Work Paper SCE13RN009

**Revision 2**

**Southern California Edison**

**Anti-Sweat Heater (ASH) Controls**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | RF-12098 and RF-48112 |
| **Measure Description** | Anti-Sweat Heater (ASH) controls based on humidity for reach-in display freezers and coolers |
| **Base Case Description** | Fixed ASH operation for reach-in display freezers and coolers |
| **Units** | Energy impacts are shown per linear foot (width) of display cases |
| **Energy Savings** | Refer to Excel Calculation Attachment |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Effective Useful Life** | 12 years |
| **Measure Installation Type** | Retrofit Add-on (REA) |
| **Net-to-Gross Ratio** | 0.6 (Com-Default>2yrs), 0.85 (Com-Default-HTR-di) |
| **Important Comments** | This work paper document does not contain a data set in conformance with the 4/1/14 CPUC Ex Ante Database Specification; SCE will provide that data set separately. |

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 05/18/2012 | Yin Yin Wu/BASE Energy, Inc.  Chris Fernandez/BASE Energy, Inc. | This is the original work paper for the bridge cycle 2013-2014. |
| 1 | 07/07/2014 | Yin Yin Wu/ BASE Energy, Inc.  Steven Wiryadinata/BASE Energy, Inc. | -Simulation models updated using DEER14 prototype models from MASControl v3.00.20  -Updated savings results based on the CZ2010 weather files  -Peak demand savings was updated based on the DEER14 peak demand period definition  -Work paper updated for reporting period, effective 07/01/14-12/31/14 |
| 2 | 02/01/2016 | Eduardo Munoz/SCE | -New template update for 2016 program year  -WP effective from 1/1/2016 thru 12/31/2016  -Removed SCE building types  -No value modifications |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
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Cal TF website: <http://www.caltf.org/>

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

The objective of this work paper is to detail the energy savings for installing anti-sweat heater (ASH) controls based on humidity for reach-in display freezers and coolers.

The base and measure cases are summarized as follows (Section 1.2 describes these cases in greater technical detail):

**Base Case**: Fixed ASH operation (no control) for reach-in display freezers and coolers.

**Measure Case**: ASH controls based on humidity for reach-in display freezers and coolers.

As shown in the table below, measures evaluated in this work paper are segregated based on refrigeration operating temperature: low temperature (freezer) and medium temperature (cooler).

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | ASH controls based on humidity for reach-in display freezers and coolers. |
| Existing Condition | Fixed ASH operation (no control) for reach-in display freezers and coolers. |
| Code/Standard | N/A |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | RF-12098 |  | Low Temperature Display Case Anti-Sweat Heater (ASH) Controls |
|  |  | RF-48112 |  | Medium Temperature Display Case Anti-Sweat Heater (ASH) Controls |

**Eligibility**

The above-described measures are eligible for installations on existing reach-in display coolers and freezers according to the descriptions shown in **Base Cases** in Section 1.2 and is applicable for any commercial retail facility, including (but not limited to) supermarkets, grocery stores, hotels, restaurants and convenience stores. Proposed ASH controls must adjust the ASH duty cycle based on humidity of air on the glass surfaces of the display cases. This measure cannot be used in conjunction with the New Refrigeration Display Case with Doors measure. Energy savings credit for reduced use of display refrigerator anti-sweat heaters can only be taken if the display refrigerators are equipped with humidity-sensing controls that reduce the amount of power supplied to the heaters as the store dew point temperature decreases.

**Express Requirements**

The rebates for these measures are a part of the Express program. To qualify for the incentive, the following requirements must be met:

* The proposed device must sense the relative humidity in the air outside of the display case and reduce or turn off the glass door (if applicable) and frame anti-sweat heaters at low humidity conditions. Equivalent technologies that can reduce or turn off anti-sweat heater based on the amount of condensation formed on the inner glass pane may also qualify. Power reduction should occur when relative humidity levels reach 55% and lower. Power reduction should decrease by at least 2% for every percentage the humidity falls below 55%.
* This can be the only Express Solution category under which the fixtures are receiving incentives. This solution cannot be used in conjunction with New High-Efficiency Refrigeration Display Cases with Special Doors (Low Temp) and Special Doors with Low/no Anti-Sweat heat on Low Temperature Display Cases categories.
* The linear footage of the installed night cover must be properly measured as the incentive is based on the linear footage of the installed night cover.

**Pacific Gas and Electric**

Requirements:

* Installation address must have a commercial electric account with PG&E.
* Must sense the relative humidity in the air surrounding the display case and reduce or turn off the anti-sweat heaters of the glass door (if applicable) and door frame during periods of low humidity.
* Equivalent technologies that reduce or turn off anti-sweat heaters depending on the level of condensation on the inner glass pane may qualify.
* Rebate is based on linear footage of the installed night cover.

Exclusions:

* Cannot be used in conjunction with the “New Refrigeration Display Case with Doors” rebate.

## 1.2 Technical Description

This work paper focuses on ASH controls based on humidity to prevent condensation (“sweating”) on the glass surface of refrigerated display cases. ASHs are electric resistance heaters installed at the following locations:

* Case mullion to prevent condensation on metal surfaces (Figure 1 ASH **Locations** Green )
* Door frame to prevent condensation on metal surfaces (Figure 1 ASH **Locations** Red)
* Glass edge to prevent condensation on the glass (Figure 1 ASH **Locations** Blue)



**Figure 1 ASH Locations**

A grocery store’s RH is closely related to the outdoor dew point (DP) temperature. Condensation occurs when the air temperature drops to the DP temperature. On warmer days when a customer opens the refrigerated display case glass door, warm moist air comes into contact with the cold glass surface which leads to condensation on the surface of the glass door. ASHs are used to evaporate this moisture from the glass surface, door frame and mullion of the cases.

In standard installations, the ASHs operate at full power 100% of the time. ASH controllers monitor the DP temperature of ambient air and adjust the duty cycle of the heaters accordingly. For example, when the air is dry and its dew point is low, the ASHs operate at a low duty cycle and surface is allowed to get cold since condensation will not form. On the other hand, when the air is humid and dew point is high, the ASHs operate at 100% duty cycle to keep the surface warm and above the dew point temperature. Between these extremes, the duty cycle is adjusted according to the measured DP.

Some of the heat generated by ASHs ends up as a load on the refrigeration system. Therefore, any reduction in ASH power not only will reduce the ASH electric demand, but also result in lower refrigeration loads. As a result, compressor run time and energy consumption are reduced. However, there will be a penalty incurred from the increased space heating energy use.

This measure applies to ASHs on both low temperature (freezer– below 32°F) and medium temperature (cooler – above 32°F) glass doors. Calculations for both coolers and freezers were carried out for all 16 California climate zones.

## 1.3 Installation Types and Delivery Mechanisms

The delivery mechanisms for this measure are Financial Support-Down-Stream Deemed; Financial Support-On-bill Finance; and Financial Support-Direct Install. The install type for these delivery mechanisms is Retrofit Add-on (REA).

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| Retrofit Add-on (REA) | Above Customer Existing | N/A | EUL | N/A |

A delivery mechanism is a delivery method paired with an incentive method. Delivery mechanisms are used by programs to obtain program participation and energy savings.

**Delivery Method Descriptions**

|  |  |
| --- | --- |
| **Delivery Method** | **Description** |
| Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. |

**Incentive Method Descriptions**

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| Direct Install | The program implements energy efficiency measures for qualifying customers, at no cost to the customer. |
| Down-Stream Incentive | The customer installs qualifying energy efficient equipment and submits an incentive application to the utility program. Upon application approval, the utility program pays an incentive to the customer. Such an incentive may be deemed or customized. |
| On-bill Finance – Loan (OBF) | The program offers financing for the cost of an efficient measure as part of the utility bill. This can be an add-on option to an existing program or can serve as an organizing principle for its own program. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

The savings presented in this workpaper were based on the DEER 2014 (DEER14) prototype building models extracted from MASControl V3.00.20 software. DEER14 was a major update to the DEER 2011 version and incorporates changes based on the new 2013 Title 24. The DEER14 database contains measures for ASH Controls on low and medium temperature refrigerated display cases (D03-230 and D03-231, respectively) which are incorporated in the prototype models. The table below summarizes the deviation from DEER.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | Yes |
| Scaled DEER measure | No |
| DEER Base Case | Yes |
| DEER Measure Case | Yes |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | Yes |
| DEER Version | DEER14 |
| Reason for Deviation from DEER | DEER presents savings per building vintage. Savings in this work paper are based on vintage 2014, v14. The updated eQuest prototypes from MASControl version 3.00.20 for vintage 2014 were used in this work paper. The eQuest model weather files were updated per DEER2014 CZ2010 weather data files. |
| DEER Measure IDs Used | D03-230 and D03-231 |

**Net-to-Gross Ratio**

The NTG values were obtained using the DEER READI tool. The relevant NTG values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| Com-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Com | Any | All | 0.6 |
| Com-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Com | Any | DirInstall | 0.85 |

Note that for the direct install delivery mechanism, a distinction between hard to reach and non-hard to reach markets will be made on a project by project basis. This work paper shows the NTG associated with a hard to reach direct install delivery mechanism and the non-residential defaulted NTG value, where in fact, a measure offered through direct install and is not “hard to reach” will receive a default NTG value.

This work paper includes measures that are offered via direct install activities into hard-to-reach (HTR) customer facilities. “Final Resolution E-4700”, dated December 18, 2014, defines specific criteria to classify customer facilities as HTR and also states that two criteria are sufficient to identify HTR customers if one of the criteria met is the geographic criteria.

SCE’s Commercial Direct Install program delivers free and low cost energy efficiency hardware retrofits through installation contractors to reduce peak demand and energy savings for small and medium commercial customers. The barriers for customer participation include limited capital resources, lack of expertise and understanding of the understanding of the benefits of energy efficiency, a suspicion of the “free offer” and its legitimacy, and language and cultural barriers. The program also addresses the ongoing concern with “split incentives”, where the customer is not the owner of the property, and therefore, lack incentive to improve their energy usage. SCE’s Commercial Direct Install program will track the following three (3) customer data points to identify direct install activities in HTR customer facilities. If geography and business size criteria are satisfied, SCE will identify the customer as HTR. If geography and language criteria are satisfied, SCE will identify the customer as HTR. Other measures in the Commercial Direct Install program will receive default NTG (NTGR\_ID: Com-Default>2), unless otherwise specified in DEER.

* **Business Size** – Customer must have less than ten employees
* **Language** – Customer’s primary language spoken is not English
* **Geography** – Businesses in areas other than the United States Office of Management and Budget (OMB) Combined Statistical Areas (CSA) of the San Francisco Bay Area, the Greater Los Angeles Area and the Greater Sacramento Area or the OBM metropolitan statistical areas or San Diego County.

The “Required Corrections to Measure Level Input Parameters Identified by Commission Staff per D.14-10-046 Order Paragraph 16”, dated November 3, 2014, includes additional clarification for the geographic criteria:

“Notes on OMB CSA designations:

The OMB has designated a 12-county CSA titled the San Jose-San Francisco-Oakland, CA Combined Statistical Area which includes the nine counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma which border the San Francisco Bay plus the three counties of San Joaquin, Santa Cruz, and San Benito that are economically tied to the nine counties that that border the San Francisco Bay.”

The OMB definition of this CSA includes Los Angeles, Orange, San Bernardino, Riverside and Ventura counties.

The OMB definition of this CSA includes Sacramento, Yolo, El Dorado, Placer, Sutter, Yuba, and Nevada counties.”

**Spillage Rate**

Spillage rates are not tracked in work papers; they are tracked in an external document which will be supplied to the Commission Staff.

**Installation Rate**

The IR values were obtained using the DEER READI tool. Currently there is no versioning on the installation rate table. There are currently no IR specific for this measure and the default value of 1 has been presented in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GSIA ID** | **Description** | **Sector** | **BldgType** | **ProgDelivID** | **GSIAValue** |
| Def-GSIA | Default GSIA values | Any | Any | Any | 1 |

**Effective and Remaining Useful Life**

The EUL and RUL values were obtained using the DEER READI tool. DEER defines the RUL as 1/3 of the EUL value. The RUL value is only applicable to the first baseline period for an RET measure with an applicable code baseline. The relevant EUL and RUL values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| GrocDisp-ASH | Anti-Sweat Heat (ASH) Controls | Com | ComRefrig | 12 | 4 |

### 1.4.2 Codes and Standards Analysis

This work paper deals with REA-type measures whose savings are not impacted by code standards. Discussion on the standards as they relate to the measures is summarized in table below and presented here for information purposes only.

The 2014 Appliance Regulations [422] addresses Walk-in Coolers and Freezers with Transparent Reach-in Doors and specifies the limit of ASH power draw based on square footage. Section 1605.1(a)(5)(C)(2) states:

*If the appliance has an anti-sweat heater with anti-sweat heat controls, and the total door rail, glass, and frame heater power draw is more than 7.1 watts per square foot (W/ft²) of door opening (for freezers) and 3.0 watts per square foot (W/ft²) of door opening (for coolers], the anti-sweat heat controls shall reduce the energy use of the anti-sweat heater in a quantity corresponding to the relative humidity in the air outside the door or to the condensation on the inner glass pane.*

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2014) | 2014 Appliance Efficiency Regulations, Section 1605.1(a)(5)(C)(2) | May 1, 2014 |

## 1.5 EM&V, Market Potential, and Other Studies – Base Case and Measure Case Information

### 1.5.1 Non-DEER Study Review

All data was taken from either DEER14 or Title 20 code standards.

# Section 2. Calculation Methodology

**Assumptions**

The following assumptions were made for the calculations of this work paper:

1. The DEER14 prototype building models were generated for a Grocery Store with multiplex-refrigeration systems for the reach-in refrigerated fixtures using the MAS Control software. Single-compressor systems are less efficient than multiplex-compressor systems. According to the DEER Report [26], single-compressor systems were typically designed prior to 1980. To be conservative, it is assumed that the generated energy savings for this work paper will also be applied to fixtures with single-compressor systems.
2. This work paper is applied to fixtures located inside a space which has space heating and space cooling. The unit energy savings is represented per linear-foot of the fixture. The resulting savings involve refrigeration load reduction and space cooling load reduction. Note that it also results in an increase to the space heating energy consumption. Since the heat gain to a fixture mainly depends on the temperature maintained for the fixture and the surrounding space temperature, it is assumed that the building types would not have significant impact on the energy savings. Thus, the resulting savings for Grocery Store is applied to all other building types considered in this work paper.

**Methodology**

The energy savings and demand reduction for this work paper is based on installing controllers on the existing anti-sweat heater (ASH) on freezers (including low temperature display cases) and coolers (including medium temperature display cases). The fixtures are applicable to, but not limited to, grocery stores. The baseline of this work paper is the ASHs operating continuously. Installing ASH control will reduce the ASH operating hours significantly, resulting in savings on the refrigeration cooling load and space cooling load.

The measures are weather sensitive and the building energy simulation tool eQuest Refrigeration 3-65 was used to determine the annual impacts. The 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study final Report [26] has included the measures of Freezer ASH Controls (D03-230) and Cooler ASH Controls (D03-231). Table below summarizes the DEER measure IDs corresponding to each solution code. Please refer to the DEER Report Section 6 for details of DEER Building Prototypes generated by eQuest (a graphical interface to DOE-2.2), Section 7.3 for general description for grocery refrigeration measures. The DEER measures consider multiplex-compressor systems as the refrigeration type.

Summary of DEER Measures and Corresponding Solution Codes

|  |  |  |  |
| --- | --- | --- | --- |
| **Solution Code** | **Measure Name** | **DEER05 Measure ID** | **DEER08 Measure ID** |
| RF-12098 | Freezer ASH Controls | D03-230 | D08-NE-GrocRefg-FixtDoors-LowTemp-FxdAntiSwt-HmdAntiSwt |
| RF-48112 | Cooler ASH Controls | D03-231 | D08-NE-GrocRefg-FixtDoors-MedTemp-FxdAntiSwt-HmdAntiSwt |

The baseline of the Freezer ASH Controls (D03-230) and Cooler ASH Controls (D03-231) measures considers the anti-sweat heaters operating at fixed full power all the time. The measure models consider ASH control based on humidity. The DEER 2014 prototypes were generated from MASControl version 3.00.20 with the weather files updated using DEER2014 CZ2010 weather data files. The built-in ASH control types based on the fixture temperature are included in table below.

Summary of Built-In ASH Control Types from DEER Prototypes

|  |  |  |
| --- | --- | --- |
| **Component** | **Freezer** | **Cooler** |
| ASH Control Type | Humidity-Ratio | Humidity-Ratio |
| Maximum Humidity | 80% | n/a |
| Minimum Humidity | 60% | n/a |
| Maximum Humidity Ratio | 0.011 | 0.011 |
| Minimum Humidity Ratio | 0.005 | 0.005 |

**Electrical and Natural Gas Energy Savings**

Once the base case and measure case model simulations were completed, the energy savings and demand reduction could be determined. Comparing the total energy consumption (electricity and natural gas) of both models, the total energy savings were determined. The unit energy savings, in kWh/yr-ft for electricity and therm/yr-ftfor natural gas, were calculated by dividing the total energy savings by the total line-up length of the fixtures. Note that the built-in fixtures were modeled per number of doors. The total line-up length of each fixture is calculated based on 2.6 ft per door.

**Peak Demand Savings**

Peak demand savings were calculated by taking the average electrical power draw between 2-5 pm in the 3 consecutive peak days specified in the DEER2013 Update documentation [386] for each climate zone. Table below summarizes the 2014 DEER Peak-Demand periods for 16 climate zones considered in this work paper. The difference in the baseline and measure peak demands represents the peak demand savings. Similar to the energy savings, the unit demand reduction, in kW/ft, was calculated by dividing the total demand reduction by the total line-up length of the fixtures.

|  |  |
| --- | --- |
|  | **2014 DEER Peak-Demand Periods** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Climate Zone** | **Dates** | **Climate Zone** | **Dates** |
| CZ01 | Sep 16-18 | CZ09 | Sep 1-3 |
| CZ02 | Jul 8-10 | CZ10 | Sep 1-3 |
| CZ03 | Jul 8-10 | CZ11 | Jul 8-10 |
| CZ04 | Sep 1-3 | CZ12 | Jul 8-10 |
| CZ05 | Sep 8-10 | CZ13 | Jul 8-10 |
| CZ06 | Sep 1-3 | CZ14 | Aug 26-28 |
| CZ07 | Sep 1-3 | CZ15 | Aug 25-27 |
| CZ08 | Sep 1-3 | CZ16 | Jul 8-10 |

Refer to the Attachment [B] for the savings summary for all measures in 16 CZs.

# Section 3. Load Shapes

The ideal load shape for net benefits estimates would represent the difference between the base case and measure case. The closest load shapes that are applicable to the measures in this work paper are listed in the table below.

Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| Assembly | Refrigeration | Assembly |
| Grocery | Refrigeration | Grocery\_Store |
| Restaurant - Fast-Food | Refrigeration | Fast\_Food\_Restaurant |
| Restaurant - Sit-Down | Refrigeration | Sit\_Down\_Restaurant |
| Retail - Multistory Large | Refrigeration | Large\_Retail\_Store |
| Retail - Single-Story Large | Refrigeration | Large\_Retail\_Store |
| Retail - Small | Refrigeration | Small\_Retail\_Store |

# Section 4. Costs

## 4.1 Base Case Cost

The base case cost is $0 since the existing ASH can continue to operate without duty cycling controls.

## 4.2 Measure Case Cost

The measure case costs were based on the “Revised DEER Measure Cost Summary (05\_30\_2008) Revised (06\_02\_2008). xls” [218] and calculated per width of display case at $37.24/ft. Cost calculation methodologies are discussed in detail in Section 4.3.

## 4.3 Full and Incremental Measure Cost

2008 DEER cost data lists equipment and labor costs for ASH controller per circuit of controlled ASHs. Based on an online survey of ASH controllers, controller capacity ranges from 16A to 30A[[1]](#footnote-1). A typical door (2.6 ft wide) with ASH draws about 1.6-amp. To be conservative, it is assumed that the electric circuit is operating at 80% of its capacity or 12.8 amps are available to control the ASHs.

* $600 material + $368.23 labor per ASH controller = $968.23 total cost per controller
* 12.8-amp per controller/1.6-amp per door x 2.6 ft per door = 20.8 linear ft. per controller
* $968.23 per controller/ 20.8 ft per controller = $46.55 per ft. of display case

From this methodology, it follows that the higher the controller capacity, the lower the cost per linear foot of door. However, since DEER does not specify the circuit capacity for the supplied price point, the lowest 16A capacity has been assumed to obtain a conservative cost.

**Full and Incremental Measure Cost Equations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| REA | MEC + MLC | MEC + MLC | N/A |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

BEC = Base Case Equipment Cost; BLC = Base Case Labor Cost

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| RF-12098 | REA | $46.55 | $46.55 | N/A |
| RF-48112 | REA | $46.55 | $46.55 | N/A |

# Attachments

A. 

B. 

C. 

# References



[218]

[386]

[422]

1. <http://www.apexcontrolsinc.com/sweatmiser/manuals/SWM-Manual-MT.pdf>

   <http://www.fridgewize.com/anti-sweat-heater-controls>

   <http://www.gemtronfooddisplay.com/downloads/Technical/CoolTrolControllerInstructions.pdf>

   (accessed 7/2/14). [↑](#footnote-ref-1)