

Aluminum Hot Rolling Mill Application Overview



Temperature Control in the Hot Rolling Mill

Aluminum sheet and plate products are used for a wide range of applications, including can stock, brazing, automotive and aerospace. These industries demand exacting tolerances and precise mechanical properties, particularly for new, technically challenging high-strength alloys. As a result, the modern aluminum hot rolling mill demands previously unobtainable levels of temperature measurement accuracy for the control of rolling mill bite, pressure, speed, and coolant. To meet this need, Williamson offers two multi-wavelength infrared technologies able to provide the unprecedented accuracy this industry now demands for temperature readings throughout the hot rolling process.

Williamson Multi-Wavelength Technologies

Williamson offers two multi-wavelength technologies for the aluminum hot rolling mill. Each technology includes application-specific ESP algorithms for optimal performance.

- The Williamson MW pyrometer includes ESP Algorithms to compensate for different surface texture characteristics of an aluminum rolled surface or the side of a coil. The MW pyrometer provides a high degree of accuracy when the aluminum surface characters are relatively consistent. It can also measure the lower temperature values that are required at the coiler.
- The Williamson MWx pyrometer includes Dynamic ESP Technology to compensate for the significant variation in surface character associated with the ingot measurement and during the reversing mill process. This dynamic technology completely eliminates any need to define and make adjustments for alloy, pass number or thickness that is so often associated with the reversing mill application.

MW and MWx Comparison

Pyrometer Type	MW-20-20	MWx-AS-11
Description	Multi-Wavelength with ESP Technology. Assumes relatively consistent surface character conditions	Multi-Wavelength with dynamic ESP Technology. Automatically compensates for changing surface character conditions.
Temperature Range	200-600°C / 400-1100°F	300-600°C / 570-1100°F
ESP Algorithms	<ul style="list-style-type: none"> • Rolled Surface • Side of Coil 	<ul style="list-style-type: none"> • Ingot • Hot Rolling
Measurements Locations		
Ingots		In Development
Reversing Mill		✓✓
Finishing Mill	✓	✓✓
Coiler	✓✓	
Continuous Caster	✓	✓✓
Single-Pass Rolling Mill/Finishing Mill	✓	✓✓
Rod & Bar Mill Caster Wheel	✓	✓✓
Rod & Bar Rolling Stands	✓✓	

✓✓ = Preferred Technology ✓ = Appropriate Technology

Aluminum Hot Rolling Mill Application Overview

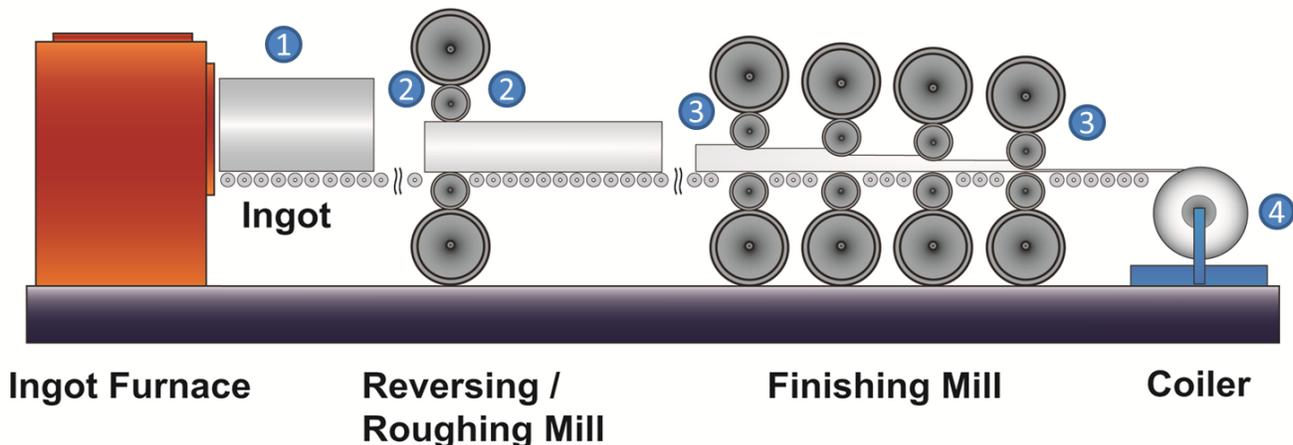
Reversing Mill Sample Data

From our online testing of the MWx, here are some results by alloy and pass at the reversing mill. With its Dynamic ESP Technology, no adjustments were required to achieve these results. Due to the logistics of capturing reference temperatures, typical test measurements were sampled from passes 5 to 18, although we expect similar performance on the earlier passes. Measurements with 1000, 4000, and 8000 Alloys are currently being tested.

Alloy	MIDDLE PASSES (Typically Pass 5 to 11)		FINAL PASSES (Typically Pass 12 to 18)	
	Average Variance	Standard Deviation	Average Variance	Standard Deviation
2000	-1°C	4.4°C	-2°C	1.7°C
3000	4°C	3.9°C	2°C	3.4°C
5000	2°C	3.2°C	2°C	2.1°C
6000	-2°C	4.7°C	-4°C	4.3°C
7000	1°C	2.9°C	-1°C	3.0°C

Aluminum Hot Rolling Mill Overview

1. Ingot: MWx
2. Reversing/Roughing Mill: MWx
3. Finishing Mill: MWx or MW
4. Coiler: MW



Application Overview

Before heading to the rolling stands, a large ingot of aluminum is heated in a furnace for hours to days. Ingots need to be heated for this long of a time so they are completely heated through to the core so that the ingot can be rolled out into a longer strip without being reheated.

Williamson Wavelength Advantage

The ingot is soaked for such a long time to assure uniform temperature prior to rolling, and the soaking time is often extended due to process down time. These extended soaking times often alter the emissive character of the aluminum even when the surface texture is reasonably consistent, and this is the primary reason why the Dynamic ESP Technology associated with the MWx pyrometer is required

Pyrometer Benefits

- Conserve Energy
- Assure Desired Aluminum Properties
- Optimize Rolling Mill Speed

Wavelength Technology

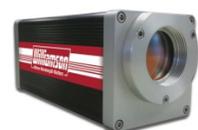
- MWx – Dynamic ESP Technology automatically corrects for variation of alloy, oxidation, elemental migration to the surface, and surface texture



Suggested Models

Traditional Configuration

Pro MWx-AS-11, 575-1100°F / 300°-600°C



Pro Series

Application Overview

At the reversing mill, rolling speed, roll bite and coolant flow may be optimized only with a precise real-time knowledge of metal temperature. The low and highly variable non-greybody emissivity character associated with this complex aluminum process dictates the use of the most sophisticated multi-wavelength infrared pyrometers as the material converts from a coarse ingot to a smooth strip.

Williamson Wavelength Advantage

The Williamson model MWx, designed specifically for the demanding aluminum hot reversing rolling mill application, uses the most advanced Multi-Wavelength Dynamic ESP Technology available for unequalled accuracy under all operating conditions.

Pyrometer Benefits

- Improved Product Properties
- Improved Process Consistency
- Faster Rolling Speeds
- No need for real-time interaction with the pyrometer.

Wavelength Technology

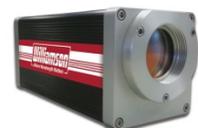
- MWx Dynamic ESP Technology corrects for the non-greybody emissivity variation associated with aluminum.
- Williamson's exclusive Dynamic ESP technology automatically corrects for variations in alloy and thickness.



Suggested Models

Traditional Configuration

- Pro MWx-AS-11, 575-1100°F / 300°-600°C



Pro Series

Application Overview

Tight control of finishing temperature assures the desired mechanical properties and a blemish-free surface. The low and highly variable non-greybody emissivity character associated with this aluminum process dictates the use of multi-wavelength infrared pyrometers.

Williamson Wavelength Advantage

The traditional multi-wavelength (MW) technology works well at the finishing mill where the process is highly repeatable. While the temperature may vary from alloy to alloy, this variation is repeatable. For exceptional accuracy and repeatability across alloys, the MWx technology is required.

Pyrometer Benefits

- Assures Desired Mechanical Properties
- Prevents Surface Blemishes
- Optimizes Line Speed

Wavelength Technology

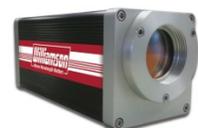
- Williamson multi-wavelength technology automatically corrects for the non-greybody emissivity variation associated with this application.
- The MWx Dynamic ESP Technology and the original MW Technology both produce repeatable temperature readings at this location across all alloys, with the Dynamic ESP Technology producing more absolutely accurate values.



Suggested Models

Traditional Configuration

- MWx-AS-11 = 575-1100°F / 300-600°C
- MW-20-20 = 400-1100°F / 200-600°C



Pro Series

Application Overview

The temperature at the coiler is an important process parameter. If the temperature is too hot, then the metal may soften and stick. If the temperature is too cool, then the material may become too hard and crack. Hand-held thermocouple probes are notoriously inaccurate and are prone to misuse and interpretation.

Williamson Wavelength Advantage

The multi-wavelength pyrometer produces a much more repeatable and accurate temperature value than the traditional thermocouple. The pyrometer can be used to measure the temperature of the strip as it enters the coiler and/or measure the side of the coil while it is being wound or after it has been removed from the coiler

Pyrometer Benefits

- Assures Desired Mechanical Properties
- Automates Temperature Measurement
- Eliminates Thermocouple Maintenance
- Provides Consistency
- Measures the Same Spot Each Time

Wavelength Technology

- Multi-Wavelength Technology assures accurate readings when viewing the non-greybody aluminum material.



Suggested Models

Traditional Configuration

- MW-20-05, 300-900°F / 150-475°C



Pro Series