

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

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.



Inspection Summary

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

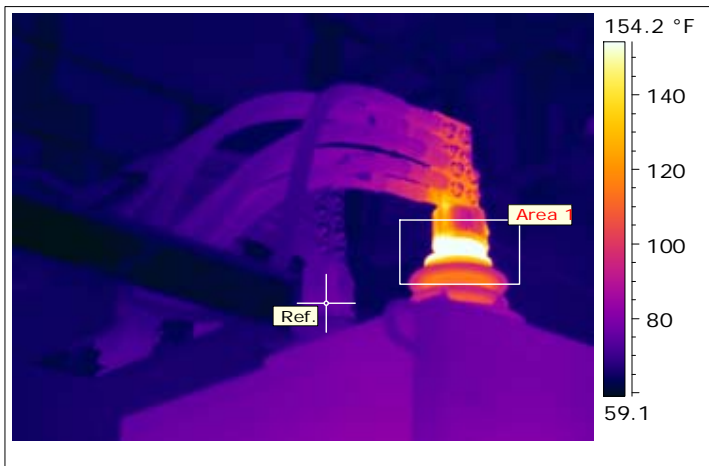
Total Estimated Repair Costs Before Failure	\$5,175
Total Estimated Repair Costs After Failure	\$82,515
Cost Avoidance =	\$77,340

**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**



Location Area	Outside Substation
Equipment Location	Main Transformer
Equipment ID	East Secondary Bushing
Est. Repair Cost Before Failure	\$5,000
Est. Repair Cost After Failure	\$78,000
Est. % of Production	90%
Est. Down Time	10-14 Days



Ref. Temperature	76.2 °F
Area 1 Max. Temperature	176.0 °F

Area 1: Rise	99.8 °F
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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:

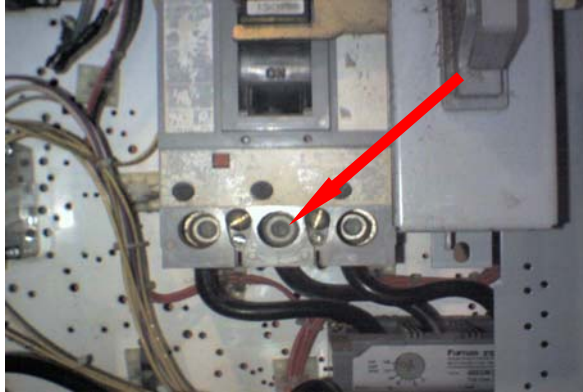
Signature:.....Date:

Finding No.

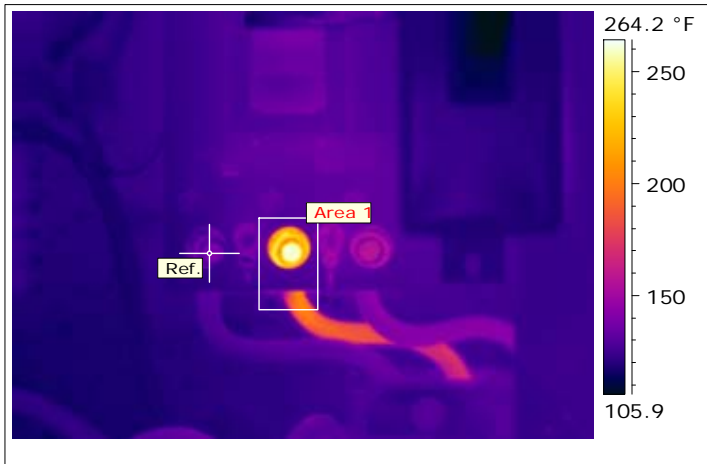
2

Category

SEVERE



Location Area	Raw Materials
Equipment Location	Pellet Feeder
Equipment ID	Main Breaker
Est. Repair Cost Before Failure	\$100
Est. Repair Cost After Failure	\$4,000
Est. % of Production	50%
Est. Down Time	2 Days



Ref. Temperature	140.1 °F
Area 1 Max. Temperature	262.5 °F

Area 1: Rise	122.4 °F
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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:

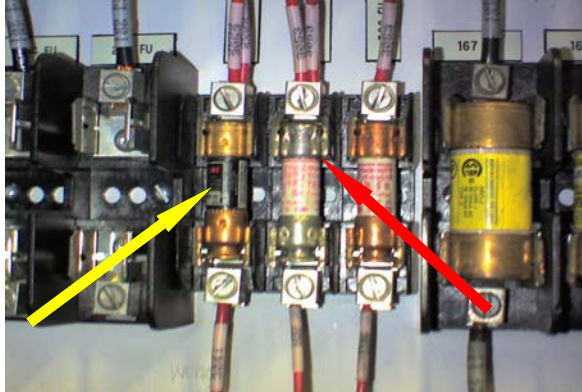
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Finding No.

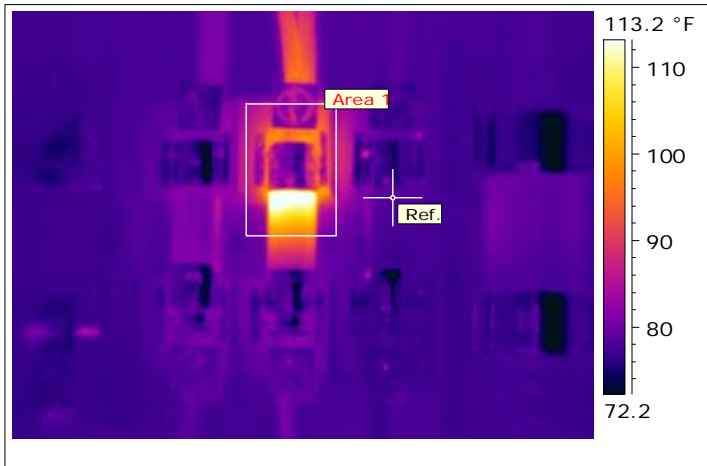
3

Category

ALERT



Location Area	Packaging Dept.
Equipment Location	Palletizer No.3
Equipment ID	Fuse No.1673
Est. Repair Cost Before Failure	\$25
Est. Repair Cost After Failure	\$40
Est. % of Production	0%
Est. Down Time	0



Ref. Temperature	78.9 °F
Area 1 Max. Temperature	121.0 °F

Area 1: Rise	42.1 °F
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Recommendation/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:

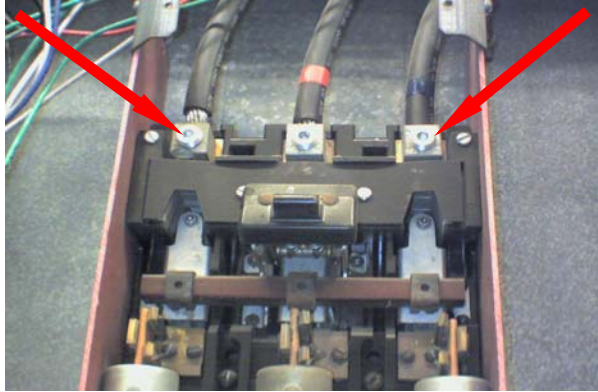
Signature:.....Date:

Finding No.

4

Category

ALERT



Location Area	Press Dept.
Equipment Location	Press No.22
Equipment ID	Disconnect
Est. Repair Cost Before Failure	\$50
Est. Repair Cost After Failure	\$475
Est. % of Production	10%
Est. Down Time	1 Day



Ref. Temperature	91.4 °F
Area 1 Max. Temperature	132.3 °F
Area 2 Max. Temperature	139.1 °F

Area 1: Rise	40.9 °F
Area 2: Rise	47.7 °F

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.

Repair notes:

Signature:.....Date:

For more information or comments contact:

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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/

The Hartford Steam Boiler Insurance and Inspection Company

HSB Thermography Services
One State Street
Hartford, CT 06102-5024



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HSB IIC Pilot Program Branch
Vibration Analysis * Ultrasound Analysis

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I. ANALYSIS BACKGROUND

The vibration measurements were collected on the machine casing at bearing locations in a vertical, horizontal, and axial direction using an accelerometer and vibration data collector. The vibration levels were compared to a database of vibration severity levels. The vibration severity levels are based on the vibration characteristics of machines with similar mechanical configurations and on ISO Standard 10816. The vibration levels were compared to previous measurements to establish the trend and determine the final severity.

CONDITION DEFINITIONS

Condition Level Vibration Analysis Indicates Action

Acceptable	Little or no deterioration in equipment condition.	There is no cause for concern. Note for future analysis.
Monitor	Developing Problems.	Monitor the vibration levels more frequently to establish a trend and to determine if repairs should be made during next shutdown.
Alarm	The machine is running rough.	Plan for a repair outage at the nearest opportunity. Until repaired, monitor closely.
Danger	A severe problem.	Correct problems immediately or at the first opportunity to avoid machine failure, unscheduled downtime, and secondary damage.

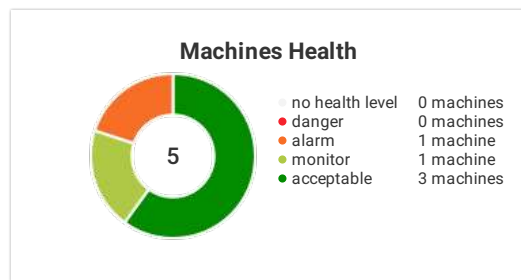
II. EQUIPMENT SUMMARY

The overall condition of equipment can have a large impact on the operation of any facility. As the condition of the equipment improves, there are several factors that are affected:

- Operating Costs will decrease.
- Reliability will increase.
- Building Environment quality will increase.


ABC Company

1234 Any Street, Any Town, US




	Health	Machine	Last Recorded	Faults	Type
1	Alarm	84-Fan Mold -10	Nov 12, 2019 GMT	Radial unbalance - Driven Fan	
2	Monitor	Shop 31 Mold Cooling Fan	Nov 12, 2019 GMT	Misalignment - Motor	
3	Acceptable	84-Fan Mold-12	Nov 12, 2019 GMT		
4	Acceptable	84-Fan Mold-7	Nov 12, 2019 GMT		
5	Acceptable	Shop 32 Mold Cooling Fan	Nov 12, 2019 GMT		


III. DETAILED ANALYSIS AND DATA




Scope



84-Fan Mold -10 - Fan
 Last Recorded Nov 12, 2019 4:05:45 PM GMT by Charlie Johnson



Critical

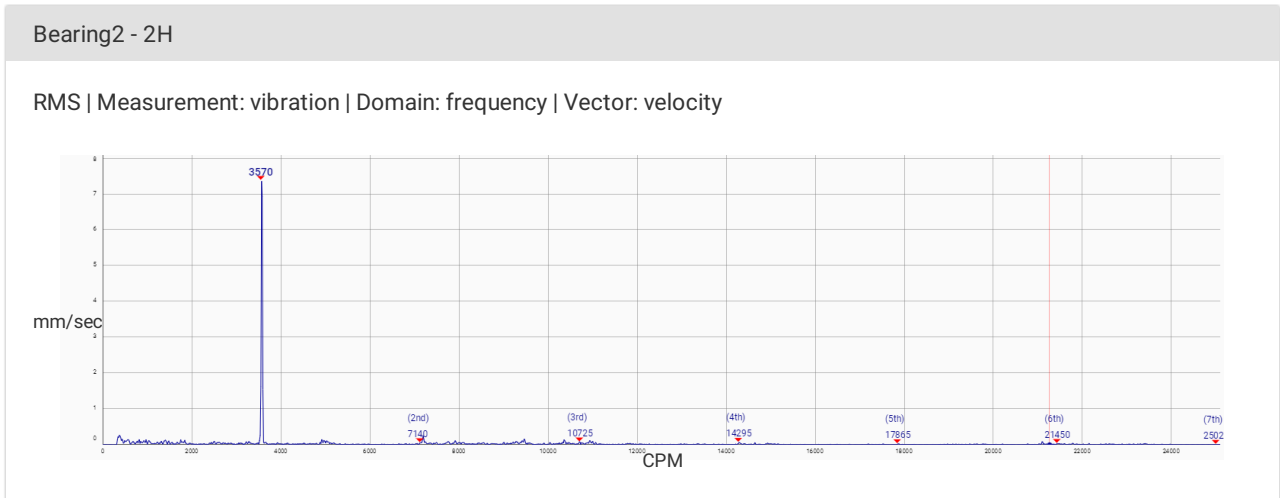


Overview
 Schedule the recommended activities in the next quarter and monitor the machine frequently until repaired.

alarm Radial unbalance - Driven Fan

The vibration levels at the fan running speed indicate a possible fan imbalance.

<p>Possible Cause</p> <ul style="list-style-type: none"> - Heavy spot. - Dirt build-up. - Erosion of fan blades. 	<p>Maintenance Practices</p> <ul style="list-style-type: none"> - Wash and clean as access permits. - Balance the fan.
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Shop 31 Mold Cooling Fan - Fan

Last Recorded Nov 12, 2019 3:54:10 PM GMT by Charlie Johnson



Critical



Overview

Monitor the machine more frequently.

monitor

Misalignment - Motor

Misalignment between the motor and the machine.

Possible Cause

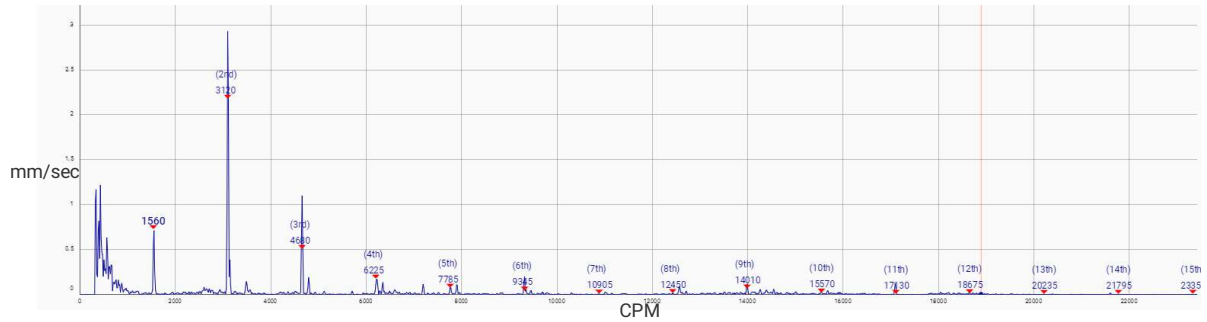
- Damaged or worn shaft or coupling.
- Pipe strain
- Soft foot
- Incorrect thermal growth offset
- Imprecise installation / maintenance practices

Maintenance Practices

- Inspect coupling for wear.
- Consider performing a precision shaft alignment.
- Continue to monitor.

Bearing1 - 1H

RMS | Measurement: vibration | Domain: frequency | Vector: velocity





84-Fan Mold-12 - Fan

Last Recorded Nov 12, 2019 4:08:29 PM GMT by Charlie Johnson



Critical



Overview

Continue with usual maintenance activities and monitoring on a regular basis.

Scope



84-Fan Mold-7 - Fan

Last Recorded Nov 12, 2019 4:11:46 PM GMT by Charlie Johnson



Critical

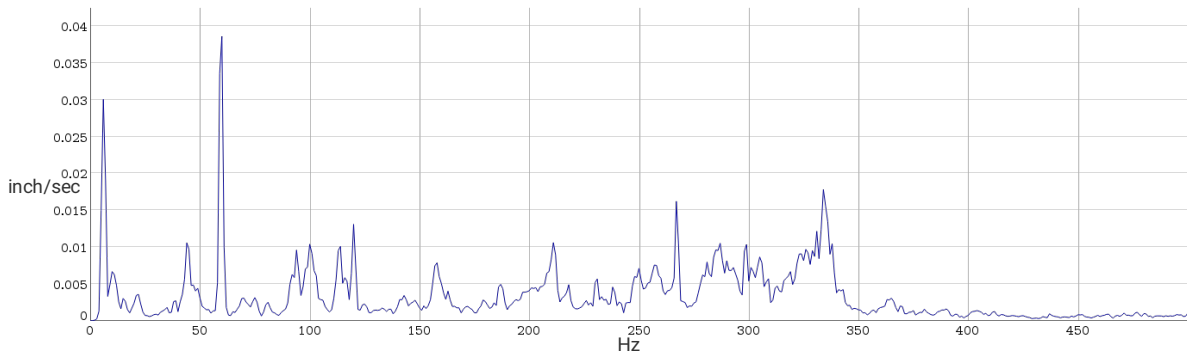
Overview

Overview

Continue with usual maintenance activities and monitoring on a regular basis.

Bearing1 - 1H

RMS | Measurement: vibration | Domain: frequency | Vector: velocity





Scope

Shop 32 Mold Cooling Fan

Last Recorded Nov 12, 2019 3:50:18 PM GMT by Charlie Johnson



Critical



Overview

Continue with usual maintenance activities and monitoring on a regular basis.