NTFB Combustion Equipment USA, Inc.

Shanghai Meiya Jinqiao Energy Limited, Shanghai China

Case Study: November, 2016

Synopsis

NTFB took on this key project in Shanghai, China to retrofit two existing 112,500 PPH Beijing B&W packaged watertube steam boilers earlier in 2016. New natural gas fired burner systems were needed to meet Shanghai's now lower NOx requirements.

Both of these D type boilers were originally manufactured by B&W's Licensee in Beijing, China, to burn fuel oil. They were both retrofitted with NTFB low NOx gas burner systems to replace a European burner design. The goal was to reduce NOx emission levels by ~70% from the previous level of 160 PPM NOx on oil to a current permit level of <50 ppm when firing natural gas, all while returning to the original full load rating of these boilers with vastly improved boiler efficiency.

NTFB's equipment scope included new low NOx gas burners, windboxes, airflow control dampers, packaged fuel burner trains mounted along the side of each boiler, burner management (bms) and combustion controls (CCS) with VFD and O2 trim.

The Technical Challenge

The existing burner on each boiler originally burned residual oil, but with unacceptable NOx and CO levels as well as the inability to attain full boiler load, resulting in inefficient operation. Along with this new retrofit, the furnace height of each boiler was reduced to only 6.3 ft with a slight increase in furnace width, along with other boiler and superheater heating surface mods to improve overall performance. This presented NTFB with the challenge of retaining their gas burner flame within the confines of the furnace cross-section without flame impingement on furnace roof tubes, all while efficiently achieving full boiler design conditions and targeted NOx and CO emission levels.

The Solution

NTFB retained the single burner approach with their streamlined style GS Low NOx gas burner. They were easily able to obtain the targeted <50 ppm NOx *without* the need for flue gas recirculation. Actual NOx level was <47.5 PPM NOx at max boiler load under automatic control.

CO emissions at maximum load are also low at <25 PPM, with excess air at <15%.

Care was taken by NTFB with custom gas burner nozzle drill patterns designed to meet this unusual furnace cross-section with a furnace height that is less than the furnace width.

Hidden Benefits

NTFB has met their customer's and the local air district requirements in Shanghai of <50 PPM NOx when firing natural gas in this unusual watertube boiler furnace shape. However, this burner solution with minimal modifications has the added benefit of being able to meet even lower NOx levels in the future, perhaps as low as 15 to <30 ppm NOx if/when needed by future air quality regulations. This would require the addition of minimum levels of induced flue gas recirculation (FGR) along with mods to the burner system for each boiler.

NTFB has again helped a key customer set the challenge for other industrial and commercial facilities to meet current and potential future NOx emission standards in Shanghai and elsewhere in China to address its serious air pollution problems.

Boiler and Burner Performance at Maximum Boiler Load (MCR)

Boiler capacity at MCR – 112,500 PPH Steam
Heat Release Rate – 132 MM Btu
Boiler Operating Pressure - 230 PSIG
Feedwater Temperature - 220 Deg F
Steam Temperature. - 482 Deg F Superheated
Combustion Air Temp - 60 Deg F
NOx at MCR - < 47.5 PPM
CO at MCR - < 25 ppm
O2 Level at MCR - <3%
Gas Supply Pressure – 30 PSIG

Burners, Combustion Controls, Burner Management, Gas Piping

Low Nox Burners – NTFB Type GS
Burner Winboxes – NTFB Type AO3
Fuel Piping – NTFB per NFPA 85
Controls (CCS) – Parallel Positioning / O2 Trim / VFD Control
Controls Designer – NTFB / Siemens
Burner Management – NTFB / Fireye Scanners

BMS - Nema 7 Explosion Proof S.S. Remote Burner Light off Panel