# Tenova FlexyTech® flameless low NOx burners: industrial applications

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## 1 SUMMARY

Growing environmental emissions constraints have led manufacturers to improve both their low NOx recuperative burners and high-efficiency low NOx regenerative burners. Fundamental research focused on flameless combustion has been performed in Europe and burners based on this technology have been applied to relatively small size burners (up to 300 kW). However no European burner manufacturer had been able to offer high thermal capacity burners (up to 5 MW) with very low NOx emissions in spite of market demand.
The development by Tenova (former Techint Technologies) of the FlexyTech® Burners to provide high thermal capacity burners with low NOx emissions is described. These burners are installed on high capacity reheating furnaces for which NOx emissions are an important concern. An overview given of the results achieved in the past four years of development of gas burners with greatly reduced NOx emissions (even below the present "Best Available Technology" limit of 40 ppm normalised at 3% $O_2$ with furnace temperature 1250°C, air preheat 450°C and air excess 5%) while maintaining high fuel efficiency and hence reduced $CO_2$ output. FlexyTech® Burners development concerns side and roof burners especially designed for different type of furnaces.
Flameless burners allow the charge to reach a very good temperature uniformity particularly when the furnace is equipped with an advanced combustion control system such as I.C.S.® (Innovative Combustion System).
The encouraging results achieved during the R&D programme have been confirmed and also improved in the industrial installation of the flameless FlexyTech® Burners. Some details and performances of the recent furnaces equipped with such burners are provided.
Tenova demonstrated that flameless technology is the best platform to answer at present steelmakers' demand concerning NOx abatement and, in mid-term, concerning energy saving and $CO_2$ emissions, coupling flameless concept to regeneration systems.

## 2 ISSUES IN STEEL INDUSTRY

The most crucial issues in steel industry have always been energy consumption and air pollution, especially after April 2002, when Kyoto Protocol on climate change became effective. Since then, performance targets for fossil-fuel fired furnaces foreseen by international authorities become stricter and stricter: by year 2020 furnace technology is challenged to seek significant improvements on NOx emissions abatement (by ~90%) and fuel consumption reduction (by 20-30%) while pursuing other goals such as fuel interchangeability, plant downsizing, product quality improvement and cost reduction.
Therefore the main goals in the design of combustion systems for steelmaking industry are energy efficiency increase and pollutant emissions reduction, both to be obtained at the same