

OUTSIDE Your Comfort Zone?

Angela Hughes

Dig deeper to solve HVAC-related comfort issues in your restaurants

As facility managers, we have a huge responsibility to the restaurants we support, and to our service vendors, to maintain the comfort of both our guests and employees during all seasons. This can often be a challenge, especially as facility managers support ever-expanding markets—and restaurants cope with aging equipment.

Many hidden problems can cause comfort issues in our restaurants. Often, these problems are related to sensible cooling load or heat gain, which is the amount of heat energy that needs to be removed to maintain the desired temperature. The sensible cooling load refers to the dry bulb temperature of the building. The latent cooling load refers to the wet bulb temperature of the building. The influence of humidity in the summertime and latent cooling load in certain areas of the country will also greatly affect the comfort level.

Of course, HVAC equipment is a significant concern for every facility manager. Restaurant facility groups commonly follow two different approaches for replacing older HVAC equipment:

- Proactive replacement. Older rooftop units are replaced according to the life expectancy of the equipment, taking into consideration run times and regional climate factors. The goal is to minimize the number of emergency failures in the field, reduce energy usage and solve recurring comfort issues caused by frequent failures in older equipment. The result should be lower overall repair and maintenance costs for the restaurants.
- Run to fail. In this approach, the rooftop unit is replaced when it fails. The source of the problem is usually a major component—such as a large compressor, condenser coil or heat exchanger—that costs more than half the price of the new unit. In the heat of the summer, this creates a stressful situation for the facility manager to get the unit replaced as quickly as possible, which can take days or even weeks, depending on the size of the failed unit. Both guests and employees are impacted when the unit is down and waiting to be replaced, which often results in lost revenue to the restaurant.

Dig Deeper

Before you replace another rooftop unit this year, whether it is a planned or an emergency replacement, be sure to partner with your local HVAC vendor. Start looking at the whole picture and dig deeper to resolve these problems that will affect equipment performance and create comfort issues for both restaurant employees and guests. The goal is to achieve the highest amount of energy savings and quickest payback on your investment.

When a rooftop system is replaced, important factors are often overlooked, during both emergency and planned replacements. The vendor is asked to survey the equipment for replacement, a quote is provided and the equipment is ordered and installed. It is uncommon for the HVAC contractor to inspect the ductwork or anything other than the unit itself.

If the entire system is not surveyed before the equipment is replaced, and if there are issues elsewhere in the system, these will surface after the new unit is installed. The complaints often reach the facility manager during a routine visit to the restaurant weeks or even months later when the installing contractor has been out multiple times to address comfort issues and cannot resolve the problem. Sometimes, the restaurant will simply decide this is the norm and live with the discomfort until staff and guests start complaining. What should be your next steps?

Identifying Underlying Problems

To solve these underlying problems, assuming there are no mechanical issues with the unit, it is important to partner with your HVAC vendor to dig deeper. The first step should be to look for the following commonly overlooked issues, which will significantly affect the system's performance:

Look for ductwork sizing issues.

If the unit has been upsized, and the ductwork has not been upgraded, this will create serious issues:

- Shortage of return ductwork. The most common reason for comfort issues when a rooftop HVAC system has been replaced is a shortage of return ductwork. If the unit is starved for return air, this will cause low airflow going from the unit on the roof back into the restaurant. The system can only supply as much conditioned air as it receives back into the unit, both from the conditioned space through the return air grilles and also from the fresh air damper, which brings in outside air. If the unit is severely short on return air, you will hear a whistling or howling noise coming from the unit, and the access panels will be almost impossible to open while the unit is running. Often, there will also be airflow noise at the return grilles inside the restaurant. This is an easy sign for a very severe return shortage or restriction. Often, though, it is not this apparent.
- Shortage of supply ductwork. This will cause ductwork to sweat badly, especially in the summertime, due to high humidity/low temperatures inside the ductwork and improper airflow from the unit on the roof. Use the anemometer tool to determine the CFM for each supply grille, and add up all supply CFM readings. If the total does not match the 400 CFM per ton rule (e.g., 2,000 CFM for a 5-ton unit), then you need to add some additional supply duct for this system. Often, a system has too much supply ductwork, which will create low airflow and the same comfort issues as a lack of supply ductwork.

Physically inspect the roof.

Look for several common areas of concern that can be hidden:

- Roof curb/adaptor curb leaks: Ensure the unit curb is not leaking air, which is caused by an improperly installed curb gasket. If it's leaking, you will be able to feel air movement around the base of the curb where it meets the unit.
- Return or supply air plenums partially blocked. The return and supply air plenums that attach to the base of the rooftop unit/curb should have adequate airflow, without being fully or partially blocked by debris or by the new unit that is sitting on the roof curb or adaptor curb. Inside the unit in the filter compartment, you should see the clear return plenum next to the evaporator coil. An adaptor curb installed with a new rooftop unit should also have clear airflow to the original supply/return plenums at roof level and not be blocked by any of the new equipment curb. You will often see condensation issues inside the unit if this problem exists.
- Dirty roof-top unit (RTU) coils or loose belts. If the evaporator coil, condenser coil or blower wheel is dirty, or the belts are worn or loose, the performance of the unit will be greatly affected. A loose belt alone can cause poor performance, waste tremendous amounts of energy and create comfort issues. Dirty coils will cause the unit to freeze up and temporarily shut down, which causes stress on the compressors.
- Loose belts on exhaust and makeup air fans. Verify the belts are not loose or worn. Turn off the unit at the breaker, remove the top cover and check belt tension. The belt should have some slight give, but not be loose when the fan runs. If the belts are loose, the fans won't move the proper amount of air, which affects overall building balance.
- Dirty filters on makeup air fans. The washable metal filters inside each makeup air fan need to be cleaned during major preventive maintenance. These are often overlooked by HVAC preventive maintenance vendors. Dirty filters can block airflow into the unit and greatly affect the building balance. If the filters are damaged or missing, be sure to replace them.

Check for negative air pressure in the restaurant.

This is a common cause of comfort issues and can be easily checked by slowly opening an exterior door. If there is a rush of air coming into the building, your restaurant is under negative air pressure. This can be due to an issue with your exhaust hoods in the kitchen, so be sure to check the following:

- Exhaust hood systems. Are the exhaust systems in your kitchen working properly and moving air? Use the paper towel test to verify if the exhaust hood is drawing air. The towel should stick to the hood filter at the back of the hood. If not, check the belts and the exhaust units on the roof to verify they are working.
- Makeup air system (compensating hoods). Is the makeup air unit on? This unit has to be working or there will be negative pressure. There should be incoming airflow, either right inside the front edge of the hood or just outside the hood through a perforated diffuser. If you cannot feel the airflow, check the makeup air unit on the roof to verify it is working.

• Exhaust-only hood system (non-compensating hoods). The required makeup air is achieved through the AC units. AC equipment should be sized correctly to allow the 100-percent fresh air being brought into these units (RTUs) to be cooled and dehumidified before entering the conditioned space.

If the exhaust and makeup air systems are working properly, don't immediately call to schedule an air balance. If your building is negative, you may need to have a certified air balance performed; however, this is the last resort. All other HVAC issues need to be resolved first, or you will be wasting your money on the air balance.

Look for cooking equipment overhanging the hood.

Exhaust hoods are designed to remove smoke, gases and heat created by cooking equipment. They will not work properly if the cooking equipment is not positioned properly under the hood canopy. For example, a conveyor oven that does not have at least 9 inches of clearance from the end of the conveyor belt to the outside edge of the hood will be releasing 400-degree heat into the conditioned space.

If the comfort complaint is in the kitchen, equipment placement is one of the first things you need to check. The cooking equipment may have been moved for convenience, and the kitchen staff and manager will need to understand why and how this is making the kitchen hot. If you have an infrared temperature gun, use it to show the manager and staff the high temperatures around the hood. It is important to note that if you do find this issue, you must explain to the general manager and staff why the equipment needs to be moved back under the hood. Obtain their 100 percent buy-in, or the equipment will be moved right back where it was after you leave and the complaints will continue.

Look at AC unit filters and location.

Often overlooked, the location and duplicity of filtering can cause serious performance issues, including:

- Dirty/blocked filters. This is the most common issue and is easy to spot. Dirty filters inside a rooftop-packaged unit will block airflow to the coil and cause the evaporator coil to freeze up and shut the system down intermittently, affecting system performance.
- Double filtering. Ensure that AC filters are only in one place—either inside the RTU or behind the filter return grilles inside the restaurant. If filters are in both places, and especially if the unit is already marginal on return airflow, this double filtering will further restrict airflow to the unit. I have found clean filters inside the unit on the roof and extremely dirty filters inside the restaurant in return air filter grilles that had been there for years, completely blocked, and restricting airflow back to the unit.
- Filters for split systems. If the building design requires split systems (in which the condensing unit is on the roof and the coil is in the attic), it is important to place the filters in return grilles inside the restaurant where they are visible, not inside the unit in the attic. Often when new split systems are installed, the filter inside the unit (from the factory) is left inside the unit and sits there for years, with clean filters in the return grilles inside the restaurant. This completely restricts the system airflow, greatly affecting system performance and energy consumption, and eventually causing compressor failure.

Dig even deeper: Check the attic space.

If the temperature in the attic is more comfortable than in the conditioned space, you need to inspect all of the ductwork in the attic. If you identify a comfort issue in one area, at a minimum, inspect just the ductwork for that problem zone:

Check condition of ductwork. Look for these common issues that will increase equipment run time and even cause damage to the compressors:

- Flex duct not strapped properly to collar of grille. Often the duct is loose or laying on top of the supply grille or improperly connected with duct tape/silver tape.
- Supply grilles not insulated. There must be an insulated backer on top of grilles to stop sweating.
- Not insulated or failed ductwork. Hard pipe/metal duct should have internal external insulation wrap. Failed internal insulation can also inhibit airflow.
- Damaged duct. Inspect the flex duct and the metal duct, looking for flattened/smashed flex duct, holes, tears/cuts, etc. Any restrictions in airflow greatly affect the performance of the unit.
- Rotted ductwork. Flex duct that is more than 20 years old will come apart when moved and is often damaged by electricians or vendors working in attic spaces.
- Ductwork not attached to grilles. Often, there will be a run of ductwork that was once attached to a supply grille or return grille and, after a remodel or ceiling replacement, was left blowing air into the attic.
- Supply diffusers are too close to return grilles. The returns should be at least two ceiling tiles from any supply grille. Otherwise, the supply air will be sucked right back into the return and never reach the conditioned space.

All of the above issues will cost your restaurant added run time and higher utility bills if they are not fixed. You are basically giving away any savings that you intended to achieve by replacing the older unit on the roof.

When choosing an air balance contractor, be sure they are certified to perform an air balance. They must be listed on either the National Environmental Balancing Bureau website, www.nebb.org, or with the Associated Air Balance Council at www.aabc.com. It is also important that your air balance vendor has experience with balancing restaurants.

Be on the Lookout for BIGGER ISSUES

Let's say that you have found and repaired a few of the issues described in this article. Is that all that you need to do? Is it safe to stop there thank your vendor and move on? Can you chalk it up to another problem solved by Facilities? Not necessarily. There are often bigger issues that are still unresolved.

The good news is that technology has provided some excellent hands-on tools that are affordable for your facility manager's tool belt. These are great assets you can use during a restaurant visit that will even detect some of the issues discussed in this article:

• Infrared digital thermometer

A great device at a price that varies from \$40 at Lowes or Home Depot to \$150 for a higher-quality Fluke or Raytek commercial mode. This tool can check the temperature of air coming out of supply duct to pinpoint non-functioning zones or find disconnected/ damaged ductwork.

• Air balance anemometer

This \$50 device mounts on any smartphone and uses an app to save collected data. There is also an extender available for reaching higher ceiling supply grilles. This is a great tool for measuring air speed/airflow coming out of supply ducts in (cubic feet per minute (CFM)). Add up the recorded CFM for all supply ducts in one zone with the RTU operating, and you will know if the unit is starved for airflow. If the CFM is very low, mark that grille with a small "X" and ask your HVAC vendor to look for disconnected/ broken ductwork for that duct run.

Both of these tools will assist you during a restaurant site visit to determine where the problem areas exist and narrow down where your HVAC vendor needs to look for the issues, which will also save you time and money.

After resolving any issues that were found, the next step is to request a certified test and balance if your restaurant is still under a negative pressure. If the restaurant is not under a negative pressure, then your work is finished.

Angela Hughes is a Facility Manager for Red Lobster, and oversees facility management for restaurants in Texas and Louisiana.