The future we see through

MELTING FURNACE

REGENERATIVE & RECUPERATIVE
BATCH CHARGERS
GAS AND OIL CONTROL STATIONS
DRAUGHT REGULATING VALVE
BOOSTER SYSTEM
TANK AIR COOLING STATION
GLASS LEVEL EAGLE
WASTE GAS SHUT-OFF

BDF® industries

OUR HERITAGE

Since 1906, BDF Industries' principal activity has been the development and integration of complex technologies to aid industrial progress.

The **worldwide market** depends on BDF's multitasking, multicultural, and multi-expertise strategy, which has evolved and shaped itself over the years in response to market demands.

BDF provides the chance to join a top-notch technological group ready to compete with present and future business opportunities in terms of **competitiveness, performances, and reliability of products** and processes thanks to its natural collaborative instinct and the professionalism shown in more than **115 years of tradition**.

The future we see through.

OUR MISSION

Manufacturer of cutting-edge machinery, BDF Industries is a group where innovation and performance converge in a never-ending quest for excellence.

MELTING

For the design and supply of furnaces, working ends, and forehearths, BDF Industries Melting's product portfolio comprises the whole glass melting and conditioning technologies. Additionally, **relevant equipment** including oil and gas burners, firing system air, exhaust reverse valves, batch chargers, and stirrers are part of the product line.

BDF Industries furnaces are engineered with an **high level of customization**, focusing in particular on energy efficiency and environmental impacts. BDF Industries is able to offer a wide range in **design, manufacture, and supply** of different furnace types for production of containers, tableware, lighting ware, and technical glassware due to a long history of experience combined with a team of skilled people who work together in a synergistic way..

FORMING

The glass container Forming product line of BDF Industries is the company's historical primary activity. BDF Industries can supply a wide range of **machines with a high level of production flexibility** to satisfy the needs of its customers.

With more than 65 years of experience in glass forming field, BDF Industries can offer a 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 at BDF Industries **in Italy**, which has relevant knowledge of production process with the most important glass manufacturers in the world (e.g. strong credentials for forming business in O-I, Saverglass, Sisecam, Vetropack, Vitro...).

SERVICE

BDF Industries has a Service division dedicated to provide a comprehensive range of **high-quality service solutions** to our clients from a single source. From glass melting to forming, filtering, energy facilities, and automation, our services serve the whole product value chain.

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 personel.

The BDF Industries Learning Center in Italy, as well as strategically situated Service Centers, provide a comprehensive range of technical training. Our technical courses are taught by field-tested experts who combine theoretical knowledge with practical expertise.

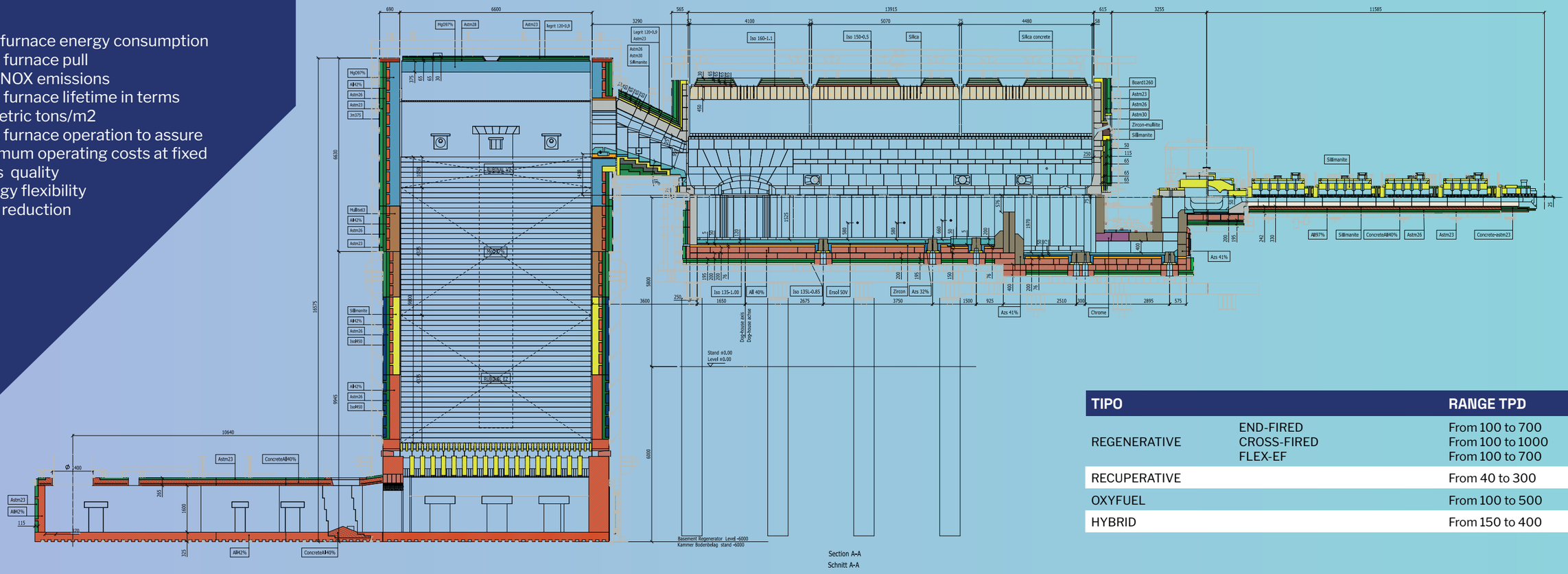
Melting Furnace

The BDF Team can meet the necessary level of technology and performance in accordance with project timing thanks to our extensive industry knowledge and corporate best practices.

Our extensive list of international references allows you to see and feel the technology and expertise we possess. Due to our R&D, BDF Industries is able to understand and meet requirements because we share expertise, excitement, and a strong sense of belonging in addition to our technological know-how and strong drive for innovation.

REGENERATIVE & RECUPERATIVE FURNACE

- Low furnace energy consumption
- High furnace pull
- Low NOX emissions
- High furnace lifetime in terms of metric tons/m2
- Best furnace operation to assure minimum operating costs at fixed glass quality
- Energy flexibility
- CO2 reduction



TIPO		RANGE TPD
REGENERATIVE	END-FIRED CROSS-FIRED FLEX-EF	From 100 to 700 From 100 to 1000 From 100 to 700
RECUPERATIVE		From 40 to 300
OXYFUEL		From 100 to 500
HYBRID		From 150 to 400

REGENERATIVE

Two regenerators chambers work together to pre-heat the air in the regenerative furnace. Refractory checkerboard layers in an offset arrangement fill the chambers. For a predetermined amount of time, cool combustion air and furnace exhaust are alternately passed through one and other chambers. The combustion air can be heated to a high degree thanks to the checkers, which are heated by hot waste gases.

OXYFUEL

Save the CAPEX of regenerators and switch your combustion to Oxyfuel. This kind of Furnace allow you to avoid heat recovery to make the combustion process efficient, and leaves all the heat for a downstream utilization.

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. The preheated air is conveyed to the burner by metallic ducts, where it matches the fuel developing the flame.

FLEX-EF

Key word for this solution is FLEXIBILITY. To reduce the impact of fuel cost increasing or CO2 fines, BDF propose a unconventional End-Fired regenerative Furnace with an important mix of energy source: electricity up to 40%, Oxyfuel, Hydrogen and air-gas combustion. All tuned accordingly with your specific plant features. Also HFO or Diesel firing system can be applied in order to give higher flexibility to your furnace.

HYBRID

Waiting for affordable and reliable Hydrogen the only way to CO2 reduction is our trailblazing view on Hybrid. Our solution is the Horizontal Hybrid Electric Melter. Our concept has been tested through 5 years of simulation and design come and seize the result.

Firing System

BDF FIRING SYSTEM are designed according to UNI EN 746:2 and present the best automatic control up to the single burner or for each burner inlet. The fuel in which we had reference are:

- Gas firing
- Heavy Oil Firing Diesel Firing LPG Firing
- Oxy firing

For our firing system we can propose our BDF designed and manufactured burners as per the following list:

- Oil burner GTO
- Recuperative Burner GBO Gas burner single input
- Gas burner dual stream low NO_x

Furnace skids

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.

Furnace skids

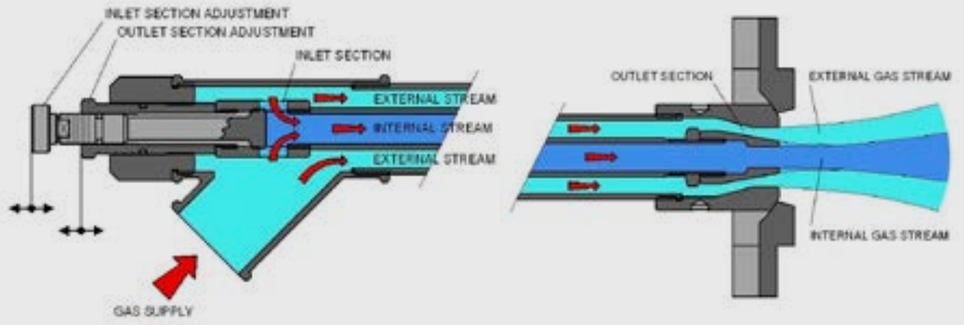
BURNERS

GAS BURNERS FOR REGENERATIVE FURNACES

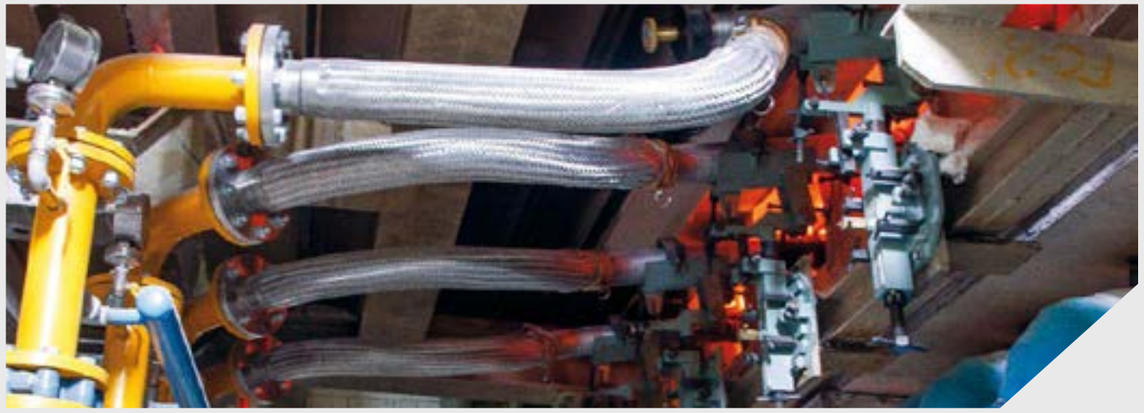
- High efficiency low nox flame
- Easily adjustable flame shape and length
- Easy angle and position adjustement

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.



Under-port burners



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 FURNECES

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.

EXHAUST DUCT

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 combustion air duct to drive the reversal process.

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

Type 3
Double butterfly valve

- One valve to gross regulation and the other bladefor fine tuning, both electrically actuated. Forecast of duty switch after a certain amount of time.

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

Type 2

Type 3

WASTE DUCT

WASTE GAS SHUT-OFF VALVE

- ESP or bag filtration
- Counter-weight motion assistance
- Guigliottine or butterfly
- Electrically actuated with position control

WASTE GAS EJECTOR

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

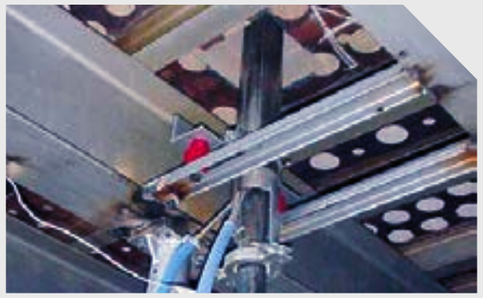
FURNACE EQUIPMENT

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 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 NO_x emission.

- Bottom or Sidewall
- Medium voltage or Low voltage



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.

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

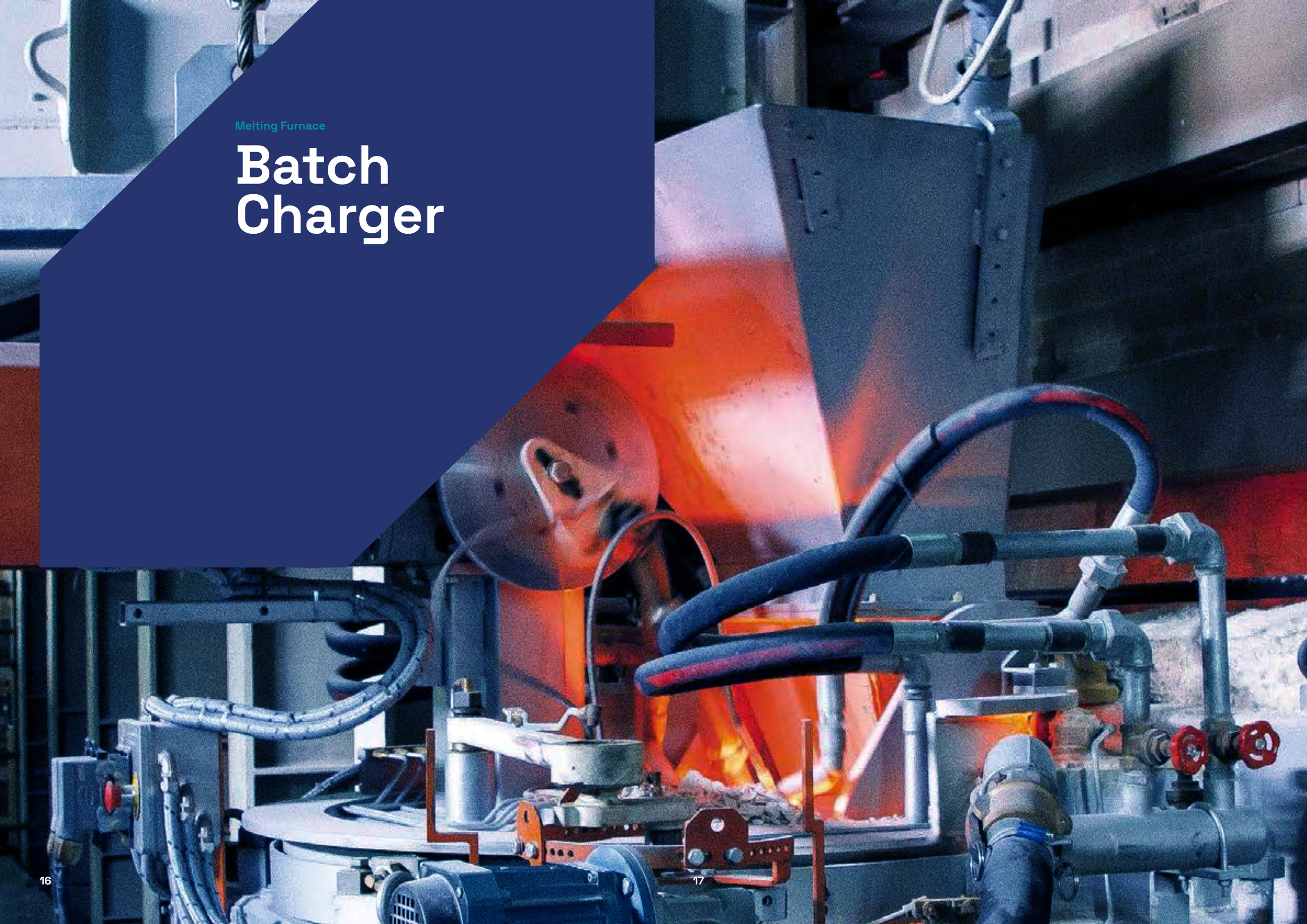
BUBBLER

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.

Melting Furnace

Batch Charger

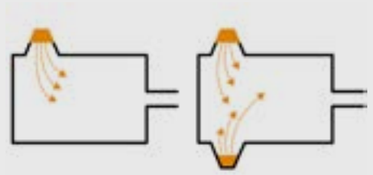


ELECTRONIC
BATCH CHARGERS

- 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
- Possible integration in Batch charger control system of Hydramix
- Possible integration in Batch charger control system of Vibrating feeder
- Possible a dedicated solution in presence of Cullet Pre Heating

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 **MEAUSURING, 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 easy 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.

EAGLE 3.1 GLASS LEVEL MEASUREMENT SYSTEM

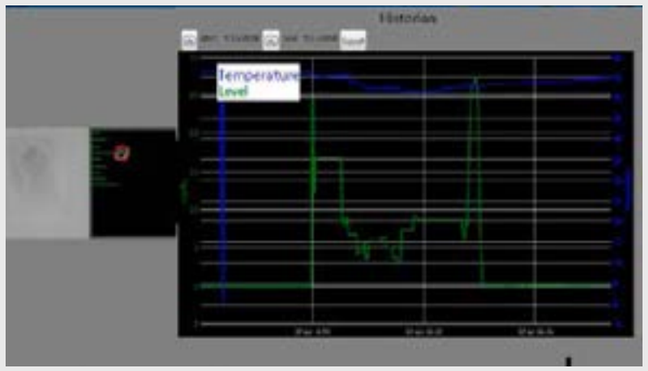
- No object in contact with glass or in the combustion chamber
- Nothing in movement
- Absolute level measure
- Easy to install
- Protective air curtain against dust
- Maintenance-free
- Self-calibrating
- Vibration proof

The new Generation Glass Level Measurement system. The system EAGLe 3.1 “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 and 3.0 is achieved: the new release 3.1 offers renewed features and improvements in the measurement and performance.

EAGLe 3.1 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 3.1 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 ±0.01mm. EAGLe 3.1 is self-calibrating and vibration-proof. EAGLe 3.1, thanks to the characteristics described, is the most advanced glass level measuring device present on the market.

Eagle 3.1 Supervision control system
Standard user-friendly supervision in operation



NATURAL GAS CONTINUOUS ANALYZER

Switch your furnace regulation from temperature based to energy based. This will allow you to pay less for your combustion where possible and avoid quality issues when the natural gas has a lower specific heat value.

This is what a continuous real time natural gas analyzer can bring to your plant.

Gas chromatographic system
usual installation

Eagle 3.1 System usual installation

SCADA SOFTWARE

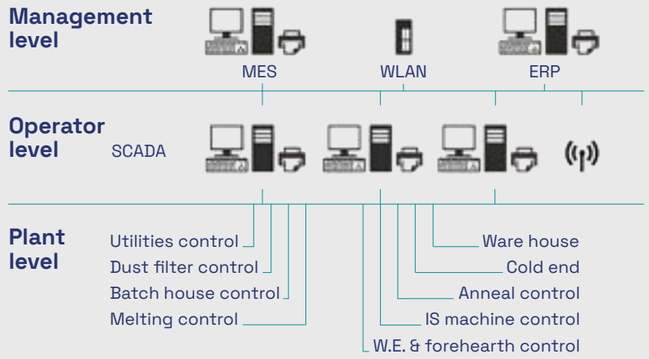
BDF SCADA system is completely open since is based in Ignition™ to other devices also as smartphones and tablet.

User management and also trend control is really simple and reliable and very useful for diagnostic in plant or by remote.

BDF also propose a Data collecting Historian product called PANORAMA. PANORAMA is oriented to fulfill all the requirements of the Industry 4.0 giving our customer the possibility to concentrate and synchronize all the BDF equipment in a single historian archive, to manage and edit report, to redirect and manage alarms (even to SMS or mail) and possibly to add manual entry (as Pull or Pack to Melt) for statistical reason.

Control cabinet

GENERAL PROCESS CONTROL ARCHITECTURE



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

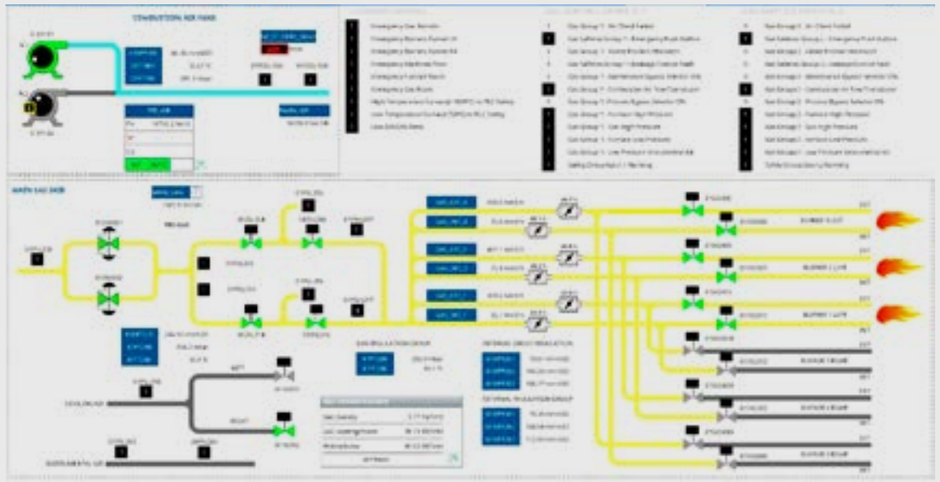
Flexible application:

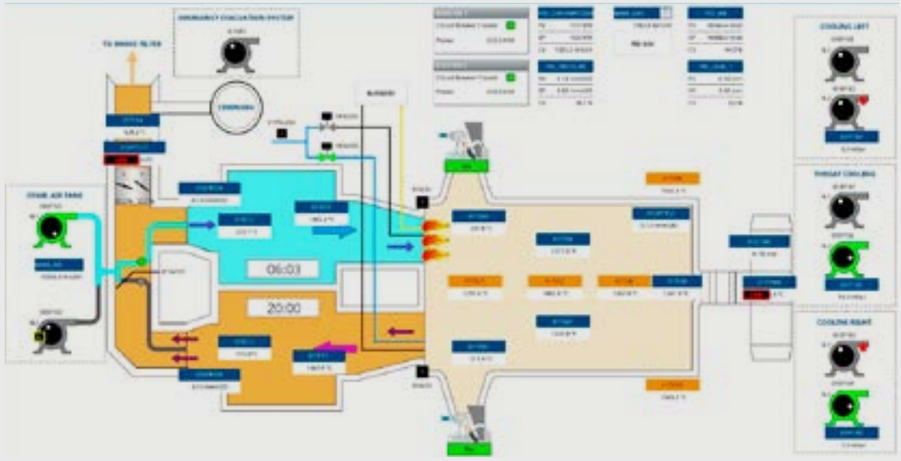
- Full supply or integration with most best-known PLC brands.
- Integration with glass plant Supervision via SCADA system (Supervisory and Data Acquisition).

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.





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