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Subject: ELECTRONIC DE-ICE CONTROLLER: FIELD DIAGNOSIS OF OPERATION OR FAULTS
Units: VARIOUS OSA AND OPA UNITS

We have been fitting an electronic de-ice controller to various units since early in 1997. This application notice gives some background information that will be useful in understanding it's method of operation and tracing of possible faults.

Operation:

The De-Ice Controller commences a De-Ice cycle when the sensor (inserted into the fins at the bottom of the coil) measures a temperature of -4 degrees. This results in the Outdoor fan (and optionally the Indoor) stopping and the cycle changing to COOLING. (The "N/C" contact of the "Fan RIV" relay on the De-Ice Controller breaks the Neutral return for both the fan(s) and the Reversing Valve.) During De-Ice cycle the L.P. switch is also bypassed via the LP. relay.

N.B. The LP. switch is and must be wired on the "Neutral" side of the compressor contactor.

The De-Ice cycle is terminated when the coil warms up to +10 degrees or if the De-Ice Cycle has lasted for 10 minutes. This results in the fan(s) restarting and the operating cycle returning to HEATING. The L.P. remains bypassed for a further 2 minutes to avoid nuisance L.P. trips. The controller dictates that there will be a minimum of 33 minutes **between** De-Ice cycles (i.e. from the end of one cycle to the start of the next).

Release number variations:

The functionality of all "Release" versions is as described below. The differences between them are purely physical / electrical in nature.

De-Ice Controllers - Release 1,2 & 3:

There are no diagnostics on the De-Ice Controller apart from the "TEST" jumper (the little black plastic block in the middle of the top edge of the Controller's Printed Circuit Board). If this jumper is removed a De-Ice cycle can start as soon as the coil sensor reaches -4 degrees without the limit of a minimum of 33 minutes between De-Ice cycles applying.

De-Ice Controllers - Release 4:

The Release 4 De-Ice Controller has a single 2 way DIP switch fitted next to the SENSOR connector to help in diagnosing field problems and to assist in testing the system at commissioning.

In normal operation both switches 1 and 2 on the DIP switch should be in the ON position.

Turning Switch 1 OFF disables the 33 minute wait between De-Ice cycles. The De-Ice Controller can then initiate a De-Ice Cycle as soon as the SENSOR bulb reaches -4 deg. C. It will terminate the De-Ice Cycle as soon as the SENSOR bulb recovers to +10 deg. C. This process can then repeat as soon as the SENSOR once again detects -4 deg. C.

Turning Switch 2 OFF should force De-Ice Cycle to occur regardless of the SENSOR temperature. The forced De-Ice Cycle should terminate as soon as the switch is turned back ON if the SENSOR is above 10°C.

Fault diagnose:

1) Is there a constant 230V AC feed to the "P" and "N" (Mains In) terminals of the De-Ice Controller?

Yes – Good Proceed to point 2.

No – The Control Circuit breaker may have tripped or there is some other wiring fault.

2) With the Unit running on HEAT cycle, move DIP switch 2 to the OFF position. The Unit should immediately enter a De-Ice Cycle. Does it?

Yes – Good. Proceed to point 3.

No – A fault is likely with the controller or the detachable sensor. Go to point 4.

3) Make sure that switch 2 is in the ON position. With the Unit running in HEAT cycle, move DIP switch 1 to the OFF position. Allow the unit to run until it is obvious from the presence of ice, or by measurement, that the SENSOR (which should be inserted in the fins, down at the bottom of the coil) is likely to be experiencing a temperature of -4 °C or lower. As soon as this temperature is reached the unit should De-Ice, returning to HEAT cycle when the coil warms up to +10°C. Does it?

Yes – Good. The De-Ice controller and sensor are working properly. Turn Switch 1 back ON.

No – If point 2 above worked but this point 3) failed then there is likely to be a problem with the sensor or its connection.

4) Isolate the power to the Unit. Unplug the SENSOR lead from the pins on the Controller PC Board. Gently pull the SENSOR lead directly away from the surface of the De-Ice Controller PCB. Do not pull at an angle! Using two individual short segments of 1 mm or less diameter wire (possibly stripped out of one of the conductors of some TPS wire) inserted into the SENSOR socket's holes, measure the resistance of the SENSOR. The resistance reading should be in line with the following figures:

-5°C – 9.25 kohm

0°C – 7.15 kohm

5°C – 5.57 kohm

10°C – 4.37 kohm

15°C – 3.45 kohm

20°C – 2.75 kohm

30°C – 1.77 kohm

40°C – 1.17 kohm

50°C – 0.79 kohm

Is the resistance reading as expected?

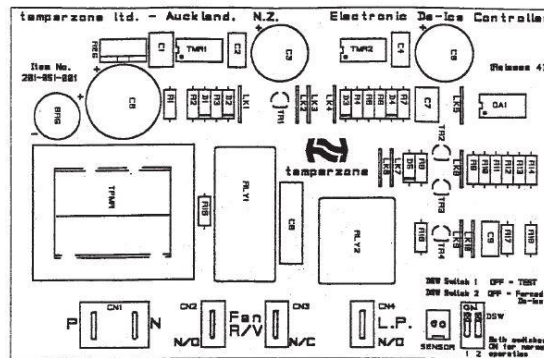
Yes – Good. Proceed to point 5.

No – The sensor is faulty. Replace it. You do not have to replace the whole controller.

5) If point 2) above failed, but point 4) passed, there is likely to be a fault with the De-Ice Controller itself and it should be replaced. However there is a possibility that the SENSOR pins on the Controller board are damaged, i.e. bent or broken, or that they have some contamination on the contact surface. This could take the form of some of the "Conformal Coating" which is applied over the entire surface of the board after manufacture and test. The SENSOR pins are masked off during this process, but maybe it wasn't done, or was not done properly if a unit exhibits problems. The service person can be asked to gently scrape the surface of each pin which is furthest away from the polarising tab on the SENSOR connector.

Having done this, re-test the De-Ice Controller as per points 2) and 3) above. If the Controller still fails to operate correctly, replace the Controller. The existing SENSOR should be left in the coil if its resistance measurements were OK. This will avoid the significant possibility of pulling the SENSOR bulb off the lead wires when extracting it from the coil.

The De-Ice Controller appears as shown below:



Wiring :

The five spade terminals along the bottom edge of the De-ice Controller have the following functions

- P - Permanent "Phase" supply to the controller
- N - Permanent "Neutral" supply to the controller.
- Fan R/V N/O - Normally Open contact of the "Fan R/V" relay
- Fan R/V N/C - Normally Closed contact of the "Fan R/V" relay
- L.P. - Normally Open contact of the "L.P." bypass relay

The Release 4 De-Ice Controller is shown in a typical single refrigeration circuit system below:

