



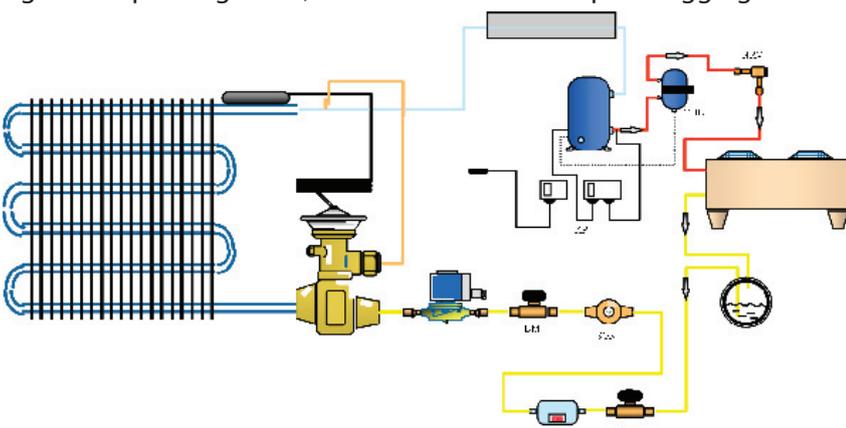
## Why Compressors Fail Part 6 - No compressor overload

One of the most common and simplest of causes of compressors failure is due to the plant electrics not having a compressor overload fitted.

When large Semi-Hermetic or Hermetic compressors are fitted to systems where the compressor contactor has no overload fitted, the compressor is left wide open to liquid washout, Valve breakages or even full blown Smash Ups. This problem can be caused by one of the components designed to save a compressor.

This component is none other than the compressor motors KLIXON. So let's look at a typical failure scenario.

Most commercial refrigeration systems use a system PUMP Down control. This system offers good protection against Liquid Migration, and to some extent Liquid Slugging.



Here we have a basic refrigeration system with the inclusion of a liquid line solenoid valve which enables the use of PUMP Down control.

The plant control is as follows. When the thermostat calls for duty the thermostat contacts are made, which then puts a live connection onto the liquid line solenoid valve. The solenoid at this point becomes energised and it then opens to allow liquid refrigerant to pass through the solenoid valve, expansion valve and into the evaporator. At this point the pressure in the low side of the system rises, which causes the Low Pressure switch to make contact which then allows the compressor starter to energise and the compressor to run. When the thermostat reaches its design cut out temperature, the stat then opens its contacts. This then de-energises the solenoid valve which closes and stops any more refrigerant entering the expansion valve and evaporator. The pressure in the low side of the system then drops as the compressor removes the vapour from



Overload relay

the evaporator and eventually the pressure in the compressors suction line reaches the Low Pressure CUT OUT Point. As the LP Switch opens its contacts, the compressors starter is de-energised, and the compressor STOPS. At this point there is virtually no refrigerant left in the Evaporator. Therefore, during the compressor OFF Cycle there is little if any Liquid migration taking place. When the compressor is called to start up once again the liquid refrigerant is injected under control from the expansion valve into the evaporator and normal safe superheat control is maintained.

The problem starts when the compressor starts to either draw excessive amps or starts to run hot, either can cause the compressor to trip on its internal Klixon.

High discharge pressures caused by high ambient temperatures or simply a dirty condenser block can cause these problems. Also an iced up evaporator or choked drier etc, can cause a low suction pressure which will cause the compressor to run extremely hot with a rise in amps drawn. Remember the KLIXON is the ultimate safety feature and is the last line of defence.

If there is no contactor overload fitted and the compressor sees one of the above problems, then the following happens.



*A dirty condenser block can be the cause of high discharge pressures.*



*Here we have a Klixon fitted to a 3-phase motor. The Klixon is the compressors last line of defence and should not be used to cycle the compressor.*

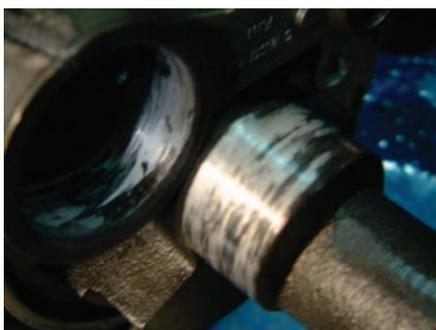
The cold room may be frozen or chilled, but it will normally be colder than the compressor.

So let's see what happens now.

The compressor starts up via the thermostat, solenoid valve and then the LP switch. The compressor runs OK. When the compressor is subjected to one of the above problem scenarios, where the amps drawn rises, or the compressor temperature rises. The compressor will get to a point where it will stop on its internal Klixon, which is at the Star point of the motor winding. The Klixon is not in the compressors safety circuit as it's in the

motor. Therefore, the thermostat is still calling for duty ie contacts closed, the solenoid valve is still energised and open, and the Low Pressure switch is still made calling for the compressor to run. However, the compressor can't run due to it being stopped on its internal Klixon. So the liquid refrigerant continues to pour uncontrolled into the cold evaporator. The refrigerant vapour slowly migrates back into the compressor slowly diluting the compressors lubricant. Depending on how hot the compressor motor has become, will have a bearing on the time that the compressor is OFF on its Klixon. This can be as long as 8 Hours.

When the Klixon does eventually reset, the compressor restarts and either the lubricant is so heavily diluted with refrigerant that the bearings are washed out and they seize, or the liquid simply floods back into the compressor causing suction and discharge valves to break and pistons and con rods to break and most likely smash the compressor.



*Seized bearings, broken pistons and con rods even completely smashed compressors are all possible outcomes when the compressor is cycling on the Klixon because no overload protector has been fitted.*

If an overload had been fitted and wired through the control circuit, providing the overload had been set to the correct setting so that any over current that the compressor initiated would cause the overload to trip, thereby stopping the compressor and also breaking the feed to the solenoid coil and forcing it to close. The compressor motor would have been saved from running in an overloaded state, which weakens the motor insulation and reduces the compressors life time, and the solenoid valve forced to shut preventing liquid refrigerant filling the evaporator and causing fatal damage to an innocent machine.

The cold room temperature alarm would give the plant operator chance to check the plant and rectify the problem, as against having to replace a costly compressor simply because of a dirty condenser or a faulty defrost control.

Saving the cost of an OVERLOAD could cost you a new very expensive compressor.

NOTE:- The liquid line solenoid valve must always be closed, if the compressor is stopped by one of its safety controls. The compressors Klixon is the last line of safety, when all else fails.

The moral of this story is Penny wise, Pound Foolish

