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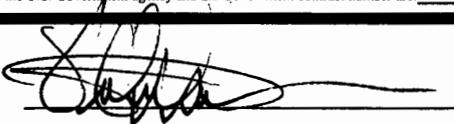
PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

INVENTOR(S)						
Given Name (first and middle [if any])	Family Name or Surname		Residence (City and either State or Foreign Country)			
Roger	Ansted		Houston, TX			
☐ Additional inventors are being named on the __ separately numbered sheets attached hereto						
TITLE OF THE INVENTION (280 characters max)						
ANTI-SWEAT HEATER CONTROL						
Direct all correspondence to: ☒ Customer Number 23873  23873 PATENT TRADEMARK OFFICE						
OR Customer Number here Type						
☒ Firm or Individual Name	Robert W. Strozier, PLLC					
Address	P.O. Box 429					
City	Bellaire	State	TX	ZIP	77402-0429	
Country	713.977.7000	Telephone		Fax	713.977.7011	
ENCLOSED APPLICATION PARTS (check all that apply)						
☒ Specification <u>9</u>	☐ CD(s), Number					
☒ Sheet of Drawings <u>3</u>	☒ Other (specify)		Postcard			
☐ Application Data Sheet. See 37 CFR 1.76						
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT						
☒ Applicant claims small entity status. See 37 CFR 1.27. ☒ A check or money order is enclosed to cover the filing fees. ☐ The Commissioner is hereby authorized to charge the filing fee to Deposit Account Number: 501518. ☒ The Commissioner is hereby authorized to charge any deficiencies or credit any overpayment to Deposit Account Number: 501518. ☐ Payment by credit card. Form PCT-2038 is attached.						
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.						
☒ No ☐ Yes, the name of the U.S. Government agency and the Government contract number are:						

Respectfully submitted,

SIGNATURE



NAME

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EXPRESS MAIL NO.: EL 961 168 185 US

Date: 2 April 2004

REGISTRATION NO.

34,024

Docket No.

04001/01PRV

ROBERT W. STROZIER, P.L.L.C.

A FIRM SPECIALIZING IN INTELLECTUAL PROPERTY LAW INCLUDING
PATENT, TRADEMARK, COPYRIGHT, TRADE SECRET LAW,
UNFAIR COMPETITION AND RELATED MATTERS

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April 2, 2004

EL 961 168 185 US	CERTIFICATION UNDER 37 C.F.R. § 1.10	2 April 2004 Date of Deposit
I hereby certify that this application and the documents referred to as enclosed therein are being deposited with the United States Postal Service in an envelope as "Express Mail Post Office to Addressee," addressed to:		
Commissioner for Patents MS PROVISIONAL PATENT APPLICATION P.O. Box 1450 Alexandria, VA, 22313-1450		
		2 April 2004 Date of Signature

Honorable Commissioner for Patents
MS PROVISIONAL PATENT APPLICATION
P.O. Box 1450
Alexandria, VA 22313-1450

Attorney Docket No:
04001/01PRV

Re: **US PSN: 60/ ; FD: 4/2/04**
Title: ANTI-SWEAT HEATER CONTROL
Our Ref. No.: 04001/01PRV

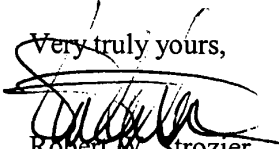
Dear Sir/Madam:

This letter is a request to file a **Provisional Patent Application** including: (1) a 9 page disclosure; (2) 3 Sheet of Drawings; (3) Check no. 3179; and (4) a Return Receipt Postcard.

Please return the enclosed postcard to acknowledge receipt and filing of this application.
Please address all correspondence in connection with this application to:

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Very truly yours,


Robert W. Strozier

RWS/sls

Enclosures:

U.S. Provisional Patent Application with 20 page Specification
Transmittal - Small Entity
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UNITED STATES PROVISIONAL PATENT APPLICATION

TITLE: ANTI-SWEAT HEATER CONTROL

INVENTOR: Roger Ansted, Houston, TX

ASSIGNEE: RTP CONTROLS

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a system and method for heating outer surfaces, especially, transparent surfaces of a cooled container to prevent condensation or sweat.

[0002] More particularly, the present invention relates to a system and method for heating outer surfaces of a cooled container to prevent condensation or sweat, where the apparatus includes a container, a cooling system and a heating system, where the heating system maintains outer surfaces above a dew point temperature of a lowest temperature point on the outer surfaces for which anti-sweat protection is desired.

2. Description of the Related Art

[0003] Many refrigerated display cases require electric strip heaters to be installed in the materials near the interface between the refrigerated zone and the ambient zone to prevent condensation (sweating) from occurring on the surfaces exposed to the ambient zone with it's potentially high levels of humidity. The strip heaters add enough heat to raise the exposed surfaces above the dewpoint of the highest design humidity condition. Years ago these heaters would be energized 100% of the time even if the ambient humidity is far less than the design humidity and the amount of heat required to prevent condensation is significantly less. Glass door coolers and freezers in particular require a large amount of "anti-sweat" heat.

[0004] The cost of electricity to operate these anti-sweat heaters can be significant. In addition to the direct cost of the electricity applied to the anti-sweat heaters, roughly half of the heat put into the frames ends up in the refrigerated space and adds a significant load to the compressor.

[0005] In the last 25 years, several control approaches have been made to reduce the amount of heat required to maintain frames sweat free. The basic approaches that have been used commercially are: (1) turn off heaters, if humidity is below a certain level (humidity sensing), (2) modulate the percentage of time the heaters are energized based on a measured zone dewpoint (dewpoint sensing); and (3) detect the presence of moisture or the approach of condensation on an exposed surface and

turn on the heat until the sensor no longer detects the need for heat (condensation sensing).

[0006] Although numerous sweat-free solutions to the problem of refrigerated display cases or for preventing condensation on outer surfaces of cooled containers, especially, transparent surface, have been tried and commercialized, none of these solutions provided an adequate and energy efficient protection against case or outer surface sweating. Thus, there is a need in the art for different system and method for sweat reduction and/or elimination on cold surfaces associated with cooled containers, especially, refrigerated display cases used in the grocery industry or related food industries or other cooled containers having outer transparent surfaces.

SUMMARY OF THE INVENTION

[0007] The present invention provides a system designed to minimize and/or eliminate condensation on desired outer surfaces of cooled containers, especially, transparent outer surfaces, where the system includes a container having at least one outer surface for which anti-sweat protection is desired, a cooling system adapted to cool an interior of the container, a sensing subsystem for determining a temperature of at least one point on an outer surface of the container, a heating subsystem adapted to heat the at least one outer surface and a control subsystem adapted to supply power to the heating subsystem to maintain the outer surfaces at a temperature above a dew point temperature associated with a coldest temperature location on the at least one outer surface.

[0008] The present invention also provides a method of reducing and/or eliminating sweat or condensation on outer surfaces of a cooled container, where the method includes the steps of cooling a container include at least one outer surface. Determining a lowest temperature or critical temperature on the at least one outer surface, without supply power to the heating subsystem, to determine a critical temperature. Measuring a temperature of a location on or associated with the at least one outer surface to obtain a measured temperature. Measuring a relative humidity of the container's surroundings. Determining a temperature difference between the measured temperature and the critical temperature to obtain a diversity factor. Supplying power to the heating subsystem to maintain the at least one outer surface at a temperature greater than or equal to the diversity factor plus a calculated dewpoint temperature derived from the measured temperature and the relative humidity.

DESCRIPTION OF THE DRAWINGS

[0009] The invention can be better understood with reference to the following detailed description together with the appended illustrative drawings in which like elements are numbered the same:

[0010] Figure 1 is a photograph of a refrigerated display container door frame showing the location

of a door frame temperature sensor.

DETAILED DESCRIPTION OF THE INVENTION

[0011] The inventors have found that an anti-sweat heater control system can be incorporated into a refrigeration circuit of a refrigerated container or plurality of refrigerated containers, where the control system includes a plurality of heaters, one for each door frame or outer surface for which anti-sweat protection is desired, a temperature sensor located at a location on or associated with at least one door frame or outer surface of the refrigerated container and a zone relative humidity sensor, where the heaters are turned on whenever the temperature sensor reading is below a diversity factor corrected set point temperature and where the diversity factor is a difference between the temperature sensor reading and a critical temperature. The benefits of using a "diversity" factor verses a fixed set point are that: (1) the temperature sensor can be located where it is convenient rather than having to locate the sensor at the critical location, which may not be in a particularly convenient location; (2) the system can be easily adjusted in the field to compensate for variations in surroundings, construction or the like; and (3) the system will save money over a fixed set point approach having a temperature sensor not optimally positioned and will work as well as a unit with a temperature sensor located at the critical location.

[0012] The present invention broadly relates to a refrigeration system including a container having at least one door frame or outer surface for which anti-sweat protection is desired, where the frame or surface optionally includes a transparent member exposed to the container's surrounding and a frame/member heater adapted to maintain the member in a substantially sweat-free condition. The system also includes a refrigeration unit for cooling an interior of the container, a temperature sensor affixed (permanently or temporarily) to a location associated with or on the member, the frame or the outer surface and a humidity sensor adapted to determine a relative humidity of the container's surroundings. The system also includes a control system that controls power to the heaters so that a temperature of the member, frame or outer surface is equal to or above a set point temperature, where the set point temperature is a dewpoint temperature minus a diversity factor, where the dewpoint is derived from the measured temperature and the measured relative humidity. The diversity factor is a difference between the temperature at the measured location minus a temperature of a coldest location, a most critical spot, on the member, frame or outer surface, when no power is supplied to the heaters and the container is in a stable cooled condition. Thus, by supplying sufficient power to the heater, the member, frame or outer surface can be maintained at a temperature above the dewpoint temperature of the most critical spot.

[0013] The present invention broadly relates to a refrigerated display case including at least on door having a transparent member exposed to its surroundings and a frame/member heater adapted to maintain the member in a substantially sweat-free condition. The case also includes a refrigeration unit for cooling an interior of the case, a temperature sensor affixed (permanently or temporarily) to a position associated with or on the door or member and a humidity sensor adapted to determine a relative humidity of the surroundings. The case also includes a controller for supply power to the heater sufficient to maintain the door and/or the member in a substantially sweat-free condition. The substantially sweat-free condition is obtained by maintaining the door and/or member at a temperature is equal to or above a set point temperature, where the set point temperature is a dewpoint temperature minus a diversity factor, where the dewpoint is derived from a measured temperature and a measured relative humidity. The diversity factor is a difference between a temperature at the measured location minus a temperature of a coldest location, the most critical spot, on the member and/or door, when no power is supplied to the heaters and the container is in a stable cooled condition. Thus, by supplying sufficient power to the heater, the member, frame or outer surface can be maintained at a temperature above the dewpoint temperature of the most critical spot.

[0014] The present invention broadly relates to a method for controlling sweat on a refrigeration system including the step of providing a container having at least one outer surface such as a door including a transparent member, where the surface and member are exposed to its surroundings, a surface heater adapted to maintain the surface and/or member in a substantially sweat-free condition, a refrigeration unit for cooling an interior of the container, a temperature sensor affixed (permanently or temporarily) to a location associated with or on the surface or member and a humidity sensor adapted to determine a relative humidity of its surroundings. The method also includes the step determining a diversity factor from a temperature measured by the sensor and a temperature of a critical spot or location on the outer surface or member (the coldest temperature location on the outer surface or member) when the container is in a stable cooled condition. The method also includes the step of obtaining a temperature from the sensor and a relative humidity from the humidity sensor. The method also includes the step of calculating a relative set point temperature derived from the sensor temperature and the relative humidity and corrected by the diversity factor. The method also includes the step of supplying power to the heater sufficient to maintain the temperature of the outer surface and/or member at a temperature above or equal to the relative set point temperature.

[0015] Referring now to Figure 1, a photograph of a temperature sensor associated with a door frame of a refrigerated case is shown.

[0016] Referring now to Figures 2A&B, a schematic of a preferred embodiment of a heater control system of this invention is shown.

Current Situation

[0017] We installed a test anti-sweat controller in a Winn-Dixie store in Orlando in mid February of 2003. The approach was to monitor the temperature of a spot on one door frame for each refrigeration circuit and control all the anti-sweat heaters of fixtures included in that refrigeration circuit a few degrees above the calculated dewpoint (based on the measured zone temperature and the measured zone relative humidity).

[0018] We discovered in late February 2003, that we did not have the most critical location. The spot we had selected was clear of moisture, but other parts of the frame were colder and had condensation. At that time, instead of moving the temperature sensor to the most critical location, I came up with an approach for maintaining the selected frame temperature a fixed value above a calculated dewpoint. Instead I adjusted the value based on the calculated dewpoint. If the dewpoint was near the design level of 55°F or 60°F, the selected frame temperature was maintained a few degrees above the calculated dewpoint. However, as the zone's calculated dewpoint lowered, the setpoint was increased proportional to a "diversity" factor. The diversity factor is arrived at by measuring how much colder the most critical spot is verses the spot selected for mounting the frame temperature sensor. In our test site, we found that the door mullion temperature would go as low as 20F when the heaters were turned off for an extended time, but the frame temperature sensor would only go as low as 40F.

[0019] We continued to run tests in the Winn-Dixie store through 2003 and installed the system on seven more refrigeration circuits. All this work was done at no charge to Winn-Dixie. Sometime around May or June 2003 we offered to sell the controllers to Winn-Dixie.

[0020] The diversity factor is measured once and then used for all other installations of similar design. The method includes the steps of:

1. operating the fixture at a design temperature with a frame sensor installed;
2. Turning off all power to the anti-sweat heaters and allowing the frame's surface temperature to drop;
3. When the frame temperatures have stabilized, determining the coldest surface temperature on the frame;

4. Subtracting the coldest measured frame temperature from the temperature measured at the installed frame temperature sensor. This is the diversity factor. For example, if the coldest frame temperature was 22°F and the installed frame sensor was measured at 36°F. Then the diversity factor would be 36-22°F or 14°F. Consequently, our controller would control the measured location as though the dewpoint was 36°F, while the controller would be actually controlling at a dewpoint temperature of 22°F. Otherwise, portion of the frame would potentially be below the dewpoint temperature and would sweat.

[0021] All references cited herein are incorporated by reference. While this invention has been described fully and completely, it should be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described. Although the invention has been disclosed with reference to its preferred embodiments, from reading this description those of skill in the art may appreciate changes and modification that may be made which do not depart from the scope and spirit of the invention as described above and claimed hereafter.

CHARACTERIZATION OF THE INVENTION

[0022] The present invention broadly relates to a refrigeration system including a container having at least one door frame or outer surface for which anti-sweat protection is desired, where the frame or surface optionally includes a transparent member exposed to the container's surrounding and a frame/member heater adapted to maintain the member in a substantially sweat-free condition. The system also includes a refrigeration unit for cooling an interior of the container, a temperature sensor affixed (permanently or temporarily) to a location associated with or on the member, the frame or the outer surface and a humidity sensor adapted to determine a relative humidity of the container's surroundings. The system also includes a control system that controls power to the heaters so that a temperature of the member, frame or outer surface is equal to or above a set point temperature, where the set point temperature is a dewpoint temperature minus a diversity factor, where the dewpoint is derived from the measured temperature and the measured relative humidity. The diversity factor is a difference between the temperature at the measured location minus a temperature of a coldest location, a most critical spot, on the member, frame or outer surface, when no power is supplied to the heaters and the container is in a stable cooled condition. Thus, by supplying sufficient power to the heater, the member, frame or outer surface can be maintained at a temperature above the dewpoint temperature of the most critical spot.

[0023] The present invention broadly relates to a refrigerated display case including at least on door having a transparent member exposed to its surroundings and a frame/member heater adapted to maintain the member in a substantially sweat-free condition. The case also includes a refrigeration unit for cooling an interior of the case, a temperature sensor affixed (permanently or temporarily) to a position associated with or on the door or member and a humidity sensor adapted to determine a relative humidity of the surroundings. The case also includes a controller for supply power to the heater sufficient to maintain the door and/or the member in a substantially sweat-free condition. The substantially sweat-free condition is obtained by maintaining the door and/or member at a temperature is equal to or above a set point temperature, where the set point temperature is a dewpoint temperature minus a diversity factor, where the dewpoint is derived from a measured temperature and a measured relative humidity. The diversity factor is a difference between a temperature at the measured location minus a temperature of a coldest location, the most critical spot, on the member and/or door, when no power is supplied to the heaters and the container is in a stable cooled condition. Thus, by supplying sufficient power to the heater, the member, frame or outer surface can be maintained at a temperature above the dewpoint temperature of the most critical spot.

[0024] The present invention broadly relates to a method for controlling sweat on a refrigeration system including the step of providing a container having at least one outer surface such as a door including a transparent member, where the surface and member are exposed to its surroundings, a surface heater adapted to maintain the surface and/or member in a substantially sweat-free condition, a refrigeration unit for cooling an interior of the container, a temperature sensor affixed (permanently or temporarily) to a location associated with or on the surface or member and a humidity sensor adapted to determine a relative humidity of its surroundings. The method also includes the step determining a diversity factor from a temperature measured by the sensor and a temperature of a critical spot or location on the outer surface or member (the coldest temperature location on the outer surface or member) when the container is in a stable cooled condition. The method also includes the step of obtaining a temperature from the sensor and a relative humidity from the humidity sensor. The method also includes the step of calculating a relative set point temperature derived from the sensor temperature and the relative humidity and corrected by the diversity factor. The method also includes the step of supplying power to the heater sufficient to maintain the temperature of the outer surface and/or member at a temperature above or equal to the relative set point temperature.

[0025] The diversity factor is measured once and then used for all other installations of similar design. The method includes the steps of:

1. operating the fixture at a design temperature with a frame sensor installed;
2. Turning off all power to the anti-sweat heaters and allowing the frame's surface temperature to drop;
3. When the frame temperatures have stabilized, determining the coldest surface temperature on the frame;
4. Subtracting the coldest measured frame temperature from the temperature measured at the installed frame temperature sensor. This is the diversity factor. For example, if the coldest frame temperature was 22°F and the installed frame sensor was measured at 36°F. Then the diversity factor would be 36-22°F or 14°F. Consequently, our controller would control the measured location as though the dewpoint was 36°F, while the controller would be actually controlling at a dewpoint temperature of 22°F. Otherwise, portion of the frame would potentially be below the dewpoint temperature and would sweat.

ABSTRACT

An improved anti-sweat heater control system is disclosed for reducing and/or eliminating sweat on cooled surfaces of a refrigerated container. A method for reducing or eliminating sweat from forming on cooled surfaces of a refrigerated container is also disclosed. A refrigerated container incorporating the anti-sweat heater control is also disclosed.

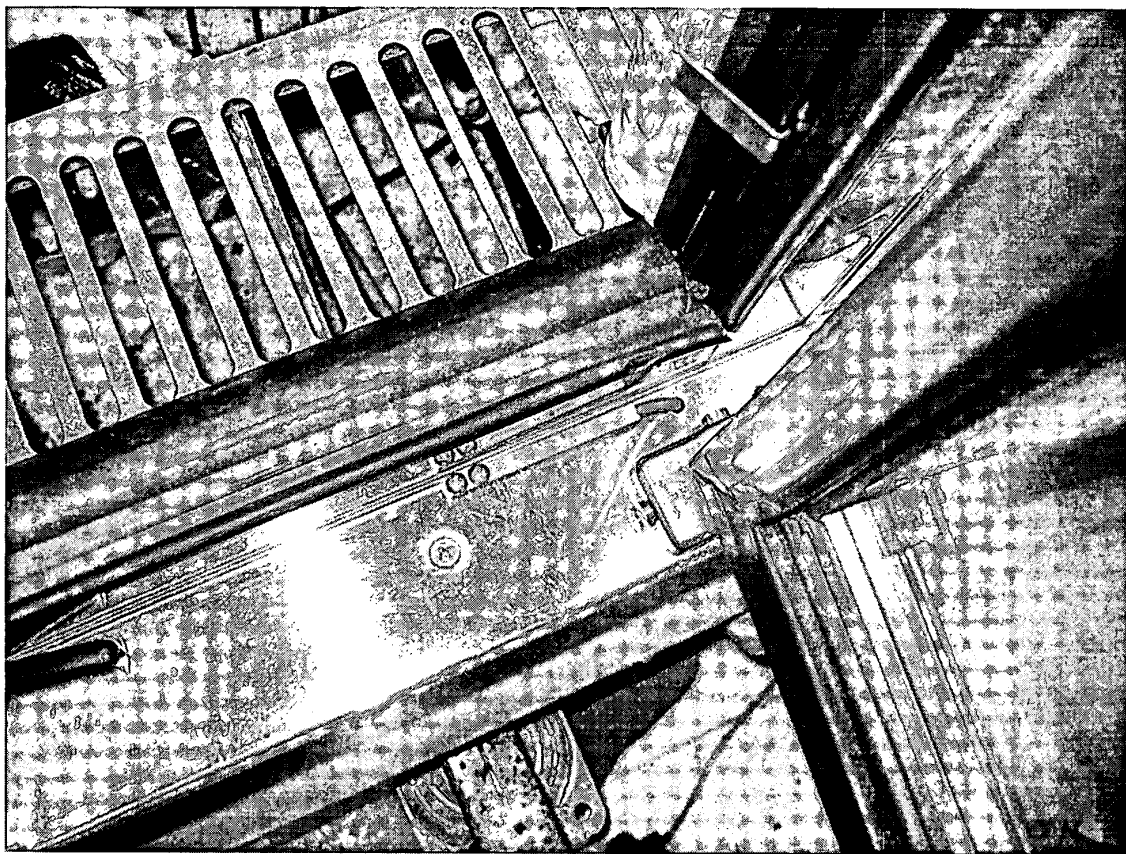


FIG. 1

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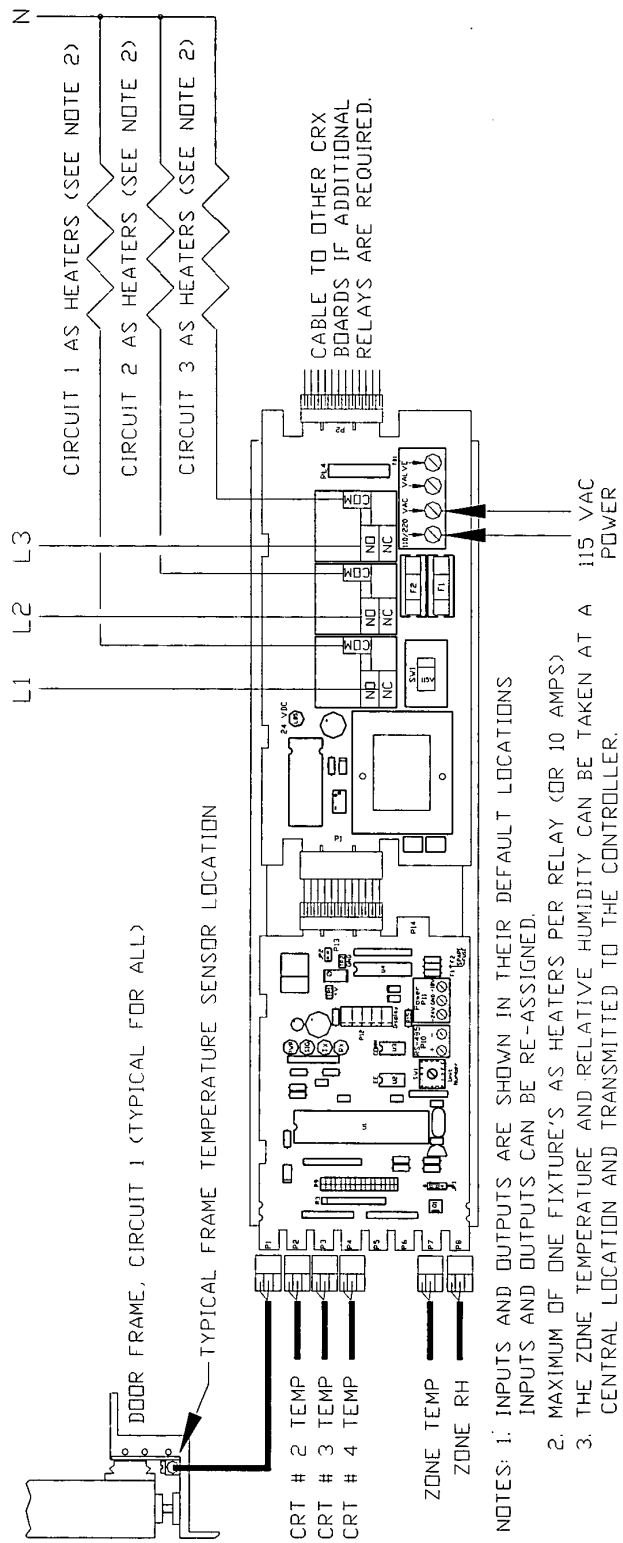


FIG. 2A

GENERAL INFORMATION:

The XE-ASC controller logic can control the anti-sweat heaters in up to four separate refrigeration circuits. A representative frame temperature is read for each refrigeration circuit and then compared to the calculated zone dewpoint. The anti-sweat heaters for that refrigeration circuit are turned on and off as required to maintain the frame temperature above the dewpoint. Each refrigeration circuit can have the anti-sweat heaters of multiple fixtures controlled as one. Typically, for installation ease, an XE-ASC will control heaters in fixtures in a common line-up.

The main benefit of the XE-ASC is that it will compensate for the actual needs of a frame on an individual refrigeration circuit rather than requiring the circuit with the most demanding heat requirements. It also allows the heat to be reduced during defrosts when the fixture is warmer.

ORDERING INFORMATION:

KITS:

- 56000 XE-ASC Base Kit, Includes:
XE-IO, XE-PWR3, XE-TERM, 3" Cable, 12" Track and TM4 (2 each)
- 56001 XE-ASC Stand-Alone Kit, Includes:
XE-IO, XE-PWR3, XE-TERM, 3" Cable, 12" Track, TM4 (2 each) and DP2 Dewpoint Sensor

INDIVIDUAL PARTS:

- 52035 XE-CM: Serial and Ethernet Communications Manager
- 50225 XE-IO: Eight Input/Output Controller
- 52170 XE-PWR3: Power Supply; 115/230 VAC In; 3 Relays
- 52041 XE-TERM: Plug-On Input Terminal Board For XE-IO
- 54000-12 Mounting Track; 12" Long
- 54000-18 Mounting Track; 18" Long
- 41061 TM-1 Temperature Sensor (cylinder 0.250" Dia.)
- 54005 TM-4 Temperature Sensor (square 0.25")
- 53002 DP2 Dewpoint Sensor
- 41135 CRX1 Relay Board (1 Addressable relay)
- 41133 CRX4 Relay Board (4 Addressable relays)
- 54002 Cable, Accessory, 3" Long
- 54010-2 Cable, Accessory, 24" Long
- 54010-6 Cable, Accessory, 6' Long

GENERAL INFORMATION:

The XE-ASC controller logic can control the anti-sweat heaters in up to four separate refrigeration circuits. A representative frame temperature is read for each refrigeration circuit and then compared to the calculated zone dewpoint. The anti-sweat heaters for that refrigeration circuit are turned on and off as required to maintain the frame temperature above the dewpoint. Each refrigeration circuit can have the anti-sweat heaters of multiple fixtures controlled as one. Typically, for installation ease, an XE-ASC will control heaters in fixtures in a common line-up.

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- 54002 Cable, Accessory, 3" Long
- 54010-2 Cable, Accessory, 24" Long
- 54010-6 Cable, Accessory, 6' Long

FIG. 2B

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

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