LAND

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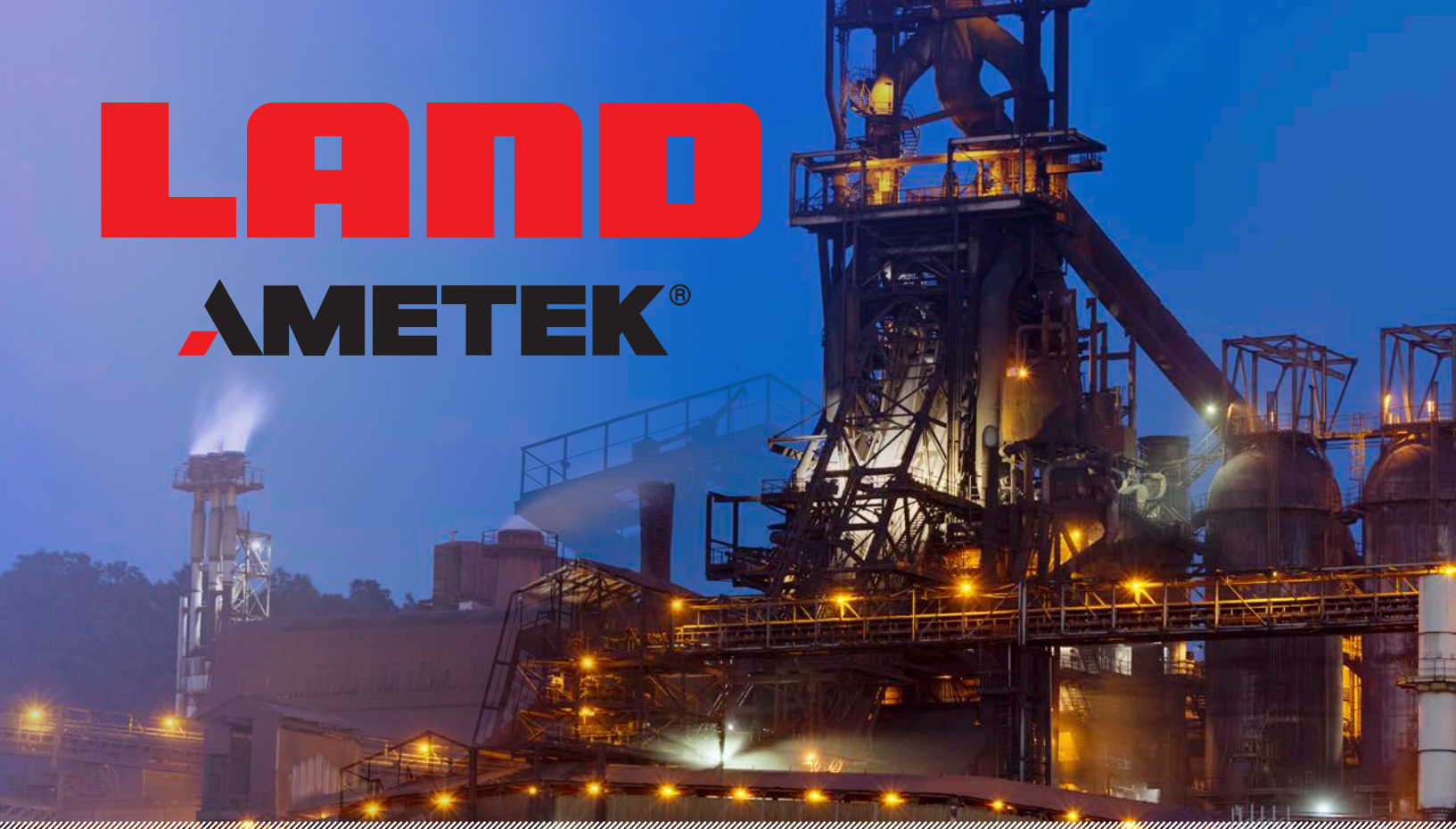

THE METALS MAGAZINE

LAND
AMETEK®

AMETEK Land is the world's leading designer and manufacturer of monitors and analysers for industrial infrared non-contact temperature measurement, combustion efficiency and environmental pollutant emissions.

We offer a trusted range of leading-edge technologies, supported by unrivalled applications knowledge, delivering highly accurate measurement solutions that meet every customer's precise process needs.

FIND WHAT YOU NEED ONLINE

The AMETEK Land website is your online guide to our products and services. Visit us to find:

- Details of our extensive product range
- Application-specific solutions
- Industry information
- Downloadable brochures, manuals and application notes
- Free software downloads
- Your nearest AMETEK Land office

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WELCOME

YOUR GUIDE TO METALS INDUSTRY SOLUTIONS

Welcome to the latest issue of AMETEK Land's magazine for professionals working in the metals production industry.

We are the world leader in non-contact temperature measurement solutions for steel, aluminium and speciality metals industries, with more than 75 years of experience in supplying essential equipment.

These dedicated, highly accurate solutions address the challenges faced by key applications, supporting higher quality, lower costs and greater safety. Our products aredesigned to operate reliably in the harsh environments encountered in metal production, delivering the highest performance standards.

In this issue, we showcase the extensive range of solutions that we provide across the metals industry, explaining how our products can work within your process and the benefits that non-contact temperature measurements provide.

We hope you find it an informative and entertaining read!

James Cross

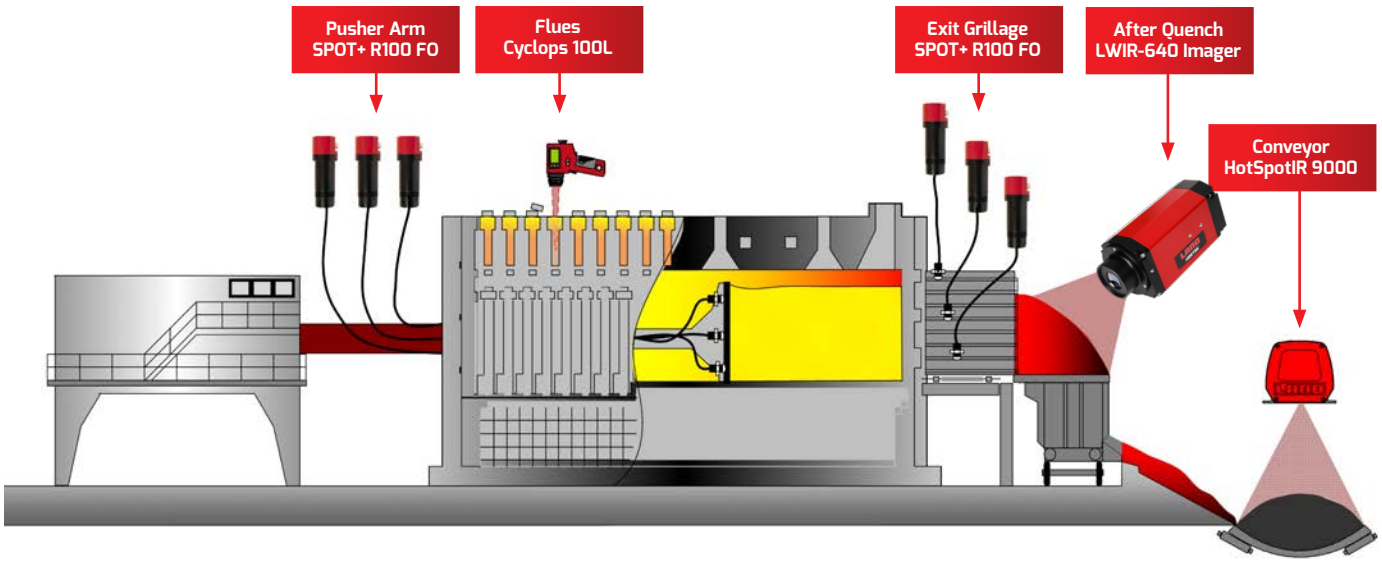
Head of Industry Management

DISCOVER THE FULL RANGE OF OUR SOLUTIONS FOR THE METALS INDUSTRY *PRODUCT GUIDE STARTS ON PAGE 41*

AMETEK LAND AND STEEL

COKE OVEN MEASUREMENTS

LOCATION:	COKE OVEN	
MEASUREMENTS:	FLUE AND COKE OVEN WALL TEMPERATURES	
BENEFITS:	IMPROVED COKE QUALITY AND YIELD	
AMETEK LAND SOLUTIONS:	CYCLOPS 100L 	SPOT+ R100 FO 



THE COKE OVENS

High-quality metallurgical coke is an essential component in the process of iron and steel production. It affects both the furnace operation and the standard of the hot metal.

Coke is produced in a coking facility, where coal is heated in the absence of oxygen. There are many opportunities for temperature measurements that will enhance the quality of the resulting metallurgical coke.

Among the most common temperature measurements are those made through the flue using a portable thermometer, such as AMETEK Land's handheld Cyclops 100L.

The Cyclops features accurate through-the-lens sighting, with a fully-focusable lens and narrow optical field of view. This allows the operator to measure down the narrow flue with ease.

The portable thermometer features onboard data logging of up to 10,000 temperature measurements. Free-to-download data analysis software is available for Windows PC and Android devices.

The Cyclops 100L also features wireless Bluetooth communications, allowing tangle-free cable free operation.

For temperature profiles along the coke oven side walls, AMETEK Land offers fibre-optic pyrometer solutions to install within the pusher arm. Typically, this involves six SPOT+ R100 systems, three mounted each side, to monitor the wall temperature profiles as the hot coke is pushed out.

The SPOT+ R100 is a ratio thermometer which is tolerant of dirty optics and the instrument does not require recalibration if a fibre-optic lightguide needs replacing.

At the exit, where the coke emerges, additional, optional fibre-optic thermometers can be used for a direct temperature measurement of the coke

The next step in the process, coke quenching, can be optimised using AMETEK Land process thermal imaging devices, such as the LWIR-640 thermal imager and HotSpotIR linescanner to detect any uncooled areas within the coke.

DOWNLOAD OUR COKE OVEN APPLICATION NOTE: WWW.AMETEK-LAND.COM

CONVEYORS

LOCATION:	CONVEYORS
MEASUREMENTS:	HOT SPOT DETECTION
BENEFITS:	FIRE AND BELT DAMAGE PREVENTION
AMETEK LAND SOLUTIONS:	HotSpotIR 9000

As the coke is transferred away from the coke oven, the HotSpotIR 9000 scanning device is located above the conveyor to detect any rogue hot inclusions that may be present. These hot inclusions can be left after inadequate quenching, and may cause fires that can damage equipment and consume coke supply.

The HotSpotIR generates high-speed alarms on the detection of even a single small hot inclusion, so the system offers very high sensitivity, enabling early action to prevent fires and belt damage.

In a similar way, any direct reduced iron (DRI) pellets being transported by a conveyor may also cause damage to the belt. In this instance, the HotSpotIR 9000 can be used to detect hot areas on the belt surface just after the product has left it.

The HotSpotIR 9000 samples 1,000 small temperature points with each 80° scan across the conveyor. It makes 100 scans per second, thereby detecting 100,000 temperature samples every second.

SINTERING PLANTS

LOCATION:	SINTERING PLANT		
MEASUREMENTS:	HEATING ZONE, SINTERING CAKE, HOT SPOTS		
BENEFITS:	FIRE AND BELT DAMAGE PREVENTION		
AMETEK LAND SOLUTIONS:	LSP-HD 62 	LWIR-640 	HotSpotIR 9000 

The sintering plant receives a blend of iron ore, ore fines, calcium or magnesium fluxing agents and coke fines. These are heated at the entry firing hood, and then the high temperature layer propagates downwards, by suction from below.

The resulting sintered cake is fused and has a more uniform clumped size. Successful sintering also removes unwanted sulphur. The sintered cake is efficient and quick to react when charged into the blast furnace.

Thermal imaging provides analysis and control for the heating zone propagation down through the sintered cake. This data is provided by an AMETEK Land LSP-HD 62 linescanner, installed looking down at the cake as it enters the sintering hood.

An LWIR-640 thermal imager can also be used to ensure that the sinter is homogenous throughout the cake, delivering real-time visualisation for rapid, informed decision-making.

A HotSpotIR is again used on the conveyor after the sintering plant to detect rogue hotspots that may cause belt damage or fires.

THE BLAST FURNACE

The blast furnace is where the raw components of iron are combined. Under a high-pressure, extremely hot air draft, they are converted into liquid iron and slag waste.

The quality and composition of the iron produced in the blast furnace is directly related to the hearth temperature. This, in turn, is dependent on the temperature of the hot air blast blown into the furnace, and so this is an essential measurement to support product quality.

Non-contact techniques are required to measure the temperature of the incoming hot air blast in the blast main, since thermocouples won't survive in this environment – they quickly degrade, and become unreliable or inoperable.

AMETEK Land's fibre-optic SPOT+ R100 views a cast hollowed refractory brick that is placed in the blast main and quickly attains the gas temperature. The SPOT+ R100 has a very rapid response speed, measured in milliseconds, and operates reliably for many years.

Some blast furnaces monitor temperatures looking along the axis of a tuyere. Again, AMETEK Land's fibre-optic SPOT+ R100 is ideal.

The temperature of the iron that is tapped is also an indication of the desired quality and blast conditions. Continuous non-contact measurement is achieved using a SPOT+ R100 pyrometer.

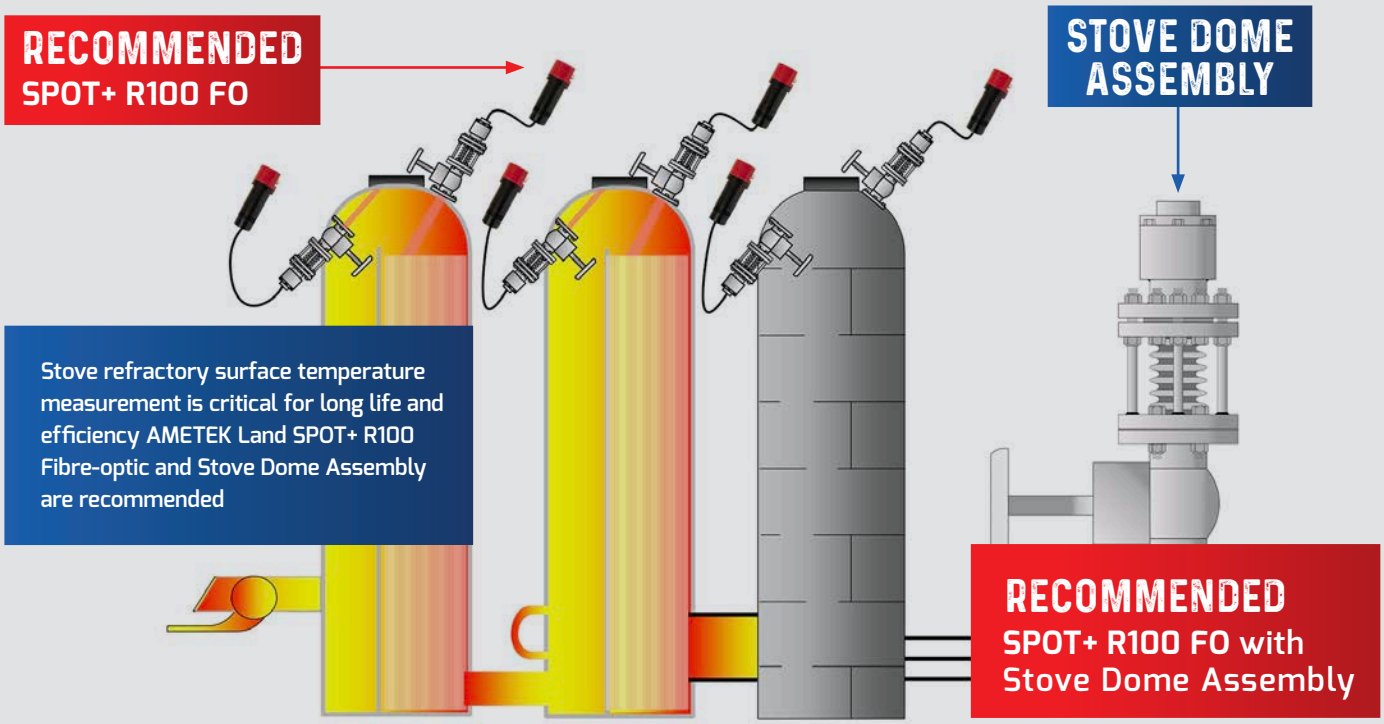
Using a short-wavelength pyrometer is advantageous in each of these applications, as it will 'see' through the gases produced by combustion.

Non-contact infrared measurements will deliver maintenance-free operation for many years. However, the harsh environment can affect the thermometer electronics, so a fibre-optic solution is beneficial, and correct installation is critical for effective operation.

LOCATION:	BLAST FURNACE
MEASUREMENTS:	HOT AIR BLAST
BENEFITS:	PRODUCT QUALITY
AMETEK LAND SOLUTIONS:	SPOT+ R100 FIBRE-OPTIC

THE STOVE DOME

LOCATION:	STOVE DOME
MEASUREMENTS:	REFRACTORY LINING
BENEFITS:	EXTENDED STOVE LIFE AND PROCESS EFFICIENCY
AMETEK LAND SOLUTIONS:	SPOT+ R100 FIBRE-OPTIC



The stoves store heat from the blast furnace waste gases. After a period of accumulation, the flow is reversed, and that hot stove is used to preheat the incoming air to the blast furnace.

Stoves are alternated, storing heat and dissipating heat on a regular flow reversal plan. For maximum efficiency, the stoves are operated at high temperatures, close to the working limit of the refractories.

This means that the refractory surfaces within the stoves must be monitored to prevent any over-temperature situations that, if left unchecked, would lead to refractory wear and premature damage.

To accomplish this, a number of SPOT+ R100 fibre-optic pyrometers are installed looking at the top of the refractory checkerwork and also looking upwards at the inside of the dome refractory lining.

This forms AMETEK Land's application-specific Stove Dome (SD) thermometer system, which delivers an accurate, rapid-response solution while avoiding the maintenance issues associated with slow-reacting thermocouples.

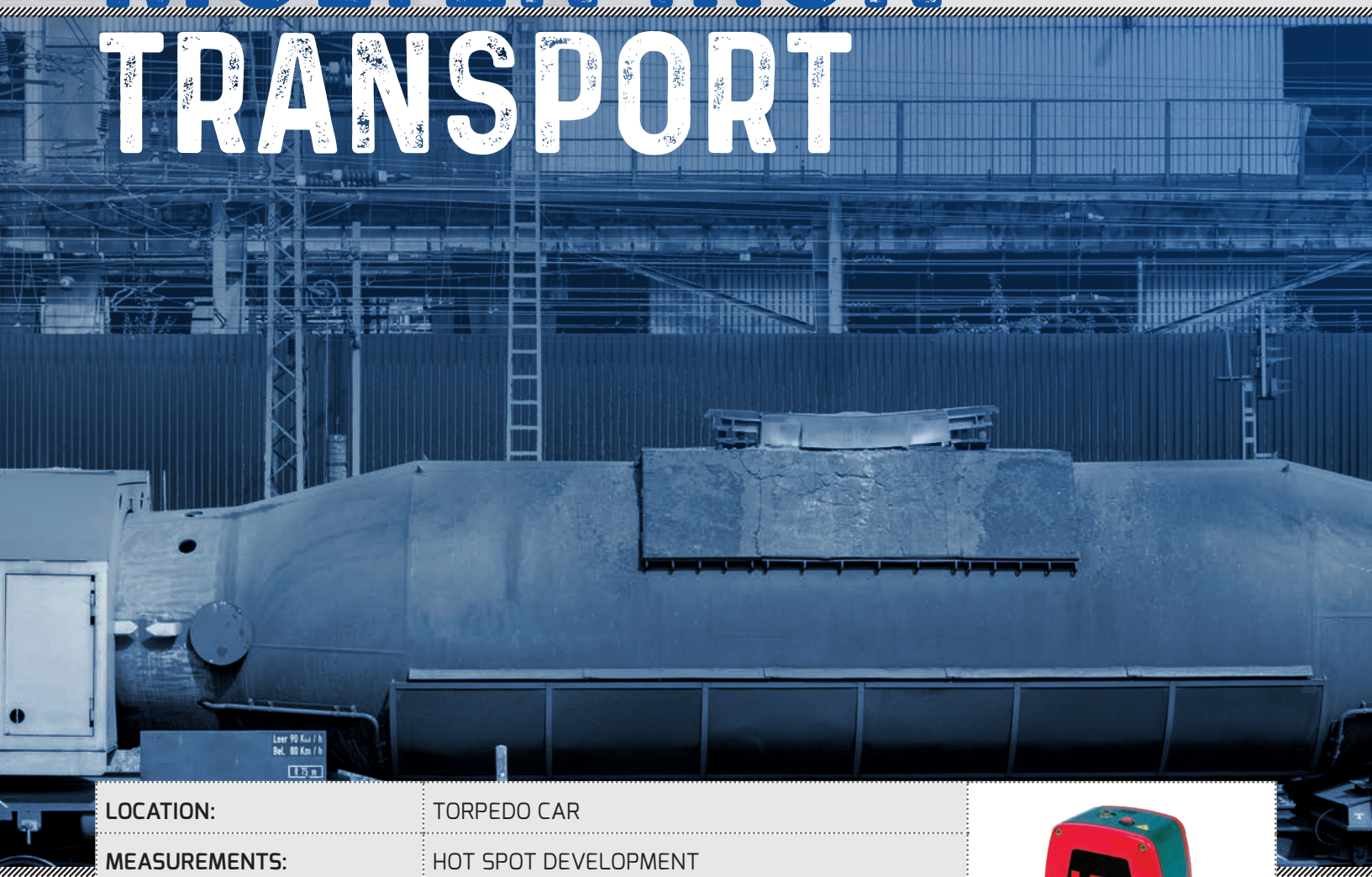
Modern blast furnace stoves work at temperatures and pressures that preclude the use of conventional thermocouples, since thermocouple metal sheaths are not typically viable above 1200 °C (2192 °F).

Alternative refractory sheaths are easily broken by brickwork movements due to thermal expansion and contraction. The useful life of thermocouple elements is reduced under these high temperature conditions due to contamination and/or migration of the tip materials.

Under sudden pressure relief – sometimes referred to as snorting – thermocouple chilling can reduce readings between 20 to 30 °C (68 to 86 °F) for about 30 seconds. This makes a thermocouple signal unsuitable for use in automatic stove changeover reversal control systems.

DOWNLOAD OUR BLAST FURNACE AND STOVE DOME APPLICATION NOTE: WWW.AMETEK-LAND.COM

MOLTEN IRON TRANSPORT



LOCATION:	TORPEDO CAR
MEASUREMENTS:	HOT SPOT DEVELOPMENT
BENEFITS:	SAFETY
AMETEK LAND SOLUTIONS:	LSP-HD 60

Torpedo cars are shaped ladles on rails that are typically used to transport molten iron from the blast furnace to the steelmaking facility.

These cars are typically lined with two or more layers of insulating refractory bricks that keep the iron hot and protect the steel shell of the torpedo car against failure.

It is important to monitor the shell temperatures using the same method each time the car passes the monitoring location. In this way, a history of hot spot progression can be developed.

Although there is a temptation for steel manufacturers to allow the refractory linings to thin, thus increasing the volume of iron that can be carried, this increases the risk of failure. Constant and repeatable thermal mapping of the shell allows early detection of areas that need repair.

AMETEK Land's Ladle Safety System features two infrared LSP-HD 60 linescanners – one located each side of the track. These are usually in a small enclosure which is heated and cooled as necessary. Each time a car passes between them, it is thermally scanned.

RF transponders, attached to each torpedo car, allow each car (and each side of the car) to be identified. This allows a history of thermal hot spot development for each car to be saved.

Climate-controlled enclosures on each side of the track house the scanners, along with the air purges and electrical interfaces. Industry-standard fast ethernet provides rapid communication to the control room.

The wide 80° vertical scan angle of the scanners and the 1,000 temperature points in each scan produce extremely high-resolution thermal images. These thermal images cover 1000 measure points in the vertical axis, providing comprehensive monitoring of the torpedo car.

LIQUID METAL IN FO

Liquid metal temperature measurement is a critical aspect of foundry applications, as it directly affects the quality and integrity of castings. Various methods are employed to measure the temperature of liquid metal during different stages of the foundry process.

One commonly used technique is the immersion thermocouple method. In this method, a thermocouple probe is inserted into the molten metal, and the temperature is measured based on the voltage generated by the thermocouple. Immersion thermocouples provide accurate and real-time temperature readings, allowing foundry operators to monitor and control the casting process effectively.

Another approach is the use of infrared pyrometers. These devices utilise the principle of analysing thermal radiation emitted by the surface of the molten metal to determine its temperature. Infrared pyrometers offer several advantages in foundry settings.

Infrared pyrometers provide fast and accurate temperature readings, allowing for real-time process control and adjustment. They are capable of measuring high temperatures typically encountered in foundry operations. These accurate and reliable temperature measurement are essential for ensuring proper casting quality, controlling solidification processes, and optimising production parameters. Infrared pyrometers offer a reliable and efficient method for liquid metal temperature measurement in foundry applications, enabling precise control of casting processes and ensuring the production of high-quality castings.

AMETEK Land SPOT+ MM MeltMaster

UNDRIES

SPOT+ MELTMASTER APPLICATION PYROMETER

The smart SPOT+ MM (Meltmaster) application pyrometer provides a single-sensor solution for liquid metal temperature measurements in foundry and tapping applications.

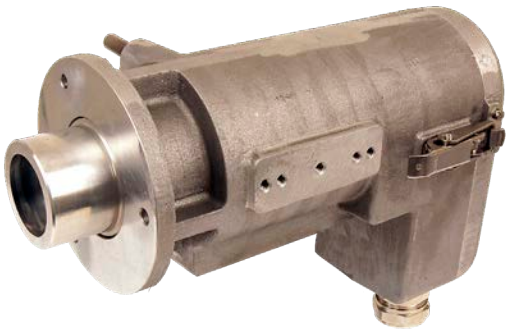
Optimised signal processing and a dedicated application mode allow the SPOT+ MM to accurately measure tapping stream temperatures independent of surface and condition changes during the process.

The SPOT+ MM has millisecond responsivity with integrated time functions to monitor and hold the tapping temperature for a configured time or until the next tapping process starts.

Multiple digital and analog interfaces enable easy integration into new and existing process control systems. The AMETEK Land Jumbo Display can be used for to monitor the tapping temperature via the 4-20 mA output of the pyrometer. An internal visual camera aids alignment and provides a remote process view via the integrated webserver of the SPOT+ MM. The webserver and Modbus TCP/IP enable full remote access to the pyrometer without the need for any additional software.

The SPOT+ MM is compatible with the SPOT+ Actuator for alignment with moving or multiple tapping streams. A further range of accessories, including the industrial enclosure with cooling and air purging options, allow the SPOT+ MM to work in harsh environmental conditions 24/7.

AMETEK Land Jumbo Display is an LED display unit, which connects via Bluetooth to tto display instant temperature measurement updates.



CYCLOPS MELTMASTER

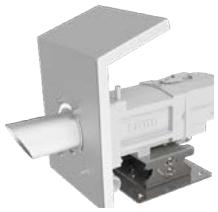
The AMETEK Land CYCLOPS MELTMASTER (C055L) enables accurate and easy temperature measurement of liquid metals in foundry processes by simply pressing a button. Additional working modes allow further and automatic processing of the measurement data.

Designed for accurate measurement of liquid metal temperatures in the range 1000 to 2000 °C / 1832 to 3632 °F

"THE C055L-2F SIGNIFICANTLY REDUCES THE USE AND COST OF DISPOSABLE 'DIP' TYPE THERMOCOUPLES"

STEEL TAPPING

LOCATION:	TAPPING PORT
MEASUREMENTS:	SLAG DETECTION
BENEFITS:	REDUCED SLAG CARRY-OVER REDUCTION
AMETEK LAND SOLUTIONS:	SDS - SLAG DETECTION SYSTEM



Once the molten iron arrives at the steel-making facility, it is typically transferred to a basic oxygen furnace (BOF), where it is purified into steel.

During the steel-making process, as scrap steel and fluxes are added to the molten iron, oxygen is blown into the mix to react and remove carbon. The fluxes make the process more thermally efficient by foaming on top of the liquid steel, and capturing impurities.

At the end of the process, the lighter slag is floating in a layer on top of the molten steel. The vessel is then tilted to start tapping the steel into a ladle.

The BOF is designed with a tapping port high in one side. This port allows the underlying molten steel to exit, while the unwanted layer of slag remains in the vessel. Only in the last few seconds of the tap does the slag finally reach the tapping port.

AMETEK Land's SDS slag detection system rapidly detects the onset of slag carry-over. Compared with alternative detection methods, it significantly reduces slag carry-over, such that systems pay for themselves within months.

This high-speed process thermal imaging system has several advantages over conventional methods for slag detection. As the SDS system utilises non-contact temperature measurement it is ideal for operations in this harsh environment for many years. The selected operating wavelength of the SDS is able to view through fumes that otherwise make visual observation difficult or impossible.

The SDS provides measurements at any time, day or night, and operates in a safe, non-contact way. Unlike manual systems possibility of operator eyesight damage is removed. No expensive disposables are required, and there are no expensive dart-loading machines.

AMETEK LAND COLLABORATES WITH DANIELI ON STEEL TAPPING SAFETY AND CONTROL – SEE PAGE 22

SLAG DETECTION

DEVELOPING AN EFFECTIVE SLAG DETECTION METHOD

TRADITIONAL MEASUREMENT SOLUTIONS

High-quality steel-making relies upon minimising the level of slag carry-over during steel tapping. Slag reduction also decreases the refractory wear in the vessels and significantly reduces the requirement to use costly additives to remove the slag.

Traditionally, operators monitored the tap visually, wearing a dark mask to prevent eye damage. Once the higher-emissivity slag began to carry over, it appeared much brighter than the preceding steel, so the operator would signal for the vessel to tilt back, ending the pour.

This method was dependent upon the skill and experience of the operator in spotting the slag and reacting quickly, and using different operators would lead to different results. Even with the same operator, results could vary according to factors such as fatigue.

In addition, eye damage often developed over the years, despite the use of eye shields, and fumes or smoke sometimes affected the operator's view.

Ceramic balls or darts were used to help the operator achieve better performance. These were precisely placed into a basic oxygen furnace or threaded into the tap hole. As the ball or dart was much lighter than the molten steel, it would float on top of it.

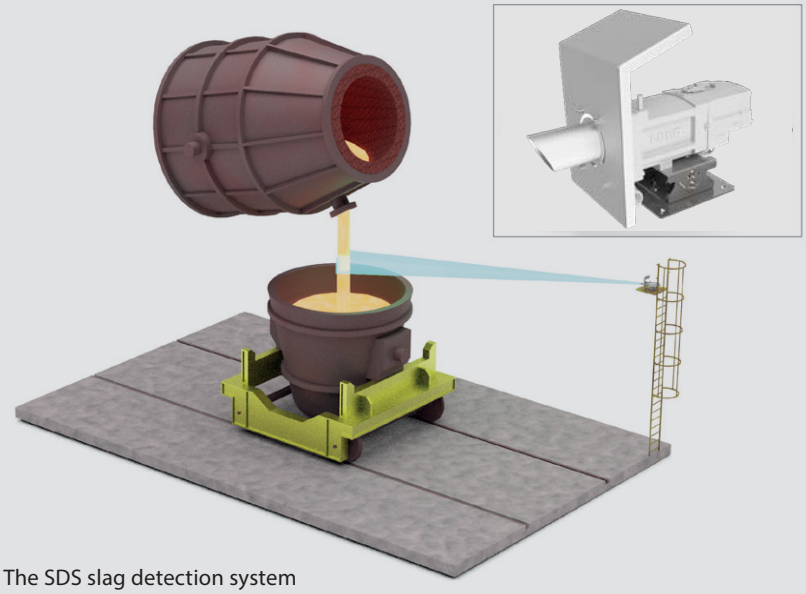
As slag began to flow through the tap hole, the density of the flow reduced, causing the dart to sink into the tap hole. This reduced the flow, giving the operator more time to respond and reverse the tilt.

Placement of these devices could prove challenging and often required an expensive, specialised machine and trained operator. This method also introduced costly consumables into the process.

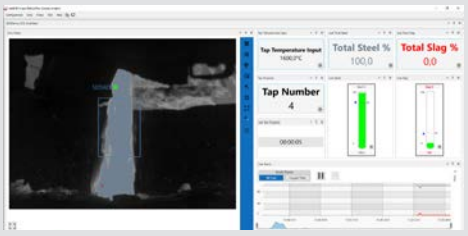
A later solution involved an induction coil fitted around the tap hole. The induction field changed according to the composition of the flow, so as slag began to carry over, the coil signal was used to determine when reversal should start.

The induction coil method, while effective, had the disadvantage that the coil life was much shorter than the vessel campaign life. Coil failure meant extra downtime or a switch back to manual slag detection.

Modern coil designs are more modular, enabling easier, quicker replacement, but still create a period of time between coil failure and replacement, with the associated device and labour costs.



The SDS slag detection system



REMOTE VIEWER

Up to 4 remote connections allow viewing of live tap information anywhere on the plant network.

LANGUAGE

The software offers local language support.

NON-CONTACT IMAGING SOLUTIONS

A more reliable slag detection method was developed using visual or thermal imaging cameras. As these were non-contact, they did not wear out, nor did they have consumable costs.

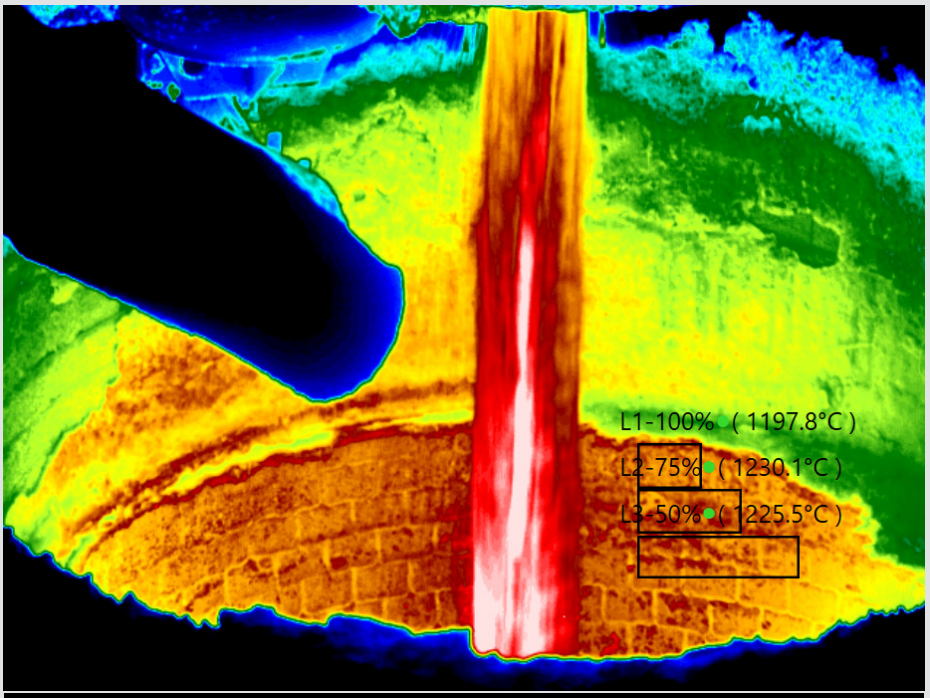
Both detectors – optical and infrared – produced more reliable, repeatable results than an operator's eye.However, the optical devices were still occasionally obscured by steam or fumes.

Infrared imagers using long wavelengths (8-14 µm) produced good results because the emissivity between steel and slag was accentuated at this range. They were also affected by some fume obscuration, though, while some of the optical materials required for these wavelengths were not durable enough for the demanding conditions of the steel mill.

It quickly became apparent that mid-wavelength thermal imagers offered significant advantages. An imager using a 3.9µm waveband could view the vessel through hot carbon dioxide and hot water vapour.

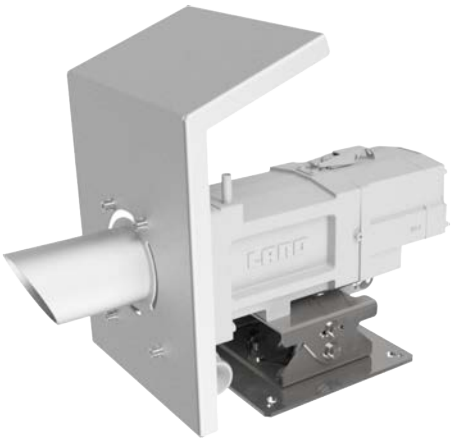
The shorter waveband also allowed for the use of extremely durable optical components, including sapphire protection windows.

These design advantages were incorporated into AMETEK Land's development of a dedicated solution for slag detection in steel-making.



Thermal image based Ladle Freeboard Measurements

AMETEK LAND'S SDS SLAG DETECTION SYSTEM



The AMETEK Land Slag Detection System is a proven solution for accurate and timely detection of slag carry-over in the steelmaking process, allowing plants to improve product quality, reduce slag carry-over and improve operator safety.

Specifically designed to survive in the challenging environment of the steel mill, it has a high-resolution thermal imaging camera to detect the transition between steel and slag, using the 3.9µm wavelength see through smoke and fumes.

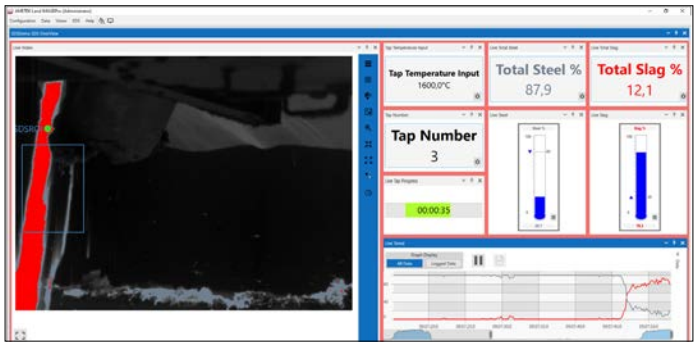
Quick termination of the tap after an alarm has been triggered is necessary to prevent excessive levels of slag in the ladle. Data presented to operators in real time enables them to make informed decisions about the tapping process.

Use of the SDS has been demonstrated to improve operator response time and consistency at the end of each tap. This results in a typical reduction in slag depths of up to 25%, compared with traditional methods of stream monitoring.

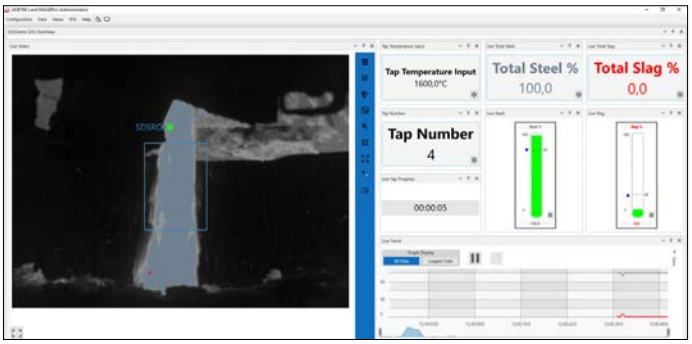
As the tap commences, application-dedicated software records it, using a stream identification algorithm, and produces a data log and graph for quality control. A stream tracking mechanism is included to ensure reliable operation in typical installation co

When slag appears and exceeds an operator-defined amount, an alarm automatically triggers. The system is designed to ensure accurate detection of steel/slag that is independent of charge weight and without operator intervention.

AMETEK Land's SDS is the definitive solution for monitoring and reducing slag carry-over in steel production facilities. It is proven to reduce slag carry-over, save money and improve operator safety.



These screens clearly illustrate how the SDS tracks the onset of slag, finally activating an alarm to stop the tapping process, preventing slag carry-over.



The alarm is now showing red. The steel content has fallen to 65.75% (slag at 34.25%). The alarm level (set at 20% slag) was triggered, the tap is then stopped.

"There are major benefits for steel producers to use AMETEK Land's thermal imaging technology, as a fast slag detection response allows plants to significantly reduce slag carry-over.

As the world moves towards a greener future, the importance of industrial decarbonisation is more important than ever. Our solutions ensure that your steel making processes are optimised throughout, saving energy and costs"

James Cross, *Head of Industry Management - AMETEK Land*

ELECTRIC ARC FURN

TRADITIONAL MEASUREMENTS

Electric arc furnaces (EAFs) are widely used in the steel industry for the production of high-quality steel. Temperature measurements play a crucial role in the efficient and safe operation of these furnaces. Traditional temperature measurement methods in electric arc furnaces have evolved over time to meet the specific challenges posed by the extreme conditions inside the furnace.

One common method of temperature measurement in EAFs is the use of thermocouples. Thermocouples are composed of two different metal wires, which generate a voltage proportional to the temperature difference between their junction and the reference junction. These devices are placed strategically within the furnace to measure temperatures at various locations. However, thermocouples have certain limitations, such as vulnerability to oxidation and corrosion in the harsh environment of an EAF.

Another traditional method used in EAFs is the utilisation of optical pyrometers. These devices measure temperature by analysing the electromagnetic radiation emitted by the heated objects. Optical pyrometers can be used from a safe distance, which is advantageous in the hostile environment of an EAF. However, they are less accurate compared to direct contact methods and can be influenced by factors like dust and smoke generated during the steelmaking process.

In recent years, advancements in technology have led to the development of more advanced temperature measurement techniques in EAFs. These innovations have enhanced temperature monitoring capabilities, allowing for improved process control and optimisation in EAF operations.

DECARBONISATION OF THE STEEL INDUSTRY

Decarbonisation in the steel industry is a critical goal to mitigate the environmental impact of steel production. One approach to achieving decarbonisation is transitioning from the Basic Oxygen Furnace (BOF) process to the Electric Arc Furnace (EAF) process.

The BOF process, which relies on the use of coke and coal for iron ore reduction, is a major source of carbon dioxide emissions. On the other hand, EAFs use electricity as the primary energy source and predominantly recycle scrap metal, resulting in significantly lower carbon emissions.

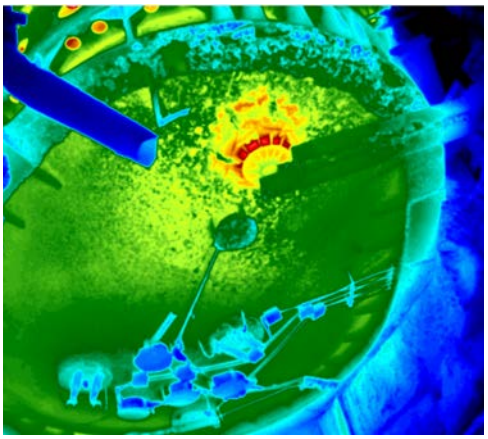
The shift from BOF to EAF involves several key steps. Firstly, increasing the scrap utilisation rate in EAFs is essential to reduce the need for raw materials and decrease carbon emissions. Furthermore, the integration of renewable energy sources into the electricity supply for EAFs can further enhance the environmental benefits.

However, the transition from BOF to EAF is not without challenges. EAFs have limitations in terms of producing certain types of steel and may require additional energy for heating and melting processes. Additionally, the availability and quality of scrap metal can impact the feasibility of the transition.

Nonetheless, the decarbonisation potential of shifting from BOF to EAF is significant. By reducing carbon emissions, improving energy efficiency, and utilising renewable energy sources, the steel industry can make substantial strides towards achieving its decarbonisation targets and contributing to global efforts to combat climate change.

THERMAL IMAGING

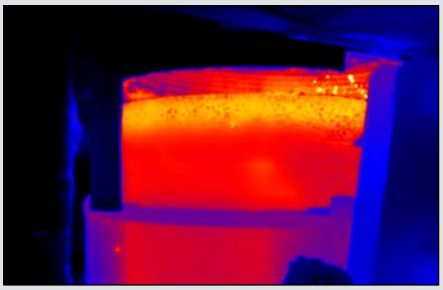
The use of infrared (IR) imaging systems in electric arc furnaces (EAFs) has transformed temperature monitoring in steelmaking. IR cameras capture thermal radiation emitted by the furnace, providing real-time temperature distribution maps. This enables operators to identify hotspots and anomalies that may affect steel production. The non-contact nature of IR imaging eliminates the need for physical sensors and offers a comprehensive view of temperature patterns. Integration with data analytics enables operators to optimize processes and make informed decisions. IR imaging systems enhance safety, productivity, and energy efficiency in EAF operations, revolutionising temperature monitoring in steelmaking.

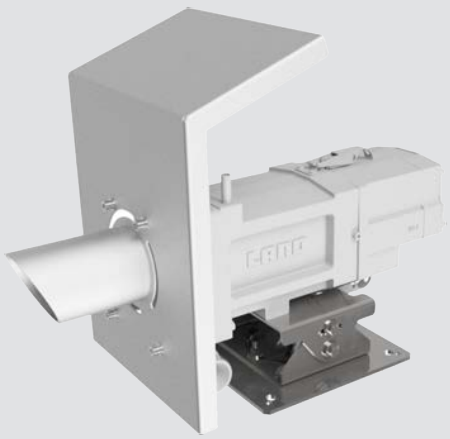


AMETEK LAND SDS V2

The AMETEK Land SDS V2 incorporating the MWIR-640 390 is an advanced infrared (IR) imaging system designed specifically for temperature measurement in Electric Arc Furnaces (EAFs). This system utilises long-wave infrared technology to capture high-resolution thermal images of the furnace interior. With its superior image quality and precise temperature measurement capabilities, the MWIR-640 390 enables accurate monitoring of temperature distribution and hotspots within the EAF. The system is capable of operating in high-temperature environments and provides real-time data for efficient process control.

By integrating the AMETEK Land SDS V2 into EAF temperature measurement, operators can enhance safety, optimise operations, and improve overall productivity in steelmaking processes.





THE METAL REHEAT

TRADITIONAL MEASUREMENTS

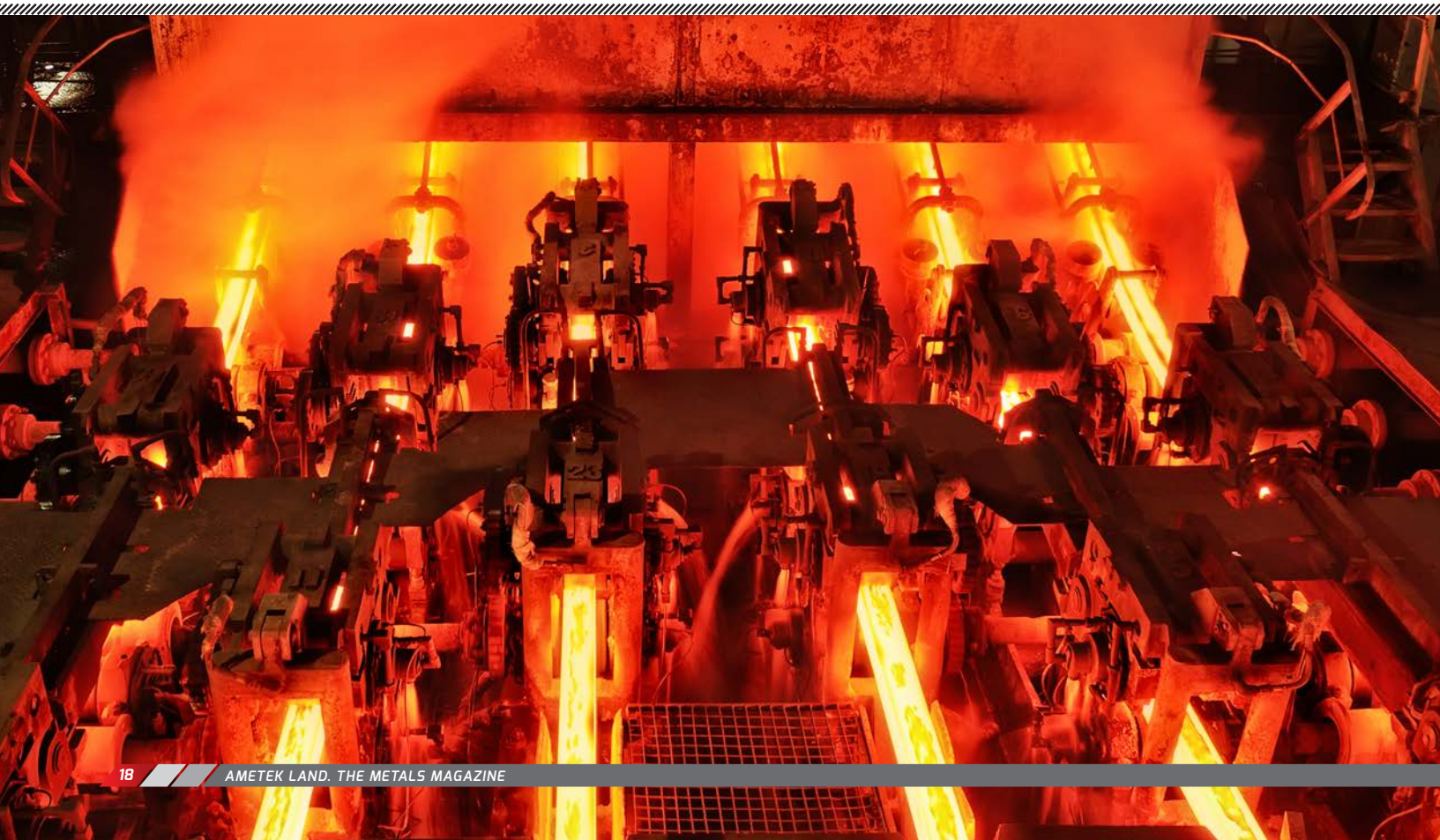
Reheat furnaces are used to bring cold metal slabs or billets to the correct temperature for rolling, extruding or forging processes. To achieve optimum quality and reduce waste, the temperature should be uniform throughout the metal product.

To ensure this uniformity, accurate temperature monitoring is required. Temperature measurements are also key to providing optimal heating trajectories for the metal. This results in significant energy savings, consistent metallurgical properties and minimal surface scaling.

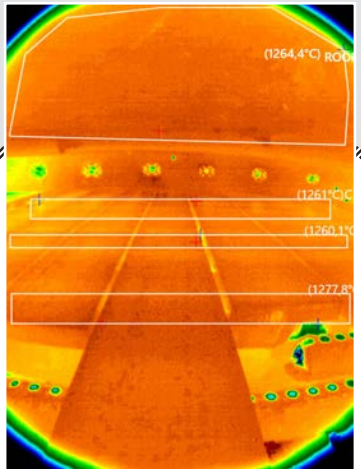
Traditionally, thermocouples have been used to measure the furnace atmosphere and surroundings, with mathematical heating models used to infer the stock temperature.

However, furnace conditions make thermocouple measurements unreliable, leading some operators to compensate by overheating the product, leaving it in the soaking zone for longer, rather than having to reheat the product later. However, this wastes energy and can cause additional surface scale.

LOCATION:	REHEAT FURNACE	
MEASUREMENTS:	STOCK TEMPERATURE	
BENEFITS:	QUALITY CONTROL AND PROCESS EFFICIENCY	
AMETEK LAND SOLUTIONS:	SPOT+ 	NIR-B-640 



FURNACE



INFRARED THERMOMETERS

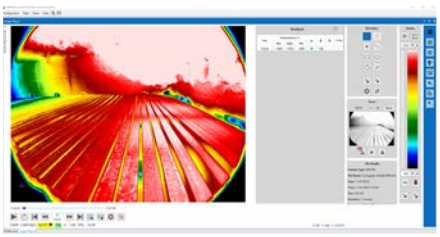
Non-contact radiation thermometers, also referred to as infrared pyrometers, have been used for many years to measure actual stock temperatures directly.

Readings from pyrometers are a sum of the emitted and reflected radiation from the stock and furnace background. To determine the correct stock temperature, the background temperature must be measured and its effects subtracted from the pyrometer reading.

A thermocouple can be used to measure the background temperature.

The AMETEK Land SPOT+ pyrometer provides this measurement, they also have a secondary input as standard.

The one disadvantage of using this method is that the pyrometer only measures a single spot. This limits usage to locations where the target is in a known position and it is acceptable to measure a small area on the surface of the metal. A complete picture of the surface temperature is not provided.



THERMAL IMAGING

Thermal imaging systems provide temperature measurements of the entire metal stock, measuring multiple areas on multiple targets. This means the camera can measure the entire product as it exits the reheat furnace, identifying anomalous readings.

In addition, thermal imaging provides a live view inside the furnace, allowing the operator to identify problems such as surface defects or hooked billets.

A hooked billet (one with a bent end) may affect billet movement out of the furnace, but would not be detected by temperature measurements alone.

Thermal imaging cameras typically require a large hole to be cut in the furnace wall to provide a viewing window. The disadvantages of this approach include costly heat wastage and heat damage to the camera.

Process thermal imaging borescope

THE NIR-B IMAGER

AMETEK Land's NIR-B process thermal imager avoids these problems by using a through-the-furnace-wall borescope with optics that deliver a wide-angle view inside the furnace.

This approach requires only a very small insertion hole through the wall, significantly reducing heat loss while also making installation much easier.

The NIR-B system can operate reliably in conditions where the furnace temperatures reach 1600 °C (2912 °F). It also features secondary temperature inputs from the furnace background, allowing it to account for the effects of background reflections.

This provides the most accurate surface temperature measurements of the stock, allowing the product to be pre-heated, heated and soaked for precisely the right time. This saves energy through reduced fuel use, increases throughput, and reduces downtime. It also improves production yields and extends the furnace life by reducing the furnace temperature.

Accurate stock temperature measurements protect the downstream processing machinery from under-temperature products, reducing the need for maintenance or repair of this equipment.

Once installed, the NIR-B monitors the furnace continuously, 24 hours a day. Temperature information is transmitted to a control system, while a live visual image allows operators to monitor for problems.

By using actual stock temperatures, the NIR-B can provide real-time, accurate process control, along with automatic file archiving and storage of complete temperature data. This supports both quality control and process efficiency.

DOWNLOAD OUR METAL REHEAT FURNACE APPLICATION NOTE: WWW.AMETEK-LAND.COM

HOT ROLLING MILLS

LOCATION:	HOT PLATE AND STRIP MILLS
MEASUREMENTS:	PLATE AND STRIP TEMPERATURE
BENEFITS:	QUALITY CONTROL AND PROCESS EFFICIENCY
AMETEK LAND SOLUTIONS:	LSP-HD 10, SPOT+ (UNDERSTRIP)

Plate mills handle very large and relatively thick flat steel plates. These plates are heated in the furnace, then rolled to the desired thickness and surface quality.

Accurate temperature measurements across the entire width of the plate are essential because the widths involved temperature variations across the plate are all too typical.

If temperature variations do exist, the rolling quality will be affected by dissimilar grain sizes or thickness effects.

Traditionally, measurements have involved conventional single-spot thermometers, which measure a line along the centre of the strip. Obviously, this only provides a very narrow measurement, and will miss temperature differences at other points on the surface.

Multiple thermometers are sometimes used, at increased expense, to view the two edges as well as the centre. This provides better detection of variations across the surface, but is still likely to miss temperature issues outside these narrow bands.

Accurate temperature measurements taken over the entire surface are preferable to ensure consistent product quality and provide the vital thermal data required for the cooling sections.

Any hot metal areas that might damage rollers or affect the surface finish or the metal can also be detected at an early stage.

MEASUREMENTS ACROSS THE METAL SURFACE

The LSP-HD 10 is ideal for this application, as it measures the complete surface temperature to precisely detect and define any temperature variations.

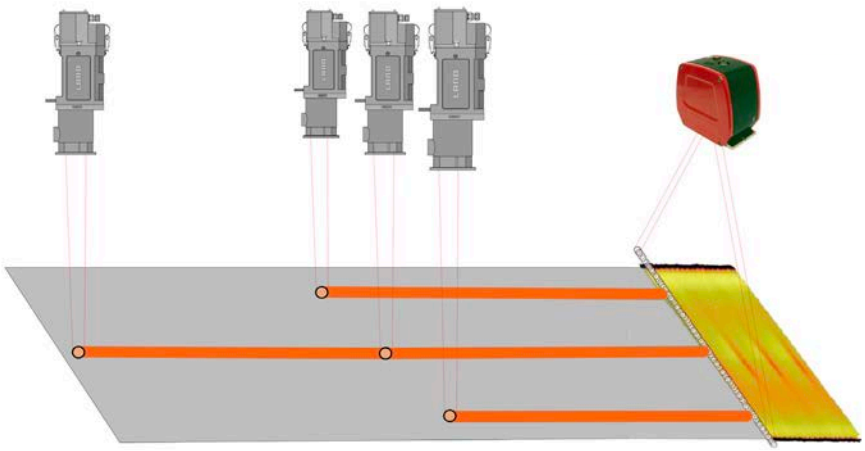
A compact, high-performance infrared linescanner, the LSP-HD provides highly accurate temperature measurements in a range of application-specific models.

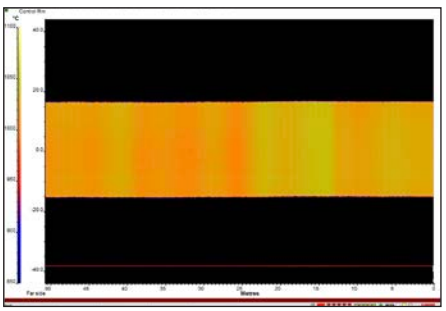
Designed for operation in harsh industrial environments, the LSP-HD 10 model measures in the range 600 to 1400 °C (1112 to 2552 °F), making it ideal for steel plate mill applications.

A scan angle of up to 80° and user-focusable optics ensure that the temperature across the entire width of the steel plate is accurately measured.

It offers industry-leading scanning performance of 1000 data points at scan speeds of 150 scans per second, detecting even the smallest temperature differences. This helps to improve process control and deliver consistent product quality.

The real-time processed data is provided via a standard plug-and-play Ethernet connection, removing the need for a separate processor and delivering all necessary electric connections through just one cable, significantly reducing installation costs.





LSP-HD views 1000 spots across the entire product surface

UNDERSTRIP TEMPERATURE MEASUREMENTS

Based around the SPOT+ infrared pyrometer, the Understrip is a fibre-optic temperature measurement system designed to provide continuous, accurate monitoring of the metal surface under the steel mill roller table.

This non-contact measurement avoids any effects from surface water or minor scale that may exist on the top side.

The Understrip system is easy to install, and is designed to provide trouble-free operation. Alongside the SPOT+ pyrometer, it consists of a low-cost sighting tube/purge unit housing a demountable fibre-optic probe, linked to an electric amplifier unit by a sealed light guide.

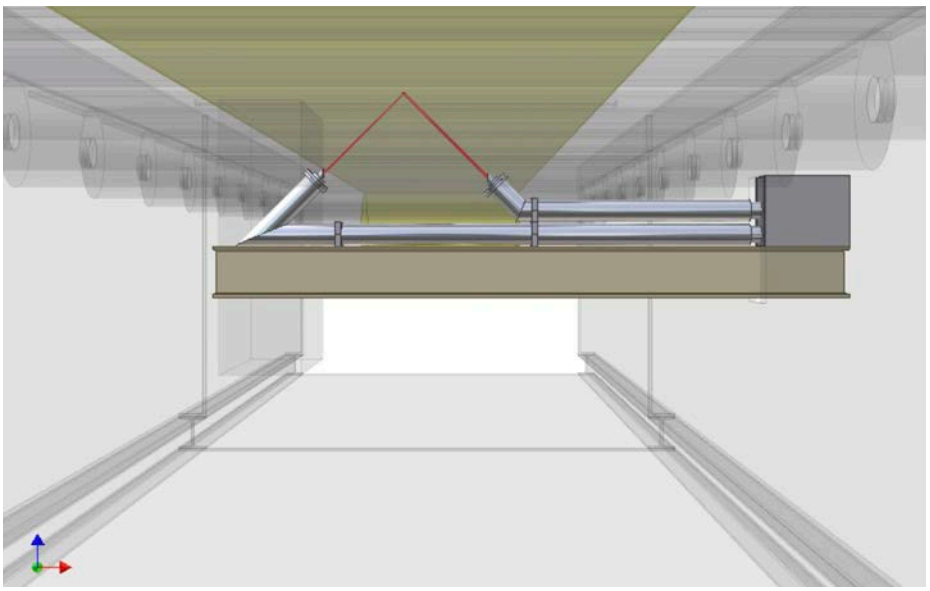
Sensor electronics are positioned remotely to avoid damage and reduce maintenance requirements.

The Understrip system requires minimal services – no water cooling is required, only a clean air supply to purge the thermometer sight path. Systems operate continuously for years with little or no maintenance.

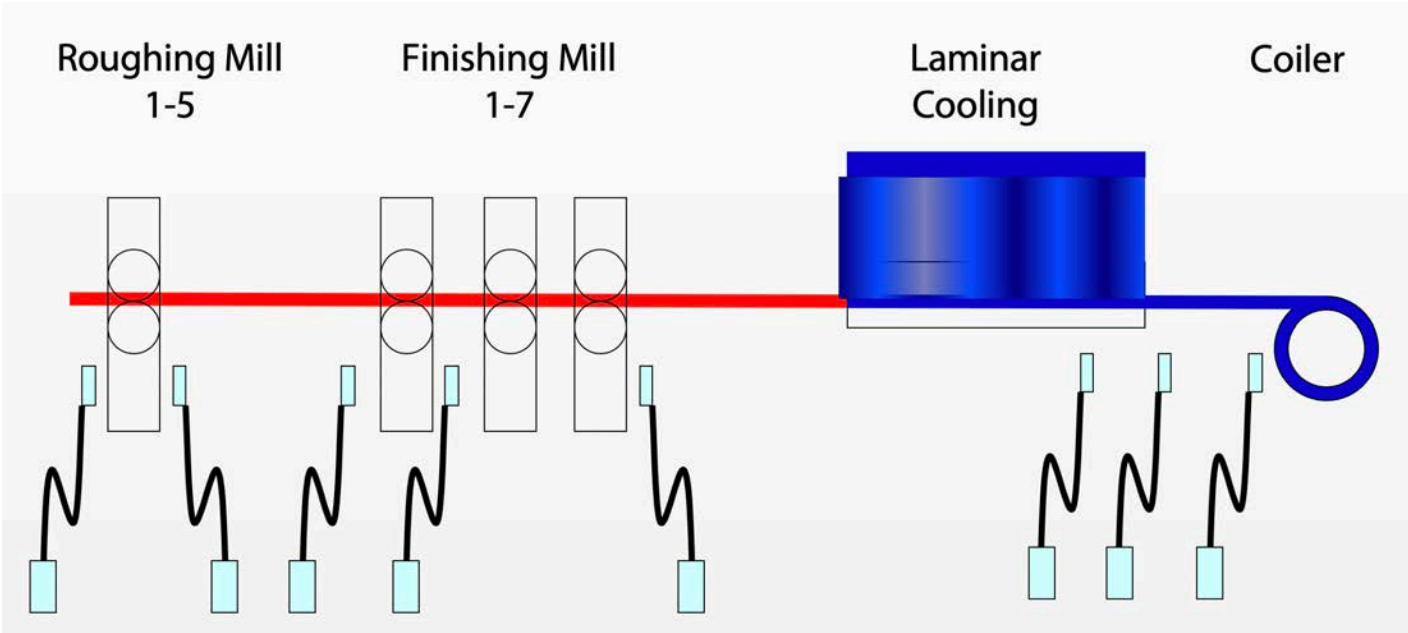
Because the SPOT+ pyrometer is used, no separate processor is required, and measurements are fast and accurate.

This ensures reliable data is obtained for the steel temperature for comparison with the readings obtained by the linescanner on the top surface of the metal.

AMETEK Land's Understrip systems are custom-designed for each mill and location to accommodate specific conditions and the variety of roll table designs that exist.



Recommended understrip solution



Recommended understrip solution

CONTINUOUS ANNEALING

LOCATION:	COIL WELDER, HOT BRIDLE, GALVANNEAL EXIT, TOP ROLL
MEASUREMENTS:	STEEL STRIP TEMPERATURE
BENEFITS:	PROCESS AND QUALITY CONTROL
AMETEK LAND SOLUTIONS:	SPOT+ GS THERMOMETERS, LSP-HD

The continuous annealing line is used to modify the grain structure of steel through heat treatment, changing its properties, including hardness and strength. It sometimes precedes hot dip metal coating operations.

The process involves several stages, focused on controlled heating and cooling to produce steel with the required qualities. In the case of a hot dip coating line, the annealed strip is cooled before being transferred to the zinc pot.

Accurate temperature monitoring and control in each heat zone is essential to control process efficiency and product quality.

The purpose of the continuous galvanizing line (CGL) is to apply a coating of zinc or zinc/aluminium onto the surface of steel strip to improve corrosion resistance.

Galvannealing is optionally performed to alloy the coating into the steel substrate. This requires accurate temperature monitoring at the exit of the galvanneal section.

Contact measurements for these processes rely on measuring heat by conduction. Methods used include thermocouples, electric resistors, colour paste, and contact-based thermometers.

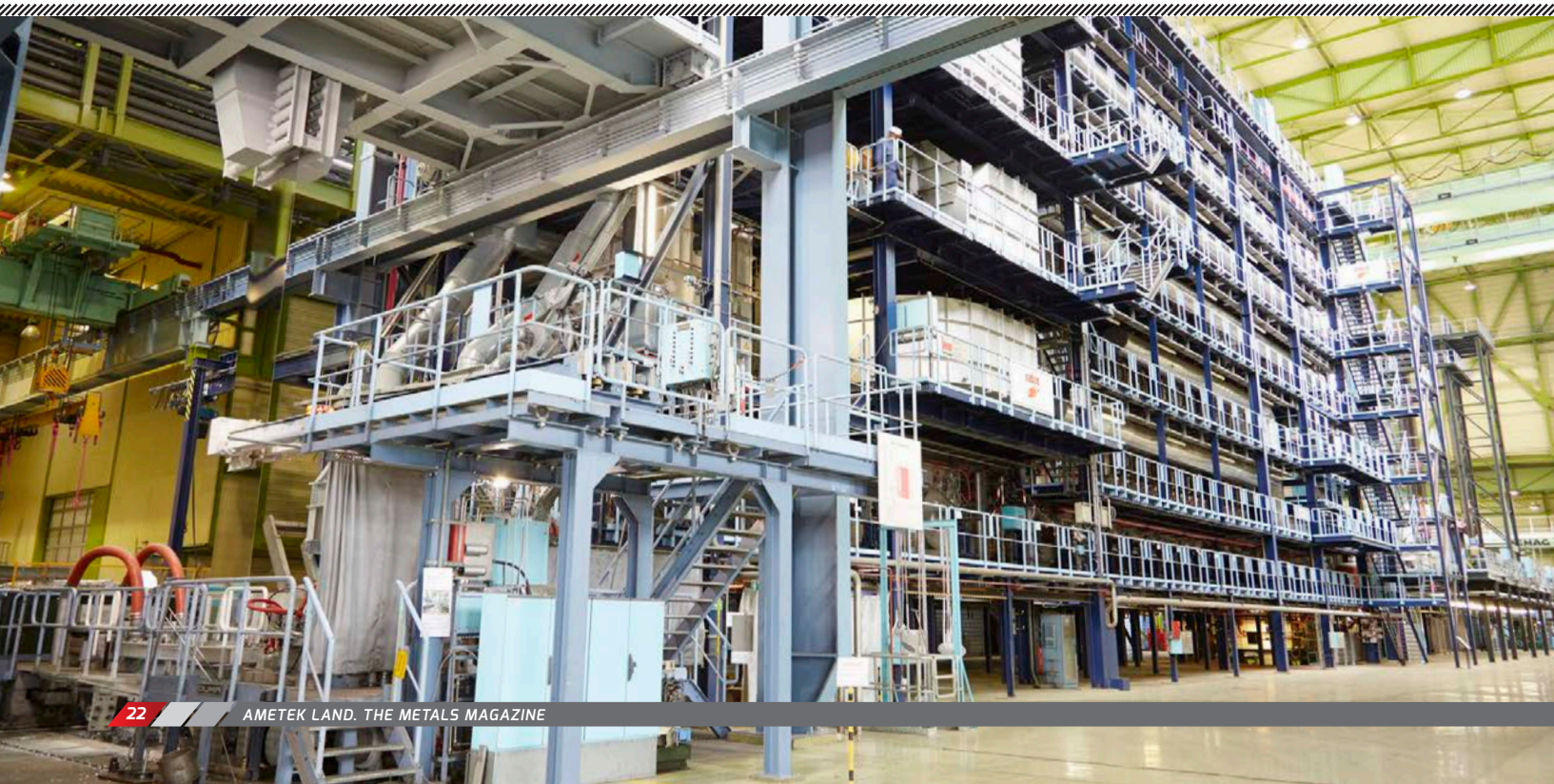
However, contact-based solutions can interfere with the process, cause surface damage to the steel, and may be adversely affected by the process heat over time.

AMETEK Land has supplied the steel industry with high-quality, reliable temperature measurement solutions for more than 70 years, and provides a range of specialist non-contact measurement instruments.

These measurements, delivered by pyrometers, linescanners and thermal imagers, take a reading of the heat radiation to determine metal temperature, based on Kirchhoff's Radiation Law.

To measure an object's temperature at high accuracy and reasonable signal-to-noise ratio, the emissivity value should be as high as possible, and the surface reflection should be as low as possible. This provides a challenge when measuring shiny metal strips, which have a low emissivity and are highly reflective.

The hot background may be reflected by the steel strip surface, affecting readings. In addition, surface properties and emissivity may change during the process.



AND GALVANIZING LINES

SPOT+ PYROMETER RANGE

The SPOT+ pyrometer range is a family of fully featured, high-performance pyrometers for fixed, non-conatact, infrared temperature measurements. They are available in a range of operating wavelengths, temperature ranges and process requirements, to fit numerous applications.

The range now includes the SPOT+ GS smart application pyrometer, a multiwavelength pyrometer specifically designed for the uncertain emissivity values of galvannealed strip steel.

It gives accurate temperature readings even when the object surface is at very low emissivity, using an innovative new algorithm that can track emissivity all the way from the liquid state.

If reflections at high temperatures are a problem, the SPOT+ GS can use background reflection, either as a pre-set temperature or taken from a thermocouple input, to calculate the correct temperature.

See page 20 for more a more detailed look at the SPOT+ GS thermometer.

LSP-HD LINESCANNER

A fast, accurate linescanner, the LSP-HD can be used to measure the temperature profile of the steel strip in different process steps, including the continuous annealing line, top of snout, after the galvanneal section, and top roll.

Designed to operate in harsh operating environments ranging from 20 to 1500 °C (68 to 2732 °F), the LSP-HD's high-quality optics produce high-definition thermal images at unrivalled scan speeds.

This industry-leading performance delivers 1000 data points at speeds of 150 scans per second, setting a new benchmark for process imaging definition and detecting even the smallest temperature differences.

This helps improve process control and keep product quality at a consistent standard.

The LSP-HD is easy to integrate using a single Ethernet data connection straight from the sensor head, with no requirement for a separate signal processor; all electrical connections are made using just one cable, so installation costs are reduced.

A NEW SOLUTION FOR GALVANIZED STRIP

AMETEK Land has created an innovative new pyrometer designed specifically to accurately measure the temperature of galvannealed and galvanized steel strip.

Developed in close collaboration with industry-leading metal producers and plant control system engineers, the SPOT+ GS steel application pyrometer provides continuous and accurate measurements of temperature on coated steel strip during the galvanneal reaction.

This enables steel producers to accurately measure the temperature in a galvanneal furnace, allowing it to run at optimum throughput rates in order to ensure consistent, high-quality premium-coated steel demanded by the automotive industry.

SPOT+ GS enables automated furnace management to provide close control of the reaction and position of the reaction zone, delivering tighter control of product quality. By maintaining control of the reaction zone, the steel application pyrometer accommodates rapid changes of line speed and furnace power with variations to substrate or coating weight.

This allows for furnace optimisation, reducing heating costs, maximising throughput and avoiding excessive over-reaction and powdering or flaking of the coating during subsequent forming operations.

The new GS+ measurement algorithm used by the device builds upon the traditional GST algorithm to extend performance all the way back to the zinc pot, tracking emissivity all the way from the liquid state.

In rare cases, it is also possible to send a reference temperature to the SPOT+ GS, via Modbus or Webserver, to adjust the measurement to special conditions. For example, if reflections at high temperatures are an issue, the

THE SPOT+ GS OFFERS:

- ☑ PRECISION OPTICS
- ☑ SENSITIVE DETECTORS
- ☑ HIGH-SPEED DIGITAL PROCESSING
- ☑ PLUG AND PLAY OPERATION
- ☑ INTELLIGENT AUTO-CALCULATION
- ☑ ACCURATE, RELIABLE READINGS

SPOT+ GS can use background reflection from a pre-set value or input from a thermocouple.

The SPOT+ GS application pyrometer can be integrated with furnace controls, PLCs and control software. By integrating directly, furnaces can run reliably and consistently and produce the highest quality products, with minimal scrap. The SPOT+ GS has additional inputs and outputs including emissivity out and LED switching, which are available as analogue/digital control I/O, as well as over Ethernet.

Combining Ethernet, Modbus TCP, video, analog and alarm outputs within one device, SPOT+ makes all these conveniently available to the operator. Pyrometer readings and configuration settings are available on the rear display and remotely via a web browser or through dedicated SPOT+ software.

SPOT+ GS is available with the free-to-download SPOTViewer software, which allows configuration, display and logging of data, and is the perfect choice for smaller operations with a single SPOT+ pyrometer. For up to 40 pyrometers, the SPOTPro software is a single control point for simultaneous monitoring, trending, advanced data logging and user management.

In addition, AMETEK Land offers a range of mountings and accessories that are compatible with all SPOT+ pyrometers, allowing for great flexibility and ease of use.

All AMETEK Land SPOT+ pyrometers are designed for high accuracy, reliability, simple installation, configuration and flexible digital communications. The SPOT+ GS pyrometer is set to lead the way in improving steel strip throughput via quality and energy efficiency.

SPOT+

Family of fully-featured, high-performance pyrometers for fixed non-contact infrared spot temperature measurements, available in a range of operating wavelengths, temperature ranges and process requirements.

Designed for easy single-person installation, SPOT+ pyrometers deliver the accurate measurements to optimise application processes and maintain high product quality. Temperature measurement range: Model specific, from 50 to 1800 °C (122 to 3272 °F).

Application-specific models available.

FIXED SPOT PYROMETERS

SYSTEM SAFETY AND

DANIELI COLLABORATION INCREASES TAPPING SYSTEM SAFETY AND CONTROL

AMETEK Land has joined forces with Danieli & C. Officine Meccaniche S.p.A. (Danieli) on automatic tapping systems to increase operation safety and improve process control for steel plants.

Established in 1914, Danieli designs plants, and manufactures and installs machines for the metals industry covering the entire production cycle from raw ore to finished steel products.

It has collaborated with AMETEK Land to produce the Danieli Automatic Electric Arc Furnace (EAF) Tapping System, which makes it possible to execute a complete furnace tapping remotely from the main pulpit of a steel plant. The system starts furnace tilting in automatic mode, controlling the furnace position during the complete tapping process.

Embedded within the system are two thermal imaging systems from AMETEK Land. The first is the world-renowned Slag Detection System branded as Danieli's Q-Slag. The second is the near-infrared (NIR) fixed thermal imager that is an integral part of the Ladle Level Detection (LLD) system. These thermal imaging systems are used in conjunction with Danieli software to control steel flow in real time.

Q-Slag makes use of an SDS Imager to detect the transition between steel and slag. It also quantifies the amount

of slag that may pass into the ladle. This is critical information for fine-tuning alloys and lime additions for the secondary metallurgy. In parallel with Q-Slag, the LLD system controls when steel inside the teeming ladle has reached pre-set level positions.

Back tilting can be done either in automatic mode (when the pre-conditions regarding steel level and weight are met) or by remote intervention of the EAF operator from the main pulpit.

Danieli selected AMETEK Land as a development partner based on LAND's 75 years of steel industry application expertise, along with the demonstrated ability of its Slag Detection System to improve operator response times and steel consistency at the end of each tap. Those improvements typically result in up to a 25% reduction in slag depths, compared with traditional methods of stream monitoring.

"We are delighted that Danieli selected AMETEK Land as a partner on their Automated Tapping System," said David Primhak, Division Vice President and Business Manager for AMETEK Land.

"There are major benefits for steel producers of using this technology. Fast slag detection response allows plants to significantly reduce slag carryover, resulting in improved yields, higher quality steel, and a reduction in costly downstream processing."

AMETEK LAND AND ALUMINIUM

AMETEK Land makes integrated thermometer systems designed solely for the temperature measurement of aluminium. Our products meet the highest standards of quality and reliability to ensure accurate performance under plant operating conditions.

Our advanced, dedicated solutions make us the preferred choice of the world's leading aluminium extruders and strip mill operators, providing the accurate, reproducible temperature measurements required.

AMETEK Land provides established and time-proven systems that are used in installations worldwide. Using our decades of experience and expertise working in the aluminium industry, we have developed market-leading products that monitor billet, slab and strip temperature, and provide essential measurements at the press and quench exit.

SMART ALUMINIUM SENSORS FOR INDUSTRY 4.0

AMETEK Land's smart aluminium sensors can achieve intelligent control and automatic alignment for autonomous operation in aluminium production processes.

The SPOT+ AL pyrometer uses complex embedded software algorithms for both temperature and emissivity outputs.

It can be coupled with AMETEK Land's, innovative smart SPOT actuator for automatic alignment. This enables it to provide accurate temperature measurements for most current extrusion, quench and strip applications, without human intervention.

The SPOT+ AL with actuator was designed in close collaboration with industry-leading aluminium producers and plant control system engineers to help improve aluminium extrusion, strip plant throughput, quality and energy efficiency.

It can capture huge amounts of data, while offering smart interpretation from multiple instruments, with application-appropriate logging of derived parameters.

This delivers on AMETEK Land's vision for Industry 4.0 in the aluminium extrusion process, with the interconnectivity of smart thermometers and actuators and 'big data' handling by cognitive computing.

The SPOT+ AL and actuator system can automatically scan to identify profile positions after a die change, alert operators to uneven die cavity or quench conditions, provide temperature measurements for accurate press/quench control, and make slight positional adjustments to track wandering profiles.

Its advanced algorithm works with low emissivity surfaces, fitting the current measurement to a complex, pseudo-3D dataset of previously calibrated emissivity, radiance and temperature values for different aluminium alloys.

From the radiance received at the different wavelengths of the thermometer, emissivity as well as temperature can be calculated.

THE SPOT+ AL & ACTUATOR

AMETEK Land's motorised actuator simplifies the process of taking accurate temperature measurement readings.

Traditionally, as die changes occur they require an operator to verify the correct pyrometer alignment, then physically reposition the pyrometer's mounting bracket or manually alter it using a motorised actuator with keypad control.

The SPOT actuator enables extremely accurate alignment, taking 900 measurement points over 90 degrees, and aligning on the optimum measurement position on the profile. This is particularly useful at the exit of the quench, where the extrusion may be liable to wander from side to side. A hotspot auto-scan feature allows the actuator to be triggered to scan the entire range of movement and then align the SPOT+ AL with the hottest part of the extrusion.

See how the SPOT+ AL and actuator work together in extrusion measurements on page 26.

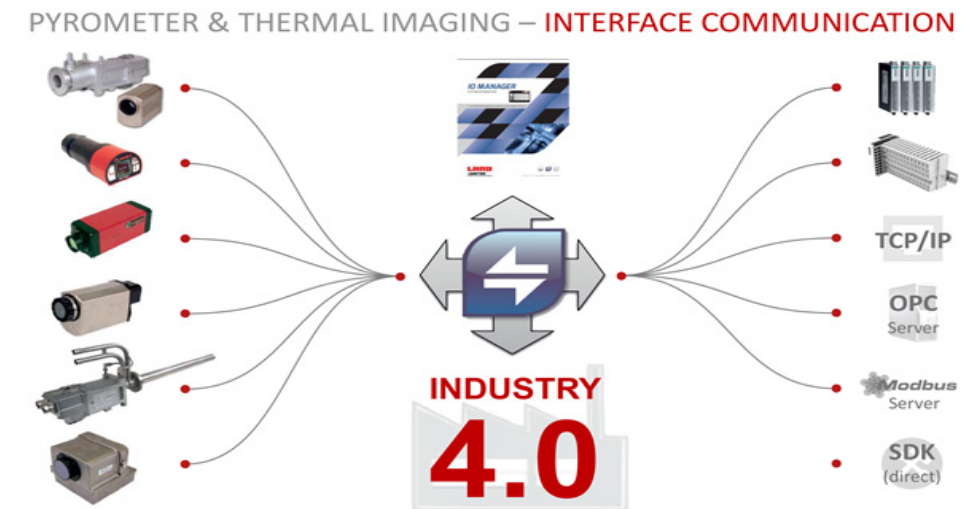
AMETEK LAND AND INDUSTRY 4.0

Industry 4.0 is a term used to describe the digitisation of industrial processes and the associated bi-directional data exchange via digital interfaces, enabling comprehensive and automated communications between machines, sensors and operators.

This optimises processes, reduces cycle times, and increases productivity, quality and safety.

The AMETEK Land range provides innovative products with industry-standard interfaces, such as Modbus/TCP and Power over Ethernet (PoE), which can be quickly and easily integrated into new or existing networks. As a result, much more data can be exchanged continuously between the measuring system and the process than just the pure measuring signal.

Many of the devices and systems already provide an integrated web server. Through this all device parameters can be viewed, configured and visualised using a standard web browser. This enables the networking and control of multiple sensors or complex measurement systems based on industry-standard digital interfaces. Other possibilities include remote access to control, visualisation and service.



TEMPERATURE MEASUREMENTS FOR

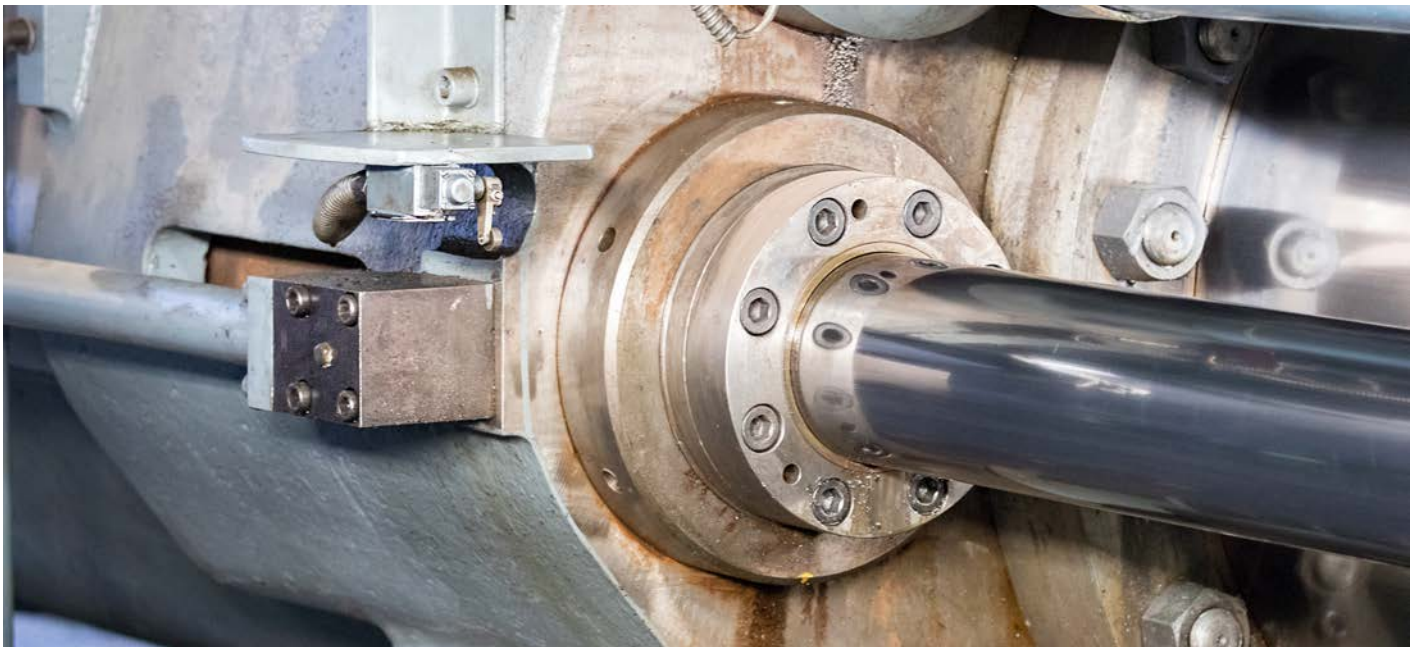
Accurate temperature measurements are essential for high quality aluminium extrusion production.

The introduction of new, specialised aluminium alloys designed for high-end applications such as aerospace, automotive or safety products has led to an increased need to meet complex mechanical specifications and to decrease final product weight.

To meet the demanding requirements of the final products, extrusion and quench process temperatures are crucial, and must be monitored precisely and continuously.

The SPOT+ AL pyrometer combines with the new SPOT Actuator to provide highly accurate process temperature measurements, along with intelligent product and process tracking. This enables continuous temperature monitoring, and improves process and product quality.

In addition, extrusion plants manufacturing lower quality profiles can increase their press speeds, improving production rates.



AN EFFECTIVE NON-CONTACT SOLUTION

To produce high-quality aluminium profiles of the required specification and properties, it is critical to understand the extrusion temperature, and to control the press speed and quench rate.

For example, the temperature of the extrusion at the press exit affects the dimensional properties and surface finish of the final product. If it is too high, the surface may suffer imperfections or even crack.

However, if the temperature is even slightly too low, the die in the extrusion press may wear more rapidly, since the metal will be harder and so requires additional pressure to extrude. As the die wears, the physical size of the extruded section changes; it is also expensive to replace the die.

Contact-based temperature measurement methods are not well suited to the extrusion process, since they are often taken manually at a single point and can damage the surface.

Non-contact temperature measurement is a better solution. Infrared pyrometers use radiated energy emitted from the aluminium surface to make their measurements. This allows extruders to continuously measure metal temperature at each stage of the process without risking surface damage.

Emissivity is an object's ability to radiate infrared energy. Aluminium alloys have unique reflectivity and emissivity characteristics, creating a challenge for conventional infrared pyrometers.

As a consequence, small changes in emissivity can cause errors in temperature readings. However, modern application-specific pyrometers such as AMETEK Land's SPOT+ AL are able to address these challenges.

These multi-wavelength pyrometers use complex signal processing algorithms, combined with powerful high-speed digital signal processing and ultra-low-noise signal amplification, to produce accurate results over a wide range of different alloys and surface conditions.

ALUMINIUM EXTRUSION PROCESSES

ACCURATE PLUG AND PLAY MEASUREMENT

The SPOT+ AL pyrometer is the result of AMETEK Land's continuous product development, based on the latest technologies and lengthy site trials.

By selecting the desired mode of operation (extrusion, quench or strip), locally configured on the pyrometer or remotely, accurate product temperatures can be measured for approximately 90% of all aluminium alloys, without the need for additional adjustments. For special alloys, it is easy to enter a temperature reference bias, based on a single thermocouple reading, into the pyrometer remotely.

Remote operation is achieved using the integrated web server via TCP/IP with a standard web browser or directly connected to the PLC.

An integrated video sighting system allows the operator to easily and correctly position the device with a motorized focus adjustment between 300mm and infinity. A bright, green, pulsed LED focus pattern projection makes it easy to verify target alignment, measurement spot location and spot size.

All configuration choices can be programmed directly on the pyrometer using the push buttons and digital display screen.

INTELLIGENT PRODUCT AND PROCESS TRACKING

The new SPOT Actuator was developed as a result of AMETEK Land's desire to provide an intelligent function to automatically track and improve process temperatures.

Capable of remote or manual operation, it can run without the need for additional software, and is easy to access and use. Combining the pyrometer and actuator allows them to communicate directly without operator intervention.

Multiple intelligent scanning modes are also available. Selecting the hot spot mode sets the Actuator to dynamically track the hottest of multiple profiles as they exit the press or quench exit.

For larger or more complex profile geometries, extrusion mode will automatically find the area emitting the most energy to ensure the correct metallurgical properties are recorded.

Using the billet scan mode, the SPOT+ AL and Actuator combination can scan the length of a billet as it arrives at the press and produces a full head-to-tail temperature profile. This allows the press speed to be optimised for each billet.

MEASUREMENT LOCATIONS

Aluminium extruders measure temperature at various locations, but the three most common are the billet, the press exit, and the quench exit.

The SPOT+ AL has three scalable modes, allowing it to be optimized for these locations, as well as the strip rolling mill. This allows the same model to be used throughout the process, which makes keeping a spare pyrometer on hand simple and affordable.

BILLET TAPER

At the start of the extrusion process, a billet is heated in a specialised reheat furnace. Typically the billet temperature is measured with either a single reading on its cut face, or by taking a profile reading along the side of the billet.

However, many extruders prefer to measure the profile temperature just as the billet arrives at the extrusion press. Using the Actuator, the SPOT+ AL can scan along the length of the billet, generating a temperature profile.

PRESS EXIT

The SPOT+ AL can be set above the press exit to scan the profile. This may be a fixed installation with a manually adjustable mount, or can be combined with the Actuator to automatically aim the pyrometer at the optimum measurement position on the new profile.

This measurement is typically fed back to the press control system to enable dynamic press speed. The well-defined measurement spot of the pyrometer and rapid 15ms response speed facilitate this dynamic tracking.

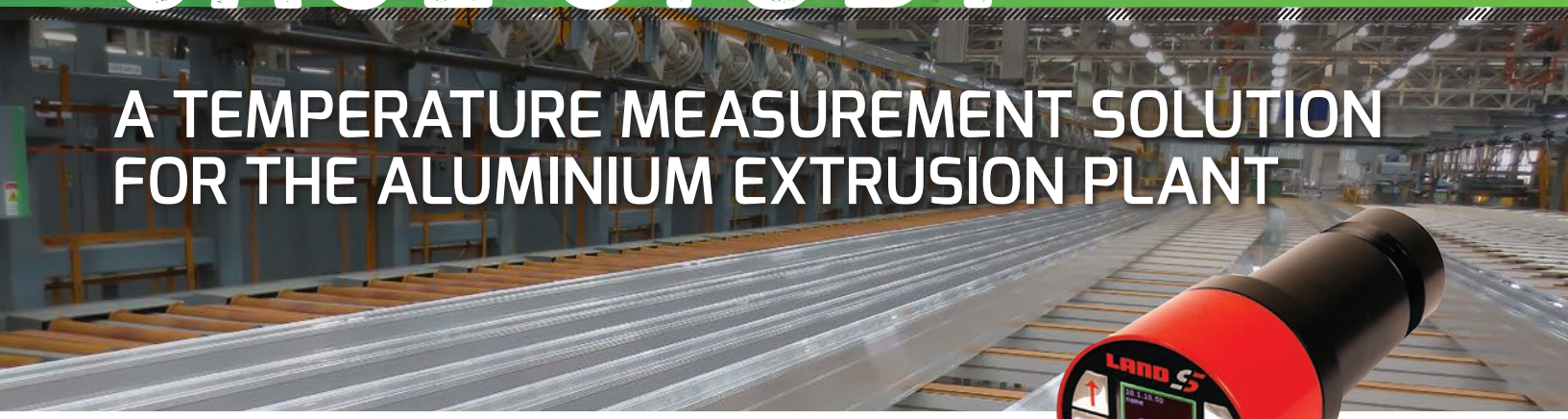
QUENCH EXIT

The SPOT+ AL can be positioned at the exit of the quench section, an important measurement location for high-strength profiles or those with specialised characteristics. Combined with the SPOT Actuator, it is installed looking downwards onto the profile.

The actuator tracks the lateral movement of the extrusion, maintaining optimum measurement position on the profile. As with the press exit, the dynamic tracking is facilitated by the defined measurement spot of the pyrometer and the 15ms response speed.

CASE STUDY

sapa:



A TEMPERATURE MEASUREMENT SOLUTION FOR THE ALUMINIUM EXTRUSION PLANT

THE COMPANY

SAPA Profiles UK is the world's leading producer of aluminium extrusions. Based in Tibshelf, Derbyshire, it supplies products to the highly controlled automotive, marine and construction industries. It is part of the Hydro Extruded Solutions group, which has its headquarters in Oslo, Norway.

THE CHALLENGE

Because of the demands upon its products, SAPA Profiles UK needed to ensure that the aluminium it processes is cooled at an exact quenching rate in order to achieve the highest quality metallurgical properties.

If this is achieved, it provides greater confidence that the extruded profiles will meet the required structural properties in subsequent testing.

In the past, SAPA Profiles UK found it challenging to measure the lower end of the temperature range. This led to the use of two separate pyrometers to ensure coverage of the wide temperature spectrum.

SAPA Profiles UK required the ability to take fast and accurate temperature measurement readings in real time. The company also needed to provide operators with vital diagnostic information about what was happening throughout the extrusion press exit and quench process.

THE SOLUTION

SAPA Profiles UK implemented AMETEK Land's SPOT+ AL pyrometers at its aluminium extrusion plant in Tibshelf. This is an innovative temperature measurement solution specifically designed for aluminium extruders and rolling mills.

The SPOT+ AL pyrometer provides high accuracy and a three-in-one capability for aluminium applications, including extrusion press exit, extrusion press quench zone and strip mills.

The device is optimised to work within low emissivity environments where regular pyrometers might struggle to provide accurate and reliable readings.

Combining the latest detectors with advanced data processing algorithms, it delivers precise, repeatable readings with industry-leading response times.

The pyrometer offers the ability to customise and tune the algorithms for bespoke applications and specific aluminium grades.

The SPOT+ AL covers temperatures from 200 to 700 °C (392 to 1292 °F), which meets SAPA Profiles UK's measurement range needs within one highly effective instrument.

SPOT+ AL at the press exit and quench displayed on the customer's PLC

A spokesman for AMETEK Land said:

"This revolutionary pyrometer is designed for high levels of accuracy and convenience. The same pyrometer type can be used at all positions in the aluminium extrusion process.

"SPOT+ AL can make a huge difference to product quality and performance for companies like SAPA Profiles UK for whom accurate temperature measurement at both ends of the spectrum is vitally important.

"The SPOT+ AL is a very user-friendly, intuitive device that has been specifically designed to integrate within existing control systems. The high ambient temperature rating of 70°C (158°F) allows the pyrometer to be used in many locations without the need for additional cooling."

CASE STUDY sapa:

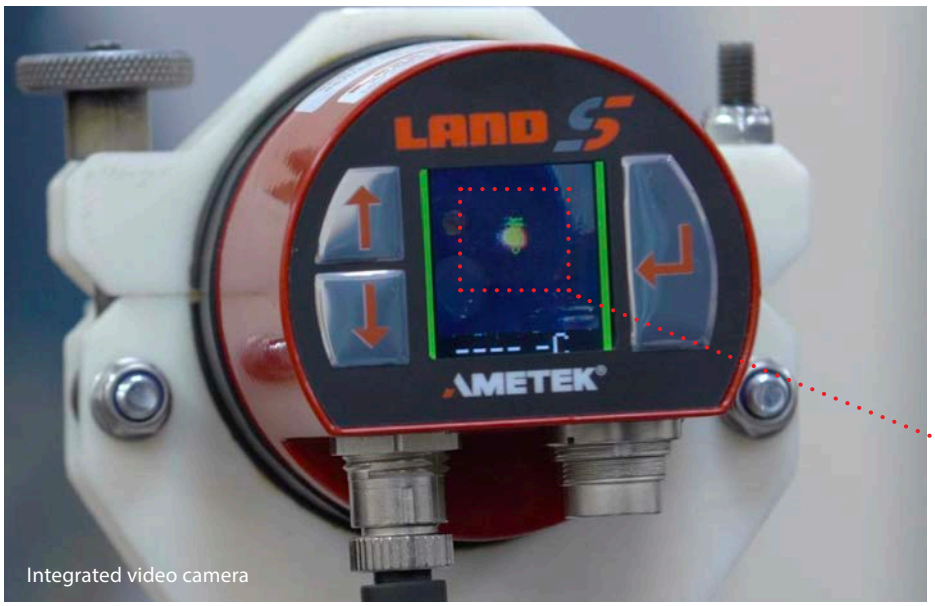
Incorporating the latest digital communication systems, the SPOT+ AL can be configured remotely through a dedicated webserver.

With Power over Ethernet capabilities, it will communicate data over Ethernet to any web browser or via Modbus TCP, DHCP, http, udp and ICMP. Along with its traditional 4-20mA/0-20mA output signal, this allows the SPOT AL EQS to be easily integrated into any plant control infrastructure.

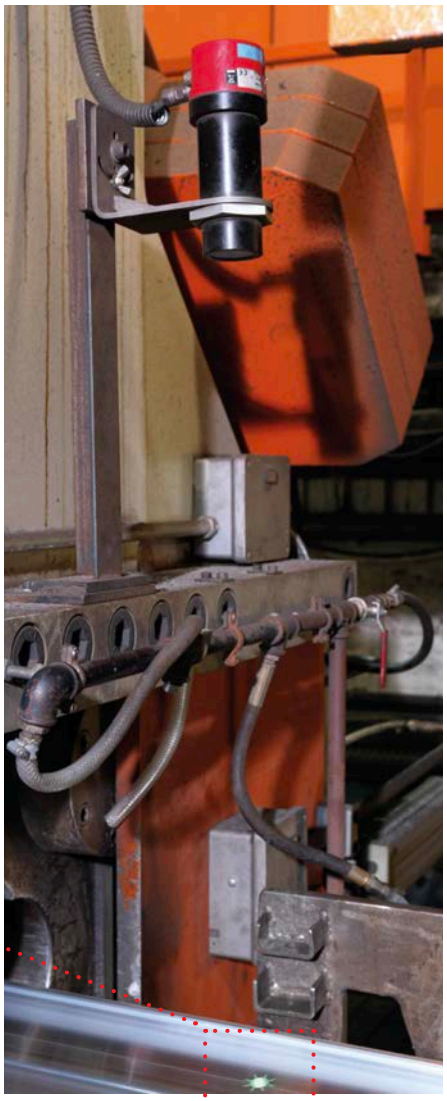
SPOT+ AL can be operated straight out of the box by just one person, providing greater convenience and ease of use. If the sensor is in an inaccessible location, SPOT+ AL provides remote viewing and motorised focus to verify alignment and ensure a high level of accuracy.

A built-in camera aids alignment and, combined with a green LED, assists the user in positioning the measurement point in the optimal location, avoiding any ambient lighting reflections.

Data from the SPOT+ AL is available remotely as snapshots using AMETEK Land's free SPOTViewer software or standard web browsers. Optional SPOTPro software allows up to 40 pyrometers to be displayed and data logged.



Integrated video camera



THE RESULT

The SPOT+ AL pyrometers delivered major efficiencies and performance benefits by accurately measuring temperature of low and variable emissivity aluminium.

Cristiano Baiano, Senior Automation Engineer at SAPA Profiles UK, said: ***"Implementing AMETEK Land's SPOT+ AL pyrometer at the press exit and after the quench at our site in Tibshelf has enabled us to continue to meet the exacting standards of our customers.***

"SPOT+ AL gives us the ability to take accurate measurements at very low temperatures, which is essential to ensure product quality and performance.

"Our operators now have all the data available that they need to make informed decisions. It was very simple and straightforward to integrate this solution into our control system."

SAPA Profiles UK now has the ability to trend data over time, via a direct digital connection. This gives operators a much-improved overview of the process performance, compared with real-time readings alone.

Operators are also able to remotely trigger the LED sighting and adjust the position of the quench exit instrument.

Cristiano added: ***"With precision control of extrusion conditions, we have minimal to zero temperature variation for each extrusion length, or from extrusion to extrusion. This results in repeatable material production with even metal quality and strength."***

THERMAL IMAGING WEDGE MEASUREMENT SYSTEM

AN EDGE-TO-EDGE SOLUTION AT THE COILER

After aluminium strips are produced, they are coiled for transport and storage. Process control and product quality requires continuous monitoring of the strip centre and edge throughout the coiling process.

If temperatures are too high, the metal may soften and stick together as it is coiled. In addition, the lubricant on the surface of the strip may ignite, causing a fire. If the temperatures are too low, the coiling action may cause the metal to crack.

Precise real-time application monitoring allows optimised process control, with accurate temperature compensation and speed adjustment based upon the coil temperature. A system which tracks the coil position also allows detection of product quality issues before dispatch, and increases product traceability.

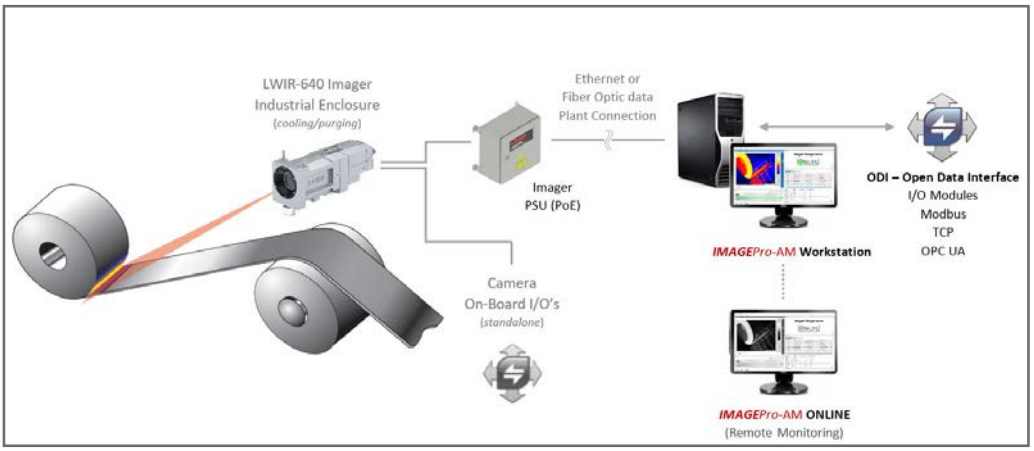
For an application-specific solution, AMETEK Land offers the Thermal Imaging Wedge Measurement System. Based upon the proven LWIR-640 thermal imager, the system delivers highly accurate edge-to-edge temperature measurements at the coiler.

The system is easily installed using Plug and Play, generating continuous real-time thermal data. The information provided allows operators to produce highly consistent products while simultaneously improving plant safety.

The Thermal Imaging Wedge Measurement System is configurable to provide measurements from 100 to 1000 °C (212 to 1832 °F) on the hot rolling mill or from 0 to 500°C (32 to 932°F) on the cold rolling mill. From these readings a continuous 384 x 288-pixel thermal image is created, using advanced radiometric infrared technology.

AMETEK Land software supports quality control using a patented technique to produce real-time thermal profiles. This live imaging provides process monitoring and automatic calculation of strip centre and edge temperatures.

The software offers up to 10 control lanes and a two-dimensional thermal map, enabling highly specific process adjustments to be made.



THERMAL IMAGING BASED WEDGE MEASUREMENT SYSTEM

The Thermal Imaging based Wedge Temperature Measuring system is designed for temperature monitoring of aluminium during strip coiling and cold rolling.

The System uses the advanced LWIR-640 thermal imaging camera to deliver accurate wedge temperature measurements at multiple positions in the wedge during the coiling or cold rolling process.

For optimised support, hot and cold mill versions cover two temperature ranges: 100 to 1000°C (212 to 1832°F) or 0 to 500°C (32 to 932°F).

LWIR-640 IMAGER SYSTEM

SURFACEVISION

ACCURATE INSPECTION SOLUTIONS FOR THE METALS INDUSTRY

AMETEK Surface Vision is the world leader in automated online surface inspection solutions. Its broad product range is optimised for the monitoring and inspection of surfaces, and for process surveillance applicationAs.

The SmartView and SmartAdvisor product lines deliver robust, flexible solutions to continuous production processes across a number of industries, with hundreds of customers and thousands of installations worldwide.

Part of the Process and Analytical Instruments Division of AMETEK Inc, AMETEK Surface Vision is based in Hayward, California, and has offices and sales representatives around the world.

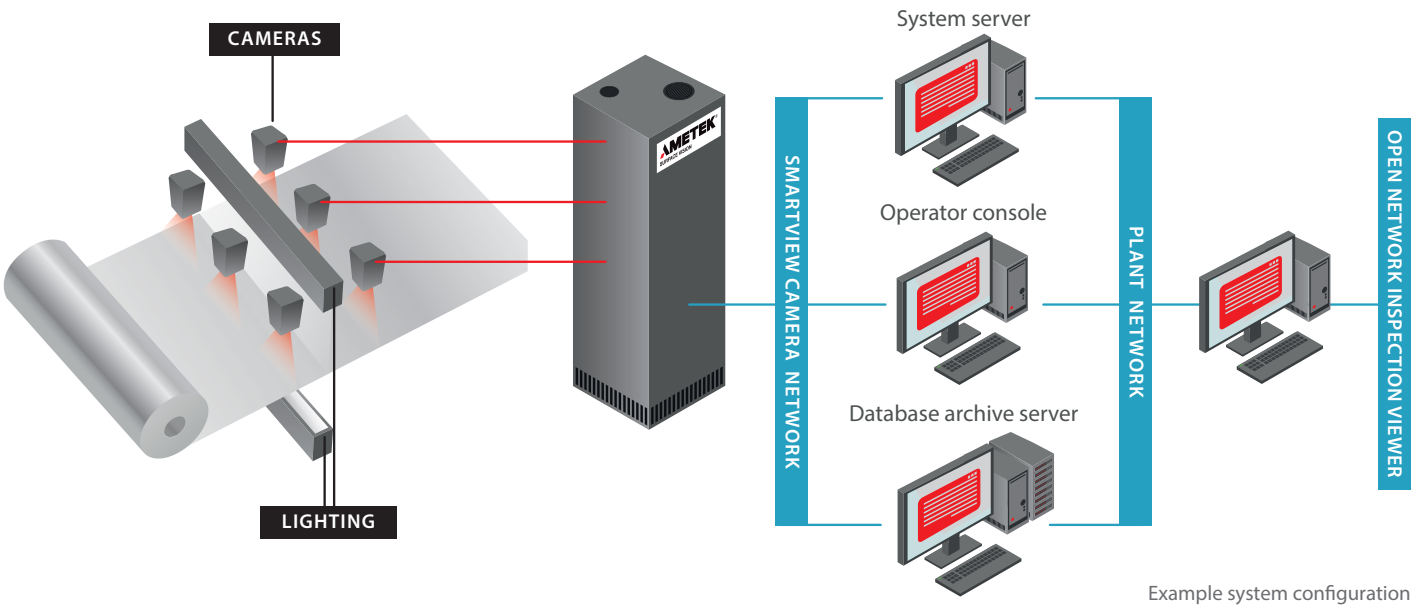
AMETEK Surface Vision delivers flexible, customisable surface inspection systems to the global metals industry, helping to optimise product quality and yield.

Its SmartView system is widely regarded as setting the standard for the industry. It combines advanced software with rugged, proven hardware to accurately detect, classify, visualise and report defects and process conditions across metal processing lines.

A SmartView system uses synchronised camera technology, supported by powerful LED lighting arrays, for high-quality defect image capture across multiple inspection angles.

Inspection data is processed through high-performance computer system for storage and analysis, using SmartView software to combine sophisticated control tools and detailed analytical real-time reporting into a simple-to-operate package.

A fully modular system, SmartView systems are designed with future-proofing in mind, and can be expanded and upgraded as necessary to meet changing operational requirements.



Example system configuration

KEY USER BENEFITS

PROCESS CONTROL

SmartView gives the user total control of the interface, allowing different colours to be assigned to different defect classes. Intuitive drop-down menus and customisable windows enable results to be narrowed down with precision, identifying only defects of interest. By providing knowledge of even the smallest defects, SmartView facilitates an immediate response to worsening conditions, reducing scrap and increasing yield.

SEAMLESS INTEGRATION

A Windows-based solution, SmartView integrates easily into existing systems, ensuring straightforward system start-up and operational flexibility. Software algorithms can be optimised for specific surface and process requirements, all performing on-line in real time. Part of the AMETEK Surface Vision modular solution, it's simple to add or remove hardware and retain seamless software control.

INTUITIVE REPORTING

SmartView is intuitive and highly configurable, enabling users to rapidly identify product and process issues. The Production Quality Advisor software suite utilises the Open SQL server database to generate custom reports for viewing or comparison. Data from one production line or an entire mill can be processed, including coil grading and map stacking solutions for easy understanding and control of product quality.

THROUGH-PROCESS VISIBILITY

SmartView software connects to the network to provide information for all users, ensuring that operators, inspectors, process engineers and managers have all the data they need, at their fingertips. The Open Network Inspection Viewer, distributed across the network, allows any user to view any current or historical inspection results remotely from any stage of production.

APPLICATION SUPPORT

When customers purchase a SmartView system, they are not just buying AMETEK Surface Vision's patented software and advanced hardware.

They also get deep applications knowledge and support.

In-depth engineering know-how and experience helps deliver a system perfectly optimised to meet the customer's unique situation and specific goals.

Global technical support is offered via phone, email and direct remote access, along with options for on-site engineering visits and training courses. This ensures customers always have access to AMETEK Surface Vision's technical expertise and applications knowledge.

A spokesperson for AMETEK Surface Vision

"Our approach is simple: to provide the latest and best inspection solution for each application, delivered with the highest consistency, and without compromise.

"No other solution has the flexibility and ease of use that SmartView offers.

For three decades we have been the industry leader in inspection software, while supplying the most comprehensive selection of lighting solutions and high-definition options to ensure process optimisation.

"SmartView provides unsurpassed image quality, reducing camera count, improving defect detection and simplifying system installation and maintenance. That's why more companies trust their surface inspections to us than anyone else."

LEARN MORE ABOUT AMETEK SURFACE VISION'S INNOVATIVE INSPECTION SOLUTIONS:: WWW.AMETEKSURFACEVISION.COM

AMETEK LAND AND FOUNDRY

MADE IN INDIA: THE CYCLOPS 055L-2F MELTMASTER

AMETEK Land now manufactures a version of its portable Cyclops 055L-2F Meltmaster non-contact thermometer at AMETEK Land's India Service Centre in Bangalore, specifically for the local foundry market.

In addition, our India Laboratory, accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL), will calibrate each thermometer against the ISO/IEC 17025:2017 standard. This free certification, valid for up to 12 months, is included during the warranty period to provide customers with a guarantee of measurement accuracy.

This latest version of the innovative Cyclops 055L-2F Meltmaster available to Indian foundries features a new, optional Bluetooth display for greater convenience when accessing data.

The Bluetooth LED unit displays real-time temperature updates, enabling simple quality and process control, along with management of furnace power, to optimise foundry performance and output.

"Customers can be assured of the highest quality manufacture to international standards, with the added advantage that each Cyclops 055L-2F Meltmaster is calibrated in our NABL-accredited laboratory before delivery," said Prasath Venkatasamy, National Service Manager for AMETEK Land in India.

"Since the equipment is made in India, our regional customers also benefit from an easier transaction and much quicker delivery times. In most cases, they will receive their Cyclops within one week of placing their order. Customers also receive local technical support and access to our calibration services."

The Cyclops 055L-2F Meltmaster has achieved renown throughout the industry for its ability to measure real molten metal temperatures despite the effects of sparks, water vapour, dust and smoke.

"Measuring molten metal temperatures in a foundry can be a slow, disruptive process," added Prasath. ***The use of disposable dip thermometers can be both expensive and hazardous.***

"The Cyclops 055L-2F Meltmaster is fast, accurate and easy to use, and does not come into contact with the liquid metal. It is proven to save foundries both time and money by reducing the number of dips required with disposable thermocouples."

A dedicated high-precision, portable non-contact pyrometer, the Cyclops 055L-2F Meltmaster is designed specifically for the measurement of liquid metal temperatures between 1000 to 2000 °C (1832 to 3632 °F).

Providing highly accurate, consistent measurements, the Cyclops gives the operator full confidence in thermal information for process and quality control applications. The Meltmaster's unique mode – one of four available simultaneously – provides advanced noise rejection, ensuring it locks onto the true liquid metal temperature.

An internal, neutral density filter is fitted within the visual sighting system.

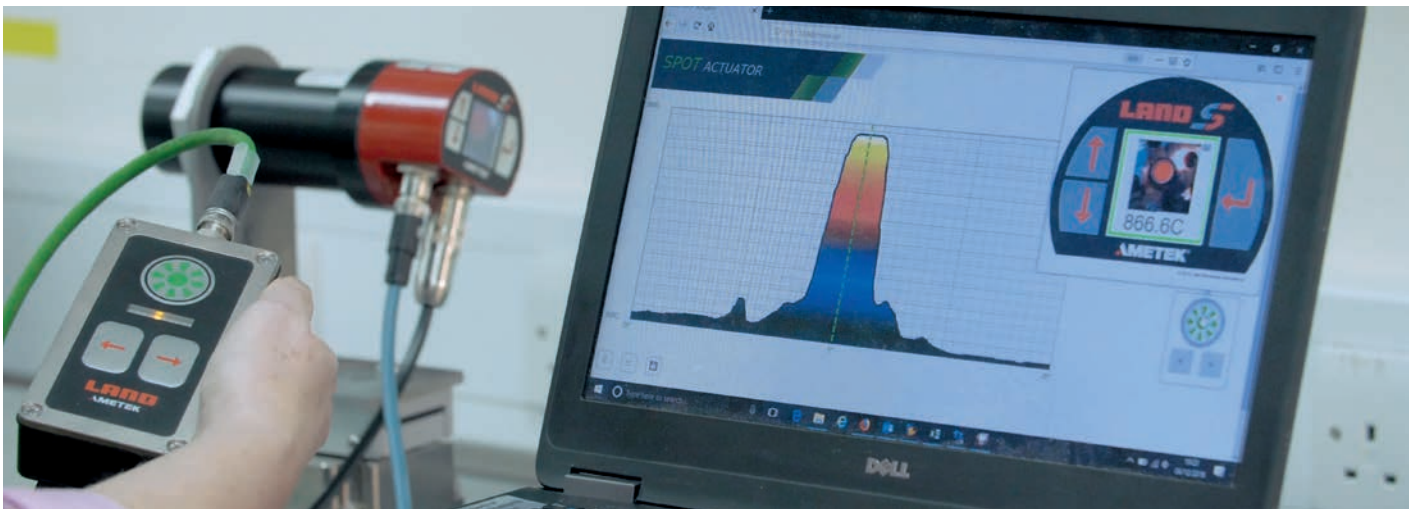
This delivers additional eye comfort for the operator when viewing high temperatures, without affecting the brightness or clarity of the internal temperature display.

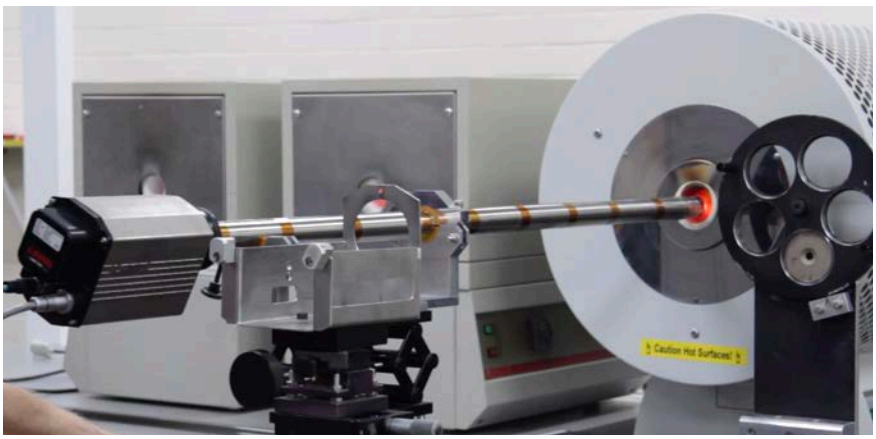
The Cyclops 055L-2F Meltmaster has a rugged instrument casing that enables extended periods of operation in harsh environments. In also has a lens protector to safeguard the optics.

- **Field of view: 9°**
- **Response time: 30 ms**
- **Display update time: 0.5 s**
- **Repeatability: <1 °C (2 °F)**
- **Weight: 0.83kg (1.8 lb)**

DOWNLOAD THE BROCHURE TODAY: WWW.AMETEK-LAND.COM

AMETEK LAND INDIA LABORATORY AND SERVICE CENTRE





Established in 2011, the centre provides a full service offering that encompasses testing, repairs and recalibration, which can be performed either at customer locations or the Bangalore facility.

The laboratory was the first OEM-approved facility to receive NABL accreditation, and is now accredited to offer thermal calibration in the 0 to 1600 °C (32 to 2912 °F) range for tests carried out in-house and 0 to 1200 °C (32 to 2192 °F) for on-site calibrations.

In 2017 it secured the best calibration measurement capability of any laboratory in India for the 0 to 550 °C (1022 °F) range.

CASE STUDY

FAST RETURNS ON INVESTMENT FROM FOUNDRY MEASUREMENTS

THE COMPANY

Based in Coimbatore, India, PSG Foundries is the foundry division of PSG and Sons. It was established in 1974 to supply high-quality castings for engineering industries in India and around the world. The foundry produces a wide range of grey iron, SG iron (nodular/ductile) and Ni-Hard castings of high integrity, creating a niche for itself in the global market. PSG Foundries produces approximately 600 tons of high-quality castings per month.

THE CHALLENGE

PSG Foundries was looking for an effective solution that would accurately measure the temperature of liquid metals at its foundry. The company purchases more than 10,000 consumable dip thermocouples every year, at a cost of around $6,000 per annum, and so wanted a new solution that was both safer and more cost-effective. Its goal was to optimise the quality of the molten metal, while achieving significant annual savings on consumables.

THE SOLUTION

For this application, AMETEK Land recommended the Cyclops 055L-2F Meltmaster, a high-precision portable thermometer. This non-contact device provides accurate measurements of liquid metal temperatures in the range 1,000 to 2,000°C (1832 to 3632°F).

The instrument delivers real liquid metal temperatures regardless of high-temperature sparks, low-temperature water vapour, dust and smoke, which can all cause measurement errors.

Emissivity compensation is provided via an icon-based menu system. The operating waveband is carefully chosen to minimise errors due to uncertainty in emissivity and the effects of atmospheric vapour components. The excellent repeatability of the Meltmaster means that measurement consistency is assured.

The Cyclops 055L-2F Meltmaster has onboard storage and fast, simple data-logging with Bluetooth and USB connectivity. Its rugged instrument casing is designed to withstand harsh environments for lengthy periods of time, while a lens protector maintains the optics in good condition.

HOW IT WORKS

The ergonomic Cyclops 055L-2F Meltmaster is designed for single-handed operation, with a contact-free measurement for improved safety in hazardous environments.

The operator stands about three or four metres away from the molten metal, and points the instrument at the liquid.

The operator then pulls the trigger to take a measurement, which is displayed in four simultaneous modes – continuous, peak, valley, and a unique advanced Meltmaster mode configured to meet the user's specific requirements.

Modes are available from logging a measurement for each trigger release to precisely executed pre-configured routes for consistent, repeated long-term readings. It can store up to 9,999 readings.

A clear, wide-angle field of view, and a small clearly defined measurement area help to ensure accurate sighting. All the processed temperature values are shown continuously on the display when the trigger is pressed.

THE RESULT

Since switching to the Cyclops 055L-2F Meltmaster, PSG Foundries has already achieved an annual saving on dip thermocouples. The Meltmaster uses no consumables, and paid for itself in less than six months.

The value to the foundry will increase over the years as the Cyclops 055L-2F Meltmaster enables the optimum, most consistent mould value by accurately measuring liquid metal temperatures using a single instrument.

Because of the non-contact measurement technique, the Meltmaster also provides the foundry with health and safety benefits. Temperature readings are triggered from a safe operational distance, providing a much higher level of operator safety.

"We have found AMETEK Land's Cyclops 055L-2F Meltmaster to be a highly effective solution for the accurate temperature measurement of molten metal," said Mr S Kupusamy, Vice President of PSG Foundries.

"It provides easy, accurate point-and-measure temperature readings. Since its introduction, our plant has significantly reduced our expenditure on disposable dip-type thermocouples."

Prasath Venkatasamy, National Service Manager for AMETEK Land in India added: ***"Foundries in India have come to realise the major advantages of the Meltmaster, both in terms of cost savings and in safer plant operation.***

"Also, since the equipment is made in India and calibrated in our own NABL-accredited laboratory, our customers benefit from an easier transaction, shorter delivery times, local technical support and access to annual calibration services."

PORTABLE, HAND-HELD
NON-CONTACT TEMPERATURE MEASUREMENT

CYCLOPS L

Portable, hand-held, non-contact spot pyrometers enabling easy and accurate point-and-measure temperature readings.

PORTABLES

SPECTRO | AMETEK MATERIALS ANALYSIS DIVISION

INDUSTRY-LEADING ANALYSIS SOLUTIONS FOR METALS

SPECTRO Analytical Instruments GmbH is one of the world's leading suppliers of analytical instruments, employing optical emission (Arc spark OES, ICP-OES) and X-ray fluorescence spectrometry (XRF) technology, used for the elemental analysis of materials in industry, research and academia.

Based in Kleve, Germany, the company manufactures advanced instruments and develops the best solutions for elemental analysis in a broad range of applications. SPECTRO is a member of the AMETEK Materials Analysis Division.

SPECTRO provides a comprehensive range of metal analysis solutions for the entire metals industry, from primary and secondary producers to recycling and powder metallurgy.

These instruments perform a diverse range of analytical tasks for metals applications.

The mobile metal analyser product line is specifically designed for location-independent use. SPECTRO analysers are used to identify, sort and analyse metals for incoming inspections, during production processes, and before delivery.

In addition, SPECTRO mobile metal analyser instruments play a major role in scrap yards, internal recycling, building sites, and chemical plants.

Because of their high levels of accuracy, stationary metal analysers are used for process control in the metal production industry, and for quality control during metal processing. They are also used in laboratories for research and development.

Trace analysis of industrial waste water and liquids from production processes – for example electrolyte and coating baths – is a typical application for the ICP spectrometers from SPECTRO, with detection limits in parts-per-billion/million ranges making them excellently suited to this task.

Even for the analysis of the main components, ICP-OES achieves highest precision using the "nesting procedure". The technology can be easily automated, making a high sample throughput and even unattended operation realisable.

For precious metals analysis, such as jewellery or dental alloys, non-destructive SPECTRO XRF spectrometers are used for analysis.

SPECTRO XRF spectrometers are also well suited to many other metals analysis tasks, such as coatings, the automatic detection of inclusions and impurities, and the examination of furnace slag.

KEY SOLUTIONS

SPECTROLAB

A high-performance, stationary arc spark optical emission spectrometry (OES) analyser for process and quality control.

Applications: primary producers, secondary producers/foundries, semi-finished products, fabricated and finished goods, recycling, precious metals.

SPECTROTEST

A mobile arc spark spectrometer delivering uncompromising metals analysis in many production, processing and recycling applications.

Applications: primary producers, secondary producers/foundries, semi-finished products, fabricated and finished goods, recycling.

SPECTROPORT

A powerful portable analyser delivering accurate results using advanced OES technology, in a unit as easy to use as a handheld device.

Applications: primary producers, secondary producers/foundries, semi-finished products, fabricated and finished goods, recycling.

SPECTRO xSORT

A robust, handheld XRF elemental analyser designed for high-throughput testing and spectrochemical analysis.

Applications: primary producers, secondary producers/foundries, semi-finished products, fabricated and finished goods, recycling, precious metals.

SPECTRO ARCOS

SPECTRO's flagship stationary ICP-OES analyser, designed for the most demanding elemental analyses in industrial and research applications.

Applications: primary producers, secondary producers/foundries, recycling, precious metals.

SPECTROBLUE

An ultra-reliable stationary ICP-OES spectrometer delivering significant cost savings alongside unmatched analytical performance.

Applications: primary producers, secondary producers/foundries, recycling.

SPECTRO XEPOS

A stationary elemental analysis spectrometer that redefines energy-dispersive XRF analysis, with exceptional levels of performance.

Applications: primary producers, semi-finished products, fabricated and finished goods, recycling, precious metals, powder metallurgy.

SPECTROMAXx

A stationary metal analyser used for material testing in foundries and for incoming and outgoing inspections in the metals industry around the world.

Applications: secondary producers/ foundries, semi-finished products, fabricated and finished goods, recycling.

SPECTROCHECK

A stationary metal analyser designed to meet the performance and budgetary requirements of small and medium-sized foundries and machining operations.

Applications: secondary producers/ foundries, semi-finished products, fabricated and finished goods.

FIND OUT MORE ABOUT SPECTRO'S INDUSTRY-LEADING ELEMENTAL ANALYSIS SOLUTIONS FOR METALS: WWW.SPECTRO.COM

SPECIALITY METALS OVERVIEW

Encompassing a number of alloys and lesscommon metals, the speciality metals industry relies upon accurate and stable temperature measurements at key points in their processing.

Temperature monitoring within these industries benefits the furnace operations involved in the commercial production processes used in the refining of speciality metals such as copper and platinum.

With many years of experience in providing non-contact temperature measurement solutions to metal processing industries, AMETEK Land's thermal imaging and infrared pyrometer solutions are ideal for critical applications in speciality metal production.

One particularly effective solution is the NIR thermal imager, which provides precision measurements for refinery process control and consistent product quality.

COPPER

In the refining process, impure copper is melted in a furnace and then cast into anodes for purification through electrolysis. Monitoring the furnace using thermal imaging supports process and quality control, and provides early warning of any damage to the furnace.

Furnace heating refines the impure copper by removing any remaining sulphur and iron, as well as burning off any oxygen. Temperature monitoring ensures that this results in copper anodes of sufficient purity (about 99%) for successful electrolysis.

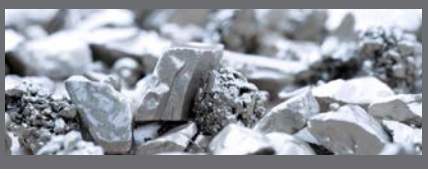
The data from an NIR imager can detect furnace issues at an early stage, allowing maintenance and safety problems to be dealt with quickly. It also ensures the copper is heated sufficiently to reach the required purity level before it is recast as an anode.

PLATINUM

The commercial production of platinum is achieved as a by-product of the copper refining process, where platinum and other noble metals are removed during electrolysis. So, the platinum refining process benefits from the same temperature measurements that support process and quality coAntrol in copper refining.

Temperature monitoring in the furnace ensures that sulphur and iron impurities are removed prior to electrolysis. This improves the quality of the platinum that is removed from the copper during electrolysis, making it easier to recover a purer product.

Any furnace issues can, again, be detected quickly using thermal readings from an NIR. This allows for early maintenance and the prevention of safety problems. Temperature monitoring also helps ensure the purity of the anode, making the electrolysis that produces the platinum by-product more efficient.



THE PRODUCTS

LWIR-640

PROCESS IMAGING

Rugged, compact radiometric thermal process imager providing unsurpassed temperature accuracy across a wide range of applications.

With four lens options, it views any target at any distance, delivering outstanding clarity for reliable process control, product quality verification or safety monitoring.

Temperature measurement range: 0 to 500 °C (32 to 932 °F) and 100 to 1000 °C (212 to 1832 °F)

Sectors: Steel

LWIR-640 IMAGER SYSTEM

PROCESS IMAGING

An application-specific version of the proven LWIR-640 thermal imaging system, designed for temperature monitoring of aluminium strip coiling.

The system uses advanced radiometric imaging to deliver accurate edge-to-edge measurement of aluminium temperature at the coiler. Hot and cold mill versions cover two temperature ranges for optimised support.

Temperature measurement range: 100 to 1000 °C (212 to 1832 °F) or 0 to 500 °C (32 to 932 °F)

Sectors: Aluminium

CYCLOPS C100L

PORTABLES

High-quality, precision-accuracy hand-held pyrometers providing easy point-and-measure temperature readings in a rugged yet lightweight design.

Designed for single-handed use, the ergonomic Cyclops C100L uses trigger control for data-logging, storing up to 9,999 readings internally for later analysis.

Temperature measurement range: 550 to 3000 °C (1022 to 5432 °F)

Sectors: Steel, heat treating

CYCLOPS 055L-2F

PORTABLES

High-quality, precision-accuracy hand-held pyrometer designed for easy point-and-measure readings of liquid metal temperatures.

Made in Bangalore, India, specifically for the local foundry market, the ergonomic Cyclops 055L-2F uses trigger control for data-logging, storing up to 9,999 readings internally for later analysis.

Temperature measurement range: 1000 to 2000 °C (1832 to 3632 °F)

Sectors: Molten metals, foundry

HotSpotIR 9000

LINESCANNING

Highly compact, fast-response infrared scanning system designed to detect emerging hotspots on conveyor belt materials.

Designed for industrial environments, the HotSpotIR monitors across 1000 temperature spots at speeds up to 100Hz, protecting conveyors against hot particles as small as 25mm (1in) in diameter.

Temperature measurement range: Model specific, from 20 to 600 °C (68 to 1112 °F)

Sectors: Steel

THE PRODUCTS

LSP-HD

LINESCANNING

Ethernet-controlled compact infrared linescanner, designed to produce advanced thermal imaging in moving processes.

Offering industry-leading scanning performance of 1000 data points even at scan speeds as high as 150 scans per second, LSP-HD sets a new benchmark for process imaging definition.

Temperature measurement range: 20 to 1500 °C (68 to 2732 °F)

Sectors: Steel

NIR-656/2K

PROCESS IMAGING

Fixed, focusable infrared thermal imaging camera designed for high temperature measurements, producing high-resolution images for a range of applications.

Versatile, accurate and reliable, the NIR delivers the continuous high-precision measurements that support consistent production quality for speciality metals such as copper and platinum.

Temperature measurement range: Model specific, from 600 to 3000 °C (1112 to 5432 °F)

Sectors: Speciality metals

NIR-B-640

PROCESS IMAGING

A short-wavelength radiometric infrared borescope imaging camera, specifically designed to measure temperature profiles in furnace interiors.

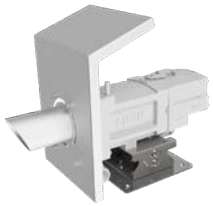
By producing a detailed, live, continuous image with accurate temperature information, the NIR-B-640 allows operators to measure from any of 324,000 live data points, enabling highly specific optimisation of furnace temperatures and fuel usage.

Temperature measurement range: Model specific, from 600 to 1800 °C (112 to 3632 °F)

Sectors: Steel

SDS - SLAG DETECTION SYSTEM

PROCESS IMAGING



The proven solution for accurate and timely detection of slag carryover in the steelmaking process, allowing plants to improve product quality, reduce slag carryover and improve operator safety.

The SDS uses high-resolution thermal imaging to detect the transition between steel and slag, delivering improved yields, higher-quality steel and a reduction in costly downstream processing.

Temperature measurement range: 500 to 1800 °C (932 to 3272 °F)

Sectors: Steel

SPOT+

FIXED SPOT THERMOMETERS

Family of fully-featured, high-performance pyrometers for fixed non-contact infrared spot temperature measurements, available in a range of operating wavelengths, temperature ranges and process requirements.

Designed for easy single-person installation, SPOT+ pyrometers deliver the accurate measurements to optimise application processes and maintain high product quality.

Temperature measurement range: Model specific, from 50 to 1800 °C (122 to 3272 °F)

Sectors: Steel, aluminium

SPOT+ MM

FIXED SPOT THERMOMETERS

The smart SPOT+ MM (MeltMaster) application pyrometer provides a single-sensor solution for liquid metal temperature measurements in foundry and tapping applications.

Optimised signal processing and a dedicated application mode allow the SPOT+ MM to accurately measure tapping stream temperatures independent of surface and conditionchanges during the process.

Temperature measurement range: Model specific, from 600 to 1800 °C (122 to 3272 °F)

Sectors: Liquid Metal and Tapping

SPOT+ AL

FIXED SPOT THERMOMETERS

An advanced, non-contact infrared pyrometer specifically designed to provide a single-sensor solution for aluminium extrusion press exit, quench and strip applications.

The SPOT+ AL blends AMETEK Land's innovative SPOT+ technology with unique data-processing algorithms to offer all three measurement modes in a single device, easily integrating with control systems.

Temperature measurement range: 200 to 700 °C (392 to 1292 °F)

Sectors: Aluminium

SPOT ACTUATOR

ACCESSORY

Specifically designed for aluminium applications using the SPOT+ AL, the SPOT Actuator is a motorised unit which provides remotely controlled target alignment for a SPOT+ pyrometer.

Compact, quick and easily configured, it can be operated in automatic or operator-controlled modes to suit the needs of an individual aluminium plant.

Sectors: Aluminium

SPOT+ GS

FIXED SPOT THERMOMETERS

An advanced, non-contact infrared spot pyrometer specifically designed for the continuous, highly accurate measurements of coated steel strip temperature during the galvanneal reaction.

The SPOT+ GS combines AMETEK Land's cutting-edge SPOT technology with specialised software algorithms to deliver the accurate measurements needed for close monitoring of the reaction zone, enabling automated furnace management and tighter product control.

Temperature measurement range: 200 to 1000 °C (392 to 1832 °F)

Sectors: Steel

UNDERSTRIP

FIXED SPOT THERMOMETERS

A fibre-optic temperature measurement system designed to provide continuous, accurate monitoring of the scale-free metal surface under the steel mill roller table.

Designed specifically for hot rolling applications in flat steel production, the Understrip is a rugged, accurate system that measures steel temperature while avoiding the effect of surface water or minor scale that may exist on the top side.

Temperature measurement range: Model specific, from 300 to 2600 °C (572 to 4712 °F)

Sectors: Steel

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