Application Note 3.1.5
Sulfur Thermal Reactor

Innovators In Noncontact Temperature Measurement

Sulfur is produced as a byproduct in the petrochemical, paper, and ore processing industries. This element is extracted from the process stream in an important effort to keep the emission streams clean. The thermal reaction that removes these gasses from the process stream is exothermal, meaning that it creates heat once the process has begun. As a result, there are several reasons to monitor the temperature of the thermal reaction.

Benefits

- Allows the process to be run efficiently at high temperatures with the assurance that refractory wall temperature is at a safe level.
- Eliminates troublesome thermocouples.

The thermal reaction is more efficient when run at higher temperatures, and the gas stream may be run through more quickly; therefore, there is tremendous incentive to run the process hot. Indeed, many plants inject oxygen in an effort to raise operating temperatures and to increase process capacity. However, the refractory walls of the vessel degrade at excessive temperatures. Therefore it is essential that the process temperature be closely monitored. These gasses are highly toxic, and therefore the safe operation of the process is highly critical.

Technical Features

- Broad Temperature Span
- No Moving Parts
- No routine calibration
- Optimum Wavelength Selection prevents interference from process gasses.
- No active cooling required.
- Dramatically Reduced Optical Contamination.
- Convenient Fiber-Optic configuration.
- Includes optional start-up thermocouple

The Williamson thermal reactor monitor represents a significant improvement over competitive products (E-Squared-T, for example). The fiber optic configuration eliminates the need to cool the sensor, and the warmer mounting assembly dramatically reduces condensation along the optical path. The Williamson wavelength is further optimized to better view through the process gasses and to reduce interference caused by optical obstruction. The Williamson sensor uses modern electronic components that do not require routine maintenance or calibration. An improved mounting assembly provides easy installation and removal when maintenance is required.

Recommended Williamson Model(s)

Refractory Wall Temperature
SRU2F-60-00-N4 Standard Configuration, NEMA4 version, 400-3000 F / 200-1650 C
SRU2F-60-00-N7 Standard Configuration, NEMA7 version, 400-3000 F / 200-1650 C
SRU1F-50-00-N4 High Performance Configuration, NEMA4 version, 700-3200 F / 375-1750 C
SRU1F-50-00-N7 High Performance Configuration, NEMA7 version, 700-3200 F / 375-1750 C
Process Gas Temperature
PRO 45-20F-00-N4-NSO256,320-FM2C (NEMA4X Environmental Rating)
PRO 45-20F-00-N7-NSO256,320-FM2C (NEMA7X Environmental Rating)
Flame Temperature
Traditional Dual-Wavelength **81-65** or Fiber-Optic Dual-Wavelength **91-65**, **N4** or **N7** configuration.

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A Comparison of Williamson and E2T SRU Refractory Wall Sensors

Feature	Williamson	E2T
Performance		
Broad Temperature Span	**400-3000 F / 200-1650 C**	**400-3000 F / 205-1650 C**
Sensor Calibration Accuracy	**0.25% of reading**	**1.0% of reading**
Repeatability	**1.0 C**	**0.20%**
Routine Periodic Calibration	**Not required**	**Required***
Long term drift free operation	**Excellent**	**Poor**
Wavelength Selection	**Optimized for SRU gasses**	**Optimized for SRU gasses**
Installation	**Fiber optics on mounting flange assembly**	**Complete sensor assembly on special hinge bracket**
Ease of Use	**Built in digital temp in sensor**	**Remote meter in control room**
Active Cooling	**Not Required**	**Required**
Ambient temp limits	**Fiber optics up to 400 F / 200 C**	**40-120 F / 5-50 C Max 200F / 95 C with water cooling**
Hazardous Environment	**UL/CSA/CEN/ATEX certification**	**CSA / ATEX certification**
Power	**24vDC**	**110 or 220Vac**
Start up temp capability	**Thermocouple assembly**	**Thermocouple assembly**
Sensitivity to Optical Contamination	**Up to 30% Reduced**	*******
Interface		
Output Signal	**Yes**	**Yes**
Alarm	**Yes**	**No**
Local and Remote Displays	**Yes**	**No**
Optional Remote Interface	**Yes**	**No**
Stand-Alone Capability	**Yes**	**Yes**

* E2T sensors are prone to calibration drift and require expensive and inconvenient routine calibration services. Williamson sensors are highly stable and do not require routine calibration.

** E2T sensors include a rotating motor assembly that is prone to failure in the hostile corrosive SRU atmosphere.

*** The fiber-optic Williamson system is less sensitive to optical obstruction and misalignment compared to the E2T system, and because the E2T system is cooled, more condensation tends to form on the viewport when an E2T system is used. The fiber-optic Williamson system allows the viewport to get warm, and so less condensation forms, further reducing potential measurement errors.

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SRU Sensor Selection Guide

Sensor Overview

The Williamson SRU Sensor monitors refractory wall temperature to prevent overheating and to maintain constant operating conditions at or near peak efficiency.

Sensor Enclosure Type	*Temperature Span*
N4 - For use in areas classified as non-hazardous	**32-xx** - Standard Temperature Span 400-3000 F / 200-1650 C
N7 - For use in areas classified as hazardous. (CENELEC Approved)	**31-xx** - High Temperature Model 700-3200 F / 375-1750 C
	Non-Standard Spans Available upon Request.

Optional Accessories:

IM - Remote Interface Module
PS - Power Supply

Common SRU Measurements

Refractory Wall Temperature: Once ignited, the Sulfur Recovery Unit is self-heating and the process is most efficient at the high temperatures associated with high flow rates. Excessively high operating temperatures, however, threaten the refractory life. The maximum process temperature and throughput is, therefore, limited by the thermal limit of the refractory brick. In most cases, the process is kept below 3000 F / 1650 C in order to prevent premature refractory wear. For high-throughput reactors, the temperature is kept very close to the design limit for the refractory wall. For these reasons, a precise measure of the refractory wall temperature is essential for the efficient and safe operation of the SRU and represents the most important process temperature.

Process Gas Temperature: Plants that have traditionally monitored the process using thermocouples often wish to replace these problematic sensors with non-contact infrared thermometers. Thermocouples have trouble surviving the high-temperature and highly acidic atmosphere. Non-contact infrared thermometers are able to measure process gas temperature from outside the process chamber, and so the maintenance issues associated with failed thermocouples are eliminated.

Flame Temperature: Plants that augment the process with oxygen in order to create a higher temperature flame often monitor the flame temperature in order to control the amount of oxygen introduced to the flame.

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