INFRARED THERMOGRAPHIC SURVEY

For

ABC Company, Inc.
123 Any Street
Any Town, US 12345

Survey Performed
March 24, 2020

By
JR Smith
AVP / Level III Thermographer
HSB Thermography Services
Ronald_Smith_Jr@hsb.com
(216) 588-1381

This report does not purport to set forth all hazards nor to indicate that other hazards do not exist. By issuing this report, neither the Company nor any of its employees makes any warranty, expressed or implied, concerning the contents of this report. Furthermore, neither the Company nor any of its employees shall be liable in any manner (other than liability that may be expressed in any policy of insurance that may be issued by the Company) for personal injury or property damage or loss of any kind arising from or connected with this inspection or failure to inspect.
ABC Company, Inc.
123 Any Street
Any Town, US 12345

Dear Mr. Johnson,

Thank you for allowing HSB Thermography Services to provide this service. We trust that this report proves helpful and is of assistance to you.

The scope of work included the following areas:

Outside Substation, Load Centers, Motor Control Centers, Control Panels, Breaker Panels, and Disconnects.

Equipment not surveyed during this visit includes de-energized, lightly loaded, inaccessible and/or deemed by facility personnel to be non-critical.

As a result of this service the following Findings are presented for your review:

1 CRITICAL
1 SEVERE
2 ALERT
0 ADVISORY

Should you have any questions or comments concerning this report or our services, we are here to assist you. Please feel free to call me at (216) 588-1381 or email Ronald_Smith_Jr@hsb.com

Sincerely,

JR Smith

AVP / Level III Thermographer
HSB Thermography Services
COMMENTS

The criteria used to categorize findings in this report are based on the potential effect that a failure will have on operations and/or production.

**ADVISORY** - The following is helpful information based on HSB’s experience and engineering judgement.

**ALERT** - The noted condition is routine in nature and is easily repairable. Cost is often limited to labor and a few minor parts.

**SEVERE** - The noted condition presents a risk of personnel injury, contained property damage and fire may be possible, and/or localized equipment damage and business interruption may result.

**CRITICAL** - The noted condition presents a significant risk of personnel injury, property or fire damage, exhibits signs of advanced degradation and imminent failure, and/or may subject the facility to an extended business interruption.

Infrared thermographic surveys are non-contact, non-destructive examinations used to find abnormal or unexpected thermal patterns or temperature differentials. These thermal patterns may indicate such conditions as loose connections, overloaded circuits or phases, deteriorated or damaged insulation or refractory, or excessive or unwanted friction, among others.

To perform the thermographic survey of your facility, HSB Thermography Services used the FLIR Thermacam infrared imaging system. This system utilizes the latest developments in un-cooled technology to generate the most accurate data available.

The calibration for this system is certified traceable to The National Institute of Standards and Technology, NIST, USA and the Swedish National Testing and Research Institute, SP. This calibration is based on the International Temperature Scale (ITS-90).

The Findings of this survey are in the following pages. These conditions warrant your attention.
### Finding Summary

<table>
<thead>
<tr>
<th>Finding No.</th>
<th>CATEGORY</th>
<th>Location Area</th>
<th>Equipment Location</th>
<th>Equipment ID</th>
<th>Est. Repair Cost Before Failure</th>
<th>Est. Repair Cost After Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CRITICAL</td>
<td>Outside Substation</td>
<td>Main Transformer</td>
<td>East Secondary Bushing</td>
<td>$5,000</td>
<td>$78,000</td>
</tr>
<tr>
<td>2</td>
<td>SEVERE</td>
<td>Raw Materials</td>
<td>Pellet Feeder</td>
<td>Main Breaker</td>
<td>$100</td>
<td>$4,000</td>
</tr>
<tr>
<td>3</td>
<td>ALERT</td>
<td>Packaging Dept.</td>
<td>Palletizer No.3</td>
<td>Fuse No.1673</td>
<td>$25</td>
<td>$40</td>
</tr>
<tr>
<td>4</td>
<td>ALERT</td>
<td>Press Dept.</td>
<td>Press No.22</td>
<td>Disconnect</td>
<td>$50</td>
<td>$475</td>
</tr>
</tbody>
</table>

**Total Estimated Repair Costs Before Failure**: $5,175  
**Total Estimated Repair Costs After Failure**: $82,515  
**Cost Avoidance**: $77,340

*Before and After costs- This estimate is based only on direct damage to the equipment and does not include the costs of business interruption, extra expenses, spoilage, etc.*
**Finding No.** 1  
**Category** CRITICAL

<table>
<thead>
<tr>
<th>Location Area</th>
<th>Outside Substation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Location</td>
<td>Main Transformer</td>
</tr>
<tr>
<td>Equipment ID</td>
<td>East Secondary Bushing</td>
</tr>
<tr>
<td>Est. Repair Cost Before Failure</td>
<td>$5,000</td>
</tr>
<tr>
<td>Est. Repair Cost After Failure</td>
<td>$78,000</td>
</tr>
<tr>
<td>Est. % of Production</td>
<td>90%</td>
</tr>
<tr>
<td>Est. Down Time</td>
<td>10-14 Days</td>
</tr>
</tbody>
</table>

**Recommendation/Comments:**

The thermal pattern indicates the transformer has an internal problem conducting heat out to the surface of the bushing. This should be investigated and repaired by a qualified HV electrical contractor.

*This is rated as “CRITICAL” due to the high replacement cost of the transformer and potential business interruption should a failure occur.*

**Repair notes:**

Signature: .................................................. Date:

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Finding No. 2

<table>
<thead>
<tr>
<th>Location Area</th>
<th>Raw Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Location</td>
<td>Pellet Feeder</td>
</tr>
<tr>
<td>Equipment ID</td>
<td>Main Breaker</td>
</tr>
<tr>
<td>Est. Repair Cost Before Failure</td>
<td>$100</td>
</tr>
<tr>
<td>Est. Repair Cost After Failure</td>
<td>$4,000</td>
</tr>
<tr>
<td>Est. % of Production</td>
<td>50%</td>
</tr>
<tr>
<td>Est. Down Time</td>
<td>2 Days</td>
</tr>
</tbody>
</table>

**Recommendation/Comments:**

The lug connection should be disassembled, cleaned, inspected for damage and repaired as necessary. Replace any discolored or damaged hardware and cut back the wire to sound conductor. Reassemble and torque the fastener according to the manufacturer’s specifications.

*This is rated as “SEVERE” due to the very high temperature and potential business interruption.*

**Repair notes:**

Signature:.....................................................Date:

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Finding No. 3  

<table>
<thead>
<tr>
<th>Category</th>
<th>ALERT</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Location Area</th>
<th>Packaging Dept.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Location</td>
<td>Palletizer No.3</td>
</tr>
<tr>
<td>Equipment ID</td>
<td>Fuse No.1673</td>
</tr>
<tr>
<td>Est. Repair Cost Before Failure</td>
<td>$25</td>
</tr>
<tr>
<td>Est. Repair Cost After Failure</td>
<td>$40</td>
</tr>
<tr>
<td>Est. % of Production</td>
<td>0%</td>
</tr>
<tr>
<td>Est. Down Time</td>
<td>0</td>
</tr>
</tbody>
</table>

**Location Image**

**Regression/Comments:**

Remove the fuse and clean the fuse and fuse clip. Reinsert the fuse ensuring the fuse clip is providing adequate tension and making good contact with the fuse. Also, all three fuses (yellow arrow) should be the same size, style, and type from the same manufacturer.

**Repair Notes:**

Signature: ……………………………………Date:

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**Finding No.** 4

**Category** ALERT

<table>
<thead>
<tr>
<th>Location Area</th>
<th>Press Dept.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment Location</strong></td>
<td>Press No.22</td>
</tr>
<tr>
<td><strong>Equipment ID</strong></td>
<td>Disconnect</td>
</tr>
<tr>
<td><strong>Est. Repair Cost Before Failure</strong></td>
<td>$50</td>
</tr>
<tr>
<td><strong>Est. Repair Cost After Failure</strong></td>
<td>$475</td>
</tr>
<tr>
<td><strong>Est. % of Production</strong></td>
<td>10%</td>
</tr>
<tr>
<td><strong>Est. Down Time</strong></td>
<td>1 Day</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Ref. Temperature</th>
<th>91.4 °F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area 1 Max. Temperature</strong></td>
<td>132.3 °F</td>
</tr>
<tr>
<td><strong>Area 2 Max. Temperature</strong></td>
<td>139.1 °F</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area 1: Rise</th>
<th>40.9 °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area 2: Rise</td>
<td>47.7 °F</td>
</tr>
</tbody>
</table>

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**Recommendation/Comments:**

The connections should be disassembled, cleaned, inspected for damage and repaired as necessary. Reassemble and torque fasteners according to the manufacturer's specifications using new hardware as required.

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**Repair notes:**

Signature: ........................................... Date:

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For more information or comments contact:

JR Smith- AVP/ HSB Thermography Services  
Cleveland, OH  
216-588-1381  
Ronald_Smith_Jr@hsb.com

<table>
<thead>
<tr>
<th>Western Region</th>
<th>Eastern Region</th>
</tr>
</thead>
</table>
| Dennis DeGerald LVL II Thermographer  
Madison, WI  
904-214-5201  
Dennis_DeGerald@hsb.com | Bill Viot LVL II Thermographer  
Hartford, CT  
860-281-2541  
William_Viot@hsb.com |
| Steve Woods LVL II Thermographer  
St. Louis, MO  
618-973-7835  
Steven_Woods@hsb.com | Charles Johnson LVL II Thermographer  
Richmond, VA  
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Charles_Johnson@hsb.com |
| Jim Nelson LVL II Thermographer  
Dallas, TX  
903-217-7016  
Jimmy_Nelson@hsb.com | Norm Gaver LVL II Thermographer  
Charlotte, NC  
704-892-33947  
Norman_Gaver@hsb.com |
| Richard Toth LVL III Thermographer  
Yuma, AZ  
916-995-2267  
Richard_Toth@hsb.com | Ron Griggs LVL II Thermographer  
Lakeland, FL  
863-413-6251  
Ronald_Griggs@hsb.com |
| Rick Stafford LVL II Thermographer  
Los Angeles, CA  
951-457-1229  
Rick_Stafford@hsb.com |

If you would like to learn more about electrical risk management, please click on the following link:

http://www.hsb.com/hsbext/Electrical_Risk_Management/