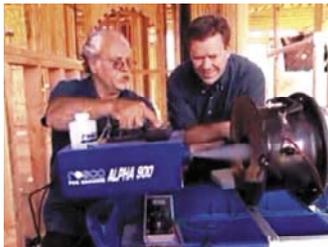


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Change-outs!
Don't Be Left-out!

Pictured above: Scott Johnson shows Steve Easley how to perform a smoke-test with a duct blaster to help demonstrate a system's duct leakage. Research shows that about 30 percent of the heated or cooled air in a home is lost from duct leaks.

Changes in California's Energy Code for 2005

Q. What are the new 2005 requirements beginning on October 1, 2005 for installers when changing out HVAC equipment, including an air handler, outdoor condensing unit, cooling or heating coil, in an existing building?

A. Field research shows that ducts in existing homes on average allow about 30 percent of the heated or cooled air to wastefully leak out before it reaches the rooms it was intended to heat or cool. In this time of a looming peak electricity crisis, this is unacceptable.

It is a particularly bad idea to waste the energy savings from a new efficient air conditioner or furnace by connecting it to a leaky duct system. By decreasing the leakage of the system, the effectiveness of the equipment is increased, the airflow improves, and the space heats or cools faster, providing the homeowner better performance, lower utility bills, and more comfort.

Also, since leaky return ducts suck in air that may be polluted from the environment they are in (attic, crawlspace, garage), sealed ducts will produce a more healthy living space. To accomplish these benefits, starting October 1, 2005, California contractors in certain climate zones will be required to do duct sealing when changing out HVAC equipment in existing buildings. Third-party field verification by a certified home energy rater (HERS rater) also is required at least on a sampling basis to insure that the duct sealing is accomplished.

These new requirements apply when replacing the air handler, the outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger. These replacements are considered alterations under the Standards.

For these change-outs in existing low-rise residential buildings in climate zones 2 and 9 through 16, contractors must use duct pressurization equipment (commonly called

a "duct blaster") to test the leakage of the duct system following protocols adopted by the Commission when 40 linear feet or more of the duct system is in unconditioned space. Contractors must comply with one of the following four duct sealing requirements:

- i. The measured duct leakage must be less than 15 percent of fan flow; or
- ii. The measured duct leakage to outside must be less than 10 percent of fan flow; or
- iii. The measured duct leakage must be reduced by more than 60 percent relative to the measured leakage prior to the installation or replacement of space conditioning equipment, and a visual inspection, including a smoke test, must demonstrate that all accessible leaks have been sealed; or
- iv. If it is not possible to meet the duct requirements above, all accessible leaks must be sealed by the contractor and verified through a visual inspection and a smoke test by a certified HERS rater.

The ducts must meet duct sealing requirements, and be insulated to R-4.2 (climate zones 6, 7 and 8), R-6 (climate zones 2 and 9 through 13), or R-8 (climate zones 14, 15, and 16), contractors must use Commission-approved sealing materials and comply with the California Mechanical Code requirements for ducts.

If the installed ducts form an entirely new duct system, the measured duct leakage must be less than 6 percent of fan flow. If the installed ducts are an extension of an existing duct

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system must meet one of the four leakage requirements stated above.

For duct sealing, the contractor is required to test every duct system that is subject to the requirements as described above, and complete and sign page 4 of the CF-6R form for every system. The CF-6R must then be posted or be provided to the building department, and a copy of the CF-6R must be given to the HERS rater for every home.

The HERS rater must do the required field verification and testing (this could be on a sampling basis as discussed below), and then complete a CF-4R form for every home.

The CF-4R must then be provided to the building department before the home can be "finalized." If the contractor complies with requirements i, ii

or iii above, the homeowner can choose either to have verification testing for his/her home or to be part of a sample, in which case the HERS rater is required to perform verification testing in only 1 out of 7 of the contractor's installations.

If the contractor is unable to comply with requirements i, ii or iii, and therefore must use requirement iv above, sampling is not an option for the HERS rater, and the HERS rater must visually inspect and smoke test every home for which the contractor uses this option.

During sampling, if the tested duct system does not pass, the HERS rater must test a second duct system from the sampling group.

If the second duct system does not pass, then the HERS rater must test the other 5 duct systems in the group, which have been previously designated by the HERS provider (in consultation with the HERS rater and the installing contractor),

before a CF-4R may be provided to the building department.

In addition to the duct sealing requirements

described above, when split system air conditioners are changed-out in existing low-rise residential buildings in climate zones 2 and 8 through 15, contractors are required to either do refrigerant charge measurement using Commission-approved protocols or install a thermostatic expansion valve (TXV). The refrigerant charge measurement or installation of a TXV must be verified by a certified HERS rater with the homeowner choosing either to have verification testing for his/her home or to be part of a sample as described above for duct sealing.

The refrigerant charge measurement protocol includes airflow measurement. The Commission recommends airflow measurement in accordance with the Commission-approved protocols for every air conditioner change-out, including package and split-air-conditioners and even when the TXV option is chosen for compliance.



**Thermostatic
Expansion
Valve**

Also, space conditioning component change-outs must meet the Standards requirements for that component. The replacement unit must meet or exceed appliance efficiency standards (e.g., air conditioners manufactured after January 23, 2006 must meet or exceed an SEER of 13.0). If a thermostat is replaced, the replacement must be a setback thermostat ("ramping" setback thermostats for heat pumps). If cooling system refrigerant suction lines are replaced, they must meet minimum insulation requirements.

By law, HERS raters must be certified by a HERS provider and be independent from the HVAC contractor. HERS raters cannot have a financial interest in the installation of the equipment. HERS raters cannot be employees of the contractor whose work they are verifying, nor can HERS raters have a financial interest in the contractor's business, or advocate or recommend the use of any product or service that they are verifying.



Proper A/C Installation
5. Check for right amount
of refrigerant



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Change-outs! Don't Be Left-out!

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The Commission expects HERS raters to enter into a contract with the building owner (or the building owner's agent) to provide independent, third-party diagnostic testing and field verification. The HERS rater cannot be hired by the installing contractor (however, a three-way contract between the building owner, installing contractor and the HERS rater is acceptable). Currently there are two Commission-approved HERS providers, CHEERS and CalCERTS, who train, certify and oversee HERS raters. Information about the HERS providers can be found at: <http://www.CHEERS.org> and <http://www.CalCERTS.com>.

Duct sealing is also required for change-outs of the same HVAC components in existing nonresidential buildings, high-rise residential buildings and hotels and motels. These requirements are very similar but a little different than for low-rise residential buildings. The duct sealing requirements must be met when single zone space conditioning equipment components are replaced and when at least 25 percent of the ducts are installed outside of the building or in unconditioned space (above an insulated drop or sheetrock ceiling).

Duct sealing must comply with requirements i, ii or iv above; complying with requirement iii is not an option. The same requirements apply for HERS rater field verification testing as for low-rise residential buildings.

When ducts are installed outside of the building or in unconditioned space in existing nonresidential, high-rise residential buildings and hotels and motels in all climate



zones and for all space conditioning system types, the ducts must meet the duct sealing requirements above, have R-8 duct insulation, use Commission-approved sealing materials and comply with the California Mechanical Code requirements for ducts.

Supply ducts installed inside the conditioned space must comply with the California Mechanical Code requirements for ducts.

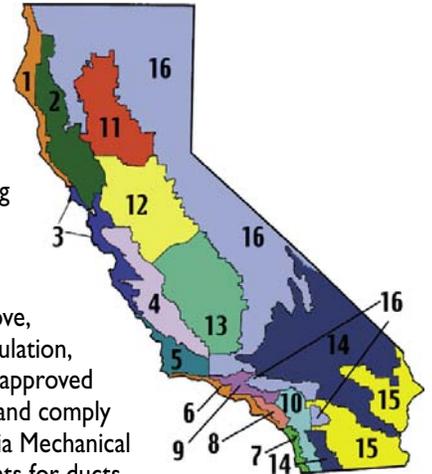
Change-outs of components in existing nonresidential buildings, high-rise residential buildings and hotels and motels must meet the requirements in the Standards for that component in the same way as they must be done for space conditioning change-outs in existing low-rise residential buildings (see the Standards mandatory requirements for more information).

To find out in which climate zone your project is located, go to the Commission's website:

http://www.energy.ca.gov/maps/climate_zone_map.html and view the climate zone map. You can find a listing of the climate zone for each California city on that webpage, or you can also call the Energy Standards Hotline and ask Hotline staff to look it up for you (916-654-5106, or 800-772-3300 in California only).

Note that there are three exceptions to the above duct sealing requirements:

1. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing (tested by a HERS rater).
2. Duct systems with less than 40 linear feet in unconditioned spaces.
3. Existing duct systems constructed, insulated, or sealed with asbestos.



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Change-outs! Don't Be Left-out!

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When replacing space conditioning equipment (or components) in low-rise residential buildings, there are other alternatives to HERS verification of duct sealing (See Table 8-3 from the Residential Compliance Manual, Chapter 8, shown below).

Table 8-3 – Alternatives to Duct Sealing and Refrigerant Charge Measurement

Climate Zone	Option 1 0.92 AFUE	Option 2 SEER-14 & EER-12, with either TXV or refrigerant charge measurement, plus Increased Duct Insulation	Option 3 SEER-14 & EER-12 with either TXV or refrigerant charge measurement, plus either 0.92 AFUE or 0.82 AFUE with Increased Duct Insulation
CZ2	Yes	No	Yes
CZ9	No	No	Yes
CZ10	No	Yes	Yes
CZ11	No	No	Yes
CZ12	Yes	No	Yes
CZ13	No	Yes	Yes
CZ14	No	No	Yes
CZ15	No	Yes	Yes
CZ16	Yes	No	Yes

1. Increased duct insulation refers to an additional R-4 insulation wrap on existing ducts and R-8 duct insulation for all new ducts.

2. Package systems may use Option 2 or 3 without meeting the requirement for a TXV (or refrigerant charge measurement)

Note - There are no duct sealing requirements in climate zones 1 and 3-8.

In climate zone 8, to avoid TXV or refrigerant charge measurement requirements, a SEER 14 air conditioner or a 0.82 AFUE furnace may be used.



- In **Climate Zones 2 and 12**: In these two climate zones, the contractor may replace an existing air conditioner with an air conditioner with any SEER that complies with the Appliance Efficiency Regulations (SEER 10 for units manufactured prior to January 23, 2006, SEER 13 for units manufactured on or after January 23, 2006), as long as the contractor also replaces the existing furnace or heat pump with a 0.92 or higher AFUE furnace or a 9.0 or higher HSPF heat pump. When this occurs there is no requirement for duct sealing or HERS verification.

- **Climate Zone 16**: In this climate zone the contractor may replace an existing air conditioner with an air conditioner with any SEER that complies with the Appliance Efficiency Regulations (SEER 10 for units manufactured prior to January 23, 2006, SEER 13 for units manufactured on or after January 23, 2006), as long as the contractor also replaces the existing furnace or heat pump with a 0.92 or higher AFUE furnace or a 10.0 or higher HSPF heat pump.

When this occurs there is no requirement for duct sealing or HERS verification.

- In **Climate Zones 10, 13, and 15**: In these three climate zones the contractor may replace an existing air conditioner
 - with an air conditioner that has a 14 or higher SEER and also has a 12 or higher EER, and
 - either does a refrigerant charge measurement or installs a TXV, and
 - adds R-4 duct wrap to all the ducts. When this occurs there is no requirement for duct sealing or HERS verification duct testing. There is, however, a requirement for HERS verification of the refrigerant charge measurement or the TXV and the EER. These measures can be HERS verified through sampling of 1 in 7 installations.

- In **Climate Zones 2 and 9 through 15**: In these eight climate zones the contractor has two choices:

1. The contractor may replace an existing air conditioner with an air conditioner that has a 14 or higher SEER and also has a 12 or higher EER, and
 - either does a refrigerant charge measurement or installs a TXV, and
 - replaces the existing furnace or heat pump with a 0.92 or higher AFUE furnace or with a 9.0 or higher HSPF heat pump.

When this occurs there is no requirement for duct sealing or HERS verification of the duct testing. There is, however, a requirement for HERS verification of the refrigerant charge measurement or TXV and the EER. These measures can be HERS verified through sampling of 1 in 7 installations; or

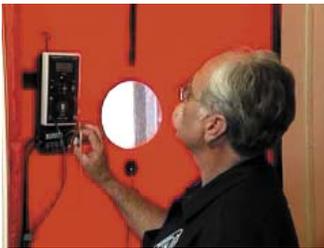
2. the contractor
 - may replace an existing air

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Training is available to companies and groups on these new requirements. To request training contact the Commission by e-mail or call

John Eash at :

jeash@energy.state.ca.us

[(916) 653-7181]

or Nelson Peña at:

npena@energy.state.ca.us

[(916) 654-4217].

conditioner with an air conditioner that has a 14 or higher SEER and also has a 12 or higher EER, and

- either does a refrigerant charge measurement or installs a TXV, and
- replaces the existing furnace or heat pump with a 0.82 or higher AFUE furnace or 8.5 or higher HSPF heat pump, and
- adds R-4 duct wrap to all the ducts in unconditioned space.

When this occurs there is no requirement for duct sealing or HERS verification of the duct testing. There is, however, a requirement for HERS verification of the refrigerant charge measurement or TXV and the EER. These measures can be HERS verified through sampling of 1 in 7 installations.

- In **Climate Zone 16**: In this climate zone the contractor has two choices:
 1. the contractor may replace an existing air conditioner
 - with an air conditioner that has a 14 or higher SEER and also has a 12 or higher EER, and
 - either does a refrigerant charge measurement or installs a TXV, and
 - replaces the existing furnace or heat pump with a 0.92 or higher AFUE furnace or with a 10.0 or higher HSPF heat pump.
 When this occurs there is no requirement for duct sealing or HERS verification of the duct testing. There is, however, a requirement for HERS verification of the refrigerant charge measurement or TXV and the EER. These measures can be HERS verified through sampling of 1 in 7 installations; or
 2. the contractor
 - may replace an existing air



conditioner with an air conditioner that has a 14 or higher SEER and also has a 12 or higher EER and

- either does a refrigerant charge measurement or installs a TXV and
- replaces the existing furnace or heat pump with a 0.82 or higher AFUE furnace or 9.0 or higher HSPF heat pump and
- adds R-4 duct wrap to all the ducts in unconditioned space.

When this occurs there is no requirement for duct sealing or HERS verification of the duct testing. There is, however, a requirement for HERS verification of the refrigerant charge measurement or TXV and the EER. These measures can be HERS verified through sampling of 1 in 7 installations.

- In **Climate Zones 1 and 3 through 8**: In these seven climate zones there are no low-rise residential requirements for duct sealing. In climate zone 8 there is a low-rise residential requirement for either refrigerant charge measurement or a TXV. In climate zone 8 the contractor may replace an existing air conditioner with a 14 or higher SEER air conditioner or replace an existing furnace or heat pump with a 0.82 or higher AFUE furnace or 8.5 HSPF heat pump. When this occurs there is no requirement for refrigerant charge measurement or TXV installation or HERS verification.

The Commission is working with HVAC trade associations such as the Institute of Heating and Air Conditioning Industries (IHACI), utilities, the Contractors State License Board (CSLB), distributors, and manufacturers to provide fact sheets for contractors to use as handouts to consumers to better explain these new requirements when bidding for change-out jobs.

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Title 24

Energy Efficiency Standards Training

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Governor

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Links for training on issues relating to California Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24, Part 6) is available on the Energy Commission's website at:

<http://www.energy.ca.gov/title24/training>

For training offered by the utilities and other organizations please see the following websites:

PG&E:

<http://www.pge.com/stockton>

SCE:

<http://www.sce.com/RebatesandSavings/EnergyCenters/workshops.htm>

SMUD:

<http://www.smud.org/education/index.html>

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<http://register.cabec.org/ceperegistration.php>

Nonresidential Fenestration Certification Initiative (NFCI)

<http://nfc.ecst.csuchico.edu>

Residential Lighting Design Guide

– Best practices and lighting designs to help builders comply with California's 2005 Title 24 energy code
<http://www.cltc.ucdavis.edu/>



Need Help? CALL THE ENERGY HOTLINE @

(800) 772-3300 or (916) 654-5106