Leveraging the Power of Infrared

Presented by:
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800-745-4620

Start Seeing the World in Infrared • www.goinfrared.com
IR use with regards to Energy Efficiency – Helping to Drive Awareness
IR use with regards to Energy Efficiency

- Basic IR Fundamentals
- Qualitative vs Quantitative Analysis

Applications
- Building Envelope / Energy Analysis
- Electrical Inspection
- Optical Gas Imaging
Infrared Radiation...

- IR is emitted by all objects
- IR radiation increases with temperature
- IR radiation is minimal at low temperatures
- IR is generated by the vibration of electrically charged particles
- IR travels through space at the speed of light
- The difference between light and IR is wavelength
Electromagnetic Spectrum...

Basic IR Fundamentals

X-Rays | Ultra-Violet | Visible | Infrared | Microwaves

Radio | UHF VHF

Visible | Infrared

SW | LW

2 5 8 12 micrometers

ITC © 2008
Why do we want to see heat?

Heat anomalies tend to indicate problems.
Basic IR Fundamentals - Methods of Heat Transfer

1) Conduction
   Heat transfer through a solid.

2) Convection
   Heat transfer through a fluid (air).

3) Radiation
   Heat transfer through electromagnetic wavelengths.
Qualitative Thermography

The practice of gathering information about a structure, system, process or object by observing images of different temperature patterns of infrared radiation across the surface of an object.
Quantitative Thermography

The measurement of infrared radiation by assigning numeric values to the observed patterns of infrared radiation.
Applications

- Electrical
- Mechanical Efficiency
- Building Envelope & Energy Savings
- Process and Quality
IR inspections of buildings can be conducted as long as there is a temperature difference between indoor and outdoor temperatures. (recommend at least 10°)

It is possible to induce and reduce this temperature difference with the use of a blower door.
Can I really see “through” the wall...
Building Envelope Applications

Missing Insulation
Building Envelope Applications
Building Envelope Applications
Building Envelope Applications

Subsurface Heating
Materials with greater thermal capacitance more readily retain heat or cold.

Water has a **high** thermal capacitance.
Evaporation of moisture causes a cooling effect.

Hot air is easily seen when ductwork is not assembled correctly or loose.
Building Envelope Applications

Low Emissivity Windows installed backwards
Applications

Electrical

Mechanical Efficiency

Building Envelope & Energy Savings

Process and Quality

ITC © 2008
Why do we want to see heat?

Heat anomalies tend to indicate problems
Why do we need to **know** the temperature?

Decisions must be made concerning repair priorities.
Electrical Applications
Loose or bad connections, or contacts that are failing have a higher resistance which equates to heat.
Electrical Applications

12kv Line >259 °C
# Overhead

<table>
<thead>
<tr>
<th>Distribution Facilities</th>
<th>Temperature Rise (delta T)</th>
<th>Grade/ Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade 3</strong></td>
<td>14 to 20 (C) 25 to 36 (F)</td>
<td>Corrective measures not required. Must be recorded.</td>
</tr>
<tr>
<td><strong>Grade 2</strong></td>
<td>21 to 60 (C) 37 to 108 (F)</td>
<td>Corrective measures required as scheduling permits or ASAP, depending on the class of load carried and the severity of temperature rise in this range.</td>
</tr>
<tr>
<td><strong>Grade 1</strong></td>
<td>61 and over (C) 109 and over (F)</td>
<td>Corrective measures required IMMEDIATELY</td>
</tr>
</tbody>
</table>
## Underground

<table>
<thead>
<tr>
<th>Distribution Facilities</th>
<th>Temperature Rise (delta T)</th>
<th>Grade/ Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 3</td>
<td>2 to 4 (C) 5 to 7 (F)</td>
<td>Corrective measures not required. Must be recorded.</td>
</tr>
<tr>
<td>Grade 2</td>
<td>5 to 10 (C) 8 to 18 (F)</td>
<td>Corrective measures required as scheduling permits or ASAP, depending on the class of load carried and the severity of temperature rise in this range.</td>
</tr>
<tr>
<td>Grade 1</td>
<td>11 and over (C) 19 and over (F)</td>
<td>Corrective measures required <strong>IMMEDIATELY</strong></td>
</tr>
</tbody>
</table>
Electrical Applications – Example Criteria

Problem = 143

Reference = 62

Or…

Delta = 81

Making this a grade 2 fix soon **
Problem= 225
Reference=91

Or…

Delta = 134

Making this a grade 1 fix Immediate
Optical Gas Imaging

Figure 5. IR spectra of Butane ($C_4H_{10}$) and Propane ($C_3H_8$).
Optical Gas Imaging
How about SF6?

LW spectrum
Product Differentiators:

- Resolution (clarity & accuracy)
- Non proprietary image format
- Visible camera integration
- GPS tagging
Thanks...