

Ultralow NO_x Burner for Boilers and Process Heaters

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Environmental Problem

In many regions of the country, particularly the Northeast, West Coast, and Texas, ambient ozone levels exceed the standards established by EPA. A key precursor of ozone production, nitrogen oxides (NO_x), leads to acid rain and contributes to ground-level ozone and smog. NO_x is produced from burning fossil fuels in vehicles and in stationary sources such as power plants, waste incinerators, manufacturing plants, commercial buildings, and homes.

Boilers and process heaters, used in a wide range of applications such as industrial process heating, petroleum refining, and chemical manufacturing, consume approximately 37% of all gas used in industry and contribute a significant percentage to overall NO_x emissions. For those regions of the country that are in nonattainment of the ozone standard, reducing NO_x emissions effectively and economically is critical to their environmental quality. If NO_x is not reduced, oxidants can build up in the atmosphere and have detrimental effects on human health, particularly the lungs and eyes.

SBIR Technology Solution

With support from EPA's SBIR Program, the California Air Resources Board, and ST Johnson Company, Altex Technologies Corporation developed and commercialized an ultralow NO_x burner that reduces NO_x emissions to below 5 ppm (3% O₂ dry). The innovative burner, called the Ultra Reduced NO_x Burner (URNB), achieves low emissions while maintaining good flame stability and heat transfer characteristics. The URNB is applicable to a broad range of firetube and watertube boilers and process heaters.

The burner has been designed for natural gas fuel, with liquified petroleum gas (LPG) as the backup fuel. The URNB can be retrofitted to conventional boilers and process heaters, or incorporated into new equipment. No special mounting or air and fuel supply modifications are required, and the URNB consumes 11% less operating power than alternative ultralow NO_x burners. Unlike alternative ultralow NO_x burner technologies that use a single flame zone to cover all burner requirements, the URNB creates several flame zones to balance all burner performance criteria.

The URNB is a reliable and low-cost boiler and process heater emissions control option for nonattainment air quality regions in the United States. Given the 28 trillion ft³ of gas consumed in boilers and process heaters in the United States, it is estimated that a full deployment of the URNB could

reduce NO_x emissions by 36,000 tons/year and save facilities \$93 million/year. In comparison to postcombustion NO_x control devices that cost up to an additional \$20,000/ton of NO_x removed, the URNB could save facilities \$720 million/year.

Commercialization Information

The URNB was tested extensively by Altex Technologies in the laboratory and by a commercialization partner, ST Johnson Company, in the field. The laboratory tests covered system scales of 1MM Btu/hr, 4MM Btu/hr, and 13MM Btu/hr. The field test was successfully conducted at 25MM Btu/hr scale in a firetube boiler. The field tests utilized



The URNB, pictured above, is a reliable and low-cost boiler and process heater emissions control option for nonattainment air quality regions in the United States.

third-party EPA source testing equipment and procedures, and were supported by the California Air Resources Board, under its Innovative Clean Air Technology Program. The field test was successful, and the URNB now is being sold at scales from 4MM Btu/hr up to 40MM Btu/hr by ST Johnson Company.

Company History

Altex Technologies Corporation was founded in 1985 to research, develop, and demonstrate fuels and combustion system innovations that increase efficiency and reduce emissions at low cost. Altex Technologies is located in Sunnyvale, California, in the heart of Silicon Valley, where low emissions and low-cost burners are highly desirable. Altex Technologies works with manufacturers to implement successful energy and environmental technologies.

ST Johnson Company, the licensed manufacturer of the URNB, was founded in 1903, and is located in Oakland, California. The URNB expands the company's product line to include ultralow NO_x burners, as well as low NO_x and conventional burners, for markets outside nonattainment regions.

SBIR Impact

- Boilers and process heaters contribute significantly to overall nitrogen oxide (NO_x) emissions.
- Altex Technologies Corporation developed the Ultra Reduced NO_x Burner (URNB), a reliable and low-cost boiler and process heater emissions control option for nonattainment air quality regions in the United States.
- With full implementation of the URNB, NO_x could be reduced by more than 36,000 tons/year and costs to reduce NO_x could be reduced by \$93 million/year, relative to alternative burner technologies.
- The URNB is being sold at scales from 4MM Btu/hr up to 40MM Btu/hr by ST Johnson Company.