



The Global Leader in Infrared Cameras

THERMACAM®
THERMOVISION®
INFRARED CAMERAS

Petroleum Refining and Petrochemical Applications



| SEE IT

| MEASURE IT

| REPORT IT

See what you've been missing.

An IR camera can show you more of what you've been missing than ever before – and in a refinery, what you miss can cost more than just time and money. It can cost lives! That's why IR thermography has been used for over two decades by the petroleum refining and petrochemical industry to identify potential trouble spots and monitor the performance of critical processing, storage and distribution equipment.

Typical inspection targets in refineries and petrochemical plants include electrical and mechanical components—as well as high-temperature piping, heaters, and heat exchangers. FLIR offers IR cameras to satisfy stringent monitoring and inspection requirements in all of these demanding environments.

All FLIR cameras are rugged and field-proven, shock resistant and environmentally sealed for survival in the refinery setting. All models accept interchangeable lenses to accommodate targets at varying distances. FLIR's exclusive Ambient Temperature Compensation (ATC) system assures accurate temperature measurement regardless of environmental conditions. Ergonomic design and user friendly controls make operation intuitive.

The ThermaCAM P Series

ThermaCAM P-series cameras offer the highest sensitivity and accuracy, sharpest imaging and the widest choice of features and accessories for the professional thermographer. The top-of-the-line P60 model includes a built-in digital camera for taking visual photos, a unique, detachable LCD and control handle for monitoring hard to access targets, and real-time field burst recording for capturing sequential IR images of short-lived phenomena and on-the-spot analysis without the need for a PC. Weight is only 4.4 pounds with battery.



The **ThermaCAM P60** is a powerful inspection system that provides high-resolution imaging, accurate temperature measurement, on-board storage of written and spoken commentary, a built-in digital visual camera, and a convenient, removable LCD and control handle.

The **ThermaCAM E4** weighs only 1.5 pounds with rechargeable Li-ion battery, yet boasts advanced features including radiometric jpeg image format, a convenient audible temperature alarm, and real-time video output.



The affordable **ThermoVision A20** and **A40** are the world's smartest infrared cameras. They feature revolutionary control capabilities that include autonomous reaction to programmable thermal parameters and remote access via Ethernet or FireWire.



ThermaCAM P60

For seeing through the flames and hot combustion products in heaters you no longer need a cooled, shortwave IR camera. We can provide the P60 with a 10.6 μm filter for this critical refinery application. The result: one uncooled camera, the P60, does it all.

The ThermaCAM E Series

These ultra lightweight, award-winning infrared cameras are powerhouses of sophistication, yet weigh only as much as a flashlight. The top-of-the-line E4 stores over 50 images in a radiometric jpeg image format that allows image post-processing on the camera or on a PC (or 100 standard jpegs), features 3 independent target spots, has a "beep" alarm for fast identification of anomalies beyond high, low, or temperature-difference thresholds, and real-time NTSC, RCA composite video output. Other E-series models are factory upgradeable to E4 specifications.

The ThermoVision A Series

FLIR A-series cameras are designed for remote 24/7 monitoring of highly critical refinery or petrochemical plant assets, such as the refractory lining inside refinery heaters, vessels, and piping, where damage could lead to catastrophic failure. The A20 and high-resolution A40 are the smallest, smartest infrared cameras ever built. With native Ethernet or FireWire® connectivity, they can be accessed from virtually anywhere using a Web browser. They feature multiple remotely controllable target spots and independent alarms and RS170 EIA/NTSC and CCIR/PAL composite video outputs. For use outdoors or for security applications, they can be equipped with specially designed environmental enclosures.

Software

ThermaCAM Reporter™ software generates professional reports from your field information in a breeze. When you can't fit an expansive subject into one image, use FLIR Image Builder software to "stitch" individual thermographs of adjacent views into one fully thermographic collage.

Cameras to fit the job.

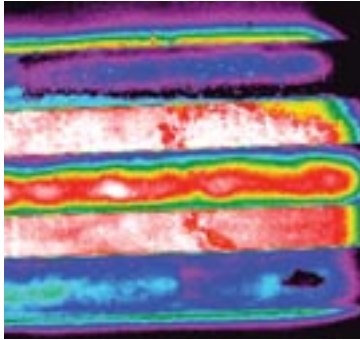
- Increase production efficiency by monitoring the condition of critical equipment and components
- Maximize plant safety by identifying potential catastrophic vessel or pipeline ruptures, fires and other risks
- Reduce the likelihood of unplanned shutdowns and resultant loss of production
- Shorten the duration of planned shutdowns by providing advance notice of needed material and personnel

Petrochemical Applications

ThermaCAM and ThermoVision cameras are increasing production efficiency and supporting safety in land-based and offshore petroleum exploration, production facilities, gas-oil separation plants (GOSPs), gas plants, refineries, petrochemical plants, and pipeline and pumping stations.

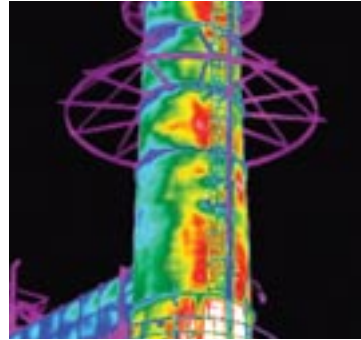
Heater tubes

This thermal image of horizontal tubes inside a gas-fired heater clearly reveals coke buildup in the center tubes.



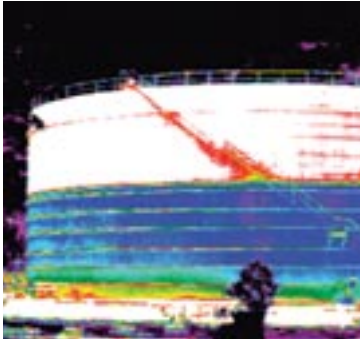
Refractory-lined equipment

Furnace refractory breakdown in a crude heater stack is clearly shown in this thermal image. If unchecked, the condition can lead to accelerated metal degradation and catastrophic failure.



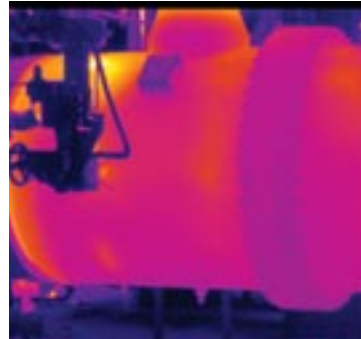
Vessel levels

Product and sludge levels are clearly imaged in this thermograph of a storage tank. A FLIR IR camera can reveal the presence of water in lube oil tanks, contaminates in caustic tanks, and hydrocarbon deposits in spent acid tanks and heat exchangers.



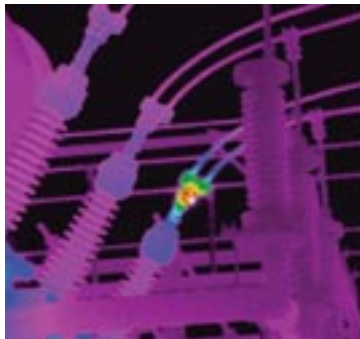
Process equipment condition

This thermal image details a 499° F hot spot on this heat exchanger. The IR camera can also provide early warning of problems or incipient failures in safety/ pressure and other valves, steam or gas lines, external piping insulation, boilers and steam turbines.



Outdoor electrical

This thermal image shows a serious connection problem on the bushing of large transformer. Such a problem, if unrepaired, can ultimately lead to unit or entire facility shutdown.



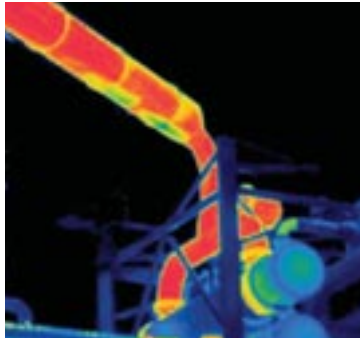
Mechanical and electrical equipment

The motor in the background is revealed by IR thermography to be much hotter than the one in the foreground, which is operating under similar load conditions. FLIR IR cameras are ideal for inspecting rotating equipment such as motors, pumps, bearings, compressors, and mechanical drive gas turbines.



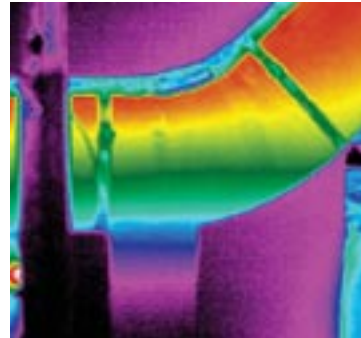
Process lines

The cool areas where liquid has condensed inside this uninsulated vapor line are clearly shown in this thermal image (see second story on next page). Pooling of condensate led to thinning of the wall by corrosion.



Line blockage

Steam was introduced at 150 psi into this plugged transfer line at the draw-off nozzle to locate the blockage. Note that the steam does not contact the bottom 3/4 of the line. The analysis and finding was that the bottom of the line and the connecting draw-off pan were badly fouled with coke.



About FLIR Systems

With over 30 years experience and more than 30,000 of its IR cameras in use, FLIR is the undisputed global leader in infrared systems. From industrial to military applications, thermography professionals have made FLIR their number one choice. No other company offers such a wide range of infrared cameras, software, service, training and support.

FLIR's ThermaCAM series of thermal imaging cameras have long set the standard for thermographic testing and analysis. Today they are the most widely used non-contact temperature measurement infrared cameras in the world.



The Global Leader in Infrared Cameras

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IR Inspection Prevents Catastrophe at Refinery Unit in Texas*

The Pressure Equipment Integrity Inspector at this state-of-the-art refinery in Texas uses a FLIR ThermaCAM long wave IR camera to assess the condition of dozens of vessels and miles of piping, all of which operate under extreme heat and pressure. He also monitors most of the plant's electrical components on a full-time basis.

"We have a redundant system," he says. "If we lose a feed to one side of the unit, it's picked up by the other. That usually allows us to fix a problem I might find without taking down the unit. Of course," he says, "there are exceptions. I recently found a hot GOAB (ground operated air breaker) running at 425° F. Normal at this time of year is about 70°. I reported it to the foreman immediately, rather than waiting to file a printed report. His eyes got big, because he was about to add another 100 amps to the 370 it was already carrying. If he had it would have blown up and shut down a third of the refinery!"

The IR camera is also used to refractory wear patterns on liquid catalytic units a full year before they are scheduled to go down for maintenance. They are then inspected six months later to assess their condition, and specifically to determine how many square feet of refractory, how much scaffolding, and what kind of manpower will be needed for their overhaul. In this area alone, the camera has already paid for itself. "That's a big, big cost savings," says the inspector. "Doing planned maintenance rather than reactive maintenance has proved to be at least three times cheaper. And extending the time between required maintenance can also save time and money." A similar predictive maintenance inspection schedule to the unit's critical heater tubing is followed, using a FLIR ThermaCAM short-wave camera.

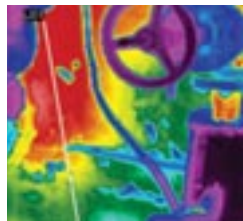
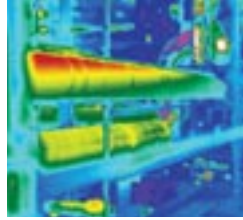
IR PdM Pays Off at Refinery in California*

A large refinery in California has two ThermaCAM IR cameras—a short wave for inspecting the hot tubes in its three dozen heaters, and a long wave for inspecting electrical, mechanical, and other process equipment and components.

"We use the short wave to verify hot temperature indications (TIs) we get from the thermocouples on the tubing," says the plant's Infrared Inspector. "When the operations people see a TI, they automatically cut feed to lower temperatures. But in many cases it's a problem with the thermocouple, not the tubing. By eliminating unnecessary cutbacks in feed, we can save as much as \$25,000 a day."

Thermocouples last only 6 or 7 years, while the tubes themselves can last as long as 35 years. Further, thermocouples are installed on every fourth tube, some of which are 100 feet long, and in all cover only about 2% of tube surfaces. To improve condition monitoring, the tubing inside the unit's 36 heaters are scanned as often as every three months, and no less than once a year. The ThermaCAM camera is used to supplement ultrasonic testing and, for example, pinpointed the cause of a leak in a crude unit's overhead vapor line (see thermal image directly to the right).

In electrical and mechanical inspections, the ThermaCAM was used to find the root cause of excessive heating in the fin fans blowing air across the tubes in an overhead cooler in the alkylation plant. The problem was traced to a wire whose insulation was completely burnt off—a potential short circuit. If the fans had stopped, the plant would have had to shut down and the company would have had to replace the lost production by purchasing on the expensive spot market."



* Infrared thermography has so significantly improved worker safety and competitive advantages for companies in the petrochemical industry that to preclude our compromising their competitive advantages we cannot identify the companies by name.

