Rotary Kilns

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.

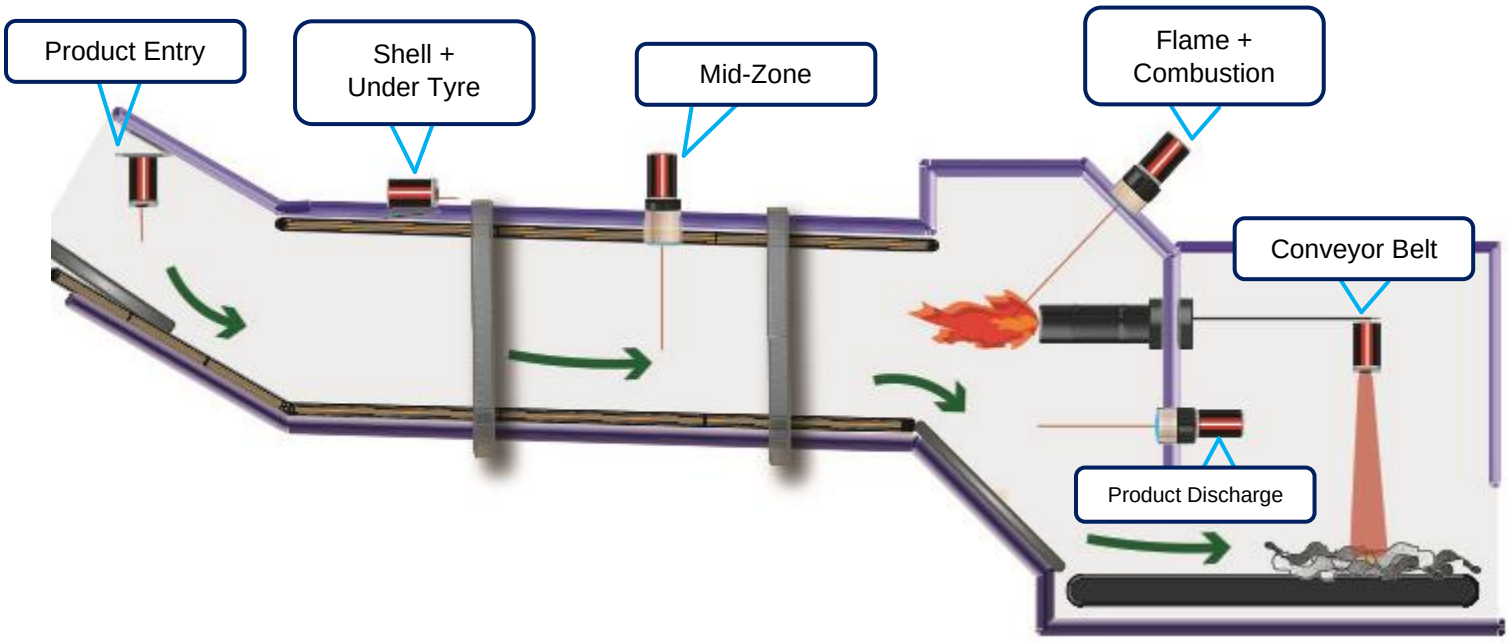
Williamson Wavelength Advantage:

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.

Measurement Area	Suggested Models
Shell + Under Tyre	SW-2A-32
	LW-GP-20
Product Entry	SW-2A-30
	SW-2A-37
Mid-Zone	SW-16-30
Product Discharge	SW-16-30
	TC-11-32
Flame Temperature	DW-08-65
	SP-FC-40
	SP-FH-30
Conveyor Belt Protection	SW-2A-30
	SW-29-08
	LP-DP-20

Rotary Kilns

Rotary Kiln Measurement Areas



Shell & Under Tyre

Application Overview

If the refractory material lining the Rotary Kiln overheats or is damaged in any way, then hot spots appear on the kiln's outer shell. Detecting these hot spots is crucial in maintaining the kiln's structural integrity, protecting human health & safety, and preventing costly downtime. Infrared pyrometers are often used to monitor shell temperature and identify hot spots before they become a problem. Rotary Kilns also have cylindrical steel castings, known as tyres, 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.

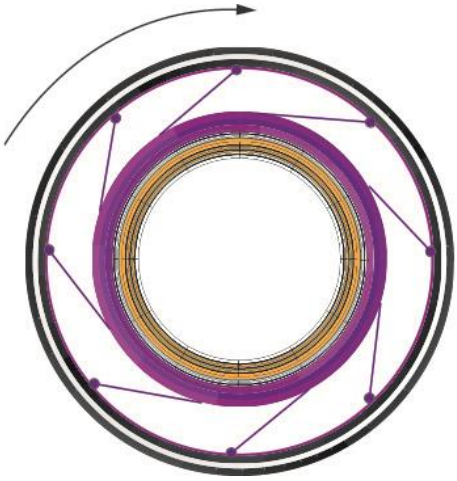
Williamson short-wavelength pyrometers are optimized to identify hot spots by providing positional information while viewing a relatively large area. Pyrometers installed for local hot spot detection at each tyre, compensate for the hard to reach measurement area. This infrared system has proven to be a highly effective lower-cost alternative to line scanning systems.

Pyrometer Benefits

- Prevents shell warping
- Eliminates production lags caused by equipment damage
- Cost effective alternative to thermal imaging systems

Wavelength Technology

- Short-Wavelength **(SW)** technology provides early hot-spot detection
- Carefully selected wavelengths tolerate rain, fog, and snow
- Tyre pyrometers view behind difficult obstructions



Suggested Models		
SW-2A-32	200 – 1000 °F 95 – 540 °C	 Pro-Series
LW-GP-20	Lower Temp. Applications	

Product Entry

Application Overview

Aggregate Materials are preheated using hot process gases that flow through the kiln and into the preheat zone. Aggregate material temperature at the Product Entry is used as a critical process parameter for overall heat balance throughout the Rotary Kiln. This important measurement often presents heavy dust and fluctuating air pressure. ***Williamson's Short-Wavelength pyrometers provide unequalled accuracy and repeatability at the Rotary Kiln Product Entry.***

Williamson SW pyrometers use a carefully selected narrowband wavelength set that tolerates severe optical obstructions and broad temperature ranges.

Pyrometer Benefits

- Ensures consistent process conditions
- Makes accurate product entry temperature readings
- Provides precise kiln heat distribution feedback

Wavelength Technology

- Short-Wavelength **(SW)** pryometers tolerate severe levels of common optical interferences
- Offers broad temperature span

Suggested Models		
SW-2A-30	200 – 1000 F 95 – 540 C	
SW-2A-37	0 – 1000 F 0 – 550 C	Pro-Series

Mid-Zone Measurement

Williamson
Where Wavelength Matters

Application Overview

Aggregate Material temperature in the middle of the Rotary Kiln provides important process efficiency and heat supply feedback. Underheated materials can compromise product quality, while overheated materials indicate fuel waste and potential equipment damage. Precise temperature control in the mid-zone improves production efficiency, increases consistent product quality, and decreases input costs by minimizing fuel waste.

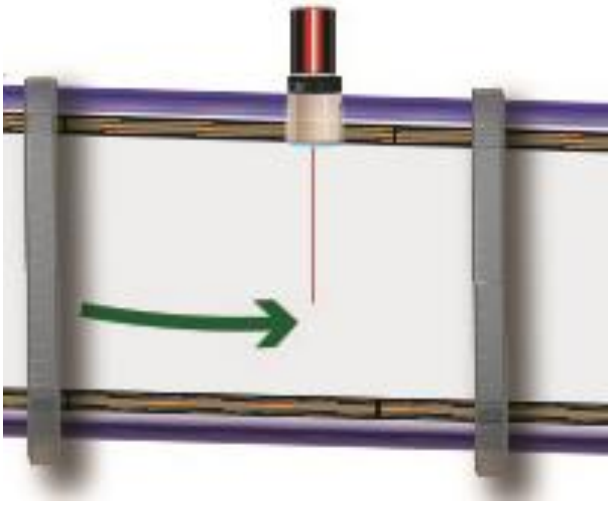
Because Rotary Kilns are extremely long, it is often difficult to obtain accurate mid-zone temperature measurements from the ends of the kiln. Instead, measurements are taken from the side of the kiln using a closed-ended viewing tube. This measurement should also be made once per rotation. ***Williamson's Short-Wavelength (SW) pyrometers use high resolution optics and temperature-based "peak hold" settings to produce highly accurate mid-zone temperature measurements with each rotation.***

Pyrometer Benefits

- Enables increased process control precision
- Improves Production Efficiency
- Accurate temperature measurements with 5 ms response time
- Uses close ended viewing tube that is installed into the side of the kiln

Wavelength Technology

- Short-Wavelength **(SW)** tech. tolerates optical obstructions
- High resolution optics ensures precise alignment
- Mid-zone specific settings allow peak hold reset between each rotation



Suggested Model		
SW-16-30	700 – 3200 °F 375 – 1750 °C	 Pro-Series

Product Discharge

Application 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 can lead to production inefficiencies, lowered product quality & yield, fuel waste, and equipment damage. There are, however, several challenges associated with this temperature measurement area including heavy dust, flames, and sight path obstructions.
These challenges combined with hostile operating conditions demand the use of Williamson's infrared technology and protective cooling system.

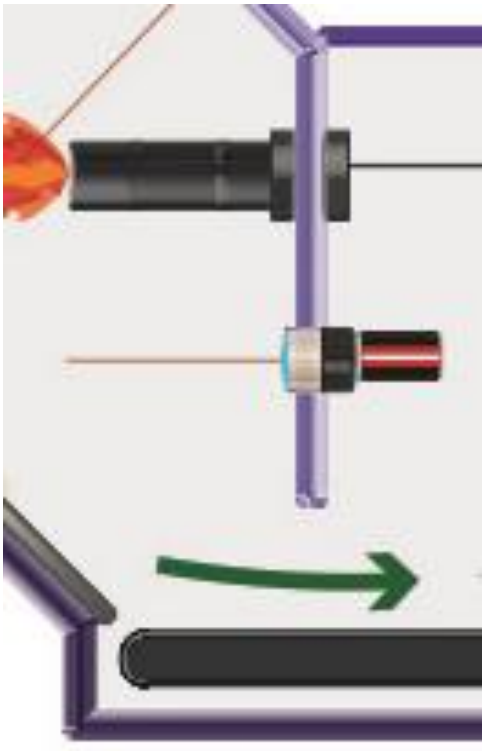
Williamson's Short-Wavelength (SW) and Two-Color (TC) pyrometers use carefully selected narrowband wavelength set(s) to view through severe optical obstructions, while the protective cooling jacket prevents pyrometer damage. Williamson pyrometers make continuous peak temperature measurements with unequalled accuracy and repeatability at product discharge.

Pyrometer Benefits

- Provides Accurate Real-Time Temperature Measurements
- Can be mounted into the kiln's existing structure
- Fiber-Optic configuration available to tolerate high ambient temperature

Wavelength Technology

- Short-Wavelength **(SW)** set is configured to view clearly through flames, combustion gases, & hot dust
- Two-Color **(TC)** technology compensates for obstructed sight path cause by dirty viewing port
- Protective Cooling Jacket shields pyrometer from hostile operating conditions



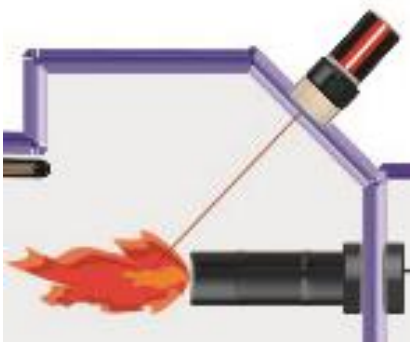
Suggested Models		
SW-16-30	700 – 3200 °F 375 – 1750 °C	 Pro-Series
TC-11-32	1300 – 3200 °F 700 – 1760 °C	

Flame Temperature

Williamson
Where Wavelength Matters

Application Overview

Flame-fired processes inside the Rotary Kiln are fueled primarily by natural gas that is frequently combined with oxygen, oil, pulverized coal, or CO_2 gas. Precise control over the fuel-to-air ratio within the kiln reduces fuel waste, heat loss, and dangerous nitrogen oxide accumulation. Flame or combustion temperature is a key indicator of the fuel-to-air ratio, and as a result, accurate and continuous flame temperature measurement is essential in optimizing Rotary Kiln operations. Traditional thermocouples used for this measurement must be frequently replaced, resulting in increased maintenance costs and production lags.



Williamson's Specialty-Wavelength (SP) pyrometers use a unique wavelength selection to accurately monitor Rotary Kiln Flame temperature from difficult angles and through severe interferences. While the protective cooling jacket enables the pyrometer to withstand hostile operating conditions.

Pyrometer Benefits

- Ensures accurate & repeatable flame temperature measurements
- Decreases input costs by optimizing fuel efficiency
- Eliminates Costly Shutdowns & Maintenance Associated w/ Thermocouples
- Prevents Hazardous Gas Build-Up

Wavelength Technology

- Specialty- Wavelength **(SP)** Tech. uses unique wavelength sets to measure flames produced by different fuel sources
- Dual-Wavelength **(DW)** may be used for large luminous flames
- Protective Cooling Jacket shields pyrometer from hostile operating conditions

Suggested Models		
Carbon (CO) Based Flames	***Non-Carbon Based Flames***	***Luminous Flames > 18"***
SP-FC-40	**SP-FH-30**	**DW-08-65**
800 – 4000 °F 425 – 2200 °C	700 – 3200 °F 375 – 1750 °C	1600 – 3200 °F 875 – 1750 °C

Conveyor Belt Protection

Williamson
Where Wavelength Matters

Application 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 and 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, and steam, water, and 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, and triggers an alarm when hot spots are detected.***

Pyrometer Benefits

- Ensures Proper Cooling
- Protects conveyor belt from hot spots
- Minimizes 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, and other optical interferences
- **SW** tech. is 4X more sensitive to hot spots compared to alternatives

Suggested Models		
SW-2A-30	150 – 900 °F 65 – 425 °C	Hot Spot Detection Tolerates Heavy Steam
SW-29-08	100 – 800 °F 40 – 425 °C	Hot Spot Detection Little to No Steam
LW-GP-20	0 – 1000 °F 0 – 550 °C	Average Temp. Value Moderate Steam