



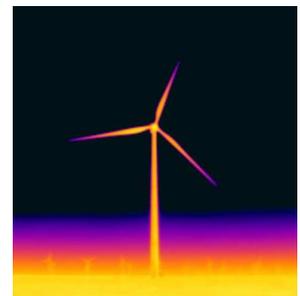
Infrared Cameras for Wind Turbines Inspection

For the renewable energy, wind energy through wind turbines is one of the main methods because many countries have the very regions for wind turbines to install. But all of these wind turbines need to be inspected and maintained. Infrared cameras play an important role in the wind turbine predictive maintenance.

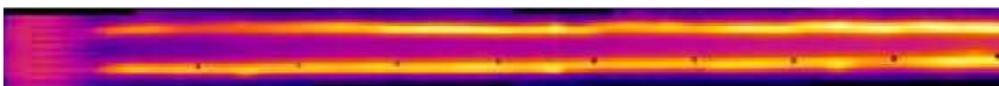
Failures

Wind turbines consist of different electrical and mechanical components. Like all other equipment these components break down after a period of running. The common cause of the failure is in either the brake mechanism or in the gearbox.

The gearbox and the brakes prevent the blades from turning too quickly. If either of these components fails then the turbine is allowed to revolve at many times its normal speed, which imposes loads on the blades well in excess of what they were designed for.



A thermal image of a wind turbine

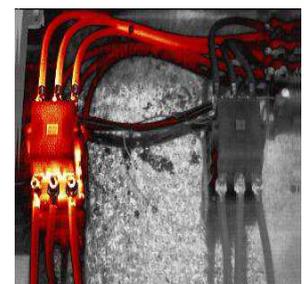


Wind turbine rotors

Rotor blade could be travelling at hundreds kilometers an hour, and when a blade or a piece of a blade suddenly detaches from the rotor it can have momentum as it is hurled away. This can lead to life-threatening accidents. There are many instances where large sections of broken blade have been found tens of kilometers or even farther from the turbine they had broken off from.

Check the electric system

Thermal imaging cameras can be used to inspect the electrical components such as transformers, connectors, controllers yaw motors and such. Thermal imaging is the only technology that allows you to inspect all electrical and mechanical components of the wind turbine and of the surrounding electrical system.



Electrical components



Thermography at Steel Industry

Infrared camera, for its non-contact and stable performance, is a reliable and vital tool to inspect and control the metallurgic production processes.

Infrared cameras show the temperature of object's surface area instead of just at a few single points of traditional methods. Thus, thermal cameras enable technicians to pinpoint potential problems fast and accurately to avoid shutdowns and failures during production process.

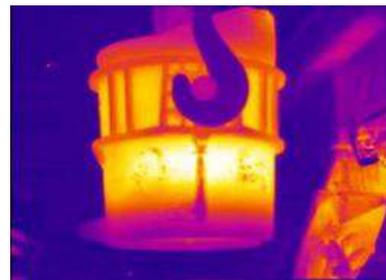
Keii offers various cameras for steel industry to inspect, maintain and observe production processes.

Ladle refractory linings

As is known to all, ladle refractory linings have limited lives and have to be exchanged even after hours of operation.

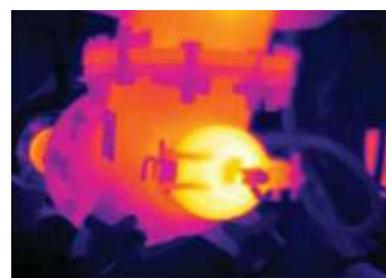
As the lining wears breaks happen, if the linings don't work well, the result can be ladle disintegration and a molten metal breakout destroying equipment and threatening workers lives.

Now, technicians can find out the hot spot soon through thermal image of steel ladle. And a few cameras can cover the entire surface of the ladle for inspection and maintenance.



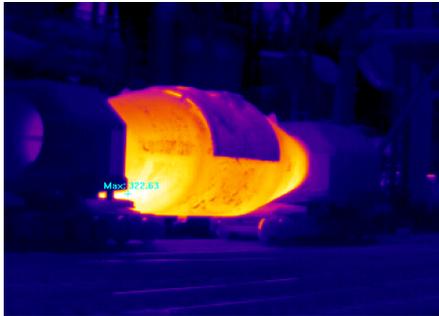
Hot-blast stove

In the production process, the hot-blast stove usually breaks by overheat. But the burning point isn't easy to find out because the stove is sealed. Infrared camera can detect the failure point accurately.



Torpedo ladles

Torpedo ladles, used to conveying the liquid pig iron from the blast furnaces to the oxygen steel works, is an important equipment during the process. Thermographic imaging enables clear conclusions to be drawn about the state of the inner refractory lining.



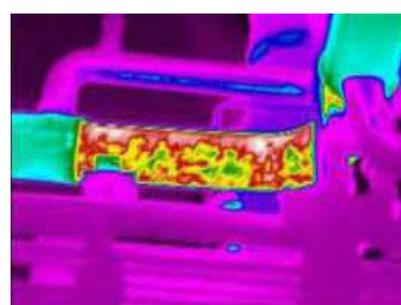
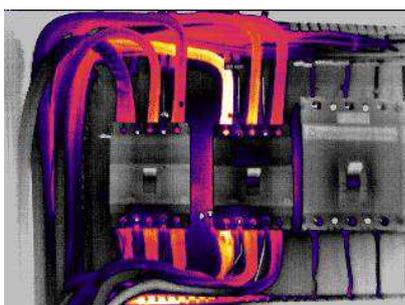
Sintering plant & Converter & Heating furnace

At a sintering plant, iron-bearing particles are formed into pellets or pulverized to be charged again into the blast furnace. The sinter, which is still hot after the production process, is transported via a conveyor belt to the sinter coolers. Infrared camera is particularly useful to detect the average temperature distribution of the sinter in order to assess the heat load on the sinter cooler. Cameras also inspect the functioning of the heating furnace and converters' floor flushers. As flushing takes place via the floor using inert gases, the openings need to remain clear. The heat distribution can be captured by an infrared image.



Electric equipment & Other devices inspection

Except for above applications, steel plants have numerous of electric equipment and mechanical devices. An infrared camera can be also used to inspect electric equipment, such as transformers, distribution boxes, switches, cables, etc. Besides, other devices like the motor of compressor, pipes need maintenance as well.





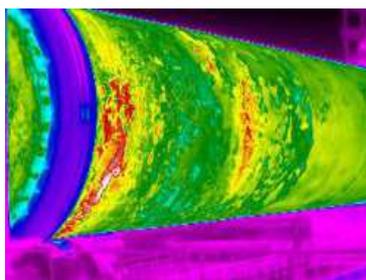
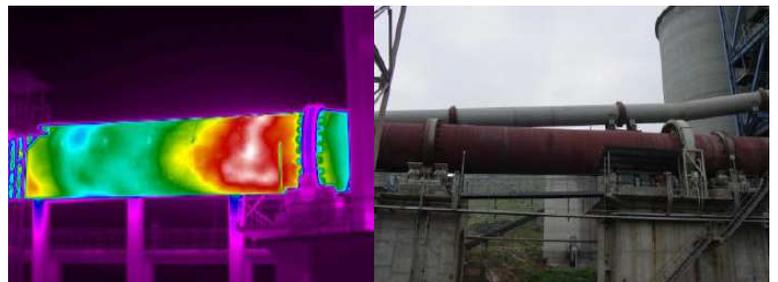
Thermography at Cement Industry

As it known to all, the rotary kiln is one of most important production equipment in cement mill. And the condition of kiln liner matters much in the safety and production process.

Failures

The common failure during production is the wear out of the kiln liner and blanking hole jamming. These failures cause burning-through of the rotary kiln.

Infrared cameras can detect and spot the failure areas through inspecting the surface temperature, and avoid the damages during cement production.





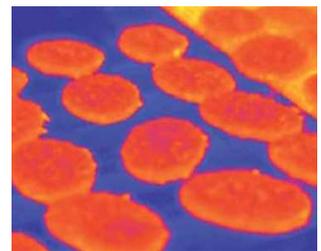
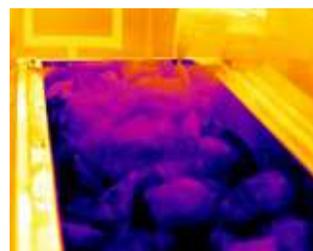
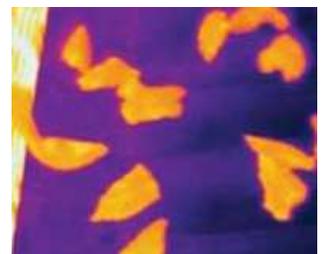
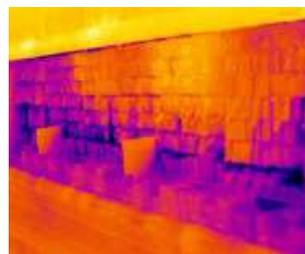
Infrared Camera for Food & Beverage

It is important to control the temperature of perishable foods throughout the production, packing and storage as improperly cooked food causes food safety problems, while infrared cameras can help to lower the errors and improve the food quality.

Quality inspections of conventional contact type temperature sensors is inaccurate and inefficient. Keii infrared cameras can automatically scan the cooked food and non-contact measure the temperature in food processing.

Usage of infrared cameras in food processing

1. Oven baked goods
2. Microwave cooked meats
3. Microwave drying of parboiled rice and other grains
4. Inspecting ovens for proper temperature
5. Proper filling of foods package Compartments
6. Checking integrity of cellophane seals over microwave meals
7. Inspecting box flap glue of overwrap Cartons





Infrared camera in Electrical Industry

Thermal Imaging has proven to be an ideal inspection method for all types of predictive maintenance in the electrical field. Infrared cameras enable you the ability to “see” and measure temperatures on defective components.

Overheating can occur in virtually all electrical components and hardware including generators, transformers, pole top connections, insulators, disconnects, jumpers, shoe connections, fuse connections, switchgear, starters, contactors and any other hardware. In transmission and distribution systems thermographic surveys can help cut production losses and prevent the eventual failure of these systems.

Monitoring transformers

In substations, transformers plays the key role and following parts need to be inspected carefully.

- **High & low voltage bushing connections**

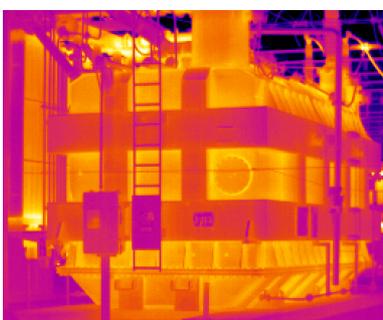
Overheating in a connection indicates high resistance and that the connection is loose or dirty. Also, compare phases, looking for unbalance and overloading.

- **Cooling tubes**

On oil-cooled transformers, cooling tubes will normally appear warm. If one or more tubes are comparatively cool, oil flow is being restricted and the root cause of the problem needs to be determined.

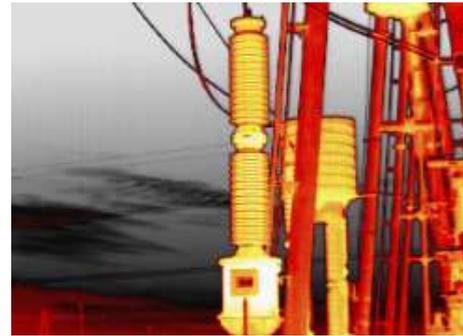
- **Cooling pumps**

Inspect fans and pumps while they are running. A normally operating fan or pump will be warm. A fan or pump with failing bearings will be hot.

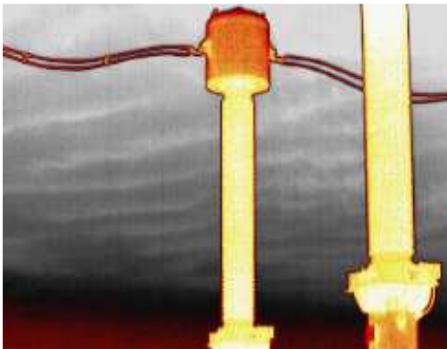




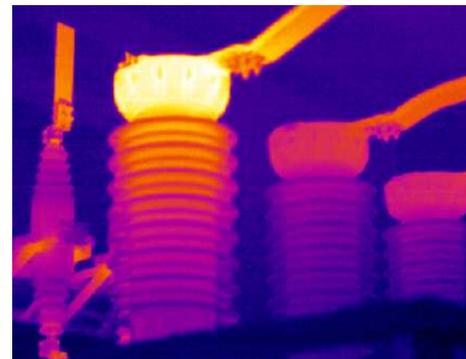
Clips
Scan the whole line, to find hot spot.
Usually failures happens on the bus clips.



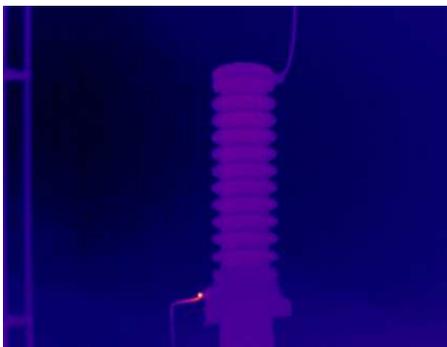
PT equipment
Scan the PT equipment and box.



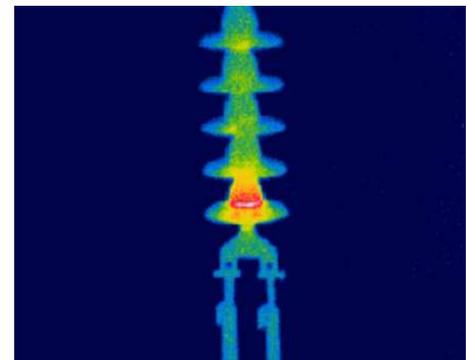
CT equipment
Scan the CT equipment from several meters away so that infrared camera can catch the whole CT.



Breaker
Breaker is another important device. When doing inspection, all breakers should be scanned carefully.



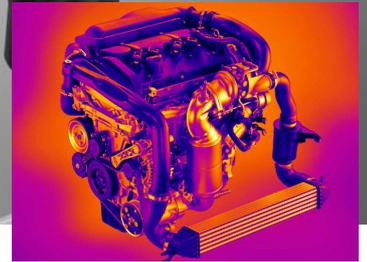
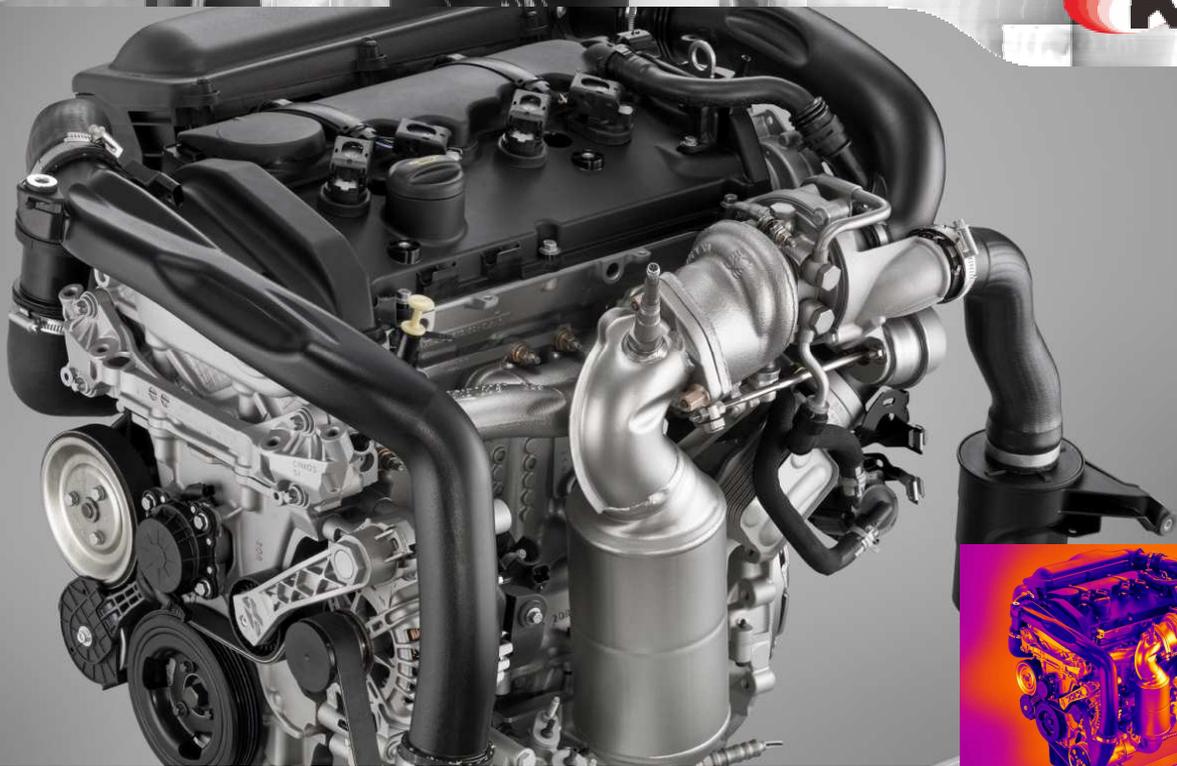
Coupling capacitor connector



Insulator

Above are some example of how infrared cameras work in the electrical industry. If you to make a comprehensive inspection of the whole substations, you can follow equipment list in a substation, scan the entire substation, saving images of any known or possible anomalies. Look especially for similar pieces of equipment under similar loading that are clearly operating at different temperatures.

A good thermographic approach to substation maintenance is to create inspection routes that include all the substations owned by your utility or facility. On a computer, save thermal images of each substation component and track temperature measurements over time. That way, you'll have baseline images with which to compare later images. Doing this will help you determine if temperature levels are unusual and, following corrective action, help you determine if maintenance was successful.



Infrared Inspection for Engines

Engines are widely used for the power drive, such as vehicles, ships, lathe, compressors, etc. But like all the other equipment, engines need inspection and maintenance to ensure the normal use.

Nowadays, the infrared cameras become an essential tools for the maintenance of mechanical machinery as it shows technicians directly the temperature distribution of engines.

For the engines, Infrared cameras are usually used to inspect the cylinder block & cover, cooling pipe & fan because these components' temperature indicates the working condition of engine.

For example, if the cooling pipe & fan shows high temperature than usual, that means problems exist in water pump, and cooling system.



Thermal images of engines