Aluminum Extrusion Application Overview

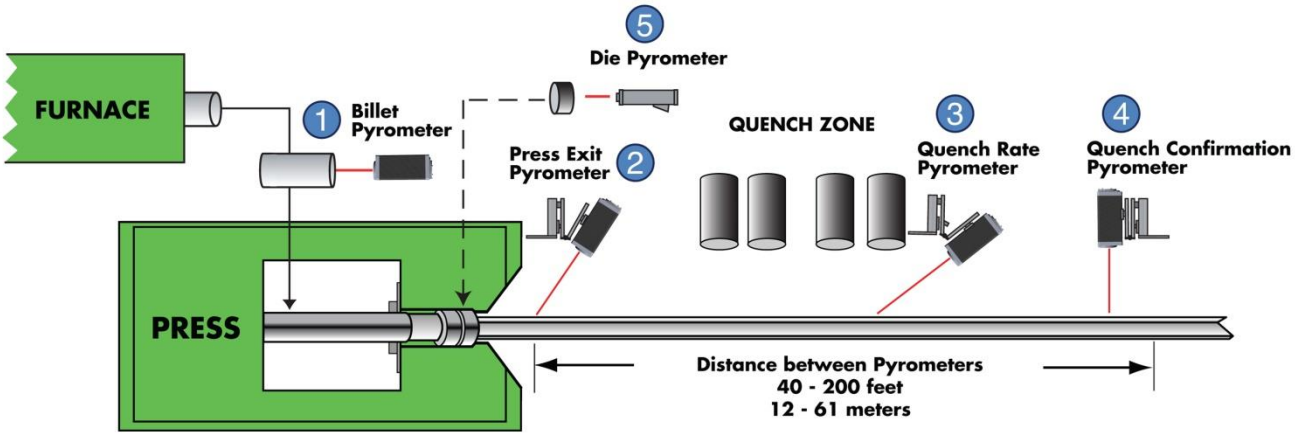
Temperature Control for Aluminum Extrusion

The goal for any extruder is to maximize throughput while maintaining quality products. Increased throughput means that each press can produce more products and be more profitable and time efficient. Temperature control is a critical component of the extrusion process. Running the presses based off of temperature control will allow the customer to maximize their press efficiency while also completely eliminating temperature-related quality defects.

Williamson Wavelength Technologies

Aluminum is a non-greybody material that has complex emissivity characteristics that vary with alloy, surface roughness and oxidation, making it a particularly difficult material to measure with ordinary infrared pyrometers. Traditional single-wavelength and ratio temperature sensors are not able to accurately measure aluminum. Williamson's multi-wavelength pyrometer uses application specific algorithms to compensate for these unique emissivity characteristics of aluminum. These algorithms allow the Williamson multi-wavelength pyrometers to achieve accurate and repeatable temperature measurements at multiple points during the aluminum extrusion process.

1. **Billet:** **MWx**
2. **Press Exit:** **MW**
3. **Quench Rate:** **MW** or **SW**
4. **Quench Confirmation:** **SW**
5. **Die:** **SW**



***Note:** Billets heated above 500°C / 925°F should be measured using the model MWx-AB. See the MWx-AB datasheet for more information

Billet Measurement

Application Overview

Billet temperature at the entry of the extrusion press is a critical process control parameter. A high billet temperature limits the maximum speed of the extrusion press and can result in quality defects. A low billet temperature can freeze in the die to create a sticker or can cause the die to break. For metallurgical properties, high strength alloys require a high billet temperature, placing additional demands on the extrusion process. A consistent billet temperature is required to assure consistent process conditions, high extrusion speed, and highly repeatable product quality.

Williamson Wavelength Advantage

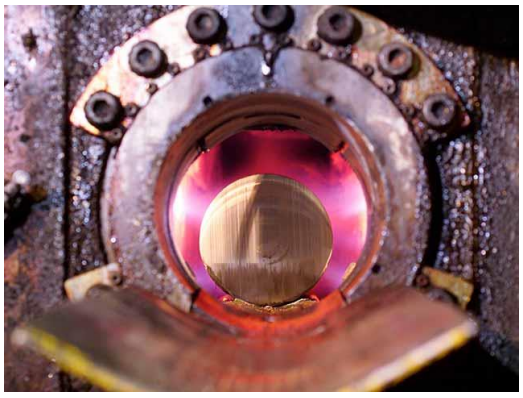
When a billet is heated above 925°F/500°C, oxides on the surface of the billet vitrify over time changing the surface characteristics. This variable surface condition dictates the use of the more advanced MWx technology. Williamson's MWx pyrometers use dynamic ESP Algorithms to overcome the vitrification and changes in relationship between wavelength and emissivity and accurately measure billets compared to the static algorithm used by traditional MW pyrometers which are not as accurate. Williamson developed the Pro MWx pyrometer with a dynamic ESP Algorithm to compensate for these more difficult, high temperature operating conditions.

Pyrometer Benefits

- Assure desired product properties
- Establish consistent operating conditions
- Maximize press speed
- Reduce down time and thermocouple maintenance

Wavelength Technology

- Dynamic ESP Technology compensates for vitrification and changes in the relationship between wavelength and emissivity.
- MWx-AB assures accurate measure of temperature for any billet surface.



Suggested Models

Pro MWx-AB-11,
550-1100°F / 285-600°C

Suggested for all cut face or side of billet measurments.
Available in Traditional Style only

Pro Series

70 Domino Drive, Concord, Massachusetts 01742 | +1-978-369-9607 | www.williamsonir.com

Press Exit

Application Overview

Aluminum Profile Temperature at the exit of the press is used to optimize extrusion speed while also eliminating cracks and surface blemishes and establishing highly repeatable mechanical properties and dimensions.

Williamson Wavelength Advantage

Williamson's multi-wavelength technology uses an ESP algorithm to correct for the low and varying emissivity of an extruded aluminum profile. This algorithm works across all different alloys and does not need a full field-of-view (FOV) to make an accurate measurement. This ability to tolerate partially filled FOVs means that the pyrometer can be mounted in a fixed location and can tolerate multiple-holed dies and small extruded profiles.

Pyrometer Benefits

- Increase extrusion speed, typically by 20% or more
- Eliminate surface blemishes and cracks
- Maintain consistent mechanical and dimensional properties
- Assure repeatable process conditions
- Reduce down time

Wavelength Technology

- MW technology automatically corrects for non-greybody emissivity variation associated with extruded aluminum profiles
- Press Exit algorithm tolerates partially-filled (12%) FOV
- Self-aligns to the small, wandering hot profile
- Automatically corrects for profile shape, size and alloy change

Suggested Models

Traditional Configuration

- Pro MW-20-20, 400-1100°F / 200-600°C

Pro Series

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Quench Rate

Application Overview

The mechanical properties of the metal are established by the rate of cooling within the critical range of about 950°F / 510°C and 600°F / 315°C. A fast rate of cooling through this span will produce small crystals, resulting in a harder metal. A slow rate of cooling within this span will produce larger crystals, resulting in a more malleable metal. A pyrometer placed at or near the 600°F / 315°C point can communicate with the press exit pyrometer to calculate and confirm the desired rate of cooling.

Williamson Wavelength Advantage

There are two different pyrometer options for the quench rate measurement. Just like at the press exit, our multi-wavelength technology can also make an accurate measurement of the profile with a partially full FOV. However, the MW technology is not that reliable at temperatures lower than 600°F / 315°C because there is just not enough infrared energy being emitted from the profile. The short-wavelength technology can measure lower temperatures, but it requires a full FOV to make an accurate measurement and there will be some error due to emissivity variation.

Pyrometer Benefits

- Assure desired product properties
- Provides temperature and quench rate (degrees per second) values with optional IMQ quench module

Wavelength Technology

- MW technology provides greatest precision and self-alignment for profile temperatures above 600°F / 315°C
- SW technology provides exceptional precision for installations where the temperature drops below 600°F / 315°C and a broader temperature span is desired

Suggested Models

Above 600°F / 315°C:

- Pro MW-20-20, 400-1100°F / 200-600°C *Tolerates partial FOV*

Below 600°F / 315°C:

- Pro SW-2A-29, 300-800°F/ 150-425°C

Tight optics for small spot size

Recommended for Both:

- IMQ Quench Module includes quench rate value (degrees per second)

Pro Series

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Quench Confirmation

Application Overview

Aluminum must be below 400°F / 200°C when exiting the quench zone to assure that established mechanical properties are maintained. Low and variable emissivity values and often narrow profiles dictate the use of a short-wavelength pyrometer with precision optics. Williamson offers the shortest wavelengths for the greatest accuracy, and the only low-temperature pyrometers able to view clearly through steam without interference. The SW technology requires a full FOV to make an accurate measurement.

Williamson Wavelength Advantage

Short-Wavelength (SW) technology assures an accurate measure of temperature for this low-temperature, low-emissivity application. The Williamson SW-2A wavelength set offers the shortest wavelength and the strongest performance for unequalled stability and accuracy. The SW technology requires a full FOV to make an accurate measurement and there will be some error due to emissivity variation.

Pyrometer Benefits

- Assure desired product properties

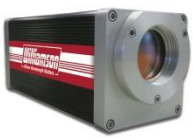
Wavelength Technology

- Short-Wavelength technology for precise temperature values.
- SW-2A wavelength set can view through steam

Suggested Models

Traditional Configuration

- Pro SW-2A-29, 300-800°F/ 150-425°C



Pro Series

Die

Application Overview

Die temperature is confirmed for each die change before entry into the press. An infrared pyrometer provides a simple way to make this reading quickly, accurately, consistently and reliably.

Williamson Wavelength Advantage

The pyrometer used for the die measurement is a short-wavelength pyrometer that is designed to minimize errors due to emissivity variation. As the die is a high-emissivity steel, the emissivity is fairly high and consistent, but there are hundreds of different dies that might slightly vary in their emissivity. Using a short-wavelength pyrometer will minimize the temperature error due to emissivity variation especially when compared with a long-wavelength general purpose pyrometer.

Pyrometer Benefits

- Prevent die damage
- Assure process consistency
- Eliminate problematic thermocouple readings
- Eliminate measurement delays

Wavelength Technology

- Short-Wavelength technology provides a high degree of accuracy for the steel die temperature.

Suggested Models

Traditional Configuration

- Pro SW-16-20 = 500-2100°F / 260-1150°C

Alternative: Pro SW-22-36 = 300-1500°F / 150-815°C

Pro Series