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Long Aquatic Center Pool Dehumidifier Replacements

Innovent reviewed the original project documents, the 2018 Engineering report on the City of Clearwater Long Aquatic Facility 50 M pool and therapy pool, and the Honeywell energy report in order to assist the project team in developing the current budget. We agree with most of the recommendations provided in the 2018 report, and also have some suggested improvements to those recommendations. Our recommendations and comments are strictly on the pool dehumidifier sizing and air distribution from those units in order to provide the aquatic center with good temperature and humidity control. The construction of the enclosure (materials and R-value, vapor barrier, thermal break, etc) is very important, but outside of our expertise.

Innovent Recommendation

Innovent recommends installing two 43,800 CFM units, each with 100 tons of packaged DX for dehumidification and sensible cooling. Each unit should be capable of providing a minimum of 8000 cfm of ventilation air for good IAQ during occupied operation with the ability to modulate up to 15000 cfm of ventilation air for efficient dehumidification and/or when large numbers of swimmers are present on the deck. During unoccupied operation, each unit's supply airflow would be reduced to 30,000 cfm, and the ventilation air to 5000 cfm. During periods of light occupancy, it may be possible to reduce each unit's supply airflow to 30,000 cfm (keeping the minimum ventilation air at 8000 cfm).

This assumes that the 50M pool is at 80 deg F water temperature, the therapy pool is at 88 deg F water temperature, and that the space setpoint is 84 deg F/60% RH. Activity factors for both pools are assumed to be 1.0.

When combined with the Carrier rooftop supplying the spectator area, the units would provide 91,000 cfm (6 air changes) of total air movement, a minimum of 16,000 cfm of fresh air, and a maximum of 30,000 cfm of fresh air.

Suggestions for Improvement to the 2018 Report Recommendations

1. Air Distribution. The 2018 report correctly states that the location of the return grilles does not meet current design standards. They are all located in the mid-height range of the walls. Low return/exhaust is required to help remove chloramines from over the pool surface and to induce fresh air to the deck for the occupants. However, current guidelines recommend a high return location as well to create a well-mixed space and prevent dead spots and corrosion of the envelope. The 2018 report stated that only low RA/EA locations were desired, which is not the case per the current ASHRAE Applications Handbook chapter on indoor pool design.

   The most economical and arguably the most effective low return/exhaust method is to locate the bottom of the grilles a few feet above the pool deck in a position to draw the supply air directed to the deck across the pool. If this cannot be achieved in a retrofit, there are bench source capture systems (mentioned in the 2018 report) available that might work.

   The new supply ducts should have nozzles directing air down across the walls toward the deck, upward toward the roof, and angled slightly downward across the pool. The high return should induce the high airflow across the space. For this pool, it is likely that 70% of the air should be delivered toward the deck and the lower third of the space height, and 30% should be delivered to the upper 2/3.

2. Supply Air Volume. Design for supply air volume at 6 air changes/hr (ACH) vs 8 ACH. Innovent agrees that the amount of total supply airflow does not meet current design standards for a facility of this type. It was originally 60,000 cfm (4 ACH), then reduced to 40,000 cfm (2.7 ACH) when the dehumidifier was installed. Current ASHRAE recommendations are 4-6 air changes for pools without spectator spaces, and 6-8 air changes for pools with spectator spaces. The difference in air movement for pools with spectators assumes that moving more air over the spectators will make them feel a little more comfortable, and generally assumes there is not a dedicated spectator unit. The Long Aquatic facility has a small dedicated spectator unit intended to make them a little more comfortable.

The number of air changes is not usually prescribed by code. The recommendations come from experience and have been determined to be the amount typically necessary to meet all air distribution requirements in an indoor pool space with reasonable supply air temperatures. Single story therapy pool spaces often require 8-10 air changes. Very tall spaces (collegiate competition pools and water parks are sometimes 40-60 feet high, for example), might use 4-5 air changes of ducted airflow with some additional HVLS fans. In Innovent's experience, the Long Aquatic facility should be designed with 6 air changes. There is significant extra cost in designing new ductwork for 8 air changes and sizing units for 8 air changes, and it can create nozzle throw issues if the intended operating airflow is significantly less than the duct is sized for.

3. Ventilation Airflow. Innovent agrees that the current ventilation of 7700 cfm does not meet current ASHRAE 62.1 Standard requirements. The 2018 report recommends designing each unit for 9900 cfm for redundancy, with the intention of operating each unit at ½ that amount. This amount is arrived at by designating a small portion of the deck surrounding the pools as wet deck, with most of the deck designated as dry deck. However, the current Standard (2019) eliminates that distinction, and the previous version also essentially eliminated it for a pool like Long Aquatic, requiring that any deck area that is capable of being wetted in occupied operation must be included.

   All of the air required by the ASHRAE calculation is required at the breathing zone, or up to 6 feet above the deck. Since some of the supply air needs to be delivered high in the space, the percentage of outside air in the ducts must be high enough to ensure that the required amount gets to the breathing zone. Innovent recommends 16000 cfm of outside air total at minimum during occupied operation as a result to achieve good IAQ.

4. Space temperature and humidity control. In 2008, a Dectron pool dehumidifier was provided as part of an energy savings upgrade from Honeywell. As noted in the 2018 report, the unit is well short of current recommendations for supply air volume and for ventilation air volume. It does not appear to be capable of humidity or temperature control. There is no discussion of how the dehumidification capacity was sized, and the

replacement units recommended in the 2018 report focus more on supply air volume and redundancy rather than dehumidification capacity. The existing unit has a total capacity of 120 tons and is well short of the capacity necessary to maintain the space, even with inadequate outside air. Innovent calculates that 200 tons are necessary to meet the dehumidification requirements. Once the enclosure is determined, sensible cooling and heating load calculations must be done to make sure that 200 tons of refrigeration will be able to maintain the space temperature in summer, and that enough heating is available in winter. The Innovent unit comes with a heat exchanger that will significantly reduce the gas heating in heating mode.