Rotary Kiln
Application Overview

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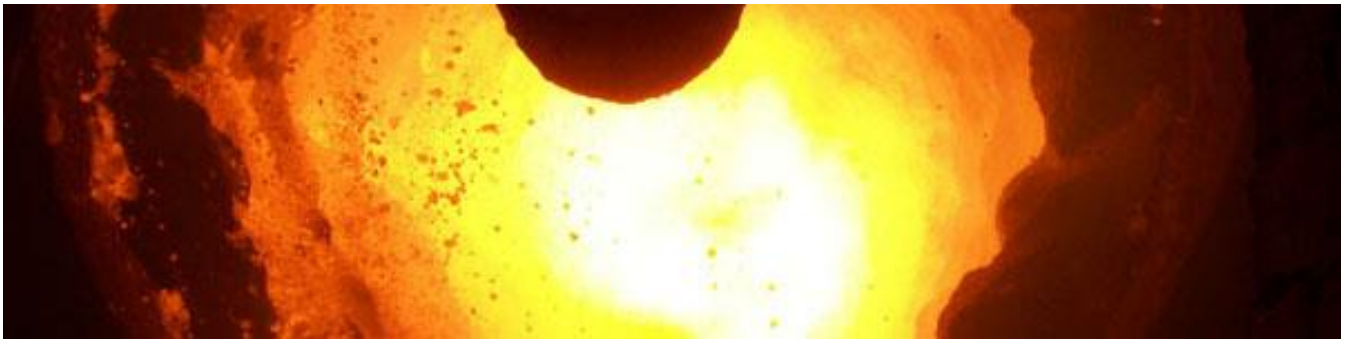
A rotary kiln is a type of furnace commonly used to heat solid materials in the form of a powder, lump or other granular form. Rotary kilns are used for any number of purposes, from heating soil to remove volatile contaminants, to heating stones to remove moisture. By far the most common materials processed within a rotary kiln are cement, lime, and iron ore. For these most common rotary kiln materials, high temperatures in the range of 1100°C / 2000°F are used to instigate a chemical conversion (cement and lime) or to fuse fines (fine ore powder) into pellet form (iron ore).

Most rotary kilns are direct fired – with a flame shooting into the kiln from the discharge end (the fire wall). As the kiln rotates, the heated material climbs the kiln wall before flopping down and flipping over. With each flop, the material travels a short distance along the length of the kiln because it is at a slight angle. This slight tilt allows the material to enter one end of the kiln and to exit the other end. This heating technique is most appropriate for powdered or pebble-like materials and this constant flopping and flipping of the material allows the heat to reach each particle without relying on conduction.

Thus viewing through optical obstructions such as flames, smoke and dust can be a challenge in a rotary kiln. Consequently when choosing a pyrometer, wavelength and alignment are important considerations.

Williamson Wavelength Advantage
Using a unique narrowband wavelength, Williamson offers unequalled performance for accurate and repeatable temperature measurement. Careful wavelength selection allows Williamson pyrometers to view through smoke, flames, dust and other common interferences which may be found in a rotary kiln.



1. Shell/Tyre:, SW, LW
2. Product Entry: SW,
3. Product Discharge: SW, TC
4. Mid-Zone Measurement: SW
5. Flame Temperature: SP, DW
6. Hot Clinker Detector: SW, LW

Shell & Under Tyre Temperature

Application Overview

If the refractory lining of the rotary kiln were to become damaged or compromised in any way, then a hot spot would appear on the outer shell of the kiln. If left unidentified, the kiln can warp, resulting in extensive damage and extended down time. Scanning or panning infrared pyrometers are commonly used to monitor the kiln shell temperature for the purpose of identifying hot spots before they can cause a problem.

Rotary kilns also have cylindrical steel castings loosely attached to the shell which allows for a smooth rotation. This presents an obstruction for the shell monitoring system. If there is a hot spot under the tyre, then the scanner will not catch it. Instead, a local hot spot monitor must be installed at each tyre.

Williamson Wavelength Advantage

Williamson offers a short single-wavelength product in addition to a third party panning system for this measurement. Panning systems with the single-wavelength model SW-2A-32 are optimized to identify hot spots by providing positional information while viewing a relatively large area of the kiln shell. The long-wavelength pyrometer offers a broad temperature span and the short-wavelength can tolerate inclement weather conditions. This system has proven to be highly effective, and is intended to be a low-cost alternative to the infrared line scanning systems that are offered by others.

Pyrometer Benefits

- Early hotpot detection eliminates downtime and maintenance costs
- Scanner system identifies hot spots and prevents shell warping
- Panning spot pyrometer is a low cost alternative to thermal imaging systems
- Fixed pyrometer can view behind obstructions

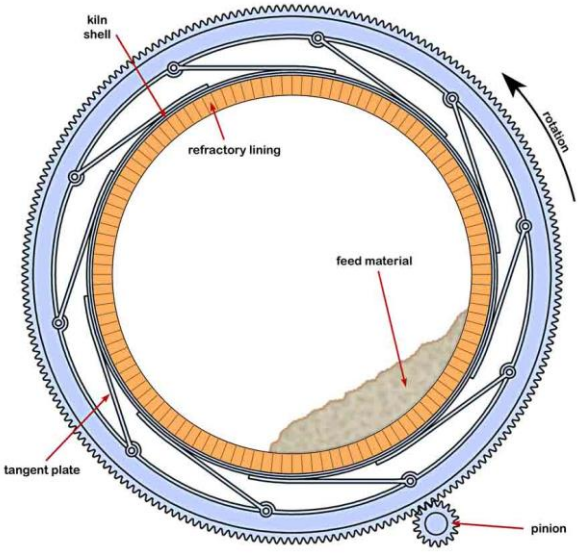
Wavelength Technology

- Long-Wavelength (LW) technology offers broader temperature span
- Short-Wavelength (SW) technology provides early warning of hot spots and better tolerates rain, fog, snow and other inclement weather conditions.

Suggested Models

Rotary Kiln Shell
Pro SW-2A-32, 200 - 1000°F / 95 - 540°C
Pro LW-GP-20, 0 - 1000°F / 0 - 550°C
Silver C9 Series, 32- 932°F / 0 - 500°C

Recommended Panning System
Consult Factory



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Product Entry

Application Overview

Before entering the kiln, the aggregate material is often pre-heated as hot process gasses pass upstream through the kiln and into the preheat zone. The temperature of the product as it enters the kiln represents a critical control parameter. The kiln control system will use the product entry temperature as a part of the total heat-balance for the process as a whole. At this point in the process, the infrared pyrometer must be able to compensate for heavy dust and optical obstruction.

Williamson Wavelength Advantage

Short-wavelength (SW) technology is recommended for this measurement, dependent upon temperature range requirements. Short-wavelength single-wavelength pyrometers provide a broad temperature span, and are able to tolerate a moderate amount of optical obstruction.

Pyrometer Benefits

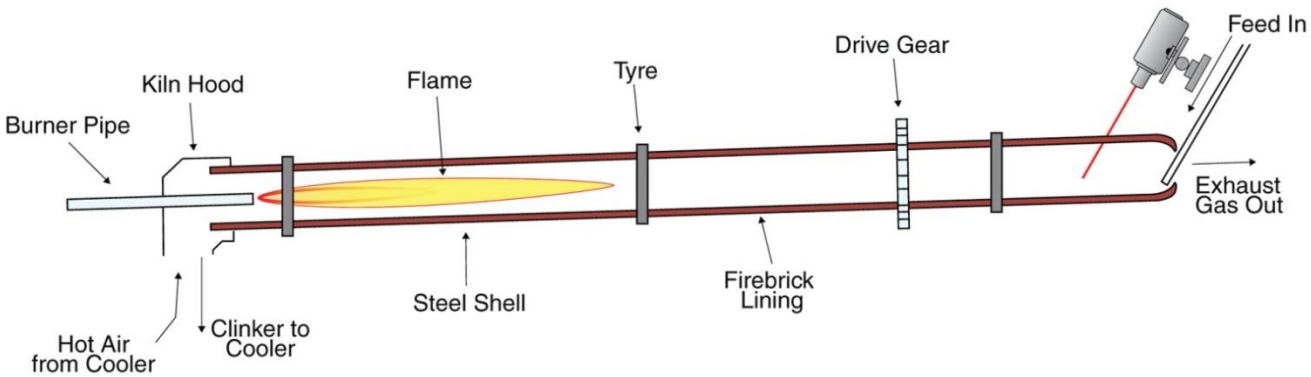
- Accurate entry temperature
- Assures consistent process conditions

Wavelength Technology

- Short-Wavelength (SW) technology offers broad temperature span and tolerates moderate to severe dust and optical obstruction

Suggested Models

Pro SW-2A-30, 150 - 800°F / 65 - 425°C
Pro SW-22-37, 300 - 2000°F /150 - 1100°C



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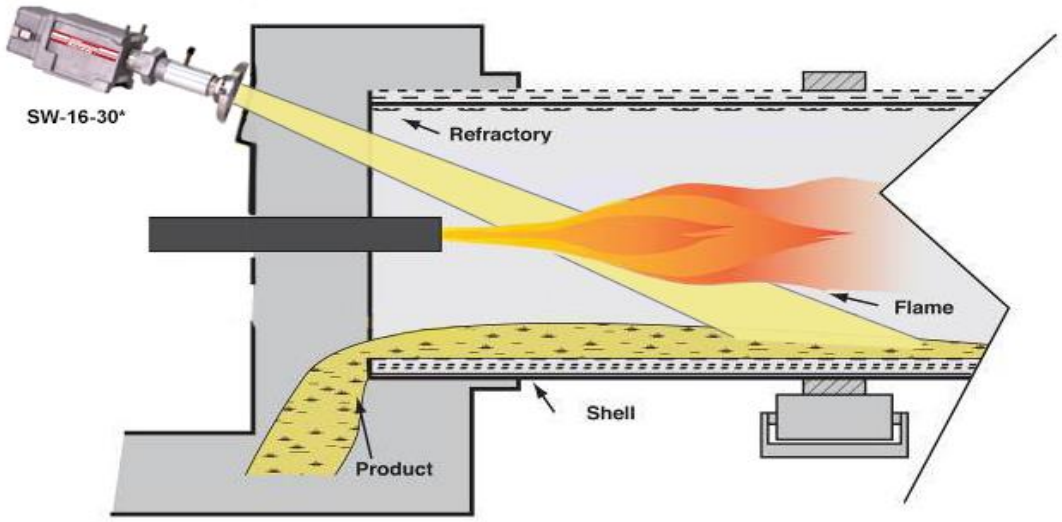
Product Discharge

Application Overview

The product gains heat as it travels through the kiln. The temperature of the product as it exits the kiln represents the peak product temperature, and is usually a primary process control parameter. At this point in the process flames and dust will be encountered. In order to provide a reliable process temperature the infrared pyrometer must be able to compensate for these significant issues.

Williamson Wavelength Advantage

Williamson offers two popular pyrometers for product discharge. The most appropriate pyrometer depends upon the product and the nature of the kiln. Using a unique narrowband wavelength, Williamson model SW-16-30 offers unequalled performance for accurate and repeatable measurement while viewing through flames, combustion gasses & hot dust. Alternately, Williamson TC-11-32 is recommended when a dirty viewing port is a primary concern.



*with Protective Cooling Jacket and Flange Mount

Pyrometer Benefits

- Broad temperature range
- Compensates for flames, smoke, dust and optical obstructions
- Fiber optic configuration available to tolerate high ambient temperature

Wavelength Technology

- Short-wavelength (SW) technology clearly views through flames.
- Two-Color (TC) technology compensates for obstructed sight path

Suggested Models

Pro SW-16-30, 700 - 3200°F / 375 - 1750°C
Pro TC-11-32, 1300 - 3200°F / 700 - 1760°C

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Mid-Zone Temperature

Application Overview

The temperature of the product in the middle of the kiln provides important feedback concerning the heating efficiency of the process. If the product is too hot in the middle of the kiln, then excessive heat is being applied to the process. If the product is too cold in the middle of the process, then the product quality may be compromised, and additional heat must be supplied. Monitoring the temperature in this zone allows for a more consistent and stable process.

Williamson Wavelength Advantage

Because rotary kilns are usually extremely long, it is often difficult to obtain a mid-zone temperature by viewing from the end of the kiln. Instead, a closed-ended viewing tube is inserted into the side of the kiln such that the end of the tube is in contact with the heated material. The short-wavelength pyrometer views into the closed-ended sight tube and measures the Mid-Zone process temperature once per rotation. A temperature based “peak hold” setting resets the measured temperature value between readings and automatically resets with each rotation.

Pyrometer Benefits

- Improves process control
- Improves efficiency
- 5ms response time
- Automatic peak hold reset for each rotation

Wavelength Technology

- High resolution optics assures precise alignment
- Single-wavelength technology assures precise accuracy

Suggested Model

Pro SW-16-30, 700 - 3200°F / 375 - 1750°C

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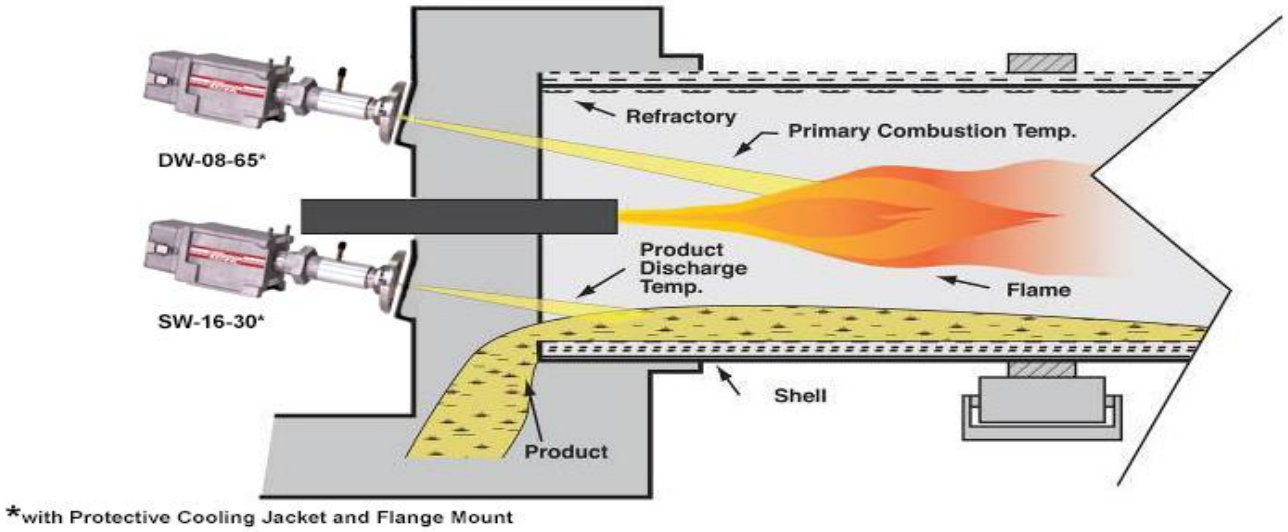
Flame Temperature

Application Overview

For most kilns, heat is transferred to the product by flame. The most common fuel is natural gas, but other fuels may be used instead of or in addition to natural gas. These other types of fuel include oxygen, oil, pulverized coal, CO gas, and other flammable gasses. The flame temperature is an important process control parameter, as many plants are striving to optimize heat transfer within the kiln while also minimizing NOx production. Precisely controlling the fuel-to-air ratio allows for process gasses introduced into the kiln to be reduced, thus reducing the heat lost through the exchange of gasses.

Williamson Wavelength Advantage

Williamson offers three popular pyrometers for flame measurement. The most appropriate pyrometer depends upon the fuel being burned.



*with Protective Cooling Jacket and Flange Mount

Pyrometer Benefits

- Reduced Fuel Consumption
- Reduced Flux Loss
- Improved Process Stability
- Improved Heat Transfer

Wavelength Technology

- Dual-wavelength (DW) model DW-08-65 may be used for luminous flames (yellow, orange or white).
- Specialty (SP) Short-wavelength technology may be used to measure any flame depending on fuel source

Suggested Models

For luminous flames larger than 18 inches: Pro DW-08-65, 1600 - 3200°F / 875 - 1750°C	For CO gas flames Pro SP-FC-40, 800 - 4000°F / 425 - 2200°C For all other flames: Pro SP-FH-30, 700 - 3200°F / 375 - 1750°C

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Conveyor Belt Protection

Application Overview

Some products, like cement, for example, tend to clump during processing within the kiln. Because large clumps of material retain their heat, these so-called Clinkers pose a thermal hazard. Rubber conveyors often have a 400°F / 200°C upper temperature limit, for example. If these hot clinkers heat the belt above its maximum temperature limit, then the belt will melt, causing expensive damage, and resulting in process down time.

Williamson Wavelength Advantage

Williamson has developed a pyrometer specifically designed for conveyor belt protection. When used to protect rubber belts, the Williamson pyrometer is installed above the conveyor belt to view the product as it passes underneath. The pyrometer is used to trigger an alarm or to trigger active cooling of the product on the belt. The Williamson product is unique in three critical areas. The Williamson hot spot detector views a large area allowing it to cover the entire width of the belt. The Williamson product includes a rate-of-change alarm allowing it to identify hot product regardless of the bulk temperature of the measured area. Finally, the Williamson pyrometer is able to view through heavy steam without interference.

Pyrometer Benefits

- Protection of conveyor belt and equipment from overheating

Wavelength Technology

- Large viewing area views entire width of belt (D/2.6 optical resolution)
- Short-wavelength technology (SW-2A-30) views through steam and tolerates moderate dust, optical obstructions and dirty optics.
- SW technology is 4x more sensitive to hot spots compared to LW

Suggested Models	
Pro SW-2A-30, 150°- 800°F / 65°C - 425°C	Exceptionally sensitive to hot spots. Views clearly through heavy steam.
Pro SW-29-08, 100°- 800°F /40°C - 425°C	Exceptionally sensitive to hot spots. Does not tolerate heavy steam.
Pro LW-GP-20, 0° -1000°F / 0° - 550°C	Provides more of an average temperature value. Tolerates moderate steam

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