HVAC Title 24 Change Out Regulations and Rater Verification

California Energy Rater and Energy Building Consultant Track

Tuesday, February 19, 2008 — Session 3 — 8:30-10:00 a.m.

2008 RESNET Conference—"A Changing Climate - An Emerging Opportunity"

WELCOME!

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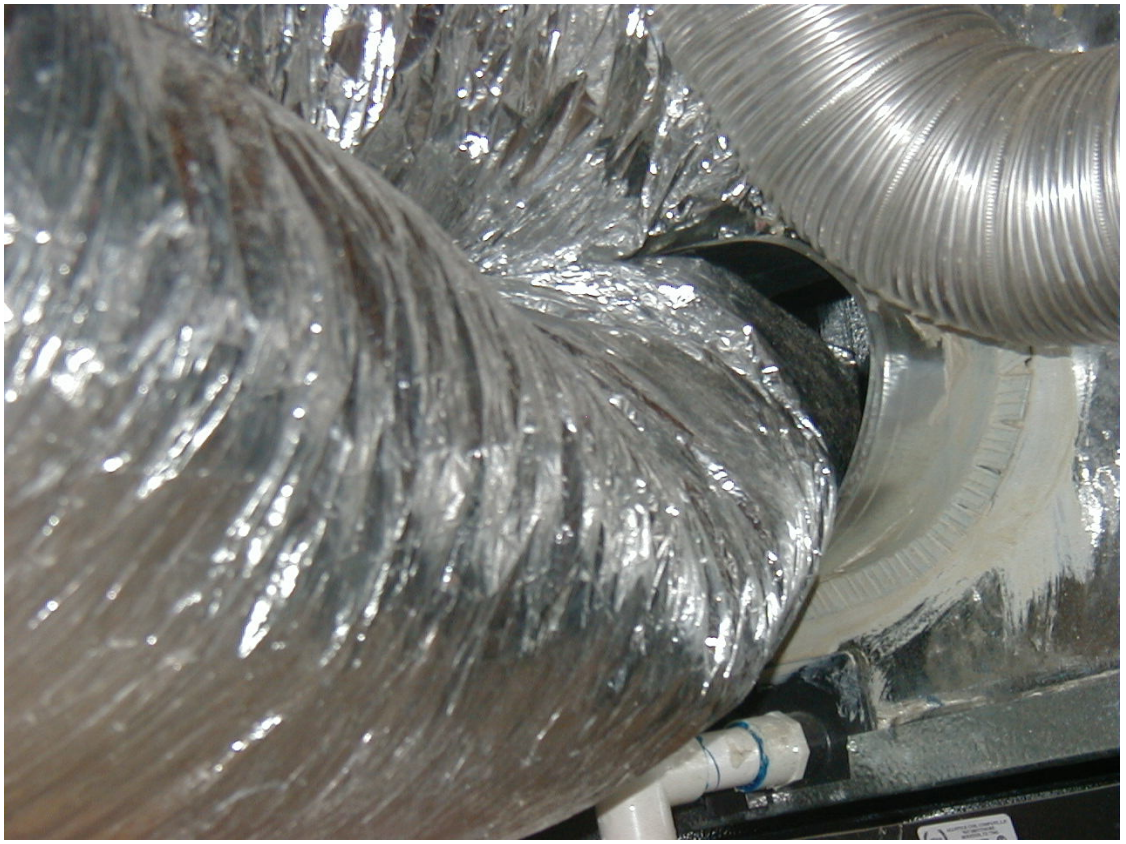
ENERGYGUIDE


Goodman



Climate Zones

Residential Duct Testing Rules

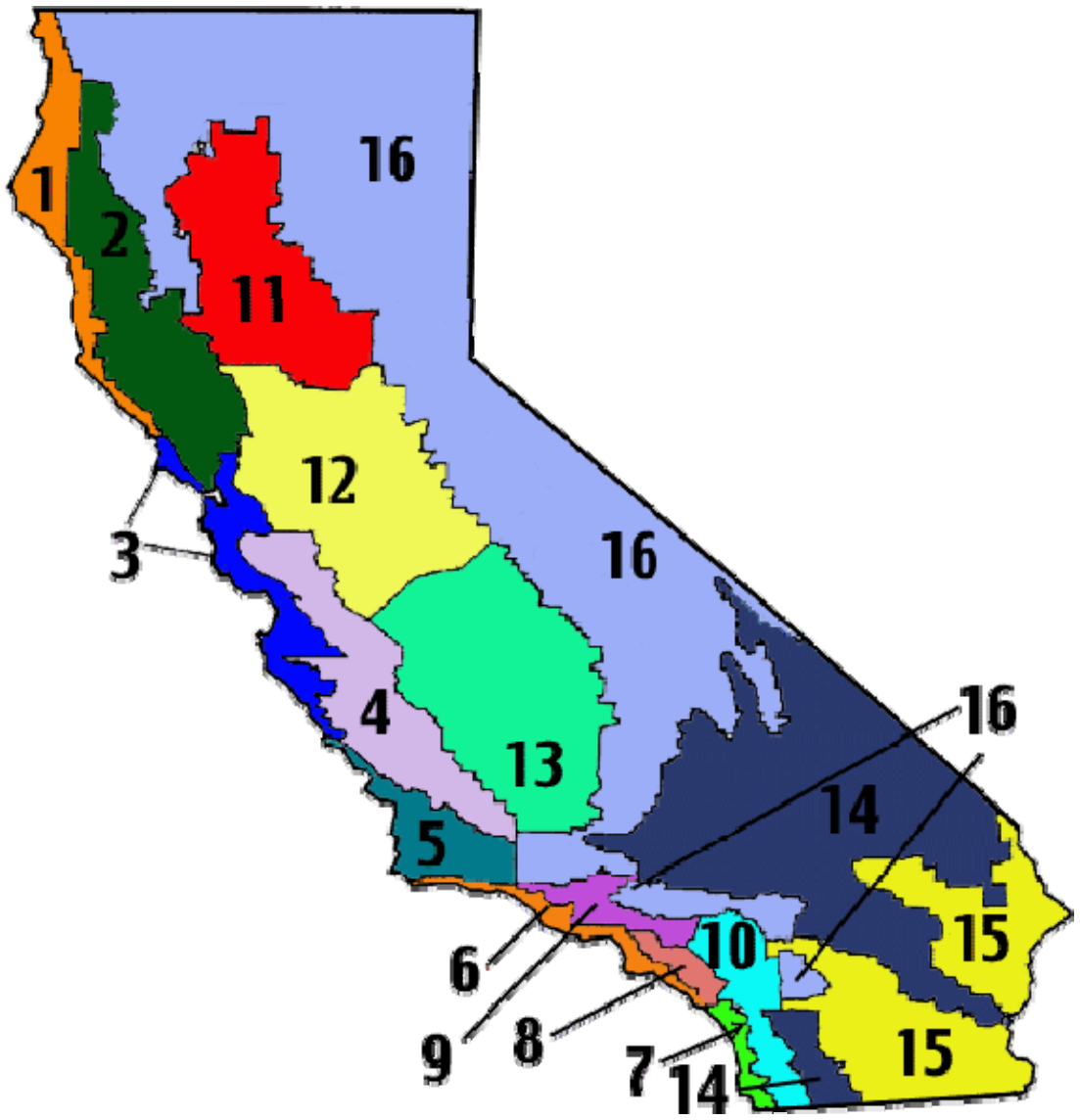
Apply ONLY in Climate Zones:

2, 9, 10, 11, 12, 13, 14, 15 & 16

Exempt Climate Zones

1, 3, 4, 5, 6, 7, 8

California Climate Zones



Ducts previously sealed

Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing (Verified by a HERS rater).

Ducts in Unconditioned Space

At least 40 linear feet of duct work must be located in unconditioned space.

Asbestos Exemption

Ductwork made with, insulated or sealed with asbestos is EXEMPT.

Duct Testing Required When Any of the Following Components are Replaced

Air handler or furnace

Outdoor condensing unit (split systems)

Heating or cooling coil

Furnace heat exchanger

Package unit

Additional Ductwork

Adding or replacing 40 linear feet or more of duct work in unconditioned space.

Maximum Leakage Rate Existing Duct Work

1. <15% of fan flow

   400 cfm/ton * .15 = 60 cfm

   3 tons * 60 cfm = <180 cfm target

   or

2. <10% Duct Leakage to Outside of house (whole house blower door test plus duct leakage test).

   or

Maximum Leakage (Continued)

3. >60% Reduction

   Test before replacement and after:

   600 cfm initial test (example only)

   60% reduction = <240 cfm target.

4. Seal all accessible leaks and verify by HERS Rater (with “smoke”)

Sealing All Accessible Leaks

Smoke Test

Inject theatrical or other non-toxic fog (smoke) into the duct blaster, with all grills and registers sealed.

Visually inspect all accessible portions of the duct system.

PASSES WHEN:

1. No visible smoke from accessible portions of the duct system.

Or

2. Visible smoke coming only from heat exchanger area of equipment.

Visual Inspection of All Accessible Leaks

Verify that the following locations have been sealed.

- Connections to plenums, and/or FAU.
- Refrigeration line and other penetrations into FAU.
- Air handler door panel.
- Register boots to surrounding material.
- Connections between lengths of duct including take-off, wyes, tees, and splitter boxes.

AND (Next page)

Visual Inspection of All Accessible Leaks

Verify that there are no excessively damaged portions of the duct system.

- Flex Duct – No more than a total of 12” linear of split or cracked vapor barrier.
- Crushed ducts where cross sectional area is reduced by 30% or more.
- Metal ducts with rust or corrosion resulting in leaks >2” in any dimension.
- Ducts subject to animal infestation resulting in in leaks > 2” in any dimension.

Maximum Leakage Rates Completely New Duct System

HVAC system change-outs that include all new duct work – same duct testing standards as new construction.

<6% of air flow (<24 cfm / ton)

Verification

1. Contractor tests

2. HERS Rater verifies

Residential Alternatives

Are there any alternatives to performing the duct sealing and testing?

Table 8-3 – Alternatives to Duct Sealing

	Option 1	Option 2	Option 3
Climate Zone	0.92 AFUE	SEER-14 & EER-12, with either TXV or refrigerant charge measurement, plus Increased Duct Insulation	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.

Option 1

Climate Zones 2, 12, & 16 only

0.92 AFUE Furnace

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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: 0.82 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-6 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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Change-outs!
Don't Be Left-out!

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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 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.

Option 2

Climate Zones 10, 13, & 15 only

SEER 14

EER 12

TXV

R-8 insulation on all new duct work

Additional R-4 on all existing duct work

Option 3—All Climate Zones

SEER 14

EER 12

TXV

Plus

0.82 AFUE Furnace

R-8 insulation on all new duct work

Additional R-4 on all existing duct work

SEER 14

EER 12

TXV

Plus

0.92 AFUE Furnace

TXV

Options 2 & 3 do not require TXV's with package systems.

Setback Thermostat

§152(b) 1 C

If the thermostat is to be replaced as part of the alteration, then a setback thermostat is required as described in Chapter 4.

Fuel Switching

§152(b) 1 C

For prescriptive compliance, new electric resistance heating systems are prohibited in alterations unless the system being replaced is an electric resistance heating system. If the existing system is gas, propane or LPG, then new electric resistance systems are not permitted. However, changing from a gas, propane or LPG space heating system to an electric heat pump is allowed as long as the heat pump efficiency meets minimum efficiency standards, and the heat pump installed size is shown to result in no more TDV energy use than the standard design heat pump using the performance method.

Table 8-4 – Acceptable Replacement Heating System Fuel Source(s)

Existing Heating System Fuel Source	Acceptable Replacement Heating System Fuel Source(s)
Electric	Electric, natural gas, or equipment with efficiency equal to or better than existing system*
Natural gas	Natural gas, or equipment with efficiency equal to or better than existing system* or a heat pump with equal or lower TDV energy use than a standard design system.
LPG	Liquefied petroleum gas, natural gas, or equipment/ system with efficiency equal to or better than existing system* or a heat pump with equal or lower TDV energy use than a standard design system.
*Proof that equipment has an efficiency that is equal to or better than the existing system can be demonstrated by an approved compliance program or other approved alternative calculation method to compare the TDV energy use of the existing system to the proposed system.	

Example 8-13

Question

I would like to replace my outdoor units in my existing house in climate zone 12 without changing the indoor unit. Can I use Table 8-3 to avoid duct sealing?

Answer

No, without changing the outdoor unit along with a matching indoor unit, it is not possible to achieve EER of 12 that is required by Table 8-3. Without changing the indoor unit as well as the outdoor units, duct sealing is the only prescriptive alternative.

Example 8-14

Question

Is HERS verification required if I choose an alternative listed in Table 8-3 to avoid duct sealing in an alteration?

Answer

Yes, HERS verification is required to verify EER of 12 and existence of TXV. However, this should be simpler verification than duct sealing.

Example 8-15

Question

How could I use Table 8-3 to avoid duct sealing if I am replacing my air conditioning unit in climate zone 11?

Answer

Based on Table 8-3, the only option available to avoid duct sealing is Option 3, the combination heating and cooling option. You must install a SEER 14 & EER 12 (note that your unit must meet both SEER of 14 AND EER of 12) equipped with a TXV (or refrigerant charge), plus a 0.92 AFUE furnace. Instead of a 0.92 AFUE furnace, you may install a 0.82 AFUE furnace and add R-4 insulation to your existing ducts and install R-8 insulated new ducts. A HERS rater must verify the TXV and the EER of 12. Note that to achieve the EER of 12 the outdoor unit must be matched with a proper indoor unit.

Example 8-16

Question

If the house in the example above is located in climate zone 13, what options do I have to avoid sealing ducts?

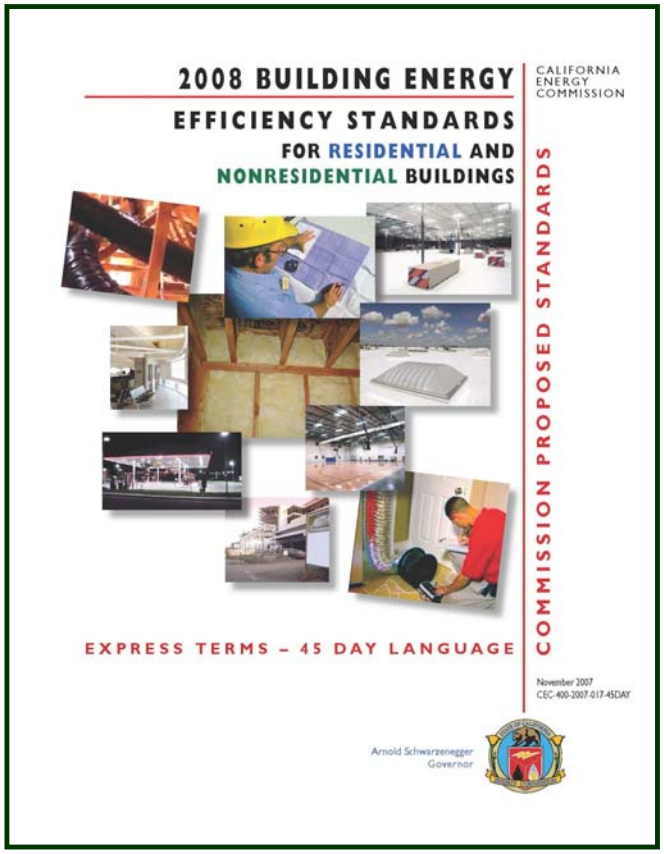
Answer

In climate zone 13, you have two options; Option 2, the cooling option and Option 3, the combination heating and cooling option. You can choose either option to avoid duct sealing.

Option 3 is similar to the answer in the example above.

Under Option 2, you must install a SEER 14 & EER 12 (note that your unit must meet both SEER of 14 AND EER of 12) equipped with a TXV (or airflow measurement), add R-4 insulation to your existing ducts and install R-8 insulated new ducts. A HERS rater must verify the TXV and the EER of 12. Note that to achieve the EER of 12 the outdoor unit must be matched with a proper indoor unit.

2008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FOR RESIDENTIAL AND
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CALIFORNIA ENERGY COMMISSION
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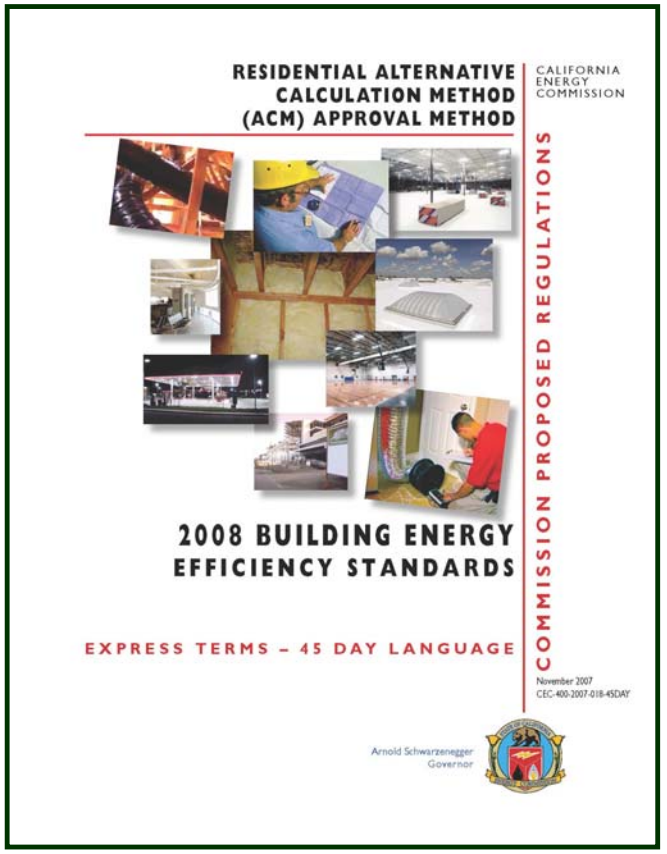
EXPRESS TERMS – 45 DAY LANGUAGE
November 2007
CEC-400-2007-017-45DAY
Arnold Schwarzenegger
Governor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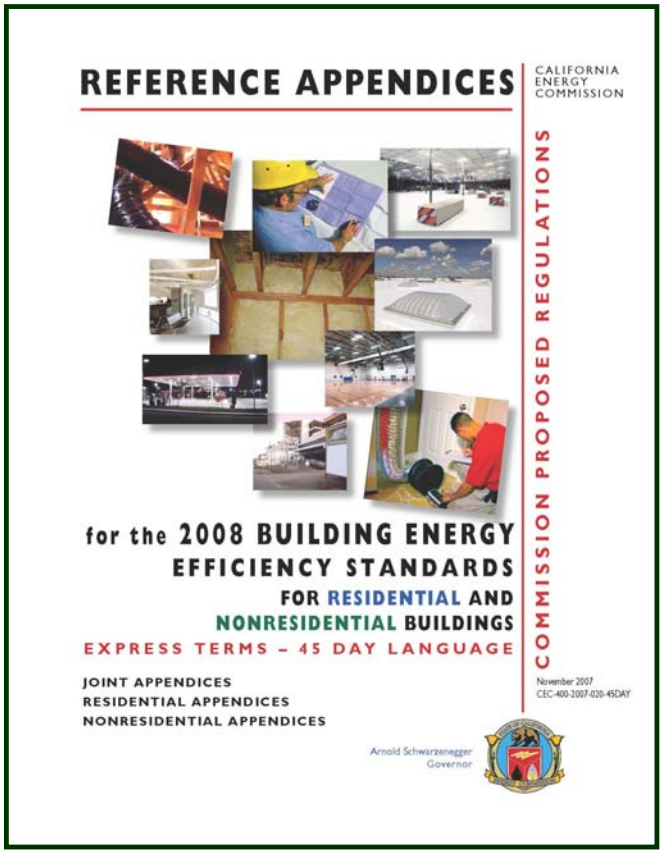
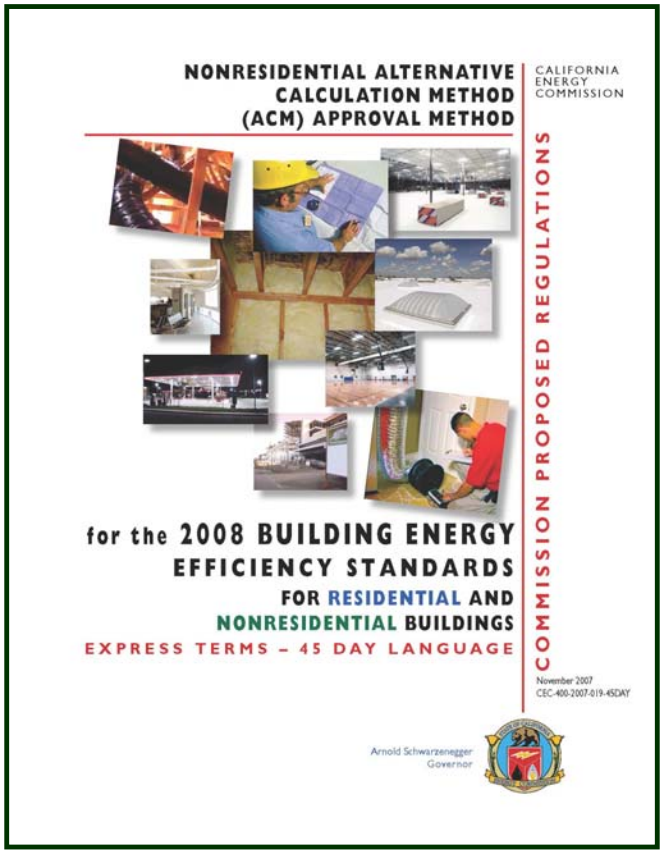




Potential New Measures

Low Leakage Ducts in Conditioned Space — RA4-2008

Compliance credit can be taken for verified duct systems that have air leakage to outside conditions equal to or less than 25 cfm when measured in accordance with Residential Appendix Section RA4-4.3.3. Field Verification for ducts in conditioned space is required. Duct sealing is required.

Low Leakage Air Handlers — RA4-2008

Compliance credit can be taken for installation of a factory sealed air handler unit tested by the manufacturer and certified to the Commission to have achieved a 2 percent or less leakage rate. Field verification is required. Duct Sealing is required.

Potential New Measures
(CONTINUED)

Improved Refrigerant Charge — RA 5-2008

Package D requires in some climate zones that split system air conditioners and heat pumps be diagnostically tested in the field to verify that they have the correct refrigerant charge (see Residential ACM Manual Section 4.7.3). For the performance method, The Proposed Design is modeled with less efficiency if diagnostic testing and field verification is not performed. The system must also meet the Adequate Airflow requirement.

Installation of Charge Indicator Light — RA7-2008

Package D specifies a Charge Indicator Light can be installed as an alternative to refrigerant charge testing. The existence of a Charge Indicator Light has the same calculated benefit as refrigerant charge testing. And requires field verification.

Potential New Measures
(CONTINUED)

Evaporatively Cooled Condensers **RA4-2008; RA7-2008**

Compliance credit can be taken for installation of evaporatively cooled condensers. Duct Sealing is required. Field verification is required.

Ice Storage Air Conditioners **RA4-2008; RA7-2008**

Compliance credit can be taken for installation of Distributed Energy Storage equipment. Duct Sealing is required. Field verification is required.

2.1 General

At the beginning of the CF-1R, notification of the use of HERS or NSHP shall be prominently displayed.

RA2.3 Summary of Documentation and Communication

For dwellings that have features requiring HERS verification, the documentation author shall submit the certificate of compliance information in electronic format to a HERS provider's data registry to register the document data. After submittal of the Certificate of Compliance information, the documentation author shall access the registered Certificate of Compliance from the provider's data registry for submittal to the builder.

The Builder shall make available to the HERS rater a copy of the registered Certificate of Compliance that was approved/signed by the principal designer/owner and submitted to the building department. The registered copies submitted to the HERS provider and to the HERS rater may be in paper or electronic format.

RA2.3 Summary of Documentation and Communication—(CONTINUED)

When the installation is complete, the builder or subcontractor responsible for the performance of the installation shall make arrangements for transmittal of the Installation Certificate information to the HERS provider data registry. After submittal of the Installation Certificate information, the builder or subcontractor shall access the registered Installation Certificate from the provider's data registry, sign the registered Installation Certificate, post a copy at the building site for review by the building inspector, and submit a copy to the building department.

RA2.3 Summary of Documentation and Communication—(CONTINUED)

The HERS rater shall confirm that transmittal to the HERS provider's data registry of the Certificate of Compliance information and the Installation Certificate information has been completed for each dwelling unit having features requiring HERS verification. The HERS rater shall complete the field verification and diagnostic testing as specified in Section RA2.6. The HERS rater shall enter the test results into the HERS provider's data registry.

The HERS provider shall make available registered copies of the Certificate of Field Verification and Diagnostic Testing, to the HERS rater, builder, and building department.

RA2.3 Summary of Documentation and Communication—(CONTINUED)

The building department shall not approve a dwelling unit for occupancy until the building department has received, for filing with the building plans, **a registered** copy of the **Installation Certificate** that has been signed by the builder or subcontractor, **and** a **registered** copy of the **CF-4R Certificate of Field Verification and Diagnostic Testing** that has been signed by the certified HERS rater, **or** has confirmed that the enforcement agency's authorized submittal to the HERS provider data registry of the documents has been completed.

RA3.1.4.3.10 Verified Low Leakage Air Handler with Sealed and Tested Duct System

An additional credit is available for verified low leakage ducts if a Low Leakage Air Handler is installed. The low leakage air handler cabinet (furnace or heat pump fan and inside coil) must be certified to the Commission to leak 2 percent or less of its nominal air conditioning cfm delivery when pressurized to 1-inch water gauge with all present air inlets, air outlets, and condensate drain port(s) sealed. The air handler must be connected to a Sealed and Tested New Duct System to receive the credit.

RA3.2 Procedures for Determining Refrigerant Charge for Split System Space Cooling Systems without a Charge Indicator Light

The purpose of this procedure is to determine and verify that residential split system space cooling systems and heat pumps have the required refrigerant charge and that the metering device is working as designed.

RA3.4 Procedures for Verifying the Presence of a Charge Indicator Light or High Energy Efficiency Ratio Equipment—(CONTINUED)

The purpose of these procedures is to verify that residential space cooling systems and heat pumps have the required components to achieve the energy efficiency claimed in the compliance documents. The procedures only apply when a Charge Indicator Light (CIL) is specified for split system equipment or an EER higher than the default is claimed.

Lighting

7. **Lighting in Kitchens.** A minimum of 50 percent of the total rated wattage of permanently installed lighting in kitchens shall be high efficacy.

EXCEPTION 1 to Section 150 (k) 7: Up to 50 watts for dwelling units less than or equal to 2,500 ft^2 or 100 watts for dwelling units larger than 2,500 ft^2 may be exempt from the 50% high efficacy requirement when the following conditions are met:

a. All low efficacy luminaires in the kitchen are controlled by a manual-on occupant sensor, dimmer, energy management control system (EMCS), or a multi-scene programmable control system.

b. All permanently installed luminaires in garages, laundry rooms, closets greater than 70 square feet, and utility rooms are high efficacy and are controlled by a manual-on occupant sensor.

Lighting—(CONTINUED)

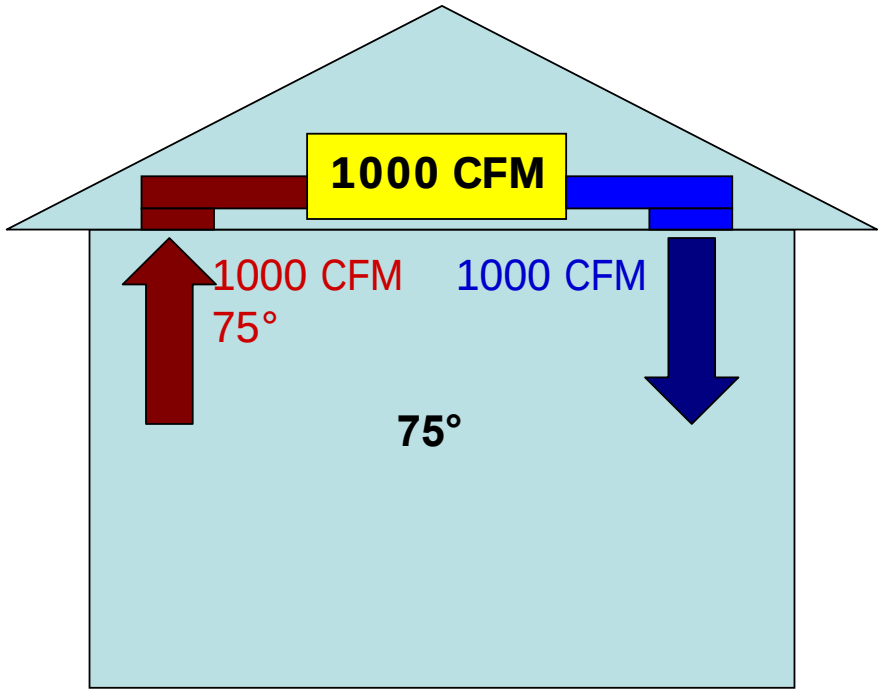
8. **Lighting internal to cabinets.** Permanently installed lighting that is internal to cabinets shall use no more than 20 watts of power per linear foot of illuminated cabinet.

Why Seal the Ducts?

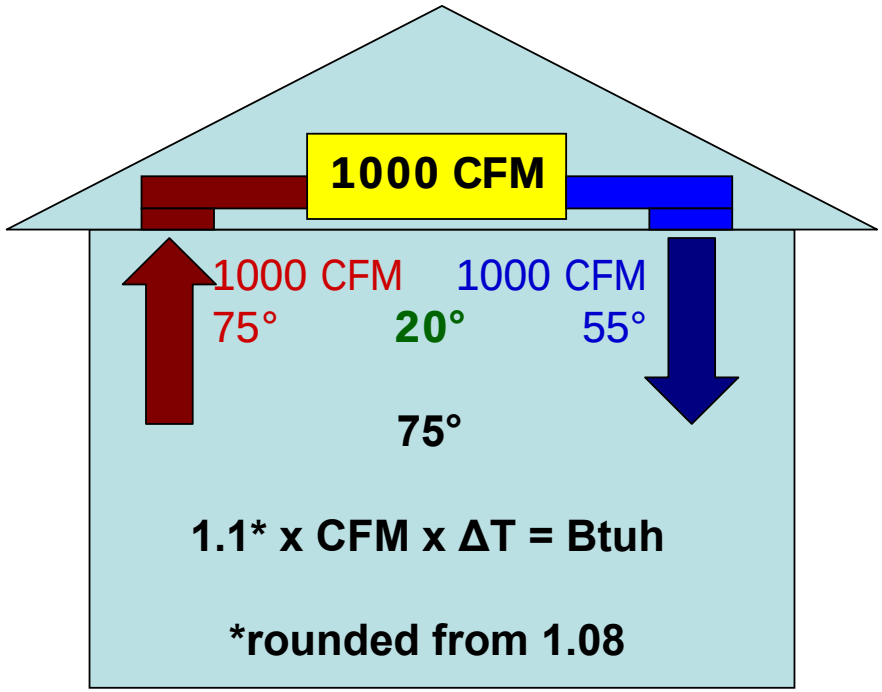
Delivered Btuh

And Duct Leakage

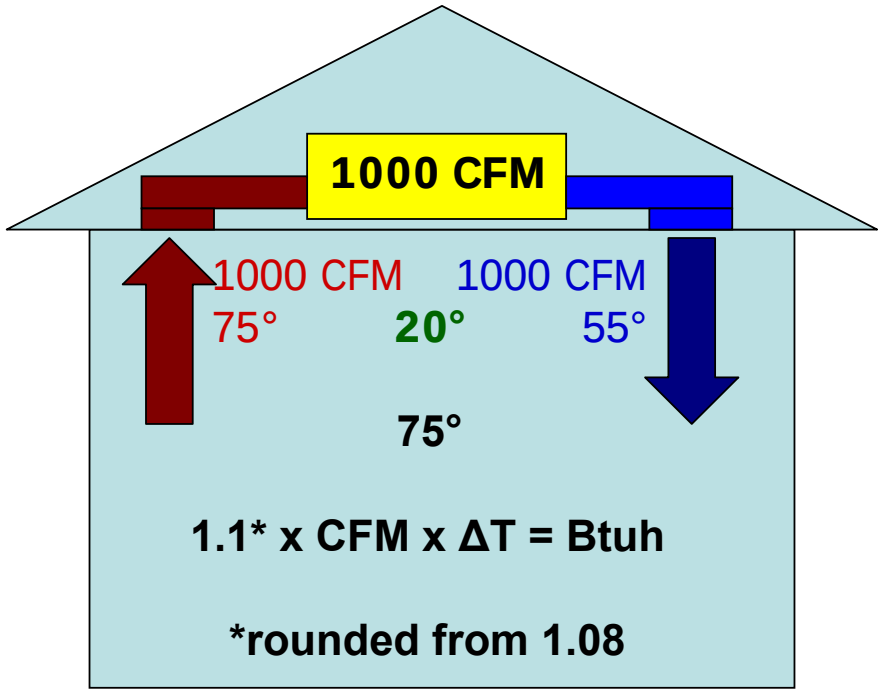
Example A
No leakage



Example A
No leakage

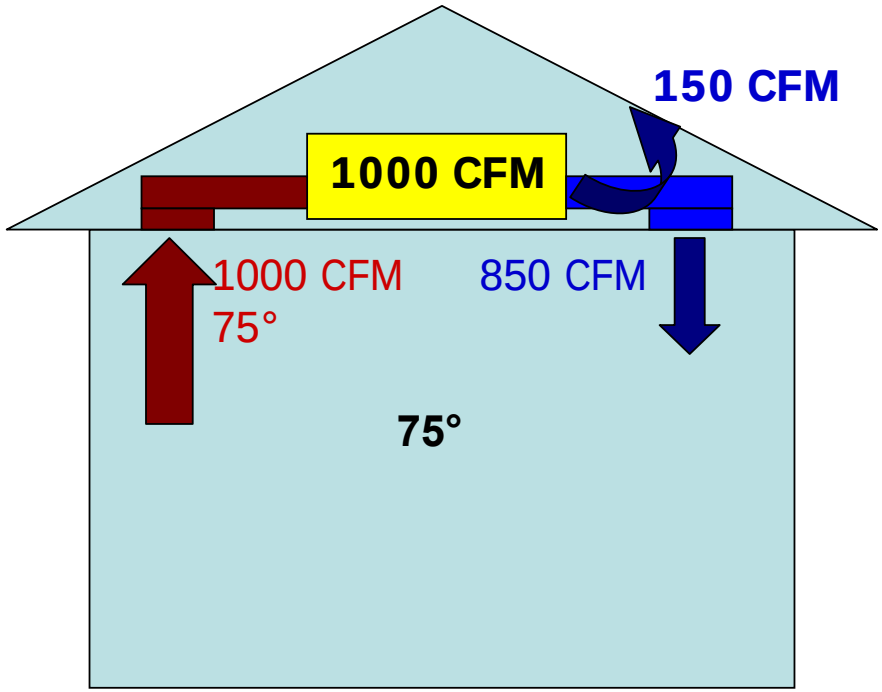


Example A
No leakage

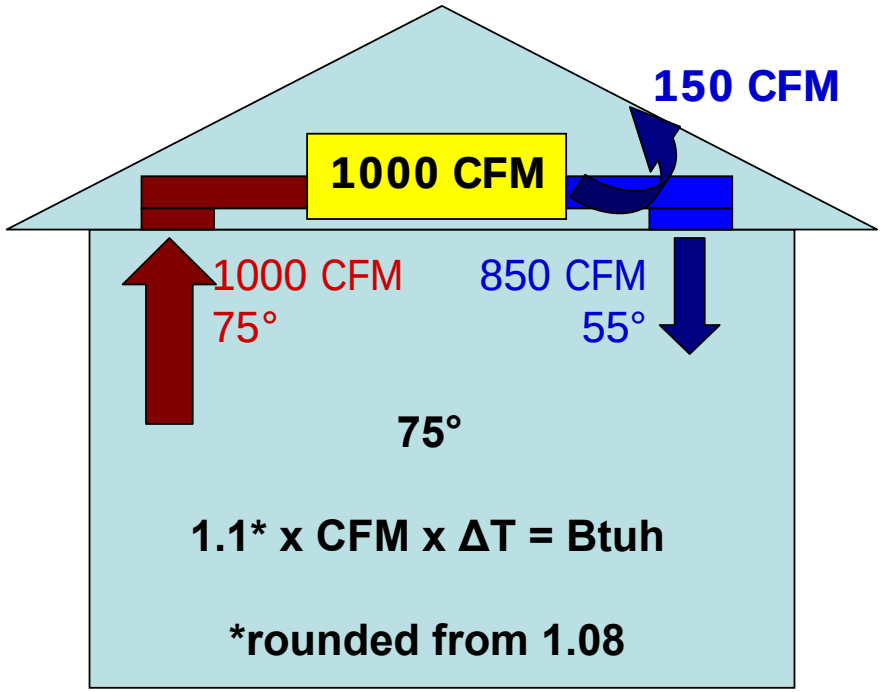


1.1 x 1000 x 20° = 22,000 Btuh

Example B
Supply-side leakage

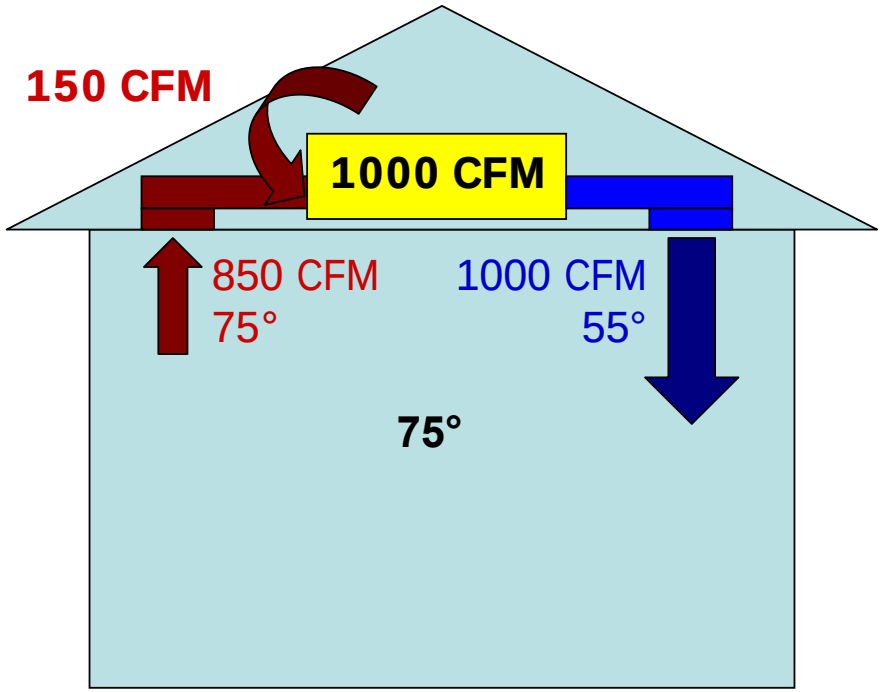


Example B
Supply-side leakage



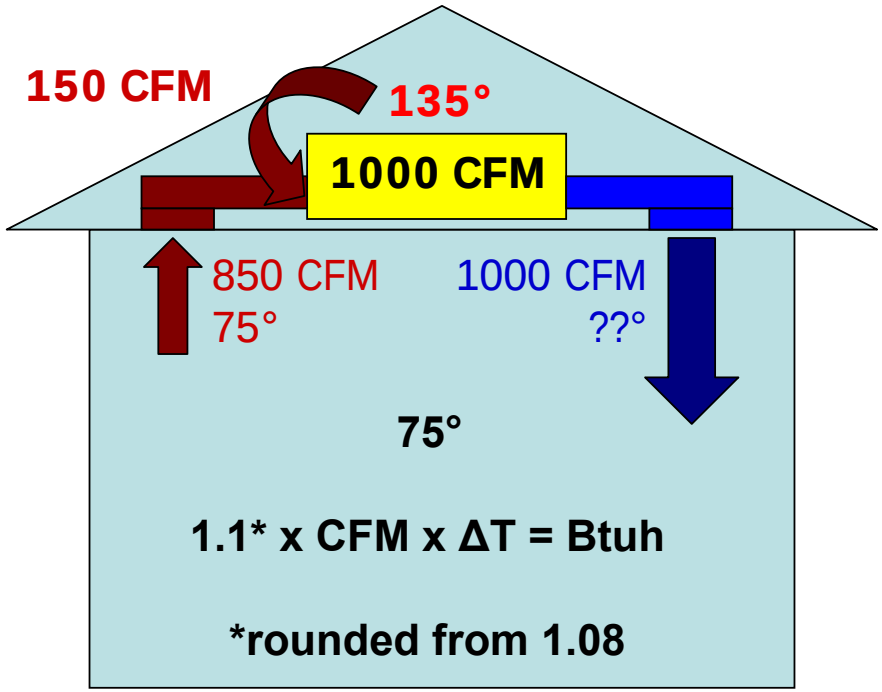
1.1 x 850 x 20° = 18,700 Btuh

Example C
Return-side leakage



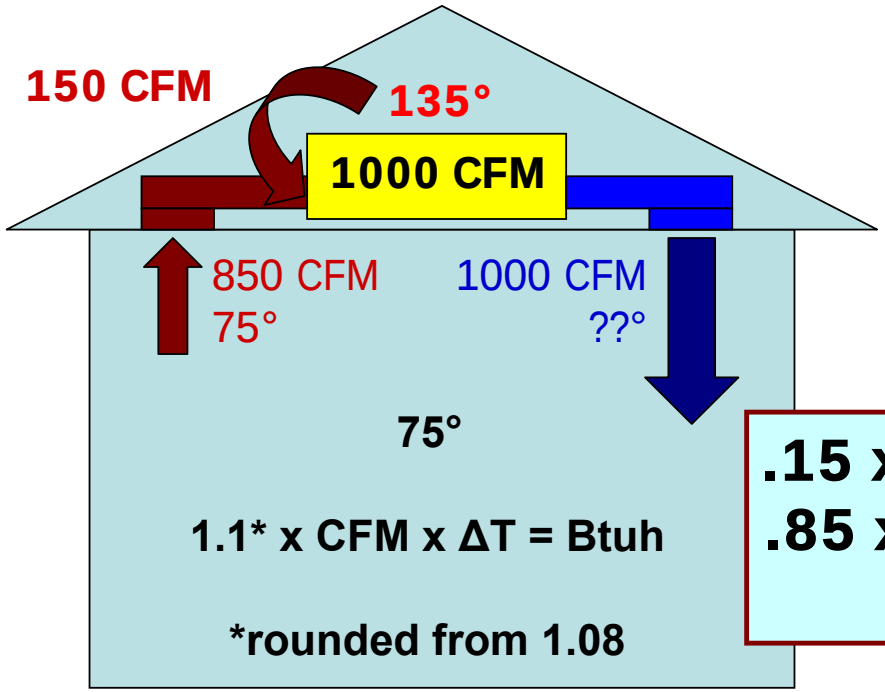
1.1 x 1000 x 20° = 18,700 Btuh

Example C
Return-side leakage



1.1 x 1000 x 20° = 18,700 Btuh

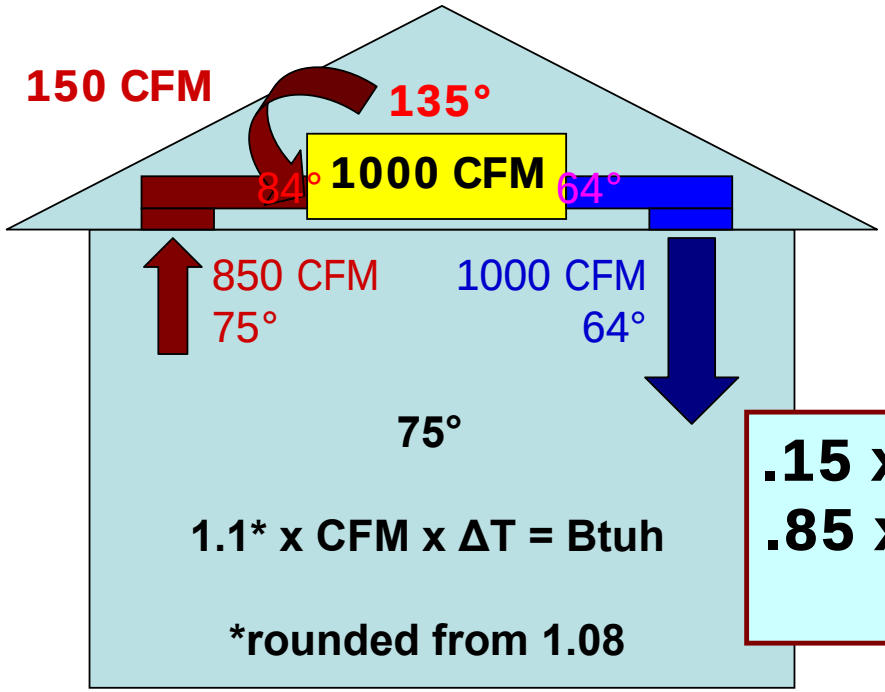
Example C
Return-side leakage



.15 x 135 = 20.25
.85 x 75 = 63.75
84.00

1.1 x 1000 x 20° = 18,700 Btuh

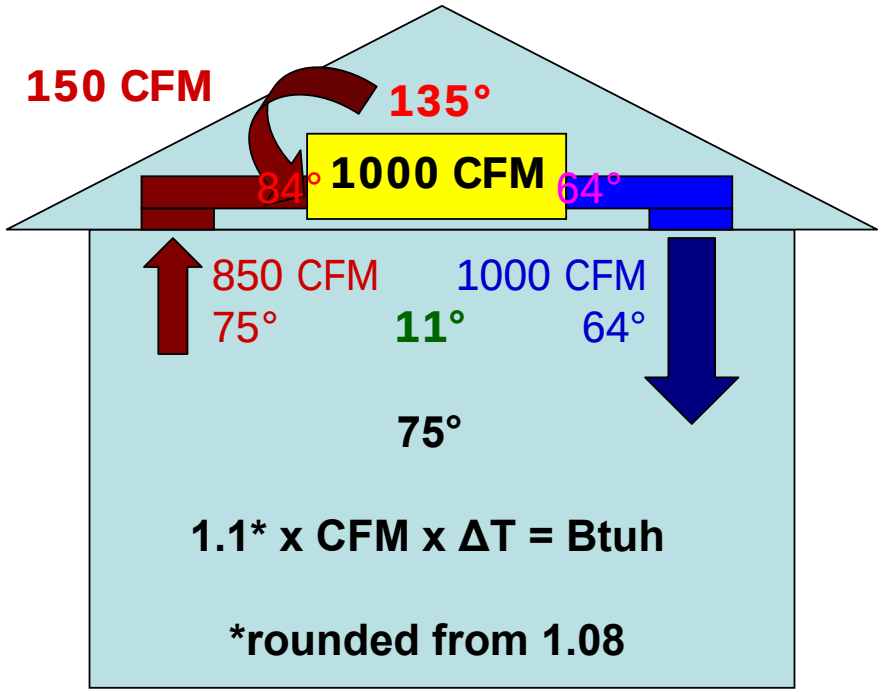
Example C
Return-side leakage



.15 x 135 = 20.25
.85 x 75 = 63.75
84.00

1.1 x 1000 x 20° = 18,700 Btuh

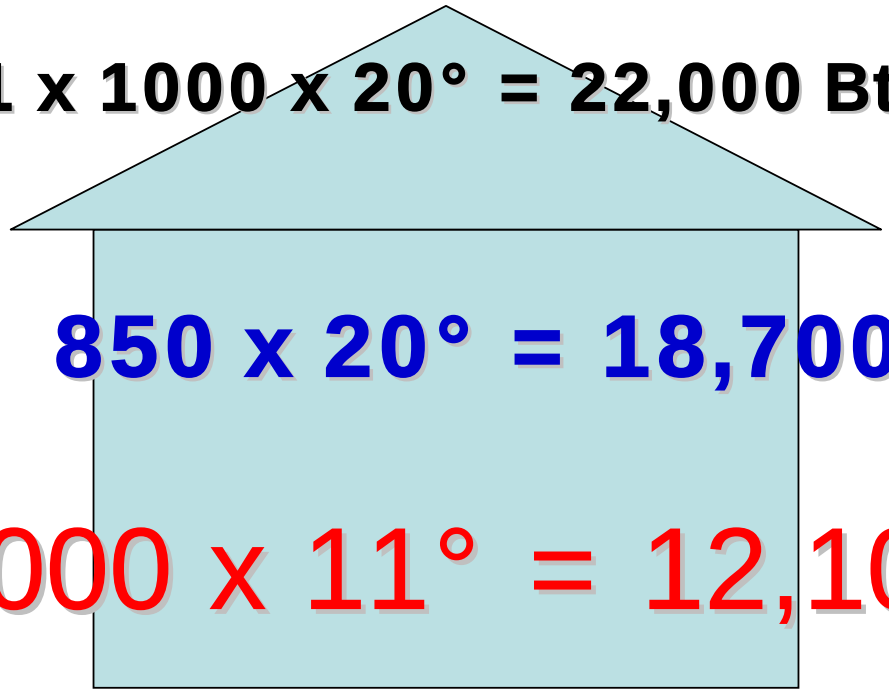
Example C
Return-side leakage



1.1 x 1000 x 11° = 12,100 Btuh

Conclusion

1.1 x 1000 x 20° = 22,000 Btuh



1.1 x 850 x 20° = 18,700 Btuh

1.1 x 1000 x 11° = 12,100 Btuh

Duct Leakage Matters