Four Seasons Environmental, Inc.

Energy Audit
DAS 0917108

Prepared for:

Ohio Department of Corrections and Rehabilitation
Lebanon Correctional Institution

Submitted To:
Ramsey E. Najjar, P.E., LEED AP
Energy Services Manger
State Architect's Office
4200 Surface Road
Columbus, Ohio 43228

3791 State Route 63
Lebanon, Ohio 45036

February 4, 2009

Four Seasons Environmental, Inc.
43 New Garver Road • Monroe, OH • 45050-1243
Telephone (513) 539-2978 • Fax (513) 539-2972
www.fseinc.net

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Energy Audit Proposal
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Four Seasons Environmental, Inc.

Section 1:
Executive Summary

Initial Activity

Four Seasons Environmental, Inc. began this audit work in accordance with DAS-097108 in September 2009.

Preliminary Energy Use Analysis

This preliminary activity resulted in the conclusion that the Lebanon Correctional Institution is currently consuming energy at a rate of $4.80 per square foot. With very little of this 435,000 square feet being air conditioned, FSE would expect the target energy consumption rate to be $2.25 per square foot.

Level I - Walk-Thru Analysis

After walking through the facilities and taking 200 photographs, FSE was able to:

- Determine a 75 percent natural gas / 25 percent electricity energy cost split.
- Understand that electricity was produced via cogeneration when the facility opened in 1959. However, the cogeneration capability was removed in 1984.
- The no cost / low cost energy savings opportunities were surprising.

FSE also spent three (3) days on site performing a thermographic audit which is included in its entirety in the last section of the Appendices. The high visibility results include:

- Identifying steam leaks and piping deterioration
- Locating Leaking Steam Traps
- Identifying condensate return receiver and pumping problems.

Section 1:
Executive Summary

Level II - Energy Study and Engineering Analysis

In this phase we were able to take a careful look at the operation and maintenance practices thanks, in large measure, to the Lebanon Correctional Institution's maintenance staff's willingness to share information. The list of energy-saving options also came into clear focus.

Assessment Summary

The following Energy Analysis features an assessment of the Lebanon Correction Institution as prepared by Four Seasons Environmental, Inc. Through data collection, facility walk throughs and data analysis, Four Seasons Environmental, Inc. proposes a number of energy-conserving measures.

As the Ohio State Architect's Office/Energy Service Group reviews this report, we believe it will benefit the readers to summarize the findings, several of which may be quite compelling.

Bring Closure to Steam Supply/Condensate Return System

	ECM Cost	Total Annual Savings	ECI (Calculated) $/ft^2
Repair Steam Leaks	$18,000	$33,393	$4.71
Replace/Repair Leaking Steam Traps	$119,700	$200,000	$4.33
Repair/Replace Condensate Return Pumps	$203,260	$94,099	$4.57
Total	**$340,960**	**$327,402**	**$4.04**

Four Seasons Environmental, Inc.

Section 1: Executive Summary

In applying our 27 years of facility operation, maintenance and repair experience, if we're asked, "What would we do first," we would focus our initial efforts on closing the steam supply/condensate return system. This $340,960 effort should pay for itself in one year.

Cause the Heating and Ventilating System to Be Restored to a Functioning, Well-Controlled System

	ECM Cost	Total Annual Savings	ECI (Calculated) $/ft^2
Replace Heating and Ventilating Units that Need to be Replaced	$2,003,000	$250,523	$4.22
Replace 1959 Existing Pneumatic Control System with New DDC Control System	$720,000	$313,154	$4.07
Update New DDC Control System Sequence of Operation	$32,000	$62,631	$4.65
Total	**$2,755,000**	**$626,308**	**$3.35**

We applaud the State Architect's office and the Lebanon Correctional Institute for taking the initiative to address this issue prior to our being commissioned to produce this audit. After the steam and condensate system has been made "tight" and the make-up water has been reduced to five percent (5%), the next priority needs to be to replace the failed heating and ventilating units and the controls so that the entire

Section 1: Executive Summary

heating and ventilating system can function up to the expectations of the client. Once the heating and ventilating air handlers have been replaced and the DDC controls have been installed, the Building Automation System can then be used to optimize the system operation in terms of temperature and energy use. The fact that the A/E selection is already in process is to be commended.

Consider Cogeneration

	ECM Cost	Total Annual Savings	ECI (Calculated) $/ft^2
Consider a Cogeneration System	$1,209,600	$370,225	$3.90

Because the existing steam plant has a 250-psi capability and sufficient capacity to generate over half of the Institution's electricity, a cogeneration installation should be carefully considered after the steam and condensate system has been made whole and the H & V air handlers/controls have been replaced.

Lights and Windows

	ECM Cost	Total Annual Savings	ECI (Calculated) $/ft^2
Replace T-12 Lamps and Ballasts with T-8 Lamps and Ballasts	$172,480	$39,968	$4.70
Replace a Variety of Windows	$7,563,300	$26,143	$4.73
	$1,293,600	$8,809	$4.77
	$541,200	$3,206	$4.78
	$290,400	$4,187	$4.78

Please note that these energy-saving methods are listed in order of priority. Further information regarding each measure is discussed later in Section 5: Recommendations.

Section 1:
Executive Summary

Long-Term Plans

CMMS

With a multi-faceted maintenance workforce in place, we suggest that with a well-orchestrated Computerized Maintenance Management System in place, such as we use at all twenty-two (22) project sites in six (6) states, to manage our preventive maintenance requirements with the able assistance of 380 employees, may benefit LeCI in the same way it has benefited FSE and all of its facility operation and maintenance clients since 1987.

Specialty Trade Outsourcing

In the event that the onsite maintenance staff identifies high-tech capabilities that are/will be needed to carry out this CMMS plan and continue a proactive preventive maintenance program, specialty trades (DDC controls/HVAC), LeCI may best be served by outsourcing selected specialty trades just as we have seen several of our Ohio-based clients do so successfully.

Ongoing Support

We structured this Energy Audit so that it can be a useful resource to the Lebanon Correctional Institution and the consulting engineer as he proceeds with the design to replace and upgrade the heating and ventilating units and controls.

Please be assured of our ongoing support of the Lebanon Correctional Institute's initiatives to reduce energy consumption and improve system performance to the client's satisfaction.

Respectfully submitted,

Reed D. Tarkington, LEED AP CFM
Vice President

Four Seasons Environmental, Inc.

Executive Summary of Suggested Capital Improvement ECM's (10 years payback or lower)

ECM No.	Agency Code	Facility Name	Current facility energy use intensity	Current facility utility cost	Suggested ECM to be implemented Now	Total Cost of Suggested ECMs	Total Calculated Savings ($)	Calculated Facility Energy Intensity after implementation	Calculated facility utility cost	Simple Payback
XXX	XXX	xxx	Kbtu/sq.ft.	$/Sq.ft.	i.e. (B1+H1) from ECM's summary	Added cost fro	Added Savings	Kbtu/sq.ft.	$/sq.ft.	years
1	DRC	LeCI	756.84	4.79	Repair Steam Leaks throughout facility	18000	33393	741.90	4.71	0.539
2	DRC	LeCI	756.84	4.79	Replace a portion of the steam traps throughout facility	119700	200000	667.35	4.33	0.599
3	DRC	LeCI	756.84	4.79	Repair/Upgrade Condensate Return system	203260	94099	714.74	4.57	2.160
4	DRC	LeCI	756.84	4.79	Repair/Replace HVAC equipment	2003000	250523.6	644.74	4.22	7.995
5	DRC	LeCI	756.84	4.79	Replace HVAC Control System	72000	313154.5	616.72	4.07	0.230
6	DRC	LeCI	756.84	4.79	Sequence of Operation Update		62630.89	728.82	4.65	
					NOTE: ECMs 1 - 6 should be considered as a minimum for this project, as they are most critical for proper facility operation.					
					TOTAL FOR HVAC ECMs (1 - 6):	**2,415,960**	**953,801**	**414.59**	**2.60**	**2.533**
7	DRC	LeCI	715.88	4.79	Install 750kW Steam Turbine cogeneration system	1209600	370225.4	716.54	3.90	3.267
					NOTE: ECM 7 should be strongly considered for this project, due to a favorable payback period, and existing infrastructure from the previous cogeneration system					
					TOTAL FOR HVAC AND COGEN ECMs (1 - 7):	**3,625,560**	**1,324,026**	**279.22**	**1.75**	**2.738**
8	DRC	LeCI	756.84	4.79	Retrofit (121) 2L 8ft T12 fixtures w/2L 8ftT8					
9	DRC	LeCI	756.84	4.79	Retrofit (831) 2L 2ft T12 fixtures w/2L 2ftT8					
10	DRC	LeCI	756.84	4.79	Retrofit (6) 4L 4ft T12 fixtures w/4L 4ft T8					
11	DRC	LeCI	756.84	4.79	Replace (112) 400w Metal Halide (MH) fixtures w/6L T8 high ballast factor (hbf)					
12	DRC	LeCI	756.84	4.79	Replace (90) 2L 8ft T12 and (10) 400w MH fixtures with (95) 4L T8 hbf					
13	DRC	LeCI	756.84	4.79	Replace (12) 250w MH w/4L T8 hbf					
14	DRC	LeCI	756.84	4.79	Replace cafeteria MH and 2L 8ft T12 w/T8 sealed fixtures					
15	DRC	LeCI	756.84	4.79	Replace (8) 175w MH w/3L T8 strip fixtures					
16	DRC	LeCI	756.84	4.79	Retrofit (9) 250w MH in Chapel w/150w quad tube CFLs					
17	DRC	LeCI	756.84	4.79	Retrofit (245) 400w HPS systems w/250w pulse start MH systems					
18	DRC	LeCI	756.84	4.79	Install new photocell or automatic controls for exterior lighting					
19	DRC	LeCI	756.84	4.79	Replace (8) incandescant exit signs w/LED exit signs					
20	DRC	LeCI	756.84	4.79	Install (14) wall and area occupancy sensors					
					TOTAL FOR ALL LIGHTING ECMs:	**172480**	**39968**	**752.44**	**4.70**	**4.315**
21	DRC	LeCI	756.84	4.79	Replace Windows in Cell Block Buildings	7563600	26144	745.14	4.73	289.316
22	DRC	LeCI	756.84	4.79	Replace Windows in Administration Building (incl. Visiting, Corridor)	1293600	8809	715.20	4.77	146.846
23	DRC	LeCI	756.84	4.79	Replace Windows in Classroom Building	541200	3207	755.50	4.78	168.771
24	DRC	LeCI	756.84	4.79	Replace Windows in Gymnasium	290400	4188	754.97	4.78	69.349
					TOTAL FOR ALL WINDOW ECMs:	**9,688,800**	**42,347**	**747.85**	**4.69**	**228.794**

Section 2:
Facility Overview

Lebanon Correctional Institution Overview

The Lebanon Correctional Institution (LeCI) is a medium-security detention facility in Ohio's Department of Rehabilitation and Corrections. Located on State Route 63, between the communities of Lebanon and Monroe in southwest Ohio, it consists of 554,000 square feet of space, 435,000 square feet or which is conditioned.

Photo Caption: The LeCI is located just north of Cincinnati, Ohio

Basic Information

Address:
P. O. Box 56
3791 State Route 63
Lebanon, Ohio 45036

Phone: (513) 932-1211

Fax: (513) 932-1320

Date Opened: 1960

Total Acreage: 1,900

Total Staff: 516

Four Seasons Environmental, Inc.

Section 2:
Facility Overview

Photo Caption: Aerial view of the Lebanon Correctional Institution.

Lebanon Correctional Institution Breakdown

The Lebanon Correctional Institution is divided into several smaller facilities, including:

- Administrative offices
- Classroom space
- Chapel
- Kitchen/dining facilities
- Laundry
- Gymnasium
- Manufacturing
- Inmate housing

The following pages will highlight the many different components of the facility.

Section 2:
Facility Overview

Administration/Visiting
The administration area contains the general offices for the Lebanon Correctional Institution, including that of the warden (Tim Brunsman). There is also an area for inmate visitation. A corridor, known as the "North Corridor," connects the administration/visiting area to the cell block corridor.

Chapel
Non-denominational worship space is provided for the inmates.

Classroom
Classroom space is provided for those inmates wishing to further their education. There are seven classrooms on the main level, and a hobby area in the lower level.

Section 2:
Facility Overview

Gymnasium/Auditorium
The gymnasium allows inmates the ability to participate in physical activities, such as basketball and weightlifting, among others. It also serves as an auditorium/assembly hall, with a performance stage and a projection room.

Kitchen/Dining
Food preparation for daily meals takes place in the kitchen area. Three dining halls are provided for the inmates to have their meals.

Laundry
As its name implies, the laundry provides clean uniforms, towels and sheets for the entire facility.

Section 2:
Facility Overview

Industries/Maintenance
The industries/maintenance building provides a manufacturing environment for the inmates. It is divided into separate areas, including a tag shop for the manufacture of automotive license plates, and a bed shop for the manufacture and repair of beds in the Lebanon Correctional Institution.

Inmate Housing (Cell Blocks)
Twelve cell blocks serve as the residence quarters for the inmates. Similar in construction, they are three-story buildings (except R-block), each with approximately 40 to 50 cells per building. Segregation cells are provided, as is hospital space for those in need of medical attention.

Section 3: Utility Analysis

Utility Analysis Summary

In reviewing the utility usage over the past three (3) years, the following observations are noteworthy:

- **2008-2009**: Unit cost of natural gas, which is approximately $0.51/ccf, is in line with current commodity natural gas purchasing contracts.

- **2008-2009**: Unit cost of electricity, which is approximately $0.074/KWH, is in line with current commodity electricity purchases. Based on our recent experience, a competitive acquisition of this utility could possibly reduce this cost by $0.01/KWH or $70,000 per year. For example, we just witnessed an electrical rate competition between DPL&L and First Energy. First Energy was the successful provider for 2010 at $0.059/KWH.

  Four (4) other local experiences wherein FSE operates and maintains these facilities are::

2009	General Electric Call Center (Kettering, OH)	400,000 square feet	$0.063/KWH
2009	IRS Service Center (Covington, KY)	400,000 square feet	$0.066/KWH
2009	Taft Laboratory (Cincinnati, OH)	165,000 square feet	$0.061/KWH
2009	Hamilton Laboratory (Cincinnati, OH)	146,000 square feet	$0.972/KWH

- **2008-2009**: The utility cost per square foot was: $4.80

  $2,087,696 / 435,000 sqf = $4.80

  This cost seems unusually high, particularly when one considers the fact that the space is largely not air conditioned. Based on

Section 3: Utility Analysis

local experience, we would expect these costs to be in the $2.25 per square foot range. Because the Lebanon Correctional Institution is older and has lengthy steam supply and condensate return runs, FSE believes that the target should be somewhat above $2.00 per square foot, instead of slightly below $2.00 per square foot. Given these circumstances, we are proposing a target of $2.25 per square foot.

Probable reasons for this anomaly are:

- Numerous steam leaks.
- Steam traps blowing through.
- Significant amounts of condensate not being returned to the steam plant.
- Steam coils are operating without adequate control.

- The 2008-2009 cost ratio between natural gas and electricity is 75 percent natural gas and 25 percent electricity, as compared and contrasted to four (4) local experiences where we operate maintenance and repair these facilities.

	Square Feet	% Natural Gas Cost	% Electricity Cost	Cost Per Square Foot
G.E. Call Center (Kettering, OH)	400,000	16.6%	83.4%	$2.06
IRS Service Center (Covington, KY)	400,000	9.4%	91.6%	$2.06
Taft Laboratory (Cincinnati, OH	165,000	23.5%	76.5%	$1.52
Hamilton Laboratory (Cincinnati, OH)	146,000	23.7%	76.3%	$2.18

Section 3:
Utility Analysis

The reason for the different natural gas/electricity mix is that all four (4) facilities are air conditioned, whereas the Lebanon Correctional Institution is not air conditioned.

- The highest priority target is therefore natural gas usage.

- If the steam leaks are repaired, the condensate return pumps are repaired or replaced, the leaking steam traps are repaired or replaced, the defunct heating and ventilating units are replaced, and a DDC control system is installed complete with Building Automation System Central Control Station, the $2.25 per square foot figure should realistically be obtained resulting in an annual savings of $1,108,946.

The State Architect's Office, DRC and LeCI have all recognized that significant opportunities exist at the LeCI site and have consequently authorized this energy audit to proceed. Four Seasons Environmental, Inc. is privileged to join with the State Architect's Office, the Department of Rehabilitation and Corrections and the Lebanon Correctional Institution in identifying energy opportunities and then proposing cost-effective solutions to those opportunities.

The following pages provide three years of past utility consumption information for the Lebanon Correctional Institution. The tables include the cost and usage for both natural gas and electricity, as well as the total costs.

Section 3: Utility Analysis

Actual Utility Figures

2006-2007 Actual LeCI Utility Figures

	Natural Gas		Electric		TOTAL
	COST	USAGE (CCF)	COST	USAGE (kWh)	COST
JUL	$65,818.44	$153,960.00	$39,088.65	$634,183.00	$104,907.09
AUG	$67,319.33	$153,912.00	$38,858.61	$617,670.00	$106,177.94
SEP	$66,234.29	$149,129.00	$38,329.26	$578,128.00	$104,563.55
OCT	$94,778.59	$192,875.00	$34,712.70	$505,418.00	$129,491.29
NOV	$134,582.03	$264,513.00	$35,552.70	$550,461.00	$170,134.73
DEC	$165,559.73	$315,477.00	$41,693.84	$593,739.00	$207,253.57
JAN	$167,084.85	$349,767.00	$39,802.22	$548,360.00	$206,887.07
FEB	$166,858.79	$357,245.00	$41,681.69	$595,309.00	$208,540.48
MAR	$153,812.97	$337,662.00	$38,853.86	$514,076.00	$192,666.83
APR	$122,194.56	$291,636.00	$38,221.51	$512,135.00	$160,416.07
MAY	$79,919.20	$212,728.00	$42,038.86	$603,502.00	$121,958.06
JUN	$72,873.98	$158,630.00	$47,637.78	$610,266.00	$120,511.76
TOTAL	**$1,357,036.76**	**$2,937,534.00**	**$476,471.68**	**$6,863,247.00**	**$1,833,508.44**

2007-2008 Actual LeCI Utility Figures

	Natural Gas		Electric		TOTAL
	COST	USAGE (CCF)	COST	USAGE (kWh)	COST
JUL	$66,657.66	$154,313.00	$47,272.79	$616,963.00	$113,930.45
AUG	$64,666.32	$155,185.00	$49,484.00	$646,163.00	$114,150.32
SEP	$64,369.36	$157,585.00	$44,672.36	$660,852.00	$109,041.72
OCT	$88,954.75	$190,868.00	$38,682.36	$535,124.00	$127,637.11
NOV	$159,506.67	$301,742.00	$40,695.70	$607,868.00	$200,202.37
DEC	$184,577.09	$390,354.00	$40,570.37	$616,225.00	$225,147.46
JAN	$182,726.73	$416,389.00	$42,357.51	$651,126.00	$225,084.24
FEB	$184,534.53	$392,128.00	$38,993.01	$567,560.00	$223,527.54
MAR	$192,879.63	$383,381.00	$40,776.00	$571,467.00	$233,655.63
APR	$139,578.36	$257,861.00	$37,121.04	$488,809.00	$176,699.40
MAY	$98,962.29	$165,184.00	$37,740.43	$513,196.00	$136,702.72
JUN	$107,229.06	$169,254.00	$45,515.05	$684,329.00	$152,744.11
TOTAL	**$1,534,642.45**	**$3,134,244.00**	**$503,880.62**	**$7,159,682.00**	**$2,038,523.07**

Four Seasons Environmental, Inc.

Section 3:
Utility Analysis

2008-2009 Actual LeCI Utility Figures

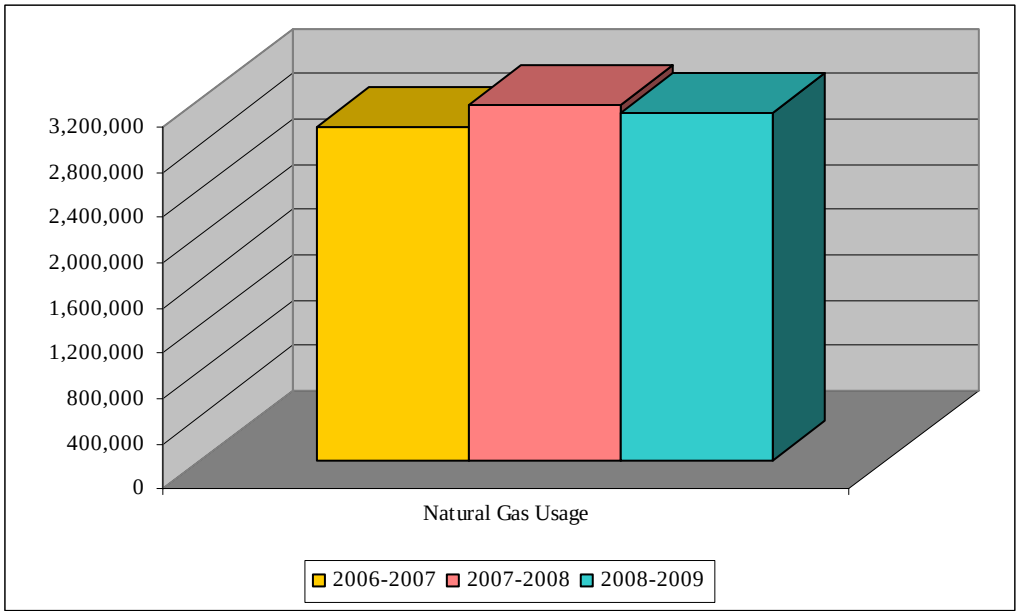
	NATURAL GAS		ELECTRIC		TOTAL
	COST	USAGE (CCF)	COST	USAGE (kWh)	COST
JUL	$126,388.91	$172,845.00	$44,280.41	$647,109.50	$170,669.32
AUG	$106,206.65	$174,687.00	$43,826.57	$637,200.00	$150,033.22
SEP	$100,569.14	$174,767.00	$47,334.53	$577,851.00	$147,903.67
OCT	$140,602.35	$249,672.00	$43,551.99	$541,910.00	$184,154.34
NOV	$182,375.27	$351,951.00	$44,783.14	$569,539.00	$227,158.41
DEC	$201,404.21	$409,030.00	$48,316.44	$637,634.50	$249,720.65
JAN	$191,699.11	$388,700.00	$43,736.66	$558,265.00	$235,435.77
FEB	$162,945.00	$359,880.00	$43,435.25	$585,053.00	$206,380.25
MAR	$166,654.64	$373,769.00	$36,125.47	$508,796.00	$202,780.11
APR	$97,111.77	$153,849.00	$35,315.17	$518,446.00	$132,426.94
MAY	$68,536.47	$188,460.00	$38,918.71	$577,614.00	$107,455.18
JUN	$25,154.87	$63,397.00	$48,423.59	$598,673.00	$73,578.46
TOTAL	**$1,569,648.39**	**$3,061,007.00**	**$518,047.93**	**$6,958,091.00**	**$2,087,696.32**

Energy Consumption Charts

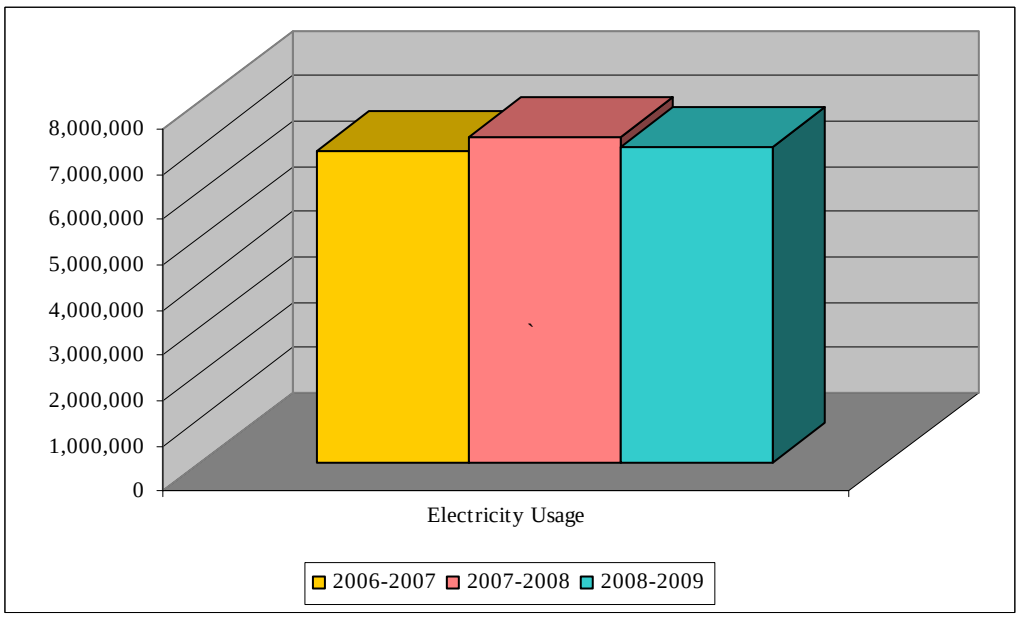
The following pages depicts the Lebanon Correctional Institution's energy consumption and expenses for the previous there (3) years. These charts show the usage and costs for both natural gas and electricity.

Section 3:
Utility Analysis

Natural Gas Consumption Chart (CCF)

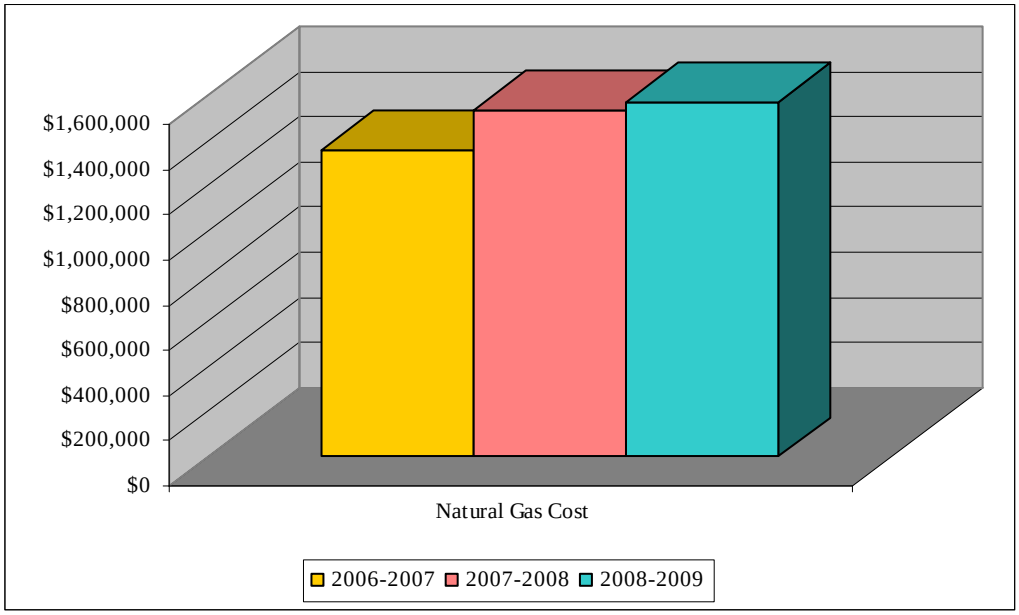


Electricity Consumption Chart (KWH)

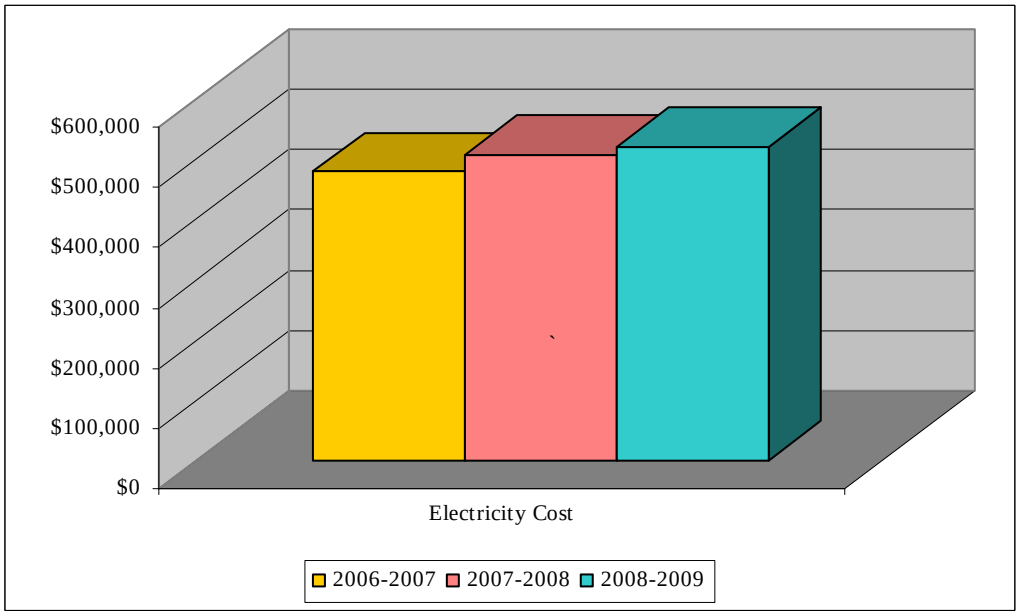


Section 3:
Utility Analysis

Natural Gas Cost



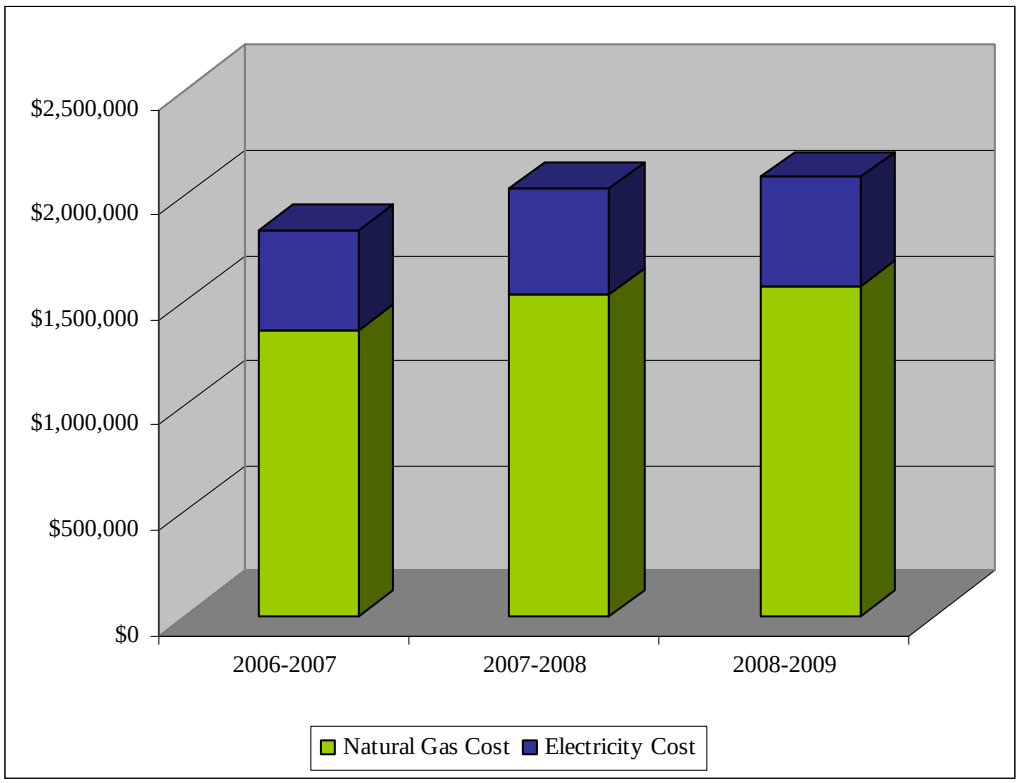
Electricity Cost



Section 3:
Utility Analysis

Total Cost of Utilities

The following chart depicts the total expenditures of utilities for the Lebanon Correctional Institution for three (3) years for both natural gas and electricity.



LeCI Energy Utilization and Cost Comparisons

Four Seasons Environmental, Inc. has broken down the Lebanon Correctional Institution's actual energy use and energy costs per square foot and compared them to the industry standards. The standards are created by the International Facility Management Association for a number of different building categories. FSE has utilized the "Public Order & Safety" and "Other" category, as the Lebanon Correctional Institution could fit under either category.

Section 3:
Utility Analysis

FSE has broken down the comparisons by the "Main Facility Conditioned Space," "Main Facility Total Area" and "All Facilities." The following are the facility area values:

- The **"Main Facility Conditioned Space"** includes only the conditioned space of the main facility. The area totals 435,813 square feet.

- The **"Main Facility Total Area"** includes both the conditioned and unconditioned space of the main facility. These areas total 554,080 square feet:
    - Main Facility Conditioned Space: 435,813 square feet
    - Main Facility Unconditioned Space: 118,267 square feet

- The **"All Facilities – Grand Total Area"** includes all areas in the Lebanon Correctional Institution. The grand total area spans 558,524 square feet:
    - Main Facility Conditioned Space: 435,813 square feet
    - Main Facility Unconditioned Space: 118,267 square feet
    - Farm Building: 336 square feet
    - Creamery: 3,508 square feet
    - Water Treatment: 600 square feet

The table on the following page depicts the energy utilization index for all three categories, as well as the target energy usage and the difference between the two.

Section 3:
Utility Analysis

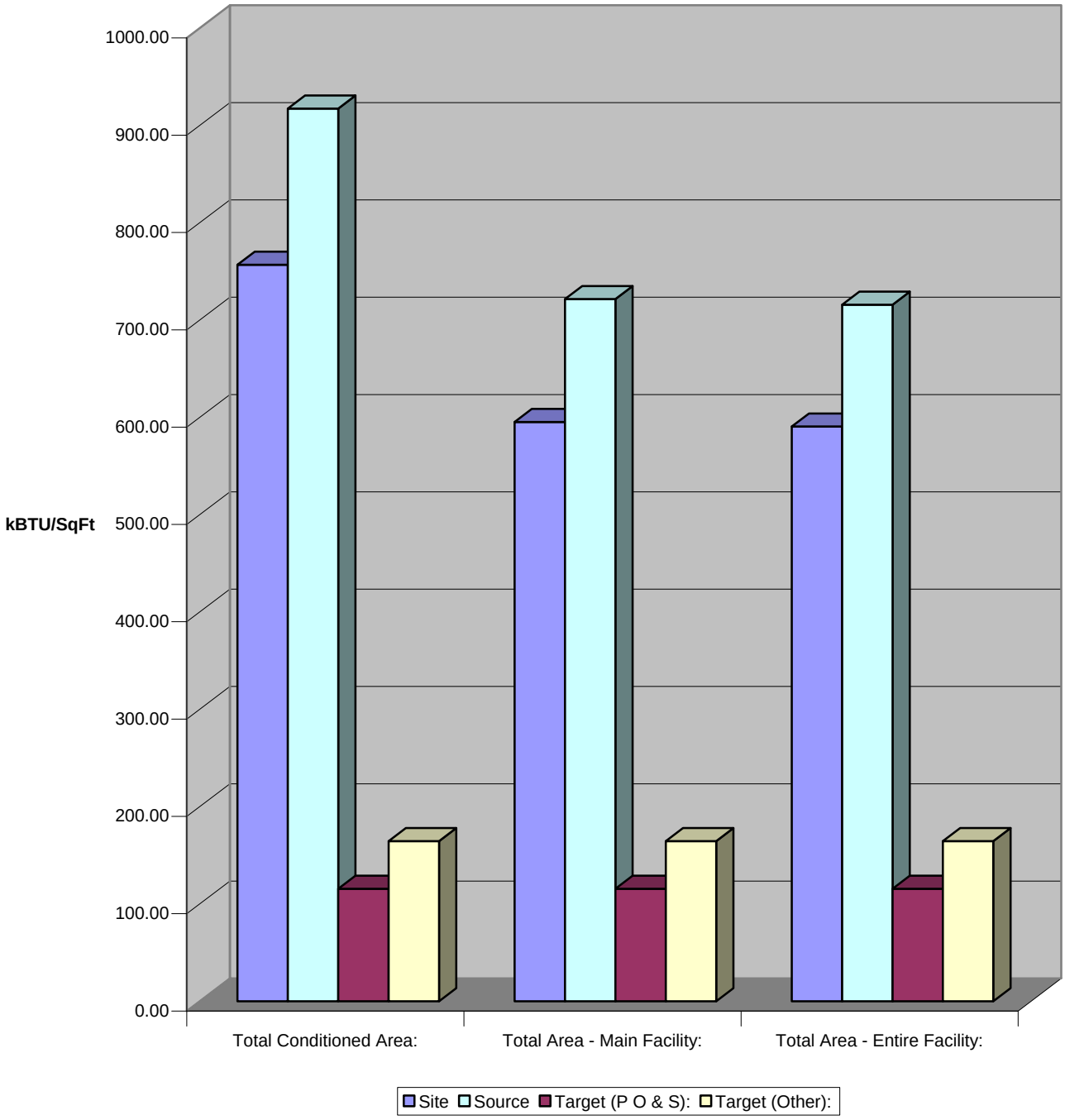
Energy Utilization Index (kBTU/SqFt)				
	Site		Source	
	Public Order & Safety	Other	Public Order & Safety	Other
Main Facility Conditioned Area	**756.84**	**756.84**	**917.33**	**917.33**
Target	115.60	164.56	115.60	164.56
Difference	641.25	592.29	801.73	752.77
Main Facility Total Area	**595.30**	**595.30**	**721.52**	**721.52**
Target	115.60	164.56	115.60	164.56
Difference	479.70	430.74	605.93	556.97
All Facilities	**590.56**	**590.56**	**715.78**	**715.78**
Target	115.60	164.56	115.60	164.56
Difference	474.96	426.00	600.19	551.23

The following table depicts the energy cost index for all three categories combined, the target energy cost and the difference:

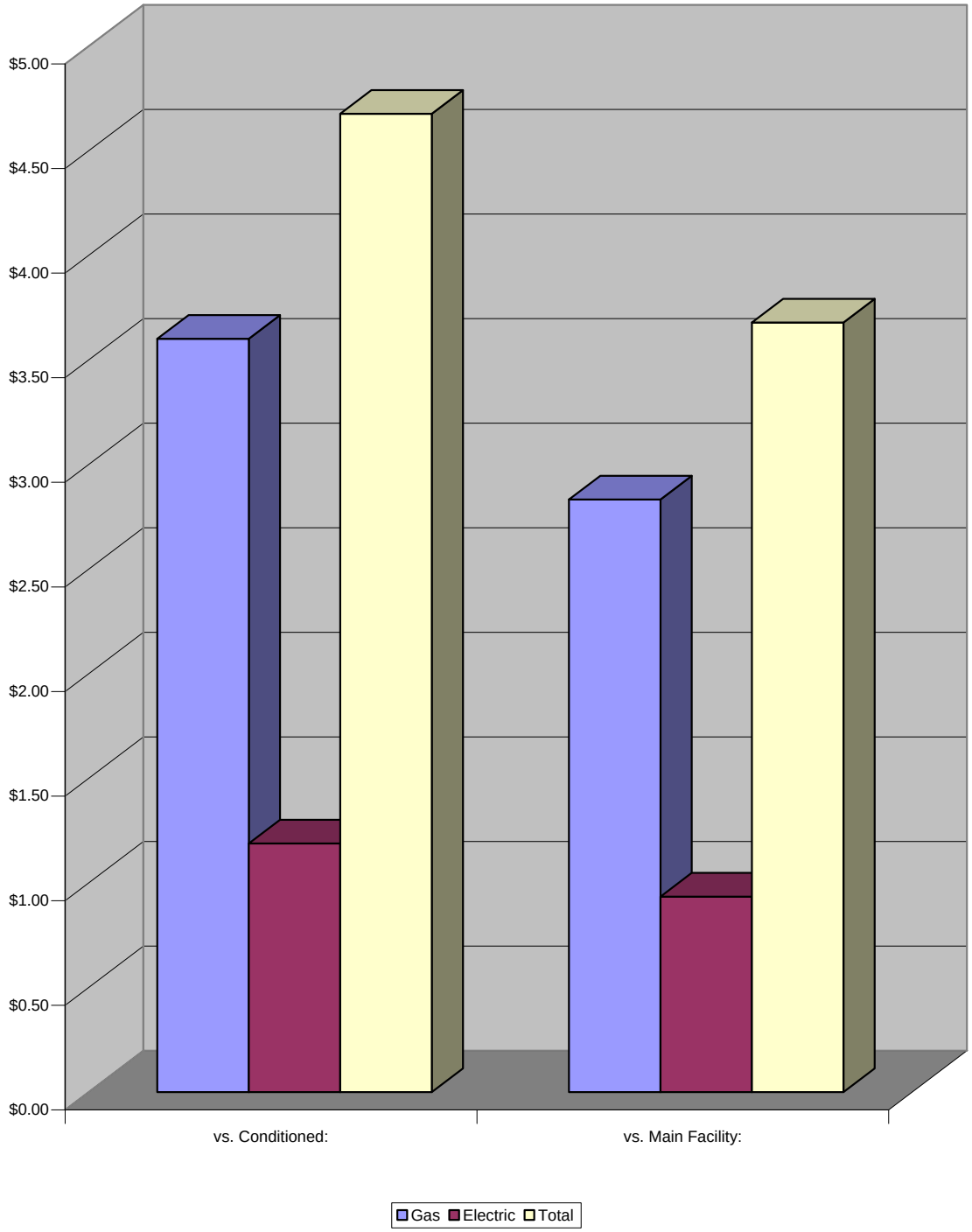
Energy Cost Index ($/SqFt)	
	Total
Main Facility Conditioned Area	**$ 4.79**
Target	$ 2.25
Difference	$ 2.54
Main Facility Total Area	**$ 3.77**
Target	$ 2.25
Difference	$ 1.52
All Facilities	**$ 3.74**
Target	$ 2.25
Difference	$ 1.49

The column charts on the following pages depict the above findings.

Section 3:
Utility Analysis



Section 3:
Utility Analysis



Section 4: Assessment of Operations and Maintenance Practices

Four Seasons Environmental, Inc.'s Observations

Four Seasons Environmental, Inc. would like to begin by formally commending the Lebanon Correctional Institution's maintenance staff in being so forthcoming in sharing the information needed to provide meaningful results to the audit. For example, Marty Westall and Tim Brashear have really been helpful in providing requested information the same day it was requested.

We are certain that the Department of Rehabilitation and Correction and Lebanon Correctional Institution are quite aware of the "state of the facility" at Lebanon Correctional Institution. Nevertheless, for purposes of this report , our observations are as follows:

Leaks

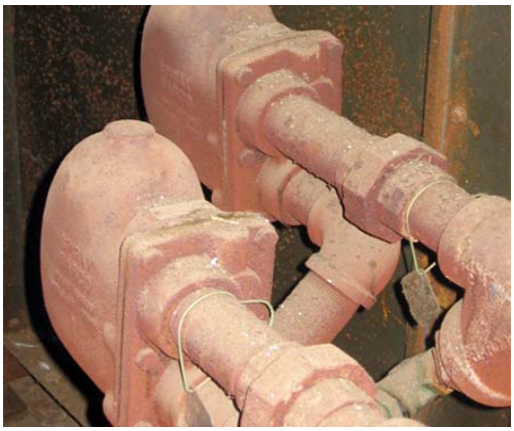
We observed numerous steam and hot water leaks throughout the facility:

(Right) Powerhouse—Condensate Return Pumps, (Left) Powerhouse—Shutoff valve leaking

Section 4: Assessment of Operations and Maintenance Practices

Steam Traps

As evident by the 169°F condensate return temperature, the maintenance staff's observations, and our own observations, perhaps 40 percent of the steam traps are blowing through.



(Left) Typical float and thermostatic steam traps.

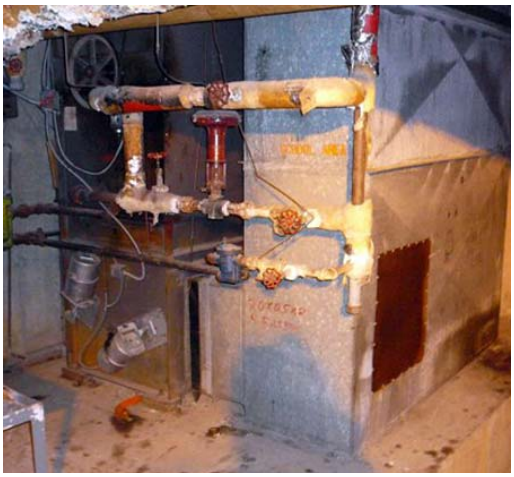
Condensate Pumps

Of the 24 condensate return pumps, many of the pumps have failed and are not returning the condensate to the central steam plant as evident by the makeup water ranging from 65 percent in July 2009 to 32.6 percent in January 2009. Condensate receivers and return pumps are shown below.

Section 4: Assessment of Operations and Maintenance Practices

Heating and Ventilating Units

Many of the existing Trane Torrivent heating and ventilating units that were originally installed in 1959 are in need of replacement. The State Architect's Office, the Department of Rehabilitation and Corrections and the Lebanon Correctional Institution have recognized this condition and are taking appropriate action in engaging an architect/engineer to design the unit replacement, along with the controls and then upgrade the entire system with state-of-the-art direct digital controls, and heating and ventilating units.



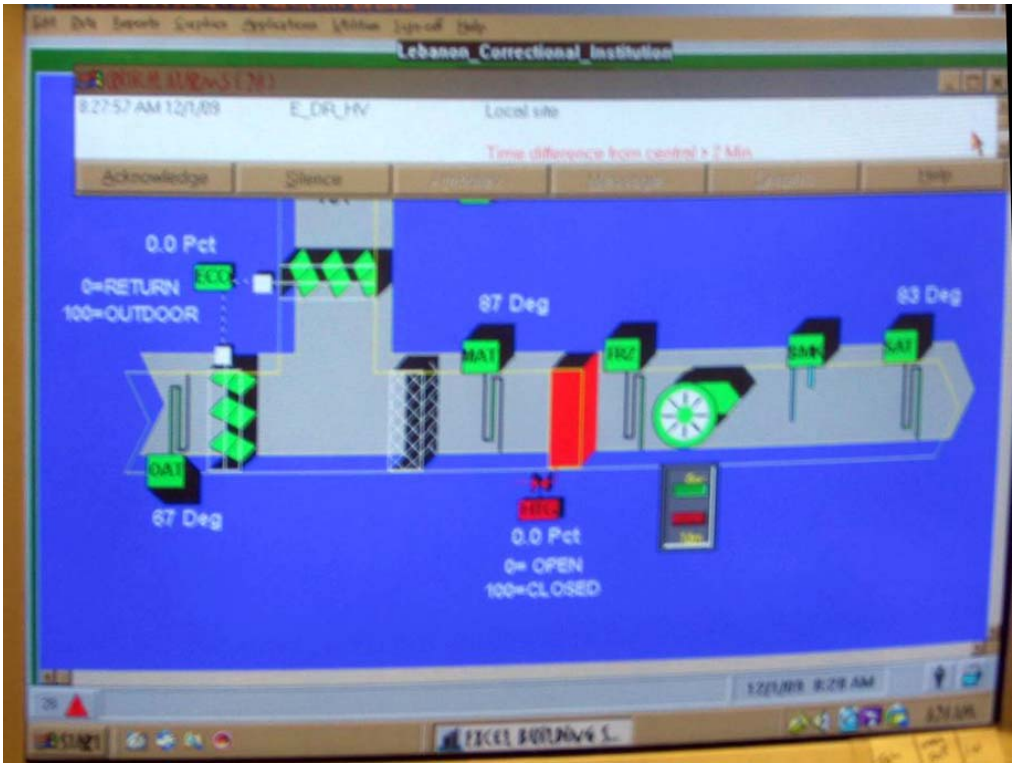
(Left) Classroom AHU that is located in tunnel, (Right) Dining Room AHU that is located in the fan room.

Controls

The existing pneumatic control system, in many cases, does not function. The existing Honeywell direct digital control system no longer functions. These problems have been recognized and are being rectified by engaging a consulting engineer to design the replacement system. The following page features photos of the pneumatic control system main control panel and the Honeywell direct digital control system graphic interface screen.

Section 4:
Assessment of Operations and Maintenance Practices

(Left) Pneumatic control system main control panel. (Below) Honeywell BAS screen.



Section 4: Assessment of Operations and Maintenance Practices

Other Observations

Insulation
In several instances, insulation is missing. Asbestos is the predominate insulation material in the facility

Roof Flashing
Four Seasons Environmental, Inc. observed several instances wherein roof flashing was missing or damaged.

Lighting
T-12 Lighting is predominate throughout the facilities.

Windows
Numerous windows in cell blocks A and B are broken and need to be replaced.

Corrosion
We observed several instances wherein overhead plumbing leaks had corroded duct work or air handlers.

Maintenance Staff

As a part of the Lebanon Correctional Institution's Energy Analysis, Four Seasons Environmental, Inc. was asked to assess the operations and maintenance practices at the LeCI. In order to comment on this issue, FSE asked LeCI to share its maintenance staff information with us. Marty Westall was again most cooperative in sharing the following information on the 33-person maintenance staff:

- Seven (7) stationary engineers
  - One (1) performs maintenance on the powerhouse
  - Six (6) staff the powerhouse with three (3), two-person shifts
- One (1) powerhouse supervisor
- Four (4) plumbers
- Two (2) electricians
- One (1) painter

Section 4: Assessment of Operations and Maintenance Practices

- One (1) carpenter
- One (1) air quality technician
- One (1) electronics technician
- One (1) telecom technician
- Four (4) maintenance repair workers
- Three (3) auto technicians
- One (1) water treatment supervisor
- Two (2) water treatment technicians
- One (1) maintenance supervisors / construction
- One (1) tool-room storekeeper

Assessment of Operations and Maintenance Practices

Having made the previously stated observations and considering the current maintenance staff, FSE's assessment of the operations and maintenance practices is as follows:

Breakdown Maintenance

It appears that most of the maintenance effort is being directed toward breakdown maintenance. Some of this effort is certainly due to the age of the equipment to be maintained, much of which is 50 years old. Still, another explanation is the staff size, which may be undersized in the high-tech trades.

Preventive Maintenance

We understand that a formal preventive maintenance program is not currently in place. In our assessment, a computerized maintenance management system would greatly benefit the Lebanon Correctional Institution. The computerized maintenance management systems FSE has used our 22 project sites in six (6) states include:

Section 4: Assessment of Operations and Maintenance Practices

- Infor's MP-2
- Maximo
- Maintenance Track

Once the major deficiencies have been corrected, the CMMS has been installed and the preventive maintenance becomes "job one," the breakdown maintenance should be greatly decreased within the first year.

Energy Management Procedures

Currently, the only energy management option available to the Lebanon Correctional Institution's maintenance staff is, in many cases, on/off manual control.

- Because the Honeywell Building Automation System does not function, the maintenance staff has very limited opportunities to manage energy. LeCI has recognized this fact and has taken proactive steps to correct this problem by engaging a consulting engineer to design a new Direct Digital Control System, including a "front end" building Automation System that will allow the maintenance staff to begin controlling LeCI's energy use from a control central location.

- Because the 1959 era pneumatic controls no longer function in many cases, many of the heating and ventilating units "run wild" in the full-heating mode.

No Cost and Low Cost Recommendations

In examining all of the options to lower energy-consumption costs and/or significantly enhance performance, we have identified eight (8) no cost/low cost options.

1. **Electricity Purchase Contract**
   With LeCI currently paying $0.074 per KWH for electricity, our 2009 experience at two (2) of our nearby facility operation main-

Section 4: Assessment of Operations and Maintenance Practices

tenance and repair sites is $0.064 per KWH. Just last month another of our local clients locked in a $0.0588 per KWH rate for 2010.

If, at no cost to LeCI, a competitive electricity contract could be purchased at $0.064 per KWH, the annual savings to LeCI would be $80,815 based on the 2008-2009 costs we have been given by LeCI.

2. **Repair the Steam Leaks**
   This estimated $18,000 cost should save $33,393 per year based on a 2 percent steam leakage rate and 2009 natural gas cost. This item needs to be accomplished for safety, as well as energy reduction purposes and may even be accomplished by the maintenance staff, thus further reducing the estimated $18,000 cost.

3. **Replace Steam Traps that are "Blowing Through"**
   We faced this exact problem on a smaller scale in 2004 at the Taft Laboratory in Cincinnati. We replaced 76 traps at a cost of $15,966, including our own labor.

   If LeCI needs to replace 40 percent of its 350 steam traps, 140 traps need to be replaced at a cost of $119,700. If LeCI could furnish its own maintenance staff labor, this cost could be further reduced. A conservative annual savings projection would be $200,000 per year.

4. **Replace All 24 condensate Receiver/Return Pumps**
   Replacing the condensate receiver/return pumps with Hoffman duplex condensate return units at an anticipated cost of $203,260 should save $94,099 in annual fuel costs.

5. **Computerized Maintenance Management System**
   Install a computerized maintenance management system to preventively maintain the facility. These systems can range in cost from $20,000 to $100,000, depending on the scope. Three (3) systems with which we are familiar include Infor's MP-2,

Section 4:
Assessment of Operations and Maintenance Practices

Maximo, and our own CMMS, *Maintenance Track*, which is currently functioning in 200 buildings in Ohio.

Because a CMMS is so important to the ongoing operation and maintenance success of the LeCI's maintenance staff, we have featured descriptions of these three (3) systems on the next ten (10) pages:

- Maintenance Track (4 pages)
- DataStream MP2 (3 pages) (*DataStream is now Infor)
- IBM Maximo (2 pages)

Section 4: Assessment of Operations and Maintenance Practices

Maintenance Track

Maintenance Track (MT) is a Computerized Maintenance Management System (CMMS) that provides for all your facility preventive maintenance and work order needs. It is a user-friendly application that requires no CMMS experience. Maintenance Track provides the tools necessary to manage your facility without spending unnecessary time at the PC. Click and go buttons make navigation to the data you need quick and easy. A realistic time expectation to administer Maintenance Track is approximately one to two hours a month.

Maintenance Track was written to service the basic maintenance needs of small to medium size facilities. Maintenance Track can generate required monthly maintenance according to the month and also manage historic data per each unique piece of equipment. Maintenance Track identifies each individual piece of equipment by its own ID number. Simply stated, Maintenance Track knows the individual name of every piece of equipment in the facility.

The main data elements Maintenance Track records for each piece of equipment are:

- *Facility, Location & Area:* Where is the equipment?
- *ID Number:* What is its name?
- *Frequency:* When is it maintained?
- *Procedures:* What do I do to maintain the equipment?

Once these data elements have been recorded for each piece of equipment, the district will be ready to begin utilizing Maintenance Track. The Maintenance Track product is delivered with a fully populated database. The above data elements are preloaded along with each individual piece of equipment making Maintenance Track ready for use upon installation.

Section 4: Assessment of Operations and Maintenance Practices

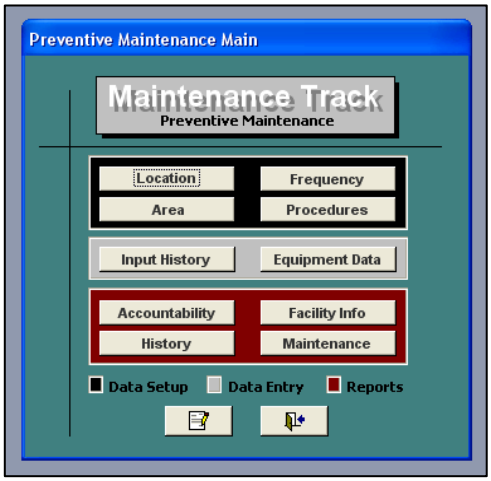
<u>Structure of Maintenance Track</u>

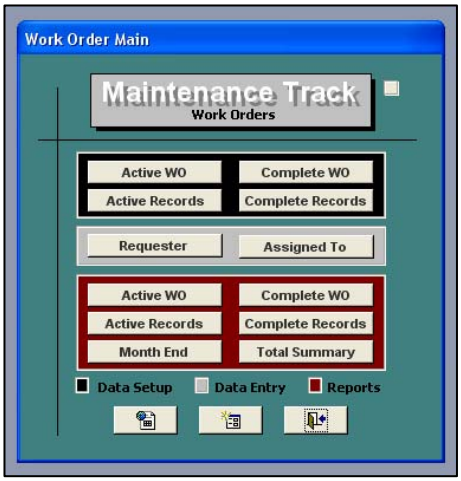
Maintenance Track consists of two main menus:

1. Preventive Maintenance Services
2. Work Order Services

Preventive maintenance (PM) is where facility information, including equipment locations, equipment areas, service frequencies, preventive maintenance procedures, service history, and equipment ID numbers are recorded, scheduled, and reported on in Maintenance Track.

Work Order (WO) is where all other non-preventive type maintenance requests are recorded and reported into Maintenance





Track.

The two systems work together through a few similar components.

Maintenance Track not only helps school districts generate work orders, but it also helps them to track which orders have been completed and even create monthly reports to show the number of work orders requested and completed.

Section 4: Assessment of Operations and Maintenance Practices

Month-End Work Order Summary Report *Date Range - 05/01/2004 through 06/30/2004*

Building 1639

Work Order Status: Active

Requested Date	Completed Date	WO ID	Area	Work Request	Comments	Requester	Assigned To
5/21/2004		94	Building	Motor is not running. Troubleshoot and repair.		Dwayne Evans	Colson/Smoaks
5/21/2004		105	Building	Troubleshoot and repair Boiler. Check all safety devices and ensure thet operate.Replace solenoids if needed and flow switch.	Generate list of materials needed to repair.	Dwayne Evans	Colson/Smoaks
5/26/2004		107	Building	AC not operating properly. Check system.		Jennifer Williams	Colson/Smoaks

3 Active Work Orders for Building 1639

Work Order Status: Complete

Requested Date	Completed Date	WO ID	Area	Work Request	Comments	Requester	Assigned To
4/27/2004	5/ 3/2004	91	Building	Check bulbs			
5/ 7/2004	5/21/2004	103	Building	Clean the supply vent in the admin and restroom areas.	Cleaned all admin and bathroom registers. Completed on 5/7/2004	Jennifer Williams	Reifer/Smith
5/10/2004	5/21/2004	102	Building	Replace filter in Admin .	Replaced 1 14x25x2 Completed on 5/10/2004	Becky Evans	Jimmy Colson

3 Complete Work Orders for Building 1639

Work Order Status: Pending

Requested Date	Completed Date	WO ID	Area	Work Request	Comments	Requester	Assigned To
5/21/2004		95	Building	Replace Compresor # 1 on york Chiller. Repair Leak in line overhead.	This is Additional Work. Wait until notified by Dwayne to start.	Skip Williams	Reifer/Smith

1 Pending Work Orders for Building 1639

7 Work Orders for Building 1639 - 05/01/2004 through 06/30/2004

Friday, August 13, 2004 *Page 1 of 4*

Additionally, the software presents many management opportunities in regards to preventative maintenance. Not only can the day-to-day planning be optimized, but there is also the ability to track the effectiveness of each technician. Finding which employee needs more training or who is capable of taking on additional responsibility is a valuable tool. The monthly and yearly summaries give a complete picture of the effectiveness of the overall maintenance plan. Below is a portion of the audit tool:

Section 4: Assessment of Operations and Maintenance Practices

Equipment Maintenance Form

Type	**VAV Box**
Assigned To	**Maintenance Staff**
Facility	East Guernsey Local School District
Location	Elementary School
Area	102
ID Number	EL-VAV-102
Frequency	Quarterly
Month	**January**

1	Lubricate fan shaft bearings if not sealed.	☐
2	Lubricate motor bearings sparingly, using SAE 10w motor oil if not sealed.	☐
3	Clean coils by vacuuming or brushing.	☐
4	Clean fan blades and interior surfaces of unit to remove soil.	☐
5	Damp wipe exterior surfaces.	☐
6	Clean up work area.	☐
7	Check to see that operating control stat activates damper per design specifications. Replace if malfunctioning.	☐
8	Check damper linkage for tightness or damage. Lightly oil moving parts.	☐
9	Inspect dampers for free movement in duct or mixing box. Replace felt or other type seals as required.	☐
10	Inspect mixing box and connecting ducts for air leaks. Correct leaks with duct tape or tighten connections as required.	☐
11	Inspect damper activators for tightness to mounting brackets.	☐
12	Tighten electrical connections to servomotors. Clean vent ports.	☐
13	If pneumatic actuator does not stroke properly, correct sticking valve stem or binding linkage. Replace diaphragm if necessary.	☐
14	Inspect for air leaks around actuator and in air line between controller and actuator.	☐
15	Check unit for noise and vibration.	☐
16	Check V-belt condition and tension. Adjust or replace as necessary.	☐
17	Clean and wash permanent filters. Recharge wire mesh filters with oil.	☐
18	Replace disposable filters.	☐

Signed _____ **Hours** _____ **Date** ___/ /___

Section 4: Assessment of Operations and Maintenance Practices

Data Stream MP2

MP2™ is a completely integrated asset management system that accommodates any size facility. You can install MP2 software on a standalone or client/server system. Furthermore, MP2 has seamless upgrade capability. For example, you can enter data into a standalone version, and then upgrade it to a client/server system with no additional data entry. This level of user control has contributed to making MP2 the choice of more maintenance professionals than any other maintenance management system in the world.

MP2 sets the industry standard for graphic-based, easy-to-use maintenance management software designed for any-size organization. A Windows-based package, MP2 requires no prior computer experience.

MP2 enables companies to:

- Organize and track inventory
- Manage equipment costs
- Track equipment history
- Schedule preventive maintenance tasks
- Maintain confidential labor records
- Allocate resources
- Generate and track work orders
- Requisition and purchase parts
- Project equipment failure and maintenance needs

Furthermore, MP2 helps customers complete critical asset management functions:

- Managers use MP2 to quickly access historical costs, performance characteristics, and warranty information associated with an individual asset or across a broad class of

Section 4: Assessment of Operations and Maintenance Practices

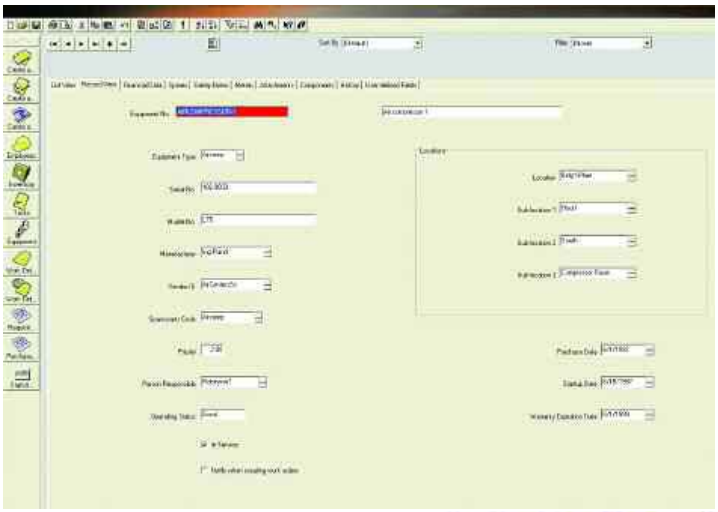
assets to decide whether incremental repairs are needed or if replacement is the answer.

- With up-to-date location and usage information from MP2, companies share assets across sites and between divisions, increasing an asset's productivity.

- MP2 allows companies to manage maintenance processes, collaborative workflow, reporting and analysis, inventory, financial and budget information, logistics, and ecommerce.

- With Datastream's fully integrated procurement network, companies can automate their maintenance, repair, and operations supply chain with demand-driven purchasing and inventory systems. This amounts to real dollars that can make a real difference to a company's bottom line.

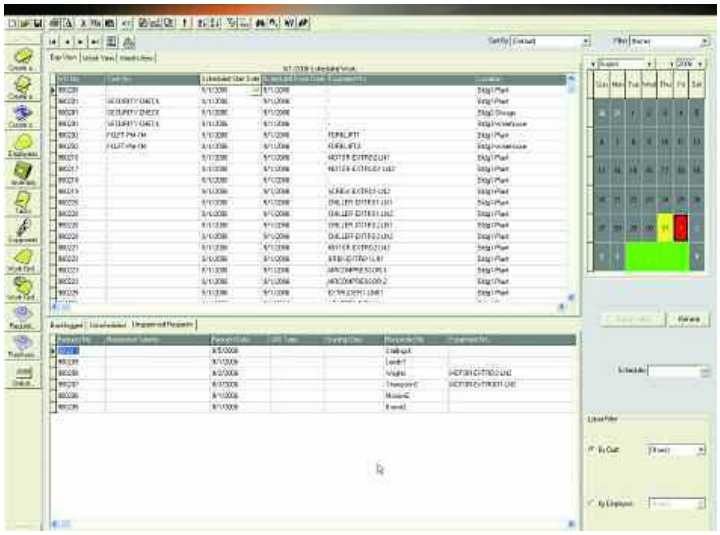
- MP2 gives users complete access to asset history, helping them determine whether an asset should be sold and increasing value at the time of the sell. MP2 offers users accurate, up-to-date information that is necessary to assess the total cost of ownership of an asset and to make decisions that benefit the organization.



The left image shows the equipment screen. The equipment module enables you to track costs, activities, location, and hierarchy.

Section 4: Assessment of Operations and Maintenance Practices

The following image shows the scheduling screen. From this screen, users can quickly view the work order schedule to gather information concerning the current maintenance resource allocation in daily, weekly, and monthly views via the color-coded calendar.



Section 4: Assessment of Operations and Maintenance Practices

IBM Maximo

IBM offers a number of different software options for facilities, including IBM Maximo Asset Management Essentials and IBM Maximo Asset Management.

Maximo Asset Management Essentials

With Maximo Asset Management Essentials, organizations can take advantage of proven Maximo technology and enjoy cost savings.

IBM Maximo Asset Management Essentials enables smaller organizations to organize, track, and manage asset and work management processes with industry-leading technology.

IBM Maximo Asset Management Essentials is an integrated solution for all assets, key functionality includes:

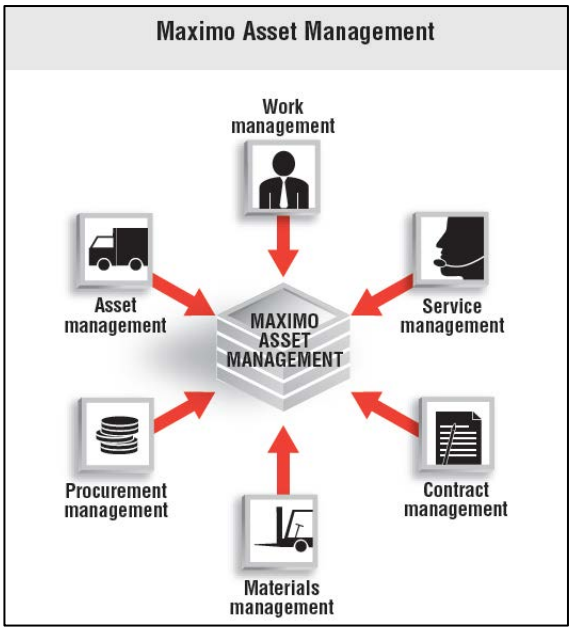
- *Asset Management*- Maximize asset return on investment by proactively managing assets to extend their life.
- *Work Management* - Achieve a more efficient workforce with work optimization and resource management.
- *Materials Management* - Plan inventory to meet maintenance demand precisely, making the right parts available at the right location when needed.
- *Procurement Management* - Improve cash flow by streamlining spare part inventory and procurement management.
- *Contract Management* - Manage your vendor contracts with comprehensive contract management support for purchase, lease, rental, warranty, rate, master, blanket and user-defined contracts.
- *Service Manage*ment - Comprehensive maintenance work management solution for planned and unplanned activities including long- and short-term planning, preventive,

Section 4: Assessment of Operations and Maintenance Practices

reactive and proactive maintenance, schedule management, resource optimization and key performance indicators.

IBM Maximo® Asset Management

IBM Maximo® Asset Management takes the power, performance and possibilities of asset management to an entirely new level. Built on a single software platform, Maximo Asset Management delivers a comprehensive view of all asset types — production, facilities, transportation and IT — across your enterprise. This holistic perspective allows you to see all of your assets, as well as identify all of the untapped potential within them. You gain the knowledge and control you need to closely align your organization's goals with the overall goals of your business.



Maximo Asset Management effectively captures and analyzes your asset and work data. To help you optimize maintenance and service initiatives throughout your enterprise, advanced capabilities in six key areas of asset management deliver knowledge and control:

- *Asset management*: All the control you need to seamlessly track and manage asset and location data throughout its entire life cycle.

- *Work management*: Manage both planned and unplanned maintenance activities, from initial work request and work order generation through completion and recording of actuals. Work planners can match job tasks to available re-

Section 4: Assessment of Operations and Maintenance Practices

sources, estimate and obtain approval of costs, establish priorities and initiate maintenance activities across the enterprise.

- *Service management*: Allow end users to submit new service requests, as well as track and update open service requests. Apply additional service management best practices through IBM Tivoli Service Request Manager and further align asset management goals and priorities in a manner that best supports overall business objectives.
- *Contract management*: Have enhanced control over your vendor contracts with this integrated contract management system. Provide comprehensive contract management support for purchase, lease, rental, warranty, labor rate, master, blanket and user-defined contracts.

- *Materials management*: Know everything — what, when, where, how much and how valuable — about asset-related materials and their usage. Materials management functionality records all material movements and adjustments, allowing for real-time material tracking, reporting and auditing.

- *Procurement management*: Support all phases of enterprise-wide procurement, including direct purchasing and inventory replenishment. You can provide buyers with extensive requisition, quotation, vendor, purchase order and contract capabilities, thereby allowing them to plan work more proactively. Maximo Asset Management easily integrates with enterprise business systems from vendors such as Oracle and SAP, and also connects to online marketplaces and exchanges.

Section 4: Assessment of Operations and Maintenance Practices

6. **Autoflame Burner Control**
   At our 175,000-square-foot USDA Laboratory site at Ft. Peirce, Florida, we have three (3) small boilers: two (2) hot water for building heat and one (1) 15 HP for process steam. In January 2004, we installed Autoflame Boiler Controls at a cost of $25,000 that paid for themselves in less than one year by causing the burner to operate at 83 percent to 85 percent efficiency from 100 percent of capacity down to 40 percent capacity. If the boilers at LeCI operate below 80 percent fuel to steam efficiency at part load, Autoflame may provide a viable, low-cost solution to increase boiler burner efficiency.

7. **Reduce Steam Discharge Pressure**
   In the event that the 250 psi cogenerate option is not exercised, consider lowering the steam discharge from 185 psi to perhaps 50 psi if the greatest need is the laundry at 40 psi, we are certain that LeCI has considered this option and, for whatever reason, it has not been exercised.

   For example, perhaps the existing steam pressure reducing stations would need to be reconfigured to allow the suggested steam discharge pressure reduction to take place. If yes, perhaps the pressure-reducing-station cost versus the energy-reduction tradeoff may be worth consideration.

8. **Specialty Trade Outsourcing**
   Thanks to Marty Westall's willingness to share his 33-person maintenance staff's skill set breakdown, the Lebanon Correctional Institution may be best served if selected high-tech specialty trades are outsourced. Such trades as DDC Controls and HVAC maintenance are often outsourced for several reasons:

   - If these trades were added to the existing staff, the wage requirement to attract a qualified personnel is higher than the owner's maintenance structure will support.

   - Even if these high-tech trades were added to the existing staff, the pay rates may be high enough to potentially cause dissention within the existing maintenance staff if a

Section 4: Assessment of Operations and Maintenance Practices

new employee were added and being paid more than many existing staff members.

- There may not be enough DDC controls work to justify adding a full-time person.

For all of these reasons, specialty trades are often outsourced.

Section 5: Recommendations

Evaluations and Assumptions

Based on the data collection, facility walk throughs and data analysis, Four Seasons Environmental, Inc. has compiled a list of recommendations to help reduce the Lebanon Correctional Institution's energy use and associated cost.

Please note the following evaluations and assumptions.

Energy Baselines

Energy baselines for the Lebanon Correctional Institution were created using existing utility data. While information was available for the past three (3) years, data from the period of July 2008 through June 2009 was used to create the energy baseline.

Assumptions

When making recommendations, FSE assumed some usage data in order to calculate savings.

Data Sources

All data received from the DRC are assumed to be accurate and up to date. Data sources used for this study include floor plans, drawings for the facility and ASHRAE standards.

FSE Narrative

The following portion of the document provides a basic overview of the recommendations Four Seasons Environmental, Inc. offers for consideration by the Lebanon Correctional Institution.

Using our 22 years of facilities operation, maintenance and repair experience at 22 project sites in six (6) sites, we would prioritize the recommendations in the following order: A, B, C and D.

Section 5: Recommendations

Priority A: Bring Closure to the Steam Supply/Condensate Return System

Stated in another way, make sure the steam and condensate systems are free of leaks and made tight to cause no steam to return to the central steam plant until it has been returned to condensate and then pumped back to the central steam plant. This activity has three elements:

1. **Repair Steam Leaks**
   Based on our observations, let's suppose that 2 percent of the steam is leaking and not being used for its intended heating purposes.

   The estimated cost of these repairs is $18,000 and the 2 percent of the annual natural gas cost that is being used to produce steam to feed the leaks would be $33,393.

   We recognize that two percent is an educated guess. Perhaps it is only .5 percent or as much as 4 percent. Regardless of the actual leak rate, the leaks must be repaired for safety and energy - conservation reasons.

2. **Replace Leaking Steam Traps**
   The fact that the condensate return temperature is 169°F is strong evidence that steam is blowing through a significant number of traps and elevating the condensate return temperatures. Some of the traps have been replaced, but we do not know how many have been replaced. In our thermal imaging survey, we randomly checked 19 steam traps, eight (8) of which were blowing through 42 percent. Thus, we have used 40 percent as a somewhat conservative estimate.

   Begin by conducting a steam trap survey:

   - Conduct a steam trap survey. One of three (3) methods should be used:
     1. Install a valve on the discharge side of the trap, slowly

Section 5: Recommendations

open the valve and see if the steam flow completely shuts off after the trap has discharged its condensate. If not, the trap is allowing steam to blow through the trap.

2. Check the trap with an infrared gun. If blow-down valves are not available downstream of the steam trap(s), utilize an infrared thermometer, such as a Fluke 561 IR Thermometer or equal. If the pipe temperature on either side of the trap is the same, the trap is blowing through. If there is a temperature difference, the trap is holding and not blowing through. Please see our thermographic audit from September 30, October 1 and October 16 2009 where 19 traps were identified via an infrared camera and eight (8) were found to be blowing through.

3. Check the trap with an ultrasonic leak detector and listen for a steam flow "hiss" when the trap empties itself of condensate. This is the least preferable method of performing a steam trap survey but can still be effective if methods one and two cannot be used.

To cite an example, we faced this exact problem in 2004 at the 165,000-square-foot Taft Laboratory in Cincinnati. This was a low-pressure steam heating application, similar to Lebanon Correctional Institution.

- We conducted a steam trap survey. We used the first method to conduct the survey and checked the valve on the discharge side of the trap.

- The steam trap survey revealed that 76 of 85 traps were blowing through. Many of the traps had been installed in 1953 and rebuilt from time to time.

- Seventy six traps were replaced at a cost of $15,996: 24 bucket traps, 32 F&T traps and 20 thermostatic traps. The cost per trap was $210.

- The actual saving in natural gas costs in the following year

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was $25,023, yielding a simple payback of eight (8) months.

- $25,023 / $81,949 = 30.5% reduction in natural gas cost
- Condensate return temperature decreased from 193°F to 105°F.
- We also noticed that the boiler run time decreased 10 percent during occupied hours and 30 percent during unoccupied hours.

While this example is smaller than LeCI, the lessons learned may be quite applicable.

To extrapolate: If replacing 89 percent of the traps at the Taft Laboratory in Cincinnati resulted in a 30.5 percent reduction in natural gas consumption, perhaps replacing 40 percent of the traps at Lebanon Correctional Institution would result in a 13.7 percent reduction in natural gas consumption. Using this analogy, the reduction in natural gas consumption would result in an astonishing cost reduction of 13.7 percent of $1,569,648 or $215,042. However, in order to be very conservative, let's assume that only $200,000 would be saved if just 40 percent of the traps were replaced. In any case, replacing the defective steam traps is will worth the effort.

Based on the LeCI condensate return temperatures of 169°F as compared to 193°F at the Taft Laboratory, another extrapolation would be:

$$\frac{(169°F—105°F)}{(193°F - 105°F)} = \frac{x\%}{89\%}$$

$$X = 89\% \times \frac{64°F}{88°F} = 42\%$$

However, again to be very conservative, let's assume that only 40 percent of the traps need to be replaced. Total estimated cost to replace 40 percent of the 350 traps is $119,700.

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The simple payback would be:

$$\frac{\text{Cost - \$119,7000}}{\text{Annual Savings - \$200,000 per year}} = 7 \text{ months}$$

3. **Replace/Repair the Condensate Return Pumps That Are Not Functioning**
   Tim Brashear was very helpful in furnishing the make-up water information we needed to determine that the make-up water in 2009 varied from 65 percent in July to 32.6 percent in January. Approximately 15,000 gallons per day of additional make-up water year round beyond the make-up water required to blow down the boilers, replace the steam lost in the deaerator and the steam that flashes in the condensate receivers.

   If one calculates just the additional cost to heat the additional 15,000 gallons of make-up water each day from 55°F to 375°F (saturation temperature of 185 psi steam), the additional annual fuel cost is $85,909.

   Then consider that the additional water may cost $2,190 per year.* Then, fuel and water equal $88,099 per year. Add to this amount that perhaps another $6,000 in water treatement could be saved and the total would be $94,099 per year.

   * 15,000 gls/day x $0.40/1,000 gls x 365 days/year = $2,190

   With an estimated cost of $203,260 to furnish and install all 24 duplex condensate pumps, the simple payback is two years and two months.

   When all three items are added together to make sure the steam and condensate system is leak free and all of the condensate is being returned to the cenral steam plant with no steam blowing into the condensate return system:

   Total Estimated Cost (on the following page):

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• Repair Steam Leaks	$18,000
• Replace 140 Steam Traps	$119,700
• Replace 24 Condensate Return Receivers and Pumps	$203,260
Total Estimated Cost	**$340,960**

Total Estimated Energy Savings:

• Repair Steam Leaks	$33,393
• Replace 140 Steam Traps	$200,000
• Replace 24 Condensate Return Receivers and Pumps	$94,099
Total Estimated Annual Savings	**$327,402**

Simple Payback $\frac{\$340,960}{\$327,402 \text{year}} = 1 \text{ year}$

Priority B: Replace Heating and Ventilating Units and Controls

This is a major undertaking wherein proactive initiatives have already been taken by the State Architect's Office, Department of Rehabilitation and Correction, and the Lebanon Correctional Institution. As we write, we understand that Engineering selection is in process so that these two (2) systems can be designed and then issued for public bids, thus completing this most needed work.

1. **Heating and Ventilating Units**
   Some of these 1959 vintage units have already been replaced. However, many additional units are in need of replacement. Two (2) reputable local mechanical contractors, RPC Mechanical and DeBra Kuempel, were kind enough to devote their time/sales efforts in generating an estimate to replace 38 heating and ventilating units in one

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case, and refurbishing 13 units and replacing 19 units in the second case.

In order to be conservative, we have elected to use the RPC estimate to replace 38 H&V units.

RPC Mechanical Estimate to replace 38 H&V units	$1,650,000
Allowance to Replace Insulation within 10' of the Air Handlers	$100,000
Asbestos Abatement Allowance within 10' of the Air Handlers	$75,000
Furnish and Install Starters Disconnects and Power Wiring at Each Unit (38 units at $2,000/Unit); Allowance	$76,000
Delete Condensate Pump Replacement (Separate Estimate from RPC, limited replacements, not all 24 units)	($50,000)
Add Variable Frequency Drives to the Fans (38 fans at $4,000 each); Allowance	$152,000
Total	**$2,003,000**

Suggested equipment supplier is the new Trane Performance Climate Changer with alternate prices accepted for Carrier and McQuay with custom-built units equal to the Trane Factory produced custom unit.

This work must be accomplished for the H&V system to function. The units are 50 years old, encumbered with corrosion , and dete-

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riorated coil fins, thus greatly inhibiting heat transfer and performance.

2. **Honeywell Building Automation System and pneumatic temperature control system**
   Replace non-functional Honeywell Building Automation System and non-functioning pneumatic temperature control system with new DDC Control System with new "front-end" Building Automation System.

   Based on our recent experience, recommended vendors include, but necessarily limited to, Johnson Metasys, Automated Logic, Siemens, Trane Tracer and Invensys.

   This DDC Control System is expected to cost $752,000. This cost is based on Debra Kuempel's estimate utilizing Automated Logic as the controls provider. Debra Kuempel visited the site, generated an H&V unit replacement cost and consequently has a reasonable understanding of the scope.

   Thus, the H&V unit replacement and the DDC control installation are estimated to cost $2,755,000.

   Once these two systems are installed, the expected utility cost savings is estimated to be 30 percent of the total 2009 utility cost, or $626,308 per year.

   The simple payback would be:

Estimated Cost	$ 2,755,000	=	4 years, 5 months
Estimated Energy Savings per Year	$ 626,308		

   While this investment does not have as attractive a payback that closing the steam/condensate system has, this work is absolutely necessary if the heating and ventilating system is to function under control.

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If both Priority A and Priority B are accomplished, the 2009 $2,087,696 energy expenditure should be reduced to $1,050,428, or $2.41 per square foot. In hitting the $2.25 per square foot target, a combination of reducing the unit electricity cost from $0.074/KWH to $0.064/KWH, changing T-12 fixtures to T-8 fixtures and utilizing the new BAS to optimize system performance with occupied/unoccupied schedules and resetting discharge temperatures based on outdoor air temperatures may need to be accomplished in order to reduce the $2.41 per square foot figure to $2.25 per square foot figure.

Priority C: Consider Cogeneration

The original 1959 installation utilized cogeneration and the cogeneration equipment was removed in 1984. The original steam distribution pressure was 250 psi when the central plant was producing electricity.

When the cogeneration equipment was removed, the boiler steam discharge pressure was reduced from 250 psi to 185 psi.

Because the 250 psi boiler discharge capability still exists, cogeneration can be reinstituted with significantly less expense when compared to cogeneration installation where the high pressure capability must be added. Coupled with the fact that the cost of electricity has risen from $0.04 KWH to $0.074 KWH in the past four (4) years and natural gas costs have fallen from $1.25/therm to $0.50/therm, it makes sense to revisit the cogeneration option.

Our feasibility grade estimate shows a cost of $1,209,000 and an annual projected energy savings of $370,225 for a simple payback of three (3) years and three (3) months, which appears to be quite attractive. However, some additional preliminary work should be accomplished prior to preceding with cogeneration.

We would therefore recommend the following approach to be taken before proceeding:

- Authorize a preliminary design and an accurate estimate

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based on that design to be performed.

- Consider maintenance staff additions, once cogeneration is complete. Will more staff be required? If yes, what impact will these additional operations and maintenance workers have on the savings.

- With these two pieces or additional justification information in hand, then make a decision to proceed with full design and construction.

In the event that the cogeneration option is chosen, there would be no need for a summer boiler. However, if the cogeneration option is not chosen, a summer boiler needs to be seriously considered.

- The smallest boiler is No. 2 with a capacity of 25,000 # per hour. FSE understands that the original B&W boiler from the 1959 installation was coal fired and has since been converted to natural gas with a No. 2 fuel oil alternative fuel available. Due to the age and the condition, it is unlikely that this boiler would be more than 70 percent or 75 percent efficient at less than 50 percent load.

- The current summer load can go as low as 6,000 # per hour. After the steam and condensate systems have been repaired and the new air handlers and controls are installed, the summer load could be as low as 3,000 # per hour.

- At 3,000 pounds per hour, the load would be so low that boilers No. 2 and 4 would probably not even stay on line and be forced to cycle. Efficiencies in such a case can fall below 50 percent when start stop cycles are considered.

- Conclusively, if the cogeneration option is not chosen, a summer boiler may rise to the level of being a necessity.

- We found this exact problem at one of our local sites in

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2002. We installed a small summer boiler at a cost of $60,000 and it paid for itself in gas-cost savings in eight (8) months.

- In like fashion, a 100, 125 or a 150 hp summer boiler would, in all likelihood, have less than a two (2) year payback.

The last item under this cogeneration heading that bears discussion is decentralizing the steam distribution system. If the facility were being built now, the decision to furnish each building with its own hot water boiler(s) would likely be the option of choice. However, given that the steam/condensate system must be repaired now and the heating and ventilating units and controls must be replaced in 2010, the better economic choice seems to be: keep the current systems in place once these needed repairs are made. After this $3.1 million expenditure has been made, and the system is performing well, it would not be cost effective to then decentralize the steam distribution system.

Priority D: Lighting and Windows

After the steam and condensate system has been repaired and the heating and ventilating units and controls have been replaced, the lighting should be changed from T-12s to T-8s when funding is available.

Then, finally, the window replacements fall into place as being less attractive.

The following pages feature a more detailed look at Four Seasons Environmental, Inc.'s recommended energy conservation methods (ECMs).

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ECM #1: Repair Existing Steam Leaks Throughout Facility

Visual inspection of the steam system revealed many steam leaks throughout the facility. These leaks present a safety hazard, as anyone working near them risks being burned by the leaking steam.

- It is estimated that there are approximately 200 leaks throughout the facility.
- While some may be repaired merely by tightening a loose fitting, in some cases equipment, such as a valve, may need to be repaired or replaced.

Recommendations:
In order to resolve the problem of steam system leaks, the following procedures are recommended:

- Tighten any loose fittings where steam is leaking.
- Repair any leaking devices or equipment, such as valves, with the same type, or equal.
- If the leaking equipment cannot be repaired, or it is not cost effective to do so, replace it with the same type or equal.

The calculations on the following page show that repairing all steam leaks will require a total investment of approximately $18,000, while providing an estimated annual savings of $33,393.

The simple payback for this ECM is approximately six months.

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Steam Pressure (psig):	**5**	**100**	
Steam Pressure (psia):	19.7	114.7	
Latent Heat of Steam @ absolute pressure (BTU/lb):	1156.30	1189.55	from Steam Tables
Steam Flow Rate (lbs/hr):	25000.0		
Estimated Steam Leak Rate (%)	2.00%		
Total Estimated Steam Leakage (lbs/hr)	638.31		
Percentage of Leaks in system:	75.00%	25.00%	
Total Estimated Steam Leakage (lbs/hr)	478.73	159.58	
Boiler daily operation (hrs/day):	24.00		
Boiler annual operation (hrs/yr):	8760.00		
Boiler efficiency (%):	80.00%		
Unit Fuel Cost ($/Mbtu):	$5.13		
Annual Energy Savings (Mbtu/yr):	**4849.17**	**1662.87**	
Total Annual Cost of Leakage ($/yr):	**$24,865.98**	**$8,527.02**	
Estimated Number of Steam Leaks in Facility:	200		
Estimated Material Cost per Leak:	$30.00		
Estimated Total Material Cost for all Leaks:	**$6,000.00**		
Estimated Labor Hours:	200	est. 1 hr./leak	
Labor Rate ($/hr):	$60.00		
Labor Sub-Total:	**$12,000.00**		
Estimated Total Investment:	**$18,000.00**		
Estimated Payback:	**0.54**	year(s)	
	6.47	month(s)	
2008-2009 Gas Cost	$ 1,569,648.39		
Annual Savings:	$33,393.00		
Estimated Annual Gas Cost:	**$ 1,536,255.39**		
Unit Gas Cost:	$ 0.513	/Therm gas cost	
Estimated Annual Gas Usage:	**2995886.551**	Therm/year	
	299588655.1	kBTU (gas)	
2008-2009 Electric Cost	**$ 518,047.93**		
Annual Savings:	$ -		
Estimated Annual Electric Cost:	**$ 518,047.93**		
Estimated Total Annual Utility Cost:	**$ 2,054,303.32**		
Estimated Annual Electric Usage:	23,741,006	kBTU (electric)	
Estimated Annual Total Energy Usage:	323,329,662	kBTU total	
Estimated Energy Utilization Index (EUI)	**741.90**	kBTU/sq. ft	
Estimated Energy Cost Index (ECI)	**$4.71**	$/sq. ft.	

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ECM #2: Replace Existing Steam Traps Throughout Facility

Thermal imaging of steam traps in the facility reveals that many traps have "failed open," and are therefore wasting valuable steam.

- Maintenance department estimates that there are 300-400 traps throughout the facility.
- While some traps look to have been recently replaced or repaired, there appears to be no maintenance log of which ones were replaced, or when the work was performed.

Types of traps:
Most of the traps in the facility are of the following types:

- Inverted bucket (IB)
- Float and Thermostatic (F&T)
- Thermostatic

Recommendations:
In order to resolve the problem of failed steam traps, the following procedures are recommended:

- Evaluate all traps using therographic imaging or ultrasonic analysis to determine whether they are working properly, in need of repair, or failed.
- Replace all failed traps throughout the facility with new traps of the same type.
- Repair any trap that is working, but not working properly.
- Tag all traps with an equipment number for CMMS/preventive maintenance purpose.
- Develop a preventive maintenance schedule for regular service of traps.
    - Create a service log for all traps to record service actions and dates.

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Cost and Payback

The calculations on the following page show that replacing failed steam traps (approximately 35 percent of the total throughout the facility) will require a total investment of approximately $119,700, while providing an estimated annual savings of $200,000.

The payback for this ECM is approximately 7 months.

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Steam Constant (lb/(hr-psia-sqin)):	24.24	
Steam Pressure (psig):	5.00	
Steam Pressure (psia):	19.7	
Orifice Diameter (inches):	0.09375	
Orifice Opening Fraction (%):	50.00%	
Steam Flow Rate (lb/hr):	2.10	
Latent Heat of Steam @ absolute pressure (BTU/lb):	1156.30	from Steam Tables
Saturation Temperature (deg. F)	228.00	from Steam Tables
Condensate Return Temperature (deg F)	170.00	
Boiler daily operation (hrs/day):	24.00	
Boiler annual operation (hrs/yr):	8760.00	
Boiler efficiency (%):	80.00%	
Unit Fuel Cost ($/Mbtu):	$5.13	
Annual Energy Savings (Mbtu/yr):	278.59	
Annual Cost Savings per Trap ($/yr):	$1,428.57	
Total Number of Traps in Facility (est.):	350	
Percentage of Traps to be replaced (est.):	40%	
Total Number of Traps to be replaced (est.):	140	
Total Annual Savings:	**$200,000.00**	
Estimated Cost per Trap:	$500.00	
Estimated Total Cost for all Traps:	**$70,000.00**	
Contractor Markup (15%):	**$10,500.00**	
Material Allowance (Pipe, Valves, Fittings):	**$19,600.00**	
Grand Total - Material:	**$100,100.00**	
Estimated Labor Hours:	280	est. 2 hrs./trap'
Labor Rate ($/hr):	$70.00	
Labor Sub-Total:	**$19,600.00**	
Estimated Total Investment:	**$119,700.00**	
Estimated Payback:	**0.60**	year(s)
	7.18	month(s)
2008-2009 Gas Cost	$ 1,569,648.39	
Annual Savings:	**$200,000.00**	
Estimated Annual Gas Cost:	**$ 1,369,648.39**	
Unit Gas Cost:	$ 0.513	/Therm gas cost
Estimated Annual Gas Usage:	2670982.454	Therm/year
	267098245.4	kBTU (gas)
2008-2009 Electric Cost	$ 518,047.93	
Annual Savings:	$ -	
Estimated Annual Electric Cost:	**$ 518,047.93**	
Estimated Total Annual Utility Cost:	**$ 1,887,696.32**	
Estimated Annual Electric Usage:	23,741,006	kBTU (electric)
Estimated Annual Total Energy Usage:	290,839,252	kBTU total
Estimated Energy Utilization Index (EUI)	**667.35**	kBTU/sq. ft
Estimated Energy Cost Index (ECI)	**$4.33**	$/sq. ft.

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ECM #3: Repair/Upgrade Condensate Return System:

Each building has its own condensate return pump "package." Each package consists of a tank and two pumps; tank sizes range from 15 gallons to approximately 38 gallons. Most of these units are located in the mechanical room of the building they serve; although some are located in the utility tunnel.

Many of these return units are leaking condensate onto the floor of the tunnel or mechanical room. This wastes energy dollars in that hot condensate that would otherwise be returned to the boiler now must be replaced with colder water from the building water supply. This water requires more energy to heat it to the steam discharge saturation temperature.

- It is estimated that there are approximately 24 condensate pump units throughout the facility.

Recommendations:
In order to resolve the problem of condensate system leaks, the following procedures are recommended:

- Examine each pumping unit to determine the source of the leak.
- Tighten any loose fittings where condensate is leaking.
- If the leaking equipment cannot be repaired, or it is not cost effective to do so, replace it with the same type or equal.

The calculations on the following page show the approximate cost of replacing all 24 units, as well as the payback period.

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Estimated flow rates of Condensate leaks (lb/hr)

Type	flow rate/leak	% of Total	No. of Leaks	Leakage
Low:	10	60%	15	144
Moderate:	20	35%	8	168
Severe:	30	5%	1	36
			24	**348**

Source: Guide to Energy Management
Capeheart, Turner, Kennedy
2008 Fairmont Press

Latent Heat of Steam @ absolute pressure (BTU/lb):		117.95	from Steam Tables
Condensate Return Temperature (deg F)		170.00	
Boiler daily operation (hrs/day):		24.00	
Boiler annual operation (hrs/yr):		8760.00	
Boiler efficiency (%):		80.00%	
Unit Fuel Cost ($/Mbtu):		$5.13	
Annual Energy Savings (Mbtu/yr):		**359.57**	
Total Annual Cost of Leakage ($/yr):		**$94,099.00**	
Number of Condensate Return Units in Facility:		24	
Hoffman Duplex Condensate Pumps		**$125,000.00**	
Contractor Markup (10%)		**$12,500.00**	
Material Allowance (Pipes, Valves, etc.)		**$12,000.00**	24units @$500
Material Sub-Total:		**$149,500.00**	
Estimated Labor Hours:		768	est. 32 hrs./receiver
Labor Rate ($/hr):		$70.00	
Labor Sub-Total:		**$53,760.00**	
Estimated Total Investment:		**$203,260.00**	
Estimated Payback:		**2.16**	year(s)
		25.92	month(s)
2008-2009 Gas Cost	$	1,569,648.39	
Annual Savings:	$	94,099.00	
Estimated Annual Gas Cost:	**$**	**1,475,549.39**	
Unit Gas Cost:	$	0.513	/Therm gas cost
Estimated Annual Gas Usage:		**2877502.401**	Therm/year
		287750240.1	kBTU (gas)
2008-2009 Electric Cost	$	518,047.93	
Annual Savings:	$	-	
Estimated Annual Electric Cost:	**$**	**518,047.93**	
Estimated Total Annual Utility Cost:	**$**	**1,993,597.32**	
Estimated Annual Electric Usage:		23,741,006	kBTU (electric)
Estimated Annual Total Energy Usage:		311,491,247	kBTU total
Estimated Energy Utilization Index (EUI)		**714.74**	kBTU/sq. ft
Estimated Energy Cost Index (ECI)		**$4.57**	$/sq. ft.

Four Seasons Environmental, Inc.

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ECM # 4: Repair/Replace Existing HVAC Equipment

Existing Mechanical Equipment and Systems:
Most of the heating and ventilating equipment within this facility is approaching or at the end of its useful life. Some components are partially dismantled or otherwise inoperable.

Most of the buildings are of a forced-air system design, utilizing steam coils located within air handlers for heat. Some buildings have hot-water systems, which utilize a system of convectors or fin-tube radiators.

The original design of the facility included no central cooling. Central air conditioning was recently added to the chapel and visiting areas; other limited areas are cooled using window-mounted air conditioning units.

Proposed Mechanical Equipment and Systems:
New mechanical equipment within this facility shall be as follows:

- Air handling units superior to existing units—i.e., 2010 units in lieu of 1959 units.
- Repair and/or replacement of ductwork and/or flexible connections as required.
- Repair/replacement of any hot-water or steam radiator or convector unit that is not functioning properly.

It is estimated that the total investment for this new equipment and the controls will be approximately $2,755,000. The total estimated savings from replacing the air handlers and the controls (see ECM #5) is $2,755,000 with estimated annual savings being $626,308, yielding a simple payback of 4 years and 5 months, ECMs 4, 5 and 6 must all be accomplished as a whole to achieve the $626,308 annual energy savings. For purposes of this exercise, we have assumed 40 percent of the $262,308 savings will come from the new air handlers, 50 percent from the new controls and 10 percent from updating the sequence of operation.

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ECMs # 5-6: Replace existing DDC Control System; Update Sequence of Operation

Existing Control System:
The control system within this facility is as follows:

- Honeywell Digital Direct Control (DDC) system front end. This was installed to provide digital control of the existing pneumatic controls, such as steam valves, thermostats, and intake air dampers.

The system is not functioning. Air handlers, heat exchangers, return and fresh air dampers, etc. are all manually controlled and adjusted per complaints. Most return air and outside air dampers are either inoperable or disconnected. Several buildings are in a "runaway" state.

Proposed Control System:
A new electronic DDC control system within this facility could fit the following description:

- Automated Logic (or equal) front end.
- Belimo (or equal) electric actuators for return air and outside air dampers, control valves, et cetera.
- Tamper-resistant temperature sensors in areas accessible to inmates.
- Temperature sensors located in the discharge, return, and outside air streams (where applicable) for more accurate control of space temperature.

It is estimated that the total investment for this new control system will be approximately $752,000. Annual savings are estimated to be $313,154, yielding a payback of 2.4 years.

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Sequence of Operations

A. Cell Blocks A thru K

Overview

- Air Handlers
  1. Each building has two (2) constant-volume air handlers (AHUs), one for the east rank of cells, the other for the west. Each AHU also provides airflow to the central gallery, thru vents mounted on the facing walls.
  2. Steam coils in the Discharge Air stream provide heat to cells and gallery.
     - One (1) Thermostat for each AHU is mounted on the gallery walls and control the steam valves feeding coils
  3. Dampers at intake regulate Return Air/Outside Air ratio.
     - In winter, intake air is mixture of return and outside air
     - In summer, intake is 100 percent outside air.
  4. Sensors
     - Sensors will monitor the room air temperature, outside air temperature, return air temperature, mixed air temperature, and discharge air temperature.

Proposed Operation

- Heating Mode:
  1. Outside air (OA) temperature is less than 70°F
  2. Return air (RA) temperature equals 68°F
     - Return Air damper will maintain a minimum of 10% airflow across the RA sensor.
  3. Mixed air (MA) temperature equals 60°F

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- As outdoor temperature drops, system will modulate OA and RA dampers to maintain RA and MA temperatures.

4. Discharge air (DA) temperature
   - As the outdoor temperature drops, the system will reset the discharge air temperature according to a discharge air reset schedule.

5. If the room air temperature sensors in the cell block area are below the setpoint, the steam valve will modulate open, allowing steam thru the coil.

6. If signal from outside air sensor is lost (or if network fails), system will revert to heating mode.

Ventilation Mode:

1. Outside air (OA) temperature is less than 70°F
   - Outside Air damper will open fully and system will run on 100% outside air.
   - Return Air damper will close fully and the RA sensor will be disabled.
   - Opening windows in monitor and cells will assist in maintaining proper ventilation.
   - Steam valve will modulate closed.

B. Cell Block R

Overview

The heating and ventilating system for this building is similar to that of Cell Blocks A-K, except that there is only one air handler serving both sides of the building.

Proposed Operation

The operation of this system is identical to that of Cell Blocks A-K.

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C. Segregation Cell Block

Overview

- Air Handlers
  The heating and ventilating system for this building consists of four air handlers. The largest of these (H & V-1) provides a mixture of outside and return air to the majority of cells in the building. The second (H & V-2) provides 100 percent outside air to the four (4) psychiatric cells. The remaining two (2) units (H & V-3 and -4) provide a mixture of outside and return air to the segregation cells. All units contain steam coils for heating purposes.

Proposed Operation

Main Cell Banks/Segregation Cells

1. The operation of this system is similar to that of Cell Blocks A-K, except:
   - In heating mode, Units H & V-3 and H & V-4 operate in tandem.
   - There is no return air or mixed air sensor on unit H & V-2, since it operates with 100 percent outside air.

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ECMs #7: Install Steam Turbine Cogeneration System

In a steam turbine cogeneration system, steam from the boiler enters a turbine-driven generator, producing electricity. The turbine exhaust, rather than being sent up the stack or otherwise wasted, is then used for another purpose, such as heating.

When it opened in 1959, the Lebanon Correctional Institution used a steam turbine cogen system. The generator was removed in 1984.

As most of the piping from the earlier system is still in place, it is possible that much of it may be re-used, thereby minimizing installation cost.

The recommended system would generate up to 750kW of electricity, based on a 250 psig inlet pressure and a 5 psig exhaust pressure. The 5 psig exhaust would then be routed to the building heating system.

The estimated total expenditure for this system (including the steam turbine generator, installation and miscellaneous materials) is $1,209,600. It is estimated that this measure will save $370,225 annually, yielding a simple payback of 3.27 years.

Our feasibility grade estimate shows a cost of $1,209,000 and an annual projected energy savings of $370,225 for a simple payback of three (3) years and three (3) months, which appears to be quite attractive. However, some additional preliminary work should be accomplished prior to preceding with cogeneration.

We would therefore recommend the following approach to be taken before proceeding:

- Authorize a preliminary design and an accurate estimate based on that design to be performed.

- Consider maintenance staff additions, once cogeneration is complete. Will more staff be required? If yes, what impact will these additional operations and maintenance workers have on the savings.

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- With these two pieces or additional justification information in hand, then make a decision to proceed with full design and construction.

		kWh	kW
Electrical Load (3 yr avg): (Avg. Monthly Usage/(24 hrs./day * 30 days/month)		582806.11	809
Generator Power Output:		432000.00	600
Remaining Load:		**150806.11**	**209**
Avg.Current Monthly Cost:	$	41,622.23	
Avg. Monthly Cost of Generated Power: (Savings)	$	30,852.12	
Avg. Annual Cost of Generated Power: (Savings)	$	370,225.41	
Payback =		**3.27**	years
		39.21	months

2008-2009 Gas Cost	$ 1,569,648.39	
Annual Savings:	$0.00	
Estimated Annual Gas Cost:	**$ 1,569,648.39**	
Unit Gas Cost:	$ 0.513	/Therm gas cost
Estimated Annual Gas Usage:	**3061007**	Therm/year
	306,100,700	kBTU (gas)
Estimated Annual Electric Usage:	6,174,605	kBTU (electric)
Estimated Annual Electric Cost:	**$ 129,241.33**	
Estimated Annual Total Energy Usage:	**312,275,305**	kBTU total
Estimated Annual Total Energy Cost:	**$ 1,698,889.72**	
Conditioned Square Footage:	435,813	sq. ft.
Estimated Energy Utilization Index (EUI)	**716.54**	kBTU/sq. ft
Estimated Energy Cost Index (ECI)	**$3.90**	$/sq. ft.

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ECMs #8– 20: Upgrade Interior and Exterior lighting systems

The Lebanon Correctional Institution lighting system was retrofitted within the last decade to replace existing T12 systems with more efficient T8 systems. However, the existing eight-foot T12 lamps and ballasts as well as two-foot T12 lamps and ballasts were left untouched. Given the large quantity of these fixtures throughout the facility, incentives from the electric utility provider (Duke Energy) and energy cost savings, these systems should all be retrofitted with higher efficacy T8 systems. Replacing these systems will reduce energy use and costs while increasing light levels and will improve the Color Rendering Index (CRI) of the light, which in turn leads to better visual acuity. In addition, a significant number of metal halide fixtures are used throughout maintenance and work areas, as well as the gymnasium, cafeteria and other spaces. Replacing these metal halide fixtures with new fluorescent systems reduces energy costs, improves light levels and extends system life. Fluorescent systems also turn on instantly after a power outage as opposed to the 10-15 minute re-strike time inherent to metal halides. This characteristic is especially important given the emphasis on security throughout the facility.

In the areas typically occupied by Lebanon Correctional staff only, occupancy sensors should be implemented to reduce energy consumption when not in use. These areas are primarily administrative offices, storage areas, and staff restrooms. Other areas, such as the classrooms, can also benefit from occupancy sensors if agreements on necessary safeguards are reached.

All exterior lighting including the yard and fence perimeter is exclusively High Pressure Sodium (HPS). HPS systems are known for a high lumen per watt efficacy and are characterized by a very orange color of light. The lumen per watt rating of HPS systems is very misleading when evaluating night time or low ambient light level environments. Past and recent research on the human visual system supports the idea that broad spectrum or high color temperature white light sources improve visual acuity during night time or low ambient light levels. An adjustment for this phenomenon is often referred to as a scotopic adjustment, or traditional lumen measurements are multiplied by a

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scotopic/photopic ratio (S/P). However, most night time vision is referred to as mesopic as it falls between the eye's photopic and scotopic response. For this reason our recommendations for site lighting are based on a conservative adjustment to account for the increase in effective lumens for recommended white light sources. Additionally, during both of our visits to the facility, the high mast lights remained on during periods of sufficient daylight. Facility staff also mentioned the high mast lights are frequently left on unnecessarily in their opinion. Significant savings can be achieved by replacing or recalibrating the automatic controls for the high mast lights in addition to reducing the system watts.

Powerhouse and Garage

The powerhouse facility's high bay metal halides should be replaced with high bay fluorescent systems to take advantage of energy savings, utility rebates, better lumen maintenance, and extended system life. Newer fluorescent systems will also restart immediately in the event of a power failure. The facility has a combination of 400, 250 and 175 watt metal halides throughout, which should all be replaced with an equivalent fluorescent system in terms of light output. Rebates from Duke Energy range from $30 to $50 per fixture replacement and energy savings are around 40-50 percent per system.

Staff offices in the powerhouse are frequently unoccupied due to the maintenance nature of their work and significant savings can be achieved by installing occupancy sensors. The restroom and storage areas through the facility are also great candidates for occupancy sensors.

The garage also has 400 watt and 250 watt metal halide fixtures in addition to a few fluorescent T12 systems and even some incandescent lamps. These can all be cost effectively replaced with more efficient, longer lasting systems that also qualify for utility rebates. Better light output and distribution will also be achieved with a replacement of the fixtures.

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Lebanon Correctional Institution (Interior)

Within the facility, there are a significant number of T12 fixtures that were not replaced during the original lighting retrofit project. The bulk of these systems are within the range lights located within the cell blocks. As documented by facility staff, there are (831) 2-lamp T12 fixtures that use an old trigger start system which is less efficacious than newer T8 systems. The components of the units we were able to view had been removed and we were unable to take a current reading of a fixture in use. However, similar units show an input wattage of 46 watts which we have used for our estimates. Staff mentioned that they were looking for a solution other than a new FAIL SAFE fixture which uses 2 biax lamps. The new fixtures are expensive and have a smaller aperture than existing fixtures which reduces the amount of light into the cell blocks. By removing the T12 components from existing fixtures, a new T8 system along with new lamp holders can be retrofitted to save energy and avoid the cost of purchasing new fixtures. Utility incentives for this measure alone are more than $3,300 which makes this an attractive component of the project.

Similarly, many of the maintenance areas still have two lamp eight-foot T12 systems that were not replaced in the previous retrofit project. These systems are inefficient and in many cases do not provide enough light for the tasks. Facility personnel in many areas have resorted to adding additional metal halide fixtures to increase light levels, which obviously increases energy consumption and costs. For these areas we recommend removing existing T12 and metal halide fixtures and replacing with an array of new high bay fluorescent fixtures. We have provided preliminary lighting calculations for some of these areas that show an increase in light levels while also reducing energy consumption and costs. Utility incentives are also applicable which improves overall payback. The cafeteria, gymnasium, visitation and other areas can also generate energy savings by replacing metal halide fixtures with new fluorescent systems. The appendix contains some lighting calculations as a reference for these sample areas.

Office spaces, storage areas, restrooms and other areas within the facility can dramatically reduce operating hours and energy costs through the use of occupancy sensors. Our analysis accounts only for savings

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in areas occupied nearly exclusively by facility staff based on concerns voiced by some personnel. However we believe proper planning and input from the warden and other officials regarding the use of occupancy sensors could yield additional savings.

There is also a combination of incandescent and LED retrofitted exit signs throughout the facility. Some exit signs are no longer operational, and incandescent signs should be replaced for safety and energy savings. We counted eight incandescent exit signs during our walkthrough, however many more should probably be replaced.

Exterior Lighting

The purpose of the facility's exterior lighting system is to assist officers on duty in monitoring the yard and fence perimeter. Given that these systems are used during the evening and early morning hours when no daylight is available, a white light source is the most appropriate choice, as white light sources are the most effective in rendering objects for the human eye in low ambient light. The current high pressure sodium lamps being used are not the optimal choice for this task. Mark Rea in 1995, then director of the Lighting Research Center at the Rensselaer Polytechnic Institute in New York, noted in a published article that at night metal halide lamps are 125 percent more effective than HPS lamps in producing the same visual effect. This effect has been demonstrated by research conducted by the United States Department of Energy at the FAA in New Jersey as well as other site locations. The DOE has dedicated a significant amount of resources to researching LEDs or solid state lighting technology for this and other reasons. Many reports are available that show positive feedback as well as significant energy savings through their demonstrations. Further analysis should be considered for LED replacements, but preliminary research shows it is feasible and offers many benefits including maintenance free operation for 10 years or more. Federal money may also be obtainable to study potential LED replacements for Lebanon's exterior lighting.

However, our current recommendation is to replace all existing HPS systems with lower wattage pulse start metal halide systems. These retrofits offer energy savings, maintenance savings, and a dramatic im-

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provement in color rendering when compared to current HPS systems. Lighting calculations are provided with a conservative S/P ratio adjustment to support our recommendation.

Financial Analysis	
Annual kWh Reduction	499,603
Annual energy Savings (current)	$ 39,968
Project Costs	
Product	$ 88,189
Labor	$ 72,306
Total w/15% Markup	$ 184,570
Duke Energy Rebates	$ 12,090
Simple Payback (yrs)	4.32
Internal Rate of Return (10yrs)*	28%
Net Present Value (10yrs)*	$ 169,421

*Includes PUCO approved rate increases for Duke Energy in 2010 and 2011

THESE FIGURES DO NOT QUANTIFY EXPECTED MAINTENANCE SAVINGS

Section 5: Recommendations

ECM #20: Replace original windows in Cell Block Buildings with Thermally Efficient Window Units

Existing window system:
The South bank of Cell Block buildings has newer windows which are double-glazed, with thermal-break frames.

- The newer windows open via a mechanical operating mechanism, and tilt out from the building.
  - A heavy-mesh screen inside the cell prevents trash from being thrown out of the window.
  - All remaining buildings have the original 1959, single-glazed, steel frame windows.
- These windows tilt in to the cell/office space
  - In the North Cell Blocks, glass panes are frequently broken, as the glass is thin (3/16" typ.) and there is no screen over the windows.
  - Inmates throw trash out of open/broken windows into prison yard

New window system:
- Install new double pane/dual glazed windows similar to those in the South Cell blocks for energy savings.
  - Primary buildings to have windows replaced are:
    - Cell Blocks A – E, and R
    - Administration, Visiting, and North Corridor
    - School
    - Gymnasium

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- Heavy-mesh screen will be provided in each cell to allow airflow, but prevent objects from being thrown out of the window.
- Thermal-break stainless-steel frames will be used.
- Complete shop drawings will be submitted to the owner complete with glass samples.

Although the calculations on the following pages show an extremely long payback period for this ECM, it is still recommended that it be executed for safety and security reasons. The newer window design will not only prevent the inmates from throwing trash out the windows, but more importantly, eliminate the breakage of glass by the inmates.

Cell Block Windows

Typ. glass thickness:	0.1875		
Typ U value:	1.25	source:	ASHRAE 90.1
Typ. SHGC:	0.82	source:	ASHRAE 90.1
Typ. VLT:	0.76	source:	ASHRAE 90.1
Typ U value (new):	0.66	source:	mfr. Specs (extrapolated)
Heating Design Temp:	-1 F	source:	ASHRAE 90.1, Dayton, OH
Heating Indoor Temp:	68 F	assumed	

Cell Blocks A, B(Bldgs G 1, 2 on dwgs)

Number of buildings: 2

						Existing Windows		New Windows	
Window Type:	Quantity:	W	H	Area/unit (sq ft):	Total Area (sq ft):	Heat Loss/unit (BTU/hr)	Total (BTU/hr)	Heat Loss/unit (BTU/hr)	Total (BTU/hr)
1	40	72.125	62.000	31.05	1242.15	2678.39	107135.68	1403.48	56139.09
2	18	77.500	62.000	33.37	600.63	2877.99	51803.91	1508.07	27145.25
3	5	32.750	62.000	14.10	70.50	1216.18	6080.92	637.28	3186.40
4	3	32.750	52.625	11.97	35.91	1032.29	3096.86	540.92	1622.75
5	24	51.875	24.500	8.83	211.82	761.24	18269.73	398.89	9573.34
6	1	72.125	52.625	26.36	26.36	2273.39	2273.39	1191.26	1191.26
7	4	51.875	62.000	22.34	89.34	1926.40	7705.60	1009.43	4037.73
	95		**Building Sub-Total:**		**2276.71**		**196366.08**		**102895.83**
	190								
			Total, G1 & G2:		**4553.42**		**392732.17**		**205791.66**

Cell Block D (Bldg R on dwgs)

Number of buildings: 1

Window Type:	Quantity:	W	H	Area/unit (sq ft):	Total Area (sq ft):	Existing Windows Heat Loss/unit (BTU/hr)	Existing Windows Total (BTU/hr)	New Windows Heat Loss/unit (BTU/hr)	New Windows Total (BTU/hr)
1	41	72.000	62.000	31.00	1271.00	2673.75	109623.75	1401.05	57442.85
2	18	77.500	62.000	33.37	600.63	2877.99	51803.91	1508.07	27145.25
3	3	32.750	62.000	14.10	42.30	1216.18	3648.55	637.28	1911.84
4	4	32.750	52.625	11.97	47.87	1032.29	4129.14	540.92	2163.67
5	24	52.000	24.500	8.85	212.33	763.07	18313.75	399.85	9596.41
6	0	72.000	52.625	26.31	0.00	2269.45	0.00	1189.19	0.00
6A	1	77.500	52.625	28.32	28.32	2442.81	2442.81	1280.03	1280.03
7	2	52.000	62.000	22.39	44.78	1931.04	3862.08	1011.87	2023.73
	93			**Building Sub-Total:**	**2247.23**		**193824.00**		**101563.78**

Cell Block E (Bldg S on dwgs)

Number of b 1

Window Type:	Quantity:	W	H	Area/unit (sq ft):	Total Area (sq ft):	Existing Windows Heat Loss/unit (BTU/hr)	Existing Windows Total (BTU/hr)	New Windows Heat Loss/unit (BTU/hr)	New Windows Total (BTU/hr)
1	41	72.000	62.000	31.00	1271.00	2673.75	109623.75	1401.05	57442.85
2	18	77.500	62.000	33.37	600.63	2877.99	51803.91	1508.07	27145.25
3	3	32.750	62.000	14.10	42.30	1216.18	3648.55	637.28	1911.84
4	8	32.750	52.625	11.97	95.75	1032.29	8258.29	540.92	4327.34
5	23	52.000	24.500	8.85	203.49	763.07	17550.68	399.85	9196.55
7	3	52.000	62.000	22.39	67.17	1931.04	5793.13	1011.87	3035.60
	96			**Building Sub-Total:**	**2280.33**		**196678.30**		**103059.43**

Cell Block R & Library (Bldg B on dwgs)

Number of buildings: 1

Window Type:	Quantity:	W	H	Area/unit (sq ft):	Total Area (sq ft):	Existing Windows Heat Loss/unit (BTU/hr)	Existing Windows Total (BTU/hr)	New Windows Heat Loss/unit (BTU/hr)	New Windows Total (BTU/hr)
1	36	72.125	61.375	30.74	1106.67	2651.39	95450.11	1389.33	50015.86
1A	0	74.875	61.375	31.91	0.00	2752.48	0.00	1442.30	0.00
2	20	51.875	24.000	8.65	172.92	745.70	14914.06	390.75	7814.97
3	2	32.750	52.125	11.85	23.71	1022.48	2044.96	535.78	1071.56
4	1	72.125	52.125	26.11	26.11	2251.79	2251.79	1179.94	1179.94
5	1	108.250	24.000	18.04	18.04	1556.09	1556.09	815.39	815.39
6	7	70.500	33.375	16.34	114.38	1409.31	9865.18	738.48	5169.35
7	1	32.750	61.375	13.96	13.96	1203.92	1203.92	630.86	630.86
8	8	70.500	24.000	11.75	94.00	1013.44	8107.50	531.04	4248.33
8A	1	74.875	24.000	12.48	12.48	1076.33	1076.33	564.00	564.00
9	3	77.375	24.000	12.90	38.69	1112.27	3336.80	582.83	1748.48
10A	1	172.000	52.125	62.26	62.26	5369.96	5369.96	2813.86	2813.86
11	1	205.000	70.875	100.90	100.90	8702.49	8702.49	4560.10	4560.10
12	1	127.750	70.875	62.88	62.88	5423.14	5423.14	2841.72	2841.72
16	1	183.750	52.125	66.51	66.51	5736.80	5736.80	3006.09	3006.09
22	1	83.250	52.125	30.13	30.13	2599.12	2599.12	1361.94	1361.94
23	2	186.000	104.000	134.33	268.67	11586.25	23172.50	6071.20	12142.39
23A	1	186.000	104.000	134.33	134.33	11586.25	11586.25	6071.20	6071.20
23B	1	186.000	104.000	134.33	134.33	11586.25	11586.25	6071.20	6071.20
30	1	51.875	33.375	12.02	12.02	1036.99	1036.99	543.38	543.38
32A	1	83.250	70.875	40.97	40.97	3534.06	3534.06	1851.85	1851.85
46	3	70.500	13.250	6.49	19.46	559.50	1678.51	293.18	879.54
64	4	172.000	52.125	62.26	249.04	5369.96	21479.84	2813.86	11255.44
78	1	39.125	71.375	19.39	19.39	1672.62	1672.62	876.45	876.45
79	1	83.250	71.375	41.26	41.26	3558.99	3558.99	1864.91	1864.91
105	1	20.000	24.500	3.40	3.40	293.49	293.49	153.79	153.79
	101			**Building Sub-Total:**	**2866.52**		**247237.77**		**129552.59**
				Grand Total:	**14175.83**		**1222665.32**		**640676.63**

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573	Total windows (All Cell Block buildings)	
$ 2,865,000.00	Total Window Cost (Total windows * $5000/unit)	
$ 687,600.00	Window installation (est. 16 hr./unit@$75/hr)	
$ 3,552,600.00	Total	
Payback = **135.89**	years	

581988.69	BTU/hr savings
5098.22	MBTU/yr savings
$ 5.13	$/MBTU gas cost
$ 26,143.08	$/yr savings
$ 236,840.00	/yr svgs req'd for 15-year payback.

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ECM #21 - 23: Replace Original Windows in Administration, Gymnasium and Classroom Buildings with Thermally Efficient Window Units

Existing window system:

- These buildings have the original 1959, single-glazed, steel frame windows.
  - These windows tilt in toward the occupied space
  - Glass panes in these windows are susceptible to breakage, as the glass is thin (3/16" typ.) and there is no screen over the windows.

New window system:

- Install new double pane/dual glazed windows similar to those in the South Cell blocks for energy savings.
  - Primary buildings to have windows replaced are:
    - Administration, Visiting, and North Corridor
    - School
    - Gymnasium
  - Heavy-mesh screen will be provided in each cell to allow airflow, but prevent objects from being thrown out of the window.
- Thermal-break stainless-steel frames will be used.
- Complete shop drawings will be submitted to the owner complete with glass samples.

Although the calculations on the following pages show an extremely long payback period for this ECM, it is still recommended that it be executed for safety and security reasons.

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Admin Building and Classroom Windows		
Typ. glass thickness:	0.1875	
Typ U value (existing):	1.25	source: ASHRAE 90.1
Typ. SHGC:	0.82	source: ASHRAE 90.1
Typ. VLT:	0.76	source: ASHRAE 90.1
Typ U value (new):	0.66	source: mfr. Specs (extrapolated)
Heating Design Temp:	-1 F	source: ASHRAE 90.1, Dayton, OH
Heating Indoor Temp:	68 F	assumed
Cooling Design Temp, DB:	88 F	source: ASHRAE 90.1, Dayton, OH
Cooling Design Temp, WB:	73 F	source: ASHRAE 90.1, Dayton, OH
Cooling Indoor Temp:	75 F	assumed

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Administration, North Corridor, & Visiting (Bldg A on

Number of buildings: 1

						Heating				Cooling			
						Existing Windows		New Windows		Existing Windows		New Windows	
Window Type:	Qnty	W	H	Area/unit (sq ft):	Total Area (sq ft):	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)
70	2	116.750	69.250	56.15	112.29	4842.54	9685.08	2537.49	5074.98	912.36	1824.725	478.08	956.16
71	6	176.750	69.250	85.00	510.00	7331.21	43987.28	3841.56	23049.33	1381.24	8287.458	723.77	4342.63
71A	2	176.750	69.250	85.00	170.00	7331.21	14662.43	3841.56	7683.11	1381.24	2762.486	723.77	1447.54
72	1	57.500	69.250	27.65	27.65	2384.98	2384.98	1249.73	1249.73	449.34	449.3435	235.46	235.46
73	2	154.000	99.500	106.41	212.82	9177.84	18355.68	4809.19	9618.37	1729.16	3458.316	906.08	1812.16
74	4	48.000	99.500	33.17	132.67	2860.63	11442.50	1498.97	5995.87	538.96	2155.833	282.41	1129.66
75	5	92.750	71.375	45.97	229.86	3965.12	19825.61	2077.72	10388.62	747.05	3735.261	391.46	1957.28
76	11	92.750	87.188	56.16	617.73	4843.56	53279.17	2538.03	27918.28	912.55	10038.1	478.18	5259.97
76A	1	92.750	87.188	56.16	56.16	4843.56	4843.56	2538.03	2538.03	912.55	912.5549	478.18	478.18
77	23	83.750	87.188	50.71	1166.28	4373.57	100592.01	2291.75	52710.21	824.01	18952.12	431.78	9930.91
77A	1	83.750	87.188	50.71	50.71	4373.57	4373.57	2291.75	2291.75	824.01	824.0051	431.78	431.78
77B	1	83.750	87.188	50.71	50.71	4373.57	4373.57	2291.75	2291.75	824.01	824.0051	431.78	431.78
78	3	39.125	71.375	19.39	58.18	1672.62	5017.86	876.45	2629.36	315.13	945.3935	165.13	495.39
79	2	83.250	71.375	41.26	82.53	3558.99	7117.98	1864.91	3729.82	670.53	1341.069	351.36	702.72
82	1	127.375	33.875	29.96	29.96	2584.40	2584.40	1354.23	1354.23	486.92	486.9164	255.14	255.14
83	3	127.375	24.000	21.23	63.69	1831.02	5493.05	959.45	2878.36	344.97	1034.922	180.77	542.30
97	4	26.375	52.625	9.64	38.56	831.34	3325.38	435.62	1742.50	156.63	626.5207	82.07	328.30
99	1	83.250	33.875	19.58	19.58	1689.12	1689.12	885.10	885.10	318.24	318.2397	166.76	166.76
100	15	83.250	71.375	41.26	618.96	3558.99	53384.88	1864.91	27973.67	670.53	10058.02	351.36	5270.40
100A	3	83.250	71.375	41.26	123.79	3558.99	10676.98	1864.91	5594.73	670.53	2011.604	351.36	1054.08
100B	3	83.250	71.375	41.26	123.79	3558.99	10676.98	1864.91	5594.73	670.53	2011.604	351.36	1054.08
101	1	209.500	144.750	198.21	198.21	17095.55	17095.55	8958.07	8958.07	3220.90	3220.901	1687.75	1687.75
103	3	83.250	24.500	14.16	42.49	1221.65	3664.95	640.14	1920.43	230.17	690.498	120.61	361.82
	98			**Building Sub-Total:**	**4736.61**		**408532.54**	52.40%	**214071.05**		**76969.90**	52.40%	**40332.23**

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Classroom (Bldg F on dwgs)

Number of buildings: 1

						Heating				Cooling			
						Existing Windows		New Windows		Existing Windows		New Windows	
Window Type:	Qnty	W	H	Area/ unit (sq ft):	Total Area (sq ft):	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)
39	2	45.500	52.125	16.47	32.94	1420.54	2841.08	744.36	1488.73	267.64	535.2767	140.24	280.48
84	10	96.000	33.875	22.58	225.83	1947.81	19478.13	1020.65	10206.54	366.98	3669.792	192.30	1922.97
85	4	125.000	33.875	29.41	117.62	2536.21	10144.86	1328.98	5315.90	477.84	1911.35	250.39	1001.55
86	3	83.250	24.500	14.16	42.49	1221.65	3664.95	640.14	1920.43	230.17	690.498	120.61	361.82
87	10	96.000	80.750	53.83	538.33	4643.13	46431.25	2433.00	24329.98	874.79	8747.917	458.39	4583.91
88	4	125.000	80.750	70.10	280.38	6045.74	24182.94	3167.97	12671.86	1139.05	4556.207	596.86	2387.45
89	1	20.000	52.625	7.31	7.31	630.40	630.40	330.33	330.33	118.77	118.7717	62.24	62.24
90	2	521.750	44.875	162.59	325.19	14023.73	28047.46	7348.43	14696.87	2642.15	5284.304	1384.49	2768.98
105	1	20.000	24.500	3.40	3.40	293.49	293.49	153.79	153.79	55.30	55.29514	28.97	28.97
106	2	45.500	24.500	7.74	15.48	667.69	1335.38	349.87	699.74	125.80	251.5929	65.92	131.83
107	2	96.000	24.500	16.33	32.67	1408.75	2817.50	738.19	1476.37	265.42	530.8333	139.08	278.16
	41			**Building Sub-Total:**	**1621.65**		**139867.44**		**73290.54**		**26351.84**		**13808.36**

Section 5: Recommendations

Gymnasium (Bldg K on dwgs)

Number of buildings: 1

						Heating				Cooling			
						Existing Windows		New Windows		Existing Windows		New Windows	
Window Type:	Qnty	W	H	Area/ unit (sq ft):	Total Area (sq ft):	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)	Heat Loss/ unit (BTU/hr)	Total (BTU/hr)
4A	1	32.750	52.625	11.97	11.97	1032.29	1032.29	540.92	540.92	194.49	194.4887	101.91	101.91
15	2	189.375	99.500	130.85	261.71	11286.06	22572.12	5913.90	11827.79	2126.36	4252.718	1114.21	2228.42
16	2	190.750	99.500	131.80	263.61	11368.00	22736.01	5956.83	11913.67	2141.80	4283.596	1122.30	2244.60
17	1	235.875	99.500	162.98	162.98	14057.29	14057.29	7366.02	7366.02	2648.47	2648.475	1387.80	1387.80
17A	1	235.875	99.500	162.98	162.98	14057.29	14057.29	7366.02	7366.02	2648.47	2648.475	1387.80	1387.80
18	3	233.250	99.500	161.17	483.51	13900.85	41702.55	7284.05	21852.14	2619.00	7857.002	1372.36	4117.07
19	1	231.875	99.500	160.22	160.22	13818.90	13818.90	7241.11	7241.11	2603.56	2603.562	1364.27	1364.27
20	1	170.250	99.500	117.64	117.64	10146.28	10146.28	5316.65	5316.65	1911.62	1911.618	1001.69	1001.69
21	1	242.875	99.500	167.82	167.82	14474.46	14474.46	7584.62	7584.62	2727.07	2727.073	1428.99	1428.99
22	1	156.250	99.500	107.96	107.96	9311.93	9311.93	4879.45	4879.45	1754.42	1754.422	919.32	919.32
23	1	155.000	99.500	107.10	107.10	9237.43	9237.43	4840.42	4840.42	1740.39	1740.386	911.96	911.96
24	1	187.875	99.500	129.82	129.82	11196.67	11196.67	5867.05	5867.05	2109.52	2109.517	1105.39	1105.39
25	3	52.000	62.000	22.39	67.17	1931.04	5793.13	1011.87	3035.60	363.82	1091.458	190.64	571.92
27	1	26.375	43.250	7.92	7.92	683.24	683.24	358.02	358.02	128.73	128.7269	67.45	67.45
31	1	77.375	62.000	33.31	33.31	2873.35	2873.35	1505.64	1505.64	541.36	541.3563	283.67	283.67
32	1	146.500	24.500	24.93	24.93	2149.81	2149.81	1126.50	1126.50	405.04	405.0369	212.24	212.24
	22			Building Sub-Total:	2270.64		195842.75		102621.60		36897.91		19334.50
				Grand Total:	8628.90		744242.73		389983.19		140219.65		73475.09

Four Seasons Environmental, Inc.

Section 5: Recommendations

Admin	**98**	Total windows (Admin only)	Heating:	
	$ 490,000.00	Total Window Cost (Total windows * $5000/unit)	194461.49	BTU/hr savings
	$ 117,600.00	Window installation (est. 16 hr./unit, $75/hr)	1703.48264	MBTU/yr savings
	$ 607,600.00	Total	$ 5.13	$/MBTU gas cost
			$ 8,735.26	$/yr savings
Payback =	**68.97**	years		
			Cooling:	
			36637.67	BTU/hr savings
			320.946005	MBTU/yr savings
			23,741	$/MBTU electricity cost
			73.97	$/yr savings

School	**41**	Total windows (School only)	Heating:	
	$ 205,000.00	Total Window Cost (Total windows * $5000/unit)	66576.90	BTU/hr savings
	$ 49,200.00	Window installation (est. 16 hr./unit, $75/hr)	583.213656	MBTU/yr savings
	$ 254,200.00	Total	$ 5.13	$/MBTU gas cost
			$ 2,990.65	$/yr savings
Payback =	**79.27**	years		
			Cooling:	
			12543.47	BTU/hr savings
			109.880834	MBTU/yr savings
			23,741	$/MBTU electricity cost
			216.06	$/yr savings

Section 5: Recommendations

Gymnasiu	**22**	Total windows (Gymnasium only)	Heating:	
	$ 110,000.00	Total Window Cost (Total windows * $5000/unit)	93221.15	BTU/hr savings
	$ 26,400.00	Window installation (est. 16 hr./unit, $75/hr)	816.617282	MBTU/yr savings
	$ 136,400.00	Total	$ 5.13	$/MBTU gas cost
			$ 4,187.52	$/yr savings
Payback =	**32.57**	years		

Section 6: Summary Table of Energy Conservation Measures

Energy Conservation Measures

The table on the following page depicts a summary of all of the Energy Conservation Measures, as recommended by Four Seasons Environmental, Inc. The table is broken down into four categories:

- HVAC
- Energy Management
- Lighting
- Building Envelope

Additionally, the subsequent table depicts the Energy Conservation Measures in more detail.

Energy Conservation Measure (ECM) Summary (all possible ECM's payback up to 20 years)*

Facility Name Lebanon Correctional Institution
Address 3791 SR 63, Lebanon, OH 45036
Building Name All

ECM No.	ECM Description	Implementation Cost	Calculated KWH reduction	Calculated KW Reduction	Calculated Elec. Savings	Calculated MCF gas Reduction	Calculated Gas Cost Savings	Calculated Water CCF	Calculated Water Cost Savings	Calculated Total Savings	Simple Payback
HVAC											
1	Repair Steam Leaks throughout facility	18000				6509.356725	33393			33393	0.539035127
2	Replace a portion of the steam traps throughout facility	119700				38986.35478	200000			200000	0.5985
3	Repair/Upgrade Condensate Return system	203260				18342.88499	94099			94099	2.160065463
4	Repair/Replace HVAC equipment	2003000	1764250.423	201.3984501	125261.78	24417.50097	125261.78			250523.56	7.995256015
5	Replace HVAC Control System	72000	2205313.028	251.7480626	156577.225	30521.87622	156577.225			313154.45	0.229918495
6	Sequence of Operation Update	32000	441062.6056	50.34961252	31315.445	6104.375244	31315.445			62630.89	0.51092999
	TOTAL FOR ALL HVAC ECMs (1-6):	**2447960**	**4410626.056**	**503.4961252**	**313154.45**	**124882.3489**	**640646.45**	**0**	**0**	**953800.9**	**2.566531443**
Cogen											
7	Install 750kW Steam Turbine cogeneration system	1209600	5184000	600	370225.41					370225.41	3.267198759
	TOTAL FOR HVAC AND COGEN ECMs (1-7):	**3657560**	**9594626.056**	**1103.496125**	**683379.86**	**124882.3489**	**640646.45**	**0**	**0**	**1324026.31**	**2.762452659**
Lighting											
8	Retrofit (121) 2L 8ft T12 fixtures w/2L 8ftT8										
9	Retrofit (831) 2L 2ft T12 fixtures w/2L 2ftT8										
10	Retrofit (6) 4L 4ft T12 fixtures w/4L 4ft T8										
11	Replace (112) 400w Metal Halide (MH) fixtures w/6L T8 high ballast factor										
12	Replace (90) 2L 8ft T12 and (10) 400w MH fixtures with (95) 4L T8 hbf										
13	Replace (12) 250w MH w/4L T8 hbf										
14	Replace cafeteria MH and 2L 8ft T12 w/T8 sealed fixtures										
15	Replace (8) 175w MH w/3L T8 strip fixtures										
16	Retrofit (9) 250w MH in Chapel w/150w quad tube CFLs										
17	Retrofit (245) 400w HPS systems w/250w pulse start MH systems										
18	Install new photocell or automatic controls for exterior lighting										
19	Replace (8) incandescant exit signs w/LED exit signs										
20	Install (14) wall and area occupancy sensors										
	TOTAL FOR ALL LIGHTING ECMs:	**172480**	**499603**	**57.03230594**	**39968**					**39968**	**4.315452362**
	NOTE: See following pages for more complete breakdown of lighting ECMs										
Windows											
21	Replace Windows in Cell Block Buildings	7563600				5096.116959	26143.08			26143.08	289.3155665
22	Replace Windows in Administration Building (incl. Visiting, Corridor)	1293600	1041.830986	0.118930478	73.97	1702.779727	8735.26			8809.23	146.8459786
23	Replace Windows in Classroom Building	541200	3043.098592	0.347385684	216.06	582.9727096	2990.65			3206.71	168.7711081
24	Replace Windows in Gymnasium	290400				816.2807018	4187.52			4187.52	69.34892251
	TOTAL FOR ALL WINDOW ECMs:	**9688800**	**4084.929577**	**0.466316162**	**290.03**	**8198.150097**	**42056.51**	**0**	**0**	**42346.54**	**228.7979136**

												$/kWh	$ 0.08		
Area Description	Existing Fixture	Watts	Volt	Qty.	Annual Op Hrs	Nex Fixture	Watts	Volt	Qty.	Annual Op Hrs	Existing kWh	New kWh	Savings	Duke Rebate	Notes
High Mast Area Lighting	400w HPS	465	480	144	5840	250w Pulse MH	288	480	144	4380	391046	181647	$ 16,752		New Photocell
Fence Lighting	400w HPS	465	480	80	4380	250w Pulse MH	288	480	80	4380	162936	100915	$ 4,962		
Ground Lighting	400w HPS	465	480	15	4380	250w Pulse MH	288	480	15	4380	30551	18922	$ 930		
Pwr House Storage	400w MH	455	277	1	8760	6L T8 Hi Bay	226	277	1	1000	3986	226	$ 301	$ 50	Wire Wall Occ Sensor
Keith Pwr House Office	3L T8	87	277	2	2250	SAME	89	277	2	1125	392	200	$ 15	$ 20	Wall Occ Sensor
Pwr House Equip Rm	400w MH	455	277	14	2250	6L T8 Hi Bay	226	277	14	2250	14333	7119	$ 577	$ 700	
Pwr House Boiler Rm	400w MH	455	277	7	2250	6L T8 Hi Bay	226	277	7	2250	7166	3560	$ 289	$ 350	
	250w MH	295	277	2	2250	4L T8 Hi Bay	148	277	2	2250	1328	666	$ 53	$ 80	
Basement	175w MH	213	277	8	6570	3L T8 4ft Strip	92	277	8	6570	11195	4836	$ 509	$ 240	
Generator Room	3L T8	87	277	4	6570	SAME	87	277	4	208	2286	72	$ 177	$ 20	Add Occ Sensor or process to turn lights out
	2L T8	58	277	1	6570	SAME	58	277	1	208	381	12	$ 30		
	2L T8 NL	58	277	0	8760	SAME	58	277	1	8760	0	508	$ (41)		Wire 1 Night Light
Eye Wash Tank Room	2L T8	58	277	9	2080	Same	58	277	9	208	1086	109	$ 78	$ 20	Wall Occ Sensor
Pwr House Tool Storage	2L T12 8ft	126	277	2	2000	2L T8 8ft	92	277	2	400	504	74	$ 34	$ 34	Wall Occ Sensor
	2L T8 4ft	58	277	2	2000	Same	58	277	2	400	232	46	$ 15		
Pwr House RR	2L T8	58	277	2	1500	Same	58	277	2	375	174	44	$ 10	$ 20	Wall Occ Sensor
Tim Brashear Office	2L T8	58	277	3	2000	SAME	58	277	3	1500	348	261	$ 7	$ 20	Wall Occ Sensor
Garage RR	2L T8	58	120	2	1500	SAME	58	120	2	750	174	87	$ 7	$ 20	Wall Occ Sensor
Garage Storage Room	100w Incdsnt	100	120	2	1250	26w CFL	26	120	2	1250	250	65	$ 15	$ 3	
Garage	400w MH	455	120	4	2000	6L T8 Hi Bay	226	120	4	2000	3640	1808	$ 147	$ 200	
	250w MH	295	120	2	2000	4L T8 Hi Bay	148	120	2	2000	1180	592	$ 47	$ 80	
Tire Storage Cage	2L T12 8ft	126	120	5	2000	2L T8 8ft	92	120	5	2000	1260	920	$ 27	$ 35	
Parking	400w HPS	465	120	6	4380	250w Pulse MH	288	120	6	4380	12220	7569	$ 372		
Electrical / Refrigeration	400w MH	455	120	5	2250	6L T8 Hi Bay	226	120	5	1687.5	5119	1907	$ 257	$ 350	Fixture Mount Occ Sensor
Recessed Range Lights (cell blocks)	2L T12 2ft	46	120	831	5110	2L T8 2ft	32	120	831	5110	195335	135885	$ 4,756	$ 3,324	
Electrical Storage	2L T12 8ft	126	120	7	2250	2L T8 8ft	92	120	7	2250	1985	1449	$ 43	$ 49	
Carpentry	2L T12 8ft	126	120	32	2250	2L T8 8ft	92	120	32	2250	9072	6624	$ 196	$ 224	
Paint	2L T12 8ft	126	120	9	2250	2L T8 8ft	92	120	9	2250	2552	1863	$ 55	$ 63	
	65w Incdsnt	65	120	7	2250	23w CFL	23	120	7	2250	1024	362	$ 53	$ 11	
Hall	400w MH	455	120	8	6552	6L T8 Hi Bay	226	120	8	6552	23849	11846	$ 960	$ 400	
Machine Shop	2L T12 8ft	126	120	22	2250	2L T8 8ft	92	120	22	2250	6237	4554	$ 135	$ 154	
Distribution	400w MH	455	120	41	2250	6L T8 Hi Bay	226	120	46	2250	41974	23391	$ 1,487	$ 2,050	
	2L T12 8ft	126	120	15	2250	REMOVE	0	120	0	0	4253	0	$ 340		
Validation	2L T12 8ft	126	120	26	2250	2L T8 8ft	92	120	26	2250	7371	5382	$ 159	$ 182	
Validation/Graphic Arts	2L T12 8ft	126	120	8	2250	2L T8 8ft	92	120	8	2250	2268	1656	$ 49	$ 56	
Validation Office	4L T12	152	120	6	2250	4L T8 4ft	109	120	6	2250	2052	1472	$ 46	$ 66	
Validation Hall (upper level)	2L T12 8ft	126	120	8	8760	2L T8 8ft	92	120	8	8760	8830	6447	$ 191	$ 56	
	incndsnt exit	25	120	1	8760	LED Exit	5	120	1	8760	219	44	$ 14	$ 10	
Tag Shop	2L T12 8ft	126	120	90	2250	4L T8 Hi Bay	148	120	95	2250	25515	31635	$ (490)		
	400w MH	455	120	10	2250	REMOVE	0	120	0	2250	10238	0	$ 819		
Gym / Stage	400w MH	455	120	27	4998	6L T8 Hi Bay	232	120	27	4998	61400	31307	$ 2,407	$ 1,350	
Cafeteria 1	400w MH Hi Bay	455	120	4	5460	6L T8 Vaportite	167	120	4	5460	9937	3647	$ 503	$ 200	
	400w MH Surface	455	120	4	5460	6L T8 Surface	167	120	6	5460	9937	5471	$ 357	$ 300	
Cafeteria 2	400w MH Hi Bay	455	120	4	5460	6L T8 Vaportite	167	120	4	5460	9937	3647	$ 503	$ 200	
	400w MH Surface	455	120	4	5460	6L T8 Surface	167	120	6	5460	9937	5471	$ 357	$ 300	
Cafeteria 3	400w MH Hi Bay	455	120	4	5460	6L T8 Vaportite	167	120	4	5460	9937	3647	$ 503	$ 200	
	400w MH Surface	455	120	4	5460	6L T8 Surface	167	120	6	5460	9937	5471	$ 357	$ 300	
Chapel	250w MH	295	120	9	2190	150w E39CFL	150	120	9	2190	5814	2957	$ 229		6hrs / day (8a-2p)
Visitation	250w MH	295	120	8	2738	4L T8 Hi Bay w/upl	108	120	8	2738	6462	2366	$ 328	$ 320	
	incndsnt exit	25	120	2	8760	LED Exit	5	120	2	8760	438	88	$ 28	$ 20	
Maint. Office (Marty)	2L T12 8ft	126	120	2	2250	2L T8 8ft	92	120	2	2250	567	414	$ 12	$ 14	Wall Occ Sensor
							At $0.08 per kWh based on last 12 mos.						$ 39,968	$ 12,091	

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Appendices

a. Make-Up Water Calculation

b. Hoffman Condensate Pumps

c. Helpful E-Mails from Lebanon Correctional Institution

d. Level I Facility Evaluation Reports

e. Level I Walk-Thru Photographs

f. Cogeneration Proposal

g. Contractor Budget Pricing Proposals

h. Thermal Imaging Report

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LCI Make-Up Water Calculations

January 2009

$$\frac{\text{Average Make-Up Water/Day}}{\text{Average Total Steam Produced/Day}} = \frac{17{,}916 \text{ gallons x } 8.34/\text{lb/gallon}}{458{,}097 \text{ lbs}} = 32.6\%$$

July 2009

$$\frac{\text{Average Make-Up Water/Day}}{\text{Average Total Steam Produced/Day}} = \frac{14{,}377 \text{ gallons x } 8.34/\text{lb/gallon}}{184{,}548 \text{ lbs}} = 65.0\%$$

Conclusion

A big thank you is in order for Tim Brashear who was so forthcoming in furnishing the data shown on the following two (2) pages and for having such meticulous records available at a moment's notice.

As LeCI personnel know only so well, the amount of make-up water is unusually high, ranging from 65 percent in July down to 33 percent in January. Once the steam leaks are repaired, steam traps are re-paired/replaced an the condensate pumps are repaired/replaced, the amount of make-up water should be reduced to less than 5 percent.

This dramatic decrease should result in the following:

- Boiler water chemical costs should decrease from 18,000 per year down to perhaps 12,000 per year.

- If the boilers are operating at 85 percent efficiency, the cost to heat just the additional make-up water from 55°F to the 375°F steam discharge temperature is $6.62/1,000 gal*.

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$$1{,}000 \text{ gals} \times 8.34 \text{ lb/gal} \times (375°F - 55°F) \times \frac{1 \text{ BTU}}{\text{Lb.} \cdot F} = 2{,}668{,}800 \text{ BTU}/1{,}000 \text{ gals}$$

$$\frac{1{,}125{,}099 \text{ BTU}/1{,}000 \text{ gal}}{.85} = \frac{\$0.50}{100{,}000 \text{ BTU}} = \$6.62/1{,}000$$

If we are making up an additional average of 15,000 gallons per day, the annual avoided cost of reducing the make up from a range of 33 percent to 65 percent down to 5 percent would be:

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Powerhouse Monthly Totals

Date	GAS	STEAM	B0. 2 Hrs	B0. 3 Hrs	BO. 4 Hrs.	Electric	Softeners	Oil(gal)	Makeup
1/1/2009	615	465,000	0	0	24	20,302	183,552	0	18,100
1/2/2009	592	451,000	0	0	24	21,145	175,776	0	18,300
1/3/2009	600	453,000	0	0	24	18,734	177,600	0	18,700
1/4/2009	584	440,000	0	0	24	20,267	170,208	0	18,300
1/5/2009	610	452,000	0	0	24	21,456	184,032	0	18,600
1/6/2009	541	439,000	0	0	24	21,917	169,824	0	18,400
1/7/2009	645	446,000	0	0	24	20,099	183,360	0	18,800
1/8/2009	601	455,000	0	0	24	21,376	145,824	0	18,100
1/9/2009	617	466,000	0	0	24	21,861	182,208	0	18,900
1/10/2009	598	451,000	0	0	24	20,502	168,000	0	18,600
1/11/2009	617	462,000	0	0	24	20,135	184,032	0	19,700
1/12/2009	613	465,000	0	0	24	20,789	165,312	0	17,900
1/13/2009	644	474,000	0	0	24	22,981	191,232	0	20,700
1/14/2009	602	463,000	0	0	24	20,640	128,832	0	15,800
1/15/2009	509	362,000	0	0	24	22,584	-	**	-
1/16/2009	313	181,000	0	12	12	23,046	-	2507	-
1/17/2009	598	449,000	0	12	12	24,015	178,656	0	17,600
1/18/2009	601	482,000	0	0	24	23,398	196,032	0	23,100
1/19/2009	692	478,000	0	0	24	23,213	165,600	0	21,600
1/20/2009	656	494,000	0	0	24	24,283	183,264	0	19,500
1/21/2009	658	497,000	0	0	24	23,826	180,000	0	18,800
1/22/2009	625	475,000	0	0	24	23,081	178,944	0	18,600
1/23/2009	613	466,000	0	0	24	21,407	183,840	0	18,900
1/24/2009	613	475,000	0	0	24	21,343	180,960	0	17,900
1/25/2009	623	487,000	0	0	24	20,909	181,440	0	19,600
1/26/2009	647	462,000	0	0	24	22,854	176,160	0	17,000
1/27/2009	657	506,000	0	0	24	21,541	172,608	0	18,900
1/28/2009	662	490,000	0	0	24	22,391	174,048	0	20,800
1/29/2009	636	509,000	0	0	24	22,769	186,240	0	23,600
1/30/2009	672	499,000	0	0	24	23,341	182,688	0	20,400
1/31/2009	693	507,000	0	0	24	20,879	182,016	0	20,200
Totals				2.00	0			2,507	
Month/Avg.		458,097							17,916

184,584 lbs steam
119,908 lbs make-up water
64.97% makeup

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Date	GAS	STEAM	B0. 2	B0. 3	B0. 4	Electric	Softeners	Oil(gal)	Makeup
7/1/2009	246	151,000	0	0	24	20,927	185,760	0	13,200
7/2/2009	272	176,000	0	0	24	20,114	184,032	0	14,500
7/3/2009	269	172,000	0	0	24	18,358	183,168	0	15,400
7/4/2009	251	166,000	0	0	24	18,247	176,736	0	14,500
7/5/2009	265	174,000	0	0	24	17,936	183,264	0	14,800
7/6/2009	271	176,000	0	0	24	20,652	188,448	0	15,400
7/7/2009	271	178,000	0	0	24	21,374	186,240	0	14,500
7/8/2009	267	178,000	0	0	24	21,401	189,504	0	14,700
7/9/2009	268	185,000	0	0	24	22,033	188,736	0	14,900
7/10/2009	289	190,000	0	0	24	20,875	196,896	0	14,600
7/11/2009	287	211,000	0	0	24	20,103	194,496	0	16,400
7/12/2009	293	171,000	0	0	24	18,722	195,168	0	15,400
7/13/2009	258	170,000	0	0	24	21,202	189,792	0	12,600
7/14/2009	222	146,000	0	0	24	22,040	190,464	0	10,100
7/15/2009	251	166,000	0	0	24	21,352	190,944	0	13,100
7/16/2009	293	205,000	0	0	24	23,703	201,600	0	16,000
7/17/2009	297	207,000	0	0	24	22,335	206,880	0	16,000
7/18/2009	295	208,000	0	0	24	18,524	205,248	0	14,800
7/19/2009	300	210,000	0	0	24	18,810	206,112	0	16,100
7/20/2009	309	201,000	0	0	24	20,890	205,248	0	15,500
7/21/2009	302	206,000	0	0	24	22,180	207,552	0	15,400
7/22/2009	298	205,000	0	0	24	21,231	211,392	0	15,000
7/23/2009	302	206,000	0	0	24	20,692	212,640	0	15,600
7/24/2009	309	209,000	0	0	24	20,818	223,488	0	15,500
7/25/2009	306	206,000	0	0	24	20,070	213,792	0	14,700
7/26/2009	301	206,000	0	0	24	19,592	214,752	0	15,800
7/27/2009	311	207,000	0	0	24	21,782	215,232	0	14,900
7/28/2009	299	201,000	0	0	24	21,855	206,784	0	16,000
7/29/2009	214	141,000	0	0	24	23,069	183,488	0	10,200
7/30/2009	166	148,000	0	0	24	23,269	193,984	0	10,000
7/31/2009	279	145,000	0	0	24	22,378	191,808	0	10,100
Totals				2.00	0			0	
Month/Avg.		184,548							14,377

184,584 lbs steam
119,908 lbs make-up water
64.97% makeup

Four Seasons Environmental, Inc.

Domestic Pump

Bulletin S225F

Domestic® Series CB™ and CBE™ Condensate Units

APPLICATION

Series CB and CBE units are designed for transfer of hot condensate in steam heating or process applications. In any system, large or small, temperature fluctuates and can approach boiling temperature. DOMESTIC offers these two styles of condensate units to meet high temperature and low return line applications.

Series CBE receivers are elevated 24 inches (610mm) above the floor and recommended where height of return lines permits their use. Featuring Series B-35 pumps, the CBE unit will handle boiling condensate (212°F/100°C at sea level).

Series CB is designed for systems with low return lines. Fitted with Series B-35 pumps, which require a maximum of 2 ft. NPSH, it will handle condensate up to 210°F (98.9°C) at sea level.

DEPENDABILITY AND EXTENDED OPERATING LIFE ARE BUILT INTO EVERY CONDENSATE UNIT COMPONENT ...

CAST IRON RECEIVERS are high quality, close grained gray iron of uniform dimensions. These receivers offer maximum protection from corrosion failure and are warranted for 20 years from date of shipment against failure due to corrosion. Each receiver comes standard with a low inlet connection, an overflow and a minimum 2" NPT air vent connection.

Series B-35 pumps assure no pump cavitation even when steam traps are leaking. These pumps use a suction inducer to create adequate NPSH assuring dependable operation. Other pumps may claim to be low NPSH, but without an inducer they merely allow cavitation to slowly destroy the pump. All DOMESTIC pumps use mechanical seals rated for 250°F (121.1°C) to assure long life.

Part of the ESP CAD and ESP PLUS Equipment Selection Programs

Domestic Pump®

ITT Industries
Engineered for life

SELECTION DATA

ALL PUMPS ARE 3500 RPM

SYSTEM CAPACITY*	PUMP CAPACITY GPM (L/M)	DISCHARGE PRESSURE PSIG (kPa)	MOTOR HORSEPOWER 3500 RPM	DISCHARGE SIZE IN. (mm)	SERIES CB MODEL NO.	CB REC. CAP. GPM (L)	CB INLET SIZE IN. (mm)	SERIES CBE MODEL NO.	CBE REC. CAP. GAL (L)	CBE INLET SIZES IN. (mm)
1,000 to 9,000 Sq. Ft. EDR ——— 250 thru 2,250 lb./hr. (113-1,021 kg/hr)	9 (34)	10-15 (69-103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1/3 1/3 1/2 3/4 1 1/2 1 1/2 3 3 5 5	1 1/2 (38)	23CB9-15 23CB9-20 23CB9-25 23CB9-30 23CB9-40 23CB9-50 23CB9-60 23CB9-75 23CB9-85 23CB9-100	23 (87)	2 (51)	23CBE9-15 23CBE9-20 23CBE9-25 23CBE9-30 23CBE9-40 23CBE9-50 23CBE9-60 23CBE9-75 23CBE9-85 23CBE9-100	23 (87)	2 (51)
12,000 Sq. Ft. EDR ——— 3,000 lb./hr. (1,361 kg/hr)	12 (45)	10-15 (69-103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1/3 1/3 1/2 3/4 1 1/2 2 3 5 5 5	1 1/2 (38)	23CB12-15 23CB12-20 23CB12-25 23CB12-30 23CB12-40 23CB12-50 23CB12-60 23CB12-75 23CB12-85 23CB12-100	23 (87)	2 (51)	23CBE12-15 23CBE12-20 23CBE12-25 23CBE12-30 23CBE12-40 23CBE12-50 23CBE12-60 23CBE12-75 23CBE12-85 23CBE12-100	23 (87)	2 (51)
15,000 Sq. Ft. EDR ——— 3,750 lb./hr. (1,701 kg/hr)	15 (51)	10-15 (69-103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1/3 1/2 3/4 3/4 1 1/2 2 3 5 5 5	1 1/2 (38)	23CB15-15 23CB15-20 23CB15-25 23CB15-30 23CB15-40 23CB15-50 23CB15-60 23CB15-75 23CB15-85 23CB15-100	23 (87)	2 (51)	23CBE15-15 23CBE15-20 23CBE15-25 23CBE15-30 23CBE15-40 23CBE15-50 23CBE15-60 23CBE15-75 23CBE15-85 23CBE15-100	23 (87)	2 (51)
22,000 Sq. Ft. EDR ——— 5,500 lb./hr. (2,495 kg/hr)	22 (83)	10-15 (69-103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1/2 1/2 3/4 3/4 1 1/2 2 3 5 5 5	1 1/2 (38)	23CB22-15 23CB22-20 23CB22-25 23CB22-30 23CB22-40 23CB22-50 23CB22-60 23CB22-75 23CB22-85 23CB22-100	23 (87)	3 (76)	23CBE22-15 23CBE22-20 23CBE22-25 23CBE22-30 23CBE22-40 23CBE22-50 23CBE22-60 23CBE22-75 23CBE22-85 23CBE22-100	23 (87)	2 (51)
30,000 Sq. Ft. EDR ——— 7,500 lb./hr. (3,402 kg/hr)	30 (114)	10-15 (69-103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1/2 3/4 3/4 1 2 3 3 5 5 7 1/2	1 1/2 (38)	36CB30-15 36CB30-20 36CB30-25 36CB30-30 36CB30-40 36CB30-50 36CB30-60 36CB30-75 36CB30-85 36CB30-100	36 (136)	3 (76)	36CBE30-15 36CBE30-20 36CBE30-25 36CBE30-30 36CBE30-40 36CBE30-50 36CBE30-60 36CBE30-75 36CBE30-85 36CBE30-100	36 (136)	3 (76)
37,000 Sq. Ft. EDR ——— 9,250 lb./hr. (4,196 kg/hr)	37 (140)	10-15 (69-103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1/2 3/4 1 1 3 3 5 5 5 7 1/2	1 1/2 (38)	36CB37-15 36CB37-20 36CB37-25 36CB37-30 36CB37-40 36CB37-50 36CB37-60 36CB37-75 36CB37-85 36CB37-100	36 (136)	3 (76)	36CBE37-15 36CBE37-20 36CBE37-25 36CBE37-30 36CBE37-40 36CBE37-50 36CBE37-60 36CBE37-75 36CBE37-85 36CBE37-100	36 (136)	3 (76)
45,000 Sq. Ft. EDR ——— 11,250 lb./hr. (5,130 kg/hr)	45 (170)	10-15 (69-103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	3/4 3/4 1 1 1/2 3 3 5 5 7 1/2 7 1/2	1 1/2 (38) ——— 2 (51)	52CB45-15 52CB45-20 52CB45-25 52CB45-30 52CB45-40 52CB45-50 52CB45-60 52CB45-75 52CB45-85 52CB45-100	52 (197)	3 (76)	52CBE45-15 52CBE45-20 52CBE45-25 52CBE45-30 52CBE45-40 52CBE45-50 52CBE45-60 52CBE45-75 52CBE45-85 52CBE45-100	52 (197)	3 (76)

$\frac{\text{*Sq. Ft. EDR}}{4}$ = Lb./hr.

SYSTEM CAPACITY*	PUMP CAPACITY GPM (L/M)	DISCHARGE PRESSURE PSIG (kPa)	MOTOR HORSEPOWER 3500 RPM	DISCHARGE SIZE IN. (mm)	SERIES CB MODEL NO.	CB REC. CAP. GPM (L)	CB INLET SIZE IN. (mm)	SERIES CBE MODEL NO.	CBE REC. CAP. GAL (L)	CBE INLET SIZES IN. (mm)
60,000 Sq. Ft. EDR / 15,000 lb./hr. (6,804 kg/hr)	60 (227)	15 (103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1 1/2 1 1/2 2 2 3 5 5 7 1/2 7 1/2 7 1/2	2 (51)	75CB60-15 75CB60-20 75CB60-25 75CB60-30 75CB60-40 75CB60-50 75CB60-60 75CB60-75 75CB60-85 75CB60-100	75 (284)	4 (102)	75CBE60-15 75CBE60-20 75CBE60-25 75CBE60-30 75CBE60-40 75CBE60-50 75CBE60-60 75CBE60-75 75CBE60-85 75CBE60-100	75 (284)	4 (102)
75,000 Sq. Ft. EDR / 18,750 lb./hr. (8,505 kg/hr)	75 (284)	15 (103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589) 100 (690)	1 1/2 2 2 3 5 5 7 1/2 10 10 15	2 (51) 2 1/2 (64)	75CB75-15 75CB75-20 75CB75-25 75CB75-30 75CB75-40 75CB75-50 Not Available Not Available Not Available Not Available	75 (284)	4 (102)	75CBE75-15 75CBE75-20 75CBE75-25 75CBE75-30 75CBE75-40 75CBE75-50 75CBE75-60 75CBE75-75 75CBE75-85 75CBE75-100	75 (284)	4 (102)
90,000 Sq. Ft. EDR / 22,500 lb./hr. (11,000 kg/hr)	90 (341)	15 (103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589)	1 1/2 2 3 3 5 7 1/2 7 1/2 10 10	2 (51)	120CB90-15 120CB90-20 120CB90-25 120CB90-30 120CB90-40 Not Available Not Available Not Available Not Available	120 (454)	4 (102)	120CBE90-15 120CBE90-20 120CBE90-25 120CBE90-30 120CBE90-40 120CBE90-50 120CBE90-60 120CBE90-75 120CBE90-85	120 (454)	4 (102)
112,000 Sq. Ft. EDR / 28,000 lb./hr. (12,701 kg/hr)	112 (424)	15 (103) 20 (138) 25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589)	3 3 5 5 7 1/2 7 1/2 10 10 15	2 (51) 2 1/2 (64) 2 (51)	NOT AVAILABLE	–	–	120CBE112-15 120CBE112-20 120CBE112-25 120CBE112-30 120CBE112-40 120CBE112-50 120CBE112-60 120CBE112-75 120CBE112-85	120 (454)	4 (102)
135,000 Sq. Ft. EDR / 00,000 lb./hr. (00,000 kg/hr)	135 (000)	25 (172) 30 (207) 40 (276) 50 (345) 60 (414) 75 (518) 85 (589)	5 5 7 1/2 7 1/2 10 15 15	2 1/2 (64) 2 (51)	NOT AVAILABLE	–	–	120CBE135-25 120CBE135-30 120CBE135-40 120CBE135-50 120CBE135-60 120CBE135-75 120CBE135-85	120 (454)	4 (102)

$\frac{\text{*Sq. Ft. EDR}}{4}$ = Lb./hr.

Series CB Standard Unit Features

- Cast iron receiver.
- All simplex receivers have a blanked opening for second pump.
- Cast Iron Receivers are warranted for 20 years from date of shipment against failure due to corrosion.
- Series B35 centrifugal pump(s) with drip-proof motors. Pump capacity sized 2 times system return rate.
- Float switch(es).

Series CBE Standard Unit Features

- Cast iron receiver mounted on a welded steel stand.
- All simplex receivers have a blanked opening for second pump.
- Cast Iron Receivers are warranted for 20 years from date of shipment against failure due to corrosion.
- Series B35 centrifugal pump(s) with drip-proof motors. Pump capacity sized 2 times system return rate.
- Float switch(es).
- Suction piping isolation valves.

Optional Features

- Water level gauge w/shutoff valve
- Dial Thermometer
- Inlet Basket Strainer
- Discharge Pressure Gauges
- Mechanical Alternator provides sequencing of duplex pumps and stand-by of second pump on high level.
- NEMA 2 – U.L. Listed Control Panels – see page 4.
- Suction Butterfly Valve (optional on Series CB Units only, on capacities to 75 gpm)
- Lifting Eyes

Ordering Instructions

Specify Model No., single or duplex, phase, operating voltage, special features.

Note: TEFC and explosion proof motors are available. The motor horsepower requirement is often greater using explosion proof motors as they have unity service factor. A horsepower increase is not necessary when using TEFC Motors.

NEMA 2/U.L. LISTED CONTROL PANEL

OPTIONAL ELECTRIC CONTROLS

Description of Optional Panel Components:

- Magnetic Starters must be used on all 3 phase motors and single phase motors over 2 HP.
- Disconnect Switches and Circuit Breakers. Either fuses or a circuit breaker is required ahead of the starters to protect against short circuits. A disconnect switch or circuit breaker also provides a means of shutting off power for service.
- Selector Switches – "Auto-Off-Hand" selector switches provide a means of shutting off pumps and a means of testing in the "Hand" position. "Off-Hand-Lead-Lag" selector switches may be furnished on duplex units with 2 float switches to provide manual alternation.
- Electric Alternator may be furnished on duplex units to provide automatic sequencing of lead pump. Use only when magnetic starters are provided and only with 2 float switches.
- Transformer is required by the National Electrical Code to reduce control voltage when power supply exceeds 250 volts. A transformer is recommended when voltage exceeds 130 volts. Refer to local codes for requirements.
- Pilot Lights – Pump running pilot lights are available to indicate pump operation.
- Audible Alarm – An alarm to indicate low or high water level may by furnished. A separate tank mounted level switch should be provided with an alarm.

Specified Panel Components to be furnished with unit at extra cost.

Standard panels are supplied with NEMA 2 enclosures and are U.L. listed unless otherwise specified.

ITT Industries

Domestic Pump

USA
Bell & Gossett
8200 N. Austin Avenue
Morton Grove, IL 60053
Phone: (847) 966-3700
Facsimile: (847) 966-9052
http://www.domesticpump.com

TÜV CERT DIN ISO 9001

ISO 9001 Certified

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Hoffman ITT

2 pages

Phone: 937 461-5960

QUOTATION

PICKREL BROS. INC.

WHOLESALE DISTRIBUTORS

PLUMBING, HEATING AND INDUSTRIAL SUPPLIES

901 S. Perry Street • Dayton, Ohio 45402

Fax: 937 461-1280

To	Four Seasons Environmental	DATE	January 8, 2010
	Fax: (513) 539-2972	JOB	Lebanon Correctional
		LOCATION	
ATTENTION	Daniel A. Fluegeman	F.O.B.	Factory
DELIVERY	4-6 Weeks ARO	TERMS	Net 30

QUANTITY	ITEM	NET EACH	NET TOTAL
	CONDENSATE EQUIPMENT		
	Note: Units Quoted are Based on Operating Conditions Specified.		
	Motors are 3500 RPM in lieu of 1750 RPM as Specified.		
	Unit in Bldg. M - Garage (In Pit)-Quoted As Standard Unit. Subject to		
	Change Upon Inspection of Location of Installation.		
	Unit in Bldg. M-Garage (Room M-01)- Quoted As Simplex Watchman Unit		
	Based on Operating Conditions.		
3	Domestic Condensate Unit, Model 94CC, Duplex, 9 GPM, 40 PSIG, 14 Gallon	$4,595.00	$13,785.00
	Cast Iron Receiver, 1 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fuses. Wt.: 477 lbs ea.		
	Tag: Bldg A-Administration; Bldg. B-Cell Block R & Library; Bldg. D-Dining.		
2	Domestic Condensate Unit, Model 64CC, Duplex, 6 GPM, 40 PSIG, 14 Gallon	$4,595.00	$13,785.00
	Cast Iron Receiver, 1 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fuses. Wt.: 477 lbs ea.		
	Tag: Bldg C-Segregation Cell Block; Bldg. E-Chapel.		
1	Domestic Condensate Unit, Model 374CC, Duplex, 37 GPM, 40 PSIG, 36 Gallon	$5,868.00	$5,868.00
	Cast Iron Receiver, 2 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fused. Wt.: 747 lbs ea.		
	Tag: Bldg. D-Kitchen		
3	Domestic Condensate Unit, Model 65CC, Duplex, 6 GPM, 50 PSIG, 23 Gallon	$5,360.63	$16,081.89
	Cast Iron Receiver, 1.5HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fuses. Wt.: 594 lbs ea.		
	Tag: Bldg. G-1Cell Block A; Bldg. G-2-Cell Block B; Bldg. M-Garage		
	(In Pit-Installation to be Verified).		
3	Domestic Condensate Unit, Model 95CC, Duplex, 9 GPM, 50 PSIG, 23 Gallon	$5,360.63	$16,081.89
	Cast Iron Receiver, 1.5 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fused. Wt.: 594 lbs ea.		
	Tag: Bldg. H-Infirmary; Bldg. J-1-Cell Block K; Bldg J-2-Cell Block J		
6	Domestic Condensate Unit, Model 66CC, Duplex, 6 GPM, 60 PSIG, 14A Gallon	$5,890.50	$35,343.00
	Cast Iron Receiver, 2 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fuses. Wt.: 532 lbs ea.		
	Tag: Bldg. G-3-Cell Block C; Bldg. R-Cell Block D; Bldg. S-Cell Block E;		
	Bldg. T-Cell Block F; Bldg. U-Cell Block G; Bldg. V-Cell Block H		

do not guarantee quantities or descriptions to agree with plans and specifications.

Please compare with actual requirements to avoid error.

TH

BY Keith H Langford

Pickrel Bros., Inc.

Phone: 937 461-5960

QUOTATION

PICKREL BROS. INC.

WHOLESALE DISTRIBUTORS

PLUMBING, HEATING AND INDUSTRIAL SUPPLIES

901 S. Perry Street • Dayton, Ohio 45402

Fax: 937 461-1280

To	Four Seasons Environmental	DATE	January 8, 2010
	Fax: (513) 539-2972	JOB	Lebanon Correctional
		LOCATION	
ATTENTION	Daniel A. Fluegeman	F.O.B.	Factory
DELIVERY	4-6 Weeks ARO	TERMS	Net 30

QUANTITY	ITEM	NET EACH	NET TOTAL
	CONDENSATE EQUIPMENT		
	Note: Units Quoted are Based on Operating Conditions Specified.		
	Motors are 3500 RPM in lieu of 1750 RPM as Specified.		
	Unit in Bldg. M - Garage (In Pit)-Quoted As Standard Unit. Subject to		
	Change Upon Inspection of Location of Installation.		
	Unit in Bldg. M-Garage (Room M-01)- Quoted As Simplex Watchman Unit		
	Based on Operating Conditions.		
2	Domestic Condensate Unit, Model 457.5CC, Duplex, 45 GPM, 75 PSIG, 52 Gallon	$8,550.00	$17,100.00
	Cast Iron Receiver, 5 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fuses. Wt.: 1022 lbs ea.		
	Tag: Bldg. L-Laundry; Bldg. W-Maintenance.		
1	Domestic Condensate Unit, Model 52CB45-100, Duplex, 45 GPM, 100 PSIG, 52	$9,484.00	$9,484.00
	Gallon Cast Iron Receiver, 7.5 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting:		
	Nema 2 Type Control Panel with Fused Disconnect w/Fuses. Wt.: 1357 lbs ea.		
	Tag: Bldg. W-Industries		
1	Domestic Condensate Unit, Model 157.5CC, Duplex, 15 GPM, 75 PSIG, 23 Gallon	$6,548.00	$6,548.00
	Cast Iron Receiver, 3 HP, 3500 RPM, ODP, 208/3/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fuses. Wt.: 712 lbs ea.		
	Tag: Bldg. K-Gymnasium		
1	Domestic Condensate Unit, Model 63CC, Duplex, 6 GPM, 30 PSIG, 14 Gallon	$4,067.00	$4,067.00
	Cast Iron Receiver, 0.5 HP, 3500 RPM, ODP, 115/1/60. Panel Mounting: NEMA 2		
	Type Control Panel with Fused Disconnect w/Fuses. Wt.: 492 lbs ea.		
	Tag: Bldg. F-Classroom		
1	Domestic Watchman Unit WC6-20B Simplex Cast Iron Receiver.	$795.00	$795.00
	Wt.: 130 lbs a..		
	Tag: Bldg M-Garage Rm. M-01		

do not guarantee quantities or descriptions to agree with plans and specifications.

Please compare with actual requirements to avoid error.

TH

BY Kirk G. Fergusson

Pickrel Bros., Inc.

Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Friday, January 22, 2010 1:52 PM
To: 'dtarkington@fseinc.net'
Cc: 'Reed Tarkington'
Subject: FW: Information Request - LeCI

Tracking:

Recipient	Read
'dtarkington@fseinc.net'	Read: 1/22/2010 2:23 PM
'Reed Tarkington'	Read: 1/22/2010 2:58 PM

Below are the monthly costs for boiler feedwater treatment at Lebanon

Thanks,

Dan Fluegeman

From: Brashear, Richard [mailto:Richard.Brashear@odrc.state.oh.us]
Sent: Friday, January 22, 2010 7:28 AM
To: 'Dan Fluegeman'
Subject: RE: Information Request - LeCI

Dan

!. We have an annual contract with Crown Solutions which is $1,877.00 monthly for the Powerhouse & Camp boilers which includes water testing & testing chemicals (for the engineers to do every shift), all labor changing filters (including filters) and reagents for monitors, & topping off chemical barrels (including the chemical costs).
2. I have seven engineers working under me, one for maintenance & six for operations (two per shift)

Tim Brashear

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Thursday, January 21, 2010 1:38 PM
To: Westall, Martin; Brashear, Richard
Subject: Information Request - LeCI

Gentlemen:

I would like to request the following information, if it is available:

1. Monthly and/or annual cost of water treatment for the boiler(s)
2. Number of employees on the maintenance staff.

Thank you,

Daniel A. Fluegeman, E. I.
Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, OH 45050
Office: 513-539-2978
Fax: 513-539-2972
Cell: 513-257-6725

Please note that an e-mail message, or a portion thereof, may be releasable as a public record in accordance with Chapter 149 of the Ohio Revised Code.

Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Friday, January 22, 2010 9:14 AM
To: 'dtarkington@fseinc.net'
Cc: 'Reed Tarkington'
Subject: FW: Condensate Temperature

Tracking:

Recipient	Read
'dtarkington@fseinc.net'	Read: 1/22/2010 1:27 PM
'Reed Tarkington'	Read: 1/22/2010 9:29 AM

I thought you'd like to see this. Obviously, a lot of traps are blowing steam through.

Thanks,

Dan Fluegeman

From: Brashear, Richard [mailto:Richard.Brashear@odrc.state.oh.us]
Sent: Friday, January 22, 2010 7:21 AM
To: 'Dan Fluegeman'
Subject: RE: Condensate Temperature

169 degrees F

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Thursday, January 21, 2010 11:37 AM
To: Brashear, Richard
Cc: 'Reed Tarkington'; dtarkington@fseinc.net
Subject: RE: Condensate Temperature

If you could take a temperature reading, that would be great. I realize that it would be just for that reading, but it would still give us an idea of what is coming back to the boilers.

Thanks,

Dan Fluegeman

From: Brashear, Richard [mailto:Richard.Brashear@odrc.state.oh.us]
Sent: Thursday, January 21, 2010 11:25 AM
To: 'Dan Fluegeman'
Subject: RE: Condensate Temperature

Dan,

We do not keep track of the condensate return temperature. If you would like, we could go down & take a temperature reading but it would only be for that one reading. The make up is in gallons.

Mark was here today & I believe from Mark's comments everything looked favorable to generating electric.

Tim Brashear

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Thursday, January 21, 2010 11:19 AM
To: Brashear, Richard
Subject: Condensate Temperature

Tim:

Do you have any information regarding the temperature of the condensate to the boiler? I notice the spreadsheet files you sent me do not have this info. Also, is the column marked “Make-up” the amount of make-up water in gallons, or pounds?

Thank you,

Daniel A. Fluegeman, E. I.
Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, OH 45050
Office: 513-539-2978
Fax: 513-539-2972
Cell: 513-257-6725

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Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Thursday, January 21, 2010 2:47 PM
To: 'dtarkington@fseinc.net'
Subject: FW: Information Request - LeCI

Tracking:

Recipient	Read
'dtarkington@fseinc.net'	Read: 1/21/2010 3:25 PM

I know you asked for this information (maintenance org chart), but I can't remember the reason you gave me. As you can see, I may have raised a red flag by asking.

Thanks,

Dan Fluegeman

From: Westall, Martin [mailto:Martin.Westall@odrc.state.oh.us]
Sent: Thursday, January 21, 2010 2:40 PM
To: 'Dan Fluegeman'
Subject: RE: Information Request - LeCI

Why are we asking about staffing levels? What does that have to do with a energy audit?

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Thursday, January 21, 2010 2:31 PM
To: Westall, Martin
Subject: RE: Information Request - LeCI

Thanks,

Dan Fluegeman

From: Westall, Martin [mailto:Martin.Westall@odrc.state.oh.us]
Sent: Thursday, January 21, 2010 2:29 PM
To: 'Dan Fluegeman'
Subject: RE: Information Request - LeCI

Staff

4 plumbers
2 Electricians
1 painter
1 carpenter
1 air quality tech
1 electronic
1 telecom
4 maintenance repair workers
7 stationery engineers
3 auto tech
2 water treatment
1 water treatment supervisor
1 power house supervisor
1 maintenance superintendent/ construction
1 tool room storekeeper

Tim will be sending you the boiler treatment cost

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Thursday, January 21, 2010 1:38 PM
To: Westall, Martin; Brashear, Richard
Subject: Information Request - LeCI

Gentlemen:

I would like to request the following information, if it is available:

1. Monthly and/or annual cost of water treatment for the boiler(s)
2. Number of employees on the maintenance staff.

Thank you,

Daniel A. Fluegeman, E. I.
Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, OH 45050
Office: 513-539-2978
Fax: 513-539-2972
Cell: 513-257-6725

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Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Wednesday, January 27, 2010 11:20 AM
To: 'dtarkington@fseinc.net'
Subject: FW: Boiler Info - LeCI

Tracking:

Recipient	Read
'dtarkington@fseinc.net'	Read: 1/27/2010 12:16 PM

Dan:

Listed below is the boiler information you requested.

Thanks,

Dan Fluegeman

From: Brashear, Richard [mailto:Richard.Brashear@odrc.state.oh.us]
Sent: Wednesday, January 27, 2010 10:44 AM
To: 'Dan Fluegeman'
Subject: RE: Boiler Info - LeCI

Dan,

As far as I know the steam flow rates (lbs/hr) is the same rate at either psig (which I may be wrong). These are estimates:

Boiler #2 25,000 ~~psig~~ #/Nr Horsepower: 662 (which the steam flow rate is lowered due to being converted to gas from coal)
Boiler #3 50,000 ~~psig~~ Horsepower: 512.2
Boiler #4 30,000 ~~psig~~ Horsepower: 366.4

1. Manufacturer
   a. Boiler #2: Babcock & Wilcox
   b. Boiler #3: Cleaver Brooks
   c. Boiler #4: Nebraska

2. Installation Date
   a. Boiler #2: 1958 or 1959
   b. Boiler #3: 1971
   c. Boiler #4: 1992

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Wednesday, January 27, 2010 9:14 AM
To: Brashear, Richard
Subject: Boiler Info - LeCI

Good morning, Tim:

I need the following information for the boilers at LeCI:

3. Manufacturer
   a. Boiler #2: Babcock & Wilcox
   b. Boiler #3: Cleaver Brooks

   c. Boiler #4: Nebraska

4. Installation Date
   a. Boiler #2: Late 1950's
   b. Boiler #3: 1971
   c. Boiler #4: 1992

5. Steam Flow Rate (lbs/hr) @ 185 psig
   a. Boiler #2:
   b. Boiler #3:
   c. Boiler #4:

6. Steam Flow Rate (lbs/hr) @ 250 psig
   a. Boiler #2:
   b. Boiler #3:
   c. Boiler #4:

I greatly appreciate your assistance (and time) on this matter.

Thank you,

Daniel A. Fluegeman, E. I.
Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, OH 45050
Office: 513-539-2978
Fax: 513-539-2972
Cell: 513-257-6725

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Meter Name	Units	Use	Start Date	End Date	Water Use	Water Cost
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	11/4/2009	12/11/2009	301120	121427.95
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	10/6/2009	11/4/2009	260180	100794.19
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	9/2/2009	10/6/2009	220870	80981.95
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	8/6/2009	9/2/2009	177190	59540.11
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	7/7/2009	8/6/2009	211920	76471.15
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	5/31/2009	7/7/2009	215000	78023.47
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	5/7/2009	5/31/2009	151080	58019.93
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	4/10/2009	5/9/2009	196500	78514.01
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	3/10/2009	4/10/2009	169390	65050.97
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	2/9/2009	3/10/2009	208990	85594.25
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	1/7/2009	2/9/2009	231350	98587.61
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	12/2/2008	1/7/2009	165970	63737.69
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	11/7/2008	12/2/2008	213660	88398.17
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	10/6/2008	11/7/2008	268390	103066.97
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	9/9/2008	10/6/2008	135130	51895.13
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	8/7/2008	9/9/2008	198930	76394.33
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	7/3/2008	8/7/2008	211920	81382.49
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	6/10/2008	7/3/2008	173690	66702.17
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	5/6/2008	6/10/2008	249060	95644.25
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	4/23/2008	5/6/2008	67440	25902.17
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	3/28/2008	4/23/2008	169390	65050.97
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	2/29/2008	3/28/2008	251940	96750.17
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	12/28/2007	2/29/2008	264140	119005.58
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	11/30/2007	12/28/2007	20916	78858.43
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	10/25/2007	11/24/2007	21534	81188.29
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	9/25/2007	10/25/2007	15015	56611.66
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	8/27/2007	9/25/2007	12712	47929.35
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	7/26/2007	8/27/2007	13882	52340.25
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	6/26/2007	7/26/2007	12128	45727.67
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	5/24/2007	6/26/2007	13391	50489.18
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	4/24/2007	5/24/2007	16400	61833.11
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	3/29/2007	4/24/2007	16400	61833.11
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	2/28/2007	3/29/2007	19143	72174.22
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	1/26/2007	2/28/2007	19143	72174.22
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	12/28/2006	1/26/2007	19143	72015.78
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	12/7/2006	12/28/2006	11649	42989.82
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	10/27/2006	12/7/2006	22489	82989.42
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	10/2/2006	10/27/2006	13516	49879.05
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	8/25/2006	10/2/2006	19918	73502.43
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	8/2/2006	8/25/2006	11317	41764.74
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	6/26/2006	8/2/2006	20366	75155.55
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	5/30/2006	6/26/2006	13259	48930.72
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	4/25/2006	5/30/2006	17018	62801.43
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	3/27/2006	4/25/2006	15325	56554.26
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	3/2/2006	3/27/2006	14094.4	52013.35
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	2/6/2006	3/2/2006	12095	44635.93
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	1/27/2006	2/6/2006	2068	7617.46
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	12/27/2005	1/27/2006	13601	50099.14
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	11/30/2005	12/27/2005	10336	37421.33
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	10/28/2005	11/30/2005	12679	45902.89
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	9/29/2005	10/28/2005	10467	37895.45
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	8/25/2005	9/29/2005	12873	46605.17
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	7/28/2005	8/25/2005	10100	36566.91
3015152-2016076/Butler County	kGal (thousand gallons)	Wastewater/Sewer	6/27/2005	7/28/2005	10730	38847.51

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Deteriorating Pipe Insulation, possible asbestos exposure (Typical throughout the facility)

Recommendation

Repair/replace insulation where necessary, abate asbestos where exposed.

Classroom AHU (located in Tunnel)

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Condensate Receiver/Pump Unit leaking (classroom bldg.)

Recommendation

Repair/replace unit

Classroom Condensate Receiver/Pump Unit (located in tunnel)

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Dining area Condensate Receiver/Pump Unit leaking

Recommendation

Repair/replace unit

Dining Room Condensate Receiver/Pump Unit (located in Fan Room 2-002 in tunnel). Note disconnected damper actuators.

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Disconnected RA/OA damper actuators. This is typical for almost all AHUs in the facility. Dampers are positioned manually.

Recommendation

re-connect actuators, ensure proper operation

Dining Room AHU (located in Fan Room 2-002 in tunnel)

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Most Hot Water Converters are not operating properly, and are leaking steam and condensate.

Recommendation

Repair all leaks, and make all repairs and adjustments necessary to restore proper operation

Typical Hot Water Converter

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Admin Condensate Receiver/Pump Unit leaking (tunnel)

Recommendation

Repair/replace unit

Admin Building Condensate Receiver/Pump Unit (located in tunnel)

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Admin HW circulating pumps: pump #1 missing, pump #2 leaking

Recommendation

Replace pump #1, repair/replace pump #2

Admin Building Circulating Pumps (located in tunnel)

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Water on floor of Cell Block R/Library fan room - HW circulating pump leak?

Recommendation

Inspect for and repair any and all leaks; repair or replace pump unit (if necessary)

Cell Block R/Library Mechanical Room

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Cell Block A Condensate Receiver/Pump Unit leaking

Recommendation

Repair/replace unit

Cell Block A Condensate Receiver/Pump Unit (located in Cell Block A fan room in tunnel)

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Water on floor of Cell Block K fan room - condensate pump receiver shows evidence of leak, but other sources are possible.

Recommendation

Find source(s) of leak(s), repair leaks. Repair/replace condensate receiver/pump unit.

Cell Block K Fan Room

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Metal Halide lighting in gymnasium

Recommendation

Replace with T8 fluorescent

Gymnasium

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Split system outdoor unit covered w/ bird droppings, presents health hazard to maintenance/service people

Recommendation

install cover/canopy above unit for protection

Outdoor unit outside Admin Building

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Cell Blocks A & B: Broken window panes, trash in yard

Recommendation

Replace window units with double glazed, thermal frame window units

Cell Blocks A and B

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Cell Block B: Broken window panes, trash in yard

Recommendation

Replace window units with double glazed, thermal frame window units

Cell Block B

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Cell Block E: Broken window panes, trash in yard

Recommendation

Replace window units with double glazed, thermal frame window units

Cell Block E

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Cell Block J: Flashing at roof missing/damaged

Recommendation

Replace flashing

Cell Block J Roof Flashing

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Cell Block K: Flashing at roof missing/damaged

Recommendation

Replace flashing

Cell Block K Roof Flashing

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Infirmary: Flashing at roof missing/damaged

Recommendation

Replace flashing

Infirmary Roof Flashing

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Cell Block B window: gaps between frame & wall, inefficient single pane glass (Common to Cell Blocks A-E and R

Recommendation

Replace North cell block windows with double-pane thermal break frame window units.

Typical Cell Window

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Powerhouse - Visible steam/condensate leaks @ Boiler feedwater pumps.

Recommendation

Repair leaks

Powerhouse - Boiler Feedwater Pumps

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Powerhouse - Visible steam leak @ steam supply shutoff valve

Recommendation

Repair or replace valve

Powerhouse - Shutoff valve leaking steam

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Powerhouse - Visible steam/condensate leaks @ Condensate return pumps.

Recommendation

Repair leaks

Powerhouse - Condensate Return Pumps

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Powerhouse - Visible leak @ steam control valve in exhaust line

Recommendation

Repair leaks

Powerhouse - Steam control valve showing visible signs of leakage

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

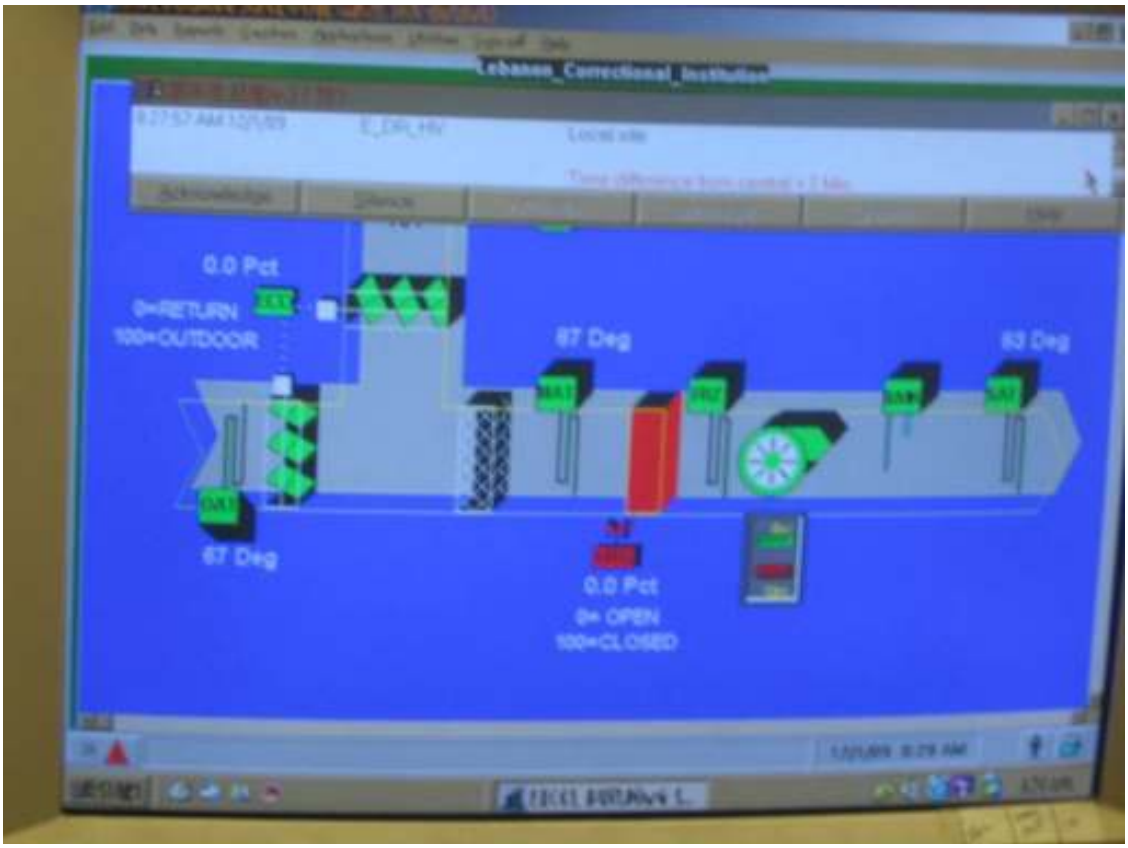
Report By: Four Seasons Environmental, Inc.

Observation

Honeywell DDC system no longer working

Recommendation

Replace control system



Honeywell DDC system graphic interface screen

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Honeywell DDC system host computer outdated

Recommendation

Replace host computer

DDC system host computer

Notes:

Observation

The pneumatic control system is in need of repair, maintenance, and upgrade. There are numerous air leaks. Control main pressure is well below control points on most systems.

Recommendation

Repair air leaks and upgrade system as necessary.

Pneumatic control system main control panel

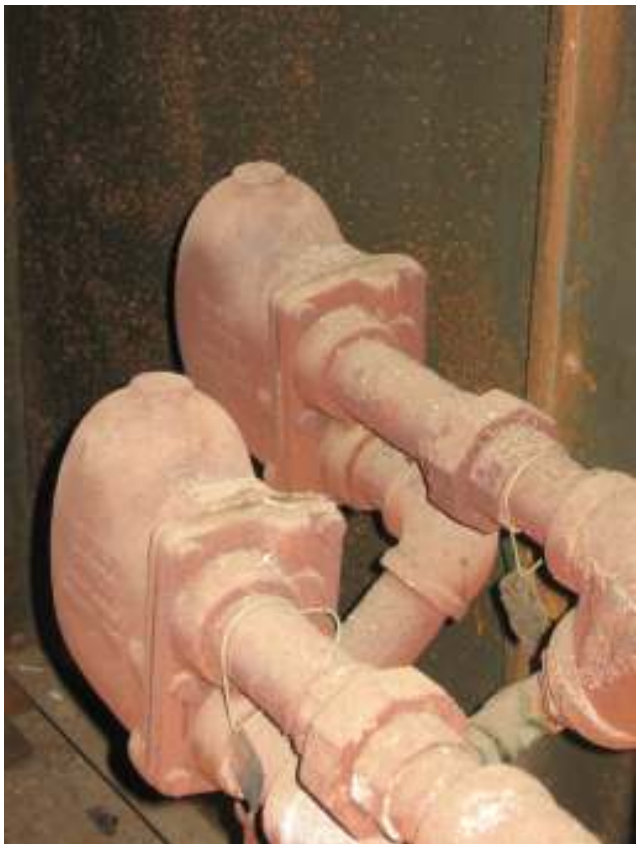
Notes:

Observation

Many of the unit steam traps have been replaced, but there are still many that need to be replaced

Recommendation

Replace failed steam traps as necessary



Typical Float & Thermostatic Steam Traps

Notes:

Observation

The building relief dampers in the Validation shop were open and seem to have failed that way

Recommendation

Repair building relief dampers

Industries Building - Building Relief Vent and Damper

Notes:

Facility Evaluation Report

DRC Lebanon - Lebanon Correction Institute

Report By: Four Seasons Environmental, Inc.

Observation

Plumbing pipes are leaking over the air handlers and their duct work. This is rusting out the systems, shortening their useful life, as well as creating health issues for maintenance people.

Recommendation

Repair plumbing leaks

Cell Block AHU showing corrosion damage from leaking plumbing overhead

Notes:

Observation

Many of the pneumatic room thermostats have been removed or damaged. The units tend to run full heat

Recommendation

Repair or replace thermostats

Typical Pneumatic Thermostat

Notes:

TRANE
TORRIVENT

• Do not pressurize.
• Do not restrict or close vent or overflow opening.
• Open inlet valve slowly.

AMER-glas
Disposable Panel Filters
12 Filters
20" x 25" x 2"
Part No. 198-800-052
AAF American Air Filter
16" x 20" x 2"
Part No. 198-500-052
AAF American Air Filter
12 Filters

198-500-052
AAF
ER-glas
ble Panel Filters
12 Filters
16" x 20" x 2"
Part No. 198-500-052
AAF American Air Filter
12 Filters

DANGER
HIGH VOLTAGE
DANGER HIGH VOLTAGE
12,470 VOLTS
WARNING
ARC FLASH & SHOCK HAZARD
Appropriate PPE and tools
Required when working on
this Equipment.
TR-1
APEL
UNNEL

AMER-glas
Disposable Panel Filters
12 Filters
20" x 25" x 2"
Part No. 198-800-052
AAF American Air Filter
12 Filters
AMER-glas
Disposable Panel Filters

198-500-052
AAF
12 Filters
16" x 20" x 2"
Part No. 198-500-052
AAF American Air Filter
15 7/8 IN x 19 5/8 IN x 1 3/4 IN
12 Filters

SCHOOL-CHAPEL
DINNING-TUNNEL
TR-1
DANGER
HIGH VOLTAGE
DANGER HIGH VOLTAGE
12,470 VOLTS
WARNING
ARC FLASH & SHOCK HAZARD
Appropriate PPE and tools
Required when working on
this Equipment.

THIS EQUIPMENT
IS BACKED
BY AN
EMERGENCY
GENERATOR
120/208 VOLT
3 PHASE

LOAD BREAK CURRENT

AREVA
LOAD BREAK CURRENT-LIMITING FUSE
JESS HOWARD ELECTRIC
COMPANY
T-18
DANGER
12,470
VOLTS

3B

OPEN DOOR
OFF
WESTINGHOUSE
AMPS 60 POLES 3
VOLTS 240 A.C. H.P. 7½
CAT. # FDPT3206
ON
ON
OPEN DOOR
OFF
Westinghouse
ON
ON

TNL/TR1/EL/PANEL-1

L1 L2 L3 N
C B A
Counter
Clock
Wire

TUNNEL EAST CORRIDOR
TRANSFORMER ROOM NO. 1
TNL/TR1/EL/PANEL-1
1. EE
2. Transformer Room Lights
3. Tunnel Blower Motors
4. Tunnel Condensation Pumps
5. East Tunnel Pillar Power
6. Schools A/C
7. Dining Hall Power
8. Dining Hall Power
9. Spared Power Panels (Prefer Closed)

1 B&H
AP68

TRONE
TOPRIVET

TRANE
TORRIVENT

BALDOR

16X20X2
8 FILTERS
1 Belt
AP68

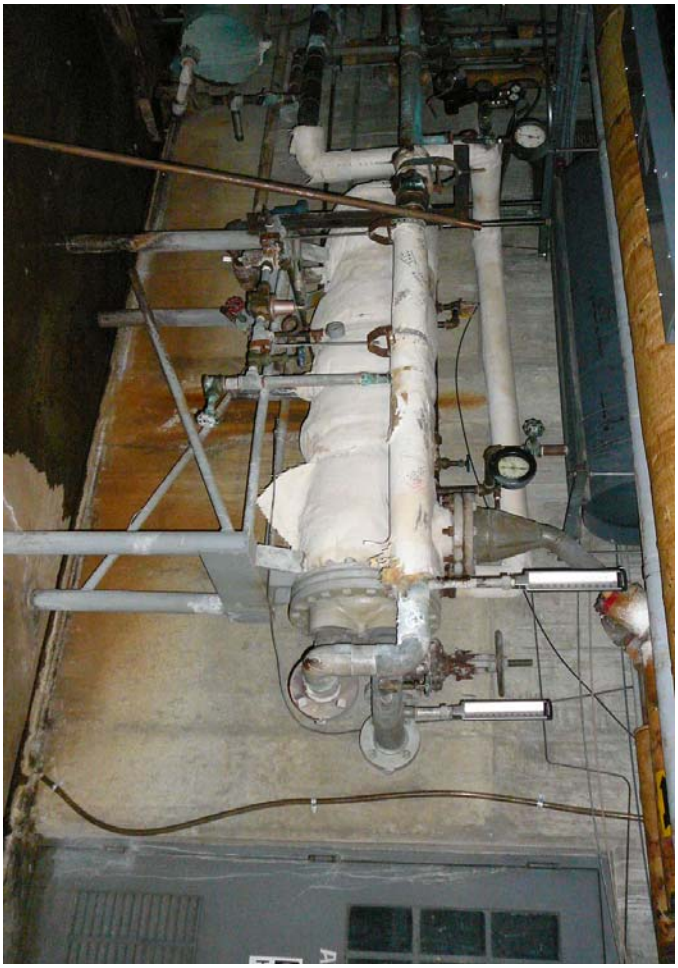
1 Belt
AP68

CRANE

CONSOLIDATED

CONSOLIDATED

FIRE
EXTINGUISHER



A.S.S.E.
1003
SET
RANGE 10-35
WATTS

11.28

INVERTER
DUTY
MARATHON
CAUTION

591-6640
591-665

591-6650

BLOWER

Apollo
CONSHOHOCKEN
PA. U.S.A.

THIS SIDE UP

THE JOHN WOOD COMPANY

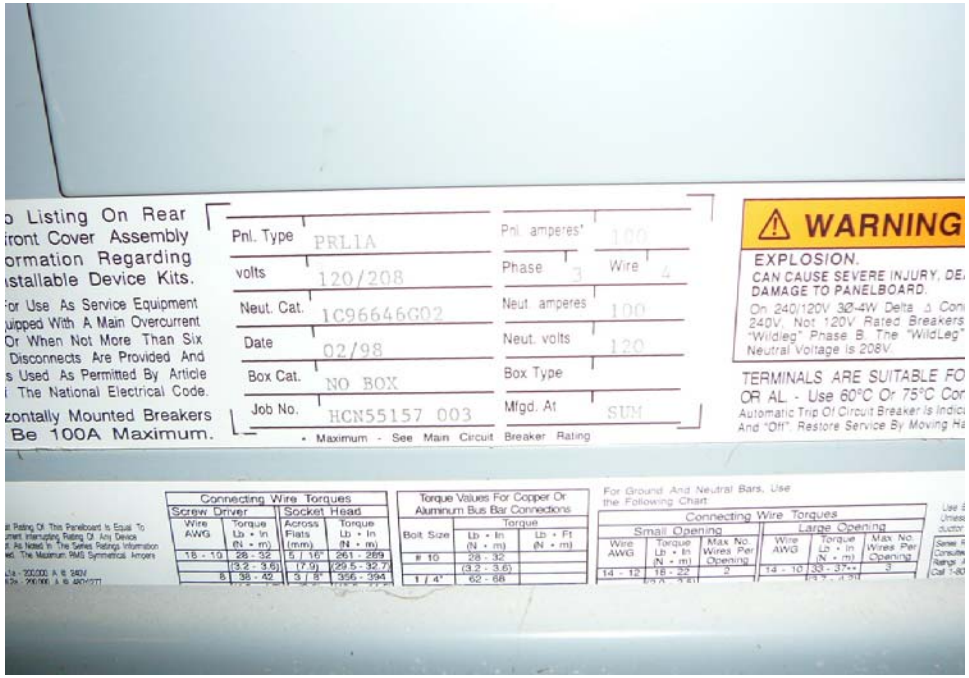
PANEL C1
120/208 VOLT
FED FROM SDP-1
IN R BLOCK

PANEL C1
120/208 VOLT
FED FROM SDP-1
IN R BLOCK

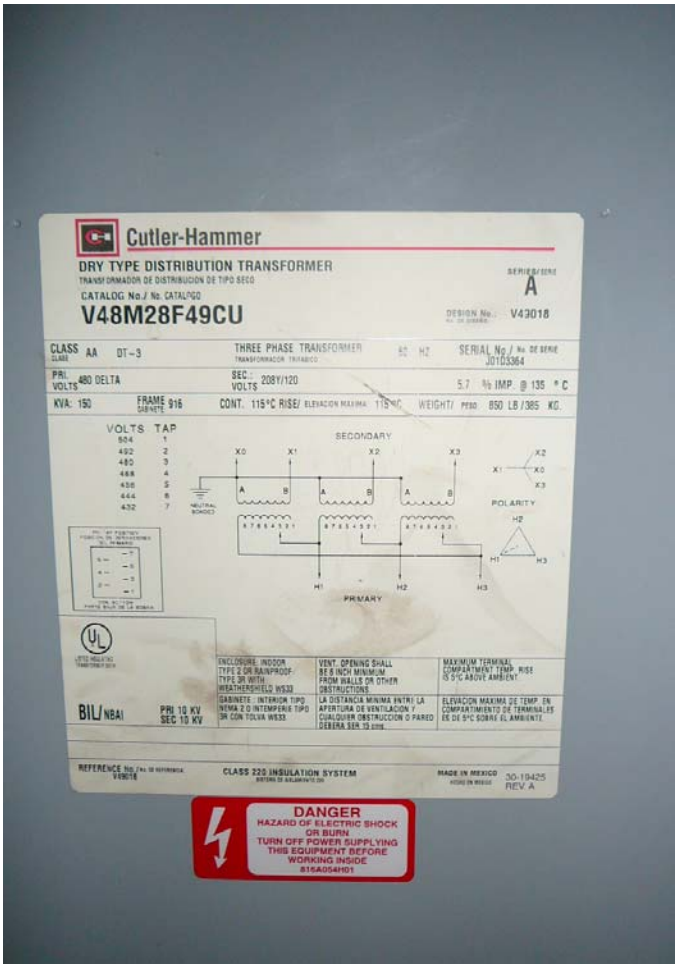
Refer To Listing On Rear Of Deadfront Cover Assembly For Information Regarding Field Installable Device Kits.
Suitable For Use As Service Equipment When Equipped With A Main Overcurrent Device Or When Not More Than Six Service Disconnects Are Provided And Panel Is Used As Permitted By Article 384 Of The National Electrical Code.
Horizontally Mounted Breakers To Be 100A Maximum.
Pnl. Type PRL1A
Pnl. amperes* 100
volts 120/208
Phase 3
Wire 4
Neut. Cat. 1C96646G02
Neut. amperes 100
Date 02/98
Neut. volts 120
Box Cat. NO BOX
Box Type
Job No. HCN55157 003
Mfgd. At SUM
* Maximum - See Main Circuit Breaker Rating
WARNING
EXPLOSION.
CAN CAUSE SEVERE INJURY, DEATH OR DAMAGE TO PANELBOARD.
On 240/120V 3Ø-4W Delta Δ Connect Only 240V, Not 120V Rated Breakers To The "Wildleg" Phase B. The "WildLeg" To The Neutral Voltage Is 208V.
TERMINALS ARE SUITABLE FOR CU OR AL - Use 60°C Or 75°C Conductors.
Automatic Trip Of Circuit Breaker Is Indicated By Handle Position Midway Between "On" And "Off". Restore Service By Moving Handle To "Off" Then "On".
Through Feed And Subfeed Panelboards Are Limited For Use On A System Capable Of Delivering Not More Than 10,000A rms Symmetrical, Unless Panelboard Has An Integral Main Or Is Connected Downstream From An Overcurrent Protective Device As Stated In The Attached "Series Rating Information Manual".

ON
OFF
CENTRAL CONTROL

2 4 6 8 10 12 14 16 18
1 3 5 7 9 11 13 15 17 19


o Listing On Rear
ront Cover Assembly
ormation Regarding
stallable Device Kits.
or Use As Service Equipment
uipped With A Main Overcurrent
Or When Not More Than Six
Disconnects Are Provided And
s Used As Permitted By Article
The National Electrical Code.
zontally Mounted Breakers
Be 100A Maximum.
Pnl. Type PRL1A
Pnl. amperes* 100
volts 120/208
Phase 3
Wire 4
Neut. Cat. 1C96646G02
Neut. amperes 100
Date 02/98
Neut. volts 120
Box Cat. NO BOX
Box Type
Job No. HCN55157 003
Mfgd. At SUM
* Maximum - See Main Circuit Breaker Rating
WARNING
EXPLOSION.
CAN CAUSE SEVERE INJURY, DE
DAMAGE TO PANELBOARD.
On 240/120V 3Ø-4W Delta Δ Con
240V, Not 120V Rated Breakers
"Wildleg" Phase B. The "WildLeg"
Neutral Voltage Is 208V.
TERMINALS ARE SUITABLE FO
OR AL - Use 60°C Or 75°C Con
Automatic Trip Of Circuit Breaker Is Indic
And "Off". Restore Service By Moving Ha
Connecting Wire Torques
Screw Driver
Socket Head
Wire AWG
Torque Lb • In (N • m)
Across Flats (mm)
Torque Lb • In (N • m)
18 - 10
28 - 32
5 / 16"
261 - 269
(3.2 - 3.6)
(7.9)
(29.5 - 32.7)
8
38 - 42
3 / 8"
356 - 394
Torque Values For Copper Or Aluminum Bus Bar Connections
Torque
Bolt Size
Lb • In (N • m)
Lb • Ft (N • m)
10
28 - 32
(3.2 - 3.6)
1 / 4"
62 - 68
For Ground And Neutral Bars, Use the Following Chart:
Connecting Wire Torques
Small Opening
Large Opening
Wire AWG
Torque Lb • In (N • m)
Max No. Wires Per Opening
14 - 12
18 - 22
2
14 - 10
33 - 37**
3

OPEN DOOR
OFF
ON
Westinghouse
3 POLE FDP SWITCH CAT# FDPT3203
30A. 240V. A.C.
STANDARD HP RATING
3
MAXIMUM HP RATING
7½
THE STARTING CURRENT OF MOTORS ABOVE THE STANDARD HORSEPOWER RATINGS MAY REQUIRE THE USE OF FUSES WITH APPROPRIATE TIME DELAY CHARACTERISTICS.
CONTINUOUS LOAD CURRENT NOT TO EXCEED 80 PERCENT OF THE RATING OF FUSES EMPLOYED IN OTHER THAN MOTOR CIRCUITS.
MADE IN U.S.A.
NP.# NA20A013P1


Cutler-Hammer
DRY TYPE DISTRIBUTION TRANSFORMER
TRANSFORMADOR DE DISTRIBUCION DE TIPO SECO
CATALOG No./ No. CATALOGO
V48M28F49CU
SERIE/SERIE
A
DESIGN No.: V43018
CLASS AA DT-3
THREE PHASE TRANSFORMER
TRANSFORMADOR TRIFASICO
60 HZ
SERIAL No./ No. DE SERIE
J0103364
PRI. VOLTS 480 DELTA
SEC.: VOLTS 208Y/120
5.7 % IMP. @ 135 °C
KVA: 150
FRAME/GABINETE 916
CONT. 115°C RISE/ ELEVACION MAXIMA 115°C
WEIGHT/ PESO 850 LB/385 KG.
VOLTS TAP
504 1
492 2
480 3
468 4
456 5
444 6
432 7
SECONDARY
X0 X1 X2 X3
NEUTRAL BONDED
POLARITY
PRIMARY
H1 H2 H3
BIL/NBAI
PRI 10 KV
SEC 10 KV
ENCLOSURE: INDOOR TYPE 2 OR RAINPROOF TYPE 3R WITH WEATHERSHIELD W532
GABINETE: INTERIOR TIPO NEMA 2 O INTEMPERIE TIPO 3R CON TOLVA W532
VENT. OPENING SHALL BE 6 INCH MINIMUM FROM WALLS OR OTHER OBSTRUCTIONS
LA DISTANCIA MINIMA ENTRE LA APERTURA DE VENTILACION Y CUALQUIER OBSTRUCCION O PARED DEBERA SER 15 cms.
MAXIMUM TERMINAL COMPARTMENT TEMP. RISE IS 5°C ABOVE AMBIENT.
ELEVACION MAXIMA DE TEMP. EN COMPARTIMENTO DE TERMINALES ES DE 5°C SOBRE EL AMBIENTE.
REFERENCE No./No. DE REFERENCIA
CLASS 220 INSULATION SYSTEM
MADE IN MEXICO
30-19425
REV A
DANGER
HAZARD OF ELECTRIC SHOCK OR BURN
TURN OFF POWER SUPPLYING THIS EQUIPMENT BEFORE WORKING INSIDE
816A054H01

PANELBOARD
"UPS-1"
ON
Cutler-Hammer
Fusible
Miscellaneous Switch
OFF
ON

DISTR. PANEL SDP-1
120/208 VOLT
FED FROM T2

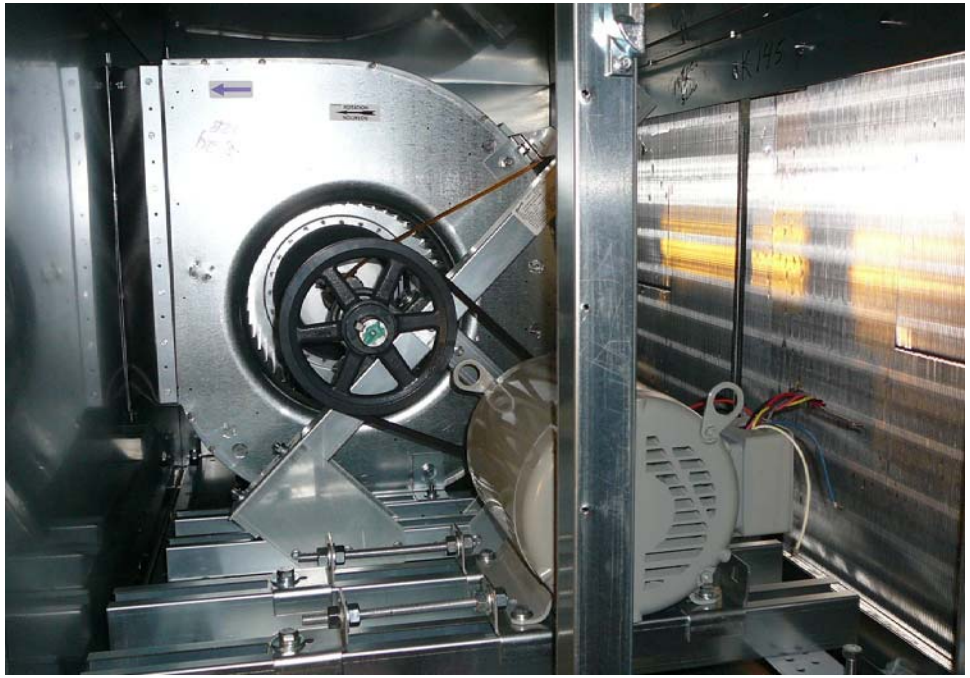
PANELBOARD
"UPS-1"
ON
OFF
C-1
PANELBOARD
"C1"
PANELBOARD
"1H"
PANELBOARD
"1C"

Westinghouse
Life-Line A
MOTOR
215
ABDP
H
USER
1778066
SER 5811
3 PHASE
60 CYC
50 CYC
VOLTS
220/440
AMPS
RPM
1145
FRONT END
WESTINGHOUSE ELECTRIC CORPORATION
MADE IN U.S.A.

16x20x
9- FILTERS
WEST UNIT

WEST
AIR FLOW
TO BLOCKS

TRANE
Airflow
M-Series
Changer™ Air Handler
ORDER NO.
(SFDL/RIGHT)
UNIT SERIAL NO.
K09F01094
UNIT MODEL NO.
MCCB012UA0A0UA
CONTROLS SERIAL NO.
K09F01095
CONTROLS MODEL NO.
SUPPLY FAN MODULE HORIZONTAL
MODULE NO.
03 OF 03
MODULE SERIAL NO.
K09F01098
TAG:
A-Block
FAN MODULE SERVICE MODEL NO.
MOTOR VOLTAGE:
MOTOR HORSEPOWER (HP):
MOTOR FLA (PER NEC):
MAXIMUM OVERCURRENT PROTECTION:
MINIMUM CIRCUIT AMPACITY:
NOTE: AN EXTERNAL OVERLOAD DEVICE IS ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (OR CEC) IS REQUIRED WHEN NOT PROVIDED BY TRANE.
SUPPLY AIR TEMPERATURE LIMITATIONS: 104 F. MAX. IN DRAW-THRU ARRANGEMENTS
200 F. MAX. IN BLOW-THRU ARRANGEMENTS
Made in USA
WARNING
WARNING
ROTATING PARTS!



E.A.&T
AIR FLOW
TO BLOCKS

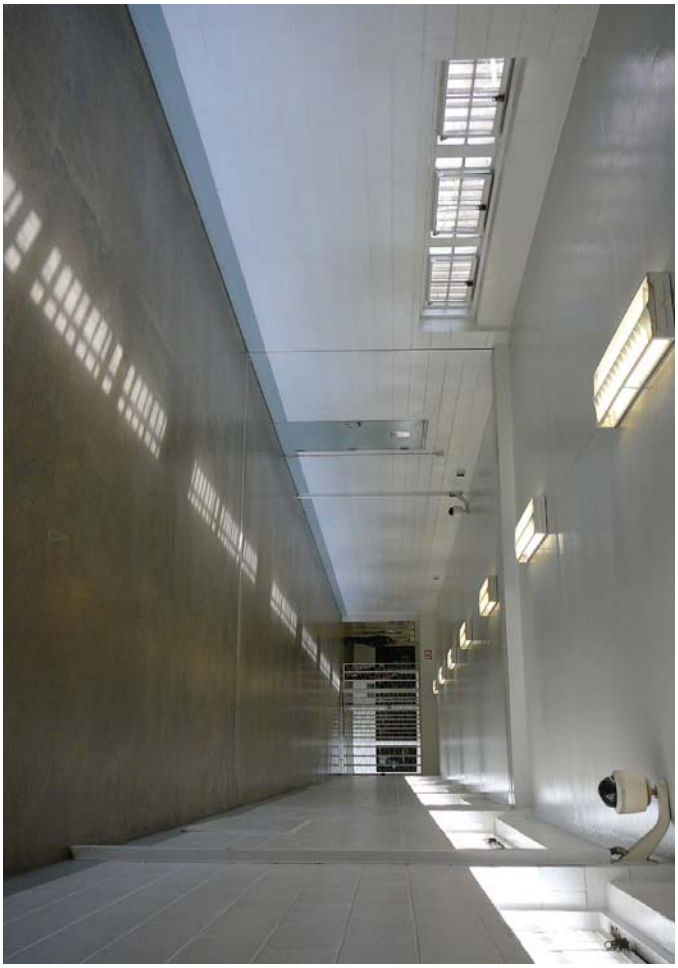
SWITCH

WARNING
LR6153
TRI-VOLT
INDUSTRIAL DUTY
THREE PHASE
MODEL
HP
PH 3
NEMA DESIGN
FRAME
RPM
1460
HZ 60/50
SF
INSUL CLASS
LR KVA CODE J
CONT
MAX AMB 40°C
MAX KVAR 1.1
6203
6205
TYPE DA
DP
VOLTS 208-220 440
AMPS 14.5-13.8/6.9
SFA 15.6 7.8
WARNING:

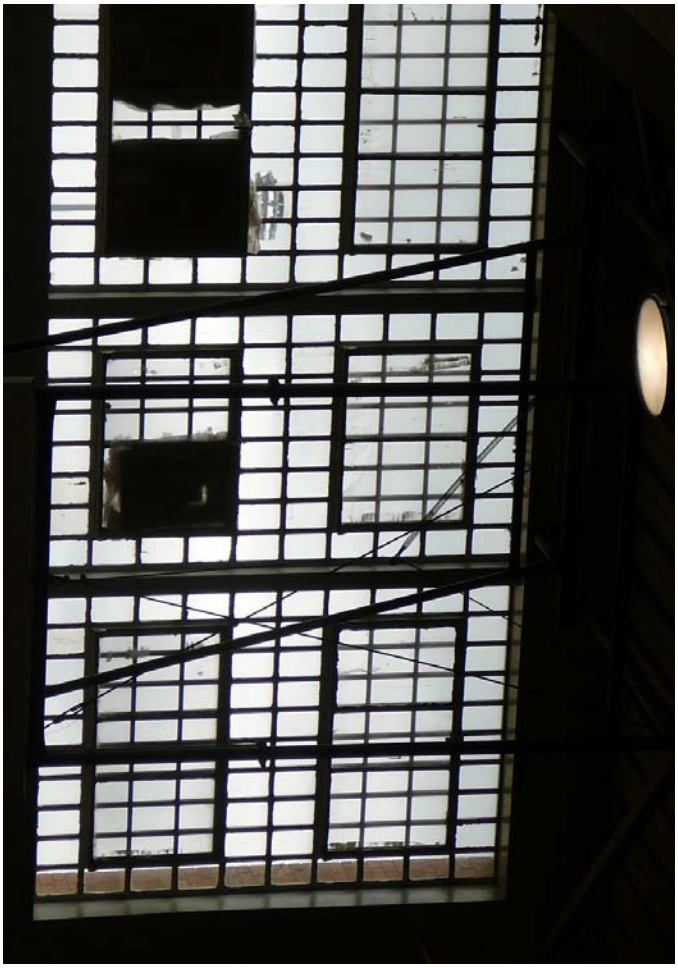
IMPORTANT
Do not install before reading installation and maintenance manual located inside door.

TRANE
Airflow
M-Series Climate Changer™ Air Handler
SUPPLY FAN MODULE HORIZONTAL
WARNING
HAZARDOUS VOLTAGE!
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW LOCK OUT AND TAG PROCEDURES BEFORE SERVICING.
INSURE THAT ALL MOTOR CAPACITORS HAVE DISCHARGED STORED VOLTAGE. UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE INSTRUCTIONS FOR CAPACITOR DISCHARGE. FAILURE TO DO THE ABOVE COULD RESULT IN DEATH OR SERIOUS INJURY.
AVERTISSEMENT
WARNING
ROTATING PARTS!
AVERTISSEMENT
PIÈCES TOURNANTES!

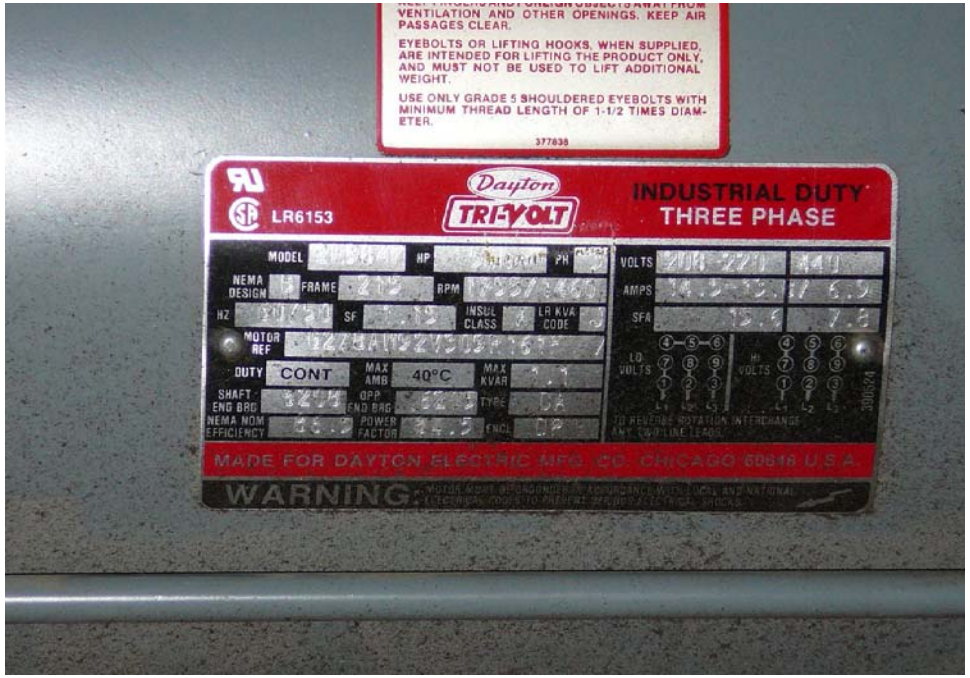
WEST
AIR FLOW
TO BLOCKS
K-Block
West Unit



GYM RULES



TRANE
TORRIVENT


VENTILATION AND OTHER OPENINGS. KEEP AIR PASSAGES CLEAR.
EYEBOLTS OR LIFTING HOOKS, WHEN SUPPLIED, ARE INTENDED FOR LIFTING THE PRODUCT ONLY, AND MUST NOT BE USED TO LIFT ADDITIONAL WEIGHT.
USE ONLY GRADE 5 SHOULDERED EYEBOLTS WITH MINIMUM THREAD LENGTH OF 1-1/2 TIMES DIAMETER.
LR6153
Dayton
TRI-VOLT
INDUSTRIAL DUTY
THREE PHASE
MODEL
HP
PH
VOLTS
NEMA DESIGN
FRAME
RPM
AMPS
HZ
SF
INSUL CLASS
LR KVA CODE
SFA
MOTOR REF
DUTY
CONT
MAX AMB
40°C
MAX KVAR
SHAFT END BRG
OPP END BRG
TYPE
NEMA NOM EFFICIENCY
POWER FACTOR
ENCL
LO VOLTS
HI VOLTS
TO REVERSE ROTATION INTERCHANGE ANY TWO LINE LEADS
MADE FOR DAYTON ELECTRIC MFG. CO. CHICAGO 60648 U.S.A.
WARNING:

SECTION
#4

IMPROPER INSTALLATION OR OPERATION OF THIS MOTOR MAY CAUSE INJURY TO PERSONNEL OR MOTOR FAILURE. READ OPERATING INSTRUCTIONS
MOTOR MUST BE INSTALLED AND GROUNDED PER LOCAL AND NATIONAL ELECTRICAL CODES
TO REDUCE POTENTIAL OF ELECTRIC SHOCK, DISCONNECT ALL POWER SOURCES BEFORE INITIATING ANY MAINTENANCE OR REPAIRS.
KEEP FINGERS AND FOREIGN OBJECTS AWAY FROM VENTILATION AND OTHER OPENINGS. KEEP AIR PASSAGES CLEAR.
EYEBOLTS OR LIFTING HOOKS, WHEN SUPPLIED, ARE INTENDED FOR LIFTING THE PRODUCT ONLY, AND MUST NOT BE USED TO LIFT ADDITIONAL WEIGHT.
USE ONLY GRADE 5 SHOULDERED EYEBOLTS WITH MINIMUM THREAD LENGTH OF 1-1/2 TIMES DIAMETER
LR6153
Dayton
TRI-VOLT
INDUSTRIAL DUTY
THREE PHASE
MADE FOR DAYTON ELECTRIC MFG. CO. CHICAGO 60648 U.S.A.
WARNING:

AMER-glas
20×25×2

Friedrich

Friedrich
SPLIT TYPE AIR CONDITIONER
MODEL NO.
SERIAL NO.

Friedrich

Friedrich

A

A

A

B

C

R

A

D

E

B

C

D
D

F

D

E

E
E

F

H

J

H

A

C

GATE E

JENN-AIR
INDIANAPOLIS

WARNING
IMPROPER MOTOR WIRING AND/OR ROTATION CAN CAUSE OVERLOAD AND BURNOUT.
THE GUARANTEE ON THIS UNIT WILL BE VOIDED IF MOTOR IS NOT CONNECTED FOR PROPER ROTATION AND VOLTAGE. MOTOR OVERLOAD PROTECTION MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE ARTICLE 430-32, FOR MAXIMUM CURRENT DRAW AND REQUIRED OVERLOAD PROTECTION REFER TO MOTOR NAMEPLATE.
BELT DRIVE UNITS ARE DESIGNED FOR SHEAVE RATIOS THAT WILL NOT CAUSE OVERLOAD WITHIN RANGE OF ADJUSTABLE SHEAVE. CARE SHOULD BE TAKEN IN CHANGING SHEAVES TO AVOID A HIGHER RATIO.
AIRMASTER.
FAN COMPANY
amca
CERTIFIED
RATINGS
SOUND
AIR
UL
LISTED
POWER ROOF VENTILATOR
7370

WARNING
AIRMASTER.
FAN COMPANY
amca
CERTIFIED
RATINGS
SOUND
AIR

GREENHECK

WARNING
IMPROPER MOTOR WIRING AND/OR ROTATION CAN CAUSE OVERLOAD AND BURNOUT.
THE GUARANTEE ON THIS UNIT WILL BE VOIDED IF MOTOR IS NOT CONNECTED FOR PROPER ROTATION AND VOLTAGE. MOTOR OVERLOAD PROTECTION MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE ARTICLE 430-32, FOR MAXIMUM CURRENT DRAW AND REQUIRED OVERLOAD PROTECTION REFER TO MOTOR NAMEPLATE.
BELT DRIVE UNITS ARE DESIGNED FOR SHEAVE RATIOS THAT WILL NOT CAUSE OVERLOAD WITHIN RANGE OF ADJUSTABLE SHEAVE. CARE SHOULD BE TAKEN IN CHANGING SHEAVES TO AVOID A HIGHER RATIO.
AIRMASTER
FAN COMPANY
1300 FALAHEE RD.
JACKSON, MICHIGAN 49202
CATALOG NO.
SERIAL NO.
AMCA CERTIFIED RATINGS
SOUND AND AIR PERFORMANCE
AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

GREENHECK
MODEL
S/N
MARK
— IMPORTANT —
ELECTRICAL — If fan motor is NOT thermally protected, remote overload protection must be installed having adequate rating as to voltage, frequency, horsepower, and full load current per phase. Where connected to a circuit protected by fuses, use time delay fuses. For supply connection use wires rated for at least 90°C (194°F).
INSTALLATION — When connecting electrical power to the fan, do not restrict motor movement. Motor must have sufficient movement for possible future belt or wheel adjustment.
CAUTION
Before initial start-up, tighten bearing set screws. Repeat after 8 hours of operation. Check periodically during maintenance inspection.
Retension V-belt drives 24 hours after initial start-up to compensate for belt and pulley seating.
Refer to "Installation, Operating and Maintenance Manual" for other pertinent information.

WARNING
ROTATION

GREENHECK
GREENHECK
MODEL
VOLTS
AMPS
SUP HP
S/N
HTZ.
60
PH.
MARK
EXH HP
CAUTION
WARNING
TO AVOID SERIOUS INJURY OR DEATH, DISCONNECT ELECTRICAL POWER PRIOR TO SERVICING.
DO NO
OVE THIS PANEL

UL

WARNING
IMPROPER MOTOR WIRING AND/OR ROTATION CAN CAUSE OVERLOAD AND BURNOUT.
THE GUARANTEE ON THIS UNIT WILL BE VOIDED IF MOTOR IS NOT CONNECTED FOR PROPER ROTATION AND VOLTAGE. MOTOR OVERLOAD PROTECTION MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE ARTICLE 430-32.
FOR MAXIMUM CURRENT DRAW AND REQUIRED OVERLOAD PROTECTION REFER TO MOTOR NAMEPLATE.
BELT DRIVE UNITS ARE DESIGNED FOR SHEAVE RATIOS THAT WILL NOT CAUSE OVERLOAD WITHIN RANGE OF ADJUSTABLE SHEAVE CARE SHOULD BE TAKEN IN CHANGING SHEAVES TO AVOID A HIGHER RATIO.
AIRMASTER
FAN COMPANY
CERTIFIED
RATINGS
SOUND
AIR
UL
LISTED
POWER ROOF VENTILATOR
737D

JennFan

JennFan
SnyderGeneral
LISTED POWER
ROOF VENTILATOR
233 L
IA

Carrier
High Effici

JENN-AIR

WARNING
IMPROPER MOTOR WIRING AND/OR ROTATION CAN CAUSE OVERLOAD AND BURNOUT. THE GUARANTEE ON THIS UNIT WILL BE VOIDED IF MOTOR IS NOT CONNECTED FOR PROPER ROTATION AND VOLTAGE. MOTOR OVERLOAD PROTECTION MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE ARTICLE 430-32, FOR MAXIMUM CURRENT DRAW AND REQUIRED OVERLOAD PROTECTION REFER TO MOTOR NAMEPLATE.
BELT DRIVE UNITS ARE DESIGNED FOR SHEAVE RATIOS THAT WILL NOT CAUSE OVERLOAD WITHIN RANGE OF ADJUSTABLE SHEAVE. CARE SHOULD BE TAKEN IN CHANGING SHEAVES TO AVOID A HIGHER RATIO.
AIRMASTER
FAN COMPANY
1380 FALAHEE RD.
JACKSON, MICHIGAN 49202
CATALOG NO.
SERIAL NO.
amca CERTIFIED RATINGS
SOUND
AIR
AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.
UL
LISTED
POWER VENTILATOR FOR RESTAURANT EXHAUST APPLIANCE
MAXIMUM OPERATING TEMPERATURE 300°
42SF

BOHN

WARNING
IMPROPER MOTOR WIRING AND/OR ROTATION CAN CAUSE OVERLOAD AND BURNOUT.
THE GUARANTEES ON THIS UNIT WILL BE VOIDED IF MOTOR IS NOT CONNECTED FOR PROPER ROTATION AND VOLTAGE. MOTOR OVERLOAD PROTECTION MUST BE IN ACCORDANCE WITH NATIONAL ELECTRIC CODE ARTICLE 430-32 FOR MAXIMUM CURRENT DRAW AND REQUIRED OVERLOAD PROTECTION. REFER TO MOTOR NAMEPLATE.
BELT DRIVE UNITS ARE DESIGNED FOR SHEAVE RATIOS THAT WILL NOT CAUSE OVERLOAD WITHIN RANGE OF ADJUSTABLE SHEAVE. CARE SHOULD BE TAKEN IN CHANGING SHEAVES TO AVOID A HIGHER RATIO.
AIRMASTER
FAN COMPANY
UL
LISTED
POWER ROOF VENTILATOR
7370
amca
CERTIFIED
RATINGS
SOUND
AIR

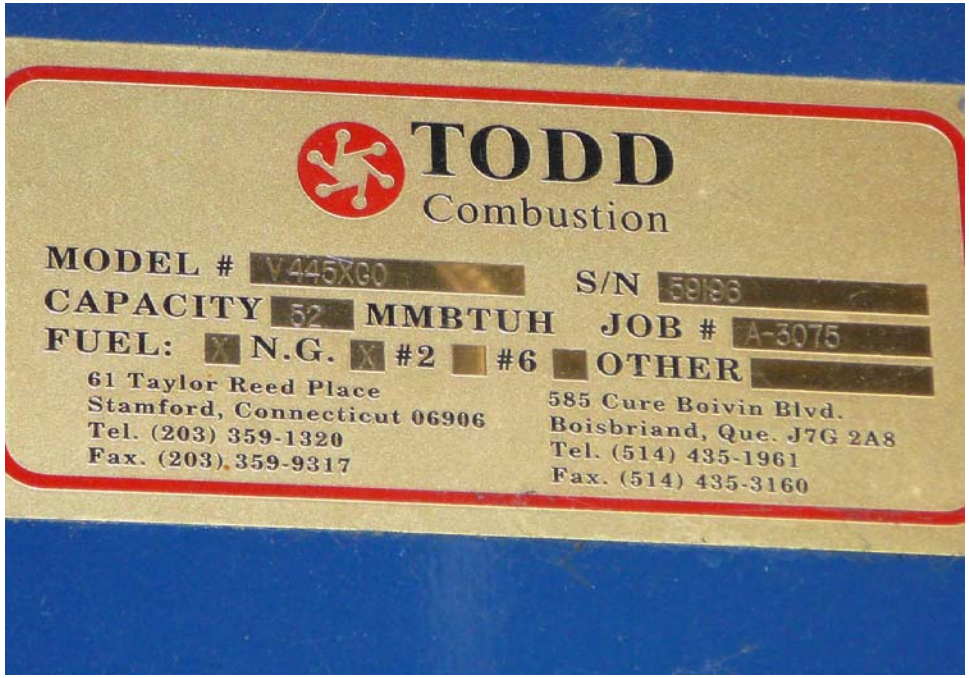
FIRE
HOSE
FIRE

EMERGENCY
EVACUATION ROUTE
DANGER
HIGH VOLTAGE
KEEP OUT
DANGER
HIGH
VOLTAGE

CB 11
FEEDER 2-3
CB 11

GENERATOR #2
CB 10

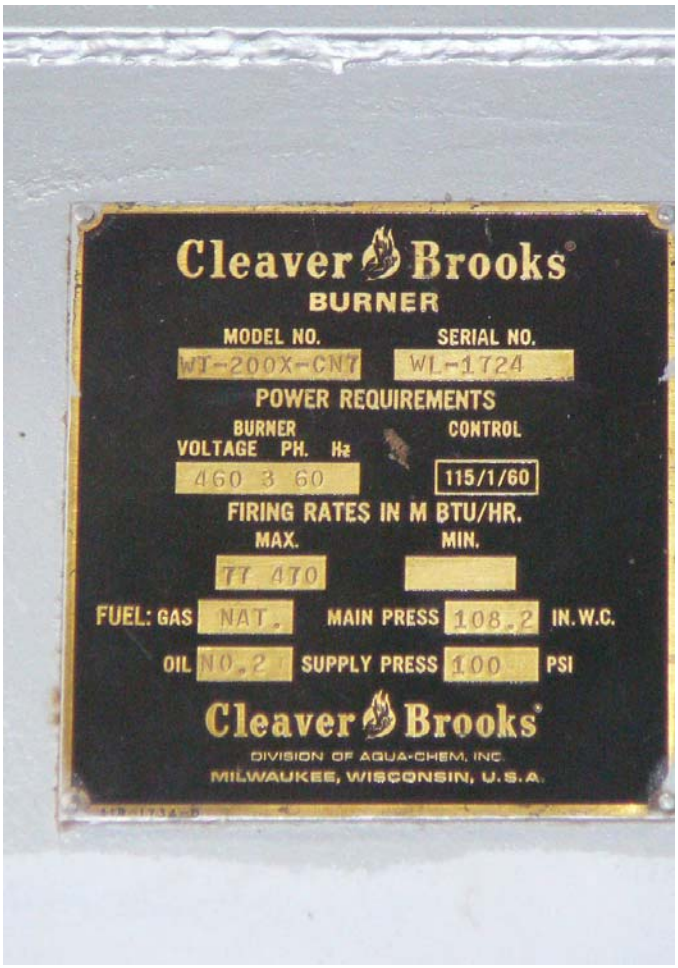
CB 10
GENERATOR 2
GENERATOR #2


TODD
Combustion
MODEL # V445XG0
S/N 59196
CAPACITY 52 MMBTUH
JOB # A-3075
FUEL: X N.G. X #2 #6 OTHER
61 Taylor Reed Place
Stamford, Connecticut 06906
Tel. (203) 359-1320
Fax. (203) 359-9317
585 Cure Boivin Blvd.
Boisbriand, Que. J7G 2A8
Tel. (514) 435-1961
Fax. (514) 435-3160

EMERGENCY
EVACUATION ROUTE

6 GT
MAX. INDEX RATE
30,000 C.F.H.
MAOP
175 PSI
AMERICAN
METER COMPANY
92 53497

Cleaver Brooks

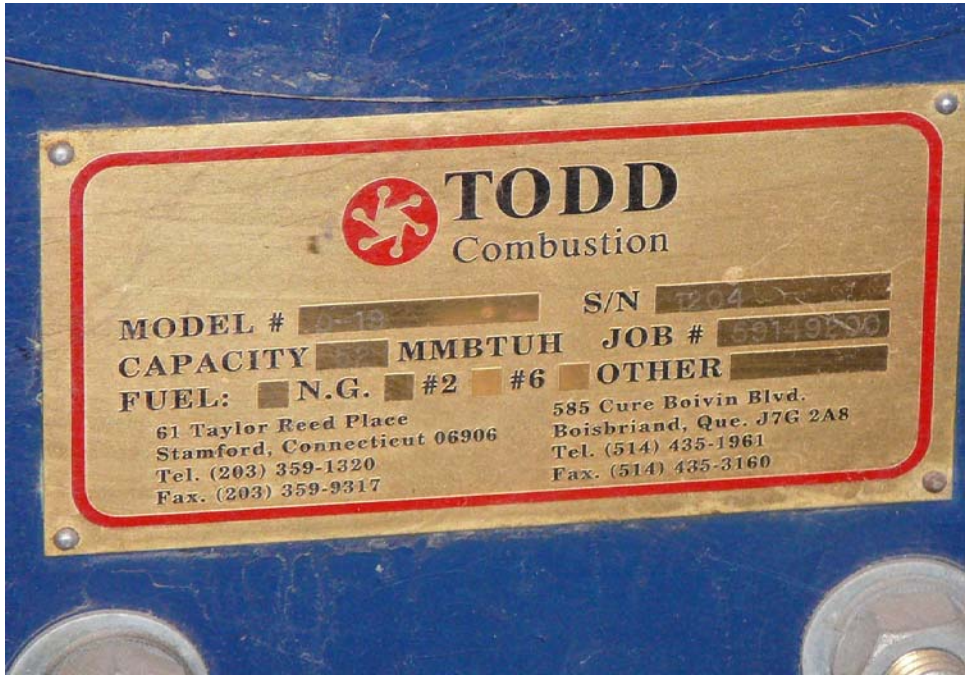

Cleaver Brooks
BURNER
MODEL NO.
WT-200X-CNT
SERIAL NO.
WL-1724
POWER REQUIREMENTS
BURNER
VOLTAGE PH. Hz
460 3 60
CONTROL
115/1/60
FIRING RATES IN M BTU/HR.
MAX.
MIN.
FUEL: GAS NAT.
MAIN PRESS 108.2 IN.W.C.
OIL NO.2
SUPPLY PRESS 100 PSI
Cleaver Brooks
DIVISION OF AQUA-CHEM, INC.
MILWAUKEE, WISCONSIN, U.S.A.

QMB SAFLEX
DISTRIBUTION PANELBOARD
MAINS AMPS
VOLTS
PHASE
WIRE
CATALOG
SQUARE D COMPANY

AIRTHERM MFG.
ST. LOUIS, MO.
MODEL NO.
SERIAL NO.

CHICAGO BLOWER

HAGAN


TODD
Combustion
MODEL #
S/N
CAPACITY
MMBTUH
JOB #
FUEL:
N.G.
#2
#6
OTHER
61 Taylor Reed Place
Stamford, Connecticut 06906
Tel. (203) 359-1320
Fax. (203) 359-9317
585 Cure Boivin Blvd.
Boisbriand, Que. J7G 2A8
Tel. (514) 435-1961
Fax. (514) 435-3160

CHICAGO
BUILT-IN QUALITY
CHICAGO BLOWER
CHICAGO BLOWER
CORPORATION
GLENDALE HTS., ILLINOIS U.S.A.
AXIAL-CENTRIFUGAL - HEAVY DUTY FANS

DANGER
MOTOR CONTROL CENTER
480V

OVERHEAD DOOR

CROWN EQUIPMENT
SYSTEMS
DAYTON, OHIO
REVERSE OSMOSIS SYSTEM
MOTOR CONTROL CENTER
480VAC 3Ø 45AMP 60HZ
MODEL NO. CRO-RO-
SERIAL NO. 6600600-B
S.S. FEED PUMP
OFF
HAND
AUTO
C.I.P. PUMP
OFF
ON
CROWN Equipment Systems

CROWN EQUIPMENT
SYSTEMS
DAYTON, OHIO
REVERSE OSMOSIS SYSTEM
MOTOR CONTROL CENTER
480VAC 3PH 45AMP 60HZ
MODEL NO. CRO-862-50 SERIAL NO. 5500502-B
R.O. FEED PUMP
OFF
HAND
AUTO
C.I.P. PUMP
OFF
ON

CROWN EQUIPMENT
A - PERMEATE CND
B - FEEDWATER CND
A - PERMEATE FLOW
B - CONCENTRATE FLOW
C - C.I.P. FLOW
CROWN EQUIPMENT
SYSTEMS
DAYTON, OHIO
120 VOLTS

EEDWATER CND
C - C.I.P. FLOW
CROWN EQUIPMENT
SYSTEMS
DAYTON, OHIO
REVERSE OSMOSIS SYSTEM
SUB PANEL
MODEL NO. CRO-862-50 SERIAL NO. 5500502-B

Dayton
SPEEDAIRE
COMPRESSED AIR

WARNING
HOSTILE DUTY HIGH EFFICIENCY MOTOR
U.S. ELECTRICAL MOTORS
MADE IN MEXICO
381980

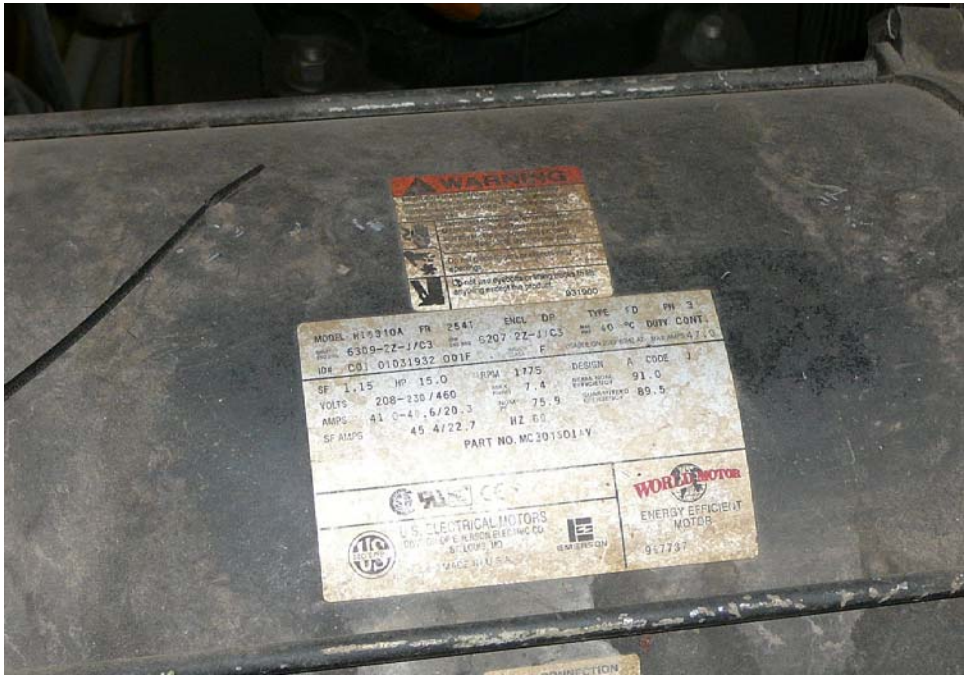
120 VOLTS
CROWN EQUIPMENT SYSTEMS
DAYTON, OHIO
120VAC 1PH 60HZ
SOLENOID SUB PANEL
SOFTENER #1

HOSTILE DUTY
HIGH EFFICIENCY

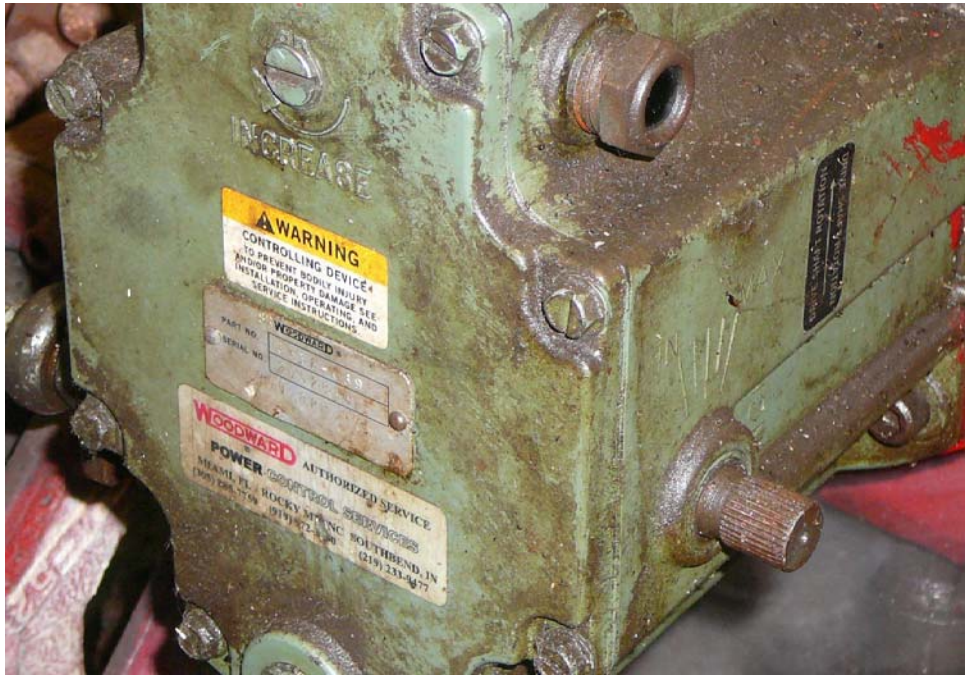
SERVICE RECORD
US MOTORS
SPEEDAIRE

DANGER
CONFINED SPACE
DO NOT ENTER
PERMIT ONLY

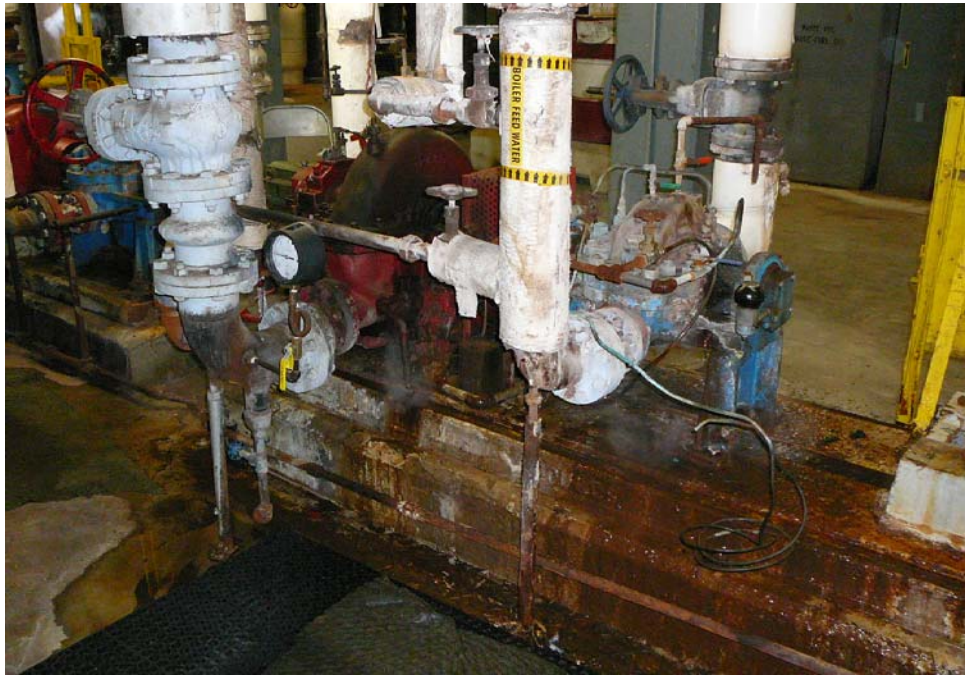
SERVICE RECORD
COMPRESSED AIR
CAST IRON SERIES
SPEEDAIRE
MADE IN U.S.A.


WARNING
MODEL HI5310A FR 254T ENCL DP TYPE FD PH 3
6309-ZZ-J/C3 6207 ZZ-J/C3 40 °C DUTY CONT.
ID# C0 01031932 001F F
SF 1.15 HP 15.0 RPM 1775 DESIGN A CODE J
VOLTS 208-230/460 7.4 91.0
AMPS 41.0-40.6/20.3 75.9 89.5
SF AMPS 45.4/22.7 HZ 60
PART NO. MC2015014V
U.S. ELECTRICAL MOTORS
WORLD MOTOR
ENERGY EFFICIENT MOTOR

Dominion
OLD DOMINION FABRICATORS
CHESTER, VIRGINIA
YEAR BUILT
MFG. SERIAL NO.
SHELL
TUBES
MAX. ALLOW. WORK PRESS.
P.S.I.
TESTED TO
MAX. ALLOW. WORK TEMP.
TANK O.D. IN.
O.A. LGTH. IN.
DISH RAD. IN.

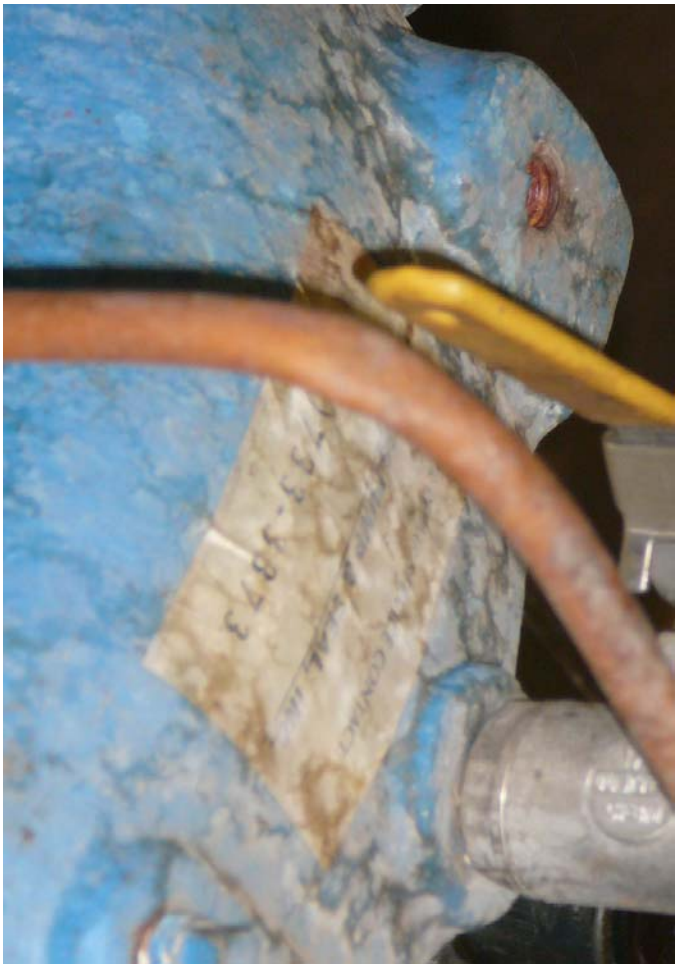

INCREASE
WARNING
CONTROLLING DEVICE
WOODWARD
POWER CONTROL SERVICES
AUTHORIZED SERVICE

YEAR BUILT
1983
MFG. SERIAL NO.
SHELL
TUBES
MAX. ALLOW. WORK. PRESS.
TESTED TO
MAX. ALLOW. WORK. TEMP.
TANK O.D. IN.
O.A. LGTH. IN.
DISH RAD. IN.
.410
ADAMSON


BOILER FEED WATER

BOILER FEED WATER

THREE PHASE INDUCTION MOTOR
280/80
280/40
140/70
BRGS. N.H. NO. 3
40
8500



BOILER FEED WATER

BOILER FEED WATER

WORTHINGTON
PART NO.
SERIAL NO.
GOOD RUN

PPLY

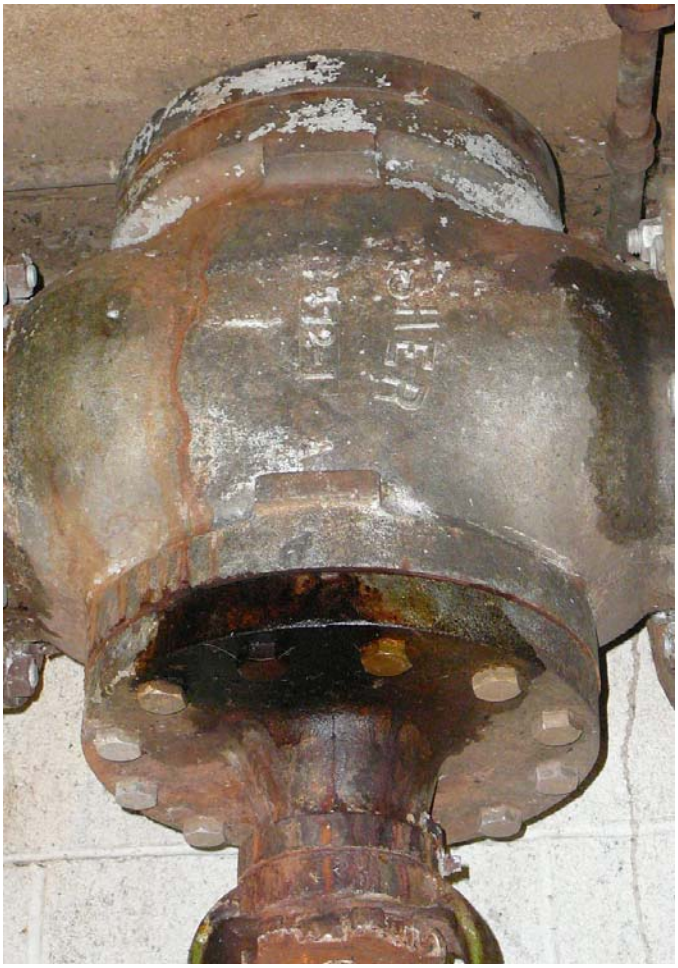
GRUNDFOS
CR 45

WLC
150/300
316
450°F

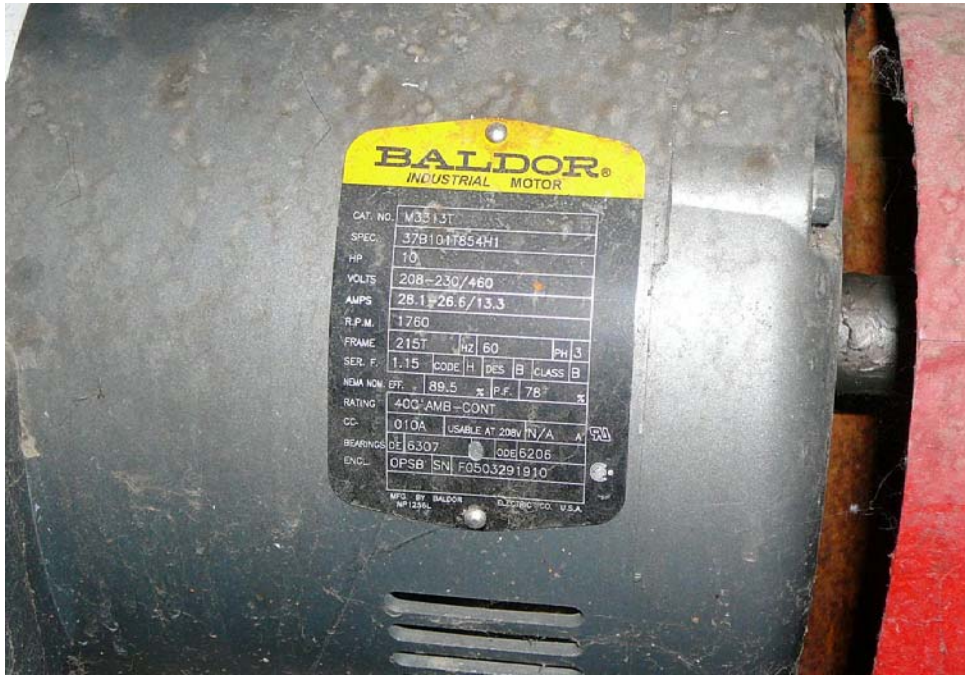
WOODWARD 0802
MANUFACTURED BY WOODWARD GOVERNOR COMPANY
WOODWARD
PART NO.
SERIAL NO.
2400RPM

3300
50
1905
50
SEE NAMEPLATE FOR OPERATING VOLTAGE & FREQUENCY
A-510109
A-509185
*MECon
*Marathon Energy Converter
MODEL
FRAME
PH
SER.
TYPE
RPM.
HZ.
PF
ENCL.
AMB.
°C
CONTINUOUS
KW
VOLTS
KVA
AMPS
STAND BY
KW
VOLTS
KVA
AMPS
FLD. AMPS
FLD. VOLTS
RISE
°C
SHAFT END BEARING
OPP. END BEARING
CLASS OF INS.
REGULATOR NO.
A. C. GENERATOR
MARATHON ELECTRIC MFG. CORP.
WAUSAU, WISCONSIN 54401

EXHAUST



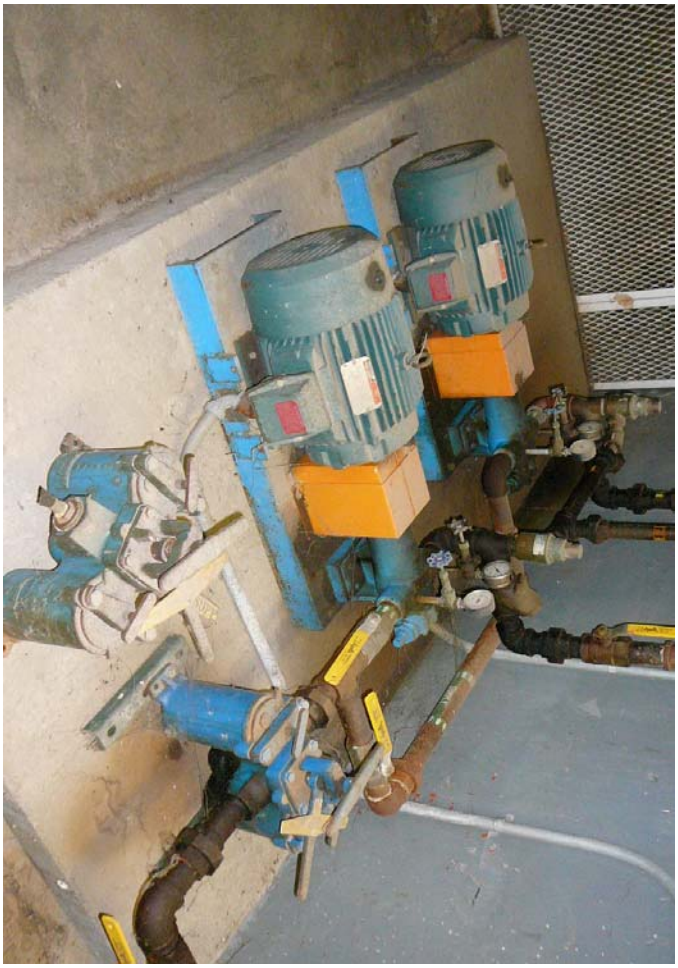
HIGH PRESSURE ST


BALDOR
INDUSTRIAL MOTOR
CAT. NO. M3313T
SPEC. 37B104T854H1
HP 10
VOLTS 208-230/460
AMPS 28.1-26.6/13.3
R.P.M. 1760
FRAME 215T
HZ 60
PH 3
SER. F. 1.15
CODE H
DES B
CLASS B
NEMA NOM. EFF. 89.5 %
P.F. 78 %
RATING 40C AMB-CONT
CC- 010A
USABLE AT 208V N/A
BEARINGS DE 6307
ODE 6206
ENC. OPSB
SN. F050329910

AMTROL INC.
THERM-X-TROL®
For the Absorption of Expanded Domestic Potable Hot Water
Model No. ST-210V
Date Code 24817901
Pre-Charge Pressure 40PSI
Max. Temperature 200F
Max. Working Pressure 150PSI

GARDNER DENVER
GARDNER DENVER
GARDNER DENVER

AUTO SENTRY-S
SHUT OFF COMPRESSOR WHEN PRESSURE IS DROPPING
GARDNER-DENVER
PRESSURE
TEMPERATURE
STOP/RESET
CONSTANT RUN
AUTO LEAD
AUTO LAG
HIGH TEMPERATURE
MOTOR OVERLOAD
CHANGE SEPARATOR
CHANGE AIR FILTER
EMERGENCY STOP
WARNING WARNING WARNING
ELECTRICAL SHOCK CAN CAUSE INJURY OR DEATH. DISCONNECT ALL CIRCUITS BEFORE WORKING ON THIS CONTROL. SEE WIRING DIAGRAM.
UNIT CAN AUTOMATICALLY RESTART. CAN CAUSE PERSONAL INJURY OR DEATH. KNOW MODE OF OPERATION BEFORE WORKING ON OR NEAR THE MACHINE
BEST VALUE DELIVERED
QUALITY WITHOUT QUESTION
MADE IN THE USA
OPERATION AND MAINTENANCE INSTRUCTIONS
OPERATION
MAINTENANCE
LUBRICANTS
GARDNER-DENVER

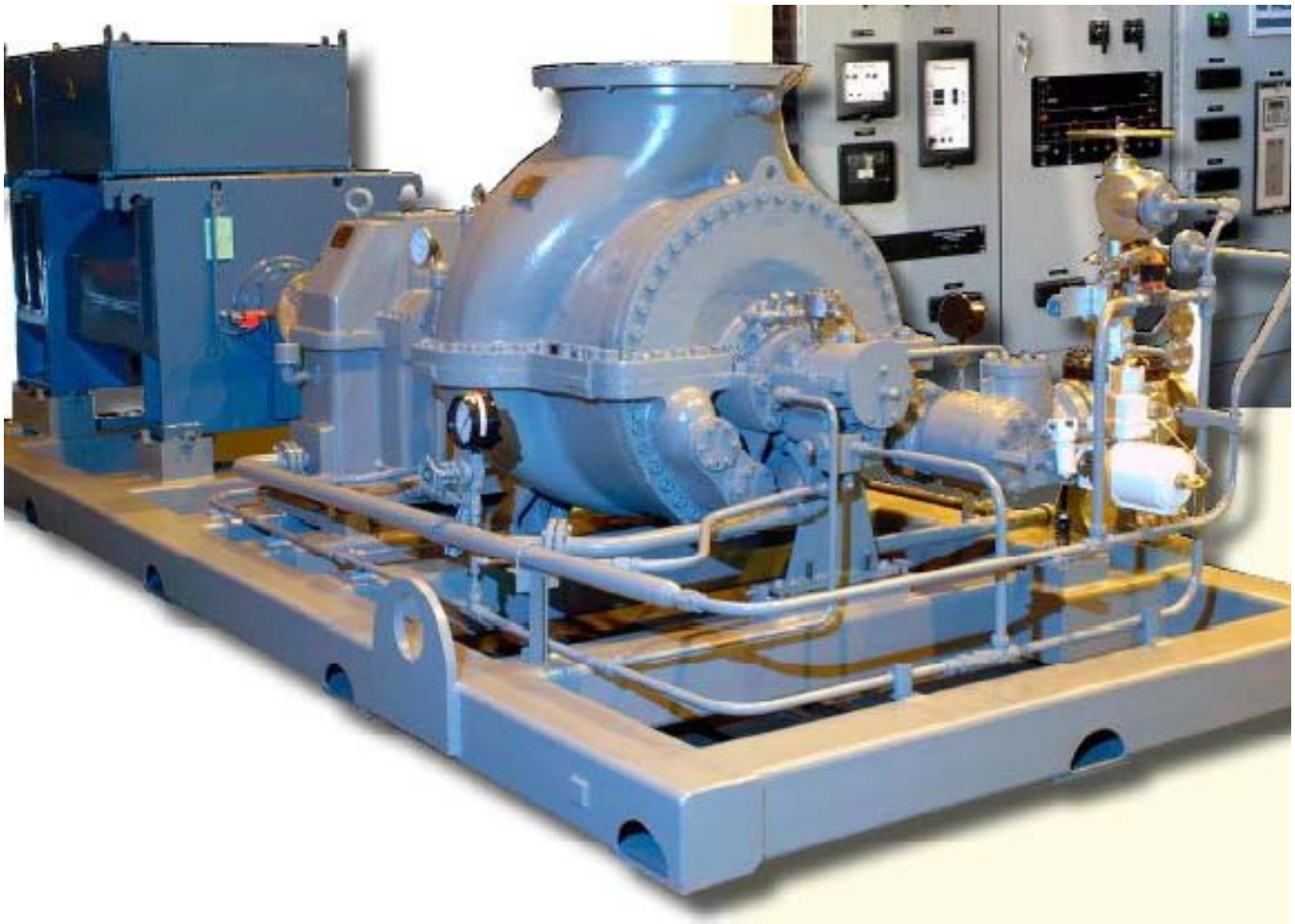


Model No. / Modèle No. / Modelo No.
5F567
Serial No. / No. De Série / No. De Serie
L 3/30/99-00010
Ratings / Classe / Classificación
SCFM
51.0 @ 175 PSI
175 PSI MAX
120 GALLON
Pump No.
Pompe No.
Bomba No.
4B246A
TK73122XHA
LR45245
Wired For / Cable Pour / Alambrado Por
460V / 60HZ / 3PH
208V 58A
230V 53A
460V 27A
208V 52A
230V 51A
460V 26A
208V 150A
230V 150A
460V 70A
208V 125A
230V 125A
460V 60A
CAUTION / ATTENTION / PRECAUCION
Manufactured / Fabriqué / Fabricado
5F567

CAT
POWER

RELIANCE ELECTRIC
DUTY MASTER
XE
ENERGY EFFICIENT, XT-EXTRA TOUGH
RELIANCE ELECTRIC INDUSTRIAL CO

Speedaire
INDUSTRIAL DUTY
AIR COMPRESSOR
MODEL 3Z412 2 STAGE ROT.
15 H.P. 3 PHASE
DAYTON ELECTRIC MFG. CO., CHICAGO 60648, U.S.A.



Single Stage and Multi Stage Steam Turbine Installation List

YR-LINE TURBINE - GENERATOR

SO NUMBER	USER NAME	USER ADDRESS	FRAME DESIGNATION	ACTUAL SHIP DATE	POWER KW	RATED SPEED	INLET PRESSURE PSIG	INLET TEMPERATURE F	EXHAUST PRESSURE PSIG
C302214	FRUIT OF THE LOOM	USA, KY, BOWLING GREEN	CYRH	Jan-94	397	3565	350	436	110
C602320	ROBERT GIFFARD HSPTL	CANADA, QUEBEC, BEAUPOR	DYR	Aug-96	302	3633	85	430	6
C602323	UNKNOWN	UNKNOWN	DYR	Aug-96	1389	4600	285	500	45
C702100	U.S. STEEL GROUP	USA, INDIANA, GARY	BYR	Oct-96	149	1800	265	550	15
C702201	CODANA S.A.	ECUADOR, GUAYAQUIL	CYR	Nov-96	300	3600	275	414	50
C702207	HITAVEITA HLIDAMANNA	ICELAND, REYKJAVIK	CYR	Jan-97	100	3060	25	267	0
C702301	LIQUID CARBONIC	URUGUAY	DYR	Nov-96	205	3000	227	482	28.4
C702303	WESTERN MICHIGAN U.	USA, MICHIGAN, KALAMAZOO	DYR	Feb-97	981	4478	200	480	60
C702304	UNKNOWN	UNKNOWN	DYR	Dec-96	1931	4800	435	456	45
C702306	UNKNOWN	UNKNOWN	DYR	May-97	1931	4800	450	460	45
C702328	UNKNOWN	UNKNOWN	DYR	Jul-97	1389	4800	285	500	45
C702331	BUEHLER LUMBER	USA, PA, RIDGEWAY	DYR	Aug-97	481	3625	250	406	20
C702702B	GENERAL MOTORS	USA, NJ, LINDEN	2DYR8-7	Feb-98	3157	5224	150	366	-13.22
C802144	WASEDA UNIVERSITY	JAPAN, TOKYO	BYR	May-98	40	3010	284	446	85
C802301	UNKNOWN	UNKNOWN	DYR	Aug-97	1924	4800	435	460	45
C802302	UNKNOWN	UNKNOWN	DYR	Aug-97	1924	4800	435	460	45
C802303	UNKNOWN	UNKNOWN	DYR	Aug-97	1924	4800	435	460	45
C802408	SAUDI CHEVRON	SAUDI ARABIA, AL-JUBAIL	BYRH	Feb-98	750	5017	600	725	150
C802700	UNKNOWN	PORTUGAL	2DYR3	Feb-98	975	5250	290	572	-12.53
C802705	AZUCARERA HONDURENA	HONDURAS, SAN PEDRO SULA	2DYR2	Aug-98	2657	4521	200	550	20
C802712	AZUCARERA YOJOA	HONDURAS	2DYR3	Jan-99	3189	5450	450	750	15
C802713B	KODIAK ELECTRIC	USA, AK, KODIAK	2DYR5	Dec-98	1790	5250	200	388	-13.46
C902300	COLBY COLLEGE	USA, MA, WATERVILLE	DYR	Sep-98	645	4500	300	417	40
C902302	PRAXAIR	CHILE, SANTIAGO	DYR	Jan-99	880	5231	170.7	375.4	28.4
C902303	INGENIO OFELINA	PANAMA	DYR	Nov-98	1052	4500	190	475	20
C902309B	CITY OF LONS DE SAUNAY	FRANCE, LONS DE SAUNIER	DYR	Mar-99	911	5200	413	599	51
C902314	SODERAL	ECUADOR, GUAYAQUIL	DYR	Jun-99	506	4523	140	360	27
C902315	BRISTOL-MYERS SQUIBB	USA, NJ, NEW BRUNSWICK	DYRH	Apr-99	1149	3625	400	448	125
C902316	CONFIDENTIAL	CONFIDENTIAL	DYR	May-99	1000	5000	275.5	415.4	50.8
C902322B	MILLENIUM	USA, MD, BALTIMORE	DYRH	Oct-99	1531	6700	425	575	150
E002307	INGENIO LA MAGDALENA	EL SALVADOR, SAN SALVADOR	DYR	Dec-00	1606	4864	250	480	20
E002309	UNKNOWN	UNKNOWN	DYR	Mar-00	1275	4600	276	414	45
E002311	UNKNOWN	UNKNOWN	DYR	Feb-00	1100	4495	290	518	51
E002315	PRIME AIR BLOWERS	USA, MA, WORCESTER	DYR	May-00	1305	4807	305	535	50
E002317	UNKNOWN	UNKNOWN	DYR	May-00	1063	4807	450	573	70
E002321	UNKNOWN	UNKNOWN	DYR	Jun-00	1800	4600	435	500	51
E002323	PONTIAN UNITED PLANTATION BHD	MALAYSIA	DYR	Jun-00	1800	4600	406	446	51
E002324	FLORAWAHANA TIRTA	INDONESIA	DYR	Apr-01	1220	4600	283	419	45
E002326	PARAKH FOOD	INDIA	DYR	Jul-00	383	3025	228	397	43
E002327	PARAKH FOOD	INDIA	DYR	Jul-00	744	4900	228	397	-5
E102214	PT SMART CORPORATION	MALAYSIA	CYR	Mar-00	1290	5000	295	420	45
E102215	PT SMART CORPORATION	MALAYSIA	CYR	Feb-01	1290	5000	290	419	45
E102233	PT SAWIT RIAUMAKUMUR	MALAYSIA	CYR	Jan-02	1085	5000	319	500	43.5
E102309	SUBANG MILLS	MALAYSIA	DYR	Mar-01	1720	4500	435	457	45
E102310	SARAWAK SUGAR	ASIA	DYR	May-01	1549	4500	286	473	51
E102313	TRIGEN-CINERGY	USA, MI, LANSING	DYRM	Aug-01	1800	5450	250	500	15
E102314	INCASI RAYA	MALAYSIA	DYR	Jun-01	1300	4500	290	473	45

SO NUMBER	USER NAME	USER ADDRESS	FRAME DESIGNATION	ACTUAL SHIP DATE	POWER KW	RATED SPEED	INLET PRESSURE PSIG	INLET TEMPERATURE F	EXHAUST PRESSURE PSIG
E102317	ROCK-TENN	USA, MI, BATTLE CREEK	DYR	Jul-01	1860	5000	400	520	75
E102326	PT FLORAWAHANA TIRTA	INDONESIA	DYR	May-01	1100	4465	290	419	45
E102331	KIRIBAYASHI CLEAN CENTER	JAPAN, MINAMI SHINSHU	DYRM	Jan-02	863	5021	290	545	-7.59
E102352	PT PERMATA HIJAU SAWIT	MALAYSIA	DYR	May-02	2460	5400	450	572	45
E102353	PENAGO UTAMA	MALAYSIA	DYR	May-02	1665	4500	435	457	46
E102358	TAIKO PLANTATION	INDONESIA	DYR	Jun-02	1400	4500	290	462	46
E102420	GEMARK SERVICES OF WEST VIRGINIA	USA, WV, BLUEFIELD	BYRH	Apr-02	279	3625	464	662	100
E102707B	UNIVERSITY OF ARIZONA	USA, AZ, TUCSON	2DYR5	Jan-02	1450	5195	125	353	-13.22
E102708B	UNIVERSITY OF ARIZONA	USA, AZ, TUCSON	2DYR5	Jan-02	1450	5195	125	353	-13.22
E102710	RIO GRANDE SUGAR GROWERS	USA, TX, SANTA ROSA	2DYR4	Aug-01	2658	4213	250	507	20
E102711	ELBERTA CRATE & BOX	USA, GA, BAINBRIDGE	2DYR3	Sep-01	1240	5447	260	409.3	-12.73
E102715B	GEMARK SERVICES	USA, WV, BLUEFIELD	2DYR3	Jun-02	2148	5620	464	662	-13.71
E202227B	PT VERITA MAJUTAMA	INDONESIA	CYR	May-03	700	5200	305	500	45
E202303	PT PALMA ABADI	INDONESIA	DYR	May-02	1250	3500	292.4	420.8	46.4
E202308B	PT INCASI RAYA	INDONESIA	DYR	Nov-02	719	4500	290	473	45
E202313B	PT PALMTEC	INDONESIA	DYR	Dec-02	1170	4280	290	419	45
E202315	PT PALMA ABADI	INDONESIA	DYR	Dec-02	1250	3500	292.4	420.8	46.4
E202316	HIRAM G. ANDREWS CENTER	USA, PA, JOHNSTOWN	DYR	Feb-03	453	4750	270	412	17
E202317	UNKNOWN	MALAYSIA	DYR	Feb-03	1399	4618	290	535	50
E202321B	PT INCASI RAYA	INDONESIA	DYR	May-03	1396	4500	290.1	473	45
E202322B	TANAH EMAS OIL PALM PROCESSING	MALAYSIA	DYR	May-03	1450	4700	305	423	45
E202325B	NEW BRITIAN PALM OIL MILL	NEW GUINEA, PAPUA	DYR	May-03	1200	4000	290	435	45
E202700	SCOTT WOOD COGENERATION PLANT	USA, VA, AMELIA	2DYR5	Aug-02	2800	5350	300	496	-13.22
E302100	KHUN HENG	MALAYSIA	BYR	Apr-03	372	4200	270	413	49.8
E302113B	CENEX HARVEST STATES COOPERATIVE	USA, MT, LAUREL	BYR	Sep-04	45	1800	150	366	1
E302304	PT SURIA AGROLIKA REKSA	INDONESIA	DYR	Jun-03	1250	3970	276	419	45
E302309B	SABANG MILL	MALAYSIA	DYR	Aug-03	2126	5400	435	456	45
E302311B	PT INCASI RAYA	INDONESIA	DYR	Aug-03	1300	4500	290	473	45
E302312	AMERIWOOD	USA, MI	DYR	Jul-03	382	3635	135	358	15
E302313B	MELANGKING OIL PALM PLANTATION	MALAYSIA	DYR	Sep-03	1275	4700	290	419	45
E302315B	LANDANG MILL	MALAYSIA	DYR	Nov-03	2000	5200	435	500	46.4
E302319	JASMAN LTD	MALAYSIA, KUALA LUMPUR	DYR	Nov-03	1200	4500	320	480	50
E302321	PT CITRA RIAU	INDONESIA	DYR	Jan-04	850.3	4500	290	419	43.5
E302322	PT SAWIT MAS	INDONESIA	DYR	Apr-04	1488	4600	305	455	45
E302324	PT TALES INTI SAWIT	INDONESIA	DYR	Apr-04	850	4500	290	419	43.5
E302326	IOI GROUP	MALAYSIA	DYR	Jun-04	2125	4600	377	443	45
E302328	PT INCASI	INDONESIA	DYR	Apr-04	1300	4500	209	473	45
E302408B	TOP GLOVES	MALAYSIA	BYRH	Oct-03	1200	5500	430	455	150
E402114	CYNIDES & CHEMICALS LTD	INDIA	BYR	Jan-05	77.3	5200	142	362	21
E402205	SMU	USA, TX, DALLAS	CYR	Dec-04	488	4800	240	403	40
E402208	GREENSBURG THERMAL LLC	USA, PA, GREENSBURG	CYR	Aug-05	210	4900	450	460	75
E402300	PT INCASI RAYA	INDONESIA	DYR	Nov-11	1300	4500	290	473	45
E402305	PUDUMJEE PULP & PAPER	INDIA, PUNE	DYR	Jun-04	526	3000	270	644	56.9
E402306	PONTIAN FICO PLANTATION	MALAYSIA	DYR	Jun-04	2143	4500	406	450	50.8
E402309	JAYASHREE CHEMICAL CO	INDIA	DYRN	Oct-04	664.5	5400	159.5	734	-11.85
E402311	US STEEL	USA, IN, GARY	DYR	Jul-04	211	1800	150	530	15
E402313	LONDON HEALTH SCIENCES CENTER	CANADA, ONTARIO, LONDON	DYR	Oct-04	2259	5400	650	650	35
E402315	MALSA	MALAYSIA	DYR	Dec-04	2000	4600	450	460	45
E402316	PT SIMPANG KANAN LESTARINDO	INDONESIA	DYR	Aug-04	1276	4500	304	423	50.8
E402318	PT PINAGO UTAMA	INDONESIA	DYR	Sep-04	2232	4500	449	572	45
E402319	PALM OIL TG	MALAYSIA	DYR	Jul-04	1876	4618	290	535	50

SO NUMBER	USER NAME	USER ADDRESS	FRAME DESIGNATION	ACTUAL SHIP DATE	POWER KW	RATED SPEED	INLET PRESSURE PSIG	INLET TEMPERATURE F	EXHAUST PRESSURE PSIG
E402321	PALM OIL TG	MALAYSIA	DYR	Jul-04	1200	4469	320	480	50
E402324	TRICOL ENGINEERING	MALAYSIA	DYR	Dec-04	1200	4280	319	427	58
E402326	EPA MANAGEMENT	MALAYSIA	DYR	Mar-05	2500	5450	450	480	45
E402327	TAMACO OIL MILL	MALAYSIA	DYR	Jan-05	2145	4500	406	450	50.8
E402328	GREENSBURG THERMAL LLC	USA, PA, GREENSBURG	CYR	Aug-05	204	3600	75	320	5
E402330	NORTH COUNTY HOSPITAL	USA, VT, NEWPORT	DYR	Nov-04	285	3640	285	417	10
E402331	NOVARTIS	USA, NJ, HANOVER	DYR	Apr-05	572.9	3600	200	387	70
E402332B	SHANGHAI HUAYI PROPENOIC ACID CO	CHINA, SHANGHAI	DYR	Aug-05	1236	3000	246	590	29
E402334	UNICO MILL	INDONESIA	DYR	May-05	1594	4600	305	423	45
E402335	TAIKO PLANTATION	MALAYSIA	DYR	Jul-05	2147	4600	435	510	45
E402336	PT AKA LESTARINDO	INDONESIA	DYR	Apr-05	1276	4900	305	423	51
E402337	PT HARAPAN BARU LESTARI	INDONESIA	DYR	Apr-05	1276	4900	305	423	51
E402338	PT GUNUNG SELAMAT LESTARI	INDONESIA	DYR	Aug-05	1276	4900	305	423	51
E402339	PT NUBIKA	INDONESIA	DYR	Mar-05	2332	5400	435	572	46
E402340	PT CAPELLA	INDONESIA	DYR	Mar-05	1200	4650	290	419	45
E402342	PT MINA PERNUDA	INDONESIA	DYR	Aug-05	1488	5075	305	572	45
E402347	PT ADEI PLANTATION & INDUSTRY	INDONESIA	DYR	Sep-05	1505	4500	290	464	46
E402350B	TONGLIAO JIANLONG ACID COMPANY., LTD	CHINA	DYR	Oct-05	1595	5000	497	815	99.3
E402700	PT KONOANKO	INDONESIA	2DYR3	Aug-04	1500	4500	305	500	4.4
E502224	SDS LUMBER CO	USA, WA, BINGEN	CYR	Feb-06	1065	5442	380	730	80
E502226	MENSILIN	MALAYSIA	CYR	Mar-06	681	4600	362	457	58
E502308	PT PINAGO UTAMA	INDONESIA	DYR	Jan-06	2100	4500	450	572	45
E502309	SG KARANG	MALAYSIA	DYR	Oct-05	1488	4490	297	421	45
E502310	PT PALMTEC	INDONESIA	DYR	Nov-05	1569	4280	290	419	45
E502315	PT KORINDO	INDONESIA	DYR	Dec-05	1394.4	4500	290	473	45
E502324	INCASI RAYA	INDONESIA	DYR	Apr-06	1300	4500	290	473	45
E502325	CENTRAL MINNESOTA ETHANOL COOPERATIVE	USA, MN, LITTLE FALLS	DYRH	Apr-06	1031	4700	600	560	150
E502326	FELDA	MALAYSIA	DYR	May-06	1913	4400	276	414	45
E502419	FRITO-LAY INC.	USA, CA, BAKERSFIELD	BYRH	May-06	197.9	3600	395	446.9	140
E502702	PT INDOPALM INDUSTRIES	MALAYSIA	2DYR4	May-06	4252	4535	609	752	72.5
E502703	PT INDOPALM INDUSTRIES	MALAYSIA	2DYR2	Jun-06	2447	5231	609	752	72.5
E502704	PT REA KALTIM PLANTATION	MALAYSIA	2DYR2	May-06	2700	4475	377	479	43.5
E502706	PT SINARJAYA	INDONESIA	2DYR3	May-06	2125	5100	435	626	1.5
E502709	ENWAVE ENERGY CORPORATION	CANADA, TORONTO, ONT	DYR8	Jan-07	5851	5004	200	388	-12.73
E602004	NORTHERN ALBERTA INSTITUTE OF TECHNOLOGY	CANADA, ALBERTA, EDMONTON	AYR	Sep-06	30	3600	110	344	15
E602118	PT PUNCAK GUNUNG MAS	MALAYSIA	BYR	Apr-07	318	4579	203	389	43.5
E602119	PT RAYA SUGARINDO	MALAYSIA	BYR	Apr-07	318	4579	203	389	43.5
E602200	CODANA	ECUADOR, GUAYAQUIL	CYR	Jul-06	531.5	4700	275	414	50
E602221	TEMBUSU POM	INDONESIA	CYR	Apr-07	636.5	4328	290.1	419	46.4
E602300	JERAM PADANG PALM OIL MILL	MALAYSIA	DYR	Aug-06	1700	4500	420.6	489	45
E602301	IOI CORPORATION	MALAYSIA	DYR	Sep-06	2125	4600	384	444	44.1
E602306	AGRO HOPE SDN BHD	MALAYSIA	DYR	Sep-06	1275.5	4280	290	419	45
E602307	FLEXITECH SDN BHD	MALAYSIA	DYRH	Jul-07	2126	4890	624	716	145
E602309	NEW BRITAIN PALM OIL	NEW GUINEA	DYR	Mar-07	1696	4500	412	527	44.94
E602311	PT SANDIKA NATA PALMA	INDONESIA	DYR	Dec-06	2120	4890	406	484	50
E602316	SACHIEW PALM OIL MILL	MALAYSIA	DYR	May-07	1272	4900	304.6	423	46.4
E602317	FELDA JENKA 21 PALM OIL MILL	MALAYSIA	DYR	Apr-07	1696	4569	319	464	46.4
E602318	FELDA JERENGGAN PALM OIL MILL	MALAYSIA	DYR	Apr-07	1693	4569	319	464	46.4
E602320	MINDO TRADE SDN BHD	MALAYSIA	DYR	May-07	1697	4554	333.6	431	46.4
E602329	EPA MANAGEMENT SDN	MALAYSIA	DYR	Jun-07	1594	4200	297.3	421	45
E602406	FRITO LAY, INC.	USA, CA, BAKERSFIELD	BYRH	Sep-06	197.9	3600	395	446.9	140

SO NUMBER	USER NAME	USER ADDRESS	FRAME DESIGNATION	ACTUAL SHIP DATE	POWER KW	RATED SPEED	INLET PRESSURE PSIG	INLET TEMPERATURE F	EXHAUST PRESSURE PSIG
E602408	CONOCO PHILLIPS	USA, MT, BILLINGS	BYRH	Aug-07	1431	6405	600	662	93.5
E602412	PT PACIFIC PALMINDO IND	MALAYSIA	BYRH	May-07	901	5200	609	748	217.5
E602701	NORTHERN NEVADA CORRECTIONAL CENTER	USA, NV, CARSON CITY	2DYR4	Mar-07	1062	4986	150	366	-12.24
E602702	NEW BRITAIN PALM OIL	NEW GIUNEA	2DYR3	Feb-07	3710	5495	412	527	-11.21
E602704	PT ASIA CITRA	INDONESIA	2DYR3	Mar-07	2650	5143	435	608	2.32
E602706	CLINTON CORRECTIONAL FACILITY	USA, NY, DANNEMORA	2DYR3	Aug-07	1611	4524	150	475	10
E602707	PT ANGELS PRODUCTS	INDONESIA	2DYR3	Jun-07	3189	4850	363	662	14.5
E603500	TERSANA BARU	INDONESIA, CIREBON	GEAR ONLY	Apr-07	NA	3016	NA	NA	NA
E603501	TERSANA BARU	INDONESIA, CIREBON	GEAR ONLY	Apr-07	NA	5273	NA	NA	NA
E702010	SASKATCHEWAN INSTITUTE OF APPLIED SCIENCE	CANADA, SASKATOON	AYR	Nov-07	30	3600	150	366	15
E702200	UNITED PLANTATIONS	MALAYSIA	CYR	May-07	850	4976	246.6	405	45.8
E702201	AMHERST COLLEGE	USA, MA, AMHERST	CYR	Aug-07	531	4850	200	387.8	40
E702208	COOLEY-DICKINSON HOSPITAL	USA, MA, NORTHAMPTON	CYR	Oct-07	246	3600	300	422	100
E702211	MAKIN GROUP	INDONESIA	CYR	Nov-07	1275	5000	298.6	536	49.8
E702308	PT OMETRACO	INDONESIA	DYRM	Aug-07	1400	4598	290	419	48
E702318	PT AGRICINAL	INDONESIA	DYR	Oct-07	1264	5500	290	500	14.5
E702322	MAKIN GROUP	INDONESIA	DYR	Nov-07	1913	5500	440.8	518	44.1
E702326	PT ANDIRA AGRO	INDONESIA, SUMATRA	DYR	Jan-08	1063	5490	304.6	500	7.3
E702703	TEMA	GHANA	2DYR8	Mar-08	6900	5150	597	734	-12.73
E702705	PT RAJAWALI NUSANTARA	INDONESIA	2DYR5	Feb-08	7440	4807	654	842	35.6

Turbine Generator Performance Summary

		Performance		
Model		DYRPE		
Total stages		One		
Power *1		750		kW
Turbine speed / generator speed		5000		rpm
Inlet steam pressure		250		psig
Inlet steam temperature		406		^{o}F
Exhaust steam pressure		5		psig
Steam rate		34.3		lb/kW-hr
Inlet steam flow		25,000		lb/hr

*1 – Power at generator terminals (includes all generator, gear and pump losses)

Steam Turbine Mechanical Summary

		Technical Data		
Model		DYRPE		
NEMA Class		III		
Inlet connection size and class		4”; 600#		
Inlet connection location *2		Right Hand		
Exhaust connection size and class		12”; 300#		
Exhaust connection location		Left Hand		
Inlet casing pressure rating		700		psig
Inlet casing temperature rating		750		^{o}F
Exhaust casing pressure rating		100		psig
Exhaust casing temperature rating		700		^{o}F
Hand valves		One		

*2 – Viewed from outboard (governor) end of the turbine

Single Stage Backpressure Steam Turbine Generator

Typical Scope of Supply

Steam Turbine:

One single stage steam turbine including the following features:

- Elliott Model "YR" turbine
- Horizontally split casing with a cast steel inlet section and a cast steel exhaust section. Inlet connection is right hand viewed from outboard (governor) end and exhaust connection is either right hand or left hand viewed from outboard (governor) end.
- Journal bearings are horizontally split sleeve type
- Built up rotor construction with alloy steel shaft and alloy steel disk
- Stainless steel steam path.
- Carbon ring type end gland shaft seals.
- Separate trip valve with electric solenoid trip features.
- One speed pickup reading a gear wheel mounted on the turbine main shaft.
- Carbon steel steam leakage drains piped to the edge of the baseplate.
- Blanket type thermal insulation covering the entire turbine casing.
- Casing drains piped to the edge of the baseplate, terminated in a NPT connection.
- One Valtek electronic - pneumatic type actuator for operating the governor valve.
- One pneumatically operated hand valve
- Mechanical type overspeed trip device.
- One shaft grounding brush
- Woodward 505 electronic governor

Synchronous Generator

One synchronous generator including the following features:

- 4160 volts, 3 phase, 60 hertz, 1,800 rpm, rated at 750 kW
- Rated at 0.8 power factor
- Direct connected, brushless exciter
- Open drip-proof type enclosure
- Stator RTD's, two per phase
- Class F insulation, designed for 80°C rise by resistance at rated load

Speed Reduction Gear

One speed reduction gear including the following features:

- Single stage double helical design
- AGMA design with a 1.1 service factor
- Cast iron casing
- Integral forged steel pinion and high speed shaft
- Built up type forged steel bull gear and steel low speed shaft
- Journal bearings are horizontally split sleeve type

High & Low Speed Couplings

- One spacer dry disk type coupling complete with OSHA compliant coupling guard between the steam turbine and gear.
- One spacer dry disk type coupling complete with OSHA compliant coupling guard between the gear and generator.

Lubrication Oil System

One lubrication oil system including the following features:

- Shaft driven cast iron main oil pump
- 460 volt / 3 phase / 60 Hertz AC electric motor driven cast iron auxiliary oil pump.
- Single 25 micron oil filters
- One shell and tube type oil cooler designed for 85 ^{o}F cooling water
- One cast iron body pressure control valve to maintain the supply oil pressure
- One cast iron body thermostatic lube oil temperature control valve (AMOT)
- Carbon steel tubing, piping and fittings for the following items:
    - Oil supply manifold to the turbine and gear
    - Oil drains from the turbine and gear
    - Interconnecting manifolds between the gear case (reservoir), pumps, filter, cooler and control valve
- Instrumentation:
    - Oil temperature indicator after the oil cooler
    - Oil supply pressure indicator
    - Low oil pressure switch to start auxiliary oil pump
    - Low oil pressure switch to trip the unit
    - High oil temperature trip switch

Baseplate

One fabricated structural steel baseplate of open construction including the following features:

- Non self support type with lifting lugs for the turbine, gear and generator
- Vertical positioning screws for turbine and gear
- Horizontal positioning screws for turbine and gear

Turbine Generator Controls - Medium Voltage Synchronous

Turbine Generator Control

- Automatic Startup
  - Fully automatic start sequence with manual override
  - Programmable hold times
  - Critical Speed Avoidance (2 speed bands)
  - Automatic synchronizing and soft-loading the generator
- On-line control
  - Exhaust or Inlet Steam Pressure control, as required
  - Power limit control
  - Soft unloading and controlled shutdown
- Lube system control logic
  - Auto/manual auxiliary pump control
  - Monitoring of lube and control oil temperatures and pressures
- Overspeed Protection
  - Dual, redundant electronic overspeed protection
  - Automatic turbine trip on generator breaker opening
  - Peak Speed Indication for overspeed trip testing

Operator Interface Touchscreen (HMI)

- 10 inch color touchscreen operator interface
- USB port for connection of printer, mouse, keyboard, etc
- The following screens are typical. Screens are customized for each application.
  - Directory screen and other screens required for HMI navigation
  - System status screen showing system status, control mode and a summary of operating parameters
  - Real-time trending screens for startup, PID tuning, and important monitored temperatures and pressures
  - Synchronizing screen showing frequency difference between generator and utility bus, auto/manual synchronizing status and other information relevant to synchronizing
  - Overview graphic showing temperature and shaft vibration level for each bearing
  - Last trip screen showing all temperature, pressure, vibration and operating parameters at the moment of the last trip
  - Screens for setpoints for control and monitoring parameters

- Alarms and shutdowns with sequence of events and time stamping
    - Last 999 alarms are stored in a buffer and can be viewed
- Complete, high accuracy electrical metering data from the generator protection relay
    - Voltage, per phase and average, L-L and L-N
    - Current, per phase and average
    - Current and voltage phase angles
    - Frequency
    - Power Factor
    - Unit breaker contact wear based on current interrupted and close-to-open operations.
    - DC battery voltage

Communications and Remote Access

- Communications
    - The system features internal communication between the PLC and the generator protection relay, and other devices as may be required for a specific application.
    - Additional communications options are available. These networks can be used to connect the controls to the plant DCS or LAN. Please consult factory for pricing.
- Teleservice
    - System includes telephone modem for remote controller and HMI service access. To insure security, the modem must be manually connected and is fully password protected.

Machinery Monitoring

Each point will have an alarm and trip point and will be displayed on the HMI

- Vibration
    - X-Y Vibration In Turbine, Reduction Gear and Generator Journal Bearings and Two Axial Displacement Probes (18 channels of 4-20 mA inputs)
- Bearing and Generator Stator Temperature
    - Bearing RTDs in Thrust and Journal Bearings (10 RTD channels)
    - Generator Stator Temperature (6 RTD channels)
- Steam Parameters
    - Inlet Steam Pressure (4-20 mA)
    - Inlet Steam Temperature (RTD)
    - Exhaust Pressure (4-20 mA)
    - Exhaust Steam Temperature (RTD)
- Lube Oil
    - Lube Oil Pressure (4-20 mA)
    - Lube Oil Temperature (RTD)
- Speed

Discrete Inputs

The system includes inputs to monitor the following. Status will be displayed on the HMI.

- Trip valve position
- Emergency trip pushbutton
- Remote emergency stop
- Turbine overspeed trip
- Low lube oil system alarms and trips as available
- AVR in manual alarm, if available
- Exciter diode alarm, if available
- Generator protection relay lockout
- Generator circuit breaker position
- Generator cooling leak detector, if required
- Additional inputs as may be required

Discrete Outputs

The base system includes switch outputs in addition to internal outputs. The outputs will be monitored and displayed on the HMI. All outputs are with 7 amp Form C relays except as noted.

- Circuit Breaker Open (Trip) (Single pole relay with one NO contact rated at 10 amps at 150 VDC)
- Circuit Breaker Close (Single pole relay with one NO contact rated at 10 amps at 150 VDC)
- Turbine Trip
- Aux oil pump start
- Emergency oil pump start, if required
- Common alarm/Common Trip

Electric Power Metering

Multi-function power monitor, 0.5% accuracy, for measurement of:

- Voltage, per phase and average, L-L and L-N
- Current, per phase and average
- Power (kW)
- kWh
- kVAR
- kVA
- Frequency
- Power Factor
-

This meter has a three-line, bright LED display and can display voltage, current and power values simultaneously. Other measurements are available by using a 5 button keypad. Min/Max readings are available for all measured parameters. Utility grade construction.

Other Components

- Overspeed Protection system (supplied by turbine manufacturer, if required)
- Circuit Breaker Position Lights
- Emergency Stop mushroom head maintained position switch with guard

Synchronizing

- Fully automatic synchronizing
- Backup manual synchronizing
- Auto voltage matching (if supported by voltage regulator)
- Synchscope with synch-check relay
- Door-mounted switches for:
    - Manual Circuit Breaker Control
    - Manual Raise/Lower Frequency (speed)

Both automatic and manual synchronizing are supervised by the synch check relay in the synch scope and the synch check in the generator protection relay.

Switchgear and Generator Protection Relay

- GE PowerVac indoor metal clad switchgear with drawout vacuum circuit breaker, ANSI C37.06 rated, 5 kV rated, 2000 amp, 5-cycle close, 250 MVA, with auxiliary contacts. Control power is 125 VDC (by others).
    - Metering and relaying current transformers, (3 for metering and relaying and 3 shipped loose for installation in generator terminal box for differential protection)
    - Metering and relaying potential transformers, drawout, fused, quantity (1 for bus and 2 for generator)
    - Breaker trip/close switch and indicating lights
    - Space heater and thermostat
    - Ground bus

- Schweitzer Engineering Laboratories SEL 300G multifunction generator protection relay, with the following functions. Relay settings by others.
    - Two-zone phase distance or voltage restrained and voltage controlled phase time-overcurrent element for backup protection (21P/51V/51C)
    - Overexcitation detection based on volts/hertz measurement. One definite-time and a composite definite/inverse-time element (24)
    - Synchronism checking (25)
    - Two sensitive directional power elements with flexibility to provide anti-motoring, over-power, or low-forward power indication (32)
    - Two-zone, positive-sequence impedance mho element for loss-of-field detection (40).

- Negative-sequence overcurrent elements, including definite-time and inverse-time operating characteristics (46).
- Residual and neutral instantaneous, definite-time, and inverse-time non-directional overcurrent elements (50/51).
- Inadvertent energization protection (50/27)
- Unit breaker failure protection (50BF)
- Phase, positive-sequence, negative-sequence, and residual overvoltage elements (59)
- Supervision of voltage-based protection functions by loss-of-relaying-potential detection logic (60)
- 100% stator ground fault detection based on measurement of neutral overvoltage plus neutral and terminal third-harmonic voltage differential with settable sensitivity (64G).
- Six over-/underfrequency elements (81)
- Percentage restraint and unrestrained phase current differential elements (87)
- Two independent relay setting groups.
- Full Event Reports and Sequential Events Records (SER)
- Breaker Monitor and Battery Monitor
- High Accuracy Metering

Documentation

The following documentation will be supplied for the above equipment in five copies plus electronically in DXF and PDF format. Note the instruction manuals are issued in six copies plus one CD ROM.

- Combined unit outline drawing showing the major equipment dimensions, weights and customer interface connections
- Turbine control system outline drawings showing the major equipment dimensions, weights and customer interface connections
- Generator switch gear outline drawings showing the major equipment dimensions, weights and customer interface connections
- P & I diagram for the supplied equipment
- System logic diagram
- Interface wiring diagrams
- Inspection and test plan
- Instruction manual

Inspection & Testing

The equipment will include the following inspections and tests:

- Steam turbine casing hydro testing (high pressure and low pressure casings including certificate of compliance
- Major steam turbine material certificates of compliance
- Steam turbine rotor balance including a certificate of compliance
- Steam turbine mechanical test at full running speed including a certificate of compliance
- Reduction gear major material certificates of compliance
- Reduction gear rotor balance including a certificate of compliance
- Reduction gear mechanical test including a certificate of compliance
- Oil system components hydro tests with certificates of compliance
- Oil system running test with a certificate of compliance.
- Generator material certificates of compliance
- Generator mechanical and electrical testing certificates of compliance

Shipping Preparation and Painting

The equipment will include the following work:

- Steam turbine internal parts are protected for storage up to six months from shipment
- Lubrication system internal parts are protected for storage up to six months from shipment
- Gearbox internal parts are protected for storage up to six months from shipment
- Complete package will be surface prepared and painted

Budget Price

Budget price for STG as outlined above is……..$560,000.00

Delivery

Approximate lead-time is 42-44 weeks after receipt of order

5301 Lester Road
Cincinnati, Ohio 45213
(513) 733-8888
Fax (513) 733-8555
E-Mail: kmadigan@rpcmechanical.com

January 21, 2010

Mr. Daniel Fluegeman
Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, OH 45050-1281

Re: Lebanon Correctional Institution/AHU Replacement Project

Dear Dan:

RPC Mechanical, Inc. is pleased to provide the following Design Build proposal for the Lebanon Correctional Institution facility.

Scope of Work
The scope includes the demolition of (38) existing air handling units with steam heating coils and the replacement of these units with new equipment. The existing pneumatic and limited DDC controls will not be reused. A new Energy Management System shall be furnished by others. Due to the nature of this facility (maximum security penitentiary), the labor rates have been increased to compensate for additional security, safety, and material handling activities. This air handling unit replacement proposal is based on the RPC Mechanical site visit on 1/19/10 and meeting with Dan Fluegeman held on 1/18/10.

- (1) C-2, Segregation, air handler, 1,250 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) C-3, Segregation, air handler, 1,250 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) C-4, Segregation, air handler, 1,250 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit

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- (1) D-1, Dining/Mess Hall, air handler, 4,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) D-2, Dining/Mess Hall, air handler, 4,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) D-3, Dining/Mess Hall, air handler, 4,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) D-4, Dining/Mess Hall, air handler, 4,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) D-5, Dining/Mess Hall, air handler, 4,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) E-1, Chapel, air handler, 3,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) E-2, Chapel, air handler, 3,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) F-1, Classroom, air handler, 5,600 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) G-1 West, Block A, air handler, 8,240 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) H-1, Hospital/isolation cell, air handler, 240 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit

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- (1) H-2, Hospital/isolation cell, air handler, 240 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) J1 East, Block K, air handler, 9,600 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) J2 West, Block J, air handler, 8,100 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) K West, Gymnasium, air handler, 9,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) K-East, Gymnasium, air handler, 9,500 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) L-1, Laundry, air handler, 16,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) L-2, Laundry, air handler, 16,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) L-3, Laundry, air handler, 15,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) R-West, Block D, air handler, 7,945 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) R-East, Block D, air handler, 6,200 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit

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- (1) T-South, Block F, air handler, 6,640 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) T-North, Block F, air handler, 5,190 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) U-West, Block G, air handler, 7,670 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) U-East, Block G, air handler, 9,200 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) V-West, Block H, air handler, 7,670 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) V-East, Block H, air handler, 7,440 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) H&V #1, Industries/Tag Shop, air handler, 25,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) H&V #2, Industries/Tag Shop, air handler, 25,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) H&V #3, Industries/Tag Shop, air handler, 25,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) H&V #4, Industries/Tag Shop, air handler, 25,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit

5301 Lester Road
Cincinnati, Ohio 45213
(513) 733-8888
Fax (513) 733-8555
E-Mail: kmadigan@rpcmechanical.com

- (1) H&V #5, Industries/Tag Shop, air handler, 25,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) H&V #6, Industries/Tag Shop, air handler, 25,000 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) Tunnel Ventilators Block H area, Lower level tunnel, air handler, 2,800 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (1) Tunnel Ventilators Bldg F area, Lower level tunnel, air handler, 2,800 cfm, xxx MBH, 208-230/3, steam coil, hookup including isolation valves, strainer, trap, vent, drain, control valve (furnished by others installed by MC, demo and disposal of existing unit
- (22) Condensate return pumps, heating system (steam condensate), 6-45 gpm, 208-230/3, duplex, 15-60 gallon receiver tank,
- (1 lot) Engineering and Mechanical permit drawings
- (1 lot) Field Supervision
- (1 lot) Air balancing (duct traverse of supply, return, and outside air of each unit)
- (1 lot) Structural steel modifications as needed

Budget price for the above scope of work $1,650,000

5301 Lester Road
Cincinnati, Ohio 45213
(513) 733-8888
Fax (513) 733-8555
E-Mail: kmadigan@rpcmechanical.com

Qualifications/Exclusions

1. Starters, disconnects, and power wiring are not included.
2. Hazardous material abatement (lead, asbestos, etc.) is not included.
3. This proposal includes standard work schedule, no OT has been included.
4. No insulation has been included.
5. No chemical treatment is included.
6. We have assumed that the project will commence and be completed within a 4-6 month time period.
7. All sheetmetal duct connections and structural steel modifications have been included.
8. All rigging has been included.
9. All hydronic accessories (isolation valves, wye strainers, steam traps, drains, vents) have been included with each unit hookup.
10. All demolition and disposal of existing equipment has been included.
11. No work in the Boiler House or Maintenance Garage is included.

Add/Alternates

1. Sum add to furnish drain pans to keep water from dripping onto new equipment is $7,500 if required. RPC Mechanical recommends repairs to existing plumbing system to fix drains as needed.

5301 Lester Road
Cincinnati, Ohio 45213
(513) 733-8888
Fax (513) 733-8555
E-Mail: kmadigan@rpcmechanical.com

Thank you for the opportunity to provide this proposal.

Sincerely,
RPC Mechanical, Inc.

Kevin Madigan, P.E.
VP Construction

Acceptance:

_____
Authorized Signature Title

_____
Date PO #

Attach.

5301 Lester Road
Cincinnati, Ohio 45213
(513) 733-8888
Fax (513) 733-8555
E-Mail: kmadigan@rpcmechanical.com

Standard Terms and Conditions
RPC Mechanical, Inc.

1) Invoices are due upon receipt and rendered as labor and material progress on the job. A late payment charge of 1.5% per month and 18% annually shall be added to the unpaid past due balance after 30 days.
2) All work to be provided under this proposal/agreement will be performed during normal working day hours of 7:30AM – 4:00PM, Monday through Friday; unless specifically noted elsewhere in this proposal/agreement.
3) All designs, engineering, drawings, specifications, processes, and the like are confidential and proprietary information of RPC. The recipient of any proprietary information agrees to: (1) maintain the confidentiality of the information; (2) not disclose the information to anyone else without RPC's permission; and (3) not use the information for any purpose other than permitted uses contemplated under this proposal/agreement.
4) This proposal/agreement is subject to revision if not accepted within 30 days following the date written.
5) If during the performance of the work as proposed; the price of steel, copper, or other commodity and as a result the cost of equipment and/or other components also increase more than the price at the time of the contract; RPC will absorb and pay the additional cost up to and including and additional 15%. If these increases exceed 15% the owner and prime contractor agrees to absorb and pay for that portion over 15%.
6) Change orders and/or extra work requests shall be executed upon written authorization from the owner, GC, or CM.
7) Costs for RPC Mechanical's products and services are based upon schedules specified in the contract documents and/or our proposal. Any schedule extensions and/or delays beyond our control, shall be subject to a claim for cost recovery.
8) RPC Mechanical, Inc. reserves the right to amend this bid and proposal in the event of a mistake.

Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Wednesday, January 27, 2010 11:21 AM
To: 'dtarkington@fseinc.net'
Subject: FW: Lebanon Correctional Institution

Tracking:

Recipient	Read
'dtarkington@fseinc.net'	Read: 1/27/2010 12:15 PM

Dan:

Below is the mechanical equipment quote from DeBra-Kuempel.

Thanks,

Dan Fluegeman

From: Greg Pownell [mailto:Greg_Pownell@emcorgroup.com]
Sent: Tuesday, January 26, 2010 11:37 AM
To: dfluegeman@fseinc.net
Subject: Fw: Lebanon Correctional Institution

Dan,

Mechanical budget below.

What is the next step?

Thanks,

Greg

Greg Pownell
EMCOR Automated Controls
Direct: (513) 527- 8136
Fax: (513) 527-8019
Email: greg_pownell@emcorgroup.com

----- Forwarded by Greg Pownell/Kuempel/EMCORGROUP on 01/26/2010 10:20 AM -----

From:	Ken Johnson/Kuempel/EMCORGROUP
To:	Greg Pownell/Kuempel/EMCORGROUP@EMCORGROUP
Date:	01/25/2010 02:39 PM
Subject:	Lebanon Correctional Institution

HVAC Budget

- Refurbish Shop units including new steam coils, motors, dampers, bearings, sheaves belts and misc. casing panels as required. Total 6 units
- Refurbish Laundry units including new steam coils, motors, dampers, bearings, sheaves belts and misc. casing panels as required. Total 3 units
- Refurbish Gym units including new steam coils, motors, dampers, bearings, sheaves belts and misc. casing panels as required. Total 2 units
- Refurbish Chapel units including new steam coils, motors, dampers, bearings, sheaves belts and misc. casing panels as required. Total 2 units

- Replace Kitchen / Dining units with new air handler, steam coil, dampers, motor etc. with sheetmetal connections and labor, pipe and piping connections. electrical disconnect and reconnect although motor starters are assumed to be reused and insulation repairs @ unit Total 2 units
- Replace Kitchen / Dining units in tunnel with new air handler, steam coil, dampers, motor etc. with sheetmetal connections and labor, pipe and piping connections. electrical disconnect and reconnect although motor starters are assumed to be reused and insulation repairs @ unit Total 3 units
- Replace Classroom unit in tunnel with new air handler, steam coil, dampers, motor etc. with sheetmetal connections and labor, pipe and piping connections. electrical disconnect and reconnect although motor starters are assumed to be reused and insulation repairs @ unit Total 1 unit
- Replace Hospital unit in tunnel with new air handler, steam coil, dampers, motor etc. with sheetmetal connections and labor, pipe and piping connections. electrical disconnect and reconnect although motor starters are assumed to be reused and insulation repairs @ unit Total 1 unit
- Replace Cell Block units in tunnel with new air handler, steam coil, dampers, motor etc. with sheetmetal connections and labor, pipe and piping connections. electrical disconnect and reconnect although motor starters are assumed to be reused and insulation repairs @ unit Total 12 units

Total budget $1,230,000.00

Ken Johnson
Construction
Debra-Kuempel
(513)271-6500
Fax: 271-4676
kjohnson@debra-kuempel.com

BUILDING RELATIONSHIPS - BUILDING SOLUTIONS

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Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Tuesday, January 26, 2010 2:59 PM
To: 'dtarkington@fseinc.net'
Subject: FW: STG Pics

Attachments: tg install list - field - final(1).xls

:g install list - field - fina...

Dan:

Below is Mark Haglage's response to our request for cogen installations. I put a hard copy of the attached file in your mailbox.

Thanks,

Dan Fluegeman
-----Original Message-----
From: Mark Haglage [mailto:mvhaglage@fuse.net]
Sent: Tuesday, January 26, 2010 10:45 AM
To: DFluegeman@FSEInc.net
Subject: FW: STG Pics

Dan,

I'm attaching a partial list of similar installations. As you can see, this equipment is used around the world.

The UC skid is not on this list….it is being shipped this week, and will be on site by the weekend. The number of installations in the Cincinnati area is limited, but there are a number of installations in the Midwest that we could visit.

Pls confirm receipt, and let me know if you need any more detail at this time.

Regards,

Mark

Steam Power llc
P.O. Box 230
4 Main Street
Milford, OH. 45150

P: 513-703-6990
e: markh@stmpwr.com

www.stmpwr.com

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Friday, January 22, 2010 2:20 PM
To: 'Mark Haglage'
Subject: RE: STG Pics

Mark:

The pics are great, thank you very much for them. What I would like to ask of you now is this: can you provide me with a list of who else is using this type of system? What I would like to see is a list of local (non-correctional) users, and also a list of any correctional facilities that use cogen. We are aware that UC is using a cogen system, but are there any others here in the Cincinnati area?

Thanks,

Dan Fluegeman

_____

From: Mark Haglage [mailto:mvhaglage@fuse.net]
Sent: Thursday, January 21, 2010 10:55 PM
To: 'Dan Fluegeman'
Cc: eds@stmpwr.com
Subject: STG Pics

Dan,

I'm attaching a few pictures of similar sized STG skids. Feel free to use any of the pics attached.

Let me know if I can be of any further assistance.

Regards,

Mark

From: Mark Haglage [mailto:mvhaglage@fuse.net]
Sent: Thursday, January 21, 2010 10:38 PM
To: 'Dan Fluegeman'
Cc: eds@stmpwr.com
Subject: Synchronous STG Budget

Dan,

I had a very good visit with Tim Brashears at LCI this morning. This is a good application for an STG package. There is plenty of room to install the skid, and all of the piping is still in place, so the installation costs will be significantly reduced. The existing MCC has spare room to handle the new controls and switchgear.

According to discussions with Tim, we should plan on boosting the steam pressure to 250 psig from the boiler to the inlet to the turbine, and exhaust from the turbine into a 5 psig header. Using these steam design parameters, we will be able to generate approximately 750 kW using 25,000 lbs/hr of steam.

Our best selection now is a synchronous STG instead of the induction unit I had budgetted previously. 750 kW represents a high percentage of the total load for the facility, and the synchronous STG will also have the capability to stay on line and generate power in case of a power failure.

I'm attaching a budgetary proposal in a Word file that you can use in your proposal as you see fit. I will also send you a photo of a similar unit under separate cover. You will notice that the price of the skid has increased from my earlier budget. There are a number of reasons for the increase, but the major reasons are as follows:

Larger power unit (750 kW vs 350 kW)
Speed reduction gear between turbine and generator now included, along with lube system
Expanded turbine/generator controls Switchgear is now included

After you have reviewed the information, let meknow if you have any questions, or need any more detail at this time.

Sincerely,

Mark Haglage

Steam Power llc
P.O. Box 230
4 Main Street
Milford, OH. 45150

P: 513-703-6990
e: markh@stmpwr.com

www.stmpwr.com

From: Dan Fluegeman [mailto:dfluegeman@fseinc.net]
Sent: Wednesday, January 20, 2010 4:47 PM
To: 'Mark Haglage'
Subject: RE: Site Visit - Lebanon CI

The main number for the correctional facility is: 513-932-1211

Marty can be reached at extension 3150. Please be advised that you cannot dial his extension directly; you must dial "O" and wait for the operator to connect you.

I believe Tim's extension is 2180; you can also have the operator connect you to him.

Thanks,

Dan Fluegeman

_____

From: Mark Haglage [mailto:mvhaglage@fuse.net]
Sent: Wednesday, January 20, 2010 4:08 PM
To: 'Dan Fluegeman'
Subject: RE: Site Visit - Lebanon CI

Dan,

confirming, I will visit the powerhouse tomorrow morning at 9 AM. Do you have a phone number or email for Tim Brashear or Marty Westall so I can let them know?

Thx,

Mark

Steam Power llc
P.O. Box 230
4 Main Street
Milford, OH. 45150

P: 513-703-6990
e: markh@stmpwr.com

www.stmpwr.com

Tracking:

Recipient	Read
'dtarkington@fseinc.net'	Read: 1/27/2010 8:13 AM

Sequence of Operations

Cell Blocks A thru K

Overview

Air Handlers

Each building has (2) constant-volume air handlers (AHUs), one for the east rank of cells, the other for the west. Each AHU also provides airflow to the central gallery, thru vents mounted on the facing walls.

Steam coils in the Discharge Air stream provide heat to cells and gallery.

(1) Thermostat for each AHU is mounted on the gallery walls and control the steam valves feeding coils

Dampers at intake regulate Return Air/Outside Air ratio.

In winter, intake air is mixture of return and outside air

In summer, intake is 100% outside air.

Sensors

Sensors will monitor the room air temperature, outside air temperature, return air temperature, mixed air temperature, and discharge air temperature.

Proposed Operation

Heating Mode:

Outside air (OA) temperature ≤ 70°F

Return air (RA) temperature = 68°F

Return Air damper will maintain a minimum of 10% airflow across the RA sensor.

Mixed air (MA) temperature = 60°F

As outdoor temperature drops, system will modulate OA and RA dampers to maintain RA and MA temperatures.

Discharge air (DA) temperature

As the outdoor temperature drops, the system will reset the discharge air temperature according to a discharge air reset schedule.

If the room air temperature sensors in the cell block area are below the setpoint, the steam valve will modulate open, allowing steam thru the coil.

If signal from outside air sensor is lost (or if network fails), system will revert to heating mode.

Ventilation Mode:

Outside air (OA) temperature > 70°F

Outside Air damper will open fully and system will run on 100% outside air.

Return Air damper will close fully and the RA sensor will be disabled.

Opening windows in monitor and cells will assist in maintaining proper ventilation.

Steam valve will modulate closed.

Cell Block R

Overview

The heating and ventilating system for this building is similar to that of Cell Blocks A-K, except that there is only one air handler serving both sides of the building.

Proposed Operation

The operation of this system is identical to that of Cell Blocks A-K.

Segregation Cell Block

Overview

Air Handlers

The heating and ventilating system for this building consists of four air handlers. The largest of these (H & V-1) provides a mixture of outside and return air to the majority of cells in the building. The second (H & V-2) provides 100% outside air to the (4) psychiatric cells. The remaining (2) units (H & V-3 and -4) provide a mixture of outside and return air to the segregation cells. All units contain steam coils for heating purposes.

Proposed Operation

Main Cell Banks/Segregation Cells

The operation of this system is similar to that of Cell Blocks A-K, except:

In heating mode, Units H & V-3 and H & V-4 operate in tandem.

There is no return air or mixed air sensor on unit H & V-2, since it operates with 100% outside air.

Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Wednesday, January 27, 2010 11:22 AM
To: 'dtarkington@fseinc.net'
Subject: FW: LCI Control Budget Pricing

Tracking:

Recipient	Read
'dtarkington@fseinc.net'	Read: 1/27/2010 12:15 PM

Dan:

Here is EMCOR's quote for controls for the Lebanon facility. Unfortunately, he provided a budgetary number, not a specific breakdown of what is being provided.

Thanks,

Dan Fluegeman

From: Greg Pownell [mailto:Greg_Pownell@emcorgroup.com]
Sent: Thursday, January 21, 2010 5:58 PM
To: Dan Fluegeman
Subject: LCI Control Budget Pricing

Dan,

I just finished the estimate and there are a few areas where I estimated the scope slightly different:

* some space sensors will be return air average only due to high cost of conduit to the space served
* occupancy sensors will only be installed in 'office' space where damage is not probable
* added a tunnel AHU to the scope
* slightly different valve count from my survey

LCI Control Budget Pricing: $752,000.00

This does not include any mechanical work (separate proposal being worked on by mechanical estimator).

Greg

Greg Pownell
EMCOR Automated Controls
Direct: (513) 527- 8136
Fax: (513) 527-8019
Email: greg_pownell@emcorgroup.com

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EVOLVED
ENERGY SOLUTIONS
6724 Perimeter Loop Rd
Box 213
Dublin, Ohio 43017

Quote

Date	Quote #
12/23/2009	19

Quote Prepared For:

Lebanon Correctional Institution
3791 State Route 63
Lebanon, OH 45036

Description	Qty	Total
Product Listed in Attached Lighting Audit Report		80,172.00
Electrical and associated Labor defined in Attached Lighting Audit Report		65,733.00
Contingencies		14,590.00
15% Markup		24,074.00
	Total	**$184,569.00**

CARDINAL DETENTION SYSTEMS INC.
230 N. CENTRAL AVE.
COLUMBUS, OHIO 43222
(614) 272-1200
(614) 351-9765 FAX

January 20, 2010

RE: Lebannon Correctional Window Replacement

TO: Mr. Dan Fluegeman

The following estimate is based on the presumably preliminary drawings we were able to obtain.

Assuming we were to build the same window that we previously installed in the above mentioned project in 2001/2002…

The window itself would cost conservatively $3,000. After speaking to several contractors who have done work of this type in the prison system, another $9,000 per window should be budgeted for installation. This would include scaffolding, masonry etc.

Again, these are estimates based on the current cost of steel and glass. Steel costs are the most fluid. Opting for triple pane glass is a negligible addition in cost. The window as currently installed already features a foam insulation "weather break".

I hope this information is helpful to you Dan. Please let us know how this project progresses. We look forward to bulding windows for the State of Ohio once again. Working with Cardinal Detention Systems, Inc. assures that Ohio jobs will be created, and our own state will benefit.

Sincerely,

Inge Stang

Dan Fluegeman

From: Dan Fluegeman [dfluegeman@fseinc.net]
Sent: Thursday, January 21, 2010 2:05 PM
To: 'Mike Newman'
Subject: RE: SL4473T2 Lebanon Correctional Institution, Ohio -- Budget Price --

Thanks, Mike. Your prompt response is greatly appreciated.

Sincerely,

Dan Fluegeman

From: Mike Newman [mailto:mnewman@cmsecurity.com]
Sent: Thursday, January 21, 2010 1:36 PM
To: dfluegeman@fseinc.net
Cc: johnjosephgallagher@comcast.net; joe@cortechusa.com; paul@cortechusa.com; Michelle@CortechUSA.com
Subject: SL4473T2 Lebanon Correctional Institution, Ohio -- Budget Price --
Importance: High

January 21, 2010

Re: Lebanon Correctional Institution Budget Price for Security Detention Windows.
Attn: Daniel Fluegeman, Four Seasons Environmental, Inc. 513-539-2978 (tel)

Hi Dan,

Per your recent request for some budget pricing for the Lebanon Correctional Institution please find following our proposal.

Per our conversation I have prepared pricing on our Series 3000 Type 13 operable over fixed thermally broken Aluminum/stainless steel hybrid Detention/Security Window. Some of the key characteristics of this window are:

Series 3000 Type 13

Thermally Broken extruded aluminum weather element at exterior with clear anodized finish (color finishes available for a nominal fee) .
14 Ga, type 304 Stainless steel security barrier at interior with 2B finish.
1/3 operable (at top) and 2/3 fixed (lower portion)
Concealed (by screen) mechanism on window frame. Must turn one direction to open and opposite direction to close.
Fixed security screen with 8 x 8 x 0.047 stainless steel mesh at operable portion. The primary function is to prevent passing of contraband. It also prevents tampering with components such as weather-strip, sash frame and glass breakage. Prevents most insects from entering.
Aluminum (clear anodized) clad tool resisting steel bars per ASTM A627-03 Grade 3.
1" nominal sealed thermo unit with clear tempered glass and low “E” coating at exterior.
3/8” mar resistant clear monolithic polycarbonate at the interior fixed portion of this window. Aside from increasing the security of the window, this additional glazing also increases the thermal properties, reduces hanging risk and protects the exterior glass from breakage.

For pricing purposes the following criteria have been used:
Window dimension: 36” x 62” high
Quantity: 1475 windows (22805 square feet)
Wall composition: Brick/block.- existing building.
Detention bars at 6” on center are tool resisting steel per ASTM A627-03 Grade 3
Fixed Security Screen: Stainless steel frame and mesh (8 x 8 x .047”, double crimped) at operable portion.

(Series 3000 Type 13) = **$4,525,000.00 ($3067.80 each)**

As we did not have time to provide a detailed calculation price may vary slightly upward or downward depending on actual quantity of windows. For budget purposes the above amount is fairly representative of other projects of similar size and properties. This window is the ideal choice for northern climates, especially when energy conservation is an important objective of the project. Also consider, glass breakage and replacement will be drastically reduced, almost eliminated with this window design.

Please do not hesitate to contact me if you have any questions or comments. Thanks for the opportunity and good luck on your proposition. Please let me know how it turns out.

Have a nice day!

Best regards,

Michael Newman
Estimating / Tech. Support
CM Security Group Inc. | Farwic

Innovation in Building Component Technology
Tel: (514) 457-6650 Ext 232 | Fax: (514) 457-4302
Toll-free : 1-800-465-CMSG |1-800-465-2674
mnewman@cmsecurity.com | www.cmsecurity.com

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DATE:

PROJECT #

PROJECT NAME:

DETENTION / SECURITY WINDOWS

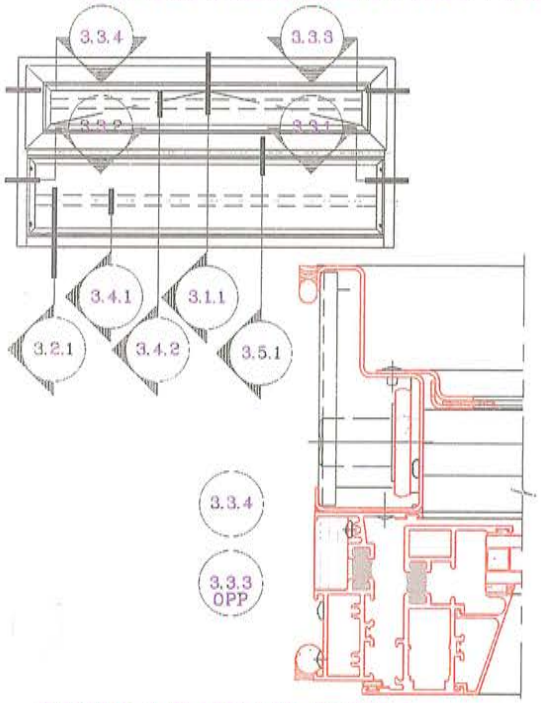
THERMAL, SERIES 3000

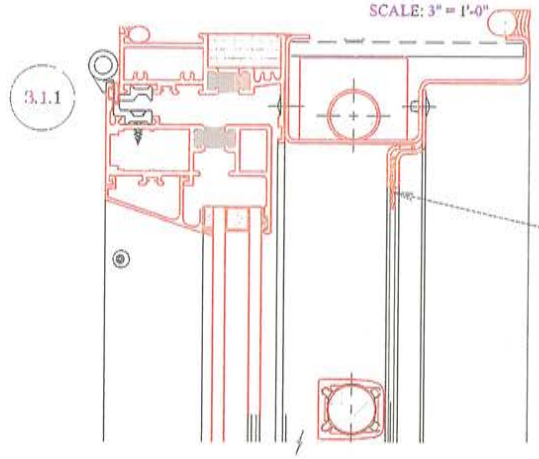
PROJECTED OUT CHAIN AND SPROCKET

INNER FRAME 304 SST / ALUM. 6063-T5 OUTER FRAME

WINDOW TYPE 13

SCALE: 3" = 1'-0"





BAR/MUNTIN SPACING VARIES ON TYPE a

FIRST & LAST BAR/MUNTIN SPACING @ 4 1/8",5 1/8"& 6 1/8" - BALANCE = 6" C/C

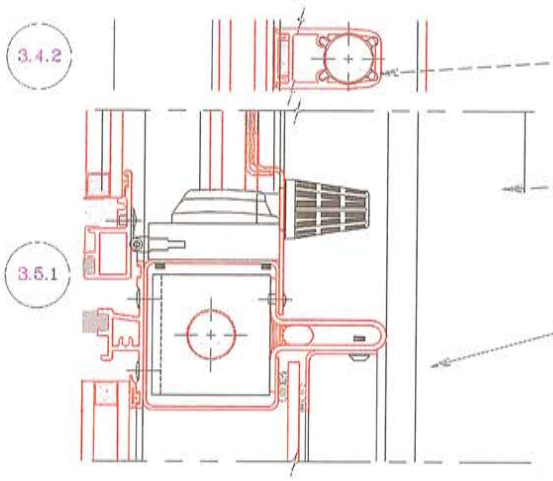
SCREENS

11B1 (MESH 0.028")

11B2 (MESH 0.047")

BAR/MUNTIN SPACING ON TYPE b & c

FIRST & LAST BAR/MUNTIN SPACING @ 6 1/8" BALANCE = 6" C/C



MUNTIN (OPERABLE) 10A, ALUM. (1)

OPERATOR CHAIN AND SPROCKET

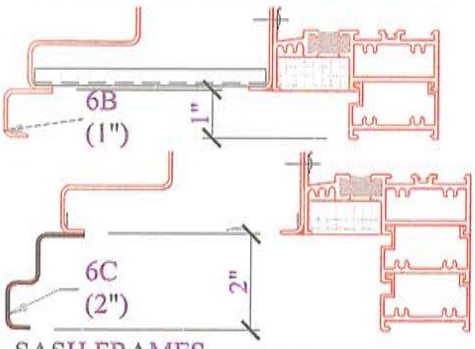
TYPE 13

GLASS STOPS 'L'

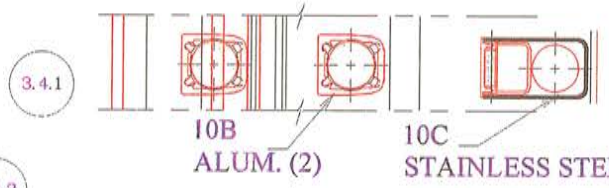
1A-8A (1/4") 1B-8A (1/2") 1C-8A (1")

1/2" 1"

TRIM AT HEAD & SILL



SASH FRAMES

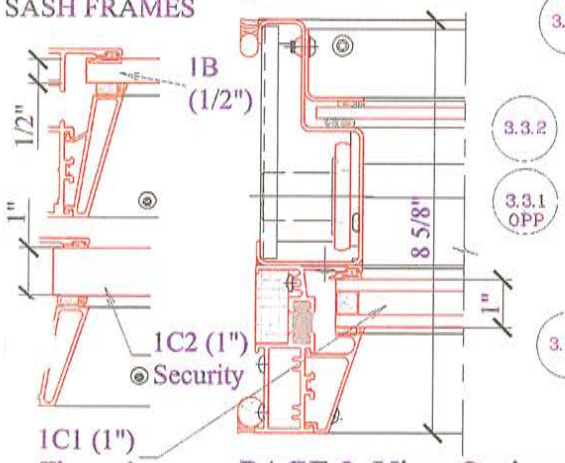


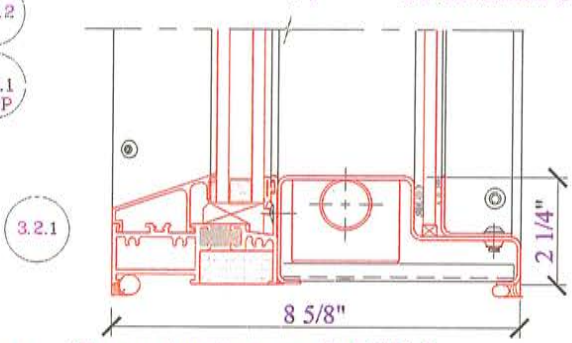
10B ALUM. (2)

10C STAINLESS STEEL

MUNTINS (FIXE)

10A ALUM. (1)





C.M. SECURITY GROUP INC.
19400 CRUICKSHANK
MONTREAL, QC
CANADA H9X 3P1
TEL.: (514) 457-6650
FAX (514) 457-4302
TOLL-FREE 1 800 465-CMSG
E-Mail: sales@cmsecurity.com
http://www.cmsecurity.com

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Section 7: Appendices

Energy Audit Synopsis

Thermography Team

Four Seasons Environmental, Inc. was retained by the Ohio Department of Corrections and Rehabilitation to perform an infrared / digital photo analysis audit and report as part of the Energy Assessment Agreement for the Maximum Security, Minimum Security and Powerhouse facilities. Thermographic site audits were performed on September 30th, October 1st and October 16th during the business day, beginning in the morning and continuing throughout the afternoon. The audits were performed to identify areas of heat loss from the facility, entrained outside air into the facility, identify any potential moisture areas and verify the operating conditions of requested mechanical and electrical assets within the facility.

The instrument employed for the audit was an Electropyhysics Hotshot LT thermal and digital imaging camera. The unit's thermal sensitivity is 0.1 degree Celsius. The camera produces theromgraphic and digital images simultaneously and stores them in the unit for future reporting. A total of five 5) spot meter points can be chosen per image for reference. These findings are downloaded and evaluated by Four Seasons Environmental, Inc. theromgraphy personnel to identify potential areas of concern present in the findings.

The audit and report was performed and prepared by Michael D. Spaulding of Four Seasons Environmental, Inc. Michael is a Level 2 certified thermorapher #25100 / #091023-7 through Infrared Training Center and Snell Infrared. He has performed more than 45 thermal facility audits for Ohio school districts, the Ohio Department of Corrections and Rehabilitations and the Ohio Department of Natural Resources facilities.

The images on the following page showcase Michael Spaulding's thermography certifications.

Section 7: Appendices

Infrared Training Center itc™

CERTIFIED

Level I Thermographer

THIS IS TO CERTIFY THAT

Michael Spaulding

HAS SUCCESSFULLY COMPLETED
THE FOLLOWING REQUIREMENTS FOR CERTIFICATION:
ATTENDING OUR TRAINING COURSE,
PASSING THE REQUIRED EXAMS, AND
SUBMITTING A PRACTICAL FIELD ASSIGNMENT.

Certified Instructor

CERTIFICATION NO. 85100
EXPIRATION DATE: AUGUST 6, 2014

Infrared Training Center - Americas

LEVEL I THERMOGRAPHY CERTIFICATION

The Snell Group™
Our Knowledge. Your Advantage.

Certificate of Completion

Be it known to all that

Michael Spaulding

has been certified to have successfully completed
a comprehensive thirty-four hour course of study in

Thermal/Infrared Thermography, Level II

presented by Snell Infrared, and
conforming to the guidelines of
the American Society for Nondestructive Testing
(ASNT)*SNT-TC-1A (2006)*

October 2009

John R. Snell, Jr.
ASNT T/IRT Level III #48166

Robert W. Spring
ASNT T/IRT Level III #85375

Certificate Number: 091023-7

Section 7: Appendices

Major Findings

This completed report meets published guidelines and standards pertaining to the infrared inspection of building envelope, mechanical and electrical systems.

The following items comprise the major areas requiring upgrade, repair and/or replacement in order to enhance overall conditions for the Maximum Security, Minimum Security, Powerhouse and Overall Site conditions of the complex. The items are listed in order of importance and impact to the facilities.

Four Seasons Environmental, Inc.

Infrared / Digital Photo Analysis Facility Observation Manual

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Prepared for:

Ohio Department of Corrections and Rehabilitation
Lebanon Correctional Institution

3791 State Route 63
Lebanon, Ohio 45036

Four Seasons Environmental, Inc.
43 New Garver Road • Monroe, OH • 45050-1243
Telephone (513) 539-2978 • Fax (513) 539-2972
www.fseinc.net

Infrared / Digital Photo Analysis
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Four Seasons Environmental, Inc.
43 New Garver Road ▪ Monroe, Ohio 45050
(513) 539 - 2978 Phone (513) 539 – 2972 Fax
www.fseinc.net

Infrared / Digital Photo Analysis

Thermographic Imaging Information

Four Seasons Environmental, Inc. was retained by Ohio Department of Corrections and Rehabilitation to perform an Infrared / Digital Photo Analysis audit and report as part of the Energy Assessment Agreement for the Maximum Security, Minimum Security and Powerhouse facilities. Thermographic site audits were performed on September 30th, October 1st and October 16th during the business day, beginning in the morning and continuing throughout the afternoon. The audits were performed to identify areas of heat loss from the facility, entrained outside air into the facility, identify any potential moisture areas and verify the operating conditions of requested mechanical and electrical assets within the facility. The audit and report was performed and prepared by Michael D. Spaulding of Four Seasons Environmental, Inc. Michael is a Level 1 certified thermographer # 25100 through Infrared Training Center. He has performed over 40 thermal facility audits for Ohio School districts and Ohio Department of Natural Resources facilities. This completed report meets published guidelines and standards pertaining to the infrared inspection of Building Envelope, Mechanical and Electrical systems.

The instrument employed for the audit was an Electrophysics Hotshot LT thermal and digital imaging camera. The unit's thermal sensitivity is 0.1 degree celsius. The Camera produces thermographic and digital images simultaneously and stores them in the unit for future reporting. A total of five (5) spot meter points can be chosen per image for reference. These findings are downloaded and evaluated by Four Seasons Environmental, Inc. thermography personnel to identify potential areas of concern present in the findings. These conclusions are determined by several methods.

These methods are:
Subjective and temperature comparison
Manufacturer recommendations and temperature comparison

Subjective and temperature comparison method uses sight evaluations of the recorded findings, taking into consideration temperatures involved in the readings to determine areas of interest.

Manufacturer recommendations and temperature comparison method accounts for maximum recommended operating temperature ratings determined by the asset's manufacturer, in addition to temperatures involved in the readings to determine areas of interest.

Several guidelines are applicable to the assets included in this report:

Electrical Asset Guideline

NFPA-70B Standard
(Recommended Practice for Electrical Equipment)
Priority Criteria for Electrical Exceptions

This is the most common differential temperature method used by thermographers. NFPA-70B is a guideline for differential temperatures and recommended actions based on Delta T temperatures.

Range 1 7.3 F (-13.72 C) to 14.4 F (-9.72 C)
Asset is to be investigated during next scheduled maintenance period.
Possible action at that time.

Range 2 14.5 F (-9.72 C) to 27.0 F (-2.7 C)
Asset should be investigated in a timely manner and evaluated for current repairs.

Range 3 27.0 F (-2,7 C) and higher
Asset should be repaired immediately.

NETA Electrical Guidelines

Utilizing differential temperatures (Delta T's) between like assets in relation to each other under similar operating conditions.

Category 1 33.8 F (1.0 C) to 37.4 F (3.0 C)
Possible deficiency – warrants investigation.

Category 2 39.2 F (4.0 C) to 59.0 F (15.0 C)
Probable deficiency – repair as time permits.

Category 3 60.8 F (16.0 C) and higher
Major discrepancy – repair immediately.

One of the above criteria, incorporated with Manufacturer's recommended operating temperatures, were used to determine report findings.

Mechanical Asset Guideline

NETA Mechanical Guidelines

Utilizing differential temperatures (Delta T's) between like assets in relation to each other under similar operating conditions.

Category 1 0.0 F (-17,7 C) to 18.0 F (-7.7 C)
Possible deficiency – warrants investigation.

Category 2 18.0 F (-7.7 C) to 36.0 F (2.22 C)
Probable deficiency – repair as time permits.

Category 3 36.0 F (2.22 C) to 72.0 F (22.22 C)
Monitor until corrective measures are accomplished.

Category 4 72.0 F (22.22 C) and higher
Major discrepancy – repair immediately.

Building Envelope Guideline

For Building infrared audits and report findings, it is recommended there be a minimum temperature differential (Delta T) of 20 degrees Farenheit (-6.66 C) between the conditioned facility interior and the unconditioned exterior of the facility exposed to present outside air conditions.

Optimal Heat Loss finding conditions exist when it is a cold day devoid of rainfall and the facility HVAC systems are placed in occupied mode to create positive pressure within the facility. Optimal Entrained outside air findings exist when the facility exhaust systems are employed during the same day's testing.

Four Seasons Environmental, Inc.

Four Seasons Environmental, Inc.
60A American Way ▪ Monroe, Ohio 45050
(513) 539 - 2978 Phone (513) 539 – 2972 Fax
www.fseinc.net

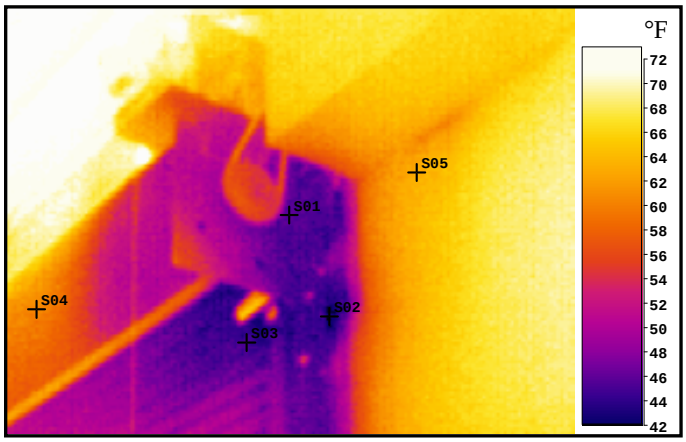
Infrared / Digital Photo Analysis

An Understanding of Infrared Thermography

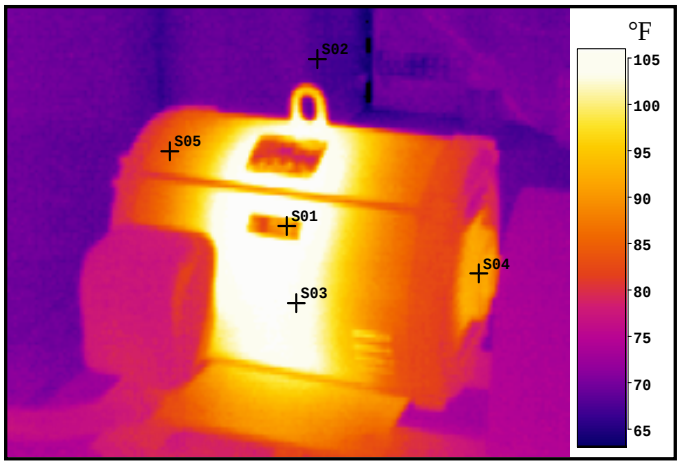
Infrared Thermography, thermal imaging or thermographic imaging is a type of infrared imaging science. Thermographic cameras detect radiation in the infrared range of the electromagnetic spectrum (roughly 900–14,000 nanometers or 0.9–14 µm) and produce images of that radiation. Thermal cameras are only able to directly detect surface temperatures, therefore internal components must be directly viewed to obtain existing conditions of these assets of interest.

Since infrared radiation is emitted by all objects based on their temperatures, according to the black body radiation law, thermography makes it possible to "see" one's environment with or without visible illumination. The amount of radiation emitted by an object increases with temperature, therefore thermography allows one to see variations in temperature. This emitted radiation is presented to the viewer as a temperature range in the visible light spectrum. Black, Blue and Purple are colder; White and Red are warmer temperatures. Assets exhibit current conditions to the viewer in this available range.

When viewed with a thermographic camera, objects and potential issues stand out well against associated backgrounds. During a Building Audit, heat loss at the exterior areas and/or colder entrained air at the interior areas become easily visible against the surrounding environments, day or night. This establishes potential areas for investigation to remedy issues and maximize the efficiency of the facility.



Likewise, potential or current equipment issues can be identified when compared to the manufacturer's specified ratings for the asset in question that is being evaluated. Electrical and Mechanical system assets can be evaluated and compared to the manufacturer's maximum recommended operating temperature for that item. Findings above or near tolerance levels should result in pending or immediate corrective action be taken for the asset. Excessive temperature can cause reduced performance, reduced efficiency and premature failure of the asset.



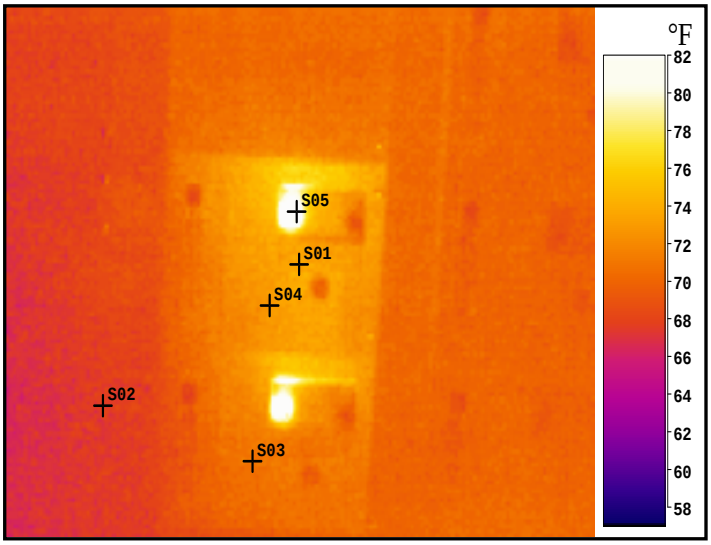
In considering Thermal Energy, it should be noted that thermal imaging displays the amount of infrared energy emitted, transmitted, and reflected by an object. Because of this, it is quite difficult to get an accurate temperature of an object using this method.

Thus, Incident Energy = Emitted Energy + Transmitted Energy + Reflected Energy where Incident Energy is the energy profile when viewed through a thermal imaging device, Emitted Energy is generally what is intended to be measured, Transmitted Energy is the energy that passes through the subject from a remote thermal source, and Reflected Energy is the amount of energy that reflects off the surface of the object from a remote thermal source.

If the object is radiating at a higher temperature than its surroundings, then power transfer will be taking place and power will be radiating from warm to cold following the principle stated in the Second Law of Thermodynamics. So if there is a cool area in the thermograph, that object will be absorbing the radiation emitted by the warm object. The ability of both objects to emit or absorb this radiation is called emissivity (see below). In outdoor environments, convective cooling from wind may also need to be considered when trying to get an accurate temperature reading.

The thermographic camera would next employ a series of mathematical algorithms. Since the camera is only able to 'see' the electromagnetic radiation that is impossible to see with the human eye, it will build a picture in the viewer and record a visible picture, usually in a JPG format. In order to perform the role of noncontact temperature recorder, it will change the temperature of the object being viewed with its emissivity setting. Other algorithms can be used to affect the measurement, including the transmission ability of the transmitting medium (usually air), temperature of that transmitting medium and others. All these settings will affect the ultimate output for the temperature of the object being viewed.

This makes the thermographic camera an excellent tool for maintenance of electrical and mechanical systems in industry and commerce. By using the camera settings and by being careful when capturing the image, electrical systems can be scanned and problems can be found. Faults with steam traps in steam heating systems are easy to locate. In the energy savings area, the thermographic camera can do more. Because it can see the radiating temperature of an object as well as what that object is radiating at, the product of the radiation can be calculated using the Stefan–Boltzmann constant.



Emissivity is a term representing a material's ability to emit thermal radiation. Each material has a different emissivity and it can be quite a task to determine the appropriate emissivity for a subject. A material's emissivity can range from 0.00 (completely not-emitting) to 1.00 (completely emitting); the emissivity often varies with temperature.

A Black Body is a theoretical object which will radiate Infrared Radiation at its Contact Temperature. If a thermocouple on a Black Body Radiator reads 50 degrees Celsius, the radiation the Black Body will give up will also be 50 degrees Celsius. Therefore a true Black Body will have an emissivity of 1.

Since there is no such thing as a Black Body, the Infrared Radiation of normal objects will appear to be less than the Contact Temperature. The rate (percentage) of emission of Infrared Radiation will thus be a fraction of the true Contact Temperature. This fraction is called Emissivity.

A table of the Emissivity of many materials and the temperatures that correspond to them are listed in this section. You will note in the table that some objects will have different emissivities in long wave as compared to mid wave emissions. As well emissivites may also change when some materials are at a different temperature.

To make a temperature measurement of an object, the thermographer will refer to the emissivity table to choose the emissivity value of the object which is then entered into the camera. The camera's algorithm will correct the temperature by referring to the emissivity percent and calculate a temperature that would more closely match the actual Contact Temperature of the object.

If possible the thermographer would try to test the emissivity of the object in question. This would be more accurate than attempting to determine the emissivity of the object via a table. The usual method of testing the emissivity is to place a material of known, high emissivity, in contact with the surface of the object. The material of known emissivity can be as complex as industrial emissivity spray which is produced specifically for this purpose or it can be as simple as standard black insulation tape, emissivity 0.97. A temperature reading can then be taken of the object with the emissivity level on the imager set to the value of the test material. This will give an accurate value of the temperature of the object. The temperature can then be read on a part of the object not covered with the test material. If the temperature reading is different, the emissivity level on the imager can be adjusted until the object reads the same temperature. This will give the thermographer a much more accurate emissivity reading. There are times however when an emissivity test is not possible due to dangerous or inaccessible conditions. In these situations the thermographer must rely on tables.

In considering <u>Passive vs. Active Thermographic reading</u>, note that all objects above the absolute zero temperature will emit infrared radiation. Passive thermography is employed where features of interest are at a higher or lower temperature than the background. Passive thermography has many applications such as exterior and interior heat loss and entrained air conditions at a facility. Active thermography requires an energy source to produce a thermal contrast between the asset and the background or similar assets in close proximity to each other. The active approach is necessary in cases that the inspected parts should usually exhibit the same readings as like assets in close proximity to the asset of issue.

The benefits of thermal imaging are many, including:

Thermal images show a visual picture so temperatures over a large area can be compared and areas of interest can be investigated and potentially rectified.

Thermal images are able to find deteriorating (i.e. at higher temperature) components prior to their failure so that preventative measures can be enacted.

Thermal images can be used to measure or observe from a distance areas inaccessible or hazardous for persons to enter (i.e. running fan and motor components inside a housing).

Thermal imaging is a non-destructive test method of evaluation.

Thermal imaging can be used to find defects in shafts, motors, pumps, piping and ductwork systems, fuses and other metal parts.

References:

Thermal imaging lights up darkened highways
http://www.monarchserver.com/TableofEmissivity.pdf

Maldague X. P. V., Jones T. S., Kaplan H., Marinetti S. and Prystay M. "Chapter 2: Fundamentals of Infrared and Thermal Testing: Part 1. Principles of Infrared and Thermal Testing," in Nondestructive Handbook, Infrared and Thermal Testing, Volume 3, X. Maldague technical ed., P. O. Moore ed., 3rd edition, Columbus, Ohio, ASNT Press, 2001, 718 p.

Four Seasons Environmental, Inc.
43 New Garver Road ▪ Monroe, Ohio 45050
(513) 539 - 2978 Phone (513) 539 – 2972 Fax
www.fseinc.net

Thermography References

National Fire Protection Association (NFPA)
NFPA-70B Standard
http://www.nfpa.org/search.asp?query=nfpa-70b
(Recommended Practice for Electrical Equipment)
Priority Criteria for Electrical Exceptions

InterNational Electrical Testing Association(NETA)
http://www.netaworld.org
Electrical Guidelines
Mechanical Guidelines

Is it worth it?-- statistics of corporate-based IR program results

Peter F. Johnson, American Risk Management Corporation (USA)

http://spiedl.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PSISDG001467000001000047000001&idtype=cvips&gifs=yes

Infrared Training Center

http://www.infraredtraining.com/

FLIR Systems

http://www.goinfrared.com/success/image_gallery.asp

http://www.goinfrared.com/news/press_room.asp

Reference library

Electrophysics Thermal Imaging

http://www.electrophysics.com/thermal-imaging/

Snell Infrared

http://www.thesnellgroup.com/Content/KnowledgeCenter.aspx

Knowledge Center Bulletins

Fluke Infrared

www.fluke .com/library

Detecting problems in buildings using infrared cameras.

Thermal building inspections bring heating and cooling losses to light.

Save money with best practices and an energy inspection checklist.

Moisture in building envelopes.

Wikipedia

http://en.wikipedia.org/wiki/Thermography

Thermography

ASTM International (formerly American Society forTesting and Materials)

http://www.astm.org/

ASTM, (1997), C1060-90(1997)e1 **Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings**, American Society for Testing and Materials, Philadelphia, Pa.

ASTM C 1153-97 (Reapproved 2003), "**Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging**," ASTM International. For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

Canadian General Standards Board

http://www.tpsgc-pwgsc.gc.ca/cgsb/home/index-e.html

Canadian General Standards Board; **Manual for Thermographic Analysis of Building Enclosures** (149-GP-2MP)

International Organization for Standardization (ISO)

ISO 6781 **Thermal Insulation, qualitative detection of thermal irregularities in building envelopes, Infrared Method**.

Herbert Kaplan, **Practical Applications of Infrared Thermal Sensing and Imaging Equipment**, 1999 Society of Photo-Optical Instrumentation Engineers

Xavier P. Maldague, **Theory and Practice of Infrared Technology for Nondestructive Testing**, 2001 John Wiley & Sons, Inc.

Four Seasons Environmental, Inc.
43 New Garver Road ▪ Monroe, Ohio 45050
(513) 539 - 2978 Phone (513) 539 – 2972 Fax
www.fseinc.net

Budgetary Analysis Overview

The budgetary analysis overview rated the facility cost of buildings as follows:

Large site – Property value over $ 25 million.

The major items of concern from the thermal visit findings are listed in order with recommendations per major category:

Maximum Security Facility – 1959 construction
Powerhouse Facility – 1959 construction
Minimum Security Facility – 1987 construction

Maximum Security Facility – 1959 construction

Window issues

Base data

R, A,B,C,D and E cell blocks have old style non security screened window units.

Large units are approx. 88” x 32” (30 panes). 18 panes broken per unit typ.
Large unit panes approx. 14” x 6”.
Small units are approx. 36” x 32” (15 panes). 9 panes broken per unit typ.
Small unit panes approx. 12” x 6”.

R cell block

R cell block has 40 large and 20 small window units (20 & 10 per sidewall).
R cell block units have average 9 panes broken per small unit and 18 panes broken per large unit.

(40 x 30)+(20 x 15) = 1,200 + 300 = 1,500 window panes in R cell block.
18 per x 40 = 720 broken panes. 9 per x 20 = 180 broken panes. 720 + 180 = 900 broken panes in R cell block.

Heat loss analysis:
Calculation reference source:
http://www.roguepark.com/rppro/samples/hlc/

A window unit 88” x 32” with all panes intact has 1,663.2 btuh loss with 48 deg. f outside air and 68 deg f indoor air conditions. Assuming 50% of panes (15) are broken multiply by 1.5 factor.
1,663.2 x 1.5 = 2,494.8 btuh escaping each cell window area assuming 88” x 32” unit, broken panes and no fpm face velocity thru open panes due to positive pressurization of tempered space.

A window unit 36” x 32” with all panes intact has 712.8 btuh loss with 48 deg. f outside air and 68 deg f inside conditions. Assuming 50% of panes (7) are broken multiply by 1.5 factor.
712.8 x 1.5 = 1,069.2 btuh escaping each cell window area assuming 36” x 32” unit, broken panes and no fpm face velocity thru open pane due to positive pressurization of tempered space.

(2,494.8 x 40) + (1,069.2 x 20) = 99,792 + 21,384 = 121,176 btuh loss from R cell block alone.

A,B,C,D and E cell blocks

Base data

A, B, C, D & E Cell block's exterior walls have 600 large window units.
(120 per cell block - 60 per sidewall).
Each window unit has average 18 panes broken.

120 x 5 = 600 units.
600 x 30 = 18,000 panes/18 = 1,000 panes broken.

A window unit 88" x 32" with all panes intact has 1,663.2 btuh loss with 48 deg. f outside air and 68 deg f inside conditions. Assuming 50% of panes (15) are broken multiply by 1.5 factor.
1,663.2 x 1.5 = 2,494.8 btuh escaping each cell window area assuming 88" x 32" unit, broken panes and no fpm face velocity thru open pane due to positive pressurization of tempered space.
2,494.8 x 600) = 1,496,880 btuh loss from A, B, C, D & E cell blocks.

Total window btuh loss:
R + A/B/C/D/E
121,176 btuh + 1,496,880 btuh = 1,618,056 btuh total window loss.
Please refer to Energy Assessment section for total financial impact to facility per this item.

Recommendation:

Replace all window units cell blocks A,B,C,D,E & R with new screened security units. This will eliminate broken window panes, greatly reduce heat loss from areas, eliminate monthly trash removal issue from yard and eliminate glass weapon hazard issue.

Steam trap issues

Base data

Random cross-section 19 traps evaluated / 8 found in failure condition (42%)
Maintenance supervisor estimation 300 + traps in Maximum security facility.
No Steam Trap inspection / maintenance log available.
Ratio 19/8 = 300/x . X = 126 traps in failure condition within facility.

Reference source:
University od Dayton Engineering Steam Trap study
http://www.engr.udayton.edu/udiac/Documents/ProcHeat_SteamTrap.doc

Recommendation:

It is the recommendation of this report that based on random sampling thermal findings (yielding 42% poor trap conditions), that the traps throughout the Maximum security facility be replaced with new units.

Please refer to Energy Assessment section for replacement cost, labor cost and total financial impact to facility (including payback estimate) per this item.

Roofing moisture issues

Base data:

Areas evaluated were asphaltic covered low slope roof areas over kitchen and laundry portions of the Maximum security facility, as well as damaged soffit and trim areas of the cell blocks.

Areas of moisture infiltration under roofing are noted in the report findings.
Areas of soffit and trim requiring repair are noted in the report findings.

Please refer to Energy Assessment section for replacement cost, labor cost and total financial impact to facility (including payback estimate) per these items.

Recommendation:

It is recommended that new roofing material be installed to repair existing roof conditions. New asphaltic or membrane system could be employed to correct moisture infiltration into areas.

Leaking steam piping and insulation issues

Base data:

Areas evaluated were steam and domestic water piping areas in tunnel portions of the Maximum security facility.

Areas of leaking steam, excessive moisture in insulation and on floor areas and damaged insulation material conditions present throughout tunnel and equipment room areas. Areas of health and safety hazards exist as noted in report findings.

Please refer to Energy Assessment section for replacement cost, labor cost and total financial impact to facility (including payback estimate) per these items.

Recommendation:

It is recommended that all steam and domestic water piping and valve leaks be repaired as required throughout the tunnel and equipment room areas of the Maximum security facility. Additionally, All damaged and moisture infiltrated insulation areas should be removed and replaced with industry standard piping insulation per required recommendations for usage in piping system application.

Powerhouse Facility – 1959 construction

Steam Equipment, Piping and component issues

Base data:

Areas evaluated were steam and domestic water piping areas in basement portions of the Powerhouse facility.

Areas of leaking steam, leaking equipment, excessive moisture in insulation and on floor areas and damaged insulation material conditions present throughout basement and tunnel areas. Areas of health and safety hazards exist as noted in report findings.

Please refer to Energy Assessment section for replacement cost, labor cost and total financial impact to facility (including payback estimate) per these items.

Recommendation:

It is recommended that all steam and domestic water piping, equipment and valve leaks be repaired as required throughout the basement and tunnel areas of the Powerhouse facility. Additionally, All damaged and moisture infiltrated insulation areas should be removed and replaced with industry standard piping insulation per required recommendations for usage in piping system application.

Wall moisture issues

Base data:

Area evaluated was basement emergency generator room wall area of the Powerhouse facility.

Area of wall insulation requiring repair as noted in report findings.

Heat loss this item of no significant value to assessment.

Recommendation:

It is recommended that the wall area noted be inspected and repair if necessary to prevent potential moisture infiltration into emergency generator room.

Minimum Security Facility – 1987 construction

Minor opening heat loss issues

Base data:

Areas evaluated were exterior structure of the Powerhouse facility.

Areas of minor heat loss at facility openings exist as noted in report findings.

Please refer to Energy Assessment section for replacement cost, labor cost and total financial impact to facility (including payback estimate) per these items.

Recommendation:

It is recommended that all noted areas be inspected for adequate seal, caulking, gasketing and threshold height in accordance with manufacturer's recommendations. Repair as required to prevent minimal heat loss conditions.

ODCR – Lebanon Correctional Institution
All Facility Summary
(Maximum, Powerhouse & Minimum)

AVERAGE SAVINGS PER IR FINDING IN LOSSES AVOIDED

Category or Range	Small Site	Large Site	World scale site
Severe or High # 3 or # 4	$3,000.00	$8,000.00	$36,000.00
Medium or Low # 1 or # 2	$500.00	$1,000.00	$3,000.00

Note:
This analysis does not consider losses from product and labor that cause unscheduled downtime.

Source: Is it worth it ? Statistics of Corporate Based IR Program Results
by Peter F. Johnson

BUDGETARY IMPACT FROM YOUR INFRARED / DIGITAL PHOTO ANALYSIS		
DCR - Lebanon Correctional Institution Site Size is: Large (over $ 25,000,000.00 Total Cost)		
14	Severe or High # 4 and # 3 potential problems found	$112,000.00
44	Medium or Low # 2 and # 1 potential problems found	$44,000.00
	TOTAL AVERAGE SAVINGS IN AVOIDED LOSSES	$156,000.00

Four Seasons Environmental, Inc.
43 New Garver Road ▪ Monroe, Ohio 45050
(513) 539 - 2978 Phone (513) 539 – 2972 Fax
www.fseinc.net

Budgetary Impact Analysis

This budgetary impact analysis represents the cost savings that may be realized by utilizing the information in the Infrared / Digital Photo Analysis report findings and recommendations. Corrective measures for the potential and existing issues outlined herein can result in extended life cycles for assets and may aid in reducing the energy costs for the facilities. Efforts to correct areas of heat loss and / or outside unconditioned air entering the facilities can result in decreased heating and cooling costs annually. These realized savings are a direct benefit to the client, it's facility personnel, preventative maintenance technicians and custodial staff.

No one can predict with accuracy the costs that the issues noted can present. A Statistics-Based Method, however, can be used along with the Infrared audit to provide estimations. A basis of historical records, collected and analyzed by industrial risk insurance companies, can identify actual past losses incurred when similar problems occurred. From this has developed a system of " Average Loss Potential Savings " which is presented as dollars saved per problem.

The Method is highly conservative in it's results. It does not account the cost of lost product and labor incurred by unscheduled downtime. These areas are often the largest monetary components related to a failure.

To determine an economic analysis, the thermographer determines the size of the audited facility. Audits are classed as follows:

Small site – Property value less than $ 25 million.
Large site – Property value over $ 25 million.
World scale site – Average horsepower load exceeding 400 HP.

The thermographer classifies the findings of interest into " Severe " and " Intermediate / Minor ". The following table is then used to calculate the ecomonic budgetary impact of this inspection:

ODCR – Lebanon Correctional Institution
Maximum Security Facility

AVERAGE SAVINGS PER IR FINDING IN LOSSES AVOIDED

Category or Range	Small Site	Large Site	World scale site
Severe or High # 3 or # 4	$3,000.00	$8,000.00	$36,000.00
Medium or Low # 1 or # 2	$500.00	$1,000.00	$3,000.00

Note:
This analysis does not consider losses from product and labor that cause unscheduled downtime.

Source: Is it worth it ? Statistics of Corporate Based IR Program Results by Peter F. Johnson

BUDGETARY IMPACT FROM YOUR INFRARED / DIGITAL PHOTO ANALYSIS		
DCR - Lebanon Correctional Instution Site Size is: Large (over $ 25,000,000.00 Total Cost)		
12	Severe or High # 4 and # 3 potential problems found	$96,000.00
30	Medium or Low # 2 and # 1 potential problems found	$30,000.00
	TOTAL AVERAGE SAVINGS IN AVOIDED LOSSES	$126,000.00

Four Seasons Environmental, Inc.
43 New Garver Road ▪ Monroe, Ohio 45050
(513) 539 - 2978 Phone (513) 539 – 2972 Fax
www.fseinc.net

ODCR – Lebanon Correctional Institution
Powerhouse Facility

AVERAGE SAVINGS PER IR FINDING IN LOSSES AVOIDED

Category or Range	Small Site	Large Site	World scale site
Severe or High # 3 or # 4	$3,000.00	$8,000.00	$36,000.00
Medium or Low # 1 or # 2	$500.00	$1,000.00	$3,000.00

Note:
This analysis does not consider losses from product and labor that cause unscheduled downtime.

Source: Is it worth it ? Statistics of Corporate Based IR Program Results
by Peter F. Johnson

BUDGETARY IMPACT FROM YOUR INFRARED / DIGITAL PHOTO ANALYSIS		
DCR - Lebanon Correctional Instution Site Size is: Large (over $ 25,000,000.00 Total Cost)		
2	Severe or High # 4 and # 3 potential problems found	$16,000.00
10	Medium or Low # 2 and # 1 potential problems found	$10,000.00
	TOTAL AVERAGE SAVINGS IN AVOIDED LOSSES	$26,000.00

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(513) 539 - 2978 Phone (513) 539 – 2972 Fax
www.fseinc.net

ODCR – Lebanon Correctional Institution
Minimum Security Facility

AVERAGE SAVINGS PER IR FINDING IN LOSSES AVOIDED

Category or Range	Small Site	Large Site	World scale site
Severe or High # 3 or # 4	$3,000.00	$8,000.00	$36,000.00
Medium or Low # 1 or # 2	$500.00	$1,000.00	$3,000.00

Note:
This analysis does not consider losses from product and labor that cause unscheduled downtime.

Source: Is it worth it ? Statistics of Corporate Based IR Program Results by Peter F. Johnson

BUDGETARY IMPACT FROM YOUR INFRARED / DIGITAL PHOTO ANALYSIS		
DCR - Lebanon Correctional Instution Site Size is: Large (over $ 25,000,000.00 Total Cost)		
0	Severe or High # 4 and # 3 potential problems found	$0.00
4	Medium or Low # 2 and # 1 potential problems found	$4,000.00
	TOTAL AVERAGE SAVINGS IN AVOIDED LOSSES	$4,000.00

Infrared Training Center itc™

CERTIFIED

Level I Thermographer

THIS IS TO CERTIFY THAT

Michael Spaulding

HAS SUCCESSFULLY COMPLETED
THE FOLLOWING REQUIREMENTS FOR CERTIFICATION:
ATTENDING OUR TRAINING COURSE,
PASSING THE REQUIRED EXAMS, AND
SUBMITTING A PRACTICAL FIELD ASSIGNMENT.

Certified Instructor

CERTIFICATION NO. 25100
EXPIRATION DATE: AUGUST 6, 2014

Infrared Training Center - Americas

16 ESQUIRE RD., NORTH BILLERICA, MA 01862 – AN ISO 9001 REGISTERED COMPANY

LEVEL I THERMOGRAPHY - CERTIFICATION - Infrared Training Center itc

Pub ITC 013 B 2003-02-03

Synopsis of Four Seasons Environmental, Inc. Commissioning Services Infrared / Digital Photo Analysis Facility Operations Manual

Thermal Photo #	Four Seasons Environmental Severity Ranking	Issue Description	Proposed Action	Potential Responsible Contractor
MAX 01	Low	R cell block - Wall and windows	Inspect	Window contractor
MAX 02	Medium	R cell block - Wall and windows	Inspect	Window contractor
MAX 03	None	Main corridor offices - Wall and windows	None required	
MAX 04	None	R cell block - Yard entry area	None required	
MAX 05	High	A cell block - Wall and windows	Inspect	Window contractor
MAX 06	High	A cell block - Wall and windows	Inspect	Window contractor
MAX 07	High	B cell block - Wall and windows	Inspect	Window contractor
MAX 08	High	B cell block - Wall and windows	Inspect	Window contractor
MAX 09	High	C cell block - Wall and windows	Inspect	Window contractor
MAX 10	High	C cell block - Wall and windows	Inspect	Window contractor
MAX 11	High	D cell block - Wall and windows	Inspect	Window contractor
MAX 12	None	Isolation cell block - Wall and windows	None required	
MAX 13	None	Isolation cell block - Wall and windows	None required	
MAX 14	High	E cell block - Wall and windows	Inspect	Window contractor
MAX 15	High	E cell block - Wall and windows	None required	
MAX 16	Medium	F cell block - Wall and windows	Inspect	Window contractor
MAX 17	High	F cell block - Wall and windows	Inspect	Window contractor
MAX 18	None	G cell block - Wall and windows	None required	
MAX 19	None	G cell block - Wall and windows	None required	
MAX 20	None	H cell block - Wall and windows	None required	
MAX 21	None	H cell block - Wall and windows	None required	
MAX 22	Medium	J cell block - Wall and soffit	Inspect	Roofing contractor
MAX 23	None	J cell block - Wall and windows	None required	
MAX 24	Low	J cell block - Wall and windows	Inspect	Window contractor
MAX 25	Low	K cell block - Wall and windows	Inspect	Window contractor
MAX 26	Medium	K cell block - Wall and soffit	Inspect	Roofing contractor
MAX 27	None	Infirmary block - Wall and windows	None required	
MAX 28	Medium	Infirmary block - Wall and soffit	Inspect	Roofing contractor
MAX 29	Low	Infirmary block - Wall and windows	Inspect	Window contractor
MAX 30	None	North gym - Wall and windows	None required	
MAX 31	None	Maintenance area - Wall right side	None required	
MAX 32	None	Maintenance area - Wall center	None required	

MAX 33	None	Maintenance area - Wall left side	None required	
MAX 34	None	Loading dock area - Wall and openings	None required	
MAX 35	None	School area - Entry wall/openings	None required	
MAX 36	None	Dining area - Wall and windows	None required	
MAX 37	None	Dining area - Wall and windows	None required	
MAX 38	None	Chapel area - Wall and windows	None required	
MAX 39	None	Guest visitation area - Wall and windows	None required	
MAX 40	None	Maintenance area - Wall and windows	None required	
MAX 41	Medium	Laundry/Kitchen areas - Roof	Inspect	Roofing contractor
MAX 42	Medium	Kitchen/Laundry areas - Roofing	Inspect	Roofing contractor
MAX 43	Medium	Kitchen/Laundry areas - Roofing	Inspect	Roofing contractor
MAX 44	Low	Kitchen/Laundry areas - Roofing	Inspect	Roofing contractor
MAX 45	Low	Kitchen/Laundry areas - Roofing	Inspect	Roofing contractor
MAX 46	None	D-W corridor - Piping	None required	
MAX 47	None	D-W corridor - Piping	None required	
MAX 48	None	Tunnel corridor - Condensate pump	None required	
MAX 49	None	Tunnel - Condensate pump	None required	
MAX 50	None	Tunnel - School unit trap	None required	
MAX 51	None	Tunnel - School unit trap	None required	
MAX 52	None	Tunnel - Condensate pump	None required	
MAX 53	Low	Nr. Transformer rm - Condensate pump	Inspect	Mechanical contractor
MAX 54	Medium	Nr. Stairwell - Condensate pump	Inspect	Mechanical contractor
MAX 55	Medium	Tunnel corridor - Traps	Inspect	Mechanical contractor
MAX 56	None	Tunnel nr. Rm D - Piping	None required	
MAX 57	None	Tunnel nr. Rm D - Piping	None required	
MAX 58	High	Tunnel - Piping in corridor	Inspect	Mechanical contractor
MAX 59	None	Tunnel - East traps	None required	
MAX 60	Low	Tunnel - Heat Exchanger	Inspect	Mechanical contractor
MAX 61	None	L-M room - Piping	None required	
MAX 62	None	Room D - AHU motor	None required	
MAX 63	Medium	Room D - Trap	Inspect	Mechanical contractor
MAX 64	None	Room D - Trap and piping	None required	
MAX 65	None	Room D-W - Trap	None required	
MAX 66	Medium	Room D-W - Trap	Inspect	Mechanical contractor
MAX 67	Medium	HW for Library - K-M pump piping	Inspect	Mechanical contractor
MAX 68	Low	Room L-M - Piping	Inspect	Mechanical contractor
MAX 69	High	Tunnel ramp - Piping mains	Inspect	Mechanical contractor
MAX 70	High	Tunnel ramp - Piping mains	Inspect	Mechanical contractor
MAX 71	None	Transformer room - Elect. Station	None required	

MAX 72	None	Transformer room - Switchpanel	None required	
MAX 73	None	Transformer room - Transformer	None required	
MAX 74	None	Transformer room - W-AST panel	None required	
MAX 75	None	Room D tunnel - Corridor trap	None required	
MAX 76	None	Room D tunnel - Corridor trap	None required	
MAX 77	Medium	Tunnel @ gate 1 - Trap	Inspect	Mechanical contractor
MAX 78	Medium	Tunnel @ gate 2 - Trap	Inspect	Mechanical contractor
MAX 79	None	Tunnel nr. Stairs - Trap and piping	None required	
MAX 80	None	Gym west mezz. - Trap	None required	
MAX 81	None	Maint. corridor - Piping	None required	
MAX 82	None	Carpenter Shop - Wall and windows	None required	
MAX 83	Medium	Gym interior - Wall and windows	Inspect	Window contractor
MAX 84	None	Gym interior - Wall and windows	None required	
MAX 85	Medium	Gym interior - Wall and windows	Inspect	Window contractor
MAX 86	None	Gym west mezz. - AHU Trap	None required	
MAX 87	Medium	Cell 1B1 - Interior window	Inspect	Window contractor
MAX 88	Medium	Cell 1B1 - Interior window	Inspect	Window contractor
MAX 89	Low	Cell 2G47 - Interior wall	Inspect	General contractor
MAX 90	Low	Cell 2G47 - Interior window	Inspect	Window contractor
PH 01	Medium	Powerhouse - Steam pump	Inspect	Mechanical contractor
PH 02	Medium	Powerhouse - Steam pump	Inspect	Mechanical contractor
PH 03	High	Powerhouse - Steam pump	Inspect	Mechanical contractor
PH 04	Medium	Powerhouse - Steam pump	Inspect	Mechanical contractor
PH 05	Severe	Powerhouse - Steam valve damage	Inspect	Mechanical contractor
PH 06	Medium	Powerhouse - Basement pump	Inspect	Mechanical contractor
PH 07	Low	Powerhouse - Basement pump	Inspect	Mechanical contractor
PH 08	Medium	Powerhouse - Nr. Tunnel	Inspect	Mechanical contractor
PH 09	None	Powerhouse - Jockey pumps	None required	
PH 10	None	Powerhouse - Tank	None required	
PH 11	None	Powerhouse - Low press. Stm. Valve	None required	
PH 12	Medium	Powerhouse - Piping	Inspect	Mechanical contractor
PH 13	Low	Powerhouse - Lower steam train	Inspect	Mechanical contractor
PH 14	Low	Powerhouse - Upper steam train	Inspect	Mechanical contractor
PH 15	None	Powerhouse - Emergency generator	None required	
PH 16	Low	Powerhouse - Generator room	Inspect	General contractor
MIN 01	None	Minimum fac. - Walls and windows	None required	
MIN 02	Low	Minimum fac. - Wall and door	Inspect	General contractor
MIN 03	Low	Minimum fac. - Wall and door	Inspect	General contractor
MIN 04	None	Minimum fac. - Walls and windows	None required	

MIN 05	None	Minimum fac. - Windows and wall	None required	
MIN 06	None	Minimum fac. - Walls and windows	None required	
MIN 07	None	Minimum fac. - Walls and windows	None required	
MIN 08	None	Minimum fac. - Walls and windows	None required	
MIN 09	None	Minimum fac. - Walls and windows	None required	
MIN 10	None	Minimum fac. - Walls and windows	None required	
MIN 11	None	Minimum fac. - Walls and windows	None required	
MIN 12	None	Minimum fac. - Walls and windows	None required	
MIN 13	None	Minimum fac. - Walls and windows	None required	
MIN 14	None	Minimum fac. - Grille and window	None required	
MIN 15	None	Minimum fac. - Walls and windows	None required	
MIN 16	None	Minimum fac. - Walls and windows	None required	
MIN 17	None	Minimum fac. - Wall	None required	
MIN 18	None	Minimum fac. - Walls and windows	None required	
MIN 19	Low	Minimum fac. - Walls and openings	Inspect	General contractor
MIN 20	Low	Minimum fac. - Wall and windows	Inspect	General contractor
MIN 21	None	Minimum fac. - Walls and openings	None required	
MIN 22	None	Minimum fac. - Walls and windows	None required	
MIN 23	None	Minimum fac. - Entry	None required	

2D 3D
Road
Aerial
Bird's eye
Labels
Traffic
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E
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14-15
11-13
09-10
07-08
05-06
01-04
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2D
3D
Road
Aerial
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Labels
Traffic
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MIN 02-03
MIN 04

Four Seasons Environmental, Inc.

Table of Contents

MAX 01. R cell block - Wall and windows issue

MAX 02. R cell block - Wall and windows issue

MAX 03. Main corridor offices - Wall and windows

MAX 04. R cell block - Yard entry area

MAX 05. A cell block - Wall and windows issue

MAX 06. A cell block - Wall and windows issue

MAX 07. B cell block - Wall and windows issue

MAX 08. B cell block - Wall and windows issue

No Action Required **Potential Issue**

MAX 09.	🟠	C cell block - Wall and windows issue
MAX 10.	🟠	C cell block - Wall and windows issue
MAX 11.	🟠	D cell block - Wall and windows issue
MAX 12.	🟢	Isolation cell block - Wall and windows
MAX 13.	🟢	Isolation cell block - Wall and windows
MAX 14.	🟠	E cell block - Wall and windows issue
MAX 15.	🟢	E cell block - Wall and windows
MAX 16.	🟠	F cell block - Wall and windows issue
MAX 17.	🟠	F cell block - Wall and windows issue
MAX 18.	🟢	G cell block - Wall and windows
MAX 19.	🟢	G cell block - Wall and windows
MAX 20.	🟢	H cell block - Wall and windows
MAX 21.	🟢	H cell block - Wall and windows

🟢 **No Action Required** 🟠 **Potential Issue**

MAX 22.		J cell block - Wall and soffit issue
MAX 23.		J cell block - Wall and windows
MAX 24.		J cell block - Wall and windows issue
MAX 25.		K cell block - Wall and windows issue
MAX 26.		K cell block - Wall and soffit issue
MAX 27.		Infirmary block - Wall and windows
MAX 28.		Infirmary block - Wall and soffit issue
MAX 29.		Infirmary block - Wall and windows issue
MAX 30.		North gym - Wall and windows
MAX 31.		Maintenance area - Wall right side
MAX 32.		Maintenance area - Center
MAX 33.		Maintenance area - Wall left side
MAX 34.		Loading dock area - Wall and openings

No Action Required **Potential Issue**

MAX 35.		School area - Entry wall/openings
MAX 36.		Dining area - Wall and windows
MAX 37.		Dining area - Wall and windows
MAX 38.		Chapel area - Wall and windows
MAX 39.		Guest visitation area - Wall and windows
MAX 40.		Maintenance area - Wall and windows
MAX 41.		Laundry/Kitchen areas – Roof issue
MAX 42.		Kitchen/Laundry areas – Roofing issue
MAX 43.		Kitchen/Laundry areas – Roofing issue
MAX 44.		Kitchen/Laundry areas – Roofing issue
MAX 45.		Kitchen/Laundry areas – Roofing issue
MAX 46.		D-W corridor - Piping
MAX 47.		D-W corridor - Piping

No Action Required **Potential Issue**

MAX 48.		Tunnel corridor - Condensate pump
MAX 49.		Tunnel - Condensate pump
MAX 50.		Tunnel - School unit trap
MAX 51.		Tunnel - School unit trap
MAX 52.		Tunnel - Condensate pump
MAX 53.		Nr. Transformer rm - Condensate pump issue
MAX 54.		Nr. Stairwell - Condensate pump issue
MAX 55.		Tunnel corridor – Traps issue
MAX 56.		Tunnel nr. Rm D - Piping
MAX 57.		Tunnel nr. Rm D - Piping
MAX 58.		Tunnel - Piping in corridor issue
MAX 59.		Tunnel - East traps
MAX 60.		Tunnel - Heat Exchanger issue

No Action Required **Potential Issue**

MAX 61.		L-M room - Piping
MAX 62.		Room D - AHU motor
MAX 63.		Room D – Trap issue
MAX 64.		Room D - Trap and piping
MAX 65.		Room D-W - Trap
MAX 66.		Room D-W – Trap issue
MAX 67.		HW for Library - K-M pump piping issue
MAX 68.		Room L-M – Piping issue
MAX 69.		Tunnel ramp - Piping mains issue
MAX 70.		Tunnel ramp - Piping mains issue
MAX 71.		Transformer room - Elect. Station
MAX 72.		Transformer room - Switchpanel
MAX 73.		Transformer room - Transformer

No Action Required **Potential Issue**

MAX 74.	🟢	Transformer room - W-AST panel
MAX 75.	🟢	Room D tunnel - Corridor trap
MAX 76.	🟢	Room D tunnel - Corridor trap
MAX 77.	🟠	Tunnel @ gate 1 – Trap issue
MAX 78.	🟠	Tunnel @ gate 2 – Trap issue
MAX 79.	🟢	Tunnel nr. Stairs - Trap and piping
MAX 80.	🟢	Gym west mezz. - Trap
MAX 81.	🟢	Maint. corridor - Piping
MAX 82.	🟢	Carpenter Shop - Wall and windows
MAX 83.	🟠	Gym interior - Wall and windows issue
MAX 84.	🟢	Gym interior - Wall and windows
MAX 85.	🟠	Gym interior - Wall and windows issue
MAX 86.	🟢	Gym west mezz. - AHU Trap

🟢 **No Action Required** 🟠 **Potential Issue**

MAX 87.		Cell 1B1 - Interior window issue
MAX 88.		Cell 1B1 - Interior window issue
MAX 89.		Cell 2G47 - Interior wall issue
MAX 90.		Cell 2G47 - Interior window issue
PH 01.		Powerhouse - Steam pump issue
PH 02.		Powerhouse - Steam pump issue
PH 03.		Powerhouse - Steam pump issue
PH 04.		Powerhouse - Steam pump issue
PH 05.		Powerhouse - Steam valve damage issue
PH 06.		Powerhouse - Basement pump issue
PH 07.		Powerhouse - Basement pump issue
PH 08.		Powerhouse - Nr. Tunnel issue
PH 09.		Powerhouse - Jockey pumps

No Action Required **Potential Issue**

PH 10.		Powerhouse - Tank
PH 11.		Powerhouse - Low press. Stm. Valve
PH 12.		Powerhouse – Piping issue
PH 13.		Powerhouse - Lower steam train issue
PH 14.		Powerhouse - Upper steam train issue
PH 15.		Powerhouse - Emergency generator
PH 16.		Powerhouse - Generator room issue
MIN 01.		Minimum fac. - Walls and windows
MIN 02.		Minimum fac. - Wall and door issue
MIN 03.		Minimum fac. - Wall and door issue
MIN 04.		Minimum fac. - Walls and windows
MIN 05.		Minimum fac. - Windows and wall
MIN 06.		Minimum fac. - Walls and windows

No Action Required **Potential Issue**

MIN 07.		Minimum fac. - Walls and windows
MIN 08.		Minimum fac. - Walls and windows
MIN 09.		Minimum fac. - Walls and windows
MIN 10.		Minimum fac. - Walls and windows
MIN 11.		Minimum fac. - Walls and windows
MIN 12.		Minimum fac. - Walls and windows
MIN 13.		Minimum fac. - Walls and windows
MIN 14.		Minimum fac. - Grille and window
MIN 15.		Minimum fac. - Walls and windows
MIN 16.		Minimum fac. - Walls and windows
MIN 17.		Minimum fac. - Wall
MIN 18.		Minimum fac. - Walls and windows
MIN 19.		Minimum fac. - Walls and openings issue

No Action Required **Potential Issue**

MIN 20.		Minimum fac. - Walls and windows issue
MIN 21.		Minimum fac. - Walls and openings
MIN 22.		Minimum fac. - Walls and windows
MIN 23.		Minimum fac. - Entry

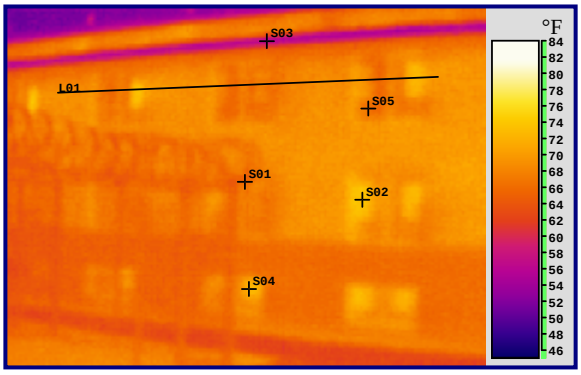
No Action Required **Potential Issue**

Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, Ohio 45050
(513) 539 - 2978 Phone
(513) 539 – 2972 Fax
www.fseinc.net

Incident Summary	
Location	R cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:37:00
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	66.4
Reference Temperature	74.6
Temperature Rise	0.1
Component Emissivity	0.93
Background Temperature	60

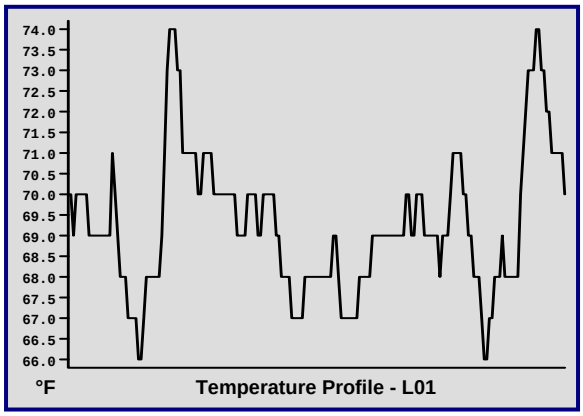
IR image file: r block1.eif



Visible Image file: r block1 VIS.JPG

Comment: -- Inspect S02 and S04 window areas for adequate seal. Repair if required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	66.4 °F
S02	Window	0.92	74.6 °F
S03	Trim	0.77	57.6 °F
S04	Window	0.92	72.9 °F
S05	Window	0.92	66.9 °F



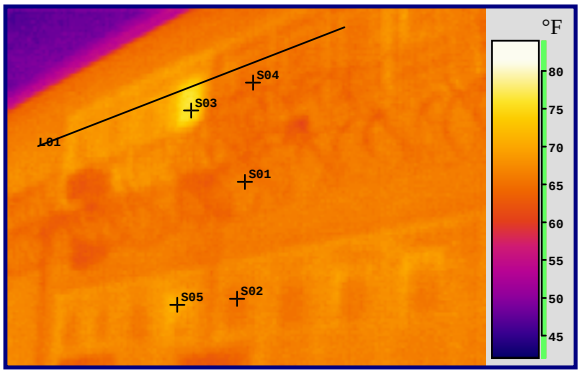
Additional Finding Data	
Distance to finding(s)	79 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66 deg f @ wall
Relative Humidity	61%
Outdoor air reading	60
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, Ohio 45050
(513) 539 - 2978 Phone
(513) 539 – 2972 Fax
www.fseinc.net

Incident Summary	
Location	R cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:37:35
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	66.3
Reference Temperature	66.0
Temperature Rise	0.9
Component Emissivity	0.93
Background Temperature	60

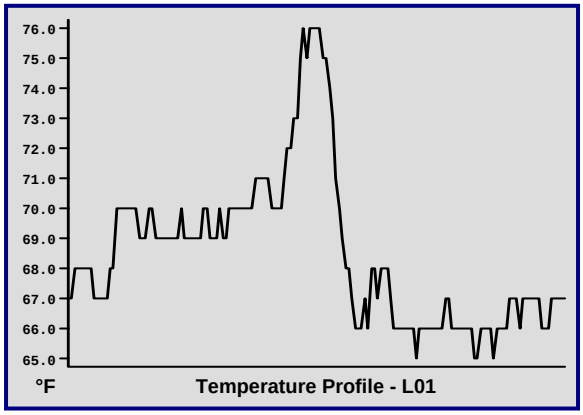
IR image file: r 2.eif



Visible Image file: r 2 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Heat loss conditions present, especially at S03 area. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	66.3 °F
S02	Window	0.92	66.0 °F
S03	Window	0.92	76.9 °F
S04	Window	0.92	65.1 °F
S05	Window	0.92	71.6 °F



Additional Finding Data	
Distance to finding(s)	58 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66 deg f @ wall
Relative Humidity	61%
Outdoor air reading	60
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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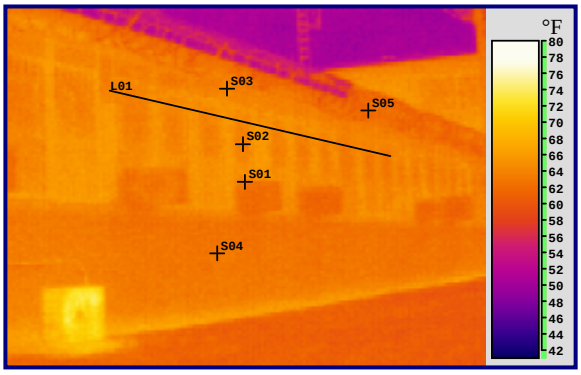
Incident Summary	
Location	Main corridor offices
Equipment	Wall and windows
Incident Date	9/30/2009 12:38:44
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	64.3
Reference Temperature	64.1
Temperature Rise	2.2
Component Emissivity	0.77
Background Temperature	60

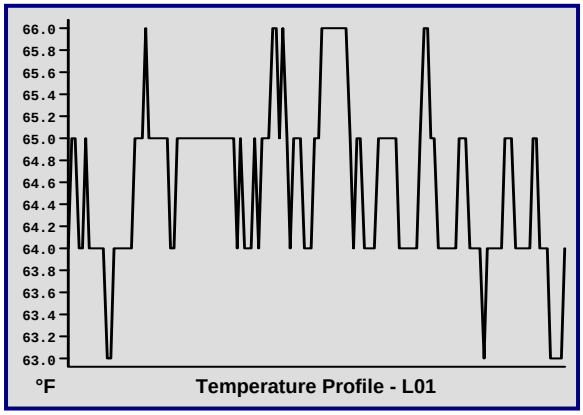
IR image file: r4.eif



Visible Image file: r4 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Framing	0.77	64.3 °F
S02	Window	0.92	64.1 °F
S03	Wall	0.93	64.2 °F
S04	Wall	0.92	63.4 °F
S05	Trim	0.77	62.5 °F



Additional Finding Data	
Distance to finding(s)	51 ft
Airspeed @ finding area	3 mph
IR thermometer reading	63 deg f @ wall
Relative Humidity	61%
Outdoor air reading	60
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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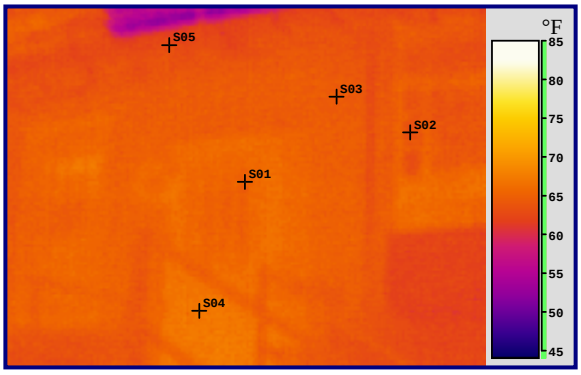
Incident Summary	
Location	R cell block
Equipment	Yard entry area
Incident Date	9/30/2009 12:39:38
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	65.4
Reference Temperature	63.9
Temperature Rise	1.1
Component Emissivity	0.92
Background Temperature	59

IR image file: r5.eif



Visible Image file: r5 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	65.4 °F
S02	Window	0.92	63.9 °F
S03	Wall	0.93	64.9 °F
S04	Door	0.95	67.6 °F
S05	Trim	0.77	63.8 °F

Additional Finding Data	
Distance to finding(s)	38 ft
Airspeed @ finding area	3 mph
IR thermometer reading	65 deg f @ wall
Relative Humidity	61%
Outdoor air reading	59
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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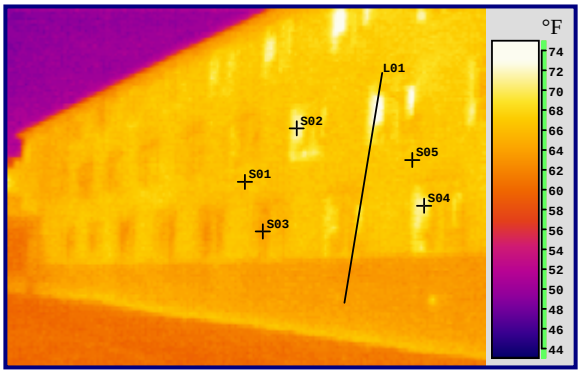
Incident Summary	
Location	A cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:41:56
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.0
Reference Temperature	72.4
Temperature Rise	3.2
Component Emissivity	0.93
Background Temperature	59

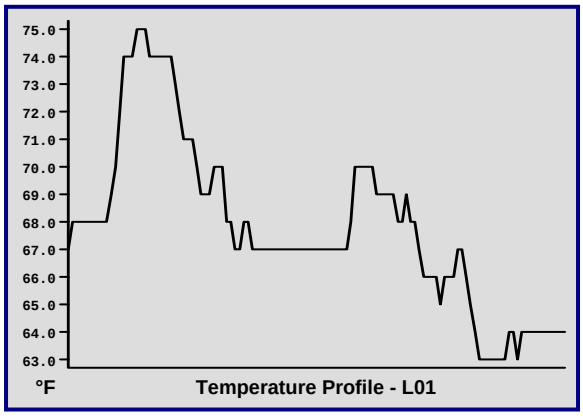
IR image file: a1.eif



Visible Image file: a1 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	67.0 °F
S02	Window	0.92	72.4 °F
S03	Window	0.92	64.5 °F
S04	Window	0.92	71.6 °F
S05	Wall	0.93	67.7 °F



Additional Finding Data	
Distance to finding(s)	80 ft
Airspeed @ finding area	3 mph
IR thermometer reading	67 deg f @ wall
Relative Humidity	61%
Outdoor air reading	59
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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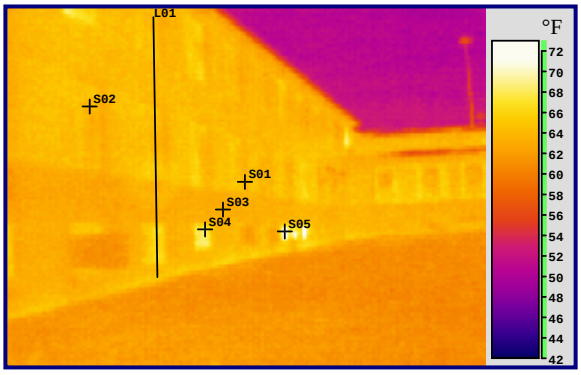
Incident Summary	
Location	A cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:42:28
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	64.6
Reference Temperature	64.6
Temperature Rise	3.2
Component Emissivity	0.93
Background Temperature	58

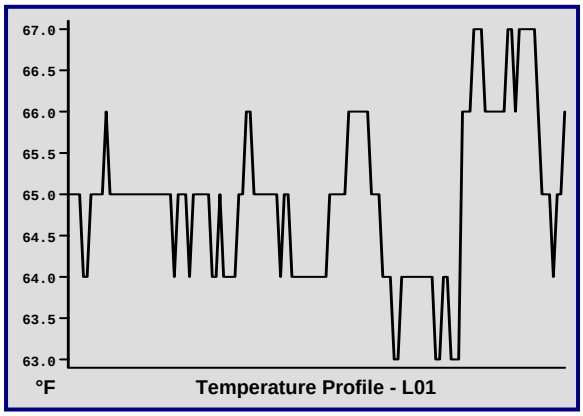
IR image file: a2.eif



Visible Image file: a2 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	64.6 °F
S02	Window	0.92	64.6 °F
S03	Wall	0.92	63.4 °F
S04	Window	0.92	68.0 °F
S05	Window	0.92	70.7 °F



Additional Finding Data	
Distance to finding(s)	81 ft
Airspeed @ finding area	3 mph
IR thermometer reading	64 deg f @ wall
Relative Humidity	61%
Outdoor air reading	58
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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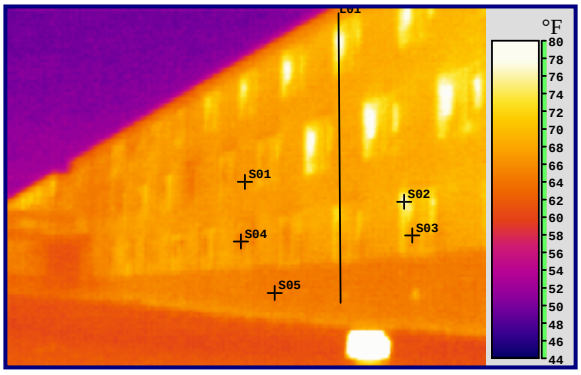
Incident Summary	
Location	B cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:43:30
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.5
Reference Temperature	77.0
Temperature Rise	3.8
Component Emissivity	0.93
Background Temperature	58

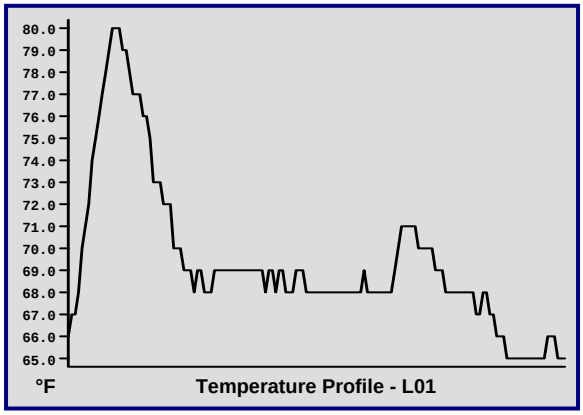
IR image file: b1.eif



Visible Image file: b1 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	67.5 °F
S02	Window	0.92	77.0 °F
S03	Window	0.92	68.3 °F
S04	Window	0.92	65.7 °F
S05	Wall	0.92	65.0 °F



Additional Finding Data	
Distance to finding(s)	79 ft
Airspeed @ finding area	3 mph
IR thermometer reading	67 deg f @ wall
Relative Humidity	61%
Outdoor air reading	58
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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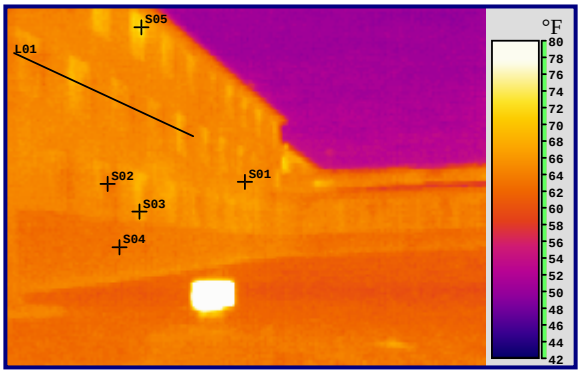
Incident Summary	
Location	B cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:44:10
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	65.8
Reference Temperature	63.8
Temperature Rise	4.6
Component Emissivity	0.93
Background Temperature	58

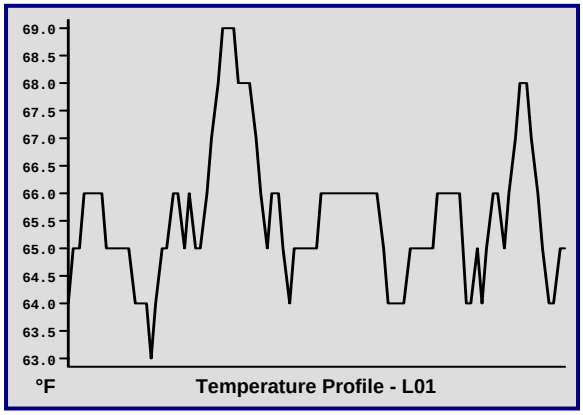
IR image file: b2.eif



Visible Image file: b2 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	65.8 °F
S02	Window	0.92	63.8 °F
S03	Window	0.92	67.4 °F
S04	Wall	0.92	63.4 °F
S05	Window	0.92	72.4 °F



Additional Finding Data	
Distance to finding(s)	86 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66 deg f @ wall
Relative Humidity	61%
Outdoor air reading	58
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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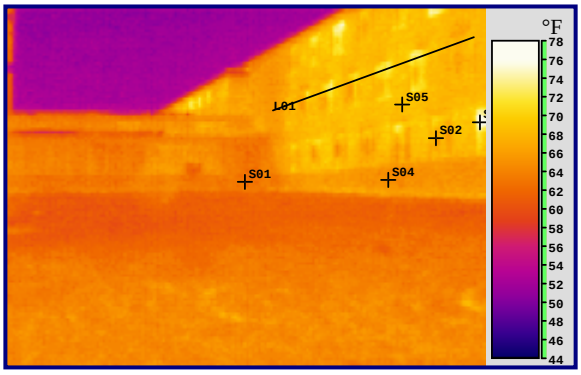
Incident Summary	
Location	C cell block
Equipment	Walls and windows
Incident Date	9/30/2009 12:45:09
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	63.2
Reference Temperature	68.0
Temperature Rise	0.4
Component Emissivity	0.93
Background Temperature	58

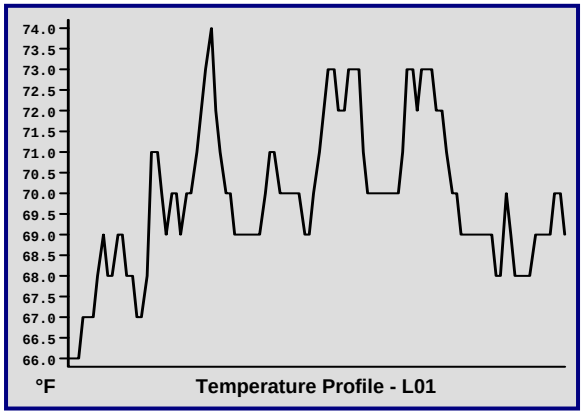
IR image file: c1.eif



Visible Image file: c1 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	63.2 °F
S02	Window	0.92	68.0 °F
S03	Window	0.92	77.1 °F
S04	Wall	0.91	65.8 °F
S05	Wall	0.93	69.6 °F



Additional Finding Data	
Distance to finding(s)	89 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66 deg f @ wall
Relative Humidity	61%
Outdoor air reading	58
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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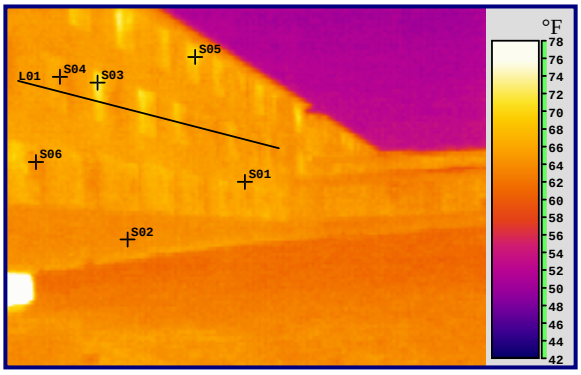
Incident Summary	
Location	C cell block
Equipment	Walls and windows
Incident Date	9/30/2009 12:45:39
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	66.1
Reference Temperature	64.2
Temperature Rise	4.0
Component Emissivity	0.93
Background Temperature	58

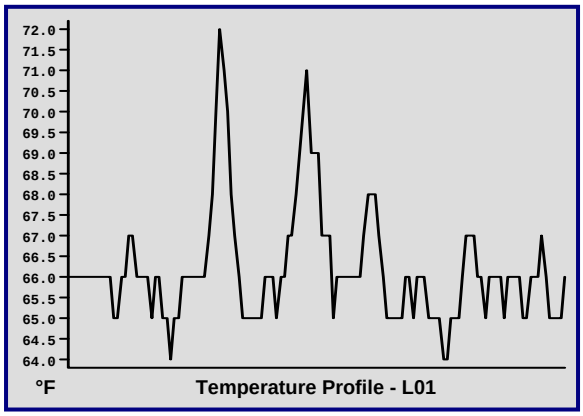
IR image file: c2.eif



Visible Image file: c2 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	66.1 °F
S02	Wall	0.93	64.2 °F
S03	Window	0.92	72.5 °F
S04	Window	0.92	65.6 °F
S05	Window	0.92	71.1 °F



Additional Finding Data	
Distance to finding(s)	89 ft
Airspeed @ finding area	3 mph
IR thermometer reading	64 deg f @ wall
Relative Humidity	61%
Outdoor air reading	58
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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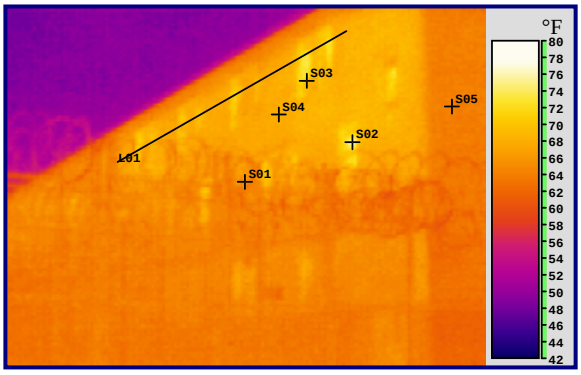
Incident Summary	
Location	D cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:46:35
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	65.2
Reference Temperature	75.4
Temperature Rise	2.8
Component Emissivity	0.93
Background Temperature	58

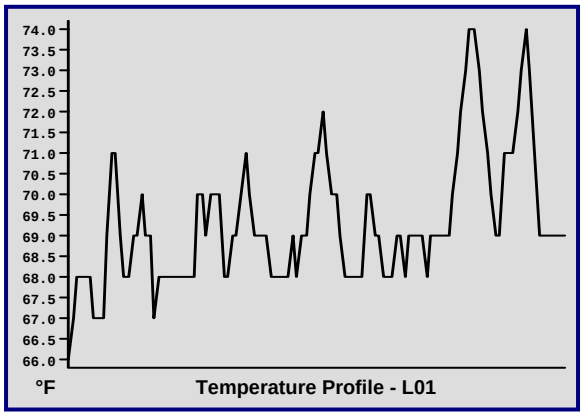
IR image file: d1.eif



Visible Image file: d1 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	65.2 °F
S02	Window	0.92	75.4 °F
S03	Window	0.92	71.0 °F
S04	Wall	0.93	68.8 °F
S05	Wall	0.93	64.5 °F



Additional Finding Data	
Distance to finding(s)	76 ft
Airspeed @ finding area	3 mph
IR thermometer reading	64 deg f @ wall
Relative Humidity	61%
Outdoor air reading	58
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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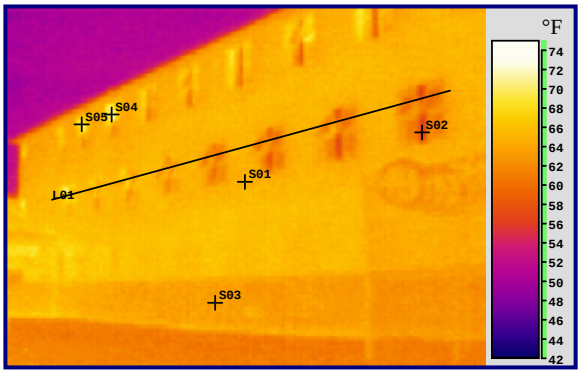
Incident Summary	
Location	Isolation cell block
Equipment	Wall and windows
Incident Date	9/30/2009 1:11:51 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	65.6
Reference Temperature	58.4
Temperature Rise	3.0
Component Emissivity	0.93
Background Temperature	54

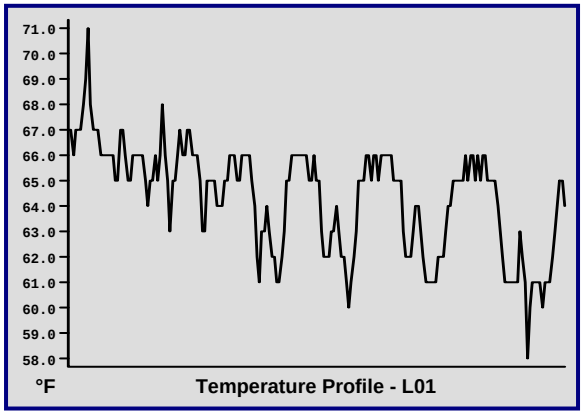
IR image file: isol1-3-1.eif



Visible Image file: isol1-3-1 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	65.6 °F
S02	Window	0.92	58.4 °F
S03	Wall	0.92	64.5 °F
S04	Window	0.92	71.1 °F
S05	Window	0.92	69.7 °F



Additional Finding Data	
Distance to finding(s)	79 ft
Airspeed @ finding area	3 mph
IR thermometer reading	64 deg f @ wall
Relative Humidity	61%
Outdoor air reading	54
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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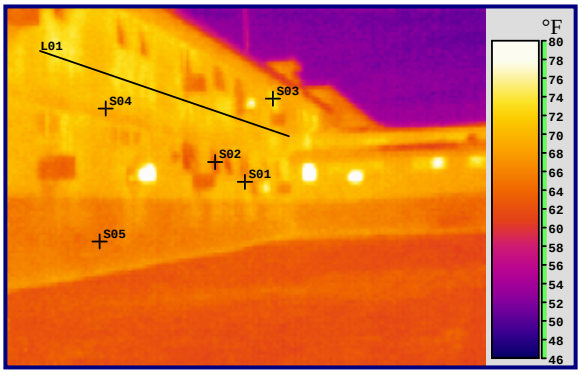
Incident Summary	
Location	Isolation cell block
Equipment	Walls and windows
Incident Date	9/30/2009 1:12:33 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	70.3
Reference Temperature	66.2
Temperature Rise	6.0
Component Emissivity	0.92
Background Temperature	54

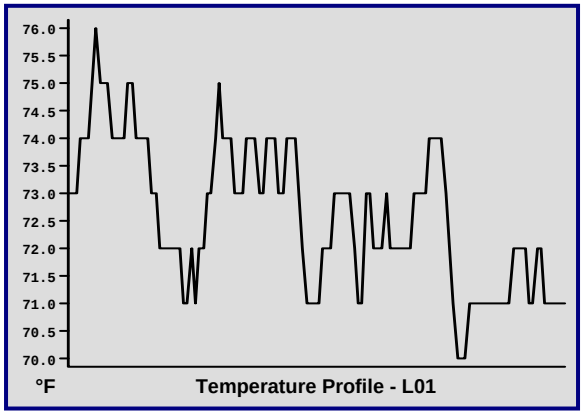
IR image file: isol123-2.eif



Visible Image file: isol123-2 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	70.3 °F
S02	Window	0.92	66.2 °F
S03	Window	0.92	73.9 °F
S04	Wall	0.93	70.6 °F
S05	Wall	0.92	66.0 °F



Additional Finding Data	
Distance to finding(s)	83 ft
Airspeed @ finding area	3 mph
IR thermometer reading	70 deg f @ wall
Relative Humidity	61%
Outdoor air reading	54
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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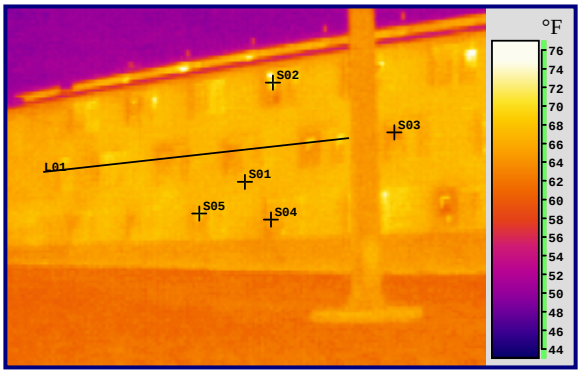
Incident Summary	
Location	E cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:47:52
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.4
Reference Temperature	70.4
Temperature Rise	4.4
Component Emissivity	0.93
Background Temperature	57

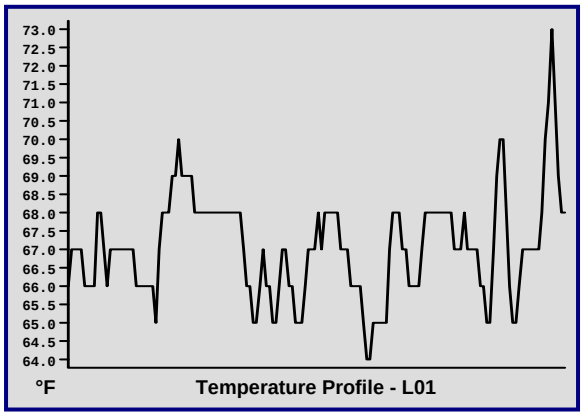
IR image file: e1.eif



Visible Image file: e1 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	67.4 °F
S02	Window	0.92	70.4 °F
S03	Window	0.92	64.4 °F
S04	Window	0.92	66.0 °F
S05	Window	0.92	69.3 °F



Additional Finding Data	
Distance to finding(s)	82 ft
Airspeed @ finding area	3 mph
IR thermometer reading	67 deg f @ wall
Relative Humidity	61%
Outdoor air reading	57
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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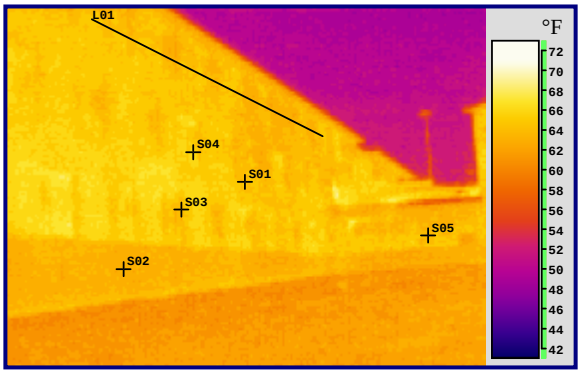
Incident Summary	
Location	E cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:48:44
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	0.93

Inspection Detail	
Component Temperature	64.2
Reference Temperature	63.2
Temperature Rise	3.0
Component Emissivity	0.93
Background Temperature	57

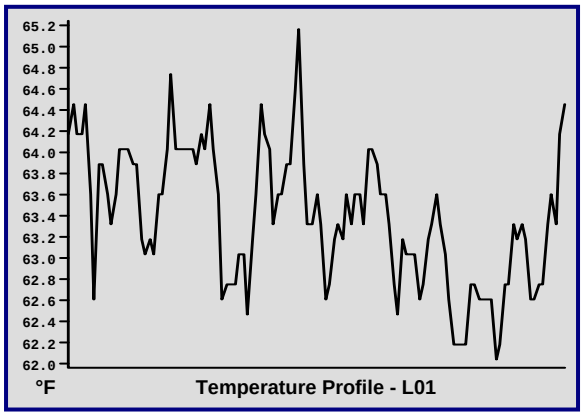
IR image file: e2.eif



Visible Image file: e2 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Massive heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	64.2 °F
S02	Window	0.92	63.2 °F
S03	Window	0.92	64.2 °F
S04	Window	0.92	65.6 °F
S05	Window	0.92	63.8 °F



Additional Finding Data	
Distance to finding(s)	79 ft
Airspeed @ finding area	3 mph
IR thermometer reading	64 deg f @ wall
Relative Humidity	61%
Outdoor air reading	57
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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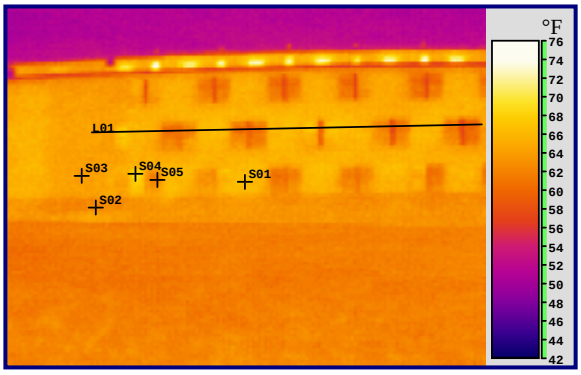
Incident Summary	
Location	F cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:50:01
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.0
Reference Temperature	63.4
Temperature Rise	5.4
Component Emissivity	0.93
Background Temperature	57

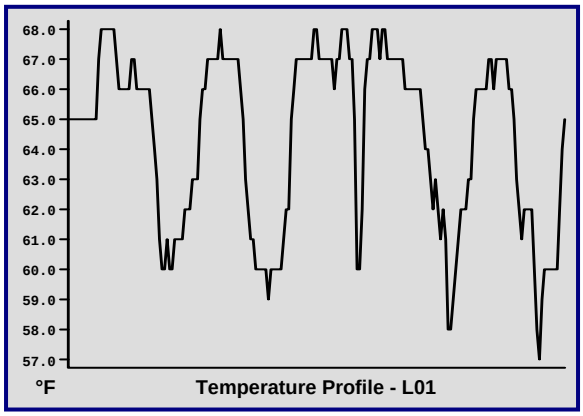
IR image file: f1.eif



Visible Image file: f1 VIS.JPG

Comment: -- Inspect S04 and soffit trim for adequate seal in light yellow random areas. Repair or replace broken window panes / units as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	67.0 °F
S02	Wall	0.92	63.4 °F
S03	Wall	0.93	64.8 °F
S04	Window	0.92	69.3 °F
S05	Window	0.92	63.3 °F



Additional Finding Data	
Distance to finding(s)	112 ft
Airspeed @ finding area	3 mph
IR thermometer reading	67 deg f @ wall
Relative Humidity	61%
Outdoor air reading	57
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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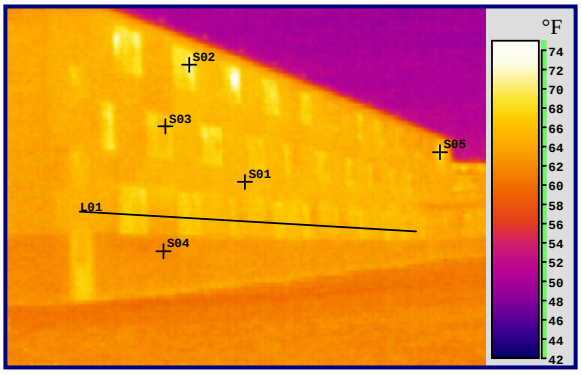
Incident Summary	
Location	F cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:52:47
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	65.9
Reference Temperature	71.5
Temperature Rise	4.3
Component Emissivity	0.93
Background Temperature	57

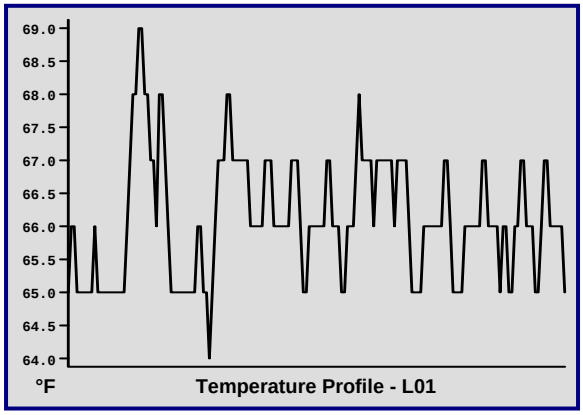
IR image file: f2.eif



Visible Image file: f2 VIS.JPG

Comment: -- Replace old windows units with screened format. Eliminate glass breakage. Significant heat loss conditions present. Eliminates monthly yard trash cleanup issue also.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	65.9 °F
S02	Window	0.92	71.5 °F
S03	Window	0.92	67.3 °F
S04	Wall	0.92	62.4 °F
S05	Window	0.92	68.4 °F



Additional Finding Data	
Distance to finding(s)	108 ft
Airspeed @ finding area	3 mph
IR thermometer reading	62 deg f @ wall
Relative Humidity	61%
Outdoor air reading	57
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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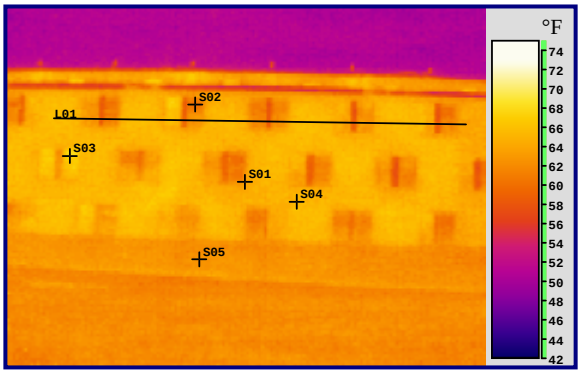
Incident Summary	
Location	G cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:56:35
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	64.0
Reference Temperature	61.0
Temperature Rise	3.0
Component Emissivity	0.92
Background Temperature	56

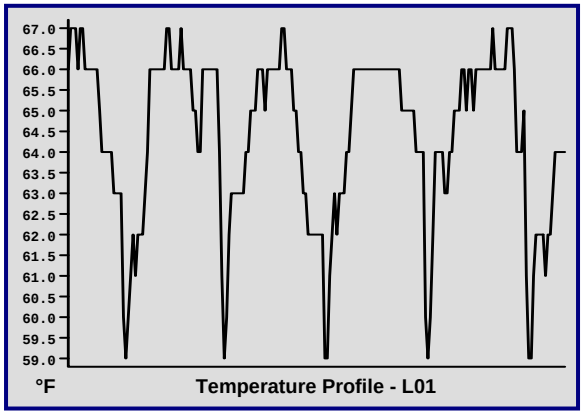
IR image file: g1.eif



Visible Image file: g1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	64.0 °F
S02	Window	0.92	61.0 °F
S03	Window	0.92	68.4 °F
S04	Wall	0.93	66.0 °F
S05	Wall	0.92	63.0 °F



Additional Finding Data	
Distance to finding(s)	112 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66 deg f @ wall
Relative Humidity	61%
Outdoor air reading	56
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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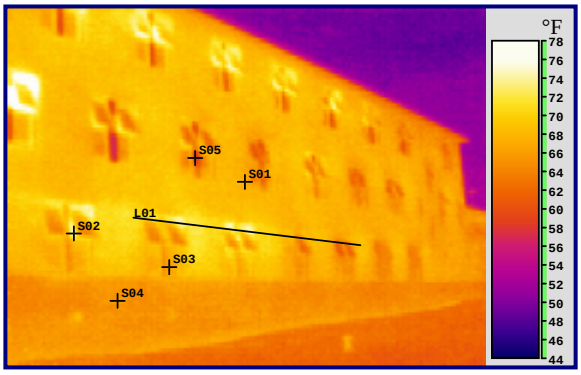
Incident Summary	
Location	G cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:57:05
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	68.0
Reference Temperature	73.3
Temperature Rise	3.2
Component Emissivity	0.93
Background Temperature	56

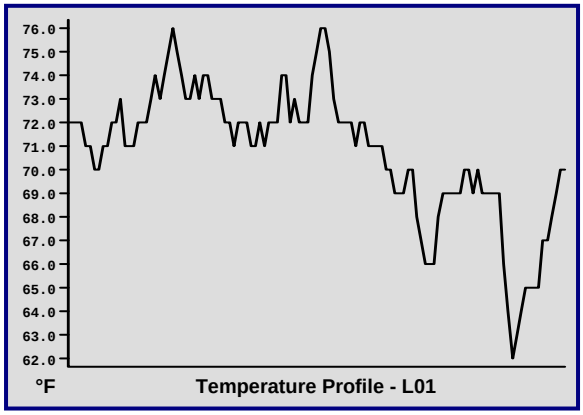
IR image file: g2.eif



Visible Image file: g2 VIS.JPG

Comment: -- No issues noted. Reflectivity of open window panes in photos no issue.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	68.0 °F
S02	Window	0.92	73.3 °F
S03	Window	0.92	67.0 °F
S04	Wall	0.92	66.3 °F
S05	Framing	0.77	62.8 °F



Additional Finding Data	
Distance to finding(s)	86 ft
Airspeed @ finding area	3 mph
IR thermometer reading	68 deg f @ wall
Relative Humidity	61%
Outdoor air reading	56
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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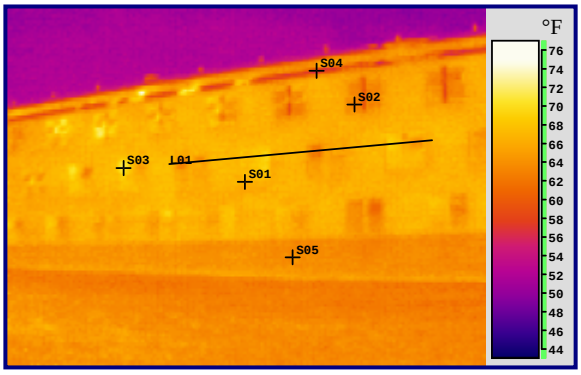
Incident Summary	
Location	H cell block
Equipment	Wall and windows
Incident Date	9/30/2009 12:58:35
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.1
Reference Temperature	63.4
Temperature Rise	4.5
Component Emissivity	0.93
Background Temperature	56

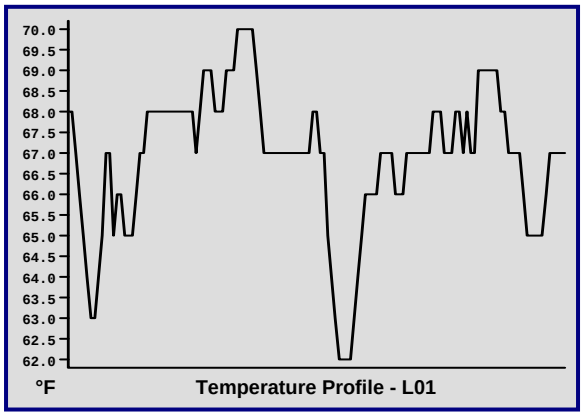
IR image file: h1.eif



Visible Image file: h1 VIS.JPG

Comment: -- No issues noted. Repair any broken window panes if required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	67.1 °F
S02	Window	0.92	63.4 °F
S03	Window	0.92	71.4 °F
S04	Framing	0.77	61.7 °F
S05	Window	0.92	64.6 °F



Additional Finding Data	
Distance to finding(s)	109 ft
Airspeed @ finding area	3 mph
IR thermometer reading	67 deg f @ wall
Relative Humidity	61%
Outdoor air reading	56
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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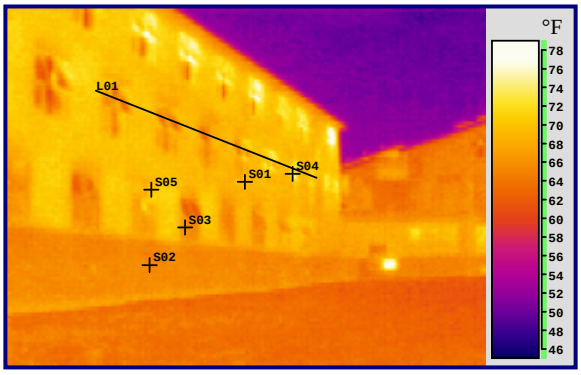
Incident Summary	
Location	H cell block
Equipment	Walls and windows
Incident Date	9/30/2009 12:59:11
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	70.0
Reference Temperature	66.3
Temperature Rise	5.9
Component Emissivity	0.93
Background Temperature	56

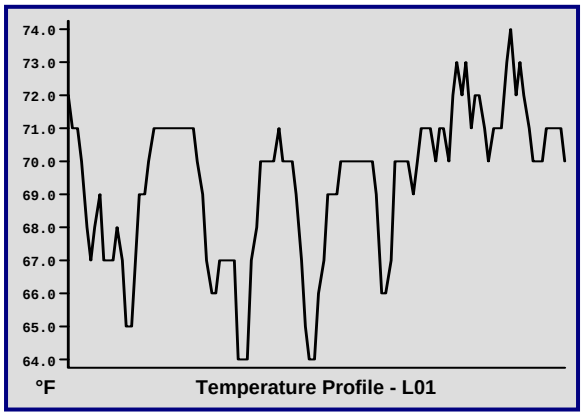
IR image file: h2.eif



Visible Image file: h2 VIS.JPG

Comment: -- No issues noted. Reflectivity on window framing shown in view no issue.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	70.0 °F
S02	Wall	0.92	66.3 °F
S03	Window	0.92	66.8 °F
S04	Window	0.92	73.6 °F
S05	Window	0.92	71.3 °F



Additional Finding Data	
Distance to finding(s)	89 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66deg f @ S0X
Relative Humidity	61%
Outdoor air reading	56
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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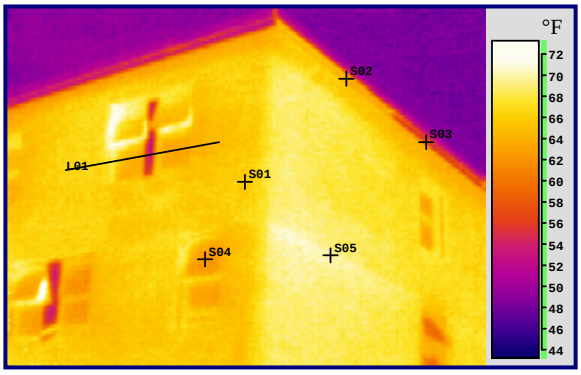
Incident Summary	
Location	J cell block
Equipment	Wall and soffit
Incident Date	9/30/2009 1:00:33 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	66.7
Reference Temperature	63.7
Temperature Rise	3.8
Component Emissivity	0.93
Background Temperature	56

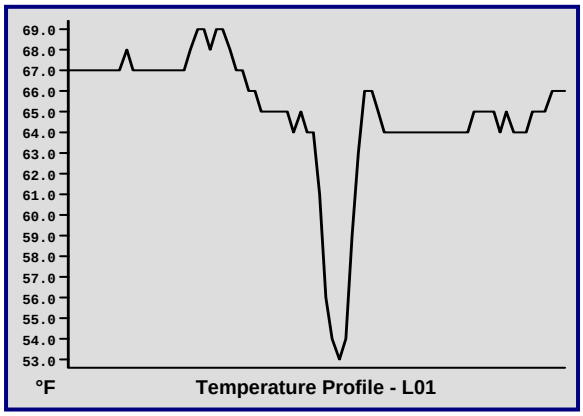
IR image file: j1.eif



Visible Image file: j1 VIS.JPG

Comment: -- Repair all roofing and soffit trim areas around perimeter of facility as required to prevent moisture infiltration.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	66.7 °F
S02	Soffit no trim	0.94	63.7 °F
S03	Soffit with trim	0.77	58.4 °F
S04	Glazing	0.92	63.0 °F
S05	Wall	0.93	70.9 °F



Additional Finding Data	
Distance to finding(s)	48 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66 deg f @ wall
Relative Humidity	61%
Outdoor air reading	56
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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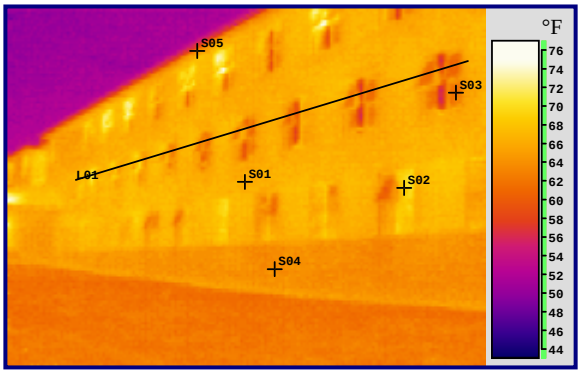
Incident Summary	
Location	J cell block
Equipment	Wall and windows
Incident Date	9/30/2009 1:01:07 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	66.8
Reference Temperature	70.3
Temperature Rise	3.5
Component Emissivity	0.93
Background Temperature	56

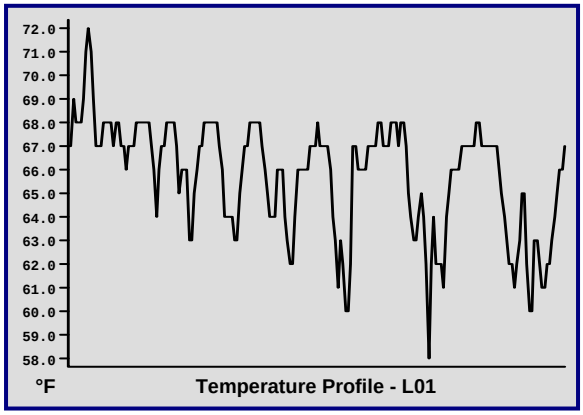
IR image file: j2.eif



Visible Image file: j2 VIS.JPG

Comment: -- No issues noted. Reflectivity on window framing shown in view not an issue.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	66.8 °F
S02	Window	0.92	70.3 °F
S03	Window	0.92	62.8 °F
S04	Wall	0.92	64.8 °F
S05	Soffit	0.77	64.5 °F



Additional Finding Data	
Distance to finding(s)	79 ft
Airspeed @ finding area	3 mph
IR thermometer reading	67 deg f @ wall
Relative Humidity	61%
Outdoor air reading	56
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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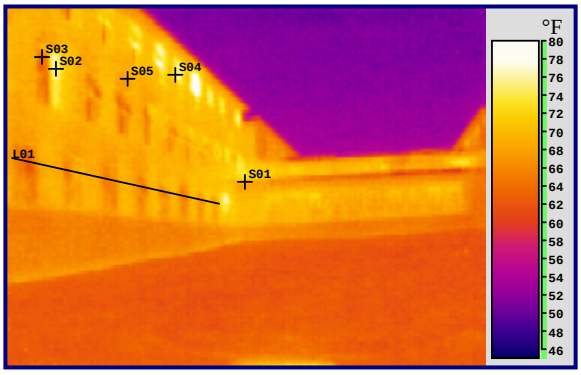
Incident Summary	
Location	J cell block
Equipment	Walls and windows
Incident Date	9/30/2009 1:01:37 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	70.6
Reference Temperature	76.8
Temperature Rise	7.9
Component Emissivity	0.93
Background Temperature	56

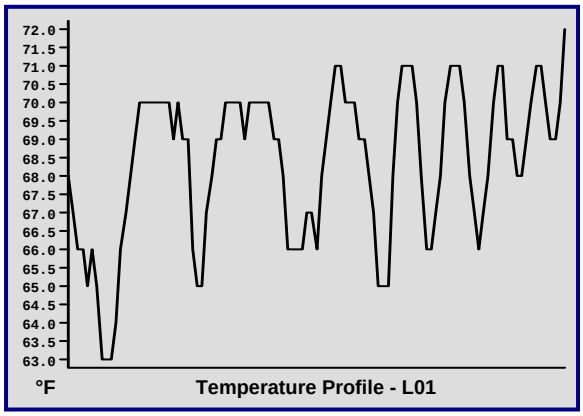
IR image file: j3.eif



Visible Image file: j3 VIS.JPG

Comment: -- Inspect S04 window areas for repair or replacement as necessary.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	70.6 °F
S02	Window	0.92	76.8 °F
S03	Window	0.92	66.0 °F
S04	Window	0.92	75.7 °F
S05	Wall	0.93	69.4 °F



Additional Finding Data	
Distance to finding(s)	92 ft
Airspeed @ finding area	3 mph
IR thermometer reading	70 deg f @ wall
Relative Humidity	61%
Outdoor air reading	56
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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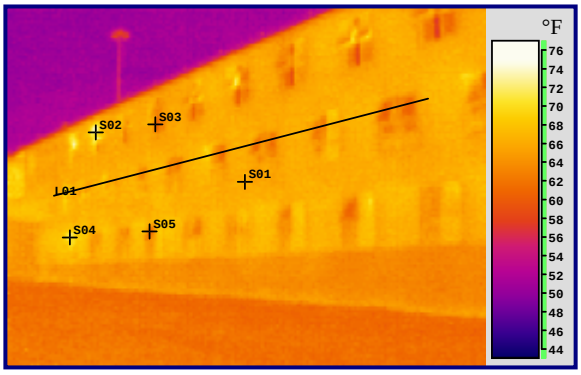
Incident Summary	
Location	K cell block
Equipment	Wall and windows
Incident Date	9/30/2009 1:02:10 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	66.9
Reference Temperature	72.6
Temperature Rise	4.1
Component Emissivity	0.93
Background Temperature	55

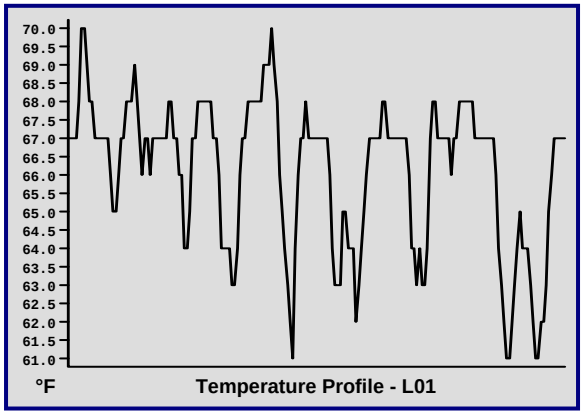
IR image file: k1.eif



Visible Image file: k1 VIS.JPG

Comment: -- Inspect S02 area windows for repair or replacement if necessary.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	66.9 °F
S02	Window	0.92	72.6 °F
S03	Window	0.92	63.9 °F
S04	Window	0.92	71.6 °F
S05	Window	0.92	64.5 °F



Additional Finding Data	
Distance to finding(s)	88 ft
Airspeed @ finding area	3 mph
IR thermometer reading	70 deg f @ wall
Relative Humidity	61%
Outdoor air reading	55
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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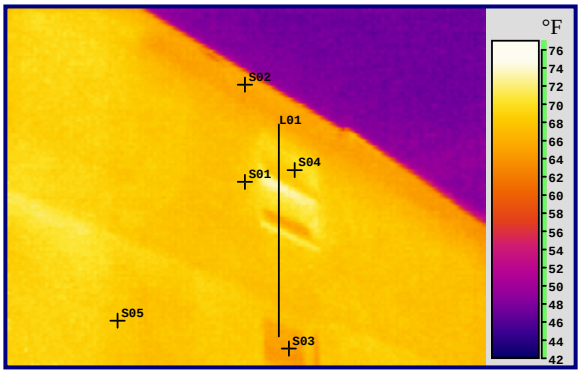
Incident Summary	
Location	K cell block
Equipment	Wall and soffit
Incident Date	9/30/2009 1:03:37 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	69.1
Reference Temperature	66.3
Temperature Rise	5.2
Component Emissivity	0.93
Background Temperature	55

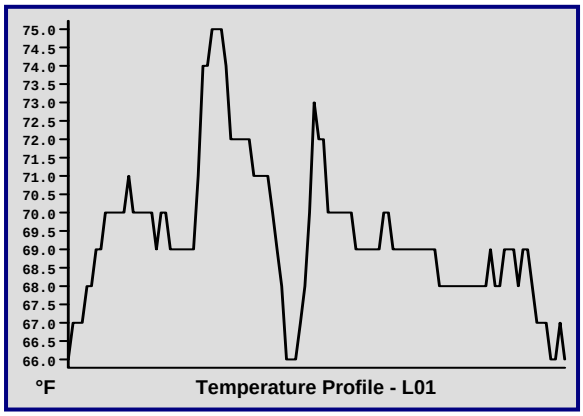
IR image file: k3.eif



Visible Image file: k3 VIS.JPG

Comment: -- Repair all roofing and soffit trim areas around perimeter of facility as required to prevent moisture infiltration.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	69.1 °F
S02	Soffit	0.94	66.3 °F
S03	Glazing	0.92	65.9 °F
S04	Glazing	0.92	70.4 °F
S05	Wall	0.93	69.0 °F



Additional Finding Data	
Distance to finding(s)	67 ft
Airspeed @ finding area	3 mph
IR thermometer reading	70 deg f @ wall
Relative Humidity	61%
Outdoor air reading	55
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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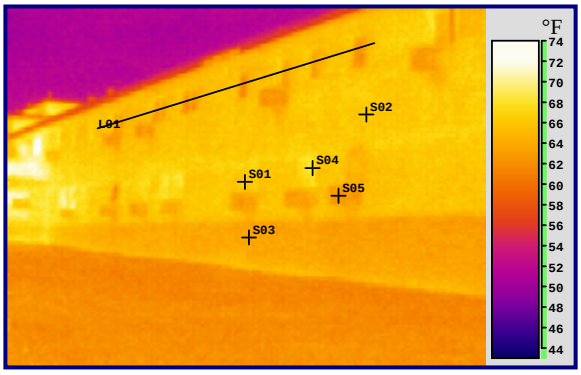
Incident Summary	
Location	Infirmary Wing
Equipment	Wall and windows
Incident Date	9/30/2009 1:04:42 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.4
Reference Temperature	67.0
Temperature Rise	4.6
Component Emissivity	0.92
Background Temperature	55

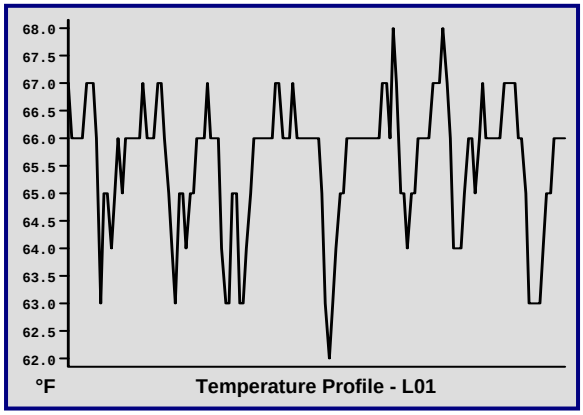
IR image file: inf1.eif



Visible Image file: inf1 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	67.4 °F
S02	Wall	0.93	67.0 °F
S03	Wall	0.92	64.3 °F
S04	Window	0.92	68.5 °F
S05	Window	0.92	63.5 °F



Additional Finding Data	
Distance to finding(s)	76 ft
Airspeed @ finding area	3 mph
IR thermometer reading	63 deg f @ wall
Relative Humidity	61%
Outdoor air reading	55
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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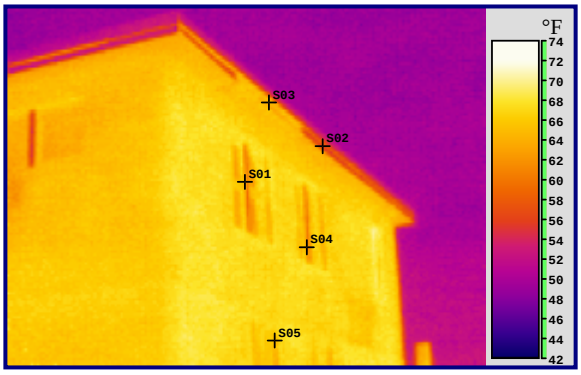
Incident Summary	
Location	Infirmary area
Equipment	Wall and soffits
Incident Date	9/30/2009 1:05:10 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	64.2
Reference Temperature	58.4
Temperature Rise	3.8
Component Emissivity	0.92
Background Temperature	55

IR image file: inf2.eif



Visible Image file: inf2 VIS.JPG

Comment: -- Repair all roofing and soffit trim areas around perimeter of facility as required to prevent moisture infiltration.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	64.2 °F
S02	Soffit with trim	0.77	58.4 °F
S03	Soffit without trim	0.94	64.4 °F
S04	Window	0.92	64.2 °F
S05	Window	0.92	66.7 °F

Additional Finding Data	
Distance to finding(s)	74 ft
Airspeed @ finding area	4 mph
IR thermometer reading	63 deg f @ wall
Relative Humidity	61%
Outdoor air reading	55
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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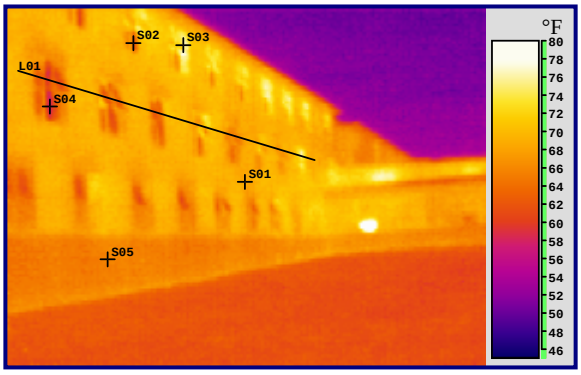
Incident Summary	
Location	Infirmary area
Equipment	Wall and windows
Incident Date	9/30/2009 1:06:09 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	69.2
Reference Temperature	66.0
Temperature Rise	5.5
Component Emissivity	0.93
Background Temperature	55

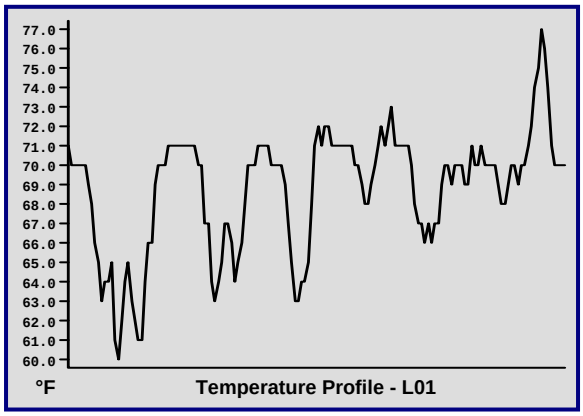
IR image file: inf3.eif



Visible Image file: inf3 VIS.JPG

Comment: -- Inspect S03 window areas for repair or replacement as necessary.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	69.2 °F
S02	Window	0.92	66.0 °F
S03	Window	0.92	75.9 °F
S04	Window	0.92	60.2 °F
S05	Wall	0.92	66.2 °F



Additional Finding Data	
Distance to finding(s)	92 ft
Airspeed @ finding area	3 mph
IR thermometer reading	66 deg f @ wall
Relative Humidity	61%
Outdoor air reading	55
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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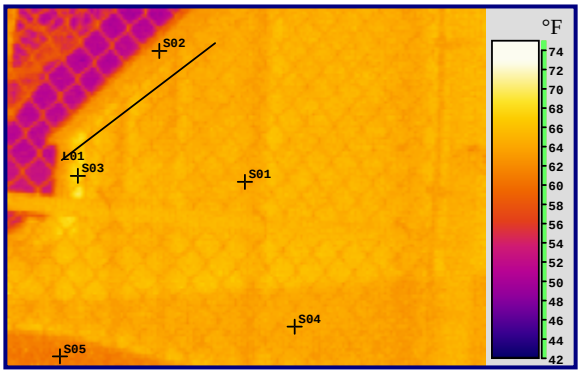
Incident Summary	
Location	North gym area
Equipment	Wall and windows
Incident Date	9/30/2009 1:13:40 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	64.9
Reference Temperature	63.7
Temperature Rise	1.5
Component Emissivity	0.93
Background Temperature	54

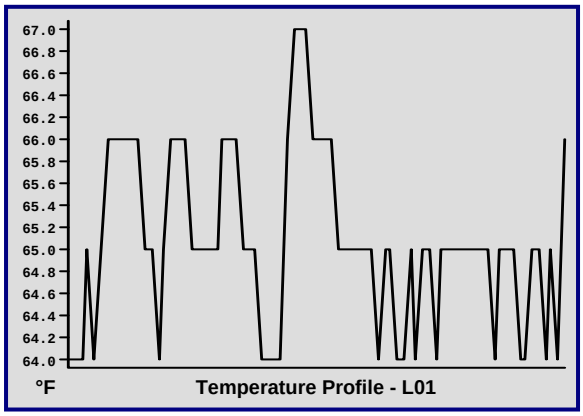
IR image file: gym no 1.eif



Visible Image file: gym no 1 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	64.9 °F
S02	Soffit	0.94	63.7 °F
S03	Window	0.92	68.7 °F
S04	Trim	0.92	65.2 °F
S05	Grade	0.78	62.9 °F



Additional Finding Data	
Distance to finding(s)	52 ft
Airspeed @ finding area	3 mph
IR thermometer reading	n/a
Relative Humidity	61%
Outdoor air reading	54
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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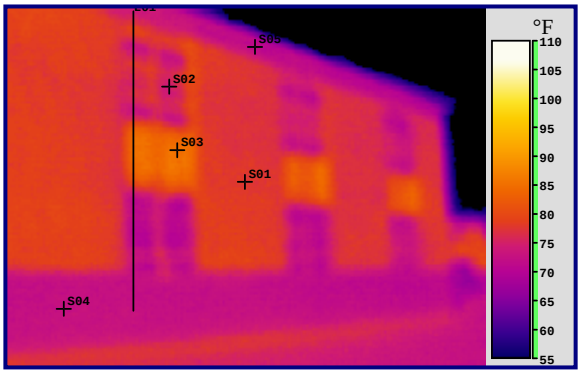
Incident Summary	
Location	Maintenance area
Equipment	Wall right side
Incident Date	9/30/2009 10:29:28
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	77.3
Reference Temperature	74.2
Temperature Rise	4.9
Component Emissivity	0.93
Background Temperature	67

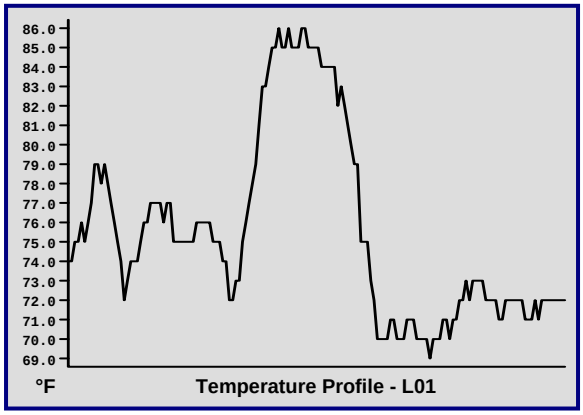
IR image file: opj 1.eif



Visible Image file: opj 1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	77.3 °F
S02	Window	0.92	74.2 °F
S03	Panel	0.92	85.2 °F
S04	Wall	0.92	71.8 °F
S05	Soffit	0.77	68.6 °F



Additional Finding Data	
Distance to finding(s)	56 ft
Airspeed @ finding area	3 mph
IR thermometer reading	72 deg f @ wall
Relative Humidity	61%
Outdoor air reading	67
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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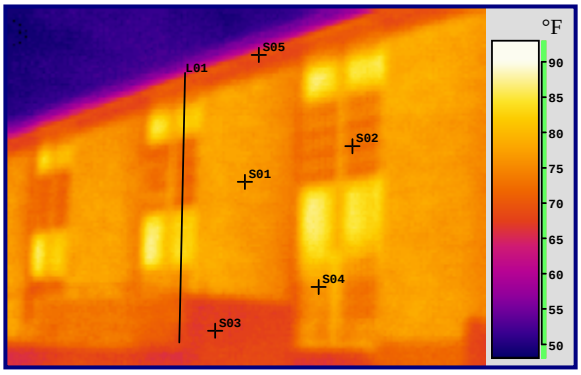
Incident Summary	
Location	Maintenance area
Equipment	Wall center
Incident Date	9/30/2009 10:30:19
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	77.0
Reference Temperature	72.2
Temperature Rise	4.8
Component Emissivity	0.93
Background Temperature	67

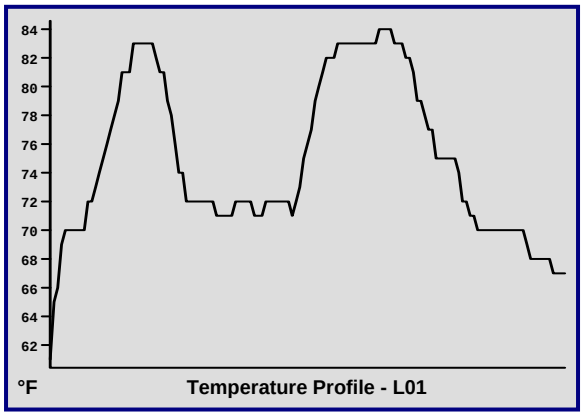
IR image file: opj2.eif



Visible Image file: opj2 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	77.0 °F
S02	Window	0.92	72.2 °F
S03	Dumpster	0.92	66.9 °F
S04	Window	0.92	76.4 °F
S05	Soffit	0.77	66.0 °F



Additional Finding Data	
Distance to finding(s)	59 ft
Airspeed @ finding area	3 mph
IR thermometer reading	n/a
Relative Humidity	61%
Outdoor air reading	67
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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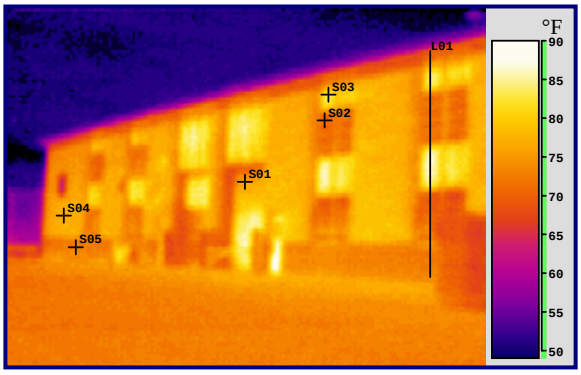
Incident Summary	
Location	Maintenance area
Equipment	Wall left
Incident Date	9/30/2009 10:33:39
Recommendation	None
Severity	None
Units	°F
Global Emissivity	0.93

Inspection Detail	
Component Temperature	75.5
Reference Temperature	70.8
Temperature Rise	6.9
Component Emissivity	0.95
Background Temperature	67

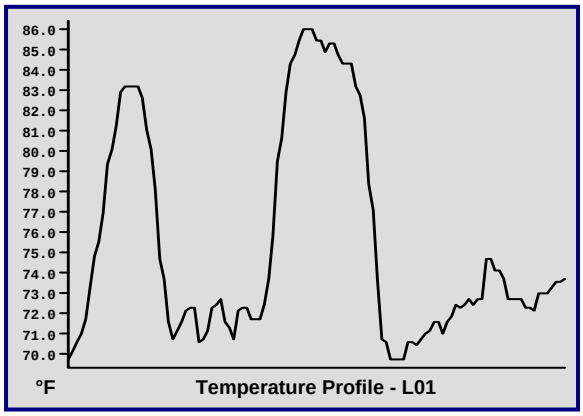
IR image file: opj3.eif



Visible Image file: opj3 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Door	0.95	75.5 °F
S02	Window	0.92	70.8 °F
S03	Panel	0.92	81.4 °F
S04	Wall	0.93	76.8 °F
S05	Wall	0.92	72.9 °F



Additional Finding Data	
Distance to finding(s)	63 ft
Airspeed @ finding area	3 mph
IR thermometer reading	73 deg f @ wall
Relative Humidity	61%
Outdoor air reading	67
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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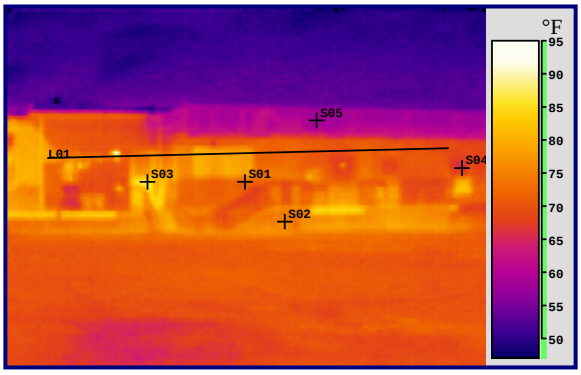
Incident Summary	
Location	Loading dock area
Equipment	Wall and openings
Incident Date	9/30/2009 10:36:40
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	72.7
Reference Temperature	75.5
Temperature Rise	7.7
Component Emissivity	0.93
Background Temperature	67

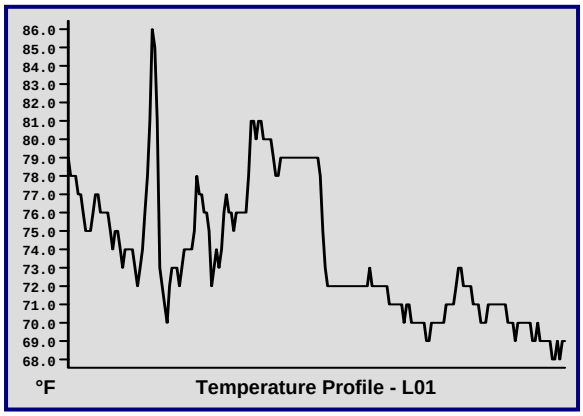
IR image file: opji5.eif



Visible Image file: opji5 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	72.7 °F
S02	Dock	0.92	75.5 °F
S03	Door	0.95	86.2 °F
S04	Wall	0.92	66.6 °F
S05	Trim	0.77	55.2 °F



Additional Finding Data	
Distance to finding(s)	110 ft
Airspeed @ finding area	3 mph
IR thermometer reading	73 deg f @ wall
Relative Humidity	61%
Outdoor air reading	67
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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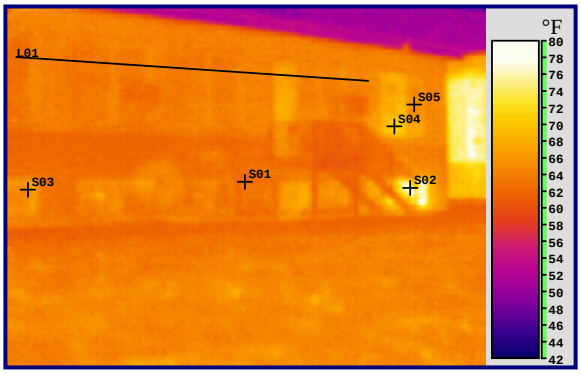
Incident Summary	
Location	School area
Equipment	Entry wall/openings
Incident Date	9/30/2009 10:41:14
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	62.4
Reference Temperature	75.8
Temperature Rise	-1.3
Component Emissivity	0.92
Background Temperature	65

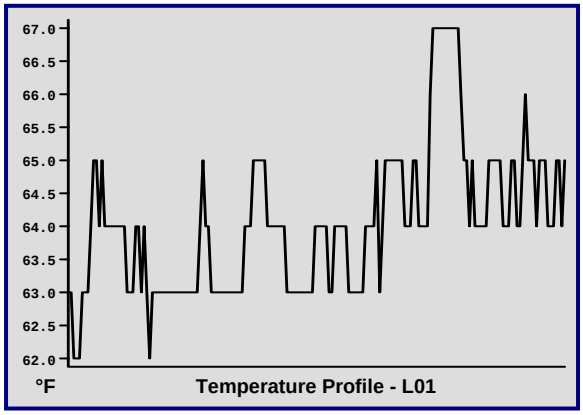
IR image file: school1.eif



Visible Image file: school1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	62.4 °F
S02	Reflectivity	0.92	75.8 °F
S03	Window	0.92	65.8 °F
S04	Door	0.92	71.8 °F
S05	Wall	0.92	65.7 °F



Additional Finding Data	
Distance to finding(s)	58 ft
Airspeed @ finding area	3 mph
IR thermometer reading	65 deg f @ wall
Relative Humidity	61%
Outdoor air reading	65
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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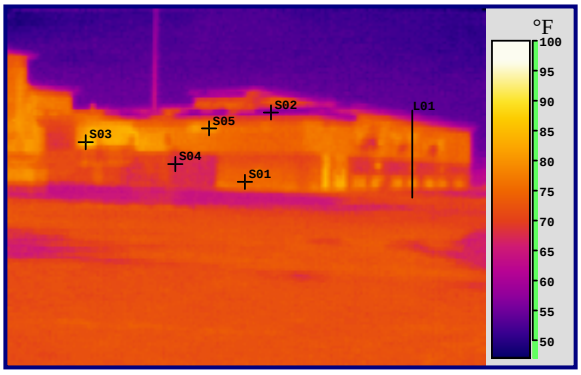
Incident Summary	
Location	Dining area
Equipment	Walls and windows
Incident Date	9/30/2009 10:37:34
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	75.7
Reference Temperature	60.0
Temperature Rise	9.0
Component Emissivity	0.92
Background Temperature	68

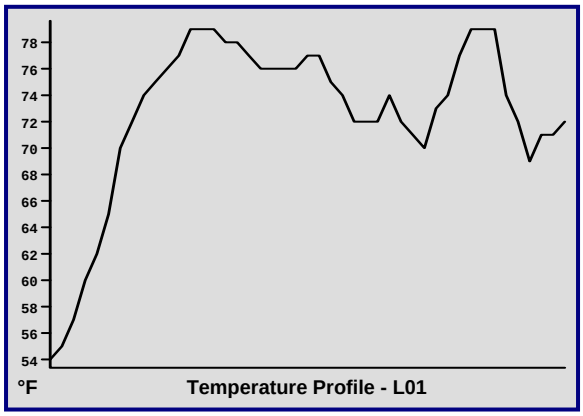
IR image file: opi6.eif



Visible Image file: opi6 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this area.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	75.7 °F
S02	Roofing	0.77	60.0 °F
S03	Wall	0.95	85.1 °F
S04	Wall	0.93	67.3 °F
S05	Window	0.92	80.1 °F



Additional Finding Data	
Distance to finding(s)	151 ft
Airspeed @ finding area	3 mph
IR thermometer reading	75 deg f @ wall
Relative Humidity	61%
Outdoor air reading	68
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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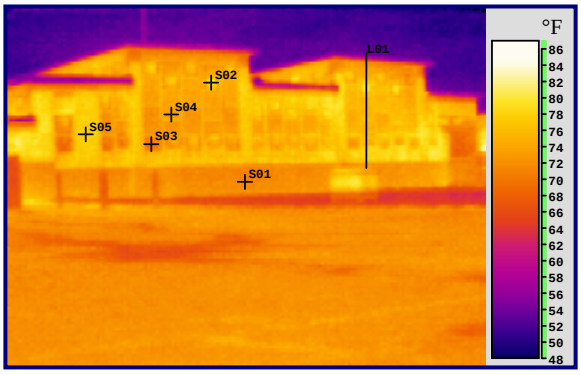
Incident Summary	
Location	Dining area
Equipment	Wall and windows
Incident Date	9/30/2009 10:38:03
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	71.6
Reference Temperature	78.8
Temperature Rise	2.3
Component Emissivity	0.92
Background Temperature	67

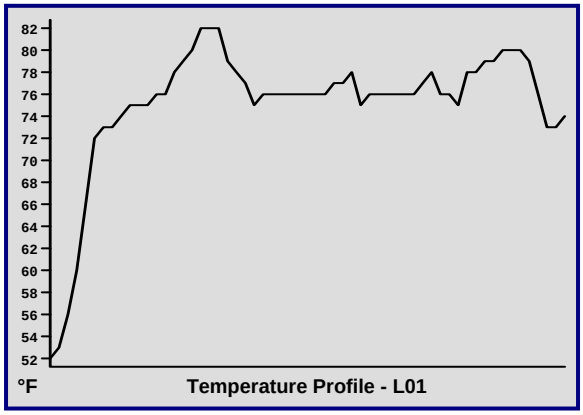
IR image file: opi7.eif



Visible Image file: opi7 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this area.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	71.6 °F
S02	Window	0.92	78.8 °F
S03	Window	0.92	70.8 °F
S04	Window	0.92	74.2 °F
S05	Wall	0.93	78.3 °F



Additional Finding Data	
Distance to finding(s)	118 ft
Airspeed @ finding area	3 mph
IR thermometer reading	72 deg f @ wall
Relative Humidity	61%
Outdoor air reading	67
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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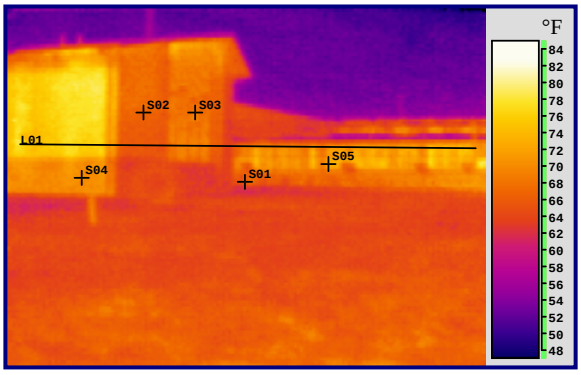
Incident Summary	
Location	Chapel area
Equipment	Walls and windows
Incident Date	9/30/2009 10:41:52
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	65.4
Reference Temperature	67.1
Temperature Rise	1.7
Component Emissivity	0.93
Background Temperature	64

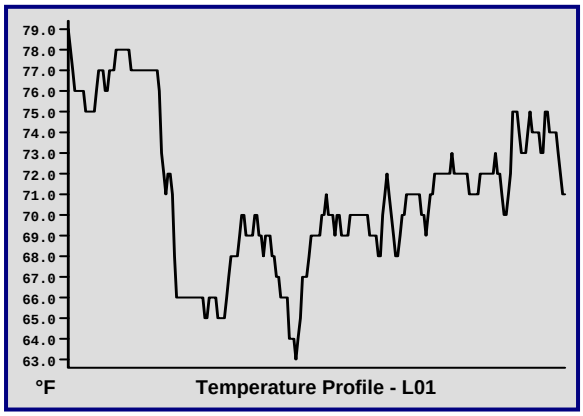
IR image file: chapel1.eif



Visible Image file: chapel1 VIS.JPG

Comment: -- No issues noted. Reflectivity at window framing in view no issue.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	65.4 °F
S02	Wall	0.93	67.1 °F
S03	Window	0.92	68.4 °F
S04	Wall	0.92	70.6 °F
S05	Window	0.92	72.5 °F



Additional Finding Data	
Distance to finding(s)	116 ft
Airspeed @ finding area	3 mph
IR thermometer reading	71 deg f @ wall
Relative Humidity	61%
Outdoor air reading	64
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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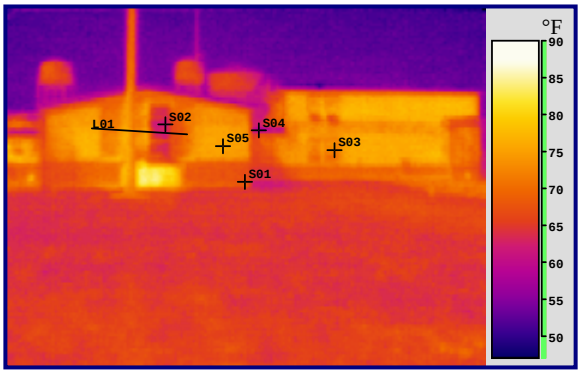
Incident Summary	
Location	Guest visitation area
Equipment	Walls and windows
Incident Date	9/30/2009 10:42:30
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.6
Reference Temperature	62.6
Temperature Rise	3.5
Component Emissivity	0.92
Background Temperature	64

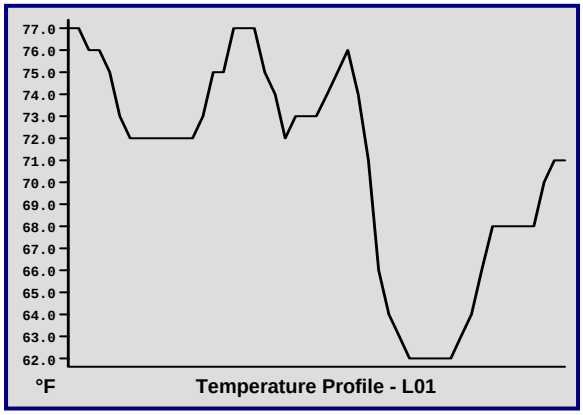
IR image file: nd chapel1.eif



Visible Image file: nd chapel1 VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	67.6 °F
S02	Windows	0.92	62.6 °F
S03	Windows	0.92	73.0 °F
S04	Trim	0.77	60.8 °F
S05	Wall	0.93	76.0 °F



Additional Finding Data	
Distance to finding(s)	124 ft
Airspeed @ finding area	3 mph
IR thermometer reading	67 deg f @ wall
Relative Humidity	61%
Outdoor air reading	64
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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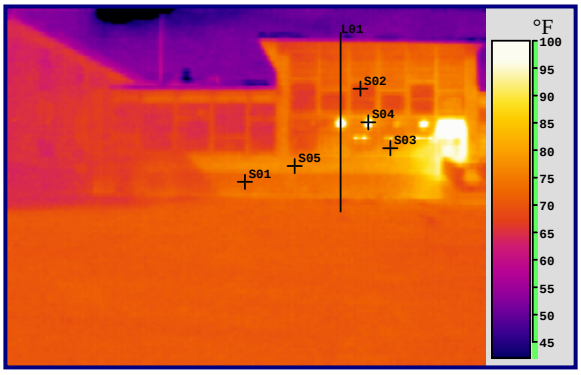
Incident Summary	
Location	Maintenance area
Equipment	Wall and windows
Incident Date	9/30/2009 10:35:07
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	72.7
Reference Temperature	68.9
Temperature Rise	4.6
Component Emissivity	0.92
Background Temperature	65

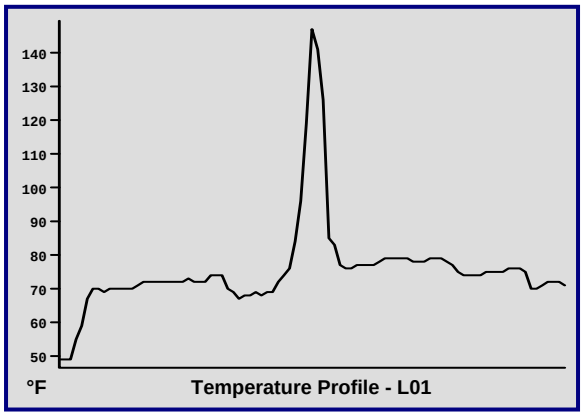
IR image file: opi4.eif



Visible Image file: opi4 VIS.JPG

Comment: -- No issues noted. Equipment reflectivity creating false image in view.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	72.7 °F
S02	Window	0.92	68.9 °F
S03	Window	0.92	78.5 °F
S04	Reflectivity no issue	0.92	103 °F
S05	Wall	0.93	77.2 °F



Additional Finding Data	
Distance to finding(s)	108 ft
Airspeed @ finding area	3 mph
IR thermometer reading	73 deg f @ wall
Relative Humidity	61%
Outdoor air reading	65
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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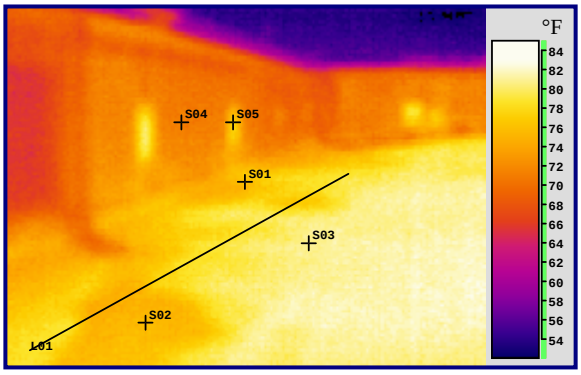
Incident Summary	
Location	Laundry/Kitchen areas
Equipment	Roof
Incident Date	9/30/2009 2:15:51 PM
Recommendation	Inspect
Severity	Low-Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	76.3
Reference Temperature	76.2
Temperature Rise	3.0
Component Emissivity	0.95
Background Temperature	61

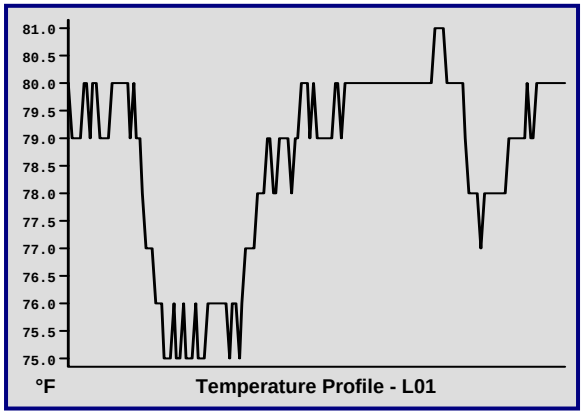
IR image file: ,Jn.eif



Visible Image file: ,Jn VIS.JPG

Comment: -- Inspect roofing seam areas for moisture infiltration.

Measurement Tool	Material	Emissivity	Temperature
S01	Inspection area	0.95	76.3 °F
S02	Inspection area	0.95	76.2 °F
S03	Roofing	0.95	82.0 °F
S04	Wall	0.95	71.8 °F
S05	Louver	0.77	80.7 °F



Additional Finding Data	
Distance to finding(s)	39 ft
Airspeed @ finding area	3 mph
IR thermometer reading	72 deg f @ wall
Relative Humidity	61%
Outdoor air reading	61
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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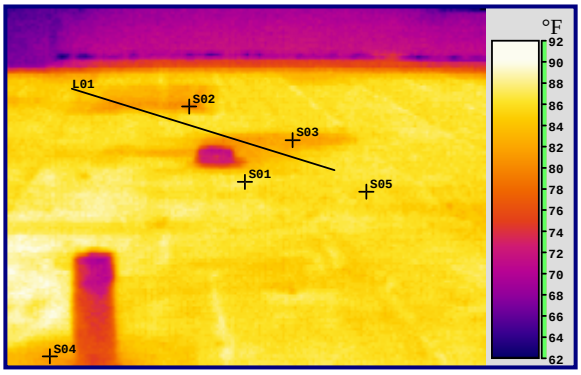
Incident Summary	
Location	Kitchen/Laundry area
Equipment	Roofing
Incident Date	9/30/2009 2:24:23 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	87.8
Reference Temperature	81.6
Temperature Rise	5.1
Component Emissivity	0.95
Background Temperature	60

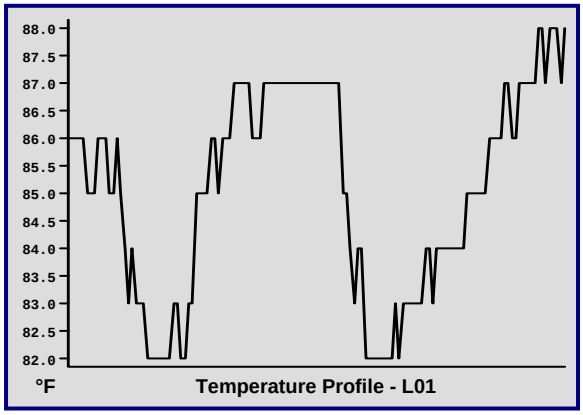
IR image file: opi ef 2.eif



Visible Image file: opi ef 2 VIS.JPG

Comment: -- Inspect roof areas at S02, S03 and S04 for potential moisture infiltration. Inspect roof seams are adequately sealed. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Roofing	0.95	87.8 °F
S02	Inspection area	0.95	81.6 °F
S03	Inspection area	0.95	83.2 °F
S04	Inspection area	0.95	82.8 °F
S05	Roofing	0.95	87.2 °F



Additional Finding Data	
Distance to finding(s)	16 ft
Airspeed @ finding area	3 mph
IR thermometer reading	87 deg f @ roof
Relative Humidity	61%
Outdoor air reading	60
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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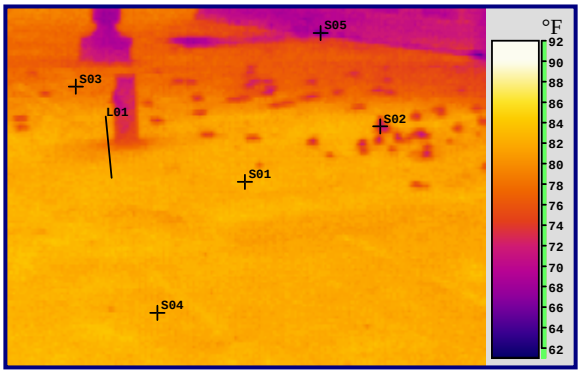
Incident Summary	
Location	Kitchen/Laundry area
Equipment	Roofing
Incident Date	9/30/2009 2:05:13 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	83.1
Reference Temperature	74.0
Temperature Rise	3.2
Component Emissivity	0.95
Background Temperature	62

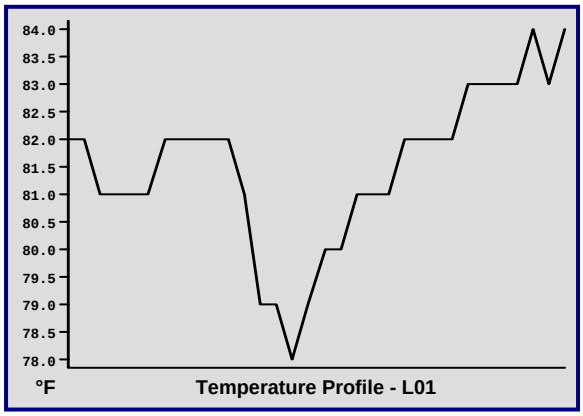
IR image file: opi kit 2.eif



Visible Image file: opi kit 2 VIS.JPG

Comment: -- Inspect S05 area for potential moisture. Repair if necessary.

Measurement Tool	Material	Emissivity	Temperature
S01	Roofing	0.95	83.1 °F
S02	Junk	0.95	74.0 °F
S03	Roofing	0.95	79.2 °F
S04	Roofing	0.95	83.0 °F
S05	Inspection area	0.95	68.5 °F



Additional Finding Data	
Distance to finding(s)	11 ft
Airspeed @ finding area	3 mph
IR thermometer reading	83 deg f @ roof
Relative Humidity	61%
Outdoor air reading	62
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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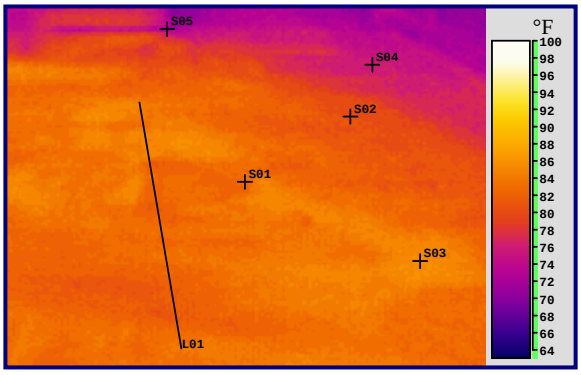
Incident Summary	
Location	Kitchen/Laundry area
Equipment	Roofing
Incident Date	9/30/2009 2:06:41 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	0.95

Inspection Detail	
Component Temperature	82.6
Reference Temperature	80.4
Temperature Rise	1.3
Component Emissivity	0.95
Background Temperature	62

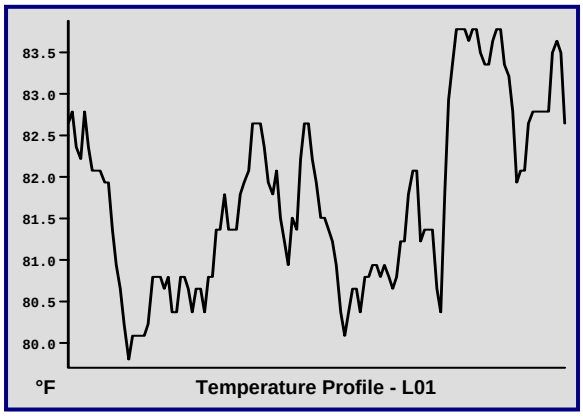
IR image file: opi kit 3.eif



Visible Image file: opi kit 3 VIS.JPG

Comment: -- Inspect S02 area for moisture. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Roofing	0.95	82.6 °F
S02	Roofing	0.95	80.4 °F
S03	Roofing	0.95	85.2 °F
S04	Roofing	0.95	75.7 °F
S05	Flashing	0.77	75.7 °F



Additional Finding Data	
Distance to finding(s)	8 ft
Airspeed @ finding area	3 mph
IR thermometer reading	85 deg f @ roof
Relative Humidity	61%
Outdoor air reading	62
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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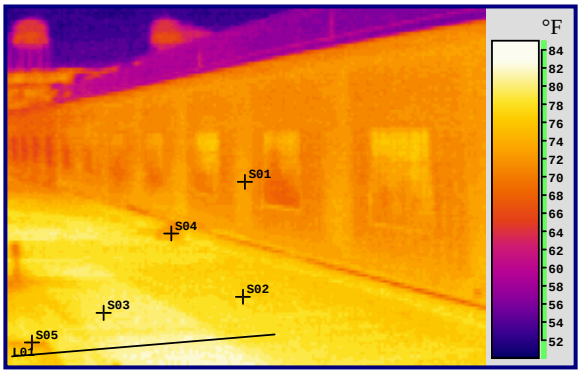
Incident Summary	
Location	Kitchen/Laundry area
Equipment	Roofing
Incident Date	9/30/2009 2:04:21 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	0.95

Inspection Detail	
Component Temperature	72.8
Reference Temperature	77.3
Temperature Rise	1.3
Component Emissivity	0.93
Background Temperature	63

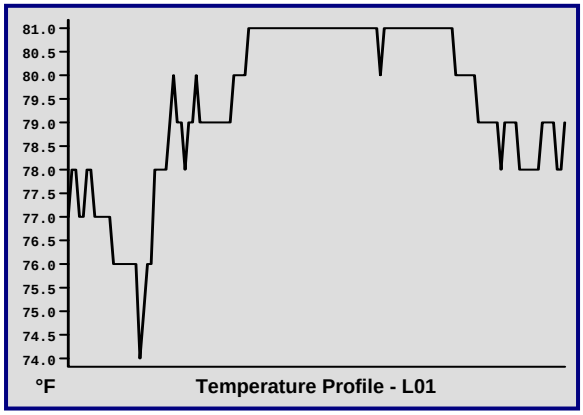
IR image file: opi kitkit1.eif



Visible Image file: opi kitkit1 VIS.JPG

Comment: -- Inspect S04 area for potential moisture. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	72.8 °F
S02	Roofing	0.95	77.3 °F
S03	Roofing	0.95	79.3 °F
S04	Inspection area	0.95	73.0 °F
S05	Roofing	0.95	74.7 °F



Additional Finding Data	
Distance to finding(s)	16 ft
Airspeed @ finding area	4 mph
IR thermometer reading	77 deg f @ roof
Relative Humidity	61%
Outdoor air reading	63
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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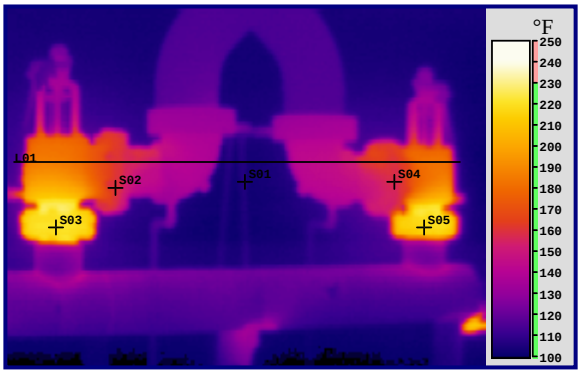
Incident Summary	
Location	D-W corridor
Equipment	Piping
Incident Date	9/30/2009 9:42:32 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	107
Reference Temperature	177
Temperature Rise	-14.6
Component Emissivity	0.92
Background Temperature	77

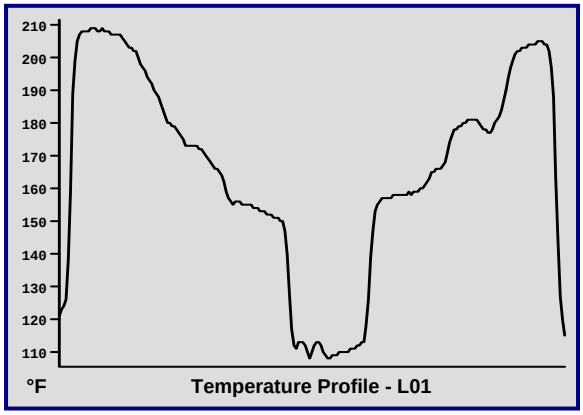
IR image file: corr at d-w.eif



Visible Image file: corr at d-w VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	107 °F
S02	Piping	0.80	177 °F
S03	Piping	0.80	249 °F
S04	Piping	0.80	174 °F
S05	Piping	0.80	245 °F



Additional Finding Data	
Distance to finding(s)	9 ft
Airspeed @ finding area	Calm
IR thermometer reading	107 deg f @ wall
Relative Humidity	53%
Space air reading	77
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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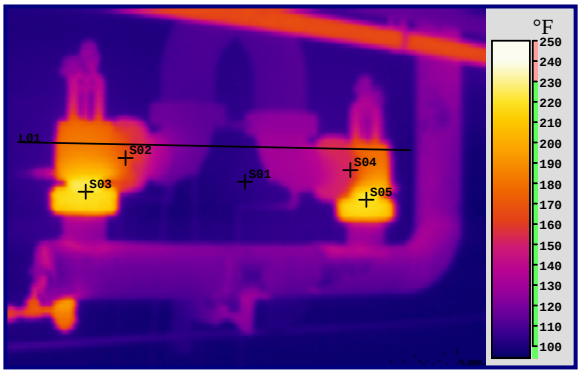
Incident Summary	
Location	D-W corridor
Equipment	Piping
Incident Date	9/30/2009 9:43:46 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	105
Reference Temperature	188
Temperature Rise	-12.4
Component Emissivity	0.92
Background Temperature	77

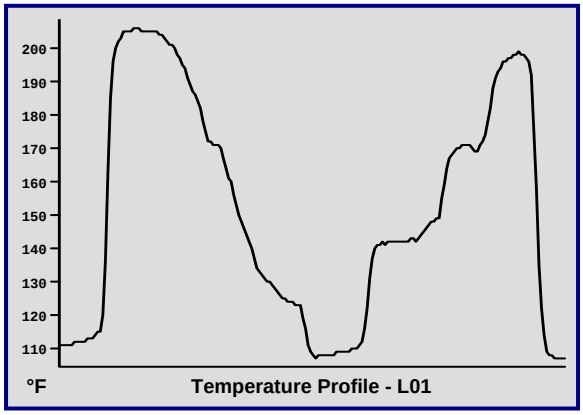
IR image file: corr at d-w2.eif



Visible Image file: corr at d-w2 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	105 °F
S02	Piping	0.80	188 °F
S03	Piping	0.80	248 °F
S04	Piping	0.80	172 °F
S05	Piping	0.80	248 °F



Additional Finding Data	
Distance to finding(s)	9 ft
Airspeed @ finding area	Calm
IR thermometer reading	105 deg f @ wall
Relative Humidity	53%
Space air reading	77
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
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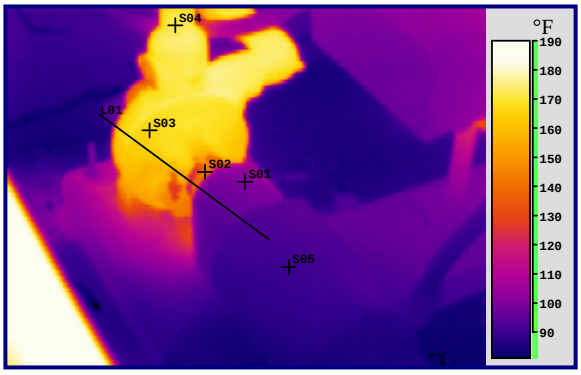
Incident Summary	
Location	Tunnel corridor
Equipment	Condensate pump
Incident Date	9/30/2009 9:20:40 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	102
Reference Temperature	140
Temperature Rise	-5.9
Component Emissivity	0.95
Background Temperature	65

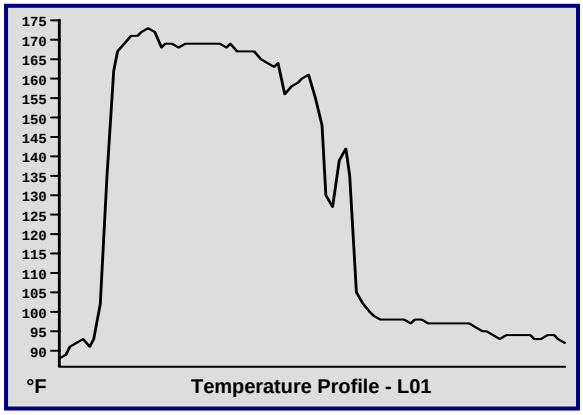
IR image file: I7 tunnel pump cond1.eif



Visible Image file: I7 tunnel pump cond1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Shroud	0.95	102 °F
S02	Coupling	0.95	140 °F
S03	Pump	0.95	170 °F
S04	Pump	0.95	177 °F
S05	Motor	0.95	91.0 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	65
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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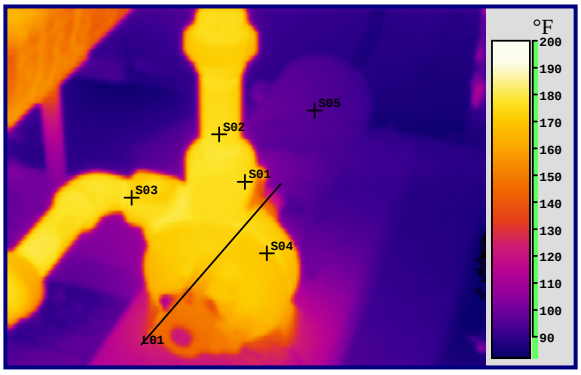
Incident Summary	
Location	Tunnel
Equipment	Condensate pump
Incident Date	9/30/2009 9:22:16 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	181
Reference Temperature	181
Temperature Rise	65.5
Component Emissivity	0.95
Background Temperature	66

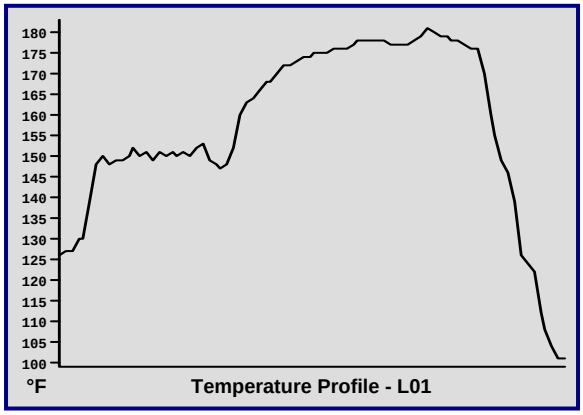
IR image file: l8 tunnel cond pump2.eif



Visible Image file: l8 tunnel cond pump2 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Pump	0.95	181 °F
S02	Piping	0.95	181 °F
S03	Piping	0.95	180 °F
S04	Pump	0.95	175 °F
S05	Motor	0.95	97.0 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	97 deg f @ mtr
Relative Humidity	53%
Space air reading	66
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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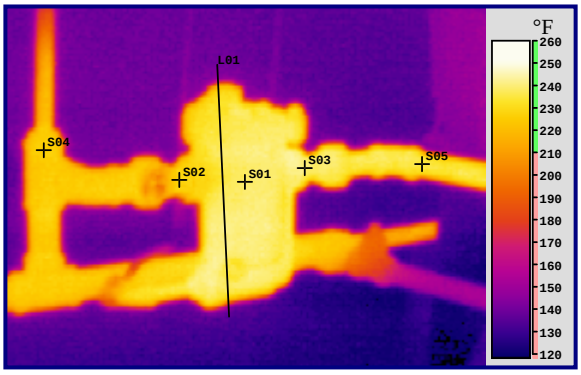
Incident Summary	
Location	Tunnel
Equipment	School unit trap
Incident Date	9/30/2009 9:16:58 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	273
Reference Temperature	259
Temperature Rise	108
Component Emissivity	0.80
Background Temperature	62

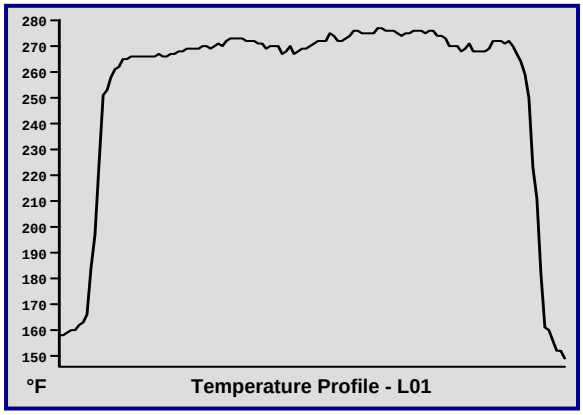
IR image file: l5 school trap1.eif



Visible Image file: l5 school trap1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	273 °F
S02	Trap	0.80	259 °F
S03	Trap	0.80	274 °F
S04	Piping	0.80	258 °F
S05	Piping	0.80	268 °F



Additional Finding Data	
Distance to finding(s)	3 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	62
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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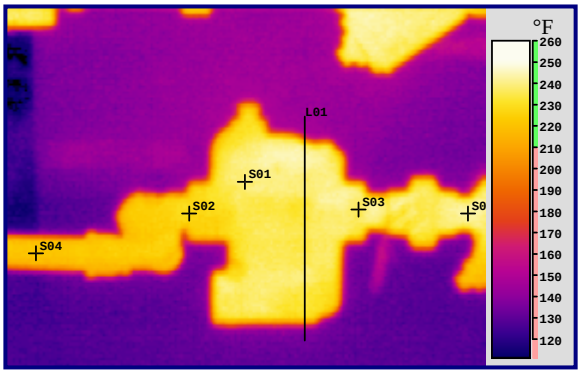
Incident Summary	
Location	Tunnel
Equipment	School unit trap
Incident Date	9/30/2009 9:17:41 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	274
Reference Temperature	260
Temperature Rise	108
Component Emissivity	0.80
Background Temperature	63

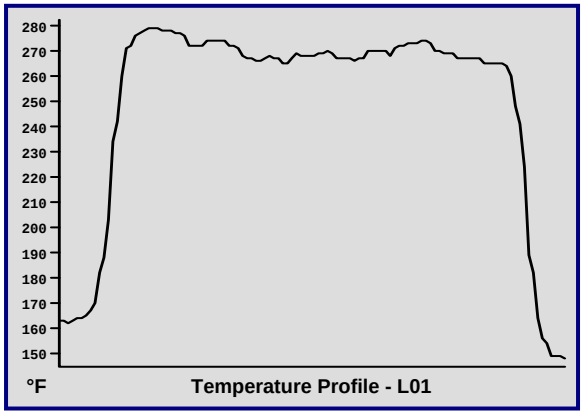
IR image file: l6 school trap2.eif



Visible Image file: l6 school trap2 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	274 °F
S02	Trap	0.80	260 °F
S03	Trap	0.80	271 °F
S04	Piping	0.80	252 °F
S05	Piping	0.80	277 °F



Additional Finding Data	
Distance to finding(s)	3 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	63
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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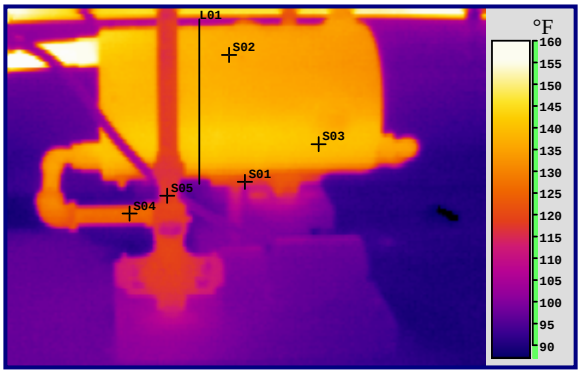
Incident Summary	
Location	Tunnel
Equipment	Condensate pump
Incident Date	9/30/2009 9:50:47 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	119
Reference Temperature	140
Temperature Rise	9.1
Component Emissivity	0.95
Background Temperature	80

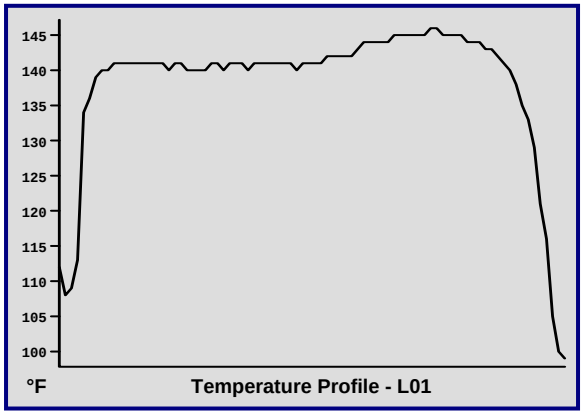
IR image file: tun cond pumpx.eif



Visible Image file: tun cond pumpx VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Base	0.95	119 °F
S02	Tank	0.95	140 °F
S03	Tank	0.95	143 °F
S04	Piping	0.80	136 °F
S05	Piping	0.80	126 °F



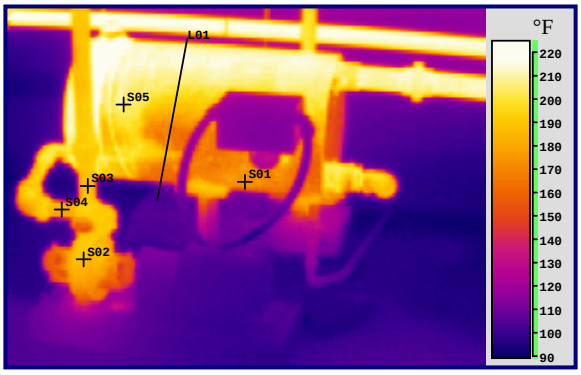
Additional Finding Data	
Distance to finding(s)	8 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	80
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, Ohio 45050
(513) 539 - 2978 Phone
(513) 539 – 2972 Fax
www.fseinc.net

Incident Summary	
Location	Nr. Transformer rm
Equipment	Condensate pump
Incident Date	9/30/2009 9:29:55 AM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	0.95

Inspection Detail	
Component Temperature	173
Reference Temperature	188
Temperature Rise	38.4
Component Emissivity	0.95
Background Temperature	70

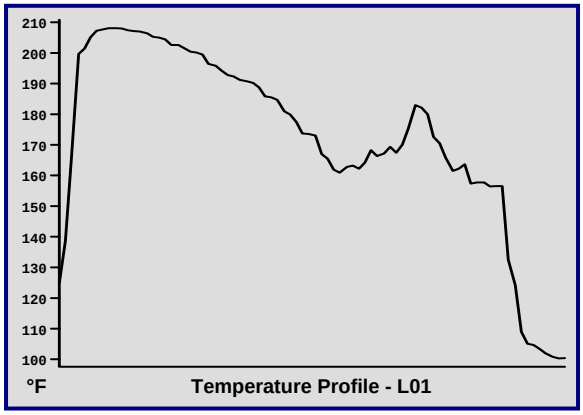
IR image file: l12 cond pump.eif



Visible Image file: l12 cond pump VIS.JPG

Comment: -- Inspect for moisture from pump and/or piping in area. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Tank	0.95	173 °F
S02	Pump	0.95	188 °F
S03	Piping	0.46	283 °F
S04	Piping	0.46	273 °F
S05	Tank	0.95	206 °F



Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	70
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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43 New Garver Road
Monroe, Ohio 45050
(513) 539 - 2978 Phone
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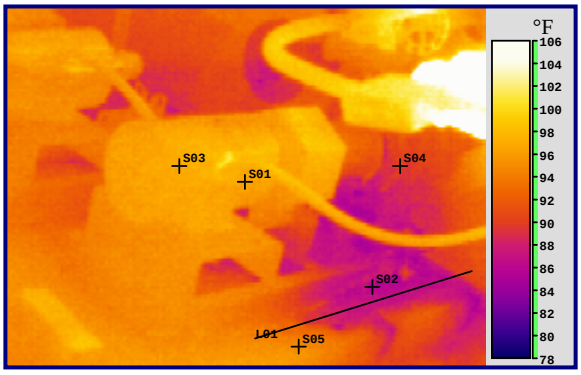
Incident Summary	
Location	Nr. Stairwell
Equipment	Condensate pump
Incident Date	9/30/2009 9:51:53 AM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	97.1
Reference Temperature	86.2
Temperature Rise	2.5
Component Emissivity	0.95
Background Temperature	81

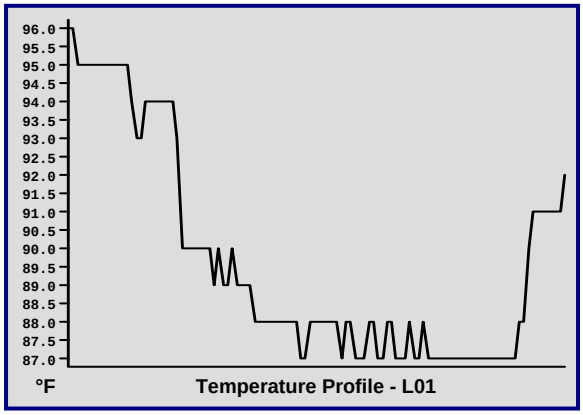
IR image file: tun pump rt side.eif



Visible Image file: tun pump rt side VIS.JPG

Comment: -- Inspect moisture from pump and piping in area. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Motor	0.95	97.1 °F
S02	Inspection area	0.92	86.2 °F
S03	Motor	0.95	98.0 °F
S04	Pump	0.95	90.5 °F
S05	Base	0.92	96.4 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	96 deg f @ base
Relative Humidity	53%
Space air reading	81
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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(513) 539 – 2972 Fax
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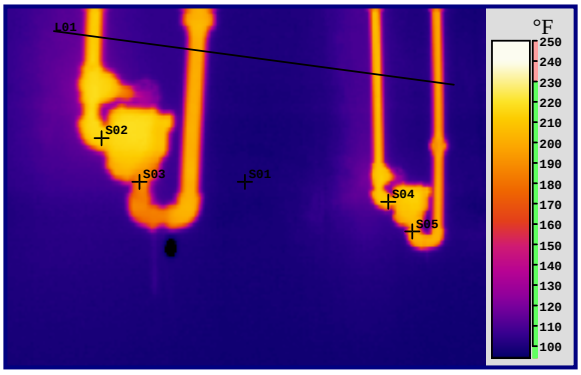
Incident Summary	
Location	Tunnel corridor
Equipment	Traps
Incident Date	9/30/2009 9:44:44 AM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	100
Reference Temperature	243
Temperature Rise	-13.4
Component Emissivity	0.92
Background Temperature	78

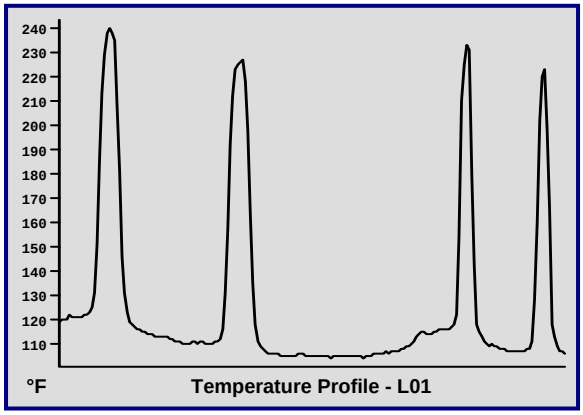
IR image file: tunnel corr leaking nr trap.eif



Visible Image file: tunnel corr leaking nr trap

Comment: -- Inspect and repair leaking trap at S03 / S03 area.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	100 °F
S02	Trap	0.80	243 °F
S03	Trap	0.80	211 °F
S04	Trap	0.80	230 °F
S05	Trap	0.80	222 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	100 deg f @ wall
Relative Humidity	53%
Space air reading	78
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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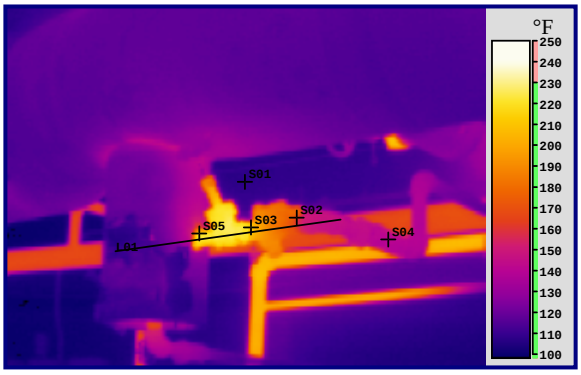
Incident Summary	
Location	Tunnel nr. Rm D
Equipment	Piping
Incident Date	9/30/2009 9:32:24 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	110
Reference Temperature	184
Temperature Rise	-13.0
Component Emissivity	0.92
Background Temperature	72

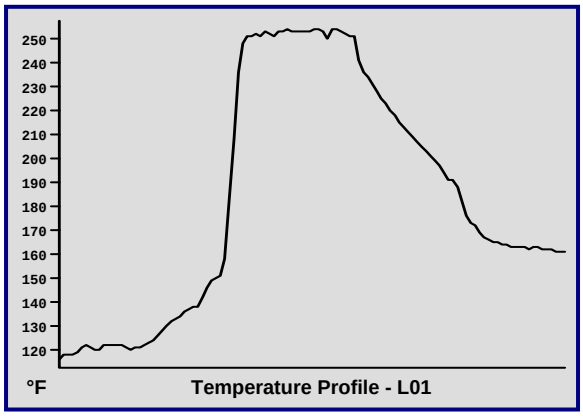
IR image file: at rm d corr lt.eif



Visible Image file: at rm d corr lt VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Deck	0.92	110 °F
S02	Trap	0.80	184 °F
S03	Trap	0.80	238 °F
S04	Piping	0.80	156 °F
S05	Piping	0.80	234 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	110 deg @ deck
Relative Humidity	53%
Space air reading	72
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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43 New Garver Road
Monroe, Ohio 45050
(513) 539 - 2978 Phone
(513) 539 – 2972 Fax
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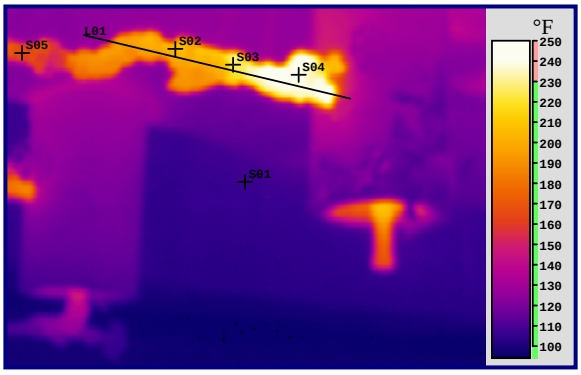
Incident Summary	
Location	Tunnel nr. Corr D
Equipment	Piping
Incident Date	9/30/2009 9:31:49 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	110
Reference Temperature	231
Temperature Rise	-11.1
Component Emissivity	0.92
Background Temperature	71

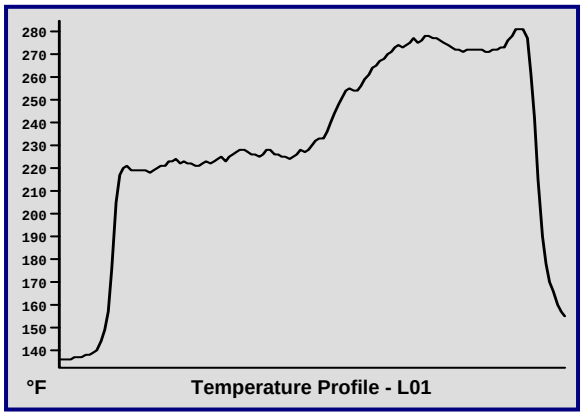
IR image file: at d corr.eif



Visible Image file: at d corr VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	110 °F
S02	Piping	0.80	231 °F
S03	Piping	0.80	254 °F
S04	Piping	0.80	273 °F
S05	Piping	0.80	184 °F



Additional Finding Data	
Distance to finding(s)	4 ft
Airspeed @ finding area	Calm
IR thermometer reading	110 deg f @ wall
Relative Humidity	53%
Space air reading	71
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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Monroe, Ohio 45050
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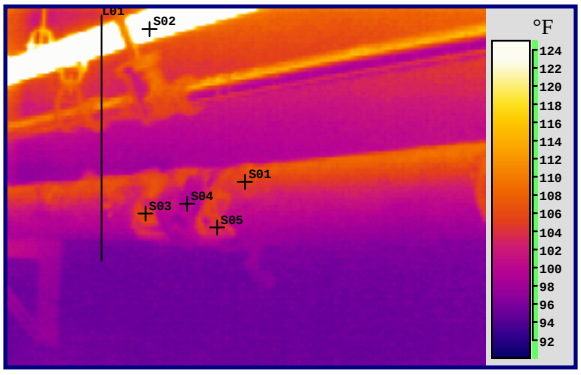
Incident Summary	
Location	Tunnel
Equipment	Piping in corridor
Incident Date	9/30/2009 9:14:37 AM
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	108
Reference Temperature	184
Temperature Rise	5.5
Component Emissivity	0.94
Background Temperature	60

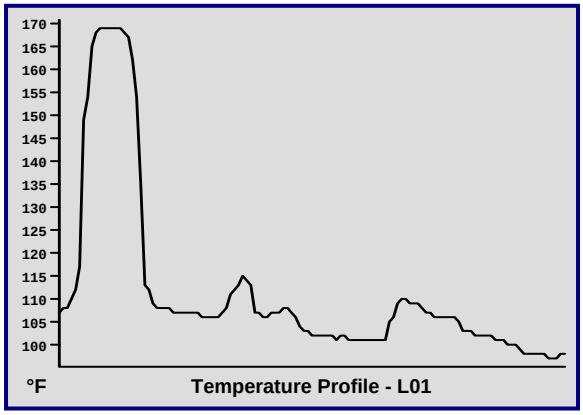
IR image file: I3 tunnel.eif



Visible Image file: I3 tunnel VIS.JPG

Comment: -- Repair or replace piping insulation throughout tunnel areas. Many areas of insulation damage and moisture infiltration present.

Measurement Tool	Material	Emissivity	Temperature
S01	Insulation	0.94	108 °F
S02	Piping	0.80	184 °F
S03	Insulation	0.94	108 °F
S04	Piping	0.80	108 °F
S05	Insulation	0.94	106 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	60
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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43 New Garver Road
Monroe, Ohio 45050
(513) 539 - 2978 Phone
(513) 539 – 2972 Fax
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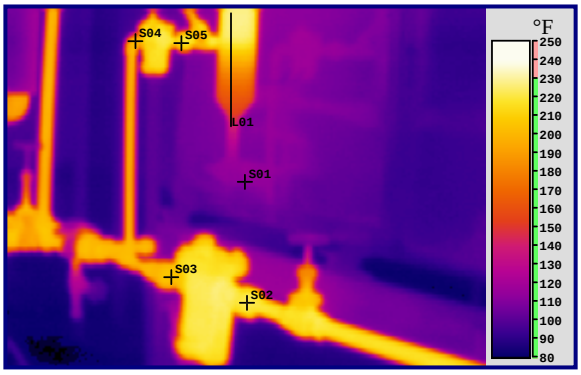
Incident Summary	
Location	Tunnel
Equipment	East traps
Incident Date	9/30/2009 10:15:08
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	114
Reference Temperature	250
Temperature Rise	-3.4
Component Emissivity	0.92
Background Temperature	83

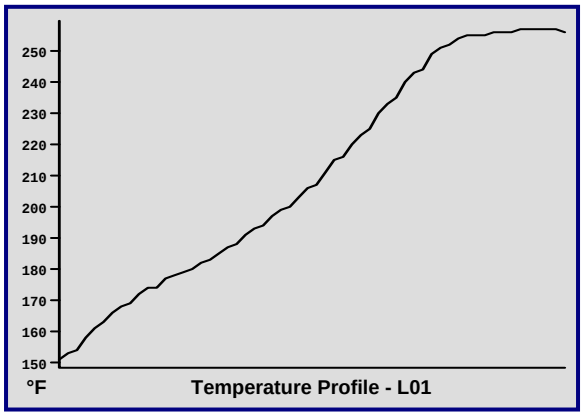
IR image file: east traps2.eif



Visible Image file: east traps2 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	114 °F
S02	Trap	0.80	250 °F
S03	Trap	0.80	229 °F
S04	Trap	0.80	215 °F
S05	Trap	0.80	239 °F



Additional Finding Data	
Distance to finding(s)	3 ft
Airspeed @ finding area	Calm
IR thermometer reading	114 deg f @ wall
Relative Humidity	53%
Space air reading	83
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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43 New Garver Road
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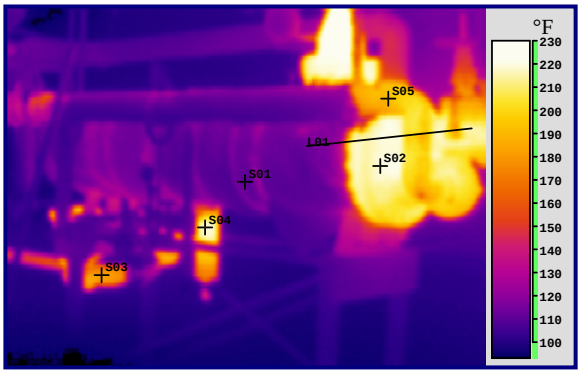
Incident Summary	
Location	Tunnel
Equipment	Heat exchanger
Incident Date	9/30/2009 9:48:51 AM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	112
Reference Temperature	247
Temperature Rise	-9.6
Component Emissivity	0.94
Background Temperature	80

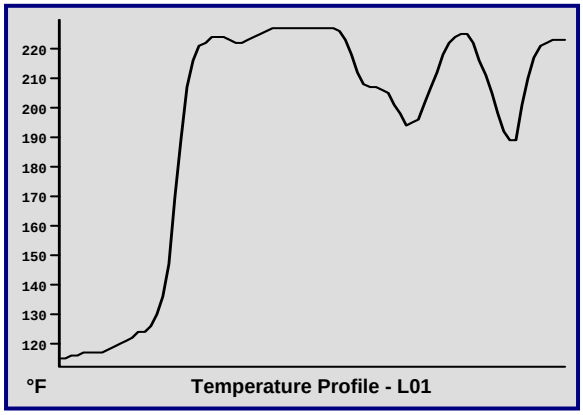
IR image file: htx tun.eif



Visible Image file: htx tun VIS.JPG

Comment: -- Repair or replace insulation at heat exchanger as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Insulation	0.94	112 °F
S02	Exchanger	0.80	247 °F
S03	Piping	0.80	201 °F
S04	Piping	0.80	245 °F
S05	Piping	0.80	215 °F



Additional Finding Data	
Distance to finding(s)	8 ft
Airspeed @ finding area	Calm
IR thermometer reading	112 deg @ insul
Relative Humidity	53%
Space air reading	80
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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Monroe, Ohio 45050
(513) 539 - 2978 Phone
(513) 539 – 2972 Fax
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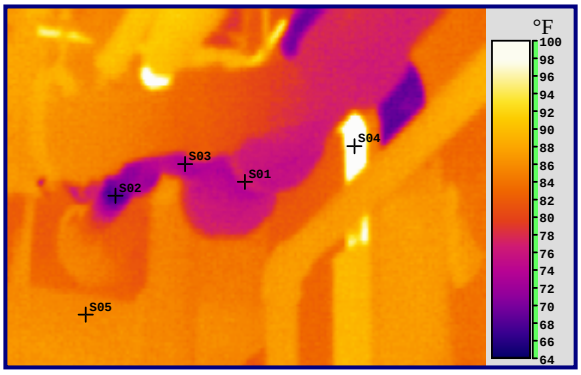
Incident Summary	
Location	L-M room
Equipment	Piping
Incident Date	9/30/2009 9:55:38 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	75.9
Reference Temperature	67.2
Temperature Rise	-7.9
Component Emissivity	0.94
Background Temperature	82

IR image file: tun rr piping lm.eif



Visible Image file: tun rr piping lm VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Piping	0.94	75.9 °F
S02	Piping	0.94	67.2 °F
S03	Piping	0.94	72.8 °F
S04	Piping	0.94	106 °F
S05	Wall	0.92	85.9 °F

Additional Finding Data	
Distance to finding(s)	8 ft
Airspeed @ finding area	Calm
IR thermometer reading	86 deg f @ wall
Relative Humidity	53%
Space air reading	82
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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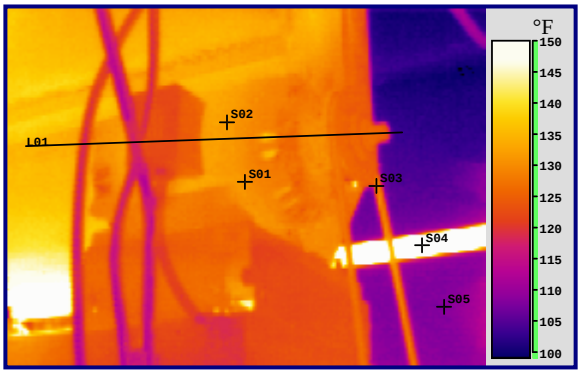
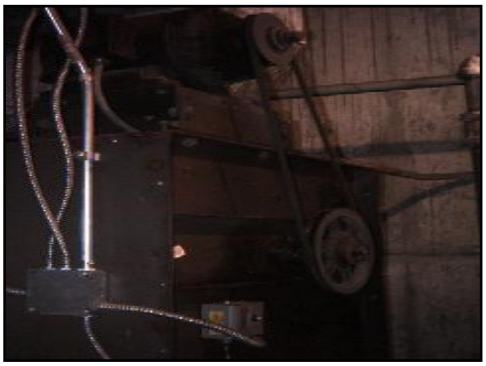
Incident Summary	
Location	Room D
Equipment	AHU motor
Incident Date	9/30/2009 9:34:47 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	133
Reference Temperature	135
Temperature Rise	8.9
Component Emissivity	0.95
Background Temperature	73

IR image file: rm d mtr ahu.eif

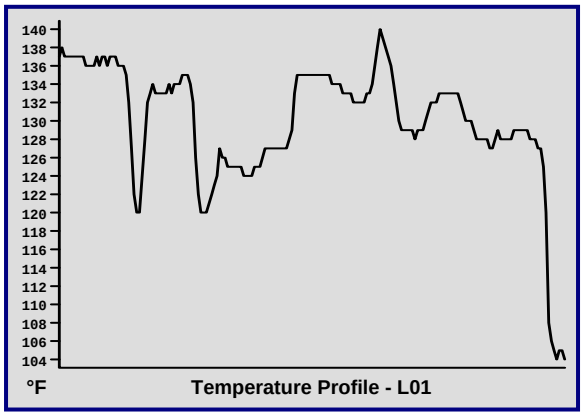


Visible Image file: rm d mtr ahu VIS.JPG



Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Motor	0.95	133 °F
S02	Motor	0.95	135 °F
S03	Belt	0.95	127 °F
S04	Piping	0.80	215 °F
S05	Wall	0.92	111 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	111 deg f @ wall
Relative Humidity	53%
Space air reading	73
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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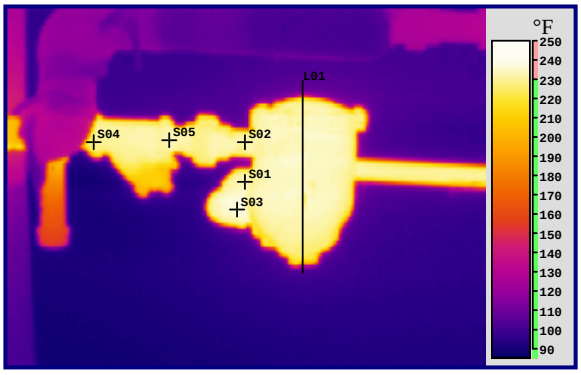
Incident Summary	
Location	Room D
Equipment	Trap
Incident Date	9/30/2009 9:36:46 AM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	0.80

Inspection Detail	
Component Temperature	233
Reference Temperature	232
Temperature Rise	110
Component Emissivity	0.80
Background Temperature	74

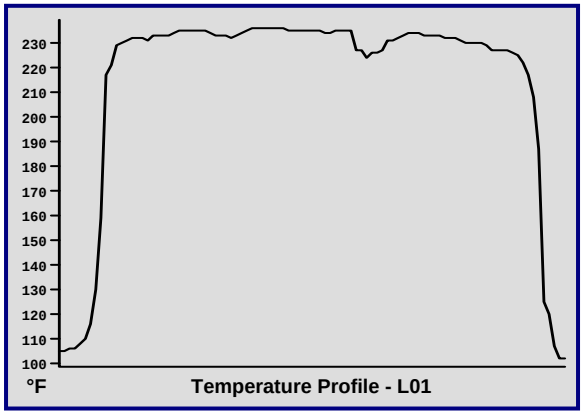
IR image file: other d trap.eif



Visible Image file: other d trap VIS.JPG

Comment: -- Inspect trap for failed condition. Repair or replace as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	233 °F
S02	Trap	0.80	232 °F
S03	Trap	0.80	237 °F
S04	Piping	0.80	228 °F
S05	Piping	0.80	234 °F



Additional Finding Data	
Distance to finding(s)	3 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	74
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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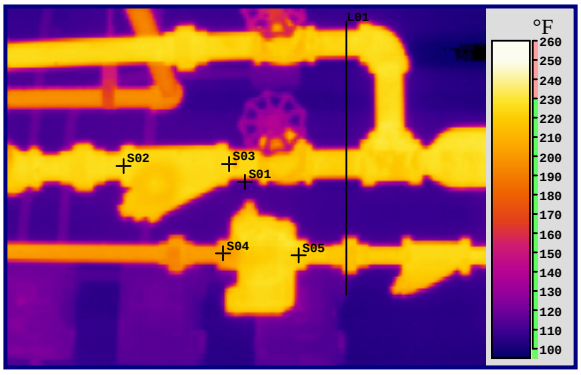
Incident Summary	
Location	Room D
Equipment	Trap and piping
Incident Date	9/30/2009 9:33:06 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	140
Reference Temperature	256
Temperature Rise	-7.1
Component Emissivity	0.92
Background Temperature	72

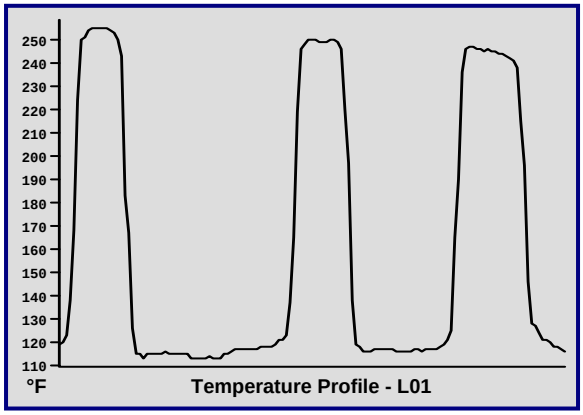
IR image file: rm d traps.eif



Visible Image file: rm d traps VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	140 °F
S02	Piping	0.80	256 °F
S03	Piping	0.80	253 °F
S04	Trap	0.80	228 °F
S05	Trap	0.80	250 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	114 deg f @ wall
Relative Humidity	53%
Space air reading	72
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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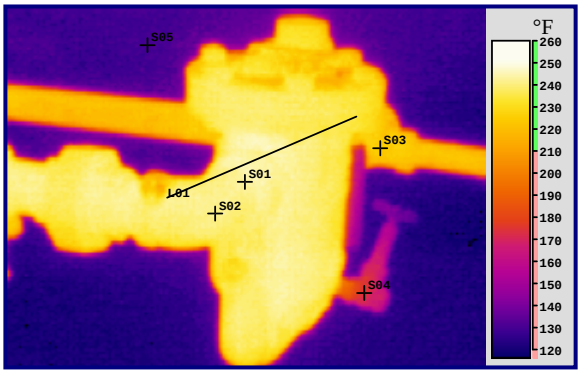
Incident Summary	
Location	Room D-W
Equipment	Trap
Incident Date	9/30/2009 9:40:50 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	276
Reference Temperature	274
Temperature Rise	102
Component Emissivity	0.80
Background Temperature	76

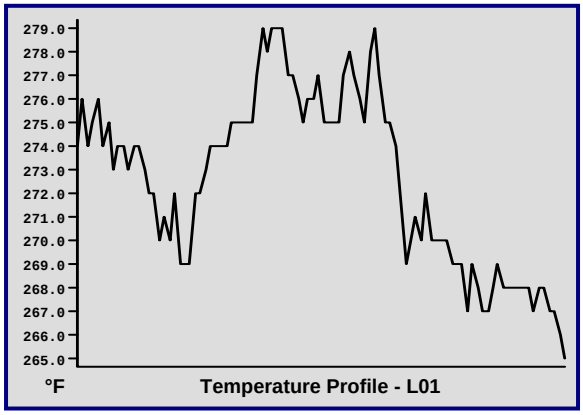
IR image file: d-w rm trap1.eif



Visible Image file: d-w rm trap1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	276 °F
S02	Trap	0.80	274 °F
S03	Trap	0.80	255 °F
S04	Piping	0.80	194 °F
S05	Wall	0.92	134 °F



Additional Finding Data	
Distance to finding(s)	3 ft
Airspeed @ finding area	Calm
IR thermometer reading	134 deg f @ wall
Relative Humidity	53%
Space air reading	76
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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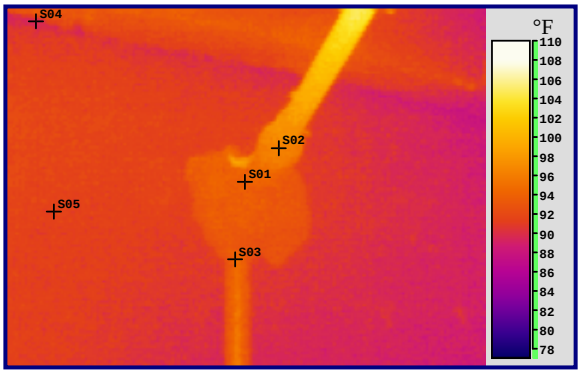
Incident Summary	
Location	Room D-W
Equipment	Trap
Incident Date	9/30/2009 9:41:41 AM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	98.0
Reference Temperature	101
Temperature Rise	6.8
Component Emissivity	0.80
Background Temperature	76

IR image file: d-w trap2.eif



Visible Image file: d-w trap2 VIS.JPG

Comment: -- Inspect for failed unit and repair or replace as required. Inspect deck to wall S04 seam for moisture infiltration from above.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	98.0 °F
S02	Piping	0.80	101 °F
S03	Piping	0.80	98.7 °F
S04	Inspection area	0.92	91.4 °F
S05	Wall	0.92	92.9 °F

Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	93 deg f @ wall
Relative Humidity	53%
Space air reading	76
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
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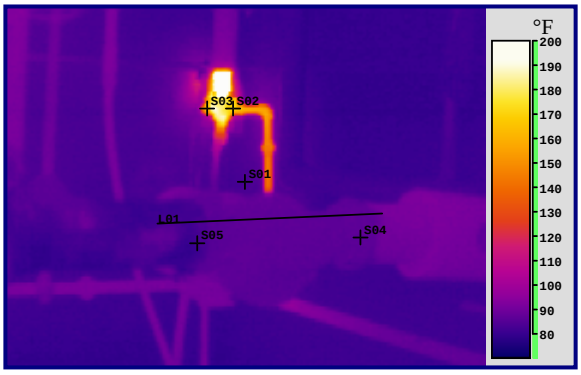
Incident Summary	
Location	HW for Library
Equipment	K-M pump piping
Incident Date	9/30/2009 9:56:48 AM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	83.0
Reference Temperature	184
Temperature Rise	-1.9
Component Emissivity	0.92
Background Temperature	82

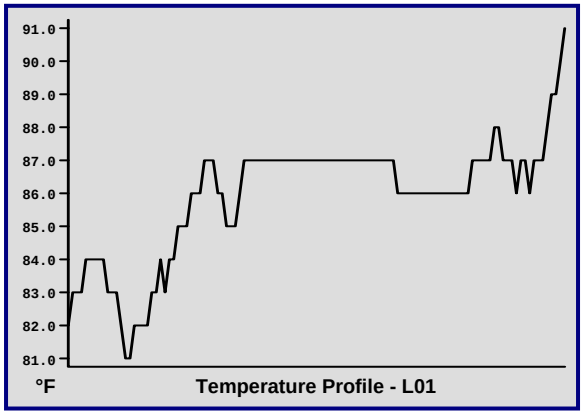
IR image file: km pump hw lib.eif



Visible Image file: km pump hw lib VIS.JPG

Comment: -- Inspect piping components for moisture issues and failure conditions. Repair or replace as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	83.0 °F
S02	Piping	0.80	184 °F
S03	Piping	0.80	178 °F
S04	Pump	0.95	86.3 °F
S05	Pump	0.95	81.5 °F



Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	82
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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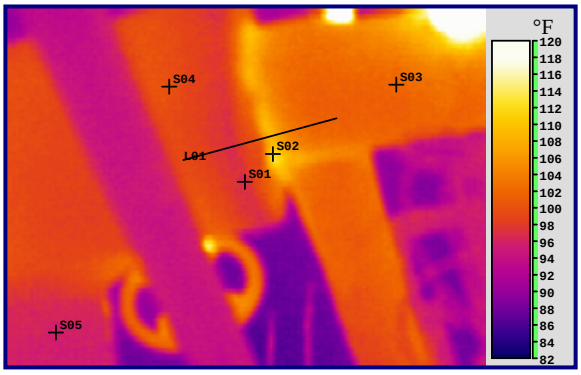
Incident Summary	
Location	Room L-M
Equipment	Piping
Incident Date	9/30/2009 10:00:28
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	98.1
Reference Temperature	113
Temperature Rise	-0.1
Component Emissivity	0.94
Background Temperature	82

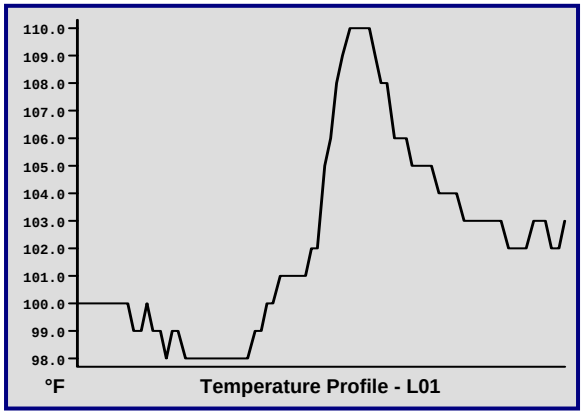
IR image file: lm hw piping.eif



Visible Image file: lm hw piping VIS.JPG

Comment: -- Inspect S02 area for moisture and/or inadequate insulation seal. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Insulation	0.94	98.1 °F
S02	Inspection area	0.94	113 °F
S03	Insulation	0.94	103 °F
S04	Insulation	0.94	101 °F
S05	Insulation	0.94	96.6 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	82
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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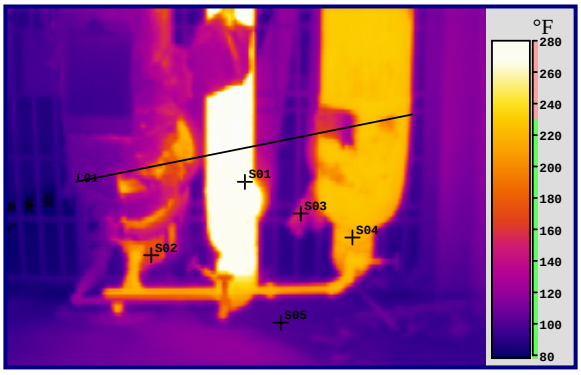
Incident Summary	
Location	Tunnel ramp
Equipment	Piping mains
Incident Date	9/30/2009 9:12:36 AM
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	287
Reference Temperature	184
Temperature Rise	152
Component Emissivity	0.94
Background Temperature	58

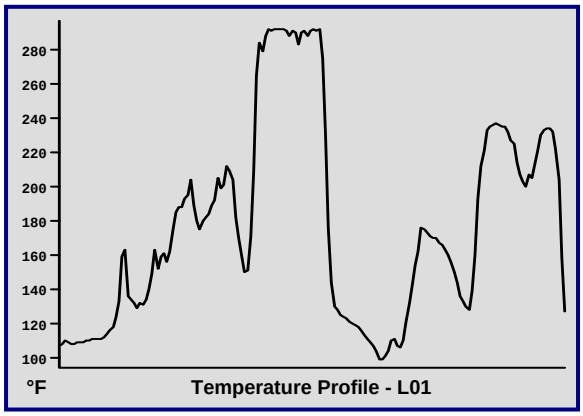
IR image file: l1tunnel.eif



Visible Image file: l1tunnel VIS.JPG

Comment: -- Repair steam leaks and moisture issues at piping risers. Replace damaged and moisture laden insulation on piping as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Inspection area	0.94	287 °F
S02	Inspection area	0.80	184 °F
S03	Piping	0.80	162 °F
S04	Inspection area	0.80	250 °F
S05	Inspection area	0.92	103 °F



Additional Finding Data	
Distance to finding(s)	8 ft
Airspeed @ finding area	Calm
IR thermometer reading	103 deg @ floor
Relative Humidity	53%
Space air reading	58
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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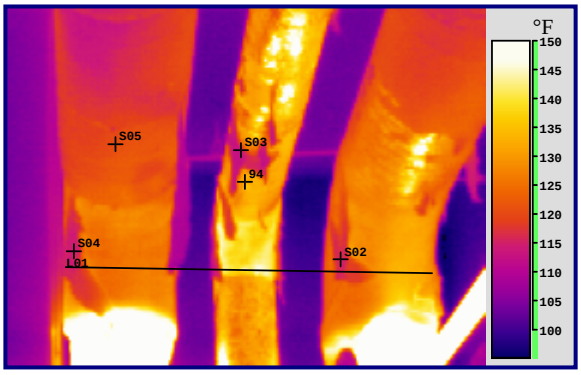
Incident Summary	
Location	Tunnel ramp
Equipment	Piping mains
Incident Date	9/30/2009 9:13:59 AM
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	136
Reference Temperature	119
Temperature Rise	13.1
Component Emissivity	0.94
Background Temperature	59

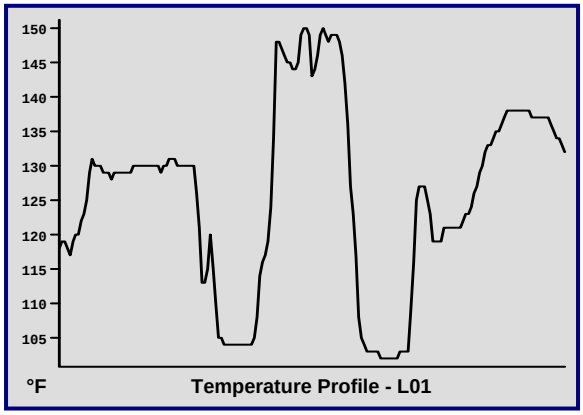
IR image file: I2 tunnel.eif



Visible Image file: I2 tunnel VIS.JPG

Comment: -- Repair steam leaks and moisture issues at piping risers. Replace damaged and moisture laden insulation on piping as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Insulation	0.94	136 °F
S02	Inspection area	0.94	119 °F
S03	Inspection area	0.94	119 °F
S04	Inspection area	0.94	118 °F
S05	Insulation	0.94	124 °F



Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	59
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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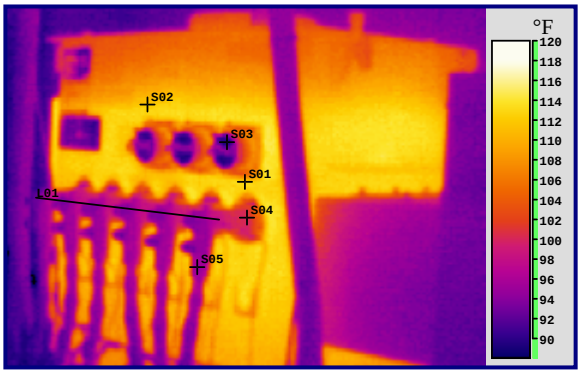
Incident Summary	
Location	Transformer room
Equipment	Elect. station
Incident Date	9/30/2009 9:25:14 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	114
Reference Temperature	114
Temperature Rise	12.3
Component Emissivity	0.95
Background Temperature	68

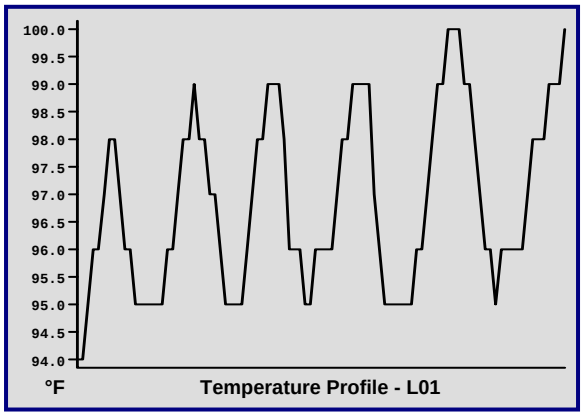
IR image file: l9 trans1.eif



Visible Image file: l9 trans1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Housing	0.95	114 °F
S02	Housing	0.95	114 °F
S03	Component	0.88	93.8 °F
S04	Lead	0.77	110 °F
S05	Lead	0.95	96.8 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	68
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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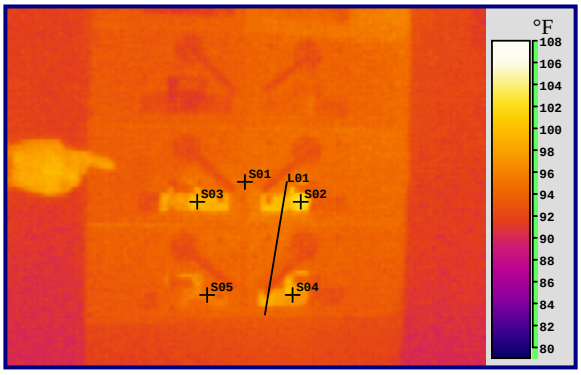
Incident Summary	
Location	Transformer room
Equipment	Switch panel
Incident Date	9/30/2009 9:28:28 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	94.7
Reference Temperature	104
Temperature Rise	1.5
Component Emissivity	1.00
Background Temperature	69

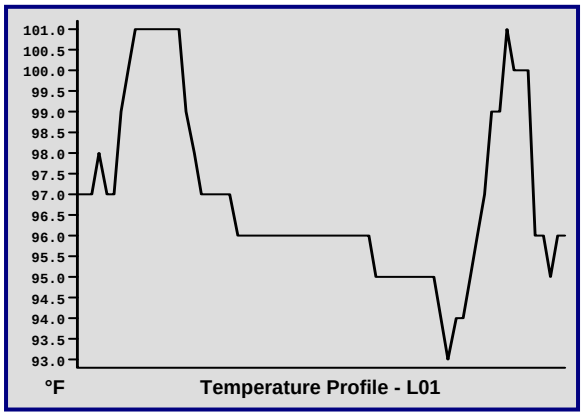
IR image file: l11 panelboard.eif



Visible Image file: l11 panelboard VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Housing	1.00	94.7 °F
S02	Switch	0.95	104 °F
S03	Switch	0.95	102 °F
S04	Switch	0.95	99.3 °F
S05	Switch	0.95	96.6 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	69
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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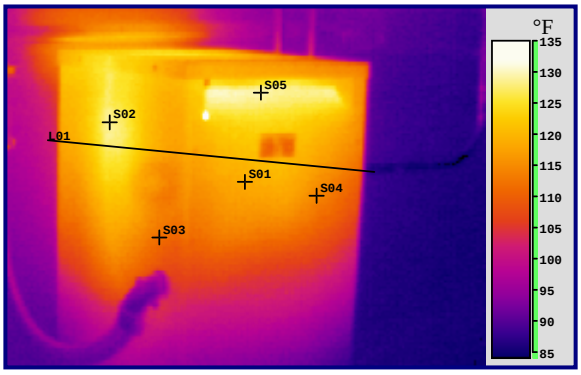
Incident Summary	
Location	Transforner room
Equipment	Transformer
Incident Date	9/30/2009 9:26:46 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	121
Reference Temperature	131
Temperature Rise	17.9
Component Emissivity	0.95
Background Temperature	69

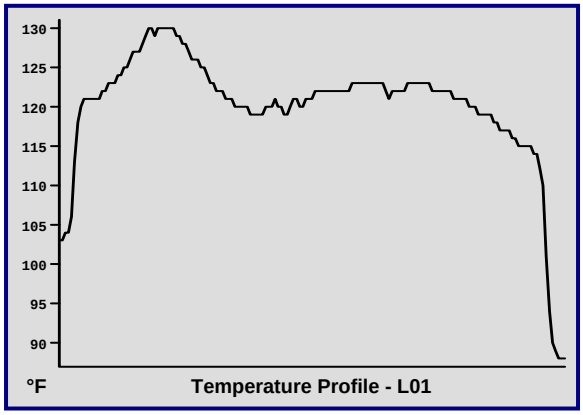
IR image file: l10 trans.eif



Visible Image file: l10 trans VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Housing	0.95	121 °F
S02	Housing	0.95	131 °F
S03	Housing	0.95	114 °F
S04	Housing	0.95	116 °F
S05	Opening	0.95	132 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	69
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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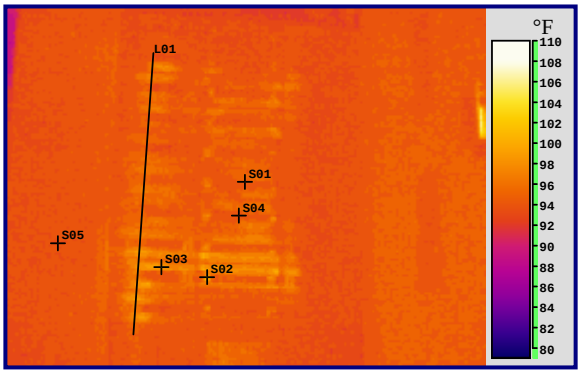
Incident Summary	
Location	Transformer room
Equipment	W-AST panel
Incident Date	9/30/2009 10:16:24
Recommendation	None
Severity	None
Units	°F
Global Emissivity	0.95

Inspection Detail	
Component Temperature	94.4
Reference Temperature	97.6
Temperature Rise	0.1
Component Emissivity	0.95
Background Temperature	83

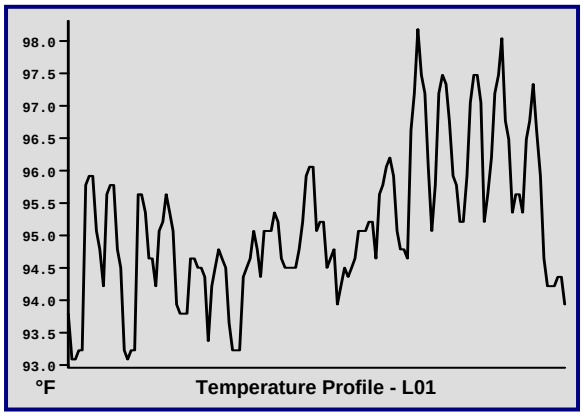
IR image file: wast pnl.eif



Visible Image file: wast pnl VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Breaker	0.95	94.4 °F
S02	Breaker	0.95	97.6 °F
S03	Breaker	0.95	97.3 °F
S04	Breaker	0.95	94.2 °F
S05	Housing	0.95	93.7 °F



Additional Finding Data	
Distance to finding(s)	4 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	83
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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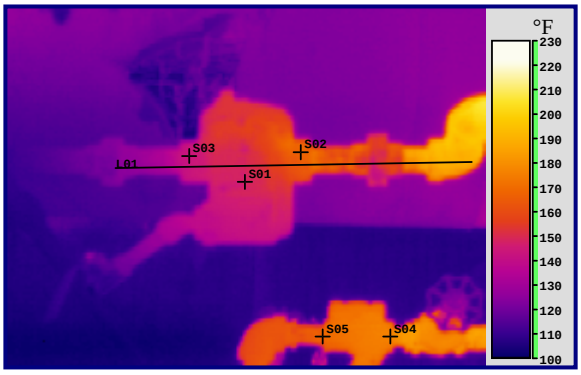
Incident Summary	
Location	Room D tunnel
Equipment	Corridor trap
Incident Date	9/30/2009 9:30:47 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	164
Reference Temperature	187
Temperature Rise	40.1
Component Emissivity	0.80
Background Temperature	71

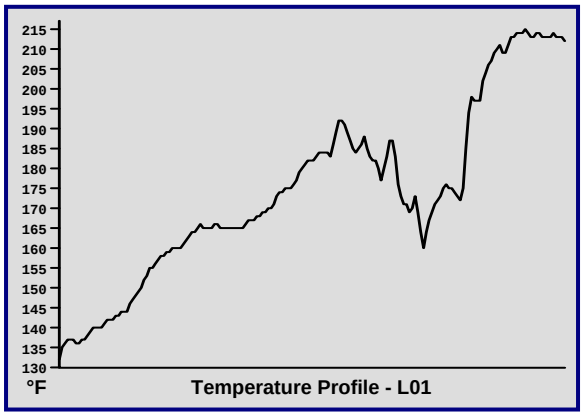
IR image file: at rm d corr trap1.eif



Visible Image file: at rm d corr trap1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	164 °F
S02	Trap	0.80	187 °F
S03	Trap	0.80	159 °F
S04	Piping	0.80	198 °F
S05	Piping	0.80	188 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	71
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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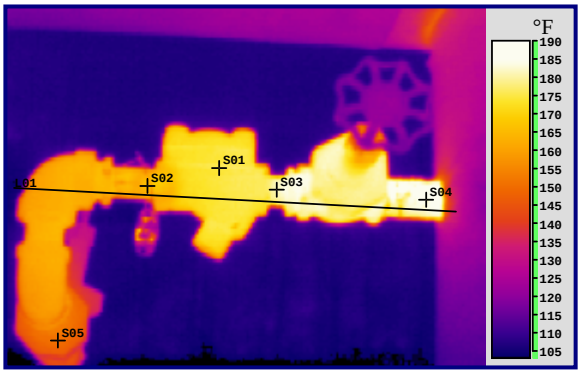
Incident Summary	
Location	Room D tunnel
Equipment	Corridor trap
Incident Date	9/30/2009 9:31:16 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	197
Reference Temperature	184
Temperature Rise	73.1
Component Emissivity	0.80
Background Temperature	71

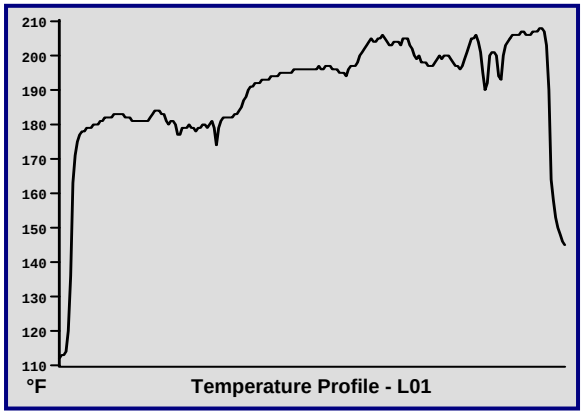
IR image file: at corr rm d trap2.eif



Visible Image file: at corr rm d trap2 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	197 °F
S02	Trap	0.80	184 °F
S03	Trap	0.80	204 °F
S04	Piping	0.80	208 °F
S05	Piping	0.80	167 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	71
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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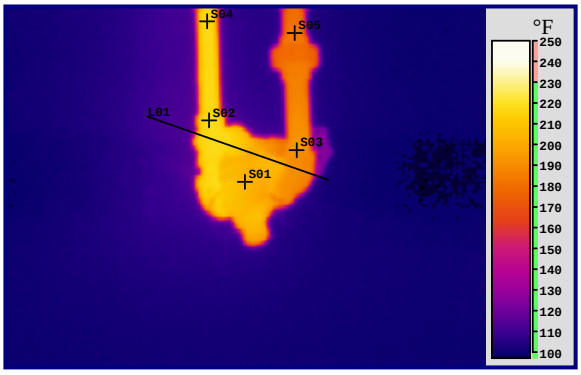
Incident Summary	
Location	Tunnel @ gate 1
Equipment	Trap
Incident Date	9/30/2009 9:45:45 AM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	231
Reference Temperature	245
Temperature Rise	119
Component Emissivity	0.80
Background Temperature	78

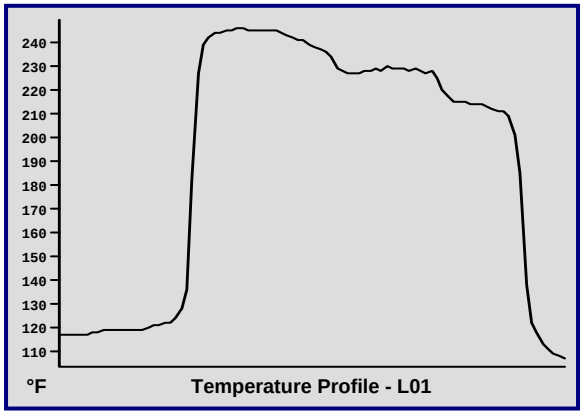
IR image file: tun trap at gate1.eif



Visible Image file: tun trap at gate1 VIS.JPG

Comment: -- Inspect leaking trap and repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	231 °F
S02	Trap	0.80	245 °F
S03	Trap	0.80	216 °F
S04	Piping	0.80	245 °F
S05	Piping	0.80	205 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	78
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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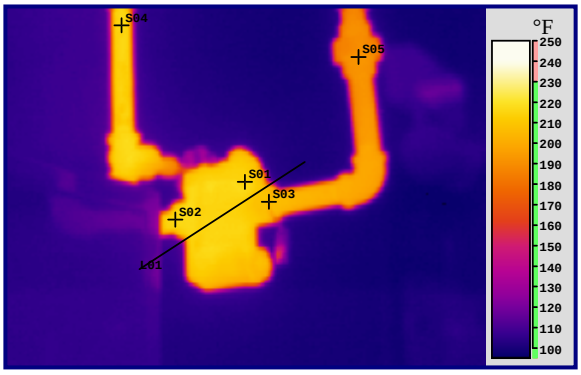
Incident Summary	
Location	Tunnel @ gate 2
Equipment	Trap
Incident Date	9/30/2009 9:46:56 AM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	242
Reference Temperature	243
Temperature Rise	124
Component Emissivity	0.80
Background Temperature	79

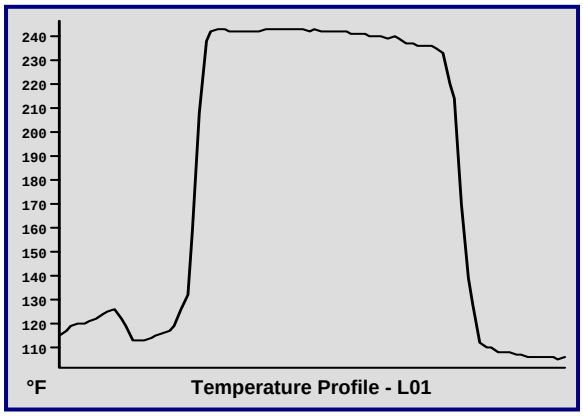
IR image file: tun trap at gate 2.eif



Visible Image file: tun trap at gate 2 VIS.JPG

Comment: -- Inspect and repair leaking trap as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	242 °F
S02	Trap	0.80	243 °F
S03	Trap	0.80	231 °F
S04	Piping	0.80	243 °F
S05	Piping	0.80	215 °F



Additional Finding Data	
Distance to finding(s)	5 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	79
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

MAX 78

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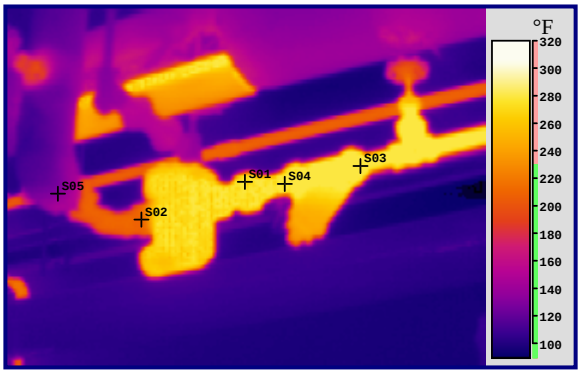
Incident Summary	
Location	Tunnel nr. Stairs
Equipment	Trap and piping
Incident Date	9/30/2009 9:52:49 AM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	313
Reference Temperature	240
Temperature Rise	172
Component Emissivity	0.80
Background Temperature	81

IR image file: trap by stair.eif



Visible Image file: trap by stair VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	313 °F
S02	Trap	0.80	240 °F
S03	Piping	0.80	319 °F
S04	Piping	0.80	317 °F
S05	Insulation	0.94	136 °F

Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	81
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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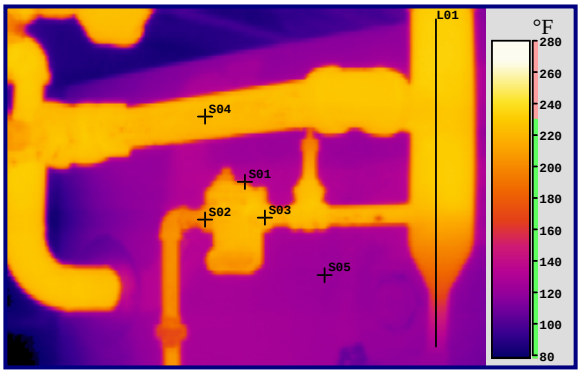
Incident Summary	
Location	Gym west mezz.
Equipment	Trap
Incident Date	9/30/2009 10:09:34
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	184
Reference Temperature	227
Temperature Rise	28.7
Component Emissivity	0.80
Background Temperature	83

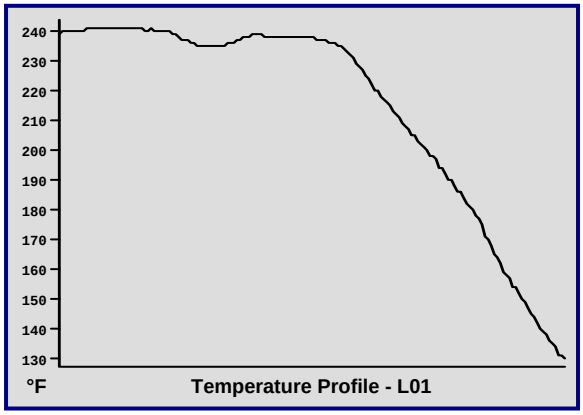
IR image file: west trap1 ahu.eif



Visible Image file: west trap1 ahu VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	184 °F
S02	Trap	0.80	227 °F
S03	Trap	0.80	248 °F
S04	Piping	0.94	228 °F
S05	Unit	0.92	125 °F



Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	125 deg f @ unit
Relative Humidity	53%
Space air reading	83
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

MAX 80

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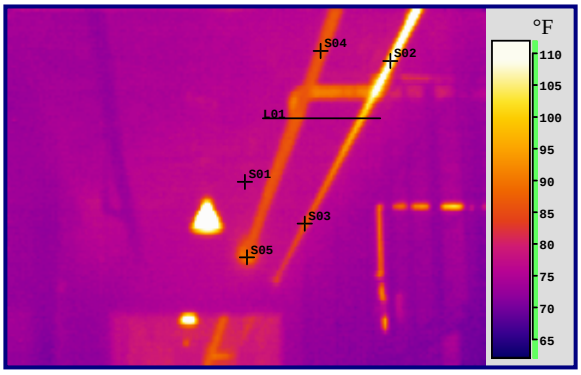
Incident Summary	
Location	Maint. corridor
Equipment	Piping
Incident Date	9/30/2009 10:51:41
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	78.2
Reference Temperature	118
Temperature Rise	2.4
Component Emissivity	0.92
Background Temperature	62

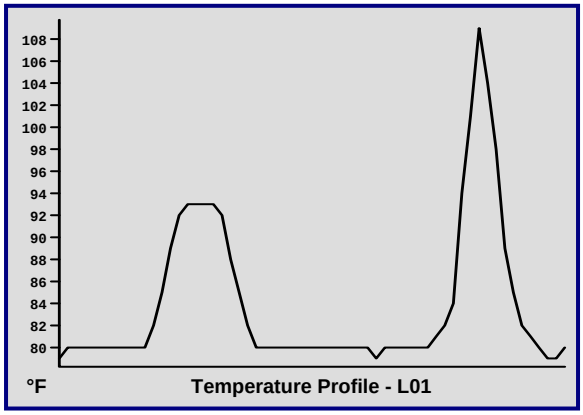
IR image file: maint corr.eif



Visible Image file: maint corr VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Deck	0.92	78.2 °F
S02	Piping	0.80	118 °F
S03	Piping	0.80	89.3 °F
S04	Piping	0.80	91.0 °F
S05	Piping	0.80	94.9 °F



Additional Finding Data	
Distance to finding(s)	29 ft
Airspeed @ finding area	Calm
IR thermometer reading	78 deg f @ deck
Relative Humidity	53%
Space air reading	62
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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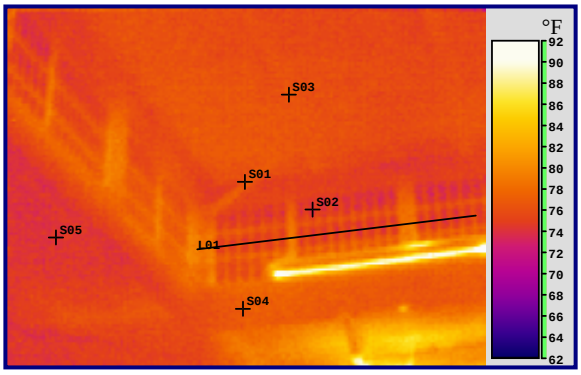
Incident Summary	
Location	Carpenter Shop
Equipment	Wall and windows
Incident Date	9/30/2009 10:54:31
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	76.5
Reference Temperature	75.4
Temperature Rise	0.0
Component Emissivity	1.00
Background Temperature	62

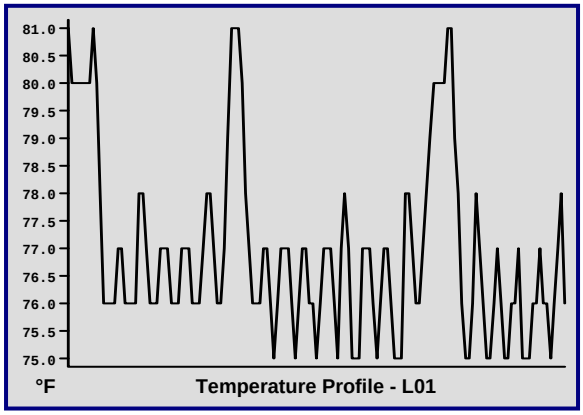
IR image file: shop winds.eif



Visible Image file: shop winds VIS.JPG

Comment: -- No issues noted. Acceptable conditions present @ this wall area.

Measurement Tool	Material	Emissivity	Temperature
S01	Bracing	0.92	76.5 °F
S02	Window	0.92	75.4 °F
S03	Roof deck	0.93	77.8 °F
S04	Roof deck	0.88	78.7 °F
S05	Roof deck	0.88	76.0 °F



Additional Finding Data	
Distance to finding(s)	52 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	62
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

MAX 82

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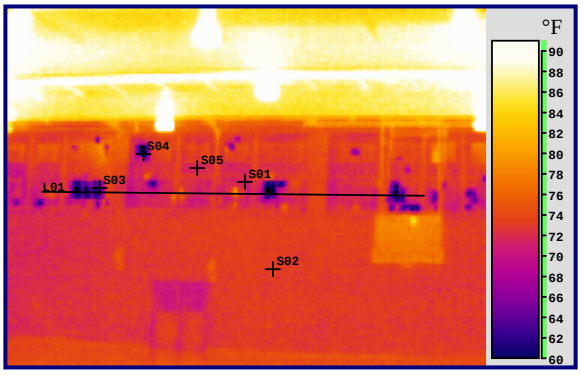
Incident Summary	
Location	Gym interior
Equipment	Wall and windows
Incident Date	9/30/2009 11:07:37
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	72.1
Reference Temperature	74.0
Temperature Rise	-6.4
Component Emissivity	0.92
Background Temperature	63

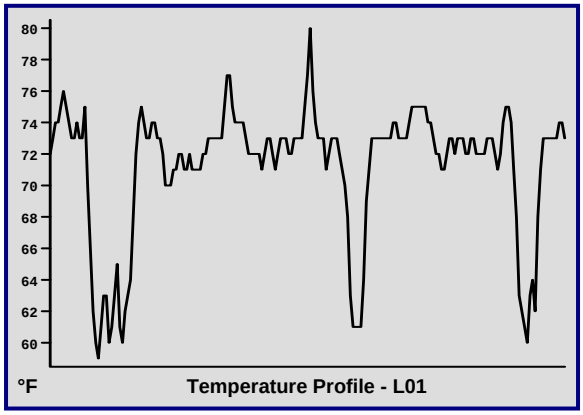
IR image file: gym1.eif



Visible Image file: gym1 VIS.JPG

Comment: -- Inspect window panes for damage as indicated in dark S03 & S04 type areas. Repair or replace as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	72.1 °F
S02	Wall	0.93	74.0 °F
S03	Window	0.92	64.1 °F
S04	Window	0.92	63.2 °F
S05	Window	0.92	72.3 °F



Additional Finding Data	
Distance to finding(s)	70 ft
Airspeed @ finding area	Calm
IR thermometer reading	74 deg f @ wall
Relative Humidity	53%
Space air reading	63
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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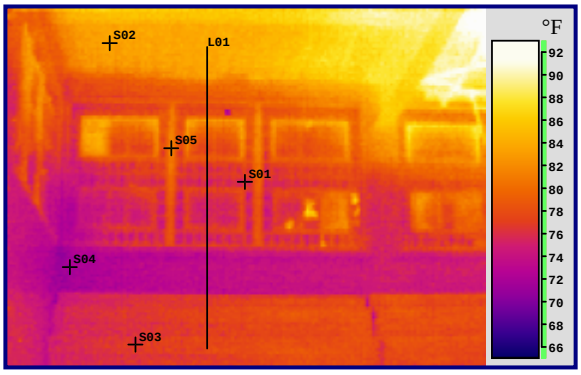
Incident Summary	
Location	Gym interior
Equipment	Wall and windows
Incident Date	9/30/2009 11:08:04
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	77.2
Reference Temperature	85.2
Temperature Rise	-1.8
Component Emissivity	0.92
Background Temperature	63

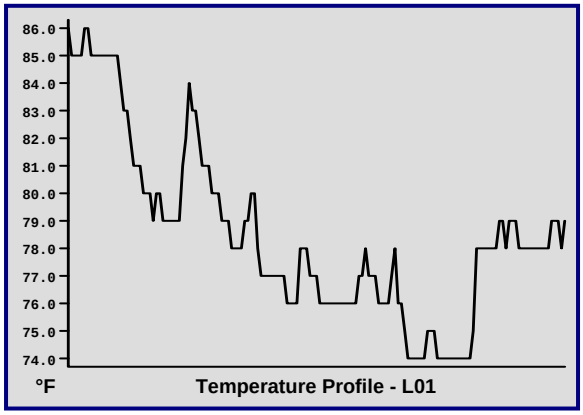
IR image file: gym2.eif



Visible Image file: gym2 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	77.2 °F
S02	Roof deck	0.91	85.2 °F
S03	Bleachers	0.93	77.7 °F
S04	Wall	0.92	72.4 °F
S05	Framing	0.77	85.5 °F



Additional Finding Data	
Distance to finding(s)	68 ft
Airspeed @ finding area	Calm
IR thermometer reading	72 deg f @ wall
Relative Humidity	53%
Space air reading	63
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
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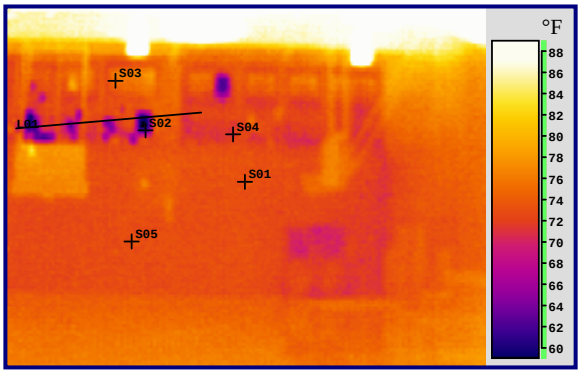
Incident Summary	
Location	Gym interior
Equipment	Wall and windows
Incident Date	9/30/2009 11:08:41
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	74.0
Reference Temperature	63.2
Temperature Rise	-2.1
Component Emissivity	0.93
Background Temperature	63

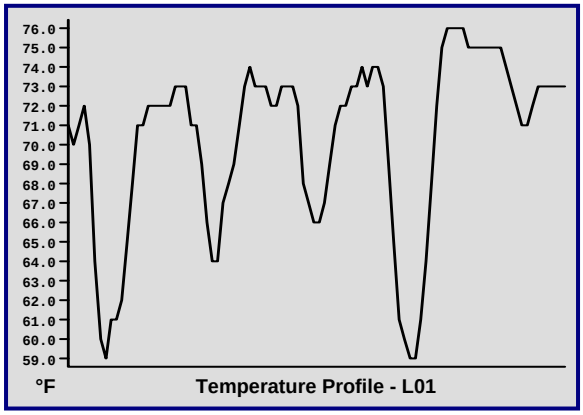
IR image file: gym3.eif



Visible Image file: gym3 VIS.JPG

Comment: -- Inspect window panes for damage as indicated in dark S02 type areas. Repair or replace as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	74.0 °F
S02	Inspection area	0.92	63.2 °F
S03	Windows	0.92	76.2 °F
S04	Windows	0.92	72.2 °F
S05	Wall	0.93	73.7 °F



Additional Finding Data	
Distance to finding(s)	74 ft
Airspeed @ finding area	Calm
IR thermometer reading	74 deg f @ wall
Relative Humidity	53%
Space air reading	63
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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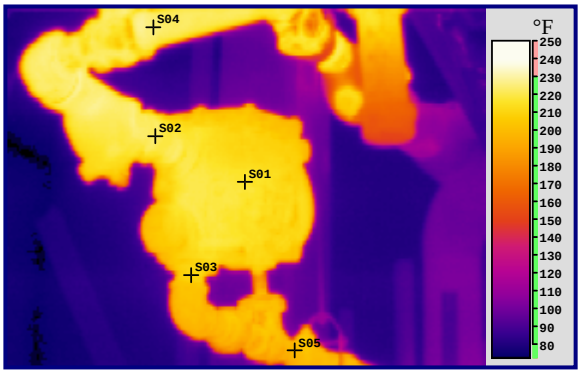
Incident Summary	
Location	Gym west mezz.
Equipment	AHU trap
Incident Date	9/30/2009 11:12:54
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	247
Reference Temperature	254
Temperature Rise	115
Component Emissivity	0.80
Background Temperature	64

IR image file: gym west unit.eif



Visible Image file: gym west unit VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Trap	0.80	247 °F
S02	Trap	0.80	254 °F
S03	Trap	0.80	239 °F
S04	Piping	0.80	257 °F
S05	Piping	0.80	225 °F

Additional Finding Data	
Distance to finding(s)	3 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Space air reading	64
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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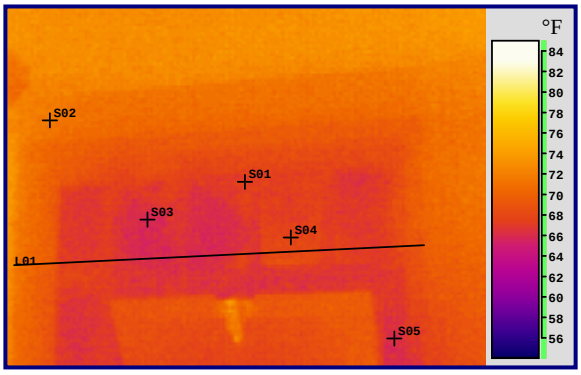
Incident Summary	
Location	Cell 1B1
Equipment	Interior window
Incident Date	9/30/2009 1:37:58 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	67.4
Reference Temperature	72.2
Temperature Rise	-2.2
Component Emissivity	1.00
Background Temperature	57

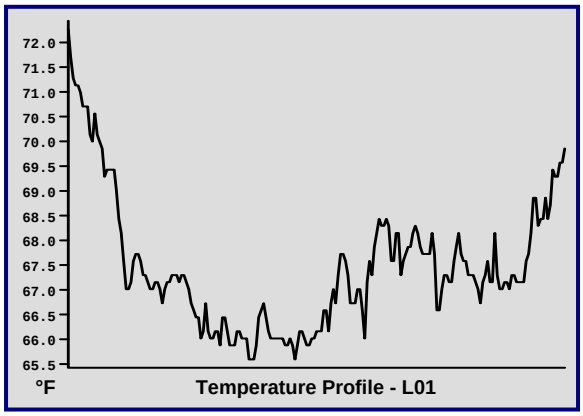
IR image file: 1b1 2.eif



Visible Image file: 1b1 2 VIS.JPG

Comment: -- Replace old window units to match cell blocks using screened windows. Eliminates broken window panes, trash issue, safety issues and excessive heat loss from facility.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	67.4 °F
S02	Wall	0.95	72.2 °F
S03	Window	0.92	65.7 °F
S04	Window	0.92	67.8 °F
S05	Framing	0.77	66.2 °F



Additional Finding Data	
Distance to finding(s)	4 ft
Airspeed @ finding area	Calm
IR thermometer reading	73 deg f @ wall
Relative Humidity	53%
Space air reading	57
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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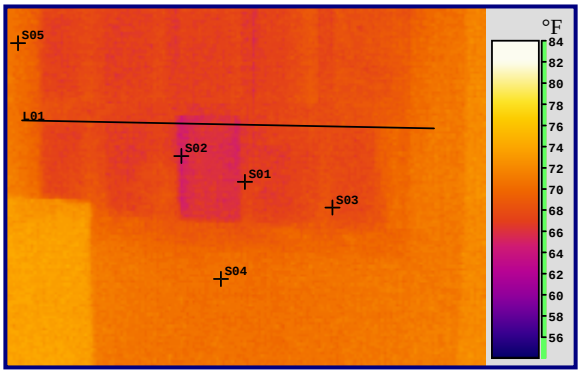
Incident Summary	
Location	Cell 1B1
Equipment	Interior window
Incident Date	9/30/2009 1:37:15 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	69.8
Reference Temperature	66.0
Temperature Rise	0.4
Component Emissivity	0.77
Background Temperature	57

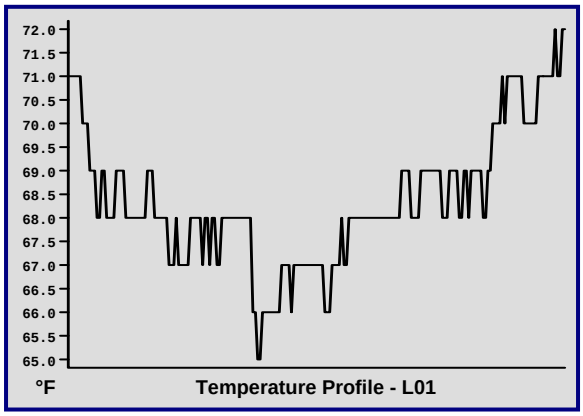
IR image file: 1b1 cell 1.eif



Visible Image file: 1b1 cell 1 VIS.JPG

Comment: -- Replace old window units to match cell blocks using screened windows. Eliminates broken window panes, trash issue, safety issues and excessive heat loss from facility.

Measurement Tool	Material	Emissivity	Temperature
S01	Framing	0.77	69.8 °F
S02	Window	0.92	66.0 °F
S03	Window	0.92	68.9 °F
S04	Wall	0.91	71.9 °F
S05	Wall	0.91	71.5 °F



Additional Finding Data	
Distance to finding(s)	4 ft
Airspeed @ finding area	Calm
IR thermometer reading	71 deg f @ wall
Relative Humidity	53%
Space air reading	57
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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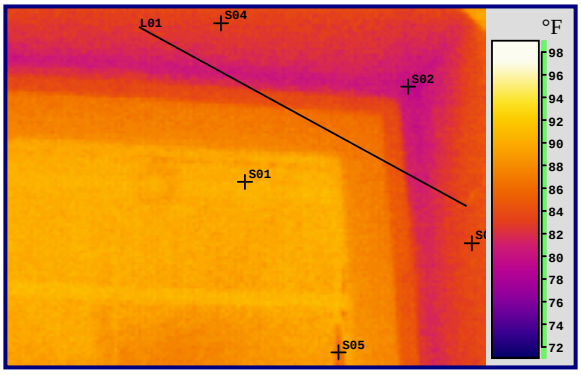
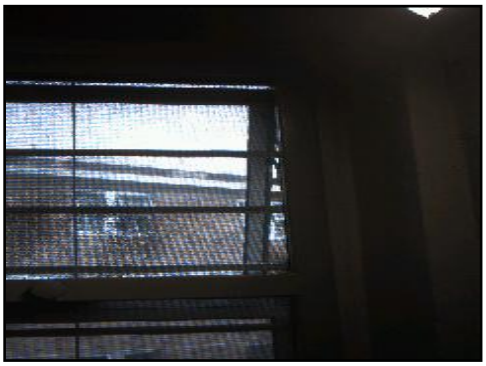
Incident Summary	
Location	Cell 2G47
Equipment	Interior wall
Incident Date	9/30/2009 1:43:47 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	92.9
Reference Temperature	81.4
Temperature Rise	6.4
Component Emissivity	0.92
Background Temperature	59

IR image file: 2g47-1.eif

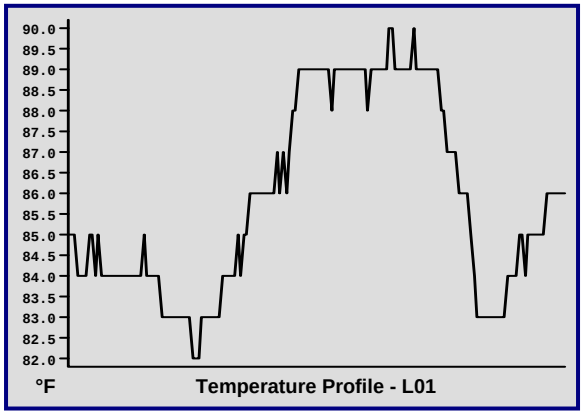


Visible Image file: 2g47-1 VIS.JPG



Comment: -- Inspect S02 corner area for outside air infiltration around window framing. Seal if required.

Measurement Tool	Material	Emissivity	Temperature
S01	Glazing reflectivity no issue	0.92	92.9 °F
S02	Wall	0.91	81.4 °F
S03	Wall	0.91	86.1 °F
S04	Ceiling	0.91	85.0 °F
S05	Framing	0.92	89.1 °F



Additional Finding Data	
Distance to finding(s)	3 ft
Airspeed @ finding area	Calm
IR thermometer reading	86 deg f @ wall
Relative Humidity	53%
Space air reading	59
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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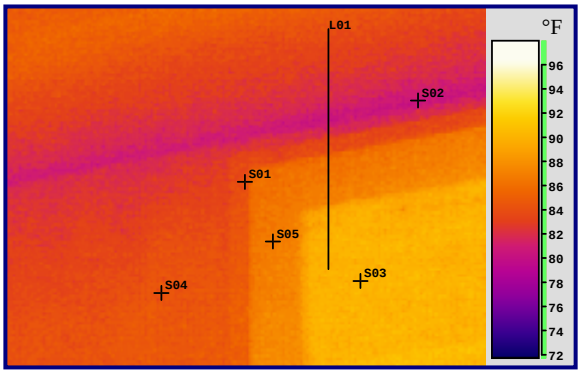
Incident Summary	
Location	Cell 2G47
Equipment	Interior window
Incident Date	9/30/2009 1:44:18 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	86.5
Reference Temperature	82.3
Temperature Rise	1.6
Component Emissivity	0.91
Background Temperature	60

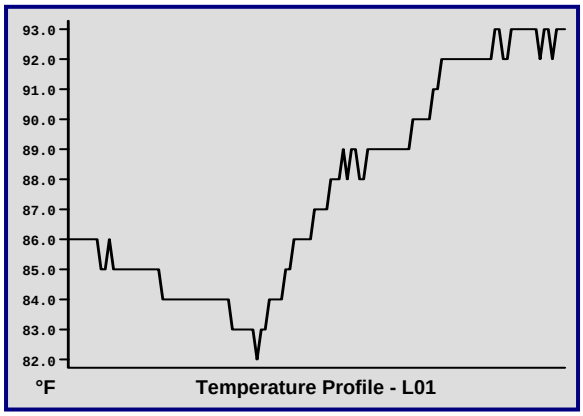
IR image file: 2g47-2.eif



Visible Image file: 2g47-2 VIS.JPG

Comment: -- Inspect ceiling floor slab seam for potential outside air infiltration or moisture from cell above. Seal as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.91	86.5 °F
S02	Inspection area	0.91	82.3 °F
S03	Window	0.92	92.3 °F
S04	Wall	0.91	86.8 °F
S05	Framing	0.77	94.1 °F



Additional Finding Data	
Distance to finding(s)	4 ft
Airspeed @ finding area	Calm
IR thermometer reading	86 deg f @ wall
Relative Humidity	53%
Space air reading	60
DCR-LCI / Maximum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

MAX 90

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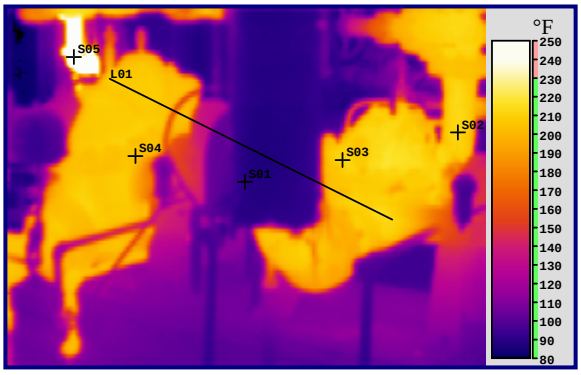
Incident Summary	
Location	Powerhouse
Equipment	Steam pump
Incident Date	9/30/2009 3:06:45 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	90.8
Reference Temperature	241
Temperature Rise	-47.9
Component Emissivity	0.94
Background Temperature	64

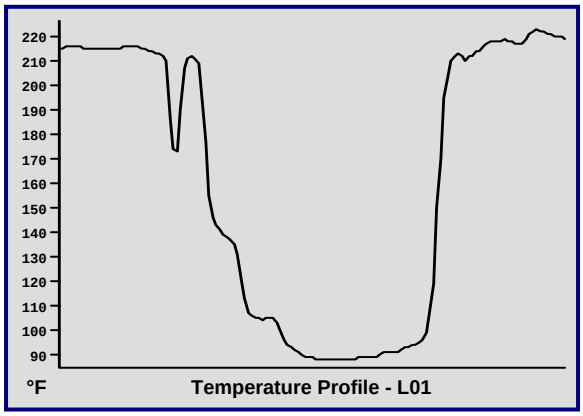
IR image file: phpump1.eif



Visible Image file: phpump1 VIS.JPG

Comment: -- Inspect pump / piping for moisture and steam leakage. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Insulation	0.94	90.8 °F
S02	Piping	0.80	241 °F
S03	Turbine	0.95	218 °F
S04	Pump	0.95	210 °F
S05	Piping	0.80	305 °F



Additional Finding Data	
Distance to finding(s)	9 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	64
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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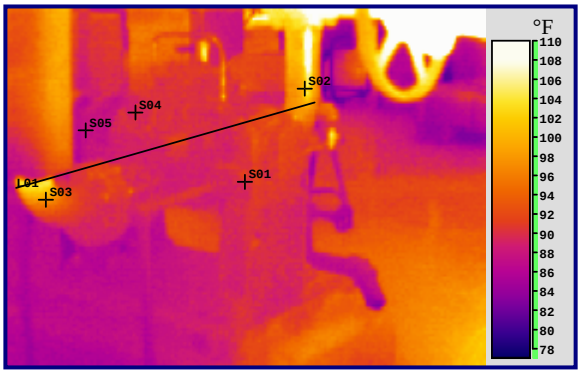
Incident Summary	
Location	Powerhouse
Equipment	Steam pump
Incident Date	9/30/2009 3:09:32 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	91.3
Reference Temperature	110
Temperature Rise	-0.6
Component Emissivity	0.95
Background Temperature	64

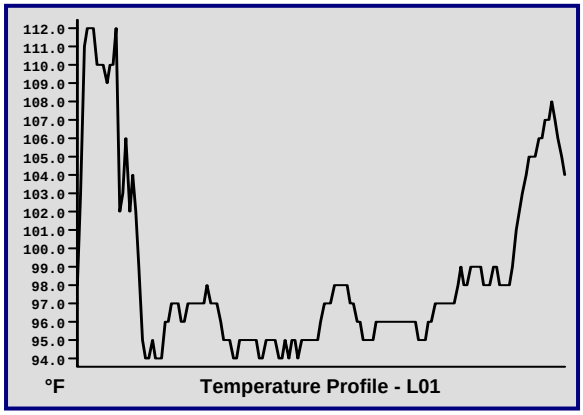
IR image file: phpump2.eif



Visible Image file: phpump2 VIS.JPG

Comment: -- Inspect pump / piping for moisture and steam leakage. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Inspection area	0.95	91.3 °F
S02	Piping	0.80	110 °F
S03	Piping	0.80	105 °F
S04	Pump	0.95	90.9 °F
S05	Pump	0.95	88.6 °F



Additional Finding Data	
Distance to finding(s)	12 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	64
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
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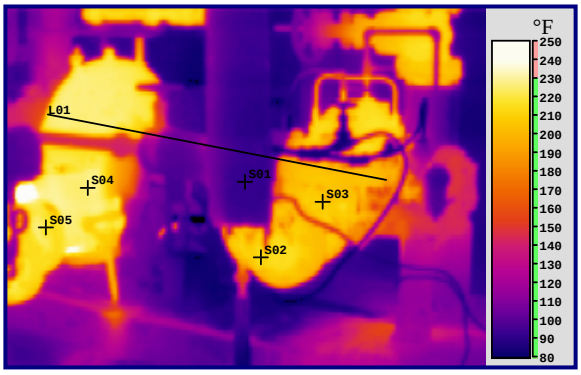
Incident Summary	
Location	Powerhouse
Equipment	Steam pump
Incident Date	9/30/2009 3:07:46 PM
Recommendation	Inspect
Severity	High
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	92.9
Reference Temperature	242
Temperature Rise	-41.6
Component Emissivity	0.94
Background Temperature	64

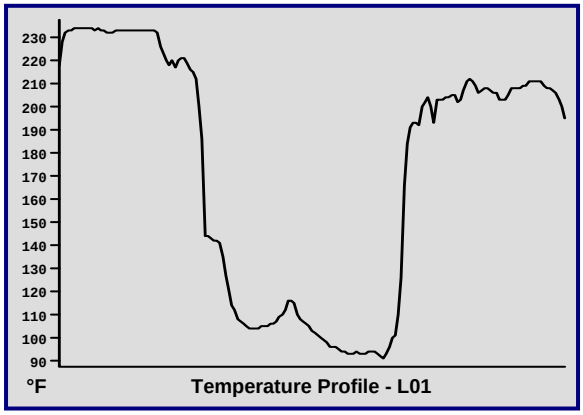
IR image file: phpump3.eif



Visible Image file: phpump3 VIS.JPG

Comment: -- Inspect pump / piping for moisture and steam leakage. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Insulation	0.94	92.9 °F
S02	Piping	0.80	242 °F
S03	Turbine	0.95	213 °F
S04	Pump	0.95	234 °F
S05	Piping	0.80	250 °F



Additional Finding Data	
Distance to finding(s)	9 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	64
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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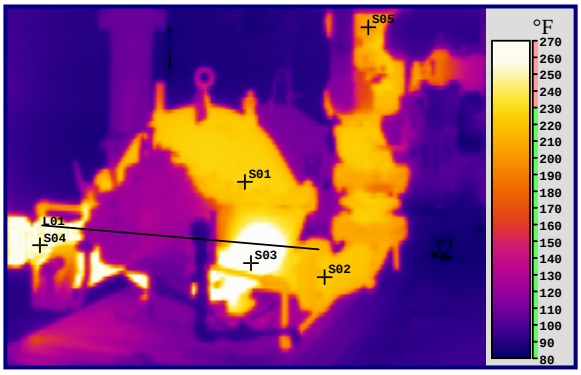
Incident Summary	
Location	Powerhouse
Equipment	Steam pump
Incident Date	9/30/2009 3:10:19 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	232
Reference Temperature	254
Temperature Rise	98.1
Component Emissivity	0.95
Background Temperature	65

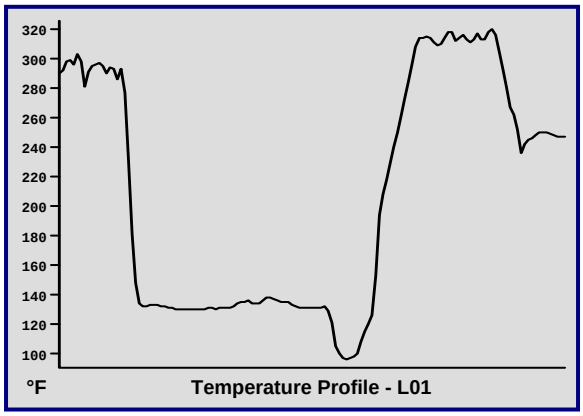
IR image file: phpump4.eif



Visible Image file: phpump4 VIS.JPG

Comment: -- Inspect pump / piping for moisture and steam leakage. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Pump	0.95	232 °F
S02	Piping	0.80	254 °F
S03	Pump	0.95	281 °F
S04	Piping	0.80	289 °F
S05	Piping	0.80	234 °F



Additional Finding Data	
Distance to finding(s)	10 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	65
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
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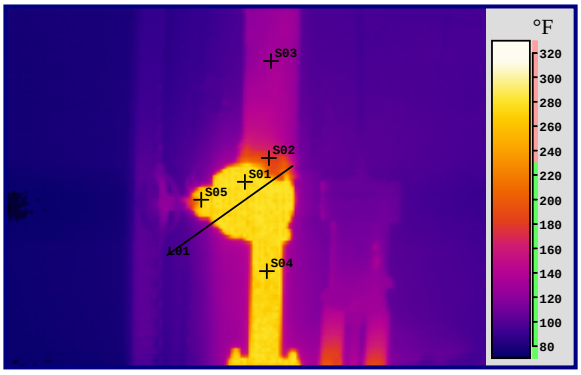
Incident Summary	
Location	Powerhouse basement
Equipment	Steam valve damage
Incident Date	9/30/2009 3:11:14 PM
Recommendation	Inspect
Severity	Severe
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	316
Reference Temperature	204
Temperature Rise	207
Component Emissivity	0.80
Background Temperature	65

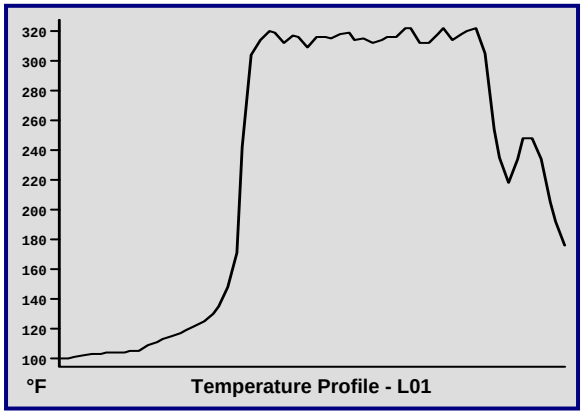
IR image file: phpump4 vlv leak.eif



Visible Image file: phpump4 vlv leak VIS.JPG

Comment: -- Repair or replace damaged valve at crane well area. Severe steam leak present.

Measurement Tool	Material	Emissivity	Temperature
S01	Valve	0.80	316 °F
S02	Piping	0.80	204 °F
S03	Insulation	0.94	135 °F
S04	Piping	0.80	312 °F
S05	Valve Stem	0.80	299 °F



Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	65
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
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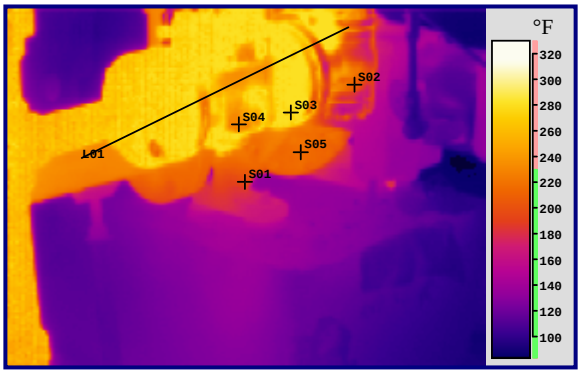
Incident Summary	
Location	Powerhouse
Equipment	Basement pump
Incident Date	9/30/2009 3:13:38 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	199
Reference Temperature	213
Temperature Rise	35.0
Component Emissivity	0.95
Background Temperature	66

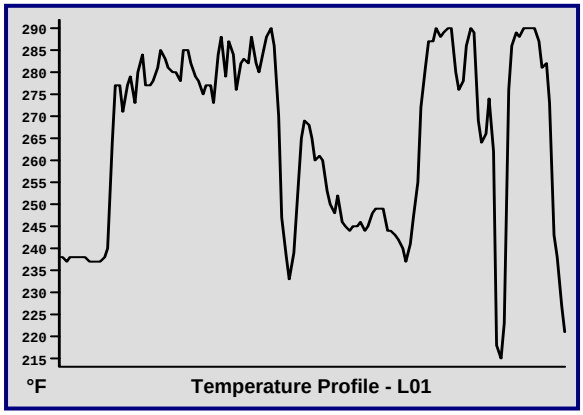
IR image file: phpump5-1.eif



Visible Image file: phpump5-1 VIS.JPG

Comment: -- Repair excessive steam and moisture leakage from pump / piping areas as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Base	0.95	199 °F
S02	Pump	0.95	213 °F
S03	Pump	0.95	287 °F
S04	Pump	0.95	240 °F
S05	Pump	0.95	223 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	66
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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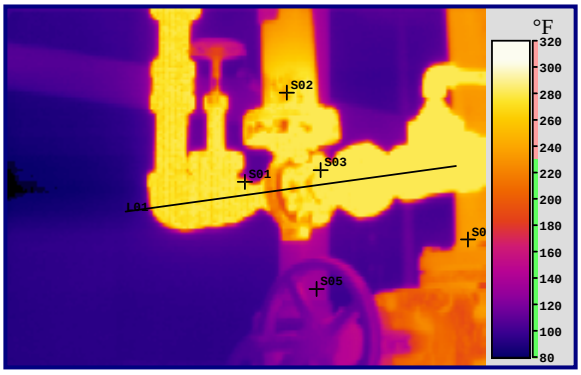
Incident Summary	
Location	Powerhouse
Equipment	Basement pump
Incident Date	9/30/2009 3:14:18 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	276
Reference Temperature	264
Temperature Rise	122
Component Emissivity	0.80
Background Temperature	66

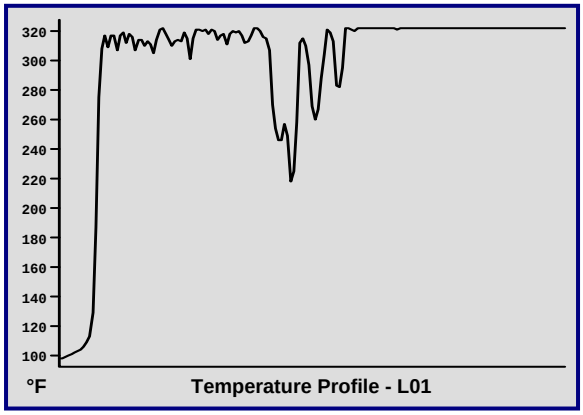
IR image file: phpump5-2.eif



Visible Image file: phpump5-2 VIS.JPG

Comment: -- Inspect piping for leakage and repair if required.

Measurement Tool	Material	Emissivity	Temperature
S01	Piping	0.80	276 °F
S02	Insulation	0.94	264 °F
S03	Piping	0.80	321 °F
S04	Piping	0.80	268 °F
S05	Insulation	0.94	135 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	66
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
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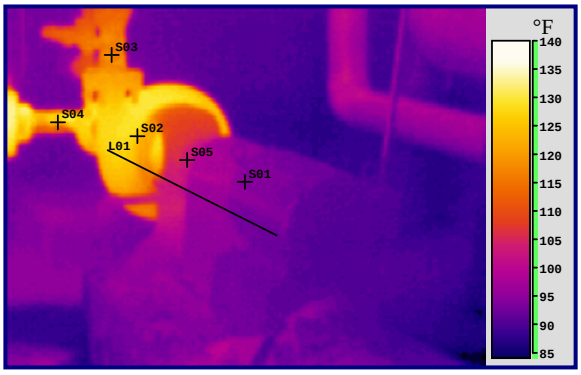
Incident Summary	
Location	Powerhouse
Equipment	Nr. Tunnel
Incident Date	9/30/2009 3:15:10 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	0.95

Inspection Detail	
Component Temperature	94.2
Reference Temperature	126
Temperature Rise	-0.9
Component Emissivity	0.95
Background Temperature	67

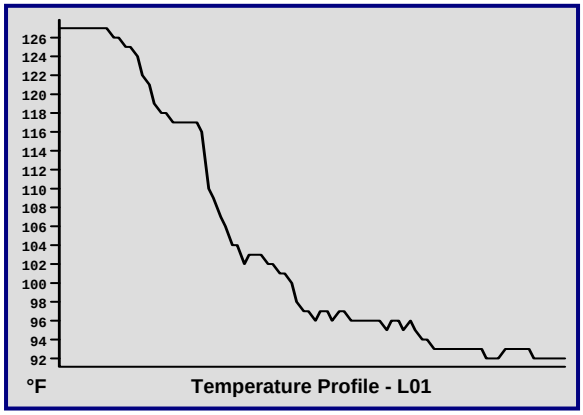
IR image file: phpump6.eif



Visible Image file: phpump6 VIS.JPG

Comment: -- Inspect pump and piping for leakage. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Motor	0.95	94.2 °F
S02	Pump	0.95	126 °F
S03	Piping	0.80	125 °F
S04	Piping	0.80	132 °F
S05	Shroud	0.95	103 °F



Additional Finding Data	
Distance to finding(s)	8 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	67
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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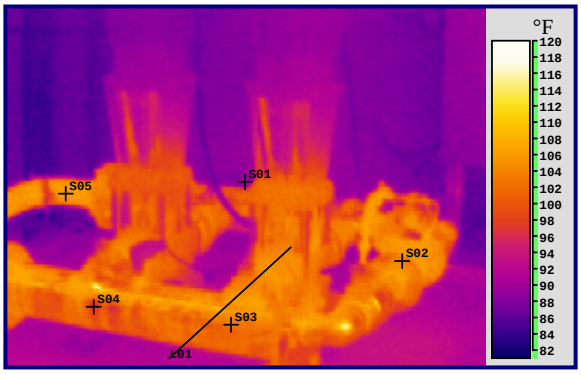
Incident Summary	
Location	Powerhouse
Equipment	Jockey pumps
Incident Date	9/30/2009 3:12:04 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	91.5
Reference Temperature	112
Temperature Rise	-2.0
Component Emissivity	0.92
Background Temperature	65

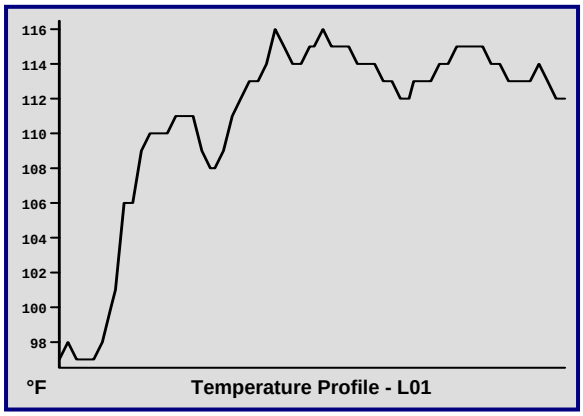
IR image file: phjockeys.eif



Visible Image file: phjockeys VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	91.5 °F
S02	Piping	0.80	112 °F
S03	Piping	0.80	111 °F
S04	Piping	0.80	105 °F
S05	Piping	0.80	115 °F



Additional Finding Data	
Distance to finding(s)	6 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	58%
Space air reading	65
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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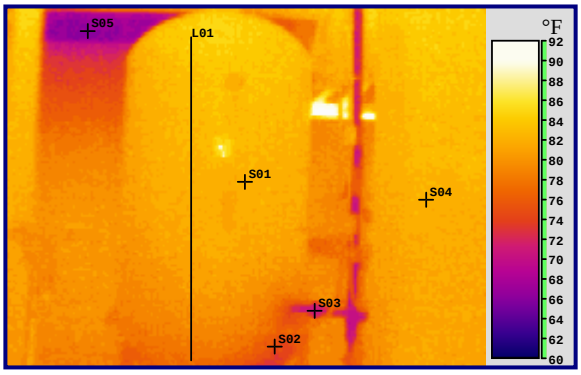
Incident Summary	
Location	Powerhouse
Equipment	Tank
Incident Date	9/30/2009 3:15:57 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	0.95

Inspection Detail	
Component Temperature	82.0
Reference Temperature	74.8
Temperature Rise	1.7
Component Emissivity	0.95
Background Temperature	63

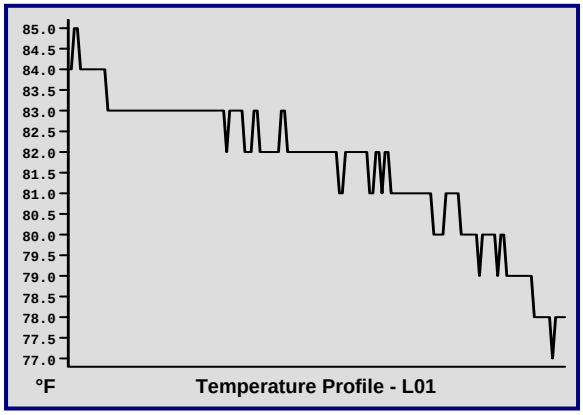
IR image file: ph tank.eif



Visible Image file: ph tank VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Tank	0.95	82.0 °F
S02	Tank	0.95	74.8 °F
S03	Piping	0.80	72.3 °F
S04	Wall	0.92	82.5 °F
S05	Window	0.92	66.5 °F



Additional Finding Data	
Distance to finding(s)	19 ft
Airspeed @ finding area	Calm
IR thermometer reading	84 deg f @ wall
Relative Humidity	53%
Outdoor air reading	63
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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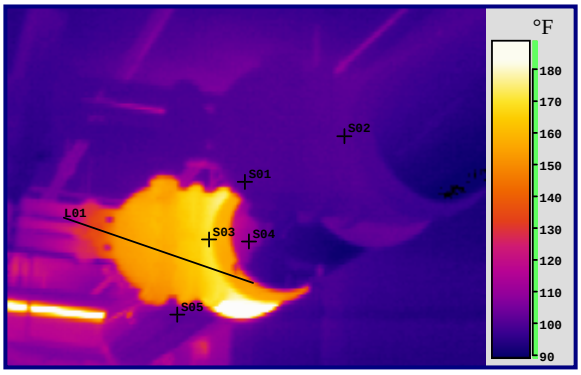
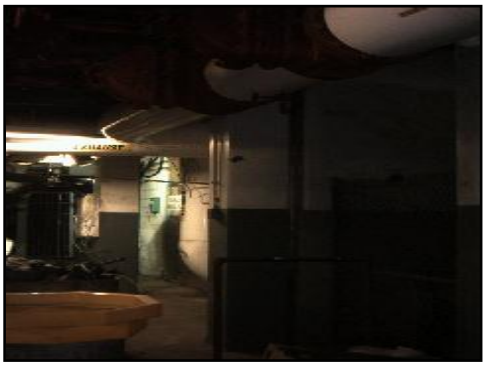
Incident Summary	
Location	Powerhouse basement
Equipment	Low press. Stm. valve
Incident Date	9/30/2009 3:25:57 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	101
Reference Temperature	101
Temperature Rise	-4.9
Component Emissivity	0.95
Background Temperature	71

IR image file: ph lowpress stm vlv.eif

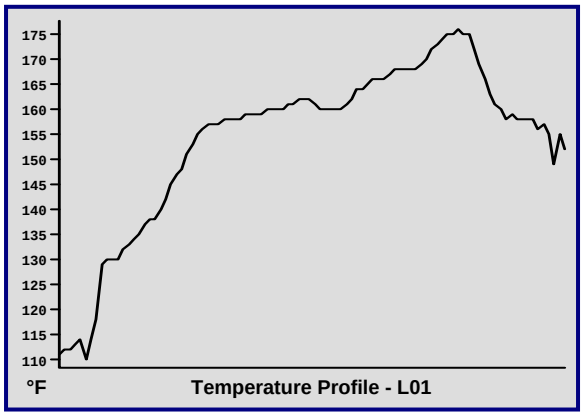


Visible Image file: ph lowpress stm vlv VIS.JPG



Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Deck	0.95	101 °F
S02	Valve	0.95	101 °F
S03	Valve	0.95	171 °F
S04	Piping	0.80	118 °F
S05	Piping	0.80	109 °F



Additional Finding Data	
Distance to finding(s)	9 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	71
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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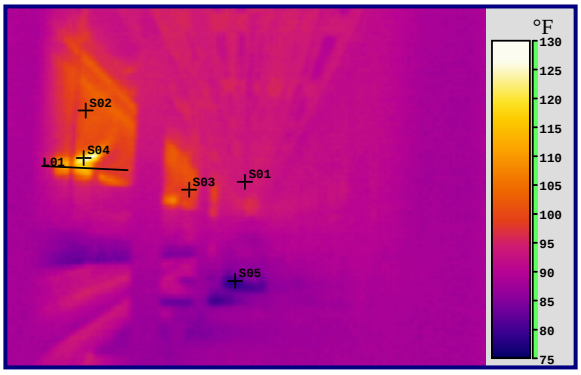
Incident Summary	
Location	Tunnel - powerhouse
Equipment	Piping
Incident Date	9/30/2009 3:16:33 PM
Recommendation	Inspect
Severity	Medium
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	95.3
Reference Temperature	103
Temperature Rise	4.4
Component Emissivity	0.93
Background Temperature	67

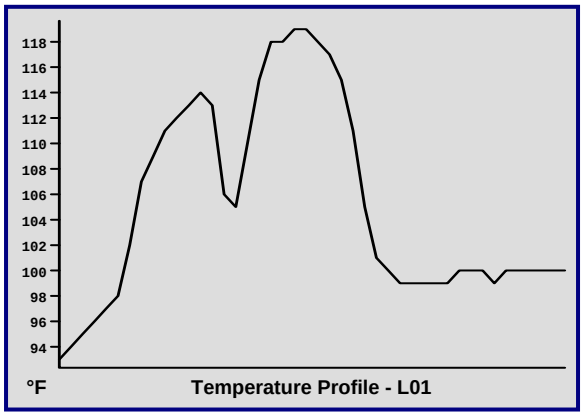
IR image file: ph tunnel end.eif



Visible Image file: ph tunnel end VIS.JPG

Comment: -- Inspect S04 area for leakage and damaged insulation. Inspect S05 for source of moisture present in tunnel. Repair items as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Deck	0.93	95.3 °F
S02	Piping	0.94	103 °F
S03	Piping	0.94	101 °F
S04	Inspection area	0.94	123 °F
S05	Inspection area	0.92	81.2 °F



Additional Finding Data	
Distance to finding(s)	40 ft
Airspeed @ finding area	Calm
IR thermometer reading	95 deg f @ wall
Relative Humidity	53%
Outdoor air reading	67
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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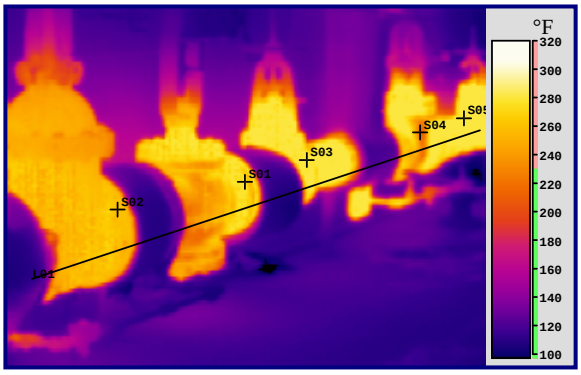
Incident Summary	
Location	Powerhouse
Equipment	Lower steam train
Incident Date	9/30/2009 3:22:03 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	310
Reference Temperature	297
Temperature Rise	149
Component Emissivity	0.80
Background Temperature	69

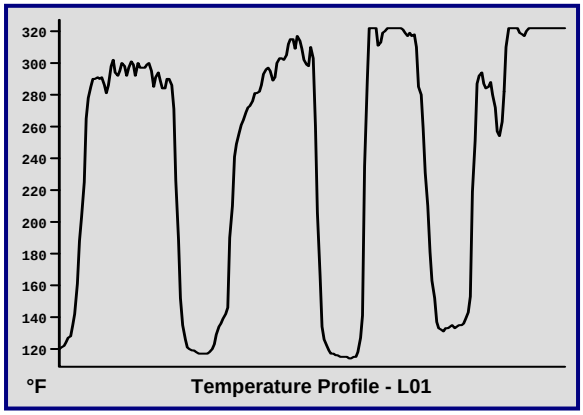
IR image file: ph stm train lower.eif



Visible Image file: ph stm train lower VIS.JPG

Comment: -- Replace damaged insulation and check for leaks at flanges. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Valve	0.80	310 °F
S02	Valve	0.80	297 °F
S03	Valve	0.80	322 °F
S04	Valve	0.80	254 °F
S05	Piping	0.80	322 °F



Additional Finding Data	
Distance to finding(s)	11 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	69
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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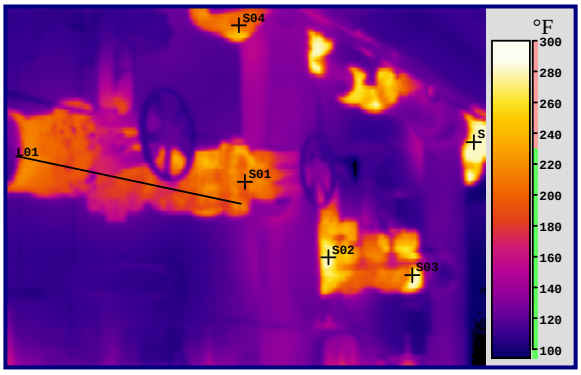
Incident Summary	
Location	Powerhouse
Equipment	Upper steam train
Incident Date	9/30/2009 3:21:04 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	232
Reference Temperature	314
Temperature Rise	97.1
Component Emissivity	0.80
Background Temperature	69

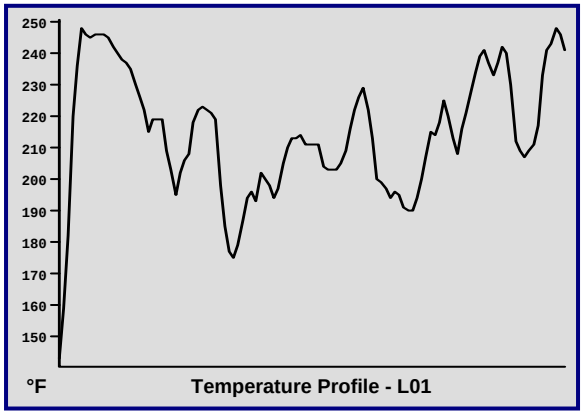
IR image file: ph stm train upper.eif



Visible Image file: ph stm train upper VIS.JPG

Comment: -- Replace damaged insulation and check for leaks at flanges. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Valve	0.80	232 °F
S02	Valve	0.80	314 °F
S03	Valve	0.80	297 °F
S04	Valve	0.80	238 °F
S05	Valve	0.80	318 °F



Additional Finding Data	
Distance to finding(s)	11 ft
Airspeed @ finding area	Calm
IR thermometer reading	n/a
Relative Humidity	53%
Outdoor air reading	69
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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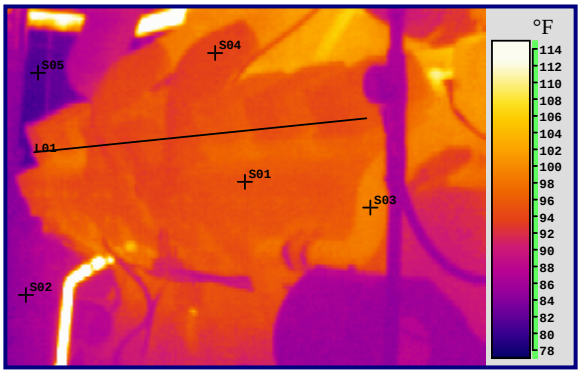
Incident Summary	
Location	Powerhouse
Equipment	Emergency generator
Incident Date	9/30/2009 3:18:09 PM
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	96.2
Reference Temperature	86.8
Temperature Rise	3.0
Component Emissivity	0.94
Background Temperature	68

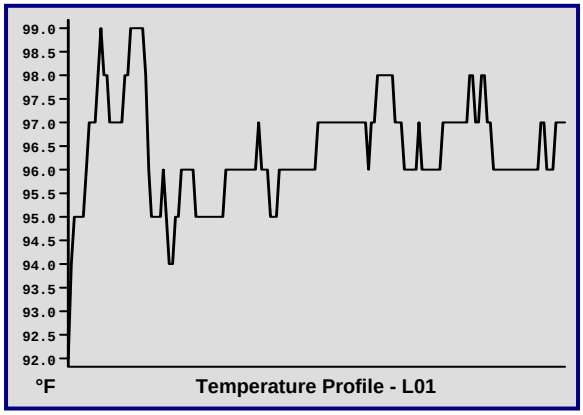
IR image file:



Visible Image file:

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Generator	0.94	96.2 °F
S02	Wall	0.93	86.8 °F
S03	Piping	0.95	101 °F
S04	Piping	0.95	95.0 °F
S05	Wall	0.93	82.0 °F



Additional Finding Data	
Distance to finding(s)	7 ft
Airspeed @ finding area	Calm
IR thermometer reading	87 deg f @ wall
Relative Humidity	53%
Outdoor air reading	68
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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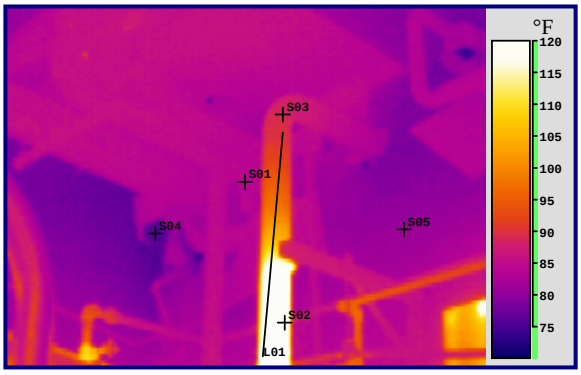
Incident Summary	
Location	Powerhouse
Equipment	Generator room
Incident Date	9/30/2009 3:19:08 PM
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	101
Reference Temperature	173
Temperature Rise	16.3
Component Emissivity	0.46
Background Temperature	68

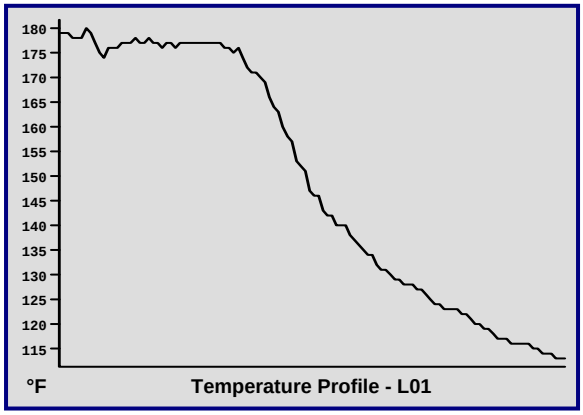
IR image file: phgen rm.eif



Visible Image file: phgen rm VIS.JPG

Comment: -- Inspect S04 corner for outside air and potential moisture infiltration. Repair as required.

Measurement Tool	Material	Emissivity	Temperature
S01	Piping	0.46	101 °F
S02	Piping	0.46	173 °F
S03	Piping	0.46	111 °F
S04	Wall	0.92	76.0 °F
S05	Wall	0.92	82.0 °F



Additional Finding Data	
Distance to finding(s)	21 ft
Airspeed @ finding area	Calm
IR thermometer reading	82 deg f @ wall
Relative Humidity	53%
Outdoor air reading	68
DCR-LCI / Powerhouse	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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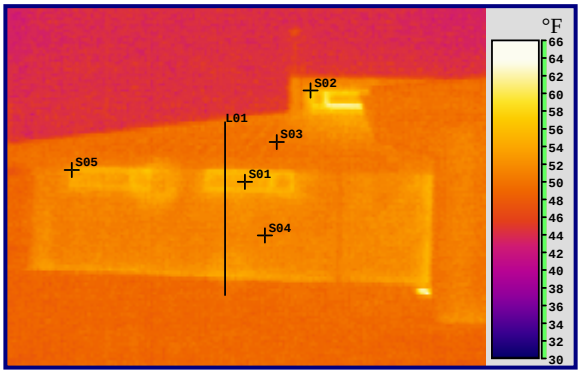
Incident Summary	
Location	Minimum facility
Equipment	Walls and windows
Incident Date	10/16/2009 9:12:15
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	53.5
Reference Temperature	53.2
Temperature Rise	4.6
Component Emissivity	0.92
Background Temperature	59

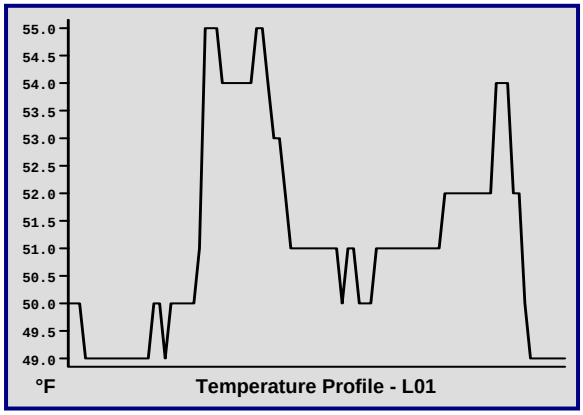
IR image file: 1.eif



Visible Image file: 1 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	53.5 °F
S02	Framing	0.77	53.2 °F
S03	Roof	0.77	47.3 °F
S04	Wall	0.93	50.7 °F
S05	Framing	0.77	51.5 °F



Additional Finding Data	
Distance to finding(s)	78 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	50 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Mimimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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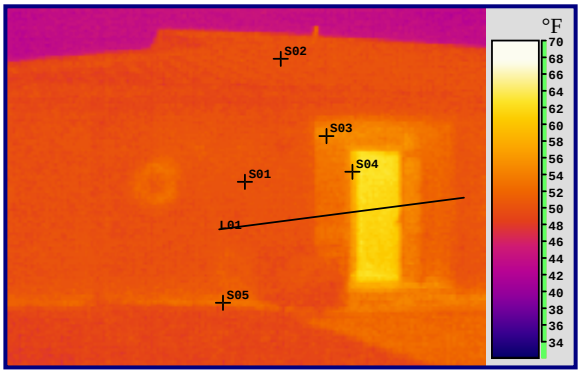
Incident Summary	
Location	Minimum fac.
Equipment	Wall and door
Incident Date	10/16/2009 9:12:56
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	49.4
Reference Temperature	47.3
Temperature Rise	-0.8
Component Emissivity	0.93
Background Temperature	59

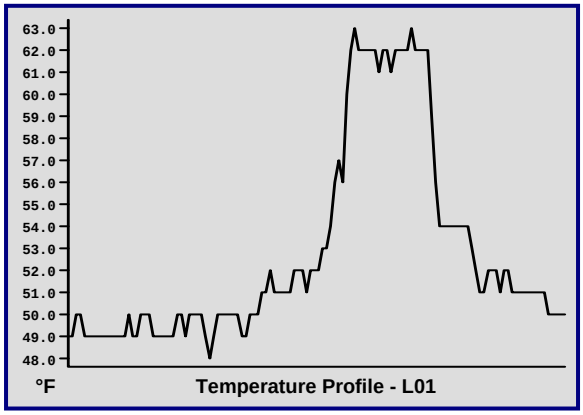
IR image file: 2.eif



Visible Image file: 2 VIS.JPG

Comment: -- Inspect S04 door perimeter for adequate seal. Repair if required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	49.4 °F
S02	Roof	0.77	47.3 °F
S03	Wall	0.93	54.6 °F
S04	Inspection area	0.88	57.8 °F
S05	Foundation	0.92	51.5 °F



Additional Finding Data	
Distance to finding(s)	51 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	49 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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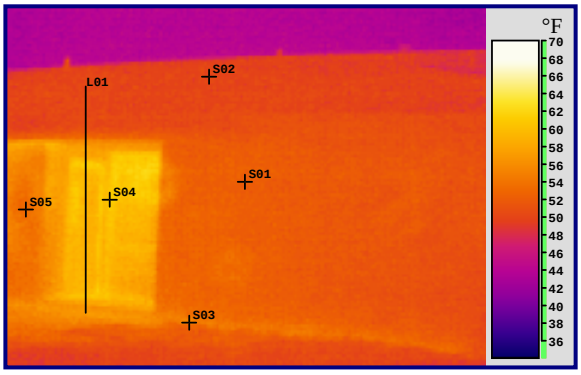
Incident Summary	
Location	Minimum fac.
Equipment	Wall and door
Incident Date	10/16/2009 9:14:08
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	51.8
Reference Temperature	47.5
Temperature Rise	0.5
Component Emissivity	0.93
Background Temperature	58

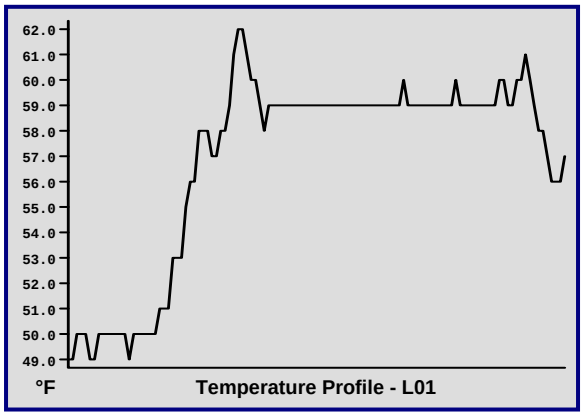
IR image file: 3.eif



Visible Image file: 3 VIS.JPG

Comment: -- Inspection of door shown on page 02, Repair door seal if required.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	51.8 °F
S02	Roof	0.77	47.5 °F
S03	Foundation	0.92	53.9 °F
S04	Inspection area	0.88	61.0 °F
S05	Wall	0.93	53.0 °F



Additional Finding Data	
Distance to finding(s)	56 ft
Airspeed @ finding area	Calm
IR thermometer reading	51 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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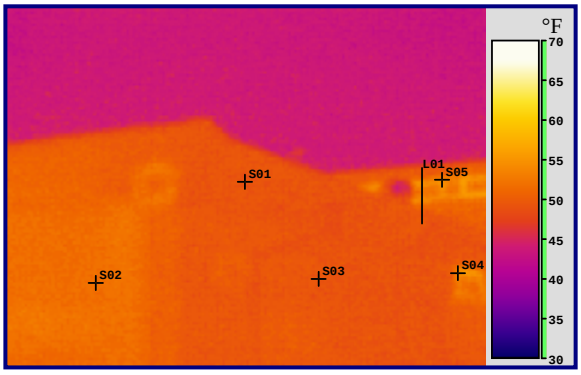
Incident Summary	
Location	Minimum fac.
Equipment	Walls
Incident Date	10/16/2009 9:14:54
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	46.5
Reference Temperature	51.8
Temperature Rise	-1.2
Component Emissivity	0.77
Background Temperature	57

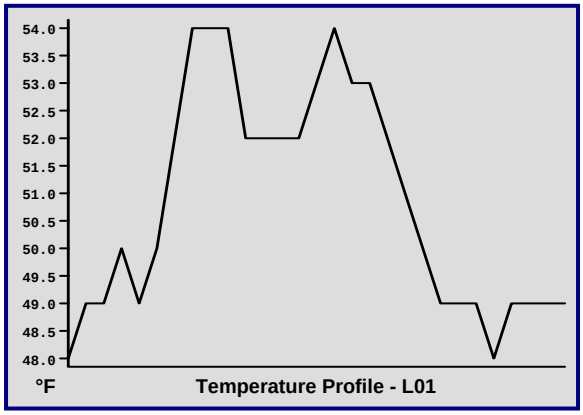
IR image file: 4.eif



Visible Image file: 4 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Roof	0.77	46.5 °F
S02	Wall	0.93	51.8 °F
S03	Wall	0.93	48.8 °F
S04	Framing	0.77	52.6 °F
S05	Framing	0.77	52.6 °F



Additional Finding Data	
Distance to finding(s)	54 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	49 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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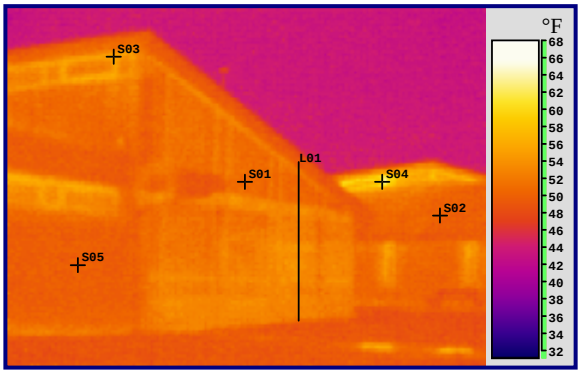
Incident Summary	
Location	-Minimum fac.-
Equipment	Windows and wall
Incident Date	10/16/2009 9:15:49
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	50.0
Reference Temperature	48.1
Temperature Rise	1.0
Component Emissivity	0.92
Background Temperature	56

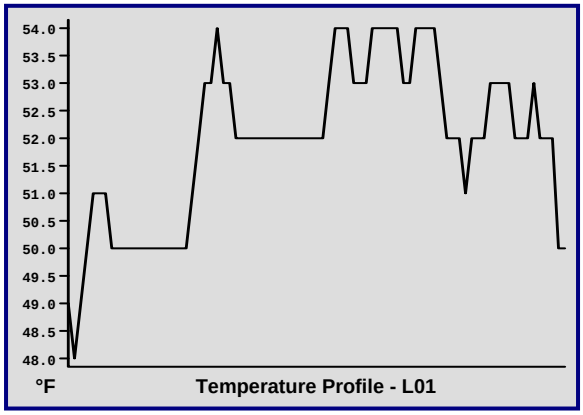
IR image file: 5.eif



Visible Image file: 5 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	50.0 °F
S02	Roof	0.77	48.1 °F
S03	Framing	0.77	54.6 °F
S04	Framing	0.77	62.3 °F
S05	Wall	0.93	49.2 °F



Additional Finding Data	
Distance to finding(s)	58 ft
Airspeed @ finding area	1 mph
IR thermometer reading	50 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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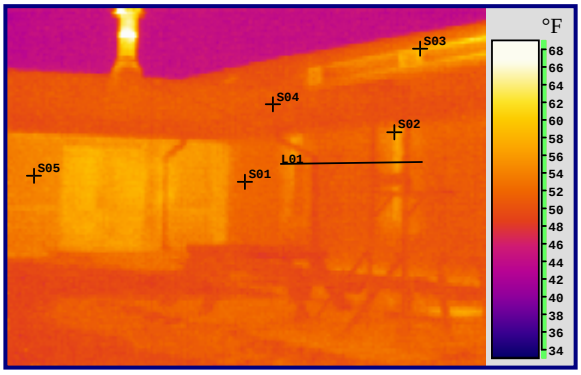
Incident Summary	
Location	Minimum fac.
Equipment	Walls and windows
Incident Date	10/16/2009 9:18:18
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	51.7
Reference Temperature	55.9
Temperature Rise	0.9
Component Emissivity	0.93
Background Temperature	54

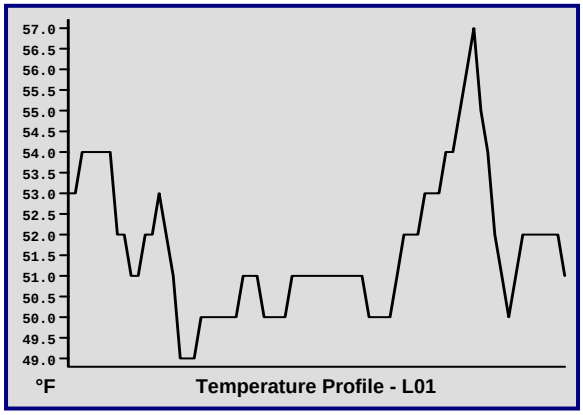
IR image file: 7.eif



Visible Image file: 7 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	51.7 °F
S02	Window	0.92	55.9 °F
S03	Framing	0.77	56.7 °F
S04	Roof	0.77	49.5 °F
S05	Wall	0.93	54.3 °F



Additional Finding Data	
Distance to finding(s)	63 ft
Airspeed @ finding area	Calm
IR thermometer reading	51 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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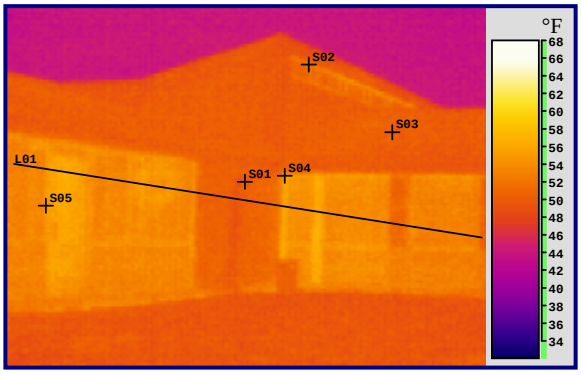
Incident Summary	
Location	Minimum fac.
Equipment	Walls and windows
Incident Date	10/16/2009 9:19:29
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	49.6
Reference Temperature	50.5
Temperature Rise	-0.4
Component Emissivity	0.93
Background Temperature	53

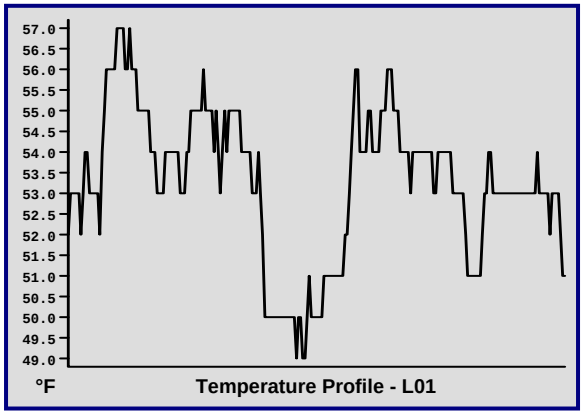
IR image file: 8.eif



Visible Image file: 8 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	49.6 °F
S02	Framing	0.77	50.5 °F
S03	Roof	0.77	49.6 °F
S04	Framing	0.77	54.2 °F
S05	Framing	0.77	54.9 °F



Additional Finding Data	
Distance to finding(s)	72 ft
Airspeed @ finding area	1 mph
IR thermometer reading	50 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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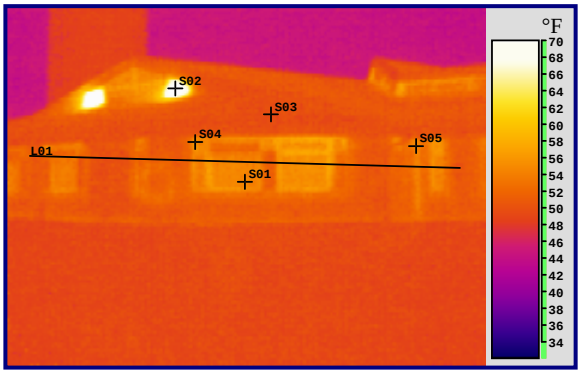
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:21:26
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	54.6
Reference Temperature	78.1
Temperature Rise	5.0
Component Emissivity	0.92
Background Temperature	51

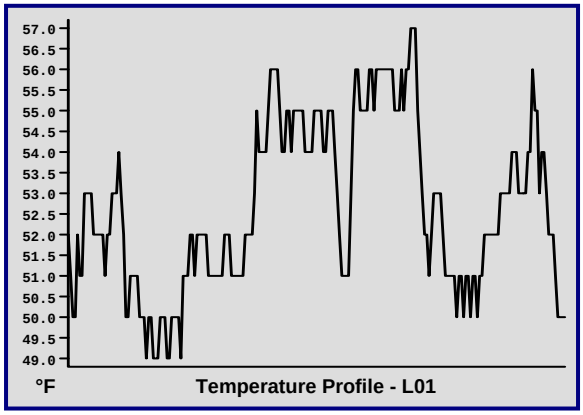
IR image file: 9.eif



Visible Image file: 9 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	54.6 °F
S02	Louver	0.77	78.1 °F
S03	Roof	0.77	49.1 °F
S04	Framing	0.77	55.8 °F
S05	Framing	0.77	55.0 °F



Additional Finding Data	
Distance to finding(s)	78 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	n/a
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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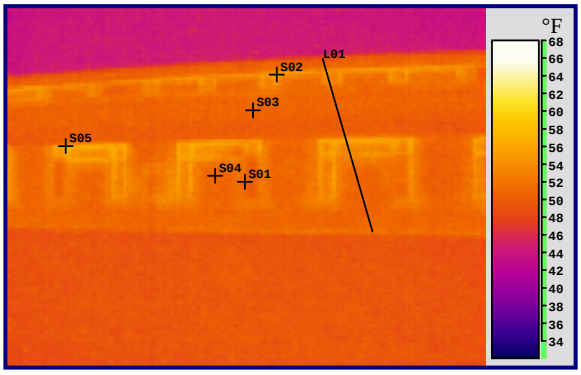
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:22:01
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	50.6
Reference Temperature	55.3
Temperature Rise	1.0
Component Emissivity	0.77
Background Temperature	51

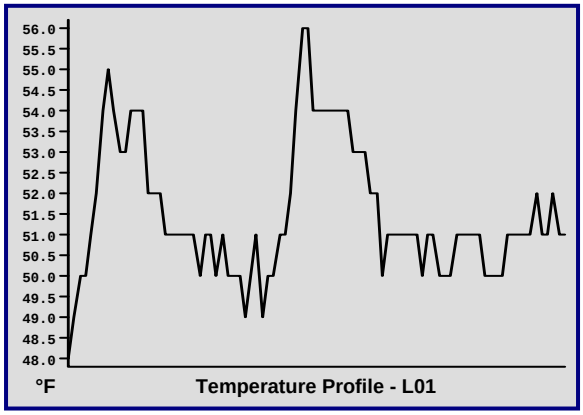
IR image file: 10.eif



Visible Image file: 10 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Framing	0.77	50.6 °F
S02	Framing	0.77	55.3 °F
S03	Roof	0.77	50.8 °F
S04	Window	0.92	51.0 °F
S05	Framing	0.77	55.4 °F



Additional Finding Data	
Distance to finding(s)	82 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	n/a
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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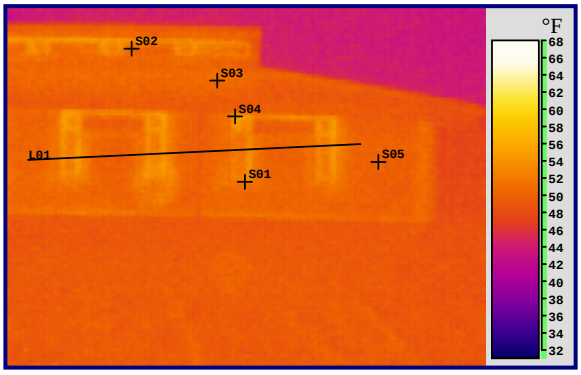
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:22:37
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	51.6
Reference Temperature	50.8
Temperature Rise	2.5
Component Emissivity	0.92
Background Temperature	50

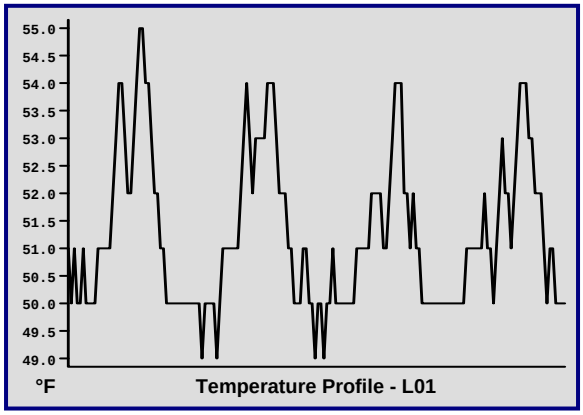
IR image file: 11.eif



Visible Image file: 11 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	51.6 °F
S02	Window	0.92	50.8 °F
S03	Roof	0.77	51.2 °F
S04	Framing	0.77	54.3 °F
S05	Wall	0.93	50.6 °F



Additional Finding Data	
Distance to finding(s)	88 ft
Airspeed @ finding area	2 mph
IR thermometer reading	50 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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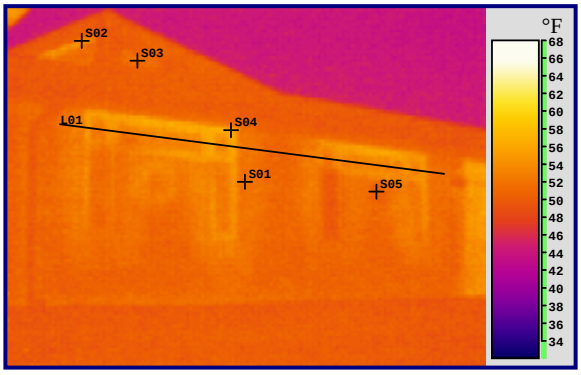
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:23:52
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	52.0
Reference Temperature	53.5
Temperature Rise	2.1
Component Emissivity	0.93
Background Temperature	49

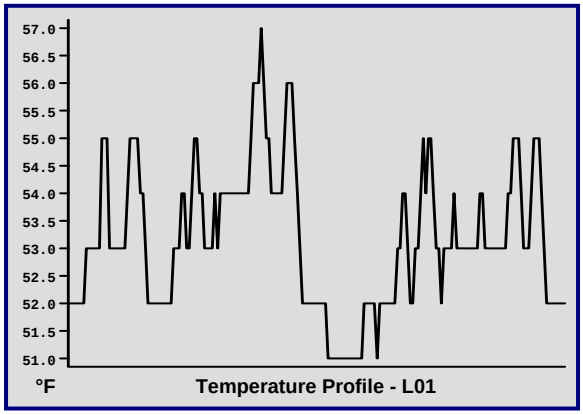
IR image file: 12.eif



Visible Image file: 12 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	52.0 °F
S02	Framing	0.77	53.5 °F
S03	Louver	0.77	52.4 °F
S04	Framing	0.77	56.7 °F
S05	Window	0.92	50.8 °F



Additional Finding Data	
Distance to finding(s)	67 ft
Airspeed @ finding area	Calm
IR thermometer reading	52 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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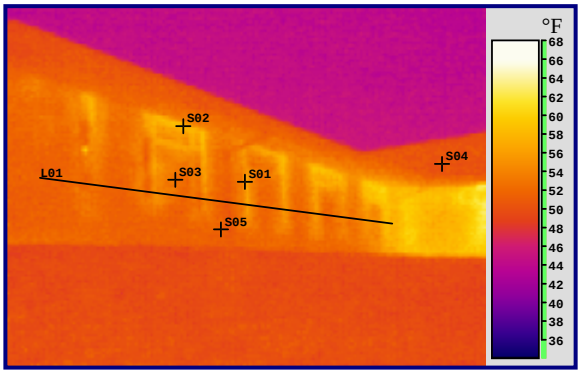
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:24:55
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	56.4
Reference Temperature	59.3
Temperature Rise	6.6
Component Emissivity	0.77
Background Temperature	49

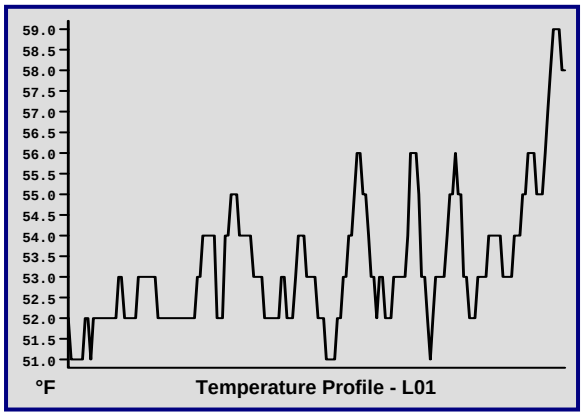
IR image file: 13.eif



Visible Image file: 13 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Framing	0.77	56.4 °F
S02	Framing	0.77	59.3 °F
S03	Window	0.92	53.0 °F
S04	Roof	0.77	50.9 °F
S05	Wall	0.93	51.7 °F



Additional Finding Data	
Distance to finding(s)	88 ft
Airspeed @ finding area	Calm
IR thermometer reading	52 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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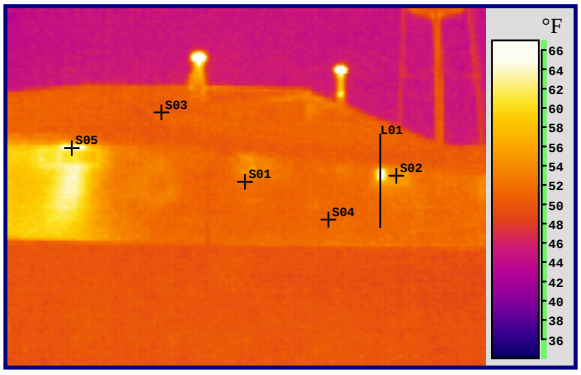
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:25:43
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	52.4
Reference Temperature	54.9
Temperature Rise	2.4
Component Emissivity	0.92
Background Temperature	48

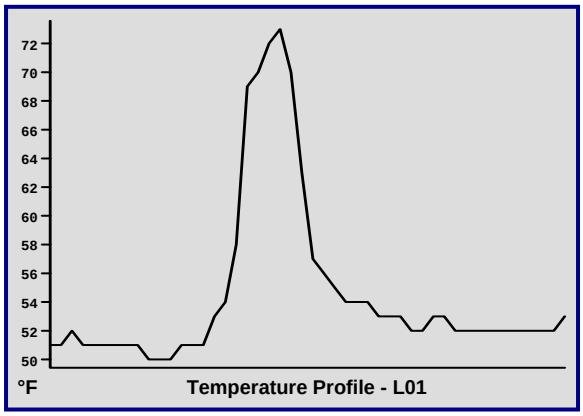
IR image file: 14.eif



Visible Image file: 14 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.92	52.4 °F
S02	Window	0.92	54.9 °F
S03	Roof	0.77	51.9 °F
S04	Wall	0.93	51.4 °F
S05	Wall	0.93	63.4 °F



Additional Finding Data	
Distance to finding(s)	93 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	51 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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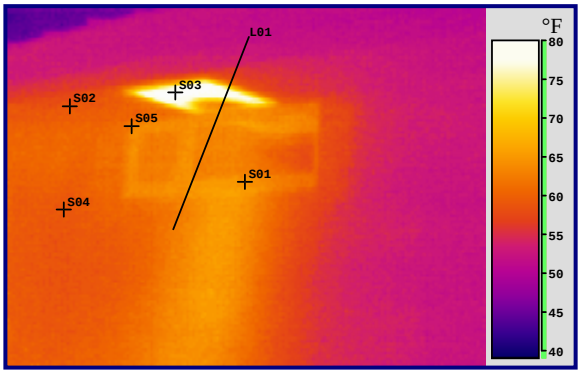
Incident Summary	
Location	Minimum fac.
Equipment	Grille and window
Incident Date	10/16/2009 9:28:00
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	69.4
Reference Temperature	62.3
Temperature Rise	12.0
Component Emissivity	0.77
Background Temperature	47

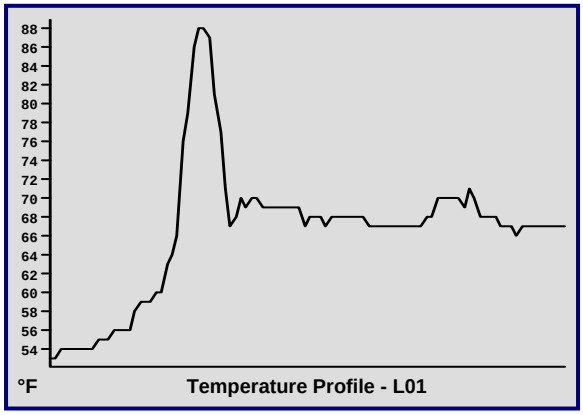
IR image file: 15.eif



Visible Image file: 15 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Framing	0.77	69.4 °F
S02	Soffit	0.77	62.3 °F
S03	Grille	0.77	88.9 °F
S04	Wall	0.93	60.0 °F
S05	Framing	0.77	67.2 °F



Additional Finding Data	
Distance to finding(s)	19 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	60 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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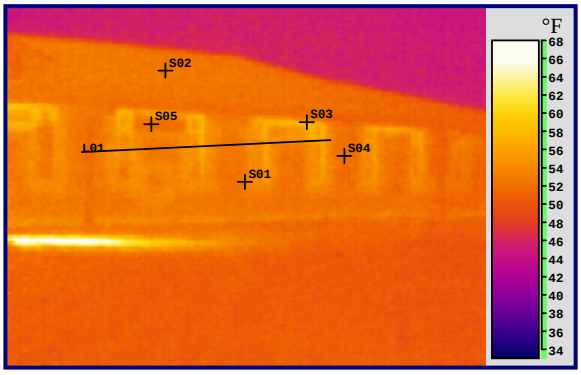
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:29:14
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	53.5
Reference Temperature	54.4
Temperature Rise	2.5
Component Emissivity	0.93
Background Temperature	47

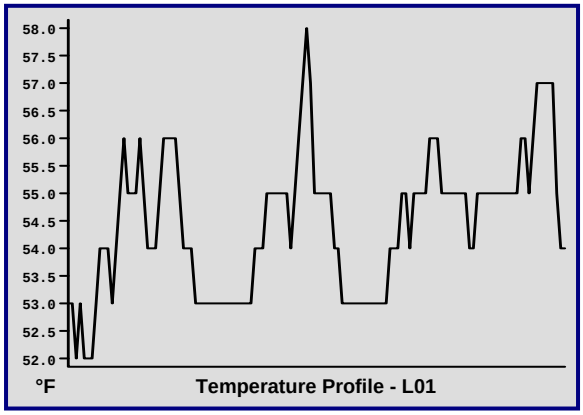
IR image file: 16.eif



Visible Image file: 16 VIS.JPG

Comment: -- No issues noted

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	53.5 °F
S02	Roof	0.77	54.4 °F
S03	Framing	0.77	58.1 °F
S04	Wall	0.93	52.7 °F
S05	Window	0.92	52.6 °F



Additional Finding Data	
Distance to finding(s)	86 ft
Airspeed @ finding area	Calm
IR thermometer reading	54 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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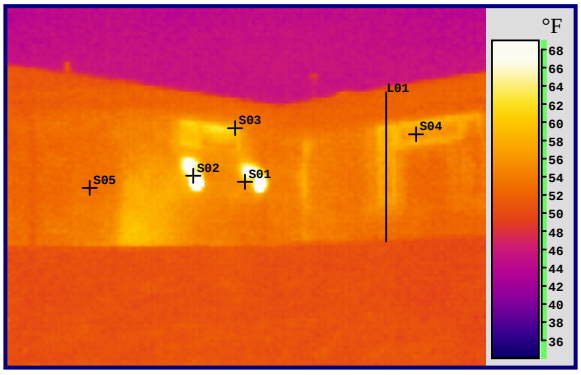
Incident Summary	
Location	Minimum fac.
Equipment	Walls and windows
Incident Date	10/16/2009 9:30:45
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	59.7
Reference Temperature	84.8
Temperature Rise	8.7
Component Emissivity	0.93
Background Temperature	46

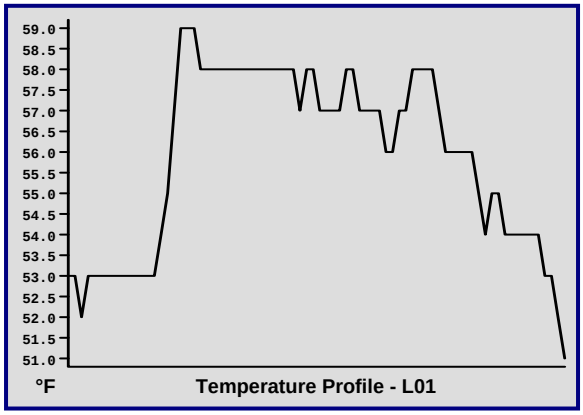
IR image file: 17.eif



Visible Image file: 17 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	59.7 °F
S02	Duct	0.77	84.8 °F
S03	Duct	0.77	62.1 °F
S04	Window	0.92	57.6 °F
S05	Wall	0.93	53.6 °F



Additional Finding Data	
Distance to finding(s)	Xxx ft
Airspeed @ finding area	3 mph
IR thermometer reading	Xx deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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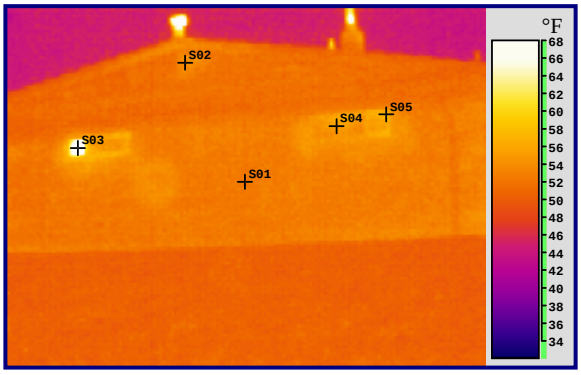
Incident Summary	
Location	Minimum fac.
Equipment	Wall
Incident Date	10/16/2009 9:31:18
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	52.8
Reference Temperature	56.3
Temperature Rise	1.9
Component Emissivity	0.93
Background Temperature	46

IR image file: 18.eif



Visible Image file: 18 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	52.8 °F
S02	Louver	0.77	56.3 °F
S03	Louver	0.77	81.2 °F
S04	Window	0.92	56.2 °F
S05	Framing	0.77	59.2 °F

Additional Finding Data	
Distance to finding(s)	79 ft
Airspeed @ finding area	Calm
IR thermometer reading	53 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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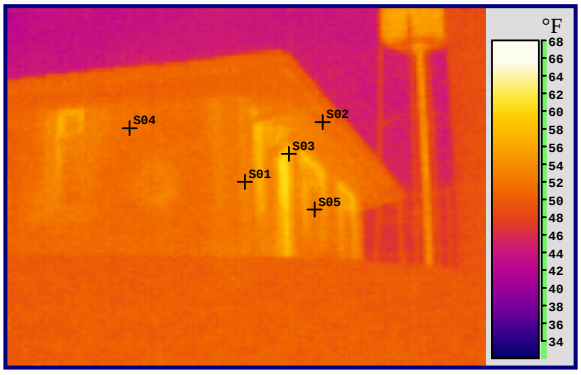
Incident Summary	
Location	Minimum fac.
Equipment	Walls
Incident Date	10/16/2009 9:32:28
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	53.9
Reference Temperature	53.3
Temperature Rise	4.0
Component Emissivity	0.93
Background Temperature	45

IR image file: 19.eif



Visible Image file: 19 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Wall	0.93	53.9 °F
S02	Soffit	0.77	53.3 °F
S03	Framing	0.77	60.7 °F
S04	Wall	0.93	52.3 °F
S05	Window	0.92	53.5 °F

Additional Finding Data	
Distance to finding(s)	86 ft
Airspeed @ finding area	Calm
IR thermometer reading	52 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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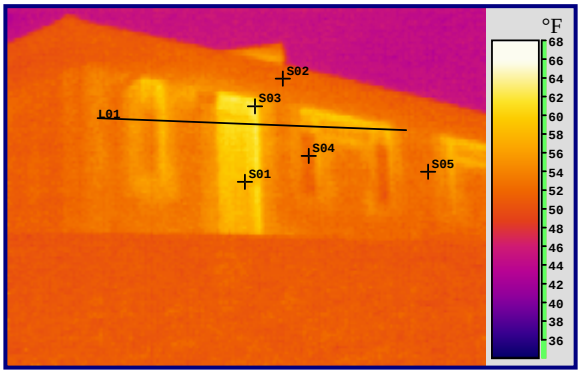
Incident Summary	
Location	Minimum fac.
Equipment	Wall and openings
Incident Date	10/16/2009 9:34:49
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	60.0
Reference Temperature	54.0
Temperature Rise	8.7
Component Emissivity	0.88
Background Temperature	44

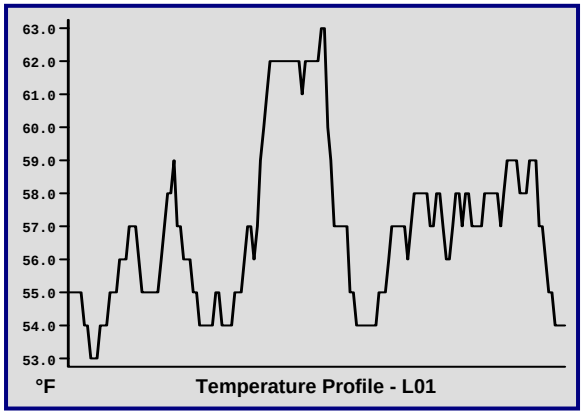
IR image file: 20.eif



Visible Image file: 20 VIS.JPG

Comment: -- Inspect Door perimeter for adequate seal. Repair if required.

Measurement Tool	Material	Emissivity	Temperature
S01	Door	0.88	60.0 °F
S02	Soffit	0.77	54.0 °F
S03	Inspection area	0.77	66.2 °F
S04	Window	0.92	53.1 °F
S05	Wall	0.93	53.4 °F



Additional Finding Data	
Distance to finding(s)	76 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	53 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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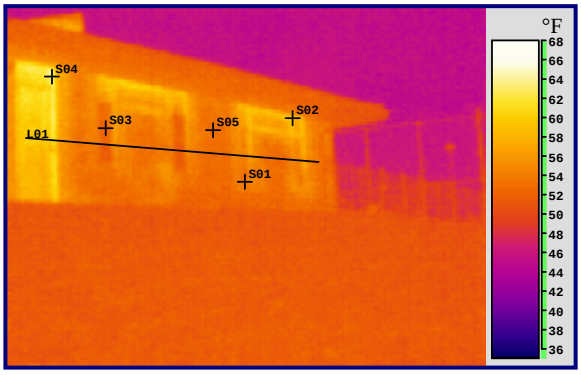
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:35:09
Recommendation	Inspect
Severity	Low
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	54.6
Reference Temperature	61.7
Temperature Rise	3.7
Component Emissivity	0.92
Background Temperature	44

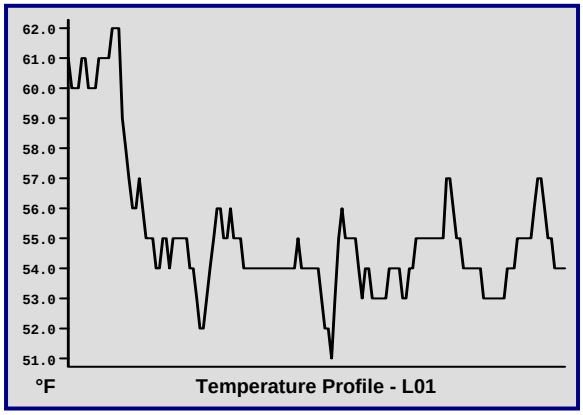
IR image file: 21.eif



Visible Image file: 21 VIS.JPG

Comment: -- Same issue as page MIN 19.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	54.6 °F
S02	Framing	0.77	61.7 °F
S03	Window	0.92	53.3 °F
S04	Inspection area	0.77	67.4 °F
S05	Wall	0.93	53.8 °F



Additional Finding Data	
Distance to finding(s)	74 ft
Airspeed @ finding area	1.5 mph
IR thermometer reading	53 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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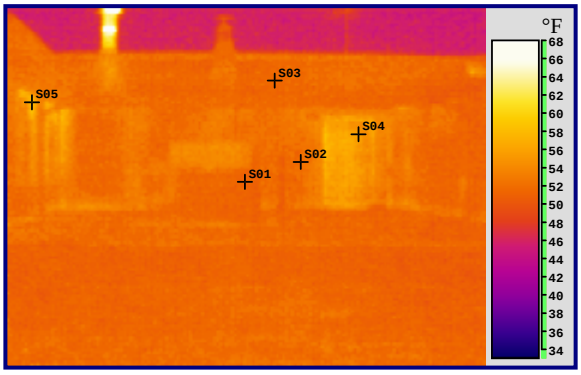
Incident Summary	
Location	Minimum fac.
Equipment	Wall and openings
Incident Date	10/16/2009 9:36:49
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	52.0
Reference Temperature	52.6
Temperature Rise	0.6
Component Emissivity	0.93
Background Temperature	44

IR image file: 22.eif



Visible Image file: 22 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Enclosure	0.93	52.0 °F
S02	Wall	0.93	52.6 °F
S03	Roof	0.77	54.0 °F
S04	Door	0.92	56.3 °F
S05	Framing	0.77	60.4 °F

Additional Finding Data	
Distance to finding(s)	89 ft
Airspeed @ finding area	Calm
IR thermometer reading	52 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

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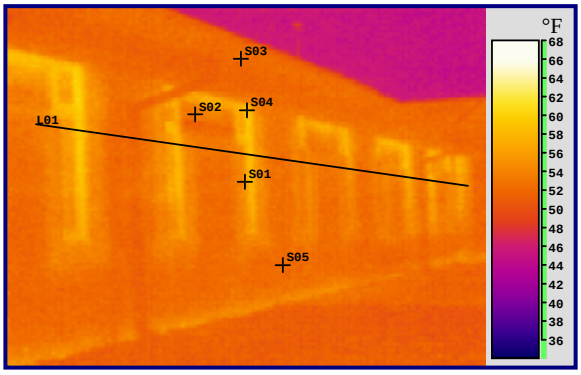
Incident Summary	
Location	Minimum fac.
Equipment	Wall and windows
Incident Date	10/16/2009 9:37:34
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	56.8
Reference Temperature	53.8
Temperature Rise	4.8
Component Emissivity	0.92
Background Temperature	43

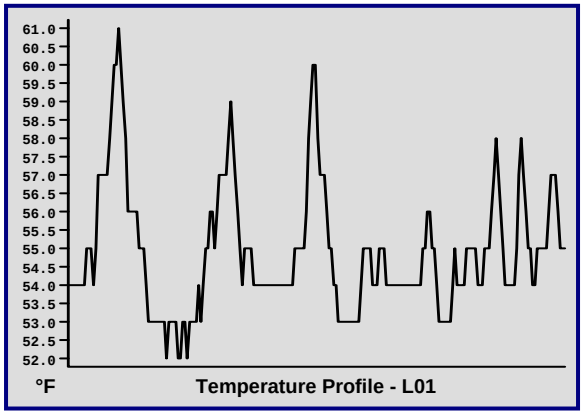
IR image file: 23.eif



Visible Image file: 23 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Window	0.92	56.8 °F
S02	Window	0.92	53.8 °F
S03	Roof	0.77	55.2 °F
S04	Framing	0.77	62.1 °F
S05	Wall	0.93	53.0 °F



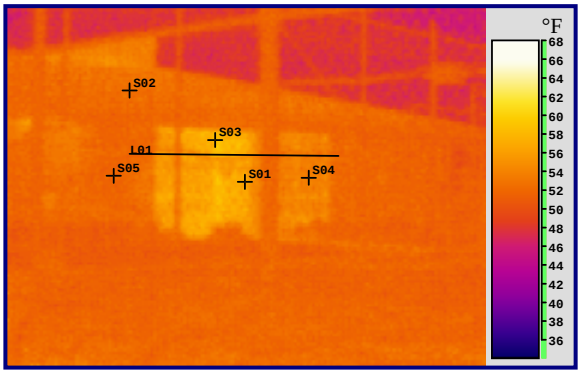
Additional Finding Data	
Distance to finding(s)	42 ft
Airspeed @ finding area	1 mph
IR thermometer reading	53 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC

Four Seasons Environmental, Inc.
43 New Garver Road
Monroe, Ohio 45050
(513) 539 - 2978 Phone
(513) 539 – 2972 Fax
www.fseinc.net

Incident Summary	
Location	Minimum fac.
Equipment	Entry
Incident Date	10/16/2009 9:39:21
Recommendation	None
Severity	None
Units	°F
Global Emissivity	1.00

Inspection Detail	
Component Temperature	57.3
Reference Temperature	55.2
Temperature Rise	5.8
Component Emissivity	0.92
Background Temperature	43

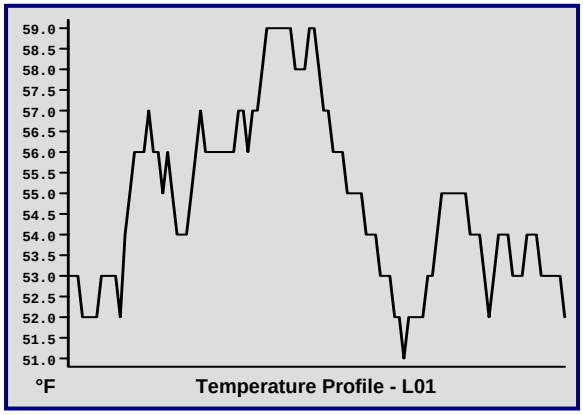
IR image file: 25.eif



Visible Image file: 25 VIS.JPG

Comment: -- No issues noted.

Measurement Tool	Material	Emissivity	Temperature
S01	Door	0.92	57.3 °F
S02	Roof	0.77	55.2 °F
S03	Window	0.92	59.4 °F
S04	Window	0.92	54.7 °F
S05	Wall	0.93	52.4 °F



Additional Finding Data	
Distance to finding(s)	68 ft
Airspeed @ finding area	1 mph
IR thermometer reading	52 deg f @ wall
Relative Humidity	49%
Outdoor air reading	42
DCR-LCI / Minimum	Facility
Michael D. Spaulding	Thermographer
Level 1 Certified # 25100	ITC