

The Locomotive

The Key to Avoiding Costly Refrigeration and Air Conditioning Failures is Proper Maintenance and Effective Protection

By James P. Brogan, Industry Consultant, The Hartford Steam Boiler Inspection and Insurance Company

Introduction

Failure of hermetic air conditioning and refrigeration equipment continues to be a leading loss category for all businesses and institutions. Because hermetic units include a motor and compressor, they cannot be repaired in the field, and require replacement of the entire unit. This drives up the cost of repairs. Because much of this equipment is located on rooftops, a crane rental may also be required, again driving up the cost of repairs.

Regardless of the type of business or institution, properly maintaining and protecting air conditioning and refrigeration equipment should be a priority. The goal of proper maintenance and protection is not only to avoid the possible inconvenience of interruption of this service, but also to have a significant impact on reducing the frequency of loss. Many rooftop air conditioning units have had one or more hermetic motor/compressor units replaced, and in some cases, far too frequently.

Causes of Air Conditioning Breakdowns

What can the owner of this equipment do to help reduce frequent failures? First, let us look at the causes behind the breakdowns. The Hartford Steam Boiler Inspection and Insurance Company is one of the largest providers of

equipment breakdown insurance and has analyzed the causes of loss several times over the past years. While there are many causes, all will fall into two general categories — mechanical failure or electrical failure.

Mechanical Breakdowns are Often Due To Lubrication Problems

Mechanical failures have traditionally represented 30 percent to 40 percent of all breakdowns. Many mechanical breakdowns are related to lubrication problems (loss of lubrication; lack of lubrication; contamination of lube oil). Lubrication problems will result in failure of various mechanical parts and often seizure of the compressor.

While oil changes are often done as part of a routine maintenance program, lube oil analysis is not. The oil removed from a unit is often disposed of without any thought of sending a sample to a lab for analysis. The cost of such testing is nominal when compared to the value of the equipment. "Spectrochemical" oil analysis will give the most information about a lube oil's condition, including any contamination or wear particles.

Yet, most service contracts do not automatically include lube oil analysis. Equipment owners should review their service contracts or maintenance program to see if this simple but



Hartford Steam Boiler

© 1996-2013 The Hartford Steam Boiler Inspection and Insurance Company
All rights reserved. <http://www.hsb.com/TheLocomotive>

All recommendations are general guidelines and are not intended to be exhaustive or complete, nor are they designed to replace information or instructions from the manufacturer of our equipment. Contact your equipment service representative or manufacturer with questions.

important predictive maintenance tool is included. This may not be practical for units under 20 tons, but it should be considered for larger units.

Heat Can Result in Breakdowns

Another simple but often-overlooked maintenance practice is related to how air mechanical refrigeration systems reject heat. In all mechanical refrigeration systems, regardless of use, heat is absorbed in the evaporator, and rejected in a condenser. The condenser may be air-cooled or water-cooled. Compression of refrigerant vapor also adds heat. The condenser must reject all heat absorbed, plus the heat of compression. Most are designed to also provide some cooling of the fully condensed liquid refrigerant (referred to as sub-cooling).

Any heat that is not rejected will stay in the refrigerant fluid. This will eventually break down lubrication, and since the refrigerant is also used to cool motor windings in hermetic units, can result in motor overheating and eventual breakdown. Keeping the condenser clean and in good overall condition should be a priority for all air conditioning and refrigeration systems.

Keep the Condenser Clean

Air-cooled condensers will often have three or more rows of finned coils that may require partial unit disassembly for proper cleaning. Simply washing the condenser with a garden hose is not adequate. In some areas, spring is a particularly tough on condensers. Airflow can be severely reduced due to plugging of the condenser with organic materials. Then, when the system is often expected to provide full capacity (in early summer months), the condenser cannot perform or properly reject heat as it was designed to do.

This is at least part of the reason June and July are peak months for losses to this equipment. Keeping your system condensers clean and in good overall condition is a basic maintenance practice that will definitely help extend the life of all motor/compressor units.

Electrical Equipment Failures

For hermetic units, electrical failures have traditionally represented 60 percent to 70 percent of total losses in each analysis period. The electrical category is comprised of several loss causes including lightning, voltage spikes and a variety of “line disturbances.” Line disturbances may include voltage sags (brownouts), power interruptions (often less than one second), phase loss, phase imbalance, voltage imbalance and harmonics. If there are unexplained failures of other equipment, especially electronic equipment, a qualified electrical service firm should be contracted to analyze the electrical power supply and distribution system for harmonics problems.

You Can Help Avoid Losses

How can an equipment owner be expected to protect their air conditioning or refrigeration system against all of these culprits? There is a lot of protection available, again at a nominal cost when compared to the value of the equipment.

Equipment and unit manufacturers will provide basic electrical protection in the form of fuses, circuit breakers and thermal overloads. Most of these units require a “three-phase” power supply. Phase monitors will shut down the motor/compressor in the event of a loss of one phase (single-phasing), phase imbalance and phase reversal. Many of these controls also monitor voltage and include a function to prevent rapid “short-cycling” of the compressor (another condition that will significantly shorten motor/compressor life). Start delay timers will help all systems avoid the destructive effect of rapid cycling of the motor/compressor on and off. This is a simple, low cost control that can be easily installed on most systems.

Protection From Voltage Surges

Voltage spikes require special treatment in the form of “Transient Voltage Surge Suppression” (TVSS) devices. Installing such devices at each unit will often be less overall cost than installing at the main electrical service entrance. If, however, other equipment — especially electronic equipment

— is at risk, consider installing TVSS devices at the main electrical service entrance. Equipment owners should talk with their service contractors or maintenance personnel to discuss what electrical protection is in place for air conditioning and refrigeration units, and what can be added at a reasonable cost.

Proper Grounding is Critical When Lightning Strikes

Lightning is certainly a more difficult problem to address due to the high voltage and short duration of strikes. Lightning will do considerably more damage to an electrical system that is not properly grounded and bonded. Assuring your system has a single point, high quality ground is the best protection against lightning strikes. Direct strikes on rooftop equipment can, of course, result in physical damage that cannot be avoided. Installation of TVSS devices and good grounding practices can help avoid significant damage to air conditioning and refrigeration equipment. A qualified electrical service contractor should be consulted for this area of protection.

Summary

If your business or institution has had loss experience with hermetic air conditioning or refrigeration equipment, there are several actions that can be taken to help prevent such losses.

Improve Maintenance Practices

You should first make an attempt to classify losses as “mechanical” or “electrical.” Qualified service technicians can often provide this information when diagnosing problems on the initial call. This will help focus maintenance efforts, and help identify opportunities for improvements in lubrication oil analysis and electrical power supply protection for your equipment. The “Recommended Accident Prevention Procedures” included in this article are what Hartford Steam Boiler considers to be “Best Practices” to help prevent losses to a variety of air conditioning and refrigeration equipment.

Protect The Electrical Power Supply

Due to the design of hermetic systems, and the frequent line disturbances experienced in most electrical power supply and distribution systems, providing additional protection for the electrical power supply to motor/compressor units in air conditioning and refrigeration systems will address the single largest category of loss. The development of solid-state devices has helped reduce the cost of such protection. When you consider the cost of replacing a single motor/compressor unit, the cost of protection can be easily justified.

About the Author

James Brogan, an industry consultant with HSB Inspection Services in Denver, received an Associate in Risk Management (ARM) designation from the Insurance Institute of America. He specializes in loss control and risk management issues associated with heating, air conditioning and refrigeration equipment and systems.