LAND

AMETEK®

TEMPERATURE MEASUREMENT IN THE AIR-COOLING ZONES DOWNSTREAM OF THE LEHR ON A FLOAT GLASS PLANT

APPLICATION NOTE



Accurately measuring and controlling the cooling rates along the length of the glass ribbon and thermal profile across the width within the annealing lehr is common practice. However, with ever-increasing demand for quality, measuring and controlling the cooling rates in the air-cooling zones is becoming necessary to attain the float glass quality during the production of glass that is thinner or thicker than standard glass (window glass).

Frequent, accurate measurements of the temperature profile are necessary to reduce stresses in the glass and to optimise the cooling rate over the entire process length. AMETEK Land has developed a range of non-contact infrared solutions for accurate temperature-cross-profile measurements utilising Landscan systems and single-point thermometers for use within the annealing lehr and downstream of the lehr in the air-cooling zones and at the cutting section. Accurate and reliable full-width measurement of the glass ribbon throughout the process guarantees a stable, continuous cooling, which avoids glass breakage and maintains quality, even with very thin or very thick glass production.

By optimising the annealing process and minimising thermal variations across the width of the glass, the production of thinner or thicker glasses is possible.

FLOAT GLASS PROD

Float glass, also known as flat glass, is produced by allowing the glass ribbon to solidify on a layer of higher-density liquid to create a flat sheet. Using this method, glass sheets can be manufactured with highly uniform thickness and very flat surfaces.

The float glass process is used to create clear, tinted or coated glass which can be used for a wide variety of applications including architectural and automotive glass. The quality of the end product is highly dependent on precision temperature measurements and uniformity of cooling.

REGENERATOR 01

FG

Temperature measurement is essential for this area of the tank. Infrared thermometers provide a long-term, cost-effective and more reliable measurement than thermocouples.



PORT ARCH 02

CYCLOPS

The Cyclops C100 2F is used to measure the optical profile along the breast wall and to carry out spot checks providing important information on basic firing conditions. The Cyclops has through the lens sighting and precision optics to measure accurately, reliably and repeatably from the target block.



TANK ROOF 03

FG

Thermocouples have been used for many years for this crucial measurement. However, non-contact fibre-optic thermometers offer temperature verification whilst remaining stable throughout the life of the tank. The Model FG operates without the need for water cooling in this high-temperature environment.

CANAL 05

FG

In addition to Model FG thermometers, short-wavelength System 4 thermometers can be used to measure the bulk temperature of the glass.

FURNACE INSIDE 04

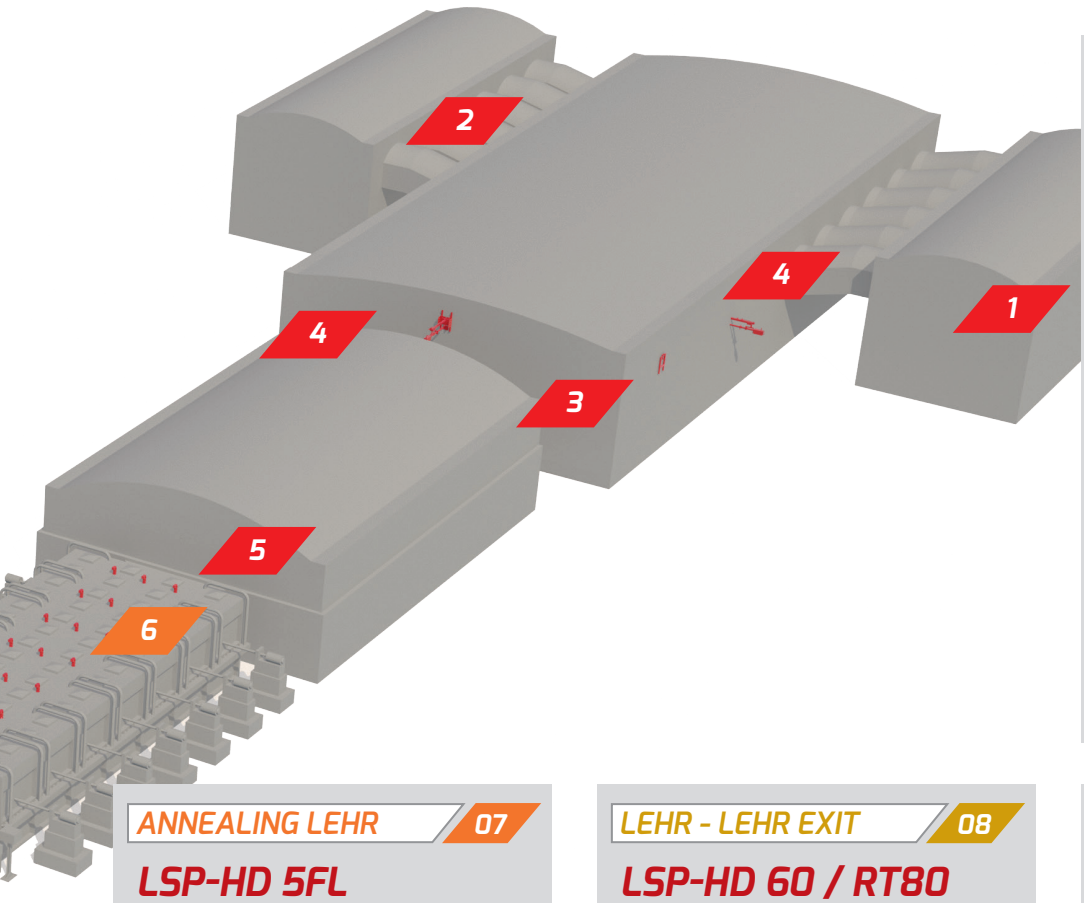
NIR-B GLASS

The melt tank experiences the highest temperatures of the glass production process. Real-time monitoring of these temperatures is vital to the efficiency of the application and the quality of the product. It is important to be able to study the entire tank interior to detect any structural damage. The NIR-B Glass thermal imaging camera creates detailed, live radiometric images that accurately measure temperatures inside of a glass melt furnace.



UCTION

AMETEK LAND HAS DELIVERED TEMPERATURE MEASUREMENT SOLUTIONS ACROSS THE FLOAT GLASS PLANT FOR DECADES, DEVELOPING DEDICATED SOLUTIONS FOR SPECIFIC APPLICATIONS WITHIN THE PROCESS. THESE RANGE FROM THE MELT TANK TO THE ANNEALING LEHR.



TIN BATH 06

FLT5A

To produce glass of consistently high quality, it is vital to understand the temperature profile at this point where the glass solidifies on molten tin. When glass is just a few millimetres thick, selected waveband thermometers operating in a narrow band around 5µm are used to accurately measure the surface temperature of the product.



ANNEALING LEHR 07

LSP-HD 5FL

After the solidified glass leaves the tin bath, it moves to the lehr where it is cooled gradually to remove internal stresses. The rate of cooling is important to ensure the glass does not break at the cutting stage, so frequent, precise temperature measurements are critical to this application.

LSP-HD 5FL is a high-speed 5µm linescanner, when integrated as part of a multihead linescanning system, provides unprecedented levels of information and control of glass temperature in the lehr.



LEHR - LEHR EXIT 08

LSP-HD 60 / RT80

Accurate temperature-cross-profile measurements utilising Landscan systems or single-point thermometers downstream of the lehr in the air-cooling zones and at the cutting section are vital when producing thin or thick glass to maintain stable continuous cooling, which avoids glass breakage and maintains quality.



BREAK DETECTOR 09

RT80 / LSP-HD 60

Measurement here is used to highlight any breakages of the glass. Acting as a single "presence detector", a thermometer or linescanner placed at this point aids the complete automation of the process.



THE LEHR MEASUREMENT CHALLENGE

The lehr is a long, temperature-controlled kiln. Glass passes through the lehr to ensure a consistent temperature gradient as it cools. If the glass was allowed to cool in ambient air, the surface would lose heat more quickly than the interior of the glass, creating stresses which are likely to crack or break the glass.

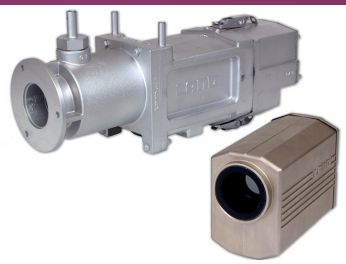
Float glass manufacturer Saint-Gobain Glass Germany GmbH challenged AMETEK Land to find a solution for the measurement of temperature distribution across the glass width in the forced air-cooling zones downstream of the annealing lehr.

The company required the solution to have a high measurement accuracy, within less than 2 °C (3.6 °F), and a high reliability over time. It also had to avoid thermometer drift and provide simple evaluation through the process control system.

A solution was proposed to monitor five zones across the width of the ribbon to monitor the effects of flow baffles and air flow on the glass temperature.

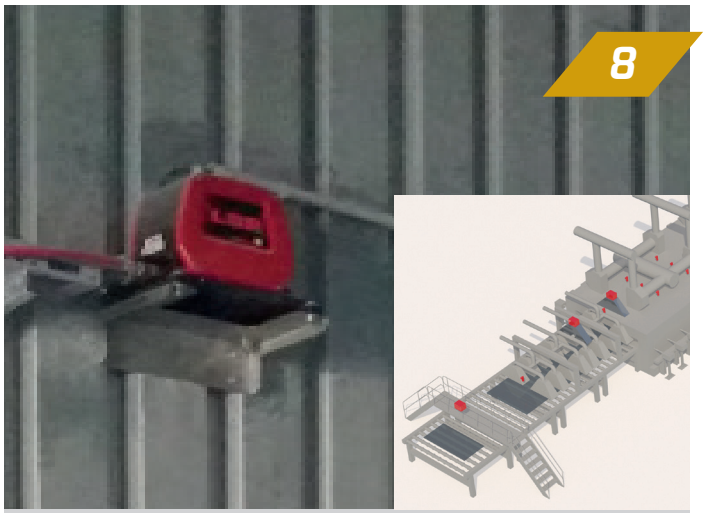
Initially, the customer favoured a five-point array of infrared thermometers in series. The solution proposed was based on the RT80A, a non-contact infrared thermometer. This was a cost-effective solution that could be easily installed. The RT80A is derived from the same thermometer series which is already used on the tin bath and provides trusted, safe temperature monitoring data.

The drawback of this method, however, is that it relies on spot measurements at the five locations, resulting in an averaged temperature indication over the respective field of view of a spot thermometer, and thus the local resolution of the actual temperature profile across the width is not very meaningful. In addition, it relies on five different detectors, each with their own drifts and deviations, increasing the systematic error in the measurement.



RT80A NON-CONTACT INFRARED THERMOMETER

THE AMETEK LAND SOLUTION



THE LANDSCAN SYSTEM MOUNTED ABOVE THE PROCESS

An alternative, improved solution is achieved using the LANDSCAN system with the LSP-HD 60 linescanner. This measurement system is capable of delivering high-resolution thermal images with fast scan speeds and sampling rates. Its 80° scan angle allows the LANDSCAN measuring head to be mounted safely above the process and continuously record and monitor the product over the entire process width. These specifications meet the requirements of the glass company.

Visual representations and thermal temperature profile across the width are displayed together with continuous temperature profiles over time (thermal map) allowing an accurate assessment of the thermal distributions over the width and length that shows clearly the overall stability of the temperatures over time at the various measuring locations.

The LANDSCAN system is not essential for standard glass, such as 4 mm thick window glass, because experience in these manufacturing processes is very good and temperature tolerances across the glass are less critical.

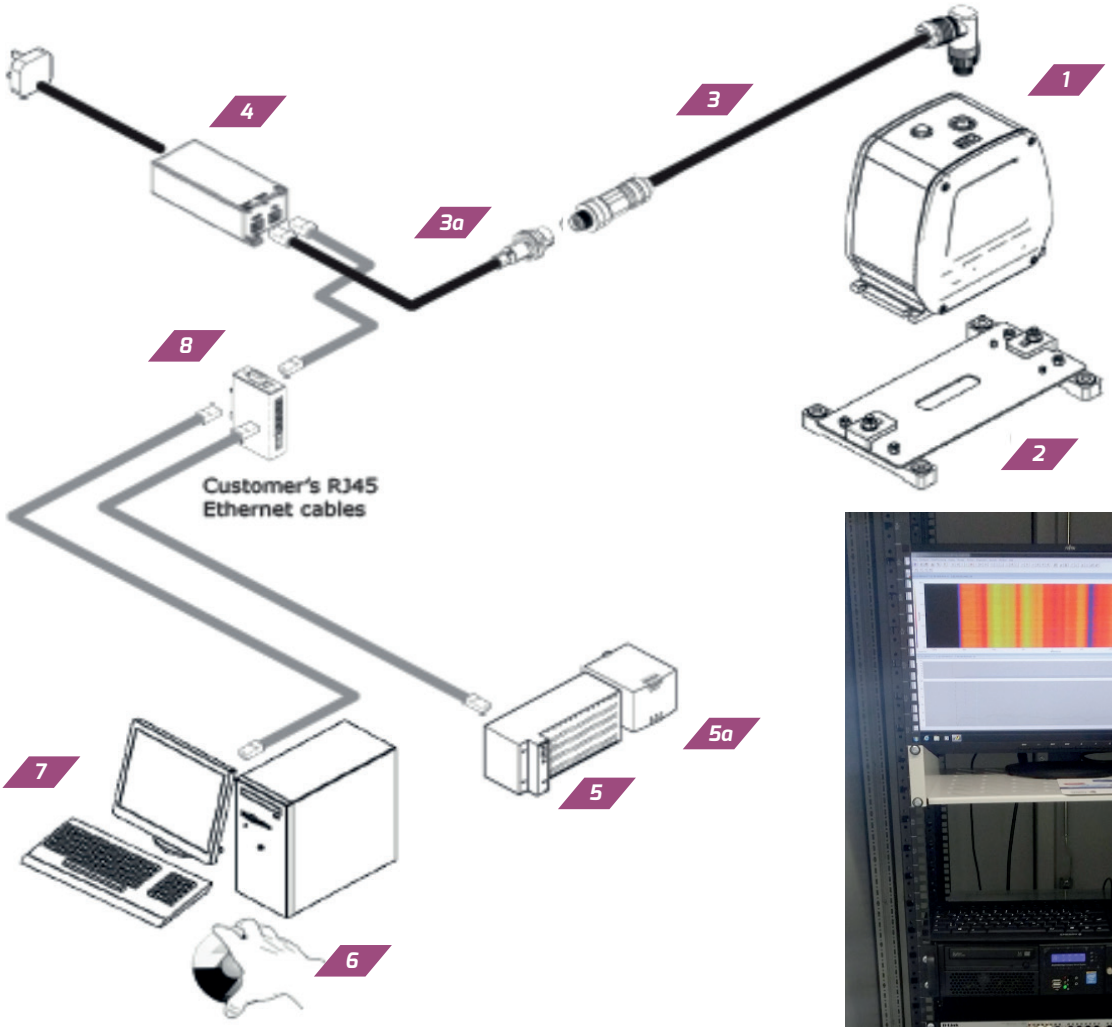
However, glasses of significantly greater or lesser thickness are more dependent on temperature tolerances across the width and length, as to prevent glass breakage or distortion, the temperature difference should be kept below 2 °C (3.6 °F).

The Saint-Gobain Glass Germany GmbH Cologne produces glasses with a thickness of 3 mm to 19 mm. The production data and experience in the production of thicker glasses are already very good and the quality of the glass product of thick glasses is guaranteed and is optimised by the LANDSCAN data.

The success of the system shows that the LANDSCAN system is suitable for wider use in the float glass industry. Further installations are already planned at other locations and glass applications and are also successfully implemented.

The LANDSCAN LSP-HD 60 is now used by Saint-Gobain Glass Germany GmbH for this measurement task and the measurement data is visualised, analysed, stored and processed using the Windows-based Control and Analyse Software (WCA) from AMETEK Land.

THE LSP-HD 60 SYSTEM



1. Scanner	5. IO Processor
2. Mounting	5a. IO PSU
3. Cable	6. WCA
3a. Adapter Cable	7. Workstation
4. PSU	8. Switch



THE VIEW ON THE INSTALLED AND RUNNING LSP-HD 60 SYSTEM

COMPACT, INFRARED

ETHERNET-CONTROLLED LINESCANNER

LSP-HD 60

LINESCANNING

A sophisticated, high-accuracy linescanner, designed to produce advanced thermal images of moving processes



THE LSP-HD RANGE

The LSP-HD range of linescanners offers general-purpose linescanners together with application-specific devices. Compact infrared linescanners develop a thermal map enabling the use of advanced thermal imaging techniques, and provide easy Ethernet integration and control.

The LSP-HD 5FL, was specially developed for applications on the glass float line, it is used for measurements in the annealing lehr where the rugged, sealed-to-process mounting with auto-shutter protection is necessary. For the measurements downstream of the annealing lehr and in the forced air-cooling zones the model LSP-HD 60 is used due to the required measuring range below 150 °C.

The LSP-HD 60 is ideal for imaging across the latitude and longitude on moving processes and operates over a lower temperature range – 20 to 250 °C (70 to 480 °F) – compared to the LSP-HD 5FL 150 to 750 °C (300 to 1380 °F). This makes the LSP-HD 60 the right measuring system with the required measuring range for this measuring task.

The specifications of the LSP-HD 60 are outstanding compared to other products in this segment. With 1000 measuring points per scan, a sampling rate of up to 150 Hz and a high local resolution, where the individual measuring points all overlap, the temperature profile is reliably detected. Due to the very fast point thermometer with a response time of 1 µs and the deflection of the measuring beam over the 80° scan angle by a rotating mirror, the comparability of the measured data with each other is optimal.

The thermometer measures at any point, eliminating drifting or different thermometer influences.

The single-cable plug-and-play installation reduces complexity and costs and enables easy integration of the linescanner into existing process control systems.

No special cabling or hardware is required. In combination with the small size of the LSP-HD 60, it is easy to install the measuring head directly behind the gauge without the need for major conversions.

The linescanner is designed for use in harsh industrial environments with ambient temperatures up to 150°C (302°F) and therefore offers maximum measurement availability and a long service life.

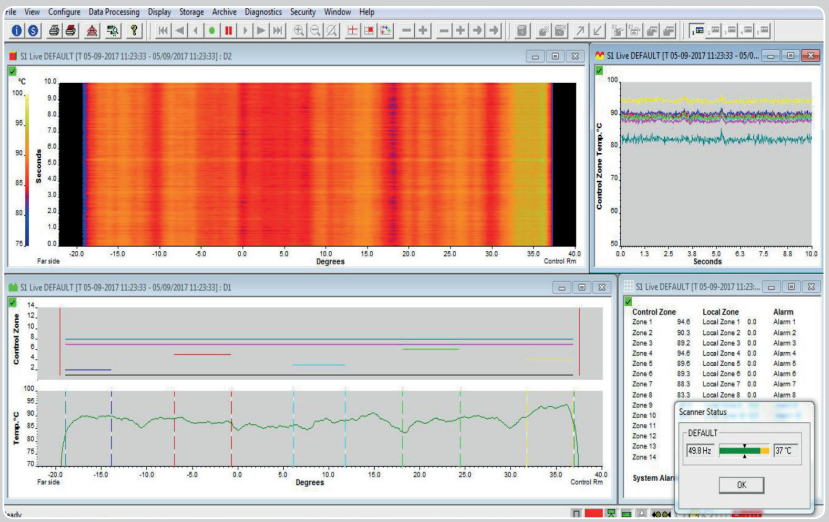
Streamed process data is available directly from the scanner through digital communication options for flexible connectivity, making it ideal for the required monitoring system.

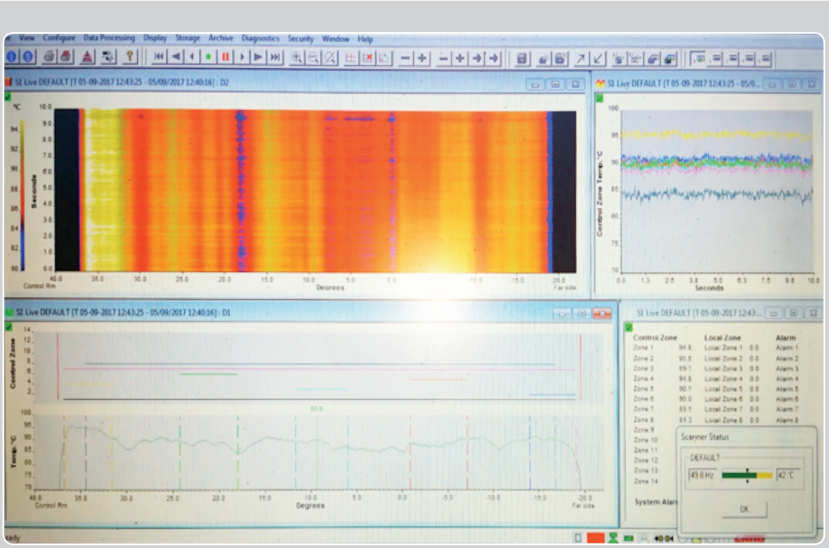


LSP-HD 60 FEATURES AND BENEFITS

FEATURES	BENEFITS
High-resolution optical system	Full-width measurement identifies smallest temperature variations
Industry-leading 150 Hz scan speed	Process modelling improves process control
Designed to operate in harsh industrial environments	Accurate thermal records for product quality data
Plug-and-play installation via a single Ethernet cable	Real-time thermal displays
Range of data output formats	Easy connection to process control system

THE LANDSCAN WCA SOFTWARE SUITE





SOFTWARE TECHNICAL ANALYSIS AND VISUALISATION OF THE MEASUREMENT DATA VIA THE WCA SOFTWARE

The LSP-HD linescanner range supports easy, plug-and-play compatibility with AMETEK Land's Landscan Windows Control and Analyse (WCA) software package.

The LANDSCAN WCA suite provides detailed control and analysis for up to eight linescanners, enabling the viewing and analysing of multiple live and historical temperature data streams.

Offering flexible, scalable capabilities, Landscan WCA delivers advanced, high-resolution thermal imaging data in real time. Tagging and linking multiple live data streams enables the easy creation of production process databases.

A PC-based platform, Landscan WCA provides access to temperature measurements and processed data through a range of standard industrial interfaces, including cross-platform TCP/IP protocol, OPC, analogue signals and alarm outputs.

The clear visualisation of the flat glass temperature profile provided by the Landscan WCA software using data from the LSP-HD was key to proving the effectiveness of the system in behind the lehr measurements.

TEMPERATURE MEASUREMENTS IN THE FORCED AIR-COOLING ZONES DOWNSTREAM OF THE LEHR ON A FLOAT GLASS PLANT

LSP-HD 60

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



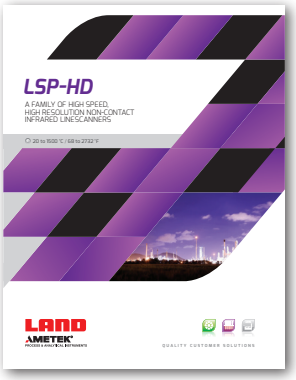
LINESCANNING

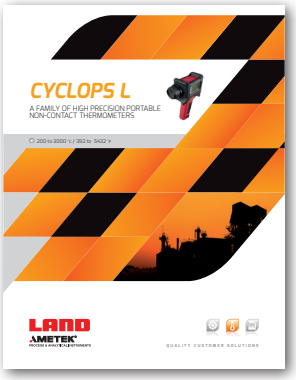
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SERVICES

Our in-house service centres provide after-sales services to ensure you get the best performance from your system. This includes technical support, certification, calibration, commissioning, repairs, servicing, preventative maintenance and training. Our highly trained technicians can also attend your site to cover planned maintenance schedules and repair emergency breakdowns.











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