

Rotary Kilns

Lime | Cement | Iron Ore

Dynamic Temperature Control

Industrial Rotary Kilns are primarily used in cement, lime, and iron ore processing. These furnaces use direct flame-fired heating methods to remove volatile compounds, instigate chemical reactions, and fuse powder into pellets.

The material is rotated as it moves through the kiln, in order to evenly heat said material without relying on conduction. There are six relevant temperature measurements throughout the Rotary Kiln. These six measurement areas are the Shell & Under Tyre, Product Entry, Mid-Zone, Flame Temperature, Product Discharge, and Conveyor Belt Protection. Inaccurate heat measurements in any one of these areas can result in major equipment damage, product irregularities, production lags, and toxic fume build-up. Rotary Kilns present several temperature measurement challenges including harsh optical obstructions, varying measurement sizes, and hostile operating conditions.

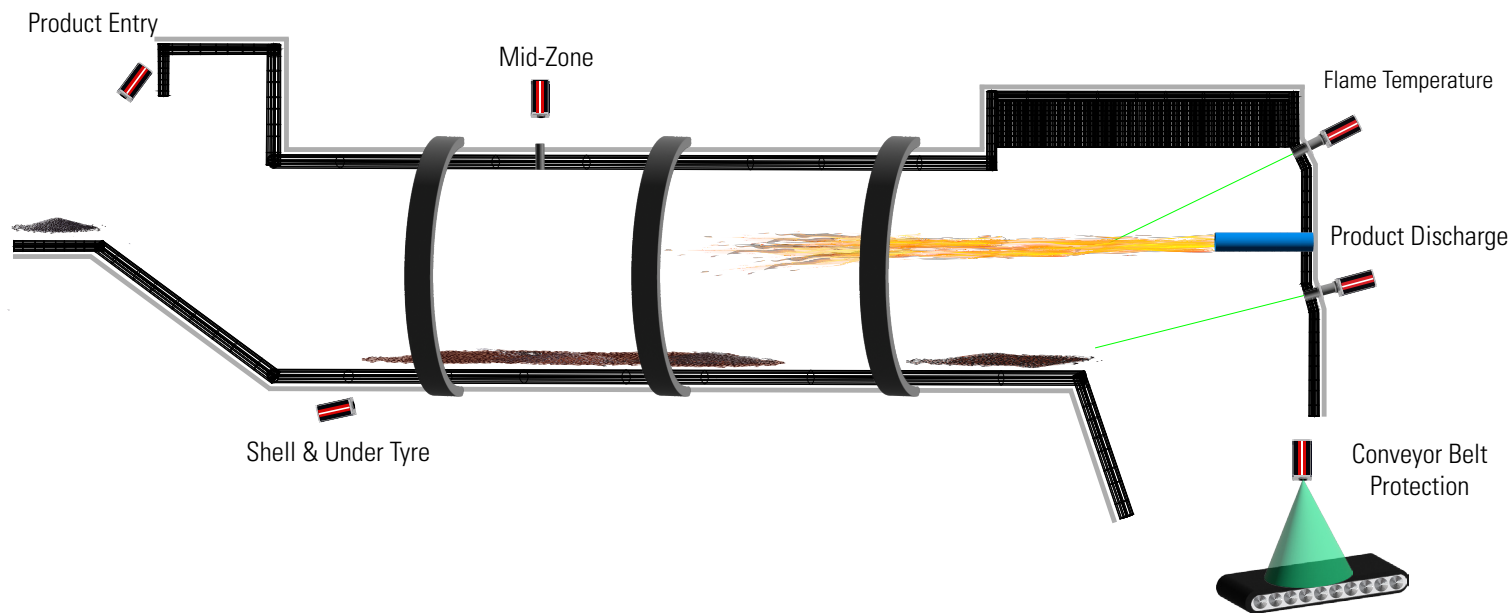


Williamson Wavelength Advantage

Using carefully selected narrowband wavelengths to view through smoke, flames, dust, and moisture, Williamson pyrometers provide unequalled accuracy and repeatably across all crucial Rotary Kiln temperature measurements.



Multi-Point Temperature Control



Recommended Technology

Rotary Kiln Measurements	
Shell + Under Tyre	SW-2A
	LW-GP
Product Entry	SW-2A
	SW-22
Mid-Zone	SW-16
Product Discharge	SW-16
Flame Temperature	DW-08
	SP-FC
	SP-FH
Conveyor Belt Protection	HSP-20
	HSP-29
	HSP-GP



Measurement Overview

If the refractory lining the Rotary Kiln overheats or is damaged in any way, hot spots appear on the kiln's outer shell. Detecting these hot spots is crucial in maintaining the kiln's structural integrity, preventing costly downtime, & protecting worker safety. Infrared pyrometers are often used to monitor shell temperature & identify hot spots before they become a problem. Rotary Kilns also have cylindrical steel castings, known as tires, attached to the shell, which obstruct the shell monitoring system. If a hot spot forms under a tyre, then the instrument will not detect it. Consequently, a local hot spot monitor should be installed at each tyre.



Pro - Series

Williamson Short-Wavelength (SW) pyrometers are optimized to identify hot spots by providing positional information while viewing a relatively large area. Pyrometers are installed at each tyre, to provide local hot spot detection in this hard to reach measurement area.

Williamson Wavelength Advantage

Pyrometer Benefits

- Protects Equipment -- Prevents Shell Warping
- Eliminates Production Lags
- Works in tandem with Thermal Imaging Systems to view behind & under Tyres along the Shell

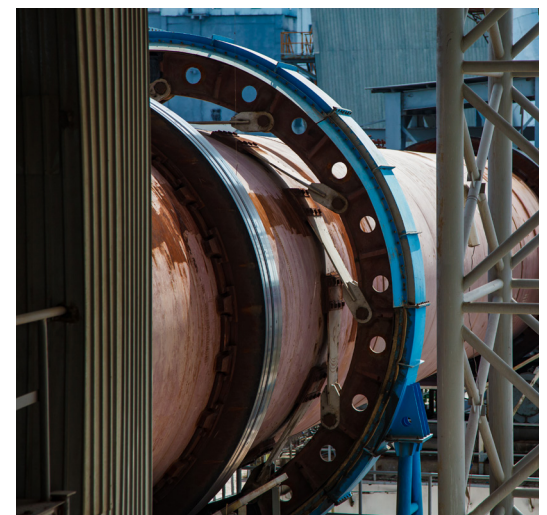
Wavelength Technology

- Short-Wavelength **SW** Technology is 4X more sensitive to hot spots compared to LW technology
- **SW** provides early hot-spot detection
- Carefully selected wavelengths tolerate rain, fog, & snow
- Tyre pyrometers view behind difficult obstructions

Recommended Model

Standard Configuration	SW-2A-32
Alternative Configuration	LW-GP-20

For facilities that must measure below 200°F// 95°C



Measurement Overview

Aggregate Materials are preheated using hot process gases that flow through the kiln & into the preheat zone. Aggregate material temperature at the Product Entry is used as a critical process parameter to achieve desired heat distribution throughout the Rotary Kiln. This important measurement often presents heavy dust, debris, & fluctuating air pressure.

Williamson Short-Wavelength pyrometers use a carefully selected narrowband wavelength that tolerates severe optical obstructions & broad temperature ranges.

As a result Williamson's Short-Wavelength SW pyrometers provide unequalled accuracy & repeatability at the Rotary Kiln's Product Entry.

Williamson Wavelength Advantage

Pyrometer Benefits

- Ensures Consistent Process Conditions
- Makes Accurate Product Entry Temperature Readings
- Provides Important Feedback for Kiln Heat Distribution

Wavelength Technology

- Short-Wavelength **SW** Pyrometers tolerate severe levels of common optical interferences
- **SW** Technology is 4X more sensitive to hot-spots compared to Long-Wavelength **LW** technology
- Provides broad temperature span

Recommended Model

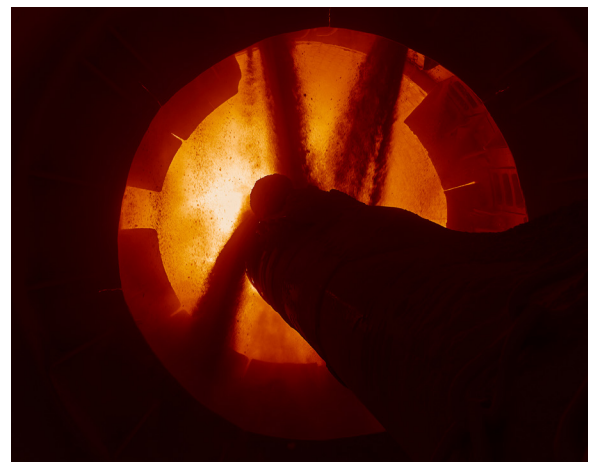
Standard Configuration

SW-2A-30

Alternative High-Temp Configuration

SW-22-37

For facilities that need to measure above 1000°F // 540°C



Measurement Overview

Aggregate Material temperature in the Mid-Zone provides important process efficiency & heat distribution feedback.

Underheated materials can compromise product quality, while overheated materials indicate fuel waste & potential equipment damage. Tight mid-zone temperature control improves production efficiency, decreases input costs by minimizing fuel waste, & helps ensure consistent product quality.

Because Rotary Kilns are extremely long, it is often difficult to obtain accurate mid-zone temperature measurements from the ends of the kiln. Instead, measurements are taken once per rotation from the side of the kiln using a closed-ended viewing tube.

Williamson's Short-Wavelength (SW) pyrometers use high resolution optics & "peak hold" settings to produce highly accurate mid-zone temperature measurements with each rotation.



Williamson Wavelength Advantage

Pyrometer Benefits

- Enables Precise Process Control
- Improves Production Efficiency
- Ensures Accurate Temperature Measurements - 5ms Response Time

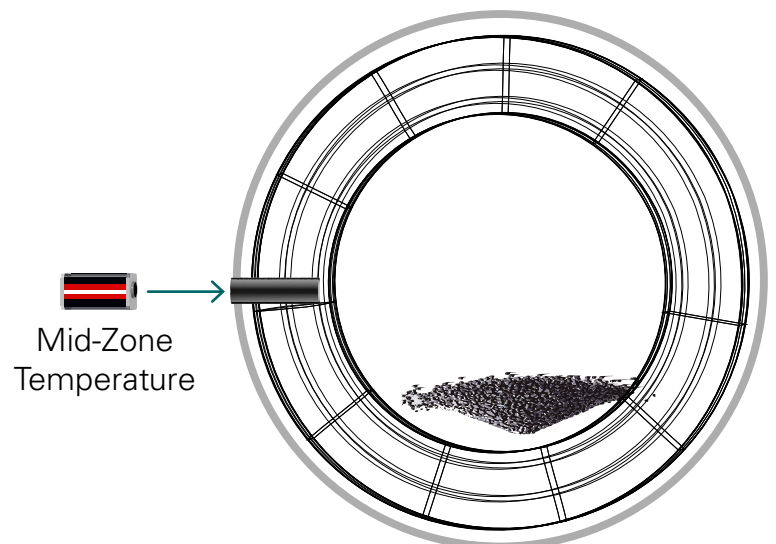
Wavelength Technology

- Short-Wavelength **SW** Pyrometers - tolerate optical obstructions associated w/ heavy dust & varying weather conditions
- Mid-Zone specific settings enable timed temperature measurements & peak hold resets b/w each rotation
- High-Resolution optics ensure precise alignment
- Utilizes close-ended viewing tube - installed into the side of the kiln

Recommended Model

Standard Configuration

SW-16-30



Measurement Overview

Peak aggregate material temperature is reached at the end of the kiln, known as product discharge.

Peak temperature or peak product temperature is the primary Rotary Kiln process control parameter.

Inaccurate or widely varying peak temperatures at product discharge indicate production inefficiencies, varied product quality & yield, fuel waste, & potential equipment damage. There are several challenges associated with this temperature measurement including heavy dust, flames, & other obstructions.

Williamson's infrared technology & protective cooling systems are designed for these hostile operating conditions.

Williamson's Short-Wavelength (SW) pyrometers use carefully selected narrowband wavelengths to view through severe optical obstructions, while the protective cooling jacket prevents pyrometer damage.

Williamson pyrometers make continuous peak temperature measurements with unequalled accuracy & repeatability at product discharge.

Williamson Wavelength Advantage

Pyrometer Benefits

- Provides Accurate Real-Time Temperature Measurements
- Helps optimize kiln efficiency
- Designed to be mounted into the kiln's existing structure

Wavelength Technology

- Short-Wavelength SW Pyrometers tolerate severe levels of common optical interferences
- Short-Wavelength (SW) set is configured to view clearly through flames, combustion gases, & hot dust
- Protective Cooling Jacket shields pyrometer from hostile operating conditions

Recommended Model

Standard Configuration

SW-16-30

For facilities where the primary concern is a dirty viewport, Two-Color (TC) may be used



Pro - Series



Protective Cooling Jacket (PCJ)

Measurement Overview

Flame-fired processes inside the Rotary Kiln are primarily fueled by natural gas that is frequently combined with oxygen, oil, pulverized coal, or CO₂ gas. Precise control over the fuel-to-air ratio within the kiln reduces fuel waste, heat loss, & dangerous nitrogen oxide accumulation. Flame or combustion temperature is a key indicator of the fuel-to-air ratio. As a result, accurate - continuous flame temperature monitoring is essential in optimizing Rotary Kiln operations. Traditional thermocouples used for this measurement must be frequently replaced, resulting in increased maintenance costs & production lags.



Williamson's Dual-Wavelength (DW) technology & durable protective cooling jacket are designed to produce accurate & repeatable flame temperature feedback in the toughest industrial operating conditions.

Williamson Wavelength Advantage

Pyrometer Benefits

- Ensures accurate & repeatable flame temperature measurements
- Decreases Input Costs - by optimizing fuel efficiency
- Eliminates Costly Shutdowns & Thermocouple-Related Maintenance
- Prevents Excessive Nitrogen Oxide Build-Up

Wavelength Technology

- Dual-Wavelength (DW) Pyrometer optimized for large luminous flames that heat Rotary Kilns
- DW distinguishes target flame from other material & obstructions in the operating environment
- Protective Cooling Jacket (PCJ) shields pyrometer from hostile operating conditions

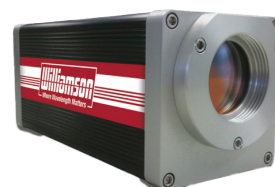
Recommended Model

Standard Configuration

DW-08-65

For recommended DW model flames must be ≥ 18 in (45cm) thick where viewed by pyrometer

Flames ≤ 18 in (45cm) require SP technology



Pro - Series



Protective Cooling Jacket (PCJ)

Measurement Overview

As the material exits the kiln, it is pushed onto a conveyor where it finishes cooling. Some products tend to form heat retaining clumps that can easily exceed the rubber conveyor belt's upper temperature limits. When this occurs, the material can cause significant equipment damage & can even present thermal safety hazards. Temperature measurement along the conveyor belt presents several challenges. The measurement area is relatively large (the entire conveyor belt,) temperature across said measurement area can vary significantly, & steam, water, & dust are common optical interferences.



Williamson's Short-Wavelength conveyor belt pyrometer monitors a large measurement area, uses a rate of change algorithm to identify hot spots regardless of bulk temperature, views through heavy obstructions without interference, & triggers an alarm when hot spots are detected.

Williamson Wavelength Advantage

Pyrometer Benefits

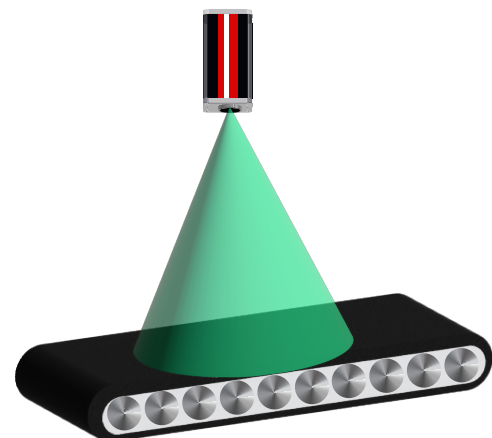
- Ensures Proper Cooling
- Protects Conveyor Belt from Hot Spots - Minimizing Equipment Damage
- Decreases Maintenance costs by using non-contact temperature measurement technology

Wavelength Technology

- Views entire width of conveyor belt
- Short-Wavelength (SW) technology views through steam and tolerates hot dust, dirty optics, & other optical interferences
- SW tech. is 4X more sensitive to hot spots compared to Long-Wavelength (LW) technology

Recommended Model

Steam Present	HSP-2A-30
No Steam Present	HSP-29-08
Near Ambient Temperatures	HSP-GP-20



Conveyor Belt Protection