High-quality metallurgical coke is a vital raw material for iron and steel production, affecting the furnace operation and standard of the hot metal. It is produced by heating coal in a coke oven in the absence of oxygen. Both the quality and quantity of coke, as well as the lifespan of the oven, depend upon uniform temperature levels, so these require close monitoring.

Temperatures can be obtained by measuring through the flues using a hand-held pyrometer, or by direct measurement of the oven wall using multiple fibre-optic ratio thermometers.
COKE PRODUCTION

Coke is produced by heating coal in a coke oven in the absence of air to remove impurities, leaving almost pure carbon.

A variety of coal known as coking (or metallurgical) coal is used for this process. This coal is typically low in ash, phosphorus and sulphur, producing limited waste and enhancing steel strength.

Before heating, the coking coal is pulverised to powder, to allow better control of bulk density. It is then heated in the coke oven to around 1000-1100 °C (1832-2012 °F), driving off volatile compounds through high-temperature decomposition (pyrolysis). The properties of coking coal cause it to soften, and then resolidify into hard but porous lumps as it goes through the heating process. This may take between 12-36 hours in the coke oven. Once pushed out of the coke oven, the hot coke is immediately quenched with water before transport and storage or direct transfer to the blast furnace.

COKE OVENS

The quality and yield of the coke, by-products and the lifespan of the coke oven are all related to the temperature and balance of the heating chambers in the coke oven battery. It is, therefore, critical to monitor temperature levels. Traditionally, flue temperatures are monitored through the top of the oven, using a hand-held pyrometer to measure the temperature of a brick adjacent to the burner. However, this can prove challenging due to the narrow width of the flue and a portable pyrometer is used with narrow field of view, fully adjustable focus and Through-The-Lens (TTL) sighting.

Alternatively, fibre-optic ratio pyrometers may be installed inside the pusher arm to measure the temperature of the coke oven walls during the pusher operation, as the hot coke is pushed out of the oven. Ideally, it is most beneficial to directly measure the oven temperature profile. In the past, this has proved costly, however, and is difficult without using specialised pyrometers supported by an installation that provides the necessary level of environmental protection.

Instead, knowing that there is a strong correlation between the temperature of the exiting coke and the oven walls, a multi-thermometer system was used to survey the temperature along the coke burden. However, a direct measurement method has now been developed, providing a complete temperature profile for controlling the efficient operation of the oven.
TEMPERATURE MEASUREMENT SOLUTIONS

Flue temperatures can be measured using a portable infrared thermometer such as the AMETEK Land Cyclops 100L.

A hand-held, non-contact device, it uses highly accurate Through-The-Lens (TTL) sighting, with a fully focussable lens and narrow optical field of view and offers wireless Bluetooth communications. This allows the operator to easily measure down narrow flues, with no connector cables to get in the way.

For operators who require a direct measurement of the coke oven side walls, a fibre-optic pyrometer solution is available to install within the pusher arm.

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Cyclops 100L

Durable and lightweight, the Cyclops 100L is a portable non-contact pyrometer ideally suited to provide precise temperature measurements of the oven flue.

It is designed for single-handed use, which means operators can take safe, accurate readings in hostile environments and have a hand free to steady themselves.

Camera quality through-the-lens sighting ensures that what the operator sees exactly the spot area being measured.

Four, trigger-controlled data-logging modes are available, with the Cyclops 100L storing up to 9,999 readings internally, ensuring there are no connecting wires to obstruct the measurement or pose a safety hazard.

The data can be transferred via Bluetooth or USB to a PC running the free-of-charge powerful Cyclops Logger software for Windows™ for the viewing and analysis of temperature readings.

A range of optional accessories includes a long eye relief eyepiece adapter for operators wearing protective goggles or a hard hat with face shield, who cannot sight directly through the eyepiece.

FEATURES

- Rugged instrument casing
- Bluetooth and USB connectivity
- Data logger software
- Multi-function display panel
- Calibrated and traceable to National Standards

BENEFITS

- Highly portable, single-handed use
- Simple, through-the-lens sighting
- Wireless operation
- Ergonomic trigger control
- Intuitive icon-based menu

DATA LOGGER SOFTWARE

Cyclops Logger software allows data to be viewed analysed and recorded on a computer or rugged mobile device. All stored measurement data can be displayed on the Measurement screen, which displays the current reading, table view and trend view.

When connected to a Cyclops L pyrometer – either wirelessly through Bluetooth or via a USB cable – the Logger software records instantaneous temperature measurements each time the pyrometer trigger is pressed.

APP NOTE

SPOT fibre-optic pyrometers are also suitable for directly measuring the coke as it leaves the oven.

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.
**SPOT FIBRE-OPTIC RANGE**

Easy to install and position, the SPOT range offers a flexible selection of pyrometers designed to match specific process challenges. It is available in a variety of operating wavelengths and temperature ranges for different process requirements, with monochromatic and ratio versions, plus hybrid models that switch detectors according to the temperature levels. For the coke oven application, a fibre-optic ratio thermometer is recommended. The fibre-optic variant is ideal for measurements in hard-to-access areas or in high-temperature environments where water cooling is not possible. Ethernet, Modbus TCP, image streaming and analogue and alarm outputs are all available to the operator, contained within a single device. In addition, signal processing is performed within the sensor, so no separate device is needed. By integrating sophisticated automatic beam alignment technologies that precisely focus the advanced infrared optics, the SPOT range delivers accurate stable measurements quickly, reducing maintenance time and enabling faster process adjustments.

**FEATURES**
- Self-contained single sensor solution
- Range of digital and analogue communications
- Local and remote motorised focus control
- Easy plug-and-play installation
- Powerful software support

**BENEFITS**
- Fibre-optic version ideal for inaccessible locations
- No separate processor required
- Scratch-resistant sapphire protection window
- LED sighting for optimum focus
- Faster, more accurate measurements

**SPOTSERVER SOFTWARE**

Dedicated software allows the operator to configure, display and log data from up to 40 different SPOT pyrometers. Variable levels of password-based access are available, to ensure security with multiple users. SPOTServer allows full configuration of data log frequency, file size, save and archive locations. It is the perfect choice for smaller operations where traditional process control systems may be absent.

**SINGLE-SPOT NON-CONTACT TEMPERATURE MEASUREMENT**

**SPOT R100 PYROMETER**

Single-spot, non-contact infrared pyrometers, optimised for a wide span of temperature ranges and process requirements.

**COMPACT, INFRARED ETHERNET-CONTROLLED LINESCANNER**

**HotSpotIR**

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

Coke leaving the oven is quenched to cool it. This ensures hot coke does not damage the conveyor belt while it is being transferred to the blast furnace. It also prevents the coke from reigniting, causing a fire that can damage equipment and consume coke supply.

Inadequate quenching may leave hot inclusions within the coke which are not easily detected by cameras or the naked eye. The HotSpotIR is a compact, fixed-focus, high-speed scanning system specifically developed to detect these hot inclusions at an early stage.

Designed for industrial environments, it rapidly identifies hot particles on a moving conveyor, preventing damage and avoiding costly shutdowns.

With high-resolution monitoring across 1000 temperature spots, user-adjustable scanning speed up to 100Hz, and repeatability of ± 0.5°C (± 0.9°F), the HotSpotIR can detect hot spots as small as 25mm (1in).

Easy to install, it uses non-contact infrared scanning to measure across a range from 20-250°C (68-482°F). The HotSpotIR connects to a dedicated processor and measures the entire belt surface, activating an alarm which can be set to trigger fire suppression systems. The continuous monitoring means hot spots can be detected and the alarm triggered in a hundredth of a second, allowing the operator to respond quickly. The result is safer employees, reduced risk of damage and downtime, and lower insurance costs.

**FEATURES**
- Wide scan angle of 80°
- Built-in laser targeting system
- Fast, 100Hz scanning speed
- Withstands high ambient temperatures
- Direct control system integration

**BENEFITS**
- Continuous automatic monitoring
- Increases confidence in safety
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AMETEK LAND PRODUCT SOLUTIONS FOR THE COKE OVEN

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

**SPOT PYROMETER**
Fully-featured, high-performance pyrometers for fixed, non-contact infrared spot temperature measurements and a range of process requirements.

**HotSpotIR**
Continuous infrared line scanning detects small, hot inclusions on the conveyor, with alarms set to operate an inverting or diverting system to prevent belt damage or fires.

DOWNLOAD THE BROCHURES AT: WWW.AMETEK-LAND.COM

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**CYCLOPS L**

**PORTABLES**

**SPOT PYROMETERS**

**LINESCANNING**

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