Infrared Energy Survey OAT-69 F 62%RH Clear
Average indoor temp 74F 59%RH

Infrared Thermographic Report
For

Report done by
John Cannamela
Level II Thermographer
Sample Report

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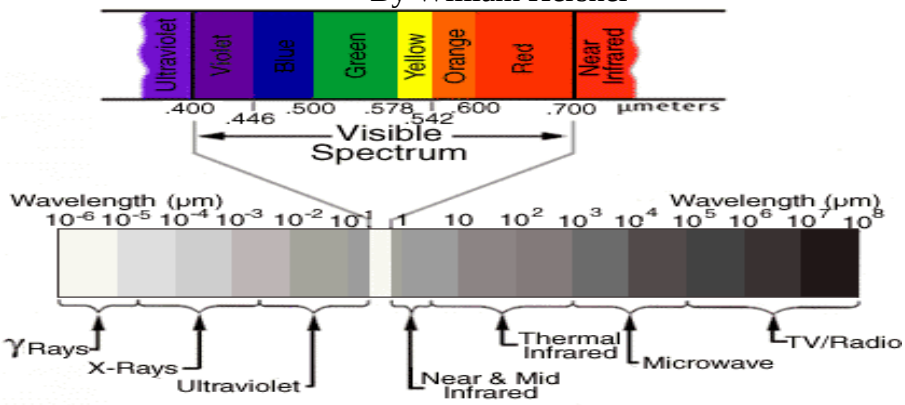
What is Infrared?

- IR is part of the electromagnetic spectrum discovered in the 1800's
  - By William Hershel



IR 101

- The IR imager sees emitted energy in the IR spectrum range from (shortwave) 3-5 microns (longwave)7-13 microns.
- The amount of energy is seen through the imager. The reason everything thing is colored is to give the eye something to interpret.
- Interpretation is key with Thermography.

How Infrared can help Commissioning

Commissioning is the process where by the system is put through its sequence of operation at its design. There are many tools and techniques to start up and check out systems. Buildings all have their own special issues not in the design, that's why we commission.

- Infrared Thermography can help as a great tool to help locate and even show why certain things don't work properly.

Building HVAC 101

Heating Ventilation & Air Conditioning

Buildings are conditioned by adding or removing heat from a given space through a medium. In this case the medium is air. The air is circulated through a refrigerated coil or DX coil or chilled water coil, which removes heat and transfers the heat through the refrigerant/water to the condenser coil/cooling tower, via a fan/pump. Dirty filters or poor air flow causes coils to freeze and Compressor failure.

Why can we see water?

Water is a conductor and transfers heat. Heat or the lack of heat is what thermal imagers see. When water, a conductor, contacts a non-conductor such as wood or sheetrock-we see the heat transfer which can be colder or hotter than the surface of which it contacts. The color of choice for cold is blue and red for hot.

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Summary
Sample Customer

BY:
John Cannamela Level II IR, HVAC Journeyman

A non intrusive survey was performed for energy improvements.
The following were examined:

System	Recommended solution	
Roof	Add layer and or coating	
HVAC	Add :economizer,DDC,Hail guard, seal ducts Have the units examined and tuned with service tool	
Coolers	Adjust gaskets	
Utilities	Monitor power consumption remotely	

Roof:
The roof has a gravel /tar coating over foam and pearlite. The R factor can be greatly improved with additional coatings of insulation on top of the existing roof.

HVAC:
2 RTU Trane 10 ton package units with electric heat.
One unit was down at time of survey
Both units show signs of water and air leakage.
Both units should have economizers installed; greatly reducing power consumption in low temp conditions when cooling in the space is needed.
Duct leakage was noted with thermal and visual images. Sealing duct will increase system efficiency and reduce wasted energy.

Coolers:
3- 1.5 horsepower coolers show some gasket leakage as shown in thermogram and visual images.

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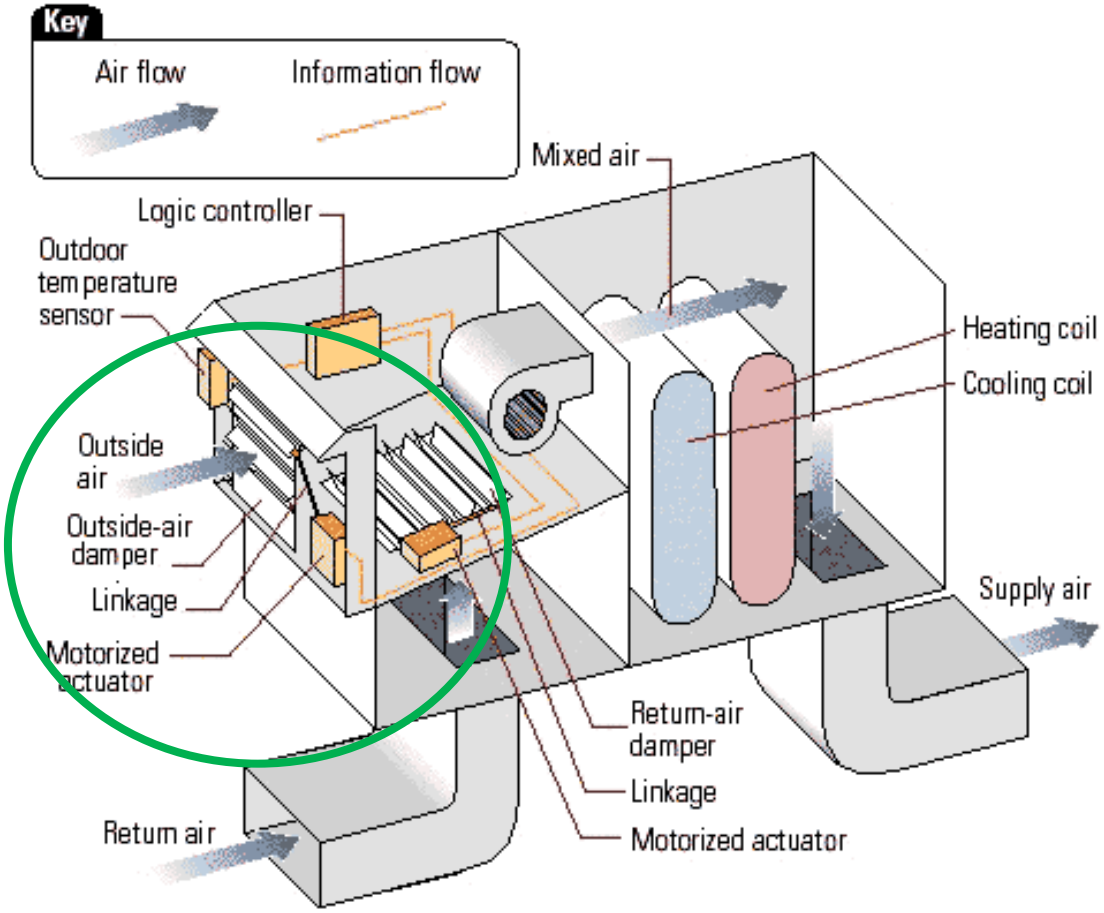
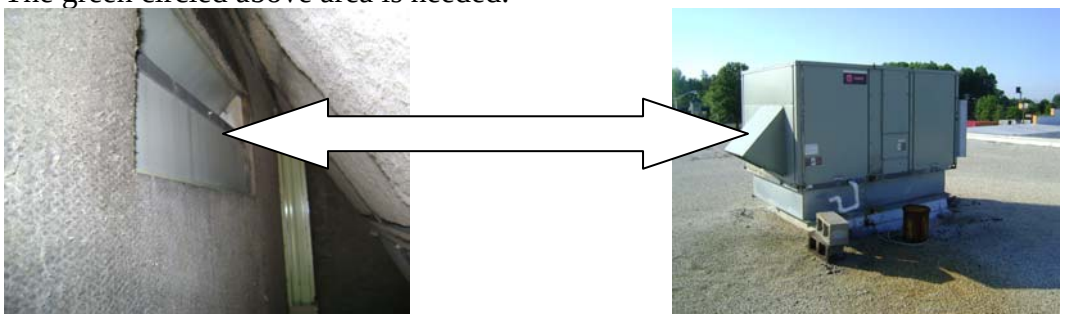
<u>Economizer Operation and why it is economically wise. It's free cooling</u>.



The green circled above area is needed.



This is your unit it has fixed damper. An economizer is motorized and operated according to outdoor air temp compared to indoor temp. This is part of the 42% savings you can enjoy if installed.

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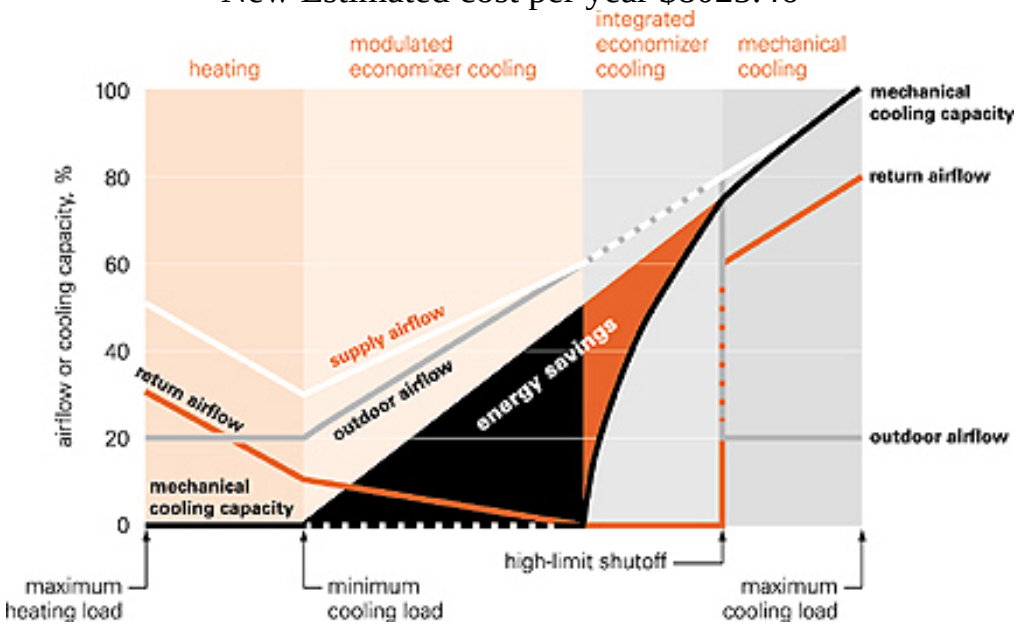
Energy Consumption Analysis

1931-CHARLOTTE, NC				
SERVICE PERIOD	# DAYS	USAGE	KW	COST
3/25-4/23/8	30	11,840	27	$636.35
4/24-5/22	30	11,120	34	$643.95
5/23-6/20	29	17,320	39	$1,030.22
6/20-7/25	35	19,920	38	$1,200.29
7/25-8/22	28	18,160	37	$1,095.87
8/22-9/23	32	20,760	37	$1,175.18
9/23-10/23	30	19,320	37	$1,001.37
10/23-11/20	28	18,040	36	$936.99
11/20-12/19	29	15,800	38	$1,011.38
12/19-1/22/9	34	23,280	38	$1,141.22
1/22-2/21	30	19,680	38	$1,021.19
2/21-3/24	31	18,920	37	$985.32
3/24-4/23	30	17,880	37	$947.66
4/23-5/21	28	18,880	39	$1,009.70
				$13,836.69

With recommended adjustments economizer, sealing duct work, 42% savings
New Estimated cost per year $8025.46



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Energy Consumption Analysis

Annual Electrical Costs (per utility data)	$13,837.00
Store Size (SF)	7,300
Average Electrical Cost / SF	$ 1.90

Retail Industry

Average Electrical Cost / SF	$ 1.10

Analysis

Excessive Electrical Consumption ($/SF)	$ 0.80
Excessive Electrical Consumption ($ / year)	$ 5,807.00
% Electrical attributed to HVAC	51%
Electrical attributed to HVAC (per year)	$ 2,961.57

Financial

Cost to Upgrade HVAC	$25,000.00

1. New high efficient equipment
2. Economizers
3. DDC Controls
4. CO2 Sensors to minimize OA
5. Repair Duct leaks
6. Seal roof curbs

Payback (electrical savings only)	8.4
Maintenance Cost on Existing Equip	$ 4,000.00
Payback (electrical and maintenance) (includes PM contract of $1500 / yr w/ purchase of new equipment)	4.6

Summary

The existing HVAC has met and exceeded its life expectancy. In addition, the HVAC equipment requires regular maintenance and is inefficient. Current systems are considerably more efficient and more reliable. Current electrical usage at Store 1931 exceeds the industry average by 42% with over 1/2 attributed to HVAC. We feel that it is in the best interest to replace the current equipment with new highly efficient units that incorporate economizers, CO2 sensors, and DDC controls. In addition, we recommend sealing existing ductwork and curb openings.

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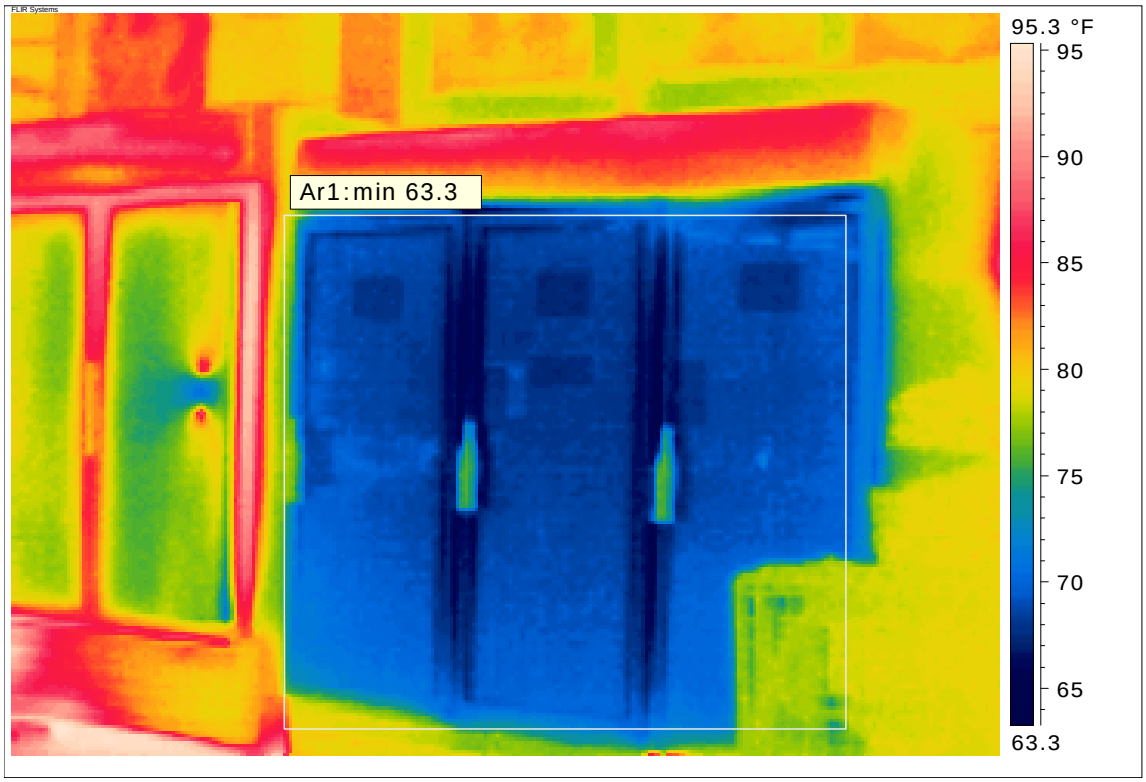

Description: gasket leakage –unit is 12 amps 1.5 HP

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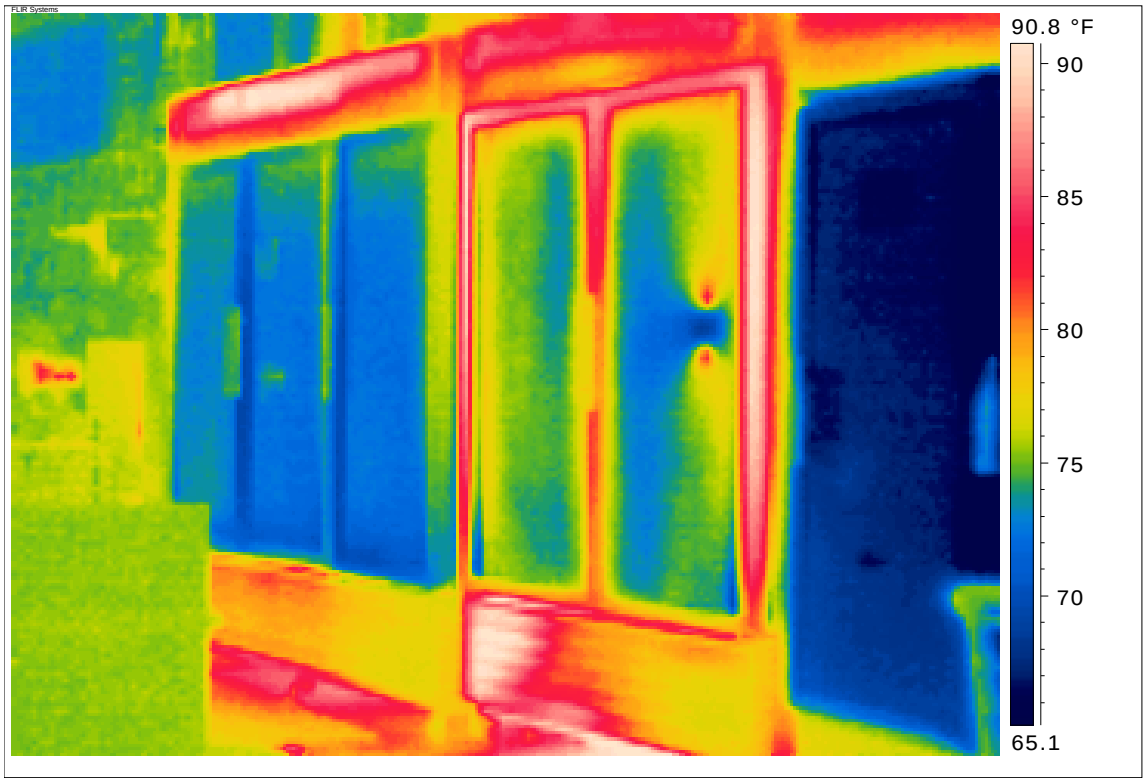

Description: Cold is blue some loss at the doors

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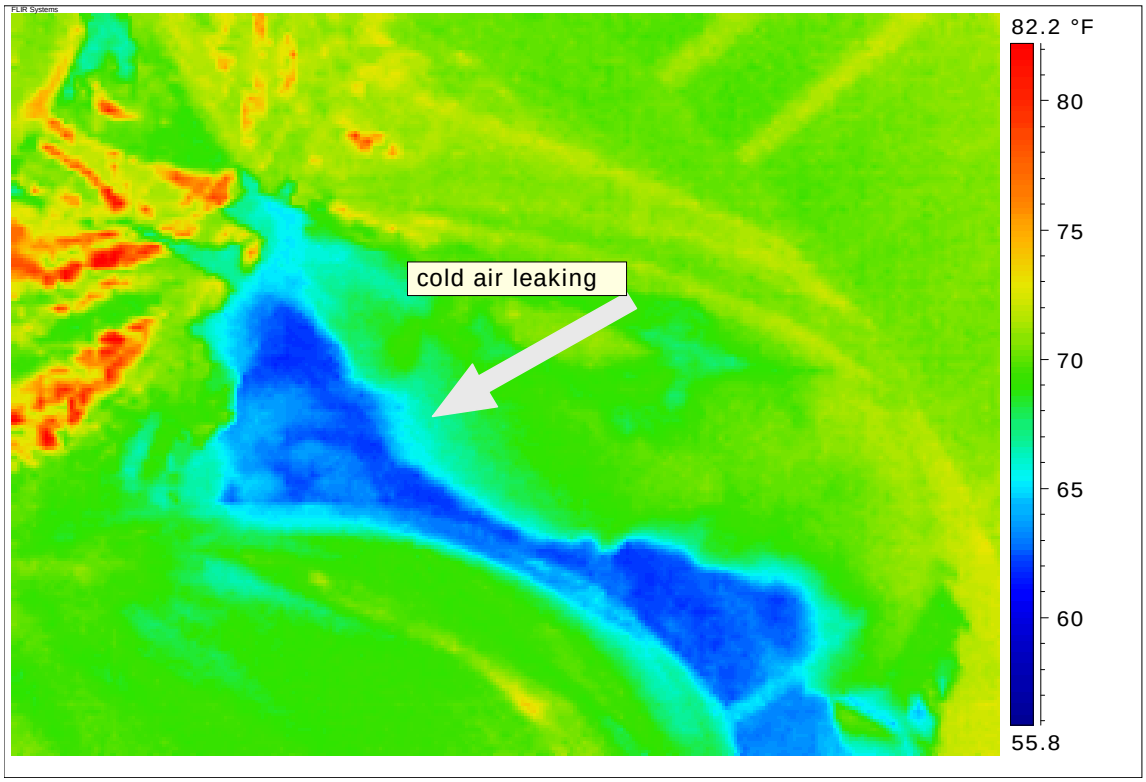
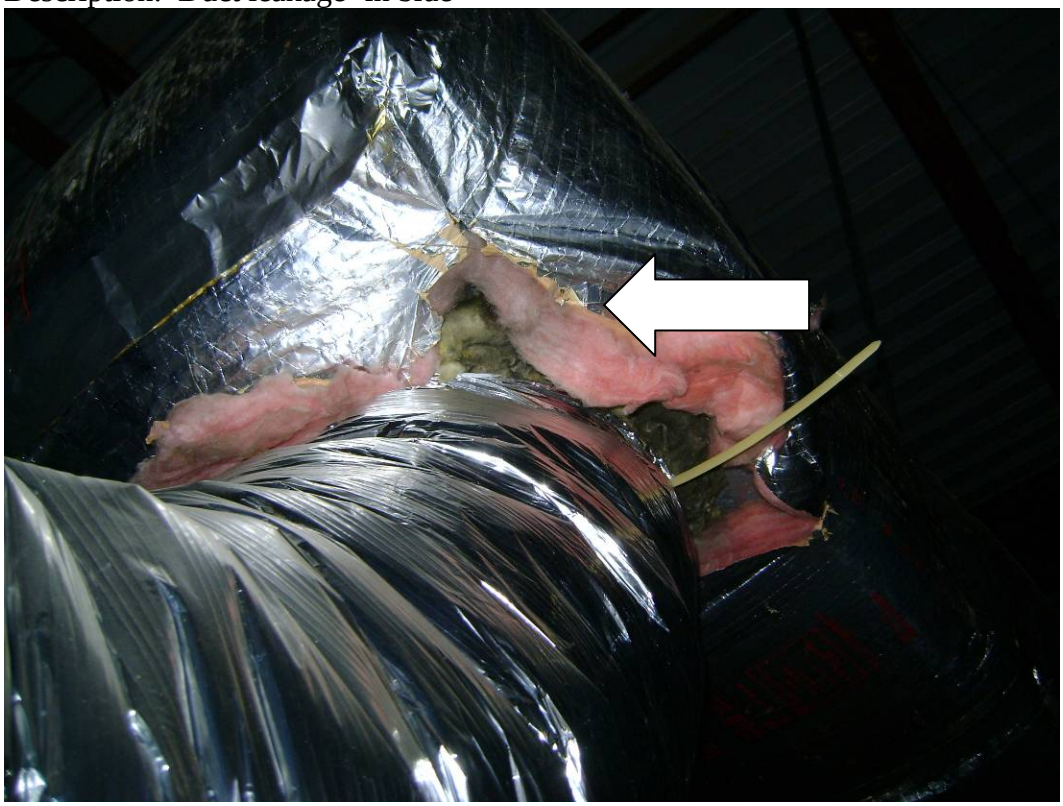


Description: Duct leakage- in blue



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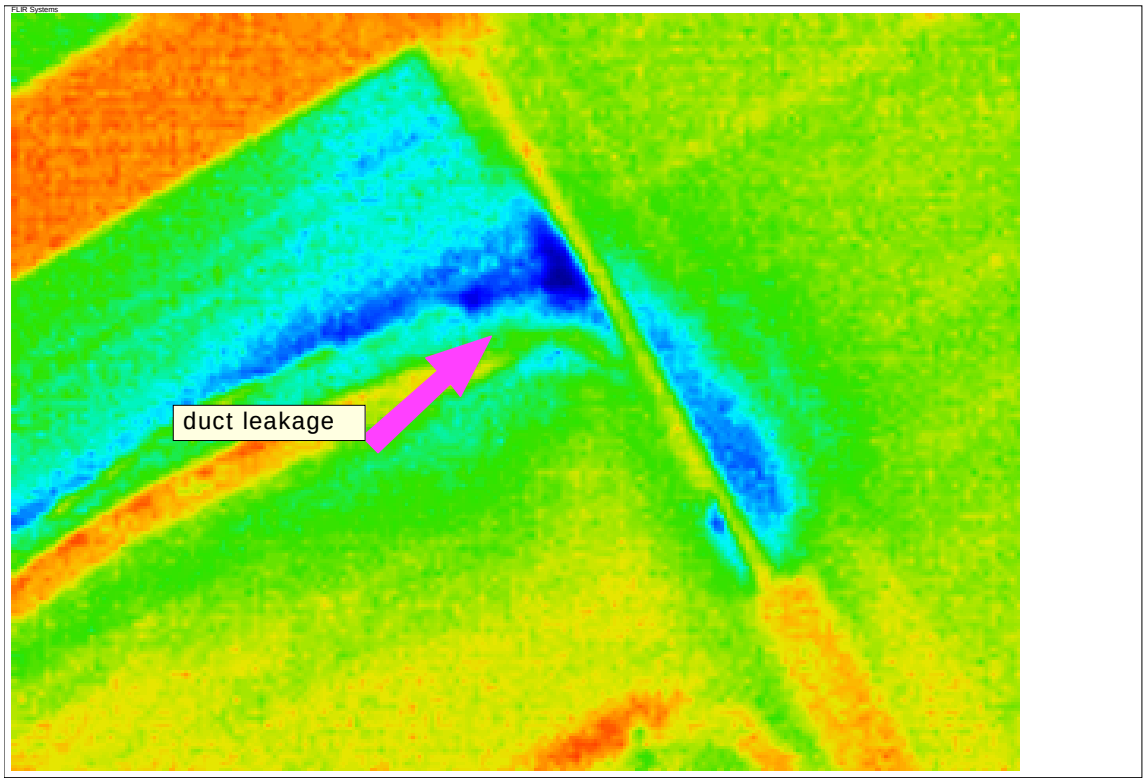

Description: Duct leakage in blue

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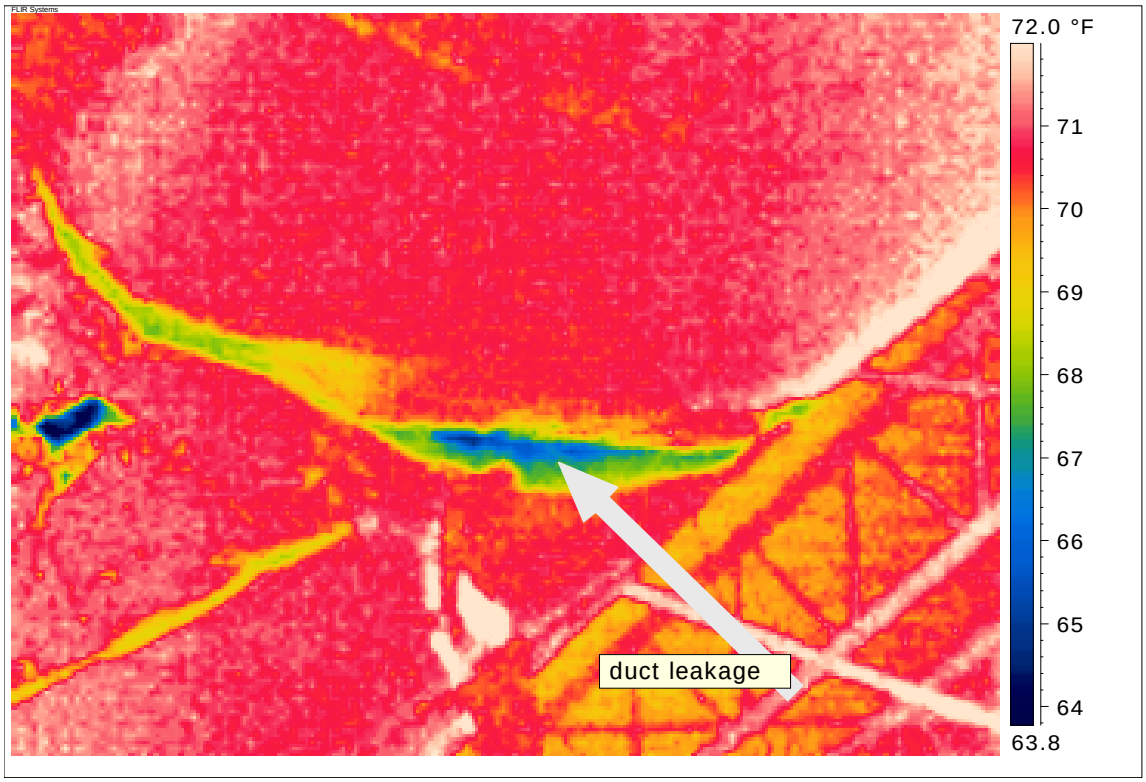

Description: duct leakage in blue

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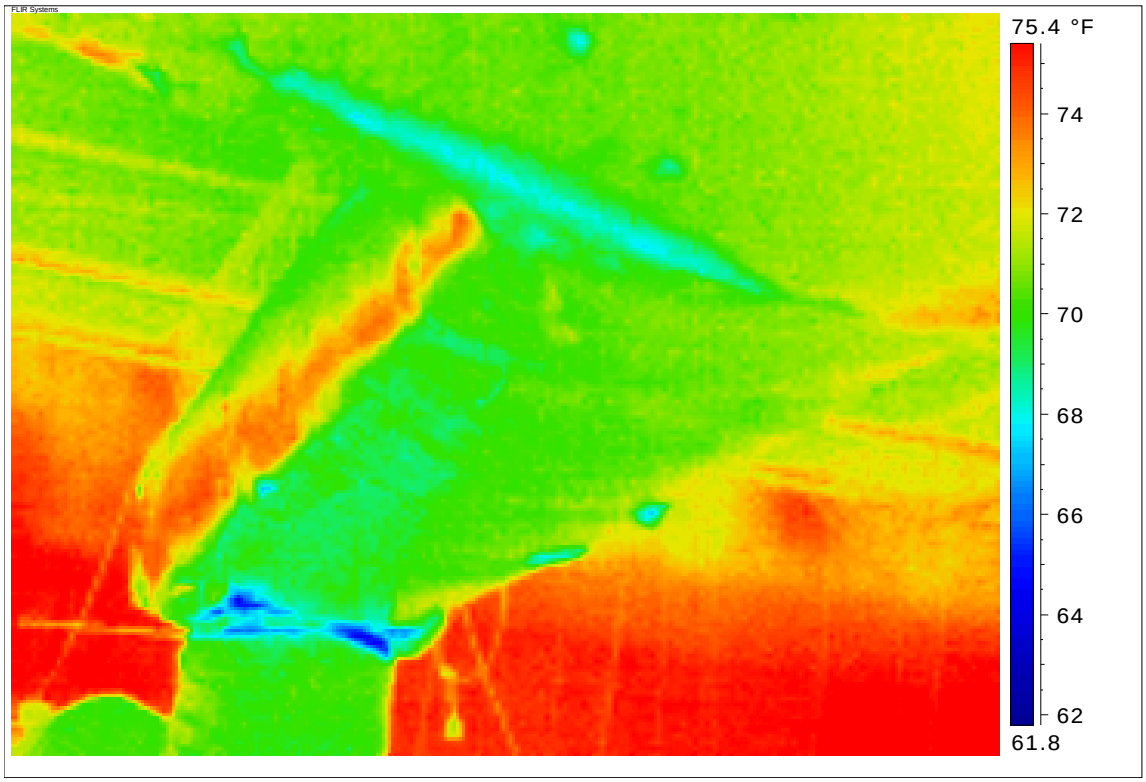

Description: duct leakage in blue

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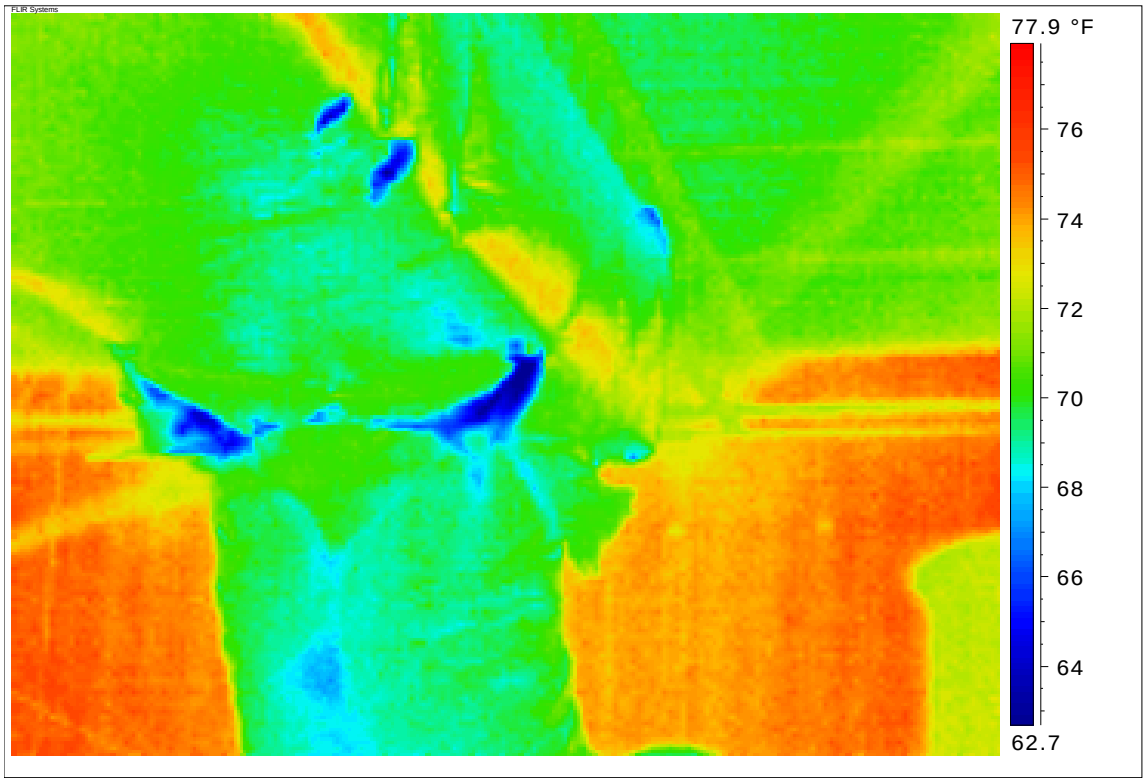
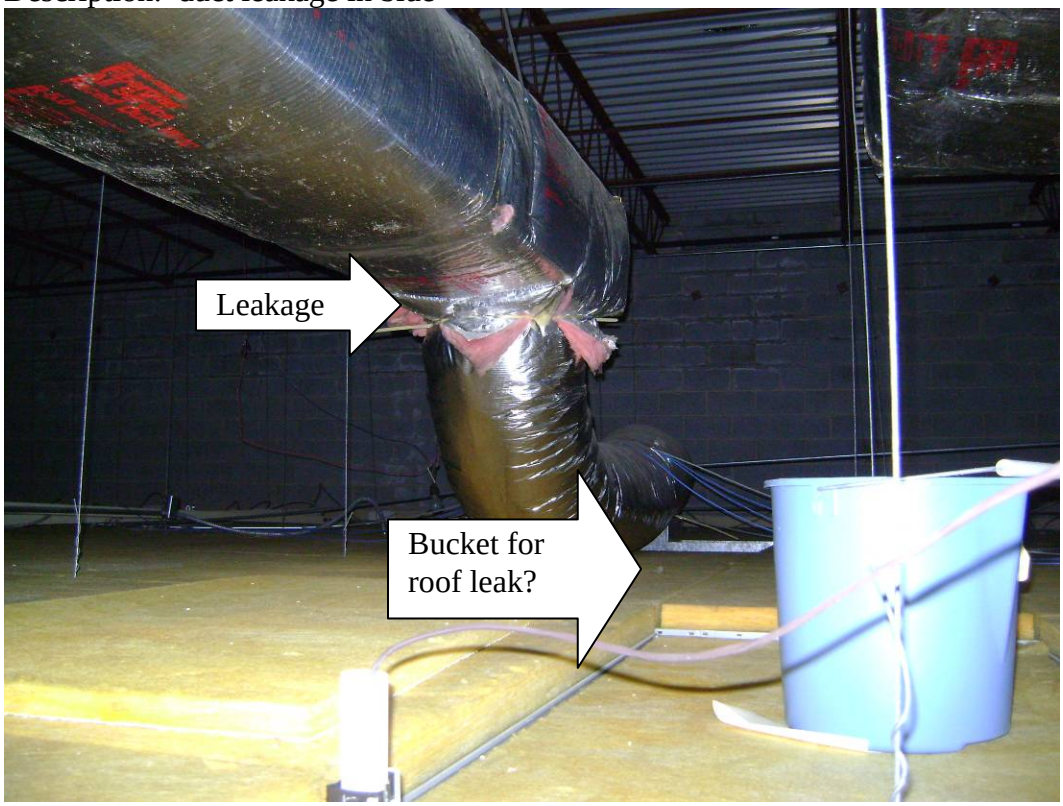


Description: duct leakage in blue



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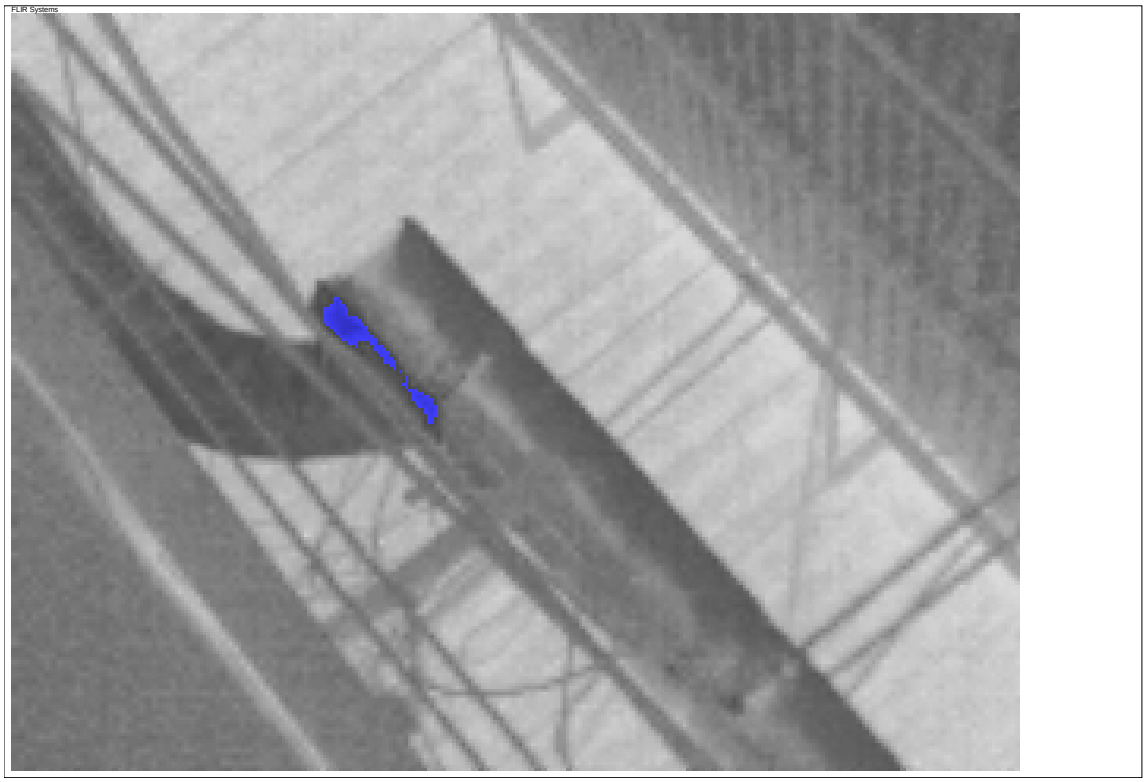
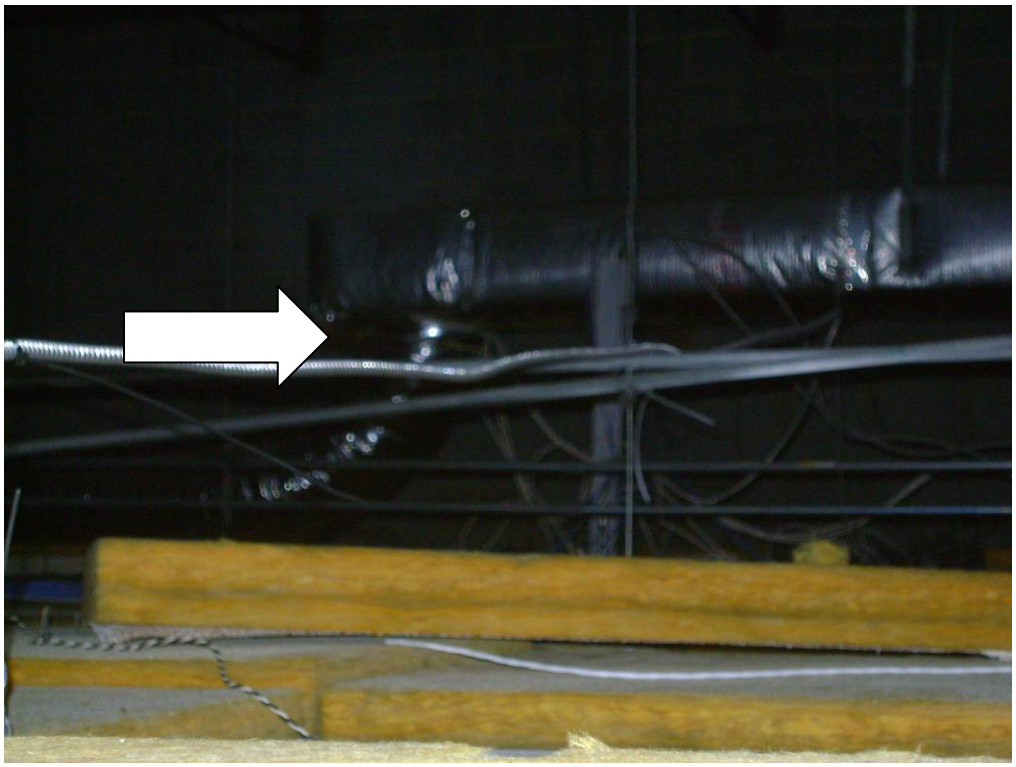


Description: duct leakage



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Description: Duct leakage in blue

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Description: cooler with door leakage

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Description: RTU needs more insulation roof curb has air leakage in blue
Also RTU should have economizer for free cooling in mild weather. The hood on the unit is only minimum air.

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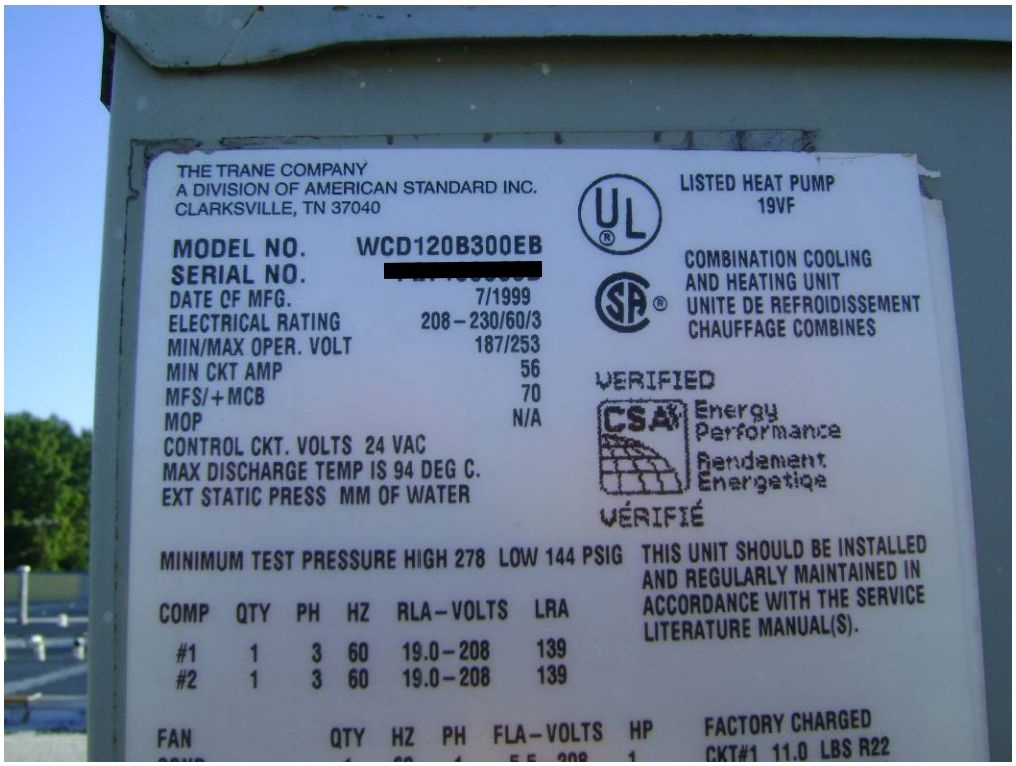
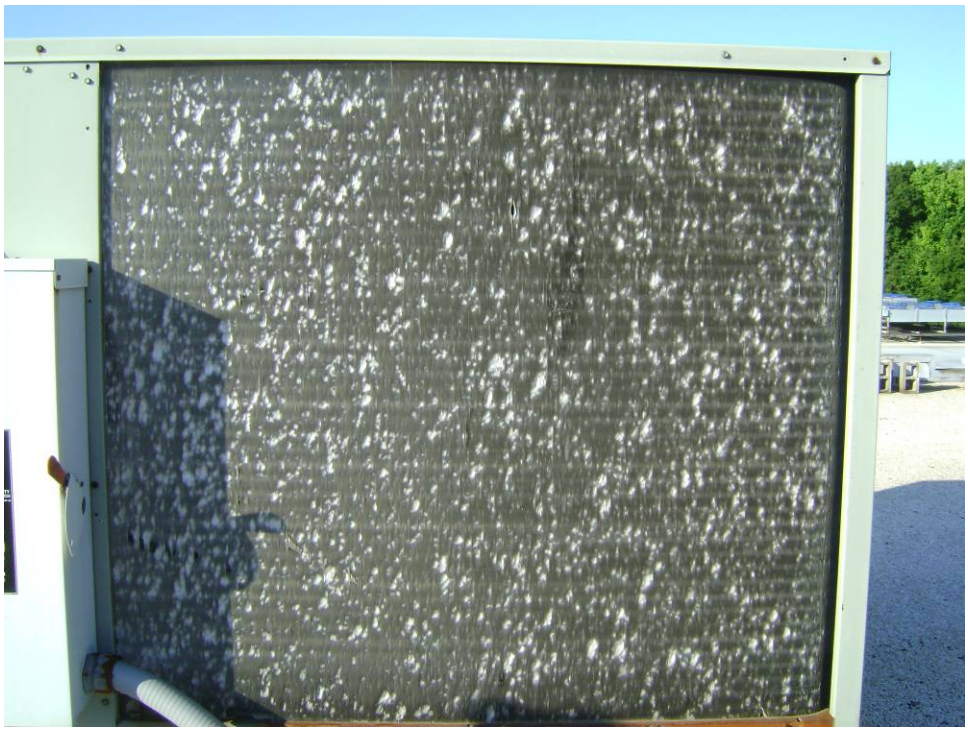


Hail damage ,unit should have hail guard .Unit power consumption is higher due to higher running pressures and poor heat transfer. Possibly one of the reasons the unit is non-operational.



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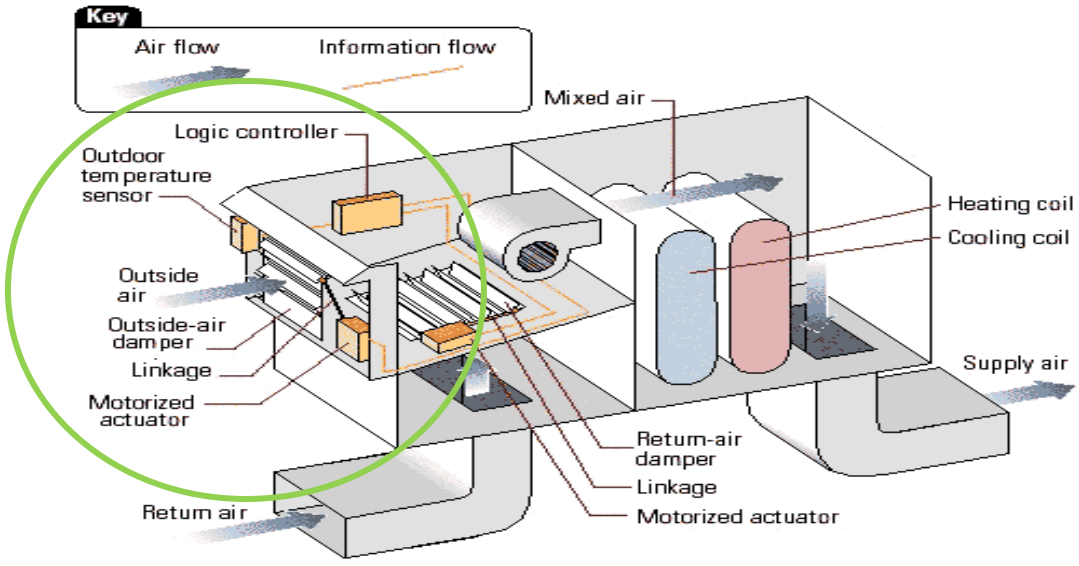
This is minimum outside air fixed damper. If this were an economizer it would allow free cooling in the cooler time of year .This missing feature can save thousands of watts and dollars per year. The economizer would also allow the store controls to purge out the store with fresh air.



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Signs of leakage without economizer system will run in cool conditions which could cause evaporator coil to freeze.