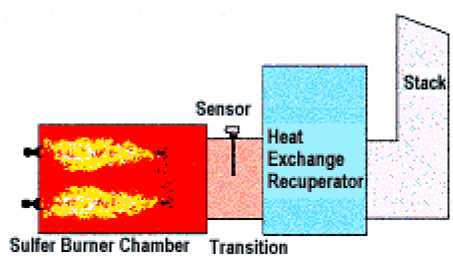
PROBLEM:

In any combustion reaction, theoretically there is a required volume of oxygen to react with a given amount of fuel. Typical combustion systems mix a fuel, such as natural gas or oil, with air. Unfortunately, air contains only 20.9% oxygen. The remaining 79.1% consists of nitrogen and other gases that are not required for combustion. These detract from the combustion process by having to be heated and causing lower efficiency.

A combustion process may be run with high levels of excess air. However, this wasted fuel contributes to pollution and causes quality defects. On the other hand, running at too low a level of excess air will create 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 metal parts, and contributes to quality defects. In most combustion processes, it is safest running with excess oxygen. The level of waste is about twice as high on the fuel rich side of stoichiometric combustion as it is on the fuel lean side. Therefore, it is best to run with slightly excess oxygen to ensure against the possibility of the more wasteful, reducing conditions.

The objective of the chemical industry today is to lower emissions while increasing a plant's performance. Burner tuning is an essential element in this strategy. Accurate control of combustion air and fuel ensures the proper ratios that yield more complete and stable combustion. This achieves a cost-effective NOx emissions control and allows the plant to become a fuel efficient, low cost producer.



Sulfuric Acid Process

SOLUTION - "Measure where it matters!"

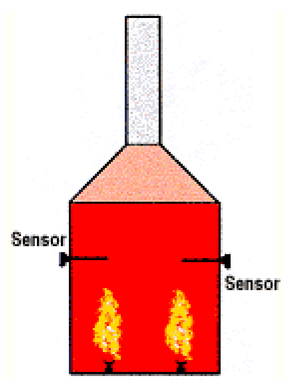
There are two major types of oxygen analyzers found in the chemical industry: low temperature, sampling types (extractive) and high temperature in-situ sensors. Both types work in furnaces, but excessive maintenance limits the usefulness and reliability of the

United Process Controls Inc.
6724 South 13th Street
Oak Creek, WI 53154 USA
+1 414 462 8200 | sales.na@upc-marathon.com

extractive units. Maintenance is required because the temperatures and process components combine to produce a very destructive environment for any equipment. 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 introduction of the high temperature in-situ oxygen sensor has virtually eliminated these problems. In-situ oxygen sensors do not require pumps, heaters, filter systems, calibration, etc. The sensor must be in the furnace where the combustion is complete. The preferred locations include the combustion chamber. Proper installation of the sensor will insure its performance.

By using multiple sensors, operations will be able to divide the combustion section into zones for burner balancing and tuning. This will pinpoint problem areas in the furnace and help to eliminate hot spots. Man-hours are reduced as a result of no calibration requirements, taking measurements with a sample system, or general maintenance. Continuous oxygen monitoring will improve the consistency of product quality and reduce maintenance costs by highlighting faults and burner imbalance.



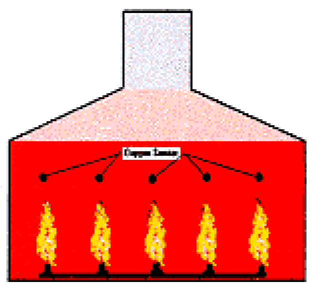
Typical Process Heater

RESULTS - "**Become a low cost, highly efficient chemical producer.**"

The cost of sensors is generally very low compared to the operating expense of the process furnace. Fuel savings are established by using a well-accepted rule of thumb from burner manufacturers. Above 1500şF, approximately 1.0 to 2.0% in fuel will be saved for every 1% reduction in excess oxygen. Generally, savings of 1 - 3% in fuel costs can be expected. Continuous excess oxygen measurement will provide a tighter, more responsive air/fuel ratio to be maintained. The result is more consistent quality.

Burner tuning is an essential element of the Chemical Strategy. Burner balancing is an important piece of the puzzle. Balanced oxygen levels reduce excess air requirements, excess NOx emissions, and hot spots. Reducing conditions are controlled to preserve the furnace refractory and metal parts. Air pollution is also a big advantage of using sensors. NOx formation is influenced by exhaust temperature, fuel level, and excess oxygen. Lowering excess oxygen will lead to lower emissions.

The high temperature oxygen sensor has been established as dependable and simple to use. It is considered a good choice to insure consistent excess oxygen in the process furnace. With the uncertainty of the gas composition being delivered to a facility, it is essential to control the air/fuel ratio to minimize emissions, maximize fuel efficiency, and maintain the standard of quality required by the chemical industry.



Process Heater - Side View