Chill-Out™ Combination Sensor | Whitepaper

A Comparison of Low-Temperature Cut-Outs in Unit Ventilators and Air Handling Units

MINCO

Abstract

Advancements in the design of unit ventilators and air handling units have come as a result of improving components to meet changing building codes and air quality standards. Because of this continuous improvement, unit ventilators are still the choice for providing conditioned outside air in industrial, commercial, office, and educational settings. Unit ventilators provide dependable service, and yet facility owners expect more. What do they want? Easier maintenance and lower life-cycle costs. These criteria are key to the decision-making process when facility owners purchase new HVAC equipment. A unit ventilator component as basic as a low temperature cut-out contributes to easier maintenance and lower life cycle costs. This paper compares two types of low temperature cutouts, the freezestat and the Chill-Out, and discusses their functionality, durability, and installation. A contrast of their differing functionalities and installation requirements shows that the Chill-Out's robust, solid state design provides a faster installation time and reduced life cycle costs. This paper is intended to help systems integrators gain a better understanding of alternatives for low- temperature cut-outs and ultimately improve unit ventilator and air handler performance for facility owners.

Two Types of Low-Temperature Cut-Outs

Systems integrators provide freeze protection for coils using one of two types of low temperature cut-out devices: a freezestat or a Chill-Out.

Freezestat

You know freezestats by a variety of names – thermostat, temperature switch, low temperature cutout control, low temperature detection thermostat, thermal cutout, and gas-filled capillary bulb and control. The freezestat has been used in unit ventilators for decades to sense coil temperature and prevent it from damage due to freezing. It consists of a vapor charged sensing element in a tubular bulb, and case containing a diaphragm and switch. In addition to the freezestat, each unit ventilator contains a separate air averaging temperature sensor for control. The element in an averaging temperature sensor can have either a continuous sensing element or a series of point sensors. The averaging sensor element is packaged inside bendable tubing.

Chill-Out

The Chill-Out combination sensor contains two sensing elements in one: a low-temperature cut-out to protect coils from freezing and an averaging temperature sensor for control. The Chill-Out's relay and control circuitry are integrated into the sensing probe as an aluminum can crimped to the end of the unit. The probe connects to the enclosure which houses controller. The probe is removable, allowing easy installation.

Chill-Out Combination Sensor

Functionality and Specifications

The freezestat is a mechanical device consisting of a diaphragm that moves as the pressure inside a capillary changes with temperature and closes a switch at a specific temperature. A freezestat is used in conjunction with an averaging temperature sensor in unit ventilators. The freezestat shuts down the flow of outside air when in an alarm state. The purpose of the averaging temperature sensor is to provide temperature input to the controller. The Chill-Out contains all solid-state electronics. The Chill-Out low

temperature cut-out senses a cold spot every 12" along its length and the contains integrated circuit (IC) temperature sensors that output 0 or 5 volts. Under normal conditions, the sensors output 5 volts. When in an alarm state the voltage drops to 0 and the relay contacts change state. The alarm state can be displayed on the controller.

The table below compares freezestat and Chill-Out specifications. You can also explore the total cost of ownership breakdown between these options with our chill-out TCO calculator here: minco.com/resource-center/chill-out-tco-calculator

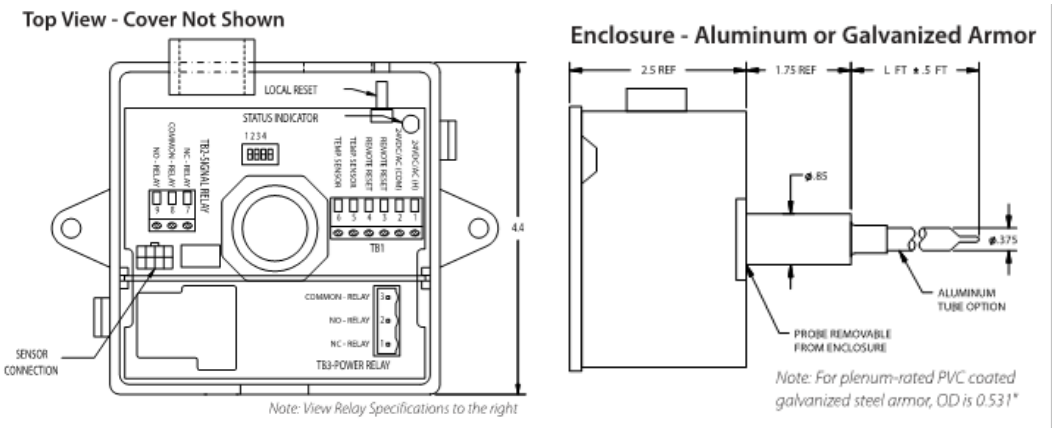
Function	Freezestat	Chill-Out
Technology	Mechanical, snap-acting contacts	Solid-state
Repeatability	Not specified	±.5°C
Setpoint	35 to 45°F (Units in °C), adjustable	41°F (5°C) or 30 to 44°F (Units in °C), adjustable DIP switch
Reset	Manual or Automatic	Manual or Automatic
Sensing element type	Vapor charged bulb (low temperature cut-out only)	**Two elements:** 1. Low temperature cutout: IC sensors soldered to flexible conductor tape 2. Averaging temperature sensor: resistance thermometer
Response time	< 2 minutes	< 30 seconds
Sensing element dimensions	.125" DIA x 20'	.375" DIA x 10' up to 50' lengths
Temperature sensitive zone	12" or 16" segments of sensing bulb	1. IC sensor: 12" segments 2. Averaging sensor: 12" segments
Visual display of cutout	None	Optional LED

Sensing Element Construction

A look at the construction and materials of the cut-out devices illustrates their ruggedness. The freezestat element is constructed of a thin diameter, thin-walled tube that is susceptible to kinking. The Chill-Out element is packaged in aluminum tubing with a thicker wall.

The table below compares sensing element materials.

Cut-out Type	Material	Diameter	Tubing Wall Thickness
Freezestat	Copper	0.125”	.030”
Chill-Out	Aluminum	0.375”	.035”



Chill-Out Combination Sensor Construction

Simplified Installation

Successful operation always depends on proper installation. Because freezestats are more fragile and have more particular installation requirements their installations are more demanding and labor intensive the Chill-Out's installation. A percentage of freezestats are damaged during installation and spares have to be swapped in before the system is checked out. The Chill-Out was designed to simplify the installation and prevent problems commonly associated with freezestat installation. The table below lists conditions that commonly occur during installation and their effect on the Freezestat and Chill-Out.

Effects of Installation Conditions on the Freezestat and Chill-Out

Installation Condition	Freezestat	Chill-Out
Kinking	Kinks or sharp bends cause poor flow in the sensing bulb and limit its effectiveness.	Element is unaffected by kinks and bends.
Vertical mounting	Sensing bulb must be mounted horizontally across face of the coil with vertical portions kept to a minimum. Vertically mounted portions of the sensing bulb create undetected cold spots. When too much of the bulb is mounted vertically improper operation results.	Orientation of the sensing element has no affect on its function. It installs directly on coils horizontally, vertically, or diagonally.
Thermostat case location	Thermostat operates ineffectively when its case is mounted in the same ambient temperature as the sensing bulb. The thermostat diaphragm must be warmer than the setpoint for effective operation.	Controls are integrated with sensing element and are unaffected by ambient temperature.

Number of Parts to Install

Near the freezestat a second temperature device, an averaging temperature sensor, is usually installed to provide input to the controller. Additionally, the thermostat control requires separate mounting. With the Chill-Out there is no second temperature device to install. The Chill-Out combines a low limit temperature cut-out, a continuous averaging temperature sensor, and the thermostat control in the same aluminum case.

Conclusion

A comparison of the freezestat with the Chill-Out demonstrates that the new technology of the Chill-Out reduces the cost of installation, eliminates the problems associated with freezestat installations, and offers facility owners a lower cost of ownership. The integration of a low temperature cut-out and an averaging sensor into a single device cuts installation labor in half. The use of sensing technology that functions regardless of kinking eliminates the problem of rough handling during installation. The new Chill-Out low temperature cut-outs help system integrators put together an improved unit ventilator for facility owners.

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References

A11 Series Low Temperature Cutout Control. Retrieved May 15, 2005 from http://cgproducts.johnsoncontrols.com/

Bulb Installation: Low Temperature Detection Thermostats. Retrieved May 15, 2005 from http://www.sbt.siemens.com/sbttemplates/library/pdf/155209.pdf

Castelvecchi, J. 2003. "Improving Profits By Reducing Rework." ASHRAE Journal 45(11):62.

Goldstein, Kyle. 2004. Unit Ventilators: A Primer. Retrieved May 15, 2005 from http://www.xpedio.carrier.com/idc/groups/public/documents/marketing/811-10177.pdf

HVAC Systems and Indoor Air Quality. Retrieved May 15, 2005 from http://www.cdc.gov/niosh/pdfs/appenb/pdf

Olsen, E. 2004. "Low Maintenance, Sustainable Solutions For Chicago Schools." ASHRAE Journal 46(9):S12-S17

MINCO

7300 Commerce Lane NE

Minneapolis, MN 55432

Tel: 763.571.3121

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