Forging Application Overview

Williamson
Where Wavelength Matters

Temperature Control for Forging Plants

The forging industry has a broad range of manufacturing processes, making many different types of products. Aluminum, copper, steel and titanium are the most popular metals that are used in the forging process. While there are a number of different ways to forge metal, the process essentially remains the same. It requires heating a piece of metal and then deforming that metal into a particular shape. For some forged parts, temperature control is critical in achieving the desired metallurgical and structural properties. The two most essential forging measurements are the billet and die temperature measurement.

Williamson Wavelength Technologies

Billet: For steel and titanium billets, The Williamson dual-wavelength (DW) compensates for emissivity variation, optical obstruction, and misalignment. The DW sensor is 20x less sensitive to surface oxides and scale. For the measurement of copper, single-wavelength (SW) or multi-wavelength (MW) models are preferred due to significant non-greybody emissivity variation. SW technology is preferred inside a flame-fired furnace, but otherwise MW technology is preferred. MW technology provides an ESP algorithm to compensate for non-greybody emissivity variation associated with copper and aluminum.

Die: Williamson offers two technologies for the measure of die temperature. The SW-16 wavelength set views clearly through flames and is preferred for static preheating processes. DW models are best when measuring dies that are in constant motion. DW models are equipped with unique ESP Filtering, used to recognize valid measurement conditions. Signal Strength and Signal Dilution filters enable the sensor to make a continuous die temperature reading while ignoring flames, lubricant spray, workpiece temperature, and closed die temperature.

Recommended Technologies				
Application	**Steel**	**Titanium**	**Aluminum**	**Copper**
Billet Temperature, Gas-Fired furnace	SW-16	SW-16	See Note	SW-16
Billet, Die entry or Induction Heater	DW	DW or TC	MW-20	MW-20
Static Die	SW-16	SW-16	SW-16	SW-16
Rapidly Recycling Die	DW-24	DW-24	DW-24	DW-24

Note: MW with a cool sight tube to prevent interference from flames and hot furnace walls.

Steel/Titanium Billets

Application Overview

For steel and titanium, the billet temperature is raised to make the metal softer and more easily deformed. Overheating the billet can cause surface defects and requires extra lubrication to prevent sticking to molds and dies. Under-heating can cause cracking and excessive die or mold wear. Clearly, precise billet temperature measurement is an important part of the steel and titanium metal forming process.

Williamson Wavelength Advantage

SW pyrometers are affected by emissivity variation, optical obstruction and misalignment. Two-color (TC) pyrometers are affected by surface scale. Williamson DW pyrometers accurately compensate for emissivity variation, optical obstruction and misalignment, and are 20 times less sensitive to scale.

Pyrometer Benefits

- Assure desired product properties
- Eliminate cracking and surface blemishes
- Avoids die and mold wear
- Minimize lubrication

Wavelength Technology

- DW pyrometers are 20x less sensitive to scale compared to SW and TC technologies

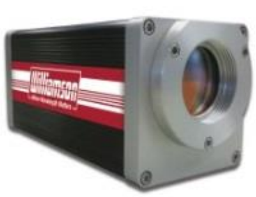
- DW compensates for emissivity variation, optical obstruction, and misalignment

Suggested Models

Carbon Steel:
Pro DW-08-50, 1300-2500°F / 700-1375°C

Stainless Steel/Titanium:
Pro DW-12-15, 750-2500°F / 400-1375°C

Inside Gas Fired Furnace:
Pro SWF-16-30, 700-3200°F / 375-1750°C



Aluminum/Copper Billets

Application Overview

For the aluminum and copper forming process, the billet temperature is raised to make the metal softer and more easily deformed. Overheating the billet can cause surface defects and requires extra lubrication to prevent sticking to molds and dies. Under-heating can cause cracking and excessive die or mold wear. Precise Aluminum or copper billet temperature measurement is an important part of optimizing this metal forming process.

Williamson Wavelength Advantage

Both single-wavelength and ratio pyrometers are affected by the non-greybody emissivity variation associated with aluminum and copper. Williamson multi-wavelength pyrometers accurately compensate for non-greybody emissivity variation to produce a highly accurate measure of temperature.

Pyrometer Benefits

- Assure desired product quality
- Avoids die and mold wear
- Minimize lubrication
- Eliminate cracking and surface blemishes

Wavelength Technology

- Multi-Wavelength technology automatically compensates for non-greybody emissivity variation

Suggested Models

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

Copper:
Pro MW-20-36, 600-1900°F / 315-1035°C

Inside Gas Fired Furnace:
Pro SWF-16-30, 700-3200°F / 375-1750°C

Static Die Temperature

Application Overview
During the forming process, die temperature influences the temperature of the surface of the workpiece and this can affect product quality. Hot dies require extra lubrication and can cause sticking and surface blemishes. Cool dies require extra lubrication and can inhibit flow and cause cracking or hardening of the workpiece.

Contact thermocouples are influenced by the temperature of the air, any wind currents, and the amount of pressure applied to the die. Infrared pyrometers provide a more accurate and more reliable measure of die temperature.

For some metal forming plants the process cycle is slow and for others it is fast. For plants that are able to easily obtain a temperature value from a relatively static die surface, the short wavelength technology is recommended.

Williamson Wavelength Advantage
Using short-wavelength technology the Williamson SW is less sensitive to emissivity variation and optical obstructions compared to longer wavelength sensors. The thoughtful wavelength selection of the 16 and 22 models allows for the sensor to view clearly through flames.

Pyrometer Benefits
- Improved surface conditions
- Improved metal flow and shape
- Lower lubricant needs
- Consistent product quality

Wavelength Technology
- Short-Wavelength technology reduces sensitivity to emissivity variation, optical obstruction, and misalignment.
- The 16 and 22 wavelength sets tolerate steam, oil, and flames without interference.

Suggested Models
Pro SW-16-20, 500-2100°F / 260-1150°C

Lower temp alt.
Pro SW-22-37, 300-2000°F / 150-1100°C

Dynamic Die Temperature

Application Overview

During the forming process, die temperature influences the temperature of the surface of the workpiece and this can affect product quality. Hot dies require extra lubrication and can cause sticking and surface blemishes. Cool dies require extra lubrication and can inhibit flow and cause cracking or hardening of the workpiece.

Contact thermocouples are influenced by the temperature of the air, any wind currents, and the amount of pressure applied to the die. Infrared pyrometers provide a more accurate and more reliable measure of die temperature.

For some metal forming plants the process cycle is slow and for others it is fast. For plants where the die is rapidly opening and closing, the dual-wavelength technology is preferred because of the ability to automatically recognize valid measurement conditions.

Williamson Wavelength Advantage

Because of a greater separation between wavelengths, the DW technology will read hottest temperature within the field of view. This allows the sensor to eliminate inaccurate reading from emissivity variation, optical obstruction, and misalignment. The DW technology also includes ESP Filtering which is used to recognize valid temperature conditions and ignore interferences.

Pyrometer Benefits

- Improved surface conditions
- Improved metal flow and shape
- Lower lubricant needs
- Consistent product quality

Wavelength Technology

- Dual-wavelength technology compensates for emissivity variation, optical obstruction, and misalignment.
- Tolerates oil, steam and flames without interference.
- ESP filtering recognizes valid conditions permitting the pyrometer to measure only when viewing the exposed die surface

Suggested Models

DW-24-27 400-1200°F / 200-650°C

Higher temp alt.

Pro DW-12-10 700-2100°F / 375-1150°C

Pro DW-08-50 1300-2500°F / 700-1375°C