

COMBUSTION CONTROL Metal

Energy & Environmental Solutions for Metal Manufacturers



- Fuel Savings
- NOx Reductions
- Higher Product Quality
- Longer Refractory Life
- Reduced Tooling Costs
- Multi-Fuel & Waste-Fuel Control

Proven technologies for: **Steel Reheat** **Aluminum Melting** **Forging** ...And More

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Where Does the Real Problem Lie?

In any combustion reaction, oxygen and fuel are mixed to give off heat and combustion products. Typically a fuel, such as natural gas or oil, is combined with air. Air contains only 20.9% oxygen with the remaining 79.1% consisting of nitrogen and other gases that are not required for combustion. These other components detract from the combustion process by absorbing heat, causing lower efficiency, and creating emissions.

A combustion process may run with high levels of excess air (oxidizing) and still heat the billets. The excess air contributes to pollution (NOx) and causes quality defects: metallurgical and high scaling. On the other hand, running at too low a level of excess air (reducing) creates problems at the other end of the spectrum. Insufficient oxygen causes raw fuel to flow up the stack. This situation creates waste and air pollution, damages the refractory and contributes to quality defects. In most combustion processes, it is safest running with excess oxygen and it reduces the amount of wasted fuel.

The Solution **“Measure where it matters!”**

There are two major types of oxygen analyzers found in the steel industry: low temperature, sampling types (extractive) and low/high temperature in-situ sensors. Both types work in steel reheat furnaces but excessive maintenance limits the usefulness and reliability of the extractive units. Heaters, pumps, sample lines and cells require continuous attention. Regular calibration services are a must. The filter system of the pumps must be cleaned periodically due to moisture in the hot gases.

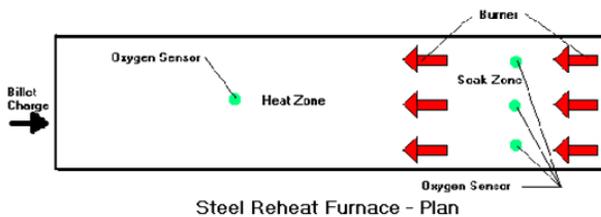
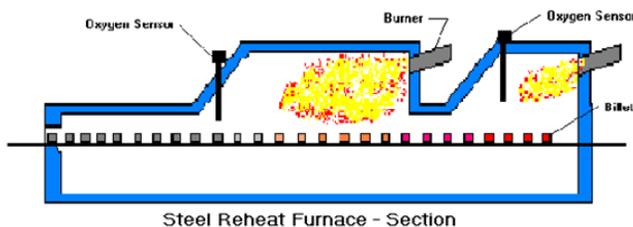
The low temperature in-situ unit is a direct reading sensor without pumps and sample lines. Temperature limitations of the sensor require that it be installed in an area downstream from the combustion zones. The measurements include the combustion excess oxygen plus all air in-leakage in the

ductwork. This does not allow the accuracy required for very efficient tight control. Maintenance is also required because of heaters and regular calibration services.

Using high temperature in-situ sensor solves these problems. High temperature in-situ oxygen sensors do not require pumps, heaters, filter systems, calibration, etc. The sensors are located in the furnace where the combustion is complete, preferably in the heating zone and soak zone. Proper installation of the sensor will ensure its performance. Continuous oxygen monitoring improves the consistency of product quality and reduces maintenance costs by highlighting faults and burner imbalance. While monitoring has its benefits, the true Return on Investment is realized when oxygen is controlled for optimized combustion.

In addition to savings through combustion optimization, users can migrate from expensive single fuels enabling them to control the BTU content for mixed fuels: waste gases fortified with natural gas. By measuring oxygen in the combustion zone of the furnace, users can react quickly to the changing BTU content of mixed fuels and maintain optimal furnace conditions.

By tightly controlling the excess oxygen and combustion processes, users will see other benefits that can save significant amounts of money. Scale production on steel is greatly minimized with tight oxygen control providing better product and reduced tooling costs. In addition to reduced scale, maintenance shutdown schedules can be reduced due to increased refractory life and reduced wear on the furnace from uncontrolled combustion.



Results: Cost Savings + Eco-Efficiency

The recurring cost of sensors is low compared to the operating expense of the reheat furnace. Fuel savings and emissions reduction are established using a well-accepted rule of thumb from burner manufacturers. Above 1500°F, fuel savings is 1-3% for every 1% reduction in excess O₂. Each 1% reduction in excess O₂ leads to 20% reduction in NO_x emissions. Continuous excess oxygen measurement provides a tighter, more responsive air/fuel ratio resulting in more consistent quality, reduced operating costs and reduced emissions.

Do the Math

**1% Drop in Excess O₂
Equals
1-3% in Fuel Savings &
20% Reduction in NO_x**

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