DISTRIBUTOR & FOREHEARTH SYSTEMS

ZEDTEC design, manufacture, install and commission working ends and forehearth systems for the worldwide glass industry.

ZEDTEC’s unique designs include the following technology:

- Forehearth simulation tools
- Rapid Cool technology
- Modular universal arch blocks
- High pressure firing
- Hot spot burners for working ends
- Air dampers
- LFV burners for conditioning zones
- Zedcel™ substructure design

Benefits to glassmakers include:

- Higher pull for a given forehearth length
- Reduced length of forehearth for a given pull
- Wider tonnage range
- Ability to delay cooling to minimise head loss
- Better control of heat / cool operation
- Better glass homogeneity improving product quality
- Reduced maintenance and faster job changes
ZEDTEC uses a number of simulation systems to provide working end and forehearth solutions.

ZEDTEC has designed and developed unique software for specifying working ends and foreheaths – Forehearth Refiner and Mathematical Emulator (F.R.A.M.E.). This calculates and simulates production conditions using a number of given parameters. This can also be used to simulate any changes which the customer may wish to implement.

Specified variables can be:
- Glass colour
- Tonnage
- Incoming glass depth
- Glass inlet temperature
- Zone temperatures
- Gob temperatures

The F.R.A.M.E. simulation tool then calculates:
- Hydraulic head loss down the length of the forehearth
- Residence time
- Gas consumption
- Valve positions for both heating and cooling

ZEDTEC has also commissioned a number of mathematical models on various parts of working end and forehearth construction to help develop and prove design concepts.
ZEDTEC’s Rapid Cool technology enables cooling air to be introduced in greater volumes due to the patented design of the superstructure arch blocks. The unique arch block design also allows efficient centre line cooling along the length of the forehearth zones.

ZEDTEC’s Rapid Cool technology allows a higher glass pull for a given forehearth length, or a shorter forehearth length due to the efficiency of this type of cooling.

Rapid Cool technology can reduce residence time, providing cooling without affecting glass quality. There are no moving parts, alleviating costly maintenance procedures and production downtime.

The basic physical operation of Rapid Cool is to introduce air down the central flue channel, which feeds into the combustion chamber. This air removes heat from the superstructure arch blocks which become a black body receiver, removing heat from the central glass stream via radiation. The air heats and expands, then flows through the side flue channels of the arch blocks before exiting through air dampers.
All refractory components are designed as modules which, prior to site installation, are dimensionally checked, machined and then pre-assembled and numbered for ease and speed of installation.

By constructing a forehearth using the modular universal arch block, this unique design allows a Standard Cool forehearth zone to be converted retrospectively to a Rapid Cool zone without the need to remove the arch block. The modular archblocks use tiles placed on top to configure the cooling flues, these tiles can be re-arranged to give alternative configurations if required.

ZEDTEC modular arch blocks are normally provided in sillimanite, mullite or zirconia mullite, although other materials are available upon request.

ZEDTEC’s unique lightweight flue blocks are normally manufactured from sillimanite using a special freeze cast technique. This enables parts to be made with thinner wall sections, thus reducing thermal mass whilst retaining the required mechanical and thermal properties.
Initially developed by ZEDTEC, the forehearth high pressure firing system has been adopted as the industry standard by the majority of the glass industry.

- This system provides greater turn down ratio from high to low fire

- The combustion system operates with combustion air, which in turn controls the gas flow to an inspirator which feeds the pencil burners for ignition

- Since the pressure of the combustion air controls the amount of fuel released, the higher manifold pressure gives a greater turndown ratio of the combustion system and consequently the better the control of heat released into the glass

- High pressure firing prevents the risk of flashback into the manifold as the velocity of the combustion mixture through the nozzle on low fire is greater than the flame speed
Hot spot burners provide a means of either heating or cooling the glass, they are normally used in working ends and are ideal for controlling glass temperature at forehearth entry points.

Benefits of hot spot burners include:

- Raise the glass temperature by up to 50°C per zone
- Cool the glass temperature by up to 100°C per zone
- No re-boil in heating on any colour of glass
- No moving mechanical part on the superstructure
- Very low maintenance
- Can be used on working end / alcoves and in frit feed sections

The burner produces a luminous ball of heat that provides direct radiation on to the surface of the glass and secondary radiation on to the glass via the arch and side wall blocks. The flame length is only around 200mm which prevents any flame impingement onto the glass.

In cooling, air is passed through the burner that generates a spiralling effect to the air flow prior to entering the combustion chamber. This cold dense air then removes heat from the surface area of the arch and side wall blocks, which then remove heat from the glass via radiation as they become a black body receiver.
ZEDTEC's air damper units double as both air inlets and flues, which are used to control combustion chamber pressure in forehearths and working ends.

- Used to control combustion chamber pressure in forehearths and working ends
- A series of internal concentric air jets create a pressurised curtain
- In heating mode, the damper is controlled to act as a barrier to keep heat and pressure in the chamber
- In cooling, the damper can be controlled to allow heat to exhaust
- In cooling, the damper can also be used to introduce cooling air into the superstructure
- No moving mechanical components on the superstructure of the forehearth, minimising maintenance requirements
By the time glass reaches the conditioning section in a ZEDTEC forehearth, most of the glass conditioning will be complete. There is still likely to be a small temperature differential between the glass at the outside of the channels and the glass on the centreline of the forehearth, due to heat losses through the refractory.

To compensate for this, ZEDTEC have developed low forward velocity burners (LFV burners) to improve glass homogeneity.

- Normally used in conditioning zones
- The LFV burners produce a short, radiant flame throughout their turndown range
- No significant heat delivery to the bulk of the glass on centre line
- Maximum heat release of 75mm from high to low fire
- Patented swirler installed with the burner block
Zedtec has developed the ZEDCEL substructure design to improve glass homogeneity in forehearths.

- Reduces heat losses in forehearths
- Helps to equalise the heat losses and therefore the glass temperature across the width of the forehearth
- Allows cool glass in corners
- Profiled channels and lightweight insulation below the corners of the channels
- Improves the heat losses from around 328 W/m to 208 W/m, increasing the corner glass temperature by 12°C