Oil Safety Controls

by

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Oil Pressure Safeties

Oil Safety Controls are probably one of the more tougher controls to get a handle on.

For years if I found an oil safety that was bad I would replace it "wire for wire" and go on to the next call.

It was some years later that I finally decided to solve the mystery of how this control works. This article will show you how to trouble shoot the oil safety and give you an in depth knowledge of its operation.

Ready? Let's Go.

Oil Safety Components

Voltage Dropping Resistor - This is the big resistor that is readily visible when the cover of the control is off. It is usually rectangular or round in shape. Its purpose is to let the control operate on 120 VAC or 208/240 VAC.

Manual Reset Button - This is usually a button on the front of the control you push to reset the control to its operating position. Sometimes the button is in the shape of a stem coming out of the top of the control.

Pump or Oil - This will be a capillary with a 1/4" flare nut on the end. It should fasten to the discharge side of the oil pump.
Suction - This will be a capillary with a 1/4" flare nut on it and will fasten to someplace where the suction pressure can be measured. Be sure not to fasten the capillary upstream of any valves such as a CPR (Crankcase pressure regulating valve)

Time Delay Heater - This heater is internal and is not visible. The purpose of this heater is to de-energize the control circuit if the oil pressure becomes too low. It takes the heater approximately 120 to 180 seconds to open the control circuit.

240 Terminal - This would be one side of your power supply when the compressor is running. You do not want this voltage present when the compressor is off because in 120 to 180 seconds the control would open and de-energize the control circuit.

L Terminal - This is the other side of your power supply. Again you do not want voltage to this terminal if the compressor is off for the same reason just stated above.

120 Terminal - This terminal would be used if your supply voltage was 120 VAC and not 208/240 VAC.

S Terminal - This is the "alarm" terminal. You can turn on a light or sound a bell or whistle to be alerted that the oil control has tripped.

M - This terminal is used for opening the control circuit in case of oil failure. It is one side of your control circuit.

2 - This terminal is usually jumpered to Terminal "M". It is necessary to be connected to "M" Terminal so the control has a complete electrical circuit internally.
Purpose

If the compressor oil pressure drops below a set level, usually 10 lbs., the oil failure control will energize a heater that will cause the control to open the compressor contactor and shut the compressor off. (Usually 120 seconds to 180 seconds.)

If the compressor oil pressure drops below the set level but rises before the 2 minutes then the heater is de-energized and the compressor is allowed to operate normally.

Testing
The easiest way to test the oil control is to take 2 of the 3 wires off of the compressor and isolate them. Turn the power back on and time how long before the oil safety opens up. (usually 2 minutes) I live in a northern area and if you leave the oil failure control cover off and the wind is blowing it will prevent the heater from getting hot enough to trip the control. (If the electrical circuit is coming off of the compressor terminals you will have to leave the wires connected together but not connected to the compressor to check the oil safety.) (See drawing below.)

Did it trip?

Yes. Then the oil control is working correctly.

No. Then take a quick look at the control. Did someone snip the heater wire and the heater can't warm up? (The voltage dropping resistor that is readily visible.)

Heater wire is O.K. Then ohm out the resister. Is it open? If it is then the control needs to be replaced. Both check O.K. then it is time to do some more testing.
Determining Oil Pressure

Check to see if you have good oil pressure. Hook one line to the suction valve to the compressor. Hook another line to the oil discharge pump.

If your oil pressure is 70 psi.

If your suction pressure is 30 psi.

Then your "Net Oil Pressure" would be 40 psi.

Or in formula talk, Discharge Oil pressure - Suction Pressure = Net Oil Pressure

Replacing the control

Usually the best way is to replace the control is "wire for wire" if you can. However, if you have been in the field very long you will find that the "older" experienced technicians used all black wires, mounted the control down low with the wires away from you and they are old and crack when you try and work with them. Oh Yeah, I forgot to mention that it is in the dimly lit corner of the compressor room, zero degrees outside with a 40 mph wind, and the ice cream case is around 45 degrees and you are starting to consider getting your resume' in order and find a "real job."
(Sorry, I digressed.)

In this case install a new Oil Control and use 4 wires instead of 3. Here's how.

From the compressor terminal, T1, run a wire to the "240" Terminal on the control.
From the compressor terminal, T2, run a wire to the "2" Terminal on the control.

Remove the jumper from "M" to "2".

Here is what you are doing. "240" and "2" are being supplied power when the compressor is running. "L" and "M" become your control circuit and should be wired in series with your compressor contactor.

Sequence of Operation

4 Wire Method

1. The compressor contactor is energized by the control circuit through "L" and "M".

2. The compressor starts and when it does voltage is supplied to terminals "240" and "2".

3. If net oil pressure exceeds the control settings, usually 10 p.s.i., the switch contacts "C" and "D" will open and the compressor will continue to run.

4. If the net oil pressure is below the control settings, usually 10 p.s.i., the "C" and "D" contacts will close and energize the time delay heater. After 120 to 180 seconds the heater will "trip" and contacts "L" and "M" will open and the compressor will
shut off. The "button" or "control" will have to be manually reset before operation can resume.

Here is what you are doing. If the compressor is running you will be supplying voltage from T1 and T2 to the oil control to terminals "240" and "2". If the oil pressure is O.K. then the heater will not heat and the unit will cycle correctly.

If the compressor is running and the oil pressure is low then you are supplying 240 volts to the oil control and will energize the heater and open the contacts "L" to "M". (If you are in a dimly lit compressor room, wire it up with the 4 wire method and then return the next morning and look everything over and dress up your wiring.

Also, a lot of technicians come off of the compressor terminals for convenience and not the terminals of the contactor. Remember to come off of the "Load" side of the contactor. You don't want voltage to the oil control if the compressor isn't running.

**Wiring**

Most units will be wired using the 3 wire method. Below is a wiring diagram showing both methods.

1. "240" - Power supplied to the oil control.

2. "L" - Control circuit coming in.

4. "2" - Should be jumpered to "M" terminal.

The operation is the same. If the oil pressure is low a heater will be energized and cause the control to open the contacts between "L" and "M".
General Discussion

Oil Safeties can trip for a multitude of reasons. Usually by the time you arrive the customer has reset the control several times and the unit is running. You are then left with the task of troubleshooting the problem while it is operating.

Here are some things to check.

1. Oil level - The oil level should be around 1/3 of the glass when it is running. Never add oil if you don't know where the oil is. In other words, if you have a broken line, and oil is all over the floor, then you may repair the line and add oil. If oil is not visible then do not add oil.

   The oil is in the system and you need to determine where. One way is to cycle the unit into a defrost and warm the evaporator coil up. When the unit comes out of defrost the oil should return to the compressor.

2. Check your oil pressure - You can't troubleshoot a bad oil safety if your oil pressure is low.

3. Check other compressors - On rack systems one compressor can be worn and pumping oil and it will run the good compressor out of oil and cause it to trip.

4. Burnt contacts on the compressor contactor - On occasions the contacts will not close well enough to start the compressor and after 2 minutes of the compressor contactor being closed and no oil pressure will trip the oil safety. Then the service tech comes along and resets the oil safety and the compressor takes off and everything checks out okay.
Hope this helps some of you out.

Comments and "smart remarks" are welcomed.

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I have done my best to make this article error free. I am not responsible if something burns up or you get electrocuted or you ruin a compressor.

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