



ENERGY SYSTEMS LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

International Energy Conservation Code 2012 & 2015

What's the Difference?



ENERGY SYSTEMS LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION

Shirley Ellis

Energy Codes Specialist

Texas A&M Engineering Experiment Station

shirleyellis@tamu.edu



Agenda

- Overview and Intent of IECC
- Scope and Administration, Definitions, Design Conditions, Existing Buildings, Referenced Standards, Atmospheric Venting Procedure and Solar-Ready
 - Chapters 1, 2, 3, 5, 6 & Appendix RA & RB
- Residential Energy Efficiency
- Commercial Energy Efficiency



Seminar Goal

The goal of this seminar is for participants to apply the 2015 IECC to increase the efficient use of energy in the construction of new buildings and alterations to existing buildings as it applies to residential construction.



Seminar Goal

- Upon completion of this seminar, participants will be better able to:
 - Ease the transition to the 2015 IECC
 - Demonstration of various changes from the 2012 IECC
 - Familiarize participants with the various compliance paths



Every Building Has Two Price Tags!

1. The purchase price

2. The cost to operate the building
over its lifetime

*When adding the two price tags, energy
efficient buildings cost much less!*

Marginal Markings within the codebook

- **Solid vertical lines** indicate a technical change from the requirements of the 2012 edition.
- **Arrows** indicate where a section, paragraph, item in a list, exception or table has been deleted.
- **A single asterisk** [*] indicates that text or a table has been relocated elsewhere in the code.
- **A double asterisk** [**] indicates that the section or table immediately following has been relocated here from a different section.



The Code Development Process

- The three groups of codes are:
 - Group A Codes –
 - IBC, IFGC, IMC, IPC, IPSDC
 - Group B Codes –
 - Admin, IEBC, IECC, IFC, IPerfC, IPoolC, IPMC, IRC, IWUIC, IZC
 - Group C Codes –
 - IGCC
- Each grouping has Committee Action and Public Comment Hearings occurring the same year.



Arrangement and format of the 2012 & 2015

- The IECC contains two separate sets of provisions
 - The IECC Residential Provisions apply to detached one- and two-family dwellings and multiple single-family dwellings as well as Group R-2, R-3 and R-4 buildings three stories or less in height
 - The IECC Commercial Provisions apply to all buildings that are not included in the definition of “Residential buildings”



Arrangement and format of the 2012 & 2015

IECC Commercial Provisions, therefore, contain provisions for residential buildings four stories or greater in height.





- Each set of provisions is independent; containing a chapter covering:
 - Scope and Administration
 - Definitions
 - General Requirements
 - Energy Efficiency Requirements
 - applicable to buildings within its scope
 - Referenced Standards
 - Residential only - Appendix RA and RB
 - Index



Table of Contents

C – Commercial Provisions		R – Residential Provisions	
Chapter 1 Scope and Administration	C-3	Chapter 1 Scope and Administration	R-3
Chapter 2 Definitions	C-7	Chapter 2 Definitions	R-7
Chapter 3 General Requirements	C-13	Chapter 3 General Requirements	R-11
Chapter 4 Commercial Energy Efficiency	C-31	Chapter 4 Residential Energy Efficiency	R-29
Chapter 5 Existing Buildings	C-95	Chapter 5 Existing Buildings	R-43
Chapter 6 Referenced Standards	C-99	Chapter 6 Referenced Standards	R-45
		Appendix RA and RB	R-49
Index	C-107	Index	R-53



Objectives of the Code

- The following are regulated:
 - Building Envelope
 - Mechanical Systems
 - Electrical Systems
 - Service Water Heating Systems



Chapter 1

- Relocation of all existing building provisions to separate chapter 6
- Construction documentation information clarified and commercial provisions increased
- Commercial required inspections expanded



Chapter 2 Definitions - Commercial

- Above-grade wall
- Air curtain
- Alteration
- Approved agency
- Below-grade wall
- Boilers, modulating & boiler system
- Bubble point
- Circulating Hot Water System
- Climate zone
- Computer room
- Condensing unit
- Conditioned space
- Continuous insulation
- Daylight responsive control
- Daylight zone
- Demand recirculation water system



Chapter 2 Definitions - Commercial

- Fan efficiency grade
- Fenestration
- Net floor area
- General purpose electric motor
- High speed door
- Historic building
- Liner system
- Low-sloped roof
- Low-voltage dry-type transformer
- Occupant sensor control
- Opaque door
- Powered roof/wall ventilators
- Radiant heating system
- Refrigerant dew point



Chapter 2 Definitions - Commercial

- Refrigerated warehouse cooler
- Refrigerated warehouse freezer
- Refrigeration system
- Registered design professional
- Repair
- Reroofing
- Roof recover
- Roof repair
- Roof replacement
- Rooftop monitor
- Saturated condensing temperature
- Small electric motor
- Variable refrigeration flow system
- Walk-in cooler
- Walk-in freezer
- Water heater



Chapter 2 Definitions - Residential

- Alteration
- Approved agency
- Circulating hot water system
- Conditioned space
- Continuous insulation
- ERI Reference design
- Fenestration
- Historic building
- Insulated siding
- Rated design
- Repair
- Reroofing
- Roof recover
- Roof repair
- Roof replacement
- Vertical fenestration



Chapter 3 – Commercial and Residential

- Tropical climate zone added
- Warm-Humid designation removed
 - Bandera
 - Dimmit
 - Edwards
 - Frio
 - Kinney
 - La Salle
 - Maverick
 - Medina
 - Real
 - Uvalde
 - Val Verde
 - Webb
 - Zapata
 - Zavala



Chapter 3 – Commercial and Residential

- Labeling and testing requirements for insulated siding added
- Garage door *U*-factor testing requirements



Chapter 5 – Commercial and Residential

- New chapter, including sections addressing
 - General requirements
 - Additions
 - Alterations
 - Repairs (Commercial only)
 - Change of occupancy or use



Residential – Existing Buildings

- R501.1 Scope
 - Additions, alterations, repairs: General
- R501.2 Existing buildings
- R501.3 Maintenance
- R501.4 Compliance
- R501.5 New and replacement materials
- R501.6 Historic Buildings



Residential – Existing Buildings

- R502 Additions
 - R502.1.1 Prescriptive compliance
 - R502.1.2 Simulated Performance Alternative – Existing plus addition compliance



Residential – Existing Buildings

- R503 Alterations
 - R503.1.1 Building envelope
 - R503.1.1.1 Replacement fenestration
 - R503.1.2 Heating and cooling systems
 - R503.1.3 Service hot water systems
 - R503.1.4 Lighting
 - R503.2 Change in space conditioning
- R504 Repairs
- R505 Change of Occupancy or Use



Commercial – Existing Buildings

- C501.1 Scope
- C501.2 Existing buildings
- C501.3 Maintenance (new)
- C501.4 Compliance
 - References to I-family of codes
- C501.5 New and replacement materials (new)



Commercial – Existing Buildings

- C502 Additions
 - C502.2. Prescriptive compliance
 - C502.2.1 Vertical fenestration
 - C502.2.2 Skylight area
 - C502.2.3 Building mechanical system
 - C502.2.4 Service water-heating systems
 - C502.2.5 Pools and inground permanently installed spas
 - C502.2.6 Lighting power and systems
 - C502.2.6.1 Interior lighting power
 - C502.2.6.2 Exterior lighting power



Commercial – Existing Buildings

- C503 Alterations
 - Exemptions
- C503.2 Change in space conditioning
- C503.3 Building envelope
 - C503.3.1 roof replacement
 - C503.3.2 Vertical fenestration
 - C503.3.2 Skylight area



Commercial – Existing Buildings

- C503.4 Heating and cooling systems
 - C503.4.1 Economizers
- C503.5 Service hot water systems
- C503.6 Lighting systems
 - Exception
- C504 Repairs
- C505 Change of occupancy or use



Chapter 6 - Commercial

- APSP – Pool and Spa
- ASHRAE – updated 90.1
- CRRC – Cool Roof
- CTI – Cooling Towers
- DASMA – Door and Access Systems Maintenance
- IEEE – Electrical and Electronic Engineers
- ISO – Standardization Organization
- NEMA Electrical Manufacturer's
- NFPA – National Fire Protection



Appendix RA

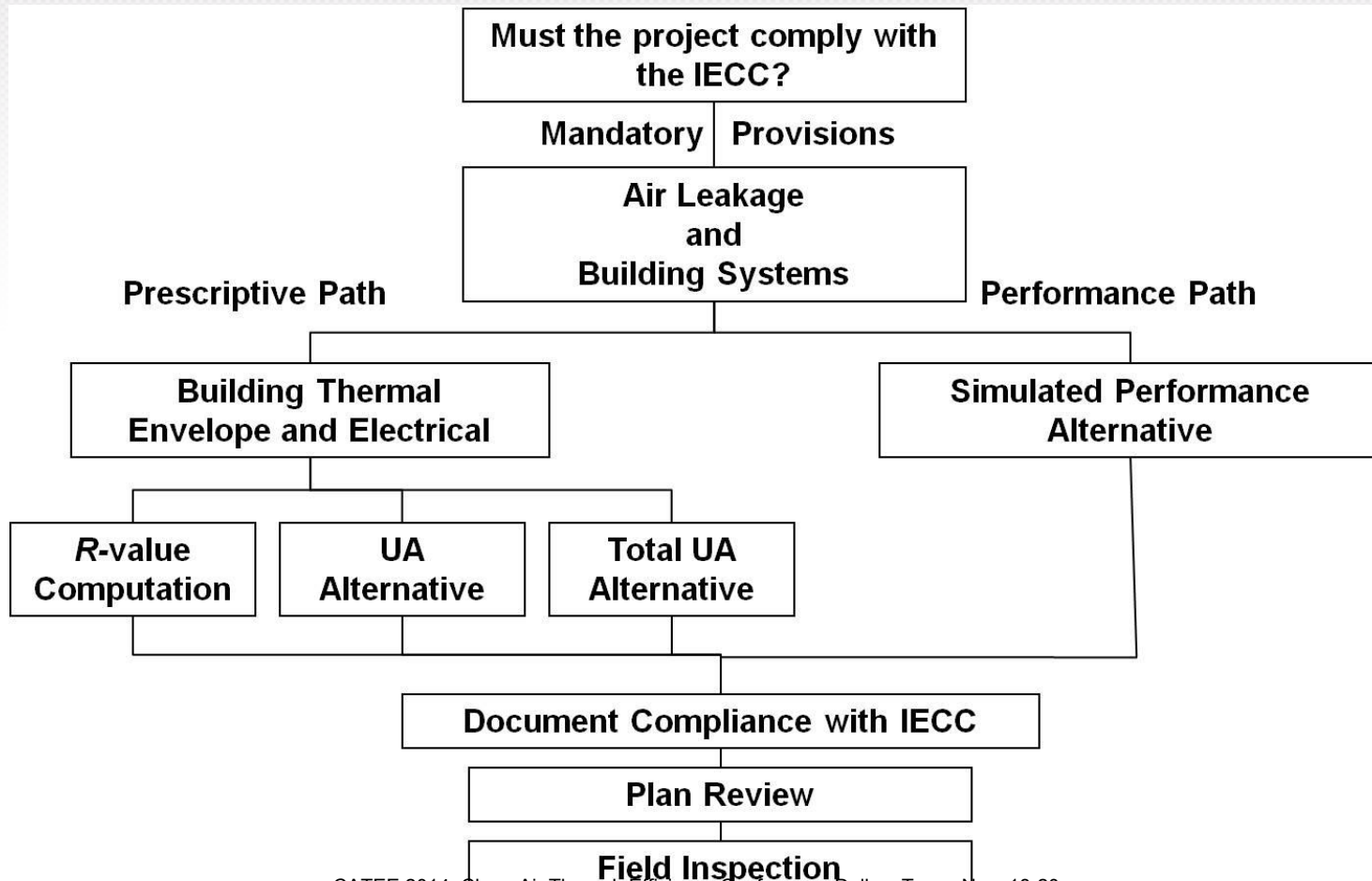
- Recommended Procedure for Worst-Case Testing of Atmospheric Venting Systems Under R402.4 or R405 Conditions $\leq 5ACH_{50}$
 - Scope
 - General Definitions
 - Testing Procedure



Appendix RB

- Solar-Ready Provisions – Detached One- and Two-Family Dwellings, Multiple Single-Family Dwellings (Townhouses)
 - Scope
 - General Definition
 - Solar-Ready Zone

IECC Residential Compliance Process





Chapter 4 - Residential

- Compliance paths
 - Prescriptive – All requirements in Sections R401 through R404
 - General, Building Thermal Envelope, Systems, and Electrical Power and Lighting
 - Performance – Section 405 and Mandatory requirements in R401 through R404
 - Energy Rating Index approach – Section 406



Residential – Building Thermal Envelope

- R402.1.3 - *R*-value computation
- Table R402.1.4 Equivalent *U*-Factors
 - *U*-Factor changes for Frame walls
- R402.2.4 Access hatches and doors
 - Exception added for vertical doors between conditioned and unconditioned spaces



Residential – Building Thermal Envelope

- R402.2.7 Walls with partial structural sheathing
 - Relocated from Table R402.1.2 and expanded
- R402.2.8 Floors
 - Exception added for placement of continuous insulation



Residential – Building Thermal Envelope

- R402.4 Air Leakage
 - Installation with manufacturer's instructions added
 - Testing – changes to the air leakage rates
- R402.2.8 Fireplaces
 - Tight-fitting flue dampers and outdoor combustion air required
 - Testing requirements for tight-fitting doors



Residential – Building Thermal Envelope

- R402.4.4 Rooms containing fuel-burning appliances
 - New requirements
 - Climate zones 3-8
 - Exceptions



Residential – Systems

- R403.1.1 Programmable thermostat
 - Manufacturer to initially program set points
- R403.2 Hot water boiler outdoor temperature setback
 - One- or two-pipe heating systems



Residential – Systems

- R403.3 Ducts
 - R403.3.1 Insulation (Prescriptive)
 - Reduces insulation from R-8 to R-6 on duct less than 3 inches in diameter
 - R403.3.2 Sealing (Mandatory)
 - Added exceptions



Residential – Systems - Ducts

- R403.3.3 Duct testing (Mandatory)
 - Testing method
- R403.3.4 Sealing (Prescriptive)
 - Limitations
- R403.3.5 Building cavities (Mandatory)
 - Shall not be used as ducts or plenums



Residential – Systems – Hot Water Systems

- R403.5 Service hot water systems
 - R403.5.1.1 Circulation systems
 - Detailed requirements
 - Return piping
 - Pump controls to start and automatically turn off
 - R403.5.1.2 Heat trace systems
 - Requirements
 - Automatically adjust the energy input to maintain the water temperature



Residential – Systems - Recirculation

- R403.5.2 Demand recirculation systems
 - Controls that start the pump
 - upon receiving a signal from the of action of a user
 - Sensing the presence of a user
 - Sensing the flow of hot or tempered water
 - Limit the temperature of the water entering the cold water piping to 104°F



Residential – Systems - Clarifications

- R403.5.3 Hot water pipe insulation
- R403.5.4 Drain water heat recovery units
- R403.10 Pools and permanent spa energy consumption



Residential – Systems - Electrical

- R404.1 Lighting equipment (Mandatory)
 - Increased to 75% of the lamps in permanently installed lighting fixtures shall be high-efficacy
 - or
 - 75% of the permanently installed lighting fixtures shall contain only high-efficacy lamps



Residential – Simulated Performance Alternative

- R405.4.2 Compliance report
 - R405.4.2.1 Compliance report for permit application
 - R405.4.2.2 Compliance report for the certificate of occupancy



Residential – Simulated Performance Alternative

- Table 405.5.2(1) - Changes
 - Opaque doors – new section added
 - Vertical fenestration – orientation
 - Air exchange rate – restored Standard Reference Design criteria
 - Internal mass
 - Cooling Systems
 - Thermal distribution systems



Residential – Energy Rating Index (ERI) Compliance Alternative

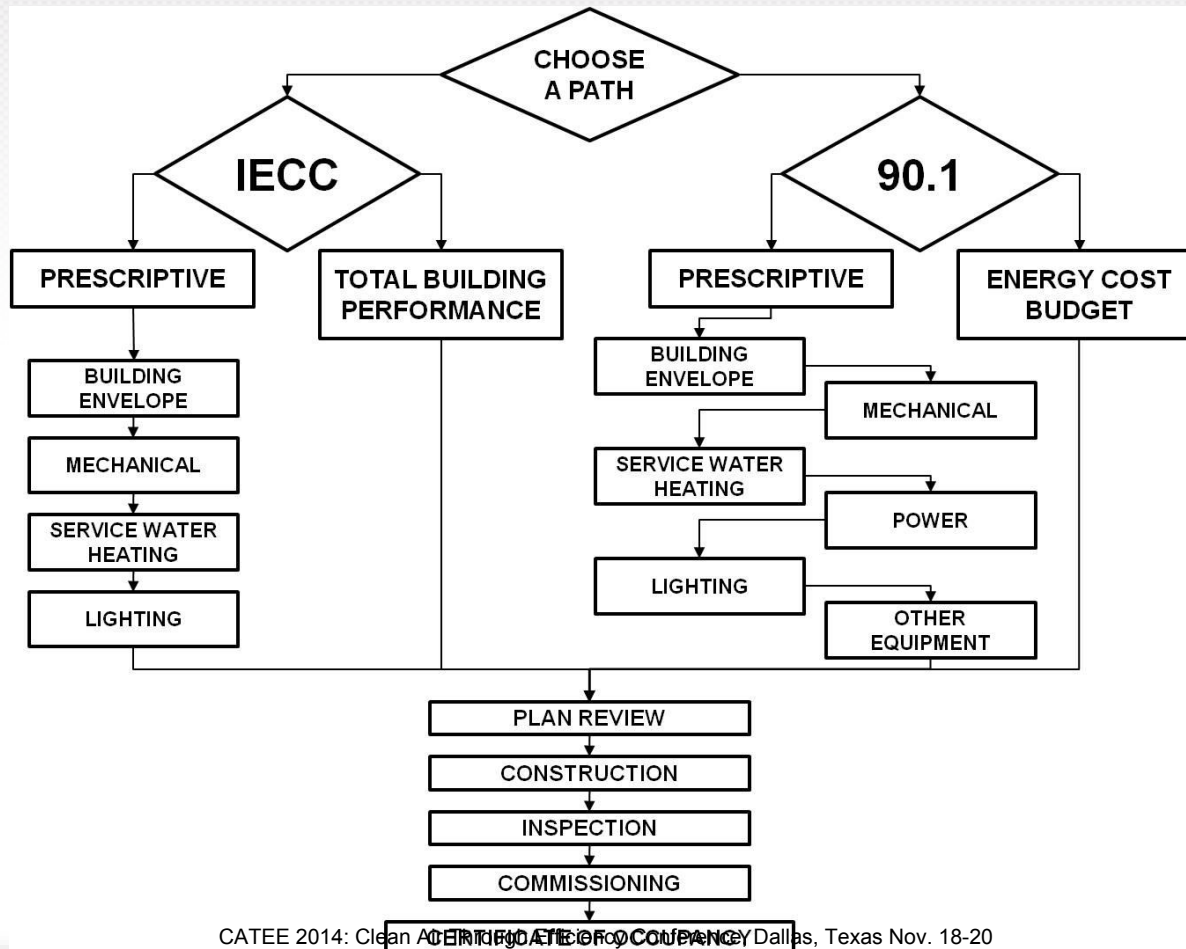
- R406.1 Scope – establishes criteria for compliance using and ERI analysis
 - Mandatory requirements
 - Energy Rating Index
 - ERI-based compliance
 - Table R406.4 (51 – 55)
 - Verification by approved agency
 - Documentation



Residential – Energy Rating Index (ERI) Compliance Alternative

- Compliance software tools
- Compliance report
- Additional documentation
- Calculation software tools
 - Minimum capabilities
- Specific approval
- Input values

IECC Commercial Compliance Process





Commercial

- C401.2.1 Application to replacement fenestration products
 - Exception added to allow area-weighted average



Commercial – Building Envelope

- C402.1 General (Prescriptive)
 - Opaque portions comply
 - C402.2 Insulation and
 - Thermal requirements of C402.1.3 *R*-value based method; C402.1.4 *U*-, *C*-, and *F*-factor; or C402.1.5 Component performance alternative
 - Roof shall comply with C402.3 solar reflectance and thermal emittance



Commercial – Building Envelope

- C402.1 General (Prescriptive)
 - Fenestrations shall comply with C402.4
 - Air leakage shall comply with C402.5
 - Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.2.15 or C403.2.16



Commercial – Equipment Buildings

C402.1.2

- Exempt from building thermal envelope
 - Not more than 500 sq. ft.
 - House electronic equipment totaling ≥ 7 watts per sq. ft.
 - Heating system capacity ≤ 5 kw and thermostat set point restrict $\leq 50^{\circ}\text{F}$
 - Average wall and roof U -factor
 - Less than 0.200 in Zones 1-5
 - Less than 0.120 in Zones 6-8
 - Zone 1 roof solar reflectance and thermal emittance



Commercial – Building Envelope

- C402.1.3 Insulation component *R*-value-based method
- C402.1.4 Assembly *U*-factor, *C*-factor, or *F*-factor-based method
- C402.1.4.1 Thermal resistance of cold-formed steel walls



Commercial – Building Envelope

- C402.2 Specific insulation requirements
 - C402.2.1 Multiple layers of continuous
 - C402.2.2 Roof assembly – exceptions
 - C402.2.3 Above-grade walls
 - C402.2.4 Floors – exceptions
 - C402.2.5 Slabs-on-grade perimeter
 - C402.2.6 radiant heating systems



Commercial – Building Envelope

- C402.3 Roof solar reflectance and thermal emittance
 - Zones 1, 2, and 3 must comply with one or more of Table C402.3 requirements
 - Exceptions
 - Aged roof solar reflectance



Commercial – Building Envelope

- C402.4.1.1 Increased vertical fenestration area with daylight responsive controls
 - Zones 1-6 vertical fenestration limitations
- C402.4.1.2 Increased skylight area with daylight responsive controls
 - Based on daylight zones



Commercial – Building Envelope

- C402.4.2 Minimum skylight fenestration area
 - Enclosed space greater than 2, 500 sq. ft.
 - Office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space manufacturing occurs, nonrefrigerated warehouse, retail, store, distribution/sorting area, transportation depot or workshop



Commercial – Building Envelope

- C402.4.2.1 Lighting controls in daylight zones under skylights
- C402.4.2.2 Haze factor
 - Exceptions
- C402.4.2 Maximum U -factor and SHGC
 - C402.4.2.1 Increased skylight SHGC
 - C402.4.2.2 Increased skylight U -factor
 - C402.4.2.3 Dynamic glazing
- C402.4.4 Doors



Commercial – Building Envelope

- C402.5 Air leakage (Mandatory)
 - C402.5.1 Air Barriers
 - Exception Zone 2B
 - C402.5.1.1 Air barrier construction
 - C402.5.1.2 Air barrier compliance options
 - C402.5.1.2.1 Materials
 - 16 options
 - C402.5.1.2.2 Assemblies
 - 3 options



Commercial – Building Envelope

- C402.5.2 Air leakage of fenestration
 - Must meet Table C402.5.2
 - Maximum Air Leakage Rate for Fenestration Assemblies
 - Exceptions



Commercial – Building Envelope

- C402.5.3 Rooms containing fuel-burning appliances
 - Exceptions
- C402.5.4 Doors and access openings to shafts, chutes, stairways and elevator lobbies
 - Exceptions



Commercial – Building Envelope

- C402.5.5 Air intakes, exhaust openings, stairways and shafts
 - Installed in accordance with C403.2.4.3
- C402.5.7 Vestibules
 - Added exception for air curtain
- C402.5.8 Recessed lighting
 - Added requirement for gasket or caulk between the housing and sheetrock



Commercial – Mechanical Systems

- C403.2.1 Calculation of heating and cooling loads
 - ANSI/ASHRAE/ACCA Standard 183
 - Adjusted to account for load reductions that are achieved where energy recovery systems are utilized in the HVAC system



Commercial – Mechanical Systems

- Minimum Efficiency Requirement Tables
 - Electrically Operated
 - Unitary Air Conditioners and Condensing Units
 - Electrically Operated Unitary and Applied Heat Pumps
 - Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Packaged Vertical Air Conditioners, Single Vertical Heat Pumps, Room Air Conditioners and Room Air-Conditioner Heat Pumps
 - Water Chilling Packages – Efficiency Requirements
 - Heat Rejection Equipment



Commercial – Mechanical Systems

- C403.2.3.1 Water-cooled centrifugal chilling packages
 - Equations 4-6 and 4-7
- C403.2.3.2 Positive displacement chilling packages
 - Air- and water-cooled



Commercial – Mechanical Systems

- C403.2.4 HVAC system controls
 - C403.2.4.1.2 Deadband
 - Exceptions
 - C403.2.4.1.3 Set point overlap restriction
 - C403.2.4.3 Shutoff Dampers
 - C403.2.4.4 Zone isolation
 - C403.2.4.5 Snow- and ice-melt system controls
 - C403.2.4.6 Freeze protection system controls



Commercial – Mechanical Systems

- C403.2.4.7 Economizer fault detection and diagnostics
 - Temperature sensors
 - Outside air
 - Supply air
 - Return air
 - Temperature sensor accuracy
 - Refrigerant pressure sensors accuracy



Commercial – Mechanical Systems

- C403.2.4.7 Economizer fault detection and diagnostics
 - Unit controller
 - Free cooling available
 - Economizer enabled
 - Compressor enabled
 - Heating enabled
 - Mixed air low limit cycle active
 - Unit controller able to manually initiate modes



Commercial – Mechanical Systems

- C403.2.4.7 Economizer fault detection and diagnostics
 - Reporting faults to a fault management app
 - FDD system
 - Air temperature sensor failure/fault
 - Not economizing when the unit should
 - Economizing when the unit should
 - Damper not modulating
 - Excess outdoor air



Commercial – Mechanical Systems

- C403.2.5 Hot water boiler outdoor temperature setback control
 - One- or two-pipe heating systems shall have an outdoor setback control
 - Lowers the boiler water temp based on outdoor temperature



Commercial – Mechanical Systems

- C403.2.6.2 Enclosed parking garage ventilation controls
 - Automobiles operating on the own power
 - Contamination-sensing devices and
 - Automatic controls to stage fans
 - Exceptions



Commercial – Mechanical Systems

- Energy recovery ventilations systems
 - Changes to Energy Recovery Requirement Tables C403.2.7(1) and C403.2.7(2)
 - Added exception
 - Heating energy recovery in Zones 1 and 2



Commercial – Mechanical Systems

- Duct and plenum insulation and sealing
 - Unconditioned spaces – R-6
 - Located outside the building
 - Zones 1-4 = R-8
 - Zones 5-8 – R-12
 - Located in the building envelope
 - Zones 1-4 = R-8
 - Zones 5-8 – R-12



Commercial – Mechanical Systems

- C403.2.12 Air system design and control
 - When the nameplate horsepower exceeds 5 hp
 - C043.2.12.1 Allowable fan floor horsepower
 - Shall not exceed Table C403.2.12.1(1) Fan Power Limitation
 - Option 1 – fan system motor nameplate hp
 - Option 2 – fan system bhp
 - Single-zone variable air volume shall comply with the constant volume fan power limitation



Commercial – Mechanical Systems

- C403.2.14 Refrigeration equipment performance
 - Energy use in kWh/day not greater than the values in
 - Table C403.2.14(1) Minimum Efficiency Requirements: Commercial Refrigeration
 - Table C403.2.14(2) Minimum Efficiency Requirements: Commercial Refrigerators and Freezers



Commercial – Mechanical Systems

- C403.2.15 Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers
 - 11 requirements
 - Warehouse coolers and freezers must comply
 - Walk-in coolers and freezers that are not site assembled or site constructed must comply



Commercial – Mechanical Systems

- C403.2.16 Walk-in coolers and walk-in freezers
 - Site-assembled or site-constructed
 - 11 requirements
- C403.2.17 Refrigerated display cases
 - Site-assembled or site-constructed
 - 3 requirements



Commercial – Mechanical Systems

- C403.3 Economizers (Prescriptive)
 - Cooling systems with a fan shall include a air or water economizer
 - 9 exceptions
 - C403.3.1 Integrated economizer control
 - C403.3.2 Economizer heating system impac
 - exceptions



Commercial – Mechanical System

- C403.3.3 Air economizers
 - C403.3.3.5 Economizer dampers
 - Comply with C403.2.4.3
- C403.3.4 Water-side economizers
 - C403.3.4.1 Design capacity
 - Exception
 - C403.3.4.2 Maximum pressure drop



Commercial – Mechanical System

- C403.4 Hydronic and multiple-zone HVAC systems controls and equipment (Prescriptive)
 - C403.4.1 Fan control
 - C403.4.1.1 Fan airflow control
 - Each system listed in Table C403.4.1.1 designed to vary the indoor fan airflow and shall comply with 3 requirements
 - C403.4.1.2 Static pressure sensor location
 - C403.4.1.3 Set points for direct digital control



Commercial – Mechanical System

- C403.4.2.4 Part-load controls
 - Hydronic systems $\geq 500,000$ Btu/h in design output capacity supplying heated or chilled water to comfort conditioning systems
 - 3 requirements 3 exceptions
 - C403.4.2.5 Boiler turndown
 - Systems with design input $\geq 1,000,000$ Btu/h
 - Table C403.4.2.5



Commercial – Mechanical System

- C403.4.3 Heat rejection equipment
 - C403.4.3.1 equipment such as air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers, and evaporative condensers used for comfort cooling apps
 - Exception where the energy usage is included in Tables C403.2.3(6) and C403.2.3(7)



Commercial – Mechanical System

- C403.4.3.2 Fan speed control
 - C403.4.3.2.1 Fan motors ≥ 7.5 hp
 - C403.4.3.2.2 Multiple-cell heat rejection equipment



Commercial – Mechanical System

- C403.4.3.3 Limitation on centrifugal fan open-circuit cooling towers
 - Combined capacity of 1,000 gpm or greater at 95°F condenser water return, 85°F condenser water supply, and 75°F outdoor air wet-bulb equipment
- C403.4.3.4 Tower flow turndown



Commercial – Mechanical Systems

- C403.4.4 Requirements for complex mechanical systems serving multiple zones
 - 4. Higher rate that can be demonstrated to reduce overall system annual energy use by offsetting losses through a reduction in outdoor air intake for the system
 - 5. Airflow rate required to comply with applicable codes or accreditation standards



Commercial – Mechanical Systems

- C403.4.4.4 Fractional hp fan motors
 - Motors $\geq 1/12$ hp and < 1 hp
 - Electronically commutated motor or
 - Have a minimum motor efficiency of 70%
 - exceptions



Commercial – Mechanical Systems

- C403.5 Refrigeration systems
 - Refrigerated display cases, walk-in coolers or walk-in freezers served by
 - Remote compressors
 - Remote condensers
 - C403.5.1 Condensers serving refrigeration systems
 - C403.5.2 Compressor systems



Commercial – Service Water Heating

- C404.2 Service water-heating equipment performance efficiency
 - C404.2.1 High input-rated service water-heating systems
 - Exceptions - 3
 - C404.4 Insulation of piping
 - Exceptions - 7



Commercial – Service Water Heating

- C404.5 Efficient hater water supply piping
 - Table C404.5.1 Piping Volume and Maximum Piping Lengths
 - C404.5.1 Maximum allowable pipe length method
 - C404.5.2 Maximum allowable pipe volume method



Commercial – Service Water Heating

- C404.6 Heated-water circulating and temperature maintenance systems
 - C404.6.1 Circulation systems
 - C404.6.2 Heat trace systems
 - C404.6.3 Controls for hot water storage
- C404.7 Demand recirculation controls
- C404.8 Drain water heat recovery units



Commercial – Service Water Heating

- C404.9 Energy consumption of pools and permanent spas
 - C404.9.1 heaters
 - C404.9.2 Time switches
 - C404.9.3 Covers
- C404.10 Energy consumption of portable spas
- C404.11 Service water-heating system commissioning and completion requirements



Commercial – Electrical Power and Lighting Systems

- C405.1 General
 - Exception – dwelling units within commercial buildings shall not be required to comply with C405.2 – C405.5, if they comply with R404.1



Commercial – Electrical Power and Lighting Systems

- C405.2.1 Occupant sensor controls
 - Classrooms/lecture/training rooms
 - Conference/meeting/multipurpose rooms
 - Copy/print rooms
 - Lounges
 - Employee lunch and break rooms
 - Private offices



Commercial – Electrical Power and Lighting Systems

- Restrooms
- Storage rooms
- Janitorial closets
- Locker rooms
- Other spaces 300 sq. ft. or less, enclosed by floor-to-ceiling height partitions
- warehouses



Commercial – Electrical Power and Lighting Systems

- C405.2.1.1 Occupant sensor control function
 - Sensors in spaces other than warehouses
 - Turn off lights in 30 minutes
 - Manual on or controlled to automatically turn the lighting on to not more than 50% power
 - exception
 - Incorporate manual control to turn lights off



Commercial – Electrical Power and Lighting Systems

- C405.2.1.2 Occupant sensor control function in warehouses
 - Aisleways and open areas controlled by occupant sensors
 - Each aisleway independently controlled and
 - Not control lighting beyond the aisleway being controlled



Commercial – Electrical Power and Lighting Systems

- C405.2.2 Time-switch controls
 - Each area not controlled by occupant sensors
- C405.2.2.1 Time-switch control function
 - Each space with time-switch control shall have a manual control for light reduction
 - Override switch
 - exceptions



Commercial – Electrical Power and Lighting Systems

- C405.2.2.2 Light-reduction controls
 - Added exception
 - Light reduction controls are not required in daylight zones with daylight responsive controls complying with C405.2.3



Commercial – Electrical Power and Lighting Systems

- C405.2.3 Daylight-responsive controls
 - Control electric lights within daylight zones
 - Spaces with more than 150 watts of general lighting within sidelight daylight zones. Does not include lighting that is required to have specific application
 - Spaces with a total of more than 150 watts of general lighting within a toplight daylight zones
 - Exceptions



Commercial – Electrical Power and Lighting Systems

- C405.2.3.1 Daylight-responsive control function
 - Each space shall be comply with 6 requirements
 - Exception
 - up to 150 watts of lighting in each space allowed to be controlled together with lighting in a daylight zone facing a different cardinal orientation



Commercial – Electrical Power and Lighting Systems

- C405.2.3.2 Sidelight daylight zone
 - Floor area adjacent to vertical fenestration
 - 5 requirements
- C405.2.3.3 Toplight daylight zone
 - Floor area underneath a roof fenestration assembly
 - 3 requirements



Commercial – Electrical Power and Lighting Systems

- C405.2.4 Specific application controls
 - Display and accent light controls
 - Lighting in cases used for display
 - Hotel and motel sleeping units
 - Master control device
 - Switch off all installed luminaires and switched receptacles with 20 minutes
 - Exception – Captive key systems



Commercial – Electrical Power and Lighting Systems

- Supplemental task lighting
- Lighting for nonvisual applications
 - Plant growth
 - Food warming
- Lighting equipment that is for sale or demonstrations in lighting education



Commercial – Electrical Power and Lighting Systems

- C405.2.5 Exterior lighting controls
 - Added exception for covered vehicle entrances or exits from buildings or parking structures where required for safety, security or eye adaption



Commercial – Electrical Power and Lighting Systems

- C405.4.1 Total connected interior lighting power
 - Added Equation 4-9
 - Added Other = The wattage of all other luminaires and lighting sources not covered previously and associated with interior lighting verified by data supplied by the manufacturer or other approved sources



Commercial – Electrical Power and Lighting Systems

- C405.4.2.2.1 Additional interior lighting power
 - Space by space method increases for merchandise display lighting
- Tables C405.4.2(1) and C405.4.2(2)
 - Changes in some values



Commercial – Electrical Power and Lighting Systems

- C405.5 Exterior lighting
- C405.6 Electrical energy consumption
- C405.7 Electrical transformers
 - Meet minimum efficiency requirements
Table C405.7
 - Exceptions - 14



Commercial – Electrical Power and Lighting Systems

- C405.8 Electrical Motors (Mandatory)
 - Minimum efficiency requirements
 - Tables C405.8(1) – C405.8(4)
- C405.9 Vertical and horizontal transportation systems and equipment
 - C405.9.1 Elevator cabs
 - C405.9.2 Escalators and moving walks
 - C405.9.2.1 Regenerative drive



Commercial – Additional Efficiency Package Options

- C406.1 Requirements
 - More efficient HVAC performance
 - Reduced lighting power density
 - Enhanced lighting controls
 - On-site supply of renewable energy
 - A dedicated outdoor air system of certain HVAC equipment
 - High-efficiency service water heating



Commercial – Additional Efficiency Package Options

- C406.1.1 Tenant spaces
 - HVAC, reduced lighting density, digital lighting controls, dedicated outdoor air system, or reduced energy use in service water heating



Commercial – Additional Efficiency Package Options

- C406.7.1 Load fraction
 - Building service water heating system
 - One or more of the following are required and sized to supply <60% of hot water
 - Waste heat recovery from service hot water, heat-recovery chillers, building equipment, process equipment, or a combined heat and power system
 - Solar water-heating systems
 - 100% of hot water shall comply with C403.4.7



Commercial – Total Building Performance

- Table C407.5.1(1) Specifications for the Standard Reference and Proposed Designs
 - Changes to footnotes
- Table C407.5.1(3) Specifications for the Standard Reference Design HVAC System Descriptions
 - Change to footnotes



Commercial – Total Building Performance

- C407.6.3 Exceptional calculation methods
 - Where the simulation program does not model a proposed design, material or device, an exception calculation method shall be used
 - Step-by-step documentation
 - Copies of all spreadsheets
 - Sensitivity analysis of energy consumption
 - Calculations performed on a time step basis
 - Performance rating performed with and with out the exceptional calculation



Commercial – System Commissioning

- C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements
 - Exceptions
 - Where the total mechanical equipment capacity is less than 480,000 Btu/h cooling and 600,000 Bth/h combined service water-heating and space-heating heating
 - Systems included in C403.3 that serve dwelling units and sleeping units



Commercial – System Commissioning

- C408.2.1 Commissioning plan
 - Conditions under which the test will be performed.
 - Testing shall affirm winter and summer design conditions and full outside air conditions”
- C408.2.2.1 Air systems balancing
 - Discharge dampers used for air-system balancing are prohibited on constant-volume fans and variable-volume fans with motor 10hp or larger



Commercial – System Commissioning

- C408.2.3.2 Controls
 - Add service water-heating controls
- C408.2.4 Preliminary commissioning report
- C408.2.4.1 Acceptance of report
 - Letter acknowledging owner receipt of report
- C408.2.5.2 Manuals
- C408.2.5.4 Final Commissioning report



Commercial – System Commissioning

- C408.3.1 Functional testing
 - Completed prior to passing final inspection
 - C408.3.1.1 Occupant sensor controls
 - C408.3.1.2 Time-switch controls
 - C408.3.1.3 Daylight responsive control
- C408.3.2 Documentation requirements
 - Provided to owner within 90 days



Thank you for your participation

