

INFRAMATION



Volume 2, Issue 7
July, 2001

REGISTER BEFORE JULY 31 - SAVE \$100!

Attending InfraMation 2001 will help you stay current with thermography trends in predictive maintenance and other technology areas. Most importantly, listen to applications and case studies to learn how infrared technology contributes to cost savings across a wide variety of industries. Hear new and invaluable presentations on infrared developments in your industry from over 35 actual IR users. If you want to maximize the ROI on your IR operation, this conference is for you. If you are just getting started and

want to see what IR can do for your operation, this conference is for you.

Papers this year include many areas of great interest to thermographers. A brief synopsis of the papers can be found on the following pages. Even if you know you are going to continue with the same applications, there are tricks of the trade you can pick up from other applications, and from the experts presenting at InfraMation. See our ad below to register or receive more information.

Inside this issue:

Last Month's Brainteaser	2
InfraMation 2001 Abstracts	3
Brainteaser of the Month	5
About the itc	6
Contact Information	6
Upcoming Classes	6

THE POWER OF LATERAL HEAT CONDUCTION

By Joseph DeMonte,
ASNT PdM Level III -
TIR Level III, *itc* Senior
Thermography
Instructor



In this month's newsletter, I would like to remind everyone of the power of lateral conduction. When looking for subsurface defects in metals, this property in materials has been known to put an end to a thermographer's day. What is lateral conduction? Why does it happen? What can you do to

compensate for it?

Conduction is the heat transfer method used to describe the process in which heat energy is transferred through a solid material. Different materials will transfer this energy at different rates depending on the **area (A)**, **temperature difference (ΔT)** across it, **thickness (L)** and the **thermal conductivity (k)**. Solid materials with a high thermal conductivity are called conductors while ones with low thermal conductivity are called insulators. If there are two different solid materials in contact with each

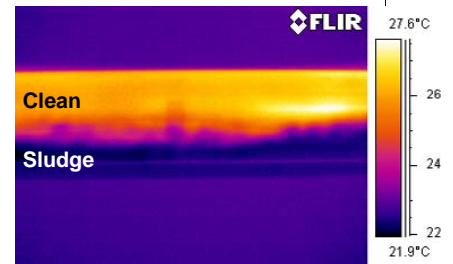


Figure 1. Thermogram of Sludge Build up

other, chances are that they will have different **k** values.

For example: An IR thermographer

(Continued on page 2)

"Great Job! InfraMation 2000 helped me stay current with the thermography industry."
- Kathryn Barker

"The exchange of quality information made InfraMation 2000 a huge success."
- Michael Gill

SECOND ANNUAL 2001 INFRAMATION THE THERMOGRAPHERS CONFERENCE

A two and a half Day Conference featuring over 35 papers on thermography successes, new applications, & tricks of the trade.

Wyndham Orlando Resort

September 30 - October 3, 2001

www.inframation.org

1 (800) 254 0632



Call today for more information! REGISTER BEFORE JULY 31 AND SAVE \$100!

LATERAL HEAT CONDUCTION (CONTD.)

(Continued from page 1)

decides to look at the bottom of a straight-tube auxiliary water heat exchanger for possible sludge build-up (Figure 1).

The sludge would most likely have an insulating characteristic when compared to the conductive steel of the heat exchanger body. In this case, the water flowing across the tubes is warmer than the outside air. Heat will conduct from the water to the inside wall and then conduct to the outside wall and on to the air. The sludge increases the thickness of the solid material that the heat must conduct through and it also has a lower thermal conductivity. Therefore the area with sludge is cooler than the clean area.

Would the sludge be visible to an infrared camera if the area affected was much smaller? To answer this we need to discuss how conduction can travel through the solid. The shape factor of the material, thickness of all materials, and thermal conductivities of the materials can give rise to some interesting thermal patterns when viewed through infrared imaging systems. Some small problems can be masked completely in a material that is in steady state heat transfer. This problem is known as **lateral conduction**. Things don't just happen in a straight line from the heat source to the environment.

I have set up a simple demonstration to show what happens to a material when there is a buildup between it and the environment. Several cups of different materials were coated with a vinyl strip of a thickness .03 inches. The next series of images show an unpainted stainless steel mug .022 inches thick while hot water (200°F) is poured into it. (Figure 2)

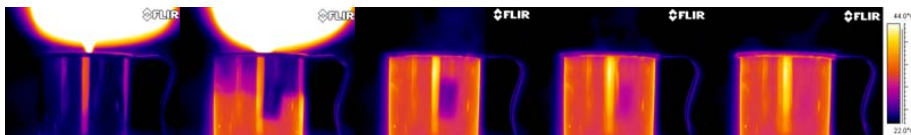


Figure 2. Stainless steel cup after being filled with hot water (series duration 26.5 seconds).

Even though the total thickness of the area with the vinyl is twice that of the area with no vinyl, heat conducted laterally across the front of the stainless steel cup makes the problem area disappear when it reaches steady state.

What we see here is defined by the steel's thermal diffusivity which is proportional to the thermal conductivity divided by the volumetric heat capacity (density times the specific heat capacity). A wet roof is an example of a system with a large volumetric heat capacity. Thermal diffusivity defines the speed at which heat travels through a material in transient heat transfer.

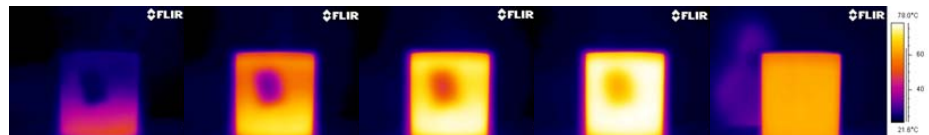


Figure 3. Ceramic cup after being filled with hot water (series duration 10:41 minutes).

The next cup is a ceramic coffee mug with a thickness of .219" and a vinyl strip of .03" on the inside. Again, hot water is poured into the cup and thermal images are taken in sequential series from transient heat flow conditions to steady state. (Figure 3).

The time table for the steel cup to conduct around the vinyl laterally was less than 20 seconds. Before the vinyl area became difficult to see on the ceramic cup, 10 minutes had elapsed.

The graph in Figure 4 illustrates this. The graph represents the temperature difference between the surface of the cup over the tape and the surrounding surface for both cups versus time. Note that there are only 9 seconds before the

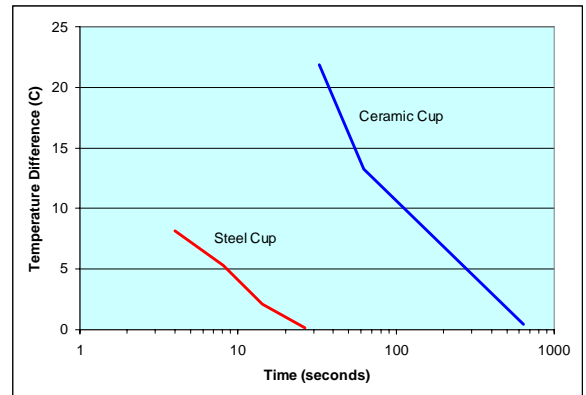
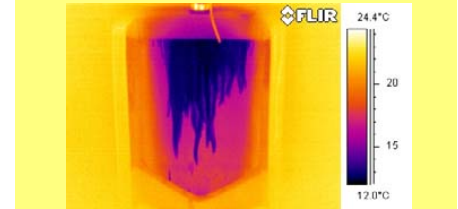


Figure 4. Time vs. temperature difference on the surfaces of the two cups.

LAST MONTHS' BRAINTEASER

This thermogram of a flushing urinal was taken by a creative student from Merck & Co. during a Level I course. Nobody guessed it correctly, but the closest guess (and the \$20 prize) goes to Julien Tremblay of ITF Technologies Optiques in Canada. He thought the thermogram showed a water spill on a wall from an air conditioner. ♦



temperature difference falls below 5 C for the steel cup but that it takes about 300 seconds for the same thing to occur in the ceramic cup!

Remember that all problems will not show up during an infrared scan if the system or material is at steady state heat transfer with it's environment. Transient heat flow can save the day when it comes to small problems or in good conductive material. Good luck and happy hunting! ♦

INFRAMATION 2001 (CONTD.)

INFRAMATION 2001 ABSTRACTS**PREDICTIVE AND PREVENTIVE MAINTENANCE OF DISTRIBUTION AND STATION CLASS LIGHTNING ARRESTERS, 23 kV AND ABOVE, WITH THERMAL IMAGING**

Larry Allen, Memphis Light, Gas and Water Division, Memphis, Tennessee

A substation thermographer describes an ongoing two-year program using IR thermography to detect faulty lightning arresters. Case histories are presented along with confirmation of findings using Doble testing and other means.

WATER DELUGE TEST METHOD FOR ESTABLISHING THROUGH-WALL WATER PENETRATION IN A CONCRETE MASONRY UNIT STRUCTURE

Kathryn M. Barker, American Infrared Testing & Consulting, St. Petersburg, Florida

An expert thermographer specializing on roofs and structures shows how conventional infrared thermographic techniques for determining leakage entry in masonry structures can be enhanced by the use of a new water deluge test method.

PETROLEUM FACILITY TRANSFORMER PREVENTIVE MAINTENANCE

Robert Bonin, Motiva, Inc., Port Arthur, Texas

IR Thermography is used as a predictive tool in the Motiva Refineries. This paper discusses how transformers are scanned and analyzed. Particular focus is on some problems found scanning the transformer oil coolers.

WHICH FREEZES FIRST, HOT WATER OR COLD? UNDERSTANDING SURPRISE IR THERMOGRAPHY OBSERVATIONS

Jeffrey A. Buss and Michael E. Leuz, Infrared Experts, Inc., Ottsville, PA

In a seemingly elementary experiment; time lapse IR imaging proves clearly that hot water does not freeze faster than cold water—but the data identifies something even more interesting.

FINDING OUR NICHE WITH INFRARED TECHNOLOGY.

Terry Christie, Oak Ridge National Laboratory, UT/Battelle, Oak Ridge, TN 37831

Optimizing the use of IR thermographic equipment to develop a

comprehensive and cost-efficient program of IR inspection is a common goal in many industries. This issue is explored from the point of view of an electrician/thermographer at a national laboratory.

THERMOGRAPHIC EVALUATION OF COATING THICKNESS IN SUPERALLOY TURBINE PARTS

E.M. (Cris) Crisman, Duke Engineering & Services, Huntersville NC.

The director of materials & metallurgy lab describes how thermographic NDT techniques are used to measure the protective coating thickness and, thereby, the useful life of blades, vanes and other critical superalloy hot section turbine components.

AIRBORNE THERMAL IMAGERY IN DETECTION OF INDOOR MARIJUANA GROWING OPERATIONS

Mark A. Dunaski, Minnesota State Patrol Aviation, Saint Paul, Minnesota 55107

A state patrol lieutenant describes how the indoor marijuana-growing environment has a significant effect on the thermal profile of a structure that can be detected by airborne IR scans.

APPLYING THE BENEFITS OF INFRARED THERMOGRAPHY IN NAVAL AVIATION

Jed Figg, and Thomas Daquila, NATEC, San Diego, California

The NATEC IR team is establishing procedures that will benefit the Navy's entire aging aircraft inventory and explore the capabilities of IR technology to become a fleet wide application for aircraft troubleshooting. This paper reports on several years of progress.

SUBSTATION PREDICTIVE MAINTENANCE: THE FUNCTION AND MALFUNCTION OF BUSHINGS

Mark B. Goff, P.E., Tennessee Valley Authority, Chattanooga TN

A seasoned predictive maintenance thermographer zeroes in on bushings, describing their thermal characteristics and how they impinge on failure prediction

FINDING SOURCES OF ENERGY WASTE WITH ULTRASOUND AND INFRARED TECHNOLOGY INTEGRATION

Mark Goodman, UE Systems, Inc., Elmsford, NY

This paper, by an ultrasound expert, describes ultrasound technology and how it can be used with infrared to locate sources of wasted energy such as compressed air leakage. Case histories illustrate how leakage of buried hot water piping is located by this multidisciplinary approach.

WHAT ARE YOU LOOKING AT?

Richard L. Harrison, Vibration analyst, Consolidated Diesel Company, Whitakers, N.C.

Diagnostic errors in thermal image interpretation can prove expensive and embarrassing for both the thermographer and the customer. In this paper an experienced thermographer and vibration analyst reviews common mistakes made with an infrared camera and how to avoid them.

DESIGN OF A NON-CONTACT WAFER TEMPERATURE UNIFORMITY MEASUREMENT TECHNIQUE

Muhammad Kashif Imam Graduate Student, Stanford University

This paper investigates the possible solution alternatives to a non-contact temperature uniformity design problem in wafer manufacturing, and presents an infrared-camera system as the eventual solution for the specified circumstance.

MASONRY FLAW DETECTION AND EVALUATION

Matthew J. Innocenzi & J. Eric Peterson, Whitlock Dalrymple Poston & Associates, Inc., Manassas, VA

A shopping center case history in which infrared thermography proved to be an extremely effective tool for evaluating the as-constructed condition of the masonry walls, and also provided a reliable, rapid means for verifying the quality of the repairs performed by the contractor.

INFRAMATION 2001 (CONTD.)

(Continued from page 3)

DETECTION OF INSECT PESTS AND RODENTS USING THERMAL IMAGING

Ken James, Roger Christiansz and Kevin Blaze, University of Melbourne, Australia

How thermal imaging is being used in Australia to detect insects, pests and rodents, such as termites, roaches, bees, rats and possums, in buildings and surrounding areas, and how, contrary to popular belief, insect heat signatures are easily detected by the new thermal cameras.

A THERMOGRAPHER'S GUIDE TO INFRARED DETECTORS

Herb Kaplan, Honeyhill Technical Company, Norwalk, CT and Tom Scanlon, FLIR Systems - Boston

The infrared detector is the heart of a thermal imaging system, and selecting the correct system is crucial to the success of thermographer's mission. This tutorial paper traces the evolution of infrared detectors and provides guidelines for selecting detector performance appropriate for the mission.

DEVELOPMENT OF A UTILITY FEEDER INFRARED THERMOGRAPHY PDM PROGRAM -WITH LESSONS LEARNED

Michael A. Kregg Commonwealth Edison, Maywood, IL

This paper traces the evolution of an IR thermography program at Commonwealth Edison for deploying a van-mounted system to survey the company's overhead distribution system in Chicago, and how lessons learned resulted in several modifications to vehicle design to help increase productivity and safety.

THERMAL IMAGE PROCESSING FOR GLUE PRESENCE DETECTION

A.-C. Legrand, P. Gorria, and F. Meriaudeau, Laboratoire Le2I, University of Burgundy (Dijon), France

Last year, researchers at a French university reported on their development of an active infrared vision system for defect detection. This paper reviews their progress in using this system to assess and control glue occlusions in cosmetic plastic lids.

FINDING INTERNAL ELECTRICAL RESISTANCE FROM EXTERNAL IR THERMOGRAPHY MEASUREMENTS ON OIL-FILLED CIRCUIT BREAKERS DURING OPERATION

Robert Madding, ITC, FLIR Boston

For many devices such as oil-filled circuit breakers (OCBs), heat transfer between the external surface and the environment can be calculated without needing to know the internal properties of the device. This paper shows how to do this based on thermograms of the external surface.

DISCOVERING MISALIGNMENT WITH INFRARED - THE DAMAGE IS DONE.

Jimmy McLeod, Mississippi Power, Mississippi

IR imaging can mean huge savings, but identifying a problem is only half the solution. Improper corrective actions and failure to understand the proper solution can cost money and, more importantly, credibility. This paper reviews misalignment problems and corrective action.

THERMAL EVALUATION OF LOW & MEDIUM TEMPERATURE REFRIGERATED FACILITIES

Phillip C. McMullan, TSI Thermo-Scan Inspections, Carmel, IL

The use of IRNDT methods to examine the thermal envelope of low and medium temperature refrigerated facilities is introduced, and the findings of these inspections on a number the commercial refrigeration facilities are reported and reviewed.

UTILIZING THERMOGRAPHY TO OBTAIN THERMAL CHARACTERISTICS OF SUPERCCELL THUNDERSTORMS AND TORNADOES

Stephen S. Moore, Intrinsic Energies Indications, LLC, Saline, Michigan

With the availability of highly reliable and portable focal-plane array, IR cameras, ground-based observation of severe thunderstorms is available. This paper reports the discoveries and findings of a thermographic study conducted on pre-tornadic supercell thunderstorms and tornadoes.

INFRARED THERMOGRAPHY IN THE EVALUATION OF CLEANING INTERVENTIONS ON ARCHITECTURAL SURFACES

A. Moropoulou, N.P. Avdelidis, E.T. Delegou, M. Kouli, University of Athens, Greece

The nonintrusive aspects of IR thermography are exploited in inspection of historic buildings and monuments, where destructive sectioning and testing is restricted. In this research work architectural surfaces are investigation before and after a pilot cleaning to assess damage.

INFRARED THERMOGRAPHY IN THE EVALUATION OF CLEANING INTERVENTIONS ON ARCHITECTURAL SURFACES

A. Moropoulou, N.P. Avdelidis, E.T. Delegou, M. Kouli, University of Athens, Greece

The nonintrusive aspects of IR thermography are exploited in inspection of historic buildings and monuments, where destructive sectioning and testing is restricted. In this research work architectural surfaces are investigation before and after a pilot cleaning to assess damage.

INFRARED THERMOGRAPHY FOR IMPROVED FIRED HEATER RELIABILITY

John J. Nyholt, BP Amoco Upstream Technology Group

This paper demonstrates how IR thermography has been instrumental in raising the fired heater reliability, particularly through combining and trending IR data with other nondestructive test data. A special emphasis will be placed on determining the ERL of fired heater tubing.

ONLINE MAINTENANCE RESOURCES

Terrance O'Hanlon, publisher Reliabilityweb.com, Fort Myers, Florida

This paper will outline the types of online resources available to the thermographer, how to get the most out of them, how to save time seeking resources and how other companies are using the Internet in order to increase Maintenance and Reliability Program effectiveness.

INFRAMATION 2001 (CONTD.)

(Continued from page 4)

TEXACO'S USE OF INFRARED ON FIRED PROCESS HEATERS

Albert Amedee Ohliger, Texaco Inc., Bellaire, Texas

How IR thermography is used to monitor skin temperatures on fired heaters at the various Texaco refineries to determine hot spots on flow restricted tube, flame impingement due to firing and burner problems and verify temperatures when thermocouple problems are suspected.

USING IR CAMERAS FOR PROCESS CONTROL

Ron Predmesky, Ford Motor Company, Dearborn, Michigan

Using infrared cameras to optimize the quality of parts produced for automobile manufacturing. Examples will be used to match levels of available automation with solutions and, in each instance, the cost savings will be discussed for justifying the approach.

DIVERSE APPLICATIONS OF IR THERMOGRAPHY IN SOUTH AFRICA

John R. Riley and Terence F Oosthuizen, Alexander Forbes Risk Engineering, Johannesburg South Africa

South African thermographers report on diverse applications ranging from platinum furnace refractory inspection, to monitoring overhead electric railroad trains traveling at 60km/h, to scanning scenes for a TV program on haunted houses, ghosts and aliens.

POWER TRANSFORMERS AND REGULATORS: THE CRITICALITY OF OIL LEVEL

James Dan Roark, Knoxville Utilities Board, Knoxville, Tennessee

The Knoxville Utilities Board had known of migratory oil problems with regulators, but had not realized the thermal effects they could have on the winding compartment. This paper illustrates how critical the temperature of power equipment can become with subtle changes in oil level.

THE PROFESSIONAL INFRARED THERMOGRAPHER

Sandy Sanor, HSB Thermography Services, Alexandria, VA

The director of thermography at Hartford Steam Boiler Co. traces

his company's thermographer training and certification program and hammers home the need for meaningful certification.

USING INFRARED IMAGING ON PRODUCTION STORAGE TANKS & VESSELS

Danny Lee Sims, Texaco Exploration & Production, Midland, Texas

As crude oil enters a storage tank, or "gun barrel" it separates into multiple phases. This paper describes how IR thermography is used to locate these phase layers as well as the emulsion "settlements" at the bottom of tanks, which can be a factor in tank bottom corrosion.

OVERVIEW OF IR APPLICATIONS IN THE AEROSPACE INDUSTRY

Rob Spring, Snell Infrared, Montpelier, VT

The use of thermography in traditional NDE/NDT has been explosive, especially in the aerospace industry. This paper will discuss and illustrate how thermography is being used for aerospace NDT, both on the manufacturing and aircraft maintenance sides.

ADVANCES IN SELECTED APPLICATIONS AND METHODOLOGY FOR AERIAL INFRARED THERMOGRAPHY

Greg Stockton, Stockton Infrared Services

For straight-down or large area viewing, aerial thermography is often superior to ground-based IR. This paper focuses on recent and ongoing advances in methodology, platform and software for airborne infrared thermography surveys that will bring the end-user a superior product.

INFRARED DIAGNOSTICS ON LIGHTNING ARRESTERS

Jeff Sullivan, Mississippi Power Company, Hattiesburg, MS

USING INFRARED THERMOGRAPHY WITH ULTRASOUND TO PREDICT MECHANICAL FAILURES

Brian D. Susralski and Thomas Griswold, United Parcel Service, Hodgkins, IL

This paper demonstrates how combining thermography with ultrasound can predict conveyor belt failure in both cases; one when

temperature increases are detected and the other when guide rollers near failure do not exhibit temperature rises but change ultrasonic characteristics.

THERMOGRAPHIC EVALUATION IN REVEALING THE THRESHOLD TO SKIN DAMAGE DURING LASER APPLICATION IN DERMATOLOGY

Roderick A. Thomas, Faculty of Applied Design and Engineering, Swansea Institute, UK

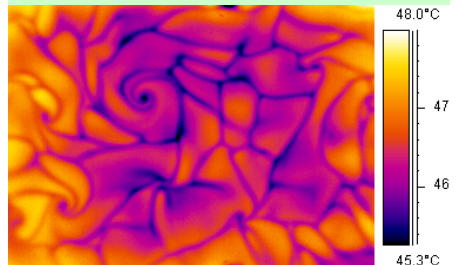
A prominent industrial condition monitoring NDT specialist and Thermography author describes how infrared thermography is used to evaluate skin surface temperature during laser surgery and how a theoretical computer model relates these values to the risk of skin damage.

Don't miss out on this opportunity to improve your thermography and enjoy Orlando. Don't delay; Register today!. Call us at 1 (800) 254 0632 or visit our website at www.inframation.org. ♦

BRAINTEASER OF THE MONTH

Here is this month's brainteaser. First reader to email me with the correct explanation wins \$20 in Infrabucks. Please put "Brainteaser" as the subject of the message.

Gary.Orlove@infraredtraining.com ♦



MISSED AN ISSUE OF THIS NEWSLETTER?

Download past issues at our website!

Just go to <http://www.infraredtraining.com/newsletter/index.htm> ♦

itc U.S.A., BOSTON

16 Esquire Road
N. Billerica, MA 01862, USA

Tel: +1-978-901-8405
Toll free: +1-866-TRAINIR
(866-872-4647)

Fax: +1.978.901-8832

E-mail:

info_us@infraredtraining.com

itc INTERNATIONAL, SWEDEN

Rinkebyvägen 19
SE-182 11 Danderyd, Sweden

Tel: +46 (0) 8 753 25 00
Fax: +46 (0) 8 753 26 01

E-mail:

itc@flir.se

About the Infrared Training Center

The Infrared Training Center offers training and certification in all aspects of infrared thermography use. Our world-class training facilities are located near Boston, Massachusetts, USA and Stockholm, Sweden and have the world's most extensive hands on laboratories for infrared applications. Please join us in exploring the fascinating world of infrared!

Your comments and suggestions about this newsletter are welcomed and encouraged. If you have an interesting application or case study to share, we encourage you to submit it for publication.

Please e-mail Gary.Orlove@infraredtraining.com or regular mail to the USA office

itc INFRAMATION - Editor / Designer: Gary Orlove

"Hands On" Thermography Training, Certification, and Support



Upcoming Classes - USA

Remember that we also teach customer site training courses at your convenience. Please contact us for more information.

July

- 10-12 -- Refresher - Boston
- 16-19 -- Level II - Portland
- 17-20 -- Level I - Toronto
- 23-27 -- Level I - Boston
- 31-Aug 3 - Level I - Salt Lake City

August

- 6-9 -- Level I - Chicago
- 13-16 -- Level II - Chicago
- 14-17 -- Level I - Edmonton, Alberta, Canada
- 20-23 -- Level II - Edmonton, Alberta, Canada
- 20-24 -- Level I - Boston

September

- 10-13 -- Level II - Kansas City
- 10-14 -- Level II - Boston
- 17-20 -- Level II - Vancouver
- 17-21 -- Level I - Boston
- 18-21 -- Level I - Denver
- 24-25 -- Software (Reporter) Calgary, Canada
- 30-Oct. 3 - InfrAMation 2001 Conference - Orlando

October

- 15-19 -- Level I - Boston
- 16-19 -- R&D - Albuquerque
- 22-26 -- Level I - Boston
- 23-26 -- Level II - Nashville
- 30-Nov. 1 -- Refresher - Boston

Upcoming Classes - Sweden

July

- 2-6 (W27) -- Level I - Italy

August

- 27-31, Swedish (W35) -- Level I

September

- 10-14 (W37) -- Level II CM
- 17-20 (W38) -- Level I - Korea
- 24-27 (W39) -- Level I - Malaysia

October

- 8-12 (W41) -- Level I
- 15-19, Swedish (W42) - Level II CM
- 22-26 (W43) -- Level I - Italy

Upcoming Classes - Germany

July

- 3-5 (W27) -- Level II R&D
- 6-7+12-14 (W27+28) -- Level II CM
- 17-20 (W29) - Application Seminar
- 23-28 (W30) -- Level I

August

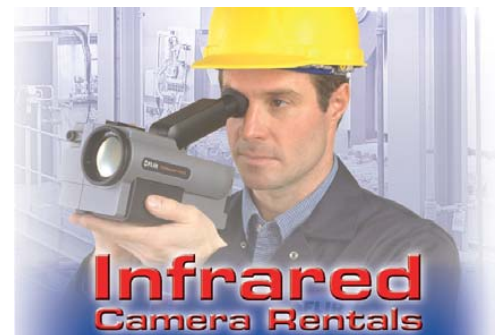
- No Classes

September

- 11-14 (W37) -- Application Seminar
- 17-22 (38) -- Level I
- 24-29 (W39) -- Level II CM

October

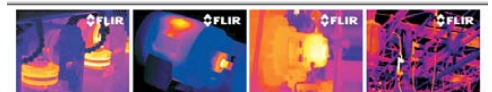
- 9-11 (W41) -- Level II R&D
- 18-20+25-27 (W42+43) -- Level II CM
- 29-Nov3 (W44) - Level I



Rent an infrared camera from **FLIR Systems** to locate electrical and mechanical problems, schedule repairs, and avoid costly plant shutdowns. Whether you have a temporary testing/inspection requirement or need to evaluate an IR camera before purchasing, renting from **FLIR** can help you solve problems.

- Rent direct from the world leading IR camera manufacturer
- Low rates and quick delivery
- Build credit toward purchase
- Wide selection of camera technologies and accessories

For more information call us toll free at
1 (866) IR RENTS
1 (866) 477 3687
www.flir.com/rentals



SUBMIT A STORY— EARN INFRABUCKS!

Any reader who submits a story we publish will receive \$100 in InfraBucks. You can spend InfraBucks on accessories like hats, mugs, beanie babies, jackets, and shirts. You can find a complete selection of items at our on line store. Just click on www.flir.com/store/index.htm. ♦