MELTING FURNACE

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

Excellence. Your Industrial Partner in Glass
FURNACES | FOREHEARTHS | IS MACHINES
QUALITY IS NEVER AN ACCIDENT.
BDF INDUSTRIES, SINCE 1906.
FURNACES

Thanks to our wealth of experience gained over the years, the Furnaces Division of BDF Industries is able to engineer hollow glass melting furnaces using the most modern techniques and technologies available on the market, simultaneously combining efficiency in consumption, durability and quality of glass requested by our Customers. The studies and research developed over recent years combined with cutting-edge design tools are today able to guarantee environmental regulations of reduction of NOx, SOx and all waste pollution related.

FOREHEARTHS

In order to work the glass gob better and create a perfect bottle, you need excellent glass conditioning. The Division of BDF Industries dedicated to the Working Ends and Forehearth is able to offer and install complete systems which are able to fully satisfy the requests of our customers. The Forehearth of the GTFS and GTHP series can be equipped with ad hoc systems guaranteeing a thermal homogeneity in the different configurations in the conditioning zone which is as close to 100% as possible, possibly installing Stirrer and/or Booster systems where required or recommended. BDF Industries is able to create a strategic connection between Furnaces-Forehearth-IS Machines: the furnaces technology developed for the Forehearth in fact allows you to bring the glass to the correct temperature from the Furnaces to the IS Machines. Our advanced knowledge of the machines allows us to associate the most suitable Forehearth according to the IS Machine.

IS MACHINES

The historical core business of BDF Industries, in which regard we have over 60 years of experience in the hollow glass world. Through our elevated know-how gained in the engineering and manufacturing of machinery, the company’s IS Machines Division currently produces the most complete range of solutions, from machines with pneumatic handling to servo-assisted handling machines, with angular or parallel mould openings/closures, combined with all the variable equipment and accessories in order to better intercept the requests of the end customer. The internal R&D Department is focused on finding the best solutions to be applied in IS Machines which not only allow the production of perfect glass containers, but also a high-performance production, reducing costs: flexibility, reliability and production efficiency have always been the fundamental advantages which BDF Industries makes available to its customers all over the world. A distinctive feature is the fully Made in Italy production: the machines are fully designed, manufactured and assembled in Italy, where there is an important knowledge of the production process.

AUTOMATION

Being able to integrate highly-sophisticated process systems such as hollow glass from the Batch house to the annealing lehr is not for everyone. BDF Industries, thanks to the vertical integration developed over the years, has managed to specialise in the engineering of all the automation of the hot end. The R&D Department, working in close contact with the Furnaces, Forehearth and IS Machines Divisions, is aimed at constant research into the most advanced control and supervision systems to best meet the demands of its customers.

ENERGY

Glass Plant is a highly energy-consuming and polluting industry, in which enormous amounts of energy are wasted and thrown away, especially in the form of heat and fine dust. Thanks to the synergy of highly-specialised teams between the Furnaces and Automation Divisions, BDF Industries is able to supply specific products for the protection of the environment and for energy recovery, using the most innovative solutions and products in compliance with the fundamental production and consumption requirements of glassworks, always paying attention to the fundamental parameters to be considered without affecting the daily tasks of the operators of the Furnaces.

SERVICE

From the Furnaces to the IS Machines passing through Working End and Foreheaths, in a single strategic Partner: for BDF Industries, the Customer satisfaction is always its goal from the phase of offer presenting up to after sales. This is why it makes use of a strong and cohesive Service structure with more than 80 people at the service of Customers all over the world, capable of helping the Customer in daily operations and able to find the most effective solutions to solve problems and increase performance. Not only after-sales service, among the activities that the Service Division performs all over the world every day, there are also those of supervision, auditing, installation, overhauling of machines and melting minor repair to guarantee complete coverage of the hot part of the glassware: from the Furnaces to the Foreheaths to IS Machines with highly-qualified technicians specialised in the individual areas of competence.
MELTING FURNACE
CONDITIONING WORKING END FOREHEARTH
FORMING IS MACHINE
FORMING DELIVERY
WARE HANDLING
ENERGY ON GLASS
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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 NOx emissions
- Best glass quality
- Best furnace operation to assure minimum operating costs at fixed glass quality
- High furnace lifetime in terms of metric tons/m²

**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 configured 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.

**REGENERATIVE & RECUPERATIVE FURNACE**

<table>
<thead>
<tr>
<th>TYPE / TPD</th>
<th>20</th>
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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.

Pressure drop design
- Pneumatic servo motor or electrical servo motor
- Emergency manual wheel
- Counter-weight motion assistance

OIL BURNER 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.

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.

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

DRAUGHT REGULATING VALVE

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

Type 1: vertical stroke guillotine valve
- High temperature resistant 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
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

BOOOSTER 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 immerged 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.
**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

All electronic devices are integrated in a single control panel located in the control room or in the doghouse area.

**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

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**

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.
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.

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

EAGLe 3.0
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
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):
  - Forehearth
  - 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.

**SCADA SOFTWARE:** HISTORICAL, WHOLE CAMPAIGN MEMORY CAPACITY, ALARM MANAGEMENT
(INCLUDED; THROUGH MOBILE AND E-MAIL)

**PLC - DCS ARCHITECTURE:** MOST PREFERRED PLC OR DCS BRAND.
PLATFORM AVAILABLE - REDUNDANCY, PLC AVAILABLE.