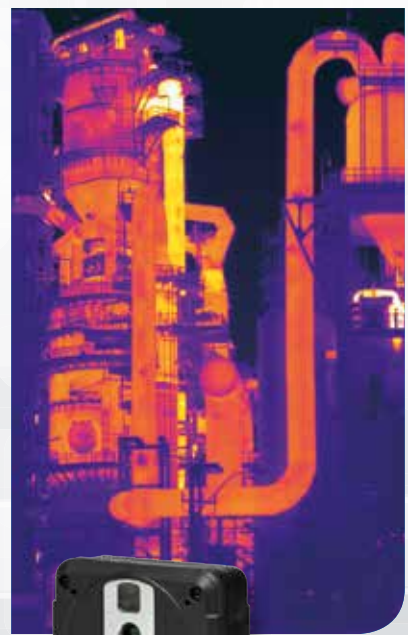# THERMAL IMAGING FOR MACHINE VISION AND INDUSTRIAL SAFETY APPLICATIONS

FLIR: THE WORLD LEADER IN THERMAL IMAGING CAMERAS

FLIR is the world leader in the design and manufacturing of thermal imaging systems for a wide variety of commercial, industrial and government applications.

FLIR thermal imaging systems use state-of-the-art infrared imaging technology that detects infrared radiation - or heat. Based on detected temperature differences, thermal imaging cameras produce a visible image of a target's thermal profile. Advanced algorithms also make it possible to read correct temperature values from this image.

We design and manufacture all of the critical technologies inside our products, including detectors, electronics, and lenses.

Thermal imaging cameras for machine vision applications

FLIR knows that a machine vision environment is totally different from any other environment in which thermal imaging cameras are being used. That is why we are designing and developing a dedicated product range for these types of applications. These cameras are designed and developed in our state-of-the-art facility in Taby, Sweden.

Thermal imaging for automation

FLIR thermal imaging cameras are ideal for a wide range of automation applications when flexibility and unequaled performance are vital. Accuracy, reliability, sensitivity and high performance are also vitally important. That's why FLIR thermal imaging cameras are widely used around the world for a wide variety of automation applications.
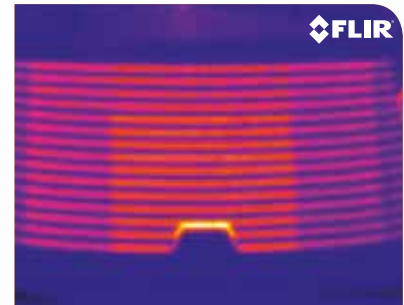
Inspection of a windshield defroster for damaged electrical elements.

Product development
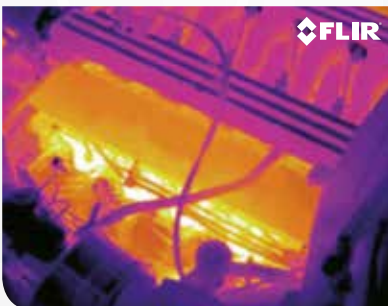

Thermal image of a car engine.

FLIR Systems Sweden

MACHINE VISION (Monitor production processes continuously)

Many industries can take advantage of implementing a thermal imaging cameras that continuously monitor production. In some cases the data acquired by a thermal imaging camera can be used to improve the production process.

Thermal imaging cameras for automated inspections

For many applications, such as the production of parts and components for the automotive or electronics industry, thermal data are critical. While machine vision can see a production problem, it cannot detect thermal irregularities. Thermal imagery provides much more information to production specialists and decision makers.
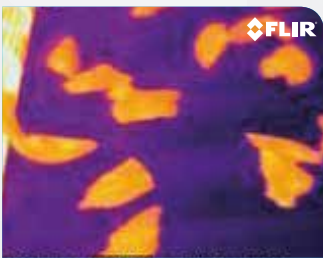
*Quality control of food production line.*

Food inspection

In the food industry, it's essential to carefully control the temperature and shape of perishable goods throughout production, transportation, storage, and sales. Food processors need tools that automate crucial operations in a way that helps minimize human error while holding down costs.

Inspection of car windscreen defrosting.

Automotive industry

New vehicles are subjected to a number of individual and automated quality control tests. Many automobile manufacturers are using thermal imaging cameras for quality control. Typical applications include inspection of rear window heating, heated seats, checking exhaust flaps, air-conditioning outlets and more.
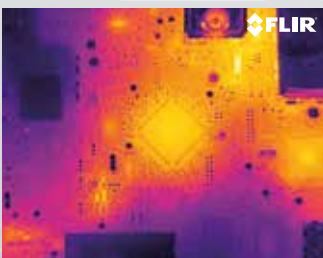
A flawed resistor detected by a thermal imaging camera.

Electronic components

Cutting down failure rates of electronic components is essential for companies that want to supply a perfect product to their customers. The only way to ensure this is by checking each individual component to provide 100% quality control.

*Thermal image shows bottles that are over- or under-filled.*

Packaging

Thermal imaging cameras make a clear distinction between what is hot and what is not. This, combined with emissivity effects, sometimes allows thermal imaging cameras to "see through" plastic or other material.

Thermal imaging cameras for process control

Assuring quality control, deciding if a product is 100% to specifications, whether it is "good or bad" is just one step. Thermal imaging cameras can help to do this and more. Often thermal imaging cameras provide valuable data about the production process. Production engineers can use these data to improve the entire production process.

Automotive industry

Cars need to be light and strong. To achieve both of these goals, modern car panels are made of a combination of a metal layer on top and a structural adhesive layer underneath. These layers are glued together using induction. The temperature has to be exactly right for the adhesion to work properly. To ensure that the adhesion goes smoothly, FLIR thermal imaging cameras can provide automatic feedback during the process.
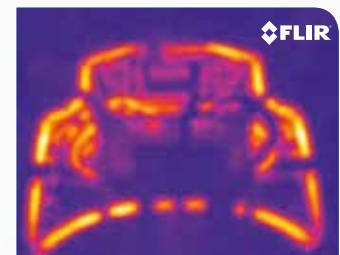
This thermal image shows induction heating at work.

Glue bead verification

Clear glue or black glue applied to a black background is very difficult for a visible light camera to see and measure. FLIR automation cameras, however, can easily determine whether the glue bead has been applied properly, has gaps, and even if it is within the allowable temperature limits.
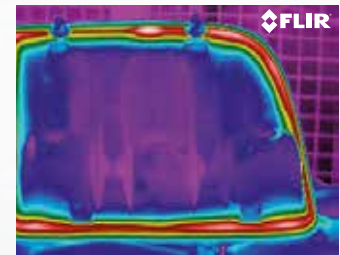
Black glue on black plastic.

## Paper moisture characterization

Paper quality can be affected by variations in moisture. FLIR thermal automation cameras pick up the temperature differences caused by moisture variations to help paper mills keep their processes in control.

Paper moisture characterization.

Weld inspection

Spot and linear welds can be inspected in real time by FLIR thermal automation cameras.
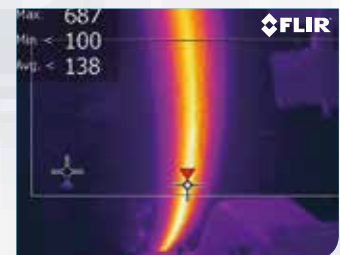
Controlling the positioning of pipes in an automated welder.

INDUSTRIAL SAFETY

Safety is important in any industry. Accidents and fire need to be avoided and production needs to be running at all times. Thermal imaging cameras can help to ensure safety and avoid unplanned outages.

Condition monitoring

Condition monitoring is all about identifying problems before failure occurs in order to prevent costly production stops. Typical equipment that is monitored includes high- and low-voltage installations, turbines, compressors and other electrical and mechanical equipment. Sometimes processes need to be monitored because an anomaly can cause dangerous situations.
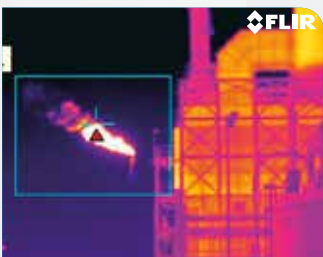
*Thermal image of a flare.*

Flare monitoring

Flares, that often have a flame that is not visible to the naked eye, need to be monitored to see if they are effectively burning the produced gasses. A thermal imaging camera can help do this.

Thermal inspection of a high voltage installation.

Substation monitoring

Utilities are looking for ways to address these issues in order to improve the reliability of electric power delivery while at the same time reducing costs. By using FLIR thermal imaging cameras and automation software, impending equipment failures and security breaches can be detected anytime, day or night, at a remote monitoring location.
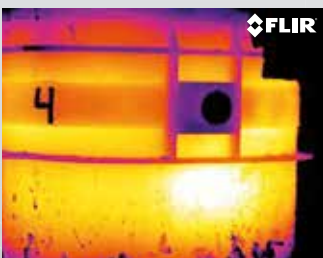
Hot spots on the ladle indicate possible failure.

Steel ladle monitoring

Steel mill ladles have limited lives. As their refractory linings wear or develop breaks due to shock, the outer part of a ladle can be exposed to excessive temperatures. If not caught in time, the result can be ladle disintegration and a molten metal breakout, threatening the lives of workers and destroying equipment.

Overloaded fuse.

### Continuous monitoring of electrical / mechanical installations

Some critical electrical and mechanical installations are monitored 24/7 with a thermal imaging camera. A fixed mounted thermal imaging camera gives you the advantage, so you don't need to rely on periodic inspections. Alarms can be set to go off once a temperature threshold is exceeded.

Fire prevention/detection

Fire can destruct entire premises and storage areas within an extremely short timeframe. The value of the destroyed goods during a fire can be tremendous, and the cost of a life that is lost during a fire is impossible to calculate. Statistics show high increase in asset loss due to fire. Thermal imaging can help prevent fires or detect them in an early stage.

Warehouse fire prevention

FLIR thermal imaging cameras provide an early warning response to hot spots that are detected. This is important for all types of warehouses. By detecting hot spots in an early stage, warehouse fires can be avoided.
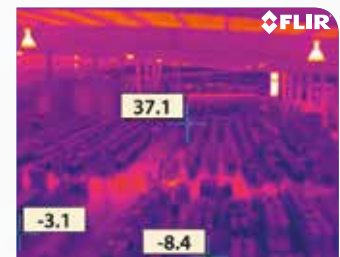
Continuous monitoring of a warehouse.

Combustible pile monitoring

Storage of some material brings along the risk of spontaneous fires. As always, prevention is better than cure. A thermal imaging camera from FLIR can help to ensure safety and detect spontaneous self-combustion. The system provides a cost-effective solution for continuous, remote monitoring of temperatures. Typical examples are coal piles, wood chips, ore milling?, fertilizers, etc.
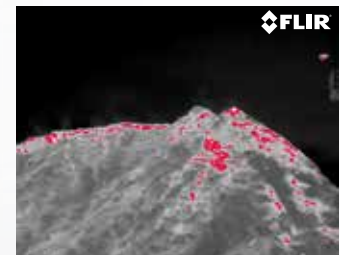
Hot spots in wood chip pile.

Waste bunker monitoring

Waste is potentially flammable when stored. Self-combustion, heat development due to pressure, spontaneous chemical reactions between the disposals and methane gas-building are potential fire creators. Thermal imaging cameras can help prevent fires.
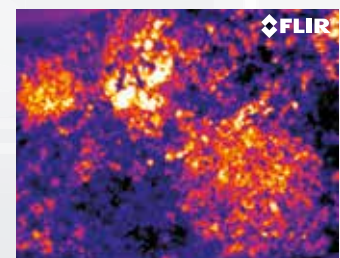
Fire detection in waste bunkers.

Hot spot detection

Electrical or mechanical installations tend to get hot before they fail. A small electrical problem can have severe consequences. Not only can production break down but sparks can fly, resulting in a dangerous fire. By monitoring electrical and mechanical installations 24/7, thermal imaging cameras can help avoid fires.
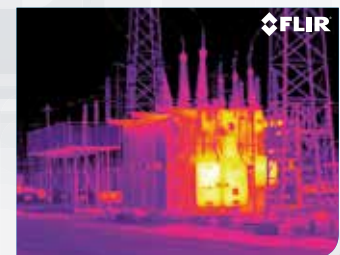
A transformer showing an excessive temperature.

CONTINUOUS OPTICAL GAS IMAGING (OGI)

Thermal imaging cameras can visualize and pinpoint gas leaks. With an optical gas imaging camera it is easy to continuously scan installations that are in remote areas or in zones that are difficult to access. Continuous monitoring means that you will immediately be informed when a dangerous or costly gas leak appears so that immediate action can be taken.

Monitoring a petrochemical installation 24/7 to increase safety.

Offshore and petrochemical industry

Many chemical compounds and gases are invisible to the naked eye, yet many companies work intensively with these substances before, during and after their production processes. A fixed mounted OGI can monitor critical areas 24/7. They can be carried out remotely, rapidly and – most important of all – problems can be identified at an early stage.

Captured gas leak from production site.

Pipeline inspection

Leak detection of gases can be performed in a non-contact mode, and from a safe distance. This reduces the risk of the inspector being exposed to invisible and potentially harmful or explosive chemicals. With an optical gas imaging camera it is easy to scan areas of interest that are difficult to reach with conventional methods. A typical application is the continuous inspection of remote pipelines.

Gas leak is clearly visible on the thermal image.

Greatly improved efficiency

Experience shows that up to 84 percent of leaks occur in less than one percent of the components in a refinery. This means that 99 percent of what are expensive, time-consuming inspection tools are being used to scan safe, leak-free components.

A leaking pressure gauge.

Protect the Environment

Several gases have a high global warming potential, and strict regulations govern how companies trace, document, rectify and report any leaks of harmful gaseous compounds, and how often these procedures are to be carried out.

SOFTWARE SOLUTIONS

In order to fully utilize the FLIR A-Series cameras and integrate them into working systems for safety and automation, the A-Series offer a set of software tools and utilities. Further information regarding downloads and updates is available at http://flir.custhelp.com/

General

IP Config (AX8, A3xx, A6xx, Ax5 only)

Utility program for network camera detection and IP address setting, the program comes with the Utility CD in the delivery box or can be downloaded from FLIR Custhelp.

FLIR Tools (A3xx, A6xx, Ax5 only)

The FLIR Axx-Series thermal imaging cameras work seamlessly together with FLIR Tools. It allows for viewing and analyzing thermal images and includes functions such as time versus temperature plots. Users who need more functionality and also want to be able to record images can optionally choose FLIR Tools+.

For Machine Vision (A315/A615/Ax5)

*   **FLIR GigE Vision compliant SDKs**
    For application development, a Pleora eBus SDK or FLIR GEV Demo sample can be downloaded from FLIR Custhelp.
*   **FLIR Camera Player**
    Utility program for first camera connection and streamed image viewing, the program comes with the Utility CD in the delivery box or can be downloaded from FLIR Custhelp.
*   **GigE Vision and GenICam compliance**
    Machine Vision camera standard supported in many third-party image processing software.
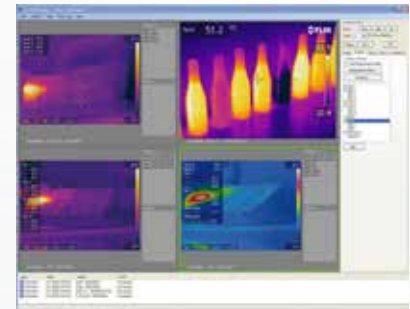
For Industrial Safety (AX8/A310/A310 pt/A310 f)

*   **FLIR IR Monitor (A310, A310f without Nexus)**
    Utility program for first camera connection and control and setup of internal features/functions, supports up to 9 cameras simultaneously, the program comes with the Utility CD in the delivery box or can be downloaded from FLIR Custhelp.
*   **Built-in Web server (AX8, A310)**
    Simple built-in camera control and image viewer, connect using http://"camera ip adress" in a Web browser or connect through the IP Config program. AX8 WEB interface is a complete setup and control interface for the camera.
*   **Ethernet/IP or Modbus TCP (AX8, A310)**
    Industrial Field bus protocols, allows Analyze, Alarm and Camera control to be shared with PLC's. This function is always turned on in the A310 Camera.
*   **ThermoVision SDK (A310)**
    An ActiveX component that allows camera control and image grabbing and transformation, purchased separately.
*   **FLIR Sensors Manager (A310pt, A310f with Nexus)**
    Manage and control A310 f and A310 pt cameras in a TCP/IP network.

ACCESSORY SOLUTIONS

In today's fast-changing environment, requirements for purchased capital equipment can change from year to year or from project to project. Things that are vital today can be redundant tomorrow. That makes it important for the equipment in which you invest to be flexible enough to meet the ever-changing needs of your applications.

No other infrared camera manufacturer offers a wider variety of accessories than FLIR Systems.

Optics – From microscope optics that resolve down to 3 μm to 1 meter telescopes, FLIR has the right optic for your application needs.

Mounts & Stands – FLIR offers multiple options for mounting camera systems including tripods and microscope stands.

Cables and Connectors – Fiber optic converters, fiber cable, extended cablelengths, and camera link PC cards are just a few of the options available from FLIR to help you meet any application requirement.

AFTER SALES SERVICE

At FLIR, building a relationship with a customer takes more than just selling a thermal imaging camera. After the camera has been delivered, FLIR is there to help meet your needs.

Because FLIR designs and manufactures their cameras from the sensor up, they can quickly troubleshoot and effectively service all aspects of FLIR camera systems. FLIR Systems offers different types of service contracts. A service contract offers you the advantage that you will never have unforeseen expenses if something should happen to your thermal imaging camera after the warranty period. Some service contracts even guarantee that you will have a replacement camera at your service if necessary.

Infrared Camera Calibration

A FULL PRODUCT RANGE FOR THE MOST DEMANDING R&D APPLICATIONS

FLIR Systems is active in all markets where the power of thermal imaging is being used for the most diverse applications. Whether it is for non-contact temperature measurement applications such as condition monitoring, automation of firefighting or for night vision applications such as security and

maritime, FLIR Systems markets a full range of cameras that is totally dedicated to the needs of the user.

The same goes for Machine Vision. Whether you are monitoring a production process, doing continuous condition monitoring in a substation, involved in fire prevention or monitoring installations for gas leaks,

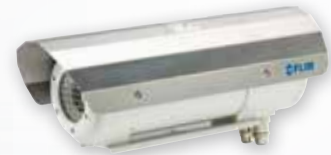FLIR Systems has the correct thermal imaging camera for your application.

Technical specifications of our products can be consulted on our website or ask for a product leaflet.

FLIR AX8

FLIR A65 / A35 / A15 / A5

FLIR A310 ex

FLIR A310 f

FLIR A310 pt

FLIR A6604

FLIR A310

FLIR G300 a

FLIR A615

PORTLAND
Corporate Headquarters
FLIR Systems, Inc.
27700 SW Parkway Ave.
Wilsonville, OR 97070
USA
PH: +1 866.477.3687

NASHUA
FLIR Systems, Inc.
9 Townsend West
Nashua, NH 06063
USA
PH: +1 603.324.7611

FLIR Commercial Systems AB
Luxemburgstraat 2
2321 Meer
Belgium
Tel. : +32 (0) 3665 5100
Fax: +32 (0) 3303 5624
e-mail: flir@flir.com

FLIR Systems AB
Antennvägen 6,
PO Box 7376
SE-187 66 Täby
Sweden
Tel.: +46 (0)8 753 25 00
Fax: +46 (0)8 753 23 64
e-mail: flir@flir.com

FLIR Systems UK
2 Kings Hill Avenue - Kings Hill
West Malling
Kent
ME19 4AQ
United Kingdom
Tel.: +44 (0)1732 220 011
Fax: +44 (0)1732 843 707
e-mail: flir@flir.com

FLIR Systems GmbH
Berner Strasse 81
D-60437 Frankfurt am Main
Germany
Tel.: +49 (0)69 95 00 900
Fax: +49 (0)69 95 00 9040
e-mail: flir@flir.com

FLIR Systems France
20, bd de Beaubourg
77183 Croissy-Beaubourg
France
Tel.: +33 (0)1 60 37 01 00
Fax: +33 (0)1 64 11 37 55
e-mail : flir@flir.com

FLIR Systems Italy
Via Luciano Manara, 2
I-20812 Limbiate (MB)
Italy
Tel.: +39 (0)2 99 45 10 01
Fax: +39 (0)2 99 69 24 08
e-mail: flir@flir.com

www.flir.com
NASDAQ: FLIR

FLIR Commercial Systems
Avenida de Bruselas, 15- 3°
28108 Alcobendas (Madrid)
Spain
Tel. : +34 91 573 48 27
Fax.: +34 91 662 97 48
e-mail: flir@flir.com

FLIR Systems, Middle East FZE
Dubai Airport Free Zone
P.O. Box 54262
Office C-13, Street WB-21
Dubai - United Arab Emirates
Tel.: +971 4 299 6898
Fax: +971 4 299 6895
e-mail: flir@flir.com

FLIR Systems Russia
6 bld.1, 1st Kozjevnichesky lane
115114 Moscow
Russia
Tel.: + 7 495 669 70 72
Fax: + 7 495 669 70 72
e-mail: flir@flir.com

Asia Pacific Headquarter
HONG KONG
FLIR Systems Co. Ltd.
Room 1613 – 16, Tower 2,
Grand Central Plaza,
No. 138 Shatin Rural Committee
Road, Shatin, New Territories,
Hong Kong
Tel.: +852 2792 8955
Fax: +852 2792 8952
E-mail : flir@flir.com.hk

FLIR Systems (Shanghai) Co. Ltd.
Head Office
Tel.: +86 21 5169 7628
Fax: +86 21 5466 0289
E-mail : info@flir.cn

Beijing Representative Office
Tel.: +86 10 5979 7755
Fax: +86 10 5907 3180
E-mail : info@flir.cn

Guangzhou Representative Office
Tel.: +86 20 8600 0559
Fax: +86 20 8550 0405
E-mail : info@flir.cn

FLIR Systems Japan K.K.
Tel.: +81 3 6277 5681
Fax: +81 3 6277 5682
E-mail : info@flir.jp

FLIR Systems Korea Co., Ltd
Tel.: +82 2 565 2714
Fax: +82 2 565 2718
E-mail : flir@flirkorea.com

FLIR Systems Taiwan
Representative Office
Tel.: +886 2 2757 9662
Fax: +886 2 2757 6723
E-mail : flir@flir.com.hk

FLIR Systems India PVT. Ltd.
Tel.: +91 11 4560 3555
Fax: +91 11 4721 2006
E-mail : flirindia@flir.com.hk

FLIR Systems Australia Pty Ltd.
Head Office (Vic)
Tel.: 1300 729 987
NZ : 0800 785 492
Fax: +61 3 9558 9853
E-mail : info@flir.com.au

NSW Office
Tel.: +61 2 8853 7870
Fax: +61 2 8853 7877
E-mail : info@flir.com.au

WA Office
Tel.: +61 8 6263 4438
Fax: +61 8 9226 4409
E-mail : info@flir.com

FLIR Systems Brazil
Av. Antonio Bardella, 320
CEP: 18085 – 852 Sorocaba
São Paulo
Tel.: +55 15 3238 8070
E-mail : info@flir.com

FLIR Systems Ltd.
920 Sheldon Ct
Burlington, Ontario
L7L 5K6 Canada
Tel.: +1 800 613 0507
E-mail : info@flir.com

ALAVA INGENIEROS

El color del color
Descubra www.termografia.es

Edificio Antalia
Albasanz, 16
28037 MADRID
Tel. 91 567 97 00
Fax: 91 570 26 61

www.alavaingenieros.com

Torre Mapfre-Vila Olímpica
Marina, 16 - Planta 11-C2
08005 BARCELONA
Tel. 93 459 42 50
Fax: 93 459 42 62

alava@alava-ing.es

www.flir.com

FLIR® | The World's Sixth Sense™