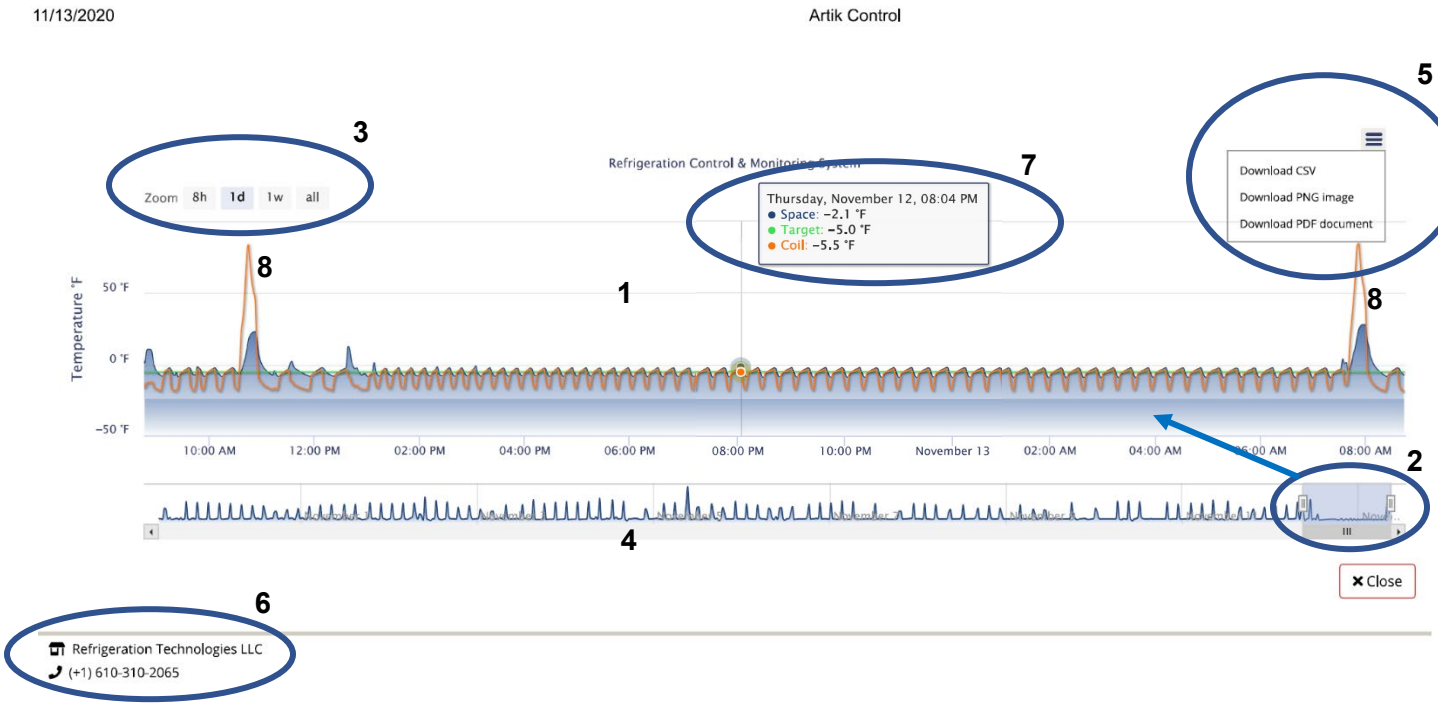
ArtikControl™

WIC / WIF

Graph Analysis Manual



RT ARTIK CONTROL

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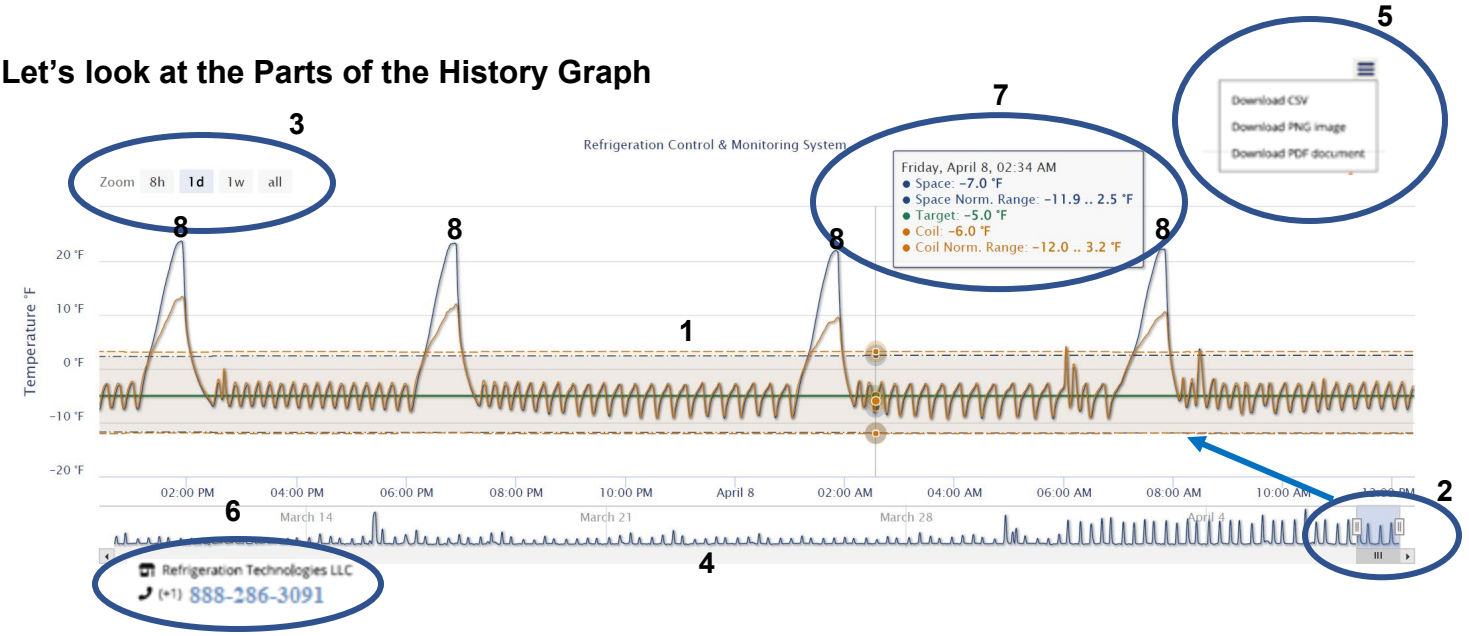
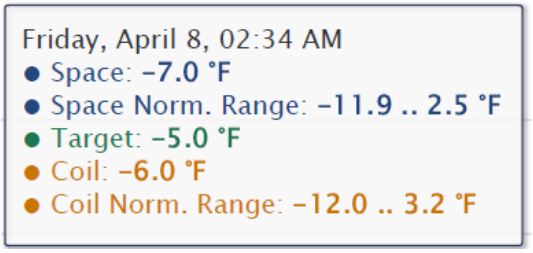
Welcome to the ArtikControl™ Graph Analysis Training Manual. In this manual we will be taking an Overview look at the History Graphs which are available on the User Interface website. We will be discussing various aspects of the Graphs which will aid you in better understanding what is happening within your Walk-in Unit. We will look at a variety of graphs which depict issues within the system to help with your troubleshooting of the system.

Graphs that will be Discussed.

Let's look at the Parts of the History Graph

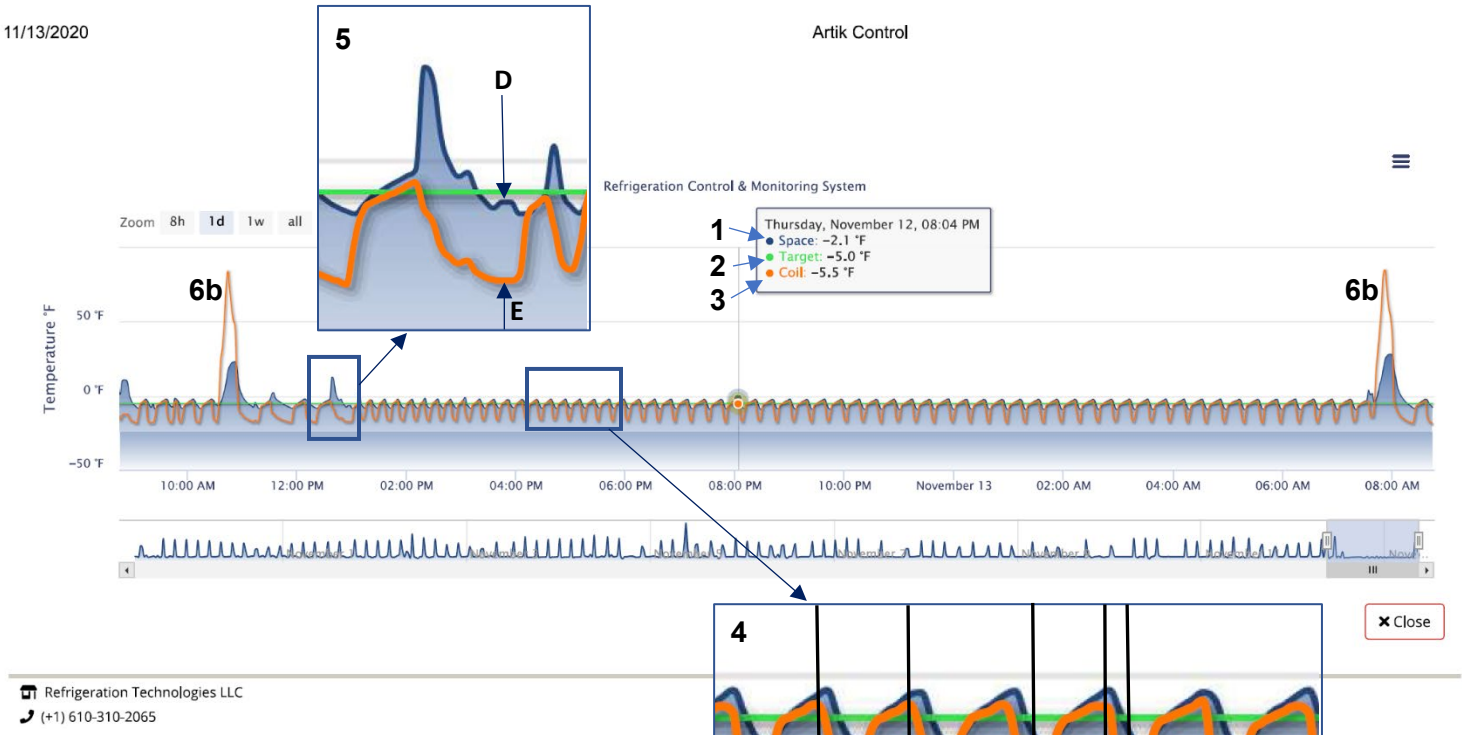


1. Main Graph Area.
2. Current Graph Segment selection.
    a. Allows you to adjust what detail and what time frame you want selected to be displayed in the Main Graph Area
3. Zoom Selection
    a. Allows you to pick predetermined time frames to be displayed in the Main Graph Area. Selection's area 8-Hours, 1 Day, 1 Week, and All.
4. Two Week Overview
    a. Graph at the Bottom shows the two weeks of Temperature information.
5. Graph Drop down Menu
    a. Allows you to save the Various Data from the Graph in Different Formats; CSV – used for Excel Format, PNG for Photo, and PDF for printable.
6. Refrigeration Technologies Contact Phone Number
    a. At the Bottom of every graph is our Contact Information, so if you have any questions we are here to help.
7. Temperature Displayed –
    a. When you mouse over the Main Graph Area it will display the 3 Temperatures being monitored, plus normal range of Space and Coil temperatures.
        i. Space Temp
        ii. Coil Temp
        iii. Target Temp



8. Defrost

What can we see looking at the Graph?

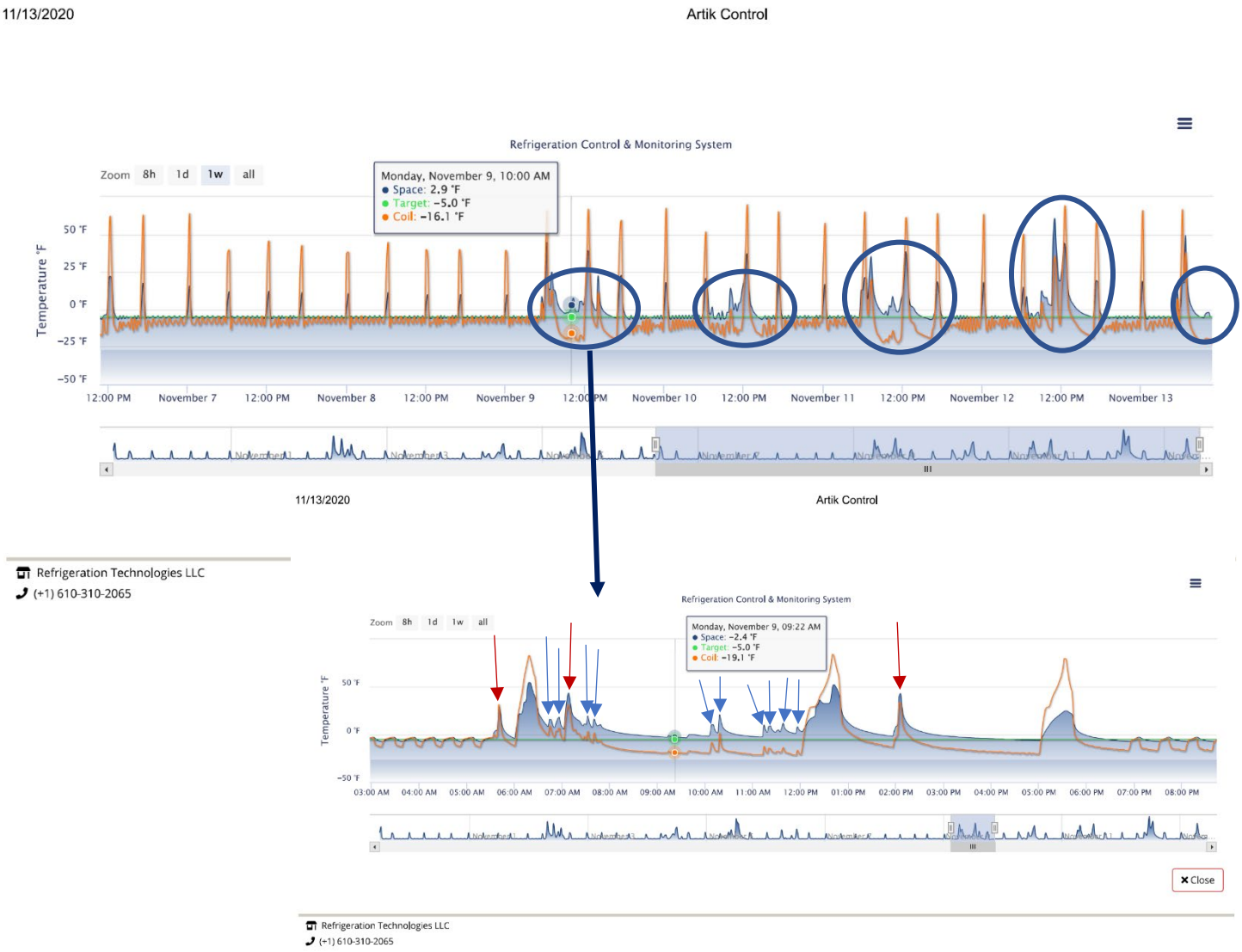


1. Space Temperature
2. Coil Temperature
3. Target Temperature
4. Compressor Cycles
    a. One Compressor Cycles is denoted by the segment labeled ‘A’. It is the time from when the Compressor Turns ‘ON’ through the Compressor ‘OFF’ cycle.
    b. Compressor ‘OFF’ Time – Denoted by ‘B’
    c. Compressor ‘ON’ Time – Denoted by ‘C’
5. Delta T (Temperature Difference between Space and Coil Temperatures)
    a. You can place the Mouse over an area on the Main Graph and it will show the Space Temp and the Coil Temp. You subtract the Coil Temperature from the Space Temperature to find the Delta T. If the Delta T is greater than 20 degrees, this can indicate a possible evaporator icing up. Temperature difference between ‘D’-‘E’.
6. Defrost
    a. Temperature or Time Termination – This Defrost has Temperature Terminated.
    b. Time between Defrost Cycles – 10am to 8am the following day (22 hrs. Defrost Cycle)

Behavioral Issues

Looking at this Graph it can help to spot various issues. One the most common is Behavioral Issues.

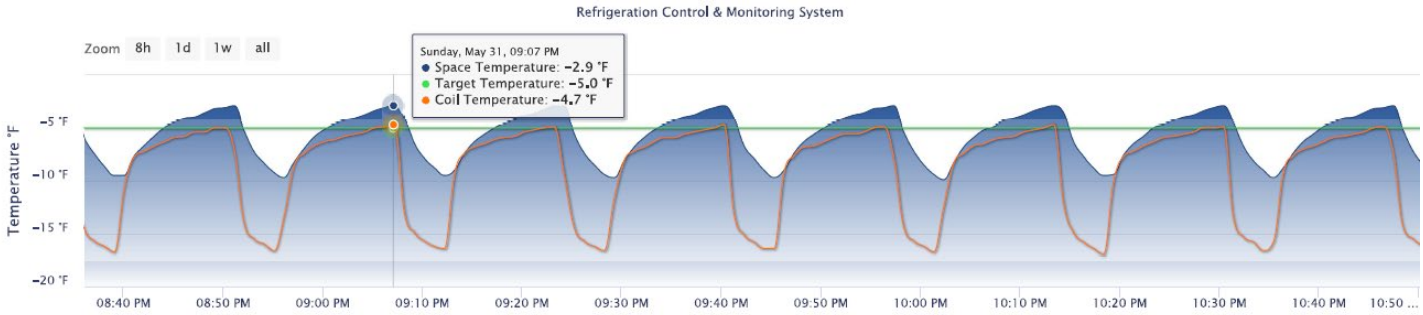
From the Areas you see Circled, the Door is being left open causing warm air to enter the Freezer space.



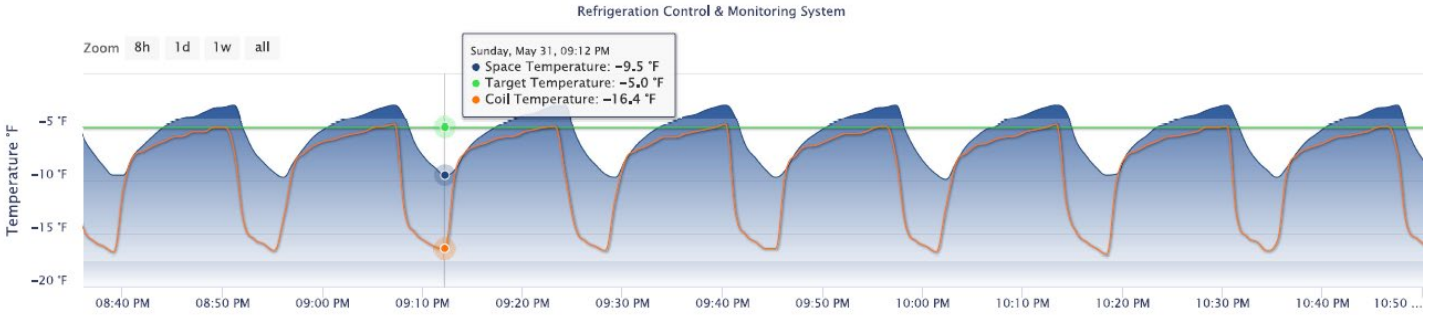
Blue Arrows indicate when the door was opened. RED Arrows indicate when the door is open and left open for an extended period. With the kitchen being in operation there is an increase amount of moisture in the air, this moist air attaches to the coil causing the coil to ice up. The icing of the coil reduces the efficiency of the Evaporator Unit, causing the system to take longer to cool the space back down to the Target temperature.

You can see the Space Temperature is -2.4°F and the Coil Temperature is -19.1°F. This gives us a Delta T (ΔT) of 16.7°F.

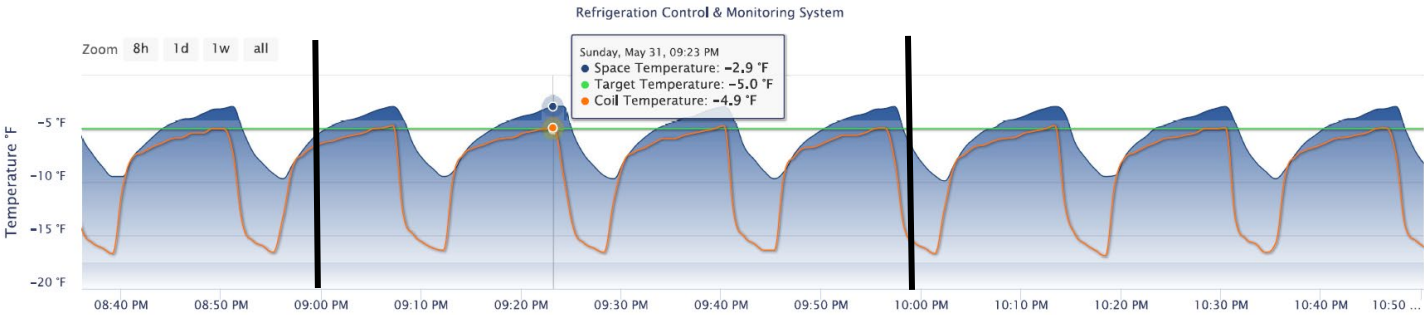
Understanding Compressor Cycles



Start of Cooling Cycle (Compressor 'ON'.) System is at the Upper Dead-band Temperature.



Completes Cooling Cycles (Compressor 'ON'.)
System has reached the lower Dead-band temperature.
Starts Compressor 'OFF' Cycle.



Compressor 'OFF' Cycle is completed because system has reached the upper Dead-band temperature.

System starts over again trying to maintain the Target Temperature ±2°F

You can see from the Graph that Compressor cycles @ 3.5 times in 1-hour.

While it is certainly important to have a minimum and maximum run time in place for proper system performance, it's equally important to have a minimum OFF time in the form of an operation time delay. This is arguably the most common cause of a short cycle. By having an effective time delay, you can potentially prevent other causes from infiltrating your system. For example, a proper time

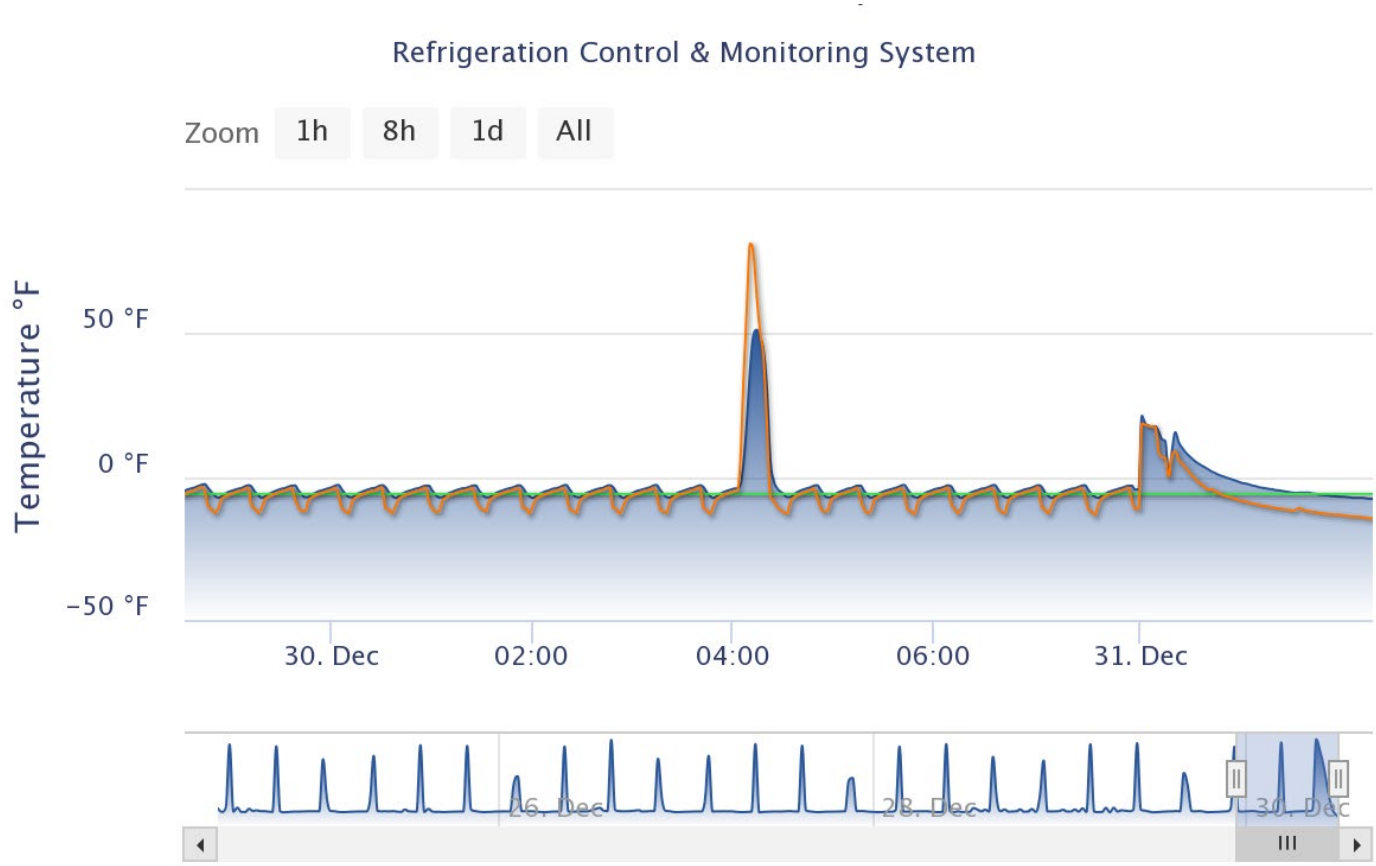
delay can keep the system from running due to discharged air still circulating in the system immediately after its operation. Another: it can allow the pressure controller to reset itself naturally while not calling for cooling as opposed to firing another cycle based on high pressure triggers due to compromised condensers.

Every time a compressor cycles, a small amount of oil that is supposed to keep it lubricated actually travels as a mixture with the refrigerant throughout the system. "*If the compressor is cycled off and on too quickly, an imbalance is created. Each time the compressor starts, oil is pumped out, but without sufficient run time the oil stays out in the system and does not return to lubricate the compressor. This imbalance will lead to a shortage of oil inside the compressor and bearing failure.*"

Compressor Minimum Cycle Off Time: The amount of time the compressor remains off between cycles. This is set to 5 minutes by default. Once your compressor has finished running a cycle, it will remain off for at least 5 minutes before engaging again even if there is an immediate call for it.

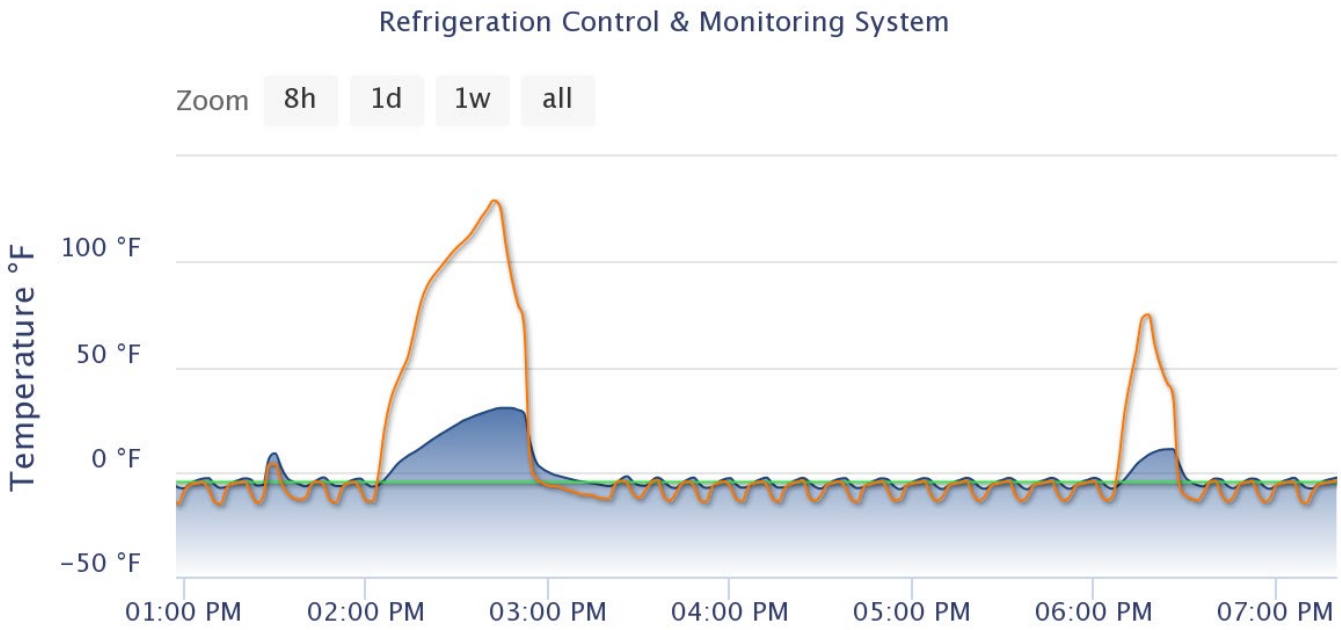
Compressor Minimum Cycle ON Time: The amount of time the compressor remains ON between cycles. This is set to 5 minutes by default. Once your compressor starts to run, it will remain running for a minimum of 5 minutes even if the set-point temperature has been reached.

Breaker Tripped on Condenser Unit



As you can see on December 31st the Temperature spiked in this Box. The Refrigeration Technician along with monitoring personnel from Refrigeration Technologies received this alarm. Since both understood that school was not in session, something happened causing the temperature to rise. The Refrigeration Technician went out and after looking over the system determined that a breaker supplying line voltage to the Condenser had tripped due to a weather-related situation.

Defrost – Temperature Termination verses Time Termination.



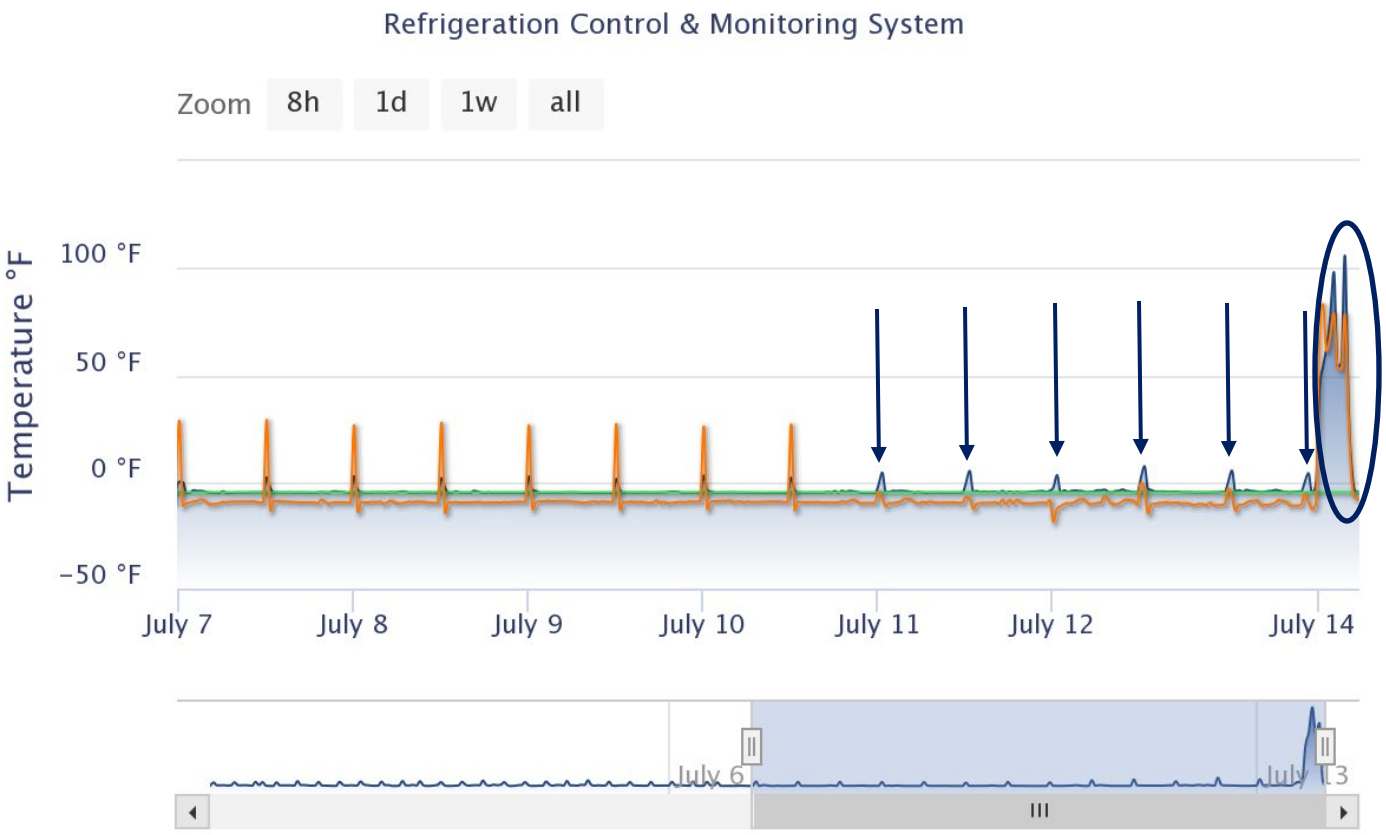
Time Defrost – Set at 40 minutes. Reached a temperature of 130 °F and requires 29 minutes to return to -5°F.

Temperature Defrost – set at 75°F. Reached a temperature of 78°F and requires 15 minutes to return to -5°F

In most of our systems, we set the Defrost Termination to Temperature Termination. This reduces the energy consumption both through a lower temperature to Defrost and a faster recovery time for the compressor to bring the Space Temperature backdown to the Target Temperature.

If we notice repeated Evaporator Coil Icing due to behavioral issues, we will put the system into Time Termination and manually activate the Defrost to make sure the coil is thoroughly cleaned of ice.

Defrost Heater Issue



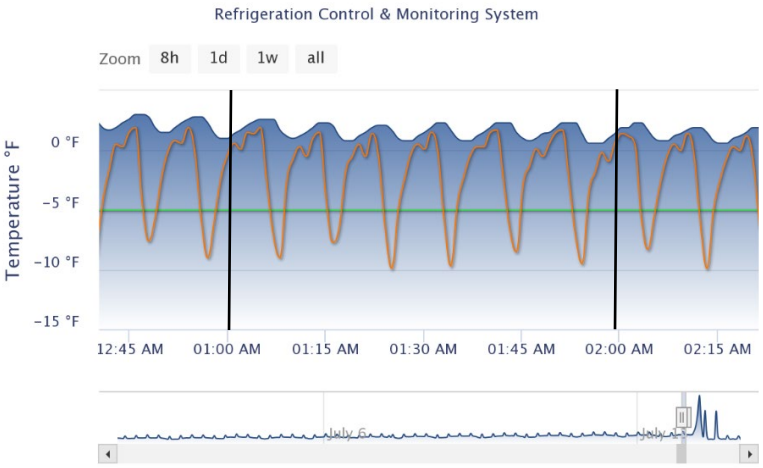
In the Graph above you can see that during the defrost cycle the coil temperature was barely raising. When the Refrigeration Technician arrived, he was able to quickly diagnose that the defrost issue was caused by a faulty wire connection not allowing the voltage to transfer down to the heater elements. Once the wiring issue was corrected the system was placed into a Time Defrost to make sure the coil was completely cleaned of ice.

Dirty Condenser Coil

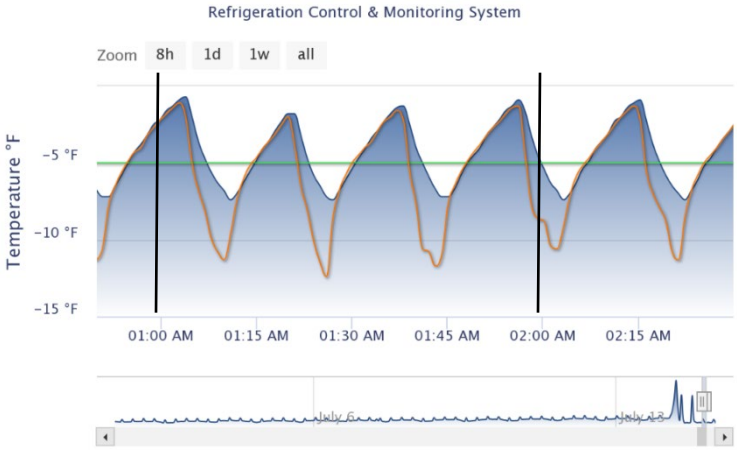
General Maintenance of your Walk-in Cooler and Freezer components can go a long way in keeping the System running efficient and helping to reduce the overall cost of running the System.

A Maintenance item that is sometimes overlooked is the cleaning of the Condenser Coils. The Condenser units for the Walk-in Cooler and Freezer are typically located outside. With the Units being located outside Debris and Dirt can be drawn into the fins of the coil for the Condenser system. This can clog the airway between the fins of the coil causing the coil to lose its efficiency in removing heat from the refrigerant causing the compressor to work harder. In extreme situations this increased usage can cause the compressor to fail.

Below is an example of a Before and After graph showing compressor cycles. You will notice that in the before graph the compressor is running about 6 times an hour to maintain the Walk-in Freezer box temperature. After the Coil was cleaned the compressor is running about 4 times an hour. That would roughly equate to a reduction in compressor cycles of over 48 less compressor cycles per day for this Walk-in Freezer. In a year that is 17,520 less compressor cycles.



Before the Condenser Coils were cleaned.

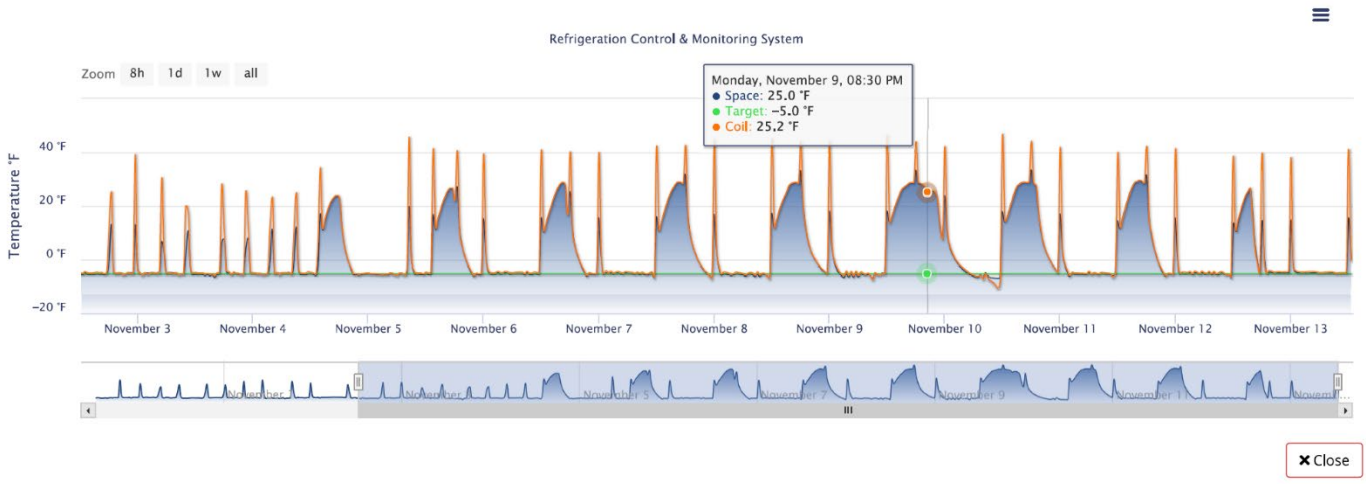


After the Condenser Coils were Cleaned.

A dirty condenser can severely limit your system's ability to reject heat for regulating temperatures and pressures needed for cooling which can lead to compressor tripping on high head pressure. If the condenser has automatic high pressure reset, it can result in short run cycles.

Another Example of how a Dirty Condenser Coil can cause the Evaporator Temperature to raise. This Condenser Coil was clogged with grass clippings.

11/13/2020 Artik Control



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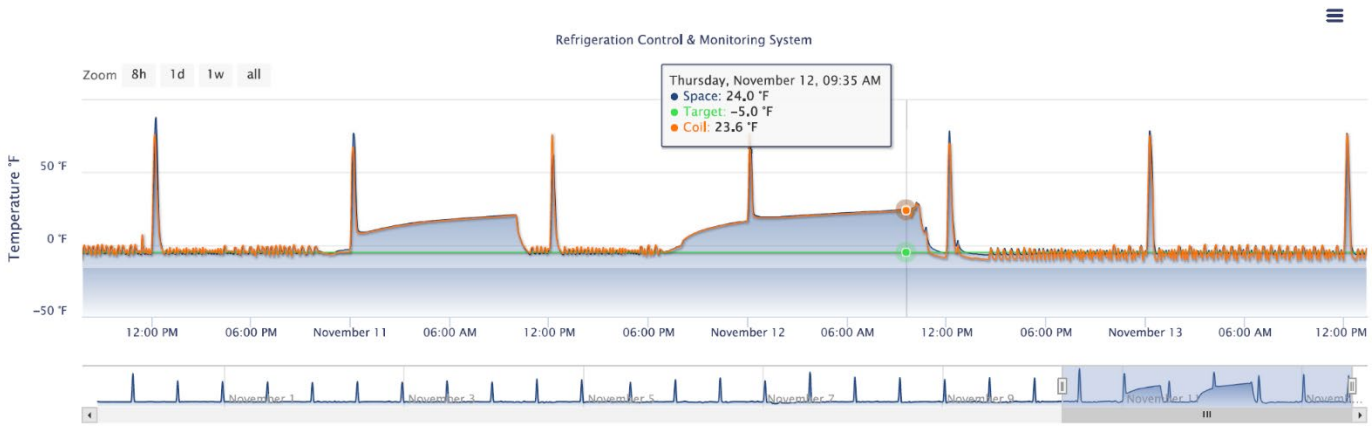
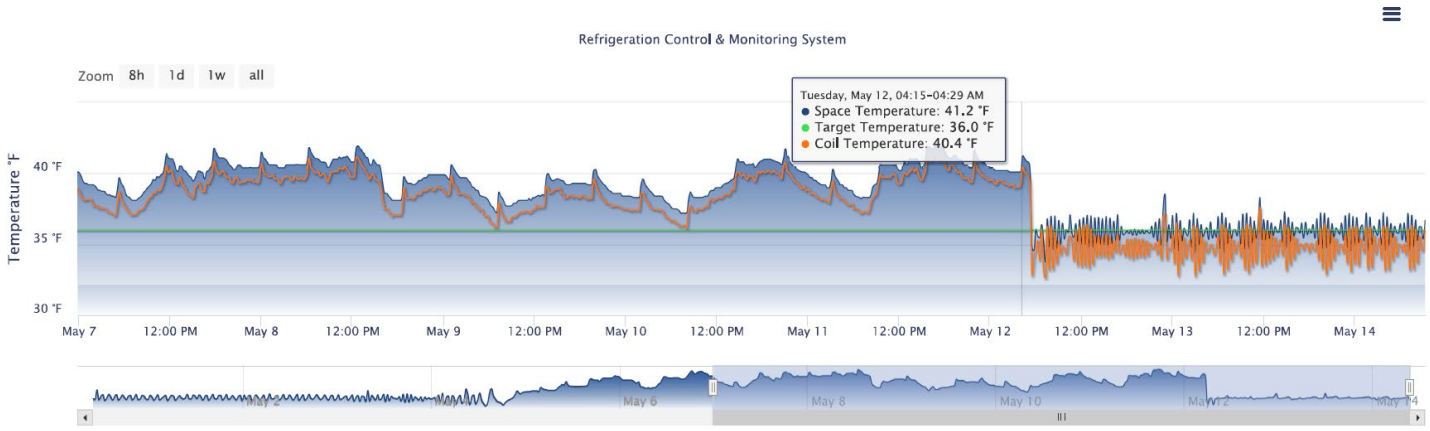
Freon Leak

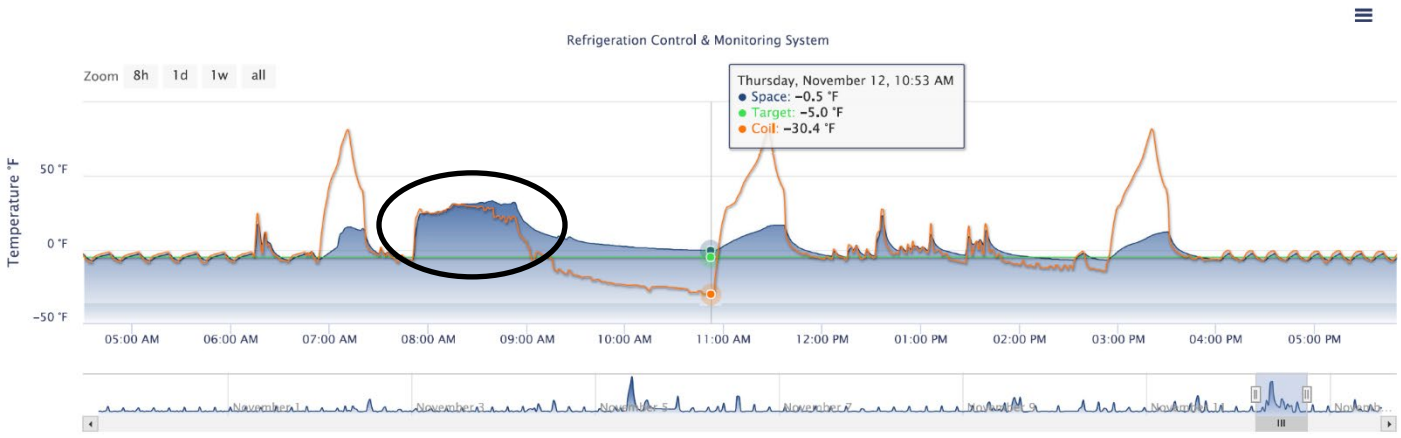


In this graph you can see how the temperature rises. This is being caused by a Freon Leak in the Condenser Unit. From the Graph you can see that the temperature in the Evaporator rises during the nighttime, this was caused by the reduced pressure being below the low cut-off pressure setting on the condenser. During the Day time when the sun causes the pressure to increase it rises above the low cut-off pressure setting and allows the system to cool.



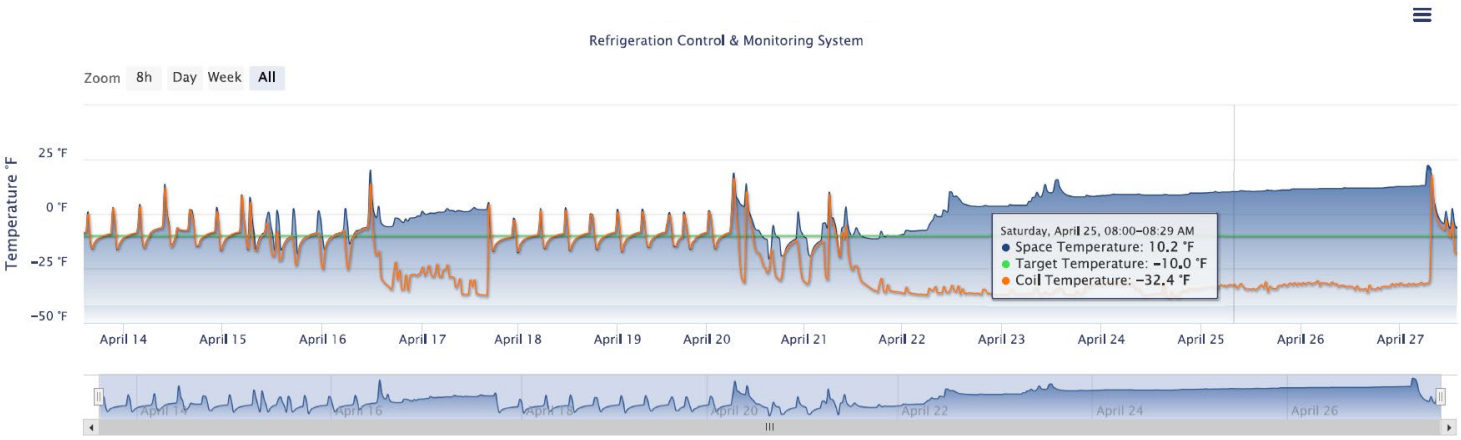
Cooler that had a Freon leak. Leak resolved, properly filled with Refrigerant system operating back to normal.

Icing on the Coil



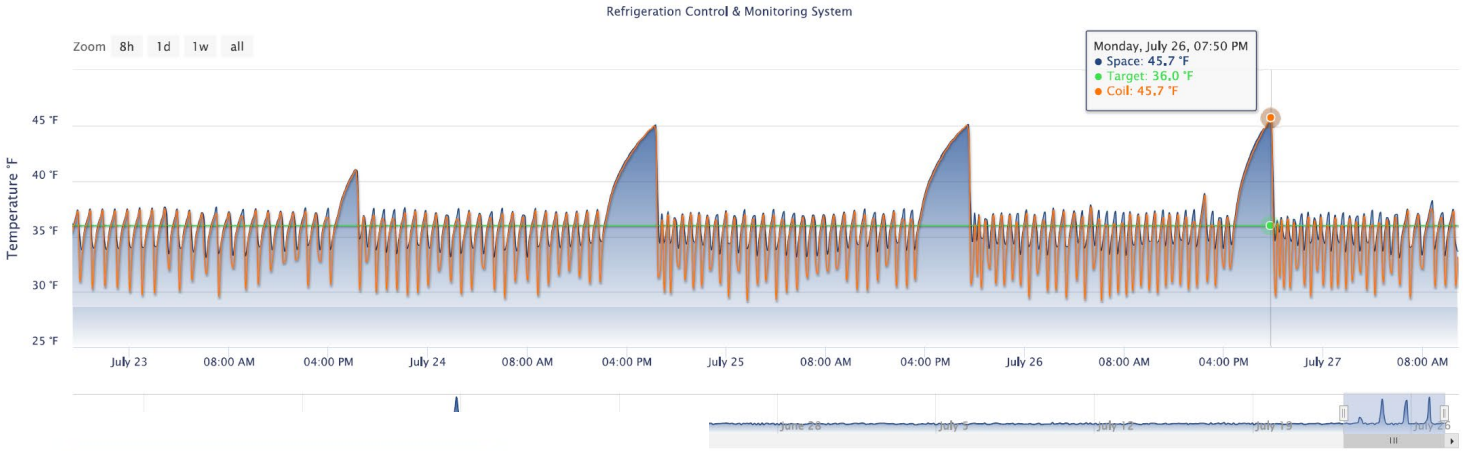
You can see in the Graph how the Door was open for an extended period allowing for warm moist air to get into the Freezer space. The moist air condenses on the coil due to the lower temperature. As the coil temperature reaches 32°F the moisture starts to freeze on the coils blocking the air space in the coils. This reduces the efficiency of the Evaporator Coil to remove the heat from the Freezer space. The condenser continues to move the refrigerant through the coils trying to lower the space temperature down to the target temperature, resulting in a ΔT greater than 20°F. The ΔT greater than 20°F is a sure sign that Ice has accumulated on the coils.

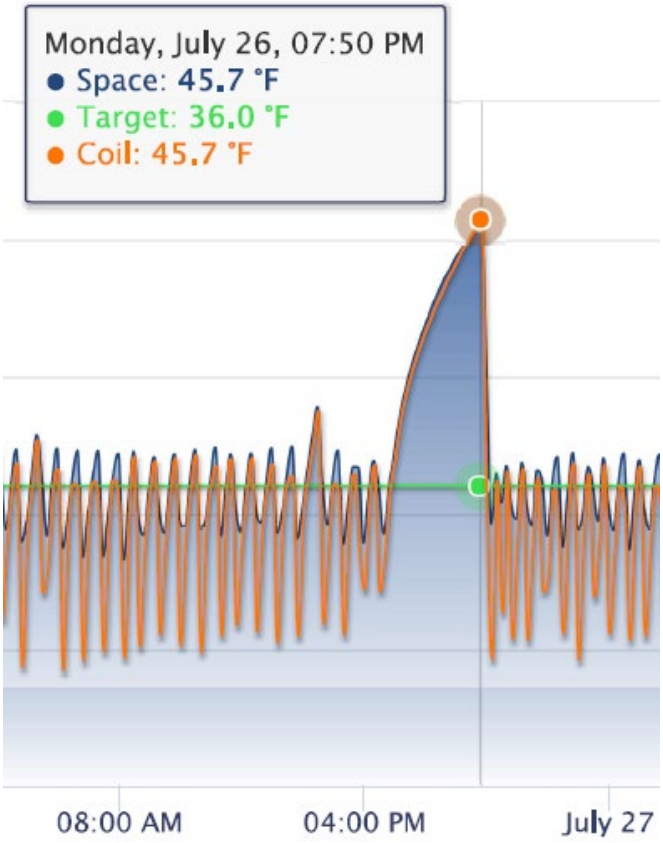
Pressure Switch Stuck.



Issues with the Freezer not cooling correctly. It was determined by the Refrigeration Technician that the condensers pressure switch was having issues. Technician replaced the Pressure switch and the unit returned to normal operation.

Pressure Switch – Adjustment / Failure Issue

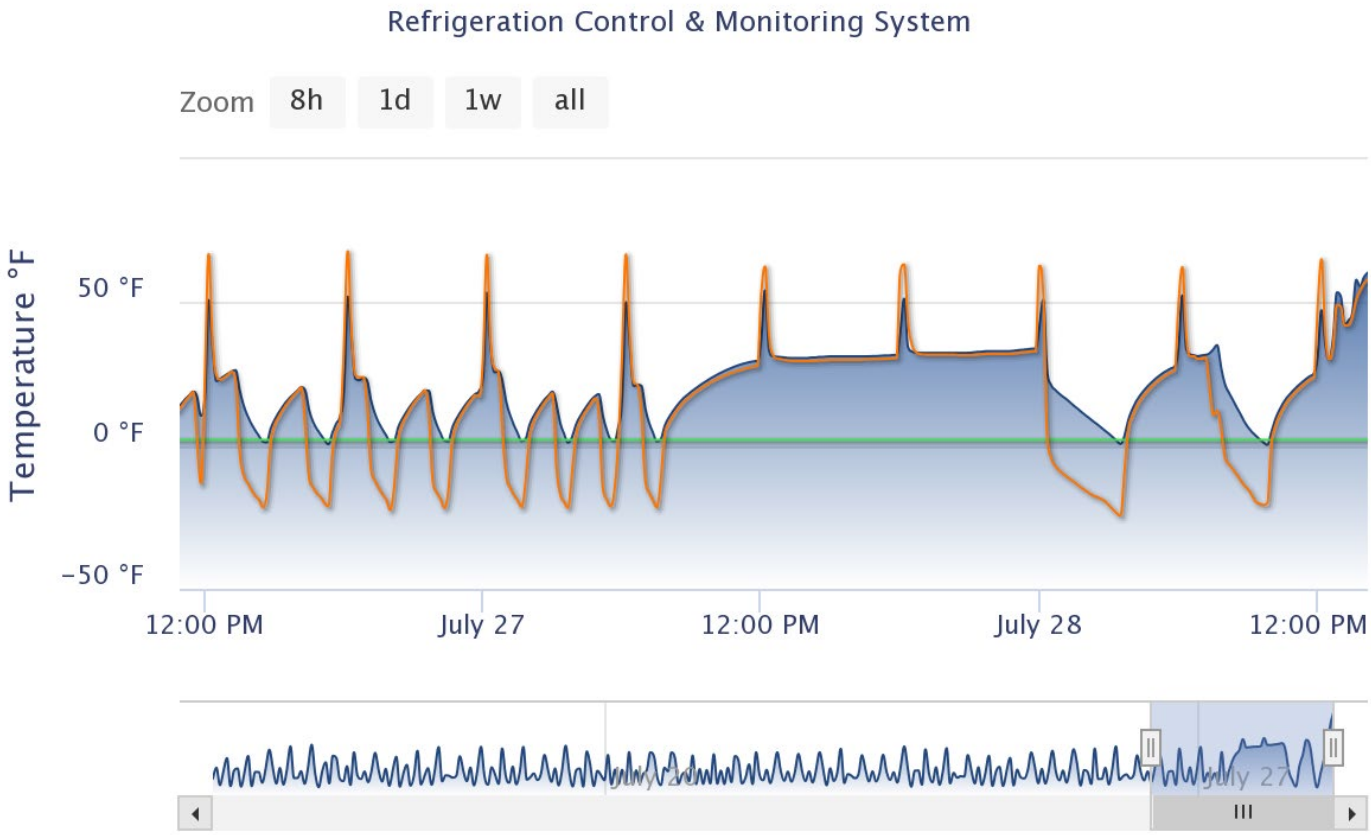




If the pressure switch is miss adjusted on the high end, an increase in outside temperature can cause the Pressure Switch upper cut-off setting to prevent the Condenser from operating when coolant is requested. You can see in the graph above that the system is not cooling starting around 4 pm each day during the heat of the day and starts to cool around 8 pm when the outside temperature starts to drop lower the refrigerant pressure in the system.

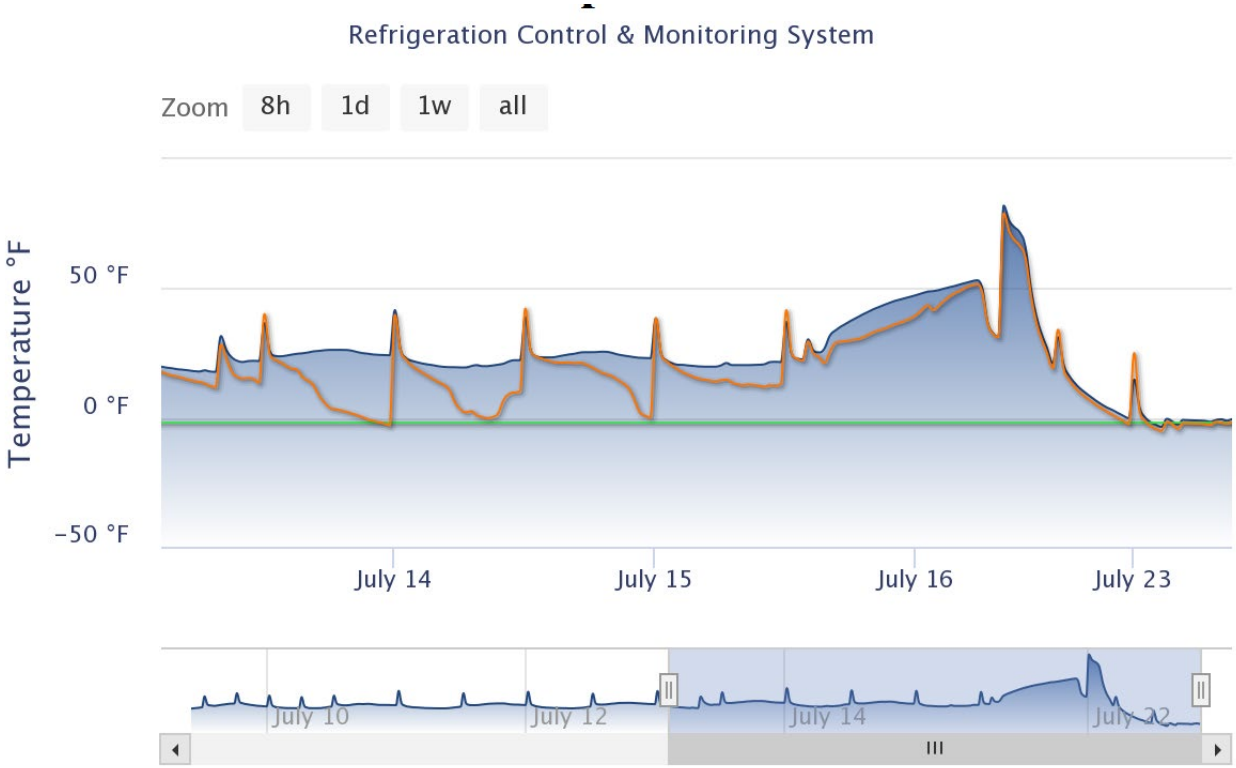
A Pressure switch that has failed will also give the same type of response.

Solenoid Sticking

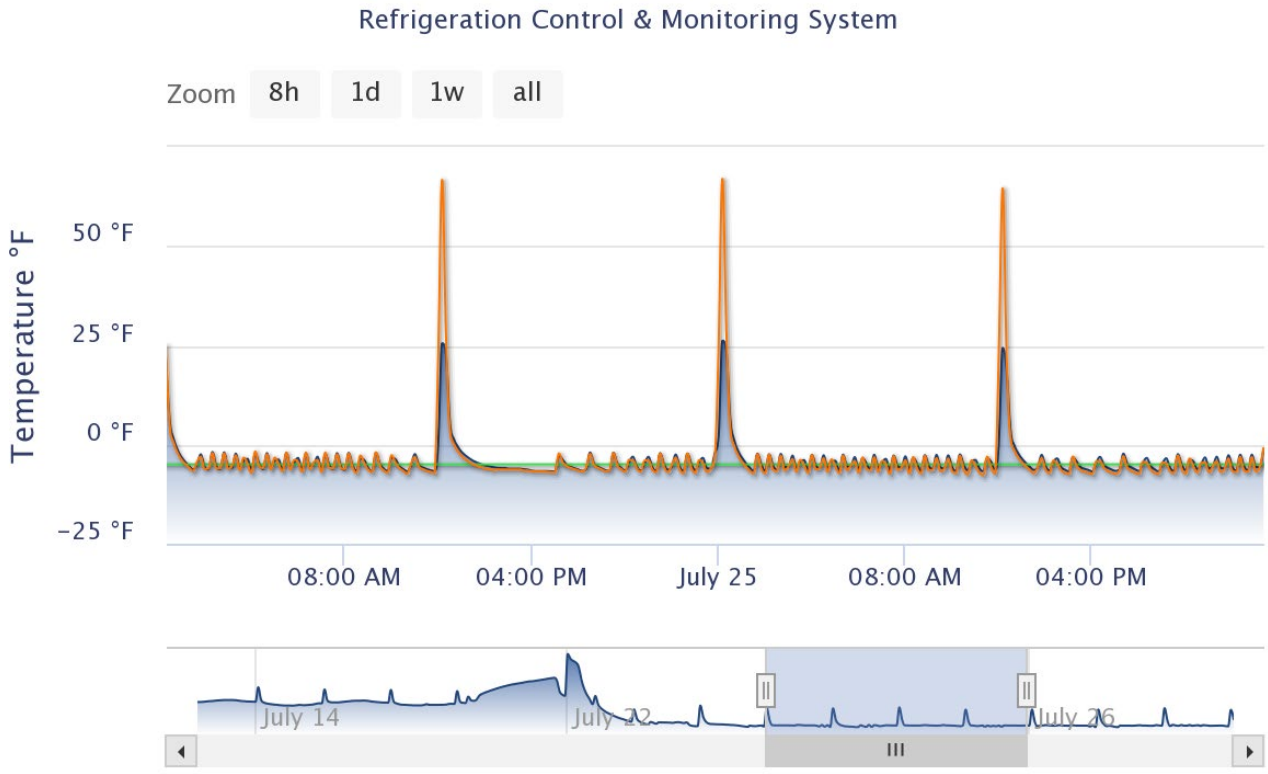


Solenoid Valve was sticking, not allowing the refrigerant to flow through the coils to cool the space. Refrigeration Technician found that the Solenoid Valve was sticking, it was getting voltage applied but was not opening the solenoid valve. Tried cleaning to no avail. Technician replaced Solenoid valve; system went back to normal operation.

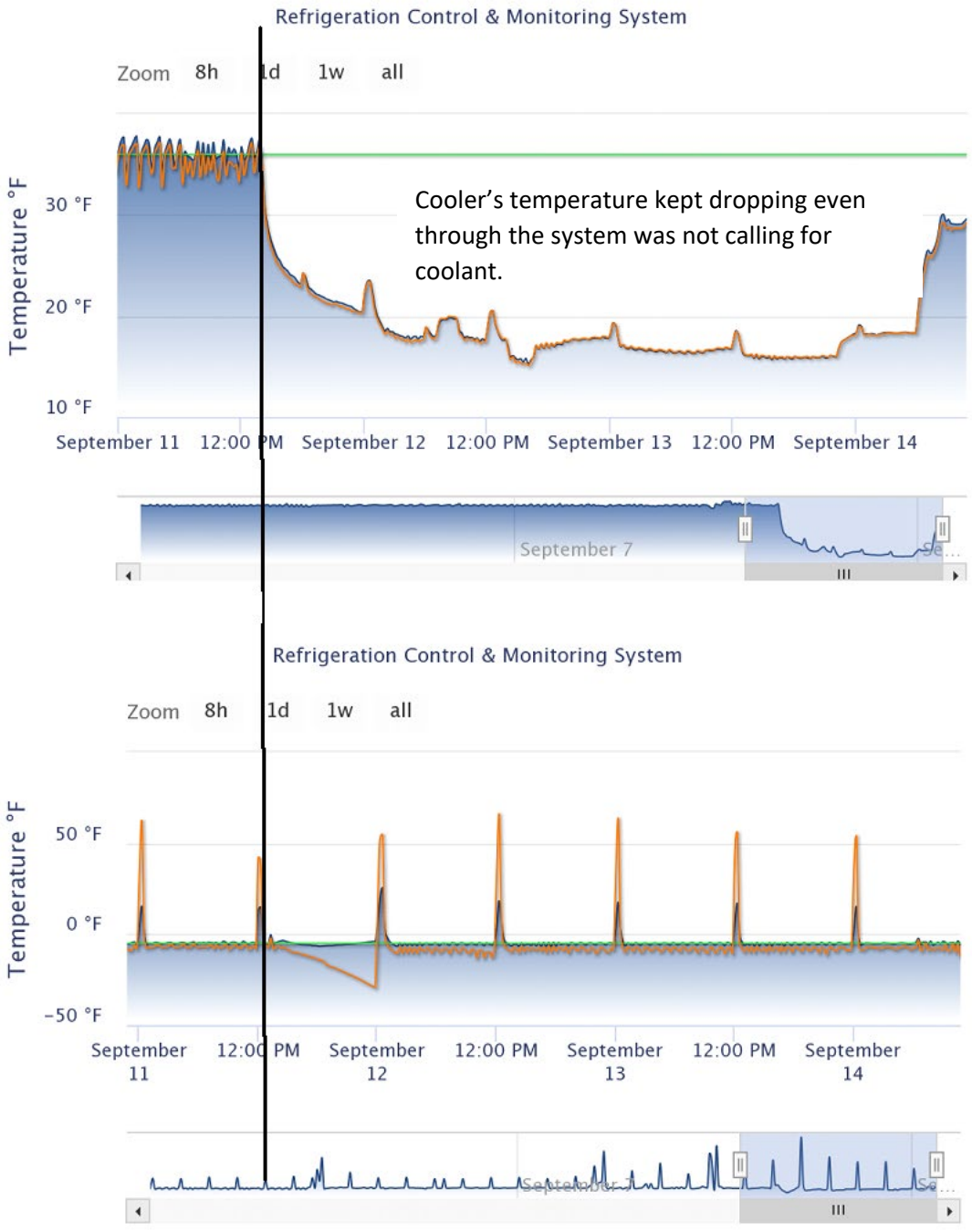
TEV (Thermal Expansion Valve) Issue



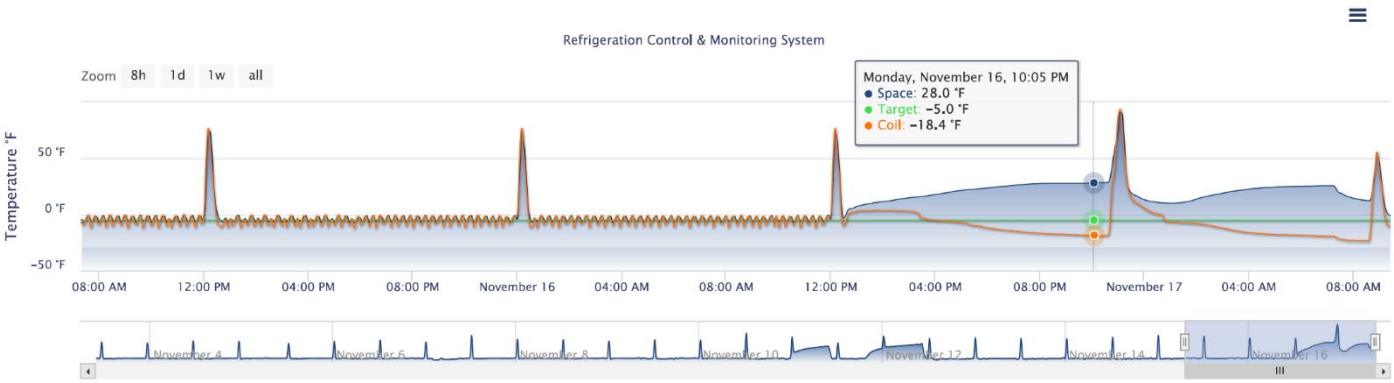
You can see from the Graph that the Freezer is not cooling correctly. It was finally determined by the Refrigeration Technician that the Thermal Expansion Valve (TEV) was causing the cooling issues.



Freezer Door left Open into Cooler Unit



The Freezer is accessed through the Cooler. The Freezer door was left open about 2 feet. This caused the coolers temperature to continue to go below the Set-point, while the Freezer Condenser continued to run trying to keep the freezer at it's set-point.



Another example of a Walk-in Freezer door that was left open. This time the door was left open was into a common space and not a refrigerated space.

In conclusion, the graphs may not always give you a cut and dry diagnosis of what exactly the problem is with the system. They can help to give you a starting location to look at to resolve the situation.

April 8, 2022

Rev 5