



SOLUTIONS FOR THE GLASS INDUSTRY

COLOURING FOREHEARTHS





GENERAL DESCRIPTION

The colouring forehearth technology was developed to allow glassmakers to produce short runs of a wide range of colours without the costs of changing colour in the furnace by adding colour in the form of metal oxides in a low melting point boron based frit.

The colour forehearth technology is very flexible allowing the full range of production in a wide range of colours including container, table ware and cosmetic containers.

Glass Service has developed colouring forehearth in various sizes and lengths, each designed for the specific pull, colour range and production.

Glass Service design and supply the forehearth colouring technology as well as all of the necessary production equipment:

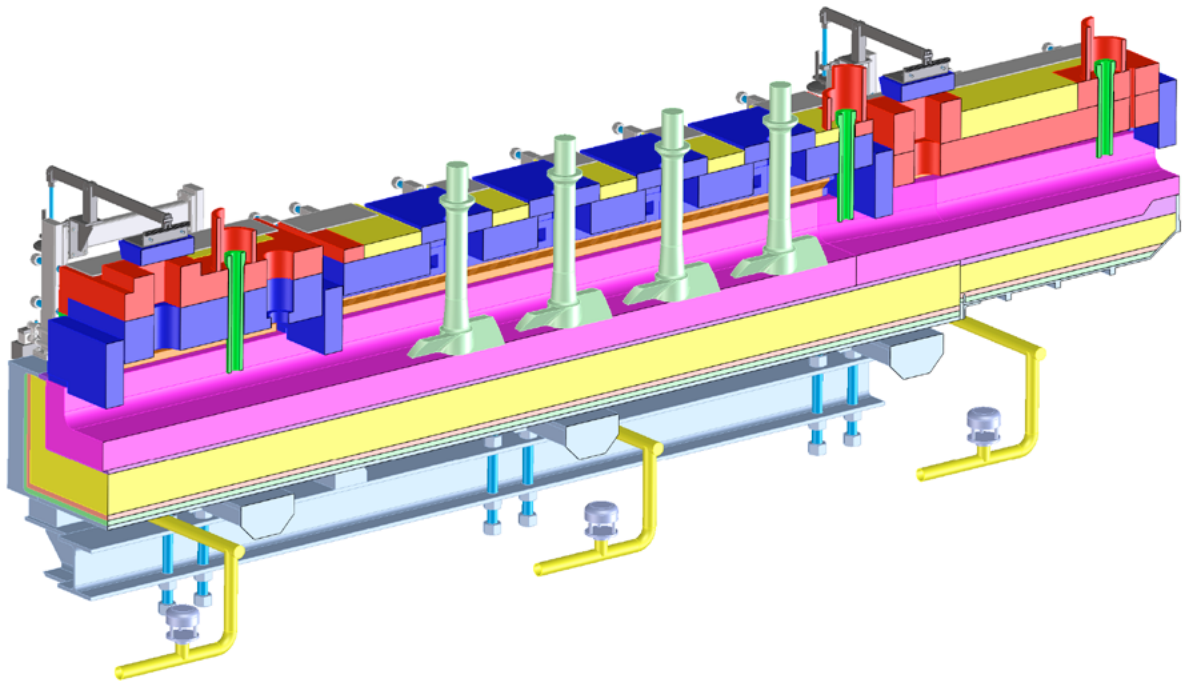
- The automatic frit dosing device
- The stirrer machine
- The control panel

The systems are of strong reliable construction, designed for continuous operation.

The main concepts of our colouring forehearth are: simplicity, flexibility and reliability.

The automatic frit dosing device and the stirrer machine can be easily adapted to a wide range of pull rates and require low maintenance even when operating under heavy working conditions.

Glass Service has designed and provided coloring forehearth to many customers in Italy, France, Turkey, Russia, China, Poland, Morocco and Spain.



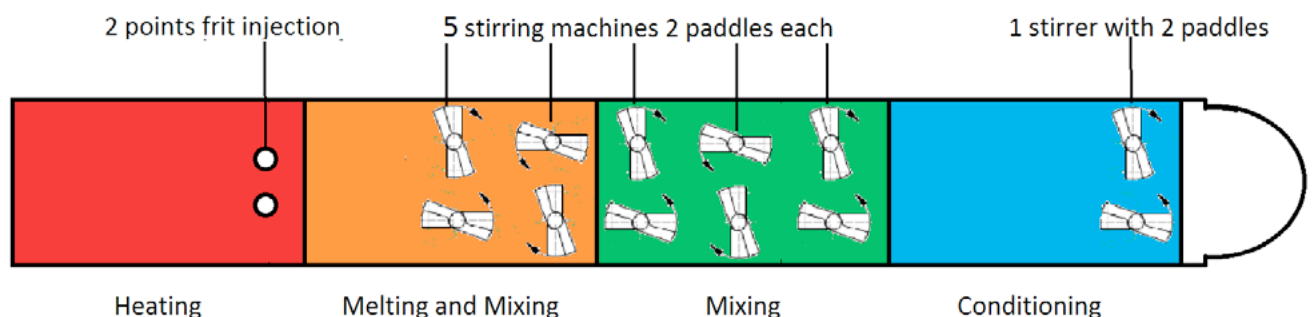
The technology include the following stage:

- Glass heating zone and colouring frit addition
 - o The glass is heated to 1250-1300 °C to melt the colouring frit, with a double row of burners installed for high melting energy input
 - o The frit is added via one or two dosing tubes which are either air or water cooled
 - Stirring zone
 - o The melted frit is mixed into the base glass melt using refractory stirrers, the number of stirrers installed being a function of forehearth dimensions and required pull
- Two different stirrer design are available,

screw and paddle

- o One stirrer mechanism is installed before the spout so that during colour changes eliminates any small colour variations and reduce colour change time

- Conditioning
 - o The glass is conditioned to the correct gob temperature in the final zone



The colouring foreheart technology has a number of critical point for successfull operation
The main are:

Issue	Solution
Accurate dosing of the frit	A good dosing device technology is required
Constant chemical composition of the frit	First quality frit
Constant redox atmosphere	High quality combustion system and FH design is required
Homogenous mixing	Good mixing technology
Conditioning	Good conditioning technology
Rapid colour change	The correct FH design is required to minimize the colour change time. The stirrer mechanism installed before the spout eliminates any small colour variations and reduce colour change time .
Long life of refractories	The frit contains a high level of boron, during melting the boron vapours corrode the standard refractory superstructure. A special design of refractory quality increase the FH life.





Glass Service has developed a new concept of frit dosing with the frit dosing unit installed at low level, the frit being transported to the forehearth pneumatically.

The main hopper contain the frit (see (1) in the sketch below).

To ensure a constant supply of frit, a dedicated sensor located on the base of the hopper generates an alarm when the hopper must be refilled.

The dosing system delivers the dosed amount of frit to the feeding transport system.

The system is controlled from a PLC with colour touch screen, installed in the control panel.

Frit flow from the dosing system (2) is controlled from the PLC which automatically adjusts the speed of the conveyor belt.

The pneumatic transport system uses a high pressure air blower (3) to blow the frit inside a stainless steel pipeline up to a centrifugal dust separator (4).

From the separator the frit falls to the feeding tubes.

The feeding tubes are installed through the forehearth superstructure.

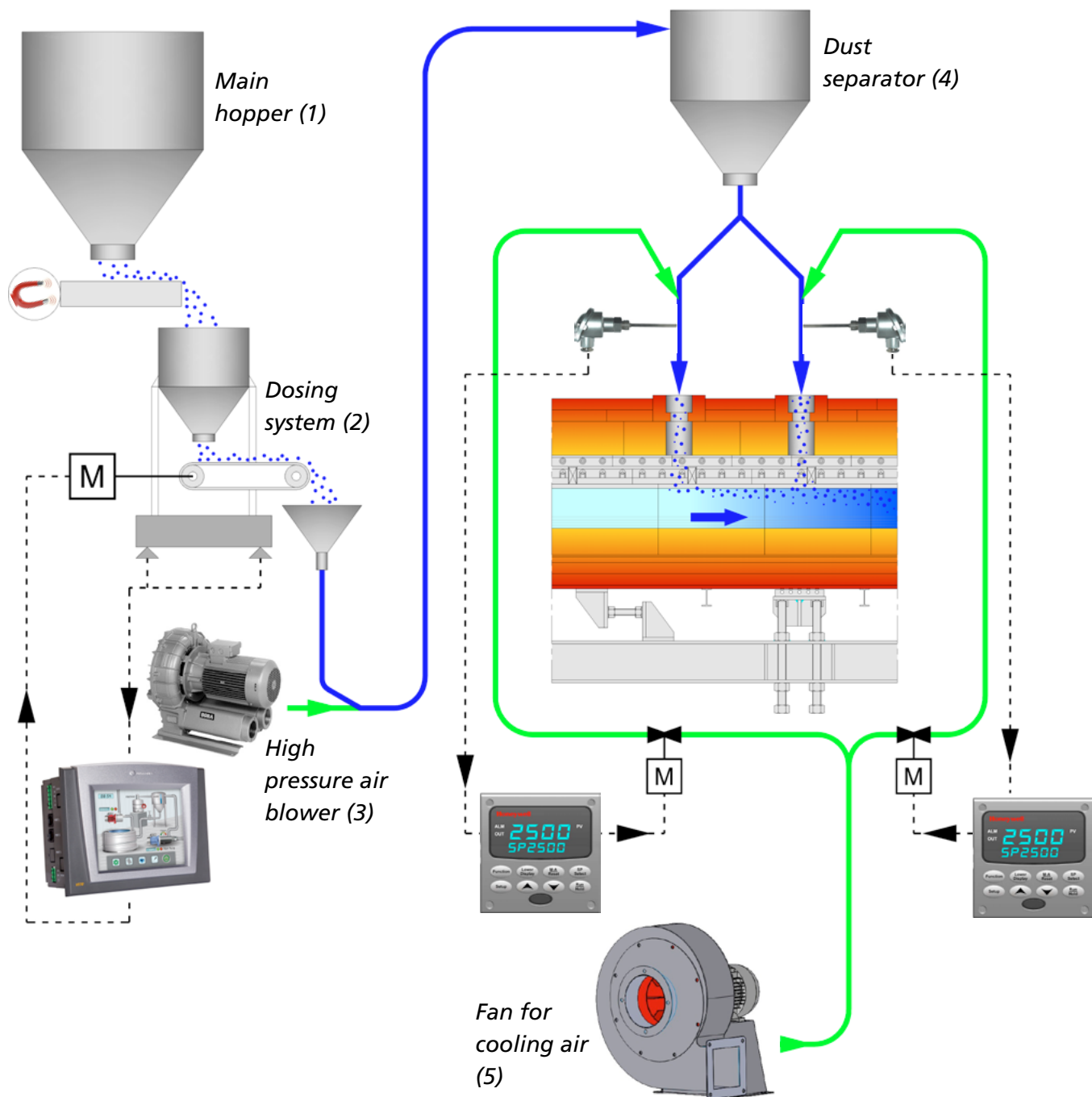
To prevent overheating each tube is equipped with cooling air, and a thermocouple, the cooling air fan (5) being controlled by a single loop controller.

This layout allows the dosing equipment to be located on the ground or in a location where the operating temperature of the electronic devices are kept below 40 / 45°C.

In addition, this allows easy access to the system for the operator, for maintenance and to add the colouring frit into the main feeding hopper.

TECHNICAL FEATURES

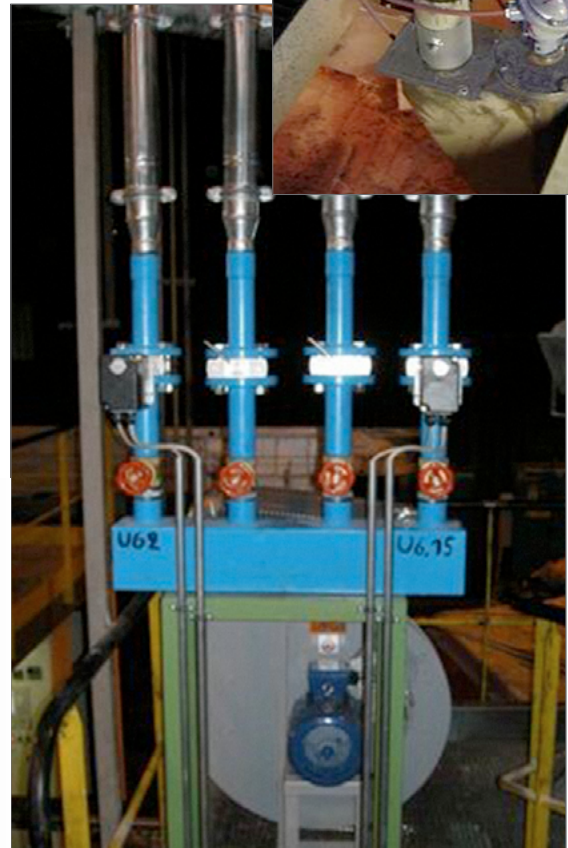
Dosing max flow	140 kg/h
Dosing min flow	5 kg/h
Main hopper (A) standard volume	600 litres
Main transfer device	Electromagnetic vibrating channel
Dosing transfer device	Special rubber belt drive by brushless motor
Scale	High precision electronic strain gage
Electronic control	Automatic by touch screen PLC



Automatic dosing system



Some pictures of frit dosing device

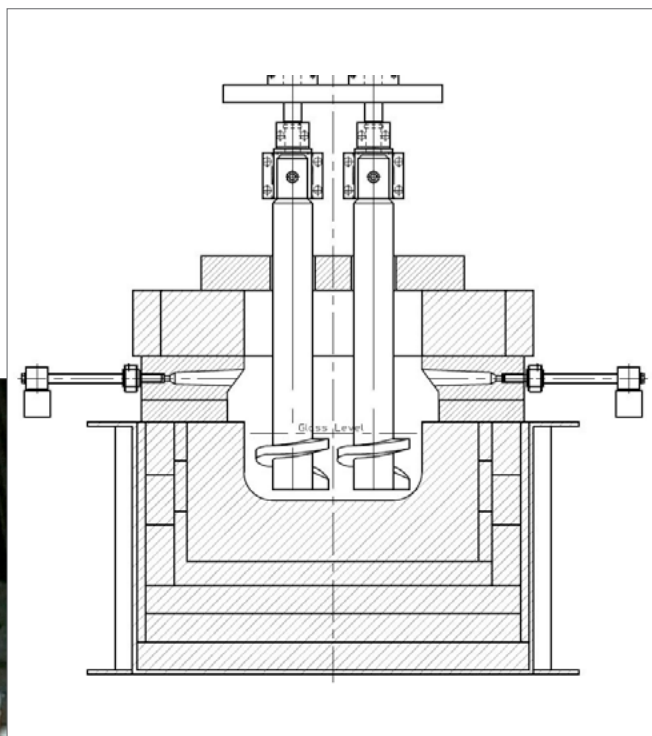


- The dosing system controlled by a PLC
- The feeding tubes are each provided with 2 thermocouples
- Temperature of the feeding tubes controlled by a UDC
- Easy access to the dosing system for the operator
- Easy maintenance
- Strong steel structure above the forehearth



STIRRER MACHINE

The stirrer machine is used for glass and colour homogenization.



TECHNICAL FEATURES

Vertical height	2.275 mm - customizable
Vertical stroke of stirring mechanism	950 mm - customizable
Distance from the centre of the forehearth to the stirrer support column	customized
N° of rotors	1 - 5
Max. weight of the stirrer screw	120 kg
Stirrer speed	1,3 - 13 rev / min
Installed power	0.75 kW
Stirrer type	screw or blade
Torque control	Torque control clutch to avoid stirrer torque braking

For more details about stirrer machines see relative documentation.



CONTROL BOARD

The design of **Glass Service** control board features the following main characteristics:

- A PLC with colour touch screen to manage the operating logic of the frit dosing to the forehearth, with an automatic continuous control of the weight/minute of the quantity of frit dosed into the system. The LOOP action operates by increasing-decreasing the speed of the belt dosing system using special high precision software

The touch screen interface can manage all of the required information for the colouring technology, managing the dosing, alarms, trends, settings, etc.



PLC touch screen

- The regulation of each single temperature parameter (internal temperature of each injection tube) is managed by a suitable Honeywell UDC 2500 regulator.
- The external temperature of each injection tube is displayed on a Honeywell DC 1030.



Honeywell UDC 2500



Honeywell DC 1030

- A series of lights and buttons mirrors exactly the operation status of the system on the front panel.
The default alarms are:
 - o high temperature into the injection tube
 - o fan motor
 - o stirrer motors
 - o high pressure air blower motor
 - o frit level in the hopper
 - o cooling air low pressure
 - o and other functions on request

- Stirrer start and stop and speed is controlled via the main cabinet
 - o small local cabinet is located at feeder level to locally stop the stirrers for security and maintenance

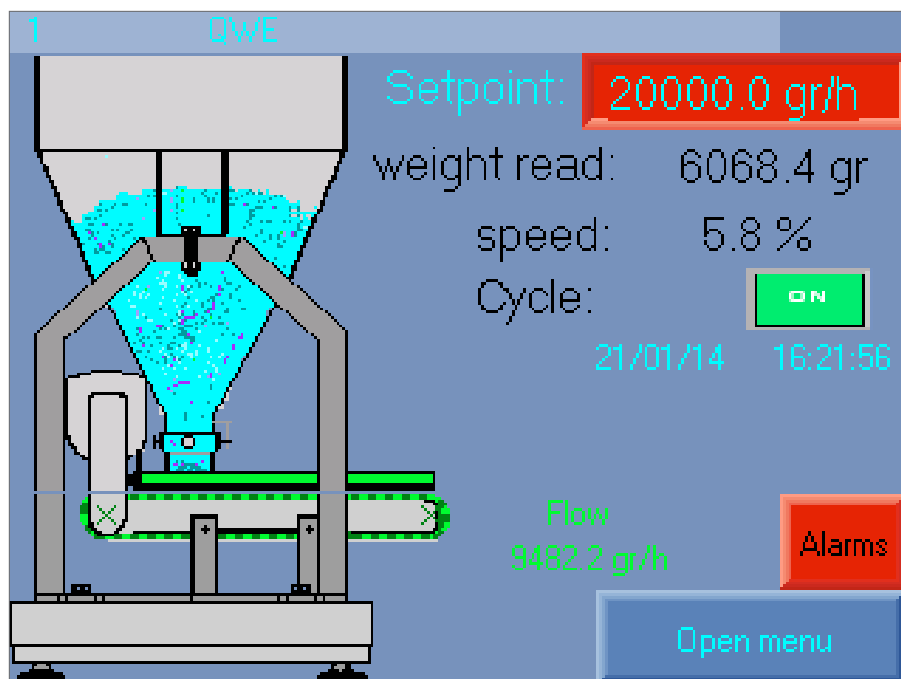


PLC SOFTWARE

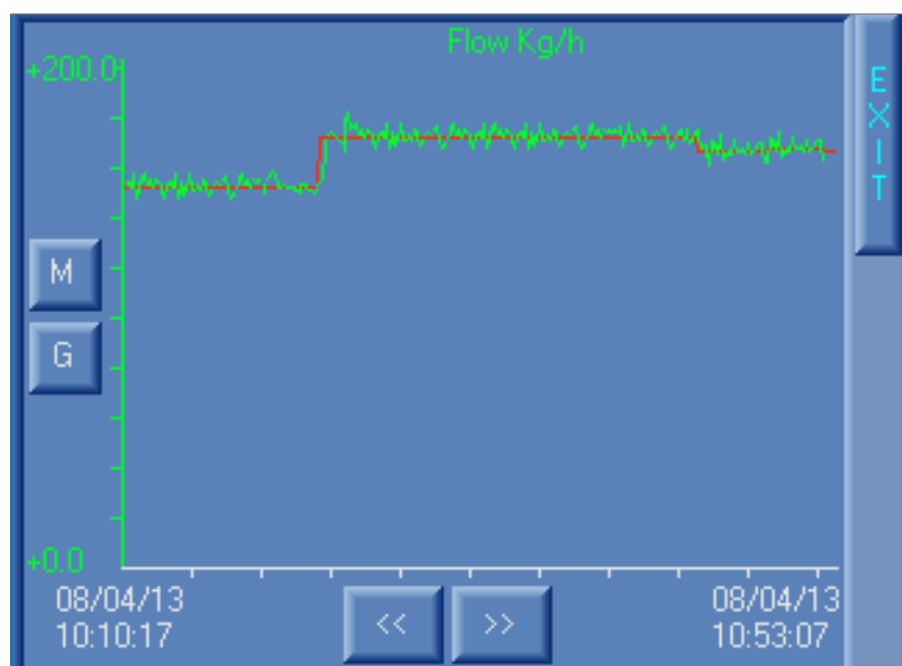
The PLC software allows the operator to change the menu language, calibrate the scale, view the history alarms, set the dosing rate, view the flow trend and manage all of the parameters in a single menu.

Additional information can be incorporated on request.

A typical screenshot:



Main page



Flow trend



CUSTOMERS WORLD WIDE

CFH-17-01-E



turn key project
batch plants
furnaces:

recuperative
regenerative
gas fired
oil fired
oxy-fuel fired
mixed fuel
electric

forehearth:

colouring forehearth
combustion systems

day tanks

mini melters

boosters

bubblers

metallic recuperators

batch chargers

stirring machines

glass level controls

frit dosing and transport

control cabinets

SCADA and DCS
cooling systems
robotics

gathering - 4 or 5 axis

services:

installation and supervision
commissioning
training
preheating
technology transfer
assistance

laboratory and analysis

refractory consulting

project financing



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