DeNOx oil and gas burners

Andreas Birle* describes how growing requirements for energy saving, NOx reduction and productivity in the glass melting process have encouraged the development of a new generation of DeNOx burners for heavy oil as well as for natural gas.

After several years of intensive development, there are now burner designs available that give energy savings and NOx reduction. The performance parameters and maintenance behaviours are an improvement on former designs and practices.

The oil-burner design with exactly centralised oil and atomising flow creates a narrow shaped oil-drop-distribution. It avoids the typical NOx forming hot flame tail fire and achieves low turbulent and low temperature oil flame geometry, which saves energy, reduces NOx and extends burner maintenance cycles by up to six months.

The low consumption of atomising air decreases the cold air input to the furnace, which is a contribution to NOx reduction and energy saving for compressed air. As a consequence of avoiding the very small and the very large oil drops, it is possible to adjust the right flame length for the glass bath (see ***Fig 1***). As a result of the oil drop distribution and the low impulse of the flame, it is also possible to adjust a very narrow angle of the fuel jet to the glass.

Because of the high combustion efficiency, it is possible to shut off single burner lenses to reduce the number of flame roots. This can result in 2-7% less energy consumption, up to 40% less atomising air consumption, a reduction in the number of burners from 30 to 22 at a cross-fired 6 port furnace, and a NOx reduction from 1300-1400 down to 650-750 mg/Nm^3 (at 8% O_2).

The technological effects on the glass melting process are decreased crown and flue gas temperatures, and increased heat transfer to the glass, which can lead to an increased glass pull, furnace life or energy saving.

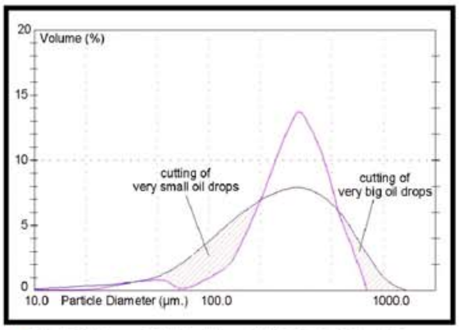
The STG DeNOx oil burner not only reduces NOx, but it saves energy and compressed air and maintenance. It can be used for natural gas or compressed air atomising and for underport position. It is available in sizes from 250 KW to 6.5 MW.

Low turbulent combustion

To reach the same results with natural gas firing, the same criteria of decreased temperature and prevention of oxygen in the flame root to the sensitive gas stream had to be applied.

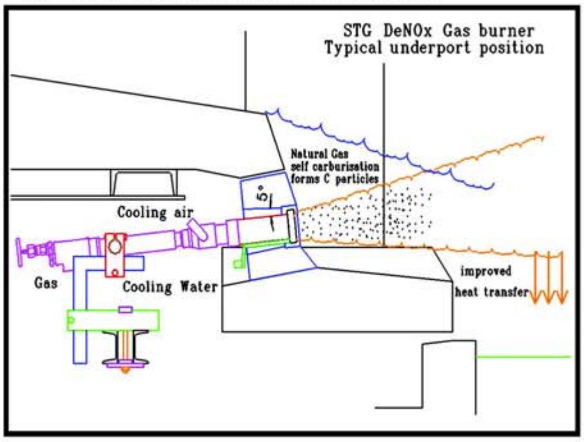
STG has developed a method of supplying gas with a minimum of turbulence, using two main characteristics. Firstly the nozzle of the burner is designed as a diffuser at an angle of a free jet stream. Secondly the diffuser is positioned so that it reaches up into the inside of the furnace chamber. There is no longer a burner block between the diffuser and the furnace.

This means that the gas enters the furnace without any disturbances, so that the gas and combustion air mix later. Self carborisation as a result of low turbulent gas flow and late mixing provides an intensified heat transfer from the flame to glass and batch, which reduces flame and crown temperatures by up to 50K. Therefore NOx formation is decreased and the lower flue gas temperature reduces flue gas energy losses. A two-stage gas flow, provided by a second central nozzle in the root of the diffuser, makes it possible to control the flame length and combustion speed for different gas flows at any time in low turbulent conditions.



▲ ***Fig 1. Oil drop distribution of STG's DeNOx oil burner.***

▼ ***Fig 2. STG's DeNOx gas burner in working position.***



This special burner working position requires a cooling system for the burner head (see ***Fig 2***). The head and the diffuser are made from heat-resistant steel and are air cooled. The leading part of the nozzle requires an additional water-cooled ring. It is also possible to shut off single burners. It is possible to achieve a 5% energy saving, 10-15 K reduction of crown temperature, a reduction in the number of burners from 14 to 12, and NOx reduction from 1100-1200 down to 450-550 mg/Nm^3 (at 8% O_2).

The effects on the glass melting process mean that most intensive heat transfer to the glass causes low crown and flue gas temperatures and can be used to increase glass pull or to save energy.

There are four sizes of burner available, covering a range from 50 to 750 Nm^3/h of gas. The best working position for the burner is the underport position.

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