COLMAC COIL
Manufacturing Inc.

Technical Bulletin

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SELF-POSITIONING SYSTEM FOR ELECTRIC RESISTANCE DEFROST HEATING ELEMENTS (US PATENT NO. 7,712,327)

Background

Air-cooling heat exchangers operating at temperatures below the freezing point of water (32F) will accumulate frost on fin and tube surfaces which must be removed periodically in order to maintain system cooling capacity. One method of removing frost involves tubular electric resistance heating elements inserted in vacant tube spaces within the heat exchanger fin bundle. These heating elements are energized periodically to warm the frosted fin and tube surfaces sufficiently to melt the frost which is then captured as liquid water and removed from the space being refrigerated. After all of the frost has been melted and removed from the heat exchanger, the heating elements are de-energized and the heat exchanger is cooled back down to refrigerating temperature. This periodic removal of frost is termed a “defrost cycle”.

As the heating elements warm up during a defrost cycle, melted frost in the form of liquid water can make its way into the space(s) occupied by the heating element(s). This liquid water re-freezes at the end of the defrost cycle, attaching itself to the heating element and to the sides of the space occupied by the heating element. As the heating element cools back down to refrigerating temperature its length is reduced by an amount equal to the coefficient of linear expansion of the metal in the heating element sheath times the length of the element times the temperature difference between the freezing point of water (32F) and refrigerating temperature. In the case of long heating elements typically found in commercial and industrial heat exchangers, the amount of expansion and contraction during the defrost cycle can be relatively large (greater than ½” for a 240” long heating element operating in a –30F refrigerated environment).

If the heating element is unrestrained, this repeated heating and cooling with its associated re-freezing of melted frost and contraction of the heating element results in the heating element “creeping” or “walking” out of the heat exchanger. The re-freezing of liquid water onto the surface of the contracting heating element generates extremely powerful forces acting to slowly move the heating element along the length of the vacant space in the heat exchanger. If the heating elements are allowed to creep or walk out of the heat exchanger, damage to electrical wiring and to the element itself will result. Simply restraining the heating element with a rigid clamping system is insufficient to keep the heating element from creeping or walking – a simple clamp cannot be designed that is strong enough to resist these forces!

Colmac Breakthrough Technology

Colmac is proud to introduce a new technology designed and proven to solve this problem. The Colmac Self-Positioning Defrost Element System provides a means of restraining electric resistance heating elements used for defrosting air-cooling heat exchangers in a way which allows limited movement of the heating element during heating and cooling but acts to return the element to its original proper position in the heat exchanger at the beginning of the next defrost cycle.

The newly patented system effectively eliminates the possibility of heating elements creeping or walking out of the heat exchanger thus preventing damage to the element or to electrical wiring attached to the element. The new system has been shown in many field installations to insure proper operation of these heating elements over their normal working life.

The Colmac system also simplifies installation of heating elements compared to current designs by minimizing the number of parts required to securely mount heating elements in the heat exchanger. In addition, the need for a separate ground strap to electrically ground the heating element sheath is eliminated.

How It Works

The Colmac Self-Positioning Defrost Element System is simple!

It works by means of a spring which is attached securely to both the heating element sheath and to the coil tubesheet. The spring allows movement of the heating element in either direction parallel to the axis of the heating element. Movement of the heating element is caused when melted frost in the form of liquid water re-freezes and bonds the heating element sheath to an adjacent heat exchanger surface at a point along the length of the heating element while the element continues to shrink as it cools to refrigerating temperature. During the next defrost cycle the defrost element heats up, ice is melted, and the spring brings the element back to its original position in the coil.

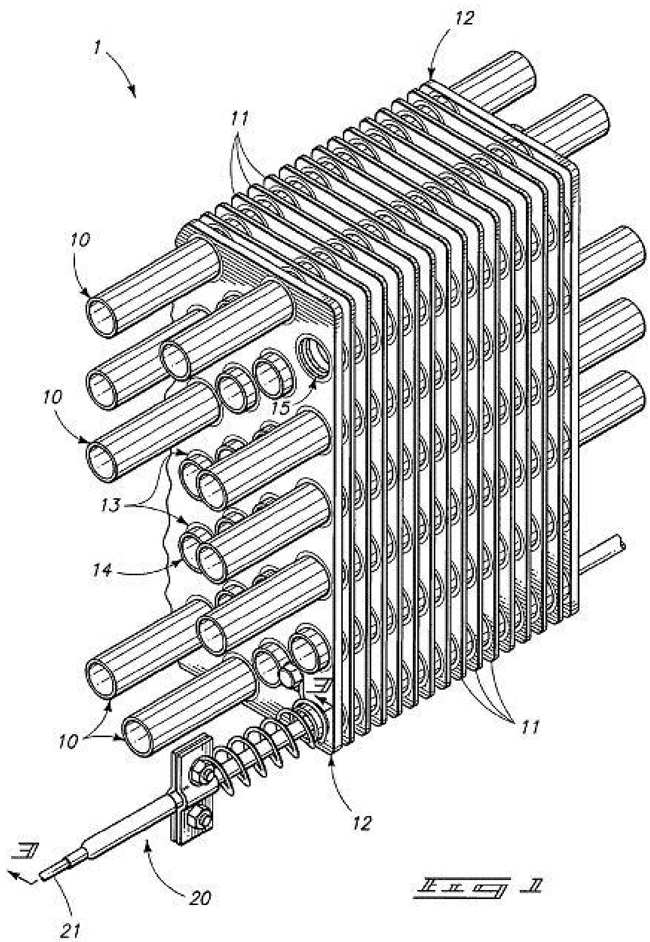
Benefits

The Colmac Self-Positioning Defrost Element system improves the reliability of electric defrost (extends the life of heating elements), and reduces first costs (wiring and installation) by:

- Eliminating damage to the defrost elements and electrical wiring caused by heating elements “creeping” out of the coil,
- Simplifying electrical wiring by eliminating the need for separate grounding of the defrost element

This new design from Colmac is offered as a standard feature on all Colmac electric defrost evaporators, and can even be supplied as a retrofit to existing evaporators. Finally, trouble-free electric defrost is possible! Demand Colmac Self-Positioning Electric Defrost on your next electric defrost evaporator order!

Figure 1 below shows the Colmac Self-Positioning Defrost Element System (item 20) installed in a finned-tube coil (item 12).



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