CombustionONE™

Improving and Sustaining the Combustion Asset
Driven by the New Standards
Yokogawa Corporation of America announces a single source solution to improve the efficiency and safety of fired heaters in refining and petrochemical plants: CombustionONE — the clear path to operational excellence of the fired heater asset.

Supporting New Industry Standards

- INCREASE SAFETY
- INCREASE EFFICIENCY
- LOWER EMISSIONS
- LOWER LIFE-CYCLE COST
Yokogawa is known worldwide for high reliability—‘install and forget’—technology. There’s a reason that governments and industries around the world have invested in Yokogawa automation solutions for managing and controlling their process. We call it ‘seven 9’s availability’, or 99.99999%, the highest reliability and lowest lifecycle cost in the process automation industry. CombustionONE is part of the VigilantPlant Solution.

**ACT WITH AGILITY**
Free of bottlenecks
Reduce delays, lost opportunities, knowledge silos

**SEE CLEARLY**
Less blind spots
Avoid guesswork, instability, sub-optimization

**KNOW IN ADVANCE**
Minimize reactive measures, unexpected downtime, quality variations

Fewer surprises
CombustionONE — improving and sustaining the fired heater asset

Managing Combustion

Fired heaters have inherent risk and are generally operating at less than optimum efficiency. CombustionONE by Yokogawa dramatically increases the efficiency of fired heaters while improving their margin of safety. The integrated CombustionONE system combines new gas combustion measurement and control technologies into one solution that improves fired heater performance and life.

CombustionONE Functional Overview

CombustionONE simultaneously controls both the air and fuel supply to fired heaters by measuring average gas concentrations across the radiant section. Measuring a cross section average concentration of combustion gases, such as O₂ and CO, has only recently been available through the use of the Tunable Diode Laser Spectroscopy (TDLS). The CombustionONE solution incorporates a TDLS analyzer with a dedicated control system and a safety system that is certified to meet FM NFPA and SIL 3 standards. The four principal capabilities include:

- **Gas Concentration Measurement**
  Using TDLS technology in the radiant section

- **Process Control**
  Controlling fuel flow and air flow

- **Safety System**
  Preventing unsafe conditions from persisting

- **Sensing and Actuation**
  Measuring air flow at multiple locations

- **Combustion Interface Unit (CIU)**
  Interfacing with combustion control & safety system and performing startup and shutdown by using standard operation procedure (SOP)

Improving performance

Increase safety

Improve thermal efficiency

Lower greenhouse gas and pollutant emissions

Increase throughput

Extend fired heater life

Best Industry Practice

Second only to raw materials costs, energy is the leading cost pressure currently affecting manufacturers. New analysis techniques, such as tunable diode laser spectroscopy (TDLS), can improve efficiency, maximize throughput, reduce emissions, and improve safety and reduce energy in combustion processes.

ARC INSIGHTS, INSIGHT# 2009-50MP, November 2009
New Standards in Combustion Management

The rapid detection of combustibles – primarily CH₄ – in the radiant section of the fired heater is recommended by industry groups; however, traditional analyzer technology cannot be installed in the radiant section due to the high temperatures. Most fired heaters do not meet the new industry recommended best practice with existing instrumentation and manual control of the air supply. Plants not meeting the new industry guidelines are at risk in the event of an incident on a fired heater. Without accurate and frequent measurements of CH₄, O₂, and CO concentrations, operators tend to allow excess air in the heater for safety concerns, reducing its thermal efficiency. Using TDLS technology, CombustionONE enables producers to meet and exceed the recommended industry best practices for safe and efficient operation of fired heaters.

Due to the lack of effective air control, excess air is typically allowed into the fired heater, reducing its thermal efficiency.
The value of CombustionONE

Asset Sustainability

Providing air and fuel coordinated control on fired heaters, CombustionONE is a stand-alone package that delivers clear value and a rapid ROI. CombustionONE is a major step in improving fired heater safety, plant energy efficiency, reducing pollutants and greenhouse gas emissions, and improving process throughput. Together, the capabilities of the solution reduce maintenance and extend the life of fired heaters.

Safety
Increase Safety
- Detect burner flame-out
- Prevent risk of unstable combustion
- Detect leakage of fuel shut-off valve
- Prevent unnecessary trips

Efficiency
Increase Efficiency
- Reduce fuel consumption
- Minimize excess air
- Maximize radiant heat absorption

Throughput
Increase Throughput
- Reduce coking
- Prevent formation of hot spots
- Operate to burner specifications

Emissions
Lower Emissions
- Reduce pollutants: NOx, CO
- Reduce greenhouse gases: CO2

Extending the Life of Fired Heaters
Fired heaters — challenges for producers

- Higher costs as operators increase $O_2$ flow to avoid a fuel-rich atmosphere
- Unexpected demand for fuel, leading to unsafe combustion conditions
- Greater risk during a process upset
- The amount of excess air and unburned fuel may not be assessed correctly during process upsets or strong winds
- Wet steam introduced on startup, requiring a steam purge, risking ignition failure
- Shorter life of convection section with afterburning due to presence of combustibles

The solution — CombustionONE

- Reduced $O_2$ and lower operating costs as the fuel-air mixture is controlled
- Fuel is limited to the available air to prevent unsafe fuel-rich combustion
- Process upsets are handled with controlled combustion conditions
- $O_2$ concentration and unburned fuel is detected readily and controlled at optimum level during upset conditions and strong winds
- Automated purge steam drain ensures a hydrocarbon-free chamber for a safe light-off
- Shortening of tube life is prevented by maximizing radiant heat absorption and eliminating afterburning caused by combustibles

Photo courtesy of Selas Fluid Processing Corp.
Leveraging advanced technology

“CombustionONE is the only integrated solution that provides increased safety margins and greater thermal efficiencies, while reducing emissions. This means greater life and lower maintenance costs for our fired heaters.”

—A Major Gulf Coast Refining Company

Furnace Model

While operators attempt to maintain ‘excess’ O₂ in the radiant section for safety, the amount indicated from a conventional O₂ sensor may be incorrect due to tramp air. In fact, it is possible that the burners may be starving for air, despite excess oxygen at the stack base. Incorporating an improved model of combustion, CombustionONE is a self-contained solution that incorporates many variables simultaneously for optimum combustion management. Since gas concentration and temperature measurements are taken rapidly using TDLS technology, the combustion model simultaneously controls both the air and fuel supply to the fired heater. Apart from simultaneous control of fuel and air concentrations, it is possible for fuel-rich conditions to occur increasing the risk of explosion. When high levels of CO or combustibles exist in the radiant section, CombustionONE rapidly detects the condition and initiates the appropriate response.

Procedural Automation

An optional Standard Operation Procedure (SOP) capability is available with CombustionONE that steps the operator through...

- Start-up and shutdown
- Cleaning
- DeCoking

SOP is a pre-determined process that prompts and guides the operator through changes in the state of the fired heater. Based on an advanced, interactive graphic software, the SOP option enforces best practices for safe, orderly and consistent operation of the fired heater. Use SOP to capture and maintain the knowledge of your most experienced operators.

Built-in Standard Operation Procedure
Global, proven combustion technology

Built-in Reliability

The CombustionONE solution is based on high-reliability components and is available in a standard configuration or custom engineered packages. The CombustionONE team provides engineered solutions to meet any physical requirements, such as extreme climates, user utility panels, location of the heater, etc. Where physical and process changes to the fired heater are required, Yokogawa partners with leading engineering companies and furnace manufacturers to provide a total solution.
A turnkey solution

Typically, the installation of CombustionONE on a fired heater is straightforward. As the Main Automation Contractor (MAC), Yokogawa manages the implementation and installation of the field automation solution, including third party products and services. Where needed, Yokogawa provides a single point of responsibility for all aspects of the project, including modifications and refurbishment of the fired heater.

The CombustionONE team will help you align the project scope with the expected benefits, resulting in greater ROI. The CombustionONE survey team can identify the particular fired heaters that will best benefit from CombustionONE and also recommend a sequence of implementation on multiple fired heaters. When projects require multiple simultaneous installations of CombustionONE on a site, Yokogawa applies a structured project methodology to ensure project quality and manage risk. The methodology employs comprehensive stage gates that ensure the highest reliability.

Benefits from Yokogawa

- **Single source provider** - automation, heater hardware and mechanical services
- **Maximum project ROI** - greatest value at lowest life cycle cost
- **Shorter project schedule** - minimum process downtime
- **Sustained support** - for the fired heater asset
Sustaining fired heater performance

Getting Started

Offering an integrated, lifecycle solution for upgrading and sustaining the fired heater asset, Yokogawa has partnered with Selas Fluid, one of the world’s leading suppliers of industrial fired equipment. Selas has over 4,000 furnace and heater installations worldwide and the engineering expertise to address any requirement. Through our partnership with Selas Fluid, Yokogawa provides a single point of responsibility for any and all upgrades that may be needed to bring your fired heaters to best industry standards and practices. Our joint methodology follows:

- Conduct an initial site survey
- Analyze site information and generate a report of findings
- Provide turnkey design that increases safety and efficiency
- Implement the design by providing installation and start-up assistance
- Sustain the fired heater asset through continuous support

Continuous Support

Fired heaters are important units to operations and producers must be able to depend on the continuous, safe operation of fired heaters. Complementing the CombustionONE solution, Yokogawa offers continuous support of the total fired heater asset, including:

- Periodic heater inspections
- Engineering design and fabrication
- Heater repair and improvements
- CombustionONE system updates
- Remote diagnostics of heater performance
- Remote and on-site assistance

The Yokogawa Continuous Support Program brings fired heaters up to the latest best practices, while improving the performance and extending the life of the asset.
CombustionONE™

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For More Information
Contact Us: CombustionONE@us.yokogawa.com

VigilantPlant is Yokogawa’s automation concept for safe, reliable, and profitable plant operations. VigilantPlant aims to enable an ongoing state of Operational Excellence where plant personnel are watchful and attentive, well-informed, and ready to take actions that optimize plant and business performance.

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