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COMMERCIAL REFRIGERATION

LOW-TEMPERATURE DISPLAY CASE DOORS WITH NO ANTI-SWEAT HEATERS

SWCR002-01

CONTENTS

MEASURE NAME

Low-temperature Display Case Doors with No Anti-sweat Heaters

Statewide Measure ID

SWCR002-01

TECHNOLOGY SUMMARY

This measure specifies the replacement of standard low-temperature (display case temperature below 32° F) reach-in display case doors with special display case glass doors that have no anti-sweat heaters (ASHs). The ASH on the glass doors and frame is eliminated but the ASH on the mullion of the cases continue to operate. Traditional clear glass display case doors consist of two-pane glass and aluminum doorframes and door rails. ASHs eliminate condensation on the door or glass surface. ASHs are traditionally designed to overcome the highest humidity conditions, as cases are built for applications nationwide.

Typical display case construction requires three ASHs:

- Case mullion heaters are installed inside the case frame to keep the doors from freezing shut,
- Door frame heaters are installed in the door frame to keep the doors from freezing shut and to provide some heat to the glass, and
- Glass heaters are located on the glass itself to raise its surface temperature and prevent condensation.

In standard installations, the ASH operates at full power, 100% of the time. Some of the heat generated by ASH will add load on the refrigeration system. The reduction in ASH power of display case doors with no ASH will reduce the ASH electric demand. As a result, compressor run time and energy consumption will be reduced.

MEASURE CASE DESCRIPTION

The measure case is defined as the replacement of standard low-temperature display case doors with special display case glass doors that have no anti-sweat heaters (ASHs). For the measure case, the ASH on the glass doors and frame is eliminated but the ASH on the mullion of the cases continues to operate.

BASE CASE DESCRIPTION

The base case is defined as the existing low-temperature, reach-in display case equipped with standard glass doors with anti-sweat heaters (ASH) with humidity-based ASH Control.

State and federal standards do not specifically regulate the display case components (such as the evaporator fan motor, case lighting and ASH door types). Solaris, on behalf of Southern California Edison

(SCE), conducted a code and market evaluation study for commercial refrigeration.[1] This study did not reference a change for standard practice for ASH Doors.

CODE REQUIREMENTS

Applicable state and federal codes for this measure are specified below.

Applicable State and Federal Codes and Standards

Code	Applicable Code Reference	Effective Date
CA Appliance Efficiency Regulations – Title 20 (2019)	Section 1605.1(a)(2)(A)	January 1, 2019
CA Building Energy Efficiency Standards – Title 24 (2019)	Appendix B, Table A-4	January 1, 2020
Federal Standards – Code of Federal Regulations (2018)	10 CFR 431.66	January 1, 2018

The California Appliance Efficiency Standards (Title 20)[2] regulates the overall performance of low-temperature vertical display cases with doors with respect maximum daily energy consumption. However, Title 20 does not specifically regulate the display case components, such as the evaporator fan motor, case lighting, and anti-sweat heaters (ASH) door types. The applicable excerpt is included below:

> *Section 1605.1(a)(2)(A) Commercial Refrigerators, Commercial Refrigerator-Freezers, and Commercial Freezers*
>
> *(A) The daily energy consumption (in kilowatt hours per day) of each commercial refrigerator and commercial freezer manufactured on or after March 27, 2017 shall be not greater than the applicable values shown in Tables A-4, A-5, and A-6.*
>
>> *Table A-4 Standards for Commercial Refrigerators and Freezers with a Self-Contained Condensing Unit That are Not Commercial Hybrid Units*
>>
>>> *For Self-Contained, Vertical Closed Transparent, Low Temperature (VCT, SC, L), the maximum daily energy consumption (kWh) is: 0.29 × V + 2.95*
>>
>> *Table A-5 Standards for Commercial Refrigerators and Freezers with a Remote Condensing Unit That are Not Commercial Hybrid Units*
>>
>>> *For Remote, Vertical Closed Transparent, Low Temperature (VCT, RC, L), the maximum daily energy consumption (kWh) is: 0.49 × TDA + 2.61*

The California Building Energy Efficiency Standards (Title 24)[3] and the Code of Federal Regulations[4] address the same overall performance for display cases as Title 20.

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[1] Southern California Edison (SCE) and Solaris. 2019 "PG&E GrocerSmart Data for DEER 2020_V3-Solaris.xlsx."

[2] California Energy Commission (CEC). 2018. *Title 20. Public Utilities and Energy*. CEC-140-2018-002-REV.

[3] California Energy Commission (CEC). 2015. *2016 Nonresidential Compliance Manual for the Building Energy Efficiency Standards for Residential and Nonresidential Buildings*. CEC-400-2015-033-CMF.

[4] Code of Federal Regulations at 10 CFR 431.66.

NORMALIZING UNIT

Linear feet (Len-ft.)

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
Normal replacement	DnDeemDI	Com
Normal replacement	DnDeemed	Com

Installation Type Descriptions

Measure Application Type	Savings	
	1st Baseline	2nd Baseline
Normal Replacement (NR)	Above Standard Practice	N/A

Eligible Products

The replacement of standard low-temperature display case doors with special display case glass doors without anti-sweat heaters (ASH) must meet the following requirements:

- An existing standard glass door with one-pane glass of a low-temperature reach-in display case is replaced with a special glass door with low to no ASH.
- The replacement door is double-pane glass with heat-reflective treatment or is gas filled.
- The replacement door will prevent condensation within the frame assembly.
- The total wattage from the door rail, glass, and frame heater does not exceed 7.1 W/ft^2 of door opening.
- The display case temperature setpoint is between 5 °F and 24 °F.
- Total door rail, glass, and frame heater amperage (at 120 volts) cannot exceed 0.925 amps per door.

It is important to note that for replacement of display case doors, the ASH on the glass doors and frame is eliminated; the ASH on the mullion of the cases continue to operate.

Eligible Building Types and Vintages

This measure is applicable for Grocery, Lodging (Hotel), Restaurant (Fast-Food), Restaurant (Sit-Down), Retail (Multistory Large), Retail (Single-Story Large), and Retail (Small) buildings of any vintage, since the use of low-temperature display cases is most common in these building types.

Eligible Climate Zones

This measure is applicable in all climate zones in California.

PROGRAM EXCLUSIONS

This measure cannot be used in conjunction with anti-sweat heat (ASH) controls.

DATA COLLECTION REQUIREMENTS

None.

USE CATEGORY

Commercial refrigeration (ComRefrig)

ELECTRIC SAVINGS (kWh)

The unit energy savings (UES) of the reduced anti-sweat heater (ASH) energy use of low-temperature display case doors are based on assumptions from the 2005 Database for Energy Efficient Resources (DEER) measure “Zero Heat Reach-in Glass Doors” (ID D03-228).[5]

Assumptions

The following assumptions were established for the calculations of the energy (and demand) impacts of this measure:

- *This measure applies to fixtures with single and multiplex compressor systems.* The DEER2020 prototype building models were generated for a Grocery building prototype with multiplex refrigeration systems for the reach-in refrigerated display cases. Single-compressor systems are less efficient than multiplex-compressor systems. According to the 2004-2005 DEER Update

[5] Itron, Inc. 2005. *2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report*. Prepared for Southern California Edison.
See 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, and Page 7-90 for a detailed description of this measure. The DEER measure ID D03-228 replaces conventional low-temperature, reach-in glass door display cases, utilizing doors with both door heaters and frame heaters, with doors having frame heaters only (no door heaters).

Study,[6] single-compressor systems were typically designed prior to 1980. To be conservative, it is assumed that the generated energy savings are also applicable to display cases with single-compressor systems.
- *This measure applies to fixtures located inside a space that has space heating and space cooling.* The unit energy savings is represented per linear-foot of the display case. The resulting savings include refrigeration load reduction and space cooling load reduction, as well as increase to the space heating energy consumption. Since the heat gain to a display case primarily depends upon the temperature maintained for the display case 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 the Grocery Store building is applied to all other applicable building types.

Base Case and Measure 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 unit energy consumption. The model is summarized as follows:

- The DEER 2020 prototypes were generated from MASControl version 3 and updated to account for current code and market conditions for commercial refrigeration systems.[7]
- The weather files were updated using DEER 2020 CZ2010 weather data files.
- The updated refrigeration prototypes for Grocery building type, building vintage 2020 and for each of the 16 California climate zones (ex: “Gro-CZ01-2020”) were altered as described below to estimate the savings.
- The DEER measure considers multiplex-compressor systems as the refrigeration type.
- The base case specifies the ASH power of 214 W per door for the door and frame heaters with humidity control.
- The measure case specifies the ASH power of 54 W per door for door frame heat only (eliminating door heaters).
- The DOE-2.2R base case and measure case models were modified based on values provided for the DEER D03-228 measure.[8] No updates to ASH door assumptions were noted in the refrigeration study conducted by Solaris for SCE.

[6] Itron, Inc. 2005. *2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report.* Prepared for Southern California Edison.

[7] Southern California Edison (SCE) and Solaris. 2019. "PG&E GrocerSmart Data for DEER 2020_V3-Solaris.xlsx."

[8] Southern California Edison (SCE) and Solaris. 2019. "PG&E GrocerSmart Data for DEER 2020_V3-Solaris.xlsx."

The table below summarizes the base case and measure case inputs from the DEER prototype models for D03-228.

Summary of Built-In Display ASH Control Types from DEER Prototypes

Input Component	Standard ASH Door (Base Case)	Efficient ASH Door (Measure Case)
ASH Heater Power[9]	0.214 kW/door	0.054 kW/door
ASH Heater Control	Humidity-Ratio	Fixed
Max Humidity Ratio	0.0111	n/a
Min Humidity Ratio	0.0054	n/a

The Standard Ash Door (base case) heater power and control type were updated in the DEER2020 building prototype model. Likewise, the efficient ASH door (measure case) heater power and control type were updated in identical DEER2020 prototype models.

Electric Unit Energy Savings

Once the base case and measure case model simulations of energy consumption were completed, the total energy savings were calculated as the difference between the modeled total (whole building) energy consumption of the base case and measure case models, as shown below. The electric UES values (kWh per year per linear foot) were calculated by dividing the total energy savings by the total line-up length of each display case.

$$ES_{Total\ Line-Up} = EC_{Base} - EC_{Measure}$$

$$UES_{Len-ft} = \frac{ES_{Total\ Line-Up}}{Length_{Total\ Line-Up}}$$

$$Length_{Total\ Line-Up} = Doors \times Length_{Door}$$

$ES_{Total\ Line\text{-}Up}$ =	*Total energy savings for the entire line-up (kWh)*
EC =	*Modeled energy consumption of the base case and measure case units (kWh)*
$UES_{Len\text{-}ft}$ =	*Unit energy savings (kWh/Len-ft)*
$Length_{Total\ Line\text{-}Up}$ =	*Length of the total door line-up*
$Doors$ =	*Number of doors in line-up*
$Length_{Door}$ =	*Typical door length (ft)*

The total linear feet used to normalize the energy savings was obtained from the building model and can be found in the table below.

[9] Itron, Inc. 2005. 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study - Final Report. Prepared for Southern California Edison.

Electric UES and Peak Demand Reduction Inputs

Parameter	Base Case Model	Measure Case Model	Source
Modeled energy consumption and demand	*Varies by climate zone*		Southern California Edison (SCE). 2019 "SWCR002-01 - eQuest Models.zip"
Length of total door line-up – low-temperature display case (ft)	283.0	283.0	Modeled as (3 display cases): 109 doors - LT_FF1ReachinCase (35 doors) - LT_FF2ReachinCase (35 doors) - LT_ICReachinCase (39 doors)
Typical door length (ft)	2.6	2.6	DOE-2.2R built-in models for DEER measures D03-207 and D03-206. Typical door length is the average of values for three cases that average to 2.59 feet per door.

The following is an example of the UES calculation for CZ08.

$$EC_{Base} = 1{,}249{,}969.92\ kWh$$

$$EC_{Measure} = 1{,}165{,}542.74\ kWh$$

$$Length_{Door} = 2.6\ {}^{ft}/_{Door}$$

$$Doors = 109$$

$$ES_{Total\ Line-Up} = 1{,}249{,}969.92\ kWh - 1{,}165{,}542.74\ kWh = 84{,}427.18\ kWh$$

$$Length_{Total\ Line-Up} = 109\ Doors \times 2.6\ {}^{ft}/_{Door} = 283.4\ ft$$

$$UES_{Len-ft} = \frac{84{,}427.18\ kWh}{283.4\ ft} = 297.91\ {}^{kWh}/_{Len-ft}$$

PEAK ELECTRIC DEMAND REDUCTION (kW)

Peak demand was calculated 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.[10] Peak demand reduction is calculated as the difference between the modeled base case and measure case peak demand from the DOE-2.2R simulations summarized in the Electric Savings section.

$$PeakDemandSav_{Total\ Line-Up} = PeakDemand_{Base} - PeakDemand_{Measure}$$

[10] California Public Utilities Commission (CPUC). 2018. *Resolution E-4952*. October 11. Op 1.

$$UnitPeakDemandSav_{Len-ft} = \frac{PeakDemandSav_{Total\ Line-Up}}{Length_{Total\ Line-Up}}$$

$$Length_{Total\ Line-Up} = Doors \times Length_{Door}$$

$PeakDemandSav_{Total\ Line\text{-}Up}$ =	*Total peak demand reduction for the entire line-up (kW)*
$PeakDemand$ =	*Modeled peak demand for base case and measure case units (kW)*
$UnitPeakDemandSav_{Len\text{-}ft}$ =	*Unit peak demand reduction (kW/Len-ft)*
$Length_{Total\ Line\text{-}Up}$ =	*Length of the total door line-up*
$Doors$ =	*Number of doors in line-up*
$Length_{Door}$ =	*Typical door length (ft)*

The following is an example of the energy savings calculations for CZ08.

$$PeakDemand_{Base} = 178.36667\ kW$$

$$PeakDemand_{Measure} = 164.37987\ kW$$

$$Length_{Door} = 2.6\ {}^{ft}/_{Door}$$

$$Doors = 109$$

$$PeakDemandSav_{Total\ Line-Up} = 178.36667\ kW - 164.37987\ kW = 13.98680\ kW$$

$$Length_{Total\ Line-Up} = 109\ Doors \times 2.6\ {}^{ft}/_{Door} = 283.4\ ft$$

$$UnitPeakDemandSav_{Len-ft} = \frac{13.98680\ kW}{283.4\ ft} = 0.04935\ {}^{kW}/_{Len-ft}$$

GAS SAVING (THERMS)

The gas unit energy savings (UES) were calculated as the difference between the modeled total (whole building) natural gas consumption of the base case and measure case models, as shown below. Because this measure reduces the amount of waste heat generated by the ASH doors, additional energy is required to heat the building during the cold season. The resultant unit gas *penalties* (therms per year per linear foot) were calculated by dividing the total energy savings by the total line-up length of each display case.

$$GS_{Total\ Line-Up} = GC_{Base} - GC_{Measure}$$

$$UGS_{Len-ft} = \frac{GS_{Total\ Line-Up}}{Length_{Total\ Line-Up}}$$

$$Length_{Total\ Line-Up} = Doors \times Length_{Door}$$

$GS_{Total\ Line\text{-}Up}$ =	*Total natural gas savings for the entire line-up (therms)*

GC =	*Modeled gas consumption of the base case and measure case units (therms)*
$UGS_{Len\text{-}ft}$ *=*	*Unit gas savings (therms/Len-ft)*
$Length_{Total\ Line\text{-}Up}$ *=*	*Length of the total door line-up*
Doors =	*Number of doors in line-up*
$Length_{Door}$ *=*	*Typical door length (ft)*

The following is an example of the gas UES (e.g., penalty) calculation for CZ08.

$$GC_{Base} = 13{,}819.59483\ therms$$

$$GC_{Measure} = 14{,}530.14460\ therms$$

$$Length_{Door} = 2.6\ {}^{ft}/_{Door}$$

$$Doors = 109$$

$$ES_{Total\ Line-Up} = 13{,}819.59483\ therms - 14{,}530.14460\ therms = -710.54976\ therms$$

$$Length_{Total\ Line-Up} = 109\ Doors \times 2.6\ {}^{ft}/_{Door} = 283.4\ ft$$

$$UES_{Len-ft} = \frac{-710.54976\ therms}{283.4\ ft} = -2.50723\ {}^{therms}/_{Len-ft}$$

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 RUL is only applicable to the first baseline period for a retrofit measure with an applicable code baseline.

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."[11] This approach provides a reasonable RUL estimate without the requiring any a prior knowledge about the age of the equipment being replaced.[12] Further, as per Resolution E-4807, the California Public Utilities Commission (CPUC) revised Add-on Equipment (AOE) 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." [13]

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[11] California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 32.

[12] KEMA, Inc. 2008. "Summary of EUL-RUL Analysis for the April 2008 Update to DEER." Memorandum submitted to Itron, Inc.

[13] California Public Utilities Commission (CPUC). 2016. *Resolution E-4807.* December 16. Page 13.

The EUL and RUL specified for this measure are presented below. The EUL represented is the estimated lifetime of zero-heat reach-in glass doors. The RUL is based upon the estimated lifetime of the host display case with doors.

Effective Useful Life and Remaining Useful Life

Parameter	Value	Source
EUL (yrs) – measure, zero heat reach-in glass doors	12.0	California Public Utilities Commission (CPUC), Energy Division. 2014. "DEER2014-EUL-table-update_2014-02-05.xlsx"
RUL (yrs) – measure, zero heat reach-in glass doors	4.0	California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 32.

BASE CASE MATERIAL COST ($/UNIT)

The base case assumes a low-temperature display case with standard glass doors that are equipped with ASH. The material costs for the base case replacement doors and heaters were derived as the average of cost data obtained from online retailers during April 2019 and normalized by linear foot.[14]

MEASURE CASE MATERIAL COST ($/UNIT)

The measure case material costs were calculated as the weighted average of actual costs from invoices of 142 projects implemented in the fourth quarter of 2006 through the PG&E Deemed Rebate Program (Small Business and Existing Facilities).[15] The invoice cost data was converted to 2018 dollars using the Historical Cost Indexes table from the 2018 RSMeans Mechanical Cost Data.[16] The average cost index of all 12 available California cities was used for this analysis. Because invoice costs were specified per door, the cost per linear foot was calculated by dividing the per door cost by the door length specified in the DOE-2.2R built-in models (see Electric Savings section).

BASE CASE LABOR COST ($/UNIT)

The base case labor cost is assumed to equal the measure case labor cost. See Measure Case Labor Cost.

MEASURE CASE LABOR COST ($/UNIT)

The estimated labor costs were derived from invoices of projects implemented in the fourth quarter of 2006 through the PG&E Deemed Rebate Program (Small Business and Existing Facilities).[17] The invoice cost data was converted to 2018 dollars using the Historical Cost Indexes table from the 2018 RS Means

[14] Southern California Edison (SCE). 2019. "SWCR002-01 Cost Calculation.xlsm."

[15] Southern California Edison (SCE). 2019. "SWCR002-01 Cost Calculation.xlsm."

[16] Gordian. (n.d.) "RSMeans Cost Index.pdf."

[17] Southern California Edison (SCE). 2019. "SWCR002-01 Cost Calculation.xlsm."

Mechanical Cost Data.[18] The average cost index of all 12 available California cities was used for this analysis. Labor costs were calculated as the difference between the total invoice and the material cost (in 2018 dollars) on each invoice. Because invoice costs were specified per door, the cost per linear foot was calculated by dividing the per door cost by the door length specified in the DOE-2.2R built-in models (see Electric Savings section).

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 ratios for all evaluated 2006 – 2008 commercial programs, as documented in the 2011 DEER Update Study conducted by Itron, Inc. This sector average NTG ("default NTG") is 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) rate represents the ratio of the number of verified installations of the measure to the number of claimed installations reported by the utility. This factor 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

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

NON-ENERGY IMPACTS

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

DEER DIFFERENCES ANALYSIS

The table below summarizes the inputs and methods that are and are not based upon the Database for Energy Efficient Resources (DEER).

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[18] Gordian. (n.d.) "RSMeans Cost Index.pdf."

The energy savings methodology is based on the 2005 DEER measure ID No. D03-228. The main difference is that DEER measure savings are presented per climate zone, per building, for six different vintages (before 1978, between 1978 to 1992, 1993 to 2001, 2002 to 2005, and 2006 and later). The savings for this measure are presented per climate zone per building type and for vintage 2020. The updated DOE2.2R prototypes from MASControl version 3 for vintage 2020 were used to calculate the savings. The DOE2.2R model weather files were updated with DEER 2020 CZ2010 weather data files.

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	Yes
DEER eQUEST Prototypes	No (MASControl version 3 for vintage 2020, Modified for 2020 refrigeration code and baselines)
DEER Version	n/a
Reason for Deviation from DEER	n/a
DEER Measure IDs Used	n/a
NTG	Source: DEER2011 (DEER2011_NTGR_2012-05-16.xls). Value of 0.60 is associated with NTG ID: *Com-Default>2yrs*
GSIA	Source: DEER READI. The value of 1.0 is associated with GSIA ID: *def-GSIA*
EUL/RUL	Source: DEER2014 (2014-EUL-table-update-2014-02-05.xls). Value of 12 years is associated with EUL ID: *GrocDisp-ZeroHtDrs* The RUL is based upon 1/3 of 12 years, associated with EUL ID: *GrocDisp-FixtDoors*

REVISION HISTORY

Measure Characterization Revision History

Revision Number	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: SCE13RN018 Revision 2 (February 8, 2016) PGECOREF123 Revision 3 (July 24, 2014) Consensus reached among Cal TF members.
01	4/18/2019	Sergio Corona TRC	Added examples of energy calculation to methodology. Updated measure energy savings based on new DEER vintage 2020 building prototypes. Updated base case and measure implementation costs. Added Normal Replacement (NR) measure application type and removed Accelerated Replacement (AR) measure application type.
			Revisions for submittal of version 01.