



Southern Nevada 2012 IECC  
Commercial Mechanical  
Requirements

Ken Baker – K energy

PNNL-SA-82107

## Simple Versus Complex Systems

### Simple systems

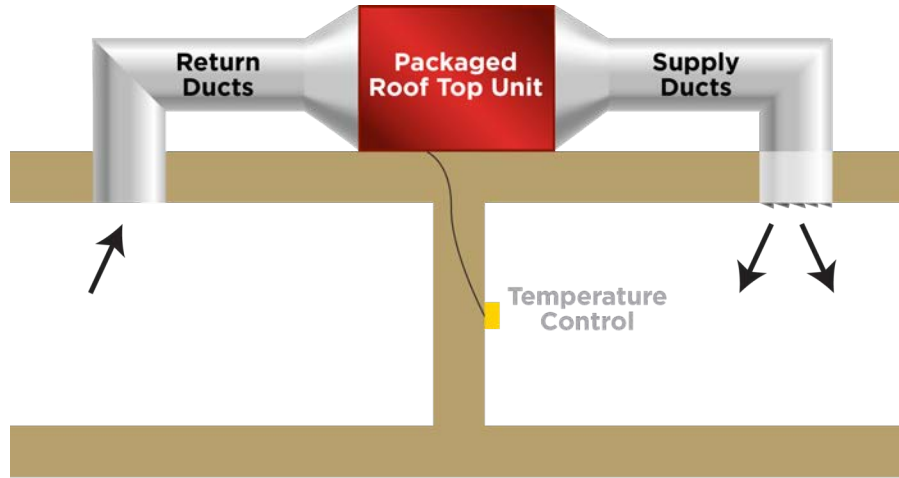
- ✓ Unitary or packaged HVAC equipment
- ✓ Serves one zone and controlled by a single thermostat

#### Section **C403.3 Simple Systems**

Buildings served by unitary or packaged HVAC each serving 1 zone controlled by 1 thermostat. Two-pipe heating systems serving multiple zones are included if no cooling system is installed [Tables C403.2.3(1) through C403.2.3(8)]

## Simple Systems

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Simple System

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## Simple Versus Complex Systems

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### Complex systems

- ✓ All equipment not covered under Section C403.3  
Simple Systems

**Section**  
**C403.4**  
**Complex**  
**Systems**

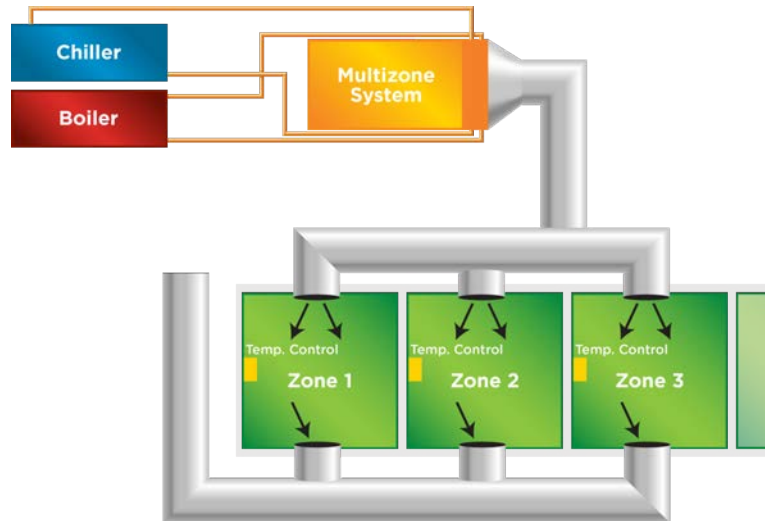
All buildings served  
by HVAC systems not  
covered under  
C403.3

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## Complex Systems



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## Mandatory Provisions C403.2

### Provisions Applicable to ALL Mechanical Systems

- ✓ HVAC Load Calculations
- ✓ Equipment and System Sizing
- ✓ HVAC Equipment Performance Requirements
- ✓ HVAC System Controls
- ✓ Ventilation
- ✓ Energy Recovery Ventilation Systems
- ✓ Duct and Plenum Insulation and Sealing
- ✓ Piping Insulation
- ✓ HVAC System Commissioning and Completion
- ✓ Air System Design and Control
- ✓ Heating Outside a Building

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## HVAC Load Calculations

### C403.2.1 Mandatory

Heating and cooling load sizing calculations required

- ✓ ASHRAE/ACCA Standard 183
- ✓ Other approved computation procedures – defined in Chapter 3
  - Interior design conditions
    - Specified by Section C302 of the IECC
      - $\leq 72^{\circ}\text{F}$  for heating load
      - $\geq 75^{\circ}\text{F}$  for cooling load

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## Equipment and System Sizing

### C403.2.2 Mandatory

Output capacity SHALL NOT exceed sizing

- ✓ Select the system which serves the greater load, heating or cooling
  - **Exceptions**
    - Standby Equipment with Required Controls
    - Multiple Units with Combined Capacities Exceeding Loads
      - Sequencing Controls Required

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## HVAC Performance

### C403.2.3 Mandatory Minimum Efficiency Requirements

Applies to all equipment used in heating and cooling of buildings

- ✓ Where components from different manufacturers are used
  - calculations & supporting data demonstrating combined efficiency meets requirements

Must comply with all listed efficiencies

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## Water-Cooled Centrifugal Chilling Packages

### C403.2.3.1

- Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F leaving chilled-water temperature and 85°F entering condenser water temperature with 3 gpm/ton condenser water flow
  - To have maximum full-load kW/ton and NPLV ratings adjusted using Equations 403 and 404
- Adjusted full-load and NPLV values only applicable for centrifugal chillers meeting all of these full-load design ranges
  - Leaving evaporator fluid temperature  $\geq 36^{\circ}\text{F}$
  - Leaving condenser fluid temperature  $\leq 115^{\circ}\text{F}$
  - LIFT is not less than 20°F and not greater than 80°F
  - **Exception**
    - Centrifugal chillers designed to operate outside of these ranges

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## Table C403.2.3(2)

Mandatory

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air cooled (cooling mode)	< 65,000 Btu/h	All	Split system	13.0 SEER	AHRI 210/240
			Single packaged	13.0 SEER	
	≤ 30,000 Btu/h	All	Split system	13.0 SEER	
			Single packaged	13.0 SEER	
Single-duct high-velocity air cooled	< 65,000 Btu/h	All	Split system	10.0 SEER	

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## Positive Displacement (Air- and Water-Cooled Chilling Packages)

C403.2.3.2

- Equipment with a leaving fluid temperature > 32°F to meet Table C403.2.3(7) when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure

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## System Controls C403.2.4.1 (Mandatory)

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Control required for each system  
✓ if zoned for each zone



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## System Controls (Mandatory) C403.2.4.1.1 Heat Pump Supplementary Heat

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### Heat pump systems

- ✓ Heat pump thermostat required when supplying electric resistance heating
- ✓ Control must prevent supplemental heat demand when heat pump can meet the heating load.
  - Except during defrost

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**Controls (Mandatory)**  
**C403.2.4.2 Set Point Overlap Restriction**

Thermostats must have at least a 5°F dead band

✓ **Exception**

- Thermostats requiring manual change over between heating and cooling

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**Controls (Mandatory)**  
**C403.2.4.3 Off Hour**

Automatic time clock or programmable system

✓ **Exceptions**

- Zones operated continually
- Zones with full HVAC load demand <6,800 Btu/h and has a readily accessible shut off switch

Thermostatic setback capabilities

- ✓ Capability to maintain zone temps down to 55°F or up to 85°F

Automatic setback and shutdown

- ✓ Seven different daily schedules/week
- ✓ Retain programming ≥ 10 hrs with loss of power **AND**
  - ✓ Manual override up to 2 hours **OR**
  - ✓ Manual timer capable of operating up to 2 hours **OR**
  - ✓ Occupancy sensor

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## Automatic Start Capabilities (Mandatory)

### C403.2.4.3.3

#### Automatic start controls for each HVAC system

- ✓ Capable of automatically adjusting daily start time to bring each space to desired occupied temperature immediately prior to scheduled occupancy

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## Controls (Mandatory)

### C403.2.4.4 Shutoff Dampers

Motorized dampers that will automatically shut when the system or spaces are not in use.

#### ✓ Exceptions

- Gravity dampers permitted in buildings < 3 stories
- Gravity dampers permitted for buildings of any height located in **Climate Zones 1-3**
- Gravity dampers permitted for outside air intake or exhaust airflows of 300 cfm (0.14m<sup>3</sup>/s) or less.

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**Controls (Mandatory)**  
**C403.2.4.5 Snow Melt Systems**

Snow- and ice-melting systems, supplied through energy service to the building, shall include

- ✓ automatic controls capable of shutting off the system when the pavement temperature is above 50°F (10°C) and no precipitation is falling
- ✓ an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F (4°C) so that the potential for snow or ice accumulation is negligible



Photo courtesy of Ken Baker, K energy

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**Demand Controlled Ventilation**  
**C403.2.5.1 (Mandatory )**

DCV must be provided for each zone with spaces > 500 ft<sup>2</sup> and the average occupant load > 25 people/1000 ft<sup>2</sup> of floor area where the HVAC system has:

- ✓ An air-side economizer,
- ✓ Automatic modulating control of the outdoor air damper, or
- ✓ A design outdoor airflow > 3,000 cfm

*Demand control ventilation (DCV): a ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.*

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## Demand Controlled Ventilation

### C403.2.5.1 (Mandatory)

#### Exceptions:

- ✓ Systems with energy recovery per C403.2.6
- ✓ Multiple zone systems without direct digital control of single zones communicating with central control panel
- ✓ Systems with design outdoor airflow < 1,200 cfm
- ✓ Spaces where supply airflow rate minus any makeup or outgoing transfer air requirement < 1,200 cfm
- ✓ Ventilation provided for process loads only

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## Energy Recovery Ventilation Systems

### C403.2.6 (Mandatory)

- ✓ Applies to fan systems with supply airflow rates > values in Table C403.2.6
- ✓ Exhaust air recovery efficiency must be  $\geq 50\%$
- ✓ When an air economizer is required
  - include a bypass or controls that permit operation of economizer per C403.4

*Energy recovery ventilation (ERV) systems: employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system.*



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## Energy Recovery Ventilation Systems C403.2.6 (Mandatory)

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### Exceptions:

- ✓ Where energy recovery ventilation systems prohibited by the IMC
- ✓ Lab fume hood system with at least one of the following:
  - VAV hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to  $\leq 50\%$  of design values
  - Direct makeup (auxiliary) air supply equal to at least 75% of exhaust rate, heated no warmer than 2°F below room setpoint, cooled to no cooler than 3°F above room setpoint, no humidification added, and no simultaneous heating and cooling use for dehumidification control
- ✓ Systems serving uncooled spaces and heated to  $< 60^{\circ}\text{F}$
- ✓ Where  $> 60\%$  of outdoor heating energy is from site-recovered or site solar energy
- ✓ Heating energy recovery in **Climate Zones 1-2**
- ✓ Cooling energy recovery in **Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8**
- ✓ Systems requiring dehumidification that employ energy recovery in series with the cooling coil
- ✓ Where largest source of air exhausted at a single location at building exterior is  $< 75\%$  of design outside air flow rate

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## Duct and Plenum Insulation & Sealing C403.2.7 (Mandatory)

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Insulation required for supply and return ducts and plenums

- ✓ Located in unconditioned space – minimum R-5
- ✓ Located outside the building - minimum R-8

### Exceptions

- ✓ When located within equipment
- ✓ When design temperature difference between interior and exterior of the duct or plenum doesn't exceed 15°F

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## Low & Medium Pressure Duct Systems

C403.2.7.1.1 and C403.2.7.1.2 (Mandatory)

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Ducts designed to operate at static pressures  $\leq 2$  in. wg

Securely fastened and sealed

✓ Exceptions

- When located within equipment
- Design temperature difference between interior and exterior of duct or plenum  $< 15^{\circ}\text{F}$

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## High Pressure Duct Systems

C403.2.7.1.3 (Mandatory)

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Ducts designed to operate at static pressures  $> 3$  in. wg to be leak tested in accordance with SMACNA HVAC Air Duct Leakage Test Manual

- ✓ Air leakage rate  $\leq 6.0$
- ✓  $CL = F/P^{0.65}$ 
  - Where
    - F = leakage rate per 100 sf of duct surface area
    - P = test condition static pressure

Must test  $\geq 25\%$  of the duct area and meet the requirements

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**Piping Insulation**  
**C403.2.8 (Mandatory)**

All piping serving heating or cooling system must be insulated in accordance with Table C403.2.8

**Minimum Pipe Insulation**  
*(thickness in inches)*

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (Inches)				
	Conductivity Btu · in./(h · ft <sup>2</sup> · F) <sup>a</sup>	Mean Rating Temperature, °F	< 1	1 to < 1½	1½ to < 4	4 to < 8	≤ 8
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	2.5	3.0	3.0

(Partial table)

**Piping Insulation**  
**C403.2.8**

**Exceptions:**

- ✓ Piping internal to HVAC equipment (*including fan coil units*) factory installed and tested
- ✓ Piping for fluid in temperature range
  - 60 < temp < 105°F
- ✓ Piping for fluid not heated or cooled by electricity or fossil fuels
- ✓ Strainers, control valves, and balancing valves associated with piping ≤ 1” in diameter
- ✓ Direct buried piping for fluids ≤ 60°F

## Protection of Piping Insulation

### C403.2.8.1 (Mandatory)

- ✓ If exposed to weather,
  - protect from damage, including
    - Sunlight
    - Moisture
    - Equipment maintenance
    - Wind
  - Provide shielding from solar radiation that can cause degradation of material
  - Adhesive tape is not allowed

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## Mechanical Systems Commissioning and Completion

### C403.2.9 (Mandatory)

Mechanical system to be commissioned and completed per Section C408.2

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## Air System Design and Control

### C403.2.10 (Mandatory)

- ✓ Maximum fan power requirements
- ✓ Applies to HVAC systems with total fan system power > 5 hp
- ✓ Each HVAC system at design conditions can not exceed allowable fan system motor nameplate hp (Option 1) or fan system bhp (Options 2) in Table C403.2.10.1(1)
- ✓ Single zone VAV systems to comply with constant volume fan power limitations

**TABLE C403.2.10.1.1(1) FAN POWER LIMITATION**

	LIMIT	CONSTANT VOLUME	VARIABLE VOLUME
<b>Option 1: Fan System Motor Nameplate hp</b>	Allowable Nameplate Motor hp	$hp \leq CFMS * 0.0011$	$hp \leq CFMS * 0.0015$
<b>Option 2: Fan System bhp</b>	Allowable Fan System bhp	$bhp \leq CFMS * 0.00094 + A$	$bhp \leq CFMS * 0.0013 + A$

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## Allowable Fan Motor Horsepower

### C403.2.10.1 (Mandatory)

BHP option includes adjustment “adders” certain devices

**Table C403.1.10.1(2)  
Fan Power Limitation Pressure Drop Adjustment**

DEVICE	ADJUSTMENT
<b>Credits</b>	
Fully ducted return and/or exhaust air systems	0.5 in w.c. (2.15 in w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 in w.c.
Exhaust filters, scrubbers, or other exhaust treatment.	The pressure drop of device calculated at fan system design condition.
Particulate Filtration Credit: MERV 9 thru 12	0.5 in w.c.
Particulate Filtration Credit: MERV 13 thru 15	0.9 in w.c.
Particulate Filtration Credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition.
Carbon and Other gas-phase air cleaners	Clean filter pressure drop at fan system design condition.

(Partial table)

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## Allowable Fan Motor Horsepower

### C403.2.10.1 (Mandatory)

#### Exceptions

- ✓ Hospital, vivarium, and laboratory systems using flow control devices on exhaust and/or return for health and safety or environmental control permitted to use variable fan power limitation
- ✓ Individual exhaust fans  $\leq 1$  hp

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## Motor Nameplate Horsepower

### C403.2.10.2 (Mandatory)

Selected fan motor to be no larger than first available motor size greater than bhp

Fan bhp on design documents

#### Exceptions

- ✓ Fans  $< 6$  bhp, where first available motor larger than bhp has nameplate rating within 50% of bhp, next larger nameplate motor size may be selected
- ✓ Fans  $\geq 6$  bhp, where first available motor larger than bhp has nameplate rating within 30% of bhp, next larger nameplate motor size may be selected

bhp = brake horsepower

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## Heating Outside a Building

### C403.2.11 (Mandatory)

Systems are to be radiant systems

Controlled by an occupancy sensing device or timer switch

- ✓ So system is automatically deenergized when no occupants are present

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## Simple HVAC Systems & Equipment

### C403.3

Unitary or packaged, single zone controlled by a single thermostat in the zone served.

#### Simple Systems

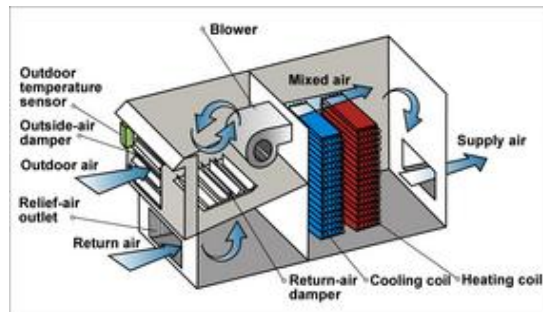
- ✓ Unitary packaged heating and cooling systems
- ✓ Split system heating and cooling systems
- ✓ Packaged terminal A/C and HPs
- ✓ Fuel-fired furnace
- ✓ Electrical resistance heating
- ✓ Two-pipe heating systems w/o cooling

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## Simple HVAC Systems & Equipment C403.3

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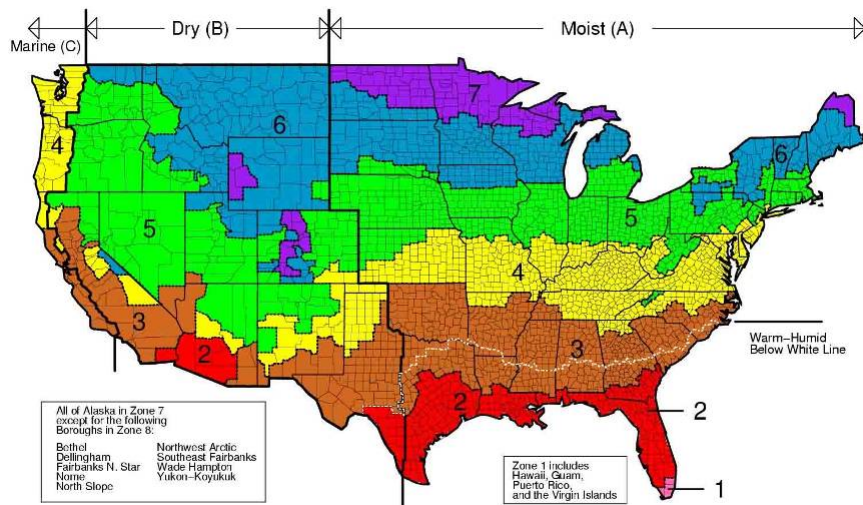
- ✓ Must include economizers dependent on climate zone
- ✓ Capable of providing 100-percent outdoor air even if additional mechanical cooling is required (*integrated economizer*)
- ✓ Must provide a means to relieve excess outdoor air



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## Climate Zones - 2012 IECC

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**Table C403.3.1(1)**

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on cooling systems $\geq 33,000$ Btu/h <sup>a</sup>

<sup>a</sup> The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater

**Exceptions** (economizers not required)

- ✓ Individual fan-cooling units with supply capacity < Table C403.3.1(1)
- ✓ Where > 25% of air designed to be supplied by the system is to spaces that are designed to be humidified > 35°F dew-point temperature to satisfy process needs
- ✓ Systems that serve residential spaces where system capacity is < 5 times requirement in Table C403.3.1(1)
- ✓ Systems expected to operate < 20 hours/week
- ✓ Where use of outdoor air for cooling will affect supermarket open refrigerated casework systems
- ✓ Where cooling efficiency meets or exceeds efficiency requirements in Table C403.3.1(2)

**Economizers**  
**C403.3.1**

Trade-off high cooling efficiency for economizer

**Table C403.3.1(2)**

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

**Air Economizers**

**C403.3.1.1.1 Design Capacity**

Capable of modulating outdoor air and return air dampers to provide up to 100% of design supply air quantity as outdoor air for cooling

## Air Economizers

### C403.3.1.1.2 Control Signal

Economizer dampers to be capable of being sequenced with mechanical cooling equipment and not be controlled by only mixed air temperature

#### **Exception:**

- ✓ Can use mixed air temperature limit control for systems controlled from space temperature

Example: single-zone systems

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## Air Economizers

### C403.3.1.1.3 High-Limit Shutoff

- ✓ Air economizers to be capable of automatically reducing outdoor air intake to design minimum outdoor air quantity when outdoor air intake will no longer reduce cooling energy usage
- ✓ High-limit shutoff control types to be chosen from Table C403.3.1.1.3(1) for specific climates
- ✓ Specifications for high-limit shutoff control type settings per Table C403.3.1.1.3(2)

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## Air Economizers

### C403.3.1.1.4 Relief of Excess Outdoor Air

- ✓ Systems to be capable of relieving excess outdoor air during air economizer operation to prevent over-pressurizing the building
- ✓ Relief air outlet to be located to avoid recirculation into the building

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## Hydronic System Controls

### C403.3.2

- ✓ Hydronic systems  $\geq 300,000$  Btu/h design output capacity supplying heated and chilled water for comfort conditioning to have controls meeting C403.4.3

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This section applies to all HVAC equipment and systems not included in Section C403.3

**Complex Systems**

- ✓ Packaged VAV reheat
- ✓ Built-up VAV reheat
- ✓ Built-up single-fan, dual-duct VAV
- ✓ Built-up or packaged dual-fan, dual-duct VAV
- ✓ Four-pipe fan coil system with central plant
- ✓ Water Source heat pump with central plant
- ✓ Any other multiple-zone system
- ✓ Hydronic space heating and cooling system

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**Table C404.2 Minimum Performance of  
Water-Heating Equipment**

- ✓ Water Heater Types Covered
  - Electric Storage
  - Gas and Oil Storage
  - Instantaneous Water Heaters – Gas and Oil
  - Hot water boilers – gas and oil
  - Pool heaters
  - Unfired storage tanks

Temperature Controls (C404.3)

Heat Traps (C404.4)



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## Pipe Insulation C404.5

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### Noncirculating system insulation requirements

- ✓ First eight feet of outlet piping on systems with no integral heat traps
- ✓ 1/2 inch of insulation required

### Circulating systems

- ✓  $\geq 1$  inch of insulation

### Exceptions

- ✓ Heat-traced piping systems meet insulation requirements per manufacturers' installation instructions
- ✓ Untraced piping within heat traced systems  $\geq 1$  inch of insulation



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## Hot Water System Controls C404.6

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### Ability to turn off circulating hot water pumps and heat trace tape when there is limited demand

- ✓ Automatically or manually
- ✓ Ready access to controls



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## Pools and Inground Permanently Installed Spas

### C404.7 Mandatory

#### Heaters (C404.7.1)

- ✓ Readily accessible on-off switch mounted outside heater so heater can be shut off without adjusting thermostat setting
- ✓ Natural gas or LPG fired pool heaters will not have continuously burning pilot lights

#### Time switches or other control method (C404.7.2)

- ✓ Automatic controls required to turn heaters and pumps on a preset schedule
- ✓ **Exceptions**
  - Where public health standards require 24 hour operation
  - Where pumps are required to operate solar and waste heat recovery pool heating systems

Note: heaters, pumps and motors with built-in timers meet this requirement

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## Covers

### C404.7.3

Heated pools and inground permanently installed spas required to have a cover

- ✓ Cover must be vapor retardant



#### Exception

- ✓ Pools deriving > 70% energy for heating from site-recovered energy

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## Mechanical Systems Commissioning and Completion Requirements

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### C408.2

- ✓ Prior to passing final mechanical inspection
  - Registered design profession or other agency approved by the jurisdiction shall provide evidence of mechanical systems commissioning and completion in accordance with the provisions of this section.
  - *Remainder of the section to remain the same.*
- ✓ Construction document notes to clearly indicate provisions for commissioning and completion requirements
  - Permitted to refer to specifications
- ✓ Copies of all documents to be provided to the owner and made available to code official upon request

## Mechanical Systems Commissioning and Completion Requirements

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### C408.2 Exceptions

- ✓ These systems are exempt from commissioning requirements
  - In buildings where total mechanical equipment capacity is < 480,000 Btu/h cooling capacity and 600,000 Btu/h heating capacity
  - Included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units

## Commissioning Plan C408.2.1

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- ✓ Developed by registered design professional or agency and include:
  - ✓ Narrative description of activities to be accomplished during each phase of commissioning
    - ✓ Including personnel who will do each activity
  - ✓ Listing of specific equipment, appliances or systems to be tested and description of tests to be performed
  - ✓ Functions to be tested, including, but not limited to calibrations and economizer controls
  - ✓ Conditions under which test will be performed
    - ✓ At a minimum, testing will affirm winter and summer design conditions and full outside air conditions
  - ✓ Measurable criteria for performance

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## Systems Adjusting and Balancing C408.2.2

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- ✓ HVAC systems balanced per generally accepted engineering standards
- ✓ Air and water flow rates measured and adjusted to deliver final flow rates within tolerances in product specifications
- ✓ Test and balance activities to include air system and hydronic system balancing

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## Air Systems Balancing

### C408.2.2.1

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- ✓ Each supply air outlet and zone terminal device equipped with means for air balancing per Chapter 6 of the IMC
- ✓ No discharge dampers on constant volume fans with motors  $\geq 10$  hp
- ✓ Air systems balanced in a manner to first minimize throttling losses, then, for fans with system power  $> 1$  hp, fan speed adjusted to meet design flow conditions

**Exception** – fans with motors  $\leq 1$  hp

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## Hydronic Systems Balancing

### C408.2.2.2

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- ✓ Individual hydronic heating and cooling coils equipped with means for balancing and measuring flow
- ✓ Hydronic systems proportionately balanced in a manner to first minimize throttling losses, then pump impeller to be trimmed or pump speed to be adjusted to meet design flow conditions
- ✓ Each hydronic system to have either capability to measure pressure across the pump, or test ports at each side of each pump

#### **Exceptions**

- ✓ Pumps with pump motors  $\leq 5$  hp
- ✓ Where throttling results in  $\leq 5\%$  of nameplate hp draw above that required if the impeller were trimmed

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## Functional Performance Testing

### C408.2.3.1 Equipment

- ✓ To demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications, such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed
- ✓ Testing to include all modes and sequence of operation, including under full-load, part-load and the following emergency conditions:
  - ✓ All modes as described in the sequence of operation
  - ✓ Redundant or automatic back-up mode
  - ✓ Performance of alarms, and
  - ✓ Mode of operation upon a lost off power and restoration of power

**Exception** – unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(3) that don't require supply air economizers

## Functional Performance Testing

### C408.2.3.2 Controls

- ✓ HVAC control systems to be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications
- ✓ Sequences of operation to be functionally tested to document they operate in accordance with approved plans and specifications

## Functional Performance Testing

### C408.2.3.3 Economizers

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- ✓ Air economizers to undergo a functional test to determine they operate in accordance with manufacturer's specifications

## Preliminary Commissioning Report

### C408.2.4

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- ✓ A preliminary report of commissioning test procedures and results shall be completed and certified by a registered design professional or other agency approved by the jurisdiction and provided to the building owner and will identify:
  - ✓ Itemization of deficiencies found during testing that haven't been corrected at the time of report preparation
  - ✓ Deferred tests that can't be performed at the time of report preparation due to climatic conditions
  - ✓ Climatic conditions required for performance of deferred tests

## Preliminary Commissioning Report

### C408.2.4.1 Acceptance of Report

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- ✓ Buildings or portions of buildings can't pass final mechanical inspection until code official has received a letter of transmittal from the building owner acknowledging the building owner has received the Preliminary Commissioning Report

## Preliminary Commissioning Report

### C408.2.4.2 Copy of Report

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- ✓ Code official is permitted to require a copy of the report be made available for review



## Documentation Requirements C408.2.5

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- ✓ Construction documents to specify that documents described in C408.2.5 be provided to building owner within 90 days of receipt of certificate of occupancy
  - ✓ Drawings
  - ✓ Manuals
  - ✓ System balancing report
  - ✓ Final commissioning report

## Documentation Requirements C408.2.5.1 Drawings

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- ✓ Include location and performance data on each piece of equipment

## Documentation Requirements

### C408.2.5.2 Manuals

- ✓ O&M manual to be provided to include all of the following:
  - ✓ Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance
  - ✓ Manufacturer's operation and maintenance manuals for each piece of equipment requiring maintenance (except equipment not furnished as part of the project). Required routine maintenance actions to be clearly identified.
  - ✓ Name and address of at least one service agency
  - ✓ HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints to be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions
  - ✓ Narrative of how each system is intended to operate, including recommended setpoints

## Documentation Requirements

### C408.2.5.3 System Balancing Report

- ✓ To include descriptions of the activities and measurements completed per Section C408.2.2 (systems adjusting and balancing)

## Documentation Requirements

### C408.2.5.4 Final Commissioning Report

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- ✓ Delivered to building owner and include:
  - ✓ Results of functional performance tests
  - ✓ Disposition of deficiencies found during testing, including corrective measure details – used or proposed
  - ✓ Functional performance test procedures used during commissioning process including measurable criteria for test acceptance

**Exception** – deferred tests which can't be performed at time of report preparation due to climatic conditions