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California Energy Commission

STAFF REPORT

Alternative Procedure to Home Energy Rating System Rater Nonresidential Duct Leakage Test Verification

California Energy Commission

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California Energy Commission

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ABSTRACT

The California Energy Commission established the Home Energy Rating System program on June 17, 1999. As part of that effort, the Energy Commission established the requirements for field verification and diagnostic testing services performed by Home Energy Rating System raters to show compliance with the *Building Energy Efficiency Standards.* Generally, a Home Energy Rating System rater is limited to residential buildings, but there are several instances where the Home Energy Rating System rater must perform verifications on nonresidential system installations.

The *Building Energy Efficiency Standards* require that air ducts installed in nonresidential buildings be tested to determine if they leak into spaces that are not intended to be occupied by people. This testing is only required for smaller nonresidential installations that are generally similar in size and design to residential installations.

The Nonresidential Appendix to the *Building Energy Efficiency Standards* further requires that these air duct leakage tests be first performed by the technician that installed the heating, ventilation, and air-conditioning system, and then verified, using the same test procedures, by a Home Energy Rating System rater.

Staff hereby proposes an alternative procedure under Section 10-109(h) of the *Building Energy Efficiency Standards* that, if adopted by the Energy Commission, would allow a certified acceptance test technician to perform the appropriate air duct leakage test in lieu of a Home Energy Rating System rater, consistent with standard acceptance testing practices for other nonresidential buildings.

Keywords: Home Energy Rating System rater, Acceptance Test Technician Certification Provider

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EXECUTIVE SUMMARY

The California Energy Commission established the Home Energy Rating System program in June of 1999, with Home Energy Rating System raters being required to perform field verification and diagnostic testing. Home Energy Rating System raters must also submit their results to a Home Energy Rating System provider. While the Home Energy Rating System rater is limited to residential buildings in most cases, they are also required to perform verification tests in nonresidential buildings under certain circumstances.

The *2013* and *2016 Building Energy Efficiency Standards* require that air ducts installed in nonresidential buildings be tested to determine if they leak into spaces that are not intended to be occupied by people. Air ducts are commonly used to conduct conditioned air to spaces within the building that are intended to be occupied. Significant energy can be saved if leaks into spaces that are not intended to be occupied, such as attics, are minimized. Therefore, the Energy Commission established allowable maximum leakage rates for air ducts in the *2005 Building Energy Efficiency Standards* for residential installations. These allowable leakage rates and associated field verification tests were also extended to nonresidential installations where the installations are similar in size and design to the home counterparts.

Thus, Sections 140.4(l), 141.0(b)2D, and 141.0(b)2E of the *2013* and *2016 Building Energy Efficiency Standards* require an air duct leakage test for smaller nonresidential spaces (5,000 square feet or less) that are served by simple space-conditioning equipment (similar to that in residential buildings). This air duct leakage test is required when the air ducts have at least 25 percent of the ducting in spaces that are not intended to be occupied by people. These requirements apply to both newly constructed buildings, and additions or alterations (including equipment change-outs) for existing buildings.

Furthermore, the Functional Testing requirements in Section NA7.5.3.2 of the Nonresidential Appendix to the *Building Energy Efficiency Standards* require that the duct leakage tests for nonresidential installations be performed by the technician that installed the HVAC equipment (or the air ducts themselves) and then verified using the same test procedures by a Home Energy Rating System rater. The intent of this duplicative test and verification requirement was to verify that the installing technician performed the correct air duct leakage testing procedure. At the time only Home Energy Rating System raters were trained and certified by an Energy Commission approved provider to conduct air duct leakage testing.

The *2013 Building Energy Efficiency Standards* added Title 24, Part 1, Section 10-103-A and 10-103-B, establishing formal requirements for training and certifying Acceptance Test Technicians by Acceptance Test Technician Certification Providers. Acceptance Test Technician Certification Providers perform a function similar in practice to the Home Energy Rating System provider, but for nonresidential buildings. Acceptance Test

Technicians are required to follow specific acceptance test procedures, which are very similar to the Home Energy Rating System procedures. Acceptance Test Technicians are also required to record the results of the acceptance tests with an Energy Commission approved Acceptance Test Technician Certification Provider.

With the establishment of the Acceptance Test Technician Certification Provider program, Energy Commission staff has reconsidered the need for redundant testing of air duct leakage in nonresidential installations, and determined that redundant testing and verification is not necessary given the similar levels of training and expertise required to become either a Home Energy Rating System rater or an Acceptance Test Technician.

Therefore, staff proposes, pursuant to Section 10-109(h) of the *Building Efficiency Standards,* an alternative procedure to step 2 of the Functional Testing requirements in NA7.5.3.2. The alternative procedure is set forth in Appendix A to this document. If approved by the Energy Commission, this alternative procedure would create a process through which an Acceptance Test Technician working under an Energy Commission approved Acceptance Test Technician Certification Provider may perform the duct leakage test verification required by Sections 140.4(l), 141.0(b)2D, and 141.0(b)2E of the *Building Energy Efficiency Standards.*

CHAPTER 1:
Background and Recommendation

Background

The Home Energy Rating System (HERS) program was established by the California Energy Commission on June 17, 1999. The Energy Commission established requirements for field verification and diagnostic testing with the *2008 Building Energy Efficiency Standards* (Standards), including specifying that this testing must be performed by HERS raters.

HERS raters are required to follow test procedures specified in the Standards and upload resulting compliance documents to the HERS registry maintained by the HERS providers. Generally, the field verification and diagnostic testing is limited to residential buildings, but there are several instances where a HERS rater must perform verifications on nonresidential installations.

On November 5, 2003, the Energy Commission adopted the *2005 Standards* that included a leakage restriction for specific ducts installed in nonresidential buildings to be verified by HERS raters. The nonresidential duct leakage tests applied to those installations when the duct (1) connects to constant-volume, single-zone air conditioners, heat pumps, or furnaces; (2) serves less than 5,000 square feet of floor area; and (3) has more than 25 percent of the duct surface area in unconditioned space. These limitations represent a very small portion of all the nonresidential buildings in California.

The air duct leakage measurement must first be performed by installation technicians and then by HERS raters to verify compliance. Table 1 (page 4) summarizes the leakage criteria and the diagnostic test procedures that must be used.

Table 1: Duct Leakage Verification and Diagnostic Test Protocols and Compliance Criteria

CASE	User and Application	Leakage Compliance Criteria, (Percent of Nominal Air Handler Airflow)	Procedures 2013 Nonresidential Appendix
New duct systems	Installation Technician Testing HERS rater Testing	6 Percent	NA2.1.4.2.1
Altered existing duct systems	Installation Technician Testing HERS rater Testing	15 Percent	NA2.1.4.2.1
Altered existing duct systems (that cannot be tested as described above)	Installation Technician Testing and Inspection HERS rater Testing and Verification	Fails leakage test but all accessible ducts are sealed. Inspection and smoke test with 100 percent verification.	NA2.1.4.2.2 NA2.1.4.2.3 NA2.1.4.2.4

Source: *2016 Building Energy Efficiency Standards, Appendix NA2, Table NA2.1-1*

When the Energy Commission approved the *2005 Standards*, nonresidential testing and balancing (T&B) contractors (who would normally have done this testing) were traditionally trained to use traverse measurements (either the equal area method or Log-Tchebycheff method) as the primary air-flow measuring process. These methods are suitable for hard duct[1] installations that are common in nonresidential buildings. However, the specific installations described in Table 1 would typically use flexible ducting, and transverse measurement methods are not suitable for flexible ducting applications. The duct pressurization and flow measurement procedures[2] established for HERS raters were more suitable for flexible ducting, and the Energy Commission also determined that traverse measurements produced results that were less reliable than the pressurization measurement method overall.

At the time, because the Energy Commission could not regulate the training of T&B Contractors, the *2005 Standards* required that the duct installation contractor use the

1 *Air ducting* is typically either "hard ducting" for "flexible ducting." *Hard ducting* is typical for nonresidential installations especially where the ducting shares the conditioned space with people. Flexible ducting is typical for residential installations where the ducting is located out of sight in unconditioned space.

2 The duct pressurization and flow measurement procedures are suitable for flexible and hard ducting installations.

pressurization measurement method to demonstrate compliance with the duct leakage limitations and that a HERS rater verify the results. Thus, the *2005 Standards* essentially required repeating the same test on each installation, performed once by the installer and once by the HERS rater.

On May 31, 2012, the Energy Commission adopted the *2013 Standards*, which included the addition of Title 24, Part 1, Sections 10-103-A and 10-103-B establishing formal requirements for training and certifying of Acceptance Test Technicians (ATTs) by Acceptance Test Technician Certification Providers (ATTCPs). (These sections were renumbered as Sections 10-103.1 and 10-103.2 by the *2016 Standards*.)

The ATTCP program provides training, certification, and oversight of ATTs that perform the acceptance tests required by the *2013 Standards* (codified in Title 24, Part 6, of the California Code of Regulations), and Acceptance Test Employers (ATE) that employ ATTs. The ATTCP programs are made available by professional organizations that are required to provide training curricula for ATTs and ATEs, certification procedures, complaint resolution (including disciplinary procedures), quality assurance, and accountability measures. Acceptance testing ensures that installed equipment, controls, and systems in nonresidential buildings operate as required by the Standards. The ATTCP programs require the specifications for performing all acceptance tests including the air distribution system leakage test consistent with the pressurization measurement method.

The California State Pipe Trades Council (CSPTC), a labor union representing plumbers, pipefitters, and HVAC, and refrigeration service technicians, submitted an application to the Energy Commission for approval as a nonresidential mechanical ATTCP on January 13, 2016. The CSPTC requested in its initial ATTCP application that ATTs be considered equivalent to HERS raters for conducting duct leakage test verifications in nonresidential buildings. This request was later redacted so as not to delay approval of the entire ATTCP application; staff has considered this request on its own merits.

Recommendation

To address CSPTC's request, and reduce costs and complexity for the marketplace with a more streamlined compliance strategy, staff proposes the alternative procedure specified in this report. The acceptance test performed by ATTs certified by an Energy Commission approved ATTCP can provide the same demonstration of compliance with duct leakage standard as the duct leakage test verification normally performed by a HERS rater per Sections 140.4(l), 141.0(b)2D, and 141.0(b)2E of the Standards.

Staff therefore proposes under to Section 10-109(h) of the Standards an alternative procedure to step 2 of the Functional Testing requirements in NA7.5.3.2. The alternative procedure is set forth in Appendix A to this document. By providing an alternative procedure that allows the acceptance test performed by an ATT in place of the verification test provided by the HERS rater, the Energy Commission removes a

redundant test requirement and provides a potential reduction in cost and complexity for the marketplace with a more streamlined compliance strategy.

CHAPTER 2: Equivalency

This chapter discusses the intent of the relevant sections of the *2013* and *2016 Standards*, the distinctions between the ATTCP and HERS programs, and the relevant equivalency of the proposed alternative procedure. There is no expected change in the energy efficiency for the limited number of nonresidential buildings that would be affected by the alternative procedure.

The Intent of the Standards

In the *2013* and *2016 Standards*, there are three sections that reference the duct leakage testing requirements: Sections 140.4(l), 141.0(b)2D, and 141.0(b)2E. The intent of these sections is to require air ducts[3] to be sealed[4] to a leakage rate[5] of 6 percent or less of the nominal air handler airflow rate[6] as confirmed through field verification and diagnostic testing. For new ducts that are an extension of an existing duct system, the combined new and existing duct system must limit the leakage rate to no more than 15 percent of the nominal air handler airflow rate, or if the test cannot be performed, a visual inspection of all repairs is acceptable. Section 140.4(l) intends for the field verification and diagnostic testing to be recorded by the HERS rater in a registry maintained by the HERS provider.[7]

Sections 141.0(b)2D, and 141.0(b)2E generally refer to Section 140.4(l) in accordance with the associated limitations. Section 140.4(l) limits the nonresidential duct leakage

3 *Air ducts* are a common means of conveying air that is either cooled or heated by mechanical means (typically air conditioning or furnace) to a space within a building that is intended to be occupied by people.

4 Sealing an air duct entails using mastic, ducting tape (not duct-tape), and mechanical fasteners and anchors to prevent air within the duct from escaping to areas (or space) outside the duct that are not intended to be occupied by people.

5 *Leakage rate* is the rate at which air within a duct escapes the duct to areas (or spaces) not intended to be occupied by people. It is measured as a percentage of air passing through the duct.

6 *Nominal air handler airflow rate* is a general value of the total air being moved through the air duct system connected to the air handler. The nominal airflow rate is based on the reliable operational level of the air handlers at the highest capacity. An *air handler* is a device used to regulate and circulate air as part of a heating, ventilating, and air-conditioning system.

7 A *data registry* is a Web service with a user interface and database maintained by a registration provider that provides for registration of residential or nonresidential compliance documentation used for demonstrating compliance with the *Standards*.

tests to those installations when the duct (1) connects to a constant volume,[8] single zone,[9] air conditioners, heat pumps[10] or furnaces, and (2) serves less than 5,000 square feet of floor area, and (3) the combined surface area of the ducts located in the following spaces is more than 25 percent of the total surface area of the entire duct system:

1. Outdoors; or
2. In a space directly under a roof that:
    a. Has a U-factor[11] greater than the U-factor of the ceiling, or if the roof does not meet the requirements of Section 140.3(a)1B, or
    b. Has fixed vents or openings to the outside or unconditioned spaces[12]; or
3. In an unconditioned crawl space; or
4. In other unconditioned spaces.

Reference Nonresidential Appendix NA1 (*Nonresidential HERS Verification, Testing, and Documentation Procedures*) provides direction for communication and documentation processes that must be completed for compliance with the requirements for duct sealing of HVAC systems covered by Sections 140.4(l), 141.0(b)2D, and 141.0(b)2E. All field diagnostic and testing results completed by a HERS rater are transferred by electronic form to the HERS provider, who in turn verifies and records the results for later reference by local jurisdictions or other authorized persons.

Reference Nonresidential Appendix NA2 (*Nonresidential Field Verification and Diagnostic Test Procedures*) contains the step-by-step procedures for field verification and diagnostic testing for air leakage testing required by *Standards* Sections 140.4(l),

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8 *Constant volume* is a type of heating, ventilating, and air-conditioning (HVAC) system. In a simple system, the supply air flow rate is constant, but the supply air temperature is varied to meet the heating/cooling demands of a space. Most constant volume systems are small and serve a single zone.

9 *Single zone* refers to an HVAC system that serves a single space within a building.

10 Heat pumps are designed to move thermal energy opposite to the direction of natural heat flow by absorbing heat from a cold space and releasing it to a warmer one. Heat pumps can provide either heating or cooling for HVAC systems or domestic hot water systems (or both).

11 The *U-factor* gives a value to the insulating quality of a building element (including walls, windows and doors) in relation to standard testing conditions (the lower the U-factor, the better the insulation value). In this instance, a space under a roof that has a U-factor greater than the U-factor for the ceiling will result in heat from the ceiling being transferred to the space. (Heat transfers along the path of least resistance.) Such a space would be considered unconditioned space, and any air leaking from a duct would be a source of wasted energy.

12 An *unconditioned space* is a space within a building that is not thermally conditioned (by heating, cooling, or controlling humidity) by mechanical means: for example, a warehouse is typically unconditioned. Unconditioned spaces can also refer to areas that are not thermally conditioned and not intended to be occupied by people (for example an attic or crawl space).

141.0(b)2D, and 141.0(b)2E. Field verification and diagnostic testing generally refers to any set of instructions for any technician to follow to verify the proper operation of any installed device or system.

Reference Nonresidential Appendix NA7.5.3 (Air Distribution Systems) requires the installation technician to perform a construction inspection and a two-step functional test. The first step is to perform the same test required in *Reference Nonresidential Appendix NA2* as a direct reference. The second step is to obtain HERS rater field verification as specified in *Reference Nonresidential Appendix NA1*.

ATTCP and HERS Program Distinctions

There are significant distinctions between the ATT and HERS rater certifications that result in incongruities. These differences are beyond the obvious distinction that the HERS verifications are intended for residential construction, while the ATTCP program is intended for nonresidential construction.

Most importantly, a HERS rater shall be an independent entity from the builder, contractor, building owner, and installing technician (i.e., the HVAC contractor). In contrast, the intent of an ATT certification is to allow the installing technician (HVAC contractor) to identify and correct faults, if any, and to then provide proof that the installed system is operating to specification. The alternative procedure would not require the ATT to be an independent third-party inspector.

The requirement for a HERS provider to maintain a data registry where completed registered compliance documents are retained is substantial (Joint Appendix JA7) and significantly regulated by the Energy Commission. Joint Appendix JA7 of the *2013 Standards* includes the roles and responsibilities of authorized users, the compliance documentation registration process that must be followed, the requirements for digital signatures, the Energy Commission approval process of the data registry, and the approval of software used for the input of data into the registry.

In comparison, the ATTCP regulations (Title 24, Part 1, §10-103.1 and §10-103.2) do not require that any ATTCP provide electronic registration of any compliance documents. ATTCP applicants are submitting electronic acceptance testing forms as a means to provide the required quality assurance of ATTs in the field. The Energy Commission does not regulate the ATTCP's electronic database to a level of detail matching the HERS Data Registry.

Alternative Procedure Equivalency

While a direct parallel cannot be drawn between the ATTCP electronic acceptance test forms database and the HERS data registry, the ATTCPs do maintain a record of the acceptance test forms. The alternative procedure requires an ATTCP to specifically record, track, and report the duct leakage acceptance test form (Appendix A). This,

coupled with the training approval that the Energy Commission conducts for the ATTCP, will ensure that the ATT and the HERS rater duct leakage tests are equivalent.

CHAPTER 3:
Potential Effects of Alternative Procedure

Potential Effects on the Regulated Community

Allowing the ATT to avoid the duct leakage field verification and diagnostic testing by the HERS rater streamlines the compliance process for nonresidential builders by eliminating duplicative testing by an independent third party. This streamlining can reasonably be expected to lower costs and increase compliance.

Based on staff investigations, the cost difference to industry between using a HERS rater or an ATT for duct leakage testing is small and dependent on the details of each construction project. Staff estimates that there were nearly 1,500 nonresidential duct leakage field verification and diagnostic test compliance documents registered in 2015. While staff is not able to provide an estimate of the total number of all registered compliance documents in 2015 (not only for the duct leakage, but all field verification and diagnostic testing compliance documents submitted to HERS providers), based on experience with the HERS providers, nonresidential duct leakage test verification documents represents fewer than 10 percent of the overall business (possibly fewer than 5 percent). HERS providers typically charge $30 for each project and $1 for each compliance document submitted. Comparatively, the union-based ATTCPs are expected to charge $40 per compliance document, while the nonunion ATTCPs are expected to charge $100 per compliance document. These charges are based on business decisions that each HERS provider and ATTCP must make to sustain operations and, in some cases, maintain a profit level. An ATT performing duct leakage tests could increase costs for a construction project from $9 to $68 per compliance document over an installing technician that is not a certified ATT. This cost difference is very small and difficult to predict with reasonable accuracy. There are clearly differences in cost, however, the overall effect is indiscernible and subject to the specific details of each construction project.

The hourly rates of lighting controls ATTs (as a proxy for mechanical ATTs) and HERS raters are very similar (between $50 and $200 per hour). Most ATTs charge $75 per hour, while most HERS raters charge $100 per hour. The construction inspection and functional testing for the duct leakage acceptance test can take between 2 and 10 hours, depending on system size, site conditions, and physical constraints. Therefore, it is possible that allowing ATTs to perform the duct leakage tests may result in labor cost savings between $75 and $250, but these savings may not be realized because there is a substantial amount of overlap in the range of hourly rates between ATTs and HERS raters.

ATTs may reduce their hourly rate for duct leakage acceptance tests when they submit a bid on the installation portion of the job. In effect, ATTs can even opt to waive their

hourly rate and perform the duct leakage acceptance tests at cost. This is an opportunity that the HERS raters do not have under the *2013 Standards*, which require the HERS raters to be a third-party agent that is independent from the builder.

As long as the enforcement circumstances do not change, it is likely that some builders would continue using HERS raters rather than ATTs due to filing costs in some situations, while others will use the ATT option to avoid a third-party evaluation and streamline their compliance.

The estimated 1,500 nonresidential duct leakage field verification and diagnostic testing registered with the HERS providers do not represent all the projects that should have been registered. Many projects go unreported by not pulling construction permits. One possible benefit of streamlining the compliance process may be a higher rate of compliance with no discernable loss of regulatory control or undue leniency. If it is easier to comply with the regulations, then it is more likely that builders will comply.

Potential Effects on Local Jurisdictions

Local jurisdictions (typically building and planning departments) would contend with two paths toward duct leakage testing compliance; however, the resulting process would be similar for both HERS raters and ATT compliance paths. The local inspector would verify that the prepared acceptance test form has a watermark from an approved ATTCP and, when appropriate, verify that the form is registered by the ATTCP online; these steps are parallel to steps taken to confirm HERS raters and documents. Staff is reasonably confident that local jurisdictions can be adequately educated to avoid any undue stress.

A notice of availability emailed to all building departments and posted online could provide this education by describing the alternative approval process, including:

- A list of the authorized ATTCPs that provide training to ATTs.
- A description of the required circumstances under which the testing is to be performed.
- A depiction of the appropriate forms and watermarks.
- The effective date (if appropriate).
- A script for the hotline staff to answer questions.

This notice could be followed up with a Fact Sheet and *Blueprint* articles, additional training as needed for building departments.

Energy Commission staff is committed to providing all necessary educational materials regarding the enforcement of the alternative procedure and will make these materials available to the relevant jurisdictions.

APPENDIX A:
Alternative Procedure to NA 7.5.3.2 Functional Testing (Step 2)

(a) Acceptance Test Technician (ATT) Performance of Duct Leakage Test in Lieu of HERS Raters.

(1) An ATT may perform the duct leakage verification required by NA 7.5.3.2 step 2 in lieu of a HERS rater, provided that is certified to by an Energy Commission approved Acceptance Test Technician Certification Provider (ATTCP) in accordance with the process set forth in Subdivision (b) .

(2) In lieu of NA7.5.3.2 step 2, the ATT must:

(A) Submit all required field verification and diagnostic testing compliance documentation to an approved ATTCP.

(B) Acceptance procedures for the certificate of acceptance documentation shall conform with the requirements in the Nonresidential Appendix NA 1.5.

(C) Submit the signed compliance document NRCA-MCH-04-A to the enforcement agency having jurisdiction in accordance with Nonresidential Appendix NA 1.3.4.

(b) Energy Commission Approval of ATTCP for Verification of Duct Leakage Test.

The ATT shall be certified by an Energy Commission approved ATTCP to perform the duct leakage acceptance test as required under the *2013* and *2016 Standards* (Sections 140.4(l), 141.0(b)2D, and 141.0(b)2E) in accordance with this alternative procedure. To be approved by the Energy Commission, an ATTCP must submit an additional application demonstrating all of the following, in addition to all of the requirements of Title 24, Part 1, and Section 10-103.2 (c):

- The ATTCP shall be approved and in good standing with the Energy Commission in accordance with 2016 Title 24, Part 1, Chapter 10, Section 10-103.2.
- The ATTCP shall maintain, or cause to be maintained by suitable contractual requirements, an electronic database approved by the Energy Commission that can record and hold for no less than five years duct leakage acceptance test compliance documentation as performed by its own certified ATTs.
- The ATTCP shall be capable of providing a print copy of each completed duct leakage acceptance test to the ATT that performed the test.
    - The copy shall bear the logo or other identifying insignia as approved by the Energy Commission on all pages of each duct leakage acceptance test compliance document.

    - The ATTCP shall provide a means of electronic verification of any duct leakage acceptance test compliance document to the enforcement agency having jurisdiction in accordance with Nonresidential Appendix NA 1.3.4.
- The ATTCP shall allow the Energy Commission access to its electronic system with the authority to visually inspect all records.
- The ATTCP shall provide all summary reports regarding the duct leakage acceptance test compliance documents as requested by the Energy Commission.
- The ATTCP shall provide all training, testing, and oversight necessary to certify ATTs to perform the acceptance test as required in Reference Nonresidential Appendix NA7.5.3 (Air Distribution Systems) and Reference Nonresidential Appendix NA2 (Nonresidential Field Verification and Diagnostic Test Procedures) in conjunction with this alternative procedure.
    - All training and testing materials must comply with the applicable requirements in Title 24, Part 1, Section 10-103.2 and must be approved by the Energy Commission.

APPENDIX B:
2013 and 2016 Title 24, Part 6 Excerpts

Title 24, Part 1, Section 10-109(h)

In addition to the procedures and protocols identified in the Alternative Calculation Method Approval Manuals and the Reference Appendices, the Energy Commission may authorize alternative procedures or protocols that demonstrate compliance with Part 6.

Title 24, Part 6, Section 140.4(l)

Air Distribution System Duct Leakage Sealing: Duct systems shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler airflow rate as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures in *Reference Nonresidential Appendices NA1 and NA2* if the criteria in Subsections 1, 2, and 3 below are met:

1. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space-conditioning system; and
2. The space conditioning system serves less than 5,000 square feet of conditioned floor area; and
3. The combined surface area of the ducts located in the following spaces is more than 25 percent of the total surface area of the entire duct system:
    - A. Outdoors; or
    - B. In a space directly under a roof that
        - a. Has a U-factor greater than the U-factor of the ceiling, or if the roof does not meet the requirements of Section 140.3(a)1B, or
        - b. Has fixed vents or openings to the outside or unconditioned spaces; or
    - C. In an unconditioned crawl space; or
    - D. In other unconditioned spaces.

Title 24, Part 6, Section 141.0(b)2D

Altered Duct Systems. When new or replacement space-conditioning system ducts are installed to serve an existing building, the new ducts shall meet the requirements of Section 120.4. If the space conditioning system meets the criteria of Sections 140.4(l)1, 2, and 3, the duct system shall be sealed as confirmed through field verification and

diagnostic testing in accordance with the procedures for duct sealing of an existing duct system as specified in *Reference Nonresidential Appendix NA2* to meet one of the following requirements:

1. If the new ducts form an entirely new or replacement duct system connected directly to the air handler, the measured duct leakage shall be equal to or less than 6 percent of the system air handler airflow as confirmed by field verification and diagnostic testing using the procedures in *Reference Nonresidential Appendix* Section NA2.1.4.2.1. Entirely new or replacement duct systems installed as part of an alteration shall be constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the existing duct system of the building, including registers, grilles, boots, air handlers, coils, plenums, and ducts, if the reused parts are accessible and can be sealed to prevent leakage.

2. If the new ducts are an extension of an existing duct system, the combined new and existing duct system shall meet one of the following requirements:

    a. The measured duct leakage shall be equal to or less than 15 percent of the system air handler airflow as confirmed by field verification and diagnostic testing using the procedures in *Reference Nonresidential Appendix* Section NA2.1.4.2.1; or

    b. If it is not possible to comply with the duct leakage criterion in Subsection 141.0(b)2Diia, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test performed by a certified HERS rater using the methods specified in *Reference Nonresidential Appendix* NA2.1.4.2.2.

EXCEPTION to Section 141.0(b)2Dii: Duct Sealing. Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos are exempt from the requirements of subsection 141.0(b)2Dii.

Title 24, Part 6, Section 141.0(b)2E

Altered Space-Conditioning Systems. When a space-conditioning system is altered by the installation or replacement of space-conditioning system equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:

1. For all altered units where the existing thermostat does not comply with *Reference Joint Appendix JA5*, the existing thermostat shall be replaced with a thermostat that complies with *Reference Joint Appendix JA5*. All newly installed space-conditioning systems requiring a thermostat shall be equipped with a thermostat that complies with *Reference Joint Appendix JA5*; and

2. The duct system that is connected to the new or replaced space-conditioning system equipment shall be sealed, if the duct system meets the criteria of Sections 140.4(l) 1, 2, and 3, as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures for duct sealing of altered existing duct systems as specified in *Reference Nonresidential Appendix NA2*, and conforming to the applicable leakage compliance criteria in Section 141.0(b)2D.

EXCEPTION 1 to Section 141.0(b)2Eii: Duct Sealing. Buildings altered so that the duct system no longer meets the criteria of Sections 144 (l)1, 2, and 3 are exempt from the requirements of Subsection 141.0(b)2Eii.

EXCEPTION 2 to Section 141.0(b)2Eii: Duct Sealing. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the *Reference Nonresidential Appendix NA2* are exempt from the requirements of Subsection 141.0(b)2Eii.

EXCEPTION 3 to Section 141.0(b)2Eii: Duct Sealing. Existing duct systems constructed, insulated or sealed with asbestos are exempt from the requirements of Subsection 141.0(b)2Eii.

APPENDIX C:
Comments and Responses

Staff published and docketed the staff report for the *Alternative Procedure to Home Energy Rating System (HERS) rater Nonresidential Duct Leakage Test Verification* on November 10, 2016. Staff held a public workshop (noticed on November 21, 2016) on December 19, 2016. A 60-day public comment period (Notice of Availability dated November 21, 2016) was held from November 21, 2016, to January 21, 2017 (61 days).

Ten comments from five commenters were received during the workshop and one written comment during the public comment period. The workshop transcripts have been entered into the docket and posted online for public review. The written comment was submitted to dockets by the commenter.

Staff will summarize all comments received provide a response, and indicate proposed changes proposed .

Written Comments

Abandonment of Independent Third-Party Requirements

Comment submitted by: Michael Bachand, Chief Executive Officer, CalCERTS, Inc.

Mr. Bachand agreed that the Acceptance Test Technicians are capable of completing the acceptance test requirements, and staff's proposal has many positive aspects. However, in his considered opinion, based on more than 10 years of experience in residential and nonresidential testing, the abandonment of an independent third-party technician requirement could have serious repercussions. Mr. Bachand believes that it could undermine the Energy Commission's long term goals for energy efficiency in nonresidential buildings and may delegitimize the importance of the verification process in the eyes of industry stakeholders. Mr. Bachand stated that the independent third-party provision has many benefits, including:

- Removing strong financial incentives to certify a building as compliant.
- Removing financial incentives for providers to falsely pass technicians in a quality assurance program.
- Safeguarding the inspection process.
- Improving compliance with the California Building Code.
- Being one of the fundamental differences between the California HERS program and other stacks.
- Improving enforcement, and removing bad actors and poor installation practices from the industry, which reduces energy costs for California's building owners.

Mr. Bachand formally requested that Energy Commission staff clarify their position on third-party independence and, in particular, to answer the following:

- What analysis was performed to justify the omission of these requirements for the ATTCPs?
- Was a similar analysis performed on behalf of HERS providers and raters?
- Does the Energy Commission intend to remove the third-party independence requirement for other acceptance technicians or for other tests?
- Can HERS providers expect a removal of the third-party independence requirements in the next iteration of Title 20 HERS Regulations?

Additionally, Mr. Bachand requested that staff discuss the reasoning for requiring third-party independence for the HERS program and not for the ATTCP program.

Staff Response

At this time, staff does not recommend removing third-party independence from any requirements in the HERS Regulations.

The HERS program was originally designed to bolster enforcement of the residential portion of the *Building Energy Efficiency Standards* and protect residential consumer investments from poor or improper installations. The concept and benefits of independent third-party HERS raters was an original foundation of the program and is the basis for the integrity of both the providers and raters.

The nonresidential acceptance test requirements (first introduced in the *2005 Building Energy Efficiency Standards*) was intended to give installation technicians a means of proving that an installed device operated as required by the approved designs and in compliance with the Standards. Thus third-party independence was not a necessary or desirable element for the acceptance test requirements. This protection or proof that the installing technician properly installed the device was meant to help motivate the technician to comply voluntarily with the Standards. Additionally, the building department inspector could then rely on the acceptance tests to approve the installation.

When the Energy Commission approved the *2005 Standards*, nonresidential testing and balancing (T&B) contractors (who would have normally done this testing) were traditionally trained to use traverse measurements (either the equal area method or Log-Tchebycheff method) as the primary air-flow measuring process. These methods are suitable for typical hard duct installations that are common for nonresidential buildings. However, these specific installations (described above) would typically use flexible ducting. Transverse measurement methods are not suitable for flexible ducting applications. For flexible ducting, the duct pressurization and flow measurement procedures established for HERS raters by the Energy Commission are more suitable. Furthermore, the Energy Commission determined that traverse measurements produced results that were less reliable than the pressurization measurement method overall.

Because the Energy Commission could not regulate the training of T&B contractors as it could for HERS raters, the *2005 Standards* required that the duct installation contractor use the pressurization measurement method to demonstrate compliance with the duct leakage limitations and that a HERS rater verify the results. Thus, the *2005 Standards* essentially required repeating the same test for each installation, performed once by the installer and once by the HERS rater.

Verbal Comments

Table 2: Verbal Comments from Staff Workshop (12/19/2016)

Commenter	Comment	Staff Response
Dave Diaz, Sheet Metal Worker, Local 104	Under the *2016 Standards*, flexible duct installations will be limited to five feet in nonresidential buildings.	While there are changes to duct installation regulations in the *2016 Standards* , this does not affect existing installations. These duct leakage acceptance tests are most often performed as part of an HVAC equipment change out and not just as a new ducting installation. Therefore, the proposed alternative is relevant.
Chris Walker, California Association of Sheet Metal and Air Conditioning Contractors	In regards to the proposed requirement, "The ATTCP shall maintain an electronic database approved by the Energy Commission." *Located in Appendix A, subsection (b), second bullet.* Consider using a different word than "maintain" to allow for the ATTCP to contract out the database services.	Staff has amended the language to read, "…to maintain or to cause to be maintained by suitable contractual requirements…"
	Are the *Blueprint* and *Fact Sheet* training materials limited to only building departments?	The *Blueprint* and *Fact Sheet* training materials are public information, available on the Online Resource Center, and

Commenter	Comment	Staff Response
		assessable to interested persons. The Commission is also willing to provide presentation and training to the public.
Patrick Pico, Bay Area Sheet Metal JATCs	In support of the alternative procedure. Their technicians have gone through training to perform the duct leakage testing. This curriculum has been in place for over 15 years and has recently been updated to include the latest SMACNA standards and HERS methodologies.	Staff thanks Mr. Pico for his comment.
George Nesbitt, HERS rater	There is very little compliance out there with the current requirements to require a HERS rater verification on nonresidential duct leakage testing. I am concerned that we're adding another option when we cannot enforce the current requirements.	Staff agrees that compliance with the Standards is not ideal. However, staff is confident, based on the performance of the Lighting Controls ATTCPs that a positive impact on compliance can be achieved with the Mechanical ATTCPs.
	What does the new procedure tell us that the current procedure does not?	The alternative procedure will record all duct leakage tests performed, as opposed to recording only the sampling test performed by the HERS rater under the current procedures (HERS raters may perform sample testing, one for every seven installations). Other than that, there are no

Commenter	Comment	Staff Response
		differences in the acceptance test itself. The same type of data is being collected.
Gary Andis, Director of Certification for NEMIC	Can the current duct leakage test be substituted for the SMACNA Duct standards duct leakage test?	This is not permitted under the alternative procedure. That change can only be proposed for the *2019 Standard* rulemaking.
	If approved, will the ATTCPs have 90 days to get Energy Commission approval to participate in the alternative procedure?	The Energy Commission will consider any application modifications provided by the ATTCPs in a timely manner.
	What time and process will be available to suggest modification to the forms for the duct leakage test?	An approved Mechanical ATTCP, can recommend modifications to any acceptance test forms in an effort to improve them for use by ATTs. Approved Mechanical ATTCPs may submit amendments to their applications now.
	If we want to get the SMACNA standards as equal to the current test procedures for the *2019 Standards*, how soon do we need to get that submitted?	Staff encourages all ATTCPs to become involved in the *2019 Standards* rulemaking process. Mr. Andis was provided a direct link to the rulemaking page to become involved and contact information for relevant staff.