LAND

AMETEK®

GLASS TANK
REFRACTORY MONITORING
APPLICATION NOTE

The condition of glass furnace refractories is vitally important to safety and process efficiency, especially towards the end of the life of the tank. Deterioration of the refractories can increase fuel costs, and may cause glass break-outs or refractory failure.

Monitoring the exterior of the melt tank with a thermal imager can provide an indication of any hot areas which may indicate refractory damage. It also gives an early warning of potential glass break-outs.

Continuous thermal imaging can also be used for accurate interior monitoring, establishing temperature trends throughout the furnace. It also detects cooler spots which may indicate refractory damage.

Detection of damage to the tank allows early maintenance and extends the tank's lifespan. Around 70% of container glass production costs come from energy, so preventing cracks and lost heat produces significant savings. Early detection of glass break-outs enhances plant safety.

THE GLASS REFRACTORY

Nearly all glass production processes begin with raw materials being melted in a furnace or tank.

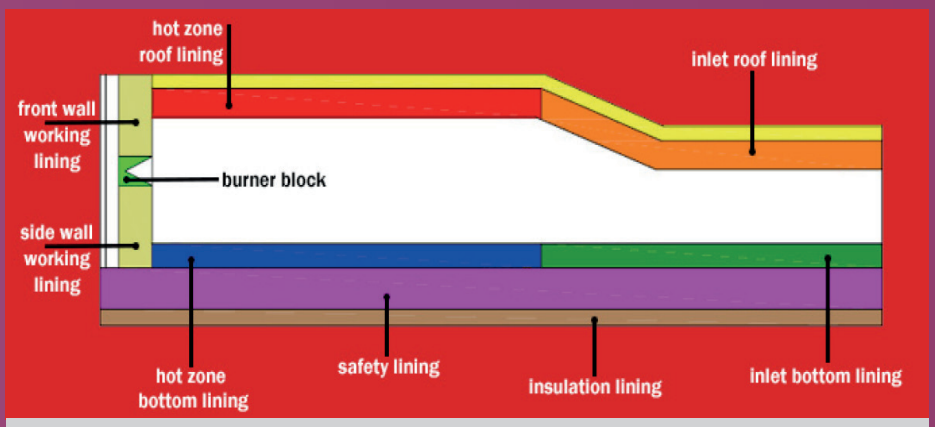
Glass melting is highly energy-intensive, and takes place in continuously operated tanks. The process can take more than 24 hours, with ingredients melted at approximately 1600 °C (2900 °F) in a Melt between two feet (0.6m) and three feet (1m) deep.

Keeping the Melt at this temperature over such a long period of time requires a great deal of energy, but around 30% of the energy used in heating the batch can be lost through the furnace structure. This means adequate insulation is essential.

Glass manufacturing is highly dependent on the performance of the tank and especially the refractory lining.

Process conditions dictate that the heat-resistant refractory will eventually deteriorate and fail. This deterioration can significantly increase fuel costs, and may cause glass break-outs, affecting plant safety.

The detection of tank damage is key to ensuring early maintenance to extend the tank's lifespan. It also minimises the risk of glass break-outs, which see molten glass leaking from the bottom of the tank. Given the high temperatures involved, this is a significant risk to the safety of plant personnel.



GLASS TANK CONSTRUCTION

EXTERNAL REFRACTORY MONITORING

Most glass plants use portable thermal imagers to monitor the exterior of the melt tank. This detects any hot areas, which indicate refractory damage or erosion is allowing heat to escape.

Monitoring is especially critical at the tank bottom, where glass break-outs can cause the maximum amount of damage.

Traditionally, portable systems have been used to reduce the number of cameras required to monitor the tank. A portable device also avoids the problems faced by fixed systems in monitoring hidden areas of the refractory.

However, there are several disadvantages of using portable measurements. They are dependent upon the operator to adequately measure the entire tank exterior surface effectively. In addition, it is not feasible for the tank to be continuously monitored.

GLASS MELTING FURNACE EXTERIOR

GLASS LEAK DETECTION

Insofar as monitoring for efficiency is concerned, regular portable measurements are often sufficient to ensure refractory condition. Break-outs, however, can occur at any time, even if checks have recently been carried out.

When a glass break-out occurs, early detection is essential, since if the leak is not detected and stopped (using water and compressed air) in the first 20 minutes, it is unlikely it can be stopped at all.

In addition to the risks to personnel, this also has considerable cost implications, since the batch is lost, the energy used for the melt is wasted, the tank will require repair or replacement, and clean-up of the plant will be necessary. Possibly of most significance, production will have to cease until the situation has been dealt with.

The ideal safety monitoring solution, therefore, is one which can continuously monitor the tank bottom from underneath, quickly detecting glass leaks before it is too late.

THERMAL IMAGING

AMETEK Land's solution for this application is the ARC monitoring system, which combines cutting-edge, high-resolution radiometric camera technology with sophisticated data processing and powerful software support. This delivers detailed thermal images with unrivaled precision.

Portable measurements only record the temperature at specific points, and so rely on the operator for adequate coverage of the tank exterior. The thermal imaging provided by the ARC camera allows a continuous view of the entire target at any distance.

Thermal data generated by the camera is presented in real time, which makes it faster and easier to detect anomalous hot spots, alerting plant staff to take immediate action.

In addition to providing a fast-response safety monitoring system, the ARC solution also supplies the thermal data necessary to detect damage or wear to the refractory lining at an early stage. This allows corrective maintenance to be scheduled at the least disruptive times.

By increasing the reliability of safety monitoring, the ARC system can also reduce insurance premiums, for an added return on investment.

MONITORING OF TANK BOTTOM TEMPERATURES

ELECTRIC BOOST ELECTRODES

It is possible to boost the energy input to the melt tank by using electrodes. These boosting electrodes are typically positioned vertically, through the base of the tank. They use electrical currents to heat the molten glass at the point of contact, increasing the melt rate for greater efficiency.

The construction of the electric boost system inevitably introduces weaknesses into the tank structure, as the electrodes pass through the refractory lining.
The ARC camera can also be used to monitor the condition of the electrodes and the refractory around them. Any hot spots around the electrodes may be an indication of damage to the tank which could lead to a glass break-out. They may also signal a failure of the electrode cooling system.

RECOMMENDED PRODUCT:

ARC IMAGER

ARC IMAGER

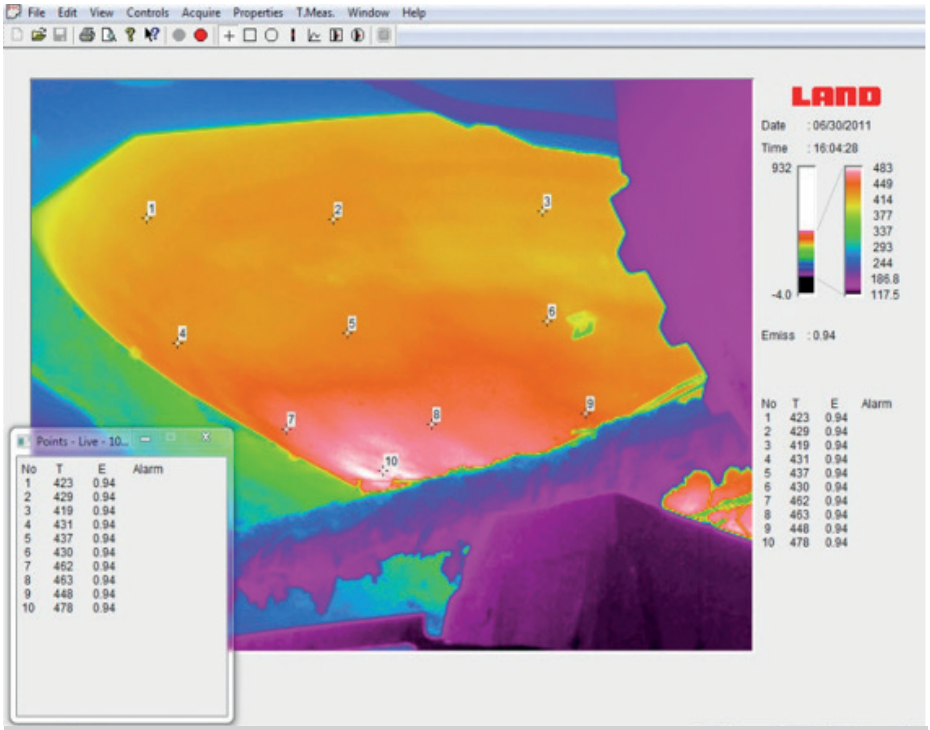
AMETEK Land's ARC imager is a rugged, versatile thermal imaging camera, delivering unsurpassed temperature accuracy in heavy industrial applications.

It offers four lens options, with viewing angles at 11°, 22°, 44° or 60°. This provides exceptional field-of-view coverage at a range of distances, offering outstanding image clarity.

Customised to precise application requirements, ARC supplies the high-accuracy thermal images needed to provide reliable process control, product quality verification, or safety monitoring.

Data-processing is performed within the ARC imager, with no separate signal processor required. User-friendly ARC Viewer software is supplied as standard, enabling real-time visualisation of the thermal data for informed decision making. Enhanced featured LIPS Imaging software and I/O processing are available options.

ARC HOUSING



GLASS LEAK DETECTION

ARC FEATURES AND BENEFITS

FEATURES	BENEFITS
High resolution 384x288 images	Unsurpassed temperature accuracy
Four lens options	View any target at any distance with outstanding clarity
Wide ambient temperature range	Suitable for installation in just about any climate
Four configurable regions of interest	Range of settings always keeps the target in view
Viewer software as standard	User-friendly software control

INTERIOR REFRACTORY MONITORING

Thermal imaging can be used to monitor conditions inside the melt tank, maintaining high-quality glass production and extending the life of the furnace.

AMETEK Land's NIR-B Glass infrared borescope imaging camera produces high-definition thermal images that enable accurate temperature measurements from any point in the image.

This provides several advantages compared with visual imaging and point temperature measurements.

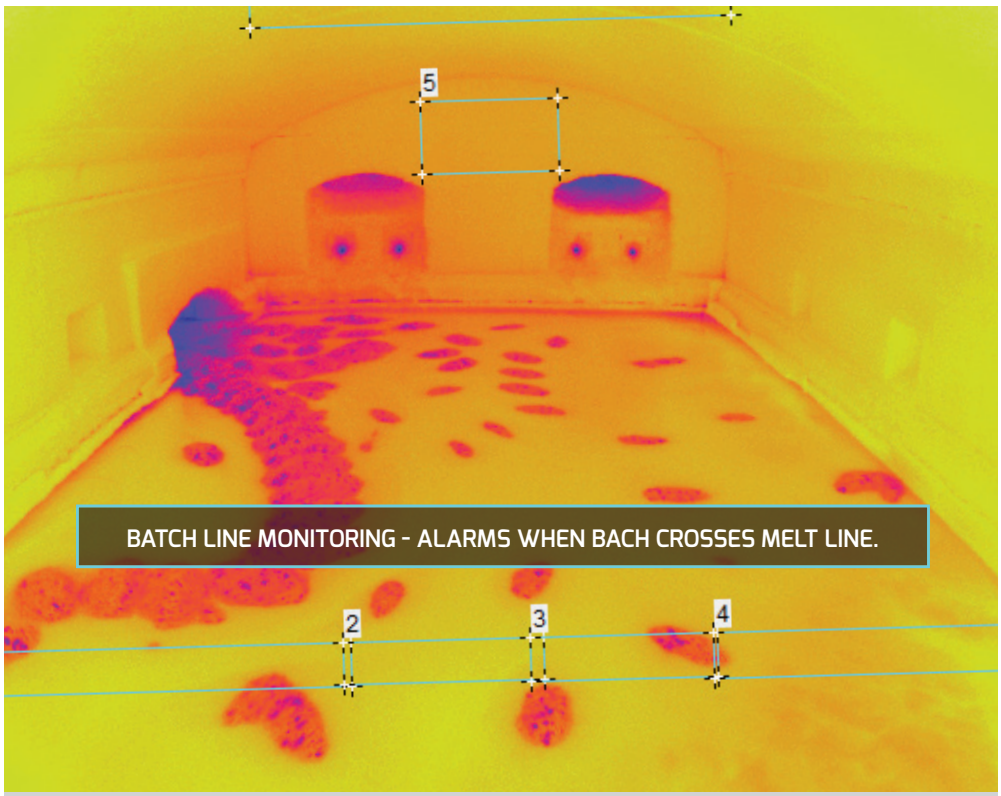
For example, a permanently installed thermal imager can actively record all necessary and useful data, allowing the video to be stopped at any frame. Measurements can then be taken of all ports at exactly the same point in the process, allowing reversals to be tuned more accurately.

The imager can also rapidly detect the beginning of any structural damage caused by the high temperatures. If a crack is developing in the refractory, it may show up as a colder area where air is being pulled in.

The NIR-B Glass is highly effective for this monitoring application, as it accurately profiles the temperature of the entire furnace, requiring only a small opening in the furnace wall.

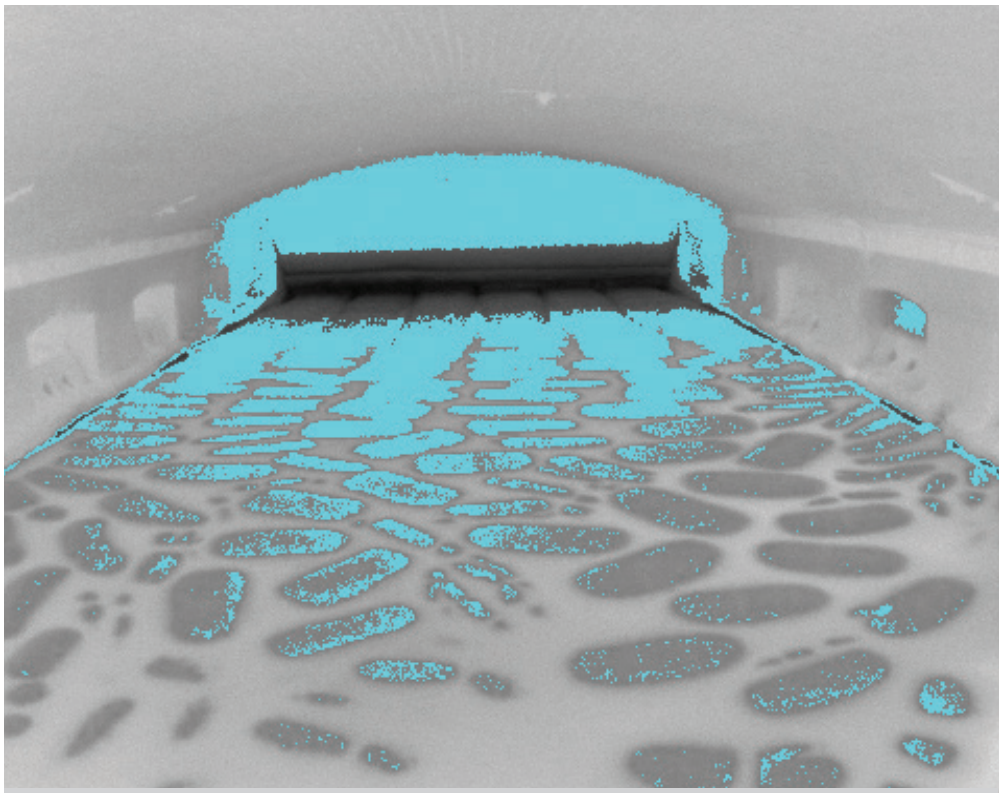
It also provides a high-quality visual image of the furnace interior, showing what is going on in the melt tank at any time, and helping to optimise flame propagation.

CONTINUOUS REAL TIME THERMAL IMAGE



CONTINUOUSLY MONITORING AND RECORDING AREAS OF INTEREST WITH HIGH AND LOW ALARM OUTPUTS.

CONTINUOUS REAL TIME THERMAL IMAGE



ENHANCED MONOCHROME THERMAL IMAGE WITH ISOTHERM HIGHLIGHTING LOW TEMPERATURE REGIONS.

RECOMMENDED PRODUCT:

NIR-B GLASS

Developed specifically for use in the glass melt tank, the NIR-B Glass continuously measures temperatures across a high-resolution 324,000-pixel image. This real-time monitoring ensures high product quality, helps detect furnace structural damage, and improves melt tank efficiency.

The camera uses proven, short-wavelength near-infrared thermal imaging technology, connecting to a Windows PC running AMETEK Land's dedicated LIPS processing software. This delivers accurate data analysis, along with automated alarms and control for 24/7 monitoring.

With a wide-angle lens tip, it has a 90° field-of-view yet only needs a small-diameter hole in the wall, minimising process disruption while ensuring a full view of the critical furnace area.

Continuous measurements ensure real-time batch monitoring, flame optimisation and the reliable provision of the data needed to improve energy efficiency, maximise pull rates and extend refractory lifetime.

In addition, the NIR-B Glass can be fitted with an auto-retract system. This is designed to protect the imager from heat damage in the event of loss of water flow, air pressure or electricity supply, or the activation of a high borescope tip temperature alarm.

DESIGNED TO PRODUCE HIGH-DEFINITION (656 X 494 PIXEL) THERMAL IMAGES

NIR-B GLASS FEATURES AND BENEFITS

FEATURES	BENEFITS
High temperature measurement accuracy	Optimum process control
Short wavelength sensor	Low sensitivity to emissivity changes
Dedicated software	Configured areas of interest and long-term data-trending
Real-time thermal data and high-res visual image	Real-time batch control and energy efficiency improvements
Continuous 24/7 monitoring	Accurate, reliable data with no blind time

AMETEK LAND SOLUTIONS FOR GLASS TANK REFRACTORY MONITORING

ARC IMAGER

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

PROCESS IMAGING

NIR-B GLASS

A borescope thermal imaging camera specifically developed to return precise temperature measurements in glass furnace applications.

PROCESS IMAGING

AMECARE PERFORMANCE 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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For a full list of international offices, please visit our website **www.ametek-land.com**

Applies in the UK

Certificate No. CC-2041
Applies in India

Applies in the US

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