

Chapter 7: Non-Residential Duct Installation Verification And Diagnostic Testing Using Home Energy Rating Systems (HERS)

7.1 Verified Duct Efficiency Improvements

The Commission has approved algorithms and procedures for determining duct and HVAC distribution efficiency for non-residential single-zone individual packaged equipment serving 5000 ft² or less via ductwork in the space between an insulated ceiling and the roof. Details of the energy efficiency calculations are presented in Appendix G.

There are two calculation procedures to determine seasonal air distribution efficiency using either: 1) default input assumptions, or 2) diagnostic measurement values. Air distribution efficiencies for heating and cooling shall be calculated separately. The ACM shall require the user to choose values for the following parameters to calculate seasonal duct efficiencies: duct insulation level and duct leakage level. The ACM shall use the defaults shown in [brackets] for the Standard Design and for the Proposed Design when the user does not enter a specific value for these parameters.:

1. Insulation level of ducts [R 4.2]
2. The leakage level of the duct system [22% of fan flow]. Two values are possible: the default or 8% of fan flow if measured and verified at no more than 6% of fan flow.

When any duct efficiency credit is claimed beyond the default assumptions that requires diagnostic testing or verification by a HERS rater or the local enforcement agency, i.e. when non-default values (except HVAC equipment capacities) are used to determine duct efficiency, the leaks in the air distribution system connections shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands and this requirement must be specified as required by the Nonresidential Manual. The ACM shall automatically use the following values from the description of the *Proposed Design* when calculating the distribution system efficiency:

- Number of stories
- Building Conditioned Floor Area
- Building Volume
- Outdoor summer and winter design temperatures for each climate zone

When more than one HVAC system serves the building, the HVAC distribution efficiency is determined for each system and a conditioned floor area-weighted average seasonal efficiency is determined based on the inputs for each of the systems.

When an existing HVAC system is extended to serve an addition, the default assumptions for duct and HVAC distribution efficiency must be used for both the *Proposed Design* and the *Standard Design*. However, when a new, high efficiency HVAC distribution system is used to serve the addition or the addition and the existing building, that system may be modeled to receive energy credit subject to diagnostic testing and verification of proper installation by a HERS rater.

7.2 California Home Energy Rating Systems

The Commission is required to regulate home energy rating system (HERS) providers in California. These regulations appear in the California Code of Regulations, Title 20, Chapter 4, Article 8, Sections 1670-1676). Approved HERS providers are authorized to certify raters and maintain quality control over ratings. Ratings are based on visual inspection and diagnostic testing of the physical characteristics and energy efficiency features of buildings, as constructed.

When compliance documentation indicates field verification and diagnostic testing of specific energy efficiency improvements as a condition for those improvements to qualify for Title 24 compliance credit, an approved HERS provider

and certified HERS rater shall be used to conduct the field verification and diagnostic testing. HERS providers and raters shall be considered special inspectors by building departments, and shall demonstrate competence, to the satisfaction of the building official, for the visual inspections and diagnostic testing. The HERS provider and rater shall be independent entities from the builder or subcontractor installer of the energy efficiency improvements being tested and verified, and shall have no financial interest in the installation of the improvements

7.3 HERS Required Verification and Diagnostic Testing

HERS diagnostic testing and field verification is required for:

- duct air sealing
- augmented duct insulation

These features shall be listed as *HERS Verification Required* features on the *Performance Certificate of Compliance (PERF-1)* and the *Mechanical Compliance Summary (MECH-1)*, and *Mechanical Distribution Summary (Certificate of Field Verification and Diagnostic Testing (MECH-5))*. Such verification constitutes “eligibility and installation criteria” for these features. Field verified and diagnostically tested features must be described in the *Compliance Supplement*.

7.4 Installation Certification

When compliance includes duct sealing, builder employees or subcontractors shall:

- complete diagnostic testing, and
- certify on the *Certificate of Field Verification and Diagnostic Testing (MECH-5)* the diagnostic test results and that the work meets the requirements for compliance credit.

When compliance credit has been claimed for duct insulation levels beyond those covered by default assumptions, builder employees or subcontractors shall record on the *Certificate of Field Verification and Diagnostic Testing (MECH-5)* the R-values for supply and return ducts.

Installer certifications are required for each and every building.

7.5 HERS Verification Procedures

HERS field verification and diagnostic testing shall be completed for each building. Field verification and diagnostic testing for compliance credit for duct sealing shall use the diagnostic duct leakage from fan pressurization of ducts in Section 4.3.8.2 of Appendix G. The HERS rater shall use the same fan flow basis as was used by the installer to calculate percentage duct leakage.

7.6 Responsibilities and Documentation

7.6.1 Builder

Builder employees or subcontractors responsible for completing either diagnostic testing, visual inspection or verification as specified in Section 7.4 shall certify the diagnostic testing results and that the work meets the requirements for compliance credit on the *Certificate of Field Verification and Diagnostic Testing (MECH-5)*.

The builder shall provide the HERS provider with the identifying location of the building to receive diagnostic testing and the expected date that testing may begin. The builder shall provide the HERS provider a copy of the *Certificate of Field Verification and Diagnostic Testing* (MECH-5) signed by the builder employees or sub-contractors certifying that diagnostic testing and installation meet the requirements for compliance credit.

The builder shall provide a *Certificate of Field Verification and Diagnostic Testing* (MECH-5) signed and dated by the HERS rater to the building official in conjunction with requests for final inspection for each building.

7.6.2 HERS Provider and Rater

The HERS provider shall maintain records of all buildings tested, corrective actions taken, and copies of all *Certificate of Field Verification and Diagnostic Testing* (MECH-5) forms for a period of five years.

The HERS rater providing the diagnostic testing and verification shall sign and date a *Certificate of Field Verification and Diagnostic Testing* (MECH-5) form certifying that he/she has verified that the requirements for compliance credit have been met. The HERS rater shall provide this certificate to the builder and the HERS provider.

The HERS rater shall not sign a *Certificate of Field Verification and Diagnostic Testing* (MECH-5) form for a building that does not have a *Certificate of Field Verification and Diagnostic Testing* (MECH-5) form signed by the installer as required in Sections 7.4 and 7.6.1.

7.6.3 Building Department

The building department at its discretion may require independent testing and field verification in conjunction with the building department's required inspections, and/or observe the diagnostic testing and field verification performed by builder employees or subcontractors and the certified HERS rater in conjunction with the building department's required inspections to corroborate the results documented in installer certifications, and in the *Certificate of Field Verification and Diagnostic Testing* (MECH-5) form.

For buildings that have used a compliance alternative that requires field verification and diagnostic testing, the building department shall not approve a building for occupancy until the building department has received from the builder a *Certificate of Field Verification and Diagnostic Testing* (MECH-5) form that has been signed and dated by the HERS rater.

