

U.S. Borax TODD® Ultra Low Emissions Burner Installation

The Situation

In November 1994, a TODD® Combustion Rapid Mix Burner (RMB), utilizing induced Flue Gas Recirculation (FGR), was retrofitted into a 21,500 lb/hr Nebraska boiler located at the U.S. Borax facility in Wilmington, CA. The RMB burner replaced an induced FGR burner permitted for 30 ppm NO_x and 400 ppm CO. The TODD retrofit consisted of replacing the existing burner and fan, and reusing the gas train and most of the control system components. The objective was to demonstrate the RMB's ability to operate at less than 9 ppm NO_x and CO across the load range (5:1 turndown).

The Boiler

A natural gas only, 26 MMBtu/hr RMB was installed on a Nebraska model NS-B-35 watertube boiler rated for 21,500 lb/hr steam flow and equipped with an economizer. The burner installation included the RMB, an induced FGR system and windbox baffles to provide uniform air distribution to the burner. The characterizable fuel valve and air dampers



Fig. 1

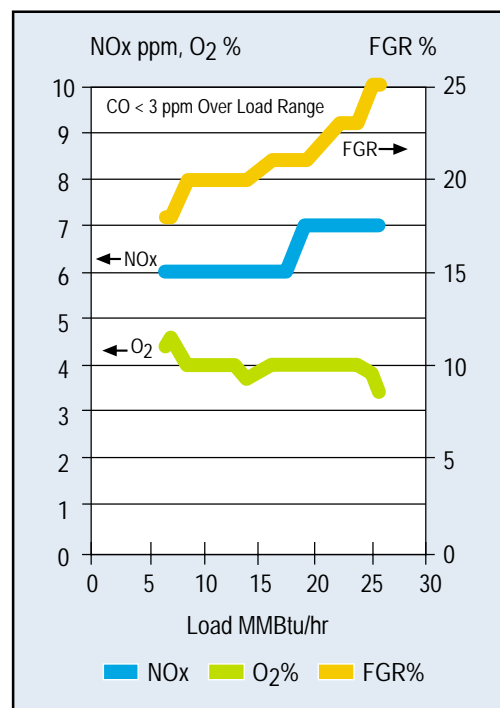


Fig. 2: Borax Data

were physically linked to provide single-point positioning control over the air / fuel ratio across the load range, while the FGR damper had a separate actuator and controller.

The TODD Result

The test results in fig. 2 illustrate the burner performance with the boiler in automatic operation. The FGR rate varied from about 18% at low load to 25% at full load. The NO_x levels varied between 6 and 7 ppm over the load range, while the CO varied from less than 1 ppm at full load to approximately 3 ppm at low load. The excess O₂ varied from about 4.5% at low load to 3.2% at full load.

The flame length was approximately 6-ft long, and the flame was extremely stable across the entire load range. There was no measurable impact on the boiler's efficiency. The burner operates with a 6.5-in. draft loss and 5 psig gas pressure at full load. The RMB burner on this boiler has been in operation since November 1994.

Third Party Test

On November 7, 1994, the boiler was source-tested per SCAQMD protocol by the Almega Corporation. The test results are shown below. The CO and NO_x numbers are corrected to 3% O₂.

Source Test Data

Load %	O ₂ %	CO ppm	NO _x ppm
25	3.4	3.0	8.2
53	2.6	0.9	7.1
98	2.7	0.1	6.8

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