TRI-COUNTY
REGIONAL ENERGY NETWORK
SAN LUIS OBISPO • SANTA BARBARA • VENTURA

Nonresidential: Energy Code Implementation Series, With 2025 Code Updates

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Energy Code Implementation Series –with 2025 Code Updates

Since the energy code update took effect in January 2023, the industry is adjusting to design, detailing and construction to meet compliance. In this series, we'll review the code requirements with a focus on what to include in construction documents to streamline the permitting process and tips for construction to ease sign-offs and occupancy.

- **Energy Code Implementation: Non-Residential**
- Energy Code Implementation: Single Family New Construction
- Energy Code Implementation: Single Family Additions and Alterations
- Energy Code Implementation: ADUs
- Energy Code Implementation: Multi-Family

https://www.3c-ren.org/calendar-of-events-and-trainings/

Today's Learning Objectives

- Understand the current and upcoming metrics and standards used in the energy code for evaluating energy performance and indoor air quality, and how choices for electric or gas equipment may impact compliance with those standards.
- Within each building type, review key mandatory measures related to energy performance, ventilation, refrigerants and insulation and review potential challenges for integration into design and construction.
- Review the prescriptive "recipe card" approach versus a building performance approach and discuss when to use each strategy to best incorporate energy efficiency and healthy interior environments into the specific project design.
- Recognize where barriers or stumbling blocks may occur within permitting and construction and tips for documentation to smooth out the process, ultimately increasing the energy efficiency, health and safety of our buildings.

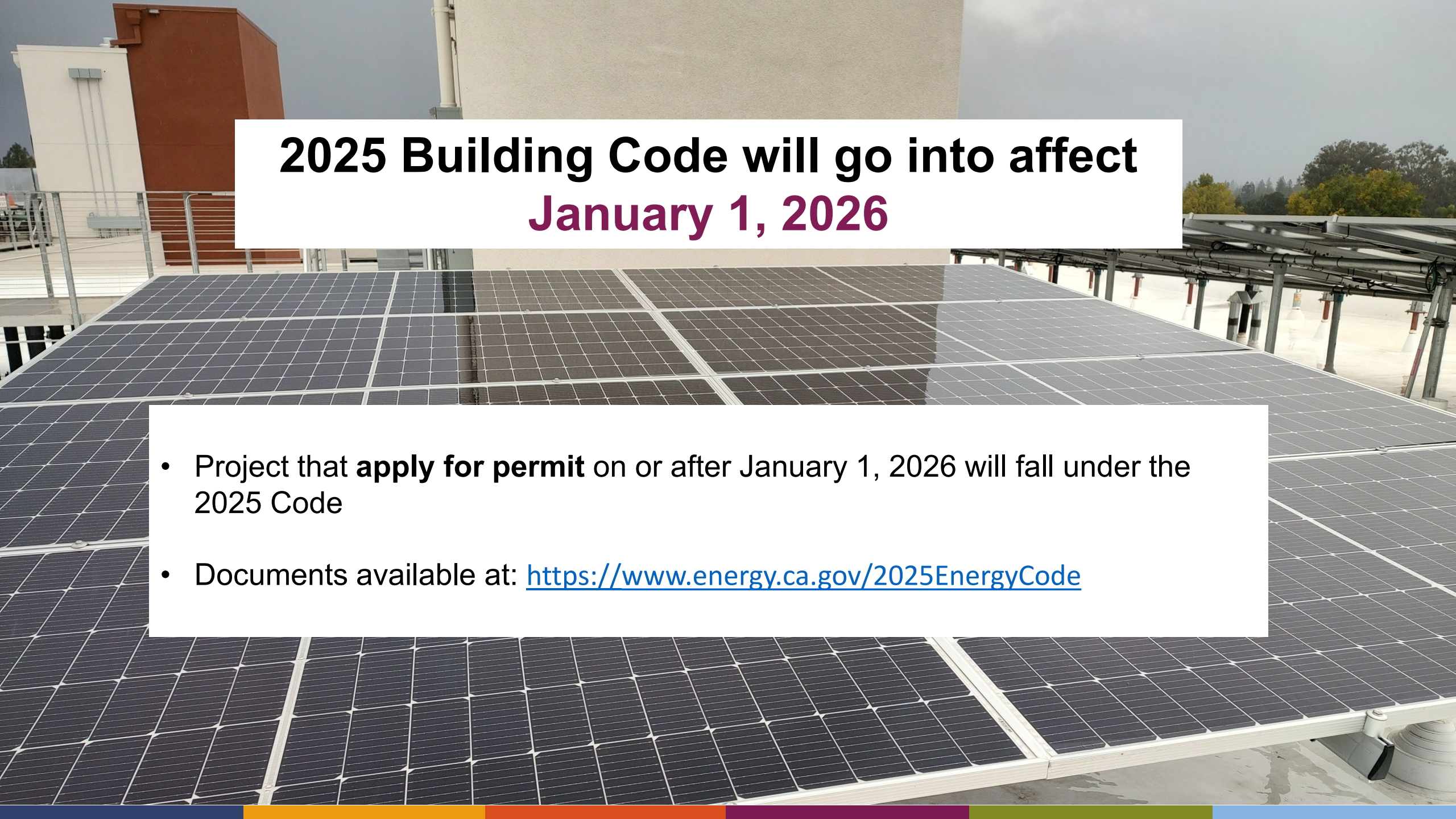
Learning Units:

1.5 AIA HSW LU approved for this course
0.15 ICC CEU approved for this course

Agenda

1. Energy Code Overview and High Level 2025 Changes
2. Mandatory Measures
3. New Construction: Prescriptive and Performance Measures

Energy Code Overview and High Level 2025 Changes



2025 Building Code will go into affect January 1, 2026

- Project that **apply for permit** on or after January 1, 2026 will fall under the 2025 Code
- Documents available at: https://www.energy.ca.gov/2025EnergyCode

Multi-year Process –Adoption Timeline for the 2025 Energy Code

California's Building Energy Efficiency Standards (aka the Energy Code) is updated every three years the by CEC. The process includes engagement with the public, industry experts, in-house expertise, and other stakeholders.

For more information visit energy.ca.gov

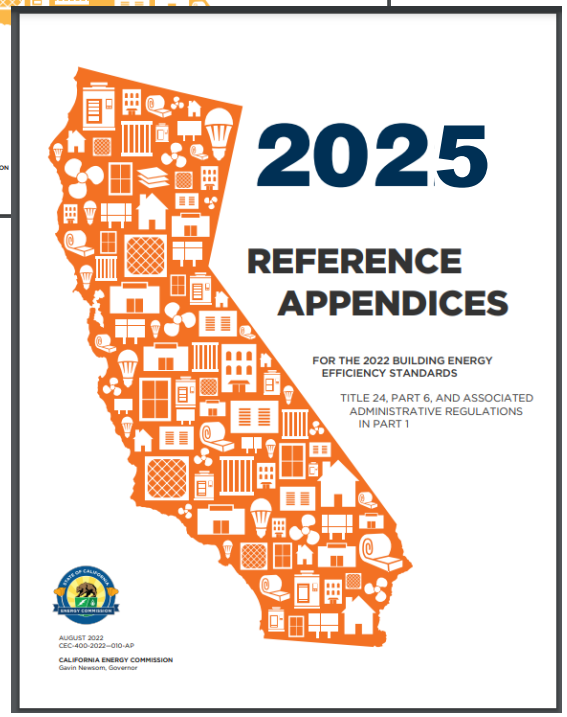
Big Picture Goals for the 2022 Code and the 2025 Update

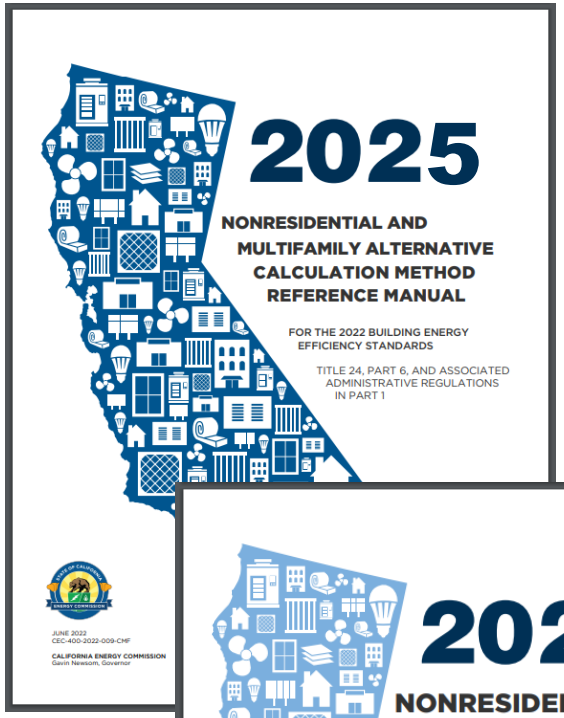
- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family and multifamily projects
- Expand PV systems and battery storage standards
- Strengthen ventilation standards
- Save water and save energy by reducing water use in homes and nonresidential buildings
  - References to following Plumbing Code for pipe sizing
  - New Requirements for Chillers and Cooling Towers

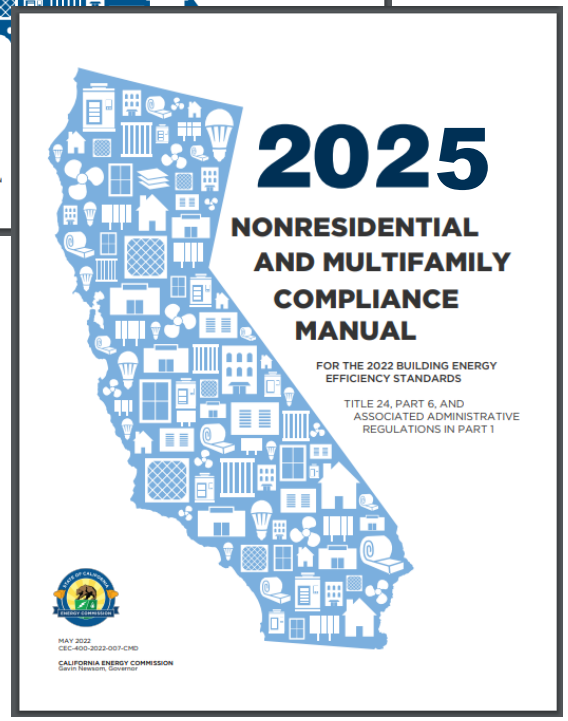
2025 Non-Residential High-Level Changes

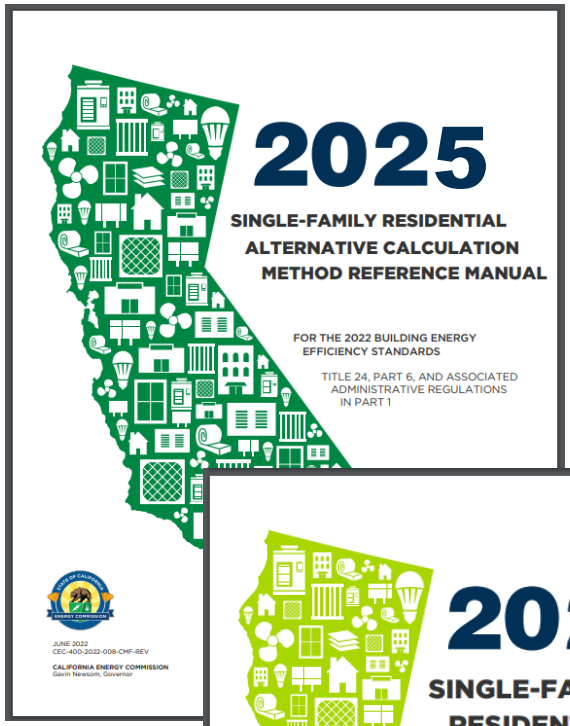
- New Performance-Method Metric
- Electric-readiness for commercial kitchens
- HVAC –Heating Types and Ventilation/DOAS – Outdoor Air (OA)
- Exhaust Systems –Added Animal/Veterinary
- Envelope –Vestibules, Walls and Roofs/Ceilings Insulation
- Photovoltaic (PV) and Battery Systems

Title 24 Part 6, 2025 Standards and Manuals

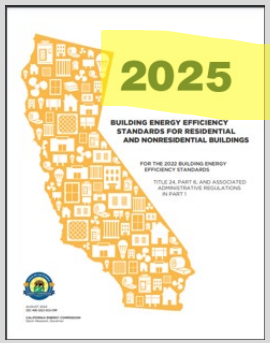








T24 Part 6 Energy Code – Subchapter Organization



All [*regulated*] *Occupancies*

(A, B, E, F, H, I, L, M, R, S, or U, except I-3 and I-4)

Subchapter 1 –All Occupancy –Scope, Definitions

Subchapter 2 –All Occupancies – Mandatory Requirements

Sec 100.0-100.3 & Sec 110.0-110.12

Non-Residential

Subchapter 3 – Nonresidential, Hotel/Motel, Covered Process –Mandatory Requirements [*HVAC and Ventilation*]

Sec 120.0-120.9

Subchapter 4 – Nonresidential, Hotel/Motel –Mandatory Requirements [*Lighting and Power*]

Sec 130.0-130.5

Subchapter 5 –Performance and Prescriptive [*New Construction*]

Sec 140.0-140.9

Subchapter 6 – Additions and Alterations

Sec 141.0-141.1

Single Family Res

Subchapter 7 –Single Family Residential Mandatory Measures

Sec 150.0

Subchapter 8 – Performance and Prescriptive [*New Construction*]

Sec 150.1

Subchapter 9 – Additions and Alterations

Sec 150.2

Multifamily Res

Subchapter 10 – Multifamily Residential Mandatory Measures

Sec 160.0-160.9

Subchapter 11 – Performance and Prescriptive [*New Construction*]

Sec 170.0-170.2

Subchapter 12 – Additions and Alterations

Sec 180.0-180.4

TABLE 100.0-A Application of Standards

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions Alterations
All Buildings	General	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0
Nonresidential, And Hotels/Motels	General	120.0	140.0, 140.2	140.0, 140.1	141.0
Nonresidential, And Hotels/Motels	Envelope (conditioned)	110.6, 110.7, 110.8,120.7	140.3	140.0, 140.1	141.0
Nonresidential, And Hotels/Motels	Envelope (unconditioned process spaces)	N.A.	140.3(c)	140.0, 140.1	141.0
Nonresidential, And Hotels/Motels	HVAC (conditioned)	110.2, 110.5, 120.1, 120.2, 120.3, 120.4, 120.5, 120.8, 120.10	140.4	140.0, 140.1	141.0
Nonresidential, And Hotels/Motels	Water Heating	110.3, 120.3, 120.8, 120.9	140.5	140.0, 140.1	141.0
Nonresidential, And Hotels/Motels	Indoor Lighting (conditioned, process spaces)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6	140.0, 140.1	141.0
Nonresidential, And Hotels/Motels	Indoor Lighting (unconditioned and parking garages)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6	N.A.	141.0

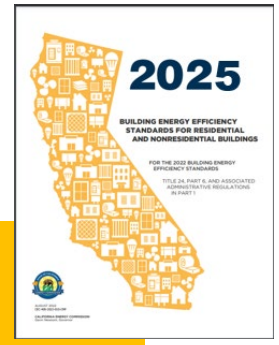


Table 100.0 – A is a means to navigate the Energy Code.

Under 2025 Code cycle new sections/occupancy categories have been added and/or expanded.

TABLE 100.0-A continued

Nonresidential, And Hotels/Motels	Outdoor Lighting	110.9, 130.0, 130.2, 130.4	140.7	N.A.	141.0
Nonresidential, And Hotels/Motels	Electrical Power Distribution	110.11, 130.5	N.A.	N.A.	141.0
Nonresidential, And Hotels/Motels	Pool and Spa Systems	110.4, 110.5, 150.0(p)	N. A.	N.A.	141.0
Nonresidential, And Hotels/Motels	Solar Ready Buildings	110.10	N.A.	N.A.	141.0(a)
Nonresidential, And Hotels/Motels	Solar PV and Battery Energy Storage Systems	N.A.	140.10	140.0, 140.1	N.A.
Covered Processes[1]	Envelope, Ventilation, Process Loads	110.2, 120.3, 120.6	140.9	140.1	110.2, 120.3, 120.6, 140.9, 141.1
Demand Responsive (DR) Controls	DR control thermostats	JA5; Exception 5 to Section 110.10(b)1A; Exception 4 to Section 110.10(b)1B.	NA	NA	NA
Demand Responsive (DR) Controls	DR Zonal HVAC Controls	110.12	NA	NA	NA

New:
Demand Responsive (DR) Controls is now included for ease of look-up.

TABLE 100.0-A continued

Occupancies	Application	Mandatory	Prescriptive	Performance	Additions Alterations
Demand Responsive (DR) Controls	DR Lighting Controls	110.12	140.6(a)2K; 170.2(e=)2Bxi	N.A.	Table 141.0-F; Table 180.2-E
Demand Responsive (DR) Controls	DR Electronic Message Center Control	110.12, 130.3(a)3	NA	NA	NA
Demand Responsive (DR) Controls	DR Controlled Receptacles	110.12, 130.5(e), 160.6(e)	NA	NA	NA
Signs	Indoor and Outdoor	110.9, 130.0, 130.3, 160.5(d)	140.8, 170.2(e)7	N.A.	141.0, 141.0(b)2H, 180.2(b)4Bvi

New:
Demand Responsive (DR) Controls is now included for ease of look-up.

The Energy Code –Three Compliance Terms

Mandatory Requirements

Energy efficiency measures that are applicable to all projects.

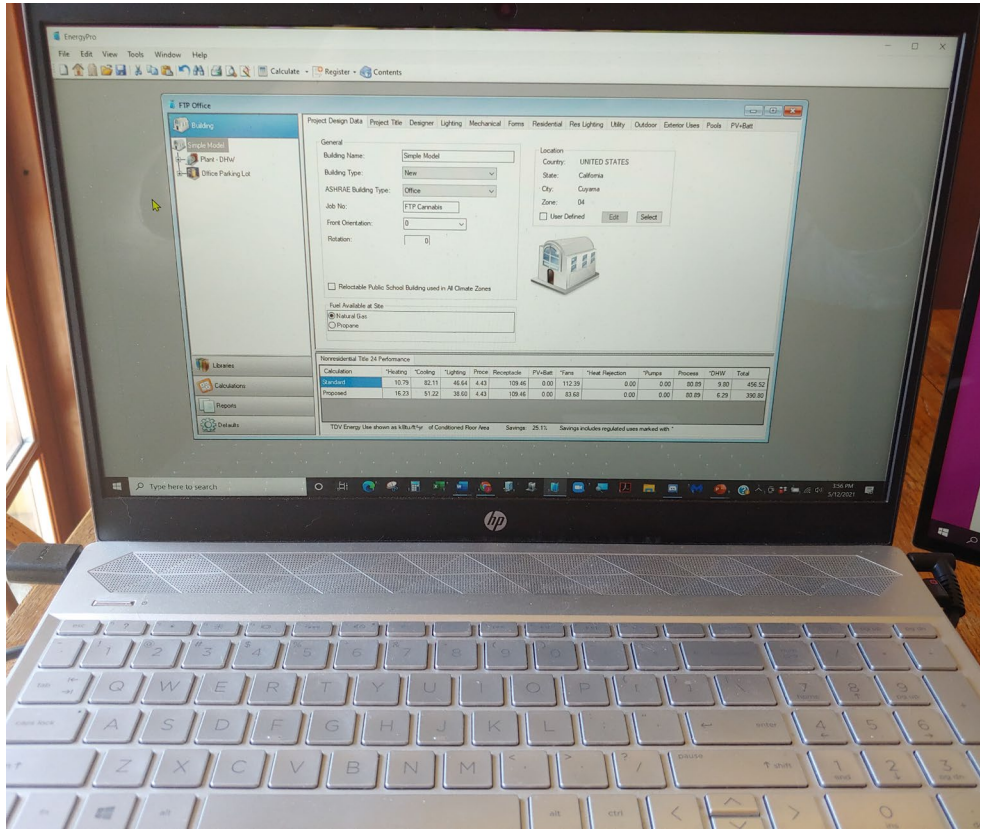
Prescriptive Component Package	**Performance Method**
Mandatory Requirements are applicable	Mandatory Requirements are applicable
Follow all the parts of the prescriptive package	Other components or measures can be traded-off as long as the Proposed Design Building can be shown to be more energy efficiency than a similar sized Standard Design Building (baseline building)
Note: used to determine the Standard Design Building	
Essentially a **checklist** approach	**Energy modeling** approach

Performance Method (i.e. Computer Modeling)

Regulated Energy-Use:

- Space Heating and Cooling
- Ventilation
- Water Heating
- Indoor Lighting
- Solar PV and Battery Storage
- Covered Process Loads

Community shared solar or battery system is allowable with specific requirements. See EXCEPTION Section 140.1(b)



Performance Method (Computer Modeling)

Two Metric Types:

- **Source Energy Budget** is the efficiency of the energy used by the building (site energy) as well the energy used to produce, procure, and distribute it from a particular source. It serves as **proxy for carbon-based metric.**
- **TDV Energy Budget** is the efficiency of the building's source energy and brings in TDV multipliers based on when the energy is being used to reflect the actual cost, supply, and demand. It serves to **encourage better performance during peak hours.**

Under 2022 Code:

- **Solar Electric PV and Battery** Storage Systems were **added** to TDV-Total
- **Source Energy** metric **added** to Performance Compliance

Long-Term System Cost (LSC) –*The New Metric for 2025 Code Cycle*

- **Source energy** – The energy used within the modeled buildings shall be represented as long-run marginal, hourly source energy.
- **Long-term system cost (LSC)** -– All electricity, gas or propane used within the modeled buildings shall be converted to LSC. LSC includes the efficiency LSC, which is the sum of LSC energy for space-conditioning, water heating, and mechanical ventilation, and total LSC, which includes efficiency LSC and LSC energy from photovoltaic, energy storage systems, lighting, demand flexibility, and other plug loads.

Example Office Building Project Results

CBECC-com

Overall Result[3]: **COMPLIES**

(not current)

	LSC*e*	LSC*t*	Source Energy
Standard Design	134.03	12.73	6.13
Proposed Design	131.10	1.06	5.66
Compliance Margins	**2.93**	**11.67**	**0.47**
	Pass	Pass	Pass

[1] Efficiency measures include improvements like a better building envelope and more efficient equipment

[2] Compliance Totals include efficiency, photovoltaics and batteries

[3] Building complies when all efficiency and total compliance margins are greater than or equal to zero and unmet load hour limits are not exceeded

Standard Design PV Capacity: 167.9 kWdc / Battery System Capacity: 296.8 kWh (power 70.50 kW)

Mandatory Measures

Laboratory (L) Added to the Scope of the Energy Code

SECTION 100.0 – SCOPE

The provisions of Part 6 apply to all buildings that are of Occupancy Group A, B, E, F, H, I, L, M, R, S, or U

Key Takeaway: Many of the 2025 Energy Code updates are intended to add consistency with the other parts of the Building Code, Title 24.

Laboratory Occupancy –Found Under '*Nonresidential Function Areas*'

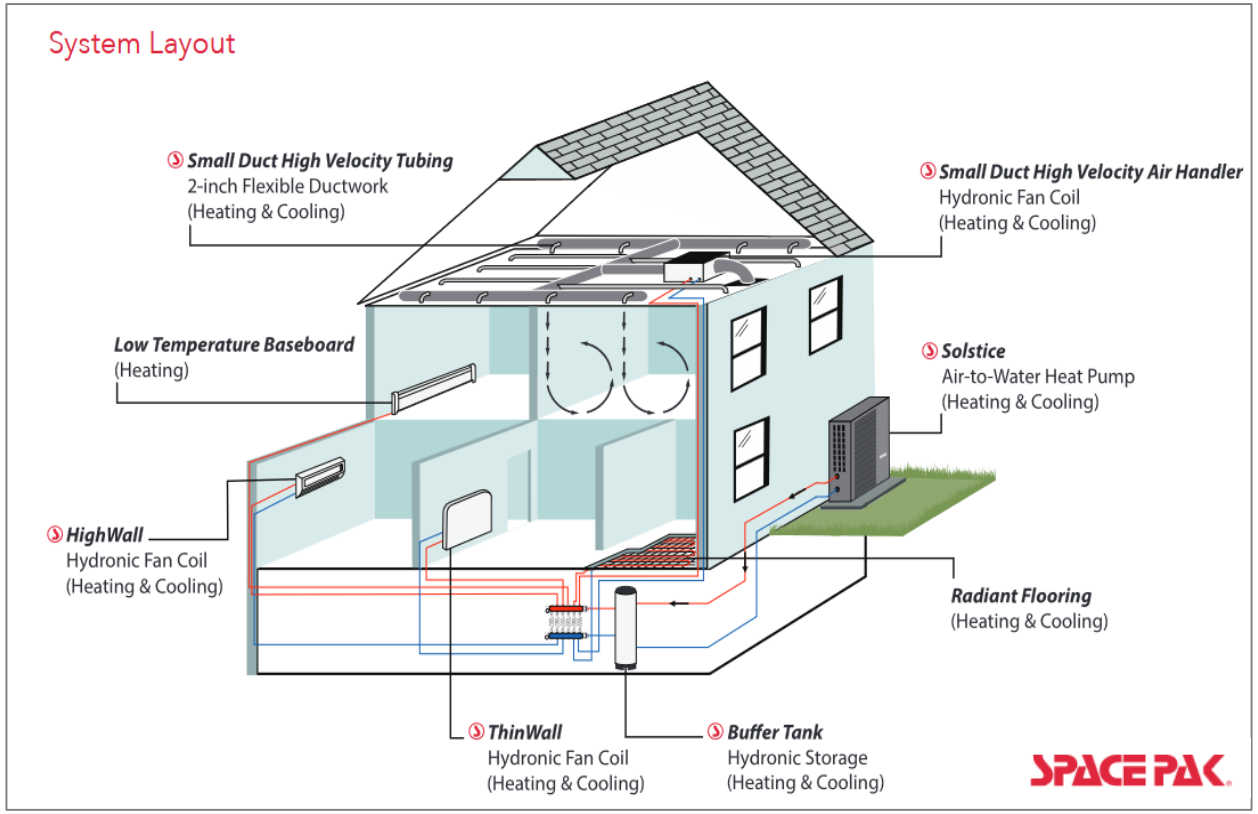
Clarified/Expanded Definition:

- Laboratory is a space or room where hazardous materials are used for activities such as testing, analysis, instruction, research, or developmental activities.
- Laboratory Suite is a Group L occupancy space within a building or structure, which may include multiple laboratories, offices, storage, equipment rooms or similar support functions.
- Laboratory, Scientific Area is a room or area where research, experiments, and measurement in medical and physical sciences are performed requiring examination of fine details. The area may include workbenches, countertops, scientific instruments, and associated floor spaces. Scientific laboratory does not refer to film, computer, and other laboratories where scientific experiments are not performed.

Air-to-Water Heat Pump (AWHP)

Added Definition:

AIR-TO-WATER HEAT PUMP (AWHP) is a factory-made packaged heat pump system containing one or more compressors, and heat exchangers for transferring heat between refrigerant and air, as well as between refrigerant and water, and various other components. Its primary purpose is to generate heated or cooled water to meet space conditioning loads, and/or and domestic hot water loads, or both.



Solstice® Inverter Monobloc

Air-to-Water Heat Pump

- Hot or Cold water circulates within the house –not refrigerant
- Uses a ducted system to deliver cooling
- Uses Mitsubishi Inverter for high performance

Heat Pump Water Heater Types Defined

WATER HEATER definitions include the following:

- **CONSUMER WATER HEATER** is a water heater that meets the definition of a consumer product under USDOE 10 CFR 430.
- **HEAT PUMP WATER HEATER (HPWH)** is a water heater that transfers thermal energy from one temperature level to another temperature level for the purpose of heating water, including all ancillary equipment such as fans, storage tanks, pumps, or controls necessary for the device to perform its function.
    - **INTEGRATED** HEAT PUMP WATER HEATER is a HPWH which has all components, including fans, storage tanks, pumps, or controls necessary for the device to perform its function contained in a single factory-made assembly.
    - **SPLIT-REFRIGERANT** HEAT PUMP WATER HEATER is a HPWH which has a single outdoor section and one or more indoor sections connected to the outdoor section via a refrigerant circuit.
    - **SPLIT-HYDRONIC** HEAT PUMP WATER HEATER is a HPWH that consists of multiple separate sections. One section houses all the refrigerant components, while one or more additional sections are designated for water storage. These sections are interconnected through a hydronic circuit.
- **MULTI-PASS** WATER HEATER is a water heater which the cold water passes through multiple times. The water temperature increases with each pass, until the storage tank reaches the intended storage temperature.
- **SINGLE-PASS** WATER HEATER is a water heater which the cold water passes through once and is heated to the intended use temperature.

Integrated

A. O. Smith - Residential

AO Smith –Small Commercial

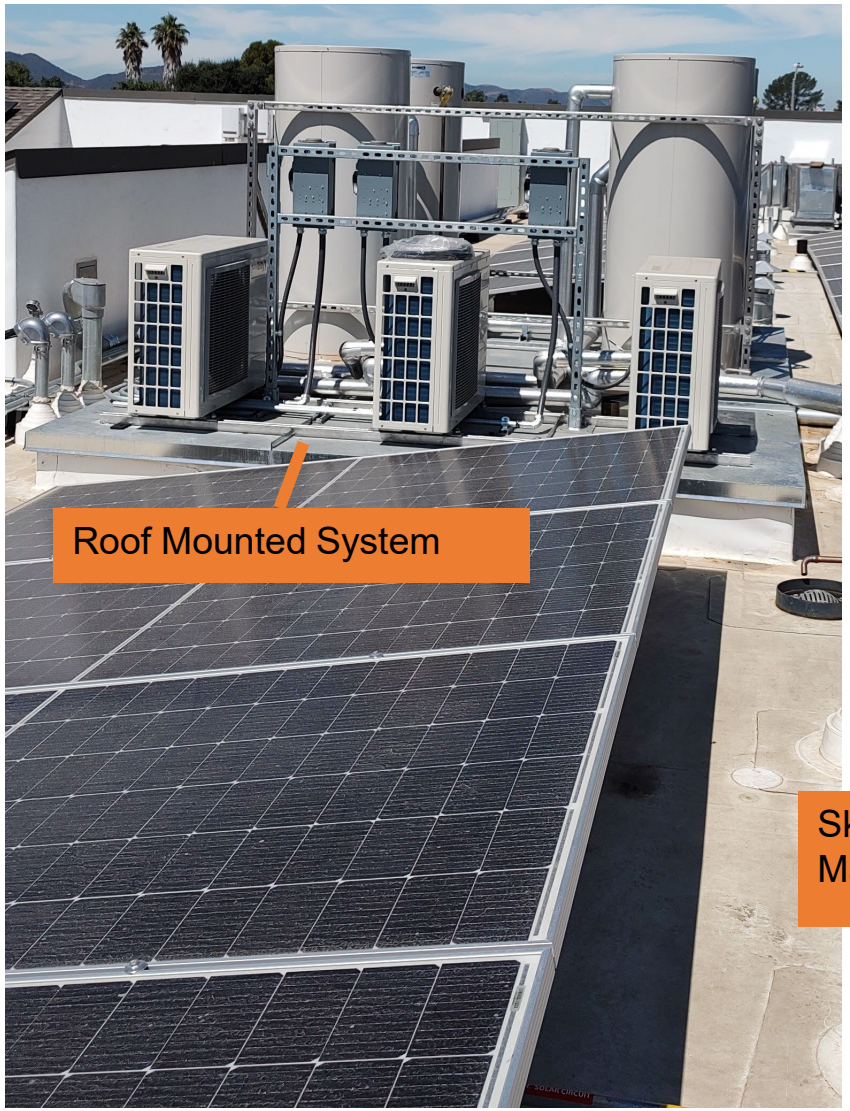
Aegis A -- Lync by Watts Large-Scale Commercial

Sanden – Multifamily – Grouped or Single Split System

Lochinvar Commercial Scale

Nyle –Industrial or Large Central Systems

Example of Split-Hydronic Heat Pump Water Heater System



Project: Harry's House – Santa Barbara County

Commercial Kitchen Defined

- KITCHEN, FULL-SERVICE COMMERCIAL is a kitchen dedicated to an establishment that offers table service by waitstaff.
- KITCHEN, INSTITUTIONAL COMMERCIAL is a kitchen dedicated to a foodservice establishment that provides meals at institutions including schools, colleges and universities, hospitals, correctional facilities, private cafeterias, nursing homes, and other buildings or structures in which care or supervision is provided to occupants.
- KITCHEN, QUICK-SERVICE COMMERCIAL is a kitchen dedicated to an establishment primarily engaged in providing fast food, fast casual, or limited services. Food and drink may be consumed on premises, taken out, or delivered to the customer's location.

Institutional Kitchen –Senior Living

All Occupancies –Equipment and Building Components

Under 2022

Increased HVAC Efficiencies:

- Various cooling systems
- Cooling towers
- Furnaces
- Boilers

New Tables for:

- Dedicated Outdoor Air Systems (DOAS)
- Computer room units
- Heat pump and heat recovery chillers

110.1 Appliances
110.2 Space Conditioning Equipment
110.3 Water Heating
110.4 Pool and Spa
110.5 Pilot Lights
110.6 Fenestration and Doors
110.7 Air Leakage
110.8 Roofing
110.9 Lighting Controls
110.10 Solar Readiness
110.11 Power Distribution
110.12 Demand Management

Dedicated Outdoor Air System (DOAS)

Heat Pump with Waste Heat Recovery

2025 Updates Mandatory Measures

110.2 Space-Conditioning Equipment

- Some Appliance Tables Removed;
- Tables updated to meet the Federal Minimum Efficiencies;
- New Table for Heat Pump and Heat Recovery Chillers
- Updated Cooling Tower Water Quality/Properties

110.3 Service Water Heating

- Installation of Heat Pump Water Heater

110.4 Pool and Spa Systems and Equipment Installation

- Sizing
- Efficiency
- Supplementary heater and cut-on/cut-off controls
- Added: Joint Appendix JA16 –Criteria for Pool and/or Spa Heating See JA16.3 for Heat Pump Pool Heater Sizing

Marina Shores, Long Beach --Onni Group

Key Takeaway:

As part of the water-energy nexus, many of these changes improve water and energy efficiency.

2025 - New Mandatory Requirements for HPWH Installations

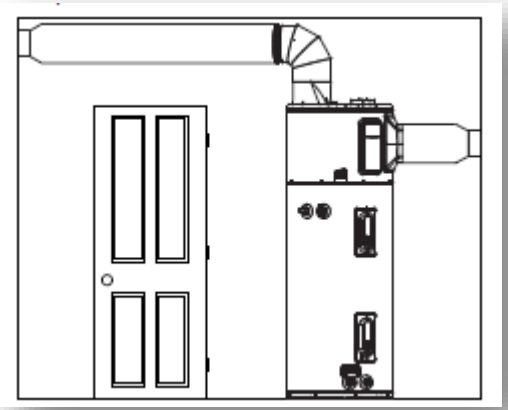
Section 110.3 Service Hot Water

110.3 (c) Installation:

1. Outlet temperature controls
2. Control for hot water distribution systems
3. Insulation
4. Water heating recirculation loops serving multiple dwelling units
5. Service water heaters in state buildings
6. Isolation valves
7. Air-Source Heat Pump Water Heaters (HPWHs)

Design Considerations – Integrated HPWH

- Integrated HPWH tanks taller than standard gas or electric units
- Requires clearances on the sides, top and back, for air flow and access to the air filters
- Operating Temp between 45 F and 90 -110F; new models between 37 F and 120 F
- Noise typically around 50 db
- System creates cold dehumidified air and condensate
- Newest models need only 450 cu ft volume, most need 750 – 1000 cu ft volume, or ducted vent kit



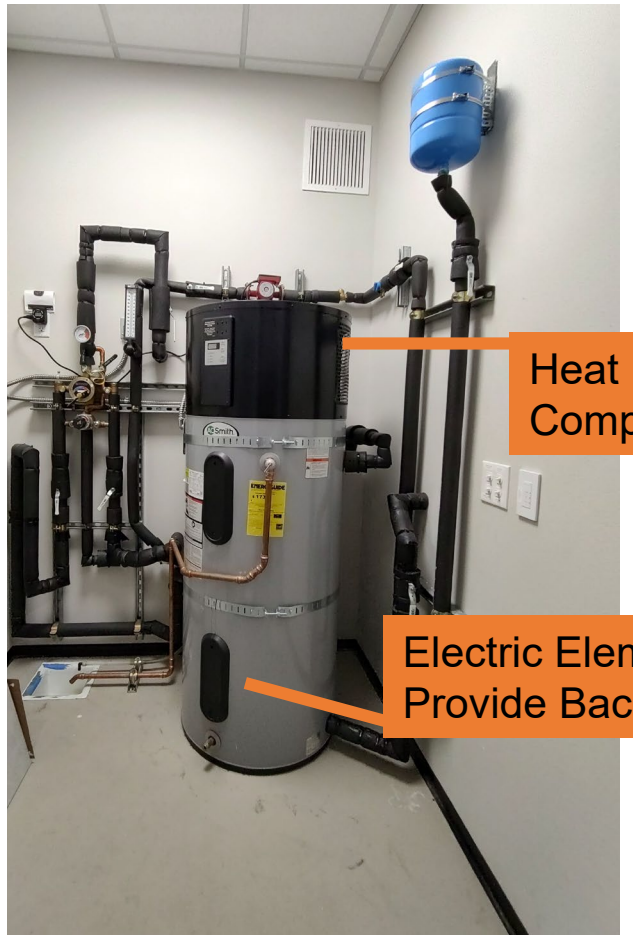
New Mandatory Requirements for HPWH

7. Air-Source Heat Pump Water Heaters (HPWHs). HPWH shall meet the following requirements:

A. Backup Heat. Backup heat is required for systems when inlet air is unconditioned, unless the compressor cut-off temperature is below the Heating Winter Median of Extremes for the closest location listed in Table 2-3 from Reference Joint Appendix JA2. Backup heat may be internal or external to the HPWH.

B. Ventilation. Consumer integrated HPWHs shall meet one of the ventilation requirements below. Minimum volume and opening size requirements shall be the sum of all HPWHs installed within the same space. Compressor capacity shall be determined using AHRI 540 Table 4 reference conditions for refrigeration with the “High” rating test point:

1. Installed using a method provided by the manufacturer to meet or exceed the level of performance provided by the ventilation requirements of Section 110.3(c)7B2 through Section 110.3(c)B4.



New Mandatory Requirements for HPWH *no Ducts*

2. For HPWH installation without ducts, the installation space shall have a volume not less than the greater of 100 cubic feet per kBtu per hour of compressor capacity, or the minimum volume provided by the manufacturer for this method; or

3. For HPWH installation without ducts, the installation space shall be vented to a communicating space via permanent openings, according to the following requirements:

i. Communicating space shall meet the minimum volume of section 110.3(c)7B2 above, minus the volume of the HPWH installation space; and

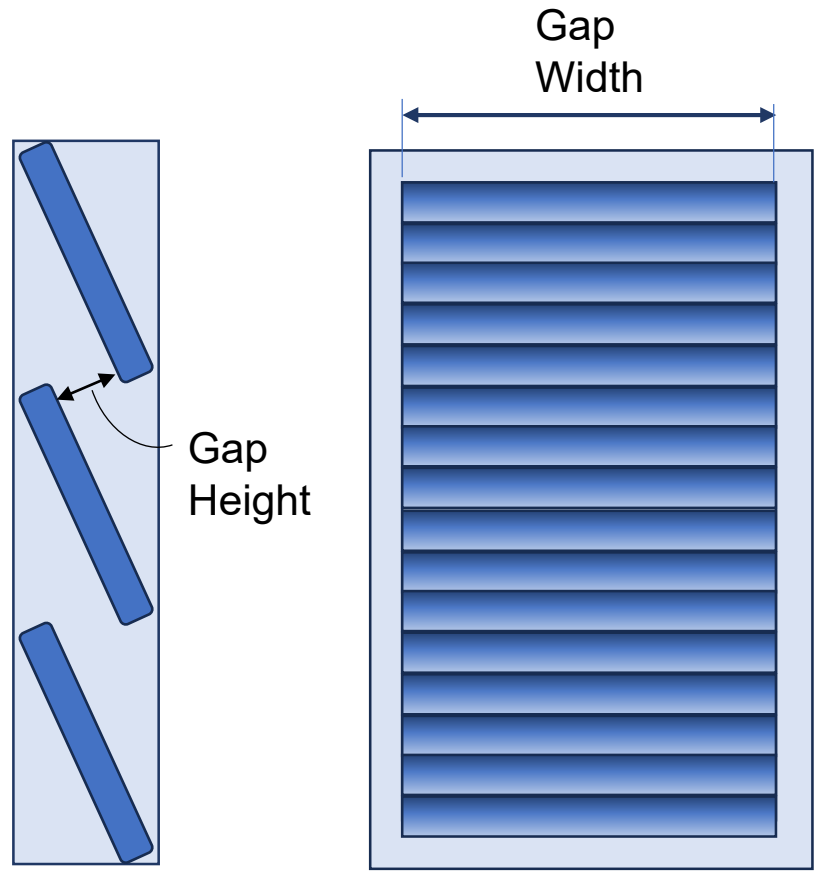
ii. Permanent openings shall consist of a single layer of fixed flat slat louvers or grilles, with a total minimum **Net Free Area (NFA)** the larger of 125 square inches plus 25 square inches per kBtu per hour of compressor capacity, or the minimum provided by the manufacturer for this method. The permanent openings shall be fully louvered doors or two openings of equal area, one in the upper half of the enclosure and one in the bottom half of the enclosure. The top of the upper opening must be 12 inches or less from the enclosure top and the bottom of the lower vent must be 12 inches or less from the enclosure bottom; or

Note:
4200 Btu/h or 4.2 kBtu/h compressor capacity is common for many residential units, i.e. 40-80 gal.

NFA = 125 sq in + 25 sq in per kBtu/h of compressor capacity or manufacturer specifications, whichever is larger.

Sidebar: New Definition –Net Free Area (NFA)

- NET FREE AREA (NFA) is the total unobstructed area within the air gaps between louver and grille slats in a vent, allowing the passage of air. The narrowest distance between two slats, perpendicular to the surface of both slats is the air gap height. The narrowest width of the gap is the air gap width.
- The NFA is the air gap height multiplied by the air gap width multiplied by the total number of air gaps between slats in the vent.



New Mandatory Requirements for HPWH *with Ducts*

4. **For HPWH installations with ducts**, the following requirements shall be met:

   i. The space joined to the installation space via ducts shall meet the minimum volume of section 110.3(c)7B2 above, minus the volume of the HPWH installation space; and

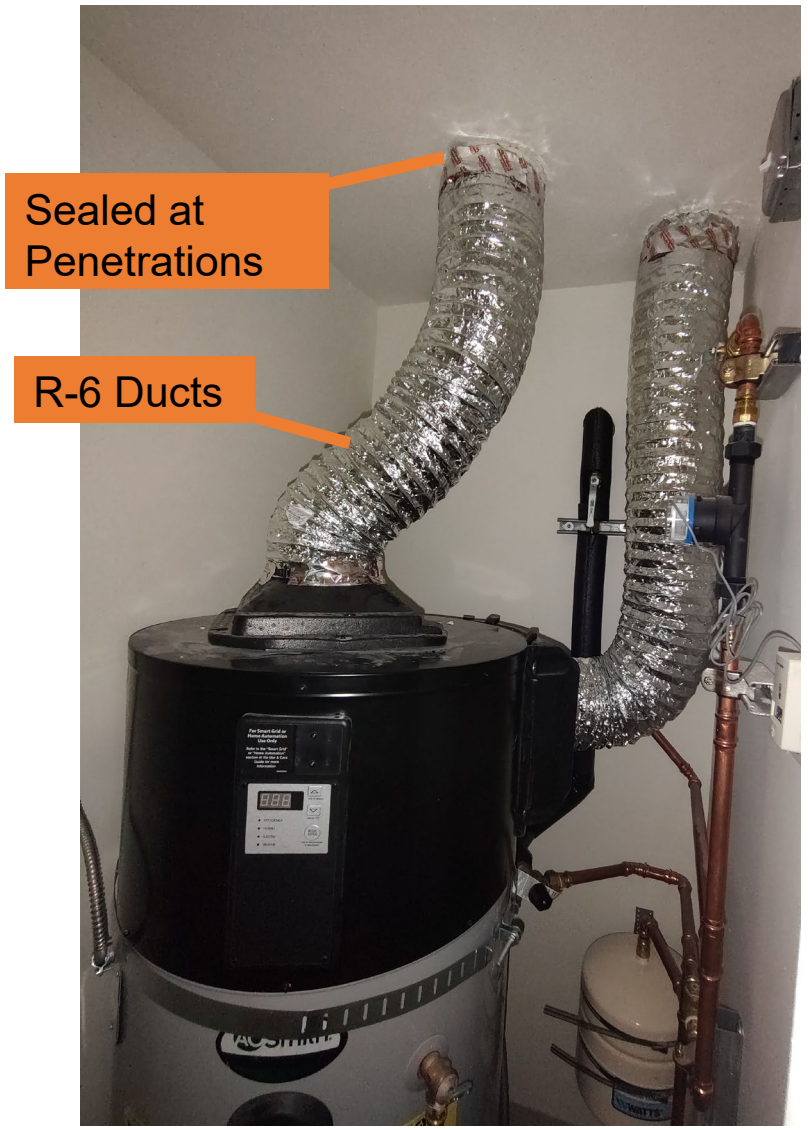
   ii. All duct connections and building penetrations shall be sealed; and

   iii. Exhaust air ducts and all ducts which cross pressure boundaries shall be insulated to minimum of R-6; and

   iv. Where only the HPWH inlet or outlet is ducted, installation space shall include permanent openings which consist of a single layer of fixed flat slat louvers or grilles in the bottom half of the room, and/or a door undercut. With a ducted inlet, the minimum NFA shall be equal to the cross-sectional area of the duct. With a ducted exhaust, the minimum NFA shall be the larger of 20 square inches or the minimum NFA provided by the manufacturer for this method; and

   v. Where the inlet and outlet ducts both terminate within the same pressure boundary, airflow from the termination points shall be diverted away from each other;

Note: Ducting only the inlet or the exhaust across the pressure boundary could interfere with balanced ventilation systems. This should be considered when specifying HPWH location and ventilation method.



Fenestration

- Section 110.6 Lists the max U-factor allowable
- NFRC certification of fenestration products and exterior doors other than field-fabricated
- For U-factor, SHGC, and VT:
  - NA6 formula can only be used for skylights ≤200 ft^2
  - Note: NA6 formula is no longer valid for vertical fenestration

Key Takeaway (2022 Code):
Nearly all projects will be using **NFRC** rated windows through out the building.

Under the 2025 Code: A weighted average U-factor was included under Mandatory Measure Section 120.7

Fenestration –Compliance, Installation, and Acceptance – NRCC, NRCI, and NRCA

Envelope Component Approach

CALIFORNIA ENERGY COMMISSION

CEC-NRCI-ENV-E

CERTIFICATE OF INSTALLATION

This Certificate of Installation documents the installation of envelope features, materials, components, and manufactured devices required to demonstrate compliance with Title 24, Part 6 per §10-103(a)3 for nonresidential, hotel/motel and high-rise residential occupancies.

Project Name:	Enforcement Agency:
Dwelling Address:	Permit Number:
City and Zip Code:	Permit Application Date:

A. GENERAL INFORMATION

01	Project Location (city):		05	Authority Having Jurisdiction:	
02	Zip Code:		06	Building Permit #:	
03	Date of Permit Set used for construction:		07	Date of As-built Set:	
04	Name of Permit Set used for construction:		08	Name of As-built Set:	

B. INSTALLER SCOPE

This table indicates construction systems and materials documented on this Certificate of Installation.

01 Roofs		02 Walls		03 Fenestration		04 Doors		05 Floors	
□	Above Deck Insulation	□	Assembly type	□	Vertical/ Glazed Doors	□	New solid doors	□	Assembly type
□	Below Deck Insulation	□	Insulation	□	Skylights			□	Insulation
□	Surface Material								

CALIFORNIA ENERGY COMMISSION **FENESTRATION ACCEPTANCE** 2022-CEC-NRCA-ENV-02-F

Project Name and Address	Authority Having Jurisdiction
Name:	Enforcement Agency:
Address:	
City, Zip:	

Building: | Floor:

☐ Construction inspection co
☐ Does not comply

Intent:	Each fenestr… California En… performance… 111. The lab… enforcement… Fenestration… thermal perf… matches the… plans. A copy… given to the…
Responsible Party	The responsi… a) Verify… and C… appro… b) For nc… coeffi… fenest…

INSTALLER AND INSPECTOR QUICK-REFERENCE:
2022 NRCA-ENV-02-F
Fenestration Acceptance

Purpose and Scope of the Test

This test is to verify that an NFRC Label Certificate or the California Energy Commission (CEC) Fenestration Certificate (NRCC-ENV-E) is provided for each site-built fenestration product being installed. These certificates identify the thermal performance of the fenestration product (e.g., U-factor, SHGC, and VT).
This test also verifies that the thermal performance of installed fenestration products matches the label certificate, energy compliance documentation, and plan specifications.

Test trigger

This test is required for newly installed site-built fenestration, window film, and dynamic glazing in new construction, additions, and alterations for nonresidential, high-rise residential, and hotel/motel buildings.

Relevant Energy Code References and Required Compliance Documents

Title 24, Part 6 of the California Building Code, Building Energy Efficiency Standards (Energy Code) sections 110.6, 140.3(a)5, 141.0(b)2A; NA7.4.1, NA7.4.2, NA7.4.3; NRCC-ENV-E Table K

Who Can Perform the Test

There are no restrictions.

Required Tools

…t visually verifies products are installed correctly, and according to …ations, and does not require special instrumentation.

…ed Time to Complete Test

…ction inspection: 0.25-0.5 hours (per fenestration/window film/dynamic

NRCI-ENV-E (Installation) is applicable to Opaque Envelope, Daylighting, and Fenestration.
NRCA-ENV-02-F (Acceptance) is the only applicable to the Fenestration

All Occupancies –Equipment and Building Components

Reminders:

- Insulation requirements for Refrigerated Warehouses
- Envelope, HVAC, lighting for Controlled Environment Horticulture

See 120.6 Covered Processes

New for 2025:

- Section 120.1 –Updated
- Section 120.6 –Added ‘Electric Ready’ for Commercial Kitchens
- Section 120.7 –Added Scope and renamed to ‘Building Envelope’

120.1 Ventilation and Indoor Air Quality

120.2 Controls for Space Conditioning

120.3 Pipe Insulation

120.4 Air Distribution Ducts

120.5 Mechanical Systems Acceptance

120.6 Covered Processes

Building Envelope

120.7 ~~Insulation Requirements~~

120.8 Building Commissioning

120.9 Commercial Boilers

120.10 Solar Readiness

2025 Energy Code: Increases the minimum PPE from 1.9 to 2.3 micromoles per joule.

Section 120.1 – Ventilation and Indoor Air Quality

- Exhaust Ventilation Rates –New categories added for Veterinarian facilities
- Outside Air (OA) Ventilation Rates –Minor variation in the way OA is calculated
- Airstream/Sources Classification –Two added categories:
  - Paint spray booths - Class 4
  - Refrigerating machinery rooms - Class 3

Small Animal Holding

New Veterinary Categories for Required Exhaust Rates

Excerpt:

Table 120.1-B – Minimum Exhaust Rates [ASHRAE 62.1: Table 6.-25]

Occupancy Category	Exhaust Rate, cfm/unit	Exhaust Rate, cfm/ft^2	Air Class	Notes
Animal imaging(MRI/CT/PET)	-	0.9	3	-
Animal operating rooms	-	3.00	3	-
Animal postoperative recovery room	-	1.5	3	-
Animal preparation rooms	-	1.5	3	-
Animal procedure room	-	2.25	3	-
Animal surgery scrub	-	1.50	3	-
Large-animal holding room	-	2.25	3	-
Animal Necropsy	-	2.25	3	-
Small-animal-cage room (static cages)	-	2.25	3	-
Small-animal-cage room (ventilated cages)	-	1.50	3	-

Under 2025 Code, Animal occupancy types were added, other occupancies remained relatively unchanged.

Updated Ventilation Rates –Outdoor Air (OA)

Updated Ventilation Zone (Vz) Formula:

Vz (cfm) = *larger of* **Rp x Pz** or **Ra x Az**

Where:

Rp = 15 cfm of OA per person

Pz = Expected number of people*

Ra = Area-based Min Ventilation (Table.1-A)

Az = Net occupiable floor area

*__For spaces without fixed seating__, the expected number of occupants shall be the expected number specified by the building designer or the default occupancy density in Table 120.1-A times the occupiable floor area of the zone, whichever is greater.

*__For spaces with fixed seating__, the expected number of occupants shall be determined in accordance with the California Building Code Section 1004.6.

TABLE 120.1-A– Continued Minimum Ventilation Rates

Occupancy Category - *Residential*	Minimum Occupant Load Density (persons / 1000 ft²) ~~Total Outdoor Airflow Rate[1] R_t cfm/ft²~~	Area-based Minimum Ventilation ~~Min Ventilation Air Rate for DCV~~ R_a (cfm/ft²)	Air Class	Notes
Common corridors	~~0.15~~5	0.15	1	F

Note: The minimum occupant density is one half of the maximum occupant load assumed for egress purposes in the CBC.

Example: 2000 sf of Res Common Corridor

Vz = **Rp x Pz** =15cfm (5/1000sf) (2000sf)
= 150cfm

or

Vz= **Ra x Az** =0.15cfm/sf (2000sf) = 300cfm

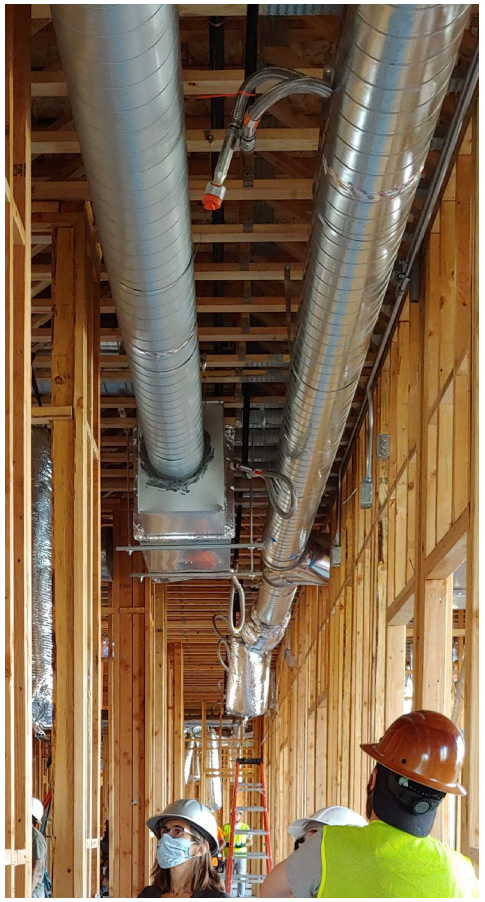
Duct Leakage Testing

New duct systems meeting the following must be "~~**HERS**~~" tested to verify no more than **6% leakage per NA7.5.3**:

- Provides conditioned air to an occupiable space for a constant volume, single zone space conditioning system
- Serves <5,000 ft^2 of CFA
- Have more than 25% of ducts in unconditioned space or outdoors

Exemptions:

- Healthcare facilities
- New duct systems not subject to testing under Section 120.4(g)1 shall instead meet the duct leakage testing requirements of CMC 603.10.1



Under 2025 Code - Reference Appendices:

- Section NA7.5.3 has been updated.
- NA7.5.3 procedures shall be used by installers, **ATTs**, and others who are required to perform acceptance testing of air distribution systems

2022 Code –Duct Leakage Verification: NRCV-MCH-04-H

Nonresidential Certificates of Verification (NRCV) are to demonstrate compliance with HERS verification

STATE OF CALIFORNIA
DUCT LEAKAGE DIAGNOSTIC TEST
CEC-NRCV-MCH-04-H (Revised 01/19) CALIFORNIA ENERGY COMMISSION

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

A. System Information		
01	Space Conditioning System Identification or Name	
02	Space Conditioning System Location or Area Served	
03	Indoor Unit Name	
04	Verified Low Leakage Air-Handling Unit Credit from NRCC-PRF-01-E	
05	Duct System Compliance Category	

B. Duct Leakage Diagnostic Test - MCH-04a - Completely New Duct System		
01	Condenser Nominal Cooling Capacity (ton)	
02	Heating Capacity (kBtu/h)	
03	Leakage Factor	
04	Air-Handling Unit Airflow (AHU Airflow) Determination Method	
05	Calculated Target Allowable Duct Leakage Rate (cfm25)	
06	Actual Duct Leakage Rate from Leakage Test Measurement (cfm25)	
07	Compliance Statement:	

C. Additional Requirements for Compliance		
01	System was tested in its normal operation condition.	
02	All supply and return register boots sealed to the surrounding material.	
03	Cloth backed rubber adhesive duct tape may not be used as the primary air sealing method for duct connections.	
04	All connection points between the air handler and the supply and return plenums are completely sealed.	
05	Verification Status:	☐ Pass - all applicable requirements are met; or ☐ Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or ☐ All N/A - This entire table is not applicable

Duct Leakage Testing Equipment: Calibrated Fan Flowmeter

NRCA-MCH-04-A was Established with an Acceptance Test Technician (ATT) in Mind

CALIFORNIA ENERGY COMMISSION **DUCT LEAKAGE** 2022-CEC-NRCA-MCH-04-A

Project Name and Address	Authority Having Jurisdiction
Name: Project Name	Enforcement Agency: Agency
Address: Project Address	Permit Number: Permit Number
City, Zip: City, Zip Code	Permit Application Date: Date

Building: Enter Value	Floor: Enter Value	Room: Enter Value	Control/tag: Value

☐ Construction inspection and functional testing comply ☐ Does not comply	Date Submitted to AHJ: Date

Intent:	Submit one Certificate of Acceptance testing duct leakage rate for each newly installed, repaired, or altered heating, ventilating or air conditioning (HVAC) duct system. Either an NRCC-MCH-E for nonresidential construction that is completed and approved by the authority having jurisdiction or an LMCC-MCH-E for multifamily construction that is registered with a CEC approved HERS data registry is required prior to beginning this acceptance test. Submit one Certificate of Acceptance for each system that must demonstrate compliance. Reference: §120.4(g), 141.0(b)2D, 141.0(b)2E, §160.3(c)2Hi, §160.3(b)5, §180.2(b)2Bii, §180.2(b)2Biii, and NA7.5.3. NOTE: Only ATT certified technicians my perform this acceptance test. HERS rater verification is permitted at the discretion of the project owner and authority having jurisdiction.

Table A: Construction Inspection
Prior to functional testing, verify and document all of the following

Step	Entry	Item	Code Reference
1.0	☐ Pass ☐ Fail	Confirm access to design drawings, cut-sheets, NRCC-MCH-E, approved by the authority having jurisdiction	§10-103(a)2A
2.0	No Entry	System Installation Type (Select **one** of Steps 2.1, 2.2 or 2.3)	N/A
2.1, or	☐	Qualifying newly constructed system	§120.4(g)1 §160.3(c)2Hi
2.2, or	☐	Qualifying altered duct systems	§141.0(b)2D §180.2(b)2Bii
2.3	☐	Qualifying altered space-conditioning systems	§141.0(b)2E §141.0(b)2Biii
3.0	No Entry	System operational capacity	N/A
3.1, or	Enter Value	Condenser Nominal Cooling Capacity (ton)	NA2.1.4.1
3.2	Enter Value	If heating only; Heating Capacity (kBtu/h)	NA2.1.4.1

INSTALLER and INSPECTOR QUICK-REFERENCE: 2022 NRCA-MCH-04-A Air Distribution System Acceptance Testing

Purpose and Scope of the Test

This test verifies all duct work associated with all nonexempt constant volume, single-zone HVAC units (i.e., air conditioners, heat pumps, and furnaces) meet the material, installation, insulation R-values, and leakage requirements specified by the Energy Code.

Test trigger

This test is only for single-zone units serving less than 5,000 ft² of floor area where 25 percent or more of the duct surface area is in one of the following spaces:

- Outdoors.
- In a space directly under a roof where the U-factor of the roof is greater than the U-factor of the ceiling.
- In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces.
- In an unconditioned crawlspace.
- In other unconditioned spaces.

Within these criteria, this test applies to both new duct systems and existing duct systems that are either being extended, or the space conditioning system is altered by the installation or replacement of space conditioning equipment. This includes the replacement of the air handler, outdoor condensing unit of a split-system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger.

Relevant Energy Code References and Required Compliance Documents

Title 24, Part 6 of the California Building Code, Building Energy Efficiency Standards (Energy Code) sections 120.4, 141.0(b)2D, 140(b)2E, 140.4(l), 141.0(b)2D, 141.0(b)2E, 160.3(c)2Hi, 160.3(b)5, 180.2(b)2Bii, 180.2(b)2Biii; NA2.1, NA7.5.3 and NRCC-MCH-E Table L.

Who Can Perform the Test

This test is intended to be performed by an acceptance test technician certified by a CEC-approved Acceptance Test Technician Certification Provider, using compliance document NRCA-MCH-04-A. At the discretion of the AHJ, a sampling of the units may be tested by the installing technician, and certified by a HERS rater.

Required Tools

- Performance of this test will require measuring duct leakage equipment:
  - Fan flowmeter (a fan with a calibrated orifice used to pressurize the

New Section –Electric Ready for Commercial Kitchens

Commercial Kitchens shall meet the following requirements:

1. *Quick-service commercial kitchens* and *institutional commercial kitchens* shall include a dedicated branch circuit wiring and outlet that would be accessible to cookline appliances and shall meet all of the following requirements:

a. The branch circuit conductors shall be rated at 50 amps minimum.

b. The electrical service panel shall have a minimum capacity of 800 connected amps.

2. The electrical service panel shall be sized to accommodate an additional either 208v or 240v 50-amp breaker.

EXCEPTION 1 to Section 120.6(k): healthcare facilities.

EXCEPTION 2 to Section 120.6(k): all-electric commercial kitchens.

Southbend

Model P36T-III shown

For use with induction safe cookware ONLY.

Induction Electrical Data	Amps*	
Elements	1 Phase	3 Phase
(6) 3.5 KW Heating Elements Total 21 KW	88	51
P36N-III with TVES/10SC	*Reference Electric TruVection Spec Sheet	

Section 120.7 –Mandatory Measures for Building Envelopes

(a) Roof/Ceiling Insulation

(b) Wall Insulation

(c) Floor and Soffit Insulation

(d) Exterior Windows

(e) Vestibules

Exception to Section 120.7: A dedicated building used solely as a data center that has a total covered process load exceeding 750 kW.

Key Takeaway:

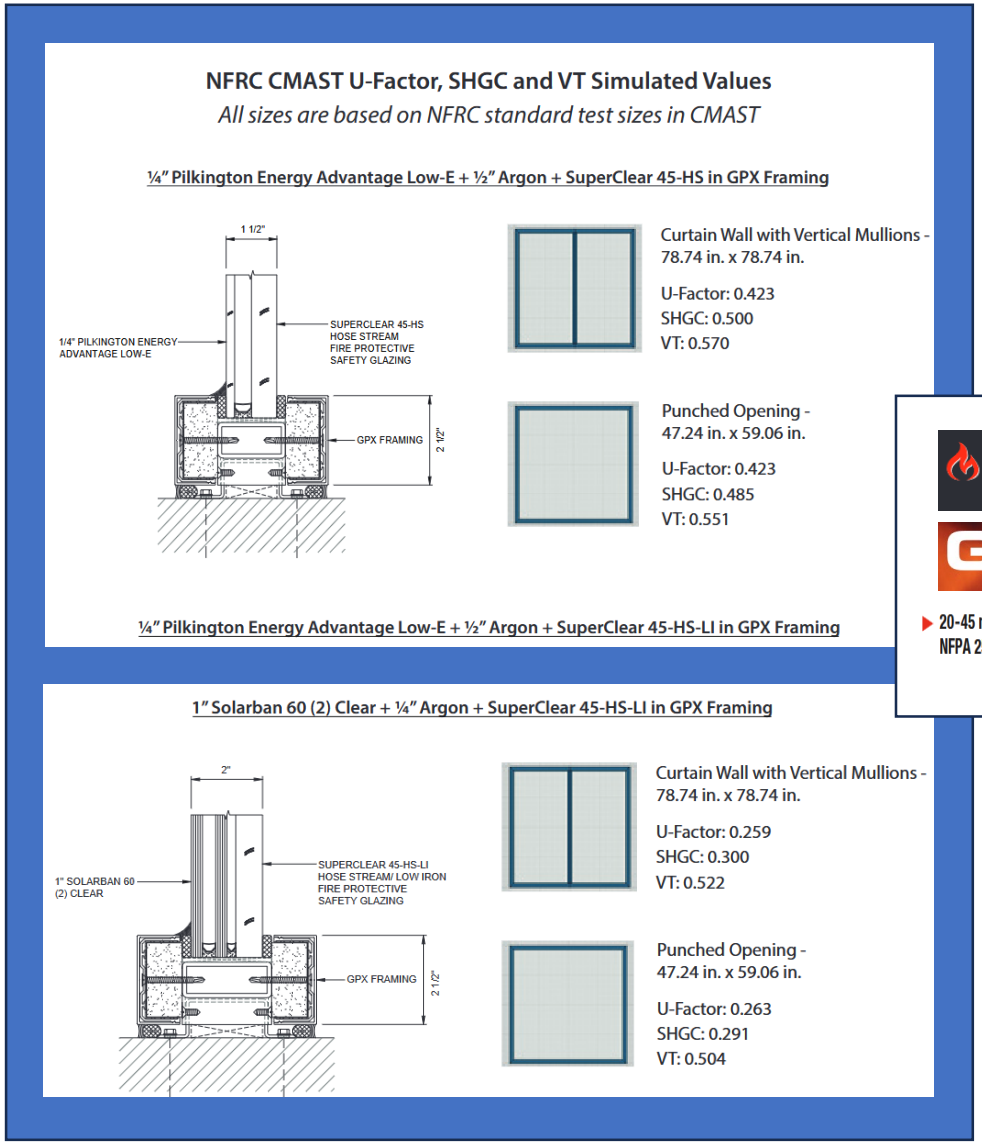
- (a)-(c) Minimum Insulation values (U-factors) did not change
- (d) Vertical fenestration assemblies: Weighted average U-factor 0.47 or less
- (e) Public entrance vestibules required for new construction –exceptions and qualifiers apply

(d) Exterior Windows

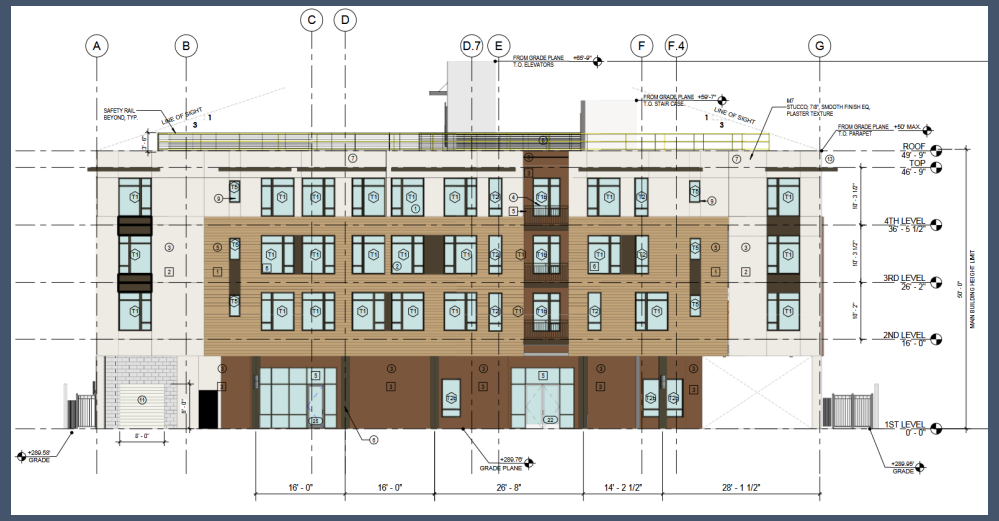
Code Language:

(d) Exterior Windows. Vertical fenestration assemblies shall have an area weighted average U-factor no greater than 0.47.

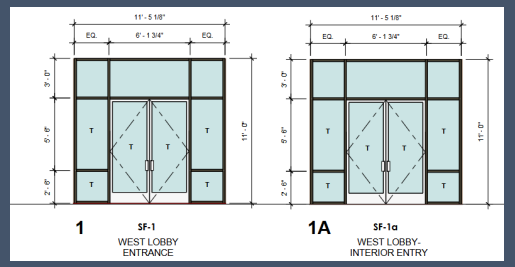
Exception to Section 120.7(d): Fenestration installed in buildings meeting Part 7 of the California Building Code, California Wildland-Urban Interface Code, and where the building is located in Fire Hazard Severity Zones or Wildland-Urban Interface (WUI) Fire Areas as designated by the local enforcement agency.



New Construction Public Entrances–Vestibules Required for Assembly, Business, Educational, Institutional, and Mercantile



Mixed Use Building



Vestibule entry is equipped with self-closing doors opening into and out of the vestibule.

Code Language:

(e) Vestibules. Public entrances in newly constructed buildings of occupancy types A, B, E, I, and M **shall include an enclosed vestibule** meeting the applicable requirements of Items 1 and 2 below:

1. All doors opening into and out of the vestibule shall be equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any main entrance doors adjacent to revolving doors.

2. Where provided, the heating system for heated vestibules and air curtains with integral heating shall be provided with controls configured to shut off the source of heating when the outdoor air temperature is greater than 45°F. Vestibules heating and cooling systems shall be controlled by a thermostat located in the vestibule configured to limit heating to a temperature not greater than 60°F and cooling to a temperature not less than 85°F.

Mandatory Measure-NEW 2025 120.7(e)

EXCEPTIONS to Section 120.7(e): Vestibules are not required for the following:

1. Doors **not intended to be used by the public**, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.

2. Doors opening directly from a **sleeping unit or dwelling unit**.

3. Doors that **open directly from a space less than 3,000 square feet** in area.

4. **Revolving doors** installed where a public entrance to a newly constructed building is required.

5. Doors used primarily to facilitate **vehicular movement** or material handling and adjacent personnel doors.

6. Doors that have an **air curtain** with a velocity of not less than 6.56 feet per second at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer's instructions. Manual or automatic controls shall be provided that operate the air curtain with the opening and closing of the door.

7. Public entrances in buildings that are located in **Climate Zones 2 through 13 where the building is less than four stories above grade and less than 10,000 square feet** in of gross conditioned floor area.

8. Buildings with building plans that have been submitted to the local planning department before the effective date of the 2025 Building Energy Efficiency Standards, where compliance with the vestibules requirements of Section 120.7(e) would require a resubmittal for approval.

Recommendation:

Read the Exemptions to 120.7(e) first, especially no. 7 concerning our 3C-REN region.

Commissioning Required for:

- Non-Residential Occupancies
  - Including Non-Res portions of Hotel/Motel and Highrise Multifamily
  - Except Healthcare which must comply with Title 24, Part 1 Chapter 7.
- New Construction
  - Includes INITIAL interiors build-out of shell construction
- 10,000 SF Trigger:
  - **“Full” commissioning** is required for conditioned floor area (CFA) of **10,000 SF or greater**
  - **“Cx-lite”** is required for CFA of **less than 10,000 SF**

Note:
This is in addition to any CALGreen commissioning requirements under Title 24, Part 11, Section 5.410.2, 5.410.4, and subsections.

Commissioning Documentation as part of 'Title 24'

2019 Code Fillable Form – OLD, offline .pdf

STATE OF CALIFORNIA

Nonresidential Building Commissioning

NRCC-CXR-E (Created 12/19) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE NRCC-CXR-E

This document is used to demonstrate compliance with mandatory commissioning requirements in §120.8 for nonresidential buildings and hotel/motel or high-rise residential buildings with nonresidential spaces. This document does not demonstrate compliance with commissioning requirements within Title 24, Part 11, which need to be documented separately if they apply.

Project Name:		Report Page:	Page 1 of 6
Project Address:		Date Prepared:	

A. GENERAL INFORMATION

01	Project Location (city)		04	Building Size (ft²)	
02	Occupancy Type		05	Nonresidential Conditioned Floor Area (ft²)	10,000 - 49,999 ft²
03	Project Type		06	HVAC System Type	

B. PROJECT SCOPE

Table Instructions: Based on project information provided in Table A, Table B indicates which commissioning related requirements apply per §120.8. Table B is not editable by the user.

Commissioning Requirements per §120.8

01	Table F: Design Review Kickoff	§120.8(d)1 and §120.8(d)2	The design review kickoff meeting establishes who will play the role of the design reviewer, the project schedule and identify owner's requirements. This meeting should be conducted during schematic design.
02	Table G: Owner's Project Requirements (OPR)	§120.8(b)	The owner's project requirements establish the owner's goals, requirements, and expections for everything related to energy consumption and operation. This should be completed during schematic design.
03	Table H: Basis of Design (BOD)	§120.8(c)	The basis of design documents the design elements such as calculations and product selections that meet the owner's project requirements and applicable regulatory requirements. This should be completed during schematic design.
04	Table I: Design Review	§120.8(d) and §120.8(e)	The design reviewer(s) reviews the construction documents for clarity, completeness, and adherence to the owner's goals. Commissioning measures must be included in the construction documents to faciliate the design review and commissioning process. For projects with ≥ 10,000 ft² of nonresidential conditioned floor area, or with complex mechanical systems, the design review is for adherence with the Owner's Project Requirements (OPR) and Basis of Design (BOD). This should be conducted during design.
05	Table J: Commissioning Plan	§120.8(f)	The commissioning plan is developed by the commissioning provider with input from the designer and defines the scope of commissioning the project. This should be drafted during design and completed during early construction.
06	Table K: Functional Performance Testing	§120.8(g)	Functional performance testing is conducted on building systems to demonstrate correct installation and operation.
07	Table L: Documentation and Training	§120.8(h)	Documentation of the operational aspects of the building shall be completed within the Systems Manual and delivered to the building owner or representative and facilities operator.
08	Table M: Commissioning Report	§120.8(i)	A complete report of commissioning process activities undertaken through the design, construction and reporting recommendations for post-construction phases of the building project shall be completed and provided to the owner or representative.

2022 Code On-Line Interview – New

Building Commissioning

Okay, let's get started documenting mandatory commissioning requirements. Completing this document may require coordination with other project team members such as the Owner or Owner's Representative, Architect, Mechanical Engineer, Lighting Designer, Plumbing Engineer, Commissioning Provider and Energy Analyst.

Which of the following occupancy types are included in your project? (Select all that apply)

Choose all that apply

Which of the following describes your project's scope?

Select one

Does this project include any of the following?

Select one

Is the building electric only?

Select one

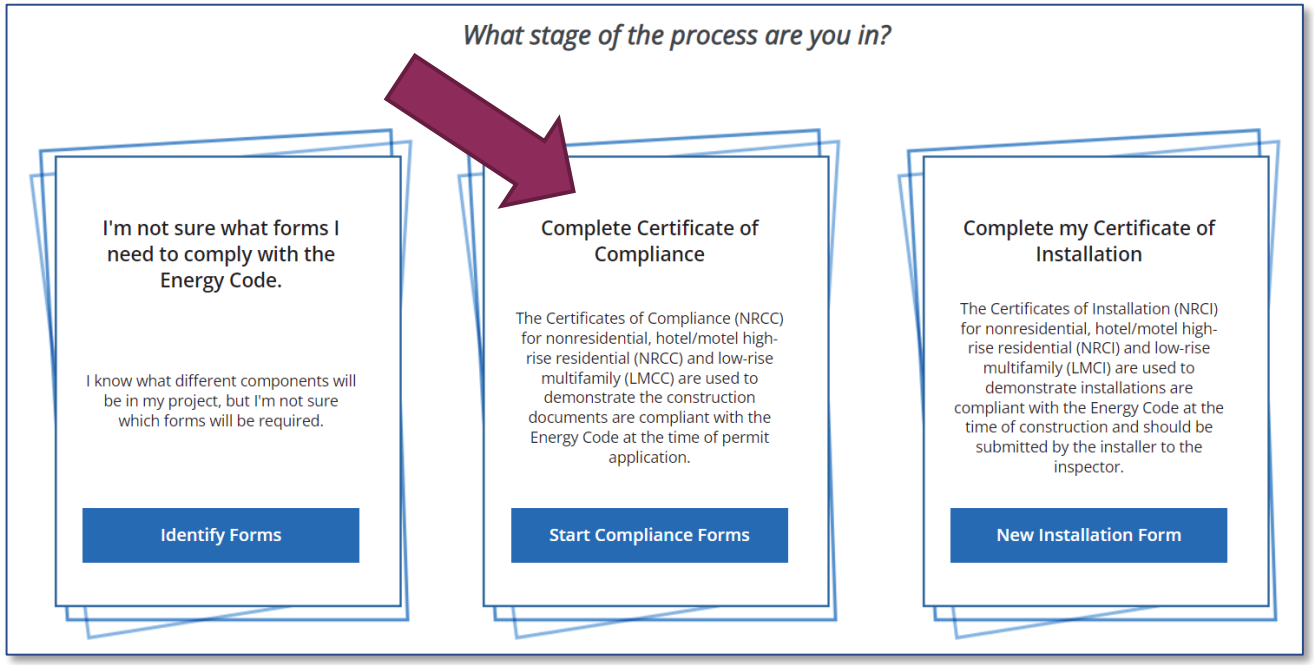
Select which fuel is available at site:

Select one

STOP! Occupancy types that are not nonresidential, hotel/motel with nonresidential occupancies, or mixed-use, and project types which are additions or alterations, are not

NRCC-CXR-E – How to Access the Commissioning Certificates

- Fill in online at www.energycodeace.com/nonresidentialforms/2022
- You have to create an account on Energy Code Ace
- Locate the 2022 Nonresidential & High-rise Multifamily forms
- Select the 2022-NRCC-CXR-E: Commissioning ‘Fill in Online’
- ‘Design Reviewer’ signs the Design Review Kick-Off and Con Docs Design Review Checklist Certificates



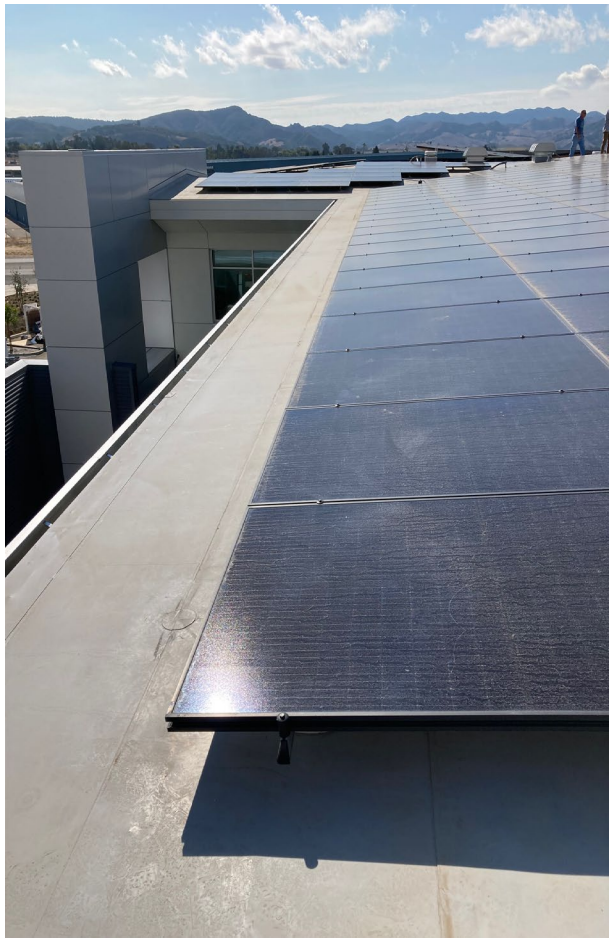
New Construction
Prescriptive and Performance

Section 140.0

- Section 140.0 –General
- Section 140.1 –Performance Approach
- Section 140.2 –Prescriptive Approach

- Nonresidential occupancies in a mixed occupancy building shall comply with nonresidential requirements in Sections 120.0 through 141.1.

140.3 Building Envelope
140.4 Space Conditioning Systems
140.5 Service Water Heating Systems
140.6 Indoor Lighting
140.7 Outdoor Lighting
140.8 Signs
140.9 Covered Processes
140.10 Photovoltaic and Battery Storage Systems



Envelope

Table 140.3-B 2022 Updates

Reminder: Separate Table 140.3-C for Guest Rooms of Hotel/Motel (High-Rise Res has been removed); and Table 140.3-D Relocatable Public School Bldgs

Lower min U-factor reqs

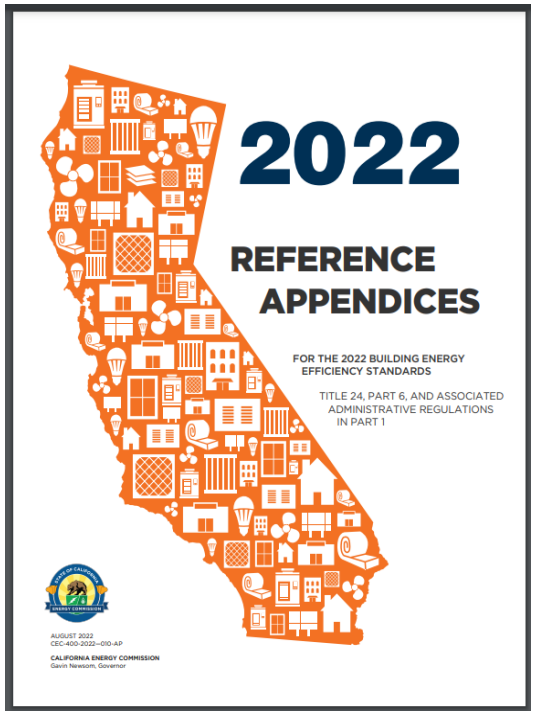
Higher min reqs

Req'd in all CZs now

				Climate Zone															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Envelope	Maximum U-factor	Roofs/ Ceilings	Metal Building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041
			Wood Framed and Other	0.034	0.034	0.034	0.034	0.034	0.049	0.049	0.049	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
		Walls	Metal Building	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
			Metal-framed	~~0.069~~ 0.060	~~0.062~~ 0.055	~~0.082~~ 0.071	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.069~~ 0.060	~~0.069~~ 0.060	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.062~~ 0.055	~~0.062~~ 0.055
			Mass Light[1]	0.196	0.170	0.278	0.227	0.440	0.440	0.440	0.440	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass Heavy[1]	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160
			Wood-framed and Other	0.095	0.059	0.110	0.059	0.102	0.110	0.110	0.102	0.059	0.059	0.045	0.059	0.059	0.059	0.042	0.059
		Floors/ Soffits	Raised Mass	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.058
			Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039
	Roofing Products	Low-sloped	Aged Solar Reflectance	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
			Thermal Emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
		Steep- Sloped	Aged Solar Reflectance	0.20	~~0.20~~ 0.25	0.20	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25	~~0.20~~ 0.25
			Thermal Emittance	0.75	~~0.75~~ 0.80	0.75	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0. 75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80	~~0.75~~ 0.80
	Air Barrier			REQ~~NR~~	REQ~~NR~~	REQ~~NR~~	REQ~~NR~~	REQ ~~NR~~	REQ ~~NR~~	~~NR~~ ~~NR~~REQ	~~NR~~ REQ	REQ ~~NR~~	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	Exterior Doors, Maximum U-factor		Non-Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50
			Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

Translation... Prescriptive U-0.060, U-0.071 and U-0.055 Nonresidential Metal Stud Wall Assemblies

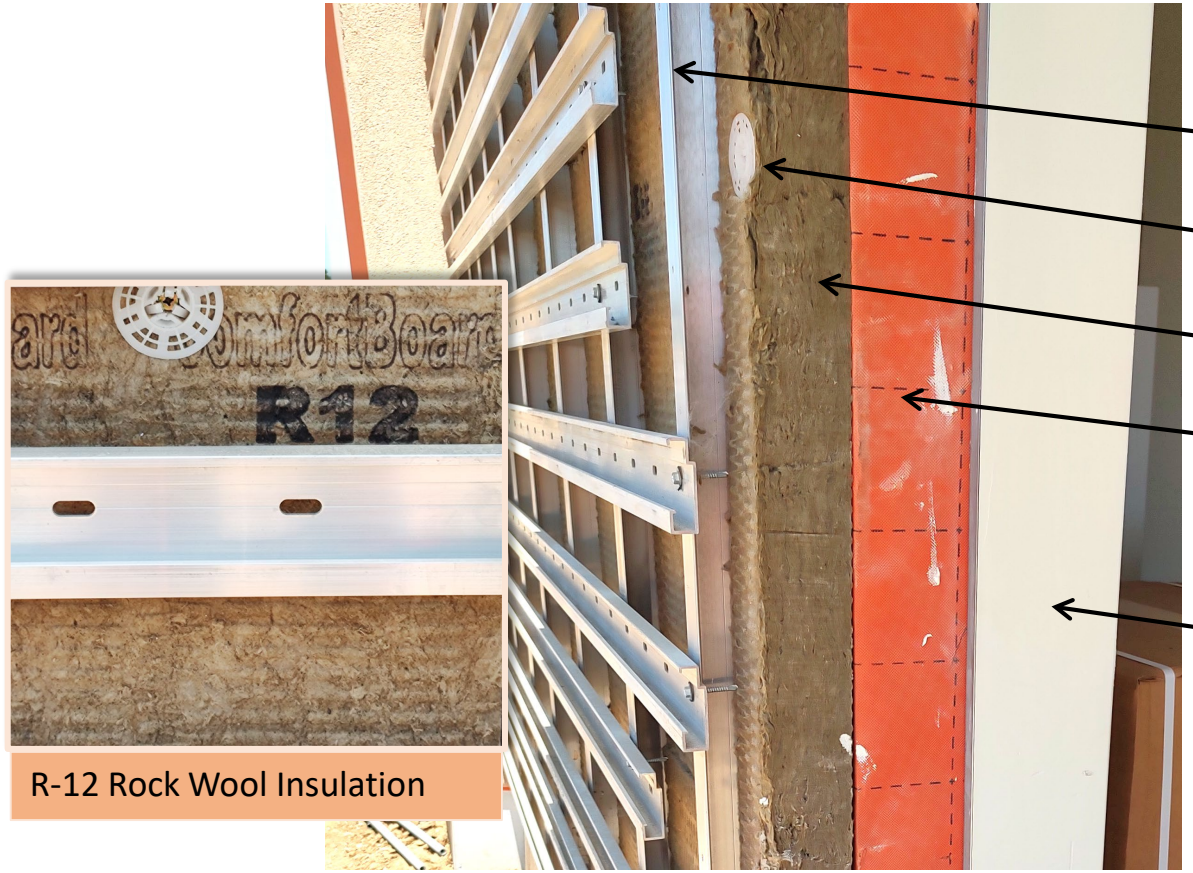
Metal Stud	Cavity Insulation	Exterior Insulation	U-Factor	Climate Zone
2x4 @ 16" o.c.	R-13 -high density batt	R-10	0.068	3
	R-13 or R-15 batt or cellulose	R-12	0.060	1, 3, 6, 7
	R-11 –batt or cellulose	R-14	0.054	All CZ's
2x6 @ 16" o.c.	R-19 -low density batt	R-10	0.065	3
	R-21 - high density batt or dense-packed cellulose	R-10	0.064	3
2x4 @ 24" o.c.	R-13 -high density batt	R-14	0.053	All CZ
2x6 @ 24" o.c.	R-19 -low density batt	R-8	0.071	3
	R-19 -low density batt	R-12	0.055	All CZ



Mandatory Minimum Metal-Framed Wall is a weighted average U-factor of **U-0.151** (i.e. R-8 continuous insulation, or R-13 cavity insulation and 1/2" of continuous rigid insulation of R-2).

Prescriptive Metal Framed Wall Example

Allowable Component in Climate Zones 1, 3, 6, 7
(For the other climate zones, increase the CI to R-14)



R-12 Rock Wool Insulation

Rain Screen – Panelized Cladding System

(CI) Fastener –with large plastic washer

R-12 Exterior Continuous Insulation (CI)

Self-adhering WRB Air Barrier – Adhered to sheathing and wrapped into door and window jams

Pre-primed Jam Extension

Not visible:
2x studs with cavity filled insulation

Prescriptive Mass Heavy Wall (8” NW CMU Solid Grout) Example

An allowable assembly in all Climate Zones.

- R-5 CI, U-0.155 covers all CZ.
- For CZ 2-5 and 10, add a layer of sheetrock with or without firring strips.
- For CZ 6-9, CMU wall can be painted –2 coats of paint meet air-barrier requirements.

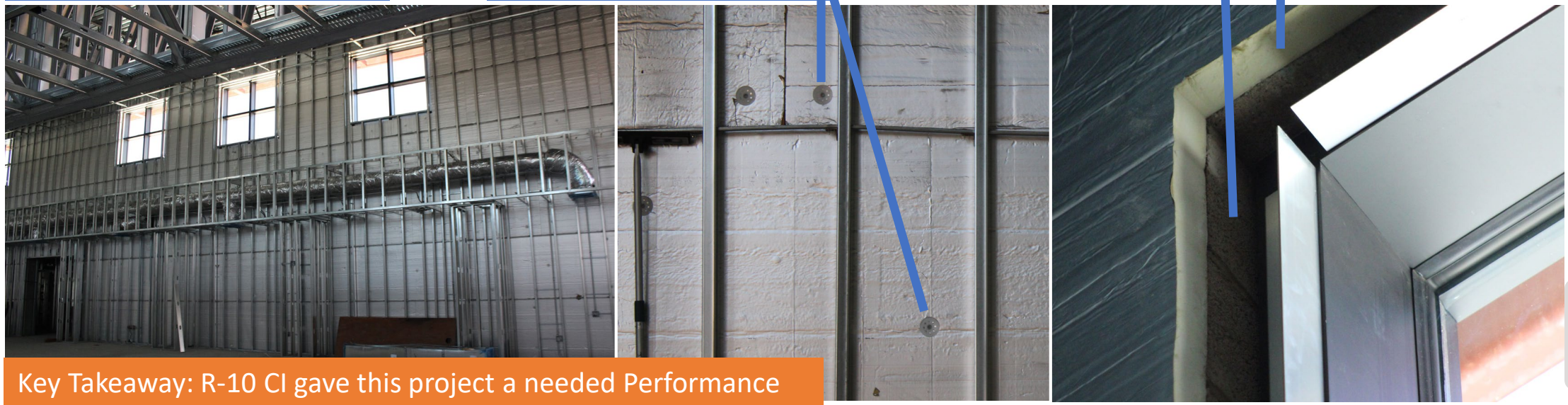
	Climate Zone															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mass Heavy[1]	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160

CMU with Interior Metal Stud

R-10 CI – Held in place with CI masonry fasteners

CMU Solid Grout

R-10 Continuous Insulation (CI)



Key Takeaway: R-10 CI gave this project a needed Performance Credit; Metal stud cavity left open for easy electrical installation.

2025 Code Prescriptive Envelope –Table 140.0-B

Envelope Feature	CZ 1	CZ 2	CZ3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Roofs and Ceilings - Metal Building Max U-Factor	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038	~~0.041~~ 0.038
Roofs and Ceilings - Wood Framed and Other Max U-Factor	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.049~~ 0.047	~~0.049~~ 0.047	~~0.049~~ 0.047	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028	~~0.034~~ 0.028
Walls - Metal Building Max U-Factor	~~0.113~~ 0.098	~~0.061~~ 0.053	~~0.113~~ 0.098	~~0.061~~ 0.053	~~0.061~~ 0.053	~~0.113~~ 0.098	~~0.113~~ 0.098	~~0.061~~ 0.053	~~0.061~~ 0.053	~~0.061~~ 0.053	~~0.061~~ 0.053	~~0.061~~ 0.053	~~0.061~~ 0.053	~~0.061~~ 0.053	~~0.057~~ 0.050	~~0.061~~ 0.053
Walls - Metal-framed Max U-Factor	0.060	0.055	0.071	0.055	0.055	0.060	0.060	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
Walls - Mass, Light[1] Max U-Factor	~~0.196~~ 0.170	~~0.170~~ 0.138	~~0.278~~ 0.227	~~0.227~~ 0.196	~~0.440~~ 0.364	~~0.440~~ 0.364	~~0.440~~ 0.364	~~0.440~~ 0.364	~~0.440~~ 0.364	~~0.170~~ 0.138	~~0.170~~ 0.138	~~0.170~~ 0.138	~~0.170~~ 0.138	~~0.170~~ 0.138	~~0.170~~ 0.138	~~0.170~~ 0.138
Walls - Mass, Heavy[1] Max U-Factor	~~0.253~~ 0.211	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	~~0.184~~ 0.160	~~0.253~~ 0.211	~~0.211~~ 0.184	~~0.184~~ 0.160	~~0.184~~ 0.160	~~0.160~~ 0.153
Walls - Wood-framed and Other Max U-Factor	~~0.095~~ 0.078	~~0.059~~ 0.053	~~0.110~~ 0.102	~~0.059~~ 0.053	~~0.102~~ 0.095	~~0.110~~ 0.102	~~0.110~~ 0.102	~~0.102~~ 0.095	~~0.059~~ 0.053	~~0.059~~ 0.053	~~0.045~~ 0.042	~~0.059~~ 0.053	~~0.059~~ 0.053	~~0.059~~ 0.053	~~0.042~~ 0.038	~~0.059~~ 0.053

Key Take Away: Roofs/Ceilings and all but Metal-framed Walls have higher insulation levels under the 2025 Code

3C REN

U-factors –Wood Wall Example

Table 4.3.1(a) – U-factors of Wood Framed Walls with installed 5/8-inch Gypsum Board[1] – 16 in. OC

		Rated R-value of Continuous Insulation[3]							
Cavity Insulation	**Nominal Framing Size**	**R-0**	**R-2**	**R-4**	**R-5**	**R-6**	**R-7**	**R-8**	**R-10**
None	Any	0.343	0.208	0.145	0.126	0.112	0.100	0.091	0.077
R-11	2x4	0.109	0.087	0.073	0.067	0.063	0.059	0.055	0.050
R-13	2x4	0.101	0.081	0.068	0.063	0.059	0.056	0.052	0.047
R-15 [2]	2x4	0.094	0.076	0.064	0.059	0.055	0.052	0.049	0.045
R-19	2x6	0.073	0.062	0.054	0.050	0.048	0.045	0.043	0.040
R-21[2]	2x6	0.068	0.058	0.050	0.047	0.045	0.041	0.040	0.038
R-22	2x6	0.071	0.061	0.053	0.050	0.047	0.044	0.042	0.039
R-19	2x8	0.064	0.056	0.050	0.047	0.044	0.042	0.040	0.038
R-22	2x8	0.060	0.052	0.046	0.044	0.042	0.040	0.038	0.036
R-25	2x8	0.056	0.049	0.043	0.041	0.039	0.037	0.036	0.034
R-30[2]	2x8	0.055	0.048	0.043	0.040	0.039	0.037	0.035	0.033

Section 140.4 Space Conditioning Systems

(a) Sizing, Equipment Selection and Type
(b) Calculations (*Rules for Sizing*)
(c) Fan Systems *(Power Allowances*)
(d) Space-Conditioning Zone Controls
(e) Economizers
(f) Supply Air Temp Reset Controls
(g) Elec Resistance Heating
(h) Heat Rejection Systems
(i) Min Chiller Efficiency
(j) Limitation of Air-Cooled Chillers
(k) Hydronic System Measures
(l) Reserved
(m) Fan Control
(n) Mechanical System Shut-off
(o) Exhaust System Transfer Air
(p) Dedicated Outside Air System (DOAS)
(q) Exhaust Air Heat Recovery
(r) DDC Controller Logic - ASHRAE Guideline 36
(s) Mechanical Heat Recovery

Under the 2025 Code:

- Section (a) System Types has expanded
- Section (r) Direct Digital Control (DDC) is new
- Section (s) Mechanical Heat Recovery is new
  - Cooling 300 Tons or greater and heating 700 kBtuh or greater
- Greater alliance with ASHRAE, for example, references to ASHRAE Guideline 36

Heat recovery flywheel for improved efficiency

Space Conditioning

140.4(a)2 For Single zone systems with direct expansion (dx) cooling ≤ 240,000 Btu/hr (i.e. 20 tons):

- School building spaces:
  - CZ 2-15: Heat pump
  - CZ 1 and 16: Dual-fuel heat pump
- Retail and Grocery building spaces
  - CZ 2-15: Heat pump
  - CZ 1 and 16: cooling capacity <65,000 Btu/hr: Furnace A/C; cooling capacity ≤ 65,000 Btu/hr: Dual-fuel heat pump
- Office, Financial Institutions and Library building spaces:
  - CZ 1-15: Heat pump
  - CZ 16: cooling capacity <65,000 Btu/hr: Furnace A/C; cooling capacity ≥ 65,000 Btu/hr: Dual-fuel heat pump
- Office Spaces within the Warehouses
  - CZ 1-16: heat pump

Key Takeaway:
Where demonstrated to be cost effective, the baseline is a heat pump.

EXCEPTION to Section 140.4(a)2: Systems utilizing recovered heat for space heating.

VRF and AWHP can be used Prescriptively with DOAS

140.4(a)3 Multi-zone space-conditioning system types.
Office and school buildings *not* covered by Section 140.(a)2:

A. Office:

i. Variable refrigerant flow (**VRF**) heat pump with heat recovery loop and dedicated outdoor air system (**DOAS**)

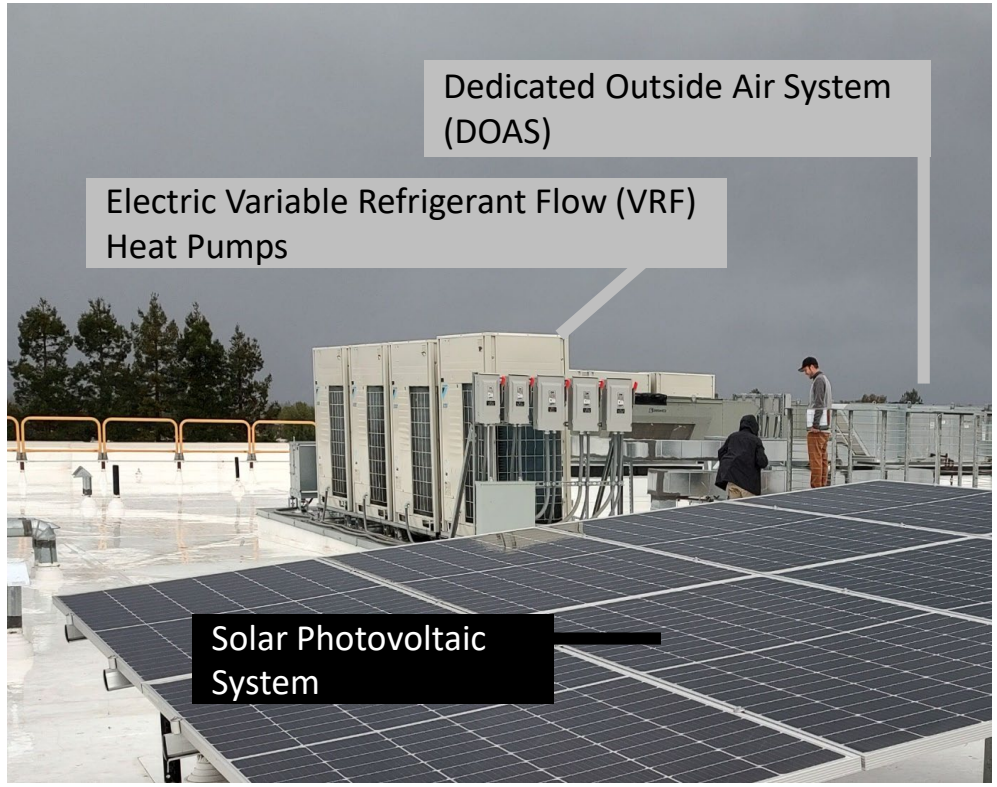
ii. Air-to-water heat pump (**AWHP**) with space-heating loop to four-pipe fan coil (**FPFC**) terminal units and a **DOAS**

iii. Air-to-water heat pump (**AWHP**) with space-heating loop, ventilation air utilizes heat recovery; and for CZ 2-4 and 6-16 use a **hydronic recirculated-air heating system**

B. School buildings:

i. Air-to-water heat pump (**AWHP**) with space-heating loop to four-pipe fan coil (**FPFC**) terminal units and a **DOAS**

Sections C – F define and list the parameters of the AWHP with space-heating loop; indoor fans; DOAS; and hydronic recirculated-air heating system.

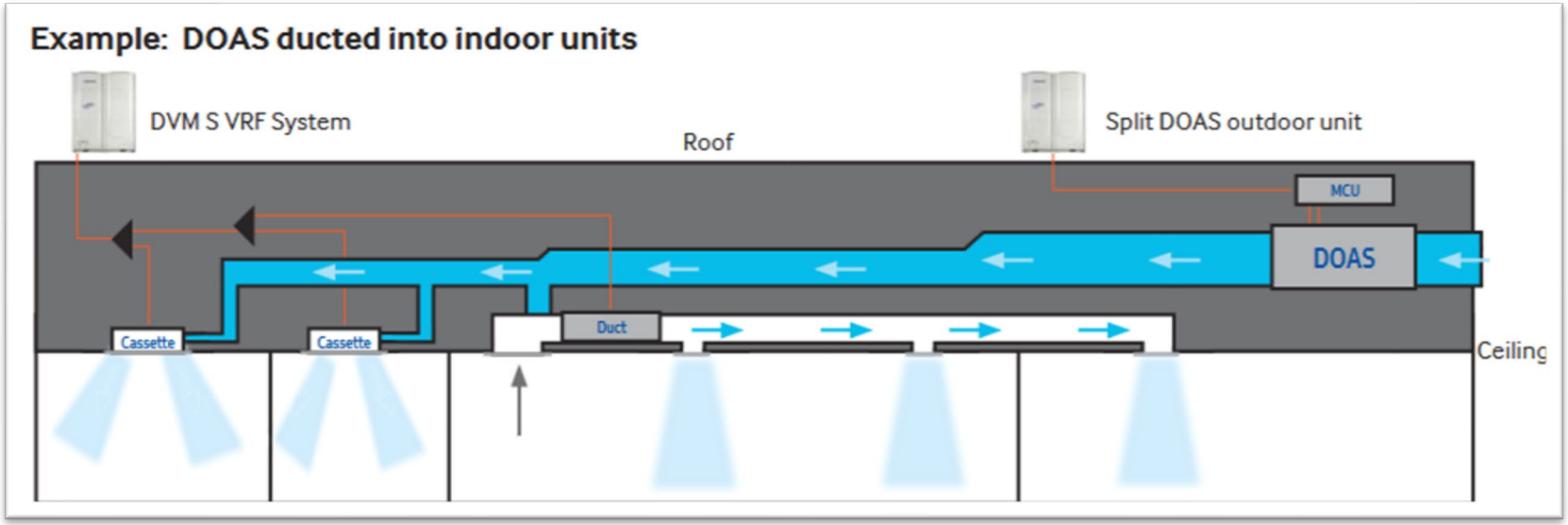


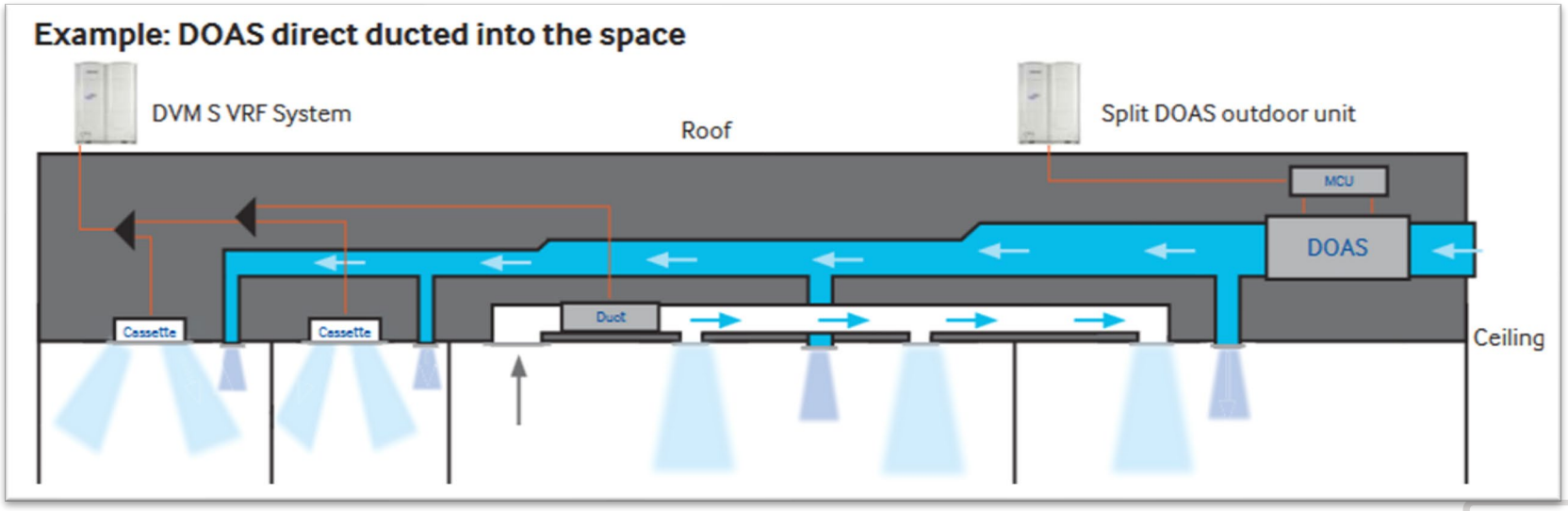
Morning Star Senior Living, San Jose, CA

Schematic of DOAS with VRF

"Back" of the outdoor unit

Winery Laboratory and Office – multi-zone VRF with ducted fan coil units





https://www.samsunghvac.com/Fresh-Access-Ventilation-Products/FA-ERV

inBALANCE™ Green Consulting

3C REN

Domestic Hot Water

Hotel/Motel

- Same requirements as multifamily Section 170.2(d) for individual or central system

Other Occupancies

- Any water heater that meets the Mandatory requirements of Sections 110.1, 110.3, 120.3
- Thermal efficiency of 90% required when a combined input rate is ≥ 1,000,000 Btu/hr, with some exceptions
- Exception: A water heating system serving an individual bathroom space may be an instantaneous electric water heater

School Buildings less than 25,000 ft^2 and under 4 stories

- CZ 2-15: a HPWH system

2025 Code language is unchanged, but…

- Referenced Mandatory requirements have changed
- Hote/Motel follows the new multifamily requirements

Residential – Single and Multifamily

Commercial – Hospitality, Retail, Schools

Solar and Battery – Highrise and Non-Residential

Occupancy Types:

- High-Rise Residential
- Grocery, Retail
- Restaurants
- Theater, Library
- School
- Warehouse
- Hotel-Motel
- Office, Financial Institution, Unleased Tenant Space, Medical Office Building/Clinic
- Events and Exhibits
- Religious Worship
- Sports and Recreation

Under the 2025 Code some occupancies types were added and some will have increased Solar PV and Battery requirements.

Prescriptive Measure

PV System Size (kW_{dc}):

$$kW_{PV} = \frac{\textbf{CFA} \times \textbf{A}}{1000}$$

CFA: Conditioned Floor Area

A: Climate Zone Factor

or

kW_{PV} = 14 W/sq ft x **SARA**

SARA: Solar Accessible Roof Area

No PV required if:

- PV size < 4 kWdc;
- SARA < 80 sq ft contiguous or < 3% of the CFA
- Snow loading parameters

2025 Update:
PV Size = 14 W/sf x SARA, low-sloped roofs
PV Size = 18 W/sf x SARA, steep-sloped roofs

VTA Housing Ohlone Station, San Jose, CA (CZ 4)

Restaurant -- 2,000 sf
Retail – 3,500 sf
Office and Unleased – 7,000 sf

SARA = 4,500 sf

kW_{PV} = (**2000** x 0.44)+(**3500** x 2.91) +(**7000** x 3.13) /1000

kW_{PV} = 33 kW

OR

kW_{PV} = 14 W/sf x 4,500 sf /1000

kW_{PV} = 63 kW

Use for the 2022 Code:

Table 140.10-A – PV Capacity Factors

-	Factor A – Minimum PV Capacity (W/ft² of conditioned floor area)		
Climate Zone	**1, 3, 5, 16**	**2, 4, 6-14**	**15**
Grocery	2.62	2.91	3.53
High-Rise Multifamily	1.82	2.21	2.77
Office, Financial Institutions, Unleased Tenant Space	2.59	3.13	3.80
Retail	2.62	2.91	3.53
School	1.27	1.63	2.46
Warehouse	0.39	0.44	0.58
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.39	0.44	0.58

Applies to new construction as **listed in Table 140.10-A** or mixed occupancy where one or more of these building types constitute at least 80% of the floor area of the building.

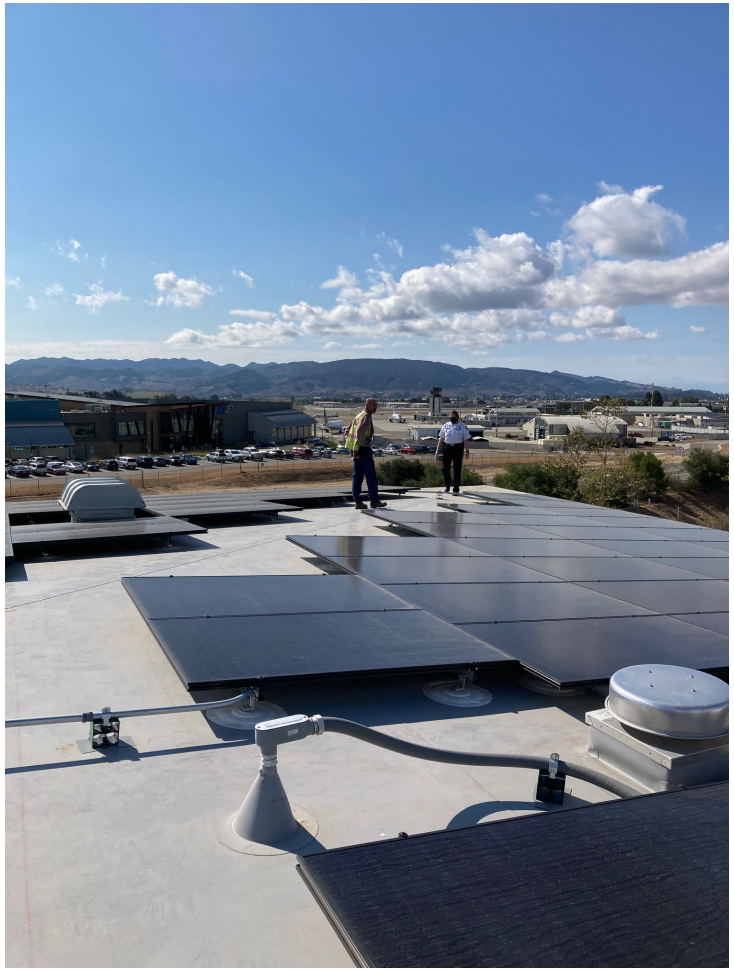
NEW Table for 2025 Code

Table 140.10-A – PV Capacity Factors (W/ft² of conditioned floor area)

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Events & Exhibits	3.48	4.28	3.66	4.32	3.77	4.05	4.28	4.83	4.63	4.80	5.04	4.44	4.95	4.36	5.48	3.38
Library	0.39	3.23	2.59	3.25	2.48	2.74	3.04	3.49	3.32	3.69	3.79	3.32	3.79	3.37	4.49	2.84
Hotel/Motel	1.69	1.90	1.66	1.97	1.69	1.87	1.94	2.22	2.09	2.20	2.30	2.05	2.30	2.02	2.72	1.73
Office, Financial Institution, Unleased Tenant Space, Medical Office Building/Clinic	2.59	3.13	2.59	3.13	2.59	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.13	3.80	2.59
Restaurants	8.55	9.32	8.16	9.65	8.21	8.73	9.11	10.18	9.75	10.28	10.85	9.73	10.69	9.73	12.25	8.47
Retail, Grocery	3.14	3.49	3.01	3.61	3.05	3.27	3.45	3.83	3.65	3.81	4.09	3.64	3.99	3.71	4.60	3.21
School	1.27	1.63	1.27	1.63	1.27	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	2.46	1.27
Warehouse	0.39	0.44	0.39	0.44	0.39	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.58	0.39
Religious Worship	4.25	4.65	3.49	4.52	3.72	4.29	4.64	5.89	5.30	5.67	5.89	4.99	5.78	4.63	7.57	3.90
Sports & Recreation	2.47	1.97	1.54	2.03	1.60	1.84	1.98	2.63	2.47	2.60	2.75	2.20	2.72	2.15	4.03	1.81
Multifamily > 3 stories	1.82	2.21	1.82	2.21	1.82	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.77	1.82

Applies to new construction as **listed in Table 140.10-A** or mixed occupancy where one or more of these building types constitute at least 80% of the floor area of the building.

Solar Access Roof Area (SARA)



- Area of a buildings' roof space capable of supporting PV system
- Area of all roof space on covered parking areas, carports and other newly constructed structures onsite that are compatible with supporting a PV system per CBC 1511.2

Exceptions:

- Any roof area that has <70% annual solar access
- Occupied roof areas per CBC 503.1.4
- Roof area not otherwise available due to compliance with other State Building Code requirements, and local codes if confirmed by the Executive Director

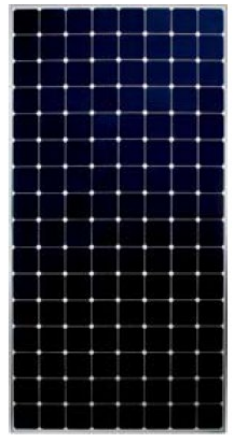
Example Estimating Quantity of Panels

Given a PV System Size (kWdc)

- Take the PV System Size (kWdc) calculated from EQ 170.2-C/D and multiply by 1000 to convert to watts.
- Look at different PV panel products and look for nominal power output (W, watts) and the panel dimensions.
- Divide PV System Size (watts) by a panel's nominal power (W, watts) to determine an estimated number of panels.

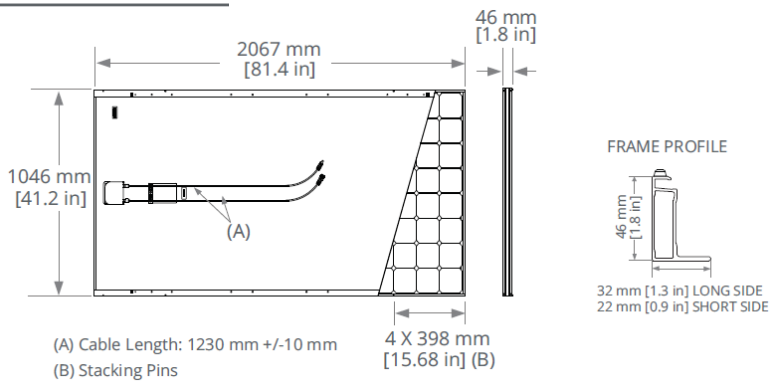
Sunpower x-series-commercial x21-470-com

	Electrical Data
	SPR-X21-470-COM SPR-
Nominal Power (Pnom)[5]	470 W
Power Tolerance	+5/−0%
Avg. Panel Efficiency[6]	21.7%
Rated Voltage (Vmpp)	77.6 V
Rated Current (Impp)	6.06 A
Open-Circuit Voltage (Voc)	91.5 V
Short-Circuit Current (Isc)	6.45 A



SPR-X21-470-COM

For estimating a layout, use the outer panel dimensions and add 0.5" as an average value for spacing between panels to allow for some of the more common mounting hardware.



PV System Size = 33 kW*1000 = 33000 W

No of Panels = PV System Size / Panel wattage

= 33000 W / 470 W

= 70.2, call it **71 Panels**

Battery Storage - 2022 Code

All buildings **required** to have a **PV system** shall also have a **battery storage system**.

Reminder: Battery system must meet **both** rated **energy** capacity (kWh) and the rated **power** capacity (kW) Calculate the energy and power capacities for each occupancy type in mixed use buildings, and sum the values.

Rated Energy capacity :

$kWh = kW_{PVdc} \times B / D^{0.5}$

D is the rated single charge-discharge cycle AC to AC efficiency of the battery (Between 0.80 and 0.95 is common.)

Rated Power capacity:

$kW = kW_{PVdc} \times C$

Table 140.10-B – Battery Storage Capacity Factors

-	Factor B – Energy Capacity	Factor C – Power Capacity
Storage-to-PV Ratio	Wh/W	W/W
Grocery	1.03	0.26
High-Rise Multifamily	1.03	0.26
Office, Financial Institutions, Unleased Tenant Space	1.68	0.42
Retail	1.03	0.26
School	1.87	0.46
Warehouse	0.93	0.23
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.93	0.23

Battery Energy Storage System (BESS) – 2025 Code

All buildings **required** to have a **PV system** shall also have a **battery storage system**.

Reminder: Battery system must meet **both** rated **energy** capacity (kWh) and the rated **power** capacity (kW) Calculate the energy and power capacities for each occupancy type in mixed use buildings, and sum the values.

New formulas

Rated Energy Capacity :

$$kWh_{batt} = (CFA \times B) / (1000 \times C^{0.5})$$

CFA: Conditioned Floor Area
B: BESS Capacity Factor in Wh/sf from Table 140.10-B
C is the rated single charge-discharge cycle AC to AC efficiency of the BESS
(Between 0.80 and 0.95 is common.)

SARA Adjusted Rated Energy Capacity :

$$kWh_{batt} = ((CFA \times B) / (1000 \times C^{0.5})) \times (kW_{PVdc,SARA} / kW_{PVdc})$$

kW_{PVdc} : From PV Capacity calculation

Rated Power capacity:

$$kW_{batt} = kWh_{batt} / 4$$

NEW Table for 2025 Code

Table 140.10-B –BESS Capacity Factors (Wh/ft² of conditioned floor area)

Building Type	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	CZ 9	CZ 10	CZ 11	CZ 12	CZ 13	CZ 14	CZ 15	CZ 16
Events & Exhibits	1.82	1.95	1.74	2.12	1.91	2.13	2.24	2.30	2.36	2.47	2.62	2.16	2.64	2.68	3.22	1.89
Library	0.37	7.17	5.97	6.75	5.64	6.08	6.19	7.13	7.18	7.56	7.17	6.93	6.88	6.81	7.93	6.40
Hotel/Motel	0.86	0.84	0.77	0.92	0.81	0.89	0.90	1.01	1.00	1.11	1.14	0.96	1.18	1.18	1.49	0.85
Office, Financial Institution, Unleased Tenant Space, Medical Office Building/Clinic	NR[1]	5.26	4.35	5.26	4.35	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26	6.39	4.35
Restaurants	4.36	4.11	3.78	4.37	3.89	4.02	4.11	4.49	4.47	4.82	5.05	4.43	5.05	5.24	6.23	4.11
Retail, Grocery	1.89	1.82	2.70	1.82	1.72	1.80	1.76	1.92	1.97	2.05	2.22	1.95	2.16	2.29	2.66	1.91
School	NR[1]	3.05	2.38	3.05	2.38	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	4.60	2.38
Warehouse	0.37	0.41	0.37	0.41	0.37	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.54	0.37
Religious Worship	2.21	2.25	1.74	2.42	2.08	2.75	2.94	3.37	3.17	3.37	3.58	2.72	3.62	3.21	4.89	2.37
Sports & Recreation	1.26	0.98	0.76	1.14	0.86	1.20	1.23	1.57	1.53	1.65	1.83	1.27	1.86	1.57	3.02	1.13
Multifamily > 3 stories	1.88	2.27	1.88	2.27	1.88	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.85	1.88

Footnote to TABLE 140.10-B:

1. NR = Not Required

Battery Storage

Exceptions:

- If installed PV system size < 15% of the size determined by Equation 140.10-A
- In buildings with system requirements with < 10 kWh rated capacity

Exemption removed under 2025

- ~~In climate zone 1, no battery storage system is required for offices, schools, and warehouses~~.

Note: For multi-tenant buildings the energy and power capacities of the battery storage system shall be based on the tenant spaces with more than 5,000 ft^2 of conditioned floor area.

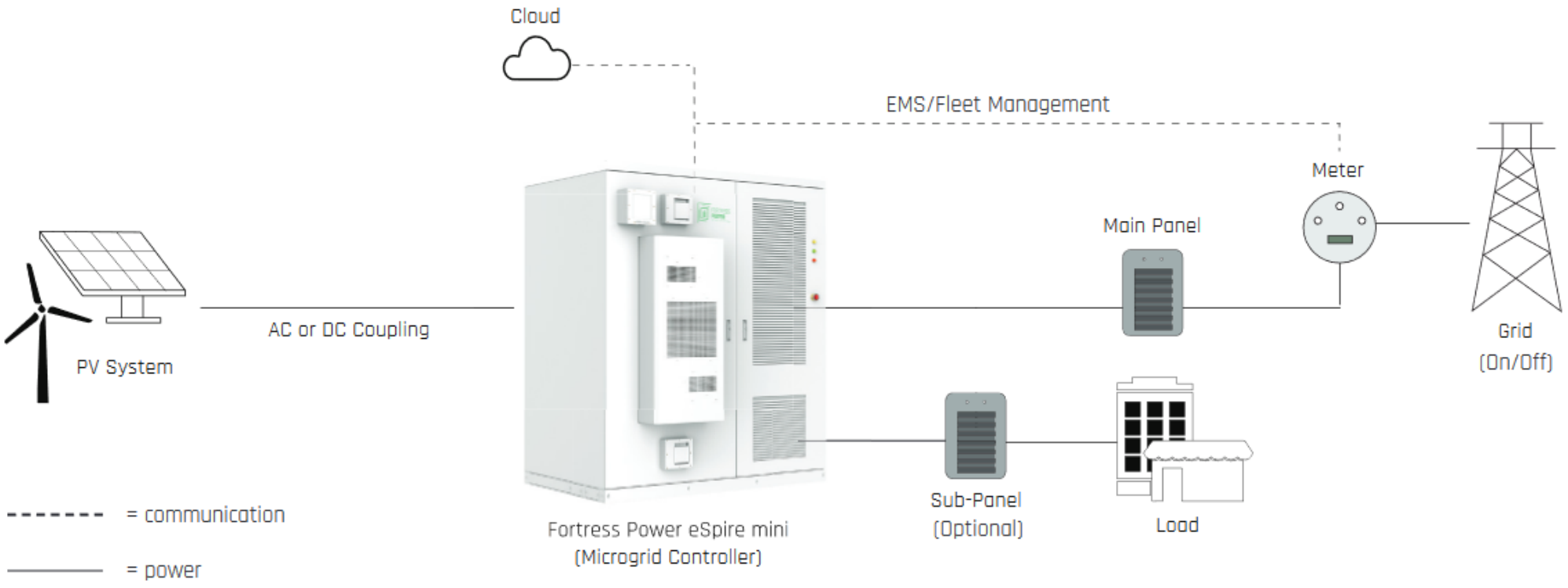
Example of a Commercial System

eSpire 280 Energy Storage System

Safe Technology & Multi-level Protection

The solution uses the best-in-class Tier 1 Lithium Iron Phosphate (LFP) chemistry forthe highest level of safety, thermal stability, and reliability; An integrated, multi-levelBattery Management System (BMS) monitors, optimizes, and balances the system.

Example of Commercial Scale System



eSpireMini_022224

Integrated, Pre-configured Packaged
Battery Energy Storage System

Photovoltaic (PV) and Battery – NRCC-SAB-E

Sample form with instructions is available on the CEC's website. Use the Energy Code Ace Forms Tool website for completing the NRCC-SAB-E form for permit.

STATE OF CALIFORNIA
Solar And Battery CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE		**NRCC-SAB-E**
Project Name: MG Rancho Mission Viejo East and West	**Report Page:**	**(Page 4 of 6)**
	Date Prepared:	2024-07-25T13:19:56-04:00

J. PHOTOVOLTAIC (PV) AND BATTERY SYSTEMS

This table documents compliance with prescriptive photovoltaic and battery system requirements in 140.10/ 170.2(g and h). Unless the project meets one of the listed exceptions, or trades-off PV in an energy model using performance path, 140.10/ 170.2(g and h) requires installed photovoltaic and battery systems for newly constructed buildings. The installed PV systems must meet the minimum requirements in Joint Appendix 11.

Photovoltaic (PV) System

01	02	03	04	05	06	07	08
Occupancy	Conditioned Floor Area (ft^2)	Area of New Roof[1] (ft^2)	Roof Area < 70% Solar Access[2] (ft^2)	Plansheet or Document showing Solar Access Calculations	Occupied Roof Area[3] (ft^2)	Solar Access Roof Area (SARA) (ft^2)	Min Size of PV System Required (kWdc)
High-Rise Residential	225,531	57,682	21,073	MEP roof plans	2,000	34,609	484.53
						Total Min Size PV System Required for all Spaces (kWdc):	484.53
						Total Size PV System in Design (kWdc):	500

[1]FOOTNOTES: Includes the area of the building's roof space capable of structurally supporting a PV system and the area of all roof space on covered parking areas, carports, and all other newly constructed structures on the site that are compatible with supporting a PV system per Title 24, Part 2 Section 1511.2.
[2]Solar access must be determined using CEC approved solar access calculation tools found at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/solar-assessment-tools.
[3]As specified by CBC Section 503.1.4.

Battery Storage System

01	02	03	04	05
Space Type	Min Size of PV Applicable To Battery Sizing (kWdc)	Rated Single Charge-Discharge AC Efficiency of Battery System[1]	Min Battery Rated Energy Capacity Required (kWh)	Min Power Capacity of Battery Required (kWdc)
High-Rise Residential	484.53	0.92	520.31	125.97
		Total Min Energy (kWh) and Power (kW) Capacity Required	520.31	125.98
		Total Energy (kWh) and Power (kW) Capacity in Design	529	143

[1]FOOTNOTE: Rated single charge-discharge cycle AC to AC (round trip) efficiency of the battery storage system

Excerpt from the Ace Forms Tool interview:

Solar & Battery Scope

This form is used to demonstrate compliance with prescriptive PV and battery requirements in §140.10/§170.2 for nonresidential, multifamily and mixed-use buildings and prescriptive solar thermal requirements in §170.2(d)3C for multifamily and hotel/ motel occupancies.

Which of the following occupancy types are included in your project? (Select all that apply)

Gymnasium Building, High-Rise Residential, Office Building & 4 more

Which of the following choices best describes the scope of your roof project? §110.10

New construction

How many above grade stories are on this project?

Building 4-10 stories

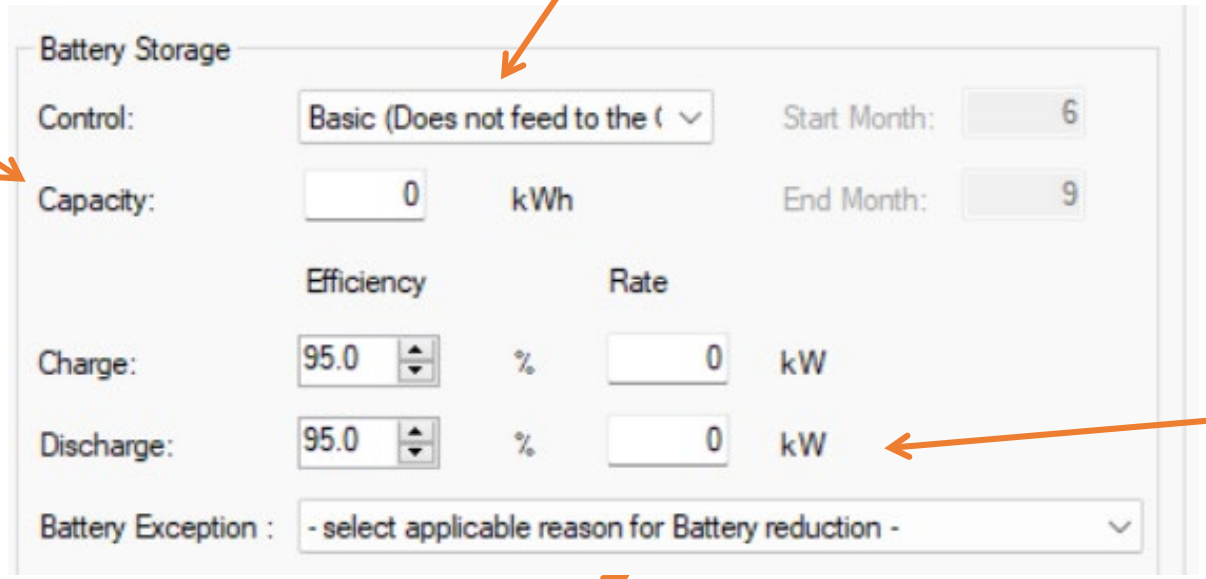
Performance Method –Example of EnergyPro v9 Input

Additional Credit can be used for reducing the “carbon” Source Metric

Control Options:

- **Basic** (Does not feed to the Grid)
- **Time of Use** [*need ‘Start Month’ and ‘End Month’*]
- **Advances DR Controls** [i.e., *Advanced Demand Response Controls / JA12 Advanced Demand Flexibility Control*]

Energy Capacity (kWh) is obtained from manufacture.



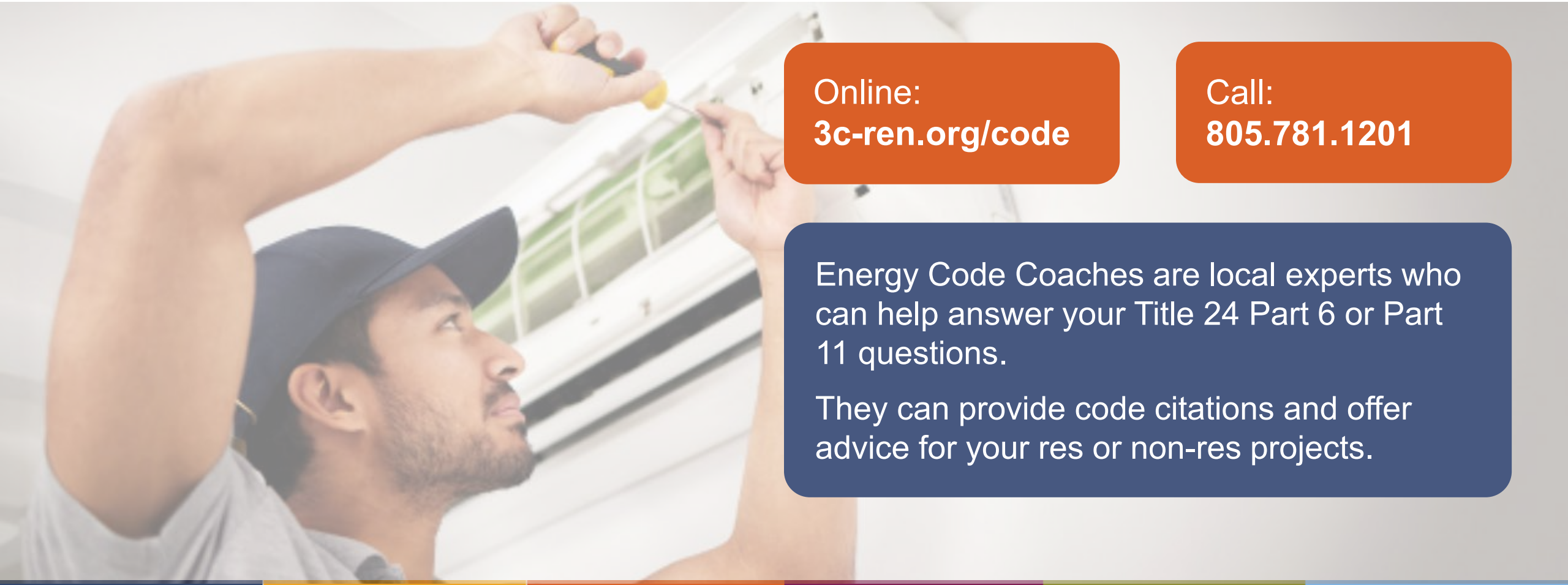
Battery Charge and Discharge Efficiency is a 95% default. [*Equivalent to 90% round trip efficiency]*

Rate of Charge and Discharge is obtained from manufacture.

Note: Battery Exceptions apply to Non-Res occupancies and Multi-Family high-rise buildings (greater than 3 stories).

Questions about Title 24?

3C-REN offers a *free* Code Coach Service



Online:
3c-ren.org/code

Call:
805.781.1201

Energy Code Coaches are local experts who can help answer your Title 24 Part 6 or Part 11 questions.

They can provide code citations and offer advice for your res or non-res projects.

Closing

Continuing Education Units Available

- Contact **nnewman@countyofsb.org** for AIA HSW & ICC LUs

Coming to Your Inbox Soon!

- Slides, Recording, & **Survey** – Please Take It and Help Us Out!

Upcoming Courses:

- Diagnosing Heating and Cooling Comfort Problems in Homes (3/18)
- Batteries: Options and Implementation for a Building's Energy Storage System (3/20)
- 3C-REN Contractor Connection Hub at Cedar Plumbing (3/27) IN PERSON
- Panel Detectives- Electrical Panel Assessments for Heat Pump Installers (4/8)

Any phone numbers who joined? Please share your name!

Thank you!

More info: **3c-ren.org**

Questions: **info@3c-ren.org**

Email updates: **3c-ren.org/newsletter**

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TRI-COUNTY REGIONAL ENERGY NETWORK

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