Work Paper SCE17RN024

**Revision 1**

**Southern California Edison**

**Refrigerated Storage Auto Closer**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | RF-16925: Main Cooler Door Auto Closer  RF-32156: Main Freezer Door Auto Closer |
| **Measure Description** | Install automatic door closer on walk-in freezer or cooler doors |
| **Base Case Description** | Existing walk-in freezers or coolers without an automatic door closer |
| **Units** | Per unit (Freezer or Cooler) |
| **Energy Savings** | Refer to Excel Calculation Attachment 1. |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 1. |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 1. |
| **Effective Useful Life** | 6.67 years, capped at the RUL of the host equipment of walk-in coolers and freezers. |
| **Measure Installation Type** | REA – Retrofit Add-on |
| **Net-to-Gross Ratio** | Com-Default>2yrs |
| **Important Comments** | This work paper has a complementary Ex Ante Database data set that will be provided in a separate submission to the California Public Utilities Commission (CPUC). |

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 10/23/2016 | Theodore D’Williams/TRC | * This Work paper is an update of SCE13RN024.3 * New calculation template for 2017 program year * Gross and incremental measure costs updated * Updated the EUL value in accordance with Draft Resolution E-4807 [D] |
| 1 | 10/16/2017 | Yin Yin Wu/BASE Energy, Inc. | - NTG of Industrial and Agricultural are not applicable and removed.  - Updated Section 1.4.2 based on the latest 2017 Title-20 code version  - DEER2017 values are checked. No change is made.  - The load shapes of E3 Alternate Building Type are updated  - The cost is updated using cost data from WO017  - The work paper calculation template is updated using Version 6.7.4 |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
|  |  |  |  |  |  |

Cal TF website: <http://www.caltf.org/>

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper details the Retrofit Add-on (REA) of main door auto closers or walk in freezers and coolers. The measure is to install auto closers on walk-ins where none was present. The base case of the measure is an existing walk-in cooler or freezer door without a door closer.

Base, Standard and Measure Cases

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Install auto closers on walk-ins |
| Existing Condition | Existing walk-in cooler or freezer door without a door closer |
| Code/Standard | Automatic door closers installed on walk-ins manufactured on or after January 1, 2009 |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
| n/a |  | RF-16925 |  | Main Cooler Door Auto Closer |
| n/a |  | RF-32156 |  | Main Freezer Door Auto Closer |

**Eligibility Requirements**

* The auto-closer must be applied to the main insulated opaque door(s) of an existing walk-in cooler or freezer that is not used for medical, scientific, or research purposes.
* The auto-closer must firmly close that door when it is within one inch of full closure.
* Auto-closer must be installed on a walk-in cooler or freezer manufactured before January 1, 2009.
* The existing condition of the walk-in cooler or freezer door without a door closer needs to be verified by any of the following:
  + Specification of existing equipment
  + Or contractor verification
  + Or the year of the walk-in cooler or freezer installed

## 1.2 Technical Description

Auto-closers on walk-in freezers and coolers can reduce the amount of time that doors are open, thereby reducing infiltration and refrigeration loads. The measures in this work paper are from DEER 2005 which assumes that auto-closers reduce infiltration by 40% on average. However, to update the measure to Title 20 (2014) compliance, the customer average, C13 (Code 13) case model was used as the baseline for this work paper. The base case of the measure is an existing walk-in cooler or freezer door without a door closer.

According to the California Commercial Saturation Survey [D], page ES-23: "65% of Food/Liquor store freezer Walk-ins have strip curtains and 35% have door auto-closers.”

## 1.3 Installation Types and Delivery Mechanisms

The program/install types for the above measures are:

* Retrofit Add-on (REA )

The delivery methods available for these measures are:

* Financial Support - Direct Install
* Financial Support – On-bill Finance – Loan (OBF)
* Partnership - Direct Install
* Partnership – On-bill Finance – Loan (OBF)

Installation Type Descriptions

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

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. |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |

Incentive Method Descriptions

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| Direct Install | The program implements energy efficiency measures for qualifying customers, at no cost to the customer. |
|  |  |
| 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 DEER Version 2014 1.0.5 [386] database contains measure energy savings and cost information for various measures as well as values from previous DEER versions. The applicable DEER Measure IDs D03-208 (RF-16925) and D03-209 (RF-32156) were not updated after DEER 2005. As a result, new simulation models using MASControl and eQUEST were generated to calculate the energy savings for solution code RF-16925 and RF-32156. DEER2014 weather files and Title 20 (2014) code updates were considered in the measure runs. The Grocery DEER prototype building was used to calculate savings for all building types covered in this work paper. See Section 2 for more information.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Work paper?** |
| Modified DEER methodology | Yes |
| Scaled DEER measure | Yes |
| DEER Base Case | Yes |
| DEER Measure Case | No |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | Yes |
| DEER Version | N/A |
| Reason for Deviation from DEER | DEER 2017 does not contain this type of measure. |
| DEER Measure IDs Used | N/A |

**Net-to-Gross Ratio**

The NTG values in the table below were obtained using the DEER READI tool v.2.4.7.

Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| Com-Default>2yrs | All other EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years | Com | Any | All | 0.6 |

**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 in the table below were obtained using the DEER READI tool v.2.4.7.

Gross Savings Installation Adjustment

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 in accordance with Resolution E-4807 [D] and Resolution E-4818 [C]. According to Resolution E-4818 [C], “the EUL of REA measures is capped at the RUL of the host equipment. 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.

According to a report [E] prepared for DOE, the expected life of the insulated box comprising the walk-in is from 12 to 25 years. Hence, host equipment is considered to have a EUL of 20 years, with a RUL of 6.7 years. Per DEER2017’s EUL table, the EUL of *Auto-Closer for Walk-In Cooler/Freezer Doors* is 8 years. Therefore, the EUL of the measures in this work paper is capped at 6.7 years.

Effectiveness Useful Life

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| GrocWlkIn-DrClsr | Auto-Closer for Walk-In Cooler/Freezer Doors | Com | ComRefrig | 6.7\* | N/A |

\* Capped at the RUL of the host equipment. See paragraph above for explanation.

### 1.4.2 Codes and Standards Analysis

The 2017 Appliance Efficiency Regulations (Title 20) [A] Section 1605.1(a)(4)(A) 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;”

The requirement of auto-closers applies to walk-ins manufactured on or after January 1, 2009. Hence, this work paper is only applicable to installing automatic door closers on walk-ins manufactured before January 1, 2009.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2017) | Section 1605.1(a)(4)(A) | April, 2017 |

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

### 1.5.1 Non-DEER Study Review

All references used in this work paper were from current or past DEER.

## 1.6 Data Quality and Future Data Needs

N/A

# Section 2. Calculation Methodology

The measures in this work paper are not in DEER 2017, so the energy savings were determined through building simulation in eQUEST 3.65 Refrigeration. Only the Grocery building type was simulated, and its savings were used for other building types because walk-in coolers and freezers generally have the same characteristics regardless of building type.

Prototype generation

MASControl v3.00.20 was used to generate the DEER 2014 Grocery prototype files using the following parameters:

•Building Type: Grocery

•Climate Zones: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16

•Vintage: “14” (years 2014-2015)

•HVAC Type: Blank (Default)

•Thermostat Options: Blank (Default)

•Case Options: CAv (Customer Average), C13 (Code 2013)

•Tech ID: “D08-NE-HVAC-airAC-SpltPkg-135to239kBtuh-10p8eer”

The C13 case model was used as the baseline for this work paper. The Energy Division advised that the prototype’s refrigeration systems were not updated after DEER 2005 and therefore may not reflect industry standard practice and/or code. Since a non-refrigeration Tech ID was selected, the HVAC system, building envelope, and other systems should be compliant with Title 24 2016 standards.

Simulation

In order to create the measure cases, the baseline eQUEST model was edited. Infiltration into the coolers is modeled as a SOURCE load in the SPACE command. The measure applies a multiplier of 0.60 to the base case source load; effectively reducing infiltration by 40% on average.

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 rate of the cooler as defined by the measure.

The simulation results were tabulated, and savings were determined; see Attachment 2. See Attachment 3 for the eQUEST files used.

Demand reduction: The DEER peak demand was calculated from the eQUEST hourly data by averaging the demand from 2pm to 5pm pm in the 3 consecutive peak days specified in the DEER2014 Update documentation [386] for each climate zone. DEER2017 Peak-Demand periods remain the same as DEER2014. Therefore, DEER 2017 is the reference in this revision. Table below summarizes the 2017 DEER Peak-Demand periods for 16 climate zones considered in this work paper.

|  |  |
| --- | --- |
|  | **2017 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 |

A complete list of savings can be found within Attachment 1.

The table below shows sample cooler energy and demand savings for this work paper.

Energy and Demand Savings

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Measure Name** | **Building Type** | **Climate Zone** | **Program Type** | **Annual Electricity Savings (kWh/unit)** | **kW Savings (kW/unit)** | **Therm Savings (Therm/unit)** |
| Main Cooler Door Auto Closer | Grocery | 1 | REA | 1416.80 | 0.44 | -0.09 |
| Main Cooler Door Auto Closer | Grocery | 2 | REA | 1798.93 | 0.64 | -0.61 |
| Main Cooler Door Auto Closer | Grocery | 3 | REA | 1836.79 | 0.58 | 0.12 |
| Main Cooler Door Auto Closer | Grocery | 4 | REA | 1910.31 | 0.52 | -0.12 |
| Main Cooler Door Auto Closer | Grocery | 5 | REA | 1725.22 | 0.31 | -0.10 |
| Main Cooler Door Auto Closer | Grocery | 6 | REA | 2327.34 | 0.30 | -0.98 |
| Main Cooler Door Auto Closer | Grocery | 8 | REA | 2429.11 | 0.56 | -0.11 |
| Main Cooler Door Auto Closer | Grocery | 9 | REA | 2298.13 | 0.65 | -0.08 |
| Main Cooler Door Auto Closer | Grocery | 10 | REA | 2264.48 | 1.24 | -0.07 |
| Main Cooler Door Auto Closer | Grocery | 11 | REA | 2110.15 | 0.79 | -0.13 |
| Main Cooler Door Auto Closer | Grocery | 12 | REA | 2074.98 | 0.46 | -0.60 |
| Main Cooler Door Auto Closer | Grocery | 13 | REA | 2342.68 | 0.79 | -0.06 |
| Main Cooler Door Auto Closer | Grocery | 14 | REA | 1813.65 | 1.22 | -0.05 |
| Main Cooler Door Auto Closer | Grocery | 15 | REA | 2356.39 | 0.37 | -0.05 |
| Main Cooler Door Auto Closer | Grocery | 16 | REA | 899.12 | 0.46 | -0.03 |

# 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 this measure are listed in the table below.

Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| Education - Primary School | Refrigeration | K\_thru\_12\_School |
| Education - Community College | Refrigeration | College\_University |
| Education - University | Refrigeration | College\_University |
| Grocery | Refrigeration | Grocery\_Store |
| Health/Medical - Hospital | Refrigeration | Hospital |
| Health/Medical - Nursing Home | Refrigeration | Medical\_Clinic |
| Lodging - Hotel | Refrigeration | Hotel\_Motel |
| Office – Large | Refrigeration | Large\_Office |
| Office – Small | Refrigeration | Small\_Office |
| 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

Values and methodologies are taken from the 2010-2012 WO017 Ex Ante Measure Cost Study Final Report (WO017) [475] prepared by Itron for the California Public Utilities Commission.

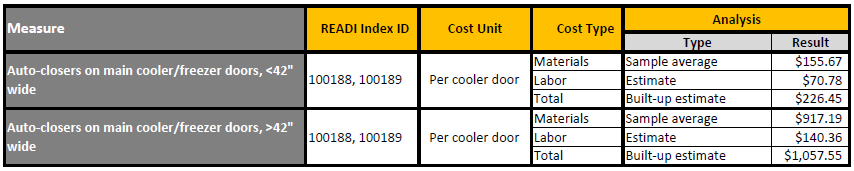
## 4.1 Base Case Cost

For this measure category, the base case cost is assumed to be zero because these are discretionary modifications (retrofit add-on) to the customers’ existing equipment. Their alternative is to make no changes to their existing system.

## 4.2 Measure Case Cost

The measure case costs were taken from WO017, Measure 1 of Appendix C. WO017 evaluated the costs of auto-closers in two subdivisions based on door sizes of <42” wide and >42” wide. Based on information provided by manufacturers, the analysis assumed that the measure cost would be for the field-installation of a *snubber-style door closer* for doors less than 42” wide, and it assumed that the measure cost would be for the field-installation of a *hydraulic armature-style door closer* specifically manufactured for a 60” wide door. Refer to WO017 for detailed descriptions of the cost basis.

The material and labor costs from WO017 for installing auto-closers on main cooler/freezer doors are extracted and shown in table below. On average, the material cost is $536.43 per door and the installation labor cost is $105.57 per door. Hence, the total measure cost = $536.43 (material) + $105.57 (labor) = $642.00 per door.



Source: WO017 [475]

***Note***: During a Cal-TF meeting [B], a weighted average approach based on the WO017 costs of two door sizes and market data from a walk-in supplier was evaluated. As a result, the cost calculated by the weighted average approach is the same as the average WO017 cost. Therefore, the average WO017 cost utilized in this work paper is considered to be appropriate.

## 4.3 Full and Incremental Measure 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-16925: Auto-closer for Walk-in Cooler (Main Solid Door) | REA | $642.00/door | $642.00/door | N/A |
| RF-32156: Auto-closer for Walk-in Freezer(Main Solid Door) | REA | $642.00/door | $642.00/door | N/A |

# Attachments

1. A1 Calculation Backup
2. A2 Calculation Template
3. A3 eQuest Files

# References



[386]

[475]

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[A] California Energy Commission. (April 2017). California Code of Regulations Title 20. Retrieved from <http://www.energy.ca.gov/2017publications/CEC-140-2017-002/CEC-140-2017-002.pdf>

[B] California Technical Forum, Commercial Refrigeration Subcommittee Meeting #5, September 2017.

[C] Resolution E-4818. D. 16-08-019 / CT6. March 3, 2017. Retrieved from <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M179/K264/179264220.PDF>

[D] Resolution E-4807 Final. December 15, 2016. Retrieved from <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M171/K329/171329677.PDF>

[E] Detlef W, Robert Z., Anthony V., & Matthew F. (1996, June). Energy Savings Potential for

Commercial Refrigeration Equipment. For Building Equipment Division Office of Building Technologies U.S. Department of Energy, Reference 46230-00. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.593.7507&rep=rep1&type=pdf>.

[F] California Commercial Saturation Survey, Prepared for California Public Utilities Commission. Itron. July 15, 2014.