By Don Langston

Prepare to Prevent

The Case for a Refrigeration Preventive Maintenance Program

It's Saturday night in the middle of the dinner rush when your chef comes to tell you some bad news. The walk-in cooler has been operating well above 41 degrees for more than an hour. This could be a disaster, with loss of product and food safety liability.

You place an overtime service call to the company that worked on this system recently. The technician arrives at your facility within a few hours to find the problem is a dirty condenser coil, which is causing the compressor to cycle on and off every few minutes through its internal safety temperature control.

After the condenser coil has been cleaned and the compressor has cooled off, the system begins to operate again. The temperature within the walk-in box pulls down below 41 degrees in a little over an hour. A couple hundred dollars later, it looks like you "dodged a bullet." Or have you?

What about the condition of the compressor; has it been damaged from the repeated on and off cycle?

Have any of the other electrical or mechanical parts of the refrigeration system been damaged?

What about the condition of food? Has the core temperature of any of the products inside the walk-in cooler risen above 41 degrees? If it has, should you throw it away or is it still safe?

What a costly headache this turned out to be. This problem would have been avoided with a regularly scheduled preventative maintenance program.

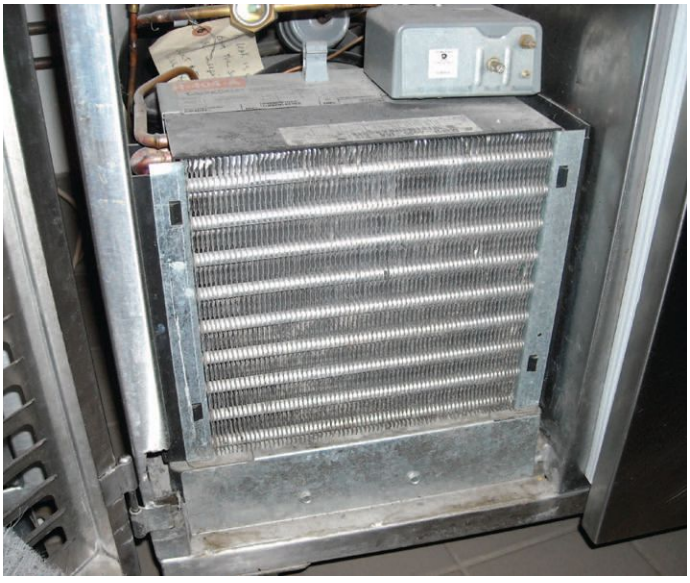
Increasing Awareness

As an experienced refrigeration service technician and a mechanical contractor, I have seen my fair share of neglected and abused refrigeration systems. As a matter of fact, most refrigeration compressors do not fail from poor manufacturing quality: they are literally murdered.

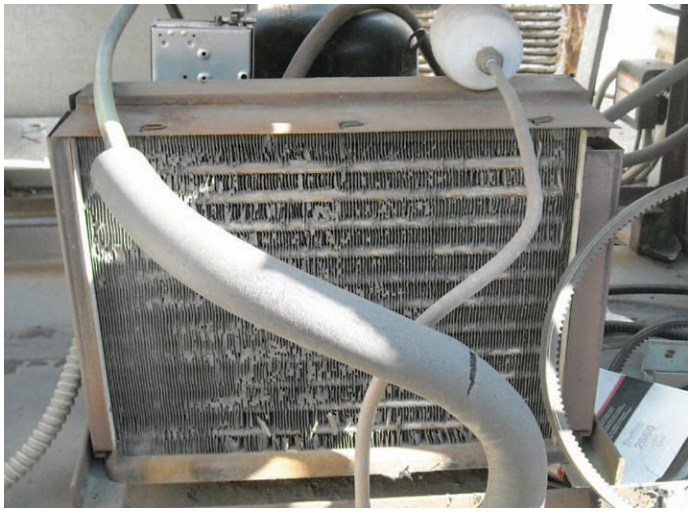
My goal is to help raise the level of awareness for the need of a comprehensive refrigeration maintenance program. First, we need to review the terms and overview of a basic vapor compression refrigeration cycle.

There are four major system components within any refrigerant compression cycle:

1. The **compressor** is the heart of the system. Think of it as a pump that circulates coolant (refrigerant) through two heat exchangers (the condenser and evaporator). The compressor draws in a low-pressure vapor (20-70 psig) from the evaporator and compresses the refrigerant to a high-pressure (150-300 psig) vapor.
2. The **condenser** is a heat exchanger similar to the radiator in your car. It removes the heat in the refrigerant



Notice how clean the fins and tubing are in this picture. A pre-filter is installed in front of the condenser coil to catch most of the dirt. This unit is on a 60-day PM cycle. It is critical that the area around the condenser be kept clear for proper air circulation.



The condenser coil in this picture is 25 years old and located near the Pacific Ocean. The complete condensing unit should have been replaced years ago. Notice how badly the fins have deteriorated to the point that they are effectively restricting the airflow across the condenser tubing. Due to the poor heat transfer of this rotted condenser coil, the compressor failed last summer. Remember, reduced airflow results in a 25 percent energy cost increase.

vapor absorbed in the evaporator and condenses it from a vapor to a liquid.

3. The **metering device** regulates the flow of refrigerant into the evaporator. It also creates a large drop in pressure, causing the refrigerant to change from a liquid to a saturated liquid-vapor mixture.
4. The **evaporator** absorbs the heat from the air and the products within the refrigerated enclosure. As the refrigerant turns to 100-percent vapor, it returns to the compressor, starting the whole process over again.

Medium-temperature systems are designed to maintain a 20-degree evaporator temperature at 120 degrees condensing temperature. These systems will typically maintain storage and holding environment of 35 to 38 degrees.

Low-temperature systems are designed to maintain a -25 degree evaporator temperature at 105 degrees condensing temperature. These systems will typically maintain storage and holding environment of -10 to 10 degrees.

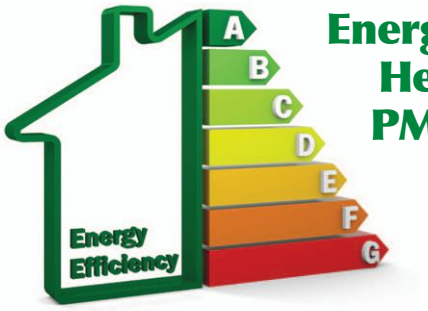
Types of Refrigeration Systems

There are two types of refrigeration systems: self-contained units and remote systems.

Self-contained units are the typical refrigerators and freezers that are moved into position and have a wall plug. As the name implies, the complete refrigeration system is "contained" within the unit.

Self-contained equipment is more prone to problems from dirt and grease affecting the condenser coil due to the

This old and tired unit stands in contrast to the other example pictured above. It is not operating efficiently, wasting hundreds of dollars a year in electrical consumption. It is only maintained a few times a year and is heading for an early grave.



Energy Savings Help Pay for PM Program

The typical commercial refrigeration system's compressor is designed to operate 10 to 12 hours per day. This translates into a typical operating range of 3,650 to 4,380 hours a year. A system that is not properly maintained would easily increase the compressor run time up to 15 to 18 hours per day, or 5,475 to 6,570 hours annually. This will add another 1,825 to 2,190 hours per year of needless wear and tear, on top of the wasted energy consumption.

Assume that the extra run time of a neglected system is 1,825 hours a year. A typical medium temperature 1-horsepower commercial compressor is consuming 3.4 kilowatts of power, and the local utility rate is $0.10 kW/h.

So, 1,825 hours x 3.4 kilowatts = 6,205 kilowatt hours x $0.10 kW/h = $620.50 in additional electrical consumption a year for this one system.

This example takes a very simplistic approach to the many variables that are not being included, such as changes in compressor amperage along with the airflow and/or refrigerant restrictions to the compressor. This example of savings of $620.50 a year is probably conservative.

This unit was found with its condensing unit enclosure lying on the roof. A rainstorm blew the cover off and damaged the fan motor, resulting in a service call.

working environment. Self-contained refrigeration equipment adds heat to the kitchen as the hot air is recycled around the condenser coil throughout its lifecycle.

Remote systems typically have the condensing unit located on a roof or equipment room connected to the evaporator coil via the two (copper) liquid and suction refrigerant lines. It is very important that refrigeration condensing units located on the roofs of restaurants are protected from the forces of nature. The typical refrigeration condensing unit will spend 15 to 20 years on the roof.

The Importance of Regular Maintenance

The purpose of a PM program is to prevent or greatly reduce the risk of failure to the covered equipment. This objective can only be accomplished by cleaning, checking and inspecting the equipment on a regular basis. When necessary, worn or suspect parts must be replaced as soon as possible to catch small problems before they cause a complete system failure.

When deciding how often to perform regular maintenance, remember that the local climate outside and the environment inside the kitchen have a strong influence on the recommended service intervals. For example, bakeries require the condenser coils to be cleaned more often than kitchens preparing soups and salads.

A small walk-in cooler refrigerator in a church kitchen that is only used two or three days a week for six hours a day may require an inspection twice a year. But a busy casual- dining establishment with self-contained refrigeration equipment will require service every 30 to 60 days. A production kitchen in a large hotel or college that serves breakfast, lunch and dinner may require monthly inspections.

A trained service professional who knows your local environment and types of equipment will be the best source of information on tailoring a plan for your specific requirements.

Benefits of a PM Program

The benefits of a robust PM program are innumerable. For example:

- The refrigeration equipment will operate more efficiently and for fewer hours per day. This will translate into reduced electrical consumption, which saves money.
- It will extend the operating life of your equipment, therefore delaying the substantial cost of equipment replacement.
- Proper preventive maintenance will reduce your emergency service repair costs by resolving many potential problems prior to failure.

THE SCOPE OF WORK • A TYPICAL PM CONSISTS OF THE FOLLOWING ITEMS	
✓	Checking the system's overall operation, including temperature readings inside the refrigeration unit, along with temperature checks to the discharge, liquid and suction lines to and from the condensing unit.
✓	Further detailed inspections of the major sub-systems should include the compressor, condenser and evaporator coils and refrigerant flow control device.
✓	Check for proper refrigerant level, along with any indication of moisture in the system.
✓	Check and verify the thermostats, pressure controls, contactors, relays and defrost time clocks are all working correctly.
✓	Inspect the low- and high-voltage electrical components and tighten the connections.
✓	Ensure proper operation of airflow by inspecting the fan motors of the evaporator and condenser coils.
✓	Clean and lubricate motors as required.
✓	Inspect and clean the condensers and evaporators coils.
✓	Check the refrigerant level indicator and inspect the condensing unit, evaporator coil and exposed refrigerant lines for any damage or visible signs of refrigerant leaks.
✓	Check the refrigeration system door gaskets, hinges and latches for proper seal and closure.
✓	Check/clean the evaporator drain pans.
✓	Check/clean the condensate drain lines to prevent obstructions.

ENERGY SAVING TIP

There are 8,760 hours in a year. The evaporator fans in medium temperature refrigeration systems operate at or close to 8,760 hours a year. The evaporator fans in low temperature refrigeration systems operate approximately 7,665 hours a year. Each evaporator fan motor can consume up to $300 annually.

Upgrading from a shaded pole fan motor to an electronically commutated motor will cut energy consumption by 50 to 60 percent annually. Upgrading further to a two-speed ECM will reduce energy consumption by up to 80 percent annually. A typical walk-in cooler evaporator will have two to four fan motors. The payback by upgrading to an ECM occurs within one to two years.

The Food Service Technology Center provides more detailed information on the subject: *www.fishnick.com/education/presentations/SDGE_Refrigeration.pdf*

- Properly maintained equipment has a lower failure rate. Frequent equipment failure can hinder the success of your business.
- The savings in electrical consumption, along with reduced repair cost, should more than offset the cost of implementing a refrigeration PM program. (See example on page 43.)

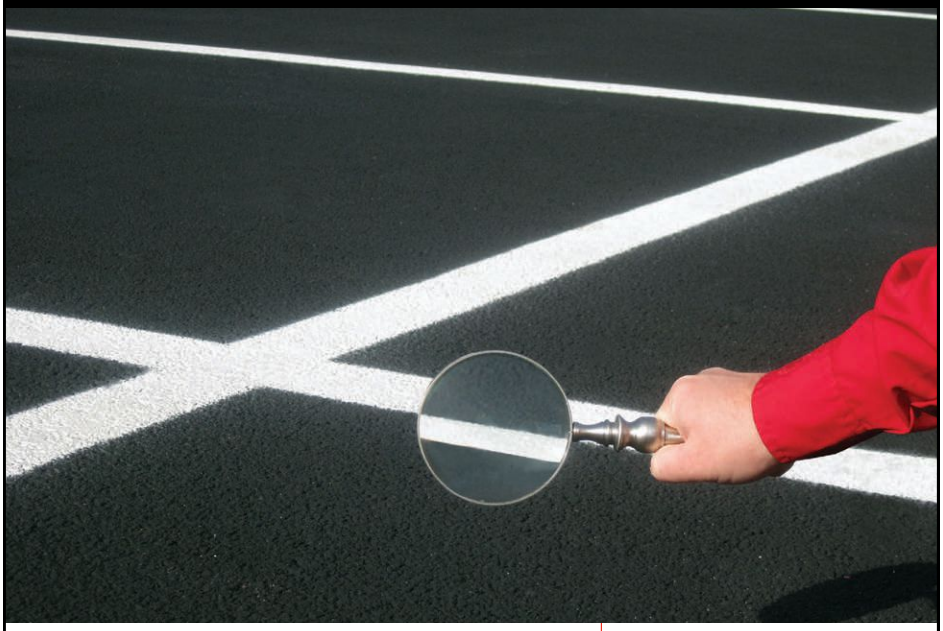
The contractor or individual performing the PM should have the proper state contractor's license or certification to work on commercial refrigeration systems. In California, it is the C-38 license, for example.

It is critical that he or she is an EPA Rule 608 certified technician. The individual should have Environmental Protection Agency-mandated refrigerant recovery machines and storage cylinders inside his or her work vehicle for any repairs needed to the refrigeration systems.

The technician or company should have experience working on commercial refrigeration equipment. There is a difference in many of the skills between technicians who work on commercial air conditioning and refrigeration. It is rare to find technicians competent in both.

In these times of economic uncertainty, maintenance programs are usually one of the first causalities of budget cutbacks. Before a maintenance program is cut for any piece of equipment, do a comparison of your energy costs versus your maintenance program

You could say we're obsessed with pavement...



That is why it has been our focus for over 36 years. Unlike a jack-of-all-trades, Rose Paving specializes solely in parking lot management. If you are responsible for multiple restaurant parking lots nationwide, we can manage the entire maintenance and repair process for you. ***Let the true experts take a closer look at your parking lot(s) today!***

- Asphalt
- Concrete
- Crack sealing
- Seal coating
- Lot marking
- Storm basin repair/ installation
- Green paving solutions

Rose PAVING CO.

We proudly specify: SealMaster Pavement Products & Equipment

For the perfect parking lot, call or click today!

(888) 773-ROSE • rosepaving.com • *blog.rosepaving.com*

During a routine maintenance inspection, we discovered the evaporator coil in this walk-in cooler was a solid block of ice. The thermostat control was turned down to 25 degrees from the 35 degrees set point, and the compressor was running continually for several weeks. The kitchen staff did not know the evaporator coil was iced up and hadn't noticed that the core product temperature had been well over 41 degrees for quite some time.

costs. It is not a zero-sum game. The decrease or elimination of a maintenance program will only lead to increased electrical costs and reduced equipment performance.

A robust maintenance program will more than pay for itself with stable refrigeration storage temperature, energy savings, increased equipment life and reduced total lifecycle costs.

This image of a dead compressor rusting away on a roof should serve as a reminder of the hidden costs of not proactively maintaining your refrigeration equipment. This walk-in freezer compressor was found during a recent inspection of a facility just purchased out of bankruptcy court. The compressor was severely neglected, died prematurely and was less than 7 years old.

Don Langston is the president of Aire Rite Air Conditioning and Refrigeration, Inc. He has spent more than 30 years within this industry. Langston has a passion to help educate customers on the proper design and operation of their equipment to maximize operating efficiency and reduce lifecycle cost.

Author's note: This article focused on air-cooled refrigeration equipment only. Water-cooled refrigeration systems will be covered in a future article.

Advertiser Index