

Furnace Tube Measurement

Production of Hydrogen in Oil Refineries



Q

Question

How do you measure tube wall temperatures in reformer furnaces to insure maximum operating efficiencies, increase tube service life, and improve safety?

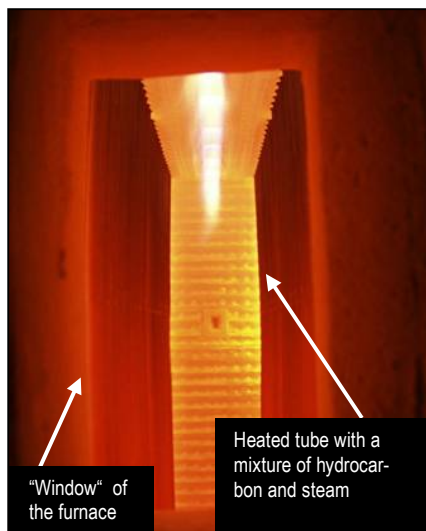


A

Answer

Situation Analysis

High-temperature reformer furnaces in petrochemical plants convert steam and hydrocarbon (i.e., methane) into hydrogen by heating this mixture in the presence of a catalyst inside banks of tubes in large furnaces. Monitoring the surface temperature of the reformer tubes is a critical parameter for maximizing the through-put of the furnace (higher temperature = greater through-put) and extending the life of the tube (lower temperature = longer life). Typical furnace tubes have a design life of 100,000 hours. Tube life is halved for every 20°C (68°F) temperature rise above the designed operating temperature of the tube material. Stressed or cracked furnace tubes can result in catastrophic failure, leading to equipment damage and injury to plant personnel. Tube wall temperatures are typically 850 to 1000°C (1562 to 1832°F). Heat is transferred to the tubes from burners and the refractory walls of the furnace. Because the furnace refractory and flames are much hotter than the tube wall, measuring the tube temperature with an infrared thermometer is difficult. Visual access to the furnace tubes can also be a challenge. Furnaces are designed with strategically placed viewing ports, but the distance to the nearest tube can sometimes exceed 6 m.



"Window" of the furnace

Heated tube with a mixture of hydrocarbon and steam

*View through a furnace viewing port at a heated tube of the steam-reformer**

- Measuring Temperature Range: 850 to 1000°C (1562 to 1832°F).
- Reformer Tube Diameter: 10 to 20 cm
- Distance to Reformer Tubes: 1,5 to 6 m

A

Answer

Solution and Improvements

The Raytek 3iPlus portable IR Thermometer provides the following features and benefits: A temperature measurement range of 600 to 3000°C (1112 to 5432°F) and 1 μ spectral response is ideal for natural gas-fired furnaces (visibly clean combustion atmosphere), especially if the furnace wall temperature is only a few hundred degrees hotter than the tubes.

The 180:1 Distance to Spot Ratio allows accurate measurement of small diameter tubes at extreme distances.

The built-in Background Temperature Compensation is a critical feature to correct the reflected background radiation from the “hotter” furnace walls. The result is a corrected tube wall temperature (cool target) measured in a “hot” environment.

The Onboard Data Logger allows storage of 100 tube temperature data points for downloading into a database for trend analysis.



Raytek 3iPlus with Scope and Laser

Raytek Product

Raytek 3iPlus

Benefits

- Increased Tube Lifetime
- Improved Safety

Accessories

- Nylon Carry Case with Shoulder Strap
- Hard Shell Case

For customized solutions to your process, please contact:

www.flukeprocessinstruments.com

Raytek®
Fluke Process Instruments