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(54) Title: REFRIGERATION SYSTEM CONTROL AND PROTECTION DEVICE

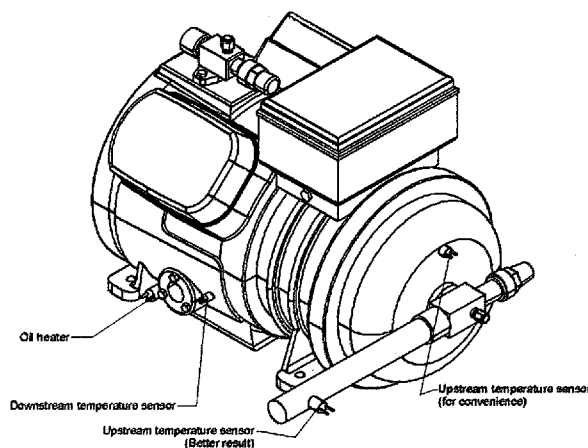


Figure 1, Sensors installation in semi-hermetic compressors

(57) Abstract: New device to protect a compressor against liquid flooding, oil heater malfunction, low refrigerant charge, high superheat. The system consists of a device that measures two temperatures separated by a heat source (The electric compressor or the suction heat exchanger or both). The temperature difference can detect a liquid return to the compressor, a high superheat, a low refrigerant charge or a crankcase heater malfunction and the temperature difference can control the electronic expansion valve.



CLAIMS

1. A multi-functional refrigeration system protection device for hermetic and semi-hermetic compressors comprising a sensor
5 that measures the temperature just before compression after the passage thru the electric motor, another sensor that measures the temperature at the suction valve at the compressor inlet, a device that measures the difference in temperature (DT) between the two sensors, **characterized by the fact that a)** the
10 temperature detection is performed after being largely heated by the electric motor (15 to 35 degrees C), **b)** the detection of the refrigerant liquid presence is checked after the refrigerant passage thru the electric motor where a significant amount of liquid refrigerant can be evaporated during this passage thus
15 eliminating false alarms, **c)** that both sensors can be installed in the compressor body and factory pre-wired and tested by the compressor manufacturer, and **d)** before starting the compressor the crankcase heater providing necessary (DT) there is no need for a startup timer, **e)** and in the absence of this (DT) that they
20 can detect a faulty crankcase heater without the need for a start-up delay timer, said device being suitable for generating one or more signals to perform one or more functions such as stopping the compressor due to faulty oil heater or liquid refrigerant presence beyond the electric motor, or trigger an alarm, or a defrost cycle, or a superheat alarm, or generating a signal to
25 indicate that the system is running safely or controlling the electronic expansion valve.

2. A refrigeration system protection device according to claim 1 suitable for generating a signal to stop the compressor in case
30 the difference in temperature (DT) is less than 25% of the normal running temperature difference (NTD), and preferably in case the difference in temperature (DT) is less than (UTD).

3. A refrigeration system protection device according to claim 1
35 suitable for generating a signal to trigger an alarm in case the

difference in temperature (DT) ranges between 25% and 50% of the normal running temperature difference (NTD), and preferably in case the difference in temperature (DT) is between (ATD) and (UTD).

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4. A refrigeration system protection device according to claim 1 suitable for generating a signal to trigger a defrost cycle in case the difference in temperature (DT) ranges between 50% and 75% of the normal running temperature difference (NTD), and preferably in case the difference in temperature (DT) is between (DTTD) and (ATD).

5. A refrigeration system protection device according to claim 1 suitable for generating a signal to trigger a superheat alarm in case the difference in temperature (DT) ranges between 125% and 150% of the normal running temperature difference (NTD), and preferably in case the difference in temperature (DT) is between (OTD) and (UOTD).

6. A refrigeration system protection device according to claim 1 suitable for generating a signal to stop the compressor in case the difference in temperature (DT) is greater than 150% of the normal running temperature difference (NTD), and preferably in case the difference in temperature (DT) is greater than (UOTD).

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7. A refrigeration system protection device according to claim 1 suitable for generating a signal to indicate that the system is running safely if the difference in temperature (DT) ranges between 75% and 125% of the normal running temperature difference (NTD), and preferably in case the difference in temperature (DT) is between (OTD) and (DTTD).

8. A device for controlling the electronic expansion valve comprising a PID controller and a refrigeration system protection device according to any of the preceding claims, by maintaining a difference in temperature (DT) close to the normal running temperature difference (NTD).

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9. A refrigeration or heat pump system comprising a device according to any of the preceding claims.

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