



C A L I F O R N I A E N E R G Y C O M M I S S I O N

CALIFORNIA'S ENERGY CODE

Is it coming to your state?

Tav Commins

Buildings & Appliances Office

Energy Efficiency and Renewables Division

California Energy Commission

HVAC Excellence Conference

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What is Covered by the Energy Code?

- Envelope, Lighting and Mechanical for:
- All new buildings, Residential and Commercial
- Additions to existing buildings
- Alterations to existing buildings



How Often Does the Code Change?

- Every three years the code is updated
- 5% to 15% more stringent
- 2008 code goes into effect June 2009



How the Code Works

- Prescriptive
 - We list the minimum energy features that must be installed
- Performance
 - Able to use a computer program to pick and choose what energy features are wanted.



Energy Features to Meet Compliance

- In the past compliance was met with efficiency measures.
- Examples
 - R19 Walls
 - R38 Ceiling
 - SEER 13 AC
 - 92% AFUE furnace
 - .48 U-Factor and .45 SHGC Windows



Energy Features to Meet Compliance

- Now looking at quality installation measures for:
- HVAC (Residential and Commercial)
- Insulation (Residential)
- Lighting (Commercial)



Who Conducts the HVAC Tests?

- Residential
 - Installing Contractor, fills out and signs CF-6R
 - HERS rater does sampling of Contractors work, fills out and signs CF-4R
- Commercial
 - Installing contractor, Commissioning Agent, or PE in charge of project fills out and signs MECH-1-A to MECH-8-A as needed.



Who Enforces?

- Building departments are required to enforce the energy code.
- Verifies that the forms were filled out correctly according to the plans.



Prescriptive Residential Quality Installation Measures Required for NEW Construction 2008 Code

- Depends on climate zone
 - Duct sealing
 - Refrigerant Charge
 - Air Handler Fan Watt Draw
 - Air Handler Fan Flow



Performance Residential Quality Installation Options for NEW Construction 2008 Code

- Duct Sealing
- Duct Location, Surface Area, and R-value
- Low Leakage Air Handlers
- Refrigerant Charge or Charge Indicator light



Performance Residential Quality Installation Options for NEW Construction, Additions, and Alterations 2008 Code

- Air Handler Fan Flow
- High EER
- Maximum Cooling Capacity
- Air Handler Fan Watt Draw



Residential Quality Installation

- Duct Sealing
 - Tape off registers and use a duct blaster to pressurize to 25 Pa.
 - Less than 6% of fan flow allowed for new duct systems
 - Less than 15% of fan flow allowed for existing duct systems



Residential Quality Installation

- Duct Location, Surface Area, and R-value
 - Duct Design shall be performed and design shall include duct layouts, grill layouts, equipment specifications and system CFM deliveries on plans.



Residential Quality Installation

- Low Leakage Air Handlers
 - Air handlers have been certified to the Commission to leak 2% or less of fan flow.



Residential Quality Installation

- Refrigerant Charge or Charge Indicator light
 - Use Commission approved procedures to verify refrigerant charge
 - Install components that continuously monitors the charge of the system



Residential Quality Installation

- Air Handler Fan Flow
 - Minimum Air flow is 350 CFM/Ton



Residential Quality Installation

- High EER
 - Verify model numbers of FAU, coil, condenser
 - Verify that they meet the minimum EER listed on compliance documents.



Residential Quality Installation

- Maximum Cooling Capacity
 - Verify the Tonnage of installed equipment is the same size as listed on the compliance documentation.



Residential Quality Installation

- Air Handler Fan Watt Draw
 - Fan must be tested and draw less watts than listed on the compliance documents



HVAC Alterations To Existing HVAC Residential

- Most replacement HVAC systems require
 - Duct testing
 - Refrigerant Charge or Charge Indicator light



Residential Quality Installation

- All Quality Installation measures require the installer to test and fill out CF-6R and certify they have done the work to code
- They give the CF-6R to a HERS rater who sample tests the installers work



HERS Testing

- HERS rater sample tests contractor's work
 - Rater looks at:
 - 1 in 7 of the contractor's jobs or
 - 1 in 30 of the contractor's jobs if using TPQCP. Can only be used for duct testing and charging.



The HERS Provider

- A provider (large business) trains and certifies individual raters
- The provider is responsible for tracking all of the raters work
- All jobs are documented in the providers web site
- The provider spot checks the raters work



HERS Required for all Quality Installation Measures

- HERS rater required to sample test all the installers jobs
- All job address listed on provider web site
- Provider to check on rater to verify they are doing work correctly



What is a Third Party Quality Control Program?

- A Third Party Quality Control Program, uses software to electronically track and verify that the installer tested the equipment properly.
- Data is electronically uploaded weekly and is electronically checked to insure the work was done correctly.



Reasons why the CEC created the TPQCP

- Requirement for Cost effectiveness of the Standards for measures and processes
- Stimulate the use of diagnostic testing equipment by HVAC contractors
- Technology is changing the market
 - HVAC Manufacturers are incorporating on board diagnostics and monitoring



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- Collect data from participating installers for each installation completed for compliance credit
- Complete data checking analysis to evaluate the validity and accuracy of the data to independently determine whether compliance has been achieved, and that **the data shall not be alterable by the installer** to indicate that compliance has been achieved when in fact compliance has not been achieved.



Third Party Quality Control Program

- Enalasy was the first TPQCP approved by the California Energy Commission
- Enalasy trains and certifies HVAC Contractors in the use of their diagnostic testing equipment
- The Enalasy testing equipment collects data from sensors and wirelessly transmits the data to the laptop for analysis



Enalasy TPQCP

- The data cannot be changed or modified by the HVAC technicians
- The CF-6R cannot be printed unless the job complies with the Title-24 requirements for that job
- The CEC only requires 1 in 30 jobs to be field verified because of this type of testing and data integrity



Air Handler Data Collection Unit

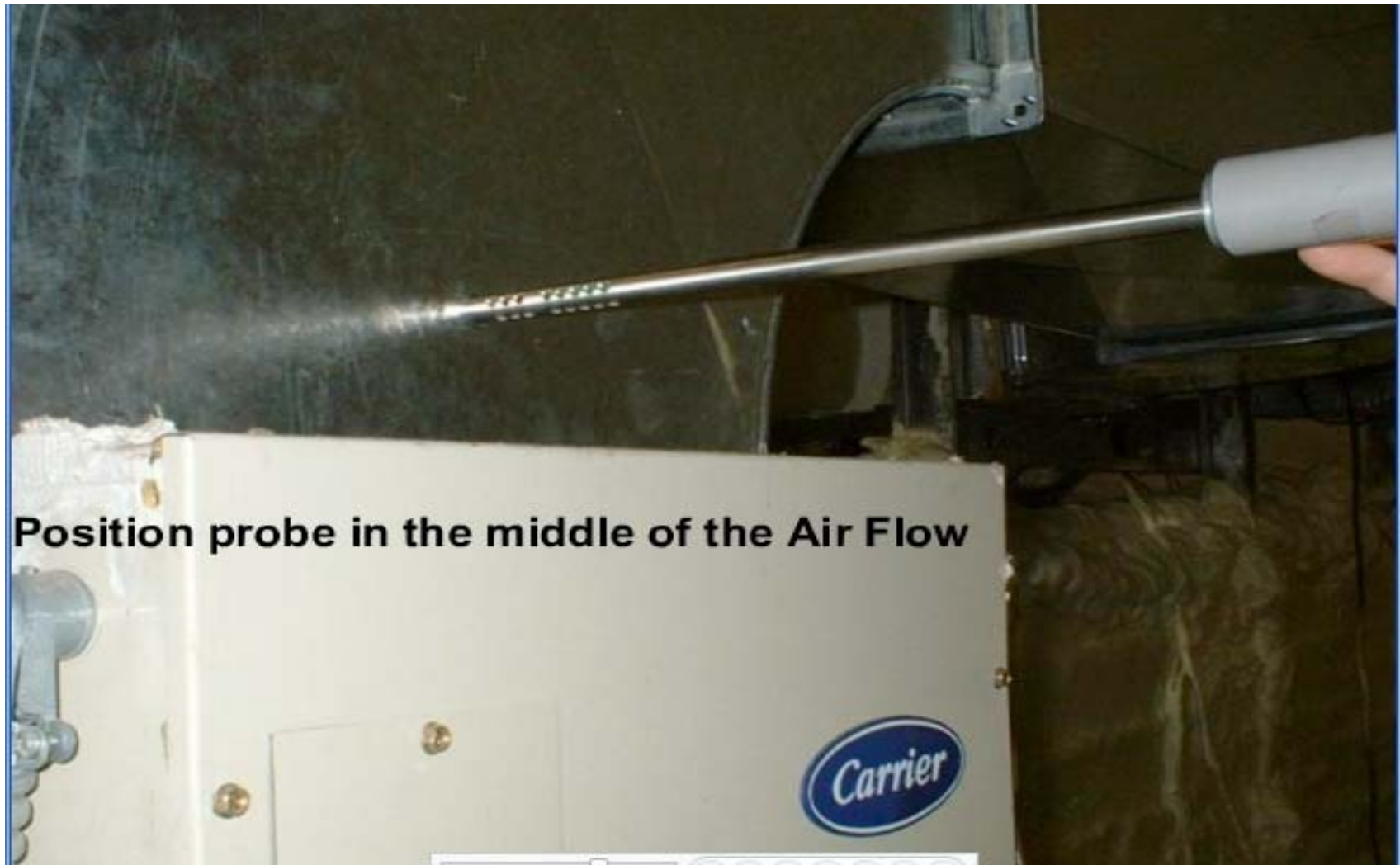


The Air Handler Data Collection Unit consists of two probes on a single harness that connects to a Radio Frequency Data Collection Unit called the Air Handler Data Collection Unit



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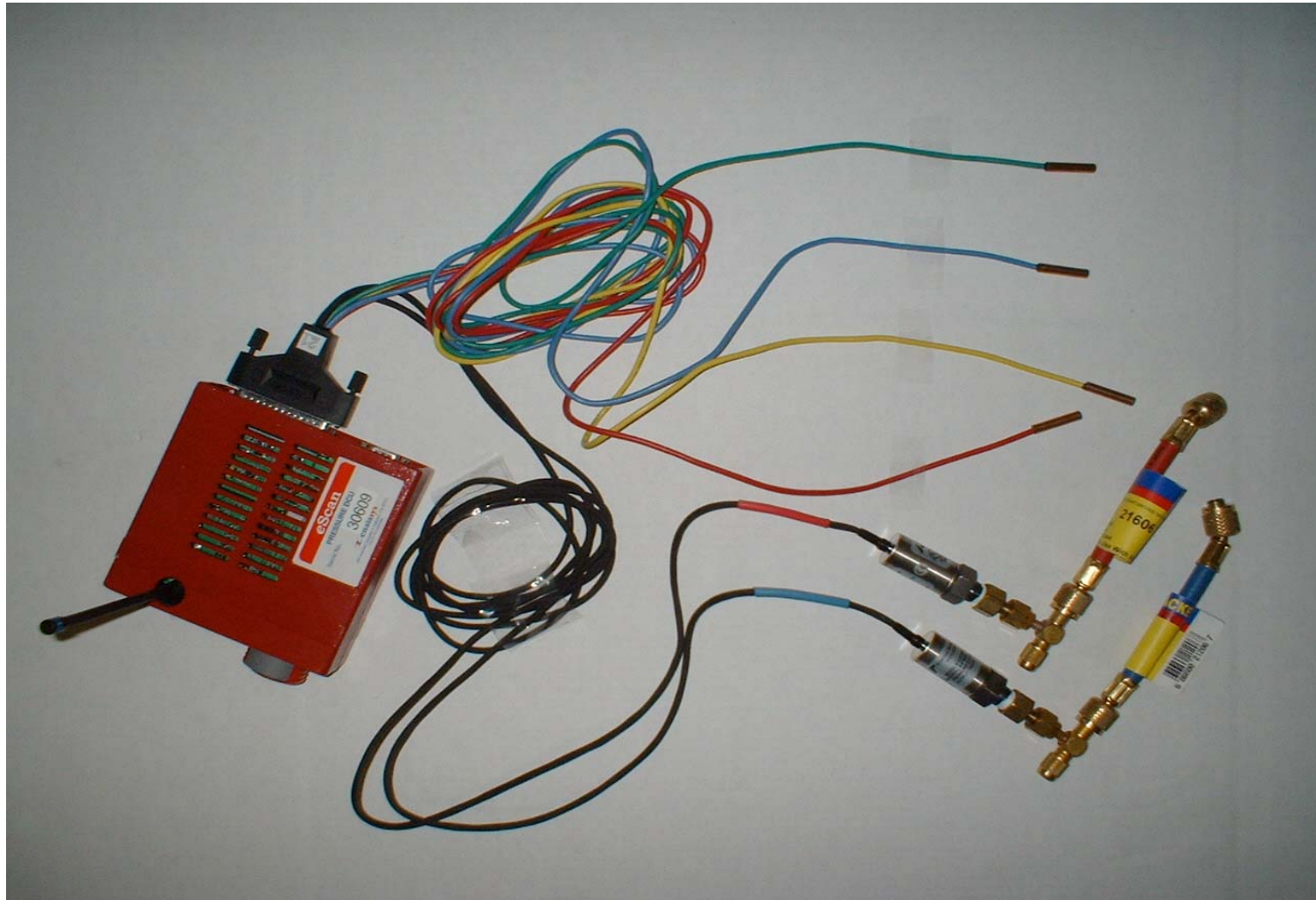
Air Handler Data Collection Unit Setup





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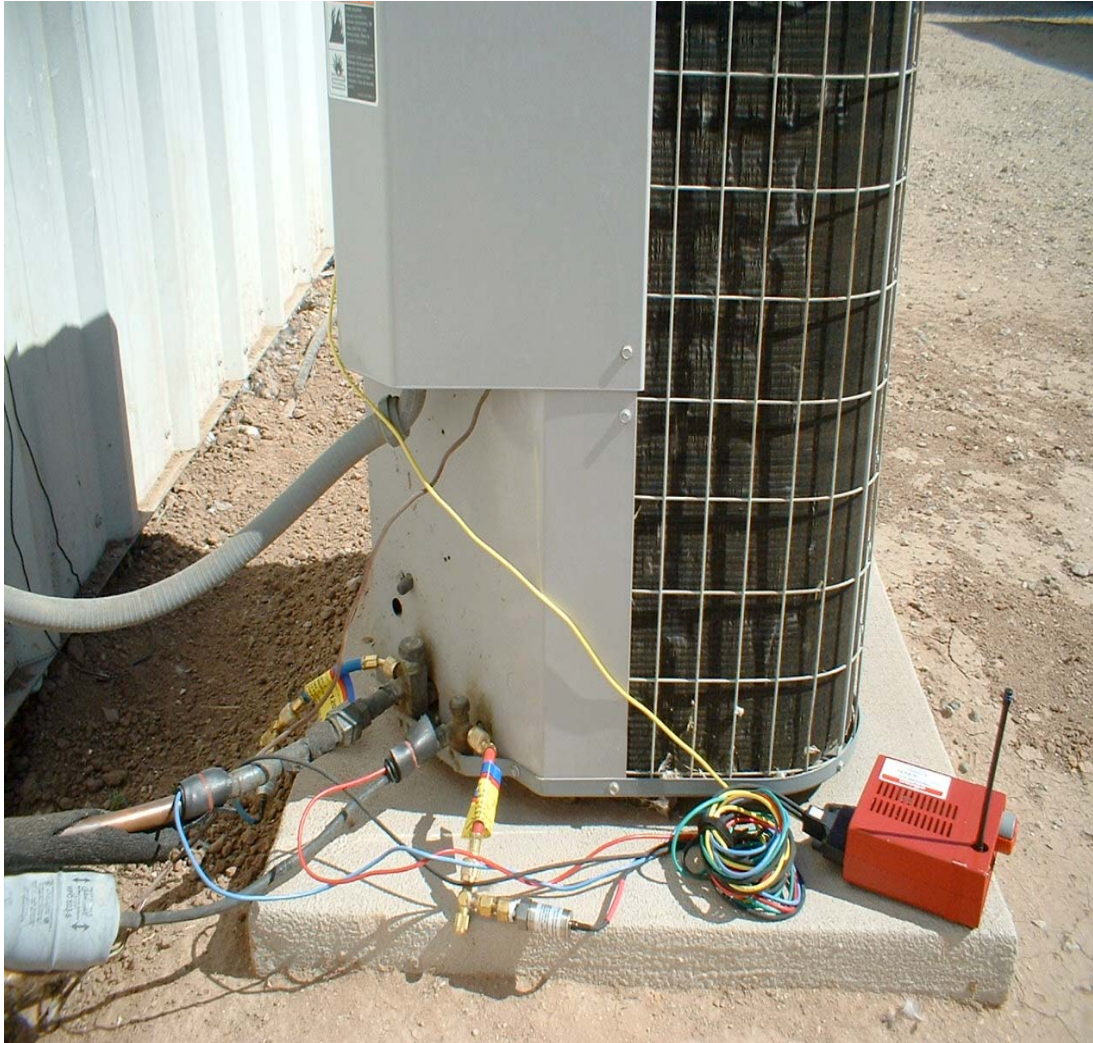
Pressure Data Collection Unit





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Pressure Data Collection Unit



Recording the "test in" data must happen no earlier than 15 minutes after turning on the system.



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Charge Rite

Program

Site ID

Contact Name

Contact Phone

Job/Ref No

Technician

Multi Family

Subpar Apartments

Cond Tons

Cond Make

Cond Model

Cond Serial

Refrigerant

RF22

Meter Device

Fixed Orifice

TXV

Freus Unit?

Test ID

Target Subcool

0

SEER

EER

Name Plate Charge

lb

oz

Ounces Added

(Negative = Re

Confirm Zero Correction

Probes Repositioned

Nameplate Illegible

Info for a

Air flow repairs

Yes

No

New Filter

Open Registers

Clean Coil

Clear Obstructions

Increase Blower Speed

Placed Sticker

Copy Current To Test In

Copy Current To Test Out

Save All Test Data

Cancel

Re-Upload

Print TPQC

Docs

Charge Rite calculated values and pass/fail determination

	Target	Actual		Target	Actual	
	Temp	Temp	Split	Super	Super	Charge
Readings	Split	Split	Diff	Heat	Heat	Diff
Current	14.4	5.5	-8.9	25.9	-1.6	-27.5
Test In						
Test Out						

Value Is High - Undercharged

Value Passes - Within Range

Value Is Low - Overcharged

Click these rows if you need to clear Test-In or Test-Out data

The Air Handler and Pressure DCUs will be polled automatically every 10 seconds

Readings from the Air Handler DCU

	Return	Return	Return	Supply	Return	Supply
Readings	Temp	Humid	WtBulb	Temp	Static	Static
Current	70.2	75.4	65.0	64.9	37.45	33.47
Test In						
Test Out						

Settled

0

Check the box to the right if you determine that you cannot settle down normally and you need to bypass the settle down. Sensor data will be transmitted to Enalaysis to troubleshoot the cause

Warning: Superheat is Negative - Check placement and attachment of sensors

Readings from the pressure DCU

	Suct	Suct	Liq	Liq
Cond	Temp	Press	Temp	Press
Temp In	64.0	50.4	87.6	66.0
				87.3

Actual Superheat Negative

Using T/P chart, 87.6 suction pressure is 52.0 degrees. Suction temp is 50.4 degrees. It is colder....there is no superheat. It is actually 1.6 degrees COLDER than having all vapor....so liquid is going to the compressor.



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Major California Market Transformation Efforts

Over 200,000 Verification Jobs completed from January 2006 to present

All IOU's in California and Nevada are using the Home Enalasy Process

PG&E as informed Enalasy that they have saved over 30MW from 1/1/07 to 1/1/08 due to Enalasy VSP jobs



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ENALASYS CORPORATION

- Anne Marie Jones
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Residential Ventilation

- ASHRAE Standard 62.2 was adopted for the 2008 code.



Residential Ventilation

- All new residential buildings required to meet the new ventilation code.
- Either continuous or Intermittent



Continuous Ventilation

- Fan on at all times
- $CFM_{Fan} = .01A_{floor} + 7.5(N_{br} + 1)$
 - Or from table
 - 1501 – 3000 sf with 4-5 bedrooms 60 cfm



Intermittent Ventilation

- Airflow of fan=Required airflow(continuous) / Effectiveness X percentage of time on
- Airflow of fan = 60cfm/ .50X.50
- 250 cfm required if fan runs 50% of the time



Commercial HVAC Requirements

- **All** newly installed HVAC systems must be verified that they work correctly
- Must test using the Acceptance Requirements



Acceptance Requirements

- The application of targeted inspection checks and functional and performance testing conducted to determine whether specific building components, equipment, systems, and interfaces between systems conform to the criteria set forth in the Standards and to related construction documents (plans or specifications).



Why Test?

- *A study by the New Buildings Institute found that:*
 - ***Economizers.*** Were not operating correctly 64% of the time.
 - ***Refrigerant charge.*** A total of 46% of the units tested were improperly charged.
 - ***Low airflow.*** 39% of the systems had under 300 cfm/ton and 20% of the systems had an average flowrate of 325 cfm/ton



Why Test?

- ***System Fans*** . Were found to be cycling on and off with a call for heating or cooling in 38% of the units tested.
- ***Unoccupied fan operation***. Fans were observed to run continuously during unoccupied periods in 30% of the systems.
- ***No outdoor air***. A physical inspection revealed that about 8% of the units were not capable of supplying any outdoor air to the spaces served.



List of the Acceptance Tests

- **MECH-2-A Outside air**
- **MECH-3-A Packaged and Split HVAC system controls**
- **MECH-4-A Economizer**
- **MECH-5-A Duct leakage**
- **MECH-6-A Demand control ventilation**



List of the Acceptance Tests

- **MECH-7-A Supply Fan Variable Flow Control**
- **MECH-8-A Hydronic System Tests**



MECH-2-A

Outside Air

- Constant Volume Systems outside air is within $\pm 10\%$ of Designers approved values
- VAV systems outside air is within $\pm 10\%$ of Designers approved values when all VAV boxes are open and closed.



MECH-3-A

Control Test

- Verify that supply fan operates continuously during occupied conditions and shuts off during non work hours.



MECH-4-A Economizer Test

- Economizer lockout Temp. setpoints set at required temp.
- Outside sensor tested and reads actual Temp.
- Set system to economizer mode and verify that outside air damper modulated to max open and return goes to max closed.
- Damper tested to open 100% before cooling begins.
- Disable economizer and outside air damper closes to min. and return air damper modulates to 100% open.



MECH-5A

Duct Pressurization

- Required for CAV system that:
 - Condition 5,000 sf of space, and
 - 25% or more of the duct work is in nonconditioned space



MECH-6-A

Demand Control Ventilation

- CO2 sensor factor or field calibrated
- CO2 sensor between 1 and 6 feet above the floor
- Outside air damper opens when CO2 in space exceeds setpoint
- Outside air damper modulates closed when CO2 in space is below setpoint



MECH-7-A

Supply Fan Variable Flow Control For Build up Systems

- Static pressure sensors factory calibrated or field calibrated
- Test static pressures at various speeds and conditions



MECH-8-A

Hydronic System Tests For Built-up Systems

- System has no flow when all coils are closed and pump is turned on
- Additional tests to verify flow