

INFRARED ELECTRICAL SYSTEM SURVEY

for

*ABC Shipping
123 Main Street
Anytown, USA*

at

*ABC Ship
ABC Terminal
Anytown, USA*



JERSEY INFRARED CONSULTANTS

P.O. Box 39
Burlington, NJ 08016
Phone: (609) 386-1281
Fax: (609) 387-4334

March 6, 2014

Mr. Smith
ABC Shipping
123 Main Street
Anytown, USA

RE: INFRARED ELECTRICAL SYSTEM SURVEY REPORT
OUR JOB NUMBER: 14-0000.00

Dear Mr. Smith;

Here is our completed report and electronic format for the Infrared Electrical System Survey performed at the ABC Ship vessel located at ABC Terminal in Anytown, USA on February 28, 2014.

Thank you for this opportunity to serve you. If you have any questions or if we can be of further assistance, please feel free to call.

Very truly yours,

MC
Level III
Infraspection Institute Certified Infrared Thermographer

MC:clt
Enclosure

INTRODUCTION TO THE INFRARED ELECTRICAL SYSTEM SURVEY

Infrared thermography is a form of non-contact, non-destructive testing used to detect and document thermal patterns and associated temperatures across a given surface. Performed regularly, infrared inspections can help to identify incipient equipment failures.

Our Infrared Surveys are performed by Certified Thermographers using a portable infrared imaging system called FLIR ThermoCAM. This equipment detects infrared energy emitted from an object and converts it into an image which is displayed on a monitor screen.

Because infrared energy is a direct and proportional function of temperature, the video image is designed to depict temperature levels on the monitor. This thermal image looks very similar to a black and white or a color television picture where the various shades of color represent different temperature levels throughout the chosen temperature range. In the black and white mode, darker shades of gray correspond to lower temperatures while lighter shades of gray correspond to higher temperatures. In the color mode, colors are matched to the reference bar at the side of the monitor screen. Temperature values increase for those colors which appear closer to the top of the scale.

Our FLIR ThermoCAM equipment has the capability to sense object temperatures from -10° Celsius to $+1500^{\circ}$ Celsius, with sensitivity of as little as 0.07 Celsius degrees.

When an area or component with an unusual temperature differential is located, our thermal imager is used to measure the temperature of the problem area.

Once the temperature and location of the problem area have been noted, a photograph is taken of the image displayed on the FLIR ThermoCAM monitor. These Thermograms, along with a standard photograph and our problem definition, provide you with the necessary information to correct a problem before it becomes serious.

For your reference as a maintenance scheduling tool, the following temperature differential table is presented. This table is intended only as a guideline based on our experience with electrical system inspections. Actual scheduling of repairs is the customer's responsibility.

Temp. Differential:	Priority 3	1 - 3 C°	Possible deficiency; inspect
	Priority 2	4 - 15 C°	Repair as time permits
	Priority 1	Over 15 C°	Major deficiency; repair as soon as possible

It must be noted that the above temperature differential/severity guide is based on our experience with electro/mechanical inspections. Although some of the problems identified in this report may seem insignificant, the ultimate decision to repair them is the customer's responsibility.

March 6, 2014

ABC Shipping
123 Main Street
Anytown, USA

THERMOGRAPHER'S COMMENTS
OUR JOB NUMBER: 14-2989.1

On February 28, 2014, an Infrared Electrical System Survey was performed at the ABC Ship vessel located at ABC Terminal in Anytown, USA.

The Survey covered electrical equipment in the areas listed on the "List of Equipment Surveyed".

One (1) problem and one (1) normal was located during the Survey, both required a thermogram. The problem was photographically recorded. This photograph, along with its respective thermogram and a brief description of the problem, appears on the following pages.

It is recommended that the cause of each problem be investigated and that the proper corrective measures be taken. A follow-up Survey should then be performed once repairs have been made. Infrared surveys are then recommended at least once a year as part of a preventive maintenance program.

Please note that all inspections are performed with the electrical system in an "as found" condition. No attempt is made to verify that the system is under full load at the time of the infrared survey.

Ammeter readings, where provided, are given as a reference only and are not necessarily indicative of an overloaded circuit.

This report depicts thermal patterns in electrical system components at the time of the infrared survey. Assurances regarding the integrity of the electrical system are neither provided nor implied.

MC
Level III
Infraspection Institute Certified Infrared Thermographer

MC:clt

ABC Shipping
123 Main Street
Anytown, USA

Job Number: 14-0000.00

Avoided Cost Analysis Report for Infrared Electrical System Survey

This Avoided Cost Analysis Report calculates the estimated cost savings realized from this Infrared Survey. The calculations utilized in this report are based upon insurance industry cost estimates for loss experience with commercial and industrial facilities. These calculations take into account the severity of each exception along with the overall size of the facility.

The calculations shown below multiply the number of exceptions found during the Survey by the severity of each exception. By inputting the cost to perform the Survey, the gross potential savings from this report are automatically calculated. The calculations are based on the cost of the Infrared Survey and do not include preparation or remediation figures.

Because no one can actually calculate the exact avoided costs provided by an infrared inspection, the numbers contained in this report are intended to serve as a guide.

Total # of Critical or Serious Anomalies = (figure based on your job)

Total # of Intermediate or Minor Anomalies = (figure based on your job)

Cost of Infrared Survey = (figure based on your job)

Gross Potential Savings = (figure based on your job)

ABC Shipping

TABLE OF CONTENTS
OUR JOB NUMBER: 14-0000.00

PICTURE	LOCATION	EQUIPMENT	
1	Control Room	SWBD, No. 1, 440V Feeder Panel	
2	Generator Room	Emergency SWBD, Circuit Breaker, Main SWBD (Bus Tie)	2

Database Terminology

Upon entering into an area, our personnel collect the necessary data to construct the database by recording the nameplate information on each piece of electrical equipment.

Listed below are some common abbreviations used for equipment type.

Air Handler Unit	AHU	Lightning Arrestor	L A
Automatic Transfer Switch	A T S	Lighting Contactor	L C
Battery Rack	B A T T	Metering Cabinet	M E T
Bus Duct	B U S	Motor	M T R
Capacitor	C A P	Motor Control Center	M C C
Circuit Breaker	C B	Motor Controller	M C
Control Cabinet	C C	Oil Circuit Breaker	O C B
Current Transformer	C T	Peckerhead	P K H D
Disconnect Switch	D I S C	Potential Transformer	P T
Distribution Panel	D P	Power Distribution Unit	P D U
Emergency Distribution Panel	E D P	Power Panel	P P
Emergency Power Panel	E P P	Power Transformer	X F M R
Emerg. Power Transformers	E X F M R	Switchgear	S G
Environmental Control Unit	E C U	Uninterruptable Power Supply	U P S
Fire Pump Panel	F P P	Voltage Regulator	V R
Generator	G E N	Variable Speed Drive	V S D
Incoming Lines	I L	Variable Frequency Drive	V F D
Junction Box	J B		

In Service	Equipment is observed in the "on" position. Unless otherwise noted, no attempt is made to verify that the device is under load.
Picture No.	Corresponds to the predictive maintenance inspection card number.
Delta T	Temperature rise noted on the predictive maintenance inspection card.
Visual	Notation for broken parts, excessive dirt, rust, dead animals, etc. The results are either pass (P) or fail (F).
Ultrasound	Results of ultrasonic test data (when performed). The results are either pass (P) or fail (F).
Follow-up Required	Indicates a follow-up Survey should be performed.
Comments	Summary of findings. More details can be found on the predictive maintenance inspection card.

Route No.: 1

Date: 2/28/2014

List of Equipment Surveyed

Location	Equipment Type	Equipment ID	In Service	Picture No.	Priority	Visual	Ultra Sound
Control Room							
Control Room	SWBD	#3 Diesel Generator	Yes			Pass	
Control Room	SWBD	#2 Diesel Generator	Yes			Pass	
Control Room	SWBD	Emergency	Yes			Pass	
Control Room	SWBD	Bus Tie	Yes			Pass	
Control Room	SWBD	Shaft Generator	Yes			Pass	
Control Room	SWBD	#1 Diesel Generator	Yes			Pass	
Control Room							
Control Room	SWBD	Back - #1 Diesel Generator	Yes			Pass	
Control Room	SWBD	Back - Shaft Generator	Yes			Pass	
Control Room	SWBD	Back - Bus Tie Panel	Yes			Pass	
Control Room	SWBD	Back - Syncro Panel	Yes			Pass	
Control Room	SWBD	Back - #2 Diesel Generator	Yes			Pass	
Control Room	SWBD	Back - #3 Diesel Generator	Yes			Pass	
Control Room	SWBD	#2 440V Feeder	Yes			Pass	
Generator Room							
Generator Room	SWBD	#1 440V Feeder	Yes	1		Pass	
Generator Room	SWBD	EMERG/SWBD Shore Connection	Yes	2		Pass	
Generator Room	SWBD	Emergency 450V	Yes			Pass	
Generator Room	SWBD	440V Feeder	Yes			Pass	
Generator Room	SWBD	220V Feeder	Yes			Pass	

Note: In service designates device was observed in the "On Position". Unless otherwise noted, no attempt is made to verify that device is under load.

*NS indicates Equipment Not Surveyed

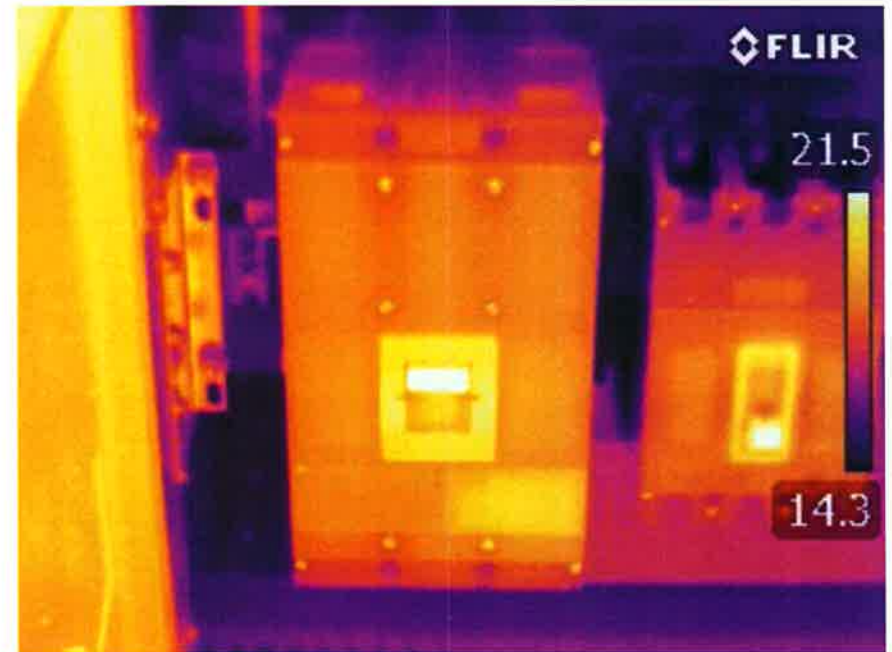
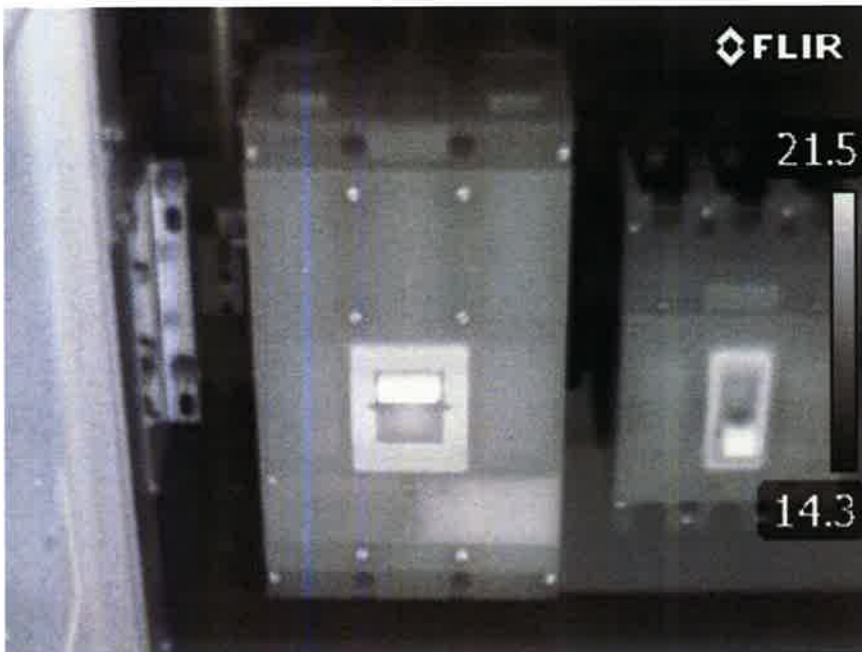
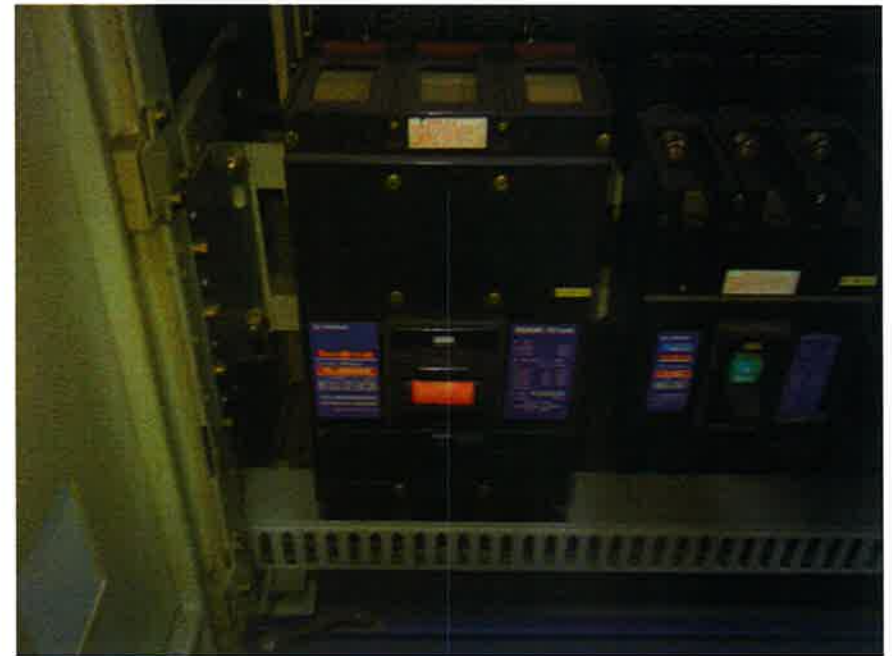
Area/Picture No. 1 **Job No.** 14-0000.00 **Date** 2/28/14
Location Control Room
Equipment SWBD, No. 1, 440V Feeder Panel
Wind Speed N/A **Wind From** N/A **Sky** N/A
Emiss. 1.00 **B/G** N/A° **Distance** 5' **Lens** 1x
Rated Load N/A **Measured Load** N/A **% Load**
Ambient Temp 22°C **N/A ° Rise Over** N/A
Comments Thermogram shows a normal thermal pattern.

Priority

Repair Check Date

° Rise Over

Notes



Area/Picture No. 2 Job No. 14-0000.00 Date 2/28/14

Location Generator Room

Equipment Emergency SWBD, Circuit Breaker, Main SWBD (Bus Tie)

Wind Speed N/A Wind From N/A Sky N/A

Emiss. 1.00 B/G N/A° Distance 5' Lens 1x

Rated Load 800/500 Amps Measured Load N/A Amps % Load

Ambient Temp 16°C 8 ° Rise Over Ambient

Comments Circuit Breaker shows abnormal temperature on top.

Thermal Anomaly Temperature: 24°C

Note: Further investigation required.

Priority 2

Repair Check Date ° Rise Over

Notes

