

## Hospital Steam Coil Issues

### Overview

MSC was retained to evaluate and diagnose an issue on the steam heating coil of AHU-10 located in a lower level mechanical room. The steam coil was logging condensate and was not draining properly under normal operating conditions causing nearly half of the effective coil surface area to be unheated.

### Scope of work performed

Document and record findings as well as any test procedures that were done. Recommend a path forward to resolve the issue. A thermal imaging camera was utilized as opposed to setting up thermocouples throughout the coil face.

### Observations notes

- Upon arriving at the unit, the logged condensate level was 24" from the bottom of the coil (Figure 1). The lower freeze stat was jumped out by others and the steam control valve was at 30-35%. The coil was operating around 3-4 PSI as observed on the installed pressure gauge.

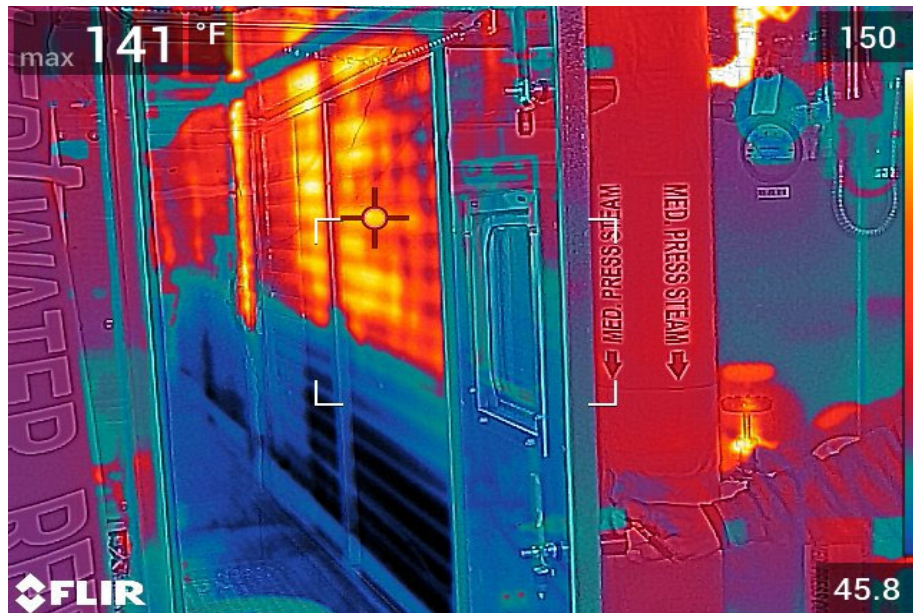


Figure 1: Heating Coil As Found

- The coil assembly has nearly a 1/4"-3/8" on 4' pitch towards the condensate drain.
- The steam coil is fed from both sides. At first glance it appears to be a no freeze coil with a 5/8" inner tube and a 1-1/8" outer tube with the steam supply being fed into the 5/8" from right to left, looking in direction of airflow. However the header on the left hand side also appears to feed the 1-1/8" tube. Due to inconsistent heat signatures in the center of the coil at part load (Figure 2) the coils circuiting was questioned.

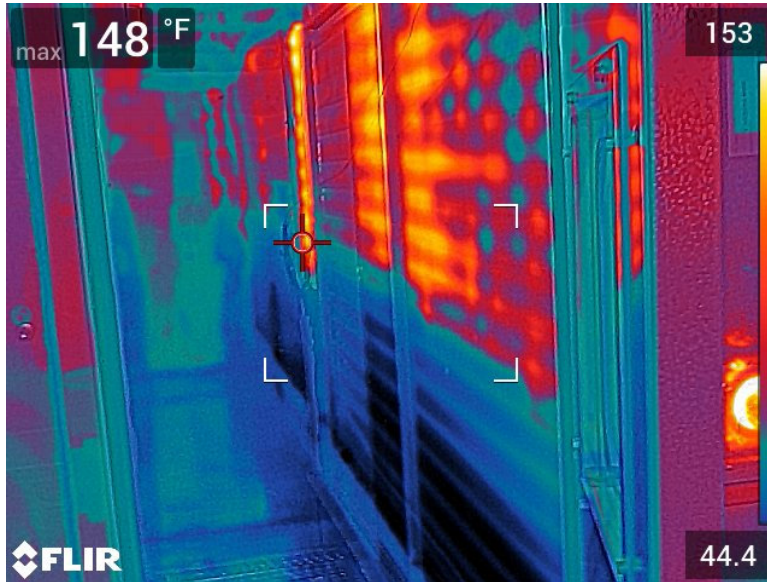


Figure 2: Centralized Heat Signatures

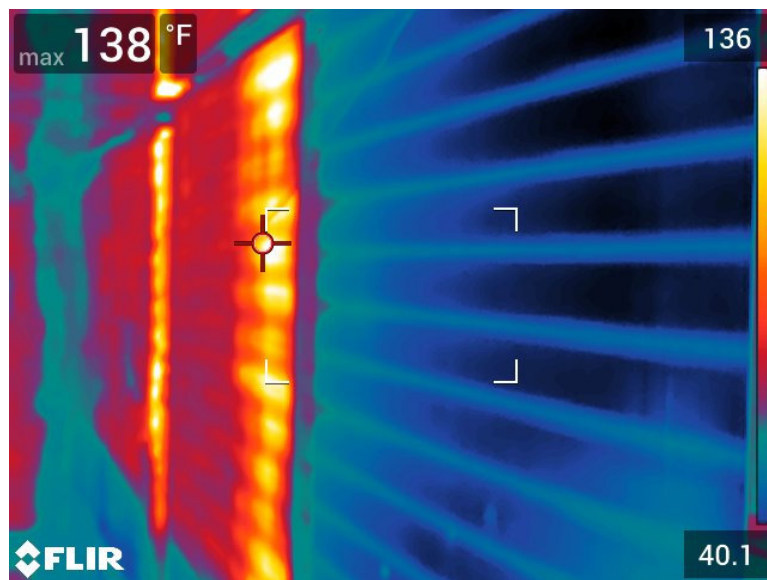


Figure 3: Left Header Blanked Off

- The supplies to each header were blanked off one at a time and the result was that each side feeds half of the coil from either side (L/R) with the middle of the coil being what appears to be the termination point for the interior dispersion tube (Figure 3).
- At this time, response from the coil manufacturer on the construction is pending.
- The condensate from the coil goes through a Spirax-Sarco FTB-200 trap which replaced a Spirax-Sarco FTI-175 before connecting with two other condensate lines as it makes its way back to a Spirax-Sarco APT14 steam powered pump trap located in an adjacent sump.
- The APT14 pump trap at the time of arrival was 115°F and the associated condensate piping was nearly 100°F.
- The coil was operating around 3 PSI during this period.
- While looking at the unit, the upper freeze stat tripped and caused the steam valve to open fully allowing 30 PSI steam to the coil. At this point, all logged condensate was pushed out and the pump trap began working (Figure 4).

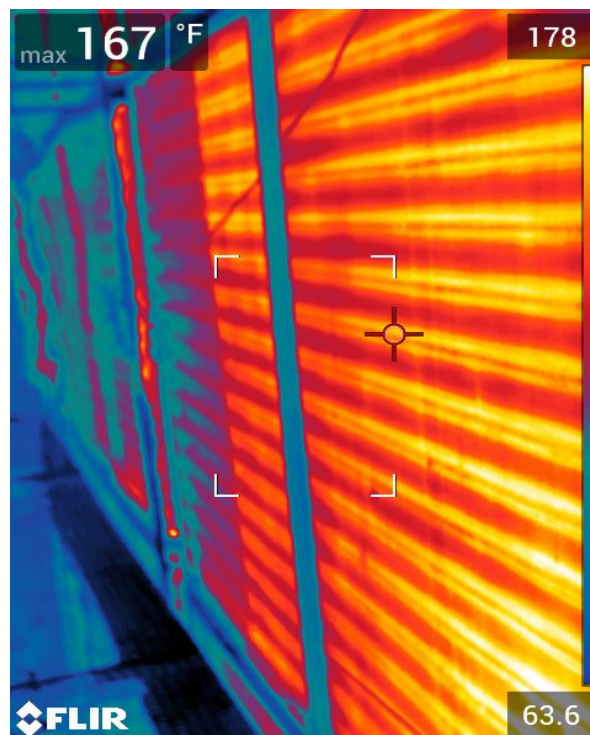


Figure 4: Coil At Full Heat

- The pump trap remained in operation the rest of the time onsite and maintained an average of 150°F at the body. It was reported that this does happen when there is a sporadic operation of the pump trap.
- Two additional condensate return lines feed into the APT-14 pump trap and they are said to be condensate returns from the two dishwashers in the adjacent space. They were not traced out and confirmed at this time.
- Once the unit resumed normal operation with a valve position of 30-35%, there was a band of condensate at the bottom of the coil nearly 8" tall. The coil maintained a pressure of 3 PSI and the condensate level held during the observational period (approx. 2 hours) (Figure 5).

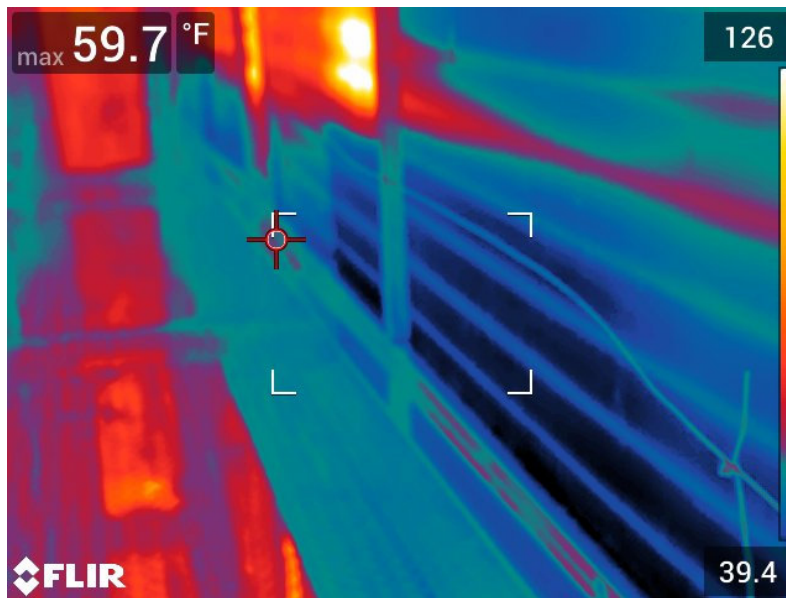


Figure 5: Lower Condensate Logging

- After observing the unit operate with the flooded bottom rows, a hose was connected after the trap to allow the coil to drain to an atmospheric floor drain. At this point all logged condensate cleared out and the unit continued to operate without logging condensate in the coil.
- The freeze stats were checked as the lower one was jumped out by others due to tripping. It was determined that the lower freeze stat was tripping around 38°F as opposed to the 35°F intended setting. This was adjusted down to 35°F utilizing the outside air as it was at the time of testing 35.5°F. Both upper and lower freeze stats now trip at similar set points.



- The unit was left operating with both freeze stats in operation, the unit controlling the steam valve above a minimum of 20% when the outside air temperature is below 40°F and with the trap draining to a floor drain in the mechanical room via a hose with a

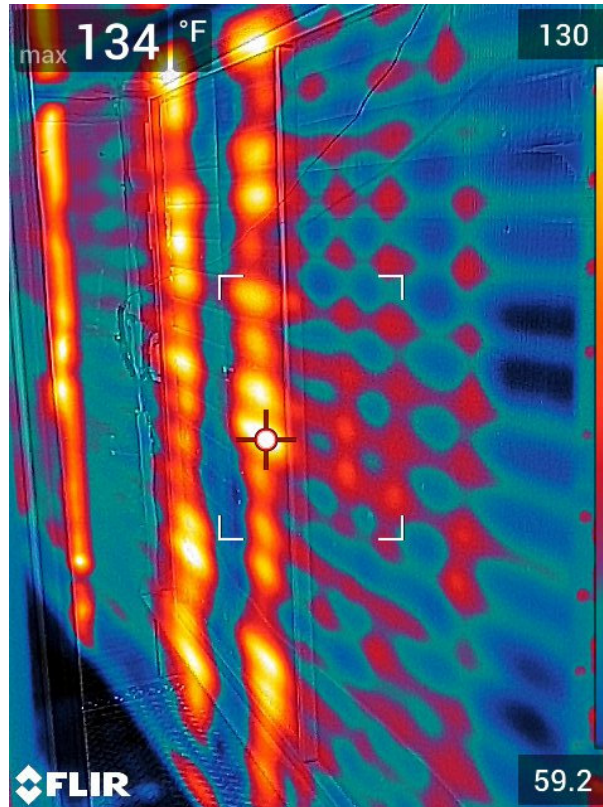


Figure 6: Trap Piping

garden hose set as a quench. The coil at this time has a uniform distribution of steam with no evidence of condensate in the coil (Figure 6). Figure 6 was taken with the steam valve at 30% open.

### Technical notes

- The elevation difference during operation when only the bottom 8" were logged with condensate with the coil at 3 PSI was 40". This was from the water level in the coil to the pump trap located in the sump. The pressure at the APT14 would be nearly 10.7 PSI at this condition.
- The elevation difference during the initial inspection when the bottom 24" were logged with condensate with the coil at 3 PSI was 56". This was from the water level in the coil to the pump trap located in the sump. The pressure at the APT14 would be nearly 13.7 PSI at this condition.

- The outside air temperature as a control point is taken at the inlet to the steam heating coil and not indicative of the actual outdoor air temperature. A 0.4°F difference between the outdoor air temperature and the preheat leaving temperature was observed with the coil off. The preheat leaving temperature sensor is mounted to the discharge of the heating coil.
- The inlet to the Spirax-Sarco FTB-200 trap is mounted 7" below the outlet of the coil, the outlet of the trap is 9" above the floor (Figure 7).



Figure 7: Trap Piping

- The initial Spirax-Sarco FTI-175 trap was replaced in an attempt to diagnose the issue by others and is still on site.
- The steam trap selections and capacities were not verified as best fit and effectiveness. They were only evaluated to make sure they could, under most cases, move the required amount of condensate.



## Conclusions

Due to space and elevation issues, the current coil and trap are unable to overcome external pressure drops required to effectively remove the steam condensate by means of the APT-14 pump trap under most low load conditions. It is recommended that the coil and trap drain to a free vented collection point where it can be pumped into the condensate collector in the mechanical room. This could be done by a similar steam powered pump trap as is in the sump or by an electric powered condensate pump and reservoir.

There is approximately 24" x 24" of floor space at the base of the coil which would fit a Xylem M2DCC24 or a Shipco ACD/ACH style dual pump condensate reservoir and pump unit. As the outlet of the current trap is 9" off the floor, selection of the unit should take into consideration the height of the condensate inlet as well. With that being said, based on dimensions, a Shipco ACD/ACDH or comparable pump unit would be a preferred selection providing it is adequately sized. A cut sheet has been provided with this report. The pump would need to overcome a maximum rise of 8' and travel across the room approximately 20' before being connected to the atmospherically vented condensate return pump station in the mechanical room.

Mechanical Service Corp.

A handwritten signature in black ink, which appears to read "Andrew Heilmann". The signature is written in a cursive style and is positioned above the printed name.

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