LAND

AMETEK®

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

APPLICATION NOTE

The cooling rate and homogeneous thermal distribution across the width and length of the glass ribbon within the annealing lehr and forced air cooling zones are essential to float glass quality.

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. With the development of the LSP-HD linescanner, AMETEK Land provides a non-contact infrared solution for accurate temperature-cross-profile measurements that optimise the annealing process and minimise thermal variations across the width of the glass, making production of thinner or thicker glasses possible.

The LSP-HD solution can cover the different locations of the lehr. The hottest locations from A to C can be covered by the LSP-HD float line mounting with the LSPHD 5FL, and the coldest from location D to E with the LSP-HD 60 or LSP-HD 5. For the typical location F, where the temperature of the glass ribbon could be below 100 °C, the LSPHD 60 will be used; this is the typical application described in this document.

THE LSP-HD RANGE

AMETEK Land's LSP-HD range 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, and is used for measurements in the annealing lehr, where a rugged, sealed-to-process mounting with auto-shutter protection is necessary. This is commonly used in location A to C.

For the measurements downstream of the annealing lehr, and especially on coldest location D to F and in the forced air-cooling zones, the LSP-HD 60 model is used, due to the required measuring range below 150 °C (302 °F).

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's 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.

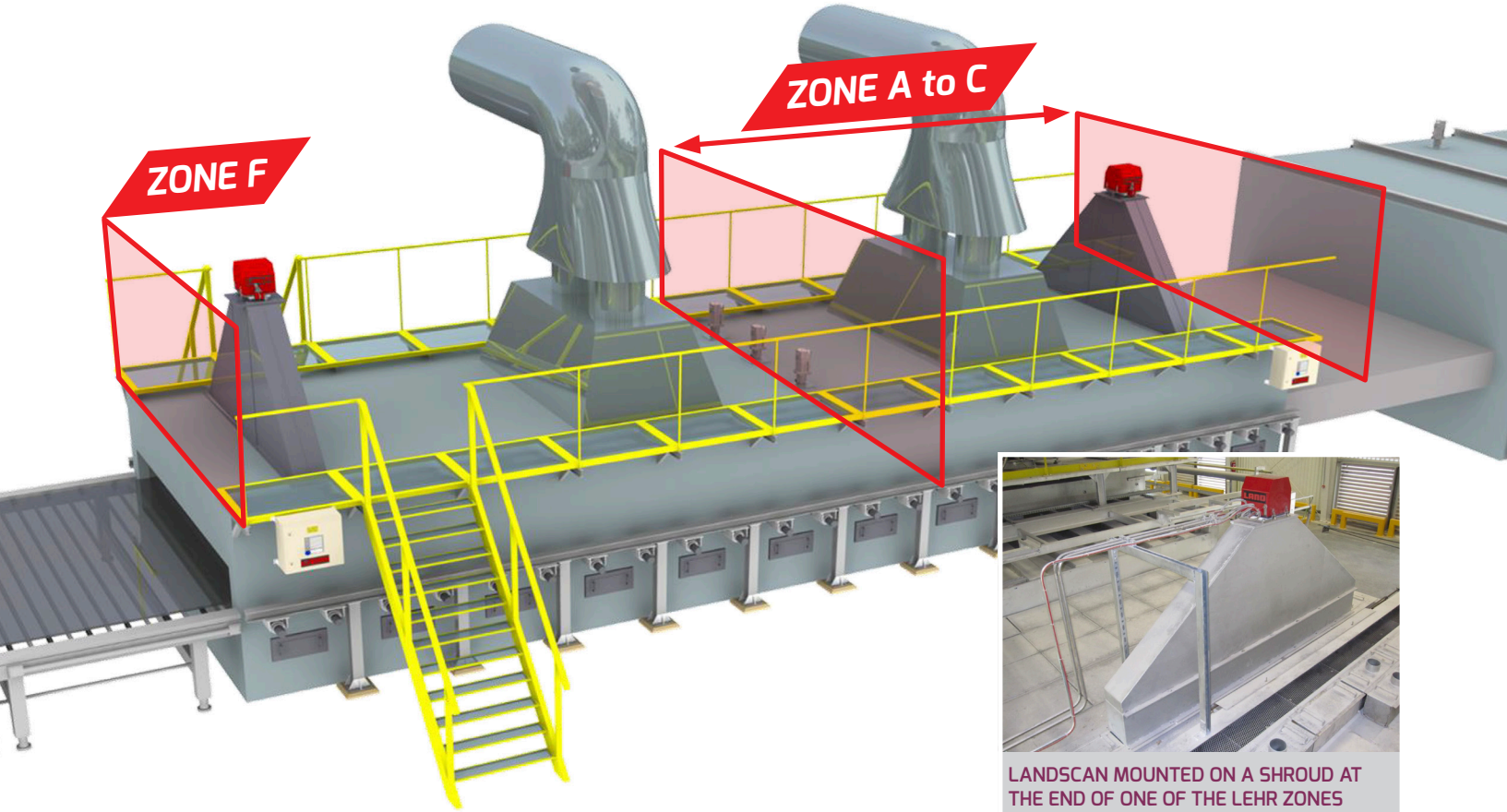
The linescanner is designed for use in harsh industrial environments with ambient temperatures up to 150 °C (302 °F), and therefore offers maximum measurement availability and a long service life.

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 AND LSP-HD 5 FL 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

LSP-HD SOLUTION FOR LEHR MEASUREMENT LOCATION F TYPICAL APPLICATION NOTE



LANDSCAN MOUNTED ON A SHROUD AT THE END OF ONE OF THE LEHR ZONES

If flat glass leaving the tin bath is 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.

To overcome this, the glass passes through the lehr – a long, temperature-controlled kiln – to ensure a consistent temperature gradient as it cools.

Previously, non-contact thermometers have provided a cost-effective solution, taking accurate spot measurements at five zones across the width of the glass. However, this results in an averaged temperature indication over the respective field of view of each thermometer, and so the local resolution of the temperature data across the width is not very meaningful.

Additionally, it relies on a different thermometers for each zone, each with its own drift and deviation, increasing the systematic error in viewing and rating.

A superior solution is achieved using the LANDSCAN system with the LSP-HD 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 overs the entire process width. These specifications meet the requirements of the glass company.

The LANDSCAN LSP-HD 60 is used for this measurement task and the measurement data is visualised, analysed, stored and processed using the Windows-based Control and Analysis Software (WCA) from AMETEK Land.

The visual representations with the thermal temperature profile across the width and the listing of the continuous temperature profiles over time (thermal map) allow an accurate assessment of the thermal distributions over the width and length, the stability of the temperatures over the time at the measuring location and the temperature difference across the glass.

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 LEHR MEASUREMENT CHALLENGE

The lehr is a long, temperature-controlled kiln divided in different locations from A to F (see diagram on page 3).

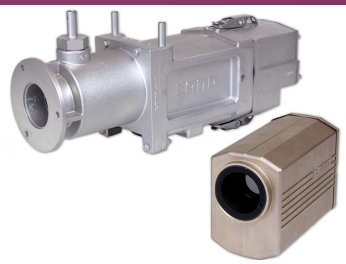
Glass passes through the lehr to ensure a consistent temperature gradient as it cools. If the glass was allowed to cool in ambient air, the surface would lose heat more quickly than the interior of the glass, creating stresses which are likely to crack or break the glass.

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 baffes 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.

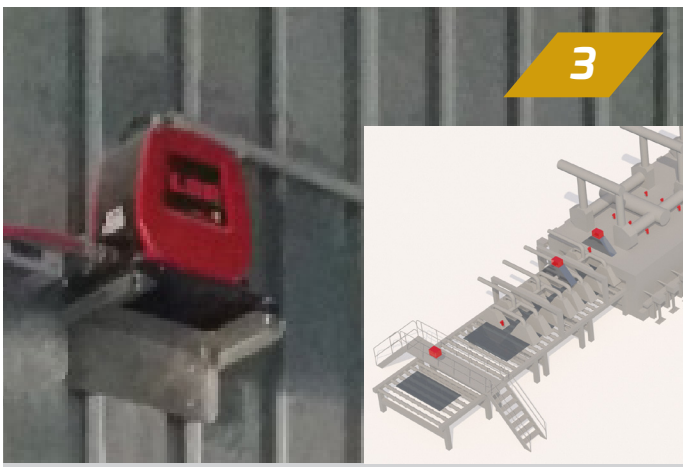
The RT80A is derived from the same thermometer series which is already used on the tin bath and provides trusted, safe temperature monitoring data.

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



LSP-HD 60 USED ON LOCATION F AT ST GOBAIN, GERMANY

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.

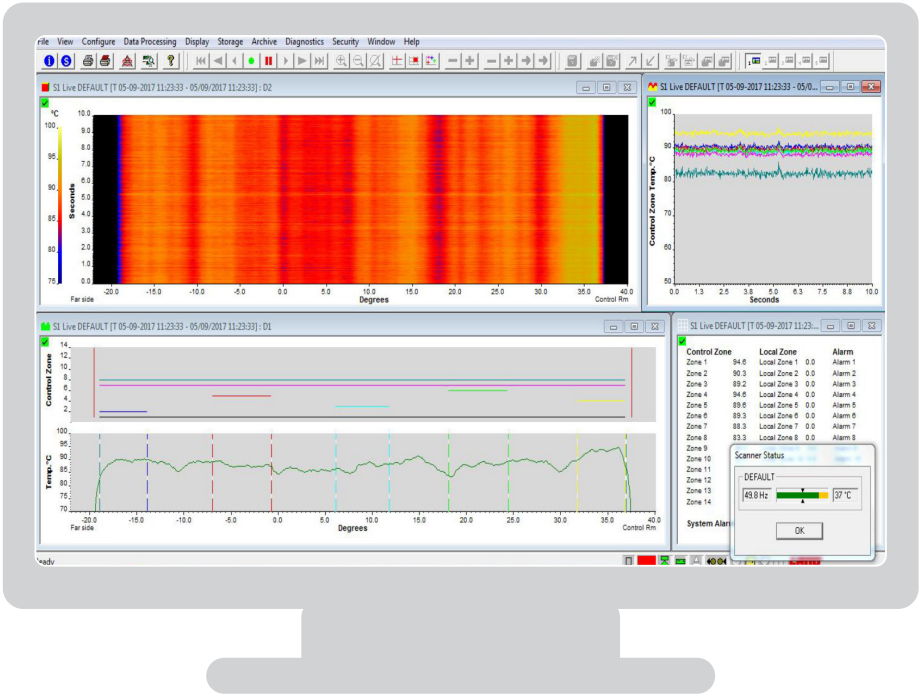
However, glasses of significantly greater or lesser thickness are more dependent on temperature tolerances across the width and length, as to prevent glass breakage or distortion, the temperature difference should be kept below 2 °C (3.6 °F).

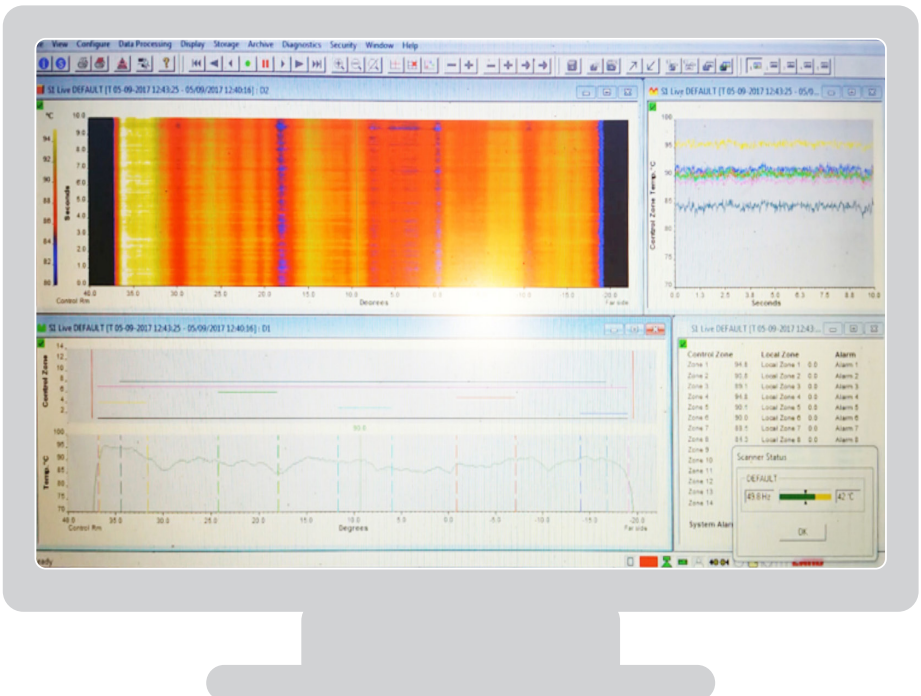
The Saint-Gobain Glass Germany GmbH Cologne produces glasses with a thickness of 3 mm to 19 mm. The production data and experience in the production of thicker glasses are already very good and the quality of the glass product of thick glasses is guaranteed and is optimised by the LANDSCAN data.

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 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 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.

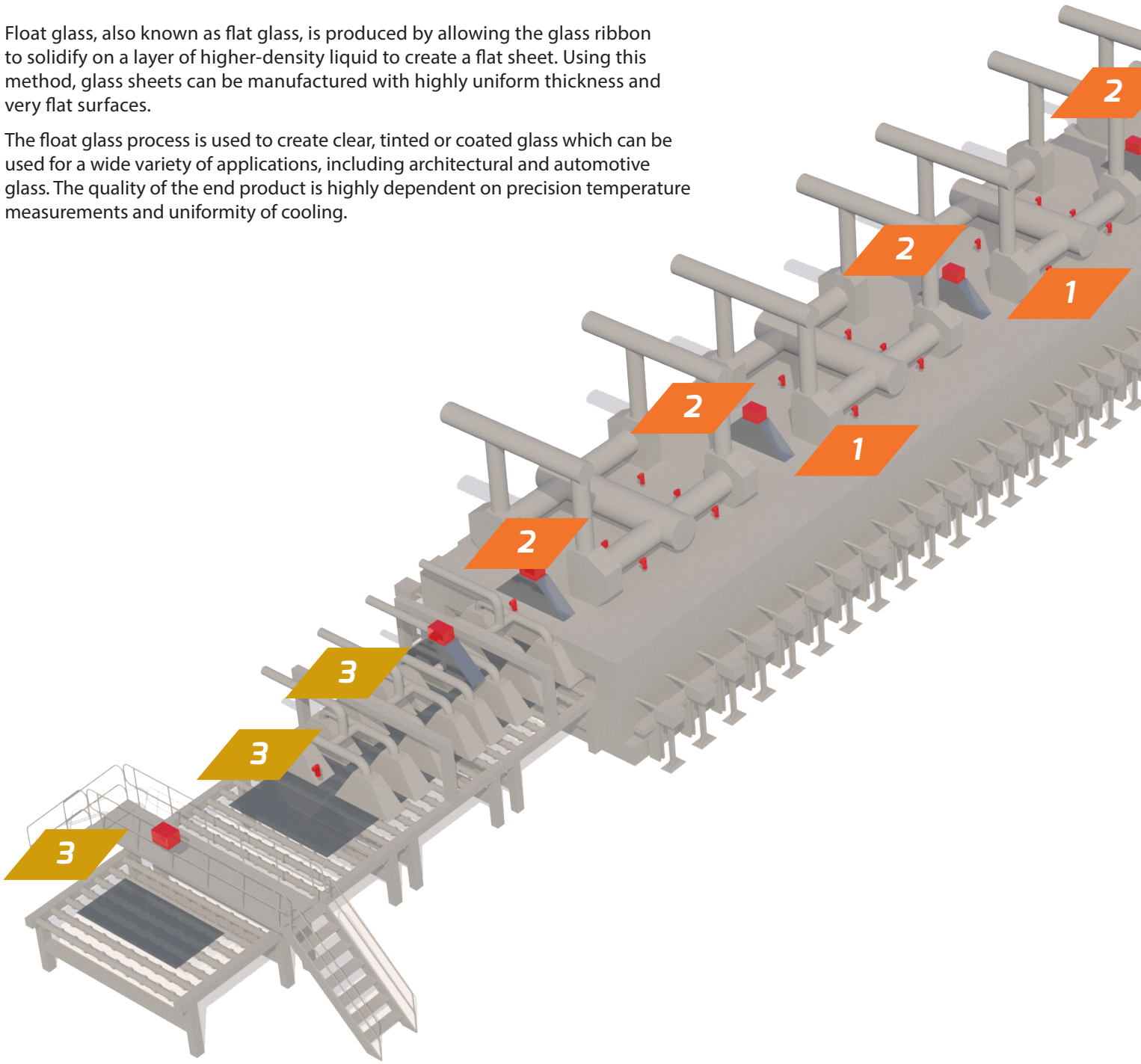
The clear visualisation of the flat glass temperature profile provided by the Landscan WCA software using data from the LSP-HD was key to proving the effectiveness of the system in behind the lehr measurements.

FLOAT GLASS PROD

AMETEK LAND HAS DELIVERED TEMPERATURE MEASUREMENT SOLUTIONS ACROSS THE FLOAT GLASS PLANT FOR DECADES, DEVELOPING DEDICATED SOLUTIONS FOR SPECIFIC APPLICATIONS WITHIN THE PROCESS.

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.



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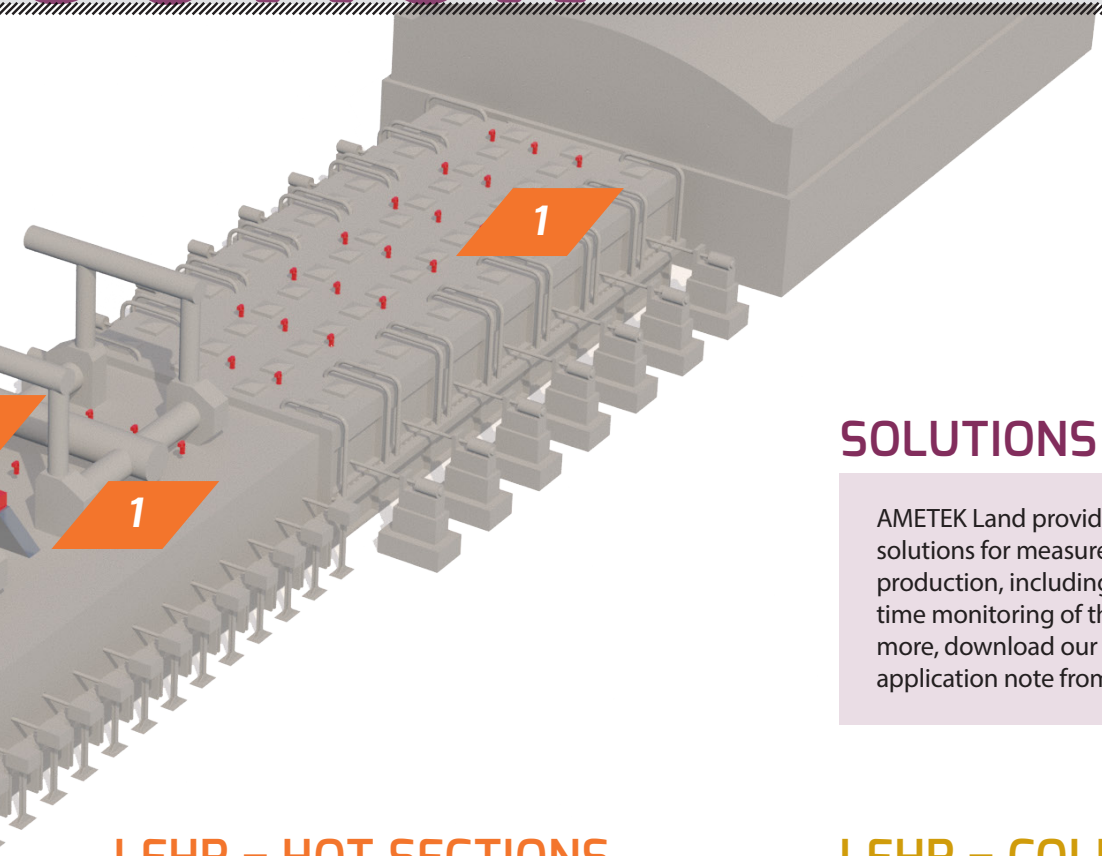


SOLUTIONS BEFORE THE LEHR

AMETEK Land provides a comprehensive range of solutions for measurements throughout float glass production, including portable thermometers and real-time monitoring of the melt tank interior. To find out more, download our Glass Tank Refractory Monitoring application note from the website.

LEHR – HOT SECTIONS

TIN BATH 1 ANNEALING LEHR 2

LSP-HD 5FL FLT5A

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.

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

LEHR – COLD SECTIONS

LEHR - LEHR EXIT 3

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.

Measurement at the annealing lehr exit 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.

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

LSP-HD 60

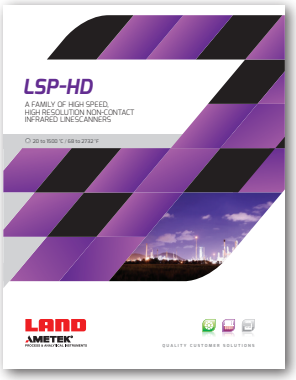
Ethernet-controlled compact infrared linescanner, designed to produce advanced thermal imaging in moving processes

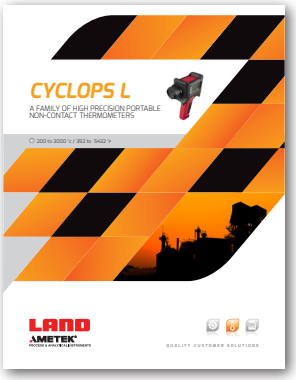
LINESCANNING

AMECARE®
PERFORMANCE SERVICES

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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