JOHN ZINK HAMWORTHY COMBUSTION®

Tangentially Fired Boilers: Reducing NOx Emissions and Retrofit Costs

Case Study

The Situation

A major oil refinery needed to reduce NOx emissions on three 550,000 lb/hr (250,000 kg/h) tangentially fired boilers. The strategy called for the application of low NOx burners with induced flue gas recirculation (IFGR) to provide reliable combustion and achieve target NOx emissions when operating with various refinery gas and load combinations. Additional customer requirements included:

+ Minimum retrofit cost
+ Short project execution timeline
+ Compatibility with existing windbox and No. 2 oil backup system

The Solution

The refinery approached us to define and implement the most economical approach. We proposed a burner design that would minimize modifications to the: existing windbox geometry, backup fuel oil firing system and ignition equipment.

CFD modeling supported the decision to proceed with the low NOx burners with the IFGR approach as a mechanism to achieve NOx reduction and maintain boiler efficiency. In addition to CFD modeling, a 1/4-scale model of one low NOx corner burner element was tested at our Test Facility under simulated field conditions. The tests demonstrated reliable low NOx characteristics of the proposed burner over the required burner turndown range.

The impact of increased IFGR rates on the boiler superheater and temperature control was evaluated using CFD and mathematical modeling. The analysis indicated that the superheater would accommodate the IFGR rates and that superheat temperature control could be maintained via existing means. The CFD study

Continued on reverse side.

Reducing NOx emissions while still minimizing retrofit costs?
That's smart. That's JZHC.

Boiler Specifications

+ Boiler Design:
Tangentially fired

+ Number of Burners:
3 elevations, 12 burners total

+ Windbox Air Temperature:
500°F (260°C)

+ Equipment:
Custom-engineered tilting burners with ultra-stable flame stabilizers and low NOx gas injectors

+ Guarantee:
0.085 lbs/MBtu (36.5 g/GJ) NOx

The Solution, continued.

of the combustion air ductwork and windboxes indicated that no modifications were necessary to achieve optimum airflow distribution to the burners. Our burner solution kept the retrofit cost to a minimum by replacing only critical burner components with custom-engineered components, while most of the oil burner system remained intact.

The equipment supplied included low NOx gas injectors, new flame stabilizers and replacement of associated windbox air nozzles (buckets). These components were designed to adapt to existing windbox compartments and burner tilt mechanisms, which avoided costly windbox modifications. In designing the replacement windbox air nozzles, care was taken to ensure that the existing oil firing equipment could be reused with minor modifications. The project had a very short execution time and was subject to rigorous quality assurance testing during fabrication. It was also imperative that the equipment attained design performance immediately after the installation outage.

The Results

All three boilers were successfully retrofitted. The burner modifications were confirmed to provide good flame shape and reliable light-offs over the boiler load range with all gas fuels and IFGR combinations. The NOx emissions were easily achieved while maintaining superheat and boiler efficiency. We received an award for "Exceptional Vendor Performance" from the refinery.

RESEARCH AND DEVELOPMENT TEST CENTER

Customers come from around the globe to our International Research and Development Test Center.

Continuous innovation is a vital part of our ongoing success. We invest heavily in facilities and experts. Our research and development center makes up the largest and most advanced testing complex of its kind. Located in Tulsa, Oklahoma, this exclusive resource allows us to push innovation, gain expertise and measure performance in a full-scale industrial setting under real-world conditions.

GLOBAL REACH

JZHC has locations all over the map, with thousands of employees worldwide.

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