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FCC International Technical Symposium 2018, Islamabad

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Revamp of Existing Burners to Increase Efficiency

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Presentation Outline

- Application Overview
- Zeeco Single-Jet Ultra-low NOx Emissions Burner
- CFD Study
- Combustion Testing
- Burner Installation
- Conclusion

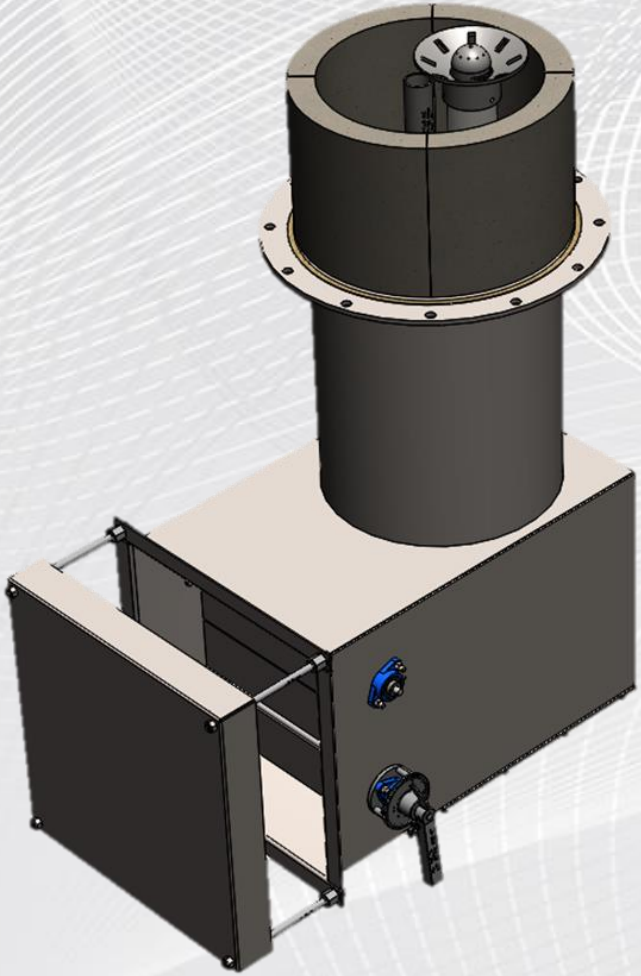
Application Overview

- Downfired Primary Reformer Furnace
- European Ammonia Production Facility
- 105 Downfired Burners > 40 years old
- NOx emissions in range of 200-300 mg/Nm^3
- Customer wanted to re-use burner windbox and damper

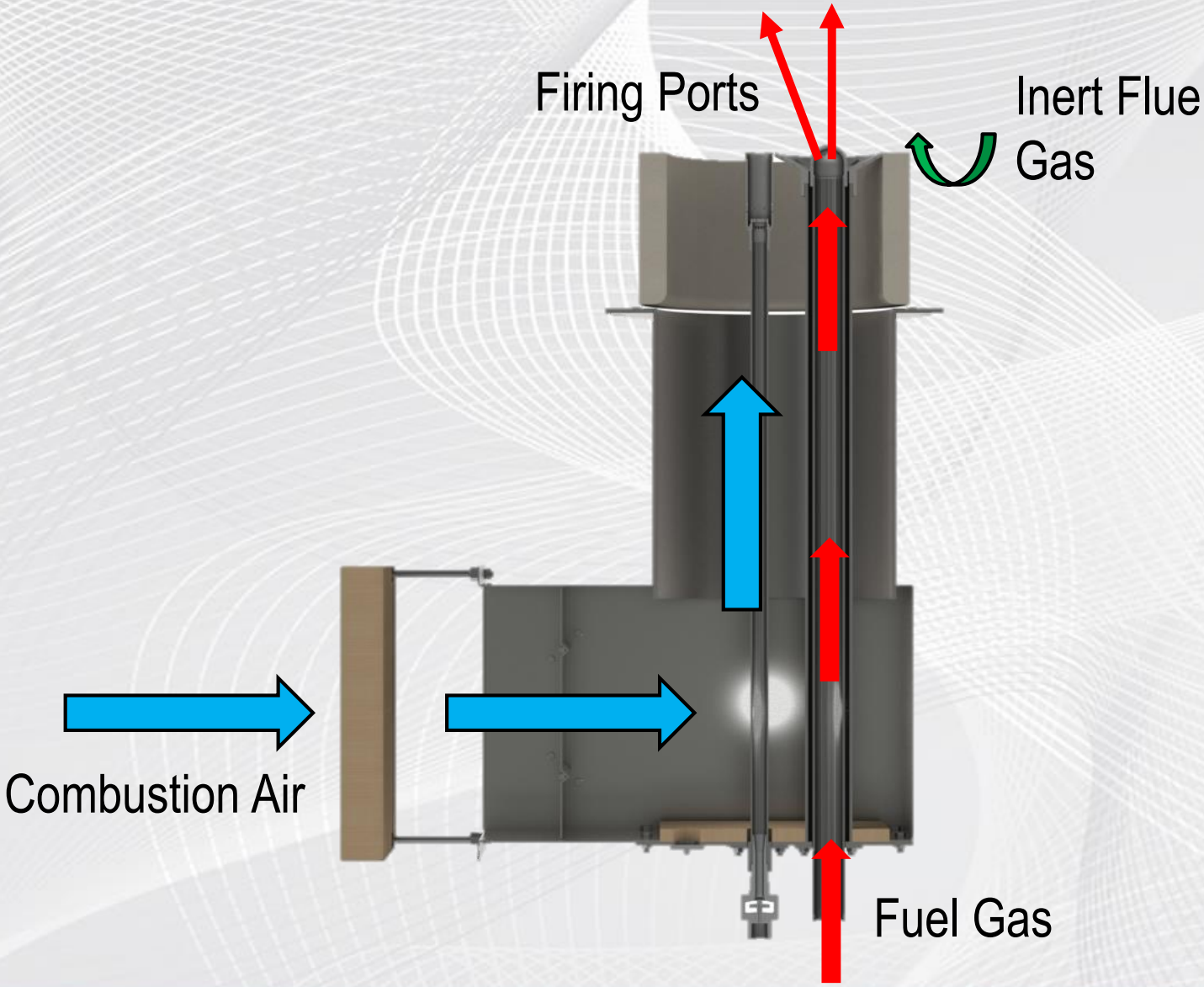
Zeeco Solution

- Supply GB Single-Jet Ultra-Low Emissions Kit:
  - Gas lance / tips
  - Cone
  - Burner Tile
- Retain existing:
  - Windbox
  - Damper / damper controls
  - Pilot
- Guaranteed NOx emissions of 120 mg/Nm^3 on Natural Gas
- Design for 10% excess air (≈2.1% O_2 by vol. of dry flue gas)

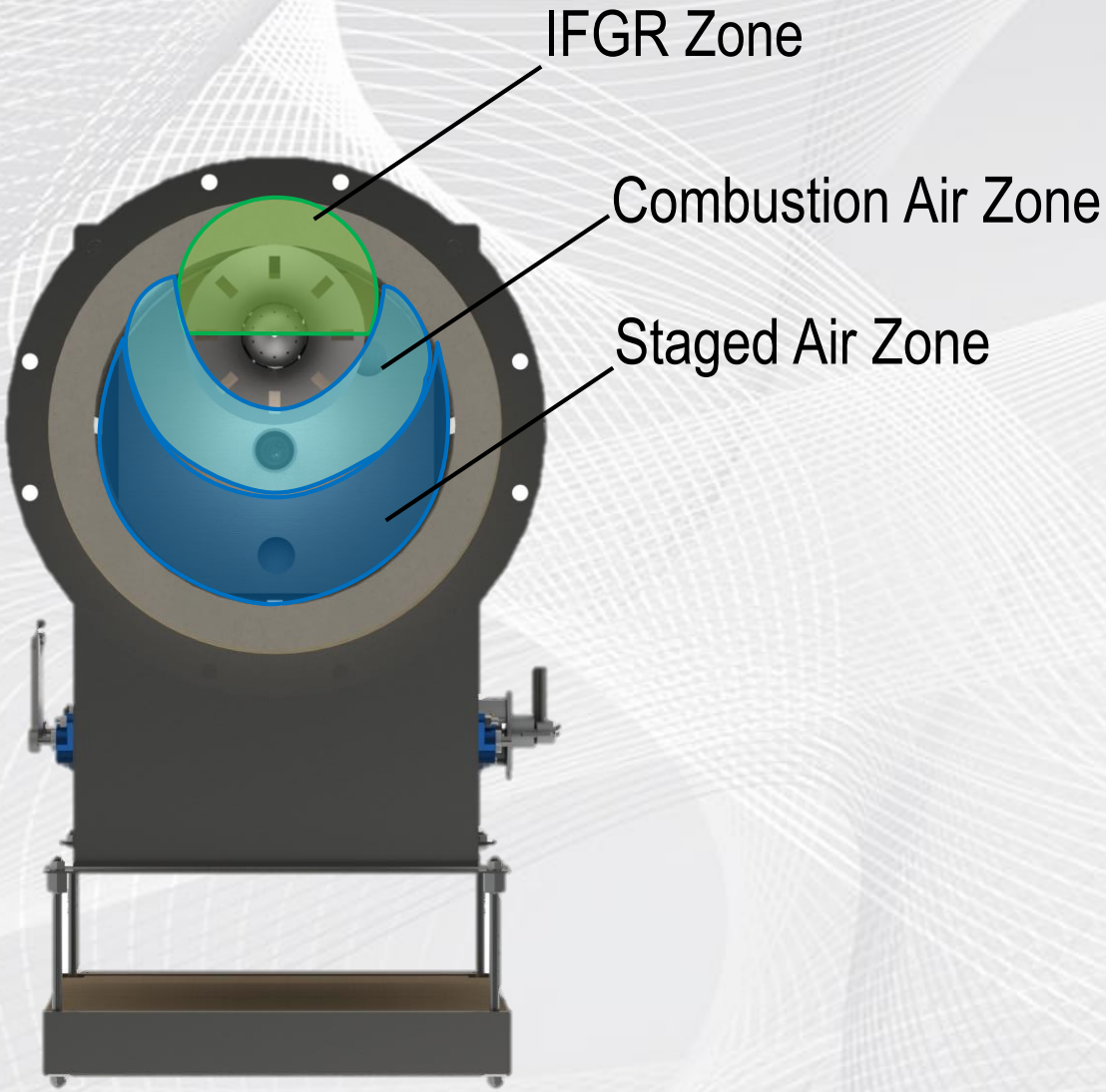
Zeeco Solution



Zeeco Single-Jet Ultra-Low Emissions Burners

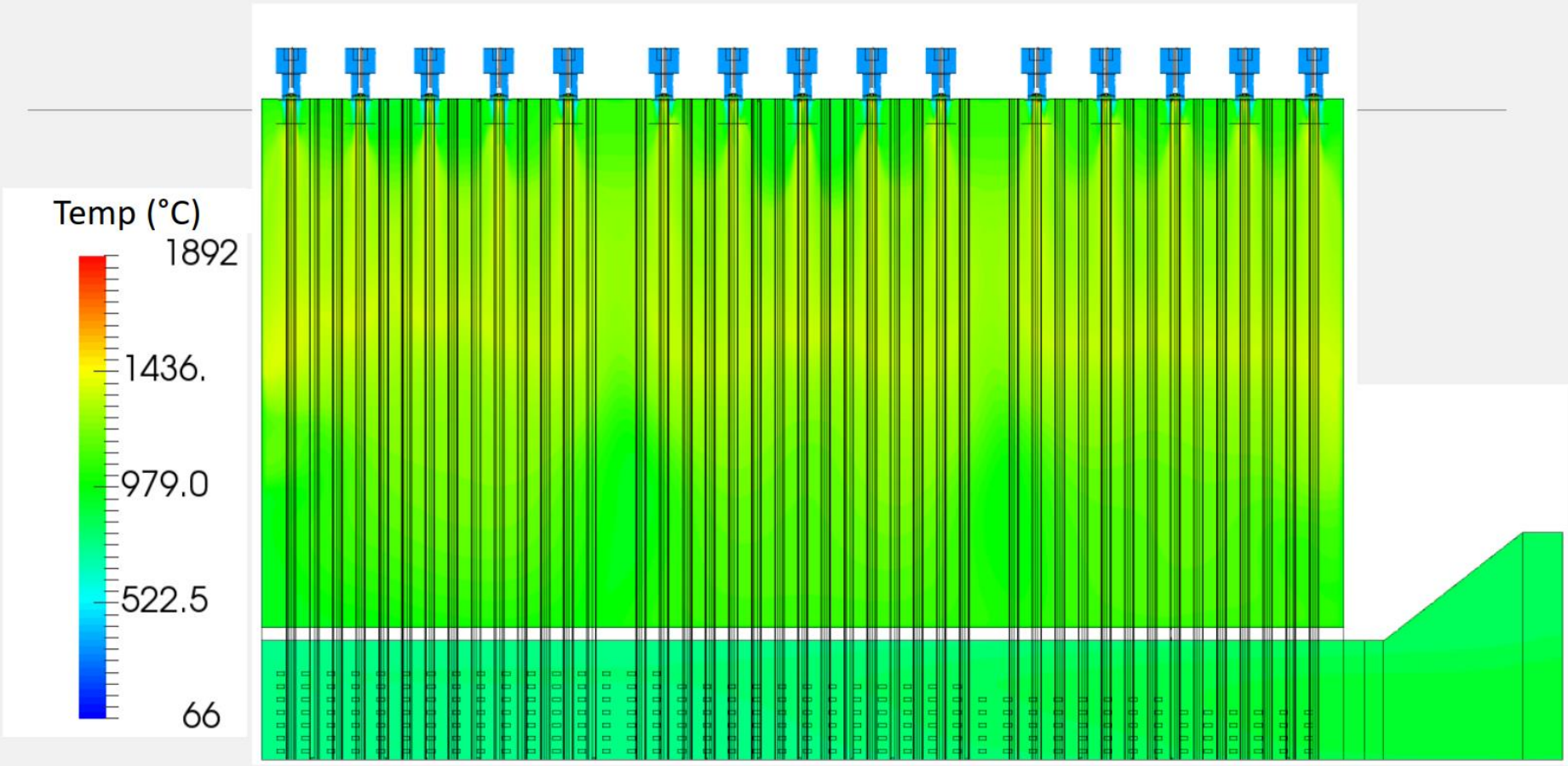


Zeeco Single-Jet Ultra-Low Emissions Burners



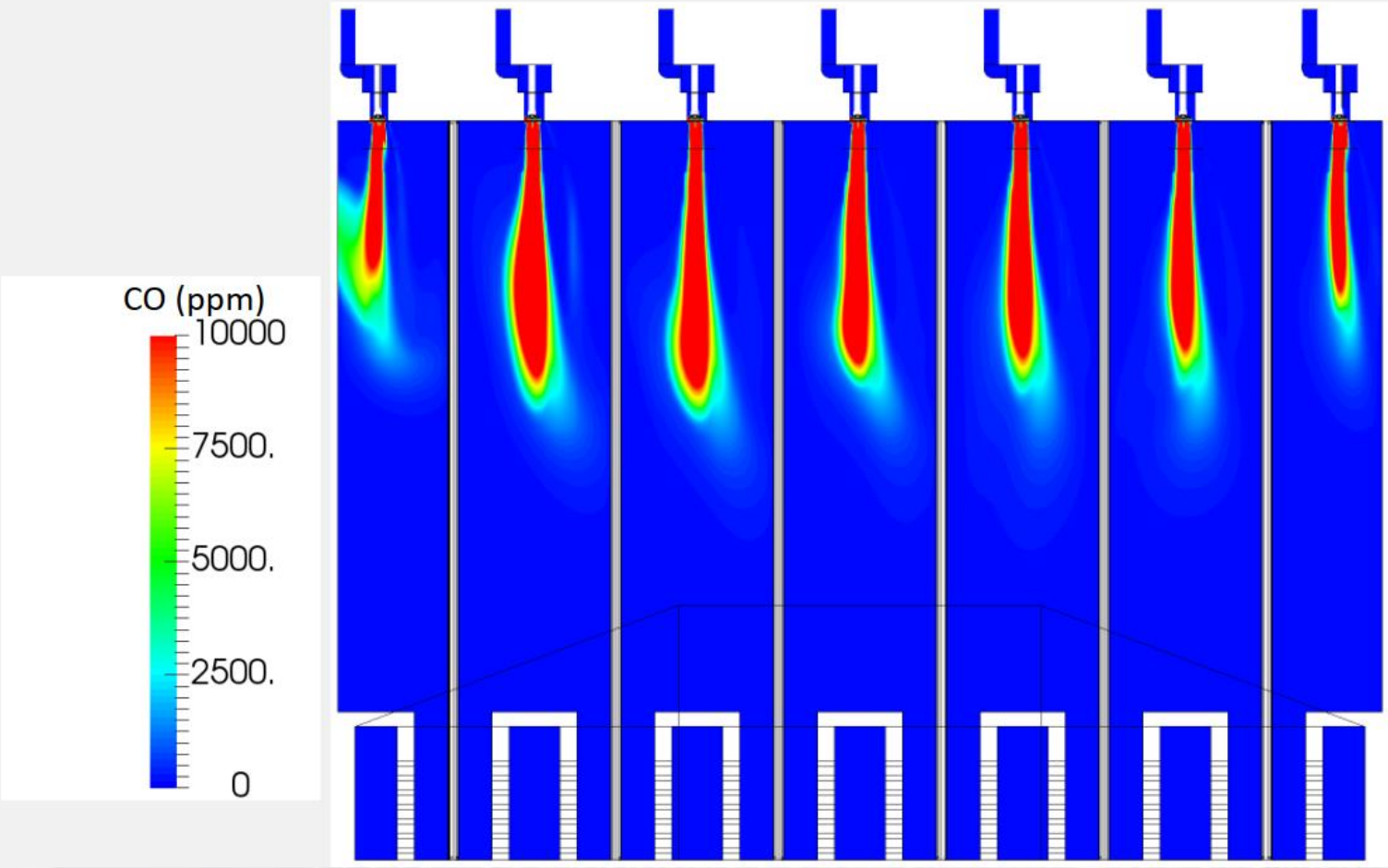
CFD Study

- Gas Temperature Contours



CFD Study

- CO Contours confirmed minimum flame interaction

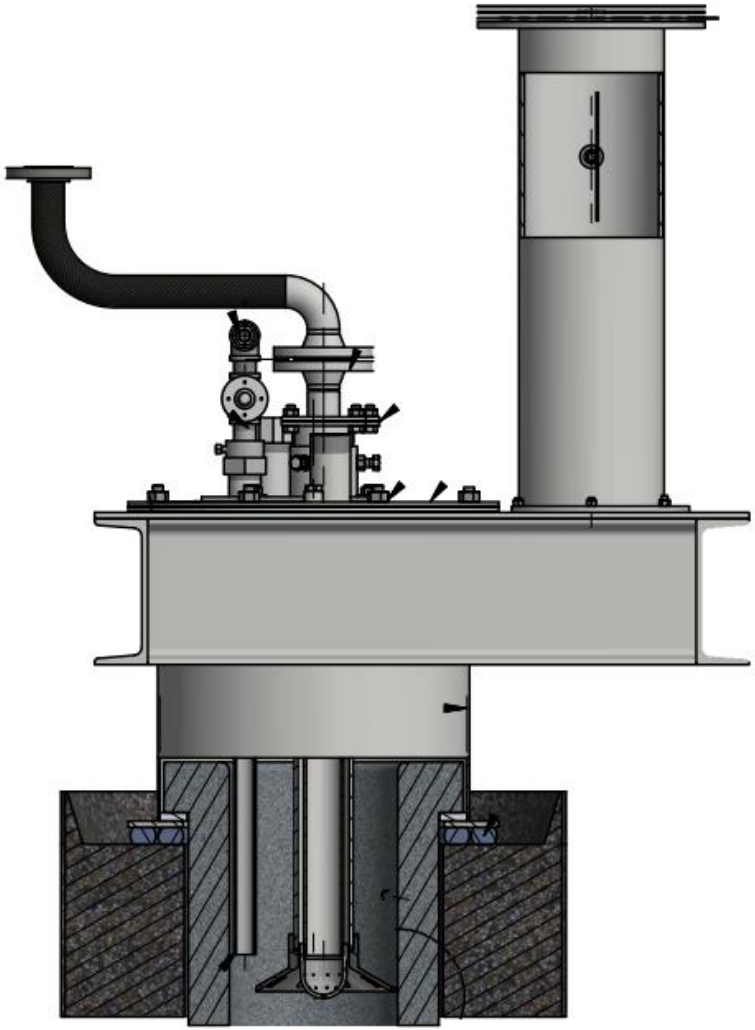


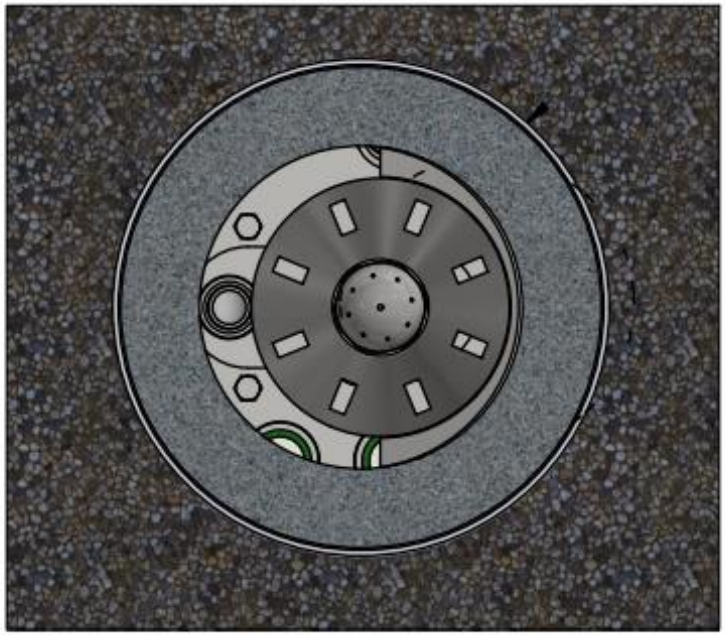
Burner Testing at ZEECO

- Combustion test performed at Zeeco Global HQ.
- Multi-burner testing to verify NOx emissions
- 80-90 mg/Nm^3 NOx
- Confirmation of no flame-to-flame interaction
- Proven flame stability at 1.1% O_2 (Dry Basis)

Zeeco Test Furnace

Burner General Arrangement Drawing





TILE VIEW

Installation

- Burners were installed early 2018
- Retrofit kits minimised installation time and labour requirements
- Burners utilised Zeeco ProFlame Scanners for flame detection
- Flexible hoses used for gas connections

Burner Performance

- Burners are achieving 90 mg/Nm^3 NOx which is significantly lower than the guaranteed NOx (120 mg/Nm^3)
- 2.0% O_2 measured in the flue gas
- No flame-to-flame interaction
- Improved heat flux profile
- Lower NOx possible if the heater excess oxygen is trimmed further

Conclusion

- Zeeco supplied 105 GB Single-Jet Inserts for a Downfired Reformer at a European Ammonia Facility
- NOx Emissions, Heat Flux Profile, and Flame-to-Flame Interaction were Confirmed by CFD and Burner Testing
- Current NOx Emissions average 90 mg/Nm^3 at 2% O_2 which meets European Legislation and NOx Guarantees
- Burners are Operating with Lower Excess Air Therefore Fuel Gas Consumption Rate is Lowered
- NOx Emissions can be Reduced Further if the Excess Air is Trimmed

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