

## Ladle Hot Spot Detection System Ladle monitoring system for steelmakers

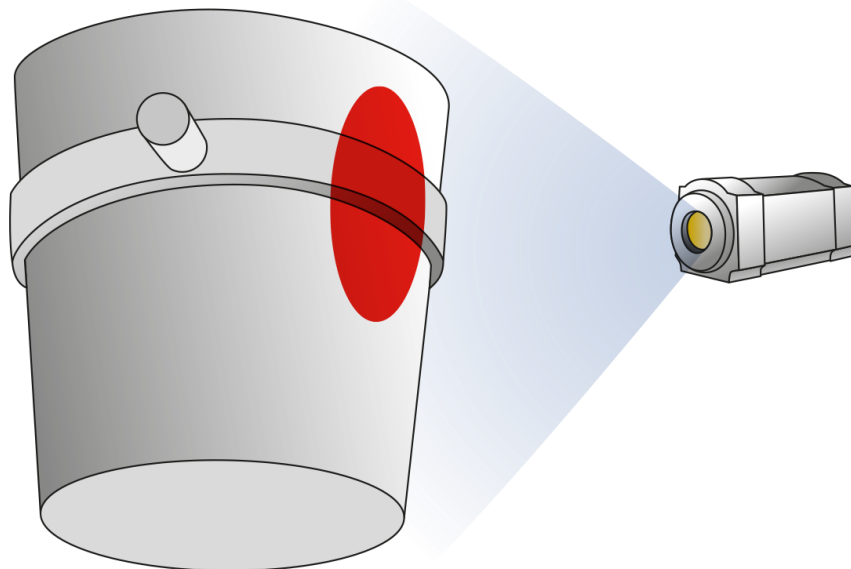
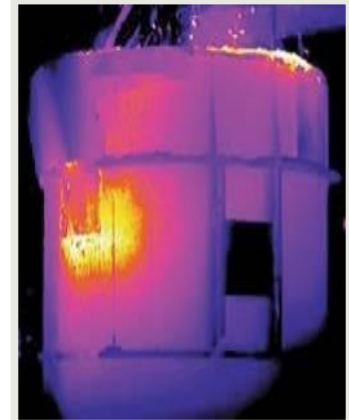
Ladlesafe infrared monitoring of your steel ladles minimises the risk of liquid steel breakout and maximises your ladle refractory lifetime.

The risk of a ladle breakout will always be present in steelmaking, with equipment damage and loss of production as the costly consequence. Your production and operation routines could minimize this risk, but the fact remains; as long as liquid steel is transported using ladles – breakouts will occur from time to time. Besides the economic impact of a ladle breakout it is a very dangerous event and there

is a potential risk of personnel injuries and loss of life. The LadleSafe system is designed to help you avoid this costly and dangerous situation.

Ladlesafe pays for itself – but if the pay back is quick enough you know best. What we do know is that a typical medium severe ladle breakout, including associated costs, corresponds to the purchasing cost of the LadleSafe system. Avoid

one breakout and the system is paid for. We also know that the yearly cost for steel ladles refractory in a medium BOF steel shop typically spans Euro 5–15 million. Increase the ladle refractory average lifetime by 1–2 % using LadleSafe and the system is paid for in a year.



Agellis follows a policy of continual improvement of design and we must therefore reserve the right to supply equipment differing in detail from that described herein.

## Key Features

### Breakout Early Warning

Early warning of potentially dangerous ladle hot spots. LadleSafe detects hot spots long before they are visible to the naked eye (red hot), thus allowing preventive actions to be taken long before a critical situation occurs.

### Temperature Trending

A LadleSafe measurement of the ladle steel structure temperature distribution also presents the temperature evolution over time. This information is useful for the refractory maintenance personnel.

### Ladle Refractory Lifetime

LadleSafe allows ladle refractory lifetime to be maximised. A direct measurement of the ladle steel structure temperature when in use is likely to reflect the refractory status. Thus, as long as the temperature stays below a predefined value, the refractory should be safe to continue using.

### Data Mining

LadleSafe contains a measurement results database to be used for evaluation purposes. This opens for a more precise ladle fleet management which avoids excess thermal loads on some ladle individuals and prolongs ladle refractory lifetime. Database mining is also useful in tracking down production actions detrimental to the ladle refractory

## User Friendly Interface



LadleSafe automatically rates and analyse each ladle view and a summary is presented to the operator

## Principles of Operation

### Technical Overview

LadleSafe is based on the thermal imaging technique, using infrared cameras to feed data to the analysis. A Windows based server hosts the LadleSafe analysis models, vision system and databases. The server communicates with plant systems (Level 1/2/3), operator clients, and peripherals using TCP/IP and industry-standard protocols for data exchange.

The LadleSafe technological package is built as a web-application for easy installation and maintenance. The user has access to the system by using the standard web-browser and a local Ethernet – no client installation required.

A typical LadleSafe set-up consists of one or several operator(s) that controls the measurement by using a touch screen client mounted at the work station pulpit, in a crane, or on the shop floor.



### Thermal cameras

LadleSafe uses Thermovision thermal cameras from Flir Systems, the world's leading supplier of infrared imaging equipment. The Thermovision A-series cameras are designed for continues 24/7 operation and is a highly accurate temperature measurement system, offering tens of thousands of individual measurement points per image.



## Technical Information

### Imaging performance

**Resolution:** 320 x 240 pixels

**Thermal sensitivity:** 70 mK at 30°C

**Focusing:** Automatic/Manual

**Detector type:** Focal Plane Array (FPA), uncooled microbolometer

**Spectral range:** 7.5 to 13 µm

### Measurement

**Measure temperature range:** -20°C up to +2000°C

**Accuracy:** ±2°C or ±2% of reading

**Emissivity correction:** Variable 0.1–1.0

### Physical specifications (camera)

**Weight:** 0.7 kg

**Dimensions:** 170 mm x 70 mm x 70 mm

**Operating temperature range:** -15°C up to +50°C

**Humidity:** < 95%, non-condensing

**Encapsulation:** Aluminum IP40 (determined by connector)  
Please note: Cameras are mounted in protective housing of higher IP-class.

### Others

A number of standard lenses are available to adapt to different measurement scenarios.

Other camera models available upon request.

Example of protective housing IP67 or higher:

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