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**COMMERCIAL REFRIGERATION**  
**AUTO CLOSER FOR REFRIGERATED STORAGE DOOR**  
SWCR005-01

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## MEASURE NAME

Auto Closer for Refrigerated Storage Door

## STATEWIDE MEASURE ID

SWCR005-01

## TECHNOLOGY SUMMARY

An automatic closer on a walk-in freezer and cooler door can reduce the amount of time that the door is open, and thus reduce infiltration and refrigeration loads.

## MEASURE CASE DESCRIPTION

The measure case is specified as the installation of an automatic door closer on a walk-in cooler or a walk-in freezer door that was not previously equipped with one.

## BASE CASE DESCRIPTION

The base case is specified as a walk-in freezer or walk-in cooler door without an automatic closer.

## CODE REQUIREMENTS

The state and federal codes and standards applicable to refrigerated storage auto door closers are noted below. The 2019 Appliance Efficiency Regulations (Title 20)<sup>1</sup> provides the following requirements for walk-in coolers and freezers manufactured on or after January 1, 2009:

*(4) Walk-In Coolers and Walk-In Freezers. Walk-in coolers and walk-in freezers manufactured on or after January 1, 2009 shall:*

*(A) have automatic door closers that firmly close all walk-in doors that have been closed to within one inch of full closure, except that this subparagraph shall not apply to doors wider than three feet nine inches or taller than seven feet;*

Note that Title 20 does not apply to add-on equipment (AOE) measures and therefore does not impact the installation of an auto door closer on a walk-in cooler or freezer door. The regulation, however, applies to walk-in coolers and freezers manufactured on or after January 1, 2009.

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<sup>1</sup> California Energy Commission (CEC). 2019. *California Code of Regulations. Title 20 Public Utilities and Energy*. CEC-400-2018-002-REV.

**Applicable State and Federal Codes and Standards**

Code	Applicable Code Reference	Effective Date
CA Appliance Efficiency Regulations – Title 20 (2019)	Section 1605.1(a)(4)(A)	Applies to walk-in freezers and coolers manufactured on or after January 1, 2009
CA Building Energy Efficiency Standards – Title 24	None.	n/a
Federal Standards	None.	n/a

**NORMALIZING UNIT**

Each

**PROGRAM REQUIREMENTS**

*Measure Implementation Eligibility*

All combinations of measure application type, delivery type, and sector that are established for this measure are specified below. Measure application type is a categorization based on the circumstances and timing of the measure installation; each measure application type is distinguished by its baseline determination, cost basis, eligibility, and documentation requirements. Delivery type is the broad categorization of the delivery channel through which the market intervention strategy (financial incentives or other services) is targeted. This table also designates the broad market sector(s) that are applicable for this measure.

*Note that some of the implementation combinations below may not be allowed for some measure offerings by all program administrators.*

**Implementation Eligibility**

Measure Application Type	Delivery Type	Sector
Add-on equipment (AOE)	DnDeemDI	Com
Add-on equipment (AOE)	DnDeemed	Com
Add-on equipment (AOE)	UpDeemed	Com

*Eligible Products*

See Measure Case Description for eligible measure offerings.

The automatic door closer must be installed on the main insulated opaque door(s) of an existing walk-in cooler or freezer.

The automatic door closer must firmly close the door when it is within one inch of full closure.

The automatic closer must be installed on a walk-in cooler or freezer that was manufactured *before* January 1, 2009.

### *Eligible Building Types*

This measure is applicable for any existing commercial building type of any vintage, including (but not limited to) supermarkets, grocery stores, hotels, restaurants, and convenience stores.

### *Eligible Climate Zones*

This measure is applicable in all California climate zones.

## PROGRAM EXCLUSIONS

A walk-in cooler or freezer manufactured *after* January 1, 2009 is not eligible.

## DATA COLLECTION REQUIREMENTS

Data collection requirements are to be determined.

## USE CATEGORY

Commercial Refrigeration (ComRefrig)

## ELECTRIC SAVINGS (KWH)

The building energy simulation model DOE-2.2R (via eQuest Refrigeration 3.65) was used to derive base case and measure case unit energy consumption (UEC).<sup>2</sup> The unit energy savings (UES) was calculated as the difference between the modeled total (whole building) energy consumption of the base case and measure case models. Methods for base case prototype and measure case simulations are provided below.

### *Assumptions*

Only the Grocery building type was simulated; insofar as walk-in coolers and freezers generally have the same operating characteristics in any building type, the Grocery savings were used for other building types.

### *Base Case Model Simulations*

The building energy simulation tool DOE-2.2R (via eQuest Refrigeration 3.65) was used to derive base case and measure case UEC. The base case model is summarized as follows:

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<sup>2</sup> Southern California Edison (SCE). 2019. "SWCR005-01 eQuest Files.zip."

- DEER 2020 prototypes were generated from MASControl version 3 and updated to account for current code and market conditions for commercial refrigeration systems.<sup>3</sup> Cooler and freezer spaces were included in models provided by Solaris, on behalf of SCE. Note that the freezer and cooler spaces in the current prototypes are slightly larger than the previous DEER prototype model.
- The original infiltration schedule (ID: D\_Gro\_All\_C\_Inf\_Yr) defined in the updated prototype models for the cooler and freezer storage spaces was removed. Instead, the door schedule (ID: StockDoorSch, included in the updated DEER model) combined with the infiltration rate changes noted in the table below were meant to simulate the difference in infiltration based on differing door usage.
- The weather files were updated using DEER 2020 CZ2010 weather data files.
- Simulations were generated for Grocery building type, building vintage 2015, and for each of the 16 California climate zones. The 2015 building vintage was used because its age most closely reflects the existing equipment remaining useful life (RUL). The RUL is used to determine the building vintage as the measure is being added on to existing equipment.

*Measure Case Model Simulations*

The base case model was modified to simulate the measure case UEC:

- The measures reduce the infiltration into the coolers and freezers by 40%.<sup>4</sup> This differs from the method used to estimate the energy savings in the DEER05 calculations. The DEER05 calculations assumed a 40% reduction in the source power of the cooler. The new method reduces the infiltration rates of the cooler and freezer, as defined by the measures.

The following parameters were edited within the separate cooler and freezer measure case building models:

**Base Case and Measure Case Infiltration Rates**

Measure	Space	Parameter	Base Case Value (CFM)	Measure Case Value (CFM)
Cooler	A_RfgWClr_C	INF-FLOW/AREA	0.0708333	0.0425000
Freezer	A_RfgWFrz_C	INF-FLOW/AREA	0.0708333	0.0425000

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<sup>3</sup> Southern California Edison (SCE) and Solaris. 2019 "PG&E GrocerSmart Data for DEER 2020\_V3-Solaris.xlsx"

<sup>4</sup> Itron, Inc. 2005. *2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report*. Prepared for Southern California Edison. December 2005. Page A-33.

### Unit Energy Savings

The unit energy savings (UES) were calculated as the difference between the modeled base case and measure case total UEC.<sup>5</sup> Given one cooler door and one freezer door per energy model, the per-door UES are equal to energy model savings.

### PEAK ELECTRIC DEMAND REDUCTION (KW)

Peak demand was calculated from the DOE2.2R hourly data as the average of the electrical power draw between 4:00 p.m. to 9:00 p.m. in conformance with the Database for Energy Efficiency Resources (DEER) peak definition.<sup>6</sup> Peak demand reduction is calculated as the difference in the base case and measure case peak demand.

### GAS SAVINGS (THERMS)

Gas savings were derived using the methodology presented in the Electric Savings section.

### LIFE CYCLE

Effective useful life (EUL) is an estimate of the median number of years that a measure installed through a program is still in place and operable. Remaining useful life (RUL) is an estimate of the median number of years that a technology or piece of equipment replaced or altered by an energy efficiency program would have remained in service and operational had the program intervention not caused the replacement or alteration.

The methodology to calculate the RUL conforms with Version 5 of the Energy Efficiency Policy Manual, which recommends "one-third of the effective useful life in DEER as the remaining useful life until further study results are available to establish more accurate values."<sup>7</sup> This approach provides a reasonable RUL estimate without the requiring any a priori knowledge about the age of the equipment being replaced.<sup>8</sup> Further, as per Resolution E-4807, the California Public Utilities Commission (CPUC) revised add-on equipment measures so that the EUL of the measure is equal to the lower of the RUL of the modified system or equipment or the EUL of the add-on component.<sup>9</sup>

The EUL and RUL for the auto closer for walk-in coolers and freezers are specified below. The RUL adopted for this measure was specified by the Ex Ante Review Consultants for the Energy Division of the California Public Utilities Commission (CPUC). The stipulated RUL assumes an of the host equipment of 20 years.

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<sup>5</sup> Southern California Edison (SCE). (n.d.) "SWCR005-01 Hourly Savings.xls"

<sup>6</sup> California Public Utilities Commission (CPUC). 2018. *Resolution E-4952*. October 11. O.P. 1.

<sup>7</sup> California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 32.

<sup>8</sup> KEMA, Inc. 2008. "Summary of EUL-RUL Analysis for the April 2008 Update to DEER." Memorandum submitted to Itron, Inc.

<sup>9</sup> California Public Utilities Commission (CPUC). 2016. *Resolution E-4807*. December 16. Page 13.

**Effective Useful Life and Remaining Useful Life**

Parameter	Value	Source
EUL (yrs) – auto door closer	8.00	California Public Utilities Commission (CPUC), Energy Division. 2014. “DEER2014-EUL-table-update_2014-02-05.xlsx”
RUL (yrs) – equal to 1/3 of the assumed EUL of host equipment equal to 20 years	6.67	California Public Utilities Commission (CPUC), Energy Division, Ex Ante Review Consultants. 2015. “2015 SCE Ex Ante Adjustments-with Solution codes and WP number.xlsx.”

**BASE CASE MATERIAL COST (\$/UNIT)**

Insofar as auto door closers for walk-in cooler/freezer is an add-on equipment measure, the base case material cost is equal to \$0.

**MEASURE CASE MATERIAL COST (\$/UNIT)**

The measure case material cost per door was derived from the 2010-2012 Ex Ante Measure Cost Study conducted by Itron, Inc. (“WO017”),<sup>10</sup> and then scaled to 2018 cost values using an average of all 12 California cities in the 2018 RS Means Historical Cost Indexes table.<sup>11</sup> The WO017 study evaluated the costs of automatic door closers in two categories based on door size (less than 42 inches and greater than 42 inches). The measure case cost was calculated as the average cost of all door sizes included in the analysis.

**LABOR COST (\$/UNIT)**

The measure case material cost of \$121.02 per door was derived from the 2010-2012 Ex Ante Measure Cost Study conducted by Itron, Inc. (“WO017”),<sup>12</sup> and then scaled to 2018 cost values using an average of all 12 California cities in the 2018 RS Means Historical Cost Indexes table.<sup>13</sup> The WO017 study evaluated the installation labor costs of automatic door closers in two categories based on door size (less than 42 inches and greater than 42 inches). The measure case labor cost was calculated as the average installation cost of all door sizes included in the analysis.

**NET-TO-GROSS (NTG)**

The net-to-gross (NTG) ratio represents the portion of gross impacts that are determined to be directly attributed to a specific program intervention. These NTG values are based upon the average of all NTG

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<sup>10</sup> Itron, Inc. 2020. *2010-2012 WO017 Ex Ante Measure Cost Study Final Report*. Prepared for the California Public Utilities Commission.

<sup>11</sup> Gordian. (n.d.) “RSMeans Cost Index.pdf.”

<sup>12</sup> Itron, Inc. 2020. *2010-2012 WO017 Ex Ante Measure Cost Study Final Report*. Prepared for the California Public Utilities Commission.

<sup>13</sup> Gordian. (n.d.) “RSMeans Cost Index.pdf.”

ratios for all evaluated 2006 – 2008 commercial programs, as documented in the 2011 DEER Update Study conducted by Itron, Inc. These sector average NTGs (“default NTGs”) are applicable to all energy efficiency measures that have been offered through commercial sector programs for more than two years and for which impact evaluation results are not available.

**Net-to-Gross Ratios**

Parameter	Value	Source
NTG – Commercial	0.60	Itron, Inc. 2011. DEER Database 2011 Update Documentation. Prepared for the California Public Utilities Commission. Page 15-4 Table 15-3.

**GROSS SAVINGS INSTALLATION ADJUSTMENT (GSIA)**

The gross savings installation adjustment (GSIA) represents the ratio of the number of verified installations of the measure to the number of claimed installations reported by the utility. The GSIA rate varies by end use, sector, technology, application, and delivery method. This GSIA rate is the current “default” rate specified for measures for which an alternative GSIA has not been estimated and approved.

**Gross Savings Installation Adjustment Rates**

Parameter	Value	Source
GSIA	1.0	California Public Utilities Commission (CPUC), Energy Division. 2013. <i>Energy Efficiency Policy Manual Version 5</i> . Page 31.

**NON-ENERGY IMPACTS**

Non-energy impacts for this measure have not been quantified.

**DEER DIFFERENCES ANALYSIS**

This section provides a summary of inputs and methods based upon the Database for Energy Efficient Resources (DEER), and the rationale for inputs and methods that are not DEER-based. The applicable DEER Measure IDs D03-208 and D03-209 were not updated after DEER 2005. As a result, new simulation models using MASControl3 and DOE2.2R were generated to calculate the energy savings. DEER 2010 weather files were considered in the measure runs. The Grocery DEER prototype building was adjusted based on current code and market conditions and was used to calculate savings for all building types for this measure.

**DEER Difference Summary**

DEER Item	Comment / Used for Workpaper
Modified DEER methodology	Yes
Scaled DEER measure	No
DEER Base Case	No
DEER Measure Case	No
DEER Building Types	Yes
DEER Operating Hours	No
DEER eQUEST Prototypes	No (MASControl version 3 for vintage 2020, Modified for 2020 refrigeration

DEER Item	Comment / Used for Workpaper
	code and baselines)
DEER Version	n/a
Reason for Deviation from DEER	DEER 2010, 2017, and 2020 do not contain this type of measure.
DEER Measure IDs Used	n/a
NTG	The value of 0.60 is associated with NTGR IDs: <i>Com-Default&gt;2yrs</i>
GSIA	The assigned default value of 1.0 is associated with <i>Def-GSIA</i>
EUL/RUL	The EUL of 8 years is associated with EUL ID: <i>GrocWlklN-DrClsr</i> The RUL of 6.67 years is calculated as 1/3 of 20 years, the EUL ID: <i>HVAC-Chlr</i> is used a proxy for 20 years.

## REVISION HISTORY

### Measure Characterization Revision History

Revision Number	Revision Complete Date	Primary Author, Title, Organization	Revision Summary and Rationale for Revision Effective Date and Approved By
01	03/31/2018	Jennifer Holmes Cal TF Staff	Draft of consolidated text for this statewide measure is based upon: PGEREF110 Revision 6 (November 8, 2016) SCE17RN024 Revision 0 (November 4, 2016) WPSDGENRR0110 Revision 1 (September 30, 2014) Consensus reached among Cal TF members.
	04/19/19	Stephen Brett Reno, TRC	Updated savings calculations using new DEER2020 vintage 2015 building prototypes. Updated to DEER2020 peak demand hours. Updated delivery types to include all eligible types. Updated cost values to 2018 values. Updated install type to AOE.
	04/30/2019	Jennifer Holmes Cal TF Staff	Revisions for submittal of version 01.