HONEYWELL UOP CALLIDUS® CUBP BREAKTHROUGH LOW NO_x STEAM CRACKER BURNER

Leverage Breakthrough Low NO_X and Extreme Fuel Gas Flexibility[1] to Accelerate your Energy Transition for Steam Cracker Service

As regulatory requirements around NO_X emissions evolve, Honeywell Callidus Ultra-Blue Petrochemical (CUBP) burners provide the ability to cut your NO_X emissions in half[1], or more, while offering seamless flexibility to fuel your furnace with hydrogen and hydrocarbon gasses.

CUBP Steam Cracker Burner Firing 100% Hydrogen

The CUBP burner achieves low NO_X through a patent-pending technology called Targeted De-NO_X Gas Injection (TDGi™). The Honeywell burner is optimized for 100% hydrogen to 100% hydrocarbon fuel sources and achieves the lowest NO_X emissions when firing 100% hydrogen.[1] In addition to low NO_X emissions limits, programs for integrated petrochemical complexes addressing energy transition, hydrogen firing, reduced carbon emission, and carbon capture will require flexible operations across widely ranging fuels. The CUBP burner enables deliberate, stepwise progression through the multi-step process of energy transition in a petrochemical complex facility.

BREAKTHROUGH LOW NITRIC OXIDE (NO_X) EMISSIONS

CUBP burners enable integrated petrochemical complex operators to meet evolving NO_X emissions regulations and internal emissions targets. Achieving emissions reduction using CUBP burners significantly lowers capital and operating expenditures compared to conventional low NO_X technology.[2]

The CUBP burner does this through Targeted De-NO_X Gas Injection (TDGi™). which augments internal flue gas recirculation by drawing a very small amount of flue gas selectively from either the combustion chamber or stack, conditioning the flue gas and then injecting it optimally within the burner.

Breakthrough NO_X emissions eliminate the need for Selective Catalytic Reduction (SCR). In cases where SCR is still needed to achieve regulatory limits, the CUBP burner can lower the rate of ammonia reducing agent consumed. Additionally, CUBP burners can reduce the amount of catalyst needed, thereby reducing both operating and capital expenses.[3]

Honeywell UOP

CUBP burners can be retrofitted to operate in your existing furnace. If the furnace has existing Callidus burners, then a simple retrofit kit may be all that is needed, reducing downtime during turnaround. [4] If other brand burners are currently installed in the furnaces, UOP can conduct a feasibility study, including the review of the overall condition and soundness of the furnace, computational simulation or physical testing, as well as an evaluation and sizing of the TDGi ducting, fan, and exchangers.

OPTIMIZED FOR 100% HYDROGEN FIRING WITH EXTREME FUEL FLEXIBILITY

The CUBP burner is designed, tested and field-proven to fire on any combustible fuel gas mixture from 100% hydrogen to 100% natural gas and any hydrogen, hydrocarbon, or inert fuel gas blend in between. This fuel flexibility enables the energy transition to low carbon operations and carbon capture technologies.

CUBP burners operate the same as conventional burners. The rate of TDGi is factory proven and set, so often, no field adjustment or modulation is necessary. Operators simply turn the TDGi fan "on" for breakthrough lower NO_X or "off" for conventional low NO_X emissions. With TDGi "on" or "off," the burner operates as a conventional natural draft, forced draft, or induced draft burner.

Finally, CUBP burners achieve their lowest NO_X emissions, on both a volumetric and mass flow basis, when firing 100% hydrogen.

ENABLING THE ENERGY TRANSITION

In addition to low NO_X emissions limits, programs for integrated petrochemical complexes addressing energy transition, hydrogen firing, reduced carbon emission and carbon capture will require flexible operation across widely ranging fuels. Energy transition in a complex facility is not a single-step event into the future operating states. Real scenarios show there will be ongoing and continual migration between various proportions of hydrogen firing and hydrocarbon fuel firing – as corporate sustainability goals, regulatory environment, technoeconomic factors, and feedstocks change over time.

Thanks to its flexible fuel capabilities that allow two-way transitioning, depending on technoeconomic and regulatory changes, the CUBP burner enables the energy transition across integrated refinery and petrochemical complexes. Callidus Breakthrough Low NO_x Technologies, as incorporated in processes that may be utilizing pre-combustion (H_2 generation / purification) and post-combustion carbon capture, provide uninterrupted operation and annual revenue generation of up to $500,000 per steam cracking furnace. [8]

OPTIMIZED FOR CARBON CAPTURE TECHNOLOGIES

By installing the CUBP burner, even if the immediate focus is NO_X reduction, the heater system will be ready for energy transition, flexible high hydrogen fuels and post-combustion carbon capture.

Pre-combustion carbon capture generally delivers high-hydrogen fuel gases to the burners – and the CUBP burner is optimized for low-NO_X and low-carbon emissions that can often be vented directly to the atmosphere and meet necessary environmental goals.

Post-combustion carbon capture systems such as Honeywell UOP's Advanced Solvent Carbon Capture (ASCC) are most effective when the CO_2 emissions are concentrated while NO_X emissions are minimized. By directing concentrated hydrocarbons streams to the CUBP burners, CO_2 emissions are concentrated for the ASCC equipment.

FEATURES AND BENEFITS

- Breakthrough low NO_X emissions
- Reduces NO_X emissions by one half compared to conventional low NO_X burners
- Flexible fuel gas: 100% hydrogen fuel gas to 100% hydrocarbon
- Low maintenance, long runtime – Optimized for 100% Hydrogen Firing[5]
- Improved throughput conversion, efficiency, yield, and runtime for steam cracking furnace installations[6]
- Furnace thermal efficiency maintained even when firing hydrogen fuel gas with lower mass flow rates[5]
- Adaptive heating of process coils to extend runtimes between decoking cycles to drive profitability[6]
- Minimizes downtime during installation and turnaround[7]

SEE FOR YOURSELF

- Pre-qualify the technology to meet your performance requirements with performance testing
- Greatly reduce or eliminate project schedule and performance risk by addressing all design questions[9]
- Callidus can perform feasibility and suitability studies of any fired equipment
- Pre-award and FEED study performance validation testing available

NOTES

1. Reference CUBP performance test reports comparing the operation with (CUBP) and without (conventional low NO_x burner) targeted flue gas recirculation. The NO_x emissions are more than 50% lower than conventional low NOx burner.

2. By eliminating the need for a typical SCR with TIC of $2M and OPEX of $250k per year.

3. By reducing the size of the catalyst bed by approximately one half, the TIC can be $0.5M lower and OPEX reduced by $100k per year.

4. By retrofitting existing Callidus burners, the retrofit kit may consist of new gas tips, possibly a new tile that fits the existing burner mounting and some internal burner parts. When non-Callidus burners are retrofit, the heater cut-out, refractory and mounting to the burner may need to be modified, requiring more time and expenditure in turnaround.

5. The Callidus "bullet" gas tips have decades of service experience on high hydrogen, high temperature steam cracking service. The H_2 Optimized burner tile has years of field proven operation in steam methane reformer service with no failures. Reference lists available upon request.

6. By alternately and selectively switching firing between H_2 fuel and conventional hydrogen fuel, the peak heat flux location on the tubes is moved approximately 5-10 ft. Therefore, by switching fuels, the operator intentionally can move the peak coking location on the tube thereby coking a longer length of the tube before steam decoke is needed. Laying down coke over a longer length of tube means more coke can be laid down and longer run time between decoke can be achieved. Longer runtime between decoke increases efficiency. The capability to move and tailor adaptively the coke build up in the tubes allows operators to optimize for increased yield.

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8. By increasing runtime between decoke cycle from 60 to 90 days, decoke cycles are reduced from six to four days per year providing two additional days of continuous operation valued at approximately $25,000 per day. Runtime results and costs/value associated with decoke will vary site to site.

9. CUBP burner new installation or retrofit is significantly lower cost (>$2M CAPEX per heater) than installing an SCR. Moreover, SCR requires structural and plots space considerations and burner installation does not.

For more information
https://uop.honeywell.com/en/equipment-and-aftermarket-services/callidus-environmental-combustion-technology

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