Short Form Work Paper WPSDGEREHC1067

**Revision 0**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Duct Seal and Test**

**December 28, 2017**

# SDG&E Duct Seal and Test

## Introduction

This short form workpaper adopts the methodology of PGE workpaper PGE3PHVC159 Rev5 and documents the values from the READI v.2.4.7 energy impacts for Res-DuctSeal-MedToLow-wtd- Residential duct seal and test. SDG&E adopts all the values in PGE3PHVC159 Rev5, with the following exceptions:

1. SDG&E will only reference SDG&E climate zones of CZ06, CZ07, CZ08, CZ10, CZ14 and CZ15.
2. GSIA ID of EUC\_GSIA\_0.75 is used to comply with Energy Division Workpaper Disposition for Residential HVAC Quality Maintenance dated May 2, 2013[[1]](#endnote-1).

The costs are adopted from 2010-2012 WO17 Ex Ante Measure Cost Study[[2]](#endnote-2).

## Document Revision History

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| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 12/28/17 | Keith Valenzuela/SDGE Contractor | * Adopted READI v.2.4.7 energy impacts for DEER 2017 Res-DuctSeal-MedToLow-wtd |
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## Measure Summary

Table 1: Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper documents ex-ante load impacts and cost-effectiveness values for testing and sealing the ducts of residential central forced air HVAC systems. The base energy consumption and measure energy consumption values are from READI v.2.4.7.  This short form workpaper details the energy impacts of testing the leakage of the duct system and when necessary sealing the ducts to prevent conditioned air from leaking from the ducts and cooling unconditioned spaces which waste energy. In addition, leaky return ducts can bring in air from unconditioned spaces which wastes energy by making the HVAC system work harder to cool the space. |
| **1.1 Measure & Baseline Data** | |
| **1.2 Technical Description** | This measure involves testing the leakage of the duct system and when necessary sealing the ducts to prevent conditioned air from leaking from the ducts and cooling unconditioned spaces which waste energy. In addition, leaky return ducts can bring in air from unconditioned spaces which wastes energy by making the HVAC system work harder to cool the space. |
| Measures | Measures:  421023-Duct Test and Seal 1976-1994 (Res-DuctSeal-MedToLow-wtd)  421024-Duct Test and Seal 1995-2005 (Res-DuctSeal-MedToLow-wtd) |
| Code for All Measures | ***Title 20:*** This measure does not fall under Title 20 of the California Energy Regulations.  ***Title 24:*** These measures do fall under Title 24 2016 of the California Energy Regulations. Under this regulation, the following is required for any new installation of air-cooled air conditioners and air-source heat pumps:  Duct systems must be sealed and verified if >40 feet of ducts in unconditioned space. Duct system leakage must be ≤15% in total, or ≤10% to the outside. Or, if unable to meet the sealing requirements, all accessible leaks must be sealed and verified by a HERS rater  Mandatory duct insulation requirements (R-6) apply to all new or replacement ducts (not existing or unaltered ducts). When replacing >40 feet of ducts in unconditioned space: CZ1-10 and 12-13: R-6 CZ11 and 14-16; R-8. HERS verification is required for insulated ducts in conditioned space.  In all climate zones, when new duct systems are installed in unconditioned space, leakage must be ≤6% of the air handler airflow.  ***Federal Standards:*** This measure does not fall under Federal DOE or EPA Energy Regulations. |
| Requirements | Per the SDG&E Quality Assurance and Quality Control Plan (QAQCP) technicians must receive training as follows:  **“**New technicians receive individual classroom training from the production supervisor and on-the-job training by serving as a helper from a certified trainer.  All technicians receive electrical training and follow safe electrical protocols, standards and practices.  The contractor regularly enrolls its technicians in technical training.  All technicians are required to attend a weekly tailgate meeting, plus a monthly technicians meeting for on-going training. The type of information that is covered in these training sessions would include measure and service standards, review of safety standards, motivation, customer service, and quality control instruction.  The production supervisor or assistant production manager also provides one-on-one training to technicians in the field.” |
| **1.3 Installation Type and Delivery Mechanisms** | |
| Installation Type | Retrofit Add-on (REA) |
| Delivery Mechanisms | Direct Install |
| **1.4.1 DEER Data** | |
| Net-to-Gross Ratio | Res-sAll-mDuctSeal |
| Effective and Remaining Useful Life | HV-DuctSeal  EUL= 18 years  RUL=EUL/3=6 |
| GSIA | Per Energy Division Workpaper Disposition for Residential HVAC Quality Maintenance dated May 2, 2013  “The statewide installation rate for DTS measures from the 2006-2008 evaluations is 0.463. This essentially means that more than half the installations have no benefit, even if, on those installations, some amount of duct sealing was performed that did not result in requisite reduction in duct leakage. In consideration of partial benefits as well as the likelihood that utilities have instituted improvements to installation and verification, staff believe that the installation rate should be increased by 50%, according to the following equation:  IRadj = 0.463 + 0.50 \* ( 1 – 0.463 ) = 0.73  Given the lack of precision in the analysis of installation rates, staff has used an installation rate of 0.75 for DTS measures.**”**  **\*Note:** The GSIA listed in READI v.2.4.7 for GSIA ID Res-DuctSeal-All is still 0.463 as referenced in the Energy Division Workpaper Disposition for Residential HVAC Quality Maintenance dated May 2, 2013. Therefore, we recommend the CPUC Staff to update the GSIA IDs to include a Duct Seal ID to have a value of 0.75. The closest available GSIA ID would be EUC\_GSIA\_0.75 but given its program specific, SDG&E will update once Commission Staff updates or creates a new GSIA ID for all Residential Duct Seal measures. |
| **Section 2. Calculation Methodology** | |
| Energy Savings/Peak Demand Reduction – All Measures | The annual energy and demand savings for the residential sector are based on the DEER measure savings from *Res-DuctSeal-MedToLow-wtd*, taken from the DEER 2017 READI v.2.4.7. The READI v.2.4.7 values are adjusted based on Energy Division Workpaper Disposition for Residential HVAC Quality Maintenance dated May 2, 2013.  From Workpaper Disposition:  “UES values for the DTS are taken directly from DEER. There are two measures in DEER, one for high initial duct leakage (measure ID *Res-DuctSeal-HighToLow-wtd*) and medium initial duct leakage (measure ID *Res-DuctSeal-MedToLow-wtd*). Disposition UES values are the weighted average of those provided in the two measures. Additionally, staff assigns the following incidence factors:  High initial leakage: 0.14  Medium initial leakage: 0.39”  Workpaper Savings = DEER values \* 0.39 |
| **Section 3. Load Shapes** | |
| Load Shape | SDGE:DEER:HVAC\_Eff\_AC Annual |
| **Section 4. Cost** | |
| **Section 4.1 Base and Measure Costs** | |
| Base Cost | The base case is the customer’s existing ducts; therefore, the base case cost is $0.00. |
| Measure Cost | The 2010-2012 WO17 Ex Ante Measure Cost Study provides duct test and seal per-dwelling costs.  The study provides costs per dwelling for duct seal and test of $71.45 for materials and $181.24 for labor for a total cost of $252.69/dwelling. Since the savings are per cap-tons the average tonnage of 3.31 per household using the 2008 DEER tonnage listed in the Energy Division Workpaper Disposition for Residential HVAC Quality Maintenance workbook titled “*20132014-ResidentialHVACMaintenance-SavingsValues-April2013-v1-2.xlsx*” was used to estimate the cost per ton of $76.34. |

1. California Public Utilities Commission, Energy Division. Workpaper Disposition for

   Residential HVAC Quality Maintenance. Sacramento, CA (2013, May 2). Retrieved 12/12/17 at <http://deeresources.com/index.php/non-deer-workpapers>. [↑](#endnote-ref-1)
2. Itron. 2010-2012 WO017 Ex Ante Measure Cost Study Final Report. San Francisco, CA (2014, May 27). Retrieved 11/14/17 at <http://www.energydataweb.com/cpucFiles/pdaDocs/1100/2010-2012%20WO017%20Ex%20Ante%20Measure%20Cost%20Study%20-%20Final%20Report.pdf>. [↑](#endnote-ref-2)