

# Seeking the perfect flame

by PeriFlame, USA

*As economic and environmental regulations lead to the need for better fuel burning efficiencies, the combustion industry continues to face challenges to provide solutions that satisfy ongoing market demands.*

**M**ore stringent environmental regulations and depleting fossil fuels are expected to lead to increased operational costs. The requirement to reduce CO<sub>2</sub> and NO<sub>x</sub> emissions also drives the need for improved combustion process efficiencies. US-based combustion technologies specialist PeriFlame has been engaged in various equipment upgrades as well as new process builds across a wide range of industrial sectors, including the cement industry.

## All in the flame?

Improving the quality of clinker heat treatment is one of the main challenges for the cement industry. The eminent criteria for product quality are the ability to satisfy temperature and chemical pattern requirements for the product's thermal treatment. More specifically, maintaining temperatures along the kiln's length and cross-section, as well as the ability to quickly and accurately regulate it are of key importance.

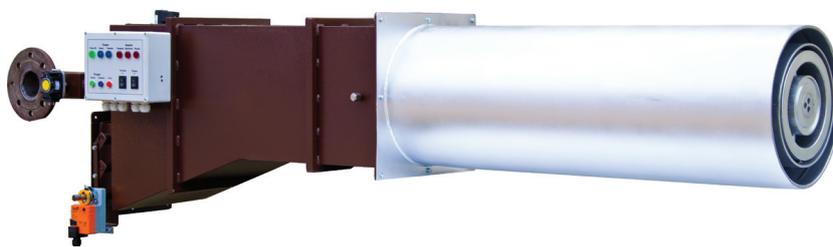
The solution partially depends on a kiln's design but is also heavily influenced by a flame's shape and the thermo-chemical parameters of its volume. In addition, exceptional flame stability (no flame-out or flame disruptions) and flame manoeuvrability during burner regulation are the two major operational requirements. Vast flame dependency makes the kiln burner one of the most important devices in the clinker's heat treatment process.

## Burner characteristics

PeriFlame's MD Burners product lines offer effective heat treatment efficiency thanks to the following:

- exceptional flame stability and the exclusion of flame-out/disruption for the 20-100 per cent capacity range, regardless of flame shape and volume. This is achieved by using a proprietary system

Stricter environmental regulations and limited fossil fuel resources are driving the need for improved burner design



that controls aeration of the flame base and microdiffusion combustion mechanism at the flame stabilisation zone.

- ability to instantly change the shape and length of the flame, while maintaining a constant heat output by switching the gas supply between two or three burner collectors. This option is available within the 40-100 per cent capacity range.
- ability to control flame length while reducing heat output using an aerodynamic nozzle. Burners sustain reliable operation at a flame length of 3-25m with diameter from 0.5-3m.
- use of an internal two-stage combustion

set-up in the flame stabilisation zone and coaxial feeding of secondary air to further suppress NO<sub>x</sub> emissions.

## Challenging stereotypes

The technological basis of MD burner design defies the widely-accepted flame structure stabilisation stereotypes and uses a proprietary straight-flow topology, allowing it to accurately define, improve and manage combustion processes. This approach provides design flexibility, taking into account relevant influences and enabling tailor-made solutions, thus providing optimal combustion.

PeriFlame's burner design uses a proprietary straight-flow topology



Consequently, customers can benefit from a reduction in fuel costs and waste heat by as much as 10-20 per cent.

"Our straight-flow design along with microdiffusion combustion mechanism of flame stabilisation provides exceptional flame stability and manageability over the full capacity range. Precisely-defined flame configuration decreases thermal pollution and fuel costs and alleviates flame impingements. Meanwhile, an internal two-stage combustion schema reduces NO<sub>x</sub>," explains PeriFlame's director of engineering, Yuri Kryzhanovskiy.

### Cement sector installations

PeriFlame has contributed to several combustion equipment upgrades as well as new projects across North America, Europe and central Asia over the past decade. Gas burners for rotary kilns (MD-G-RK product line) ranging in capacities from 10M-50MW are installed and used in 20, 40 and 80m-long kilns in Europe and central Asia.

A recent modernisation project in Kazakhstan enabled a domestic cement producer to reduce fuel costs by using a MD-2500-G-RK burner. Prior to this upgrade, the cement plant had been experiencing high fuel and operational costs, as well as frequent burner failures, which directly translated to high raw material costs. Essentially, the customer wanted to reduce thermal pollution, fuel costs and stoppages caused by the malfunctioning burners. As a result, the MD-2500-G-RK was engineered to run on natural gas, providing 32MW of capacity and producing a 22m-long flame. The burner delivers a transparent flame for two-thirds of the flame's length over the entire capacity range with maximal convective heat transfer. As a result, exhaust temperatures were reduced, and ultimately thermal pollution lowered.

### Dual-fuel burners and alternative fuels

There has also been increased demand for better dual-fuel burning technology as the rate of alternative fuels usage increases.

For combustion equipment, one of the main challenges of burning heavy oils or waste oils is providing a stable and manoeuvrable flame over the full capacity spectrum. PeriFlame addresses these challenges by using a proprietary system of pneumatic and steam atomisers. Flexibility in its atomiser capacity range allows MD burners to deliver a flame with a wide gamut of flame length adjustment.

In addition, the pneumatic atomiser system allows regulation and adjustment of flame parameters without negatively influencing combustion characteristics. These advanced combustion features are made possible by a proprietary topological schema design, which shows that combustion completeness is not dependent on fuel pressure and is solely managed by the atomising agent (air or steam) pressure.

### Breaking with convention

Based on PeriFlame's experience, combustion equipment that uses the widely-accepted flame stabilisers is mostly restricted by a conventional topological burner schemas, configurations and spatial parameters, rather than the properties of the fuel used. PeriFlame provides combustion equipment solutions that allow for process modernisation and improved performance. ■

# PeriFlame

## Industrial Combustion Technologies and Solutions

PeriFlame-OEM Offers Industrial Combustion Equipment for all industrial use cases, including:

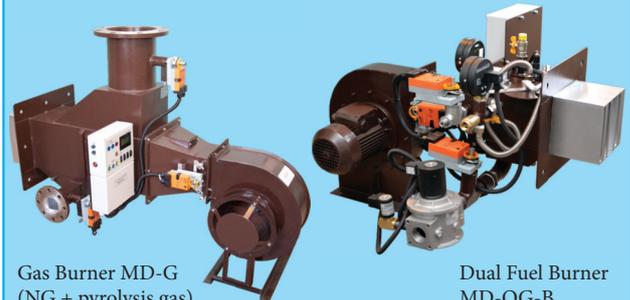
- Heating Boilers
- Steam Generator Boilers
- Technological furnaces
- Dryers
- Oil reforming
- Degassing mines
- Rotary Kilns.



MD-G (Natural Gas)

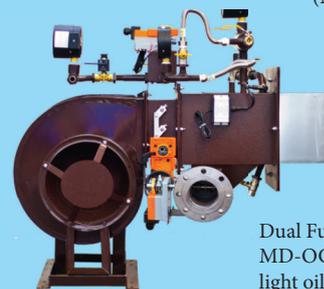
PeriFlame's engineered MD product lines are based on PeriFlame's proprietary, industry-tested combustion technology "MCT". Our equipment delivers clean, safe and efficient combustion experience each and every time. PeriFlame's products are tailored to our customers' environments. By optimizing efficiencies and improving performance reliability we enhance combustion processes.

PeriFlame's MD-G, MD-O and MD-OG product lines offer a wide range of burner models. MD burner lines support all fuel-types and offer a gamut of customizable equipment options. Single unit capacities 0.3MW-100MW.



Gas Burner MD-G  
(NG + pyrolysis gas)

Dual Fuel Burner  
MD-OG-B  
(NG + heavy oil)



Dual Fuel Burner  
MD-OG-B (NG +  
light oil)

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