

Controlling HVAC Costs

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Facilities managers for retail chains deal with a multitude of issues on a daily basis. Invariably, when asked, most facilities managers will tell you that the most costly issue they deal with is HVAC. Not only are the systems expensive to purchase and maintain, but they are more technically complex than any other system found in a retail store with the exception of elevators and escalators. In addition, as I'm certain store managers have informed you, HVAC failure impacts sales adversely like no other facilities issue. In many cases, product may be damaged due to an HVAC system failure. Chocolate and lipstick melt at high temperatures and customers perspiring as they try garments on can render the product non-saleable.

It is obvious that retail stores need reliable HVAC systems. The challenge is obtaining reliability and comfort at the minimum possible cost. When we speak of cost with respect to an HVAC system we're discussing the total cost of ownership over the term of the lease for a typical retail space. Life-cycle costs include the initial purchase price of the equipment and controls, the cost of preventive maintenance, the cost of making repairs, and the utility costs. Each of these individual costs has an effect on the other costs incurred. Through experience, facility managers and HVAC professionals have developed strategies that provide a reasonable level of reliability at an acceptable cost.

Cost of initial purchase:

The initial purchase of HVAC equipment may or may not fall within the realm of the facility manager, however whenever possible facility managers should provide input when equipment is purchased. The practice of construction departments mortgaging the future of their companies by choosing HVAC equipment based strictly on first cost must end. Most stores are heated and cooled with packaged rooftop units or split systems. These units have a usable life span of approximately 15 years. The typical lease for a retail store is 10 years. Therefore, when leasing space, using existing equipment that is more than five years old should be avoided. The cost of maintaining old equipment will exceed the cost of purchasing new. If the equipment reaches a point where it can no longer be repaired, it must be replaced. The cost of replacing a unit in an existing store will probably exceed the cost of replacing the unit during the initial build-out by approximately 30%. In addition, the difference in utility costs for the operation of an old inefficient unit versus the operation of a new high efficiency unit, over the term of the lease will usually exceed the cost of installing the new unit during the build-out. The bottom line is, when opening a new location replace the HVAC equipment unless the existing equipment is less than five years old.

Quality of equipment.

There are many options that must be evaluated when choosing new equipment. The first choice is what quality of equipment to purchase. Higher quality equipment usually contains protective devices such as high-pressure cutouts, and low-pressure cutouts that protect the compressor. In addition, higher quality equipment is usually easier to service due to hinged access panels and wiring diagrams that are easy to follow. Higher quality units use multiple compressors and the quality of the economizer components and electric motors may be better than those used on low-end equipment. Many manufacturers make two levels of equipment. Some manufacturers make only high quality units and others specialize in the low end of the market. My recommendation is to buy high quality equipment only. It has been our experience that the savings over the life of the equipment outweighs the increased cost of high quality equipment.

Hi efficiency versus standard efficiency.

The next item to consider is the efficiency of the equipment. Typically, high efficiency equipment will be 15% to 20% more efficient than standard equipment. High efficiency equipment is usually high quality equipment so there is an added benefit. The difference in cost between standard and high efficiency equipment is usually about 12%. Depending on electric utility rates and the number of hours of operation, high efficiency equipment usually pays for itself within three years. Most manufacturers have computer programs that can predict the payback period relatively easily. Our experience has been that unless the utility rate is less than \$.05 per KWH or the lease has less than three years to run, high efficiency is the way to go.

Options and Accessories.

There are many factory-installed options and field installed accessories to choose from when ordering a packaged air conditioning unit. Certain items are available as either field installed or factory installed. Our experience has been that if an item is required and it is available as a factory installed option, it is usually less expensive to order the option rather than ordering the item as a field installed accessory. Not only is manufacturing labor less expensive than field furnished labor, but you are assured that the device is installed properly.

Outside air economizers should be installed on all new units except those installed in extremely hot and humid areas such as Miami and Houston. Economizers pay for themselves in short order and they reduce the number of hours that compressors must operate at reduced ambient temperatures.

Our experience has shown that power exhaust accessories should be installed in all units with a capacity of 7.5 tons or more. Economizers bring in cool outdoor air; however air must be exhausted from the space at the same rate the economizer brings outdoor air into the space. Try blowing into a plastic bag and you'll get the picture. Once the bag is full no more air can enter unless you make a hole in the bag to allow air to escape.

Barometric relief dampers provided with economizer packages by most manufacturers do not exhaust this air in sufficient quantities to allow the economizer to be effective. Power

exhaust accessories provide a positive means of exhausting warm air from the space so that the economizers can actually perform as required.

In certain geographic areas where the environment has proven to be corrosive, equipment should be ordered with epoxy coated condenser coils. For example, on the Island of Puerto Rico, aluminum fins on condenser coils usually corrode and require replacement within five years if the coils are not coated. There are several areas in the continental United States where this is also an issue. Be especially mindful of this possibility in ocean resort towns where salt spray from the ocean can reach the equipment.

Hail guards are a good idea in all geographic areas that are prone to hail storms. We have found that it is prudent to install hail guards in most areas of the Midwest. If you ever have to wait three weeks for a new condenser coil, and then pay \$3500.00 for a coil replacement you will begin to order all new units with hail guards.

Low ambient accessories are devices that allow air conditioning compressors to operate during periods of low outdoor ambient temperature. Each manufacturer specifies the lowest temperature his equipment will operate at without the addition of low ambient accessories. Although a unit may be equipped with an outdoor air economizer, if the space temperature rises more than two degrees above thermostat set point, the compressor may be energized. Any HVAC technician will tell you that he has seen mechanical cooling operating at outdoor temperatures of 35°F and below. In my opinion, all units should be equipped with low ambient controls. However, if the manufacturer's literature states that the unit will operate down to 45°F or lower, you can probably get away without installing a low ambient accessory.

Convenience receptacles, smoke detectors, and disconnect switches are all items that will be required when installing a new unit. Most manufacturers offer these as factory installed options. Request alternate pricing for these items and request the lead time increase due to their installation. You will probably find that it is less expensive to have them factory installed than it is to have them furnished and installed in the field.

Anti-short-cycle timers are a good idea and are standard on most high quality units. These devices delay the compressor from restarting for several minutes after it has shut down. This prevents "short cycling," of the compressor, which can cause it to burn out.

High and low pressure safety controls are standard on most quality air conditioning units. If they are offered as an accessory, specify the accessory, or better yet, buy a unit that contains these devices as standard equipment. Many compressors have failed due to the fact that they ran for days with no refrigerant due to the fact that the unit was not equipped with a \$25.00 low-pressure switch. Almost as many compressors have failed because the unit had a bad condenser fan motor or a dirty condenser coil and no high-pressure switch was present to shut the compressor down.

Phase protectors are devices that shut a unit down if the incoming voltage is too high or too low. They will also shut a unit down if voltage on one of the three phases of the

incoming power is lost or varies too much with respect to another phase. I recommend that these devices be installed at sites that have a history of power problems or multiple burned compressors. In theory they will protect the compressors and motors from brownouts and power problems. Our experience has been that they work to some degree, but they are also one more place for a problem to occur.

Warrantees.

Most packaged air conditioning equipment below 15 tons is sold with a one-year parts warranty and an additional four-year extended warranty on the compressor. For units 15 tons and above, the extended compressor warranty is optional and must be purchased from most manufacturers at a cost less than \$10.00 per ton. Some manufacturers offer extended compressor warrantees as standard on all equipment. Heat exchangers may be warranted from one to 10 years depending upon the manufacturer and the type of steel used in the heat exchanger. I strongly recommend that you purchase all HVAC equipment with extended compressor warrantees. In addition, if extended heat exchanger warrantees are available at a nominal charge, I encourage you to opt for these as well. Incidentally, since manufacturers warranty only the parts, any HVAC service company can exchange defective parts free of charge, for a period of one year on any manufacturer's unit.

Controlling Cost With Controls:

One method of reducing operating costs is to reduce the hours of equipment operation. This serves to reduce wear and tear, which reduces maintenance and service costs. Reducing the number of hours of operation also reduces utility costs. We reduce operating hours by using controls.

The economizers mentioned earlier are nothing more than a group of controls that allow outdoor air to be utilized for cooling in lieu of operating compressors, when outdoor temperature and humidity levels are low enough to allow the air to be used to provide cooling.

Night heating setback and night cooling set-up are common control strategies that are used to reduce equipment run time and costs. At minimum every retail store should be equipped with digital programmable thermostats or light sensing thermostats that can be programmed for these strategies.

During occupied hours, most local ventilation codes require that the unit fans run continuously to bring in a minimum percentage of outdoor air for ventilation purposes. During unoccupied periods, the fans should only be brought on with a call for heating or cooling. This strategy can save many hours of fan run time each day and reduce the need to heat and cool the store during unoccupied periods because outdoor air is not introduced during unoccupied periods.

One recent control strategy allows the quantity of outdoor air introduced by the HVAC equipment to vary with the number of occupants in the store. An electronic counter counts the number of occupants, or Carbon Dioxide levels within the store are measured

and the amount of outdoor air introduced is varied to meet ventilation code requirements. Most people don't realize how much of their heating and cooling capacity is utilized to condition outdoor air for ventilation purposes. If winter temperatures get below 30°F and summer temperatures get into the mid ninety's, you are probably using 30% of your heating and cooling capacity to condition outdoor air. This translates to a significant source of possible cost savings with no downside.

Sophisticated energy management systems can monitor equipment and dial out when equipment is malfunctioning. These systems also allow operators to make adjustments and perform some diagnostic tests via modem. This cuts down on equipment downtime, prevents small problems from causing large problems, and reduces the number of nuisance emergency calls.

The most drastic cost saving strategies employed by energy management systems allow the operator to select and maintain a power demand threshold. When electrical demand at a location approaches the threshold, individual compressors or units are shut down for predetermined lengths of time in a predetermined order. As these loads are brought back on line and the threshold is approached, other units will be rotated off line. This results in lower utility cost and less hours of operation, however it can also lead to periods of discomfort in extreme weather.

Controlling the Cost of Maintenance and Service:

Every facility manager knows that HVAC equipment requires preventive maintenance. We also know that if the required preventive maintenance is not performed, the number of emergency service calls will increase and the overall cost of maintenance and service will increase. There is a balance that must be struck between the appropriate degree of preventive maintenance and an acceptable quantity of emergency service calls. The question is how much maintenance is enough? The answer is, it depends. It depends on the number of hours the store is occupied each day. It depends on the type of system that has been installed. It depends on how perishable your product is. It depends on what degree of reliability your operations department demands. It depends upon your budget, and mostly it depends on how much revenue you lose when your system is down.

To develop an HVAC maintenance strategy, the facilities manager must specify some minimum performance levels and then determine how far above those levels he needs or wants to go. To begin, let's separate filter changes and preventive maintenance. One does not equate to the other. I have seen programs where stores are scheduled for monthly filter changes, but no one ever does an operational check on the units. On the other hand, I've seen equipment that receives quarterly operational inspections where the filters are never replaced until they cause a malfunction. Filter changes are a simply a part of preventive maintenance.

Filter Replacement.

We know that clogged filters cause units to freeze-up. This causes some condensate leaks and can cause compressor damage. Therefore, at minimum we want to change the air filters before they get dirty to the point where they can cause damage. Equipment is

designed to operate with about 400 cubic feet of air per minute, per ton of air conditioning capacity, passing through the filters. When the volume of air drops to 300 cubic feet of air per ton, you are in danger of coils freezing. Unfortunately, most units are not equipped to tell us when they reach this threshold. I recommend starting a maintenance program with the minimum number of filter replacements you feel will be required in your stores. This will probably be four changes per year. Track emergency service calls for condensate leaks due to frozen coils and increase the filter change frequency in those locations. Your service contractors will let you know if more frequent filter replacement is required. We know from experience that some geographic areas will require additional filter changes due to climate or other factors. These locations will become evident in short order. I will leave the discussion of what type of air filter to use up to others with specialized knowledge in filter design and selection. My own opinion is that you should use the air filters that you can afford. If the filters are 10% efficient panel filters or 30% efficient pleated filters, evaporator coils and ceiling tiles will still get dirty and require cleaning. Also depending on the number of pleats per inch, 30% efficient, pleated filters may require more frequent replacement than 10% efficient filters.

Preventive Maintenance.

Preventive maintenance, other than filter replacement consists of operational checks, lubrication, checking operation of safety controls, inspecting the condition of components, taking and recording measurements with specialized instruments, and replacing consumable components such as drive belts and batteries. The frequency of preventive maintenance inspections and the actual work scope during each inspection, depend on all of the factors mentioned above. Since we're discussing controlling costs, my recommended minimum frequency is two preventive maintenance inspections annually. This is required for safety and to reduce the possibility of minor problems causing major component failures. At least one of these visits should include a belt replacement and the cleaning of the condensate drainage components.

Coil Cleaning.

In my opinion, to minimize cost and to minimize the adverse affect on the equipment, condenser coils should be cleaned when a technician determines that they are dirty. This determination can be made by an experienced technician measuring the subcooling taking place in the condenser as well as by a visual inspection. Our experience has shown that on average, most condenser coils require cleaning every second or third year.

Evaporator coils should also be cleaned when they get dirty. Visual inspection combined with superheat measurements and tracking full load blower motor amperage will give an experienced technician a good idea of when the evaporator coil requires cleaning. Our experience has shown that on average evaporator coils require cleaning every four or five years. Keep in mind that these are national averages and that there are exceptions based upon many factors. All evaporator cleanings should include a thorough cleaning of the blower wheels and scrolls. What's the sense in cleaning the coil if the blower can't move sufficient air over the coil because the wheels are encrusted with dirt?

Recommendations.

When repairs are required, I strongly recommend the use of replacement parts furnished by the original equipment manufacturer. Experience has taught us that in most cases, it is best to keep the unit as close to factory specifications as possible. The money saved by using universal replacement parts is not worth the possible problems that can be caused by mismatched components, difficulty in troubleshooting at a later date, and the possible difference in duty ratings and efficiencies.

After more than 30 years in the HVAC service business I'm sorry to say that I've come to the conclusion that 50% of the participants in this business are less than honest and 50% are less than technically competent. Thank goodness the two groups are not mutually exclusive. Actually, in my opinion, one out of four service contractors is the type of contractor you want servicing your stores. HVAC service is extremely difficult to police due to the fact that the work cannot normally be observed, it's extremely technically complex, and time is always of the essence. There are however some recommendations and suggestions that will make living with the HVAC demon easier.

Knowledge is King when it comes to controlling HVAC costs. You don't need to be an expert, but you do need to understand enough to ask the questions that will allow you to make appropriate decisions. Don't be afraid to question your service contractors. The worst that will happen is that they will know someone is watching, and you may gain some additional knowledge. Design professionals, equipment manufacturers and quality service providers may be able to offer recommendations if you're not certain of the appropriate method to resolve a problem.

If you suspect that you're being overcharged for a component, call the manufacturer of the unit and request the suggested list price for the part.

Maintain accurate site histories that allow you to determine which calls should be callbacks, and where there are ongoing problems that may require a fresh approach.

Track the age of your equipment, keep copies of extended warranty certificates and learn how to read the equipment serial numbers to determine the age of the equipment. It's a sin to pay for a compressor or a heat exchanger that should be covered by the manufacturer's extended warranty.

If knowledge is King, experience is the Queen of controlling HVAC costs. Establish a partnership with your HVAC service contractor(s). If you play hardball you'll probably lose because you're playing in his ballpark and on his field. If experience tells you that you're getting more than you're paying for, you're probably not actually getting it at all, or you didn't need it to begin with. There used to be a company in New York City that specialized in \$600.00 residential compressor replacements. Of course 90% of the compressors he replaced weren't bad to begin with, and at \$2.50 for a can of black spray paint he was making money hand over fist. His customers thought they'd received the deal of a lifetime. The going rate for a compressor replacement was \$1200 and they found a contractor who did the job for \$600.00. He became the company that specialized in compressor replacements.

Use your experience to determine if the pricing or the labor rate makes sense for the scope of work that is required. You know where the contractor who comes in 10% high is coming from. It's the contractor who comes in 30% low that you have to worry about. Develop relationships with contractors who have reputations for quality work and integrity. You will end up paying less to service contractors of this caliber than you will to contractors whose rates are significantly lower. Would you rather pay \$65.00 an hour for 3 hours to a technician who is a good troubleshooter, or \$50.00 an hour to a technician for 5 hours to a technician who substitutes parts till he finds the one that makes the system work?

I recommend that facilities managers steer clear of all-inclusive fixed cost maintenance and service plans. These plans reward the contractor with more profit when he provides less service. There are many HVAC components and services that can be eliminated short term, but which have devastating long-term results. The thought of always being in budget is extremely tempting, but I have never seen this type of program work to the retailer's advantage long term.

There are many true professionals in the HVAC service industry who can meet your requirements and resolve your issues in a reasonable length of time and at reasonable cost. The secret is to find one, partner with him or her, and work together to meet the individual needs of your stores.