



2022 Denver Energy Code Contractor/Inspector Commercial Code Considerations *Part 1: Requirements for All Compliance Paths*

Community Planning and Development /
Office of Climate Action, Sustainability and Resiliency

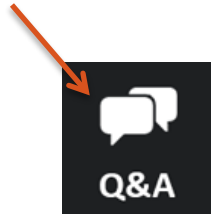
June 14, 2023

INTERPRETATION INSTRUCTIONS

- This session is available in both English & Spanish. Click on the “Interpretation” icon at the bottom of the Zoom window and choose either "English" or “Spanish”
 - Submit questions using the “chat” function in the bottom of the Zoom window
 - At the end of the presentation, we will answer as many questions as possible
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 - Envíe preguntas usando la función "chat" en la parte inferior de la ventana de Zoom
 - Al final de la presentación, responderemos tantas preguntas como sea posible

Questions?

- Time is reserved at the end of the presentation for Q&A
- Please use the Q&A feature to submit your questions



- Responses to all questions not addressed today will be sent out by email to registered participants
- Additional questions may be sent to: energy.review@denvergov.org

Training Series

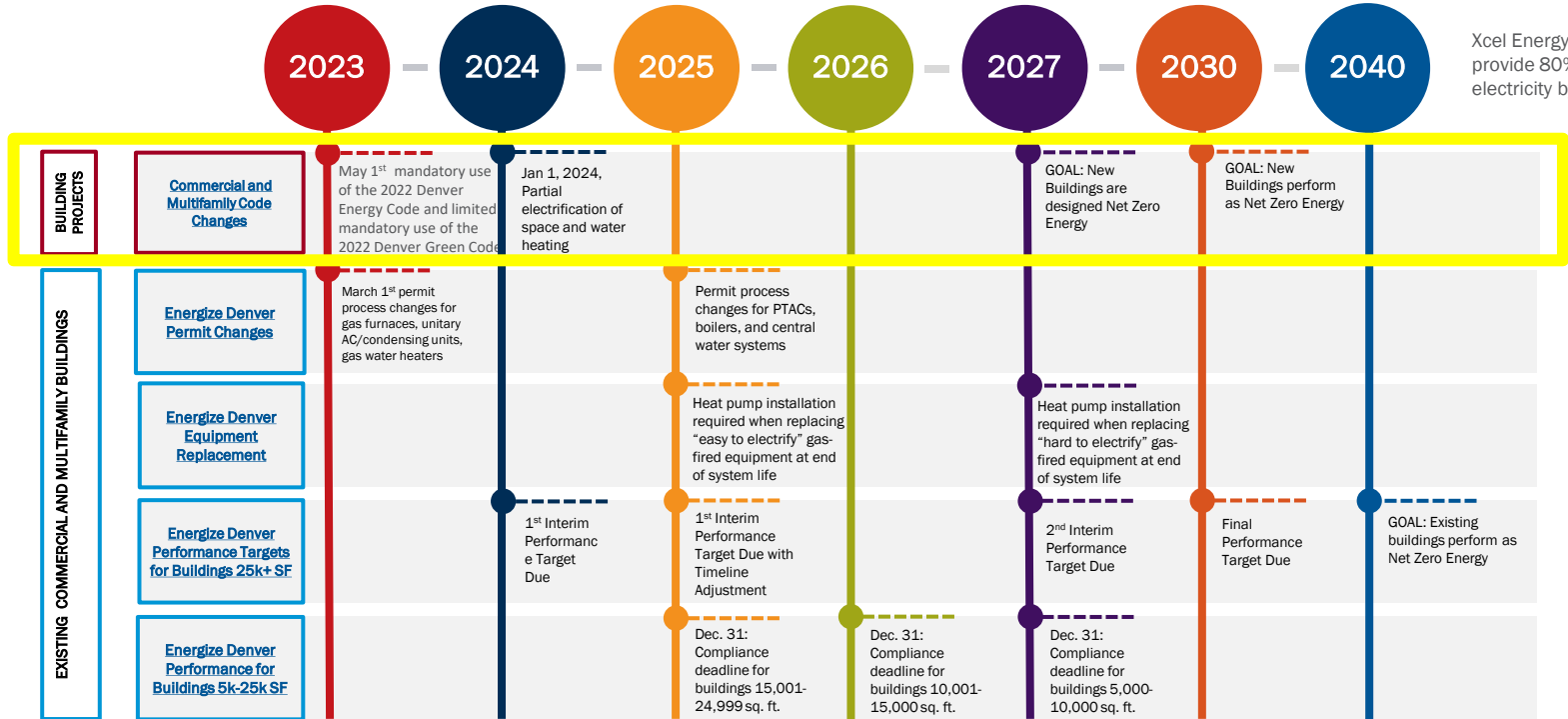


SCAN ME



	Commercial/Multifamily (Wednesdays at 12 pm)	Residential (Thursdays at 1 pm)
	Electrification May 24	Compliance Overview May 25
Prescriptive Path	May 31	June 1
Performance Paths	June 7	June 8
Contractor/Inspector Part 1	June 14	June 22
Contractor/Inspector Part 2	June 21	June 29

Timeline - Commercial Electrification and Performance Requirements



Xcel Energy required to provide 80% renewable electricity by 2030

2022 Denver Energy Code – All Paths

- This is a high-level summary of the **commercial requirements for all paths** of the 2022 Denver Energy Code
- Does not include all changes to the 2022 Denver Energy Code. Please refer to the 2022 Denver Energy Code for specific code language. [Denvergov.org/BuildingCode](https://denvergov.org/BuildingCode)
- Denver-specific COMcheck and REScheck are anticipated fall 2023

Net Zero Energy Hub – Codes and Resources

www.denvergov.org/EnergyCode

Resources for:

- New provisions in the 2022 Denver Energy Code
- The Denver Energy Code compliance pathways
- Specifics to each phase of a new building project, from design and construction to alterations and additions
- Training videos to walk you through specific provisions that have been updated since the 2019 Denver Building Code

Home / Government / Agencies, Departments, and Offices / Climate Action, Sustainability & Resiliency / High Performance Buildings and Homes / **Net Zero Energy Hub - Codes and Resources**

Net Zero Energy Hub - Codes and Resources

This resource hub pulls together information from Denver and pairs it with resources from across the country to help building owners, professionals, and residents:

- Learn about changes in the 2022 Denver Building and Fire Code and the 2022 Denver Green Code
- Understand the importance of building electrification and energy efficiency
- See examples of successful Net Zero Energy building projects in a variety of building types and uses
- Navigate new regulations and requirements with confidence!



Resources for New Commercial and Multifamily Buildings

Buildings that are regulated by the Denver Commercial Building Code, which include commercial buildings and multi-unit residential buildings that are not regulated by the Denver Residential Code.



Resources for New Single Family, Duplex, and Townhomes

Any detached one- or two-family dwelling unit and townhomes three stories or less are regulated by the Denver Residential Code.

New Building Electrification Pilots



Design Support: partial funding for drawing sets and as-built drawings that can be reviewed by Denver builders to help inform how electrification can work for their projects



Pilot Projects: partial funding for builders or property owners interested in leveraging city funds to help a new building project be built all-electric

www.denvergov.org/NetZero



Equity and Local Focus: 50% of the pilot project funds will be prioritized for affordable housing or otherwise serve or benefit under-resourced communities in Denver. Denver-based and/or MWBE firms and organizations are especially encouraged to apply for incentives.

Tips for referencing code

2022 Denver Amendments

+

2021 International Energy Conservation Code (IECC)

=

2022 Denver Energy Code (DEC)

Agenda

- Energy code overview
- Setting up for success
- Electrification for alterations
- Envelope
- HVAC
- Water heating
- Power and lighting
- Commissioning
- Q & A

Purpose: This presentation provides an overview of the installation and testing requirements and considerations for commercial building projects.

See recordings of previous trainings for more details on design and building permit submittal considerations.



2022 DEC Requirements Overview

Definition: Commercial Building

Residential buildings are detached one- and two-family dwellings and multiple single-family dwellings (townhouses) and Group R-3 and R-4 buildings three stories or less in height above grade plane.

Commercial buildings are all other buildings

Definition: All-Electric Property

All-Electric Property is one that contains no permanently installed equipment or appliances that utilize *combustion*, plumbing for fuel gas or fuel oil or *fuel gas* utility connection, installed within the *building(s)* or site, except for *emergency power systems* and *standby power systems*.

Commercial Compliance Process

- Choose a Compliance Pathway (C401.2.1): Prescriptive or Performance
- Meet requirements for all paths - partial list:
 - HVAC/DHW/Lighting Commissioning
 - Building Envelope Verification and Air Leakage Testing
 - Complete 2022 DEC Checklist for Requirements
 - ❖ *Includes reporting Energize Denver Ordinance 2030 EUI Target*
- Related
 - Denver Green Buildings Ordinance - denvergov.org/Greenroofs
 - Denver Green Code - denvergov.org/Greencode

All Pathways – Denver Green Buildings Ordinance

Green Buildings Ordinance (GBO) applies to:

- New buildings and additions 25,000 square feet or larger
- Existing buildings 25,000 square feet or larger, upon roof recover or replacement
- Some multifamily residential projects need only comply with roof reflectance requirements and not additional green building options

NOTE: New construction options which require an extra **12% or 5% energy savings** beyond code also require the project to be an **All-Electric Property***



denvergov.org/greenroofs

**Green Building Ordinance updates for Council approval June 2023 and effective October 1, 2023*

All Pathways – Denver Green Code (DGC)

Limited mandatory use for new and *major renovation commercial projects*

denvergov.org/GreenCode

Table 101.4.1 Limited Mandatory Use: Quantity of Provisions Required		New Construction	Major Renovation
Chapter 1	Scope and Administration: Ecological Impact Statement (EIS)	0	0
Chapter 2	Reserved	n/a	n/a
Chapter 3	Definitions	n/a	n/a
Chapter 4	Residential Energy [RE]	0	0
Chapter 5	Site Sustainability	4	2
Chapter 6	Water Use Efficiency [WE]	1	0
Chapter 7	Commercial Energy	1	1
Chapter 8	Indoor Environmental Quality [EQ]	1	1
Chapter 9	Materials and Resources [MR]	3	1
Chapter 10	Construction and Plans for Operation [CX]	2	2



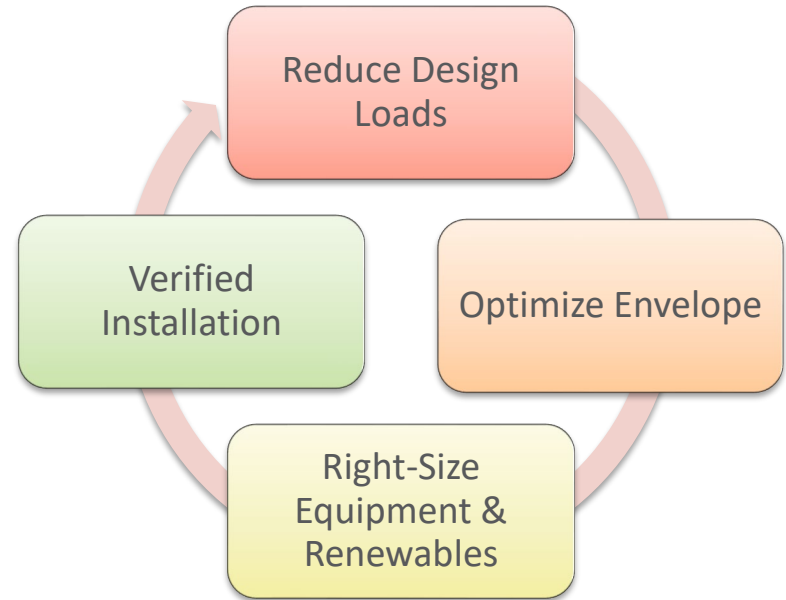
Setting up for Success

Success with Energy Compliance

- Energy is interdisciplinary and holistic
- Design team has weighed tradeoffs to select options that will optimize the design and achieve compliance

Therefore

- Build to construction documents
- Use RFIs before making substitutions
- Understand the impact of changes



Inspector Support at Preconstruction Meetings

Energy-specific preconstruction meeting

- Attendees: Inspector, GC, PMs, Air barrier consultant, optional design team members
- Agenda topics:
 - ✓ Identify compliance path
 - ✓ Use 2022 DEC checklists and approved construction documents to tailor the discussion
 - ✓ Identify critical components of the design and construction that will achieve success



2022 Denver Energy Code Checklists

- Index to design documents for energy information
- See checklists in drawings for each discipline

CHECKLISTS:
 General Compliance
 Building Envelope
 HVAC & Kitchen
 Service Water Heating
 Power & Lighting
 C406 (Prescriptive Only)

Code Section	Focus Area	Code Description	Drawing or Specification Number to demonstrate compliance (N/A if not applicable)	Submitter Notes (e.g. If "N/A" Please explain why requirement does not apply or is not demonstrated on drawings/specs)	Submittal Requirements and Clarifications
ALL COMPLIANCE PATHS					
C402.1.5	Minimum insulation	Roofs, walls, and floors shall meet applicable maximum U-factor requirements of Table C402.1.5	A-301	<i>Reference to Drawing</i>	Indicate location of: - Supplemental calculations if applicable

Compliance Pathway

- Check drawings for General Checklist:

2022 Denver Energy Code - Commercial Compliance Checklist

Prescriptive Path - General

- Inspector can see Permit Scope of Work text box where review team will list the **compliance path** from four options:
 - Prescriptive Compliance Path
 - C407 Energy Cost
 - Appendix SE Site Energy
 - Appendix PT Performance Target

All-Electric Property

- Check drawings for General Checklist:

GENERAL		RESPONSE	SUBMITTER NOTES
Property type	Is this an all-electric property? (Y/N):	Y	ALL-ELECTRIC PROPERTY. A property that contains no permanently installed equipment or appliances that utilize combustion, plumbing for fuel gas or fuel oil or fuel gas utility connection, installed within the building(s) or site, except for emergency power systems and standby power systems.

- Inspector can see Permit Scope of Work text box where review team will list **All-Electric Property** status, if applicable:
 - All-Electric Property
- If All-Electric Property, permanent fuel equipment and utility connection are only allowed for *emergency power systems and standby power systems*

Other Inspector Instructions

Inspector can see Permit Scope of Work text box where review team will list, if applicable:

- If alteration selected **test all gas piping**:
 - C503.3.3 Test all gas piping serving replacement furnace per Section 406 of the IFGC
 - C504.4.1 Test all gas piping serving replacement water heater per Section 406 of the IFGC
- If prescriptive path **C406 Reduced Air Infiltration** is used:
 - C406.9.1 Reduced Air Infiltration 0.25 cfm/sq. ft.
 - C406.9.2 Further Reduced Air Infiltration 0.15 cfm/sq. ft.
- If prescriptive path **C406 Renewable Energy** is used:
 - C406.5.1 Basic Renewable Credit with ___ kW_{DC} array
 - C406.5.2 Enhanced Renewable Credit with ___ kW_{DC} array
- If performance path **Renewable Energy** is included for compliance via drawings, lease, or contract:
 - Renewable Energy ___ kW_{DC} array



Permit Parity - Alterations

Existing Building Electrification Requirements

Partial electrification of space and water heating and cooling equipment upon system replacement in all existing commercial and multifamily buildings when cost-effective

Amending Denver Building and Fire Code	2023	2025	2027
Permit process: Requires plan review for unitary AC/condensing units serving a heated space, gas furnaces, gas hot water heaters – including cost feasibility of electrification	X		
Equipment replacement: Heat pumps required upon replacement of unitary AC/condensing units serving a heated space, gas furnaces, gas hot water heaters when cost-effective		X	
Permit process: Requires plan review for PTACs, VTACs, boilers, and central hot water systems – including cost feasibility of electrification		X	
Equipment replacement: Heat pumps required upon replacement of PTACs, VTACs, boilers, and central hot water systems when cost-effective			X

Overview of Changes Effective March 1, 2023

Permit process changes to near parity in permitting between gas systems and electrification

As of March 1, 2023, when replacing a unitary air conditioner or condensing unit, a natural gas furnace, or natural gas water heaters in commercial and multifamily buildings with another gas system or unitary AC, there are new requirements in Denver Energy Code, based on Energize Denver:

- Quick permits - permits that can be issued without the need for a plan review - for affected equipment will no longer be available
- Affected equipment replacements will require a plan review – including submitting additional documents like an Electrification Feasibility Report (EFR) during the permitting process - to obtain a permit
- Boilers are not affected until 2025

Furnace Permitting Changes Effective March 1, 2023

Permit process changes to near parity in permitting between gas systems and electrification

C503.3.3 When a gas-fired warm-air furnace is replaced with a gas-fired warm-air furnace, **two** of the following are required;

- An Electrification Retrofit Feasibility Report.
- Right sizing of equipment
- Perform leak testing of all gas pipes per Section 406 of IFGC

C503.3.2 Also, the new fossil fuel furnace shall meet **one** of the following:

- Low-nitrogen dioxide emissions shall not exceed 14 nanograms of nitrogen dioxide per joule of useful heat delivered to the heated space.
- An Annual Fuel Utilization Efficiency of not less than 90 percent.

Exceptions:

- This section shall not apply when equipment is replaced as an Emergency equipment replacement.
- This section shall not apply to the replacement of gas-fired boilers used for space heat or water heat until 2025.

Exception: Indoor gas-fired make-up air units are not required to comply with this section.

AC and water heater permitting changes effective March 1, 2023

Permit process changes to near parity in permitting between gas systems and electrification

C503.3.3 When a unitary air conditioner or condensing unit serving a heated space is replaced with another unitary air conditioner, or condensing unit, **one** of the following is required:

- Provide an Electrification Retrofit Feasibility Report (EFR)
- Right sizing of equipment

C503.4.1 When a gas-fired storage water heater or instantaneous water heater is replaced with another gas-fired storage water heater or instantaneous water heater, **one** of the following is required:

- Provide an Electrification Retrofit Feasibility Report
- Perform leak testing of all gas pipes per Section 406 of IFGC

Exceptions:

- This section shall not apply when equipment is replaced as an Emergency equipment replacement.
- This section shall not apply to the replacement of PTAC, VTACs and gas-fired boilers used for space heat or water heat until 2025.

Permitting Changes Effective March 1, 2023

Permit process changes to near parity in permitting between gas systems and electrification

SYSTEM DETAILS

Beginning March 1st, 2023, commercial and multifamily projects cannot apply for a Quick Permit when replacing the following equipment:

compressors, condensers, direct expansion air conditioning units, and split A/C units that serve a heated space, gas-fired forced air heating systems, gas-fired roof top units, and gas-fired potable water heaters. The

replacement of gas-fired boilers for space heat or for service water heating, PTACs, or VTACs will continue to qualify for a Quick Permit until 2025. Visit www.denvergov.org/quickpermits to learn more.

Does the repair/replacement require additional associated upgrades? (I.e., replacement of gas-fired equipment with higher efficiency equipment that might also require a change in flue material): *

Yes No

For replacements, are you using equipment that is compatible with how the system was originally designed? (I.e., replacing equipment under a kitchen hood for which the hood was not originally designed): *

Yes No

Are you replacing any equipment subject to the Energize Denver requirements (listed above)? *

? Yes No

If the project is replacing:
compressors, condensers, direct expansion A/C units, split A/C units that serve a heated space, gas-fired forced air heating, gas-fired RTU, or gas-fired potable water heaters

Answer **Yes** here



Envelope

C402.1.5 Minimum Insulation Requirements

- All conditioned areas are insulated
 - Cores (i.e., stair/elevator in an unconditioned parking garage)
 - Back of house spaces
- Can exclude spandrel and up to 5% of remaining envelope
- Exception for data centers or computer rooms

Insulation Inspection

Component	NEW Maximum U-Factor	C402.1.3 R-Value Reference	C402.1.4 U-Factor Reference
Roof insulation above deck	0.048	R-30	U-0.032
Roof metal building	0.055	R-19+R-11 LS	U-0.035
Roof attic and other	0.027	R-49	U-0.021
Wall mass	0.090	All Other: R-11.4ci Group R: R-13.3ci	All Other: U-0.090 Group R: U-0.080
Wall metal building	0.069	R-13+R-14ci	U-0.050
Wall metal framed	0.064	R-13+R-10ci	U-0.055
Wall wood framed and other	0.064	R-13+R-7.5ci OR R-20+R-3.8ci	U-0.051
Above grade floors mass	0.074	All Other: R-14.6ci Group R: R-16.7ci	All Other: U-0.057 Group R: U-0.051
Above grade floors framed	0.074	R-30	U-0.033

C402.5.1.5 Envelope Performance Verification

Colorado registered design professional or approved agency shall

- ✓ Review of continuous air barrier in construction documents
- ✓ Inspect continuous air barrier components and assemblies during construction while the air barrier is still accessible for inspection and repair
- ✓ Provide commissioning report for completed inspections

Air Barrier Inspection

C402.5 Air Leakage Testing



- Required for
 - New commercial buildings and new envelope assemblies of alterations
- For R and I occupancies: C402.5.2 Dwelling and sleeping unit enclosure testing
 - Sampling permitted for 8 units or more
 - Apply weighted average
- For all other occupancies: C402.5.3 Building thermal envelope testing
 - Entire envelope of stories with a roof, entrance, exposed floor, or below grade
 - Building sections totaling at least 25% of walls for remaining conditioned space

C402.5 Air Leakage Rates

Test with corrective action until measured air leakage is

1) At or below target

-OR-

2) At or below the maximum limit (from exceptions) plus

- Conduct a diagnostic evaluation using smoke tracer or infrared imaging while building is pressurized along with a visual inspection of the air barrier
- Any leaks noted shall be sealed
- Submit additional report identifying corrective actions taken

Measured Air Leakage	C402.5.2 Dwelling and Sleeping Units	C402.5.3 All Other
Pressure Differential	50 Pa	75 Pa
Target	0.3 CFM/SF	0.4 CFM/SF
Maximum Limit	0.45 CFM/SF	0.6 CFM/SF

Envelope Verification Documentation



Before 100% design:

- Perform continuous air barrier envelope verification

During Construction

1. Inspect continuous air barrier and assemblies conducted while air barrier is still accessible for inspection and repair
2. Perform air leakage testing following 2022 DEC
3. If project does not meet leakage targets, perform diagnostic testing and corrective action until below maximum limit in exceptions

Final Commissioning Report

1. Identify deficiencies found during design review and details of corrective measures taken

Envelope Verification and Air Leakage Testing

Commercial / Steel Frame Air Sealing

- Review architectural detailing
- Identify air barrier location
- Coordinate with air barrier consultant
- Understand building pressurization strategies
- Review testing plan / schedule
- Request clarification as needed



Envelope Verification and Air Leakage Testing

Top of Wall and Electrical Penetrations



Air barrier not continuous



Electrical box not sealed



Wiring penetrations nicely sealed

Envelope Verification and Air Leakage Testing

Sealing at Window and Door Openings



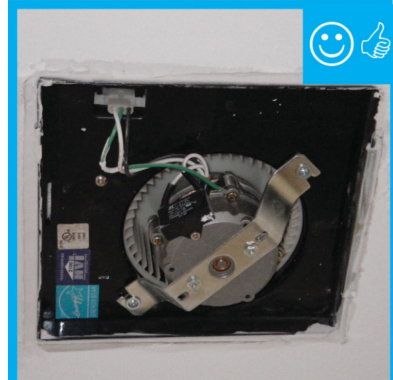
Envelope Verification and Air Leakage Testing

Sealing at Wall Transition at each Floor / Level



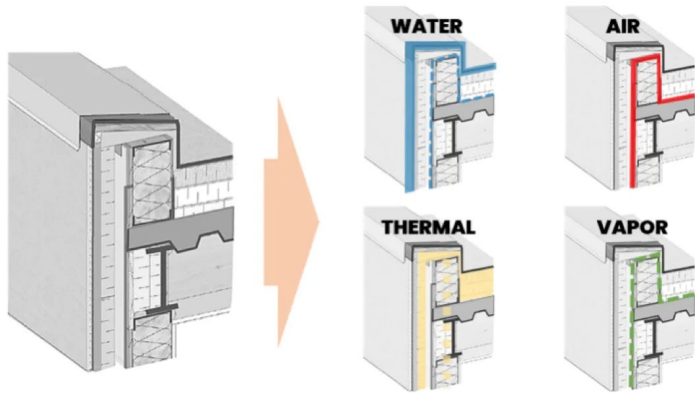
Envelope Verification and Air Leakage Testing

Envelope Penetrations



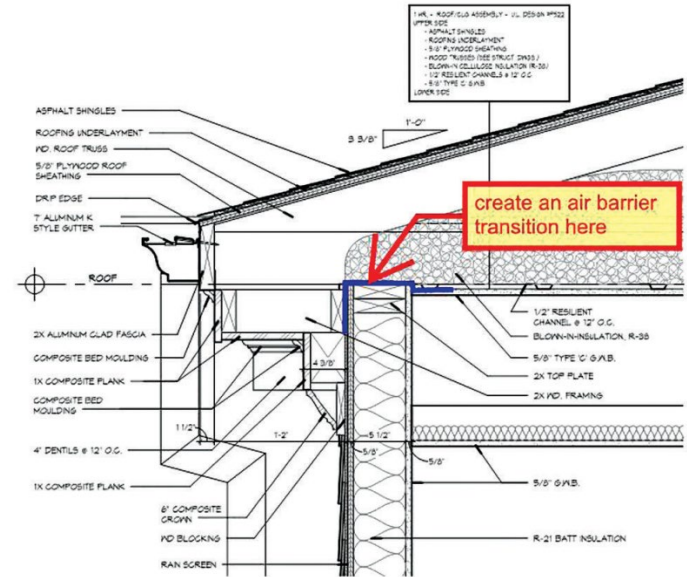
Envelope Verification and Air Leakage Testing

Sealing air barrier connections – Air barrier



Sealing at parapets

*Image credit – AIA



Sealing at roof eaves

*Image credit – TAM Consulting Inc, Building Envelope Technology Symposium

Envelope Verification and Air Leakage Testing

Sealing air barrier connections – Air barrier continuity



Sealing between dissimilar materials

**Image credit – TAM Consulting Inc, Building Envelope Technology Symposium*



Sealing at seams and connections

**Image credit – Engineered Woods*

Typical Verification Items

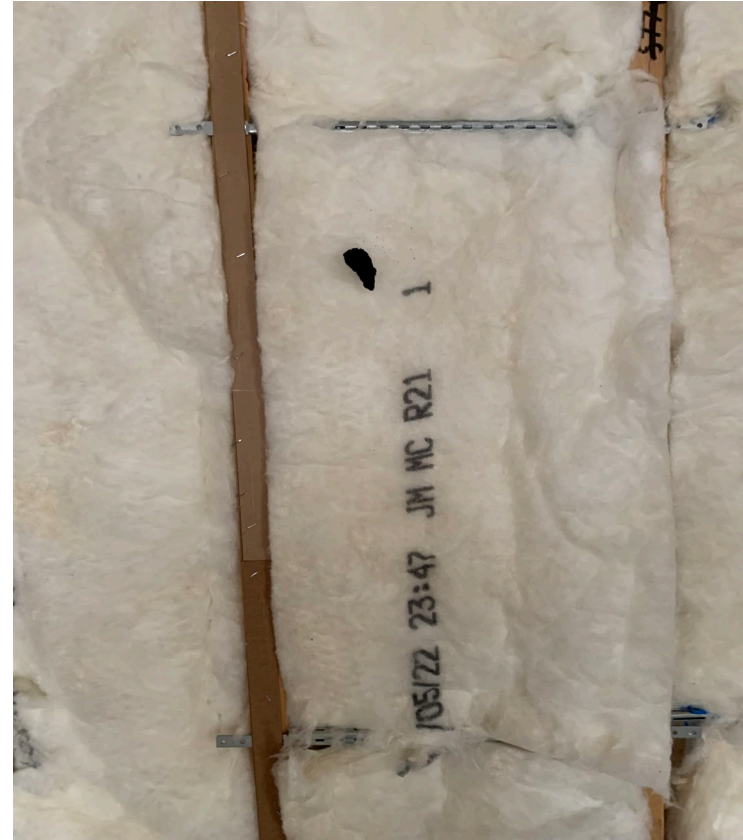
Even spray foam is not infallible. Ensure proper installation.



Typical Verification Items

Insulation R Value

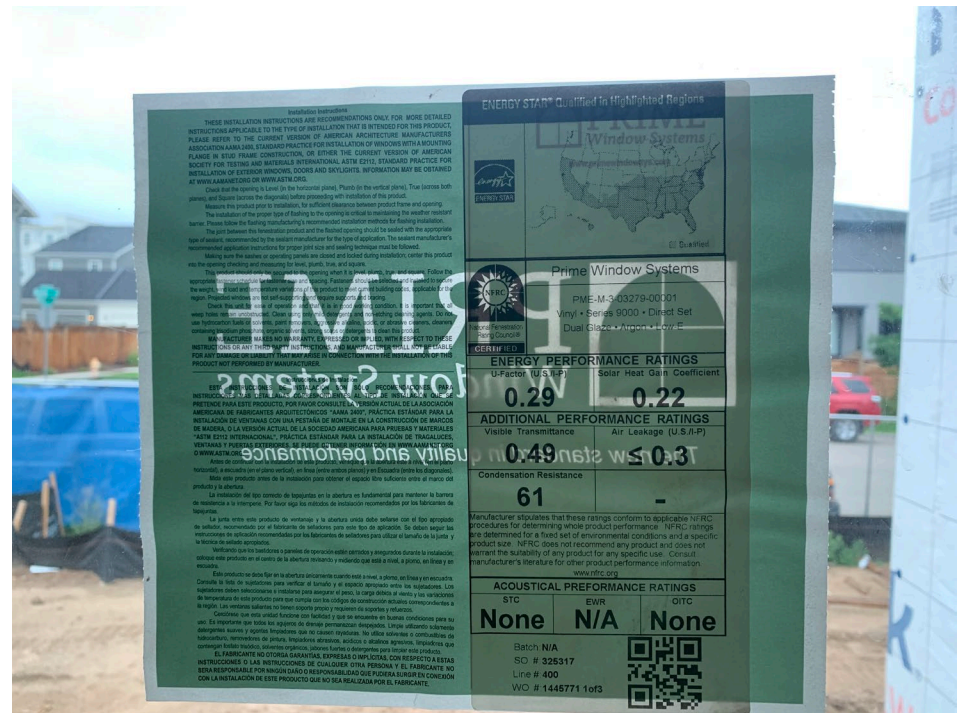
Framing Inspection



Typical Verification Items

Fenestration U-Factor and SHGC

Framing Inspection



Air Leakage Testing

Example 1. Apartment unit leakage tests at 0.4 cfm/sf.

What measures are required to verify compliance with the air leakage requirement?

Answer: Since the tested leakage rate exceeds 0.30 cfm/sf but not 0.45, the exception in C405.5.2 applies. Diagnostic testing is required to identify and seal sources of air leaks. Provide a report. Retesting is not required.

Air Leakage Testing

Example 2. A small office building is tested for air leakage, and the tested leakage rate at a test pressure of 75 Pa is 0.72 cfm/sf.

Does this building comply? If not, what steps are required to ensure compliance?

Answer: Since the leakage rate exceeds 0.60 cfm/sf from the exception in C405.5.3, the project requires air sealing remediation and retesting to comply with the 2022 DEC.



HVAC

Multifamily Mechanical Ventilation Requirements

Denver Mechanical Code Section 401.2 – Ventilation Required

- Occupied spaces (other than R) must provide natural or mechanical ventilation
- Dwelling units must provide balanced mechanical ventilation
 - **Natural ventilation is NOT allowed in dwelling units** due to 2022 Denver Energy Code air leakage requirements

Denver Mechanical Code Section 403.1 – Ventilation System

- Mechanical ventilation must be balanced with supply air approximately equal return or exhaust air
- **Exhaust-only ventilation is NOT allowed**
- The system can produce a space with negative or positive pressure

Mechanical Rough Inspection

Partial Electrification for Space Heating

C403.2.4 – Space heating equipment

- Effective date of **January 1st, 2024**
- Fossil-fuel warm air furnaces and electric resistance space heating equipment are not be permitted for space heating
- Focus on systems with design, technology, and equipment that is currently available
- Aligns with Energize Denver requirements

Mechanical Rough Inspection

Exceptions:

- Emergency power or standby power, as approved by building official
- Makeup air systems where ERV is prohibited by Denver Mechanical Code
- Electric resistance used for heat pump supplementary heat
- Electric resistance up to 5 W/sf
- Gas furnaces or electric resistance in heated plenums
- Electric resistance in buildings that [use a performance path for compliance](#)
- Replacement furnaces that comply with Alterations C503.3.3

Partial Electrification for Space Heating

C403.2.4 – Space heating equipment

Allowed Gas/Electric Resistance Equipment Examples

Boilers – fossil fuel and electric

Unit heaters – fossil fuel and electric

Radiant heat

Electric reheat in VAV boxes

Prohibited Equipment Examples with Limited Exceptions*

Furnaces

Gas RTUs

Gas DOAS / MAU*

Electric resistance FCUs*

Electric resistance PTAC/VTAC*

C403.4.1.1 Heat Pump Supplementary Heat

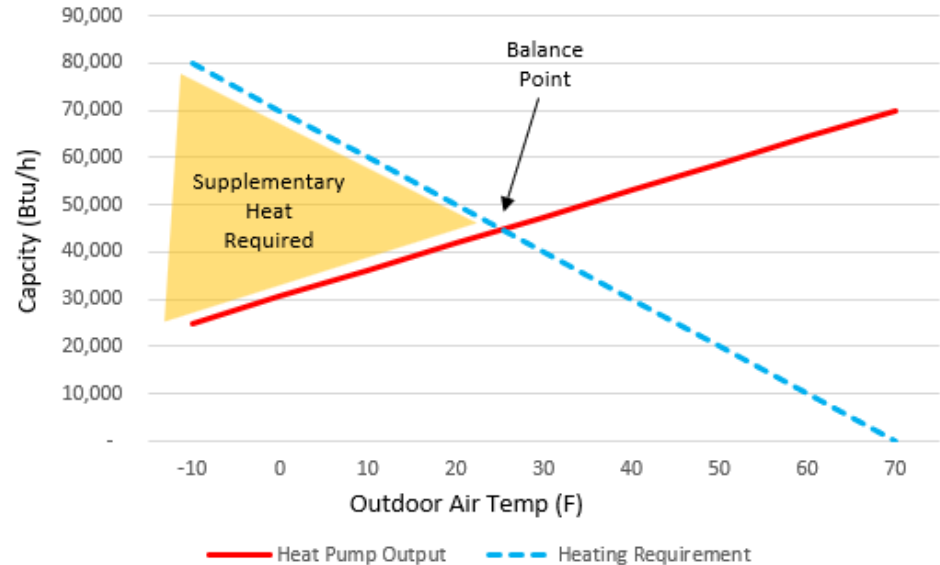
C403.4.1.1 - Controls that limit supplementary heat

Electric resistance or fossil fuel allowed:

- If the heat pump cannot meet load
- If the heat pump is in defrost mode
- If the vapor compression cycle malfunctions
- If the thermostat malfunctions

Commissioning

Heat Pump Output vs Requirement



C403.2.3 Fault Detection Diagnostics



- Buildings 25,000 SF or greater require automated fault detection and diagnostic system
- System testing recommended to be part of Mechanical commissioning
- Exception: Heated-only warehouses, R-1 and R-2 occupancies

Commissioning

C402.5.11 Operable Openings Interlocking

- Interlocks are required for operable windows to set back heating and cooling setpoints
- Projects that use evaporative cooling may still have the cooling system enabled when windows are open



Commissioning



Water Heating

C404.10 Partial Electrification for Water Heating

- Effective date of **January 1st, 2024**
- Fossil fuel and electric resistance instantaneous and storage water heaters are not be permitted to provide potable hot water
- Focus on systems with design, technology, and equipment that is currently available
- Aligns with Energize Denver requirements

Exceptions:

- Electric resistance elements in heat pumps
- Electric resistance elements for recirculation loop temperature maintenance
- Electric storage water heaters with a volume ≤ 20 gallons
- Instantaneous electric water heaters within 10 feet of point of use
- Hot water storage tanks without electric resistance or fossil-fuel heating elements
- Water heating systems that require water temperature $\geq 141^\circ\text{F}$
- Electric resistance equipment where on-site renewables serves 100% the annual service water heating requirement
- Electric resistance storage water heating equipment where solar thermal serves 75% of the annual service water heating requirement
- Systems ≥ 200 MBH, operating temperature ≥ 210 F, ≥ 120 gallons (per updates June 2023)
- Electric resistance in buildings that **use a performance path for compliance**
- Replacements of gas-fired storage water heaters or instantaneous water heaters that comply with Alterations C503.4.1

Plumbing Rough Inspection

C404.10 Partial Electrification for Water Heating

Allowed Equipment Examples

Boilers – fossil fuel and electric

Heat pump water heaters - individual

Heat pump water heaters - central

Prohibited Equipment Examples with Limited Exceptions*

Gas storage water heaters

Electric resistance storage water heaters*

Gas instantaneous water heaters

Electric instantaneous water heaters*

C404.12 Water Heater Equipment Locations

When required by C405.15 – Additional electric infrastructure for water heating equipment less than 300,000 Btu/h

- Minimum dimensions 3' x 3' x 7'
- 760 cubic feet
- -OR-
- 16" x 24" grill to a heated space AND 8" duct less than 10' for exhaust air

Exceptions:

- Less than 20 gallons of storage
- Instantaneous heaters within 10' of point of use
- Manufacturer recommendations for a specific heat pump water heater



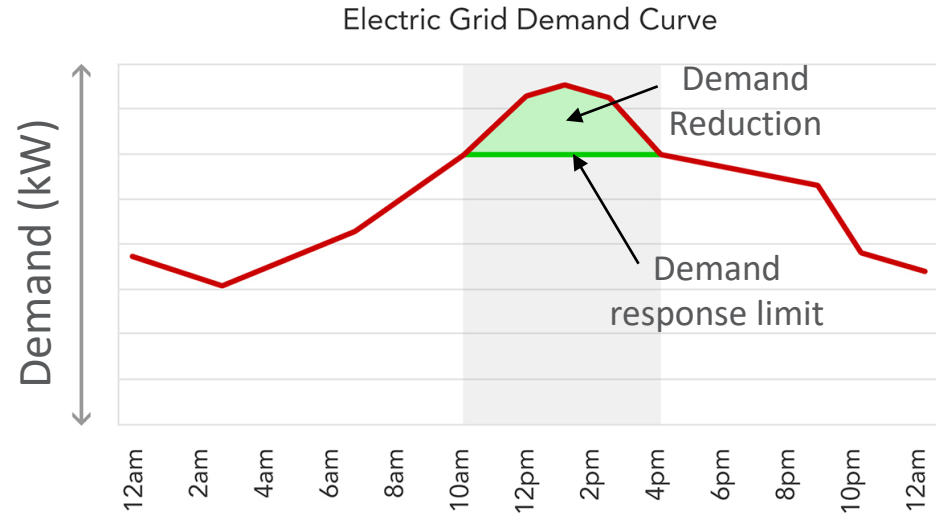
Plumbing Rough Inspection

C404.11 Demand Response Water Heating

- Electric storage water heaters
- 40-120 gallons
- Input rating less than 12 kW
- ANSI/CTA-2045-B Level 1 demand responsive controls

Exceptions:

- 180F water delivery temperature or higher
- Water heaters that comply with Section IV, Part HLW or Section X of the ASME Boiler and Pressure Vessel Code
- Water heaters that use 3-phase electric power



Commissioning



Power & Lighting

C405.12 Energy Monitoring

New buildings 25,000 sf or larger shall be equipped to measure, monitor, record and report electricity consumption data for all end uses in Table C405.12.2 separately

Exemptions:

- HVAC/DHW equipment serving individual dwelling units
- Tenant spaces 2,500 sf or less

**Table C405.12.2
Energy Use Load Categories**

Total HVAC system
Interior lighting
Exterior lighting
Plug loads
Process loads
Building operations and other miscellaneous loads

Electrical Final Inspection, Commissioning

C405.15 Electric Ready Infrastructure

Fossil fuel appliances and equipment or connections serving new buildings:

- Provide a junction box within same space as fossil fuel appliance or equipment connected to an electrical panel by continuous raceways
- Junction box, raceway, and bus bar in the electric panel and conductors serving the electric panel shall be sized to accommodate electric equipment sized to serve the same load as the fossil fuel appliance or equipment
- Panel shall have reserved physical space for a three-pole circuit breaker
- Junction box and electrical panel directory entry for the dedicated circuit breaker space shall have labels stating, “For future electric equipment”

Electrical Rough and Final Inspections

Applicable fossil fuel appliances/equipment

Water heating equipment < 300 MBH

Warm air furnaces serving spaces without space cooling

Fireplaces, ranges, and stoves not defined as commercial cooking appliances

Commercial cooking appliances

Fossil fuel appliances and equipment serving dwelling units or sleeping units

C405.13 Electric Vehicles

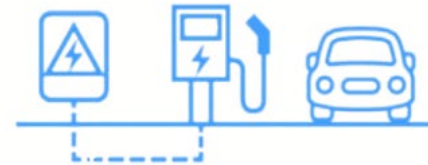
- EV Installed: Ready to plug in the car
- EV Ready: Conduit/Wire, panel space, no Charger
- EV Capable: Raceway or cable assembly



EV Capable



EV Ready



EV Installed

Electrical Underground, Rough and / or Final Inspections



Commissioning

C408 Commissioning

C408.2 - Mechanical & Service Water System Commissioning:

- ✓ Commissioned by a Colorado registered design professional or approved agency
 - Exceptions for
 - Small capacity systems in C408.2
 - Systems for individual sleeping and dwelling units
 - Systems in existing buildings where the area of work is less than 10,000 square feet
- ✓ Air balancing testing (TAB) to be completed by an approved contractor

C408.3 - Lighting Controls Functional Testing:

- ✓ Commissioned by a Colorado registered design professional or approved agency
 - Exception for systems in existing buildings where the area of work is less than 10,000 square feet and the new installed lighting load is less than 10 kW*

**Updates for Council approval June 2023*

C408 Commissioning

Required at Permit:

- ✓ Letter with qualifications of the commissioning agent

Required at project completion:

- ✓ Preliminary Commissioning Report
- ✓ Final Commissioning Report
- ✓ HVAC, SHW, and Lighting Controls

Commissioning Compliance Checklist

Project Information	Project Name:
	Project Address:
	Registered design professional or approved agency who completed commissioning:
Commissioning Plan (Section C408.2.1)	Commissioning Plan was used during construction and includes all items required by Section C408.2.1: (owner or owner representative to initial here)
Systems Adjusting and Balancing (Section C408.2.2)	Systems Adjusting and Balancing has been completed 1. Air and water flow rates have been measured and adjusted to deliver final flow rates within the tolerances provided in the produce specifications.
Functional Testing (Sections C408.2.3 and C408.3.1)	HVAC Equipment Functional Testing has been executed. If applicable, deferred and/or follow-up testing is scheduled to be provided on: __
	HVAC Controls Functional Testing has been executed. If applicable, deferred and/or follow-up testing is scheduled to be provided on: __
	Economizers Functional Testing has been executed. If applicable, deferred and/or follow-up testing is scheduled to be provided on: __
	Lighting Controls Functional Testing has been executed. If applicable, deferred and/or follow-up testing is scheduled to be provided on: __
Supporting Documents (Sections C408.2.5)	Service Water Heating System Functional Testing has been executed. If applicable, deferred and/or follow-up testing is scheduled to be provided on: __
	Manuals, record documents and training have been completed or are scheduled 1. System documentation has been provided to the owner or scheduled to be delivered to the owner on: __ 2. Record documents have been submitted to owner or scheduled to be delivered to the owner on: __ 3. Training has been completed or scheduled to be completed on: __
Preliminary Commissioning Report (Section C408.2.4 and C408.3.2.3.1)	Preliminary Commissioning Report submitted to Owner and includes all items required by Sections C408.2.4 and C408.3.2.3.1 as amended: (owner or owner representative to initial here) _
Certification	I hereby certify that the commissioning provider has provided me with evidence of mechanical, service water heating and lighting systems commissioning in accordance with the Denver Energy Code.
	Signature of Building Owner or Owner's Representative _____ Date _____

New Commissioning Requirements

	Prescriptive	Performance
C402.5.11 Interlock operable openings	●	●
C403.2.3 / C406.11 Fault detection and diagnostics	●	●
C403.4.1.1 Heat pump supplemental heating	●	●
C403.8.6.2 Intermittent toilet exhaust control	●	
C404.11 Demand responsive water heating	●	●
C405.2 Lighting power reduction demand response	●	
C405.12 Energy Monitoring	●	●
C405.13.5.1 EV circuit capacity management	○	○
C406.16 Demand responsive thermostats	○	

C408 Systems Commissioning Documentation

At permit:

- Include a letter with qualifications of the systems commissioning agent(s)

Preliminary Commissioning Report

1. Itemization of deficiencies found during testing and not yet corrected
2. Results of functional performance tests
3. Functional performance test procedures used during the process
4. Submit to electrical and mechanical/plumbing inspector at final inspection

Final Commissioning Report

1. Results of functional performance tests
2. Disposition of deficiencies found during testing, including details of protective measures used or proposed
3. Functional performance test procedures used during the process



Existing Building Support and Resources

Resources and technical assistance available through the Electrification Program website, www.denvergov.org/BuildingElectrification or contact us at:

- electrification@denvergov.org:
 - Electrification Feasibility Reports and incentives
- mechplumb.review@denvergov.org:
 - Permitting and code compliance



Electrification Program

Starting on **March 1, 2023**, the requirements for pulling a permit to replace your AC units, gas-fired furnaces, and hot water heaters in commercial and multifamily buildings is going to change. For the fastest permitting process, we strongly recommend that you plan now for the new requirements.



Planning for Equipment Replacement

Starting on March 1, 2023, the requirements for pulling a permit to replace your gas-fired appliances is going to change. Learn more about what to expect.



Code Changes In 2023, 2025, and 2027

Energize Denver requires electrification for space and water heating equipment. This will happen through a series of updates to the Denver Building Code. Learn more about what to expect.



Electrification Feasibility Reports

Denver's updated building code will soon require you to look at whether electrifying your space and water heater and cooling is a good choice for you. Find out more about these requirements.



Incentives and Financing

We want to help you replace your



Home Electrification Incentives



Why Electrify?

Shifting to electric equipment like

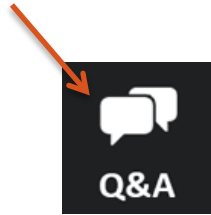
How is electrification in existing buildings going for you?

CASR's existing building electrification team would love to hear stories and feedback from contractors and building professionals about how heat pump installation is going for you!

If you'd like to share your experience with CASR email electrification@denvergov.org

Questions?

- Time is reserved at the end of the presentation for Q&A
- Please use the Q&A feature to submit your questions



- Responses to all questions not addressed today will be sent out by email to registered participants
- Additional questions may be sent to: energy.review@denvergov.org

Thank you!

For more information, visit:

[Denvergov.org/EnergyCode](https://denvergov.org/EnergyCode)

[Denvergov.org/BuildingCode](https://denvergov.org/BuildingCode)

Contact us:

Questions about energy code: energy.review@denvergov.org

Questions about programs & resources: sustainability@denvergov.org