MELTING FURNACE

COMBUSTION BURNERS
REGENERATIVE & RECUPERATIVE FURNACE
WASTE DUCT EQUIPMENT
BATCH CHARGERS
GAS AND OIL CONTROL STATIONS
DRAUGHT REGULATING VALVE
BUBBLER BOOSTER SYSTEM
TANK AIR COOLING STATION
GLASS LEVEL EAGLE
BURNERS
WASTE GAS SHUT-OFF VALVE
THROAT BOOSTER
COMBUSTION EQUIPMENT

GLASS | AUTOMATION | ENERGY
ALL IN ONE
QUALITY IS NEVER AN ACCIDENT.  
BDF INDUSTRIES, SINCE 1906.
BDF industries Melting product line includes the complete glass melting and conditioning technologies for design and supply of furnaces, working end & forehearths. The range of products includes also the relevant equipment like oil and gas burners and firing system, air and exhaust reverse valve, batch chargers, forehearth glass mixers etc.

BDF Industries furnaces are engineered by high level of customization with focus on energy efficiency and the attention to the environmental impacts.

Long time experience skilled people work together in synergic team with young generation technician in order to offer a wide range in design, manufacture and supply of different furnaces types for production of containers, tableware, lighting ware and technical glassware.

BDF Industries glass container forming product line is the historical core business. BDF Industries is able to provide a wide range of machineries with a high level of production flexibility to meet the customers’ requirements.

With more than 65 years’ experience in glass forming field, BDF Industries can offer the complete range of IS machine including gob forming and delivery, ware handling, container and variable equipment. The glass forming machineries are fully designed and assembled in house by BDF Industries in Italy, which has relevant knowledge of production process of the most important glass manufacturers in the world (e.g. strong credentials for forming business in O-I, Saverglass, Sisecam, Vetropack, Vitro...)

Our R&D office is focused to find the best solutions applied into IS machines in order to match lower production costs for our Customers thanks to higher reliability and maintainability of our product. We continue to work towards research and innovations that will deliver genuine advantages in productivity and efficiency for our customers glass factories located in different area around the world.

The automation team involved in the Glass Industries focused its activity in the engineering process and software, during reconditioning and retrofitting of all part of Glass Factory including: plant designing, installation and start-up, network configuration, control, staff training, customer service and remote assistance.

The experienced, qualified, passionate and customer-focused staff is there to add value for customers, partners and suppliers.

As part of its own philosophy, the team believes and operates in the sustainable development: the application of its carefully designed and implemented systems greatly save energy and relevant impact on the environment, thus improving the quality of life and the safety of the operators in the field as well as adding economic and social value to the community.

A fundamental key of success in the automatic control is the interlink with melting and forming teams which makes the final product completely fit with the Glass Factory requirements.
ENERGY
The large BDF Industries experience in the glass industry and automation makes us the more qualified counterpart when it comes to improve, re-qualify or reinvent a glass production plant.

To master the challenges of global competition, our customers must minimize costs, continually increase the productivity of their systems and meet ever-stricter environmental regulations.

Our innovative and ecofriendly solutions help to conserve natural resources, improve energy and capital utilization and optimize processes. For our customers, this means lower raw materials consumption, fewer emissions, greater energy efficiency, lower costs and increased output. The experience into demanding environment as the glass industry is our key point to succeed around you.

We can all make a difference. By applying different type of technologies, BDF Industries is able to supply a full package of energy recovering and/or renewable energy systems.

Resources from waste: heat recovery system of waste gases to produce electric energy via ORC turbine or steam turbine. Waste gases treatment: dust filtration and waste gases chemical compounds abatement techniques. These are some package solution examples of what BDF Industries can offer, develop, deliver and install.

SERVICE
The reliable and innovative partner for running glass making plants to maximize productivity, quality, reliability, maintain assets and contain costs.

BDF Industries has a Service organization dedicated to provide a complete spectrum of the highest quality service solutions to satisfy the needs of our clients from a single source. Our services support the entire product value chain from melting glass making to forming, filtering, energy facilities and automation.

The service product line includes installation & startup, upgrades of mechanical equipment and automation, technical assistance for repairing and overhauling, training, performance evaluation & long term service agreement, integrated maintenance management & diagnostic solutions and systems, spare parts.

The contents of service are the following:
• Supply local qualified supervisors
• Supply of certified end/or upgraded OEM (Original Equipment Manufacturer) spare parts for all maintenance operations
• Performance of all equipment maintenance
• Repairs using state-of-the-art technology
• Optimization of Spare Parts inventory
• On the job Training of local maintenance and operation personnel

The BDF Industries service team supports the strategic goals of glass factory by stimulating growth in core skills and providing personalized programs for the glass industry.

The BDF Industries Learning Center in Italy and strategically located Service Centers offer a wide range of programs in technical courses. Our technical courses are presented by field-tested experts combining understanding of theory and practical experience.

The quality training provided is a prerequisite to improve the skills of operating and maintenance personnel, so as to assure knowledge, safety and higher equipment availability.
REGENERATIVE & RECUPERATIVE FURNACE
Our long experience in the field and perfect knowledge of production processes allow our engineers to professionally cope with all projects, resulting in the optimization of the preparation and presentation times needed for the technical/commercial proposal.

The expertise acquired throughout the years and the big number of fully-functioning plants installed allow BDF Industries to offer new and innovative solutions when it comes to implementing plant engineering projects. Not only does our Group supply turn-key plant solutions, but our commitment and responsibility is from the beginning to the stage we are there to start the plant ourselves.

Thanks to our internal division, the BDF Industries share not only the technological know-how and a big push for innovation, but also expertise, enthusiasm and a deep sense of belonging that makes it possible to understand and satisfy the requirements of the Hollow Glass Maker.
REGENERATIVE & RECUPERATIVE FURNACE

- Low furnace energy consumption
- High furnace pull
- Low NO\textsubscript{x} emissions
- Best glass quality
- Best furnace operation to assure minimum operating costs at fixed glass quality
- High furnace lifetime in terms of metric tons/m\textsuperscript{2}

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<th>TYPE / TPD</th>
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<td>RECUPERATIVE</td>
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**REGENERATIVE**

In Regenerative Furnace, air preheating is achieved by two regenerators chambers. The chambers are filled with layers of refractory checkers, arranged in offset position.

The exhaust from the furnace and the cold combustion air are passed, alternately, through one and other chambers for a certain period of time.

The checkers, heated by hot waste gases, releases the accumulated heat allowing to reach a high temperature typically 1300° C to the combustion air.

**RECUPERATIVE**

In Recuperative Furnace, air preheating is achieved by the heat exchange from the exhaust to the combustion air by means of metal recuperator.

The exhaust pass through a metal heat exchanger and transmit the heat to the combustion air.

To increase the air temperature, the recuperator may be configure in a double stage reaching 750°C typically. The preheated air is conveyed to the burner by metallic ducts, where it matches the fuel developing the flame.

The system is composed with:
- Tubes in stainless steel.
- Casing of the tube cage made of carbon steel, internally lined with ceramic fibre+rock wool.
- Double shell recuperator internal plate made of stainless steel.
- Air intermediate duct made of carbon steel.
- External insulation of the double shell recuperator and of the intermediate duct with rock wool finished with galvanised plate.
- Air inlet and outlet flanged connections.
- Tightness test in our workshop.
GAS AND OIL CONTROL STATIONS

The gas and oil stations are the systems through which gas or oil are controlled in flow, pressure, temperature to feed the burner properly. For the regenerative furnaces the systems allow to switch the firing from one combustion side to the other.
GAS BURNERS FOR REGENERATIVE FURNACES

- HIGH EFFICIENCY LOW NOx FLAME
- EASILY ADJUSTABLE FLAME SHAPE AND LENGTH
- EASY ANGLE AND POSITION ADJUSTMENT

The BDF gas burners have been designed for underport installation in End-Fired and Cross-Fired furnaces. In order to achieve a better flame shape and length on each burner the gas is split in two streams into the burner and flows into the tank through two concentric nozzles.

The different impulse of the two streams allows controlling the flame shape and length. The knobs installed in the rear part of the burner allow adjusting the two-flow impulse in order to reach the best furnace performance. Both the internal and the external nozzles are made of high temperature resistant stainless steel.

A special support allows adjusting the zenith and azimuth angles as well as the vertical and horizontal burner axes. The support has been designed for tool-less adjustment as well as the burner fixing and removal. When one of the side firing is in stand-by the relevant burner nozzles are cooled by a compressed air stream.
OIL BURNER FOR REGENERATIVE FURNACES

The BDF oil burners have been designed for underport installation in End-Fired and Cross-Fired furnaces. In order to achieve a better flame shape and length the heavy oil is atomized by compressed air.

Both the internal and the external nozzles are made of high temperature resistant stainless steel. A special support is available to adjust the burner position. The support enables to adjust the zenith and azimuth angles as well as the burner vertical and horizontal axes.

Before being sent to the burners the heavy oil must be heated, by a group of electric heaters suitable, at a temperature up to 120 °C in order to reduce the viscosity to a value suitable for the best combustion in the tank.

BURNERS FOR RECUPERATIVE FURNACES

The BDF preheated air burners have been developed for Recuperative Furnaces. The hot air flow from the recuperator may be independently adjusted per each burner.

In the body of the burner the air meets the fuel stream that is introduced by a gas or oil lance. For natural gas combustion system we recommend the use of BDF special design for gas lances using a double stream of gas for a better regulation of the flame length and shape.

The burner is suitable for operation with air pre-heating temperature up to 800°C.
**DRAUGHT REGULATING VALVE**

To be installed in the waste gas to control the melting tank pressure.

**Type 1: vertical stroke guillotine valve**
- High temperature resistance steel
- Driver
  - Pneumatic servo motor or electrical servo motor
  - Emergency manual wheel
- Counter-weight motion assistance

**Type 2: vertical shaft butterfly valve**
- The servo-actuator can be disconnected from the air source and manually operated in emergency

Complete with driving system and transducer
- Emergency manual regulation
- Manual gate up to 20% by pass opening

**REVERSAL VALVE**

- Up to 600°C (900°C in special execution)
- Low pressure drop design
- Driven by a reversible electric gear motor or pneumatic actuator
- Emergency driven by manual wheel
- Tailor-made design for special applications

**EXHAUST DUCT**
WASTE GAS SHUT-OFF VALVE

- ESP or bag filtration
- Counter-weight motion assistance
WASTE GAS EJECTOR

- High efficiency draught made of high resistance steel
- Fan speed controlled by inverter
- Self-supporting metallic chimney
THROAT BOOSTER

The throat booster system is a safety system used to avoid the glass freezing in the throat during the furnace heat-up and/or when the production is stopped and no glass is flowing through the throat.

- Typical power: 60 kW approx (during normal operation, the system is switched off)
- Power supplied by two molybdenum electrodes in glass
- Water-cooled holder
- Thermocouple to detect the holder temperature

BOOSTER SYSTEM

By exploiting the glass property to be electric conductor at high temperature, it is possible to feed some additional electric power by means of molybdenum electrodes immersed in the glass and connected to a variable voltage electric transformer. The effect of the extra power is to enhance the glass molten, to increase the pull, the quality and to reduce the NOx emission.

- Bottom or Sidewall
- Medium voltage or Low voltage

BUBBLER

The bubbler principle is to blow a small amount of air into the glass bath in order to obtain a vertical glass current from bottom to top. The air bubbles lift upwards the colder glass from the bottom.

- It generates big improvement of the glass current motion
- Effective push-back batch force
- Better heat exchange between flames and glass
- For coloured glass it contributes to increase the pull and the glass quality
TANK AIR COOLING STATION
Necessary to cool the melting tank soldier blocks to prolong the furnace life and to prevent leakage.

THROAT AIR COOLING STATION
Necessary to cool the throat refractory blocks.
BATCH CHARGERS

BATCH CHARGERS

batch charger video
BATCH CHARGER
ELECTRONIC BATCH CHARGERS

• Getting-over of all the mechanical limits
• Servo motor pusher driven
• Rotation angle and rotation sequence setting by keyboard
• More charging position (max 5 memorizable positions)
• Automatic loading control
• Batch quantity setup: independent setting of pusher stroke and velocity
• Remote machine setup from control panel in control room
• No mechanical intervention required for pusher stroke adjustment

3 POSITION BATCH CHARGERS

• 3 different charging positions
• Minimum manual operations
• From the control panel it is possible to set the number of pulses of the pusher in one direction
• Less manual setup
• Pusher stroke: mechanical setting
All electronic devices are integrated in a single control panel located in the control room or in the doghouse area. PLC and HMI touch screen are installed in the control cabinet.

Operator interface can easily control:
- Rotating position
- Angle
- Residence time
- Number of strokes
- Rotation sequence

Pusher:
- Zero point
- Stroke
- Velocity

All functions are surveyed and they are optically and acoustically indicated should any failure occur. If required, basic control module is available with std. batch charger.

For double doghouse furnaces, each machine can be set separately and synchronized with combustion reversal, in order to feed more or less batch depending on the combustion side.

BATCH CHARGERS
MEASURING, CONTROL AND SUPERVISING SYSTEM
EAGLe 3.0
GLASS LEVEL MEASUREMENT SYSTEM

- NO OBJECT IN CONTACT WITH GLASS
- NOTHING IN MOVEMENT
- ABSOLUTE LEVEL MEASURE
- EASY TO INSTALL
- PROTECTIVE AIR CURTAIN AGAINST DUST
- MAINTENANCE-FREE
- SELF-CALIBRATING
- VIBRATION PROOF

The new Generation Glass Level Measurement system.

The system EAGLe 3.0 “Enhanced Absolute Glass Level” (Patented) allows to measuring the glass level through the optical reflection of a fixed pointer mounted out of contact with glass or the burner reflection.

Innovative and technologically evolution of E.A.G.Le 2.0 is achieved: the new release 3.0 offers renewed features and improvements in the measurement and performance.

EAGLe 3.0 is composed of video camera placed in a rigid industrial casing and mounted at approx. 50 cm from the measurement point using a small hole (50x50 mm) in the furnace working end.

A new protective air curtain is designed in order to avoid the possible dust coming out from the small hole.

All the parameters of calibration and tuning can be read and set from whatever PC (Personal Computer) only one cable for data collection and power.

EAGLe 3.0 acquires and processes the images through advanced algorithms controlled by a system of Artificial Vision in an industrial computer equipped of a touch screen operator panel.

The real pointer-reflected image or the burner reflection are acquired at high frequency enabling thus to establish the actual level of glass with absolute precision higher than ±0.05mm.

EAGLe 3.0 is self-calibrating and vibration-proof.

EAGLe 3.0, thanks to the characteristics described, is the most advanced glass level measuring device present on the market.
GLASS LEVEL PNEUMATIC MEASURING SYSTEM

- High accuracy level detection, typically within ± 0.1 mm
- Easy and reproducible height adjustment
- Easy and quick probe replacement
- Electrically earth-insulated probe available for furnaces with booster
- Turret suitable to support the glass level probe
- Manually adjustable height with graduated scale and position indicator
- Water-cooled glass level probe
- Pneumatic panel

EAGLe 3.0 SUPERVISION CONTROL SYSTEM

Standard user-friendly supervision in operation.
Control systems focused on key-performance factors to grant:
• Minimum Energy Consumption and Operation Cost
• Glass Quality
• Low Polluting Emission
• Furnace Life-Time
• Reliability elaboration of Trend Process

The System allows effective, reliable control and recording of real time or historical data during the whole furnace campaign.

Continuous monitoring and control of parameters such as:
• Pilot Temperatures
• Combustion
• Electric Energy and Energy Consumption

Flexible application
• Full supply or integration with most best-known PLC brands.
• Integration with glass plant Supervision via SCADA system (Supervisory and Data Acquisition):
  - Forehearts
  - Batch House
  - Forming Area
  - Cold-End
  - Whole Production Process
  - Plant Utilities

The application of a SCADA acquisition system creates a multi-terminal network for a fast access to required information and grants a constant overview of:
• Process
• Centralized Controls
• Historical
• Trend
• Correlation between different areas of the plant process.

Access from different places and with hierarchies levels is available to ensure a proper flexibility and safety managing.

**GENERAL PROCESS CONTROL ARCHITECTURE**

- **management level**
  - MES
  - WLAN
  - ERP

- **operator level**
  - SCADA
  - Utilities Control
  - Dust Filter Control
  - Batch House Control
  - Melting Control

- **plant level**
  - Ware House
  - Cold End
  - Anneal Control
  - IS Machine Control
  - W.E. & Forehearth Control
In order to ensure a continuous improvement of the products, BDF Industries reserves the right to make modifications to the characteristics and pictures (without notice).