Progress Supply Inc. THE INSIDE STORY

Helpful Information for HVAC Contractors from Progress Supply

This is one of a series of technical bulletins from your friends at Progress Supply

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LOSS OF OIL

We have now discussed four of the six causes of Mechanical Failure of compressors. In this article, I will look at the failure of a compressor due to the ***'Loss of Oil.'***

When we speak of the loss of oil we are referring to oil leaving the compressor and not returning. We generally are not discussing the oil leaving the system because if the oil left the system so would the refrigerant. This would be a catastrophic failure.

Yes, losing a compressor is a catastrophic failure, especially to the system's owner. Not only is the replacement expensive, but there may also be an expensive loss of product.

Every compressor 'pumps' a little oil out to the system as it 'pumps' the refrigerant throughout the system. This occurs as the pistons move some of the oil off of the walls of the cylinders. The oil in circulation with the refrigerant is beneficial to several parts of the system. The oil does lubricate items such as the thermal expansion valves, pressure regulators and the like. However, if the oil does not return to the compressor, there exists the potential of that catastrophic failure of the compressor.

Loss of oil in a hermetic and/or an air-cooled compressor will result in a catastrophic failure. Loss of oil in the larger semi-hermetic compressor that uses the external oil pump should not result in a catastrophic failure.

The Sentronic, the lube oil safety control, should shut off the compressor when the compressor's oil level or differential pump pressure gets too low, providing that the Sentronic is in operating condition. Even if the Sentronic is operational, all too often, non-technical persons may constantly reset it when it stops the compressor and, ultimately, cause a catastrophic failure.

If the refrigerant and oil leave the compressor together, why don't they come back together? Refrigerant and oil are chemicals. Sometimes they mix well together and sometimes they don't. Let's take a look at the loss of oil why's and wherefore's.

The problem generally occurs between the expansion device and the compressor, in the low-pressure part of the system. One of the ways one can be better assured that oil will return to the compressor, barring a component or people failure, is to have properly designed and installed piping and a proper operating system.

Some of the system problems that cause loss of oil are: *short cycling, low loads, piping, improper traps, inadequate defrosts, loss of charge and pressurized crankcase.* Let's look at each of these.

Short Cycling. There is a difference between true short cycling and rapid restarts that are a part of a continuous pump down. During a continuous pump down, with the liquid line solenoid closed, the compressor may restart several times and in a very short period of time. When the system is properly pumped down and the liquid is out of the evaporator, the compressor will stop and stay off until the next call for cooling and the liquid line solenoid valve opens.

Short cycling occurs when the suction pressure continues to rise after the compressor shuts off. Shortly thereafter the compressor restarts and this short on and off cycle continues. This occurs because of a leaking solenoid valve. The short run time allows the refrigerant and some oil to leave the compressor. There are two reasons the oil cannot return to the compressor. One is the short run time and second is that the solenoid valve is closed, therefore, the oil cannot return to the compressor.

Low Loads. The function of the thermostatic expansion valve (TXV) is to regulate the amount of refrigerant entering the evaporator. It does this by measuring the coil's outlet super heat. As the load falls off, the superheat becomes less. As this happens, the TXV will begin to close, reducing the amount of refrigerant entering the evaporator. As the TXV closes, the quantity of refrigerant to the coil is reduced. The velocity of the return vapor is also reduced. If the low load persists for a long period of time, this lowered velocity will allow oil to remain in the evaporator and potentially in the suction line.

Piping. Piping has a lot to do with both system capacity and oil return. Piping is a mixed bag. It should be large enough to keep the pressure drop low and small enough to keep the velocity up. This sometimes results in decisions to be made that may cause system problems. Installation also has an effect on the system, especially oil return.

If the evaporator is higher than the compressor, oil return is generally not a problem. The oil can return by gravity. The problem occurs when there is lift in the suction line or if there are long horizontal runs.

A rule of thumb is that the vertical piping should be designed to have a velocity of at least 1500 FPM. It should not exceed 3000 FPM. Keeping the velocity within these parameters should not result in oil return problems.

Oversized piping in either the vertical or horizontal runs reduces the velocity and can cause the oil not to return under light loads. Horizontal piping ***must*** be installed with its pitch down in the direction of flow. It is recommended that the pitch be ½ inch per 10 feet. If, for any reason, the pitch is up, oil return will be a problem.

Inadequate Defrosts. Defrosts cost money. Defrosts use energy, electrical energy, and this has a price. Any way in which defrosts can be shortened or avoided will save money. Defrost methods may be electric defrost or hot gas defrost, especially in freezer applications. Air defrost is generally used in cooler applications. Regardless of the type of defrost, as stated before, defrosts cost money. Operators would like to have fewer defrosts to conserve energy, however, skipping a defrost or two can have detrimental effects on the system.

A missed or deleted defrost cycle may allow ice or frost to build up on the coil. This will create low load conditions and may cause oil to be trapped in the coil. Additionally, ice or frost will restrict air flow and may cause the temperature in the space to rise. Defrosts are an important part of the system operation.

Even in a cooler application, using air defrost, missed or eliminated defrost cycles can cause blocked coils. This will cause a low load condition, trapping oil in the coil and not letting oil return to the compressor.

Improper Traps. There are two types of improper traps. One is an intentional trap improperly made, and the second is a trap in horizontal piping not intended to be there. A manufactured trap is a proper trap. The vertical lines of the trap are as close together as the bottom U bend will allow. This allows a minimum of oil to collect in the trap quickly, reducing the cross sectional area, increasing the velocity over the oil and moving it out of the trap on to the compressor.

If the trap is field fabricated, for it to be a proper trap it should be made from short radius street ells. This brings the vertical lines as close together as can be done. Using regular ells and a short nipple creates an improper trap. Another improper trap can be in a horizontal run of pipe when the piping is not properly supported. If there is a downward arch in the piping between the supports, an improper trap is created. This can cause oil to be trapped and not let it return to the compressor.

Loss of Charge. When a leak occurs in a refrigerant system, not only does refrigerant leak out but so does some oil. Most often, the location of these leaks is found because of the oil found at or near the leak. A lot of refrigerant can leak out of a system but a lot of oil probably will not. However, should there be a rupture of the suction line near the compressor, there will be a quick and large outpouring of refrigerant and oil. In this case, there will be a large loss of oil out of the compressor.

Pressurized Crankcase. Pressurized crankcase is an overheat problem that looks to the technician as a loss of oil. It really is not a loss of oil, it is just not knowing where the oil is and why. This problem manifests itself as a trip of the lube oil safety control and causes many technicians to be baffled. The lube oil safety control has tripped but when they look into the sight glass the oil is in the compressor crankcase. When they check the oil pump differential, pressure it is alright.

If the compressor operates for a period of time in an overheated condition, the rings will wear from lack of lubrication. The pistons and cylinder walls may also wear. When this occurs, refrigerant blow by will occur and, ultimately, the amount of blow by will raise the pressure in the crankcase to a level that the oil return check valve will close, not allowing any oil to return to the crankcase. Very soon, the oil level in the crankcase will drop and the oil pump will not have oil. The lube oil safety control will trip, stopping the compressor. The pressures between the motor compartment and the crankcase will equalize, the check valve will open and the oil will return to the crankcase. Yes, it is a loss of oil problem to the compressor, except it really is an overheat problem that manifests itself as a loss of oil problem. The solution to this problem is a subject for another ***Inside Story.***

Loss of oil is a serious problem that the technician must be aware of. Understanding piping and system operation can help the technician prevent loss of oil problems.