THE CASE FOR A REFRIGERATION PREVENTATIVE MAINTENACE PROGRAM

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Setting the Foundation

The Refrigeration System

Compressor

The heart of the system; the compressor circulates coolant (refrigerant) through two heat exchangers (condenser and evaporator)

Condenser

A heat exchanger similar to the radiator in your car. It removes the heat in the refrigerant vapor absorbed in the evaporator and condenses it from a vapor to a liquid

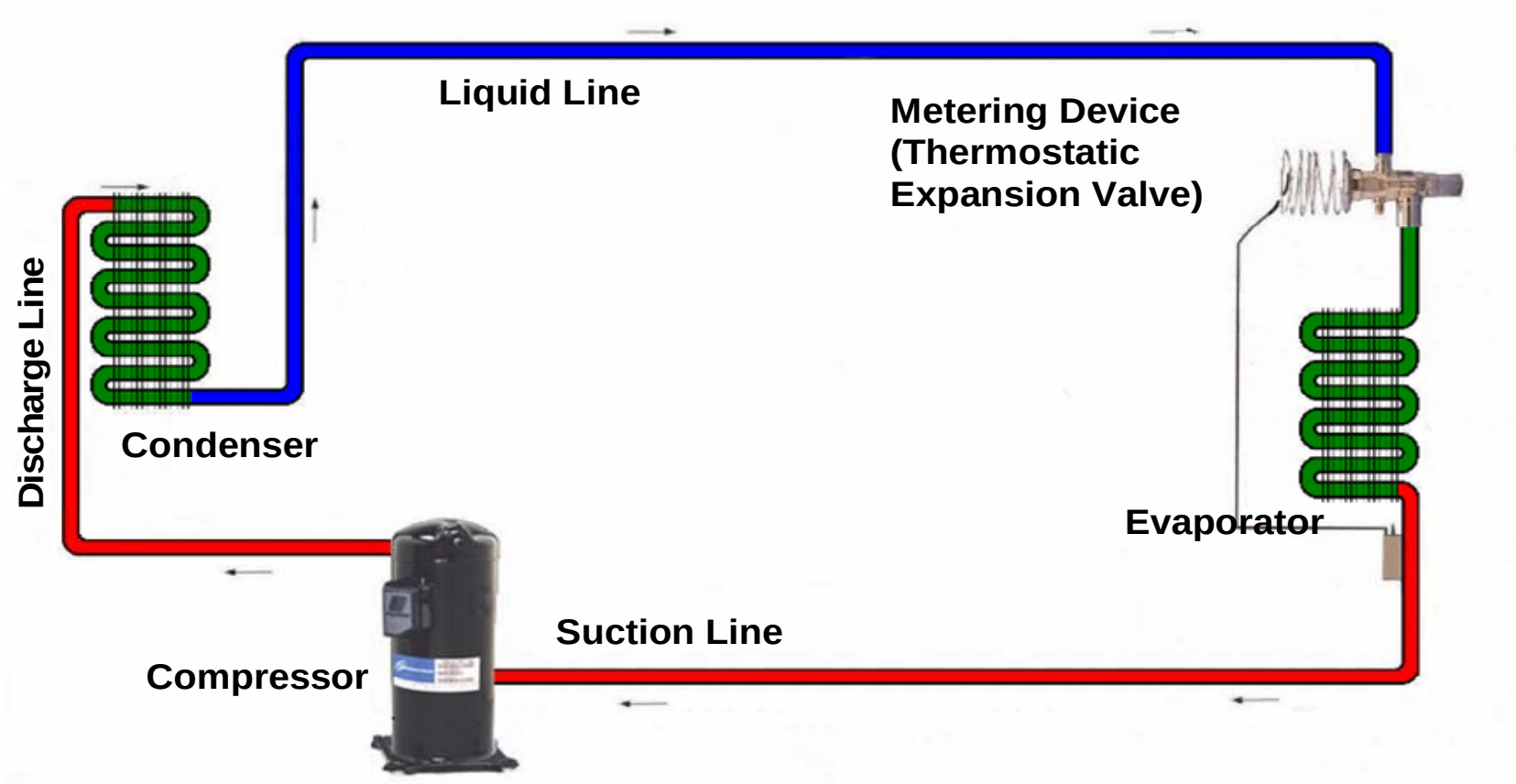
Metering device

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

Evaporator

Absorbs the heat from the air and the product within the refrigerated enclosure. As the refrigerant turns to 100 % vapor, it returns to the compressor, starting the whole process over again

The Basic Refrigeration Cycle



Setting the Stage

Once upon a time... during dinner rush!

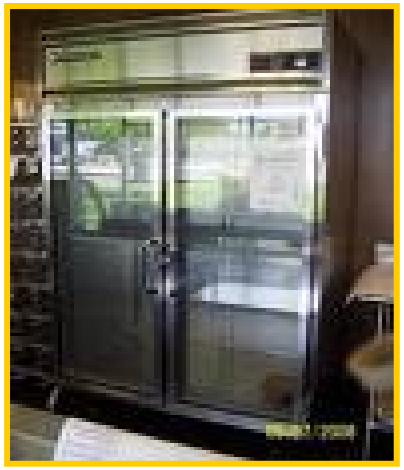
- Your walk-in cooler is operating well above 41 degrees, and has been for more than an hour
- You place an overtime service call
- Problem identified...a dirty condenser coil causing the compressor to cycle on & off every few minutes
- Solution implemented...the condenser coil is cleaned
- Results...hundreds of dollars later, the 'bullet was dodged'... or was it?

What about?

- The compressor...was it damaged?
- Are there any other damaged electrical or mechanical parts?
- What about the condition of your food?

Refrigeration System Types

Two types of refrigeration systems

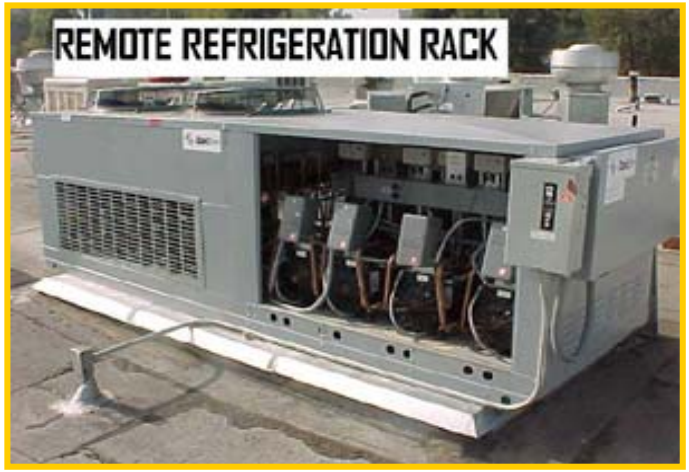


Self Contained Refrigeration Units

- Typical plug-in refrigerators and freezers that are moved into position. As the name implies, the refrigeration system is "contained" within the unit

Remote Refrigeration Systems

- Typically have the condensing unit located on a roof or equipment room connected to the evaporator coil via the two refrigerant (liquid and suction) lines



Self Contained Refrigeration

Self Contained Units....

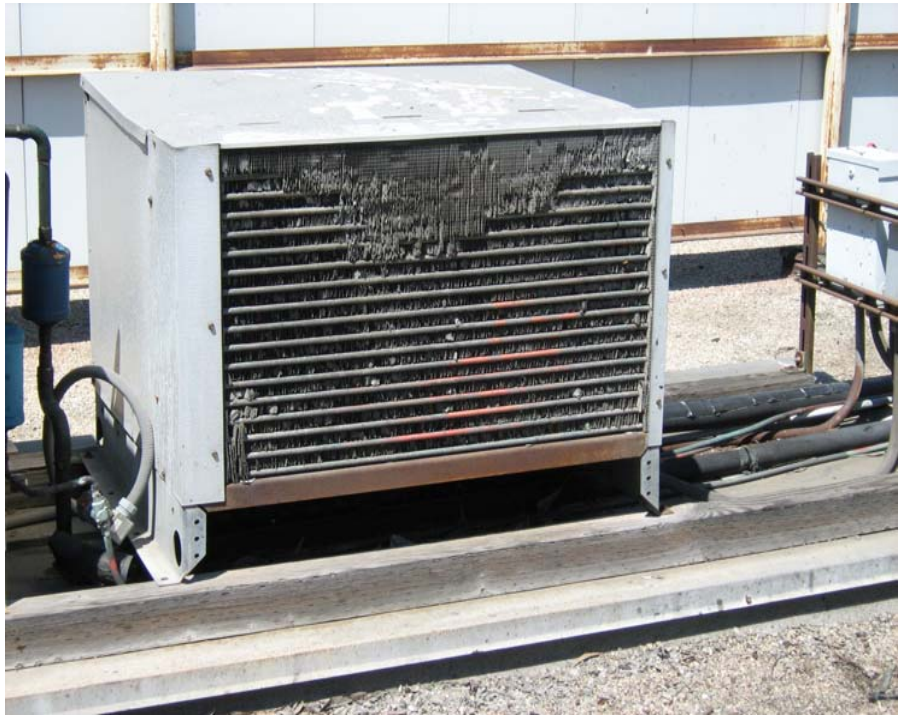
- Are more prone to dirt and grease fouling problems of the condenser coil due to the working environment
- Add heat to the kitchen as the hot air is recycled around the condenser coil throughout its lifecycle
- Critically needs the area around the condenser to be kept clear for proper air circulation

The unit in this picture is on a 60-day Preventative Maintenance (PM) cycle....Notice how clean the fins and tubing are in this picture

Remote Refrigeration Systems

Remote Refrigeration Units....

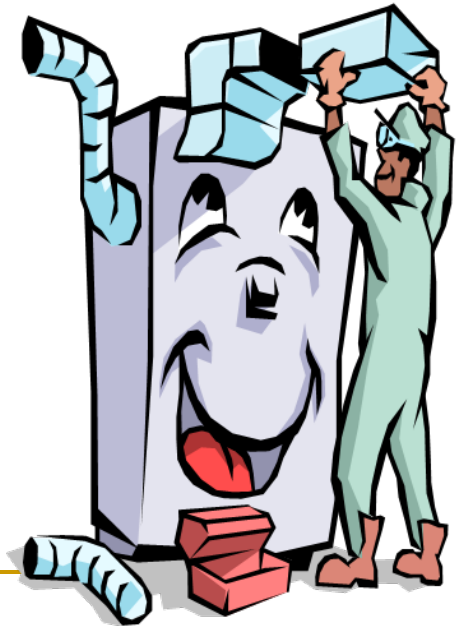
- Are more prone to the effects of the environment
- Are often out-of-sight, out-of-mind
- May require multiple locations, and therefore increase maintenance time
- Have refrigeration lines that are often open to the elements and possible damage



Preventative Maintenance Program

Why Bother with Preventative Maintenance?

- Refrigeration equipment will operate more efficiently and fewer hours per day. This translates into reduced electrical consumption...saving money
- Extends the operating life of your equipment; therefore, delaying the substantial cost of equipment replacement
- Reduces emergency service repair costs by resolving many potential problems prior to failure
- Lowers equipment failure rate...Frequent equipment failure can hinder the success of your business
- Savings in electrical consumption + reduced repair cost should more than offset the cost of implementing a refrigeration PM program



Preventative Maintenance Program

How often should refrigeration equipment be serviced?

- The local climate outside and the inside work environment within a kitchen have a strong influence on the recommended service intervals
- A kitchen that prepares a lot of product with flour such as a bakery will require the condenser coils cleaned more often than a kitchen preparing soups and salads
- A small walk-in cooler refrigerator in the kitchen of a church used two or three days a week for 6 hours a day may only require an inspection twice a year
- A busy casual dining establishment that has a majority of self-contained refrigeration equipment will require service every 30-60 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

Preventative Maintenance Program

Energy Saving Potential – Compressors

Typical commercial refrigeration	Commercial refrigeration without PM
❑ Compressor designed to operate 10-12 hours per day ❑ Typical operating range of 3650-4380 hours annually	❑ Compressor run time increases up to 15 – 18 hours per day ❑ Operating range increases to 5475 – 6570 hours annually

Assumptions

- ❑ Extra run time of a neglected system will be an extra 1825 hours a year
- ❑ Medium temperature 1 HP commercial compressor is consuming 2.0 – 3.4 kW
- ❑ 0.15 $/kWh utility rate

❑ 1825 hrs/yr x 2.5 kW = 4,563 kWh x 0.15$/kWh = $684.45

This is a conservative energy savings example

Preventative Maintenance Program

Energy Saving Potential – Evaporators

- There are 8760 hours (24 hours x 365 days) in a year
- Evaporator fans in medium temperature refrigeration systems operate at or close to 8760 hours annually
- Evaporator fans in low temperature refrigeration systems operate at or close to 7665 hours annually
- A single evaporator fan motor can consume up to $ 300.00 annually
- Many utility companies offers rebate up to $20.00 per motor to upgrade the smaller shaded pole fractional HP motors to either high efficiency Permanent Split Capacitor (PSC) motors or Electronically Controlled motors (ECM)

Preventative Maintenance Program

What is the scope of work for a refrigeration PM program?

- Check overall system operation: Temperature readings inside the refrigeration unit, along with temperature checks to the discharge, liquid & suction lines to & from the condensing unit
- Further detailed inspections of the major sub-systems including the compressor, condenser & evaporator coils & refrigerant flow control device
- Check for proper refrigerant level, and look for any indication of moisture in the system
- Verify the thermostats, pressure controls, contactors, relays & defrost time clocks all work correctly
- Inspect the low and high voltage electrical components & tighten the connections
- Ensure proper operation of airflow by inspecting the fan motors of the evaporator & condenser coils
- Clean & lubricate motors as required
- Inspect & clean the condensers and evaporators coils
- Check the refrigerant level indicator, inspect the condensing unit, evaporator coil & exposed refrigerant lines for any damage or visible signs of refrigerant leaks
- Check the refrigeration system door gaskets, hinges & latches for proper seal & closure
- Check/clean the evaporator drain pans
- Check/clean the condensate drain lines to prevent obstructions

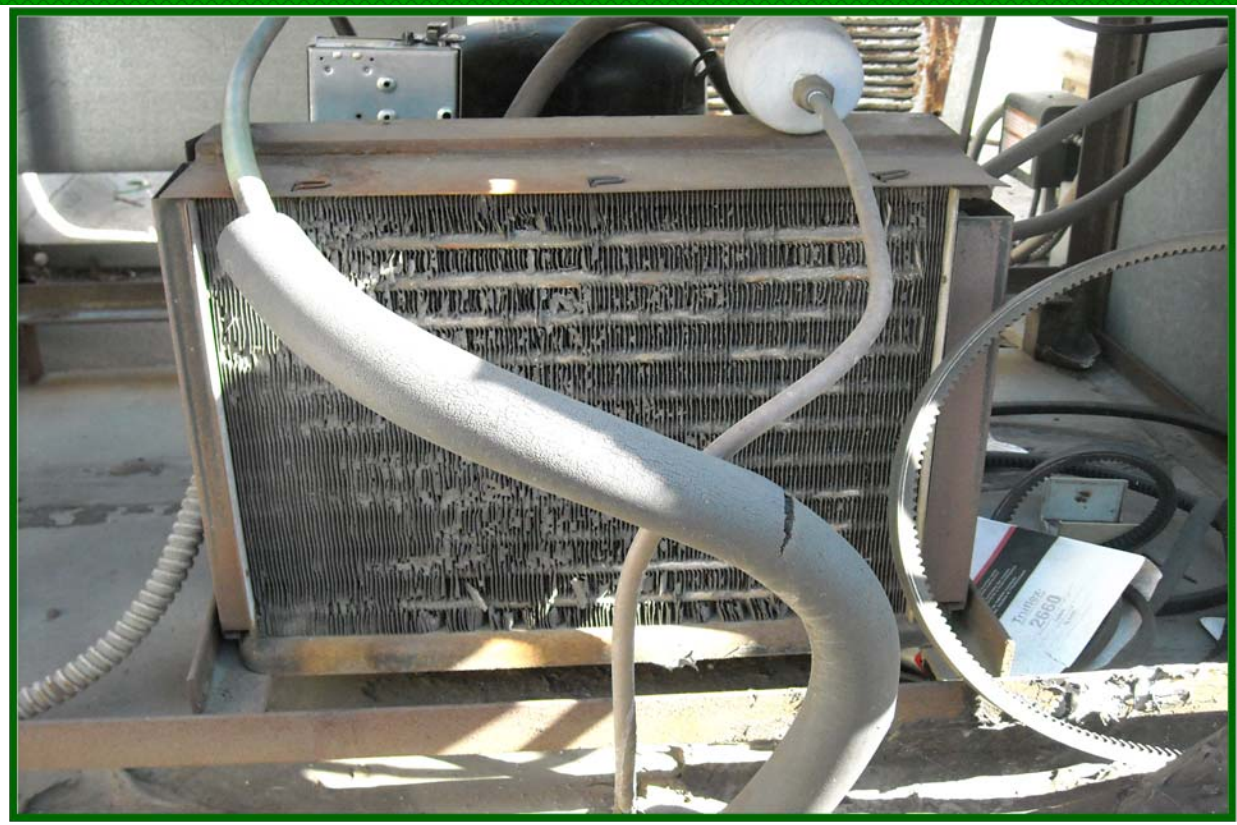
Importance of a PM Program

What is Found When a PM Program Does Not Exist

- Neglected equipment
- Poor efficiency
- Equipment headed for an early grave

Importance of a PM Program

- Deteriorating condenser coil
- Fins imploding and restricting air flow across condenser tubing
- Unit should have been replaced 10 years ago
- Impact to the adjacent compressor due to poor heat transfer



Importance of a PM Program

Can you see the Evaporator Coil? ⟶

- Evaporator coil in this walk in cooler was a solid block of ice
- Thermostat control was turned down to 25° from the 35° set point
- Compressor was running continually for several weeks and was found in this condition during a routine maintenance inspection
- Kitchen staff did not know the evaporator coil was iced up, and failed to notice that the core product temperature was over 41° for quite some time

Iced evaporator coils = Damaged compressors!

Importance of a PM Program

Once a fine compressor...

Here Lies “Rusty”

- A severely neglected piece of equipment
- Early equipment loss, unit is less than 7 years old

Found during a facility inspection, this image of a dead compressor rusting away on a roof serves as a good reminder of the ‘hidden costs’ of not proactively maintaining refrigeration equipment. This severely neglected compressor died prematurely at an age of less than 7 years and wasted thousands of KWH along the way!

Who Does Preventative Maintenance?

The contractor or individual performing the work should...

- Have the proper State contractor's license or certification to work on commercial refrigeration systems
  - ✓ *Example-in California, it requires a C 38 license*
- Be an EPA Rule 608 certified technician with a universal rating
- Have the EPA mandated refrigerant recovery machines, storage cylinders and vacuum pumps inside their work vehicle for any repairs needed to the refrigeration systems
- 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

Sample of Available Rebates

Energy Saving Measures for Refrigeration

- Insulation for bare suction pipe
  - ✓ $1.00 per linear foot
- Door gaskets on walk-in refrigerators & freezers
  - ✓ $4.00 per linear foot
- Strip curtains for walk-ins
  - ✓ $3.00 per sq/ft
- Anti-sweat controls (ASH)
  - ✓ $14.00 per linear foot
- Auto door closers
  - ✓ $40.00 for cooler doors
  - ✓ $50.00 for freezer doors

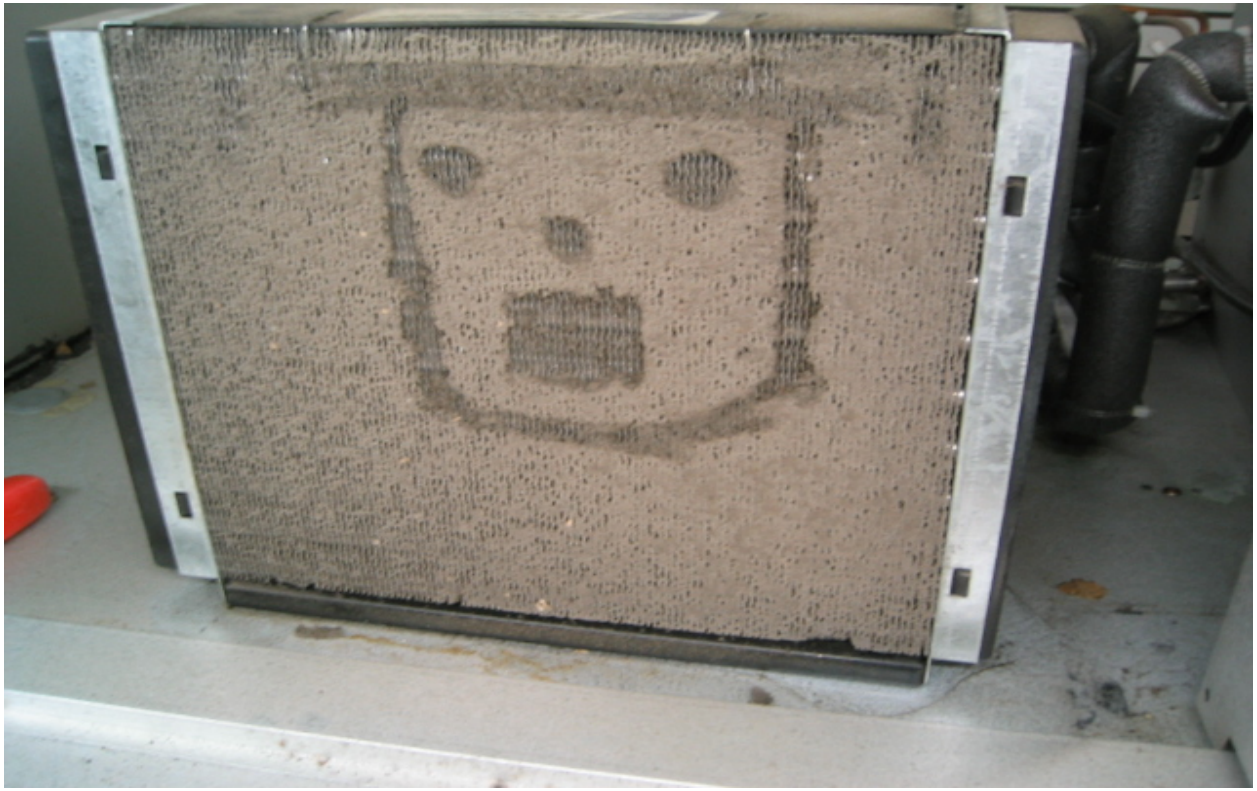
Closing Thoughts

Maintenance programs are usually one of the first causalities of budget cut backs. Before cutting a PM program...

Remember a robust maintenance program will:

- More than pay for itself in energy savings
- Increase the life of your equipment life
- Reduce the total lifecycle cost of your equipment
- Reduce the risk of product loss

Thank You!



Questions?