Thermal imaging for automation / process control

Discover a wide variety of applications

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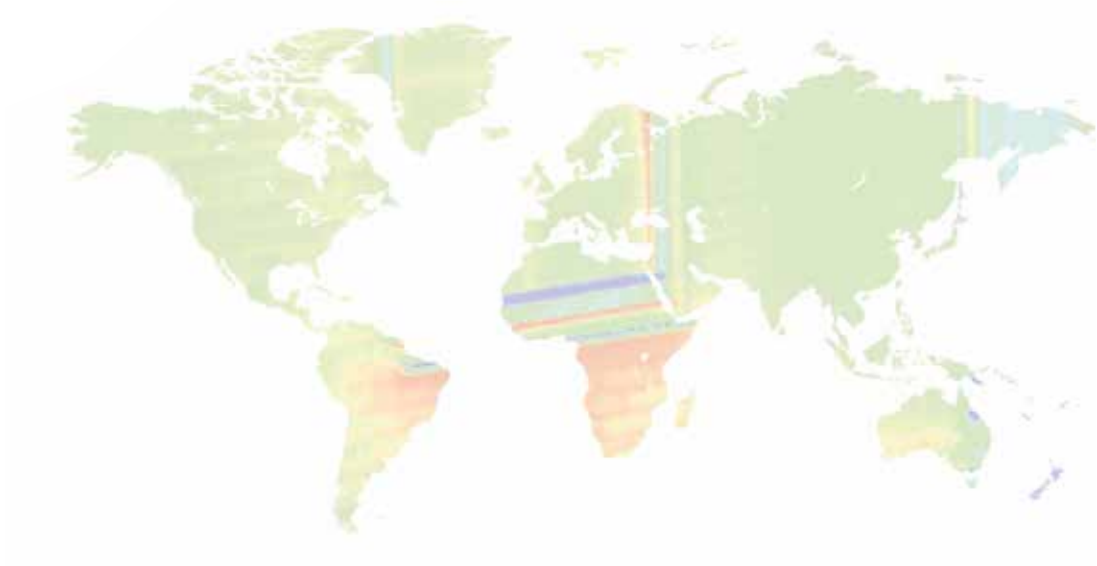
1 Introduction



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

Rapidly emerging markets and organization
Interest for thermal imaging has grown considerably over the last few years in a large variety of markets. To face this increased demand, FLIR Systems has expanded its organization drastically. Today we employ more than 4,000 people. Together, these infrared specialists realize a consolidated annual turnover of more than 1 billion US dollars. This makes FLIR Systems the largest manufacturer of commercial thermal imaging cameras in the world.

Manufacturing capabilities

FLIR currently operates 6 manufacturing plants: three in the USA (Portland, Boston and Santa Barbara, California) one in Stockholm, Sweden, one in Estonia and one near Paris, France.

FLIR, Sweden

FLIR ATS, France

FLIR, Boston, USA

FLIR Santa Barbara, USA

All markets and all applications

FLIR Systems is totally focused on thermal imaging cameras. No other manufacturer produces more thermal imaging cameras than FLIR Systems.

FLIR Systems is active in all markets where thermal imaging cameras are being used: electrical / mechanical, building, automation / process control, maritime and security are just a few markets in which FLIR Systems thermal imaging cameras have proven their worth.

2 The thermal imaging camera and how it works

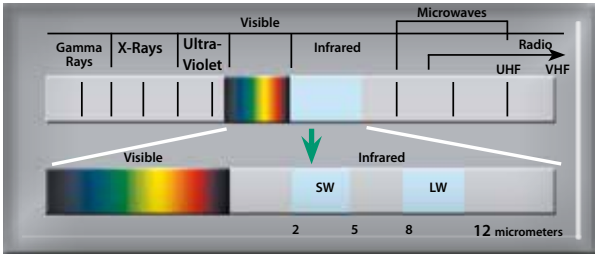
A thermal imaging camera records the intensity of radiation in the infrared part of the electromagnetic spectrum and converts it to a visible image.

What is infrared?
Our eyes are detectors that are designed to detect electromagnetic radiation in the visible light spectrum. All other forms of electromagnetic radiation, such as infrared, are invisible to the human eye.

The existence of infrared was discovered in 1800 by astronomer Sir Frederick William Herschel. Curious to the thermal difference between different light colors, he directed sunlight through a glass prism to create a spectrum and then measured the temperature of each color. He found that the temperatures of the colors increased from the violet to the red part of the spectrum.

After noticing this pattern Herschel decided to measure the temperature just beyond the red portion of the spectrum in a region where no sunlight was visible. To his surprise, he found that this region had the highest temperature of all.

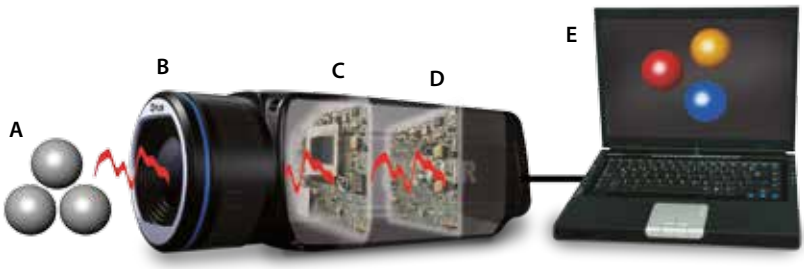
Infrared radiation lies between the visible and microwave portions of the electromagnetic spectrum. The primary source of infrared radiation is heat or thermal radiation. Any object that has a temperature above absolute zero (-273.15 degrees Celsius or 0 Kelvin) emits radiation in the infrared region. Even objects that we think of as being very cold, such as ice cubes, emit infrared radiation.



We experience infrared radiation every day. The heat that we feel from sunlight, a fire or a radiator is all infrared. Although our eyes cannot see it, the nerves in our skin can feel it as heat. The warmer the object, the more infrared radiation it emits.

The thermal imaging camera

Infrared energy (A) coming from an object is focused by the optics (B) onto an infrared detector (C). The detector sends the information to sensor electronics (D) for image processing. The electronics translate the data coming from the detector into an image (E) that can be viewed on a standard video monitor or LCD screen.



Infrared thermography is the art of transforming an infrared image into a radiometric one, which allows temperature values to be read from the image. So every pixel in the radiometric image is in fact a temperature measurement. In order to do this, complex algorithms are incorporated into the thermal imaging camera. This makes the thermal imaging camera. This makes the thermal imaging camera a perfect tool for automation / process control applications.

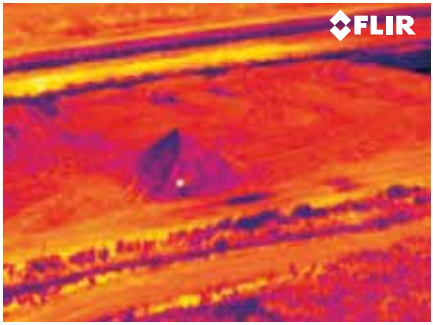
3 Why use thermal imaging?

Production engineers and technicians are faced by the demand for higher production output at a constant quality and at lower cost. The FLIR thermal imaging cameras are the most effective tool available for infrared machine vision, closed loop process control and quality assurance imaging, helping you to validate and increase product quality and throughput and thereby give your products a competitive edge and increased profitability.

FLIR thermal imaging cameras:

- See the heat produced
- Can trigger alarms
- Are non-contact, quick and easy to use
- Perform inspections when systems are in production
- Identify and locate the problem
- Measure the temperature
- Store the information
- Save you valuable time and money

Inspection of car windscreen defrosting.



Coal pile monitoring.

FLIR Systems offers a wide range of thermal imaging cameras. Whatever your automation / process control application, FLIR will have just the right thermal imaging camera for you.

4 Our customers testify

FLIR Systems has many customers that are active in a wide variety of markets. FLIR Systems thermal imaging cameras are being used by a wide variety of people.

All of them have discovered the benefits that thermal imaging has to offer. They know that thermal imaging cameras are helping them to save time and money on a daily basis.

Many have chosen for a FLIR Systems thermal imaging cameras. They have acknowledged that FLIR Systems produces the most advanced, the most ergonomic and the most user friendly systems.

On the following pages you will find a couple of short testimonies of users of FLIR thermal imaging cameras. It are these users that are the best promotion for thermal imaging technology and for FLIR Systems.

Do not take it from us. Read what the users of FLIR thermal imaging cameras have to say.

Thermal alarm system ensures children's safety at Istanbul Sabiha Gökçen Airport

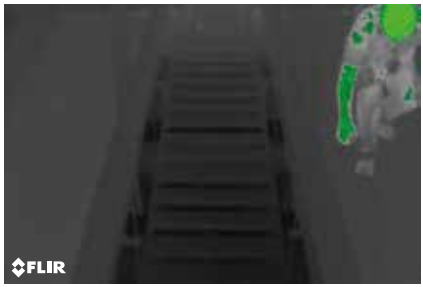
Check in areas at airports might not seem like a dangerous place, but they are more dangerous than one might think. Each year there are several accidents worldwide where children escape the attention of their parents and sneak through the rubber flaps into the baggage belt conveyor system.

"We have performed a lot of tests and this system works really well.", explains Kaan Türkmen. "Several of our employees have climbed into the system and as it turns out the conveyor belt stops running every time we try it."

If a Region Of Interest (ROI) reaches the threshold temperature, the alarm goes off.

Suitcases do not trigger the alarm, even if the treshold temperature is reached. The percentage of the ROI that reaches that temperature is too small.

This screenshot from the FLIR software shows footage from the four FLIR thermal imaging cameras that cover all eight conveyor belts.



If a person enters the conveyor belt area the automatic temperature alarm will stop the conveyor belt system.

Thermal imaging cameras prevent fires at Korean coal power plant

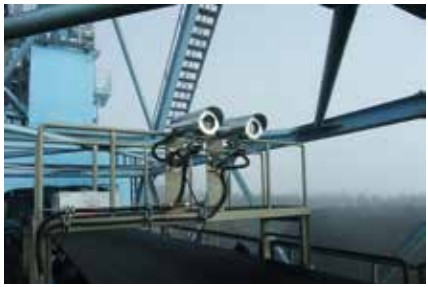
To avoid the risk of spontaneous combustion in the coal conveyor system at the Dangjin Coal Fired Power Complex (DCFPC) in South Korea the owner of the plant, the Korea East-West Power Company (EWP), has installed a Hotspot detection system based on thermal imaging cameras.

"When the bituminous coal ignites the fire would not only be dangerous for the plant's personnel and likely destroy part of the conveyor system, it would also cause power generation to come to a complete stop. This scenario is not acceptable.", says Kim Young Min manager at DCFPC. "That is why we installed a number of FLIR thermal imaging cameras."

The footage and thermal data from the seven FLIR thermal imaging cameras is sent to the PLC and to the control room.

The PLC immediately stops the conveyor belt and activates the sprinkler system when the temperature alarm is triggered.

The thermal imaging early fire warning system is very effective in preventing coal fires.



FLIR thermal imaging cameras, mounted in protective housings, above the coal transport belts.

Thermal imaging warning system helps ensure the safety at Transpole

Natural gas storage can be dangerous, for if a fire breaks out there is a very small but definite risk it might cause a devastating gas explosion. An early warning system using thermal imaging cameras from FLIR Systems provides the solution.

"Thermal imaging cameras might be slightly more expensive than CCTV cameras and smoke detectors at the initial purchase, but as they require no light whatsoever to function the maintenance costs and energy bills are kept low. This solution is also the only system that can help you to actually prevent the fire, making it the best fire warning system on the market today.", explains P. Bourrier, director of ALOATEC

The live thermal video produced by the FLIR thermal imaging is shown on two touch screens, one at the depot's entrance and another in the main office.

The touch screen interface shows the floor plan and live thermal video footage of all thermal imaging cameras..

FLIR thermal imaging cameras continuously monitor the entire premises.

Thermal imaging increases productivity and improves safety in the plywood industry

When manufacturing plywood and veneer, it is critical that logs be softened before they are transported into plants for peeling and further processing. If not sufficiently softened, logs can split in the peeling process, resulting in lost productivity and waste.

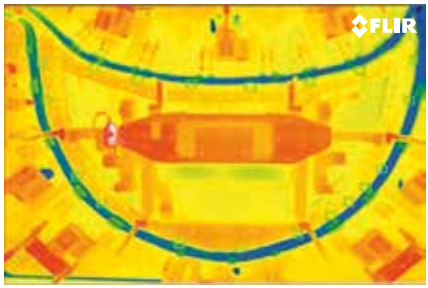
Thermal imaging cameras detect heat energy and, as such, see through fog, steam, smoke and other obscurants. By using thermal imaging cameras, several major North American plywood manufacturers have implemented systems that allow crane and out feed cab operators to see through steam and maintain optimal productivity.

Visual and thermal image of the assembly line; the thermal imaging camera helps the operator see through the steam to safely complete his tasks.

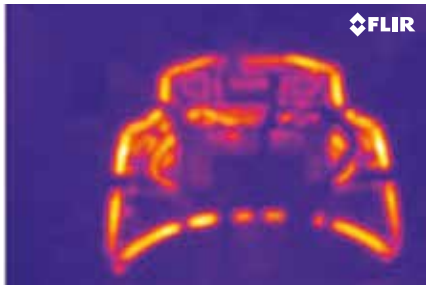
Visual and thermal image; the steam obscures the view of the log, while the log vats are clearley visible in the thermal image.

FLIR thermal imaging cameras help to ensure consistent quality of FIAT cars

Modern car panels are made of a combination of a metal layer on top and a structural adhesive layer underneath glued together. The temperature has to be exactly right for the adhesion to work properly. FIAT has started to use FLIR thermal imaging cameras to provide automatic feedback during the process.



Each green square in this thermal image stands for one of the measurement spots, 19 in this case. The user can define as many measurement spots as needed.



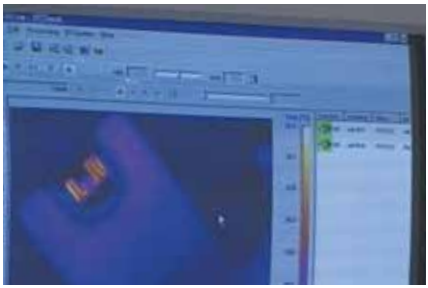
This thermal image shows induction heating at work. The metal parts heat up from room temperature to 180 °C in matter of seconds.

Roberto Ricca, Director of Sales at Inprotec is very happy with the quality of the FLIR thermal imaging camera. "It provides exactly the detailed thermal data needed for this type of application."

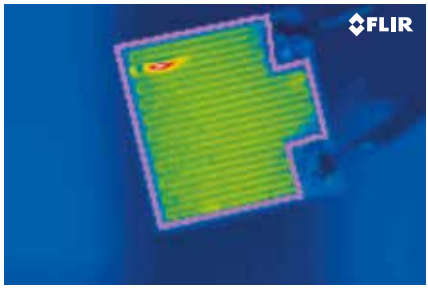
The technicians at Inprotec inserted the thermal imaging camera in a hard protective exterior.

100% quality control of resistors with FLIR thermal imaging camera

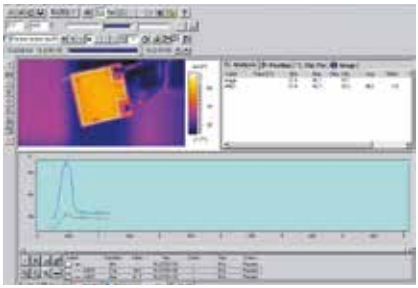
Cutting down failure rates of electronic components is essential for companies that want to supply a perfect product to their customers. The only way to ensure this is by checking each individual component to provide 100% quality control.



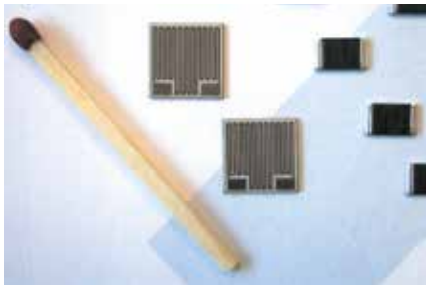
Fully automated quality control thanks to the FLIR Systems thermal imaging camera.



A flawed resistor controlled with a thermal imaging camera



The FLIR Systems thermal imaging camera detects even the smallest defect in a resistor.



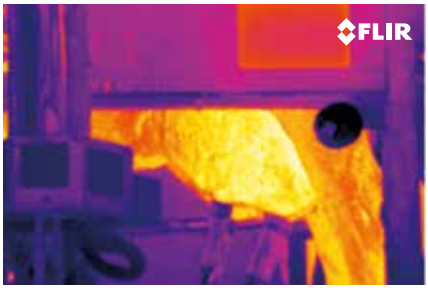
100% perfect resistors produced by Isabellenhütte-Heusler.

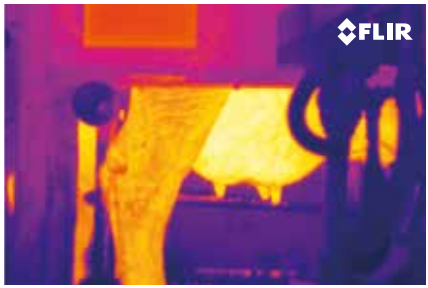
"Thermal imaging proved to be the perfect way to ensure that our quality standards are even higher than before.", says Mr. Eichman, Production Manager at Isabellenhütte.

Automatic health check in dairy farms using FLIR thermal imaging cameras

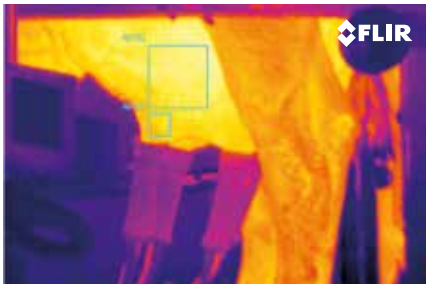
A big problem in present day dairy farming is a disease called Mastitis. It is a persistent inflammation in the cow's udders. This potentially fatal mammary gland infection is the most common disease in dairy cattle. Thermal imaging can help to detect the disease in an early stage.

"I was shocked to find that the average dairy farmer is currently losing 20,000 to 60,000 Euros each year due to Mastitis. That is a large sum of money. We therefore set out to find a solution for this problem: an automatic early detection system based on thermal imaging technology."

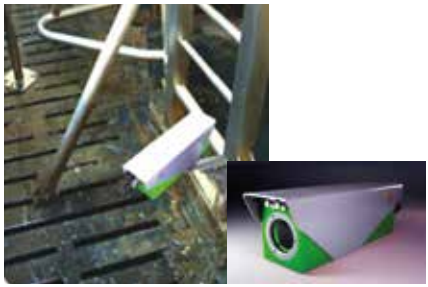




The two FLIR thermal imaging cameras record images of the cow's udder from both sides.



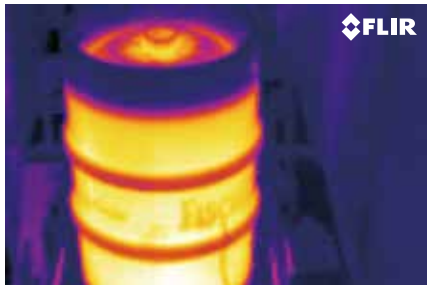
Automatic analysis software uses algorithms to detect developing Mastitis in thermal images of cow udders.



To protect the FLIR A310 against the adverse conditions in a dairy farm the cameras are mounted in a waterproof housing with automatic window cleaning system.

Thanks to thermal imaging "Erdinger Weissbräu" kegs contain beer!

Erdinger is known for its strict quality policy. Its production processes, from selection and acceptance of raw materials to filling and maturing, are strictly monitored. Thermal imaging plays a crucial role.



As a keg containing lye has a higher temperature than a keg filled with beer. With a thermal imaging camera it was easy to identify wrongly filled kegs by measuring their temperature.

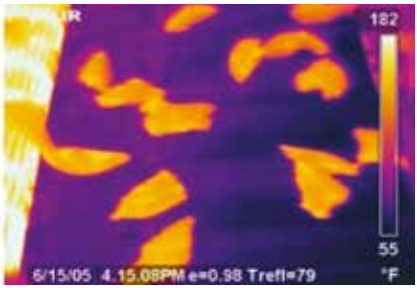
The thermal imaging camera (top left in the image), checks each passing keg.

Thermal image of a keg filled with beer.

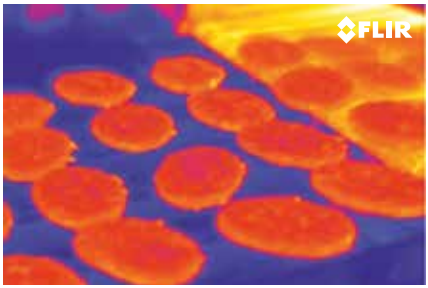
A FLIR Systems thermal imaging camera now measures the temperature of every keg before it leaves the conveyor belt of the filling installation. If the thermal imaging camera identifies a keg with a different temperature, it sets off an alarm and the conveyor belt is automatically halted. The keg is then manually removed.

Thermal imaging cameras in the food industry

In the food industry, it's essential to carefully control the temperature 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.



An IR temperature measurement and thermal image are used to locate undercooked chicken tenders and stop the line so undercooked ones can be removed.



Thermal image for checking hamburger doneness by measuring temperature

Thermal image shows bottles being filled automatically. Bottles that are over-or under-filled can be removed.

Thermal imaging is first and foremost a quality assurance (QA) tool. Controlling the quality and safety of cooked meat products is an excellent use of this technology. A permanently mounted thermal imaging camera can record the temperature of, for example, chicken tenders as they exit a continuous conveyor oven.

FLIR thermal imaging camera ensure that the cars produced at Ford Genk work perfectly.

Three FLIR thermal imaging cameras installed at Ford Genk in Belgium test the temperatures of front window heating elements, rear window heating elements and the air conditioning vent outlet

"Before these automatic systems were installed at Ford Genk the cars were checked by hand. Automatic testing systems are much quicker and more reliable. FLIR thermal imaging cameras are the perfect tool for such tests, for they are accurate, reliable and maintenance free.", explains Arthur Knuysen, head of the quality control department at Ford Genk.

This FLIR thermal imaging camera is used to check the air conditioning system.

The programmable logic controller (PLC) compares the measurement data with previously defined parameters.

Ford Genk has three FLIR thermal imaging cameras for testing the front window heating system, the rear window heating system and the air conditioning system. The locations of the thermal imaging cameras are marked in red.

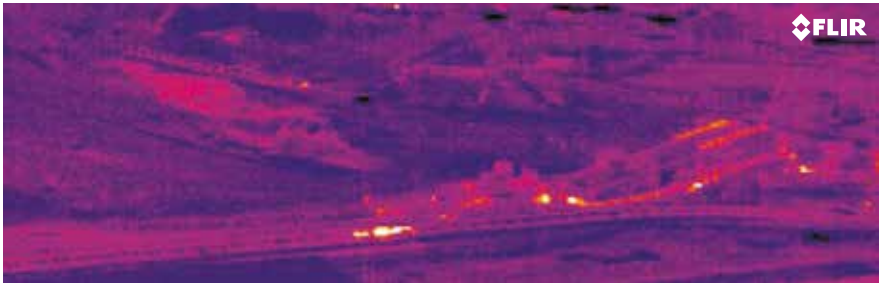
Thermal imaging camera keeps fire risk under control in coal pile storage site

Coal storage in large coal piles brings with it the risk of spontaneous fires. As always, prevention is better than cure. A thermal imaging camera from FLIR Systems helps to ensure safety at the Nástup Mines Cooperation in Tusimice, Czech Republic.

FLIR Systems thermal imaging cameras were selected because of the company's extensive experience in a wide range of continuous thermal monitoring applications.

The FLIR Systems thermal imaging camera mounted on a mast overthe Nástup Mines Cooperation.

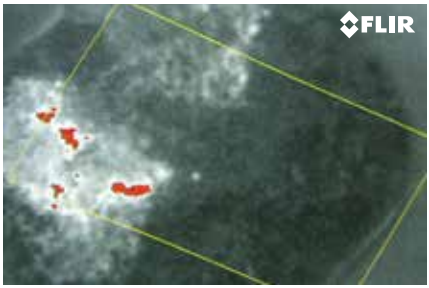
The overlay of a coal pile with a hot spot as possible combustion point.



This thermal image taken by a FLIR thermal imaging camera mounted on top of a mast shows two coal piles separated by a loading zone.

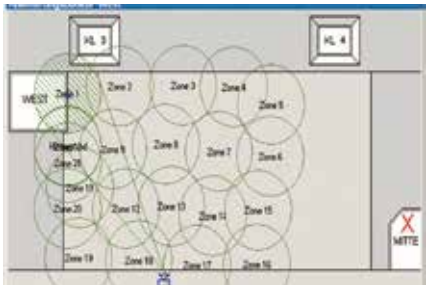
Thermal imaging cameras for fire prevention and detection in solid waste bunkers

Waste is potentially flammable when stored: self-combustion, heat development due to pressure, spontaneous chemical reactions between the disposals, methane gas-building, are potential fire creators. Thermal imaging cameras can help to prevent fires.



The thermal image shows hot-spots in the waste. This means a danger for spontaneous self-combustion.

FLIR Systems thermal imaging cameras are the preferred cameras for fire prevention and fire detection in solid waste bunkers

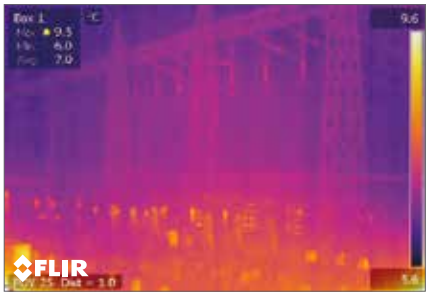


The waste bunker surface is divided in zones. The FLIR thermal imaging camera checks every zone.

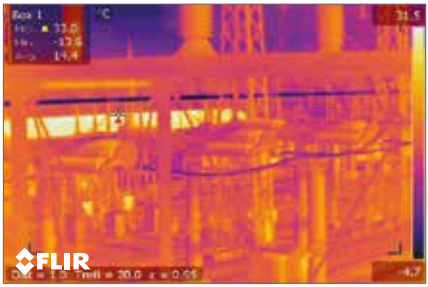
The control room of a waste bunker. If the thermal imaging camera detects a hot spot an alarm will go off.

Thermal imaging cameras monitor electrical substations

With hospitals and other emergency services depending on electricity an extended power failure might cost lives. That is why the Norwegian government and energy companies are monitoring electrical substations with thermal imaging cameras.



Four thermal imaging cameras monitor critical components within the substation. If any point within the camera's field of view reaches a temperature that is higher than the previously determined threshold temperature an alarm will go off.

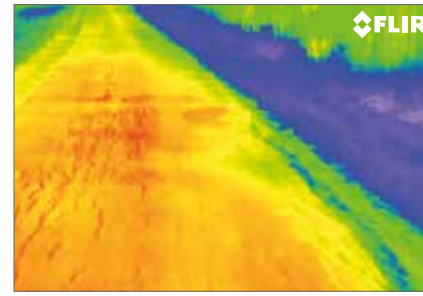


The temperature alarm system allows the control room operators to alert the Lyse Energy maintenance crew to problems before they turn into costly breakdowns.

"The four FLIR thermal imaging cameras that are incorporated in the alarm system continually monitor the critical parts of the substation.", explains Noralarm Sales Manager Mikke Ståhl. "If any part of the monitored equipment rises above the threshold temperature an alarm will go off."

FLIR Thermal imaging cameras determine road conditions in Finland

The roads in Finland comprise 78,141 kilometers of highways, paved roads and gravel roads. Monitoring and maintaining these roads can be challenging in a country where in the winter temperatures can drop to -40 °C and days become so short that the sun does not clear the horizon at all in some areas.



Thermal images taken in late spring are extremely valuable for road repair teams, because they show the location of the thawing ice in the underlying road structure.

Good quality pavement (figure on left) provides a very homogenous thermal image while the thermal image to the right shows signs of cracks and water ingress in the asphalt.

This special setup to check bridges includes a FLIR thermal imaging camera with a 90° wide angle lens.

"With a thermal imaging camera from FLIR you can find water ingress in the road surface that is invisible to the human eye.", explains Saarenketo co-founder and Managing Director of Roadscanners.

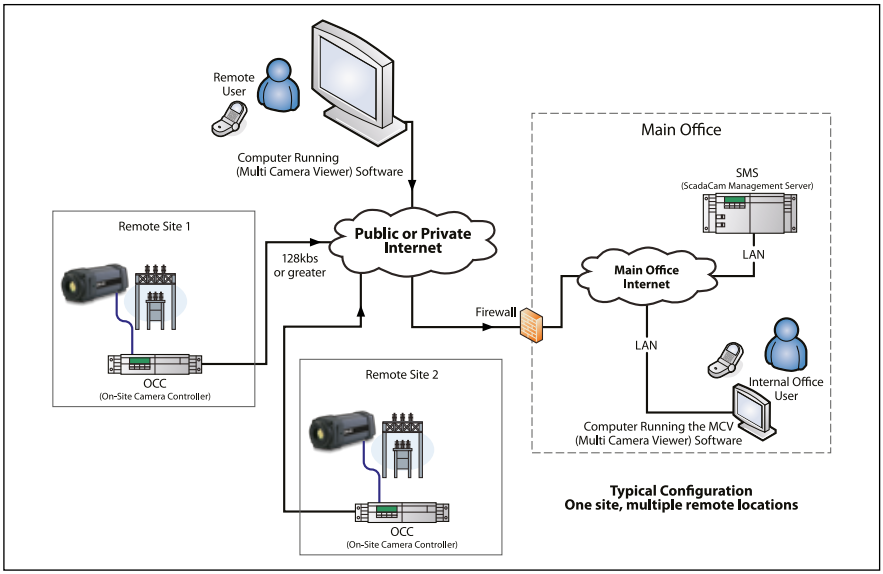
Thermal imaging cameras for substation monitoring

By using FLIR thermal imaging cameras and automation software, impending equipment failures and security breaches in electrical substations can be detected anytime, day or night, at a remote monitoring location. The net effect is increased reliability and reduced cost.

High voltage electrical installations tend to heat up before they fail. By monitoring HV-equipment continuously with thermal imaging cameras costly breakdowns can be avoided.

One large utility discovered a hot bushing rod in a substation transformer and repaired it at a cost of only €12,000. A similar problem that occurred before the firm instituted its thermal imaging program resulted in a catastrophic failure that cost more than €2,250,000.

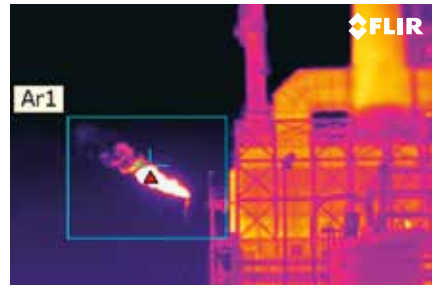
Schematic overview of substation monitoring system



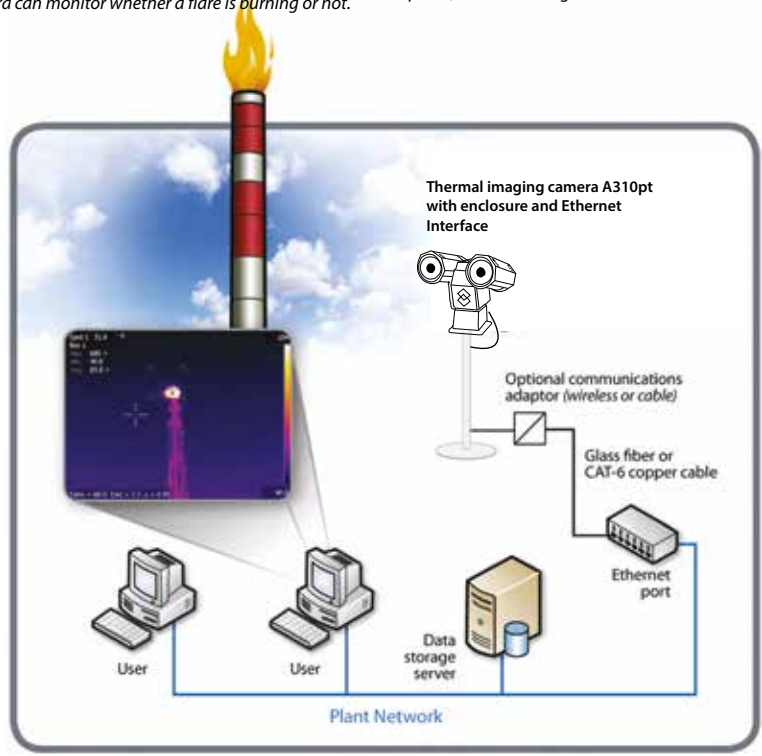
Thermal imaging cameras for flare monitoring

Flare stacks are used in many industries to burn off unwanted waste gas byproducts. Thermal imaging cameras are an ideal monitoring tool, since they allow automated remote monitoring on a 24/7 basis in virtually any weather.

Although invisible to the naked eye a thermal imaging camera can monitor whether a flare is burning or not.

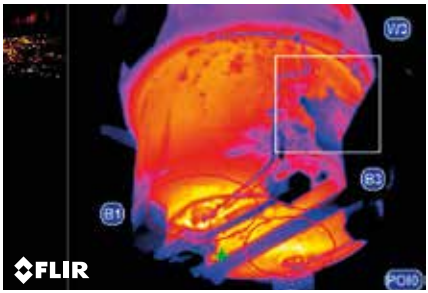


If the flare is not burning gases can enter the atmosphere, an alarm can go off and action can be taken.

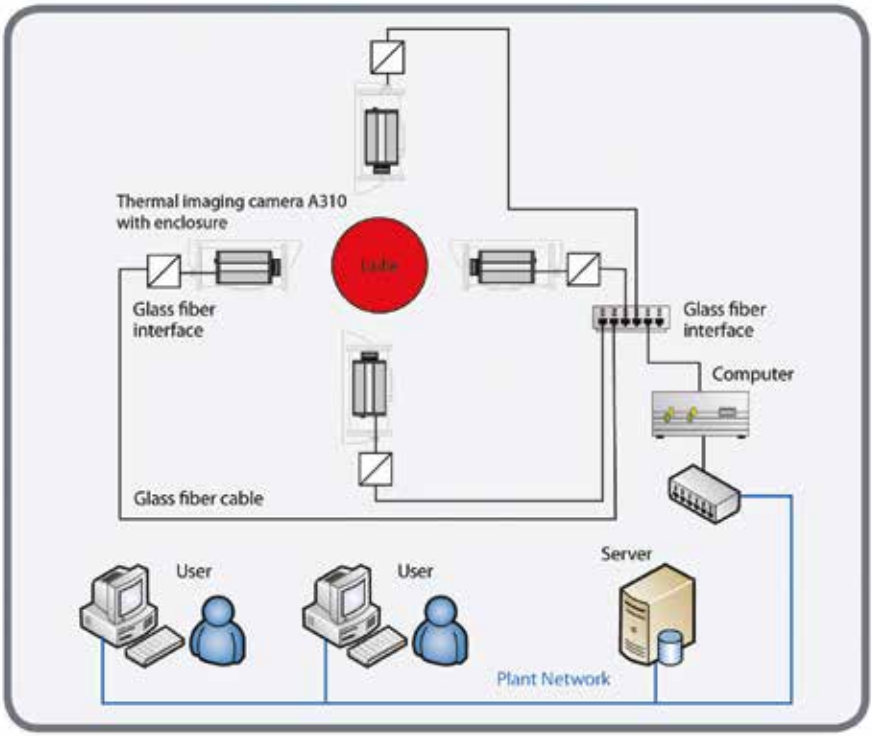


Mill ladle refractory monitoring

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.

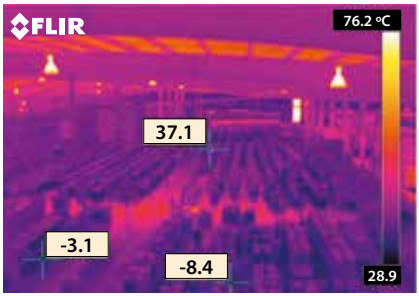


Thermal imaging cameras can detect hot spots on the ladle that warn of a failure far sooner than a visual inspection. This allows the ladle to be taken out of service before accidents occur.

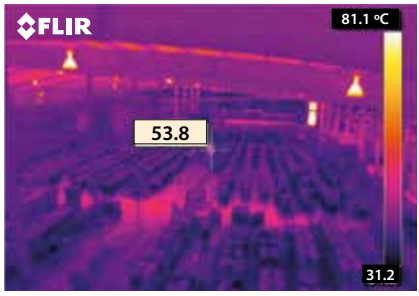


Thermal imaging cameras for warehouse asset protection

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.

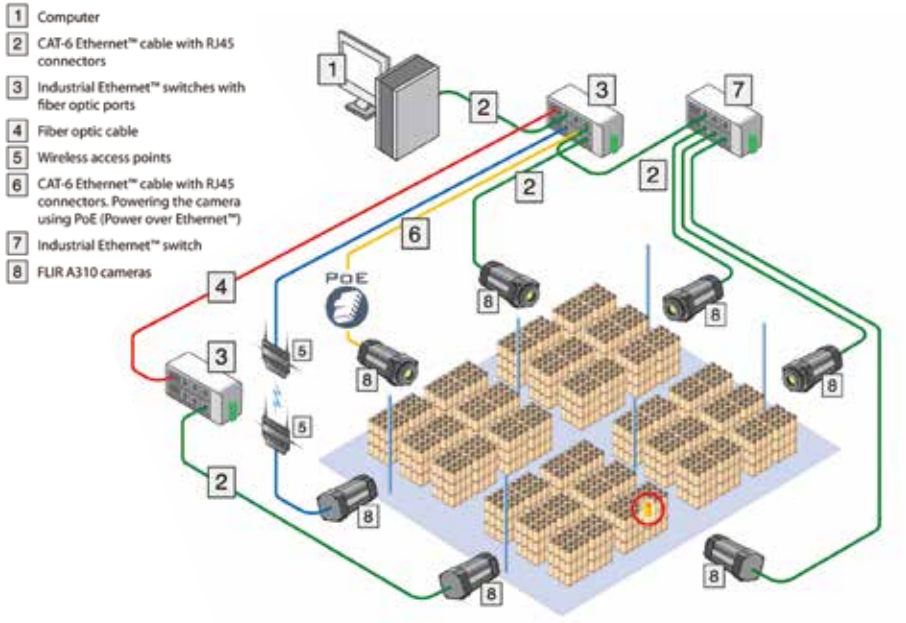


A hazardous waste storage area showing two safe spot temperature readings (-3.1°C and -8.4°C), plus one reading 37.1°C that is abnormally high.



A subsequent image of the same area shows that the abnormal reading has increased, causing an alarm to go off.

Schematic overview



5 Thermal imaging: a wide variety of applications

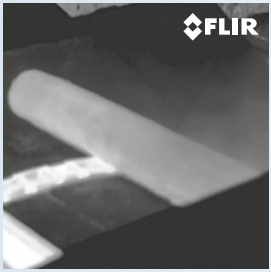
As more and more people are discovering the benefits that thermal imaging cameras have to offer, volumes have gone up and prices are coming down. This means that thermal imaging cameras are finding their way to more and more markets. FLIR Systems has the correct camera for every application.

Electrical / Mechanical

In industrial environments thermal imaging is used to find hot-spots that can lead to failures in electrical and mechanical installations. By detecting anomalies at an early stage production breakdowns can be avoided and money can be saved.

Security

Our security customers benefit from thermal imaging cameras because they help them to secure facilities like ports, airports, nuclear facilities, warehouses, estates and many more against intruders.

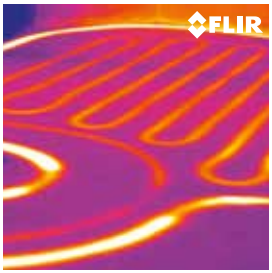


Cores & components

FLIR Systems also markets a wide variety of thermal imaging cores that other manufacturers integrate in their own products.

Building diagnostics

Building professionals look for insulation losses and other building related defects with a thermal imaging camera. Finding insulation losses and repairing them can mean huge energy savings.

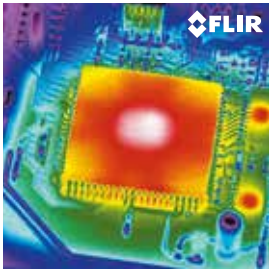


Border security

Border security specialists protect their country's border against smugglers and other intruders. With a thermal imaging camera they are able to see a man at a distance of 20 kilometers away in total darkness.

Science / R&D

Thermal imaging also plays a pivotal role in both applied and fundamental R&D. It can speed up the design cycle so that products can go to market faster. For these demanding applications FLIR Systems markets extremely high performance thermal imaging cameras.



Maritime

On both yachts and commercial vessels, FLIR thermal imaging cameras are being used for night time navigation, shipboard security, man-overboard situations and anti-piracy.

Transportation

FLIR thermal imaging cameras are installed in cars for driver vision enhancement. They help the driver to see up to 4 times further than headlights. They are also installed in specialty vehicles such as fire-trucks, mining and military vehicles.

Automation / process control

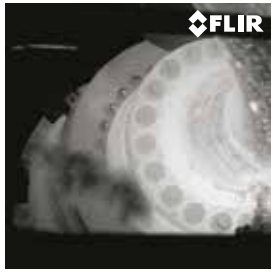
Thermal imaging cameras are also installed to continuously monitor production processes and to avoid fires.

Law enforcement

Police officers use the power of thermal imaging to see without being seen. They can easily find suspects in total darkness without giving away their position.

Optical gas imaging

Gas leaks can also be detected seamlessly with a thermal imaging camera.



Personal vision systems

Outdoor enthusiasts can see clearly at night with the help of a thermal imaging camera.

Firefighting

Firefighters are able to see through smoke. It helps them to find victims in a smoke filled room and also to see if fires are well extinguished. It helps them to save lives.

Extech

Under the Extech brand, FLIR systems is marketing a full line of test and measurement equipment.

6 Selecting the correct thermal imaging camera manufacturer

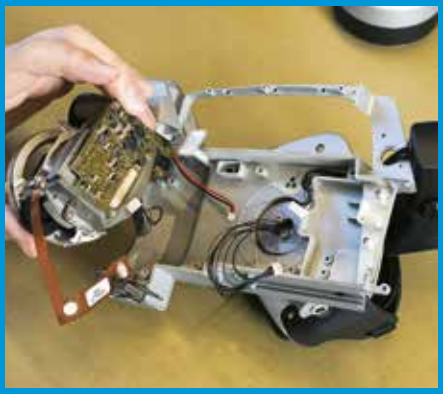
Since thermal imaging cameras have become increasingly popular over the last few years more and more manufacturers are starting to produce thermal imaging cameras.

Regardless of your application, there are some considerations to take when investing in a thermal imaging camera.

The correct camera for the correct application
Choose a thermal imaging camera manufacturer that offers you a choice. Different applications require different types of thermal imaging cameras. First time users have different needs than those that have already discovered the benefits of thermal imaging. Different image qualities are available. A reliable manufacturer offers you a thermal imaging camera that is completely suited for your application.

Choose a system that can grow with your needs
As you start to discover the benefits thermal imaging has to offer your needs will undoubtedly change. Go for a manufacturer that is able to take your first camera back and offer you a more advanced model. Make sure that accessories are available. Lenses are important. Some applications require a wide angle lens, others are better served with a telephotolens.

Software is important
For practically all applications it is important to have the correct software. It will help you analyze and report your findings. Make sure that the hardware manufacturer is able to deliver you the correct software as well.



Service
Once in operation a thermal imaging camera rapidly becomes a vital piece of equipment. Make sure that the manufacturer can service your camera in the shortest period of time if a problem should occur.

Training
Using a thermal imaging camera is as easy as using a camcorder. There are however some things you need to take into account. A reliable thermal imaging camera will be able to give you initial or extensive training so that you can get the most out of your thermal imaging camera.

itc INFRARED TRAINING CENTER

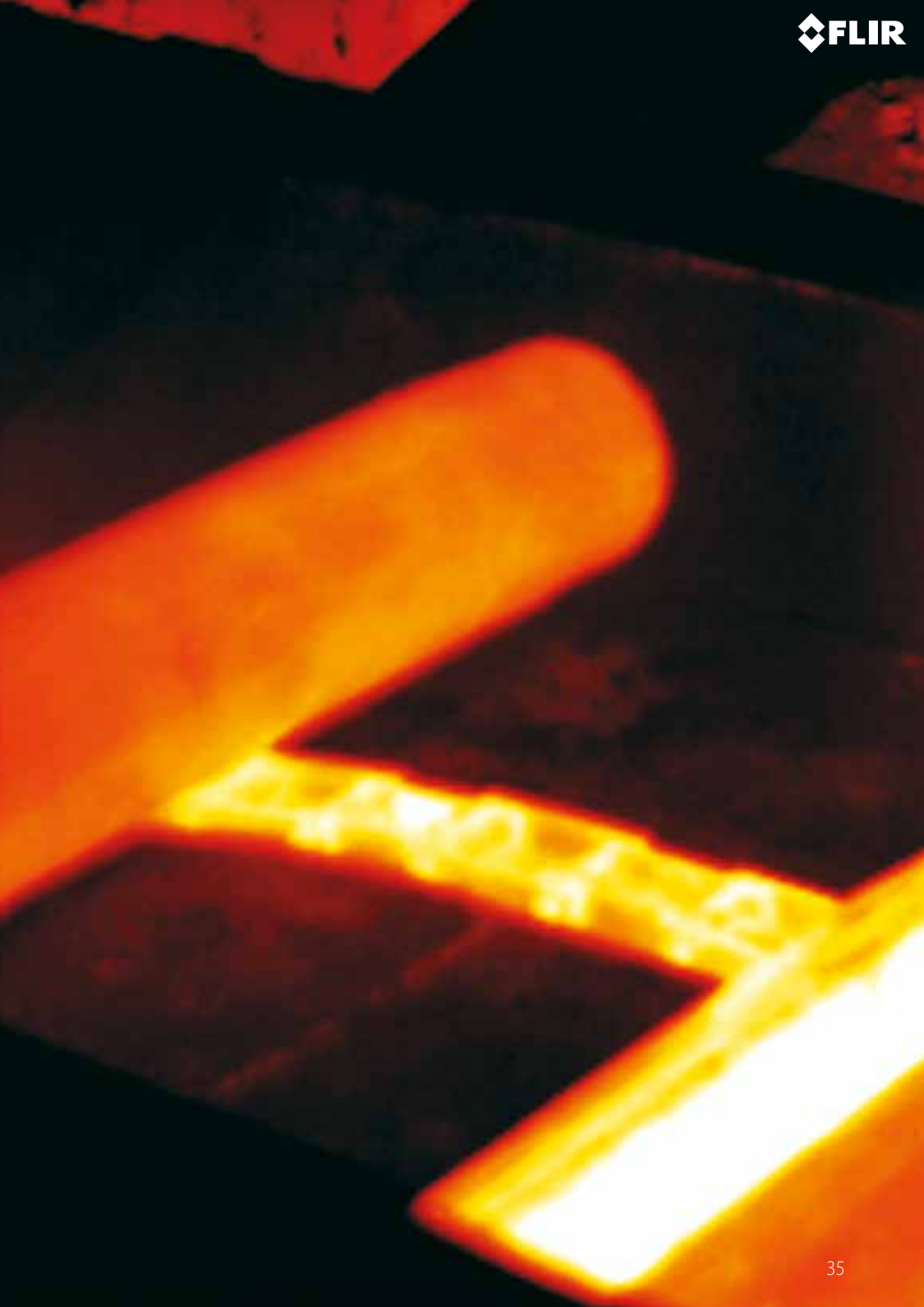
7 Send us your application

On the previous pages you could read how some of our users are using FLIR thermal imaging cameras.

We are always looking for new application stories and new customer testimonies. If you have an interesting application please contact us. We will be happy to include you in the next edition of this booklet.

Please fill out the following form, scan it and send it to flir@flir.com or fax this form to +32 3 303 56 24

Company	:	
Name	:	
Address	:	
Postal Code	:	
City	:	
Country	:	
Tel	:	
Application	:	
Short Description	:	



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