

COLOURING FOREHEARTHS

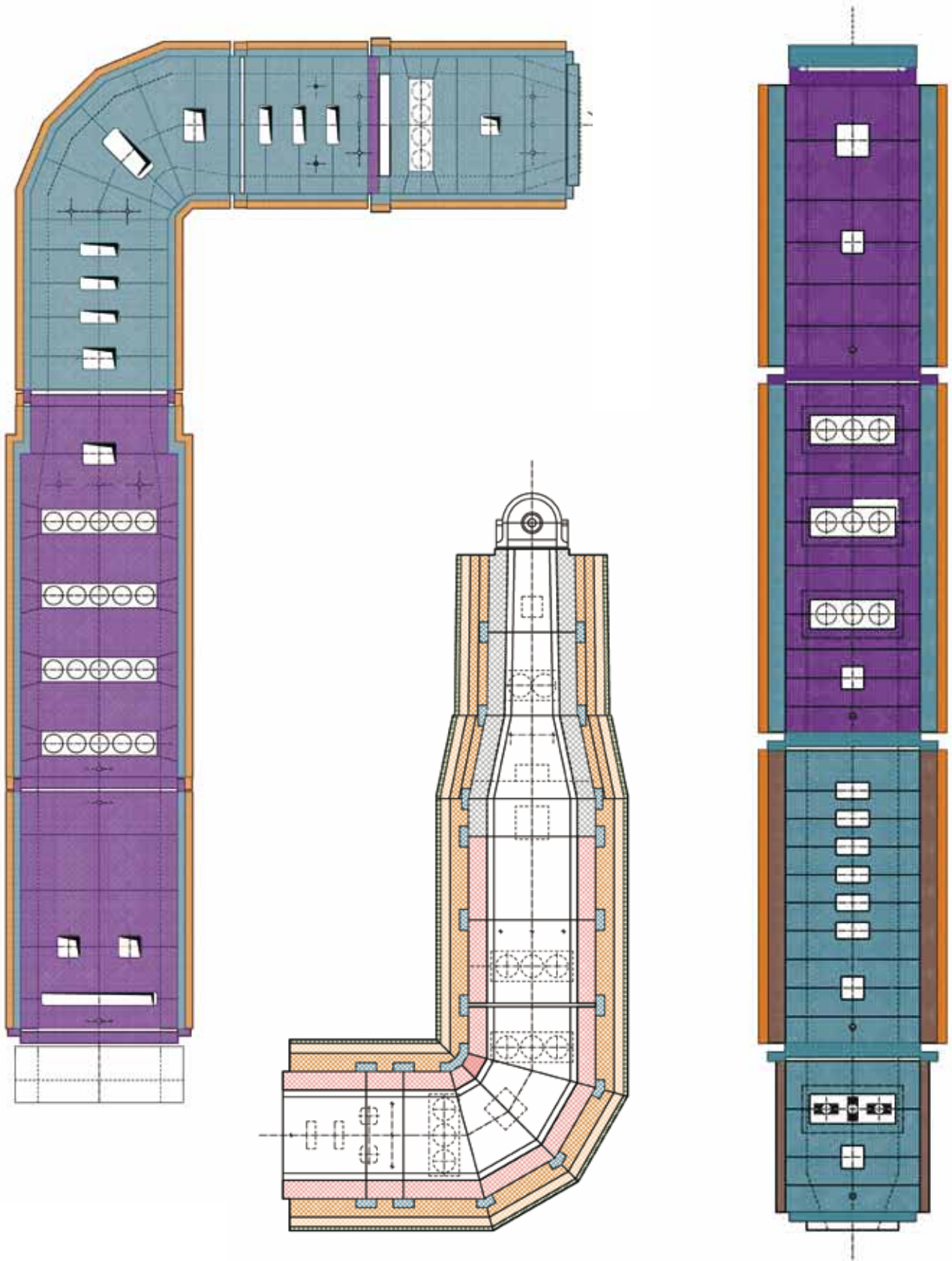
innovation
ENGINEERED IN GERMANY

HORN
GLASS INDUSTRIES

FOREHEARTH DESIGN

All forehearths are individually designed depending on the colours required, the tonnage and the conditions on site. All forehearths gen-

erally consist of a heating up / dosing zone, a stirrer zone, a cooling zone, as well as a conditioning zone.



Individual colouring forehearth layouts

HEATING UP ZONE

The first section for colouring glass is the heating up zone. A dosing device is installed at the start in order to feed the colouring agents onto the glass surface. Furthermore, the glass is heated up to approximately 1260 - 1310°C to enable the melting of the colouring agents in this section. Therefore the combustion system is intensified by means of two burner rows at each side along the heating up zone.

STIRRER ZONE

The function of the stirring zone is to mix the molten colouring agent with flint glass. For this purpose the roof of this zone has several openings through which ceramic stirrers are installed.

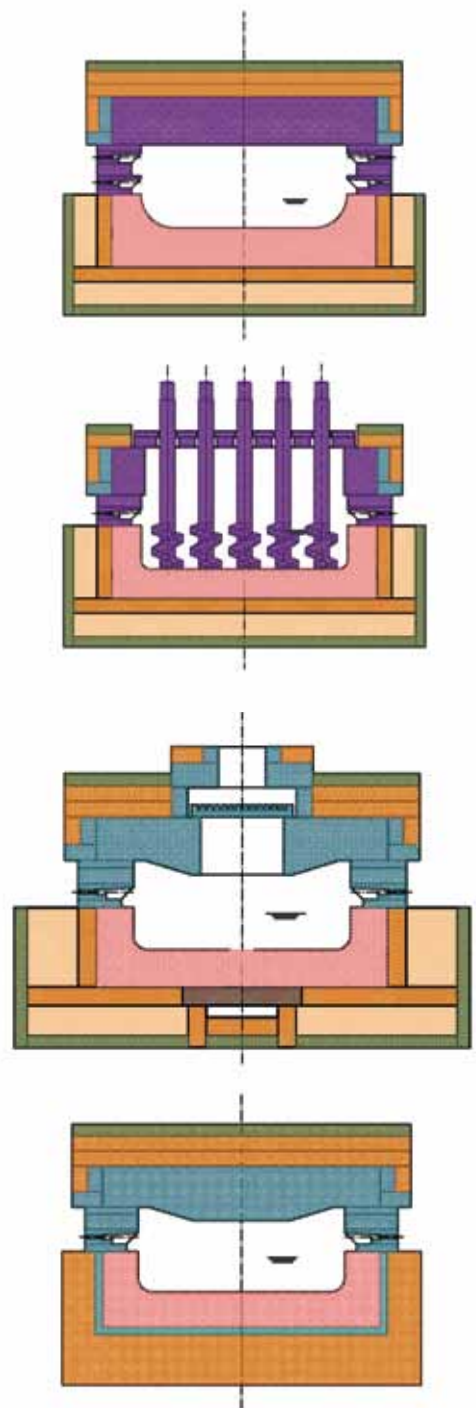
The number of stirrers and stirrer rows depends on the type of colours and the total pull of the forehearth. A certain amount of inactive time has to be considered in this zone. Therefore the stirrer zone can be designed with wider channels and / or higher glass levels.

COOLING ZONE

The first zone behind the stirrer zone is constructed as a cooling zone. Due to the higher temperature required for melting and stirring, the glass has to be cooled and conditioned for the forming process. Cooling facilities such as radiation openings and indirect cooling air channels in the roof are applied according to the type of forehearth such as the GCS Series 200 or 300. Cooling zones are designed individually depending on the articles being produced and the type of colouring agents.

EQUALIZING ZONE

Finally there is an equalizing zone, which is part of the colouring forehearth. This zone ensures the final conditioning for the forming process. For temperature homogeneity reasons, an additional stirring system is advantageous. The openings in the superstructure for the stirrers are planned during engineering.



REFRACTORY

The channel blocks in the heating up and stirrer sections are made of fused cast alumina-zirconia-silica material (AZS). Cooling and equalizing section channels can be provided as fused cast AZS, alpha / beta alumina or bonded zircon mullite.

Superstructure material in the heating up and stirrer section is made of special bonded alumo-zirconoxide refractory material (zircon mullite) with high density and low porosity in order to reduce corrosion due to the high temperature and aggressive evaporations from the colouring agent. The refractory superstructure in the cooling and equalizing sections features a special design for optimal cooling and heating efficiency and is made of high alumina materials.

Ultramodern insulation materials are used for all sections to achieve extremely low heat loss values in order to reduce fuel consumption and improve the thermal homogeneity of the glass.

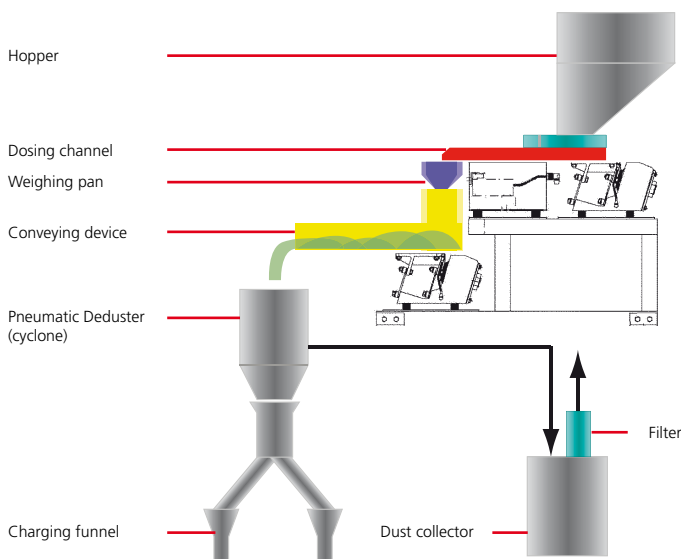


DOSING DEVICE

Either frits of colouring concentrate (colouring product) are used for the colouring process. Copper, chrome, nickel, selenium, cobalt and other elements can be used to produce an entire range of colours. Various combinations of these elements enable a very large palette of colours.

In order to feed these colouring agents, a specially designed feeding unit needs to be installed. This feeding unit consists of several components:

- A small batch hopper is used to store the colouring agents
- A dosing chute feeds the adjustable quantity of agents from the hopper to a weighing pan
- A special weighing socket weighs the exact quantity of colouring agent
- A conveyer device to charge the pneumatic deduster
- A pneumatic deduster reduces the fine particles from the agent to prevent refractory corrosion
- Charging funnels with distributor for single or double charge, feed the agents through the roof of the forehearth onto the glass surface



STIRRER SYSTEM

A stirrer bank consists of several stirrers, coupler bearings and a chain drive as well as cooling equipment for drives and couplers. The elements are mounted as a complete unit in a steel support frame together with a small control panel to control the rotating direction and the speed of the stirrer. The stirrer types are engineered individually to achieve the best results in colour homogeneity.

Each individual stirrer bank can be winched upwards out of the glass separately in order to execute maintenance work (e.g. change of stirrers). In this case the stirrers hang right above the forehearth superstructure. Alternatively, the stirrer bank can be moved laterally to a platform beside the forehearth which facilitates maintenance procedures such as changing the stirrers.



HORN COLOURING FOREHEARTHS

A colouring forehearth is a favourable method for the production of coloured glass without having to change the colour in the entire furnace. The advantages are having two colours simultaneously and the possibility of a temporary colouring process. Thus the flexibility of the glass melting furnace can be increased and two different colours can be produced from one furnace.

For many years HORN has successfully designed colouring forehearth according to the specific requirements of glass manufacturers. Several installations for varying glass applications such as container glass, tableware or sheet glass have been carried out world wide. All colouring forehearth can be provided together with refractory material, combustion system and control equipment.



LAMBDA CONTROL

The lambda control is an optional tool which ensures constant oxygen content in the gas-air-mixture. Hereby the mixture can be set up in reducing, neutral or oxidizing conditions, without measurement and manual adjustment at the gas stations. This significantly simplifies the procedure of frequent colour changes to colours which require different combus-

tion conditions. Furthermore, the lambda control is advantageous when the gas composition fluctuates from time to time.

The natural gas is analyzed by a sensor. According to the gas composition and the required lambda value, the required quantity of air is mixed with natural gas.

GENERAL INFORMATION



Advantages:

- Wider range of production possibilities
- Wide colour range to meet most requirements
- Free colour matching
- High flexibility (small production series)
- Faster re-colouring
- Low discolouring
- Good colour distribution
- Lower energy requirements



Design features:

- 25% to 30% longer than normal forehearth
- Channel width from 16 – 48"
- Length from 18' or longer is possible and can be adapted to local situation
- The GCS Series 200 or 300 forehearth conditioning system is applied after colouring



Glass types

- Cosmetics glass
- Crystal glass
- Tableware
- Container glass
- Figured glass



Glass Colours:

- Green and different types of green such as antique green, emerald green, dead leaf green
- Cobalt blue
- Black
- Smoke
- Bordeaux
- Pink
- Violet
- Yellow
- Black
- Grey
- Purple



Period for colour changes

- flint to coloured: approx. 6 hours
- coloured to flint: approx. 8 - 12 hours



Special equipment options

- Drainage system "VARI-DRAIN"
- Stirring system for equalising zone
- Forehearth boosting