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COMBUSTION AND ENVIRONMENTAL SOLUTIONS. PURE AND SIMPLE.[®]





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BURNERS

Company Profile

ZEEGÓ

- Privately held, incorporated in 1979
- 250-acre facility in Broken Arrow, OK
- Specialists in the design and manufacturing of combustion equipment



Zeeco's Global Presence



Installations in over 62 Countries 46 International and 20 Domestic U.S. Locations 500+ Total Employees • 300+ Engineering & Design Staff



Project Background Valero Boiler Retrofits



- Valero Corpus Christi emission reduction project goals
 - Retrofit existing boilers with low emission technology
 - NO_x < 0.03 lb/MM Btu HHV
 - CO < 50 ppmv at 3% O₂ dry
 - UHC / Particulate / VOC < 15 ppmv at 3% O₂ dry
 - Minimize installation costs
 - Minimize operating costs
 - Minimize maintenance costs

Boiler 132-B-1 / B-2



- Two (2) boilers relocated from ship to plant site
 - Two burners per boiler
 - 75 MM Btu/hr per burner
 - 17' H x 8' W x 14' D
 - 78,782 Btu/ft³ volumetric heat release
 - Ambient air
 - Brick lined outer wall
- Refinery fuel gas (730-2919 Btu/scf LHV) with up to 40 mol% H2



► Boiler 132-B-1 / B-2





NO_x Emissions vs Peak Flame Temperature





Fuel Reconditioning for Lower Thermal NO_x



- Simple design for a complex problem.
- The fuel gas is mixed with inert products of combustion before combustion occurs, thus "reconditioning the fuel gas".



Traditional Burner Stabilization



The Free-Jet concept is similar to conventional burners which uses a tip next to a ledge to stabilize a gas/air mixture on a refractory tile ledge.



Free-Jet Design Advantages



- Stable flame over a wide range of conditions
- Compact design makes this burner a great choice for retrofit applications
- Compact flame shape



► GLSF Free-Jet Boiler Burner





Gas Tip Comparison



- Shown left: A standard low NO_x gas tip that may have as many as six ports including very small ignition or "stability" ports
- Shown right: Patented Free-Jet gas tip with a single port design—no small ignition ports required



Low-Maintenance Gas Tip Design



Free-Jet has 68% less exposed tip area



➤ Free-Jet Burner



Due to the compact design and flame shape of the Free-Jet burner, the burners can be retrofitted into applications where other Next Generation Emission burners cannot be installed.



Boiler 132-B-1 / B-2





Boiler 132-B-1 / B-2





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Free-Jet Stabilization

As the oxygen content in the boiler is reduced, the flame front moves from the tile's 1st stabilization ledge to the 2nd stabilization ledge. At high excess oxygen levels, the flame stabilizes on the 1st ledge like a conventional burner flame stabilizes on a refractory tile ledge, without the sweeping effect from combustion air flow.



Project Review, Valero Boiler Retrofits

- Considerations during the retrofit
 - Accurate & complete data from existing operation for retrofit design
 - Boiler tramp air leakage addressed
 - Combustion air forced draft fan controls
 - Steam into fuel not required for NO_x control
 - Maximize use of available air pressure drop
 - Reuse existing windbox and fuel gas train

Tramp Air Leakage











Tramp Air Leakage







> Project Review, Valero Boiler Retrofits

- Conclusions
 - Challenging retrofit due to age of boilers
 - Lack of accurate design data
 - Tramp air leakage had to be addressed
 - No external FGR required
 - Steam into air stream ~ 0.3 0.4 # steam / # fuel
 - Met emission guarantees for NO_x (<0.03 lb/MM)
 - Met emission guarantees for CO (<50 ppmv)

Zeeco Free-Jet Applications



- Zeeco Free-Jet Burners have now been installed in over 300 furnaces and boilers.
- First installation started up in 2000
- Maintenance free design
- They are used in the following types of services:
 - Cabin furnaces, vertical cylindrical furnaces, cokers, ethylene crackers, reformers, OTSG's, boilers, and incinerators.





Thank You

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Questions?

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