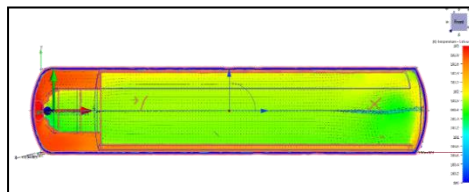
Different possible configurations of autoclaves depending on Customer technical requirements:

- For laboratories and serial production
- Horizontal or vertical construction
- With automatic, semi-automatic or manual door opening system.
- Maximal internal diameter: 6.000 mm
- Fluid: Nitrogen, air and mix
- Maximal length: 50.000 mm
- Maximal working temperature: 450°C.
- Maximal pressure: till 50 Bar.
- Temperature uniformity:  $\pm 2^{\circ}\text{C}$
- Vacuum control and forced cooling systems.



### AUTOCRAVE OPERATING CYCLE

The continuous research to improve the production cycle allowed us to increase total output of the autoclave at enviable values. Usage of special high output fans coupled with channel heat exchangers and optimized air recirculation ducts, allowed us to make experience enough to propose the Customer the best thermo-dynamic solution to carry out the cycle requested with the best energy saving.



Technical values are provided to the best of our knowledge and are based on data considered reliable. Users are responsible for verifying suitability and assume all associated risks.



### CLOSING SYSTEM

ITALMATIC is skilled in the construction of more kinds of door closing systems, like teeth system with outside rotary ring, teeth system with rotary cover and clamp system. Although the safety of the different system is not under discussion, the choice of the model to be used is given by the type of autoclave and by its use.

The sealing is warranted by the use of a special lip seal, this seal allows a perfect sealing of the autoclave even in case of little deformation of coupling flanges.

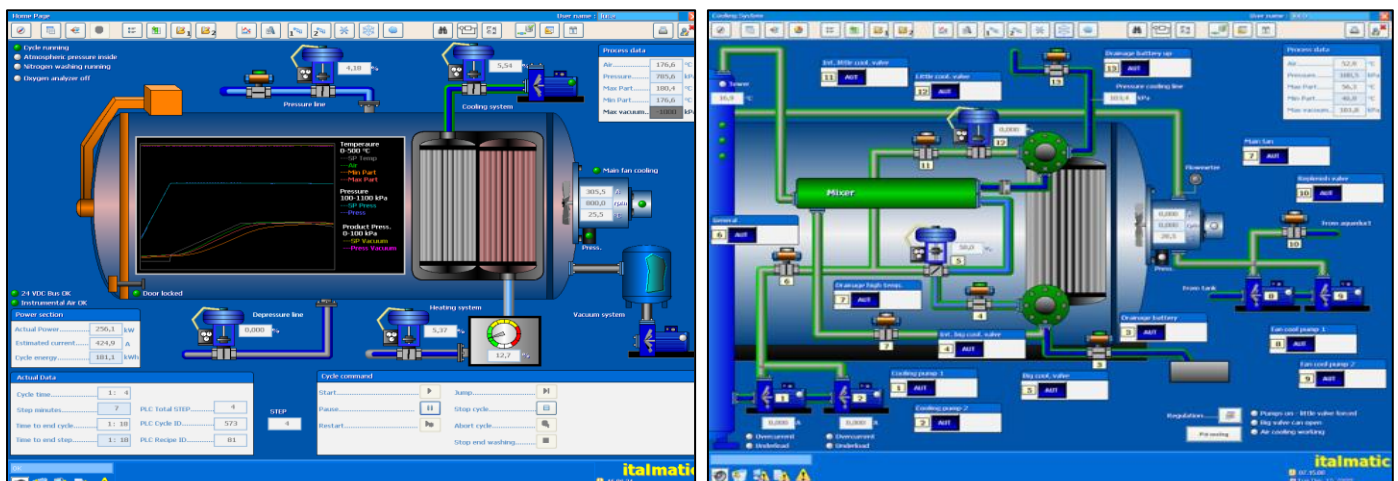
Tested safety block run by sequential electric logic with mechanical controls assures a complete safety of use.



### AUTOCLAVE REGULATION SYSTEM

ITALMATIC autoclave regulation system is based on an applicative software which manages all the inlet and outlet signals for a correct control of the selected functioning cycle.

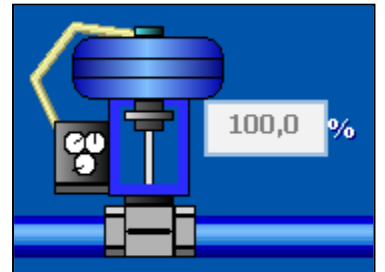
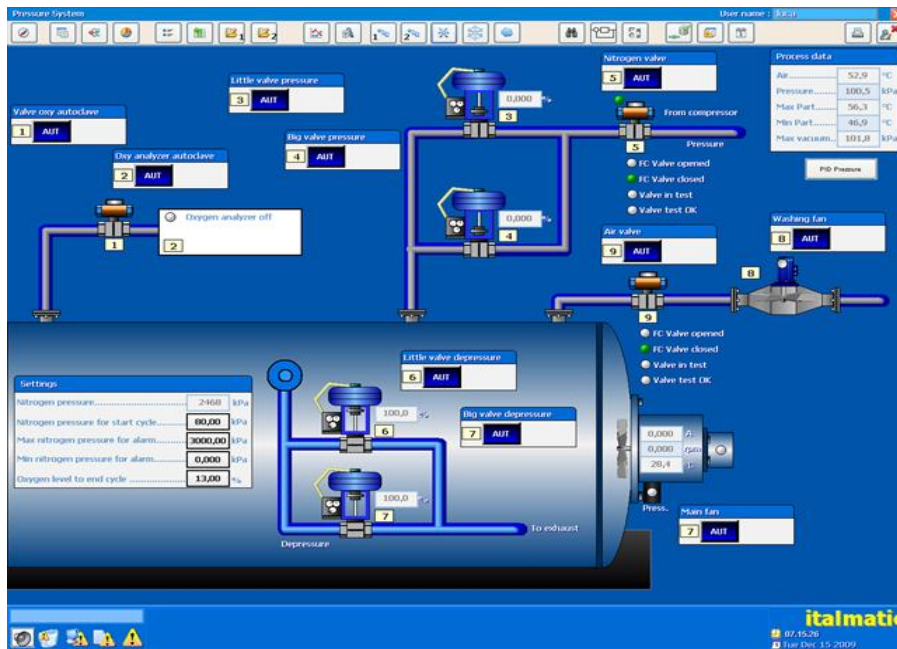
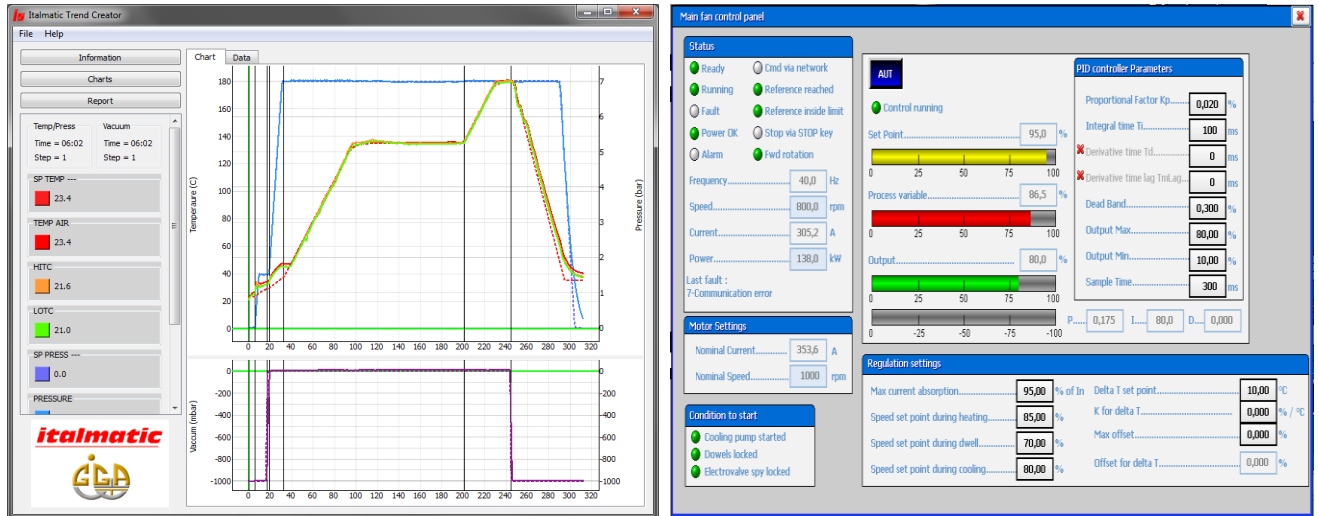
Particular care is taken even for the pressurization and depressurization cycle; in fact such systems are dimensioned with respect to the acoustic limits according to the current security norms and working hygiene.



### MANAGING AND CONTROL BOARD CONTROL SYSTEM PC-PLC

ITALMATIC has realised a control system PC + PLC with dedicated software which allows:

1. Simple entering of the arranged recipes.
2. Storage of many recipes.
3. Process data visualization of the operating cycle, by means of dedicated video pages.
4. Visualization and monitoring of the services.
5. Data storage of productive cycles
6. Printing of trend graphics and of the recipes of the productive cycles



## DESCRIPTION

### AUTOClave BODY

It consists of a cylindrical body electro-welded with elliptic bottom at the back end, and movable elliptic bottom at the front.

The body is completed with a series of support saddles suitably dimensioned and able to support the autoclave frame and the load coming from the material to be processed and required service connections.

Inside the autoclave there are:

- Electric heating batteries
- Cooling batteries fed by water
- Set of truncated cone conveyor
- Centrifugal fan for fluid re-circulation
- Set of duct for fluid re-circulation
- Connections for vacuum lines and related thermocouples
- Gangways to move trolley



Technical values are provided to the best of our knowledge and are based on data considered reliable. Users are responsible for verifying suitability and assume all associated risks.



Autoclave basic configuration:

- Door opening/closure system manual or hydraulic.
- Inside insulation
- Fluid recirculation channel
- Motor with ventilator+ inverter
- Water/ Air inlet/outlet control valves
- Power control board
- Vacuum lines (quantity according to Customer's technical specification) + measure connectors (quantity according to Customer's technical specification)
- Thermocouples of « J -type» or « K-type » (quantity according to Customer's technical specification)
- Safety valve
- Pressure warning valve connected to the manual cam for door opening.
- Atmospheric pressostat which allows the door opening
- Electric logic which does not allow to pressurize if the door is not closed.
- Manual button to stop the autoclave in case of emergency.
- Analogic manometer and thermometer.
- Over pressure pressostat
- Thermostat at max temperature at manual rearmament

### AIR RECIRCULATION

The inside venting will be assured by a centrifugal fan dynamically balanced and directly coupled on the main motor shaft, positioned on the back bottom of the autoclave, that warrants the fluid recirculation needed for a better heat transfer to the products under working.

The fan of centrifugal type will exhaust from the heating batteries by means of a suitable cone with conic frustum and will recirculate the fluid in the autoclave.

### THERMAL INSULATION

Thermal insulation guarantees that the temperature of the external side of the autoclave is into the requested limits by the current rules, with exception of the thermal points.

The thermal insulation is protected by stainless, particularly fixed to allow a free dilatation of the covering elements.

### MOTOR FAN + INVERTER

Motor is cooled by water, completed with fan statically and dynamically balanced and with an automatic system arranging, in case of breakdown of the cooling pump, to insert water from the municipal water system.

### HEATING BATTERIES

The heating batteries are installed in the back part of the autoclave, completely jointed.

### COOLING BATTERIES

Supply and assembling on the autoclave of regulating valves, intercepting valves and dedicated by pass for the cooling system are included in delivery.

### PRESSURIZATION / DEPRESSURIZATION SYSTEM

Supply and assembling on the autoclave of regulating valves, intercepting valves and dedicated by pass for the pressurization in air or nitrogen and depressurization are included in delivery.

### VALVES AND SERVICE PIPING

The order includes the supply of piping between the autoclave and adjusting valves, interception valves and dedicated by-pass for the following services:

- air pressurization in the autoclave
- depressurization
- cooling water system



## Industrial and laboratory autoclaves «ITALMATIC» for polymer composites production

---

### POWER CONTROL BOARD

The power section, consisting of standard modular racks of primary producers, contains all of the components needed for the power electric feeding of the different components of the plant.

Power control board complete with:

- Power section with modular racks consisting of: electric distribution on bars, motors protection with magneto thermic overload cut-out, motor control by contactors and SCR
- Control section with PLC complete with auxiliaries dimensioned for analogic/digital signals foreseen in the plant.
- Emergency circuit with safety devices in Class 3/4
- Transformers and feeders to feed auxiliary circuits
- Operator interface with PC and Vijeo-CITECT S.C.A.D.A. Supervisor, package dedicated to the polymerization, for running and supervision of process data. Complete of data-recording with database MySQL for traceability of cycle for over 20Years with Reports and Trend Graphic
- UPS group to keep the PC and the PLC fed in case of lack of electricity from the net
- Switch Ethernet for connection in the net of the PC and of the PLC for on line assistance and exchange of data among the computers of the company's net
- Venting groups with filter for control board cooling
- Lighting plant inside the control board with movable neon lamps
- Siren for indication of alarms and process anomalies
- Meters, warning lamps, pushbuttons necessary for the control and running of the machine conditions
- "Safeties" by-pass system for electric board opening under tension
- Thermocouples Type J to control uniformity of autoclave temperature and pieces to be processed, mounted with islands I/O distributed in the area
- Software SCADA package dedicated to the polymerization , for running and supervision of process data
- Software DIAGNOSTIC package dedicated to the polymerization to run process anomalies
- Software Viewer Italmatic to visualize all cycle in different PC for quality and event reports

### CONTROL AND MANAGING SYSTEM

According to the needs which are always more restrictive in terms of product quality and development of new technologies, where high precision standard and repeatability are requested, ITALMATIC has developed a control and managing system able to guarantee the conformity of these standards.

The configuration applied foreseen.

### OPERATOR INTERFACE (PC-PLC)

- PC with monitor 20" + advanced software and license
- U.P.S. continuity Group
- Color printer laser

The PC brand will be Lenovo or similar. The software shall meet WIN XP-7 and displays graphics for the visualization of all the process data:

Main synoptic which allows the visualization and the supervision in real time of:

- Cooling system
- Cooling tower
- Heating circuit
- Pressurization circuit
- De-pressurization circuit
- Autoclave temperature, samples temperature, heating and cooling system temperature, environment temperature.
- Status and step number of the working cycle
- Active alarms
- Positive and negative hysteresis of the working step
- Vacuum unit video pages
- Temperature video loop pages, pressure loop, vacuum loop and status of the alarms in line
- Synoptic alarms to monitor the activated/deactivated alarms, with reference to the date and time of the status change with the possibility to rebuild the historical intervened alarms.
- Video pages of setting-up and visualization of the recipes with developed functionalities like pressure trigger on temperature and vacuum trigger on temperature or pressure.
- Video pages with graphic trends of the selected pressure parameters, vacuum and temperature.
- Automatic control for uniformity temperature Pieces with DELTA T air /pieces device.

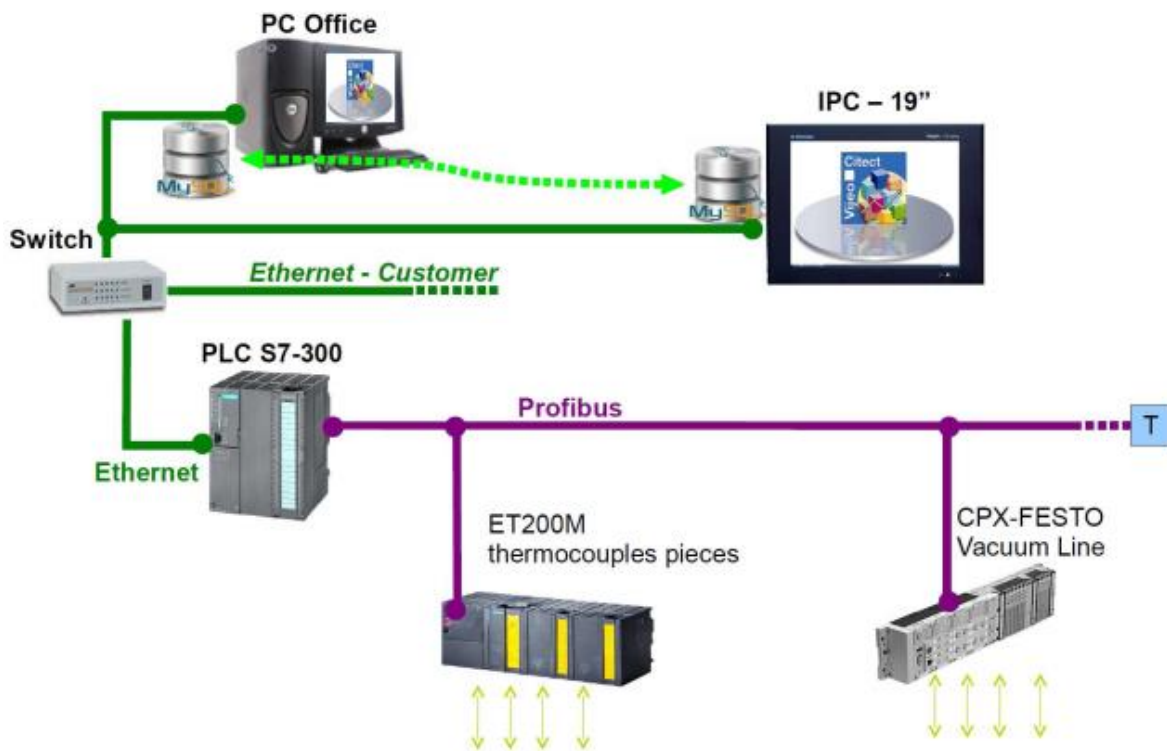


## Industrial and laboratory autoclaves «ITALMATIC» for polymer composites production

- Printing of the production cycle with significant data of the lot and the carried out production.
- The hardware of control is made for the management of the following variables:
- Auxiliary temperature probes, out of which:
  - Temperature heating circuit
  - Temperature cooling circuit
  - Temperature cooling motor circuit
  - Temperature PID control (heating-cooling)
  - De-Pressure PID control (depressurization)
  - In-Pressure ON/OFF control (Pressurization)
  - Automatic Vacuum control
  - Control thermocouples temperature samples with possibility to insert the "delta T" air/piece system
- Logic managing of interblock and alarms, like:
  - Door closure and block
  - Run / Hold thermic cycle
  - Thermic motors and alarms of high temperature and pressure

The control system foresees the cycle running not only on parameters connected with time but it offers the possibility of trigger function connecting the cycle to events

The system S.C.A.D.A. (Supervisory Control And Data Acquisition) is modular and expansible allowing in every moment to expand the number of signals to be managed according to the expansions of the plant without the substitution of the control system.



### VACUUM UNIT

Autoclave will have coupling (vacuum + measure) connections inside and the lines will be automatically controlled.

Each vacuum and measure line will be supplied with a hand-operated ball valve to isolate the system from the vessel.

Each vacuum line is supplied with resin trap system and air valve(s), operated by control system, allowing line activation and blocking according to preset parameters of vacuum and environment. Each set of source/sensing lines will be assigned a number which can be logged in the run data.





## Industrial and laboratory autoclaves «ITALMATIC» for polymer composites production

- Vacuum pump (efficiency is defined by Customer's technical specification)
- Vacuum tank (volume is defined by Customer's technical specification)
- Transducers for vacuum degree measuring on measure line (probe)
- Resin trap system on vacuum lines
- PC- controlled pneumatic valves on the vacuum lines
- PC-controlled pneumatic valves on the venting lines
- External manual valves on the vacuum lines
- External manual valves on the probe lines
- Set of connections pipes 1/2" among vacuum lines
- Set of connections pipes 1/4" among probe lines

All mounted on standard racks with valves and tubing.



### THERMOCOUPLES FOR PROCESS MANAGEMENT

The autoclave will be equipped with thermocouples (quantity depends on Customer's technical specification) « J-type » for temperature control of fluid re-circulating in the autoclave, and temperature uniformity during the cycle. These thermocouples will be mounted in thermal wells. Minimum one will be placed at the top of the vessel near the door end and will be utilized as the vessel control thermocouple. The second will be placed at the top of the vessel, near the rear area. Both of them will be identified and monitored continuously on the control panel.

Beside these Thermocouples the autoclave will have:

- Thermocouples (quantity depends on Customer's technical requirements) « J-type » for the temperature of a piece. These thermocouples are placed next to the door.
- 1 thermocouple for water temperature for the cooling circuit
- 1 thermocouple for the cooling circuit of the pressurized motor
- 1 thermocouple for the temperature of the heating system
- Each thermocouple will be assigned a number, which can be logged in the run data.

### SECURITIES AND AUTOCLAVE CONTROLS

Security system regularly approved by the current rules, made up of:

- Safety Valve
- Robust manual cam for the blocking of the door into position and block the unlocking rotation of the lock ring. The manual cam is equipped with a limit switch set to disable the hydraulic system when shut and disable the heat and pressurization functions when open.
- A spring-loaded, pneumatic cylinder which prevent the rotation of the cam which blocks the door with the autoclave under pressure.
- Pressure warning valve to control that there is no pressure before the opening of the door, connected to the manual cam.
- Atmospheric pressostat which allows the door opening
- Electric logic which does not allow pressurizing if the door is not closed.
- Manual button to stop the autoclave in case of emergency.
- Analogic manometer and thermometer.
- Over pressure Pressostat
- Thermostat at max temperature at manual rearmament.



### PRESSURE DISCHARGE SILENCER

Sound absorber provides venting noise level on the depressurization side that does not exceed 85dB at a distance of 2 m from the vent discharge when the vent valve is fully opened at the maximum working pressure.



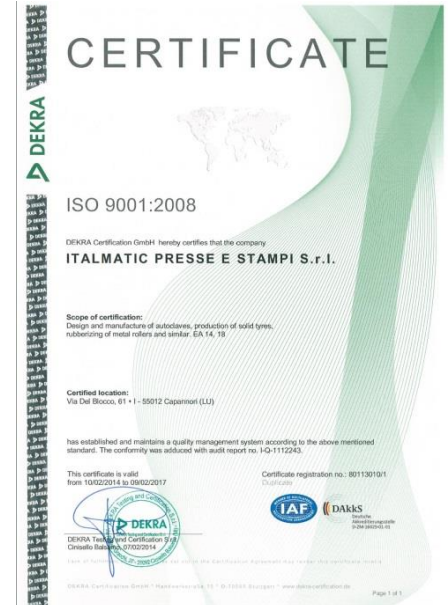
### AUXILIARY EQUIPMENT

At Customer's option, autoclave can be supplied with auxiliary equipment, such as:

- Vacuum station
- Nitrogen station
- Evaporating tower(system of water cooling)
- Air compressor station
- Buffer air tank
- Refrigeration air dryer
- Contact panel (jack panel)
- Trolley + under-trolley
- Connection bridge
- Water treatment system (purifying, softening...)

### OPTION SERVICE

- Design of autoclave setting
- Industry safety expertise of project
- Civil works for wiring and piping
- Project documentation and following of registration RTN



### NOTES

Our specialists will choose optimal equipment type for best feet to Customer's technical specification, provide commissioning and staff training, and fulfill warranty and post warranty service as soon as possible. Quality control system "ITALMATIC, corresponds to standards EN9100, and it is the base of autoclave production in accordance with European safety standards, as well as with Russian 97/23 PED and GOST requirements. Please contact us to get further information, as well as to make an equipment design according to your technical specification. Standard warranty period: 12 months