Short Form Work Paper PGE3PREF120

**Revision 5**

**Pacific Gas & Electric**

**Refrigeration Case SCT Control**

**April 1, 2017**

# PG&E Refrigeration Case SCT Control

## Introduction

This short form workpaper documents (WP) the values adopted from SCE’s WP entitled “Refrigeration Floating Suction and Head Pressure Controls” (SCE17RN023.0 – Refrigeration Floating Head Pressure Controls\_Final.docx). PG&E adopts SCE measure code RF-31355 Floating Head Pressure Controls on Commercial Air-Cooled Multiplex Refrigeration System and RF-41488 Floating Head Pressure Controls on Commercial Evap-Cooled Multiplex Refrigeration System.

## Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 4/7/2008 | Dennis Krieger (PECI Engineering) | Original Workpaper. |
| 1 | 6/7/2012 | Laura Konstin  (EnergySmart Grocer) | Updated to PG&E 2013-2014 format  Update cost data to reflect DEER 2008  Update EUL to reflect DEER 2008 |
| 2 | 5/15/2014 | Brian Owens PECI | Updated calculations with 2009 weather data |
| 3 | 3/15/2016 | Linda Wan (PG&E) | Updated to ex ante format 2016 |
| 4 | 1/10/2017 | Linda Wan (PG&E) | * Removed measures R117 & R118 |
| 5 | 4/1/2017 | Linda Wan (PG&E) | Removed measures R115 & R122.  Converted PG&E legacy workpaper “PGE3PREF121 R3 – Refrigeration Case SST Control” to short form workpaper.   * Adopted lead IOU workpaper measure code RF-31355 & RF-41488 from SCE’s “SCE17RN023.0 Refrigeration Floating Head Pressure Controls” dated December 9, 2016. |

## Measure Summary

Table : Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper documents ex-ante load impacts for SCE’s “Refrigeration Floating Suction and Head Pressure Controls”. The base energy consumption and measure energy consumption values are from LegacyIDs D03-221, D03-222, D03-223, D03-224, D03-225, & D03-226 from READI v2.4.7. |
| **1.1 Measure & Baseline Data** | Measures:   |  |  |  | | --- | --- | --- | | PG&E Measure Code | SCE Product Code | Description | | R116 | RF-31355 | Floating Head Pressure Controls on Commercial Air-Cooled Multiplex Refrigeration System | | R123 | RF-41488 | Floating Head Pressure Controls on Commercial Evap-Cooled Multiplex Refrigeration System | |
| **1.2 Technical Description** |  |
| Measures | Base Cases:  1. RF-31355: Multiplex system, air-cooled condenser, fixed SCT = 80°F  2. RF-41488: Multiplex system, evap-cooled condenser, fixed SCT = 80°F  Measure Cases:  1. RF-31355: Floating head pressure control for commercial air-cooled multiplex refrigeration systems. This measure comprises three DEER measures, described as follows:  a) DEER ID: D03-221: Multiplex system, air-cooled condenser, fixed SCT = 70°F  b) DEER ID: D03-223: Multiplex system, air-cooled condenser, control SCT to ambient + 12°F TD, 70oF min, backflood setpoint of 68°F  c) DEER ID: D03-225: Multiplex system, air-cooled condenser, control SCT to ambient + 12°F TD, 70°F min, backflood setpoint of 68°F, variable-speed fan control  2. RF-41488: Floating head pressure control for commercial evap-cooled multiplex refrigeration systems. This measure comprises three DEER measures, described as follows:  a) DEER ID: D03-222: Multiplex system, evap-cooled condenser, fixed SCT = 70°F  b) DEER ID: D03-224: Multiplex system, evap-cooled condenser, control SCT to wetbulb + 17°F TD, 70°F min, backflood setpoint of 68°F  c) DEER ID: D03-226: Multiplex system, evap-cooled condenser, control SCT to wetbulb + 17°F TD, 70°F min, backflood setpoint of 68°F, variable-speed fan control |
| Code for All Measures | As cited per SCE workpaper  Chapter 10.5 of the California’s Title 24 2016 Non-Residential Compliance Manual [496] addresses commercial refrigeration systems in retail food stores. Chapter 10.5.2, Section A requires that all new commercial air-cooled and evaporative condenser fans be continuously variable speed. Additionally, head pressure must float in response to Tdb or Twb, and the minimum SCT must be 70oF or less. Table 10-2 in Title 24 specifies the minimum specific efficiency requirements (Btu-h/Watt) for new fan-powered condensers. Chapter 10.5.3, Section A requires floating suction pressure controls based on worst-case demand for all new remote refrigeration systems.  Chapter 10.6.3 addresses the mechanical systems serving refrigerated warehouses. Section B requires that all new commercial air-cooled and evaporative condenser fans be continuously variable speed. Additionally, head pressure must float in response to Tdb or Twb, and the minimum SCT must be 70oF or less. Table 10-6 in Title 24 specifies the minimum specific efficiency requirements (Btu-h/Watt) for new fan-powered condensers. Floating suction pressure controls are not mandatory. Additionally, areas within refrigerated warehouses designed for quick chilling or freezing of products are exempt. |
| Requirements | As cited per SCE workpaper  Proposed head pressure controls must operate the refrigeration systems according to:   * 12°F temperature difference (TD) between Tdb and SCT for air-cooled commercial systems on all building types except refrigerated warehouse * 17°F TD between Twb and SCT for evap-cooled commercial systems on all building types except refrigerated warehouse * 9°F TD between Twb and SCT for evap-cooled process systems on refrigerated warehouses * Minimum SCT of 70°F   The proposed suction pressure controls must operate the refrigeration systems according to:   * Worst zone demand. The maximum suction setpoint is 5°F above the design temperature. The minimum is the same as the base case.   The following are ineligible:   * New construction installations. * Floating head pressure controls on air-cooled process refrigeration systems. * Floating suction pressure controls on refrigeration systems with variable speed evaporator fans. * Any improvements which results in increased system energy use   Additionally, calculation of the design cooling load (tons) is to be based on connected display cases, walk-in coolers and freezers, cooled storage and prep areas only. Subcooler loads and air conditioning loads are ineligible for consideration. |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| Installation Type | Retrofit Add-on (REA) |
| Delivery Mechanisms | Downstream Rebate – Deemed |
| **1.4.1 DEER Data** |  |
| Net-to-Gross Ratio | Com-Default>2yrs |
| Effective and Remaining Useful Life | |  |  |  |  | | --- | --- | --- | --- | | EUL ID | Description | Sector | UseCategory | | GrocSys-FltHdPres | Refrigeration Upgrades (Head Pressure) – Grocery | Com | ComRefrig | |  | | | | |
| **Section 2. Calculation Methodology** | DEER 2005 |
| Energy Savings/Peak Demand Reduction – All Measures | **As cited in READI v2.4.7, Version DEER2005, Source D06 v2.01, the Savings are the following for “IOU” location and building type “Com”:**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | PG&E Measure Code | SCE Solution Code | BldgVint | KWh/yr Savings | KW/yr  Savings | Therm/yr Savings | | R116 | RF-31355 | Ex | 1193.67 | 0.01213 | 0.318 | | R116 | RF-31355 | New | 670 | 0.04091 | 0.228 | | R123 | RF-41488 | Ex | 1533.33 | 0.03613 | 0.320 | | R123 | RF-41488 | New | 384.33 | -0.01107 | 0.199 |   Please see PGE3PREF120 R5 Additional Calculations for more information. |
| **Section 3. Load Shapes** | PGE:COMMERCIAL:4 = Commercial Refrigeration |
| **Section 4. Costs** | The Gross Measure Cost is obtained from costs documented by SCE work paper “SCE17RN023.0 – Refrigeration Floating Head Pressure Controls\_Final.docx” Section 4- Cost. |
| **Section 4.1 Base and Measure Costs** |  |
| Base Cost | As cited per SCE workpaper |
| R116 | $ 0 |
| R123 | $ 0 |
| Measure Cost |  |
| R116 | $539.94 |
| R123 | $565.34 |