

Software&Technologie Glas GmbH Cottbus
Bahnhofstraße 76
D-03058 Kiekebusch
Germany

Tel.: (+49) 355-590 200
Fax: (+49) 355-541 124
e-mail: STG@STG-Cottbus.de
www.STG-Cottbus.de

EsDeNOx: The STG Energy saving Technology to reduce NOx Emission in conventional regenerative glass tank furnaces

Using the know-how and the tools of energy saving in the heating of glass tank furnaces, STG GmbH Cottbus has developed a DeNOx technology,

- which reaches a 50...70% reduction in NOx-emission, down to 350...800 mg/Nm³ of NOx,
- which is accompanied by 5% and more of energy saving plus increased melting capacity.

The EsDeNOx-Technology is based on a remarkable increase of energy transfer from the flames to batch and glass directly. So the basic elements of EsDeNOx Technology are:

- *STG DeNOx Natural Gas Burner or STG DeNOx Heavy Fuel Oil Burner*
- *STG Lambda Control based on Zircon-Dioxide Lambda sensors*
- *OMC Optical Melting Control, computerized furnace TV picture processing*

EsDeNOx Technology is available for conventional regenerative glass tank furnaces, end port or cross fired furnaces, using natural gas or heavy fuel oil or mix of them, having burners/injectors in underport- or in sideport-position.

Lambda Control based on Zirkondioxide Lambda Sensors

The Lambda Control system has to organize the correct supply of total combustion air, to make sure, that the excess of oxygen over the stoichiometric ratio to the fuel will be optimum low and stable at any time and at any burner, port by port, firing side by firing side. Only the cooperation of this both elements of DeNOx technology enables to the target results of NOx reduction and energy saving.

Lambda control – that means:

- *Measuring flue gas composition downstream just after furnace chamber and monitoring the actual figure of uncontrolled parasite air infiltration*
- *Based on that minimize air infiltration, which is always reason of energy losses and extended NO formation*
- *Compensate changing parasite air infiltration by modified combustion air input. This has to be done in the way of predictive control due to long response time of such a control loop*

Since more than 10 years STG has a growing experience in production, installation and maintenance of Zirkondioxide Lambda Sensors, which are used now in about a hundred furnaces in Europe and worldwide. Service life of the sensors was extended step by step using long time experience of sensor maintenance to now up to 3..4 years service.

STG DeNOx Heavy Fuel Oil Burner

Growing requirements for NO_x-reduction in the flue gases of glass tank furnaces lead STG to develop a new generation of DeNO_x oil-burners, which produce a narrow-shaped oil-drop-distribution and avoid the very small oil drops as well as the very big oil drops.

Main oil burner data are:

- Capacity : size 1 260...3000 kW
size 2 650...5000 kW
- Heavy fuel oil : 75...130 °C , 6 bar
- Atomizing air or gas: 0,05...0,25 Nm³/kg, 0,2...2,5 bar

The special DeNO_x and Energy saving characteristics of this burner are based mainly on the narrow-shaped distribution of oil-drop-sizes.

STG DeNOx FreeJet gas burners produce lower NOx than heavy oil burners

The technological target is the same as for oil: avoid rapid temperature increase at flame root and increase energy release in order to reach low flame temperature.

STG FreeJet gas burner forms a narrow funnel, just following the opening angle of a free gas jet up to the open furnace chamber. This low turbulence gas flow is mixing with combustion air and starting combustion much later than conventional burner type, giving the gas enough time and space for self-carburization, to form small carbon particles, which increase the emissivity of the gas flame and let the flame temperature drop down for more than 50 K.

Main gas burner data are:

- Capacity : size 1 300...1800 kW
size 2 800...5000 kW
- Gas pressure : 0,9...1,2 bar
- Cooling air : 50 Nm³/h, 0,3 bar

OMC - Optical Melting Control: stable glass quality by stable glass temperature

Keeping stable glass quality or even to improve it is a basic principle of any energy saving and NO_x reducing technology.

New tools for direct and continuous control of melting and refining process of glass in the furnace are an indispensable component of successful EsDeNO_x Technology.

OMC – Optical Melting Control uses the standard TV signal of a furnace camera, directed on batch melting area of the furnace.

The melting zone of furnace represents the user-defined area of interest. Inside the melting zone each pixel is identified by digital filter to be batch or molten glass. So computerized picture processing during reversal at no-fire-situation provides the percentage of batch covered area, different for left and right firing side, and the speed of melting alongside furnace length-axis – which can be understood as a melting gradient .

Percentage of batch covered area and melting gradient may be used as an indicator not only for energy supply to the melting area but as an indicator for stable recirculation glass flow and stable hot spot situation too. So furnace TV picture processing helps to keep optimum energy transfer to melting area and optimum glass quality conditions.