2016 Nonresidential HVAC Overview

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Outreach and Education Unit

Location
Date

Todays Training Outline

- Training Goals
- Standards Background
  - ✓ CEC History
  - ✓ 2016 Standards overview
  - ✓ Future energy and GHG goals
- Energy Standards Basics
  - ✓ Mandatory requirements overview
  - ✓ Compliance overview
  - ✓ Navigating The Standards
  - ✓ Demonstrating Compliance
- Nonresidential HVAC Meat and Potatoes
  - ✓ Mandatory Requirements
  - ✓ Prescriptive and Performance Requirements
  - ✓ Additions and Alterations
- Enforcement
- Resources

Goals for this Training

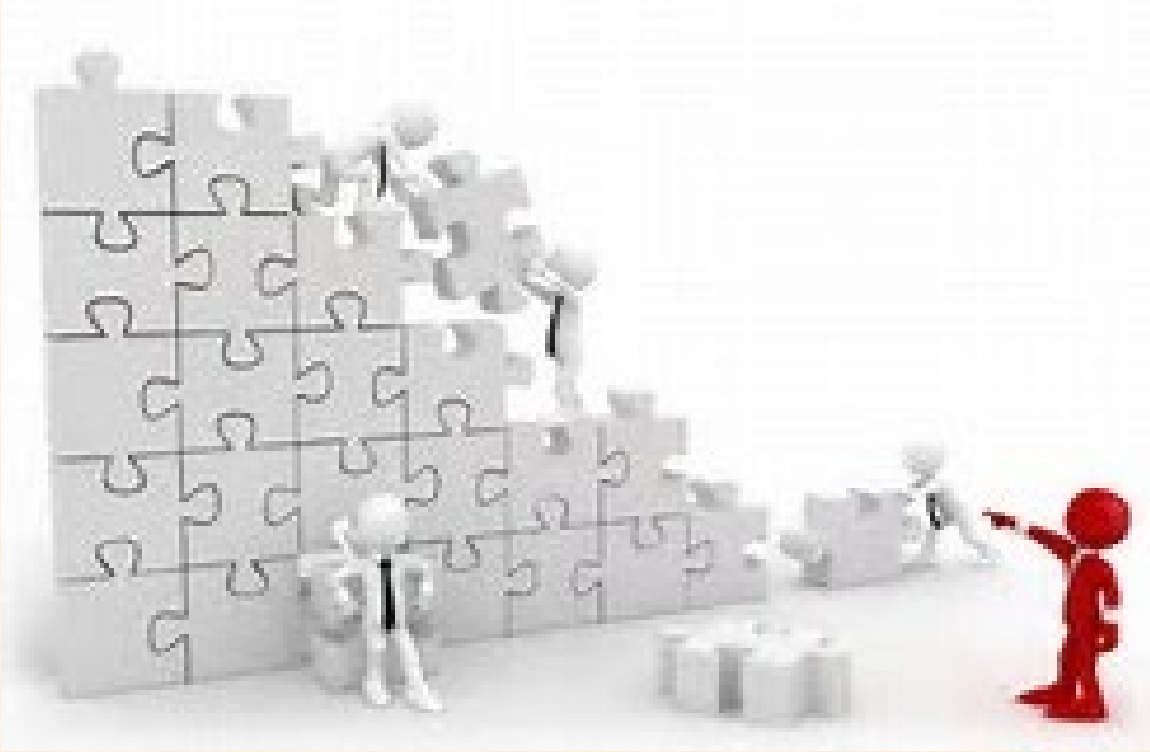
- **Basic understanding of the following:**
  - Structure of the Standards
  - Application of mandatory requirements
  - The differences between prescriptive and performance compliance
  - Nonresidential mechanical forms

- **General understanding of following:**
  - Mandatory requirements related to nonresidential HVAC
  - Nonresidential HVAC prescriptive requirements

QUESTIONS…

- **If you have questions please feel free to ask at anytime:**
  - During class
  - During breaks
  - The end of class; or
  - After class

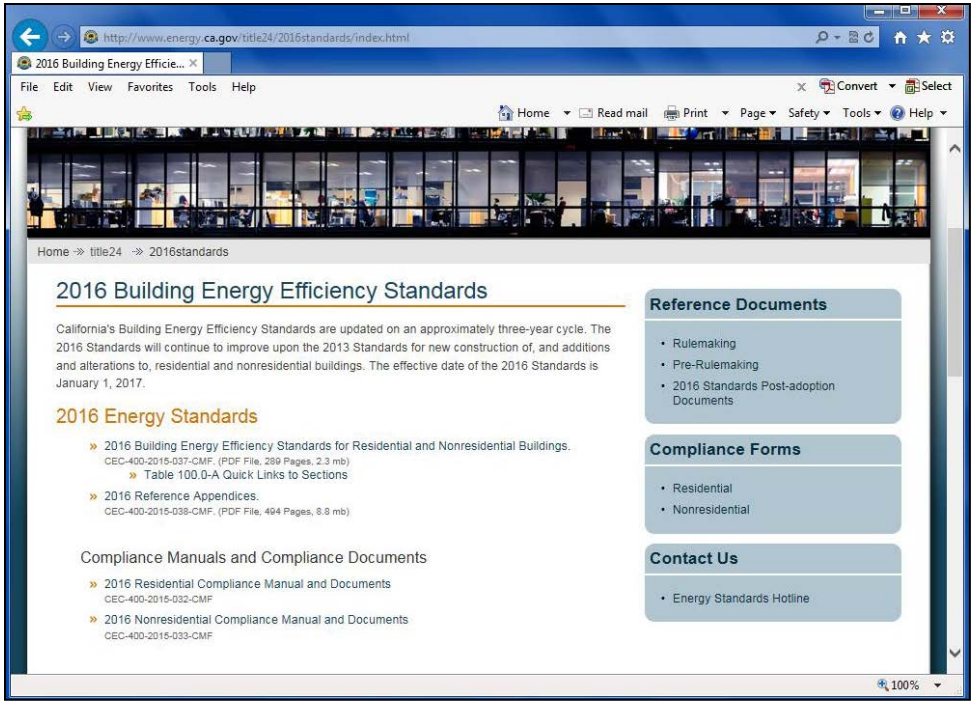
Energy Standards Background



A Little CEC History

- **Our governing document is Section 25402 of the Public Resources Code also known as the <u>Warren Alquist Act</u>**
  - Signed into law in 1974 by Ronald Reagan and launched by Jerry Brown in 1975
  - The act created the Energy Commission in 1974 and gave it authority to develop and maintain Building Energy Efficiency Standards
  - Mandates Building Efficiency Standards and requires the building departments to enforce them through the permit process
  - Requires the Standards and new requirements to be cost effective over the economic life of the structure
  - Requires the Energy Commission to update the Standards periodically (about every 3 years)

2016 Documents



- **Building Energy Efficiency Standards**
- **Reference Appendices**
- **Residential and Nonresidential Compliance Manuals**
- **Alternative Calculation Method (ACM) Manuals**
- **All docs. available online at:**
  www.energy.ca.gov/title24

Summary of 2016 Major Changes

- **Envelope U-factors**
  - Maximum values lowered
- **Indoor and outdoor lighting**
  - Power allowances reduced
  - Indoor lighting alterations
- **Equipment efficiencies**
  - Minimum efficiencies increased (based on federal standards)
- **HVAC Controls**
  - Door and window interlocks to turn HVAC off automatically
  - Direct digital controls to the zone
- **Covered Processes**
  - New requirements for elevators and escalators/moving walkways

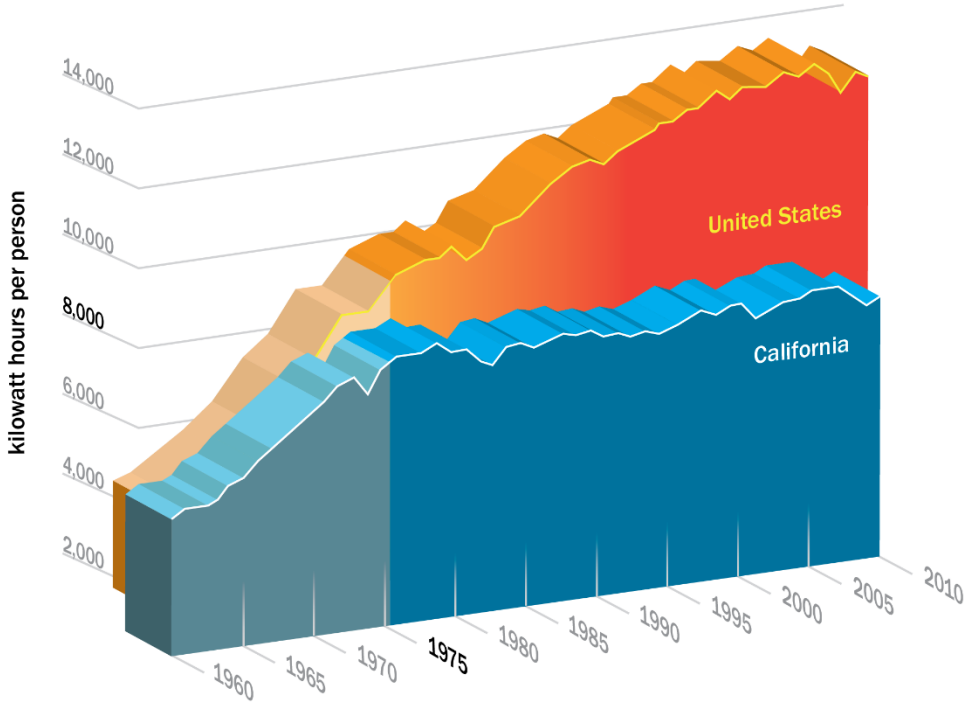
2016 Nonresidential Energy Savings

- **Overall, 5% more efficient than 2013 Standards**
  - Electricity Savings = 192 GWHs
  - Demand Reduction = 80 MW
  - Gas Savings = (0.9) Mtherms

2016 Energy Savings

"The Rosenfeld Effect"

Total per capita electricity use has stayed relatively flat in California in the last four decades while it has risen sharply in the country as a whole. This is often credited to Berkeley Lab physicist Art Rosenfeld's influence on California energy policy. Rosenfeld started championing energy efficiency in the early 1970s as a way to save energy resources.



Credit: Lawrence Berkeley National Laboratory

What the Future Holds

- **<u>AB 32</u> – Reduces GHGs and carbon footprint**
- **<u>SB 350</u> – Doubles efficiency and increases renewable energy to 50%**
- **<u>CPUC/CEC Strategic Plan:</u>**
  - ZNE goal for residential buildings by 2020
  - ZNE goal for nonresidential buildings by 2030

Energy Standards will "evolve/expand" and become more stringent to reach these goals

QUESTIONS…

About CEC or Standards?

Energy Standards Basics

Energy Standards Basics Topics

- **Mandatory Measures**
- **Prescriptive Compliance Approach**
- **Performance Compliance Approach**
- **Navigating The Standards**
  - Structure of the code (Part 1 and Part 6)
  - Navigation features in the electronic PDF.
- **Demonstrating Compliance**
  - What type of forms are there
  - When are they required
  - Smart form features

Mandatory Measures

- **Must always be met or exceeded**
- **Establish minimum level of energy efficiency and/or performance**
- **Apply to the different building components**
  - Envelope
  - Lighting
  - Mechanical
- **Sometimes are superseded by more stringent prescriptive requirements**

Prescriptive Measures

- **Set of predefined efficiency requirements that must ALL be met or exceeded when using the prescriptive compliance approach.**
- **Separate compliance for each "group" of building components.**
- **Simplest approach, but less flexible.**
- **Establishes baseline for the Standard building budget under the Performance Approach.**

Performance Compliance

- **Also known as the computer method**
- **Requires the use of Energy Commission approved software**
- **Most flexible approach, allows for trade-offs**
- **Proposed Design TDV energy ≤ Standard Design TDV energy budget**
- **Modeling, budgets, assumptions, etc. located in the Nonresidential ACM Reference Manual**

Navigating The Standards

TITLE 24 - THE CALIFORNIA BUILDING STANDARDS CODE

- **Part 1 (Administrative Code)**
  - Chapter 10: the administrative requirements
- **Part 6 (Energy Code)**
  - Subchapters 1 through 9
  - Mostly referred to by Section numbers
  - These are the technical requirements

BSC Code Book

Title 24 Part 1, Chapter 10

Section Title	Section #
Scope	10-101
Definitions	10-102
Permit, Certificate, Informational, and Enforcement Requirements for Designers, Installers, Builders, Manufacturers, and Suppliers	10-103
Nonresidential Lighting Controls Acceptance Test Training and Certification	10-103.1
Nonresidential Mechanical Acceptance Test Training and Certification	10-103.2
Exceptional Designs	10-104
Enforcement by the Commission	10-105
Locally Adopted Energy Standards	10-106

Section Title	Section #
Interpretations	10-107
Exemption	10-108
Compliance Software, Alternative Component Packages, Exceptional Methods, Data Registries and Data Input Software, Alternative Residential Field Verification Protocols, and Electronic Document Repositories	10-109
Procedures for Consideration of Applications Under Sections 10-104, 10-106, 10-108, and 10-109	10-110
Certification and Labeling of Fenestration Product U-Factors, Solar Heat Gain Coefficients, Visible Transmittance and Air Leakage	10-111
Criteria for Default Tables	10-112
Certification and Labeling of Roofing Product Reflectance and Emittance	10-113
Determination of Outdoor Lighting Zones and Administrative Rules for Use	10-114

Title 24 Part 6

Subchapter	Subchapter Title	Sections
1	**All Occupancies** - General Provisions	§100.0 - §100.2
2	All Occupancies - **Mandatory** Requirements for the Manufacture, Construction and Installation of Systems, Equipment, and Building Components	§110.0 - §110.11
3	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies and Covered Processes - **Mandatory** Requirements	§120.0 - §120.9
4	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Mandatory** Requirements for Lighting Systems and Equipment, and Electrical Power Distribution Systems	§130.0 - §130.5
5	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Performance and Prescriptive Compliance Approaches** for Achieving Energy Efficiency	§140.0 - §140.9
6	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Additions, Alterations, and Repairs**	§141.0 - §141.1
7	Low-Rise Residential Buildings - **Mandatory** Features and Devices	§150.0
8	Low-Rise Residential Buildings - **Performance and Prescriptive Compliance Approaches**	§150.1
9	Low-Rise Residential Buildings - **Additions and Alterations** to Existing Low-Rise Residential Buildings	§150.2

Navigation Features

- **Easy Navigation Features Added**
  - Section and Table references hyperlinked throughout Energy Standards.
  - TABLE 100.0-A separated with section hyperlinks.
  - Chapter hyperlinks in Nonresidential Compliance Manual.
  - Links work both online and in the downloaded version.

Demonstrating Compliance

How To Demonstrate Compliance

- **Compliance demonstration starts with compliance documents (forms).**
  - Completed by designers, consultants, builders, contractors, technicians, HERS raters, ATTs, etc.
  - Submitted to enforcement agencies for verification at different stages of construction.
  - There are four form categories.
    - Certificate of Compliance (NRCC)
    - Certificate of Installation (NRCI)
    - Certificate of Acceptance (NRCA)
    - Certificate of Verification (NRCV)
  - There are several sub-categories of each related to the building component –MCH, ENV, LTI, …etc.

What is the NRCC?

- **Nonresidential Certificate of Compliance**
  - Used to demonstrate compliance of the design.
  - Completed by designer, architect, energy consultant, engineer, etc.
  - Required with or on plans at permit.
  - Plans Examiner verifies NRCC matches specs on plans.

STATE OF CALIFORNIA
MECHANICAL SYSTEMS
CEC-NRCC-MCH-01-E (Revised 01/16)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE	NRCC-MCH-01-E
Mechanical Systems	Page 1 of 3

Project Name:	Date Prepared:

A. MECHANICAL COMPLIANCE DOCUMENTS & WORKSHEETS (check box if worksheet is included)

For detailed instructions on the use of this and all Energy Efficiency Standards compliance forms, refer to the 2016 Nonresidential Manual
Note: The Enforcement Agency may require all forms to be incorporated onto the building plans.

What is the NRCI?

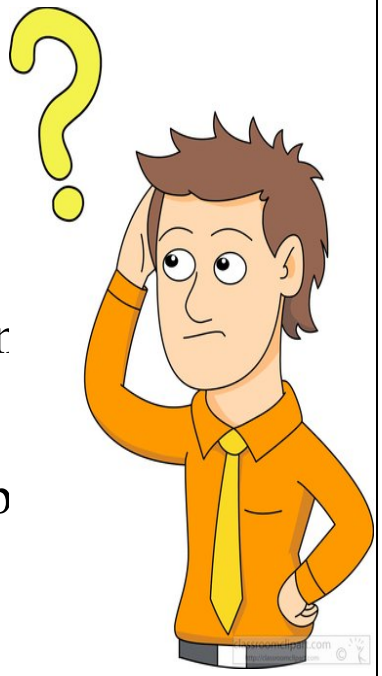
- **Nonresidential Certificate of Installation**
  - Confirms compliance at installation.
  - Completed by builder or installing contractor.
  - Required for Final Inspection.
  - Field Inspector verifies installed equipment and efficienc meet design documentation (NRCC forms) and plans.

STATE OF CALIFORNIA
MECHANICAL
CEC-NRCI-MCH-01-E (Revised 01/16) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		NRCI-MCH-01-E
Mechanical		Page 1 of 2
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

A. GENERAL INFORMATION 26

What is the NRCA?



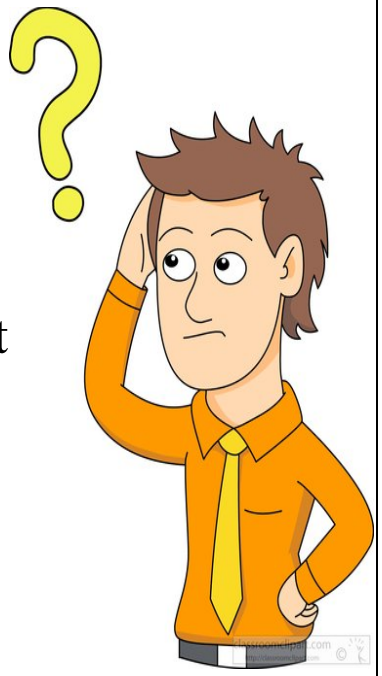
- **Nonresidential Certificate of Acceptance**
  - Confirms compliance with acceptance testing requiremer installation (HVAC & Lighting).
  - Completed by builder/installing contractor, OR an Accep Test Technician (ATT) when required.
  - Required for Final Inspection.
  - Field Inspector verifies applicable tests and forms are complete and accurate.

STATE OF CALIFORNIA
OUTDOOR AIR ACCEPTANCE
CEC-NRCA-MCH-02-A (Revised 07/16)

CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE		NRCA-MCH-02-A
Outdoor Air Acceptance		(Page 1 of 3)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:
System Name or Identification/Tag:	System Location or Area Served:	

What is the NRCV?



- **Nonresidential Certificate of Verification**
  - Confirms compliance with HERS testing requirements at installation (duct leakage & hot water piping).
  - Completed by certified HERS rater, and forms must be registered with an approved HERS Provider.
  - Required for Final Inspection.
  - Field Inspector verifies testing and forms are completed, signed, and registered.

STATE OF CALIFORNIA
DUCT LEAKAGE DIAGNOSTIC TEST
CEC-NRCV-MCH-04-H (Revised 01/16)

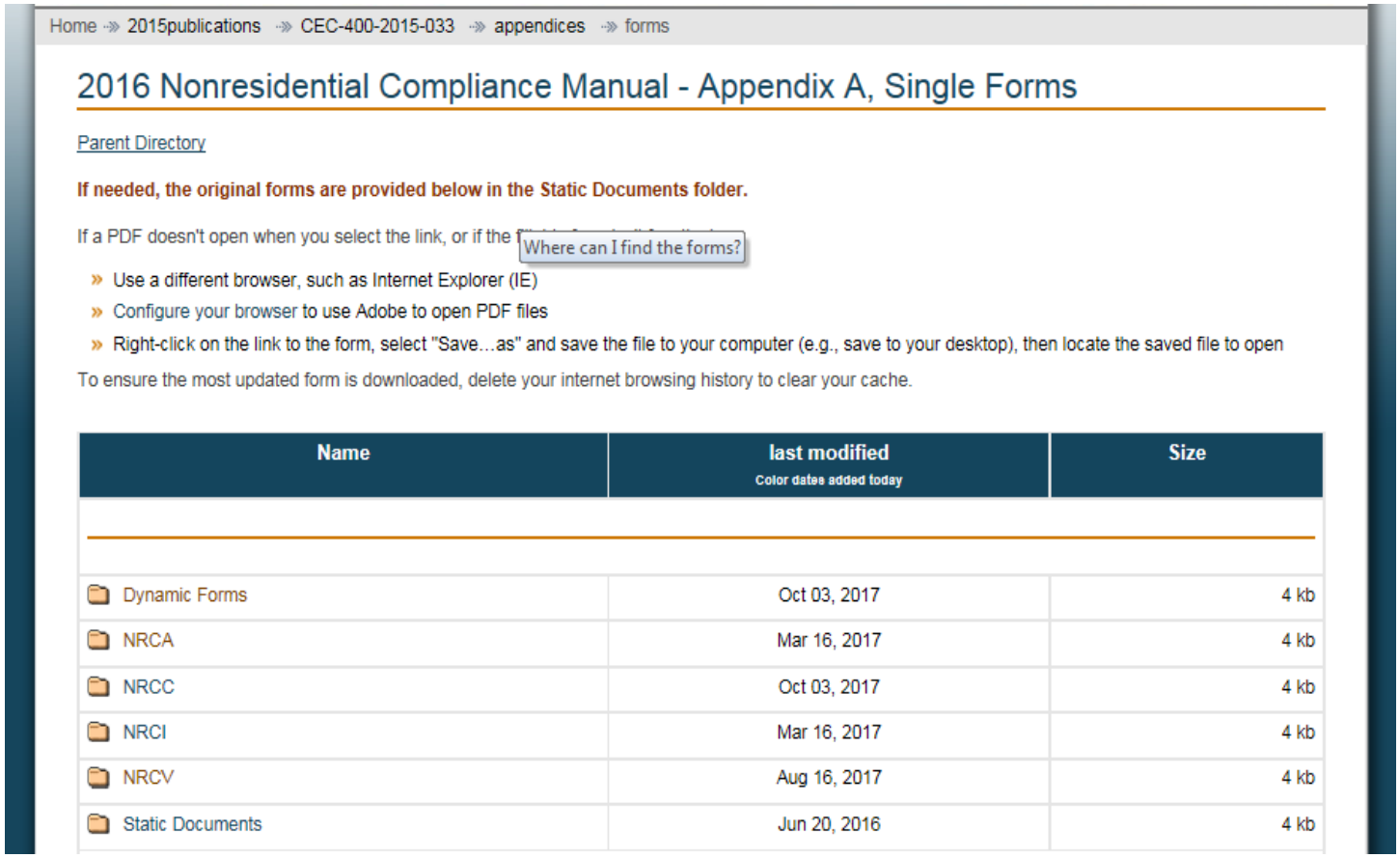
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF VERIFICATION		NRCV-MCH-04-H
Duct Leakage Diagnostic Test		(Page 1 of 2)
Project Name:	Enforcement Agency:	Permit Number:
Project Address:	City:	Zip Code:

A. System Information

Where can I find the forms?

Appendix A of the 2016 Nonresidential Compliance Manual



Home » 2015publications » CEC-400-2015-033 » appendices » forms

2016 Nonresidential Compliance Manual - Appendix A, Single Forms

Parent Directory

If needed, the original forms are provided below in the Static Documents folder.

If a PDF doesn't open when you select the link, or if the f

Where can I find the forms?

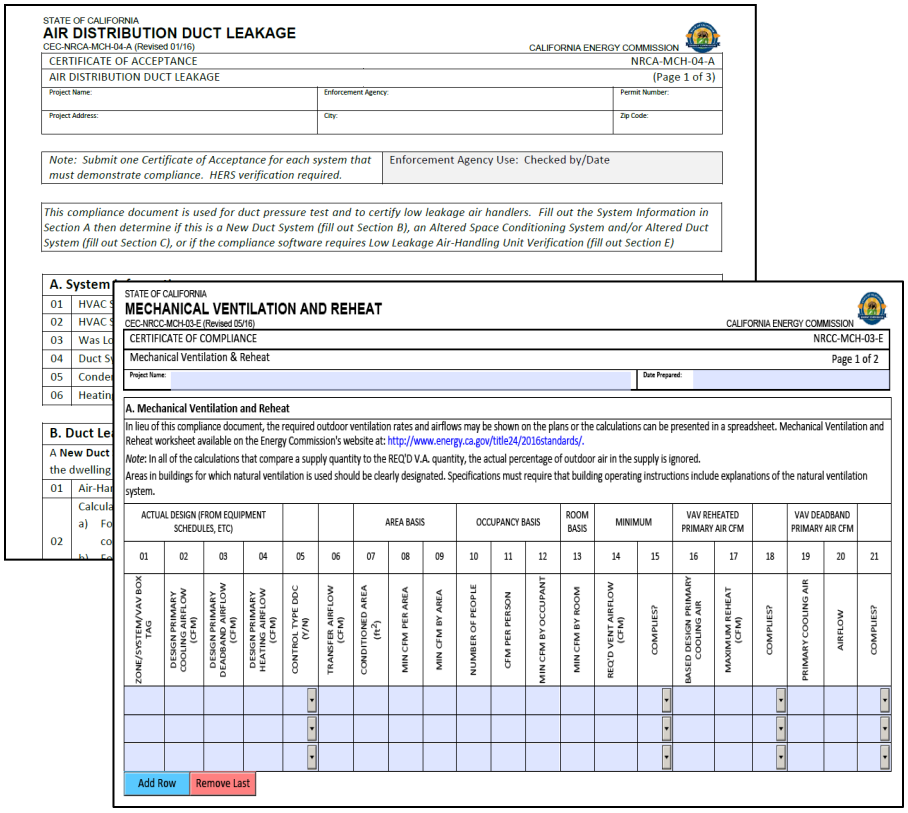
- Use a different browser, such as Internet Explorer (IE)
- Configure your browser to use Adobe to open PDF files
- Right-click on the link to the form, select "Save...as" and save the file to your computer (e.g., save to your desktop), then locate the saved file to open

To ensure the most updated form is downloaded, delete your internet browsing history to clear your cache.

Name	last modified Color dates added today	Size
Dynamic Forms	Oct 03, 2017	4 kb
NRCA	Mar 16, 2017	4 kb
NRCC	Oct 03, 2017	4 kb
NRCI	Mar 16, 2017	4 kb
NRCV	Aug 16, 2017	4 kb
Static Documents	Jun 20, 2016	4 kb

http://www.energy.ca.gov/2015publications/CEC-400-2015-033/appendices/forms/

Dynamic "Smart" Forms



STATE OF CALIFORNIA
AIR DISTRIBUTION DUCT LEAKAGE
CEC-NRCA-MCH-04-A (Revised 01/16)
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF ACCEPTANCE — NRCA-MCH-04-A
AIR DISTRIBUTION DUCT LEAKAGE — (Page 1 of 3)

Project Name: | Enforcement Agency: | Permit Number:
Project Address: | City: | Zip Code:

Note: Submit one Certificate of Acceptance for each system that must demonstrate compliance. HERS verification required. | Enforcement Agency Use: Checked by/Date

This compliance document is used for duct pressure test and to certify low leakage air handlers. Fill out the System Information in Section A then determine if this is a New Duct System (fill out Section B), an Altered Space Conditioning System and/or Altered Duct System (fill out Section C), or if the compliance software requires Low Leakage Air-Handling Unit Verification (fill out Section E)

A. System

01	HVAC S
02	HVAC S
03	Was Lo
04	Duct Sy
05	Conde
06	Heatin

B. Duct Le

A **New Duct** the dwelling

01	Air-Ha
02	Calcula a) Fo co b) Fo

STATE OF CALIFORNIA
MECHANICAL VENTILATION AND REHEAT
CEC-NRCC-MCH-03-E (Revised 05/16)
CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE — NRCC-MCH-03-E
Mechanical Ventilation & Reheat — Page 1 of 2

Project Name: | Date Prepared:

A. Mechanical Ventilation and Reheat

In lieu of this compliance document, the required outdoor ventilation rates and airflows may be shown on the plans or the calculations can be presented in a spreadsheet. Mechanical Ventilation and Reheat worksheet available on the Energy Commission's website at: http://www.energy.ca.gov/title24/2016standards/.

Note: In all of the calculations that compare a supply quantity to the REQ'D V.A. quantity, the actual percentage of outdoor air in the supply is ignored.

Areas in buildings for which natural ventilation is used should be clearly designated. Specifications must require that building operating instructions include explanations of the natural ventilation system.

ACTUAL DESIGN (FROM EQUIPMENT SCHEDULES, ETC)						AREA BASIS			OCCUPANCY BASIS			ROOM BASIS	MINIMUM		VAV REHEATED PRIMARY AIR CFM			VAV DEADBAND PRIMARY AIR CFM		
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
ZONE/SYSTEM/VAV BOX TAG	DESIGN PRIMARY COOLING AIRFLOW (CFM)	DESIGN PRIMARY DEADBAND AIRFLOW (CFM)	DESIGN PRIMARY HEATING AIRFLOW (CFM)	CONTROL TYPE DDC (Y/N)	TRANSFER AIRFLOW (CFM)	CONDITIONED AREA (ft^2)	MIN CFM PER AREA	MIN CFM BY AREA	NUMBER OF PEOPLE	CFM PER PERSON	MIN CFM BY OCCUPANT	MIN CFM BY ROOM	REQ'D VENT AIRFLOW (CFM)	COMPLIES?	BASED DESIGN PRIMARY COOLING AIR	MAXIMUM REHEAT (CFM)	COMPLIES?	PRIMARY COOLING AIR	AIRFLOW	COMPLIES?

Add Row | Remove Last

- **ALL 2016 NR forms are "dynamic" and "fillable"**
- **Some auto fill and conduct simple math calculations**
- **Interactive instructions**
- **Add and delete table rows**

Note about the Nonresidential Data Registry

- **<u>All</u> nonresidential forms are required to be registered (§10-103)**
  - Contingent upon approval of a nonresidential data registry.
  - To date, no such registry has been approved.
  - This means that registration is not required at this time.
  - No application has been submitted as of yet to review.

Code Quiz:

- What are the four types of forms and in what order are they typically used?
  1. NRCC – Certificate of Compliance.
  2. NRCI – Certificate of Installation.
  3. NRCA – Certificate of Acceptance
  4. NRCV – Certificate of Verification

- Which compliance approach offers the ability to trade off energy features?
  a) Performance Compliance Approach
  b) Prescriptive Compliance Approach

- Can you trade off mandatory measures for other higher efficiency features when using the Performance Approach?
  a) Yes
  b) No
  c) Maybe

QUESTIONS…

About Compliance Approaches, Navigation?

The Meat and Potatoes of Nonresidential HVAC

Title 24 Part 6

Subchapter	Subchapter Title	Sections
1	**All Occupancies** - General Provisions	§100.0 - §100.2
2	All Occupancies - **Mandatory** Requirements for the Manufacture, Construction and Installation of Systems, Equipment, and Building Components	§110.0 - §110.11
3	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies and Covered Processes - **Mandatory** Requirements	§120.0 - §120.9
4	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Mandatory** Requirements for Lighting Systems and Equipment, and Electrical Power Distribution Systems	§130.0 - §130.5
5	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Performance and Prescriptive Compliance Approaches** for Achieving Energy Efficiency	§140.0 - §140.9
6	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Additions, Alterations, and Repairs**	§141.0 - §141.1
7	Low-Rise Residential Buildings - **Mandatory** Features and Devices	§150.0
8	Low-Rise Residential Buildings - **Performance and Prescriptive Compliance Approaches**	§150.1
9	Low-Rise Residential Buildings - **Additions and Alterations** to Existing Low-Rise Residential Buildings	§150.2

Part 6 Nonresidential HVAC Sections

Subchapter	Subchapter Title	Section	Section Title
2	**All Occupancies** - **Mandatory** Requirements for Systems and Equipment	§110.1	Mandatory requirements for Appliances
		§110.2	Mandatory requirements for Space-Conditioning Equipment
		§110.5	Pilot Lights Prohibited
3	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies and Covered Processes - **Mandatory** Requirements	§120.1	Requirements for Ventilation
		§120.2	Required Controls for Space-Conditioning Systems
		§120.3	Requirements for Pipe Insulation
		§120.4	Requirements for Air Distribution Systems, Ducts and Plenums
		§120.5	Required Nonresidential Mechanical System Acceptance
		§120.8	Nonresidential Building Commissioning
		§120.9	Mandatory Requirements for Commercial Boilers
5	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Performance and Prescriptive Compliance**	§140.1	Performance Approach: Energy Budget
		§140.2	Prescriptive Approach
		§140.4	Prescriptive Requirements for Space Conditioning Systems
6	Nonresidential, High-Rise Residential, Hotel/Motel Occupancies - **Additions, Alterations, and Repairs**	§141.0	Additions, Alterations, and Repairs to Existing Nonresidential, High-Rise Residential, and Hotel/Motel Buildings

Subchapter 2

All Occupancies

Mandatory Requirements

for the Manufacture, Construction and Installation of Systems, Equipment and Building Components

(Sections §110.0 -§110.11)

§110 Series
All Occupancies Mandatory HVAC Requirements

- **§110.1 - Mandatory Requirements for Appliances**
- **§110.2 - Mandatory Requirements for Space Conditioning Equipment**
- **§110.5 - Natural Gas Central Furnaces, Cooking Equipment, and Pool and Spa Heaters: Pilot Lights Prohibited**

§110.1 – Mandatory Requirements for Appliances

§110.1 – Mandatory Requirements for Appliances

- **Systems, equipment and appliances may be installed only if they are certified and listed as follows:**
  - If the item is covered by Title 20, it must meet the Title 20 efficiency requirements and be listed in the Title 20 database (MAEDBS).
  - Items having efficiency requirements in Title 24, Part 6 must be listed in one of the following:
    - Title 20 database
    - Federal database
    - Approved trade association database such as AHRI or CTI
  - If the equipment cannot be listed, you must demonstrate efficiency conformance per the procedures outlined in Section 10-109 of Part 1.

§110.2 - Mandatory Requirements for Space Conditioning Equipment

§110.2 - Mandatory Requirements for Space Conditioning Equipment

- **All equipment covered in this section must be certified by the manufacturer.**
  - **(a)** All equipment listed in TABLE 110.2-A through TABLE 110.2-K must meet the applicable efficiencies when tested per the listed test procedure.

❖ EXCEPTION:

✓ There are exceptions for some water chilling packages, some positive displacement chillers and equipment serving refrigerated warehouses or commercial refrigeration. See §110.2(a) for details.

§110.2 - Mandatory Requirements for Space Conditioning Equipment

- **(b)** Heat pumps with supplementary electric resistance heaters must have controls that:
  - **Prevent supplementary heater** operation when the heating load can be met by the heat pump alone.
  - The **cut-on and cut-off temperatures** for the electric resistance heating must be lower than the heat pump cut-on and cut-off temperatures.

❖ EXCEPTION:

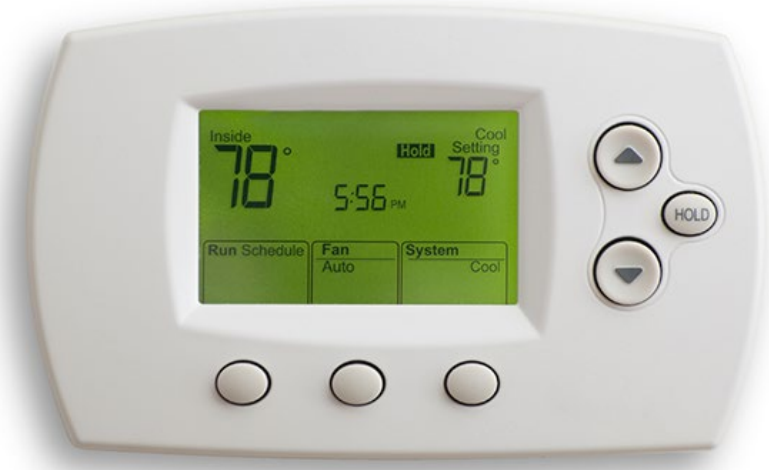
✓ There are exceptions for defrost, transient periods, and room air conditioners.

§110.2 - Mandatory Requirements for Space Conditioning Equipment

- **(c)** Thermostat Requirements
  - All unitary systems without an EMCS must have a **setback thermostat** that can be programed with at least four temperature setpoints within 24 hours.
  - Thermostats for heat pumps must also control **supplementary electric resistance** heaters as discussed on the previous slide.

❖ EXCEPTION:

✓ Gravity gas wall heaters, gravity floor heaters, gravity room heaters, non-central electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners, and room air-conditioner heat pumps are not required have to have setback thermostats..



§110.2 - Mandatory Requirements for Space Conditioning Equipment

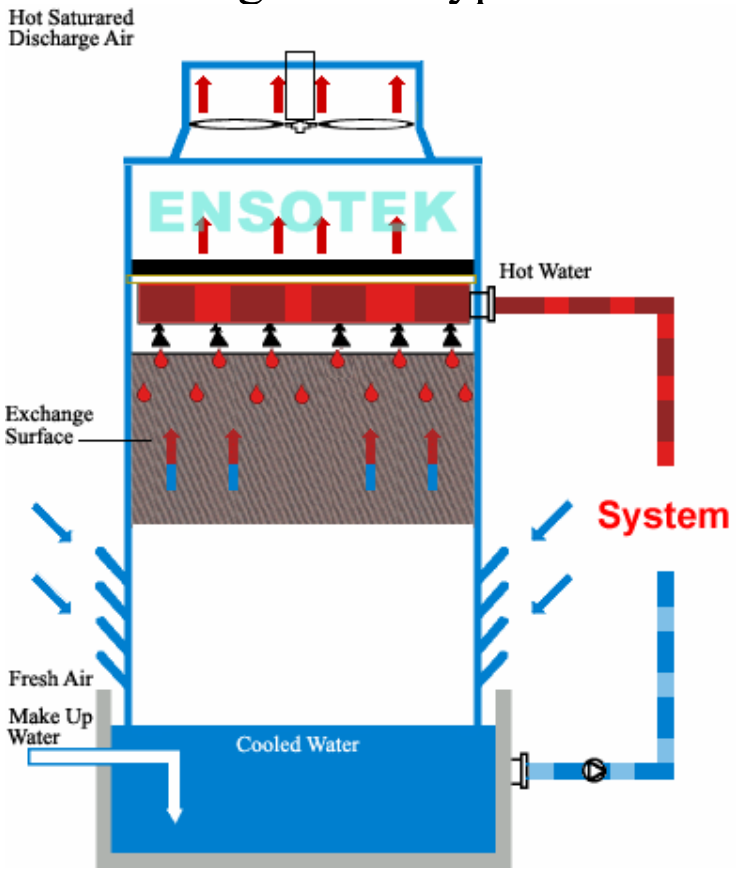
- **(d)** Gas- and Oil-Fired Furnace ≥225,000 Btu/h must have controls to limit Standby Loss:
  - They must have an **intermittent ignition or interrupt device** (IID).
  - They must have either **power venting** or a **flue damper**.
  - A **vent damper** is permissible with furnaces using combustion air from the conditioned space.
  - All furnaces not located within the conditioned space must have **jacket heat losses** not exceeding 0.75 percent of the input rating.

§110.2 - Mandatory Requirements for Space Conditioning Equipment

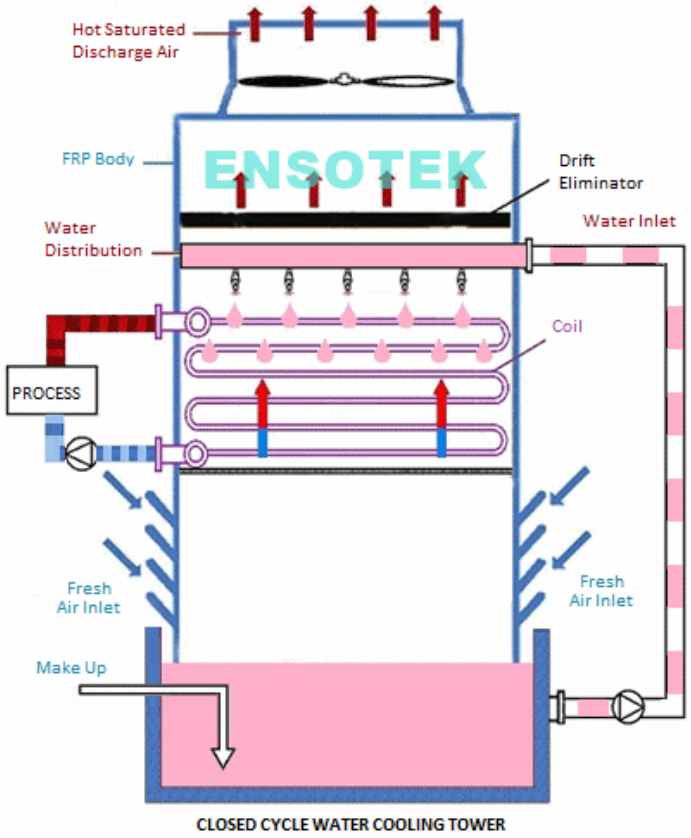
- Cooling towers

§110.2 - Mandatory Requirements for Space Conditioning Equipment

- Cooling towers types



OPEN CYCLE



CLOSED CYCLE

§110.2 - Mandatory Requirements for Space Conditioning Equipment

- **(e)** Cooling towers ≥ 150 tons must have the following:
  - Conductivity or Flow-based controls that **maximize cycles of concentration** based on local water quality and an approved calculator using a **Langelier Saturation Index** (LSI) of 2.5 or less.
  - The NRCC-MCH-06 form is used to document this and must be signed by the Professional Engineer (P.E.) of Record.
  - Have a **flow meter** with an analog output for flow either hardwired or available through a gateway on the makeup water line and have an **overflow alarm**.
  - They must be equipped with **Drift Eliminators** that achieve drift reduction to 0.002 percent of the circulated water volume for counter-flow towers and 0.005 percent for cross-flow towers.
  - Nonresidential Manual chapter 4.6.1.1 is a good resource for cooling tower water conservation information.

§110.2 – Mandatory Requirements for Space Conditioning Equipment

- **(f)** Low leakage air handler compliance credit:
  - The air handler must be listed on the Energy Commission's list of certified products.
  - After installation, the system and attached ducts must be leak tested by a **HERS rater** and the documentation uploaded to the **HERS Registry**.
  - Credit is only available if the performance method is used.

§110.5 - Natural Gas Central Furnaces, Cooking Equipment, and Pool and Spa Heaters: Pilot Lights Prohibited

§110.5 - Natural Gas Central Furnaces, Cooking Equipment, and Pool and Spa Heaters: Pilot Lights Prohibited

- **Any <u>natural gas</u> system or equipment listed below may be installed only if it does not have a continuously burning pilot light:**
  - Fan-type central furnaces.
  - Household cooking appliances.
    - ❖ EXCEPTION:
      - ✓ Household cooking appliances without an electrical supply voltage connection <u>and</u> each pilot consumes less than 150 Btu/hr.
  - Pool heaters.
  - Spa heaters.

All Occupancies Mandatory Requirements

- Code Quiz:
  - Is this thermostat allowed for gravity gas wall heaters or room air conditioners?
    - ✓ Yes

  - Is it allowed for a forced air system?
    - ✓ No

All Occupancies Mandatory Requirements

➢Code Quiz:

- In order to be legally installed in California, space-conditioning equipment with requirements in the Standards must…what?
  a) Meet the listed efficiency requirements.
  b) Be listed in an approved database.
  c) Both a and b.

All Occupancies Mandatory Requirements

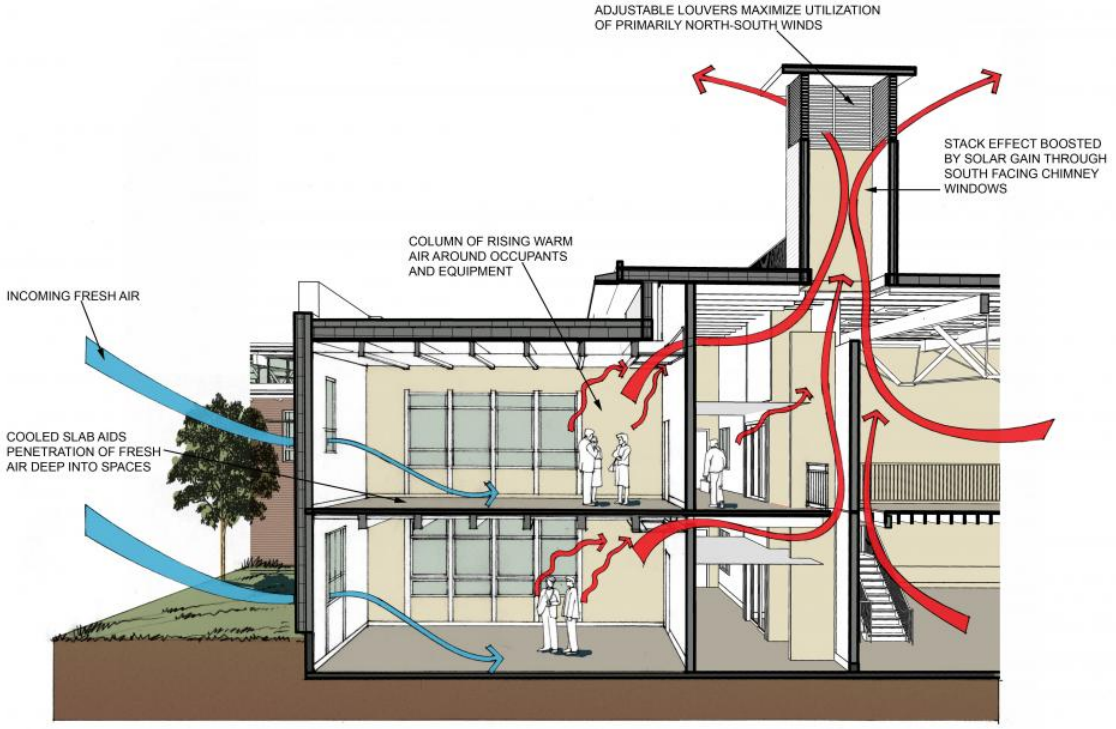
- **Takeaways from all occupancy mandatory requirements**
  - Title 24, Part 6 requires all equipment to meet the efficiency requirements listed in Title 20 and Title 24 and be listed in an **approved database**.
  - Heat pumps must have controls **limiting supplementary electric heaters**.
  - Central systems must have an EMCS or **setback thermostat**.
  - Gas- and Oil-Fired Furnaces must have controls to **limit Standby Losses**.
  - Cooling towers ≥ 150 tons are required to have **water saving controls** for maximum cycles of concentration, overflow, and water drift loss.
  - Continuously burning **pilot lights are prohibited** on natural gas forced air furnaces, kitchen appliances and pool and spa heaters.
  - These requirements are **mandatory** and are applicable to **all buildings**.
  - ❖ Always check for exceptions.

Subchapter 3
Nonresidential, High-Rise Residential, Hotel/Motel Occupancies, and Covered Processes
Mandatory Requirements
(Sections §120.0 -§120.9)

§120 Series
Nonresidential, High-Rise Residential, Hotel/Motel Occupancies Mandatory Requirements

- §120.1 - Requirements for Ventilation
- §120.2 - Required Controls for Space-Conditioning Systems
- §120.3 - Requirements for Pipe Insulation
- §120.4 - Requirements for Air Distribution Systems, Ducts and Plenums
- §120.5 - Required Nonresidential Mechanical System Acceptance
- §120.8 - Nonresidential Building Commissioning
- §120.9 - Mandatory Requirements for Commercial Boilers

§120.1 – Requirements for Ventilation



Ventilation Background

- **CEC is <u>required by law</u> to ensure building standards are consistent with Health and Safety Code §105400 and §105410.**
- **These codes are not tied to the Warren Alquist Act (PRC25402) which created the Energy Code.**
- **Ventilation requirements are the only requirements in Part 6 not necessarily required to be cost effective.**

§120.1 – Requirements for Ventilation

- **§120.1 requires enclosed spaces to be ventilated with outdoor air as outlined in this section and Part 4 (CMC) of Title 24.**
- **Where there is an inconsistency between Part 6 and Part 4, the most stringent requirement must be implemented.**
- **Natural or mechanical ventilation may be used to meet ventilation requirements.**
- **Spaces or buildings not normally used for human occupancy and work such as refrigerated warehouses are exempt – but, designers should use common sense.**

§120.1 – Requirements for Ventilation

- **(b)1. Natural ventilation**
  - The openable area that supplies outside air must not be less than 5 percent of the conditioned floor area of the ventilated space.
  - The ventilated spaces must be within 20 feet of operable opening for nonresidential spaces and 25 feet for residential spaces.
  - Where openings are covered with louvers or other obstructions, openable is based on the unobstructed area through the opening.
  - The operable openings must be readily accessible to building occupants.

§120.1 – Requirements for Ventilation

- **(b)2. Mechanical Ventilation**

  - Minimum required mechanical ventilation to be supplied to each space must be the larger of the following:
    - The conditioned floor area of the space times the ventilation rate from TABLE 120.1-A.
    - The requirement in the CMC.
    - ✓ We have done the math for you in Table 4-14 in the Nonresidential Compliance Manual.
  - ❖ Outdoor air may be transferred from other ventilated spaces if both of the following are satisfied:
    - ✓ The transfer air has no unusual indoor air contaminants.
    - ✓ The system must have capacity to supply all spaces **at the same time**.

§120.1 – Requirements for Ventilation

- **(c) Operation and control requirements**
  - **1.** The minimum outdoor air must be supplied at all times **unless**:
    - The space is intermittently occupied and controlled with an **Occupancy Sensor** (OS) or **Demand Control Ventilation** (DCV).
    - A temporary reduction is allowed for up to 30 minutes at a time if the average rate for each hour is ≥ the required rate. (DCV or OS not required)
  - **2.** A preoccupancy purge is required in the hour prior to occupancy. The **lesser** of the following must be provided to the entire building:
    - The minimum required rate of outdoor air.
    - Three complete air changes.
      - ❖ Not required in spaces not normally occupied or with natural ventilation

§120.1 – Requirements for Ventilation

- **(c) Operation and control requirements – cont.**
  - **3. Demand Control Ventilation** is required on HVAC systems if they have **all** the following characteristics:
    - They have an air economizer.
    - They have an occupant density of 25 per 1,000 ft^2 or more for egress.
    - Either a single zone systems or a multiple zone systems with Direct Digital Controls (DDC) to the zone level.

❖ EXCEPTIONS:

✓ There are several exceptions to demand control ventilation (§120.(c)3.) related to airborne contaminates, space type, occupant density, exhaust rate, and space size.

§120.1 – Requirements for Ventilation

- **(c) Operation and control requirements – cont.**
  - **4.** Requirements for DCV systems with **CO_2 Sensors**
    - CO_2 sensors are required in **each room** with no less than **one per 10,000 ft²**.
    - When a zone or a space is served by more than one sensor, **a high CO_2 signal from any sensor** in the zone or space must trigger a ventilation increase.
    - CO_2 sensors must be located between 3 ft and 6 ft above the floor or at the anticipated height of the occupants heads.
    - CO_2 must be maintained to **600 ppm or less plus the outdoor air CO_2** concentration, **but** the space ventilation rate does not have to be exceeded.
    - Outdoor air CO_2 must be determined by assuming 400 ppm, or measuring with a CO_2 sensor located within 4 feet of the outdoor air intake.

§120.1 – Requirements for Ventilation

- **(c) Operation and control requirements – cont.**
  - **4.** Requirements for DCV systems with **CO_2 Sensors** – cont.
    - If a sensor fails, the system must reset to supply the minimum outside air to the zone served by the sensor when the zone is occupied.
    - Sensor readings for each zone must be displayed continuously, and must be recorded on systems with DDC to the zone level.
    - Manufacturers must certify their sensors accuracy for 5 years.

§120.1 – Requirements for Ventilation

- **(c) Operation and control requirements – cont.**
  - **5.** Requirements for systems with **Occupancy Sensors**
    - Per section 120.2(e)3.B, occupant sensor control devices are **required for the following spaces** unless they have operations that generate harmful dust, fumes, vapors or gasses:
      - ✓ Multipurpose rooms less than 1000 ft^2;
      - ✓ Classrooms over 750 ft^2.
      - ✓ Conference, convention, auditorium and meeting rooms greater than 750 ft^2.

❖ EXCEPTION:

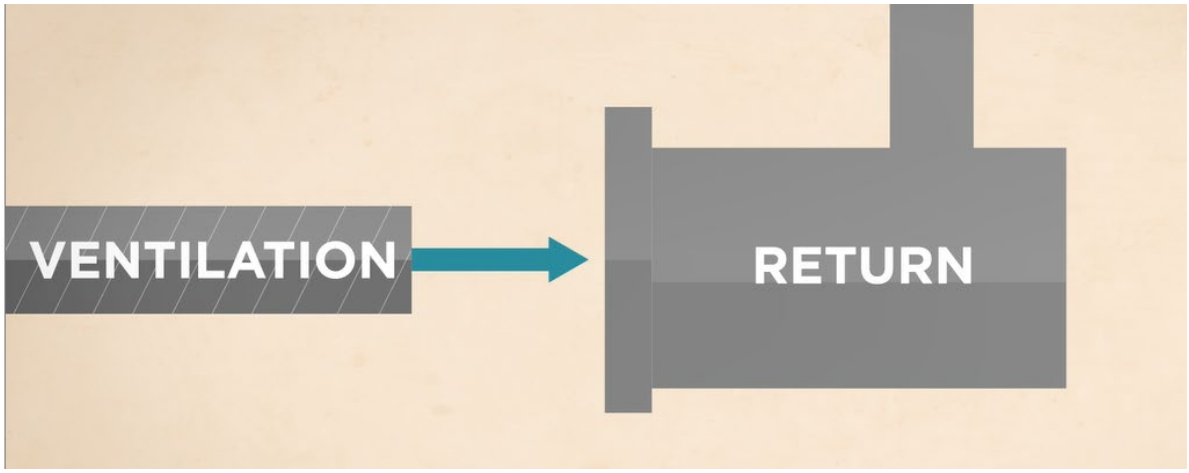
✓ Occupancy sensor ventilation control is not required if DCV with CO_2 sensors is required.

§120.1 – Requirements for Ventilation

- **(c) Operation and control requirements – cont.**
  - **5.** Requirements for DCV systems with **Occupancy Sensors** – cont.
    - They must be placed so they can detect occupants in the entire space.
    - Occupant sensors **controlling lighting** may be used for ventilation as long as the ventilation signal is independent of daylighting and manual controls.
    - Single zone damper or a **single zone system serves multiple rooms**, must have a sensor in each room.
    - A zone is not considered vacant until all rooms in the zone are vacant.
    - The sensor must reduce the ventilation within 30 minutes after being vacant.
    - During normal occupancy hours **spaces must receive** at least 25 percent of the ventilation rate listed in TABLE 120.1-A over period of 120 minutes.

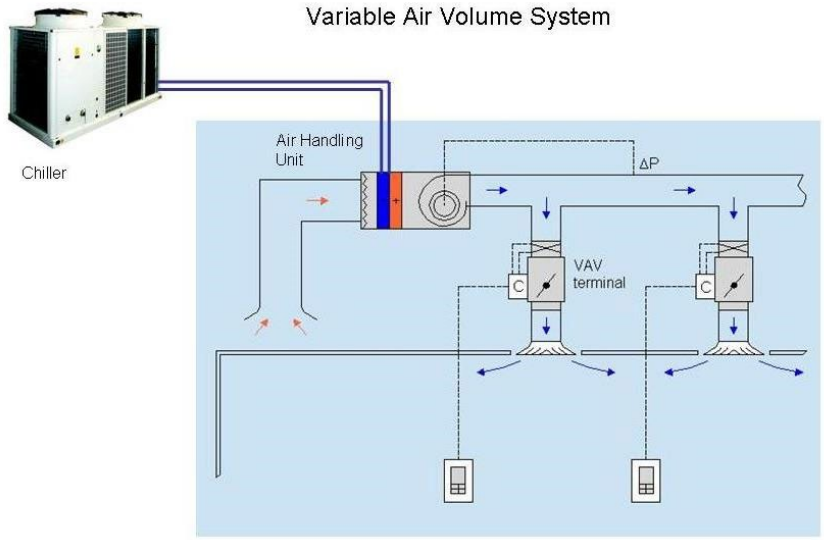
§120.1 – Requirements for Ventilation

- **(d) Ducting for Zonal Heating and Cooling Units**
  - Where a return plenum is used to supply outdoor air, the outdoor air should be ducted to discharge either:
    - Within 5 feet of the intake; or
    - If the velocity is ≥ 500 feet per minute, it can be up to 15 feet away if it is directed substantially toward the intake.



§120.1 – Requirements for Ventilation

- **(e) Design and Control Requirements for Outdoor Air**
  - Systems must be designed with and have ductwork, dampers, and controls to supply the larger of:
    - (1) the required **outside air rates**; or
    - (2) the rate required for **make-up of all exhaust systems** that are required for processes, for control of odors, or for the removal of contaminants.
  - VAV system measured outside air ventilation rates must be within 10 percent of the required rate. Fixed minimum damper position is not considered to be dynamic and is not allowed.



§120.1 – Requirements for Ventilation

- **Enforcement for Ventilation**
  - Permit and Plans Review:
    - Multi zone systems:
      - ✓ Verify NRCC-MCH-01 shows ventilation equipment and test requirements.
      - ✓ Verify NRCC-MCH-02 shows the equipment, their mandatory and prescriptive efficiency requirements, and the actual efficiencies.
      - ✓ NRCC-MCH-03 shows the ventilation requirements and calculations data.

      Note: In lieu of NRCC-MCH-03, the required outdoor ventilation rates and airflows may be shown on the plans or the calculations can be presented in a spreadsheet.
    - Single zone, packaged systems:
      - ✓ Single zone, package systems can use NRCC-MCH-04 and NRCC-MCH-05 in place of the MCH-01, 02, and 03.
      - ✓ Verify NRCC-MCH-04 has the appropriate acceptance tests marked.
      - ✓ Verify NRCC-MCH-05 shows the equipment, their mandatory and prescriptive efficiency requirements, and the actual efficiencies.

§120.1 – Requirements for Ventilation

- **Enforcement** - cont.
  - Permit and Plans Review – cont.
    - Natural Ventilation
      - ✓ Verify the NRCC-MCH-01 shows the location in the design plans of the naturally ventilated spaces and related operable openings.
      - ✓ Verify the design plan spaces meet the mandatory requirements for openable area and distance per §120.1(b)1.
    - Performance Compliance
      - ✓ Verify the NRCC-PRF-MCH-DETAILS section of the NRCC-PRF-01 includes all zones in the plans.
      - ✓ Verify NRCC-PRF-MCH-DETAILS areas match plan areas.
      - ✓ Verify occupant densities listed on NRCC-PRF-MCH-DETAILS meet the requirements of 120.1(a).

Note: Calculations performed by the software are most likely correct if the data was entered correctly and completely.

§120.1 – Requirements for Ventilation

- **Enforcement – cont.**
  - Field Inspection:
    - NRCI-MCH-01
      - ✓ **Verify** this form shows the test result documents (NRCA forms).
      - ✓ **Sign** each line after test results have been verified (for your own reference).
    - **Verify** NRCA-MCH-02 Outdoor Air Acceptance is **complete and consistent** with NRCC and design plan documents ventilation and equipment.
    - If Demand Control Ventilation is used, verify NRCA-MCH-06 is complete and accurate.
    - If natural ventilation is used, operable openings and space dimensions should be compared to plan requirements.

Note: If performance method is used, the NRCI and NRCA documents are still required.

§120.1 – Requirements for Ventilation

- Quiz Question:
  - Where do the required ventilation rates come from?
    a) Table 120.1-A.
    b) 15 cfm per the expected number of occupants.
    c) The mechanical code requirements.
    d) The greater of all the above.
    e) The greater of a) and c).
- Quiz Question:
  - How many CO_2 sensors are required in a 15,000 ft² space without demand control ventilation?
    a) None.
    b) One.
    c) Two.

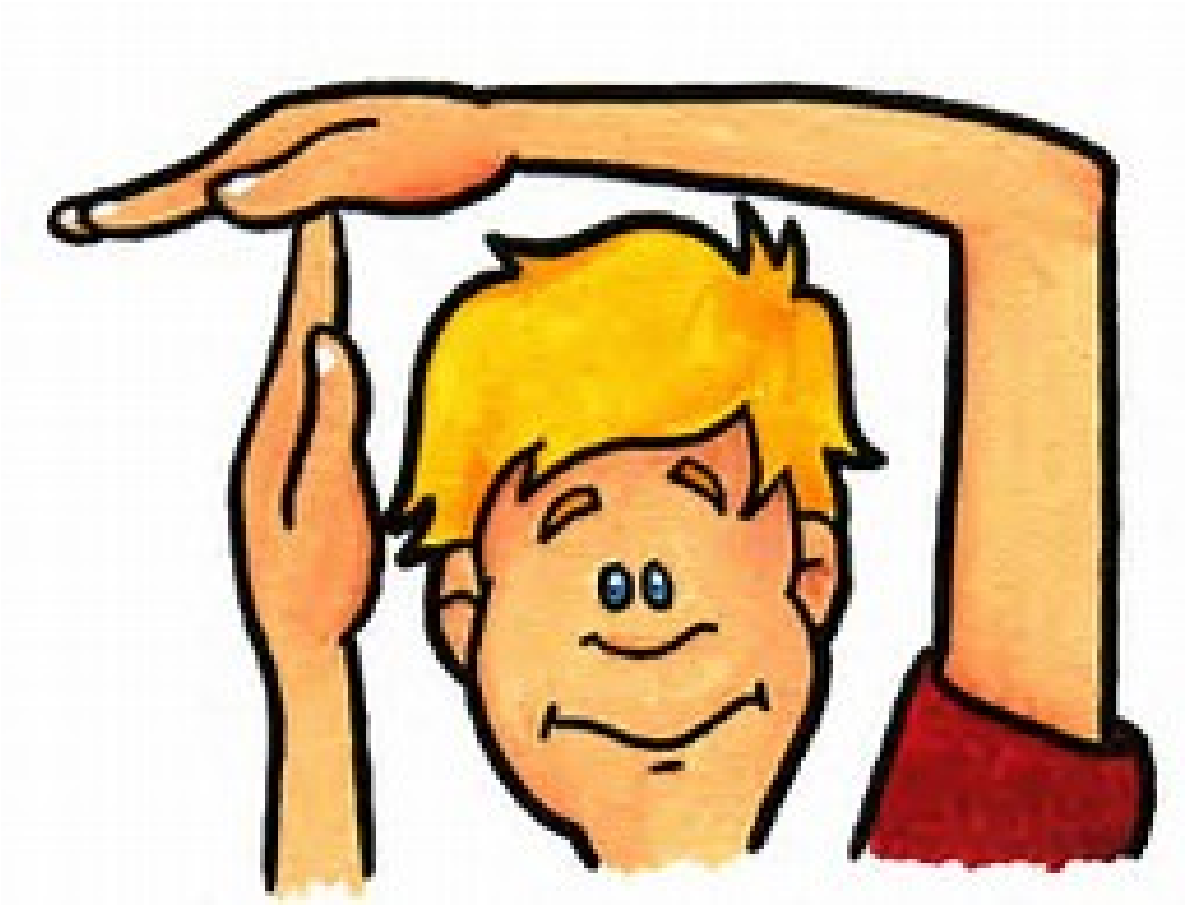
§120.1 – Requirements for Ventilation

- Quiz Question:
  - Can transfer air be the only source of ventilation air for a space?
    a) Yes.
    b) No.
- Quiz Question:
  - When is ventilation to a space NOT required?
    a) In spaces not normally used by humans.
    b) When a space is scheduled to be unoccupied.
    c) Intermittently with occupancy sensors.
    d) Ventilation is always required.
    e) a), and b).
    f) a), b), and c).

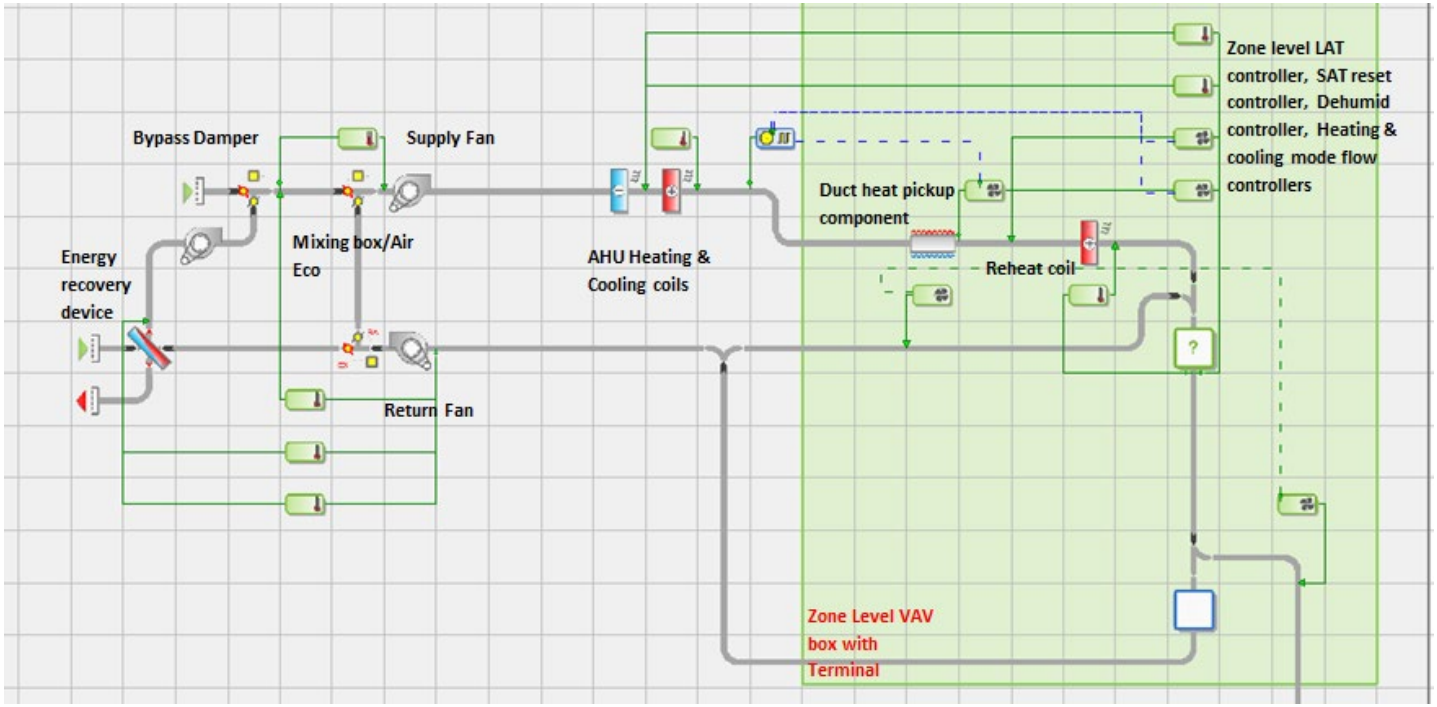
§120.1 – Requirements for Ventilation

- **Takeaways for Ventilation**
  - Natural or mechanical ventilation is required for all spaces and buildings unless it is not normally occupied.
  - For mechanical ventilation, the highest rate of ventilation from Part 6 and Part 4 must be supplied to each space.
  - All rooms in a demand control ventilation zone must have CO_2 sensors.
  - Occupant sensing controls must be listed in the Title 20 database.
  - Occupant sensors for ventilation control are not required in areas with DCV but may still be required for space conditioning.
  - There are functional and location requirements for CO_2 sensor and occupant sensors.
  - A preoccupancy purge is required in the hour before scheduled occupation.

Time for a Break?



§120.2 – Required Controls for Space Conditioning Equipment



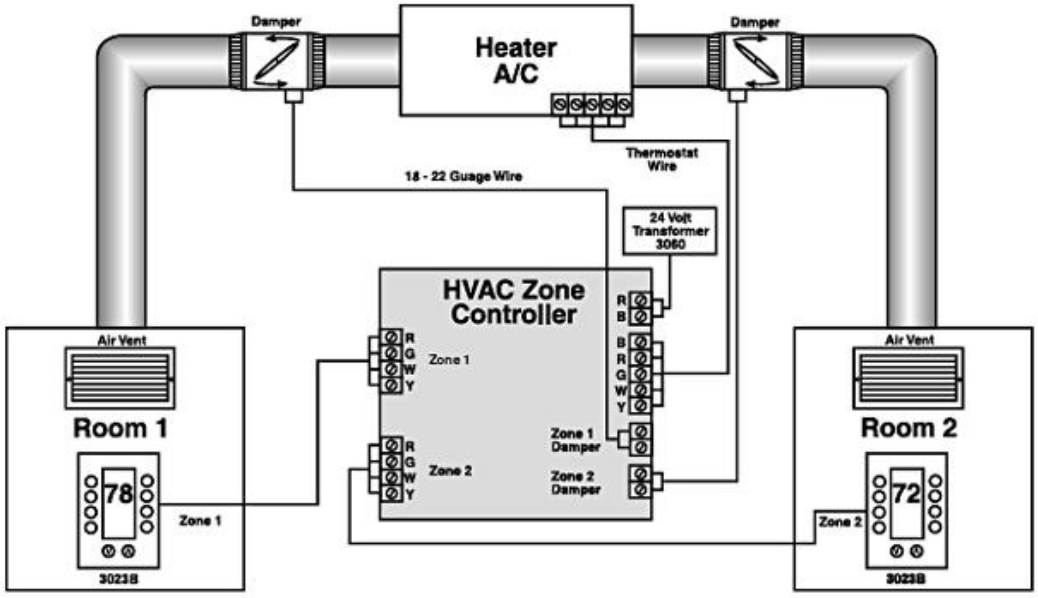
§120.2 – Required Controls for Space Conditioning Equipment

- **§120.2 is applicable to nonres, high-rise res, and hotel/motel buildings and covers the following controls types:**

- ✓ Zonal Thermostatic Control
- ✓ Hotel/Motel Guest Room and High-rise Residential Dwelling Unit Thermostats
- ✓ Heat Pump Controls
- ✓ Shut-off and Reset Controls
- ✓ Isolation Area Devices
- ✓ Dampers for Air Supply and Exhaust Equipment
- ✓ Automatic Demand Shed Controls
- ✓ Economizer Fault Detection and Diagnostics (FDD)
- ✓ Direct Digital Controls (DDC)
- ✓ Optimum Start/Stop Controls

§120.2 – Required Controls for Space Conditioning Equipment

- **(a) Thermostatic Controls for Each Zone**
  - Each zone or dwelling unit must have an individual thermostatic control or be controlled by an Energy Management Control System (EMCS).



❖ EXCEPTION:

✓ There is an exception that allows for an independent perimeter heating or cooling system to serve more than one zone without individual thermostatic controls. See Exception to 120.2(a) for details..

§120.2 – Required Controls for Space Conditioning Equipment

- **(b) Criteria for Zonal Thermostatic Controls**
  - Thermostats must be able to set temperatures to the following:
    - Down to 55°F or lower for heating
    - Up to 85°F or higher for cooling
  - If used for both heating and cooling it must also have a **dead band** of at least 5°F where space conditioning is shut off or reduced to a minimum.

❖ EXCEPTION:

✓ Systems with thermostats that require manual changeover between heating and cooling modes do not need a dead band.

§120.2 – Required Controls for Space Conditioning Equipment

- **(b) Criteria for Zonal Thermostatic Controls – cont.**
  - **Single zone** systems must have one of the following:
    - An **Occupant Controlled Smart Thermostat** (OCST) certified to the Commission per Reference Joint Appendix JA5 requirements; **or**
    - If the system has DDC to the zone, **Demand Shed Controls** per §120.2(h).

❖ EXCEPTIONS:

- ✓ Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants or animals.
- ✓ Package terminal air conditioners, package terminal heat pumps, room air conditioners, and room air-conditioner heat pumps.

§120.2 – Required Controls for Space Conditioning Equipment

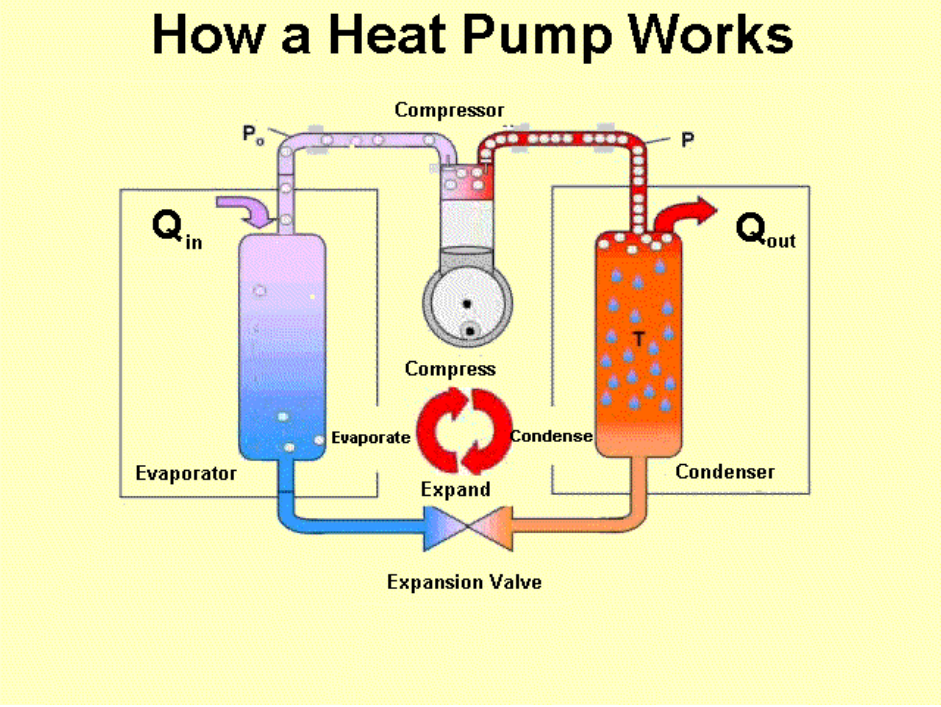
- **(c) Hotel/Motel High-rise Res. Dwelling Unit Thermostats**
  - **Hotel/motel guest room** thermostats must have all the following:
    - Must be an EMCS or setback thermostat.
    - Numeric temperature setpoints in °F and °C.
    - Setpoint stops that prevent guest room occupants from adjusting the setpoint more than ±5°F (±3°C).

    ❖ EXCEPTION:
    - ✓ Thermostats that are integrated into the room heating and cooling equipment.

  - **High-rise residential** dwelling units must be controlled by a setback thermostat but can use OCST per JA5 or EMCS.

§120.2 – Required Controls for Space Conditioning Equipment

- **(d) Heat Pump Controls**
  - All heat pumps with supplementary electric resistance heaters must have controls that comply with Section 110.2(b).



§120.2 – Required Controls for Space Conditioning Equipment

- **(e) Shut-off and Reset Controls**
  - **1.** The controls must be able to automatically shut off the system during periods of nonuse and must have **one** of the following:
    - An **occupancy sensor**; or
    - A **4-hour timer** that can be manually operated; or
    - An **automatic time switch control** listed in the Title 20 database (MAEDBS), with an accessible manual override for up to 4 hours.

❖ EXCEPTION:

✓ Mechanical systems serving retail stores and associated malls, restaurants, grocery stores, churches, and theaters equipped with 7-day programmable timers.

§120.2 – Required Controls for Space Conditioning Equipment

- **(e) Shut-off and Reset Controls – cont.**
  - **2.** When turning the system on after a shutdown, controls must automatically restart the system to maintain:
    - A setback heating thermostat setpoint.
    - A setup cooling thermostat setpoint.

❖ EXCEPTION:

- ✓ Not required for cooling where the Summer Design Dry Bulb 0.5 percent temperature per JA2 is less than 100°F.
- ✓ Not required for heating where the Winter Median of Extremes outdoor air temperature per JA2 is greater than 32°F.

§120.2 – Required Controls for Space Conditioning Equipment

- **(e) Shut-off and Reset Controls – cont.**
  - **3. Occupant sensors** must be installed in the following spaces unless they have operations that generate dusts, fumes, vapors or other contaminates:
    - Multipurpose rooms less than 1,000 square feet,
    - Classrooms greater than 750 square feet, and
    - Conference, convention, auditorium and meeting center rooms greater than 750 square feet.
  - When unoccupied, sensor(s) must trigger the following actions:
    - Automatically setup the cooling by at least 2°F and setback the heating by at least 2˚F; **and**
    - Automatically reset to the minimum ventilation rate described in Section 120.1(c)5.

§120.2 – Required Controls for Space Conditioning Equipment

- **(e) Shut-off and Reset Controls – cont.**
  - **3. Occupant sensors – cont.**

❖ EXCEPTIONS:

- ✓ Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.
- ✓ Where it can be demonstrated to the satisfaction of the enforcing agency that it will not result in a decrease in overall building source energy use.
- ✓ Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.
- ✓ If Demand Control Ventilation with CO_2 sensors is implemented as required by Section 120.1(c)3 and 120.1(c)(4).

§120.2 – Required Controls for Space Conditioning Equipment

- **(e) Shut-off and Reset Controls – cont.**
  - **4. Hotel and motel guest rooms** must have captive card key, occupancy sensing, or automatic controls that adjust setpoints by 5°F, within 30 minutes after vacancy.

§120.2 – Required Controls for Space Conditioning Equipment

- **(f) Dampers for Air Supply and Exhaust Equipment**
  - Outdoor air supply and exhaust equipment must have **dampers that automatically close** upon fan shutdown.

❖ EXCEPTIONS:

- ✓ When the equipment serves an area that must operate continuously.
- ✓ When it is a gravity type or other nonelectrical equipment with readily accessible manual damper controls.
- ✓ At combustion air intake and shaft vents.
- ✓ When it is prohibited by other provisions of law.

§120.2 – Required Controls for Space Conditioning Equipment

- **(g) Isolation Area Devices**
  - Each zone, or any combination of zones not exceeding 25,000 ft^2, is considered a separate isolation area.
  - Each isolation area must have isolation devices, such as valves or dampers that control heating or cooling independently of other isolation areas.
  - Each isolation area must have shut-off and reset controls such as an automatic time switch, occupancy sensor, or a 4 hour manual timer.

❖ EXCEPTION:

✓ Zones that must be heated or cooled continuously do not need to be isolated.

§120.2 – Required Controls for Space Conditioning Equipment

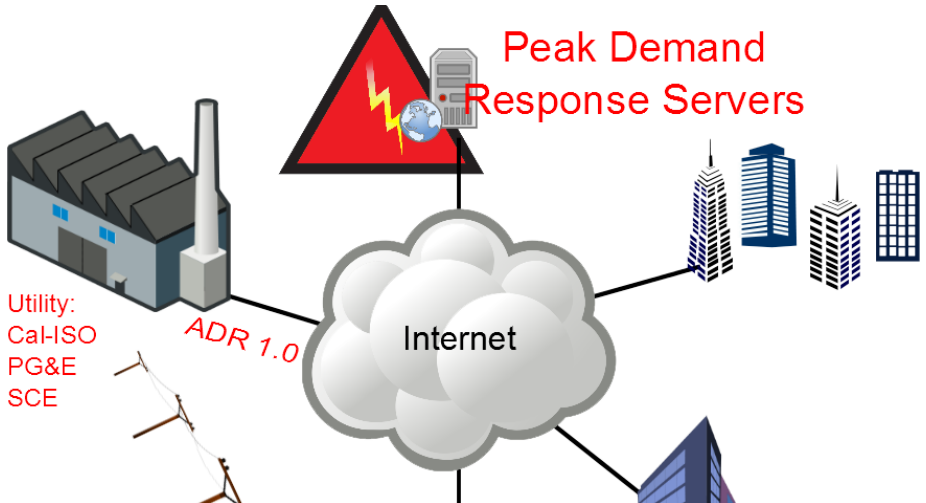
- Code Quiz:
  - A 100,000 ft^2 building needs to have 80,000 ft^2 continuously conditioned. How many isolation zones are required?
    a) One
    b) Two
    c) Three
    d) Four
  - When are Occupancy Sensors required?
    a) Multipurpose rooms less than 1,000 square feet.
    b) Classrooms less than 750 square feet.
    c) Conference, convention, auditorium and meeting cente less than 750 square feet. Four
    d) All of the above.

§120.2 – Required Controls for Space Conditioning Equipment

- **(h) Automatic Demand Shed Controls**
  - Automatic Demand Shed Controls are required in **non-critical zones** on HVAC systems **with DDC to the Zone** level and must allow authorized facility operators to perform the following operations:
    - **Increase cooling** or **reduce heating** set points by 4 degrees or more on a signal from a centralized contact or software point within an EMCS.
    - Remotely **reset** the temperatures back to the original setpoints.
    - **Adjust the rate of change** for the temperature setup and reset.

§120.2 – Required Controls for Space Conditioning Equipment

- **(h) Automatic Demand Shed Controls – cont.**
  - The system must also have the **capability** to receive a **demand response signal** to conduct a centralized **demand shed** that resets the setpoints by 4 degrees or more for the demand response period.
  - **Demand Response Signal** is a signal sent by the local utility or Independent System Operator (ISO) to a customer, indicating an approach of a price limit or brownout or other energy events.



§120.2 – Required Controls for Space Conditioning Equipment

- **(i) Economizer Fault Detection and Diagnostics (FDD)**
  - Economizer FDD is required for all newly installed air-cooled packaged direct-expansion units with the following:
    - Cooling capacity greater than 54,000 Btu/hr
    - An air economizer
  - Temperature sensors must be permanently installed to monitor:
    - Outside air
    - Supply air
    - Return air
  - Temperature sensors must have an accuracy of ±2°F in the range of 40°F to 80°F.
  - The controller must be capable of displaying the value of **each** sensor

§120.2 – Required Controls for Space Conditioning Equipment

- **(i) Economizer Fault Detection and Diagnostics (FDD) – cont.**
  - The controller must provide system status by indicating the following conditions:
    - Free cooling available;
    - Economizer enabled;
    - Compressor enabled;
    - Heating enabled, if the system is capable of heating; **and**
    - Mixed air low limit cycle active.
  - The unit controller must have the capability to **manually initiate** each operating mode so that the **operation** of compressors, economizers, fans, and heating systems can be **independently** tested and verified.

§120.2 – Required Controls for Space Conditioning Equipment

- **(i) Economizer Fault Detection and Diagnostics (FDD) – cont.**
  - Faults must be reported in **one** of the following ways:
    - Reported to an EMCS that is monitored by facility personnel.
    - Reported to a fault management application which automatically provides notification of the fault to a remote HVAC service provider.
    - Display the fault on one or more zone thermostats, or a device or sign within five (5) feet of zone thermostat(s), clearly visible, at eye level, and meeting the following requirements:
      - ✓ Display instructions to contact appropriate building personnel or an HVAC technician; and
      - ✓ In buildings with multiple tenants, the display must either be within the property management offices or in a common space accessible to the facilities manager.

§120.2 – Required Controls for Space Conditioning Equipment

- **(i) Economizer Fault Detection and Diagnostics (FDD) – cont.**
  - The FDD system must detect the following faults:
    - Air temperature sensor failure/fault;
    - Not economizing when it should be;
    - Economizing when it should not be;
    - Damper not modulating; and
    - Excess outdoor air.
  - The FDD systems must be **certified** to the Energy Commission as meeting all of these requirements.

§120.2 – Required Controls for Space Conditioning Equipment

- **(j) Direct Digital Controls (DDC)**
  - DDC must be provided as specified in Table 120.2-A.

BUILDING STATUS	APPLICATIONS	QUALIFICATIONS
Newly Constructed Buildings	Air handling system and all zones served by the system	Individual systems supplying more than three zones and with design heating or cooling capacity of 300 kBtu/h and larger
Newly Constructed Buildings	Chilled water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design cooling capacity of 300 kBtu/h (87.9 kW) and larger
Newly Constructed Buildings	Hot water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design heating capacity of 300 kBtu/h (87.9 kW) and larger
Additions or Alterations	Zone terminal unit such as VAV box	Where existing zones served by the same air handling, chilled water, or hot water systems that have DDC
Additions or Alterations	Air handling system or fan coil	Where existing air handling system(s) and fan coil(s) served by the same chilled or hot water plant have DDC
Additions or Alterations	New air handling system and all new zones served by the system	Individual systems with design heating or cooling capacity of 300 kBtu/h and larger and supplying more than three zones and more than 75 percent of zones are new
Additions or Alterations	New or upgraded chilled water plant	Where all chillers are new and plant design cooling capacity is 300 kBtu/h (87.9 kW) and larger
Additions or Alterations	New or upgraded hot water plant	Where all boilers are new and plant design heating capacity is 300 kBtu/h (87.9 kW) and larger

§120.2 – Required Controls for Space Conditioning Equipment

- **(j) Direct Digital Controls (DDC) – cont.**
  - The DDC system must meet the control logic requirements for ventilation 120.1(c) and demand shed requirements in 120.2(h), and the following:
    - **Monitoring zone and system demand** for fan pressure, pump pressure, heating and cooling;
    - **Transferring demand information** from zones to air distribution system controllers and from air distribution systems to heating and cooling plant controllers;
    - Automatically **detecting** the zones and systems that may be excessively driving the reset logic and generate an alarm or other indication to the system operator;
    - Allow for **operator removal** of zones(s) from the reset algorithm;
    - For new buildings, **trending and graphical displaying** of input and output points.

§120.2 – Required Controls for Space Conditioning Equipment

- **(k) Optimum Start/Stop Controls**
  - Space conditioning systems with **DDC to the zone** level must have optimum start/stop controls.
  - The control algorithm must, **as a minimum**, be a function of the difference between occupied space temperature setpoint, the outdoor air temperature, and the amount of time prior to scheduled occupancy.
  - Mass radiant floor slab systems must also incorporate **floor temperature** into the optimum start algorithm.

§120.2 – Required Controls for Space Conditioning Equipment

- Code Quiz:
  - Economizer FDD is required for all newly installed air-cooled packaged direct-expansion units?
    a) True
    b) False
    - Required only if the cooling capacity is greater than 54,000 BTU/h (4.5 tons) and it has an economizer.
  - Automatic demand shed controls per 120.2(h) are only required for systems with DDC to the zone.
    a) True
    b) False

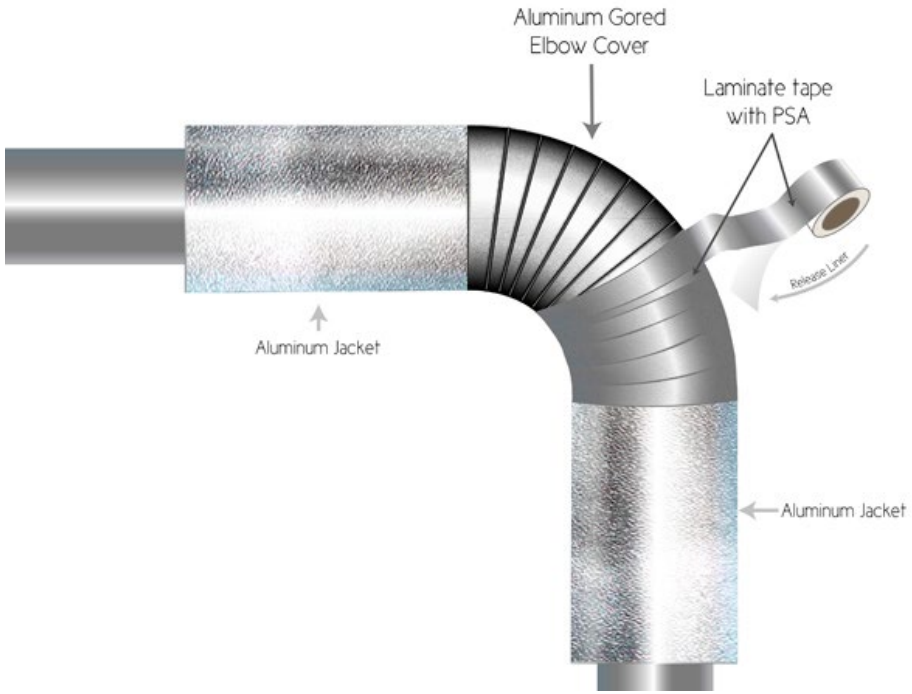
§120.2 – Required Controls for Space Conditioning Equipment

- **Takeaways for Required Controls**
  - **High-rise Residential dwellings** must have
    - Setback capabilities
    - Can be an EMCS
    - Can be JA5 OCST
  - **Hotel/Motel guest rooms** must have the following controls:
    - EMCS with setback capabilities, DDC with setback capabilities, or capabilities or a setback thermostat, unless it is integrated into the room unit.
    - Allow guests to adjust setpoint no more than ±5°F.
    - Captive card or occupancy sensing that automatically adjusts setpoint 5°F within 30 minutes of vacancy.

§120.2 – Required Controls for Space Conditioning Equipment

- **Takeaways for Required Controls – cont.**
  - **Nonresidential** systems must have the following controls:
    - Each zone must have a JA5 certified OCST or DDC to the zone with demand shed controls.
    - DDC to the zone controls are required on systems 300kBtu/h and larger.
    - Systems with DDC to the zone are required to have Demand Shed capabilities.
    - Controls to automatically shut off the system during periods of non-use.
    - Controls must restart the system to normal operations after shut down.
    - Some spaces are required to have occupancy sensors.
    - Air supply and exhaust equipment need dampers.
    - Isolation area devices are required on spaces larger than 25,000 ft^2.
    - On systems larger than 54,000 Btu/hr., economizers are required to have FDD.
  - Always check for exceptions

§120.3 – Requirements for Pipe Insulation



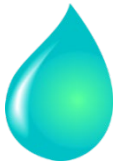
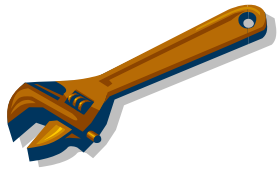
§120.3 – Requirements for Pipe Insulation

- **General Requirements**
  - Insulation is required on the following:
    - Space cooling refrigerant suction, chilled water and brine lines.
    - Space heating systems steam, steam condensate and hot water lines.
  - Insulation thickness levels are specified in Table 120.3-A.
  - If the conductivity is outside the range listed in Table 120.3-A, the calculation method shown in §120.3(c)2 must be used.
  - Example

§120.3 – Requirements for Pipe Insulation

- **Insulation Protection**
  - Insulation must be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind.
    - Sunlight
    - Wind
    - Moisture
    - Equip. Maint.



  - Insulation exposed to weather must be **water retardant** and provide **shielding from solar radiation** that can cause degradation of the material.
  - Insulation covering **chilled water piping and refrigerant suction piping** located outside the conditioned space must have a **Class I or Class II vapor retarder**.
  - All penetrations and joints must be sealed.

§120.3 – Requirements for Pipe Insulation

- **Exceptions to §120.3 pipe insulation requirements**

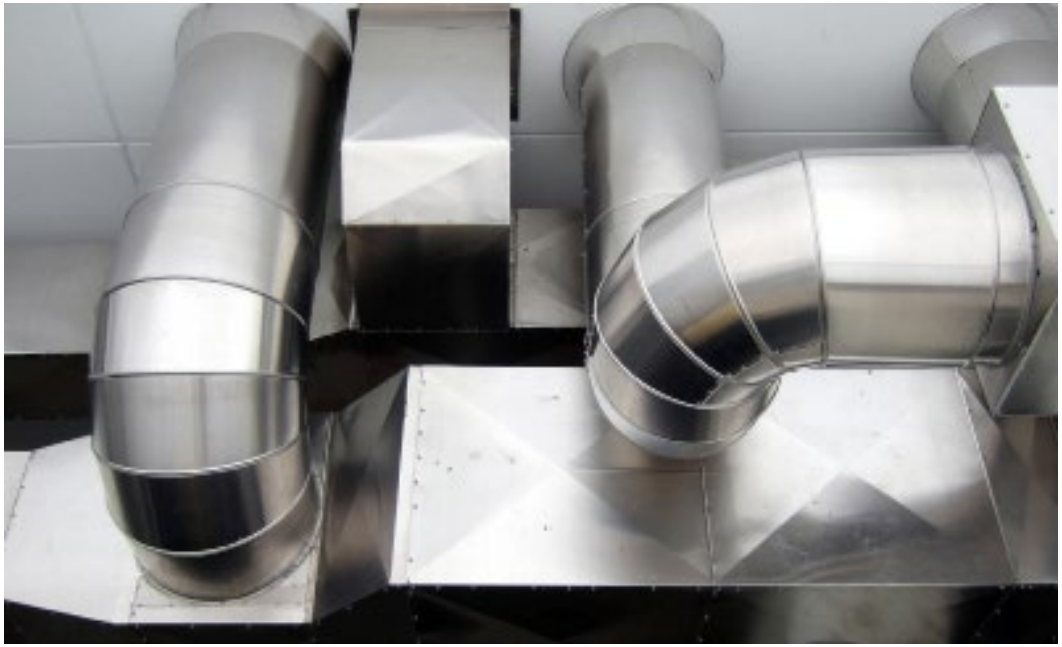
❖ EXCEPTIONS:

- ✓ Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.
- ✓ Piping with a design operating temperature range between 60°F and 105°F.
- ✓ Gas piping, cold domestic water piping, condensate drains, roof drains, vents, or waste piping.
- ✓ Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.
- ✓ Piping that penetrates framing members is not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing must have grommets, plugs, wrapping or other insulation to prevent contact with the metal framing.

§120.3 – Requirements for Pipe Insulation

- **Takeaways**
  - Insulation is required on HVAC lines outside the range of 60°F to 105°F.
  - Thickness is based on table 120.3-A or the calculation method shown in §120.3(c)2.
  - Outdoor insulation must be protected from the elements.

§120.4 - Requirements for Ducts and Plenums



§120.4 - Requirements for Ducts and Plenums

- **(a) Duct Insulation and Sealing**
  - All air distribution systems must be installed, sealed and insulated to meet the requirements of the CMC and ANSI/SMACNA-006-2006 *HVAC Duct Construction Standards - Metal and Flexible*, 3rd Edition.
  - This includes the following:
    - Ducts
    - Plenums
    - Building cavities
    - Mechanical closets
    - Air-handler boxes
    - Support platforms used as ducts or plenums

§120.4 - Requirements for Ducts and Plenums

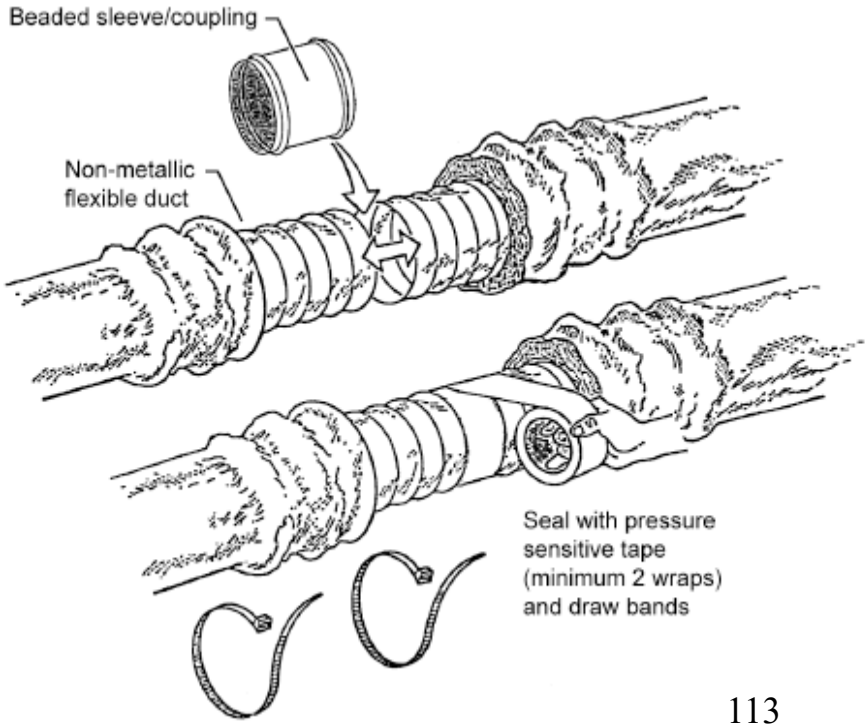
- **Duct Insulation and Sealing – cont.**
  - Connections of metal ducts and the inner core of flexible ducts must be mechanically fastened.
  - Openings must be sealed with mastic, tape, aerosol sealant, or other duct-closure system that meets the requirements of UL 181, 181A, or 181B.
  - If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape must be used.

§120.4 - Requirements for Ducts and Plenums

- **(a) Duct Insulation and Sealing – cont.**
  - Supply and return ducts located in the following spaces must be insulated to a minimum of R-8:
    - Outdoors;
    - In a space between the roof and an insulated ceiling;
    - Directly under a roof with fixed vents or openings to the outside or unconditioned spaces;
    - In an unconditioned crawlspace;
    - In other unconditioned spaces.
  - Parts of the ducts not located in one of these spaces, including buried in concrete slab, must be insulated to a minimum of R-4.2.
  - Parts of the ducts enclosed inside directly conditioned spaces do not need to be insulated.

§120.4 - Requirements for Ducts and Plenums

- **(b) Duct and Plenum Materials**
  - The energy code requires UL and ASTM material performance testing for the following:
    - Factory fabricated ducts
    - Field fabricated ducts
    - Tapes
    - Mastics and Mesh
    - Aerosol sealants
    - Draw bands
    - Insulation R-values
  - See §120.4 for test requirements.

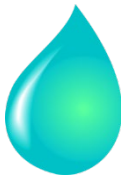
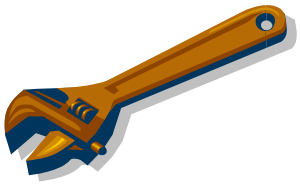


§120.4 - Requirements for Ducts and Plenums

- **(f) Protection of Insulation**
  - Insulation must be protected from sunlight, moisture, equipment maintenance, and wind.
  - Insulation exposed to weather must be protected by aluminum, sheet metal, painted canvas, or plastic cover.
  - Cellular foam insulation must be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation.

▪ Sunlight ▪ Wind ▪ Moisture ▪ Equip. Maint.



§120.4 - Requirements for Ducts and Plenums

- **Takeaways**
  - R-8 insulation in unconditioned spaces and outside
  - Insulation not required inside conditioned space
  - R-4.2 everywhere else
  - Duct and sealing materials must be UL or ASTM tested as applicable
  - Insulation must be protected from the elements

§120.5 – Required Nonresidential Mechanical System Acceptance

§120.5 – Required Mechanical System Acceptance

- **Acceptance testing is required for HVAC, indoor/outdoor lighting, site-built fenestration, and covered processes.**
- **Applicable mechanical acceptance tests must be specified on the NRCC-MCH form at permit.**
- **Field technician must report results of acceptance testing on respective NRCA-MCH form at final inspection.**
- **Test procedures are located in Reference Nonresidential Appendix NA7.**
- **Field technicians performing testing for HVAC will need to be a CMATT when thresholds are satisfied.**
- **For a list of required Acceptance Tests, see §120.5.**

§120.8 – Nonresidential Building Commissioning

§120.8 – Nonresidential Building Commissioning

- **Conditioned nonresidential buildings and spaces 10,000 ft^2 or more must comply with all sections in §120.8.**
  - (b) Owner's or owner representative's project requirements
  - (c) Basis of design
  - (d) Design phase design review
  - (e) Commissioning measures shown in the construction documents
  - (f) Commissioning plan
  - (g) Functional performance testing
  - (h) Documentation and training
  - (i) Commissioning report

§120.8 – Nonresidential Building Commissioning

- **Buildings <u>less than 10,000 ft^2</u> must comply with only the following sections:**
  - (d) Design Phase Design Review
  - (e) Commissioning Measures Shown in the Construction Documents

- Commissioning requirements also apply to nonresidential spaces within **mixed occupancy** hotel/motel and high-rise residential buildings based on the square footage of the nonresidential spaces.

§120.8 – Nonresidential Building Commissioning

- **(b) Owner's or Owner Representative's Project Requirements (OPR)**
  - Document showing owners energy efficiency expectations, ventilation requirements, occupancy schedule, equipment expectations…etc.
- **(c) Basis of Design (BOD)**
  - A written explanation of how the system designs meet the OPR.
    - ✓ HVAC systems and controls
    - ✓ Lighting systems and controls
    - ✓ Water heating systems and controls
    - ✓ Envelope features

§120.8 – Nonresidential Building Commissioning

- **(d) Design Phase Design Review**
  - Design Review Kickoff
    - ✓ Discuss the project scope, schedule, documentation and coordination of team activities and responsibilities.
  - Construction Documents Design Review
    - Reviewer verifies the construction documents meet the design requirements as shown in the NRCC-CXR checklists.
  - Reviews may be conducted and signed off by:
    - ✓ **< 10,000 ft²**: the building design engineer, architect, or contractor.
    - ✓ **10,000 ft² to 50,000 ft²**: an in-house engineer or architect not associated with the project, or a third party design engineer, architect, or contractor.
    - ✓ **> 50,000 ft²** : a third party design engineer.
    - ✓ Buildings > **10,000 ft²** with complex mechanical systems: a third party engineer, architect, or contractor.

§120.8 – Nonresidential Building Commissioning

- **(e) Commissioning measures shown in the construction documents**
  - Complete descriptions of requirements necessary for commissioning must be included with the construction documents (plans and specifications).
- **(f) Commissioning Plan**
  - Developed during the design phase, the plan documents how the project will be commissioned.
  - Includes general project information, commissioning goals, systems to be commissioned, and plans to test systems and components.
- **(g) Functional performance testing**
  - Functional performance tests will demonstrate installation and operation of systems per the acceptance test requirements in Sections 120.5.

§120.8 – Nonresidential Building Commissioning

- **(h) Documentation and Training**. A Systems Manual and Systems Operations Training must be completed.
  - **Systems Manual**. A manual of the operational aspects of the building must be completed and delivered to the building owner and facilities operator.
  - **Systems Operations Training**. Training of the maintenance staff for each equipment type or system must be documented in the commissioning report.
- **(i) Commissioning Report**.
  - A complete report of commissioning process activities undertaken through the design and construction must be provided to the owner.
  - The report documents the commissioning process and test results.
  - The report should include confirmation that commissioned systems meet the conditions of the OPR, BOD, and Contract Documents.

§120.8 – Nonresidential Building Commissioning

- **Enforcement**
  - Permit and Plans Review:
    - Verify completion of applicable NRCC-CXR-01-E through NRCC-CXR-04-E, and signature page, NRCC-CXR-05-E.
    - Receive a copy of the OPR and BOD, or verify NRCC-CXR-01-E indicates they were reviewed at Design Review Kickoff.
    - Commissioning measures are received with the construction documents.
    - Receipt of a copy of the Commissioning Plan.
  - Field Inspection:
    - Review NRCA/NRCV acceptance test documents.
    - Verify System manual is on site and complete.
    - Verify training plan exists and review training attendance forms.
    - Verify Commissioning report is on site and complete.

§120.8 – Nonresidential Building Commissioning

- Code Quiz:
  - When is commissioning required?
    a) Nonresidential buildings and spaces greater than 10,000 ft^2.
    b) Nonresidential buildings and spaces less than 10,000 ft^2.
    c) Both a) and b).

  - Who can conduct a design review for a building > 50,000 ft^2?
    a) A third party engineer, architect, or contractor.
    b) In-house engineer or architect not associated with the project.
    c) Both a) and b).

§120.8 – Nonresidential Building Commissioning

- Code Quiz:
  - Which commissioning measures are mandatory for a new, 9,999 sf motel building? Choose all that apply.
    a) Owner's or owner representative's project requirements
    b) Basis of design
    c) Design phase design review
    d) Commissioning measures shown in the construction documents
    e) Commissioning plan
    f) Functional performance testing
    g) Documentation and training
    h) Commissioning report
    i) None.

§120.8 – Nonresidential Building Commissioning

- Code Quiz:
  - Which commissioning measures are mandatory for a new, 7,000 sf nonresidential building? Choose all that apply.
    a) Owner's or owner representative's project requirements
    b) Basis of design
    c) Design phase design review
    d) Commissioning measures shown in the construction documents
    e) Commissioning plan
    f) Functional performance testing
    g) Documentation and training
    h) Commissioning report

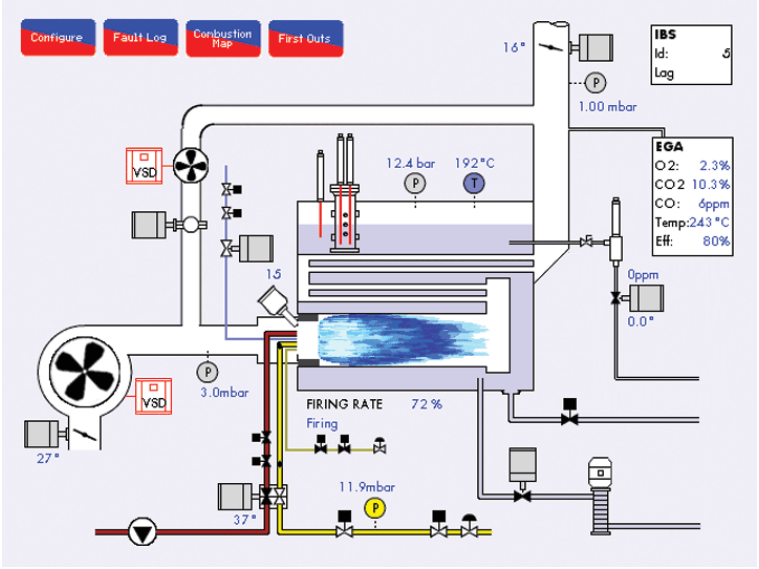
§120.8 – Nonresidential Building Commissioning

- **Takeaways**
  - **Design Review and Commissioning Measures are required for <u>all nonresidential</u> buildings regardless of size.**
  - **OPR, BOD, Commissioning Plan, Systems Manual, Training and Commissioning Report are also required for <u>nonresidential</u> buildings and spaces > 10,000 ft^2.**
  - **Nonresidential spaces of Hotel/Motel and High-rise Residential buildings also require commissioning.**
  - **Commissioning compliance documents must be signed by a <u>licensed</u> engineer, architect or contractor.**
  - **Building size and equipment type (simple or complex) determines who can or must sign off.**

§120.9 – Requirements for Commercial Boilers

What is a "Commercial Boiler"??

- **Standards §100.1 Definitions:**
  - Commercial Boiler
    - A type of boiler with a capacity (rated maximum input) of 300,000 Btus per hour (Btu/h) or more and serving a space heating or water heating load in a commercial building.



§120.9 – Requirements for Commercial Boilers

- **Mandatory Requirements for Commercial Boilers**
  - Combustion air positive shut-off is required on all newly installed boilers as follows:
    - All boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is designed to operate with a nonpositive vent static pressure.
    - All boilers served by one stack with a total combined input of 2.5 MMBtu/h (2,500,000 Btu/h).
  - Combustion air fans 10 horsepower or larger must have **one** of the following:
    - Variable speed drive motor, or
    - Controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume.

§120.9 – Requirements for Commercial Boilers

- **Mandatory Requirements for Commercial Boilers**
  - Boilers 5 MMBtu/h (5,000,000 Btu/h) input and greater must control **excess (stack-gas) oxygen** concentrations.
    - Must be less than or equal to 5.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent.
    - Combustion air volume must be controlled with respect to firing rate or flue gas oxygen concentration.
    - Use of a common gas and combustion air control linkage or jack shaft is prohibited.

❖ EXCEPTION:

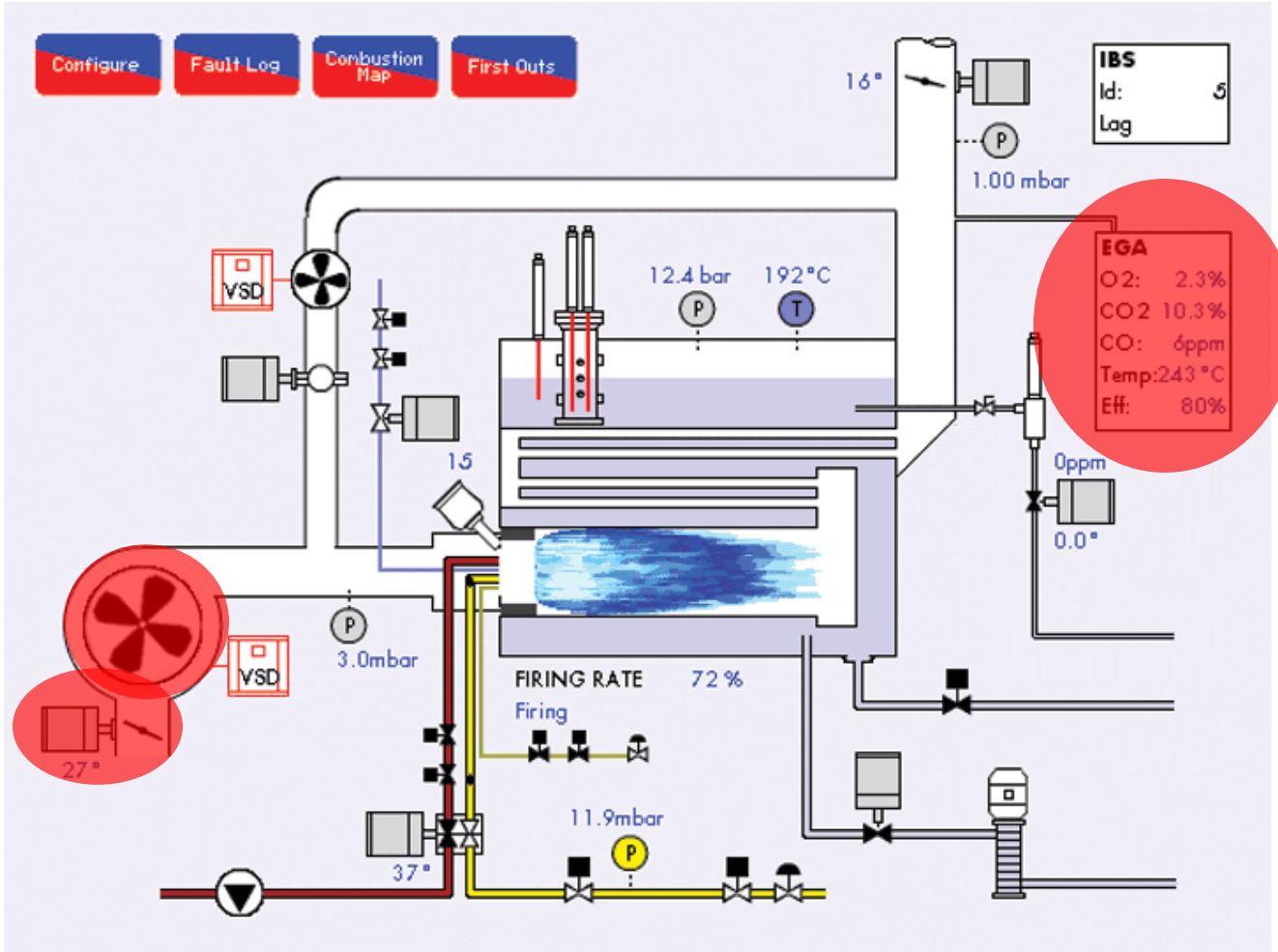
✓ Boilers with steady state full-load thermal efficiency 85 percent or higher are exempt from stack gas requirements.

§120.9 – Requirements for Commercial Boilers

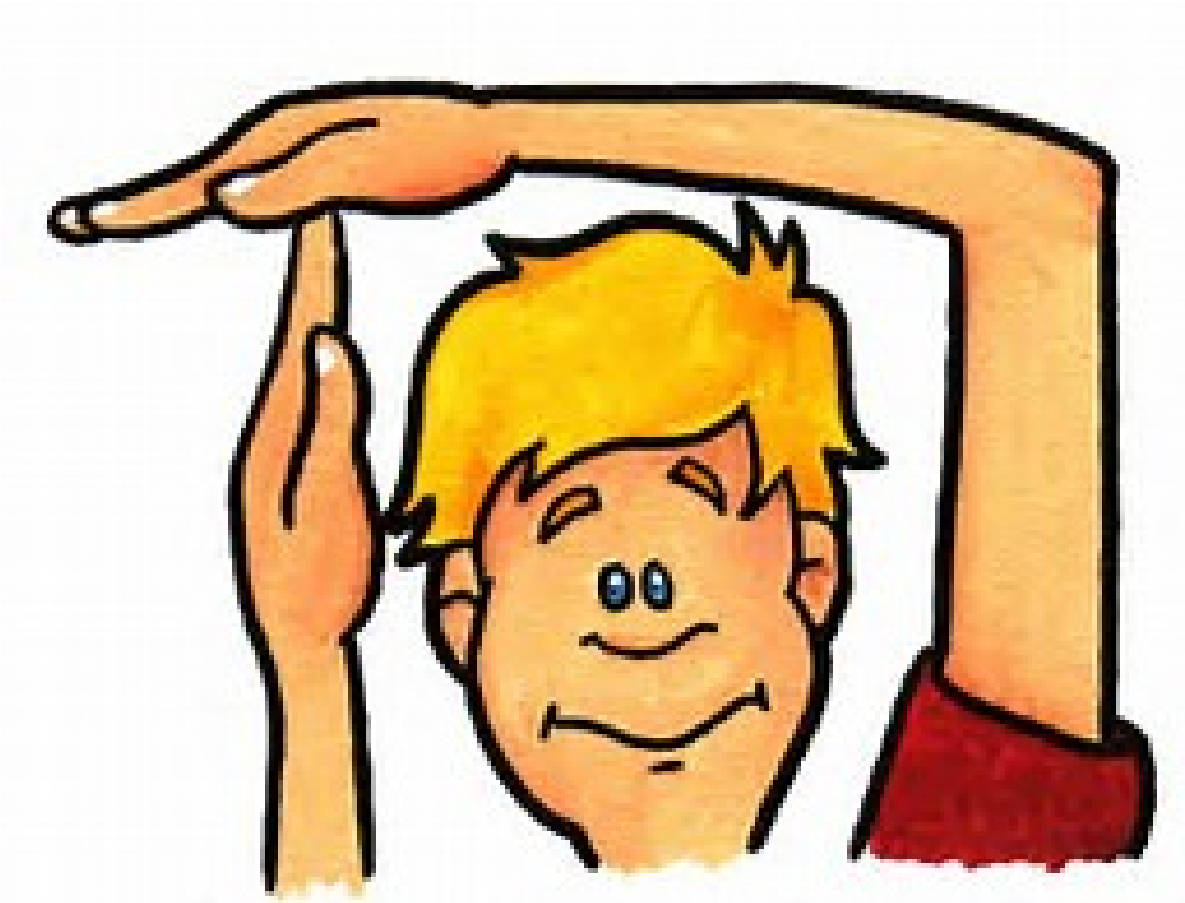
- **Takeaways**
  - **Combustion air positive shut-off requirements.**
  - **Combustion air fan motors 10 horsepower or larger must be variable speed or have controls to reduce airflow and power.**
  - **Limits on excess oxygen levels in the exhaust gas.**
  - **These requirements are all mandatory.**

§120.9 – Requirements for Commercial Boilers

- Code Quiz: Identify the three devices with T24 requirements.



Time for a Break?



Subchapter 5

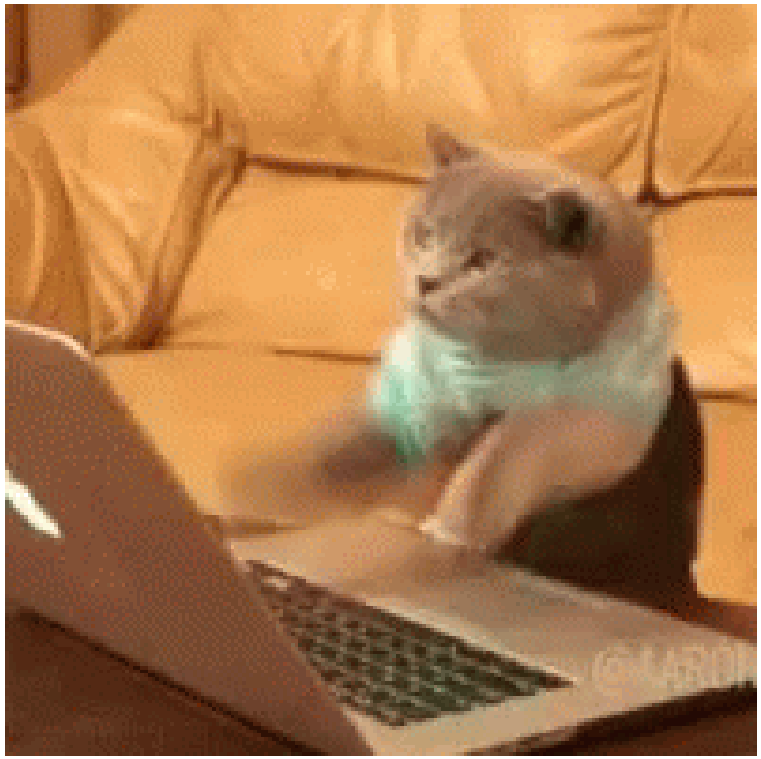
Nonresidential, High-Rise Residential, and Hotel/Motel Occupancies—Performance and Prescriptive Compliance Approaches for Achieving Energy Efficiency

(Sections §140.0 -§140.9)

§140. Series
Performance and Prescriptive Compliance

- **§140.1 - Performance Approach: Energy Budget**
- **§140.2 - Prescriptive Approach**
- **§140.2 - Prescriptive Requirements for Space Conditioning Systems**

§140.1 – Performance Approach: Energy Budgets



§140.1 – Performance Approach: Energy Budgets

- **A building complies with the performance approach if the energy budget calculated for the Proposed Design Building is no greater than the energy budget calculated for the Standard Design Building.**

§140.1 – Performance Approach: Energy Budgets

- Energy Budget for the **Proposed Design** Building.
  - The energy budget for a Proposed Design is calculated from the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation, service water heating and covered process loads.
- Energy Budget for the **Standard Design** Building.
  - The energy budget for the Standard Design Building is determined by applying the mandatory and prescriptive requirements required for the Proposed Design Building And calculating the TDV energy for space-conditioning, indoor lighting, mechanical ventilation, service water heating, and covered process loads.
- **Calculation** of Energy Budget.
  - The TDV energy for both the Standard Design Building and the Proposed Design Building are computed by Compliance Software certified for this use by the Commission. The processes for Compliance Software approval by the Commission are documented in the **ACM Approval Manual**.

§140.4 – Prescriptive Requirements for Space Conditioning Systems

§140.4 – Prescriptive Requirements for HVAC

- **§140.4 covers the following prescriptive topics:**
  - Sizing and Equipment Selection
  - Calculations
  - Power Consumption of Fans
  - Space-conditioning Zone Controls
  - Economizers
  - Supply Air Temperature Reset Controls
  - Electric Resistance Heating
  - Heat Rejection Systems
  - Minimum Chiller Efficiency
  - Limitation of Air-Cooled Chillers
  - Hydronic System Measures
  - Air Distribution System Duct Leakage Sealing
  - Fan Control
  - Mechanical System Shut-off

§140.4 – Prescriptive Requirements for HVAC

- **(a) Sizing and Equipment Selection**
  - Heating and cooling equipment must be the smallest size, within the available options of the desired equipment line, necessary to meet the design heating and cooling loads of the building.

❖ EXCEPTIONS:

- ✓ Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building TDV energy use.
- ✓ Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating.
- ✓ Multiple units of the same equipment type, such as multiple chillers and boilers, having combined capacities exceeding the design load, if they have controls that sequence or otherwise optimally control the operation of each unit based on load.

§140.4 – Prescriptive Requirements for HVAC

- **(b) Calculations**

  - Heating and cooling **design loads** are determined in accordance with the ASHRAE Handbook, Fundamentals Volume, or as specified in a method approved by the Commission.
  - Other calculation methods such as ACCA, SMACNA, etc., are acceptable as long as they are based on ASHRAE.
  - **Indoor** design conditions are determined in accordance with ASHRAE Standard 55 or ASHRAE Handbook, Fundamentals Volume.
  - **Outdoor** design conditions are selected from Reference Joint Appendix JA2, which is based on climate data from the ASHRAE.

§140.4 – Prescriptive Requirements for HVAC

- **(b) Calculations – cont.**
  - Load calculations should include the following:
    - Outdoor air ventilation
    - Envelope thermal conductance and air leakage
    - Solar heat gain
    - Shading such as overhangs
    - People loads based on occupant density
    - Process loads
    - Lighting loads
    - Any anticipated miscellaneous loads

§140.4 – Prescriptive Requirements for HVAC

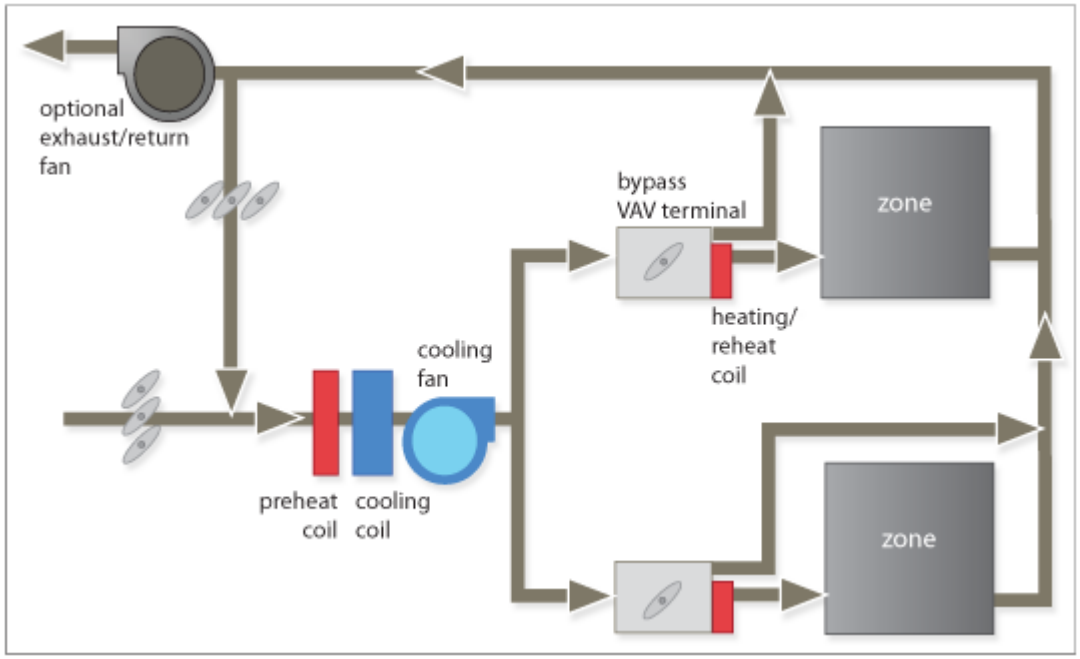
- **(b) Calculations – cont.**
  - **Safety factor**. Design loads may be increased by up to 10 percent to account for unexpected loads or changes in space usage.
  - **Other loads**.
    - Loads such as warm-up or cool-down are based on the heat capacity of the building and contents, the degree of setback, and desired recovery time
    - They may be assumed to be up to 30 percent for heating and 10 percent for cooling on top of the 10 percent safety actor.
      - ✓ Cooling: 1.1 x 1.1 = 1.21 => 21%
      - ✓ Heating: 1.1 x 1.3 = 1.43 => 43%

§140.4 – Prescriptive Requirements for HVAC

- **(c) Power Consumption of Fans**
  - Constant volume fan systems.
    - The total **fan power index** at design conditions of **each fan system** with total horsepower over 25 hp cannot exceed **0.8 watts per cfm** of supply air.

§140.4 – Prescriptive Requirements for HVAC

- **(c) Power Consumption of Fans – cont.**
  - Variable air volume (VAV) systems.
    - The total **fan power index** at design conditions of **each fan system** with total horsepower over 25 hp cannot exceed **1.25 watts per cfm** of supply air.
    - Static pressure sensors used to control VAV fans.



§140.4 – Prescriptive Requirements for HVAC

- **(c) Power Consumption of Fans – cont.**
  - Air-treatment or filtering systems.
    - For systems with air-treatment or filtering systems, calculate the total Adjusted Fan Power Index using Equation 140.4-A:

Adjusted total fan power index = (Fan power index) x (Fan Adjustment)

$$\text{Fan Adjustment} = 1 - \left(\frac{SP_a - 1}{SP_f} \right)$$

WHERE:

SPa = Air pressure drop across the air-treatment or filtering system.

SPf = Total pressure drop across the fan.

§140.4 – Prescriptive Requirements for HVAC

- **(c) Power Consumption of Fans – cont.**
  - Fractional HVAC fan motors have individual efficiency requirements.
    - HVAC motors for fans that are < 1 hp and ≥ 1/12 hp must be ECMs or have a minimum motor efficiency of 70 percent.
    - These motors must also be capable of speed adjustment.

❖ EXCEPTIONS:

- ✓ Motors in fan-coils and terminal units that operate only when providing heating to the space served.
- ✓ Motors in space conditioning equipment certified under Section 110.1 or 110.2.

§140.4 – Prescriptive Requirements for HVAC

- **(m) Fan Control**
  - Each **cooling system** listed in TABLE 140.4-D must vary the indoor fan airflow as a function of load:

TABLE 140.4-D FAN CONTROL SYSTEMS

Cooling System Type	Fan Motor Size	Cooling Capacity
DX Cooling	any	≥ 65,000 Btu/hr
Chilled Water and Evaporative	≥ 1/4 HP	any

  - These systems must have least 2 speed fan control.

§140.4 – Prescriptive Requirements for HVAC

- **(d) Space-conditioning Zone Controls**
  - Each zone must have controls preventing **reheating, recooling, or simultaneous heating and cooling** to the same zone.

EXCEPTIONS:

- ✓ Zones with special pressurization relationships or cross-contamination control needs.
- ✓ Zones with systems in which at least 75 percent of the energy for reheating, or warm air in mixing systems, is from a site-recovered or site solar energy source.
- ✓ Zones where specific humidity levels are required.
- ✓ Zones with a peak supply-air quantity of 300 cfm or less.
- ✓ Zones with DDC meeting flow rates described in 140.4(d), exception 1.

§140.4 – Prescriptive Requirements for HVAC

- **(e) Economizers**
  - Each cooling air handler that has a design total mechanical cooling capacity over 54,000 Btu/hr must include either:
    - An air economizer capable of modulating outside-air and return-air dampers to supply 100 percent of the design supply air quantity as outside-air; or
    - A water economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 50°F dry-bulb and 45°F wet-bulb and below.

❖There are several exceptions listed in §140.4(e)1

§140.4 – Prescriptive Requirements for HVAC

- **(e) Economizers – cont.**
  - If an economizer is installed to meet the prescriptive requirement, it must have controls that:
    - Prevent an increase in the building heating energy use during normal operation.

❖EXCEPTION:
- ✓ Systems that provide 75 percent of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source.

    - Must provide partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

§140.4 – Prescriptive Requirements for HVAC

- **(e) Economizers – cont.**
  - Air economizers must be a type listed in, and have **high limit shutoff** shown in TABLE 140.4-B.

TABLE 140.4-B AIR ECONOMIZER HIGH LIMIT SHUT OFF CONTROL REQUIREMENTS

Device Type[a]	Climate Zones	Required High Limit (Economizer Off When):	
		Equation[b]	Description
Fixed Dry Bulb	1, 3, 5, 11-16	$T_{OA} > 75°F$	Outdoor air temperature exceeds 75°F
	2, 4, 10	$T_{OA} > 73°F$	Outdoor air temperature exceeds 73°F
	6, 8, 9	$T_{OA} > 71°F$	Outdoor air temperature exceeds 71°F
	7	$T_{OA} > 69°F$	Outdoor air temperature exceeds 69°F
Differential Dry Bulb	1, 3, 5, 11-16	$T_{OA} > T_{RA}°F$	Outdoor air temperature exceeds return air temperature
	2, 4, 10	$T_{OA} > T_{RA}-2°F$	Outdoor air temperature exceeds return air temperature minus 2°F
	6, 8, 9	$T_{OA} > T_{RA}-4°F$	Outdoor air temperature exceeds return air temperature minus 4°F
	7	$T_{OA} > T_{RA}-6°F$	Outdoor air temperature exceeds return air temperature minus 6°F
Fixed Enthalpy[c] + Fixed Drybulb	All	$h_{OA} > 28$ Btu/lb[c] or $T_{OA} > 75°F$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[c] or Outdoor air temperature exceeds 75°F

§140.4 – Prescriptive Requirements for HVAC

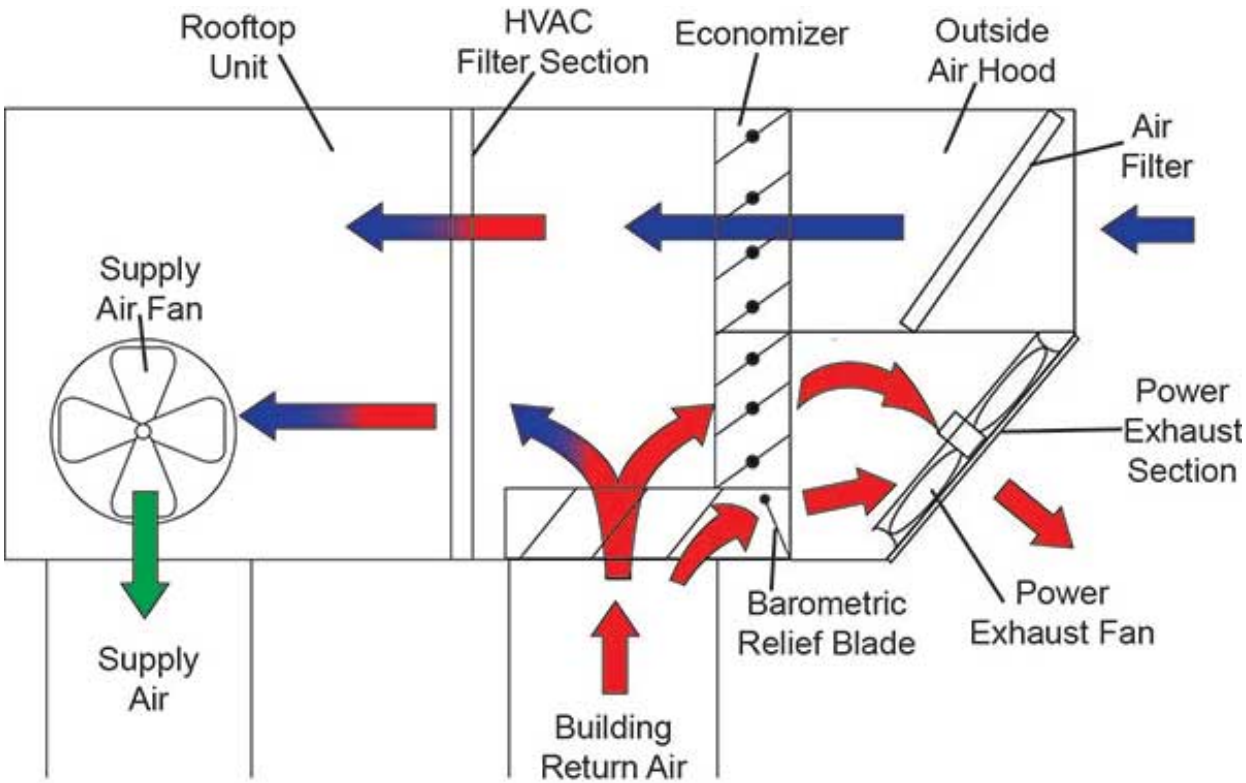
- **(e) Economizers – cont.**
  - Air economizer air damper requirements:
    - **Warranty**. 5-year Manufacturer warranty of economizer assembly.
    - **Damper reliability testing**. Suppliers must certify that all dampers and actuators will open and close against the rated airflow and pressure of the system for 60,000 cycles.
    - **Damper leakage**. Outdoor and return air dampers must be tested to have a maximum leakage rate of 10 cfm/sf at 1.0 in. w.g., and the **leakage rates must be certified to the Energy Commission** per Section 110.0.
    - **Adjustable setpoint**. If the high-limit control is fixed dry-bulb or fixed enthalpy + fixed dry-bulb then the control must have an adjustable setpoint.

§140.4 – Prescriptive Requirements for HVAC

- **(e) Economizers – cont.**
  - Air economizer air damper requirements – cont.
    - **Relief air system**. Relief air systems must allow 100 percent outside air without over-pressurizing the building.

§140.4 – Prescriptive Requirements for HVAC

- **(e) Economizers – cont.**
  - All economizers must be acceptance tested or be certified by the manufacturer to the Commission.



§140.4 – Prescriptive Requirements for HVAC

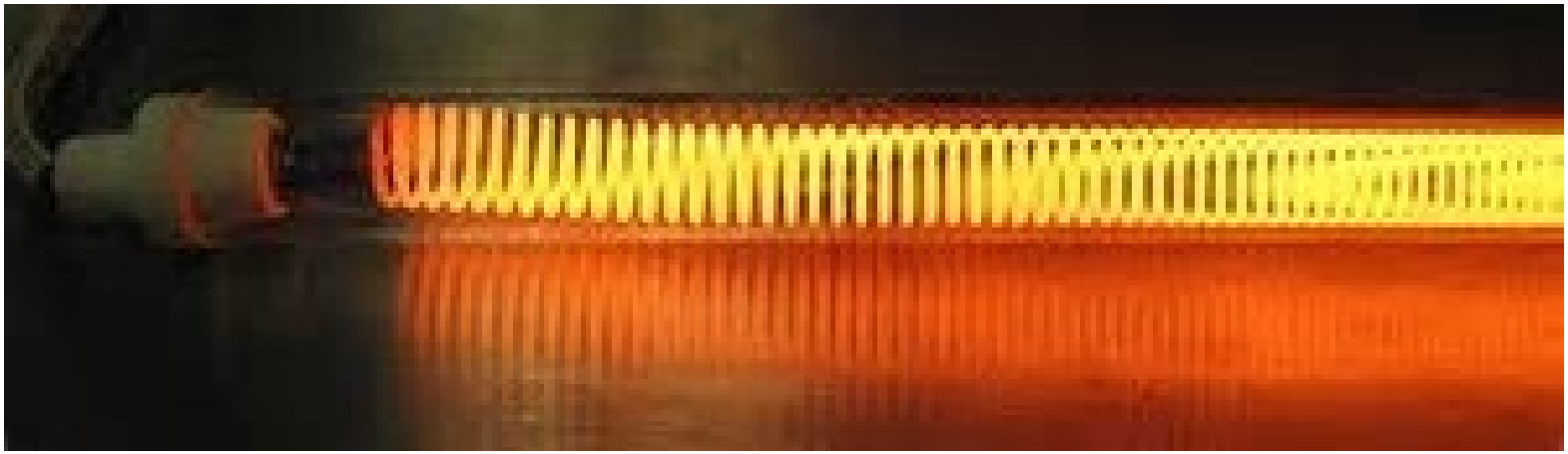
- **(f) Supply Air Temperature (SAT) Reset Controls**
  - Space-conditioning systems **supplying multiple zones** must include controls that **automatically reset supply-air temperatures**.
  - **SAT** must be reset by the following:
    - In response to representative building loads or to outdoor air temperature.
    - At least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

❖ EXCEPTIONS:
✓ There are some exceptions for certain zonal controls and process humidification requirements..

§140.4 – Prescriptive Requirements for HVAC

- **(g) Electric Resistance Heating**
  - Electric resistance heating systems cannot be used for space heating.

❖ EXCEPTIONS:
- ✓ There are exceptions related to solar power, heat pumps, percentage of total building design output, maximum wattage, and building features.



§140.4 – Prescriptive Requirements for HVAC

- **(h) Heat Rejection Systems**
  - Cooling system **heat rejection equipment** such as **condensers**, and **cooling towers**.
  - Fan Speed Control
    - Fan motor 7.5 hp (5.6 kW) or larger must be able to operate at 2/3 of full speed or less.
    - Fans must be able to change speed in order to control condenser temperature or pressure.

❖ EXCEPTIONS:
✓ Of course, there are exceptions to Fan Speed Control. See §140.4(h)2.

§140.4 – Prescriptive Requirements for HVAC

- **(h) Heat Rejection Systems – cont.**
  - Tower Flow Turndown
    - **Open cooling towers** with multiple condenser water pumps must be designed so that all cells can be run in parallel with the larger of:
      - ✓ The flow that is produced by the smallest pump; **or**
      - ✓ 50 percent of the design flow for the cell.
  - Limitations on **cooling tower centrifugal fans**
    - Open cooling towers with a combined rated capacity of 900 gpm and greater at 95°F condenser water return, 85°F condenser water supply, and 75°F outdoor wetbulb temperature, must use propeller fans and cannot use centrifugal fans.

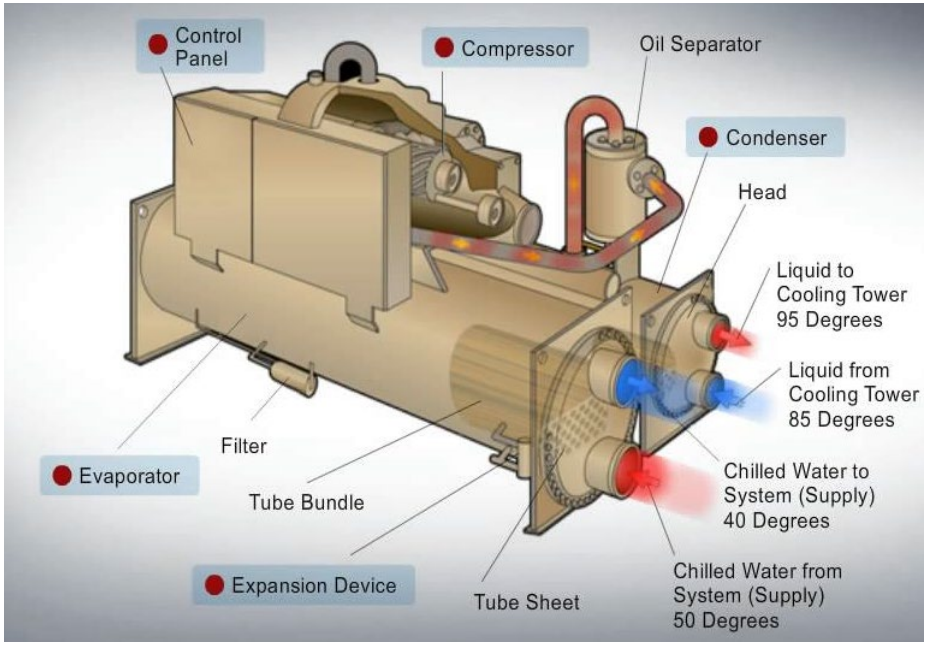
❖ EXCEPTIONS:
✓ There are exceptions to the Limitation on Centrifugal Fan Cooling Towers. See §140.4(h)4.

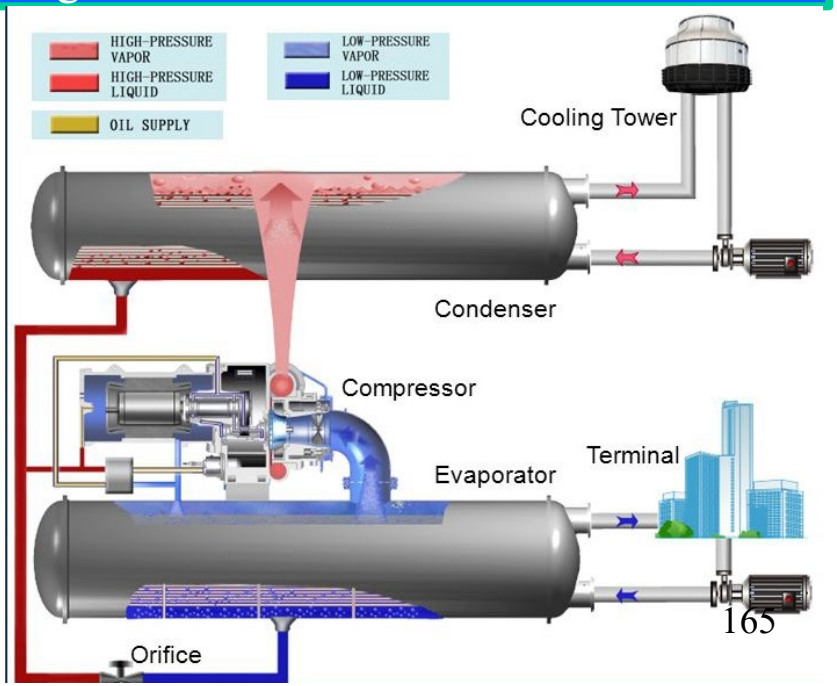
§140.4 – Prescriptive Requirements for HVAC

- **(h) Heat Rejection Systems – cont.**
  - Multiple Cell Heat Rejection Equipment
    - Multi cell heat rejection equipment with variable speed fan drives must:
      - ✓ Operate the maximum number of fans allowed by the manufacturer.
      - ✓ Control all operating fans to the same speed.
      - ✓ Minimum fan speed is based on the manufacture's specifications.
      - ✓ Staging of fans is allowed once the fans are at their minimum operating speed.

§140.4 – Prescriptive Requirements for HVAC

- **(i) Minimum Chiller Efficiency**
  - Chillers must meet or exceed Path B from TABLE 110.2-D.
    - EXCEPTIONS:
      - ✓ There are exceptions related to electrical service size, chillers with heat recovery systems, thermal energy storage and number of chillers.

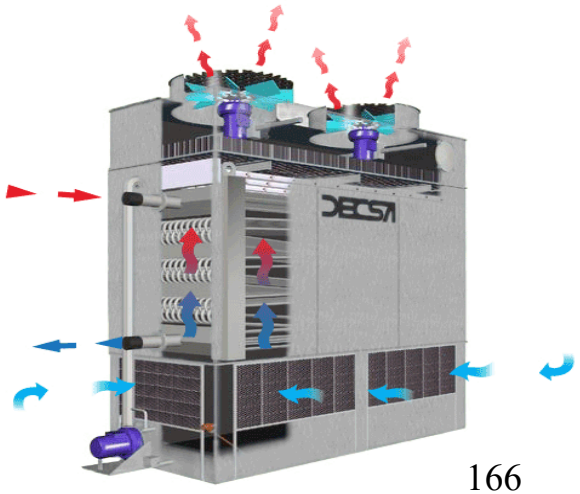




§140.4 – Prescriptive Requirements for HVAC

- **(j) Limitation of Air-Cooled Chillers**
  - Chilled water plants cannot have more than 300 tons of capacity provided by air-cooled chillers.

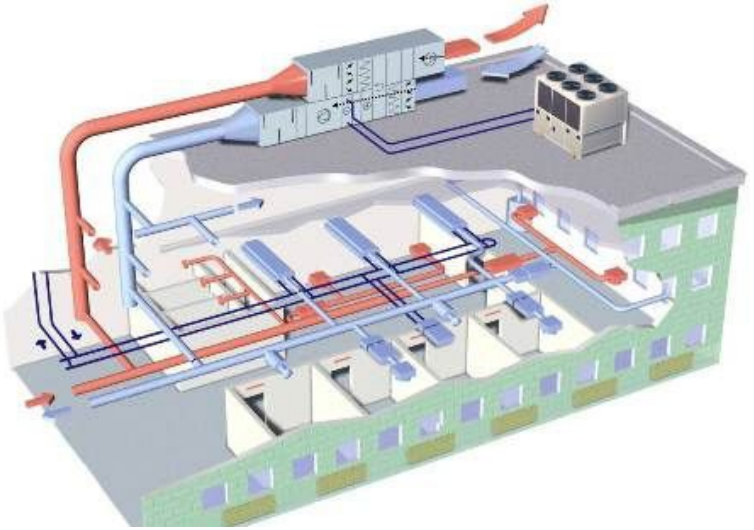
❖ EXCEPTIONS:
- ✓ There are exceptions related to poor water quality, thermal energy storage and certified high efficient air cooled chillers.

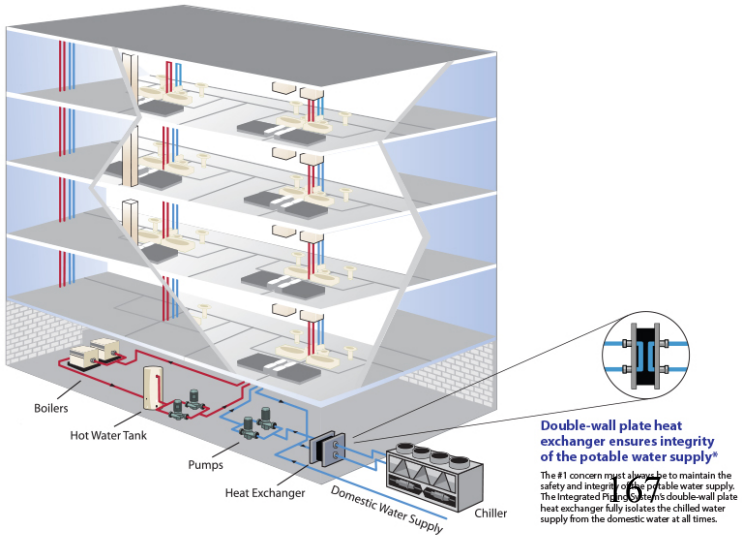


§140.4 – Prescriptive Requirements for HVAC

- **(k) Hydronic System Measures**
  - 1. HVAC chilled and hot water must have **variable fluid flow** and be **capable of reducing pump flow rates** to no more than the larger of:
    - ✓ 50 percent or less of the design flow rate; **or**
    - ✓ the minimum flow required by the equipment manufacturer.

❖ EXCEPTION:
- ✓ Systems that include no more than three control valves or have total pump power less than 1.5 hp.





§140.4 – Prescriptive Requirements for HVAC

- **(k) Hydronic System Measures – cont.**
  - 2. Chiller Isolation
    - System with **parallel chillers** must have provisions to **automatically shut off flow** to chillers not in while still **maintaining flow** through operating chiller(s).
    - Chillers that are piped **in series** are considered to be one chiller.
  - 3. Boiler Isolation
    - Hot water plants with **more than one** boiler, must automatically shut off flow through boilers not in use while maintaining flow through other operating boiler(s).

Acceptance testing is required for both of these.

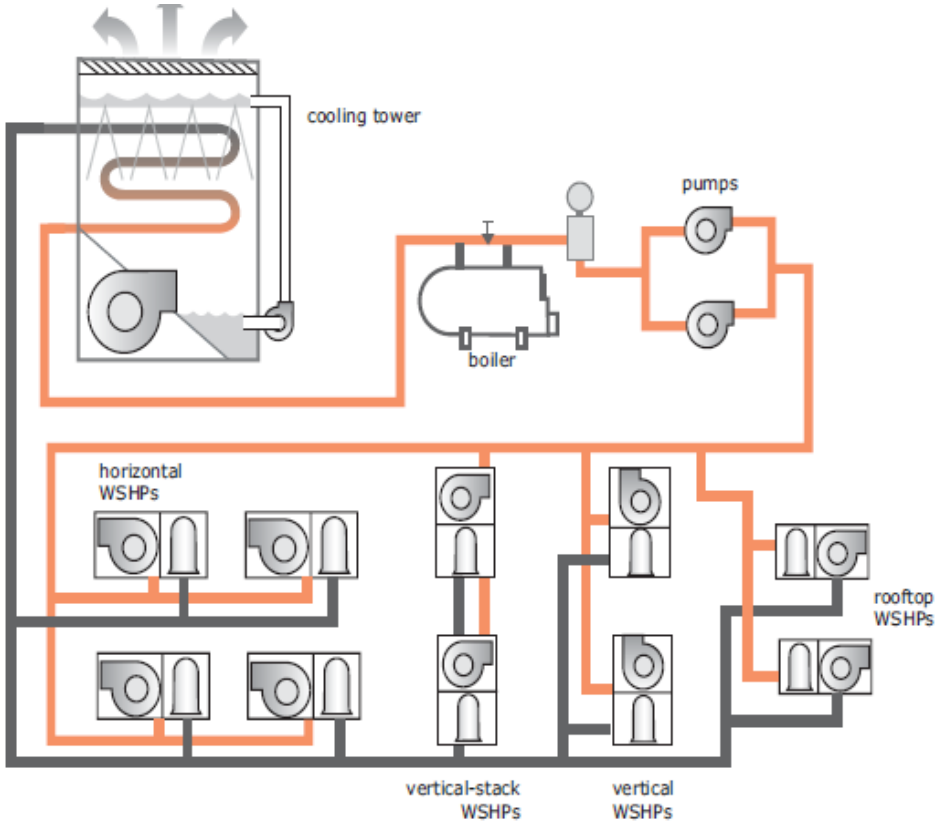
§140.4 – Prescriptive Requirements for HVAC

- **(k) Hydronic System Measures – cont.**
  - 4. Chilled and Hot Water Temperature Reset Controls
    - Systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water must have controls that **automatically reset supply water** temperatures as a function of building loads or outside air temperature.
  - 5. Water-Cooled Air Conditioner and Hydronic Heat Pump Systems
    - Systems with total pump system power exceeding 5 hp must have **variable flow controls**.
    - Each air conditioner or heat pump must shut off water flow when the compressor is off.

Acceptance testing is required for these also.

§140.4 – Prescriptive Requirements for HVAC

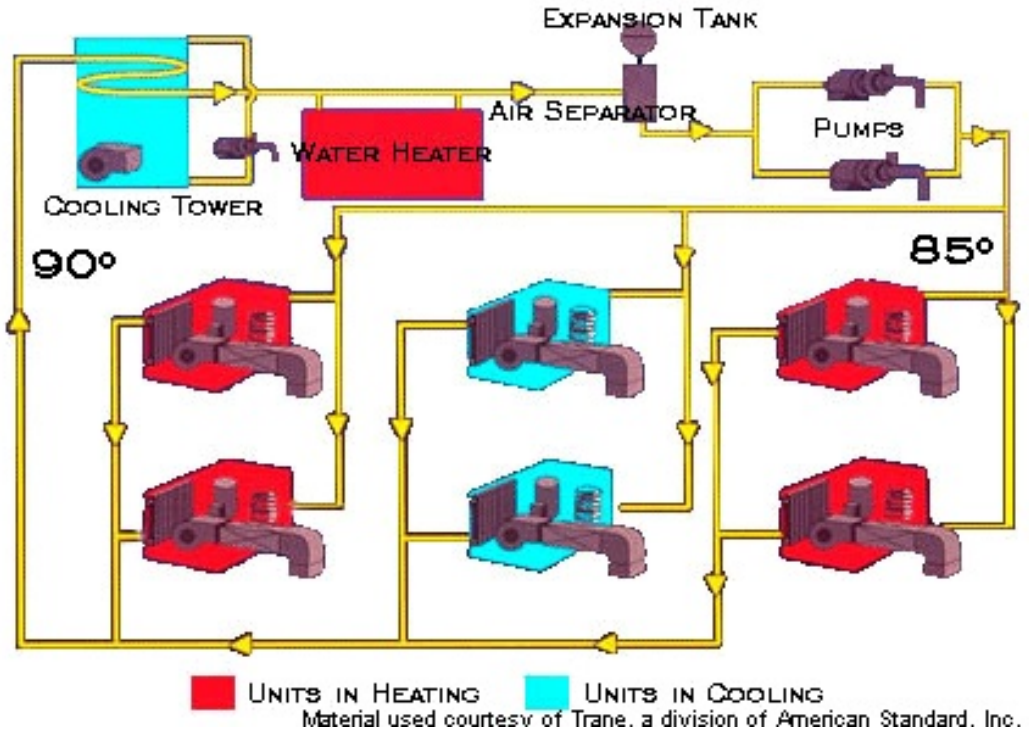
- **(k) Hydronic System Measures – cont.**
  - 6. Variable Flow Controls
    - Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp must have motors with 30% power at 50% flow.
    - Pressure Sensor Location and Setpoint depends on DDC to the coil or not.



- EXCEPTIONS:
  - ✓ There are exceptions to Variable Flow Controls. See §140.4(k)6.

§140.4 – Prescriptive Requirements for HVAC

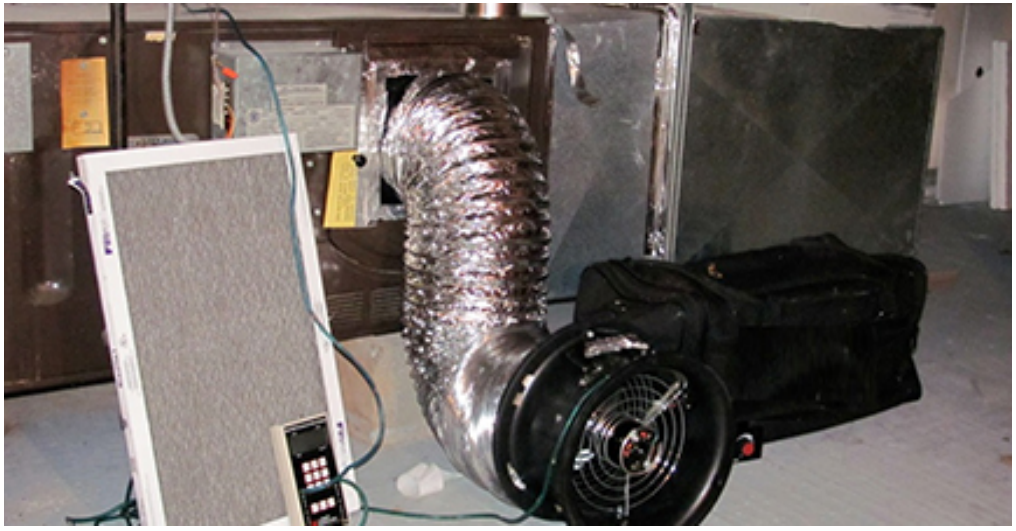
- **(k) Hydronic System Measures – cont.**
  - 7. Hydronic Heat Pump (WLHP) Controls
    - WLHPs with central heat rejection and heat addition must allow for a water supply temperature **dead band** of **at least 20°F** between initiation of heat rejection and heat addition.



- EXCEPTIONS:
  - ✓ Systems with a temperature optimization controller.

§140.4 – Prescriptive Requirements for HVAC

- **(l) Air Distribution System Duct Leakage Sealing**
  - Duct systems must be sealed to a leakage rate ≤ 6 percent of the nominal air handler airflow rate as **verified by a HERS rater** in accordance with Reference Appendices NA1 and NA2 **if all the following are met**:
    - The space is served by a constant volume, single zone system.
    - The space conditioning system serves less than 5,000 square feet.
    - Has more than 25 percent of the duct surface area in unconditioned space.



§140.4 – Prescriptive Requirements for HVAC

- **(n) Mechanical System Shut-off**
  - Any space with operable openings to outdoors must have interlock controls.
  - When open for more than 5 minutes:
    - disable or reset the setpoint to 55°F for mechanical heating, **and**
    - disable or reset the setpoint to 90°F for mechanical cooling.

- EXCEPTIONS:
  - ✓ They are not required on openings with automatic closing devices or in spaces without thermostatic control.

§140.4 – Prescriptive Requirements for HVAC

- Code Quiz:
  - Load calculations are based on which of the following?
    a) ACCA
    b) ASHRAE
    c) SMACNA
    d) All of the above
  - When do fan power index requirements apply?
    a) Each fan > 25 hp.
    b) Each fan system > 25 hp.
    c) Both a) and b).

§140.4 – Prescriptive Requirements for HVAC

- Code Quiz:
  - When is an economizer mandatory?
    a) On systems with cooling capacity over 54,000 Btu/hr.
    b) On all VAV systems.
    c) Both a) and b).
    d) Not mandatory.

  - When is an economizer required prescriptively?
    a) On systems with cooling capacity over 54,000 Btu/hr.
    b) On all VAV systems.
    c) Both a) and b).

§140.4 – Prescriptive Requirements for HVAC

- **Takeaways**
  - **Heat and Cooling loads must be calculated based on ASHRAE.**
  - **A safety factor increase is allowed.**
  - **Fan power index requirements for motors over 25 hp and efficiency requirements for motors less than 1 hp.**
  - **Zonal controls required to prevent reheat, recooling and mixing.**
  - **Economizers are required on air handlers over 54,000 Btu/hr**
  - **Economizers have acceptance testing or certification requirements.**
  - **Multi-zone systems are required to have SAT reset controls.**
  - **Heat rejection systems have requirements for fan and pump controls and motor efficiencies.**

§140.4 – Prescriptive Requirements for HVAC

- **Takeaways – cont.**
  - **Chiller efficiencies must meet path B in Table 110.2-D.**
  - **Limitation of no more than 300 tons of air cooled chiller capacity.**
  - **Hydronic systems have requirements for isolation, variable flow control, and fluid temperature reset.**
  - **Single zone systems less than 5,000 sf may need HERS duct testing.**
  - **DX, chilled water and evaporative cooling systems have fan motor control requirements.**
  - **Mechanical shut-off devices are required for operable openings in spaces with thermostatic controls.**
  - **These are prescriptive requirements and do not need to be met when using the performance approach.**

Subchapter 6
Nonresidential, High-Rise Residential, Hotel/Motel Occupancies – Additions, Alterations, and Repairs
(Sections §141.0 -§141.1)

§141.0 Additions Alterations and Repairs

- §141.0(a) – Additions
- §141.0(b) – Alterations
- §141.0(c) – Repairs

§141.0(a) – Additions

§141.0(a) – Additions

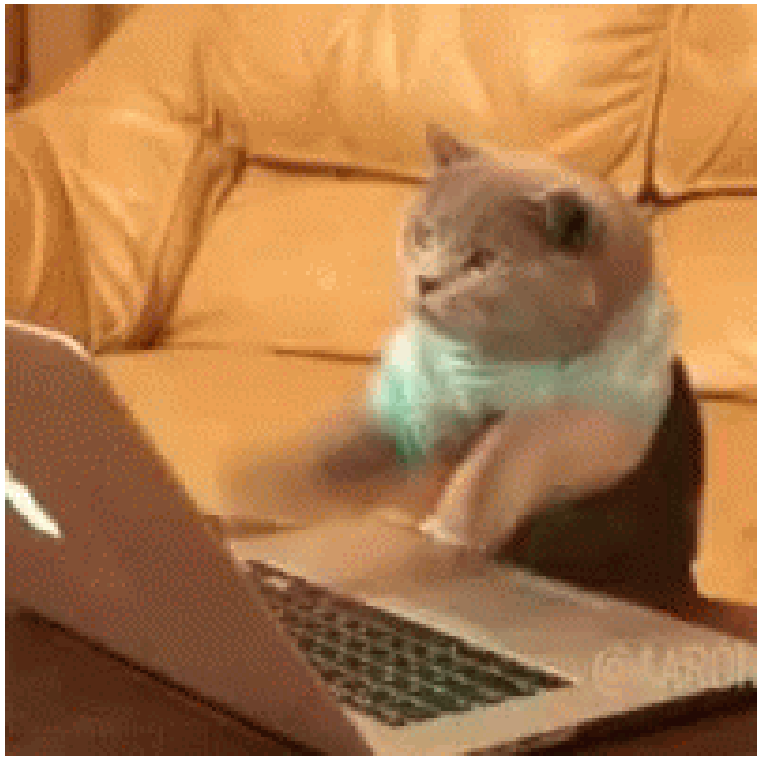
- **1. Prescriptive approach.**
  - Newly installed space-conditioning systems installed in an addition must meet the applicable prescriptive requirements of §140.4 and all applicable mandatory requirements as discussed in previous sections.

Addition Definition:

Any change to a building that increases conditioned floor area and conditioned volume.

§141.0(a) – Additions

- **2. Performance approach**
  - All applicable mandatory measures must be achieved or exceeded.
  - Either the **addition alone can comply or** the **existing plus addition** or the **existing plus addition plus alteration** approach can be taken.



§141.0(a) – Additions

- **Exceptions for additions that apply to both prescriptive and performance approach:**

❖ EXCEPTIONS:

- ✓ When expanding existing systems, existing systems and equipment need not comply with current requirements except for duct sealing.
- ✓ Duct Sealing. When ducts are extended from an existing duct system, the existing and extended ducts must have ≤ 15% leakage or pass smoke test.
- ✓ There are exceptions allowing expansion of existing systems with electric heat when adding VAV boxes to the addition. See Exception 2 to Section 141.0(a).

§141.0(b) – Alterations

§141.0(b)2. - Alterations: Prescriptive Approach

- **C. New or Replacement Space-Conditioning Systems or Components**
  - New Systems or Components **except** ducts must meet the requirements of section §140.4 applicable to the systems or components being altered.

- EXCEPTIONS:
  - ✓ Replacements of electric resistance heaters with equivalent or smaller heaters for high rise residential units.
  - ✓ Replacement of electric reheat with equivalent or smaller heaters, when natural gas is not available.
  - ✓ Mechanical System Shutoff Devices in §140.4(n) are not required for new or replacement space conditioning systems.
  - ✓ Economizer FDD in §120.2(i) is not required for alterations of space-conditioning systems or components.

§141.0(b)2. - Alterations: Prescriptive Approach

- **D. Altered Duct Systems**
  - New or replacement ducts must meet mandatory requirements for Ducts and Plenums in §120.4.
  - If the space conditioning system meets the criteria of Section140.4(l), the duct system must be tested by a HERS rater:
    - **Entirely new or replacement** duct system directly connected to the air handler, must have leakage ≤ 6 percent when tested per NA2.1.4.2.1.

NOTE: Entirely new or replacement duct systems means at least 75 percent new duct material. Up to 25 percent may consist of reused parts from the building's existing duct system, including registers, grilles, boots, air handlers, coils, plenums, and ducts, if the reused parts are accessible for sealing.

§141.0(b)2. - Alterations: Prescriptive Approach

- **D. Altered Duct Systems – cont.**
  - ➢ HERS testing – cont.:
    - When ducts are extended from an existing duct system, the existing and extended ducts must be tested by a HERS rater to have ≤ 15% leakage or pass smoke test per NA2.1.4.2.2.

❖ EXCEPTION:
✓ Existing duct constructed, insulated or sealed with asbestos.

§141.0(b)2. - Alterations: Prescriptive Approach

- **E. Altered Space-Conditioning Systems**
  - When replacing the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:
    - An Occupant Controlled Smart Thermostat (OCST) that complies with Reference Joint Appendix JA5 must be installed; **and**
    - If the system meets the criteria of Sections 140.4(l)1, 2 and 3, the connected duct system shall be sealed and tested as discussed previously.

- EXCEPTION:
  - ✓ Exception: Ducts documented to have been previously tested by a HERs Rater.
  - ✓ Exception: Existing duct systems constructed, insulated or sealed with asbestos.

§141.0(b)3. – Alterations: Performance Approach

- **Performance Approach**
  - All applicable mandatory measures for the new equipment must be met.
  - For an altered components, the standard design is based on either the existing conditions or the prescriptive requirements, which ever has higher efficiency.
  - For components not being altered, the standard design is based on the existing conditions.
  - The proposed design must be based on the actual values of the altered components.

§141.0(b) – Alterations

- **Exceptions to Alterations**

❖ EXCEPTIONS:

- ✓ When HVAC systems are altered, the existing systems and equipment need not comply with the current requirements.
- ✓ When existing systems or components are moved in a building, the existing systems or components need not comply with the current requirements.
- ✓ There are exceptions allowing expansion of existing systems with electric heat when adding VAV boxes to the addition. See Exception 3 to Section 141.0(b).

§141.0(c). – Repairs

- **A repair is the reconstruction or renewal for the purpose of maintenance of a component, system, or equipment of an existing building.**
- **Replacement of any component, system, or equipment for which there are requirements in the Standards is considered an alteration and not a repair.**
- **Repairs do not have requirements under Part 6 except they shall not increase the preexisting energy consumption of the repaired component, system, or equipment.**

§141.0 – Additions, Alterations and Repairs

- Code Quiz:
  - Is economizer FDD per 120.2(i) required on an altered system?
    a) No
    b) Yes because it is a mandatory measure.
    c) Only when an economizer is added or replaced.
    d) b and c.
  - A JA5 thermostat is required for alterations to a duct system?
    a) True.
    b) False.

§141.0 – Additions, Alterations and Repairs

- Code Quiz:
  - What are the triggers for duct testing requirements?
    - ✓ Constant volume single zone.
    - ✓ System serves less than 5,000 sf.
    - ✓ More than 25% of ducts in unconditioned space.
  - What is the leakage requirement for a replacement duct system?
    - a) ≤ 6%.
    - b) ≤ 15%

§141.0 – Additions, Alterations and Repairs

- **Takeaways**
  - ➢ All mandatory measure apply to new and altered components.
  - ➢ 140.4 is the bases for the performance approach standard model.
  - ➢ 140.4 requirements must be met or exceeded for the altered components when complying prescriptively.
  - ➢ Existing systems and equipment are not required to meet current code.
  - ➢ Duct testing is required on existing ducts if ducts are extended.
  - ➢ Altered systems other than ducts, require a JA5 Thermostat.
  - ❖ Always check the exceptions.

QUESTIONS…

About Additions, Alterations or Repairs?

Enforcement

Enforcement Process

Permit Application

- NRCC Forms on/with plans and signed by the proper person.
- The OPR and BOD or verify NRCC-CXR-01-E indicates they were reviewed.
- Commissioning measures are shown in the documents.
- Commissioning Plan if applicable.

Plan Check

- Verify plans reflect the requirements of the energy compliance documents.

Construction Inspection

- Verify mechanical systems and documentation for systems that cannot be verified at final.

Final Inspection

- Review NRCA/NRCV forms and compare to NRCC forms and installed equipment.
- Verify System manual and Commissioning Report are on site and complete if applicable.
- Verify training plan and training attendance forms if applicable.

Enforcement Process

- **How do I know what mandatory and prescriptive measures are required?**

2016 ENERGY CODE

Ace Resources Title 24, Part 6 Triggers

Nonresidential

New HVAC: Simple and Complex Systems

HVAC Simple Systems

	Mandatory Requirements								Prescriptive Requirements			
Space Conditioning Equipment [A]	Zone Thermostat[F] §120.2(a), (b) Setback Capable[G]	DCV[H] §120.1(c)	Heat Pump Controls[I] §120.2(d)	Shutoff and Reset[J] §120.2(e)	Ventilation Dampers §120.2(f) Automatic close upon fan shutdown[L]	Isolation Devices[N] §120.2(g)	Demand Shedding[O] §120.2(h)	Economizer FDD[P] §120.2(i)	Zone Control[Q] §140.4(d)	Supply Temperature Reset[R] §140.4(f)	Economizer[P,S] §140.4(e)1- 5	Variable Flow Control[T] §140.4(k)6 §140.4(m)
Package Terminal Air Conditioner [B,C]	YES[D]	YES	no	YES[K]	YES	no	YES	YES	YES	YES	no	YES[U]
Unitary Air Conditioners and Condensing Units [D]	YES	YES	no	YES[K]	YES	no	no	YES	no	no	YES	YES[U]
Unitary Heat Pumps [E]	YES	YES	YES	YES[K]	YES	no	no	YES	no	no	YES	YES[U]
Applied Heat Pumps[E]	YES	YES	YES	YES[K]	YES	YES	YES	YES	YES	no	YES	YES[U]
Forced Air Furnace	YES	YES	no	YES[K]	YES[M]	no	YES	no	no	no	no	no
Unit Heater	YES	no	no	YES[K]	no	no	no	no	no	no	no	no

Enforcement Process

- **How do I know what acceptance tests are required?**

Acceptance Tests: HVAC Simple Systems

The measures below trigger these acceptance tests	NRCA-MCH-02-A Outdoor Air	NRCA-MCH-03-A Constant Volume, Single-zone, Unitary A/C and HP	NRCA-MCH04-A Air Distribution Duct Leakage	NRCA-MCH-05-A Air Economizer Controls	NRCA-MCH-06-A Demand Control Ventilation	NRCA-MCH-07-A Supply Fan VFD	NRCA-MCH-08-A Valve Leakage	NRCA-MCH-11-A Automatic Demand Shed	NRCA-MCH-12-A Fault Detection and Diagnostic for DX Systems	NRCA-MCH-13-A Fault Detection and Diagnostic for AHUs	NRCA-MCH-16-A Supply Air Temp Reset	NRCA-MCH-18-A[A] Energy Management Control System
Zone T-Stats	no	YES	no	no	no	no	no	no	no	no	no	YES
DCV	YES	YES	no	YES	YES	YES	no	no	no	no	no	YES
Heat Pump Controls	no	YES	no	no	no	no	no	no	no	no	no	no
Shutoff and Reset	no	YES	no	no	no	no	no	YES	no	no	no	YES
Ventilation Dampers	YES	YES	YES	YES	no	YES	no	no	no	no	no	YES
Isolation Devices	no	YES	YES	no	no	no	YES	no	no	no	no	YES
Demand Shedding	no	no	no	no	no	no	no	YES	no	no	no	YES
Economizer and/or FDD	YES	YES	no	YES	no	YES	no	no	YES	YES	no	YES
Zone Control	no	YES	no	no	no	no	YES	YES	no	no	no	YES
Supply Temp. Reset	no	no	no	no	no	no	no	no	no	no	YES	YES
Variable Flow Control	no	no	no	no	no	YES	YES	no	no	no	no	YES
Duct Systems	YES	no	YES	no	no	no	no	no	no	no	no	no

Let's finish with some Resources

Online Resource Center (ORC)

www.energy.ca.gov/title24/orc/

2016 Approved HERS Providers

- **Nonresidential HVAC duct leakage testing**
  - CalCERTS
  - CHEERS

More information at:
http://www.energy.ca.gov/HERS/providers.html

Approved ATTCPs

- **Mechanical ATTCPs**
  - National Energy Management Institute Committee (NEMIC) (replaced Testing, Adjusting, and Balancing Bureau (TABB))
  - National Environmental Balancing Bureau (NEBB)
  - The California State Pipe Trades Council (CSPTC)
  - Refrigeration Service Engineers Society (RSES)

More information at:

http://www.energy.ca.gov/title24/attcp/

Blueprint

- Email Newsletter
- Published quarterly
- Clarifications on frequently asked questions

Issue 113 | March – April 2016

BLUEPRINT

California Energy Commission
Efficiency Division

In This Issue

New Mechanical Acceptance Test Technician Certification Provider

On January 13, 2016, the California Energy Commission (Energy Commission) approved the National Environmental Balancing Bureau (NEBB), as a mechanical Acceptance Test Technician Certification Provider (ATTCP).

This gives NEBB the authority to train, certify, and oversee acceptance test technicians (ATTs) and their employers. NEBB will train and certify ATTs to perform all 17 mechanical acceptance tests required in the *2013 Building Energy Efficiency Standards* (Energy Standards).

The Conditions of Approval are available for review in the **Executive Director's recommendation**.

For more information, please visit: **http://energy.ca.gov/title24/attcp/**.

Small Duct High Velocity Space Conditioning Systems

Small duct high velocity (SDHV) systems may be used to comply with the Energy Standards. The following is a list of requirements with direction on how SDHV systems can comply with the low-rise residential requirements of the Energy Standards.

Mandatory Requirements

United States Department of Energy Standards:

SDHV systems manufactured on or after January 23, 2006, and before January 1, 2015, must have a minimum Seasonal Energy Efficiency Ratio (SEER) of 11, and a minimum Heating Seasonal Performance Factor (HSPF) of 6.8.

SDHV systems manufactured on or after January 1, 2015, must have a minimum SEER of 12, and a minimum HSPF of 7.2.

Energy Standards:

Section 150.0(m)13B - Single zone systems that use forced air ducts to supply cooled air to an occupiable space must either meet minimum airflow and fan efficacy requirements, or meet the return duct and grille sizing requirements of **TABLES 150.0-C or 150.0-D**.

NOTE: The return duct and grille sizing alternative will likely be the method chosen for compliance when installing a SDHV system.

Section 150.0(m)15 - Specific to systems with multiple thermostatically controlled zones, this section requires the same mandatory airflow and fan efficacy requirements as **Section 150.0(m)13B**. However, it does not have the same duct and grille sizing alternative. If such systems cannot satisfy the airflow and fan efficacy requirements of this section, compliance must be demonstrated via the performance approach.

The duct leakage and insulation requirements apply as with any other system.

Prescriptive Requirements

The refrigerant charge and duct insulation requirements apply as with any other system.

www.energy.ca.gov/efficiency/blueprint/

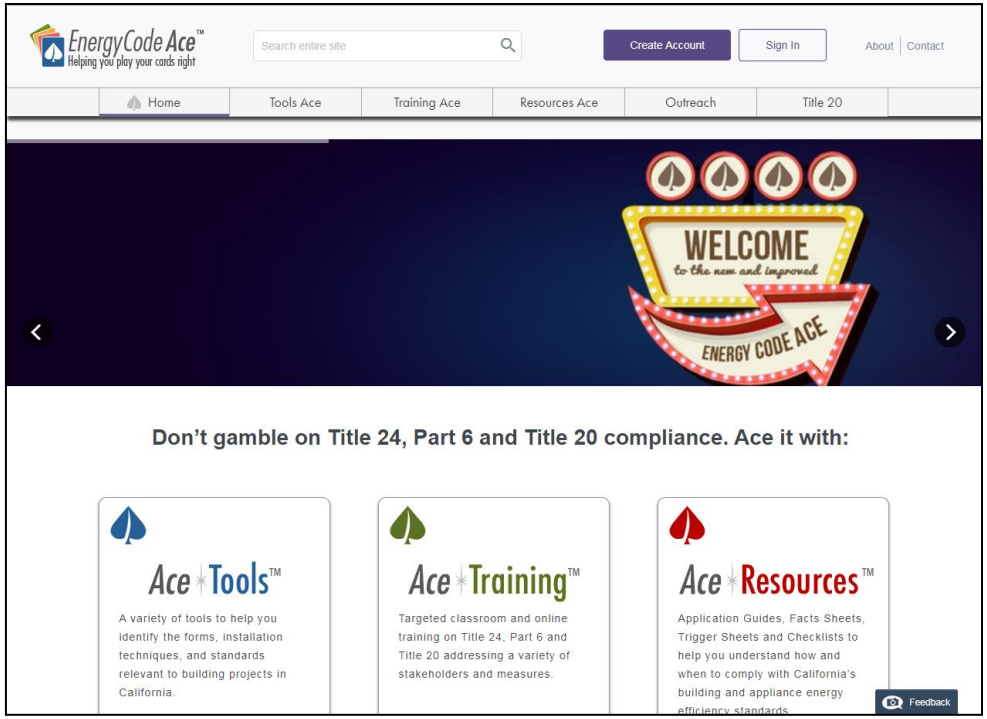
Email Lists

- Receive updates on the Energy Standards
- Sign up
  - www.energy.ca.gov/listservers/
- Subscribe to the following Efficiency Lists
  - Building Standards
  - Blueprint
- Respond to confirmation email within 24 hours

Hotline

- Toll-free in California
- Open Monday through Friday
  - 8:00 a.m. to noon, and
    1:00 p.m. to 4:30 p.m.
- Call at:
  - 1-800-772-3300 (In CA)
  - (916) 654-5106 (Outside CA)
- Or, email at: Title24@energy.ca.gov

Energy Code Ace



- Forms & Resource tools
- Free training in person and online
- Checklists, Trigger Sheets for building departments

www.energycodeace.com

QUESTIONS…

About Resources?

The End

THANK YOU VERY MUCH!!!