Welcome

HVAC Change Out Regulations and Rater Verification

California Track

Douglas Beaman

Douglas Beaman Associates
612 – 13th Street
Modesto, CA 95354

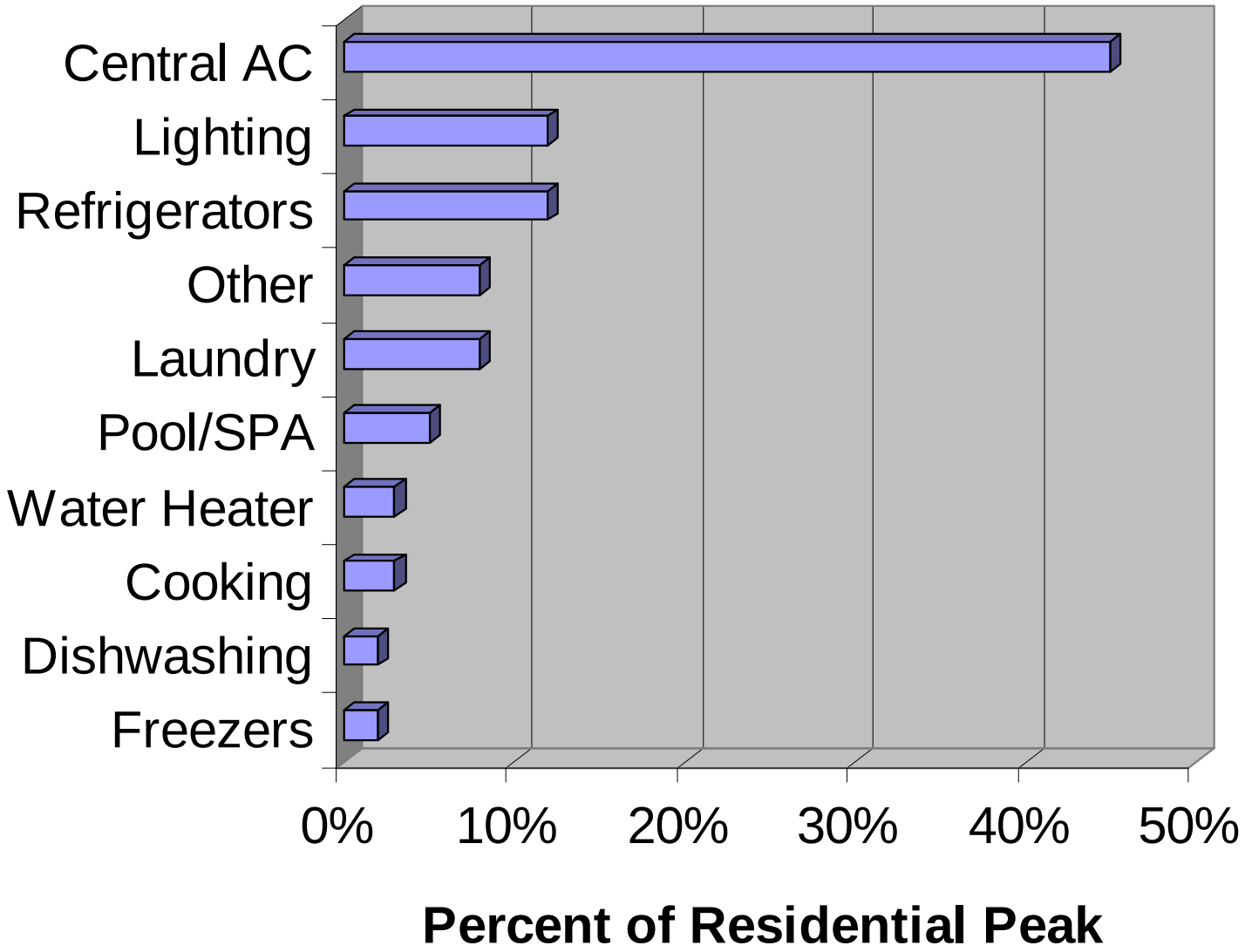
(209) 524-1000
Doug@DougBeaman.com

Why Change-Outs?

California Energy Standards are starting to address energy efficiency of existing homes and businesses as well as new buildings.

AB 549

California law requires Energy Commission to address existing buildings – both homes and commercial buildings

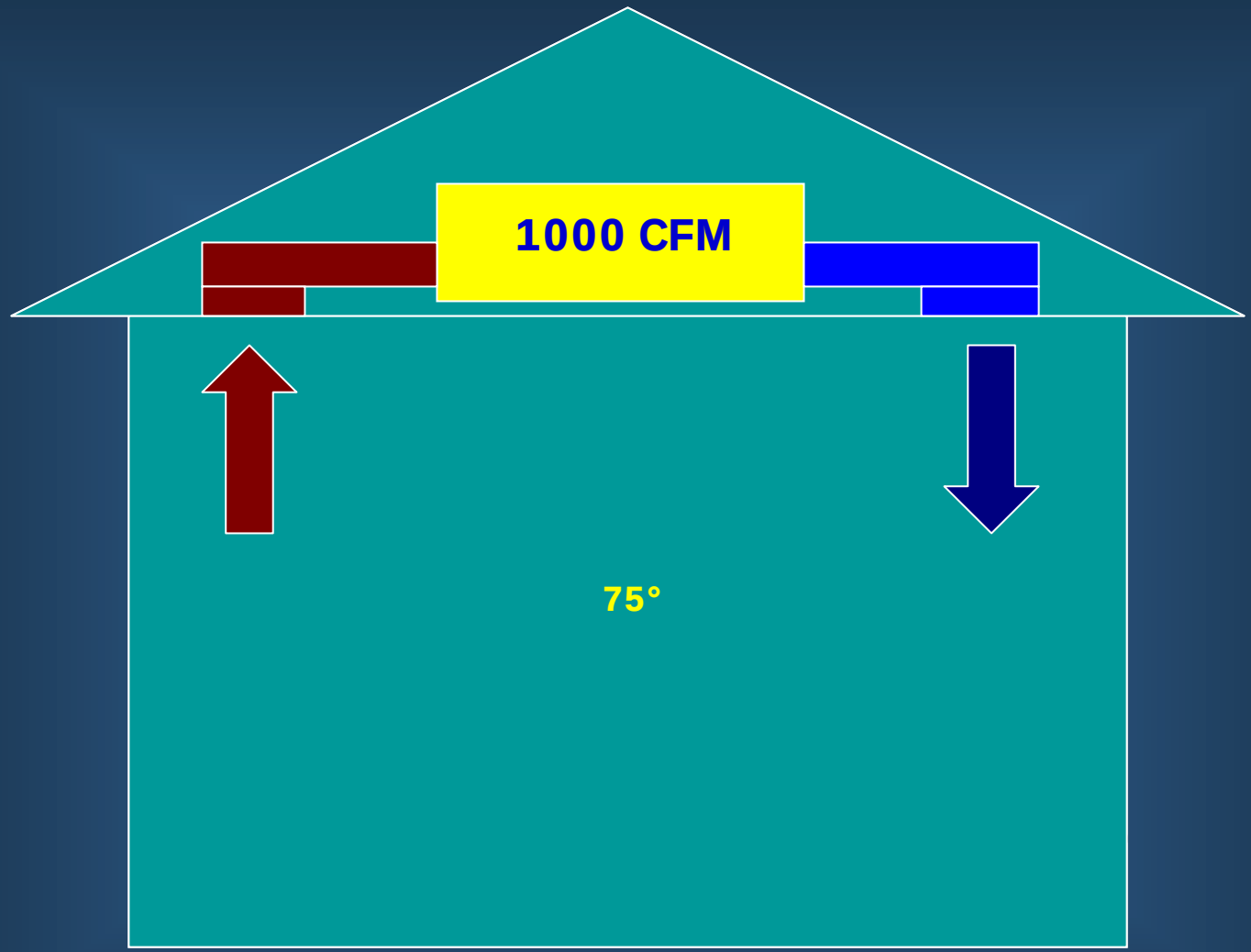

Central AC
Lighting
Refrigerators
Other
Laundry
Pool/SPA
Water Heater
Cooking
Dishwashing
Freezers
0%
10%
20%
30%
40%
50%
Percent of Residential Peak

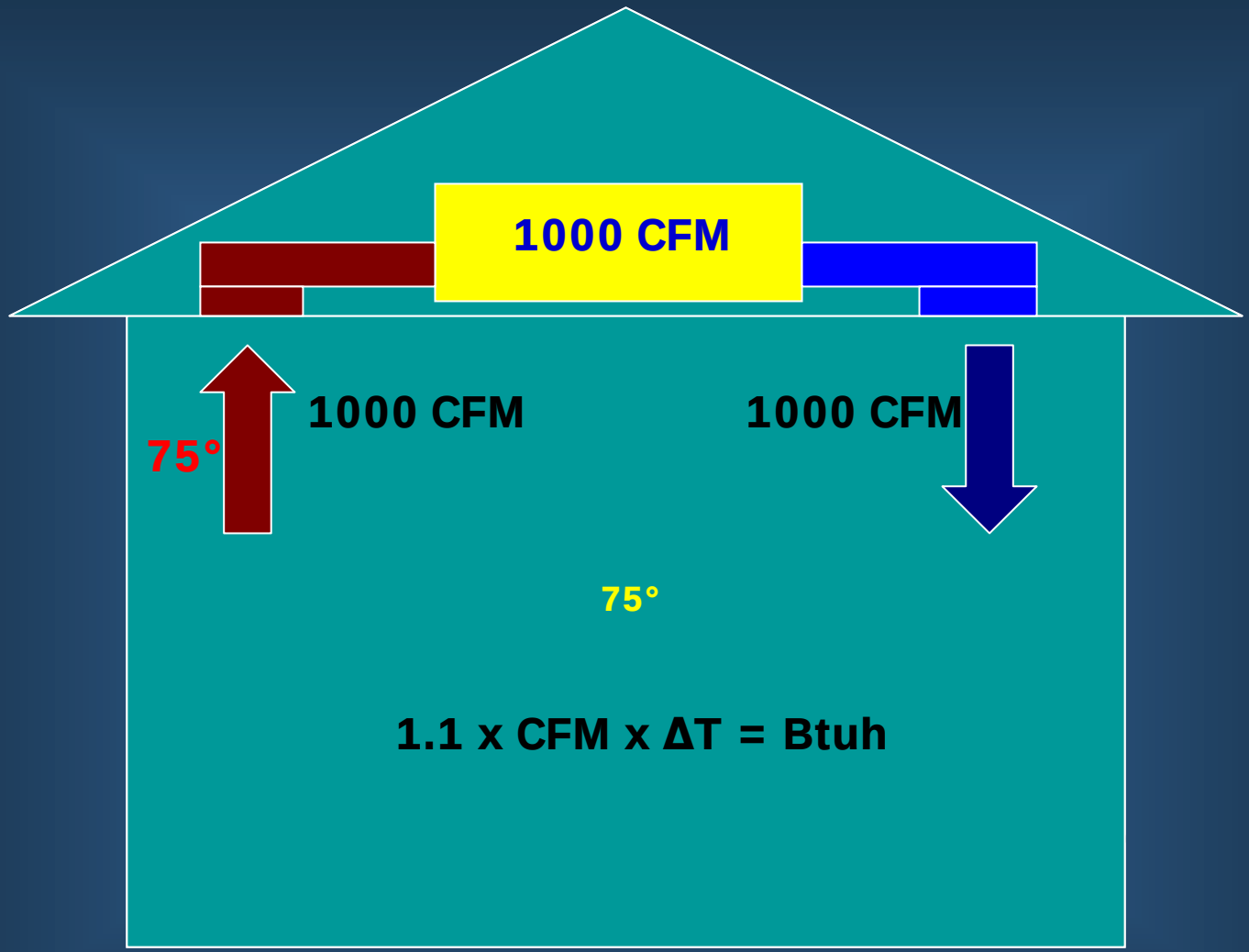
Delivered Btuh

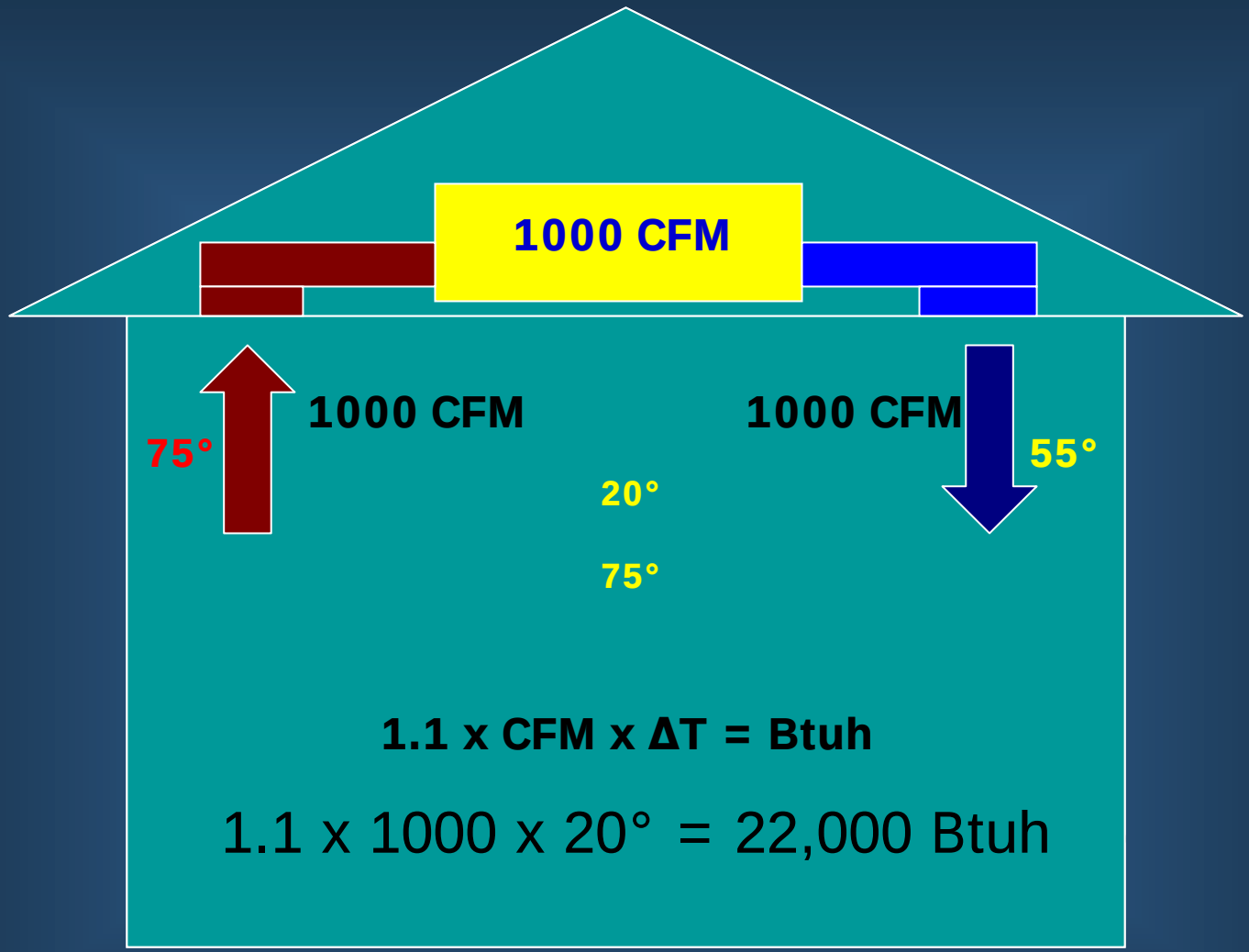
And Duct Leakage

Example A

No leakage

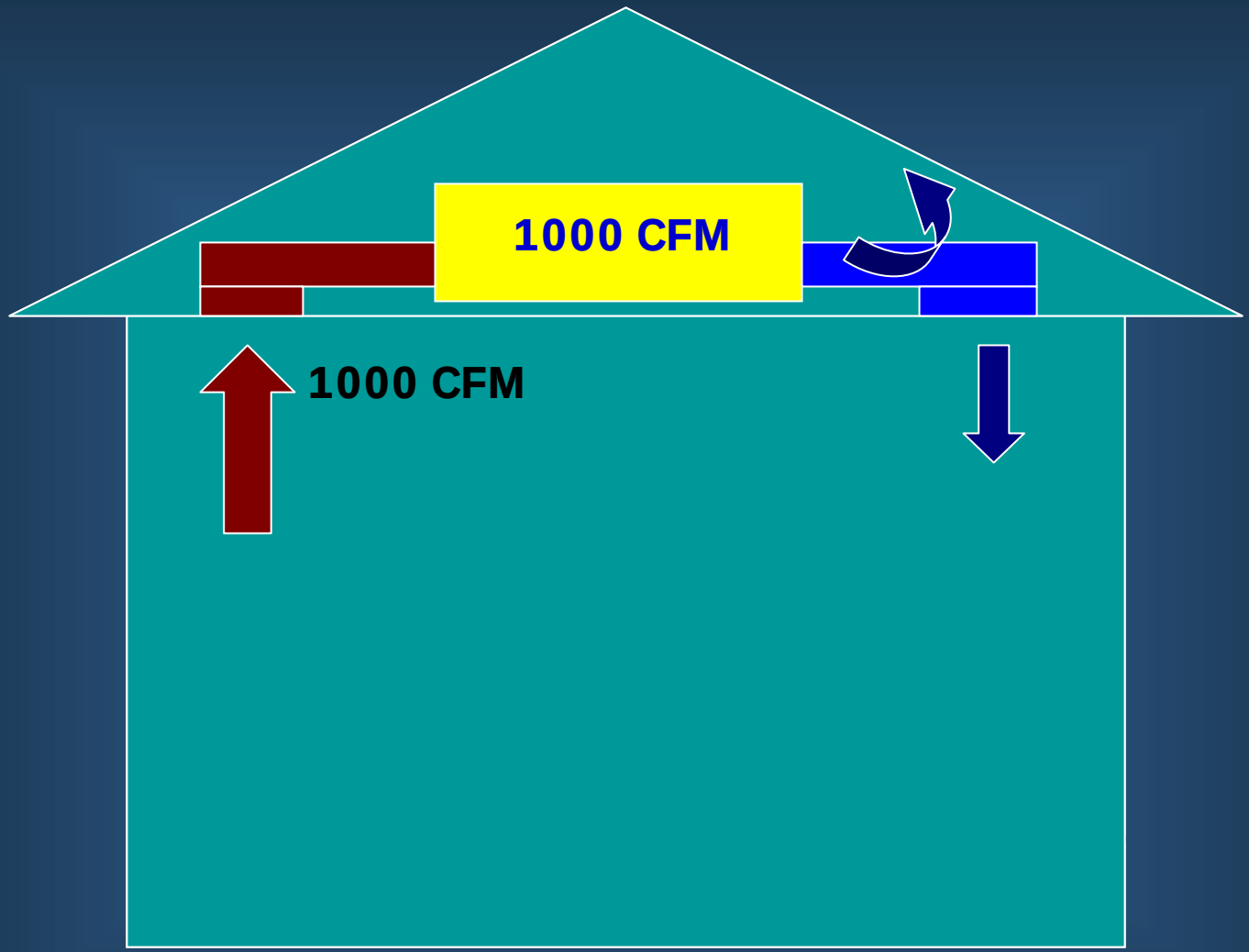

1000 CFM
75°

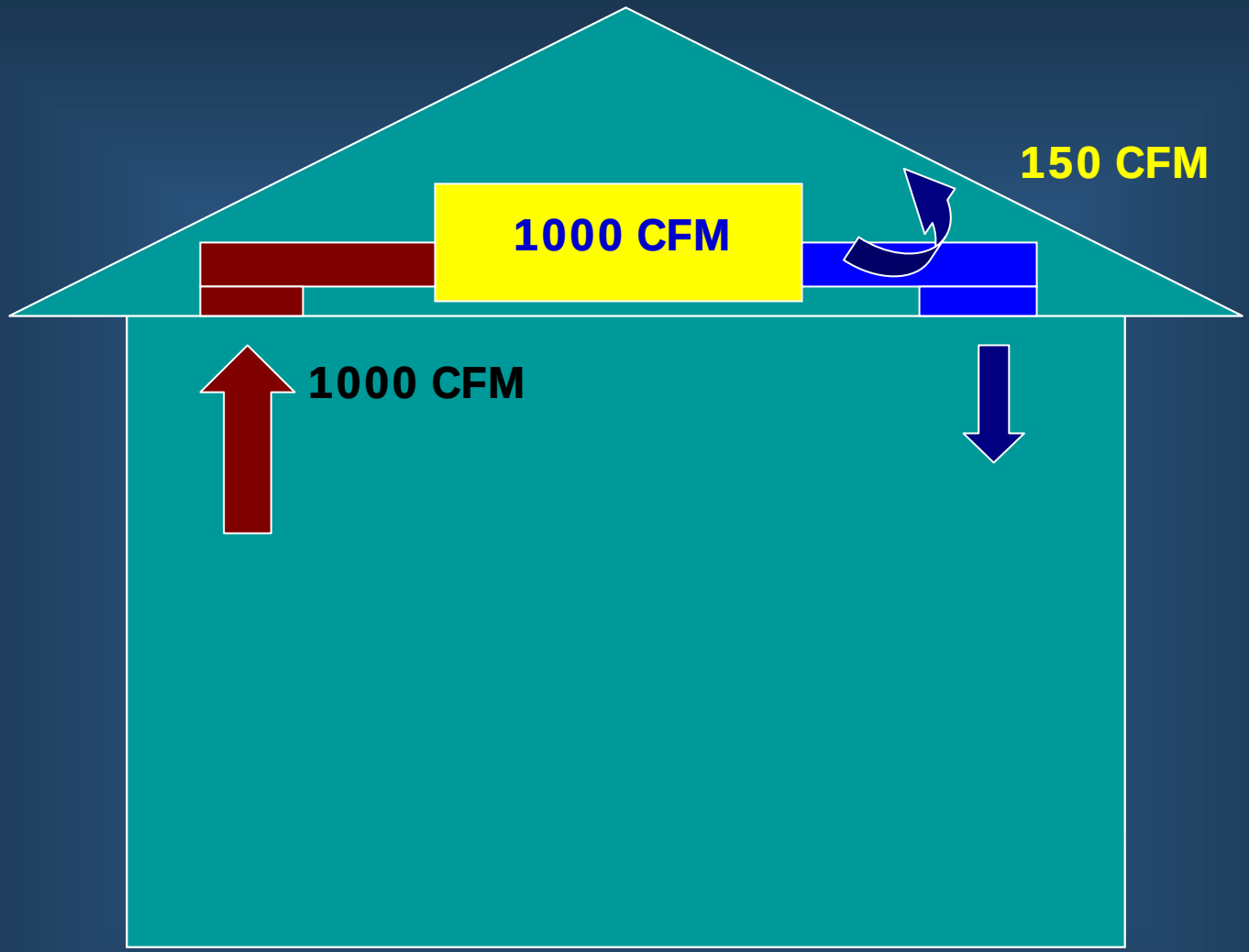

1000 CFM
1000 CFM
1000 CFM
75°
75°
1.1 x CFM x ΔT = Btuh

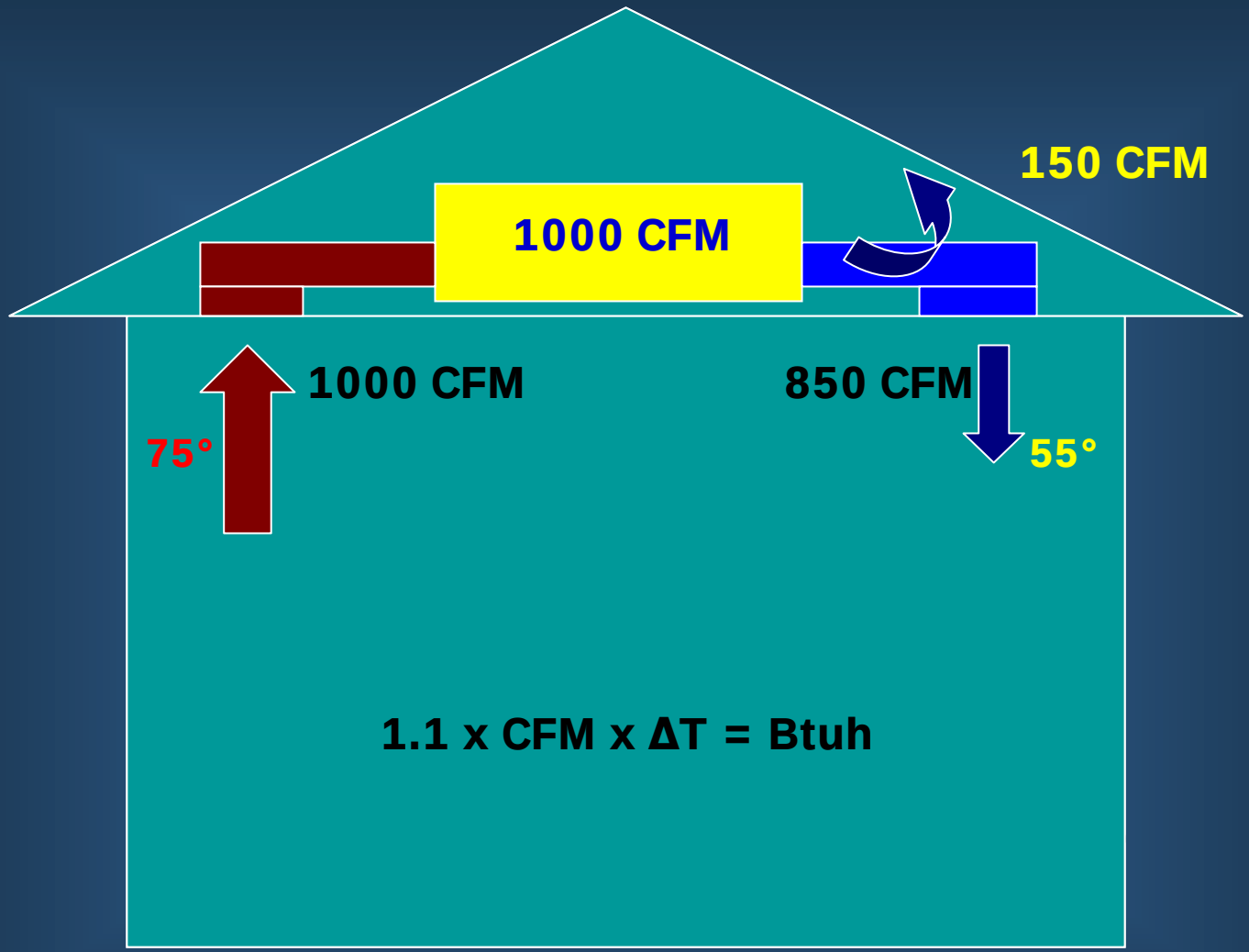

1000 CFM
1000 CFM
75°
1000 CFM
55°
20°
75°
1.1 x CFM x ΔT = Btuh
1.1 x 1000 x 20° = 22,000 Btuh

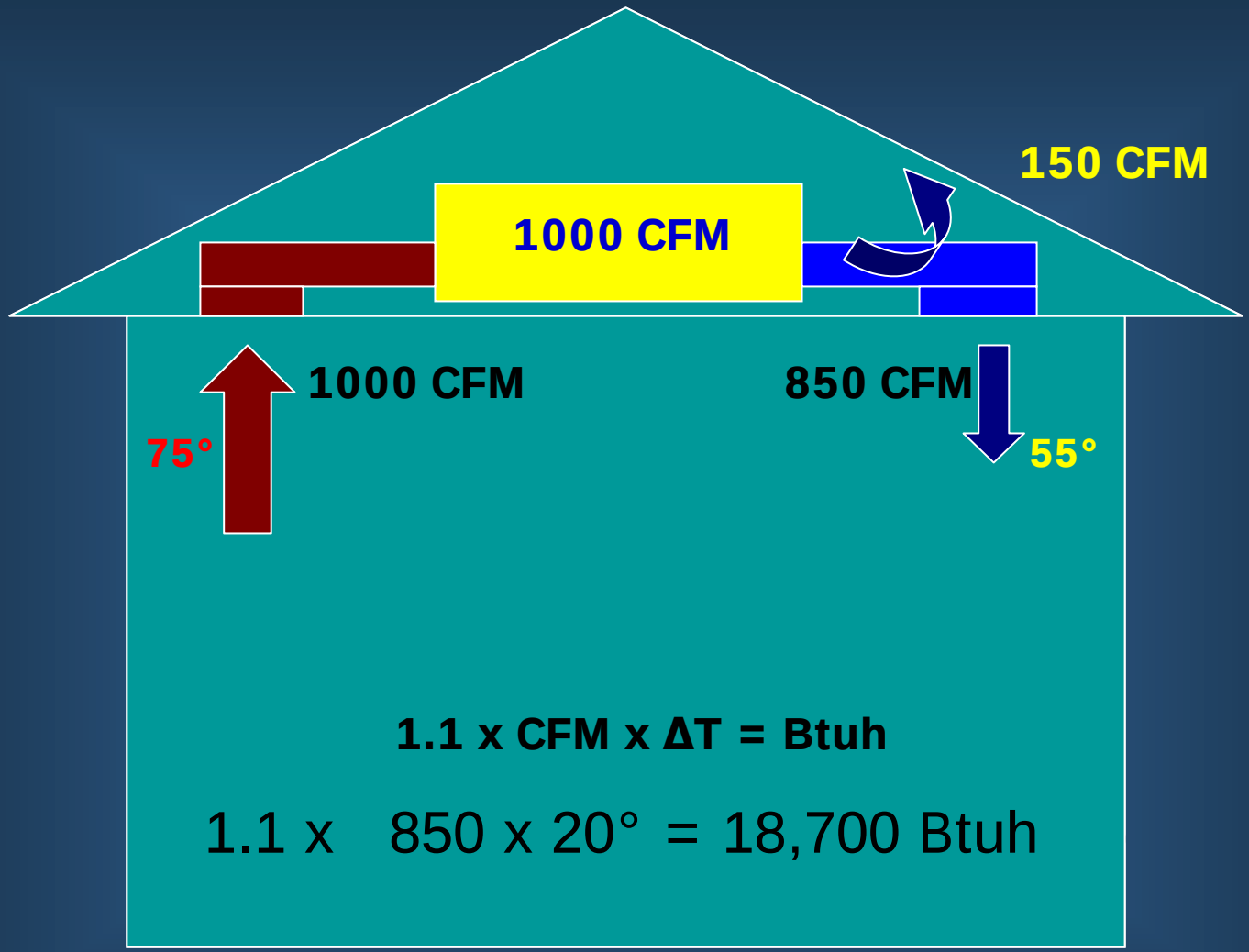
Example B

Supply-side leakage


1000 CFM
1000 CFM


150 CFM
1000 CFM
1000 CFM


150 CFM
1000 CFM
1000 CFM
75°
850 CFM
55°
1.1 x CFM x ΔT = Btuh

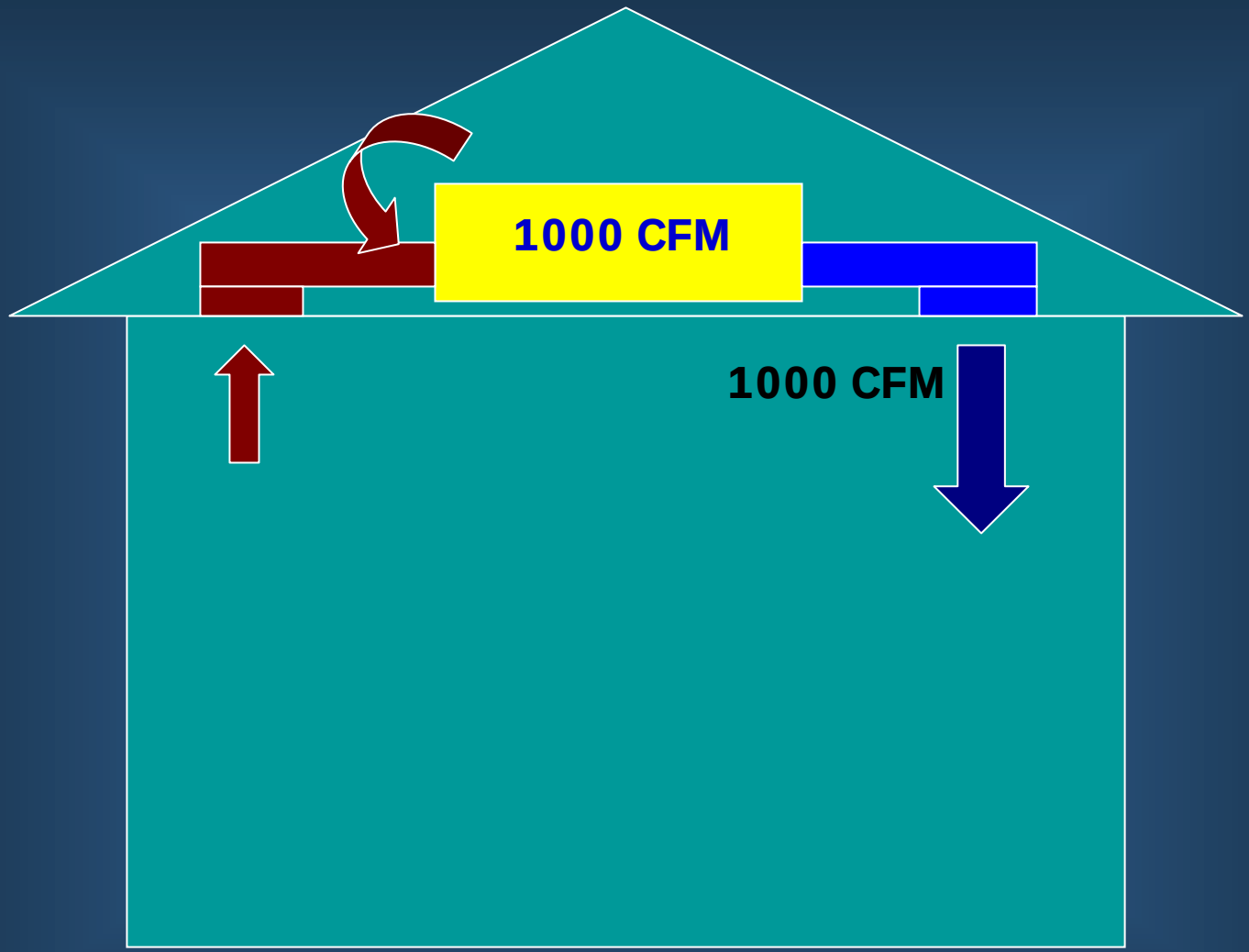


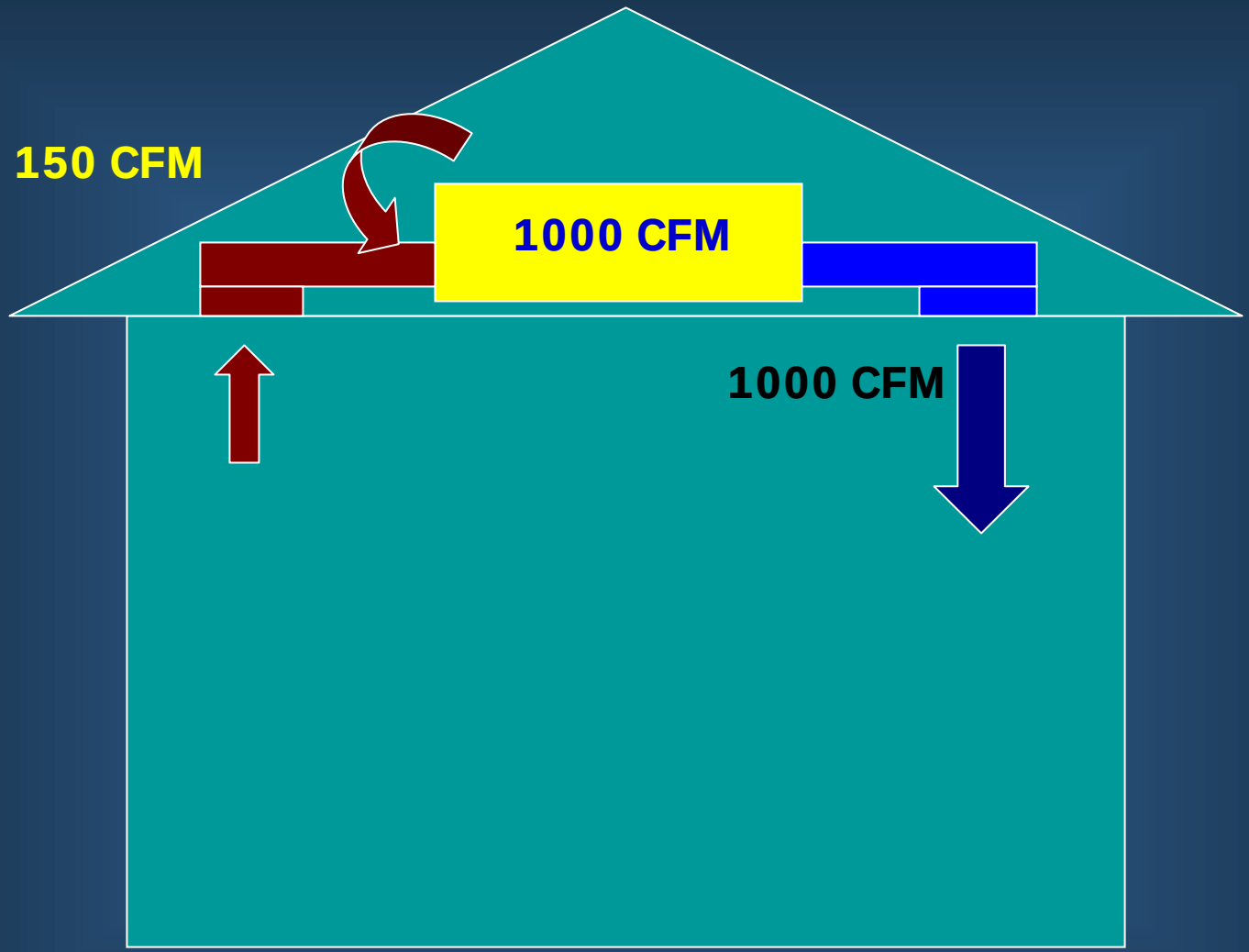
1.1 x CFM x ΔT = Btuh

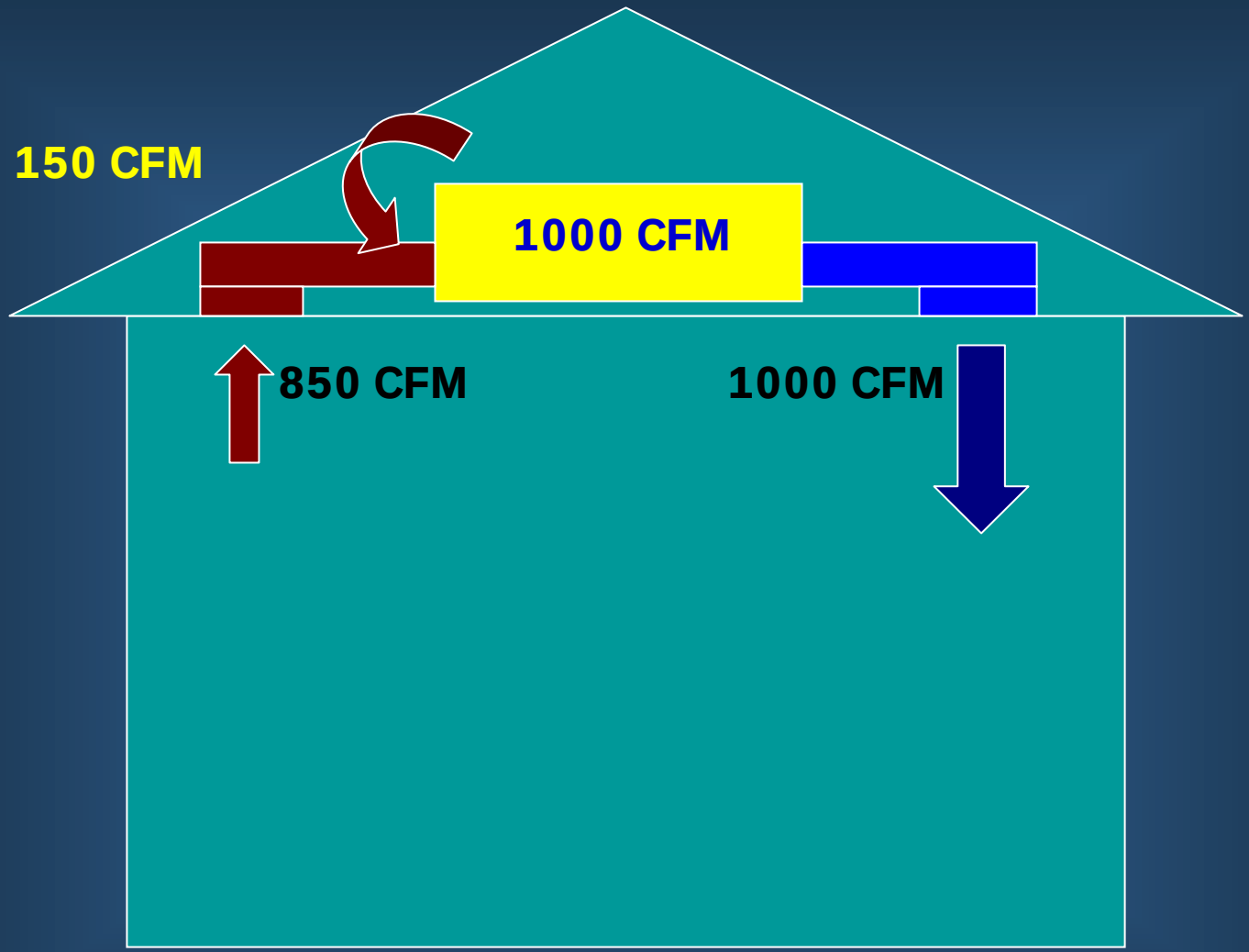
1.1 x 850 x 20° = 18,700 Btuh

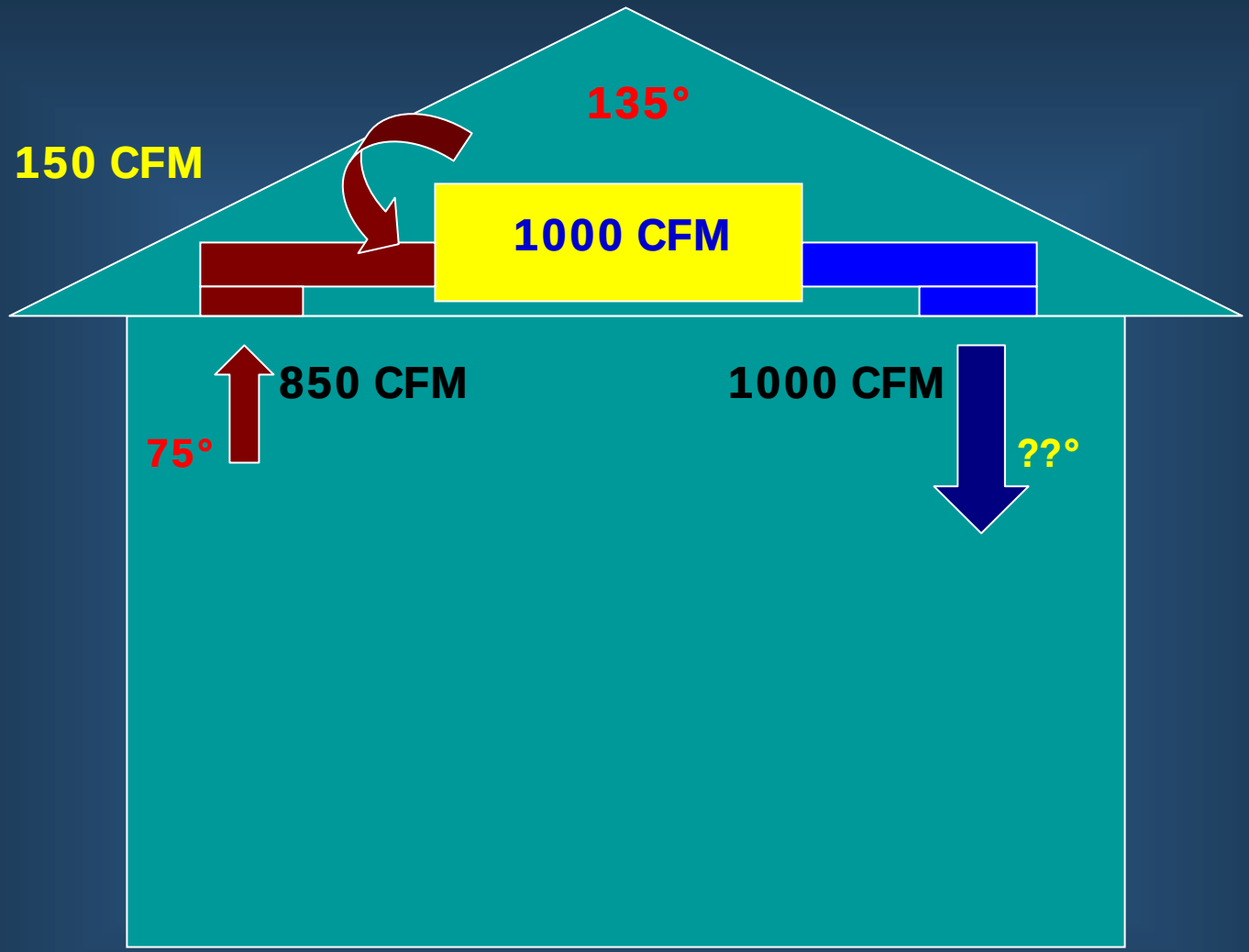
Example C

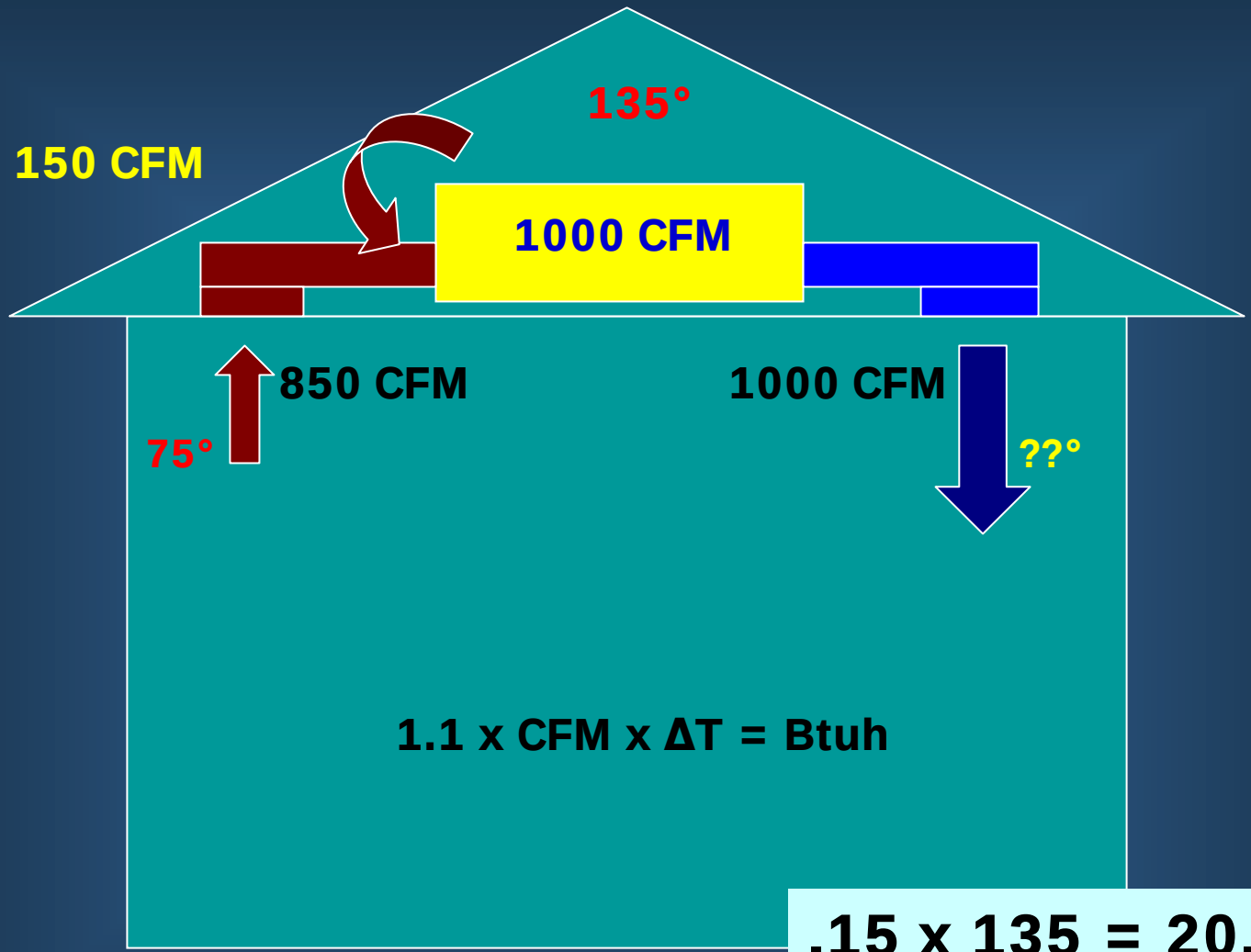
Return-side leakage


1000 CFM
1000 CFM

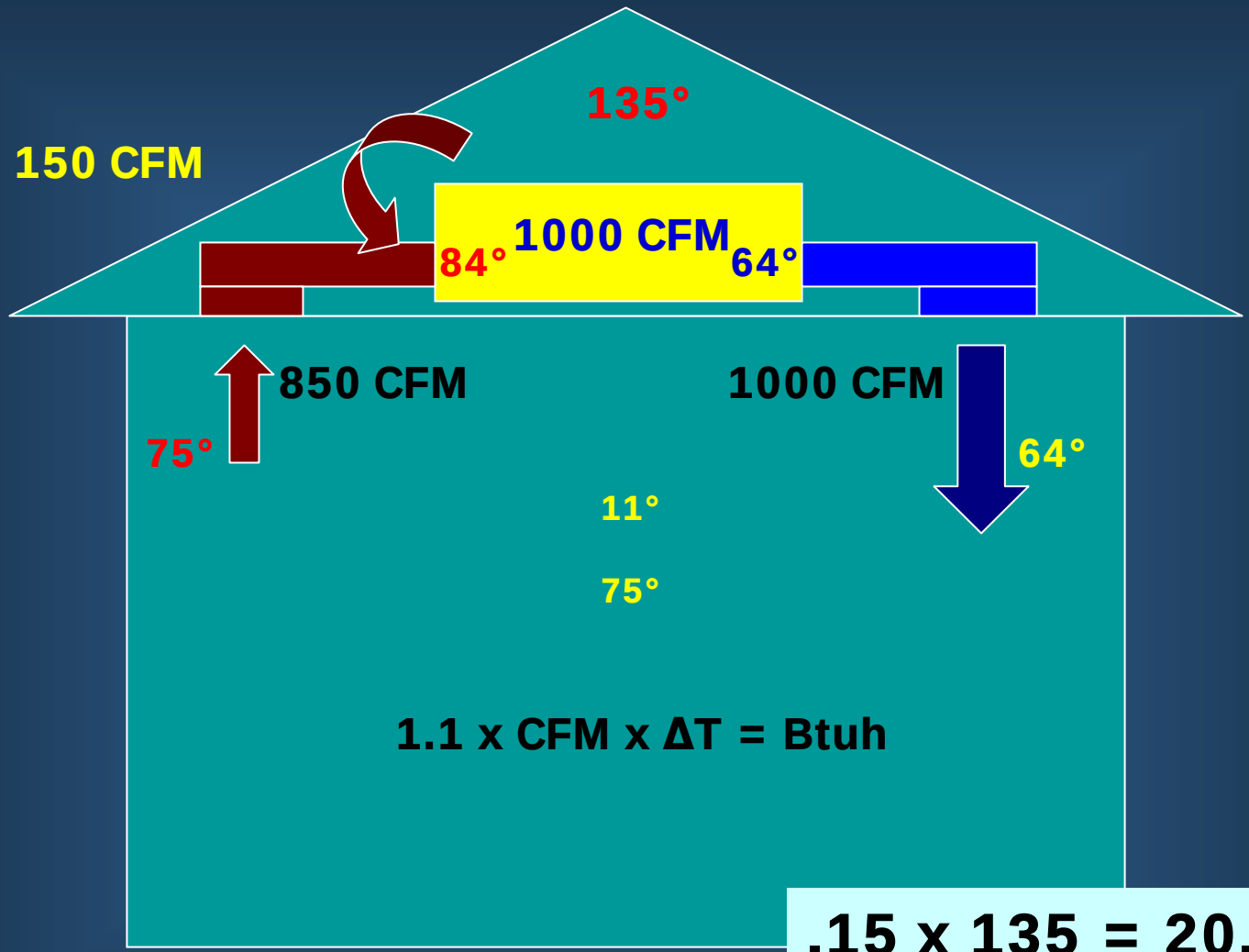

150 CFM
1000 CFM
1000 CFM


150 CFM
1000 CFM
850 CFM
1000 CFM

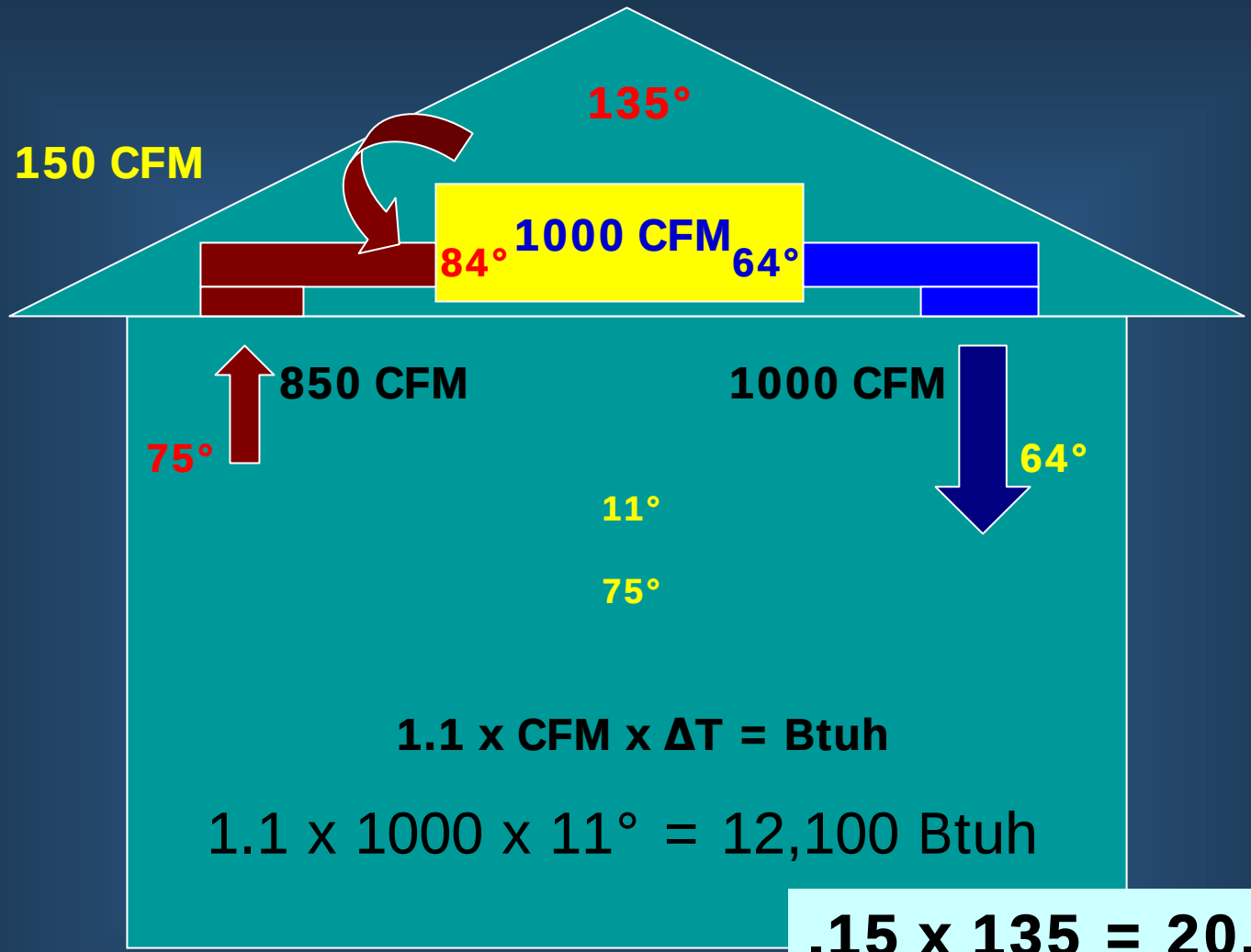

135°
150 CFM
1000 CFM
850 CFM
75°
1000 CFM
??°



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



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



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

Conclusion

1.1 x CFM x ΔT = Btuh

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

1.1 x CFM x ΔT = Btuh

1.1 x 1000 x 20° = 22,000 Btuh

100%

1.1 x 850 x 20° = 18,700 Btuh

85%

1.1 x 1000 x 11° = 12,100 Btuh

55%

Duct Leakage Matters

Climate Zones

Residential Duct Testing Rules

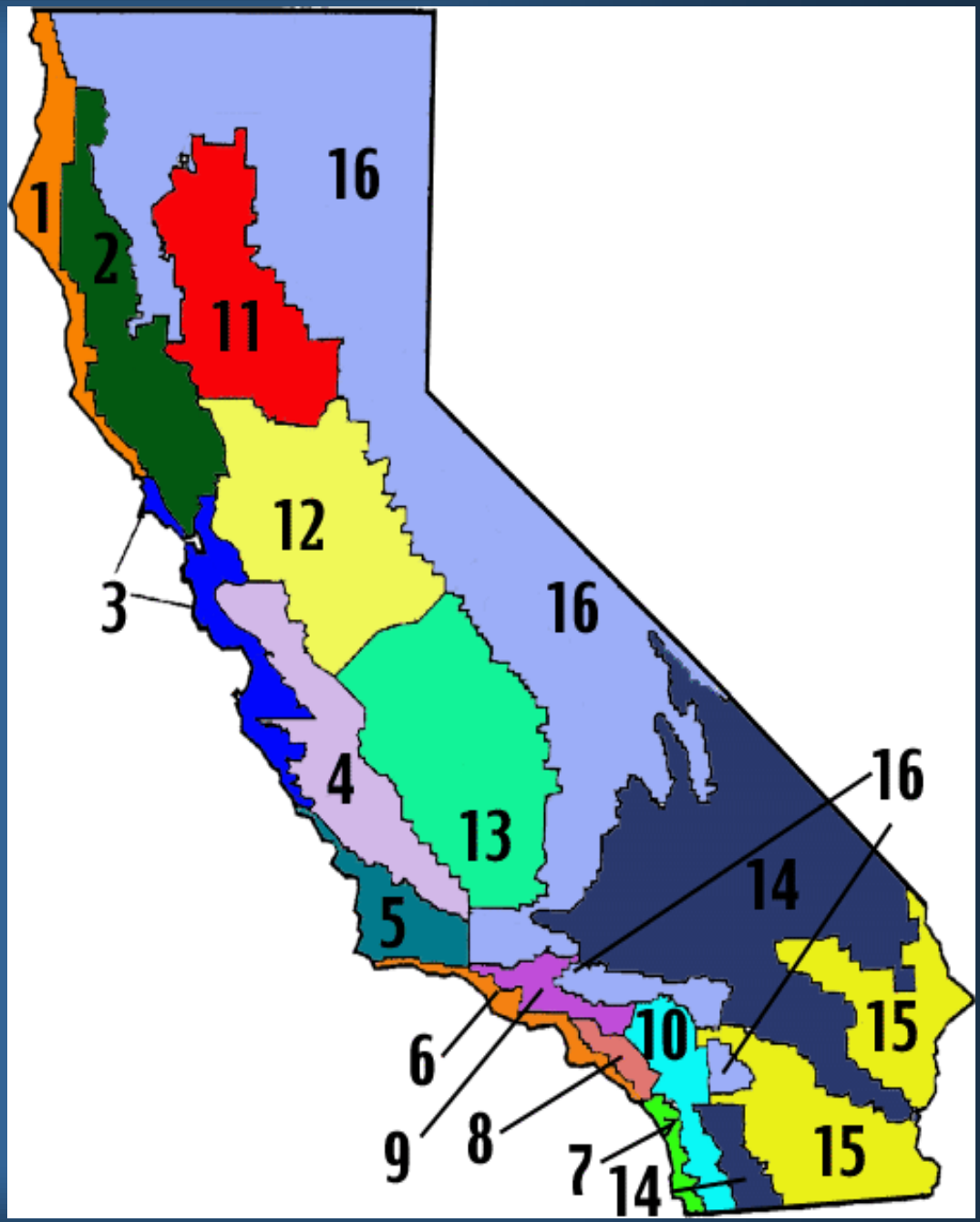
Apply ONLY in Climate Zones:

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

Exempt Climate Zones

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

California Climate Zones



Ducts in Unconditioned Space

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

Asbestos Exemption

Ductwork constructed, insulated or sealed with asbestos is EXEMPT.

Duct Testing Required When Any of the Following Components are Replaced

- Air handler or furnace
- Heating or cooling coil
- Furnace heat exchanger
- Outdoor condensing unit (split systems)
- Package unit
- Heat Pump
- Adding or replacing 40 linear feet or more 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. >60% Reduction

   Test before replacement and after:

   600 cfm initial test (example only)
   60% reduction = 240 cfm target

   or

Maximum Leakage (cont)

3. Duct leakage to outside of house <10% or less (whole house blower door test plus duct leakage test)

   or

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

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 each system 100%

2. HERS Rater verifies minimum of 1 in 7 (can be sampled).

Non-Residential Change-outs

NonResidential Change-Outs

Building Permit applied for after **September 30, 2005**
- NO ▶ Duct Sealing and Testing is **NOT Required.**
- YES ▼

All Climate Zones
- NO ▶ Duct Sealing and Testing is **NOT Required.**
- YES ▼

Asbestos free (System is not sealed, insulated or constructed with Asbestos.
- NO ▶ Duct Sealing and Testing is **NOT Required.**
- YES ▼

Constant Volume System
- NO ▶ Duct Sealing and Testing is **NOT Required.**
- YES ▼

(VAV systems are excluded)

System (1 unit) serves less than 5,000 square feet.
- NO ▶ Duct Sealing and Testing is **NOT Required.**
- YES ▼

More than 25% of duct surface area is located outdoors or in uncondtioned space.
- NO ▶ Duct Sealing and Testing is **NOT Required.**
- YES ▼

Job includes **replacing or installing** HVAC units or any of the following components:

- Furnace/Air Handler
- Cooling or Heating Coil
- Furnace Heat Exchanger
- Outdoor Condensing Unit of a Split System
- Package Unit
- Heat Pump
- Adding or replacing any length of duct work.

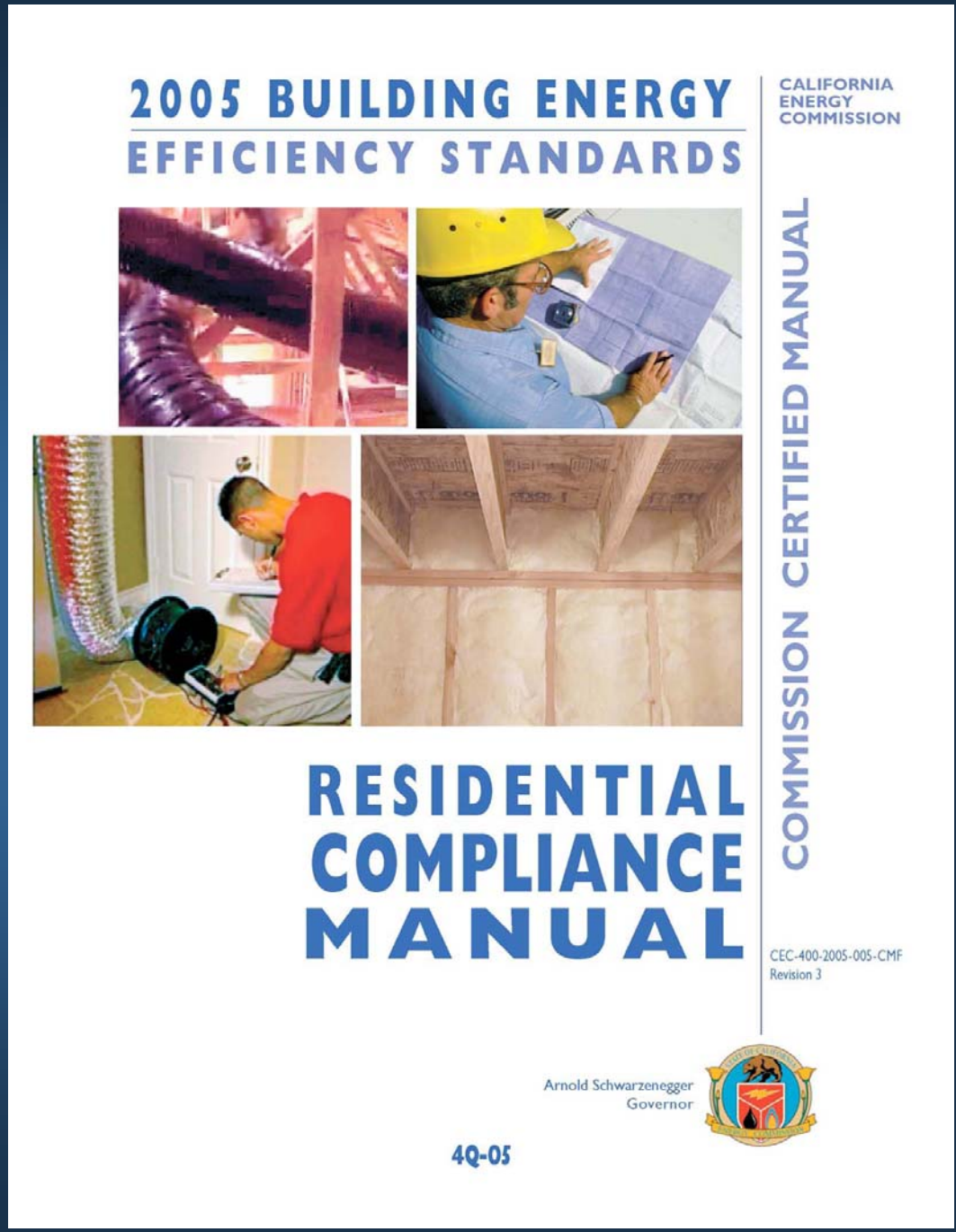
- NO ▶ Duct Sealing and Testing is **NOT Required.**
- YES ▼

Duct Sealing and Testing **is REQUIRED**

Other Considerations:

R-8 Insulation is mandatory on all additional ducting in unconditioned space.

Designed to be used by building departments, builders, energy consultants.



Duct Sealing and Testing for HVAC System Change-outs

Procedures to Comply with Change-out Rules

What Do I Do Now

If you have determined that your Residential or NonResidential HVAC System Change-out requires duct sealing and testing:

Follow these steps.

Complete Your Work

Complete your work as you would any other job.

Contractor Test & Seal

Test and seal the ductwork as necessary.

Contractor does not have to be certified to perform this test.

Contractor Test & Seal (cont)

The sealing and testing does not have to be performed at the same time as the change-out work.

It must be completed before the building permit is “signed-off”.

Contractor Test & Seal (cont)

Contractor may hire another firm to test or seal but contractor is still responsible.

HERS raters have test equipment and can perform tests for contractor:

HERS rater may not be hired to seal system.

CF-6R

After the system is sealed, form CF-6R is completed showing results of contractor tests.

Site Address **Permit Number**

INSTALLER COMPLIANCE STATEMENT *FOR DUCT LEAKAGE*

ALTERATIONS: Duct System and/or HVAC Equipment Change-Out			
4	Enter Tested Leakage Flow in CFM from CF-6R: **Pre-Test** of Existing Duct System Prior to Duct System Alteration and/or Equipment Change-Out.		
5	Enter Tested Leakage Flow in CFM: **Final Test** of New Duct System or Altered Duct System for Duct System Alteration and/or Equipment Change-Out.		
6	Enter Reduction in Leakage for Altered Duct System [_____(**Line # 4**) Minus _____(**Line # 5**)] – (Only if Applicable)		
7	Enter Tested Leakage Flow in CFM to Outside (Only if Applicable)		✓ ✓
8	Entire New Duct System - Pass if Leakage Percentage ≤ 6% for Final or ≤ 4% at Rough-in [100 x [_____(**Line # 5**) / _____**Line # 2**)]		☐ Pass ☐ Fail
TEST OR VERIFICATION STANDARDS: For Altered Duct System and/or HVAC Equipment Change-Out Use one of the following four Test or Verification Standards for compliance:			✓ ✓
9	Pass if Leakage Percentage ≤ 15% [100 x _____(**Line # 5**) / _____ (**Line # 2**)]		☐ Pass ☐ Fail
10	Pass if Leakage to Outside Percentage ≤ 10% [100 x [_____(**Line # 7**) / _____ (**Line # 2**)]		☐ Pass ☐ Fail
11	Pass if Leakage Reduction Percentage ≥ 60% [100 x [_____(**Line # 6**) / _____ (**Line # 4**)] and Verification by Smoke Test and Visual Inspection		☐ Pass ☐ Fail
12	Pass if Sealing of all Accessible Leaks and Verification by Smoke Test and Visual Inspection		☐ Pass ☐ Fail
	Pass if One of Lines # 9 through # 12 pass		☐ Pass ☐ Fail

HERS Rater

Contractor facilitates the hiring of a HERS rater to verify test results.

HERS rater must review CF-6R for each job prior to performing their verification.

Independent Third Party

The HERS rater may NOT be an employee of the installing HVAC contractor.

HVAC contractors may be HERS raters, but they may NOT test their own work.

CF-4R

The HERS rater will perform a duct leakage test and fill out form CF-4R.

CERTIFICATE OF FIELD VERIFICATION & DIAGNOSTIC TESTING (Page 1 of 8) CF-4R

ALTERATIONS: Duct System and/or HVAC Equipment Change-Out		
Enter Tested Leakage Flow in CFM from CF-6R: **Pre-Test** of Existing Duct System Prior to Duct System Alteration and/or Equipment Change-Out.		
Enter Tested Leakage Flow in CFM: **Final Test** of New Duct System or Altered Duct System for Duct System Alteration and/or Equipment Change-Out.		
Enter Reduction in Leakage for Altered Duct System [_____(**Line # 4**) Minus _____(**Line # 5**)] – (Only if Applicable)		
Enter Tested Leakage Flow in CFM to Outside (Only if Applicable)		✓ ✓
Entire New Duct System - Pass if Leakage Percentage ≤ 6% for Final or ≤ 4% at Rough-in [100 x [_____(**Line # 5**) / _____**Line # 2**)]		☐ Pass ☐ Fail
TEST OR VERIFICATION STANDARDS: For Altered Duct System and/or HVAC Equipment Change-Out Use one of the following four Test or Verification Standards for compliance:		✓ ✓
Pass if Leakage Percentage ≤ 15% [100 x _____(**Line # 5**) / _____ (**Line # 2**)]		☐ Pass ☐ Fail
Pass if Leakage to Outside Percentage ≤ 10% [100 x [_____(**Line # 7**) / _____ (**Line # 2**)]		☐ Pass ☐ Fail
Pass if Leakage Reduction Percentage ≥ 60% [100 x [_____(**Line # 6**) / _____ (**Line # 4**)] and Verification by Smoke Test and Visual Inspection		☐ Pass ☐ Fail
Pass if Sealing of all Accessible Leaks and Verification by Smoke Test and Visual Inspection		☐ Pass ☐ Fail
Pass if One of Lines # 9 through # 12 pass		☐ Pass ☐ Fail