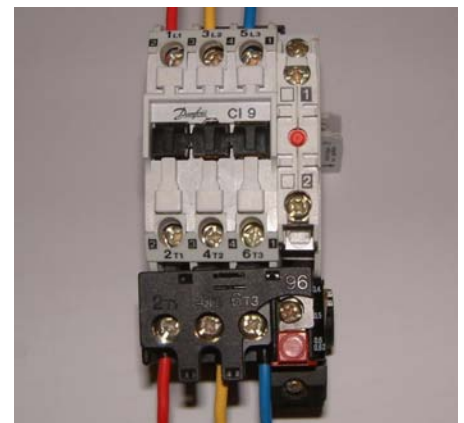




## Why Compressors Fail Part 7 - Failing to change compressor electrics after a burnout

In our previous article we discussed the problems associated with not fitting a compressor overload this time we are looking at what can happen when engineers fail to replace the compressor electrics after a compressor failure. It is customary to fit a contactor, with an overload protector, into the electrical control circuit of the compressor, however, we are aware of many instances where a new compressor has been fitted, after a failure, and this new compressor fails due to the compressor electrics not being replaced.



Contactor and Overload relay for 3-phase system



Here we can see the type of damage that has occurred to the contacts inside the contactor after a compressor failure.

It is often the case that after a compressor failure the contactor itself is also damaged. This will result in the contactor either not working at all or not working correctly. In this situation some engineers have condemned the new compressor has being DOA (Dead On Arrival) or the new compressor has been fitted and then suffered catastrophic damage and itself needed replacing.

The best way to illustrate the impact of this is by recalling a couple of 'real-life' scenarios where these problems have occurred.

A couple of years back during the summer, when Glenn was on a well earned vacation and unaware of the unfolding drama, a customer experienced a compressor failure on one of their sites so a replacement compressor was purchased and fitted. During the installation a new drier was fitted and the plant was evacuated and charged. The plant was started up and appeared to be running OK, so the customers' engineer left the site. The following day the site engineer phoned to say that the compressor was running but not doing any cooling.

The original engineer attended the site for a second time and found the compressor was running but not pumping, the suction and discharge pressures were the same. The compressor was removed from the plant and returned to the Wholesaler under warranty and a second compressor was purchased and fitted. The plant was started and appeared to be running OK, so the engineer left the site.

The following day there was a further phone call to say that the new compressor was running and not pumping, exactly the same problem as with the first replacement compressor. A third compressor was purchased and fitted and everything worked OK for a couple of days and then the same problem occurred again.

A fourth replacement compressor was purchased and fitted it to work for a couple of days before the same failure occurred once more. At this point the engineers' manager decided to have the last 2 compressors cut open to see what the fault was. When

these two compressors were cut open it was found that the suction valve was smashed and the centre of the piston had a large hole through it, therefore, the compressor was unable to pump. All other components of the compressor were in mint condition.



*In the first picture we can see where the valve has been smashed and in this case pieces are embedded into the valve plate. The second picture is typical of the damage that is caused when pieces of the valve fall into the cylinder. This type of damage is caused when the compressor tries to pump liquid refrigerant.*

The customer interpreted this damage as being down to the compressors having had a faulty batch of pistons and, therefore to blame.

A fifth compressor was now purchased which had a completely different serial number, from the others previously fitted, to make sure that the piston fitted to this compressor was from a different batch. This fifth compressor was then fitted to the plant but it suffered exactly the same fate as the previous four compressors. The customer purchased a sixth compressor and fitted it but would not run it until Glenn had returned from his vacation and could attend the site to see the compressor running.

Upon his return Glenn was informed of the situation and immediately attended the customer's site.

The site was a simple air conditioning computer room with a condensing unit sitting on the floor outside the room and a floor to ceiling air handling unit inside the computer room. The unit was controlled with a room stat that drove a cam motor in one direction to bring on heating coils or, in the reverse direction, to bring on the cooling mode. When the unit called for cooling, the cam motor would cycle and energise a liquid line solenoid valve. As the pressure in the valve evaporator and suction line exceeded the LP switch pressure setting, the compressor would start. When the cooling was satisfied the cam motor would cycle back de-energising the solenoid valve and pumping the system down and stopping the compressor on the LP switch.

After questioning the engineer about what he had done and seeing how the system operated the problem became obvious.

The problem was simply that the engineer had not changed or inspected the compressor contactor. The contactor had no overload fitted and the contactor's contacts had partially melted away during the original compressor burn out. When the new compressor was fitted the compressor ran but was only running on 2

phases instead of the designed 3 phases due to one contact leg making little or NO contact.

This caused the compressor to trip on its internal klixon. The system was still calling for duty and consequently the liquid valve was still energised. This allowed the system charge to migrate from the condenser/receiver and into the evaporator and the compressor. Whilst the compressor was in the tripped condition, liquid refrigerant was running uncontrolled into the compressor shell. When the klixon eventually reset itself, the compressor re-started and then tried to pump on the liquid refrigerant that had filled the compressor. This caused the suction valve to break and fall into the cylinder bore and onto the piston. As the piston travelled back up the cylinder the valve plate was compressed between the piston crown and the discharge valve assembly. This caused the piston crown to smash and a hole through the piston was the result.

On running the compressor and quickly measuring the phase loadings, the problem was quickly confirmed. The contactor was replaced along with an overload which was connected through the control circuit, and the plant test run. All phase loadings were now equal and the compressor operated and cut out on temperature correctly. No further problems occurred on this site.

A similar problem occurred via one of the wholesalers recently. During the warranty inspections it was noticed that 2 large MT160 compressors had been returned as being DOA. On carrying out the electrical checks all was OK. The compressors were then test run and again all was OK. On speaking with the wholesaler they requested that the machines be cut open and fully stripped. This was carried out and all parts were found to be in mint condition. We requested the customers contact details. On contacting the customer and making inquiries as to the plant and what they were doing etc it turned out that they were just fitting the 3rd compressor on this site. They were asked to check the compressor contactor before they tried to run the new compressor as we didn't want it damaged.

They then removed the contactor and found that the contacts were so badly burnt away that the compressor could never start as there was actually no electrical contact of any value.

**So these 2 customers ended up with an expensive piece of compressor education, caused by simple negligence and ignorance.**

On single phase machines where start capacitors and relays are involved, always replace the electrics when fitting a new compressor as a faulty relay or capacitor could quickly burn out the start winding on a replacement machine in a matter of seconds.

Contactors can be tested by simply putting an ohmmeter across the contactor terminals and manually pushing the contactor contacts in and then measuring the resistance across the contacts. Resistance readings, of no more than a couple of ohms, is acceptable, any more, then the contacts should be cleaned and polished or replaced.

Testing of capacitors can be done with an ohmmeter, megger or a simple capacitor tester

**Remember :-** Capacitors store electrical charge always make sure they are safe by grounding them.

Always make sure the system isolator is switched OFF and fuses removed before carrying out testing of this nature.



*Single phase starter kit.  
This should always be replaced when fitting a new compressor.*

It is important to not only replace the contactor and overload protector after a compressor failure but you should also ensure that they are wired correctly into the electrical control circuit, below we have a couple of photo's showing the correct wiring for both 3-phase systems and a single phase system using a 3-phase contactor.

### 3-Phase.

Please note that since 2004 a new standard has been adopted across the European Union for the colour coding of the wiring for 3-phase systems and it is likely that you will encounter both the older and newer standards.

**The new European standard came into effect from April 2004 and is as follows,**

L1 = Brown    L2 = Black    L3 = Grey    Neutral = Blue    Earth = Yellow/Green

**For the UK until April 2006 it was possible to still use the old standard which is as follows,**

L1 = Red    L2 = Yellow    L3 = Blue    Neutral = Black    Earth = Yellow/Green

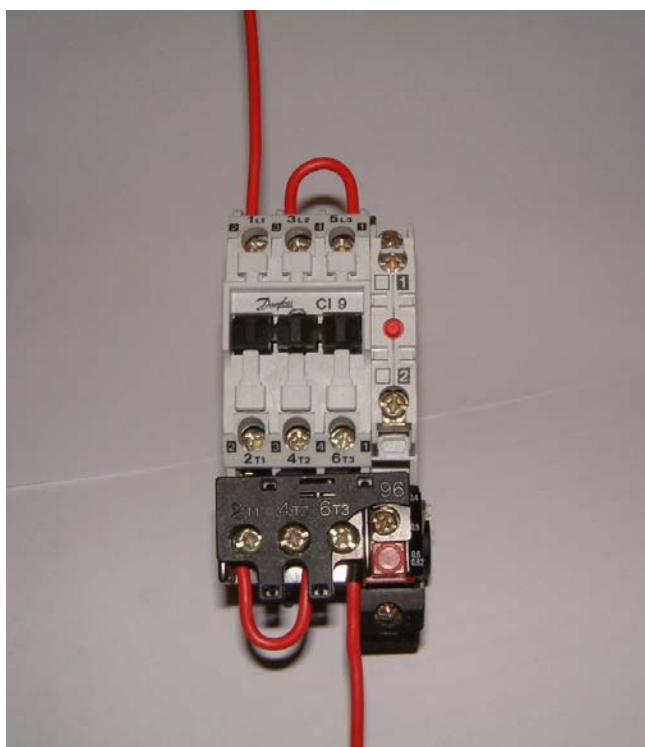
**The older European Standard varied for different countries but was typically as follows,**

L1 = Black or Brown    L2 = Black or Brown    L3 = Black or Brown    Neutral = Blue    Earth = Yellow/Green



#### 3-Phase

*This contactor is wired to the older UK standard, however, it still illustrates the correct wiring of the 3-phases. With the new European standard the Red wire would be replaced with a Brown wire, the Yellow wire would be replaced with a Black wire and the Blue wire would be replaced with a Grey wire.*



#### Single-Phase

*This is the correct wiring for a single phase compressor with a 3-phase contactor and overload Protector. The overload protector must be sized for the full running current.*

### Remember :-

**Always replace compressor electrics after a burn out or when fitting a new compressor. Electrics are cheap compared to a further new compressor**