2019 Energy Code (Energy Standards) Water-Heating – Nonresidential

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Outreach and Education

Efficiency Division

Goals of this Training

Review the Energy Code requirements for water-heating systems

- All Occupancies
  - Mandatory requirements, features, and devices
- Newly Constructed Buildings
  - Mandatory
  - Prescriptive
- Existing Buildings - Additions and alterations
  - Prescriptive

Questions…

Please feel free to ask at anytime!

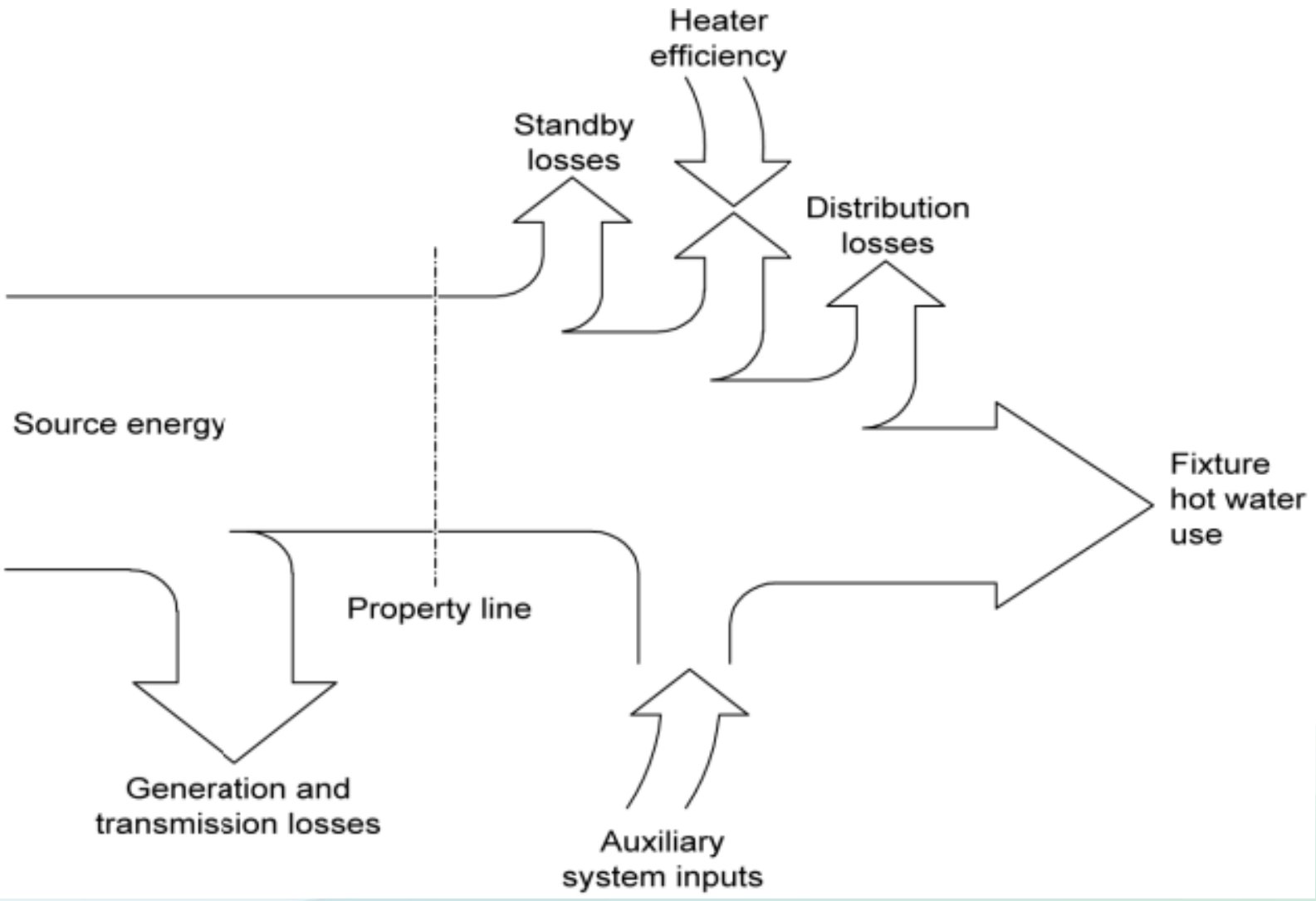
- During training
- At break
- Afterwards

- **Your questions enhance the class**

Energy Commission History

- Warren-Alquist Act created the Energy Commission (CEC) in 1974 and gave it authority to develop and maintain Energy Code
- Standards must be cost-effective over the useful life of the equipment/measures
- CEC updates the Energy Code every 3 years

Why Do We Have Water-Heating Energy Standards?



Approaches

- **Mandatory** - measures that must be met, regardless of compliance approach
- **Prescriptive Approach** – "grocery list" comprising the standard design building; all-or-nothing, very specific
- **Performance Approach** - more efficient features may make up for less efficient ones (trade-offs); uses modeling software to show that the proposed design's TDV energy is equal to or less than that of the standard design (more later)
- Can mix-and-match approaches for Envelope, Mechanical, Covered Processes and Water-Heating, or do trade-offs within the same component type

§ 140.0

PERFORMANCE & PRESCRIPTIVE APPROACHES – HIGH-RISE RESIDENTIAL, HOTEL/MOTEL, AND NONRESIDENTIAL OCCUPANCIES

§ 140.0 – Compliance Approaches

- High-rise residential, hotel/motel, and nonresidential occupancies must meet all of these:

a) §§ 110.0-110.12 [Mandatory for all buildings; *for water-heating: §§ 110.0, 110.1, 110.3*]

b) §§ 120.0-130.5 [mandatory for high-rise residential, hotel/motel, and nonresidential buildings; *for water-heating: § 120.3*]

c) New construction – Performance (§ 140.1) or prescriptive (§§ 140.2-140.9 *[for water-heating: § 140.5]*) requirements for that Climate Zone

- § 141.0 for additions and alterations

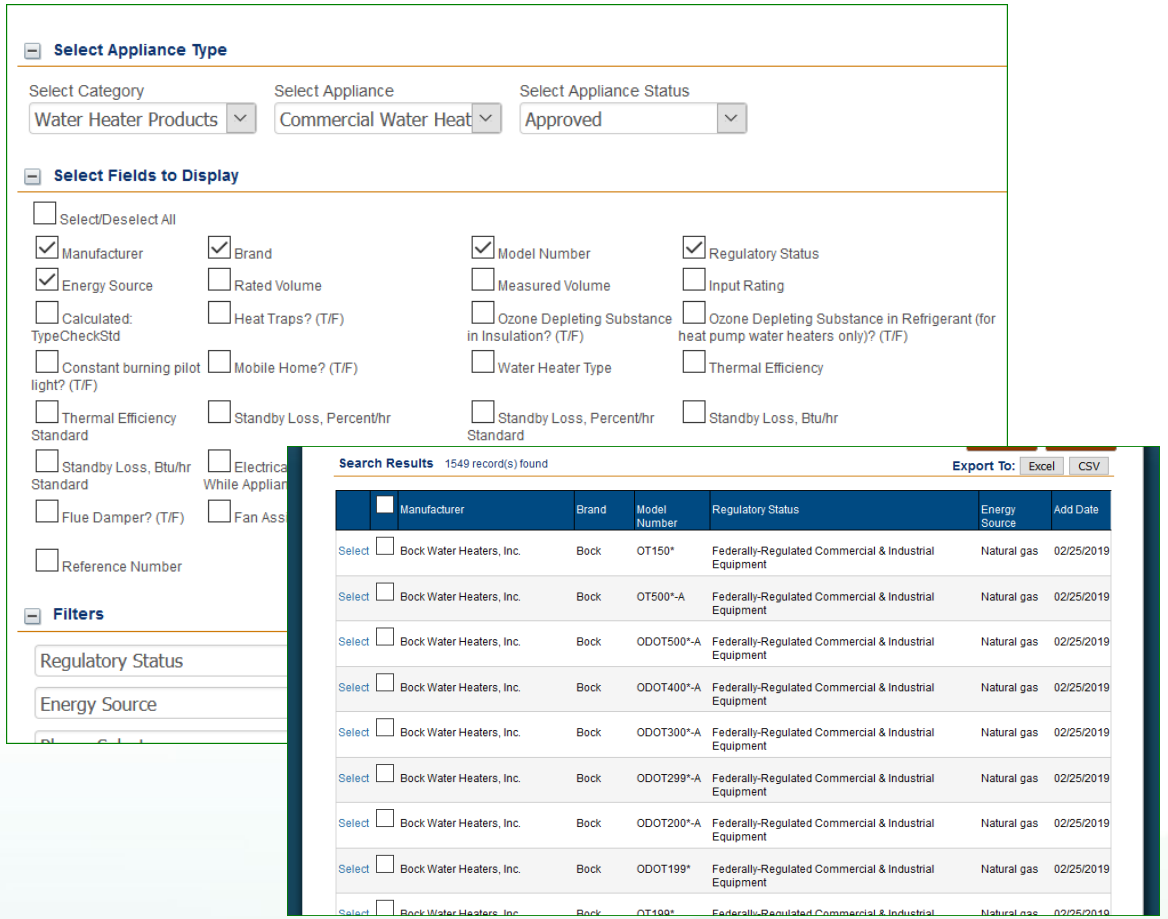
§§ 110.1 & 110.3

MANDATORY REQUIREMENTS – ALL OCCUPANCIES

§§ 110.1(a)&(b) - Mandatory Requirements; Appliances

a) A water-heater is allowed to be installed only if it meets Title 20 minimum efficiencies

b) Verify the water-heater's efficiency using MAEDbS database, an equivalent federal directory, or an approved trade association directory (more later)



Look up appliances on the Modernized Appliance Efficiency Database System

A Closer Look at MAEDbS

Select Appliance Type

Select Category: Water Heater Products
Select Appliance: Commercial Water Heat
Select Appliance Status: Approved

Select Fields to Display

- [ ] Select/Deselect All
- [x] Manufacturer
- [x] Brand
- [x] Model Number
- [x] Regulatory Status
- [x] Energy Source
- [ ] Rated Volume
- [ ] Measured Volume
- [ ] Input Rating
- [ ] Calculated: TypeCheckStd
- [ ] Heat Traps? (T/F)
- [ ] Ozone Depleting Substance in Insulation? (T/F)
- [ ] Ozone Depleting Substance in Refrigerant (for heat pump water heaters only)? (T/F)
- [ ] Constant burning pilot light? (T/F)
- [ ] Mobile Home? (T/F)
- [ ] Water Heater Type
- [ ] Thermal Efficiency
- [ ] Thermal Efficiency Standard
- [ ] Standby Loss, Percent/hr
- [ ] Standby Loss, Percent/hr Standard
- [ ] Standby Loss, Btu/hr
- [ ] Standby Loss, Btu/hr Standard
- [ ] Electrical Power During Recovery While Appliance is Heating
- [ ] Electrical Power During Standby
- [ ] R-value of Insulation
- [ ] Flue Damper? (T/F)
- [ ] Fan Assisted Combustion? (T/F)
- [ ] Hot Water Supply Boiler? (T/F)
- [x] Add Date
- [ ] Reference Number

Filters

Regulatory Status	Equals	B - Both Federal and State Sta
Energy Source	Equals	5 - Heat pump

Search Results 1549 record(s) found — Export To: Excel CSV

Select	Manufacturer	Brand	Model Number	Regulatory Status	Energy Source	Add Date
Select	Bock Water Heaters, Inc.	Bock	OT150*	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	OT500*-A	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	ODOT500*-A	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	ODOT400*-A	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	ODOT300*-A	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	ODOT299*-A	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	ODOT200*-A	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	ODOT199*	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019
Select	Bock Water Heaters, Inc.	Bock	OT199*	Federally-Regulated Commercial & Industrial Equipment	Natural gas	02/25/2019

§ 110.1(c) - Mandatory Requirements; Appliances

- Conformance with efficiencies required by Part 6 must be demonstrated by default to the mandatory efficiencies, or procedures approved per Part 1, § 10-109, when:

1. Data to verify conformance is not available
2. Field verification and diagnostic testing required, but no CEC-approved protocol for that appliance
3. On-site modifications affect its performance
4. US DOE waived federal test procedures, but waiver does not say how to determine the efficiency

§§ 110.3(a)&(b) - Mandatory Requirements; Service Water-Heating

(a) Only systems and equipment manufacturer-certified as meeting § 110.3 are allowed to be installed

1. Service water-heating systems must have temperature auto controls able to adjust from the lowest to the highest acceptable settings for the intended use (ASHRAE Handbook, HVAC Applications Vol., Table 3, Ch. 50; or CA Plumbing Code, Table 613.1)

   - EXCEPTION: Residential occupancies

(b) Water-heating equipment must meet all Title 20 requirements, including:

1. Meeting all listed standards
2. Meeting standards via all listed test methods
3. Meet all requirements for all functions
4. If the requirement is for equipment at the min/max rated capacity, the controls must make that capacity possible at steady-state operation

§ 110.3(c)1 - Mandatory Requirements; Service Water-Heating Installation

Systems > 167,000 BTU/hr – outlets needing higher-than-service water temperatures (ASHRAE Handbook), must have separate remote heaters, heat exchangers, or boosters to supply the higher temperature:

- EXCEPTION: Systems covered by CA Plumbing Code, § 613.0 must follow those requirements

§§ 110.3(c)2&3 - Mandatory Requirements; Service Water-Heating Installation

2. Service hot water systems with circulating pumps or electrical heat trace systems must be able to auto-shutoff
   - EXCEPTION: Systems serving healthcare facilities
3. Unfired service water-heater storage tanks and solar water-heating back up tanks must <u>have/meet one of</u>:
   A. External insulation, R-12 or more
   B. Internal and external insulation, R-16 or more (combined)
   C. Tank surface heat loss < 6.5 BTU per hour per square foot (water-air temperature difference of 80°F)

§ 110.3(c)4 - Mandatory Requirements; Service Water-Heating Installation

Recirculation loops serving multiple dwelling units, high-rise residential, hotel/motel, and nonresidential occupancies must meet/have all of the following:

A. Air release valve or vertical pump installation

B. Recirculation loop backflow prevention

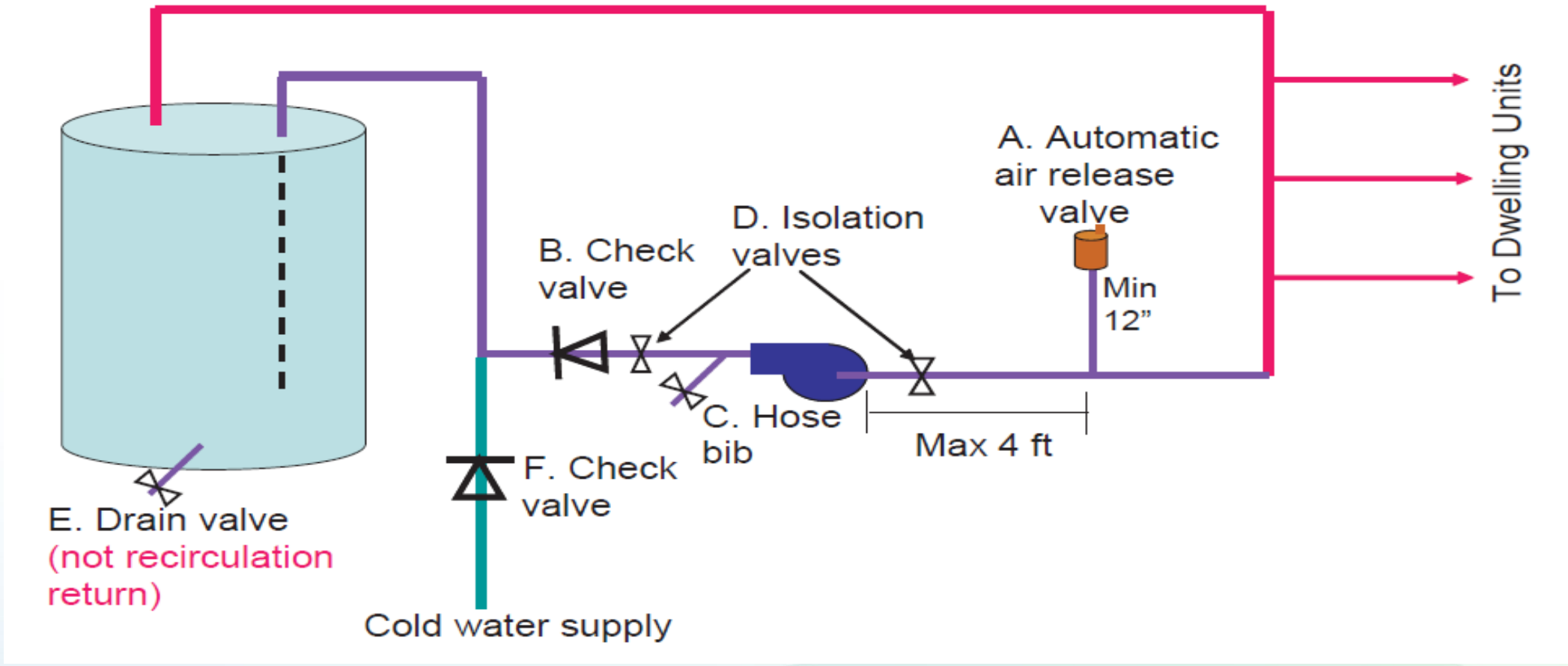
C. Equipment for pump priming

D. Pump isolation valves

E. Cold water supply and recirculation loop piping cannot connect to the hot water storage tank drain port

F. Cold water supply backflow prevention

§ 110.3(c)4 - Example



§ 110.3(c)5 – Mandatory Requirements; Service Water-Heating Installation

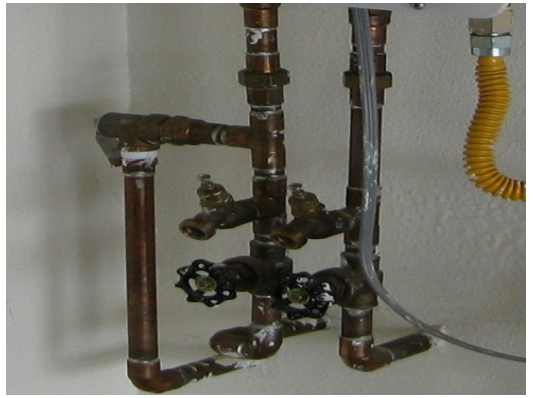
New State-built buildings must get 60% or more of their water-heating energy from site solar/recovered energy

- EXCEPTION: Buildings for which the Division of the State Architect (DSA) determines this requirement to be infeasible

§ 110.3(c)6 – Mandatory Requirements; Service Water-Heating Installation

- Isolation valves
  - Required for instantaneous (“tankless”) water-heaters > 6.8 kBTU/hr (2 kW)
  - Must be installed on both cold and hot water lines, each with hose bibbs or other fittings for maintenance flushing

Source: http://andrews-plumbing.com



§ 110.3(c)6 - Example

Source: homedepot.com

§ 110.1 - SUMMARY

- water-heaters must be manufacturer-certified as meeting Title 20 to be installed
- Verify water-heater efficiency using MAEDbS or other approved directory
- Demonstrate conformance with required efficiency by default to the mandatory efficiency, or approved procedures if one of these applies:
  - Data to verify is not available
  - No CEC-approved field verification testing protocol
  - On-site modifications affect performance
  - Federal test waiver does not say how to determine the efficiency

§ 110.3 – SUMMARY

- water-heaters must be tested per, and manufacturer-certified as meeting, Title 20 requirements
- Separate heaters for above-service temperature outlets (> 167 kBTU/hr)
- Auto-shutoff controls for systems with circulation pumps or electric heat trace systems
- Unfired water-heating tanks must have required insulation/tank surface heat loss
- Recirculation loops serving multiple dwelling units/high-rise residential, nonresidential, and hotel/motel occupancies must meet plumbing/installation requirements (diagram)
- 60% of water-heating energy must be solar/recovered energy in newly constructed State buildings
- Isolation valves and fittings for tankless water-heaters > 6.8 kBTU/hr (2kW)

§ 120.3

MANDATORY PIPE INSULATION REQUIREMENTS – HIGH-RISE RESIDENTIAL, HOTEL/MOTEL, AND NONRESIDENTIAL OCCUPANCIES

§ 120.3(a)3 – General Requirements for Pipe Insulation

The following water-heating piping must be insulated, per TABLE 120.3-A:

A. Recirculating system piping, including the supply and return piping to the water-heater

B. First 8 feet of hot and cold outlet piping, including pipes between a storage tank and a heat trap, for a non-recirculation storage system

C. Externally heated pipes

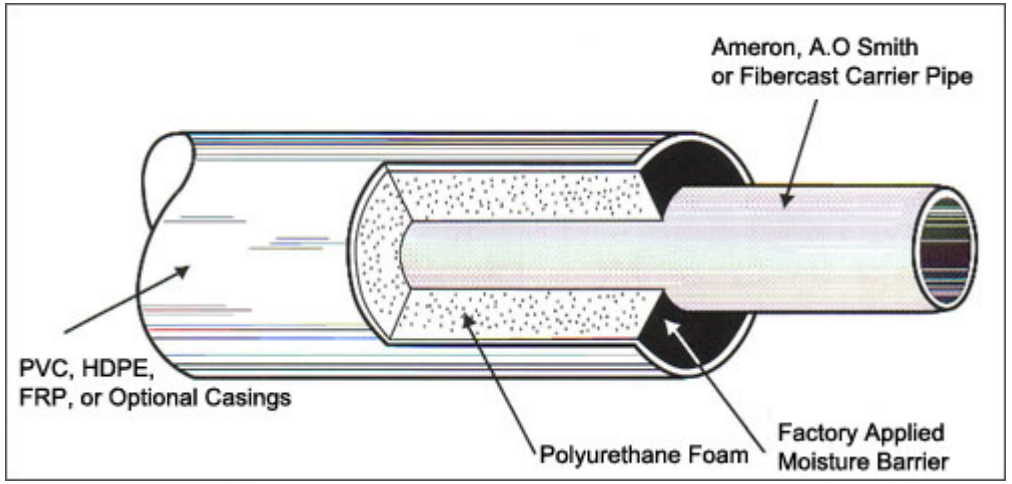
§ 120.3(b)1 - Insulation Protection

Protect insulation from weather and maintenance

1. Insulation exposed to weather must have an outdoor-suitable cover.
    - Solar-resistant and water retardant
    - Protection cannot be adhesive tape

§ 120.3(b)3 - Insulation Protection, cont.

Below-grade insulation must be in a waterproof, uncrushable sleeve/casing



Source: https://www.insul-tek.com

§ 120.3(c)1 – Insulation Thickness

Insulate pipes according to TABLE 120.3-A.

TABLE 120.3-A PIPE INSULATION THICKNESS

Fluid Operating Temperature Range (°F)	Insulation Conductivity			Nominal Pipe Diameter (in inches)				
	Conductivity (in Btu·in/h·ft²·°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				**Minimum Pipe Insulation Required (Thickness in inches or R-value)**				
Above 350	0.32-0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R 37	R 41	R 37	R 27	R 23
251-350	0.29-0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R 24	R 34	R 35	R 26	R 22
201-250	0.27-0.30	150	Inches	2.5	2.5	2.5	3.0	3.0
			R-value	R 21	R 20	R 17.5	R 17	R 14.5
141-200	0.25-0.29	125	Inches	1.5	1.5	2.0	2.0	2.0
			R-value	R 11.5	R 11	R 14	R 11	R 10
105-140	0.22-0.28	100	Inches	1.0	1.5	1.5	1.5	1.5
			R-value	R 7.7	R 12.5	R 11	R 9	R 8

TABLE 120.3-A now allows for insulation by thickness AND R-values

Example – § 120.3(c)1

TABLE 120.3-A PIPE INSULATION THICKNESS

Fluid Operating Temperature Range (°F)	Insulation Conductivity			Nominal Pipe Diameter (in inches)				
	Conductivity (in Btu·in/h·ft²·°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				Minimum Pipe Insulation Required (Thickness in inches or R-value)				
Above 350	0.32-0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R 37	R 41	R 37	R 27	R 23
251-350	0.29-0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R 24	R 34	R 35	R 26	R 22
201-250	0.27-0.30	150	Inches	2.5	2.5	2.5	3.0	3.0
			R-value	R 21	R 20	R 17.5	R 17	R 14.5
141-200	0.25-0.29	125	Inches	1.5	1.5	2.0	2.0	2.0
			R-value	R 11.5	R 11	R 14	R 11	R 10
105-140	0.22-0.28	100	Inches	1.0	1.5	1.5	1.5	1.5
			R-value	R 7.7	R 12.5	R 11	R 9	R 8

- Say you have:
  - Domestic hot water (DHW) pipe 4 inches in diameter
  - Fluid temperature will be 105°F – 140°F
  - Pipe insulation with a conductivity of 0.22 – 0.28 BTU-inch per hour-square foot-degree F
- *Then the pipe must be insulated to 1.5 inches thick, OR an R-value of R-11*

§ 120.3(c)2 – Insulation Thickness

If insulation has a conductivity outside of the range in TABLE 120.3-A, use this equation to calculate the thickness:

$$T = PR \times ((1 + (t/PR)^{K/k} - 1)$$

T = minimum insulation thickness, for material with conductivity K (inches)

PR = pipe outer radius (inches)

t = insulation thickness, from TABLE 120.3-A (inches)

K = conductivity of alternate material at the mean rating temperature in TABLE 120.3-A for the applicable fluid temperature range (BTU-inch per hour per square foot, per °F)

k = lower value of the conductivity range in Table 120.3-A for the applicable fluid temperature range (BTU-inch per hour per square foot, per °F)

§ 120.3 – SUMMARY

- Protect outdoor insulation
- Insulate hot water piping to the required minimum thickness or R-value in TABLE 120.3-A
  - If the insulation conductivity is not in the range on TABLE 120.3-A, use the equation

§ 140.5

PRESCRIPTIVE REQUIREMENTS – HIGH-RISE RESIDENTIAL, HOTEL/MOTEL, AND NONRESIDENTIAL OCCUPANCIES

§ 140.5 - Prescriptive Requirements for Service Water-Heating Systems

a) Nonresidential occupancies - Must meet §§ 110.1, 110.3, and 120.3.

b) High-rise residential and hotel/motel occupancies - Must meet § 150.1(c)8

§ 150.1(c)8- Prescriptive Compliance

Only *manually-controlled demand recirculation distribution systems (RA4.4.9)* allowed for individual dwelling units

Must meet A, B, or C:

§ 150.1(c)8Ai-iii – Prescriptive Compliance

A. Systems serving individual dwelling units (5 options):

Option	Type	Fuel	Gal	Max kBTU/hr	Additional Requirements
Ai	Tankless	Gas/propane	N/A	200	• Can be 1 or more
Aii	Storage	Gas/propane	≤ 55	75	• Windows U-factor ≤ 0.24, weighted average • Choose one: ○ Compact distribution (RA4.4.6) ○ Drain Water Heat Recovery (DWHR) (RA3.6.9)
Aiii	Storage	Gas/propane	> 55	75	

§ 150.1(c)8Aiv&v- Prescriptive Compliance

Option	Type	Additional Requirements

Aiv	Heat pump water-heater (HPWH)	• Tank indoors
		• Choose one:
		  ○ Compact distribution (RA4.4.6) and DWHR (RA3.6.9)
		  ○ ***CZs 2-15:*** PV capacity 0.3 kWdc over § 150.1(c)14 requirement
		  ○ ***CZs 1&16:*** PV capacity 1.1 kWdc over § 150.1(c)14 requirement

Av	HPWH	• Tank indoors
		• NEEA Tier 3 or higher
		• ***CZs 1&16***, choose one:
		  ○ PV capacity 0.3 kWdc over § 150.1(c)14 requirement
		  ○ Compact distribution (RA4.4.6)

§ 150.1(c)8B – Prescriptive Compliance

B. Central water-heating systems serving multiple dwelling units must have:

i. Gas or propane water-heater*

ii. Recirculation meeting § 110.3(c)2 & 4, with 2 or more separate loops serving separate dwelling units, able to auto-control the pump by hot water demand and return temperature

- EXCEPTION: Buildings with 8 or fewer units can use 1 loop

*A HPWH was recently approved as a central water heater for multiple dwelling units! Download Blueprint #129 for details

§ 150.1(c)8B & C – Prescriptive Compliance

iii. Solar water-heating meeting RA4, with these minimum solar savings fractions:

Option	CZs 1-9	CZs 10-16	Additional Requirements
Biiia	0.20	0.35	N/A
Biiib	0.15	0.30	DWHR (RA3.6.9)

C. Any water-heating system the Executive Director determines uses no more energy than B

§ 140.5 - SUMMARY

- Nonresidential occupancies must meet mandatory water-heating requirements
- High-rise residential and hotel/motel occupancies must meet these requirements:
  - Individual dwelling units
    - Only Demand Recirculation Systems with a manual on/off
    - Gas/propane water-heaters (§ 150.1(c)8Ai-iii)
    - HPWH (§ 150.1(c)8Aiv-v)
  - Multiple dwelling units
    - Natural gas or propane water-heating equipment
    - Recirculation with 2+ loops, with auto pump controls
    - Solar water-heating system (field-verified DWHR option)

**A HPWH was recently approved as a central water heater for multiple dwelling units!
Download Blueprint #129 for details

§ 140.1

PERFORMANCE APPROACH – HIGH-RISE RESIDENTIAL, HOTEL/MOTEL, AND NONRESIDENTIAL OCCUPANCIES

§ 140.1 – Performance Approach Energy Budgets

- Proposed Design complies if its energy budget is no larger than the Standard Design budget.
- Energy budget = TDV energy for HVAC + indoor lighting + mechanical ventilation + service water-heating + covered processes

a) Standard Design budget is determined by applying mandatory and prescriptive requirements

b) Proposed Design budget is determined by calculating its TDV energy

c) TDV energy must be calculated using CEC-approved compliance software

HERS-Verified Performance Credits

- Only applicable to residential projects
- Pipe Insulation Credit (RA3.6.3, 4.4.14) – HERS verifies correct insulation installation
- Compact Hot Water Distribution Credit, Basic (RA4.4.6), Expanded (RA3.6.5, 4.4.16) – HERS verifies piping and design requirements have been met (more later)
- Drain Water Heat Recovery Credit (RA3.6.9, 4.4.21) – HERS verifies DWHR unit and installation requirements have been met (more later)

Compact Hot Water Distribution System (CHWDS) Credits

- Water-heaters too far from their points of use (POU's) require more piping, wasting energy
- Only for single-family homes or multifamily dwelling units with individual water-heaters
- Requires plan calculations (next slide)
- *Expanded credit* available via HERS field verification (RA3.6.5):
  - No hot water pipes > 1" diameter
  - No more than 8 ft., total, of 1" diameter pipes
  - 2- and 3-story buildings – no hot water pipes in the attic, unless the water-heater is also in the attic
  - HERS-verified Demand Recirculation (RA4.4.17)

CHWDS Credit Calculation

- In the plans, *measure distances between the water-heater and the POU's in feet* (next slide)
  - *Draw measurement points for second floor POU's as though they were on the first floor*; vertical pipes are ignored (next slide)
- Apply the equations below
- *For credit, weighted distance < qualification distance*

Weighted distance = x × (ft. to furthest Master Bath fixture) + y × (ft. to furthest Kitchen fixture) + z × (ft. to furthest fixture)

Qualification distance = (a + b × [conditioned floor area, sqft])/(# of water-heaters) *

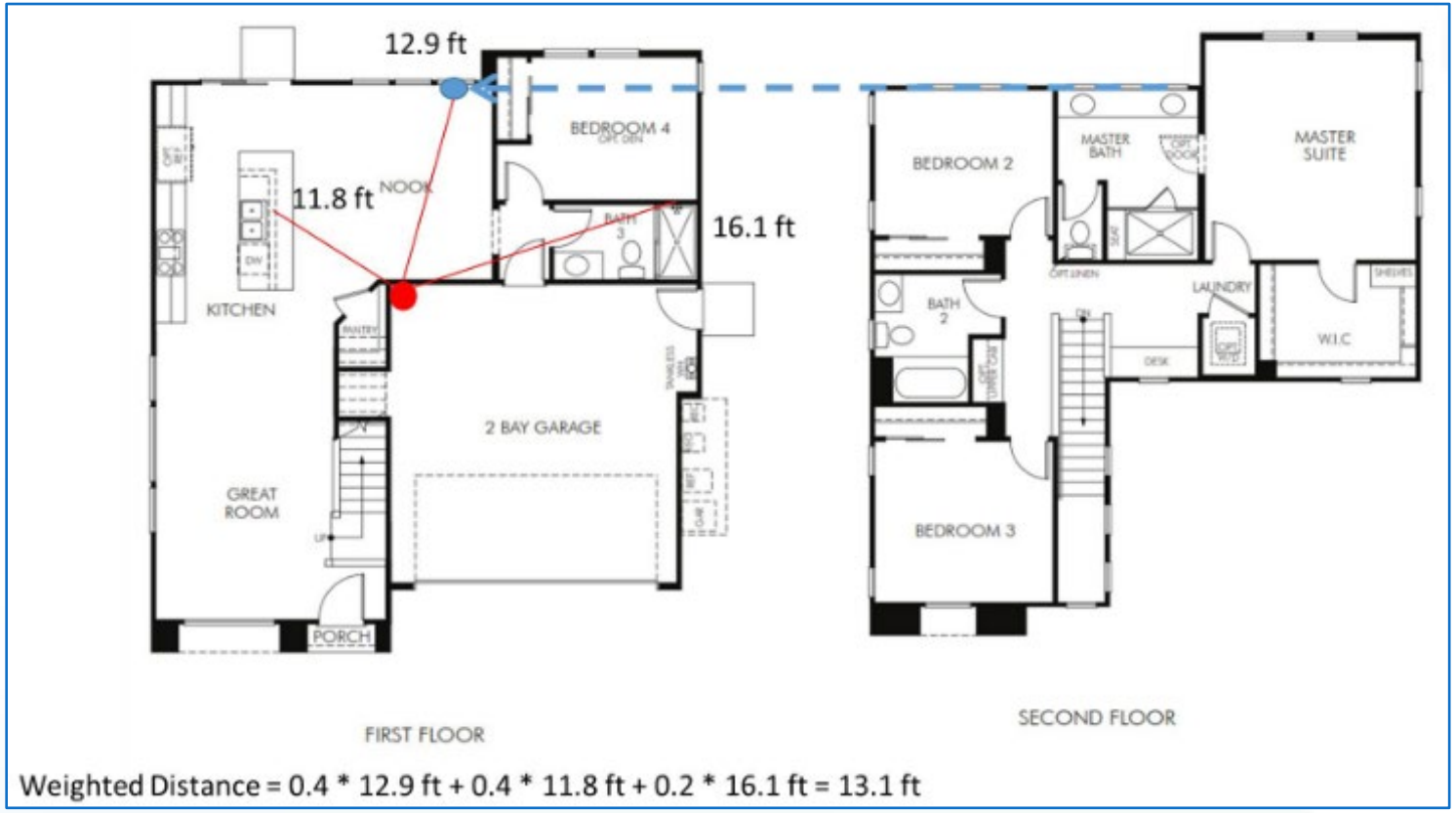
*See RA4.4.6 for details on coefficient values a, b, x, y, z

CHWDS Credit Calculation (Example A)

Source: 2019 Residential Compliance Manual

- Weighted distance = (0.4 x 28.9) + (0.4 x 31.1) + (0.2 x 34.3) = 30.9 ft
- Qualification distance = (15 + 0.0045 × 1814)/1 = 15 + 8.163 = *~23 ft*

CHWDS Credit Calculation (Example B)

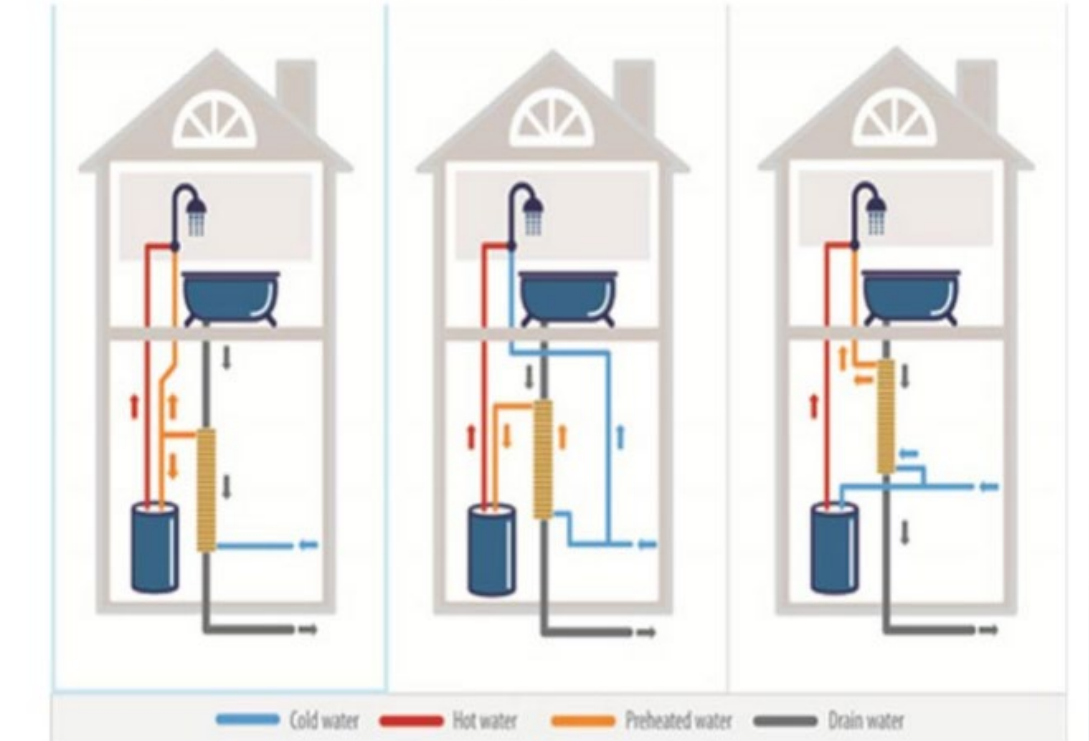


Source: 2019 Residential Compliance Manual

- Weighted distance = 13.1 ft
- Qualification distance = (15 + 0.0045 × 1814)/1 = 15 + 8.163 = *~23 ft*
  Same floor plan, but different water locations yield different results!

Drain Water Heat Recovery (DWHR) Credit

Figure 5-3: The Three Plumbing Configurations of DWHR Installation (From left to right: Equal Flow, Unequal Flow - Water Heater, Unequal Flow - Fixture)



Source: 2019 Residential Compliance Manual

- Saves energy by recycling heat from water flowing down the drain, via preheating water
- Three possible configurations – equal flow, unequal flow (water-heater), and unequal flow (fixture)
  - *Equal flow* preheats water going to both the fixture and the water-heater (maximizes benefit)
  - Unequal flow preheats water going to the fixture *or* water-heater

DWHR Credit Requirements

- For credit, the DWHR unit must
  - Be certified to the CEC as…
    - Having a rated effectiveness ≥ 42%
    - Meeting the table at right
  - Meet the requirements on the next slide

Unit Type	Meet These Standards	Testing/Labeling per
Vertical	CSA B55.2	CSA 55.1 *or* IAPMO IGC 346-2017
Sloped	IAPMO PS 92	IAPMO IGC 346-2017

DWHR Credit Requirements, cont.

- DWHR unit must be HERS-verified that it/its…
  - Make, model, and effectiveness match the plans and documents
  - Model is certified to the CEC as qualified for credit*
  - Configuration and percentage of showers served match the compliance documents
  - At least, transfers heat from the master shower/showers above the first floor back to showers served by the water-heater/the water-heater itself
  - Is installed within 1° of the rated slope
  - Is installed per the CA Plumbing Code

*Download the Certified List

§ 141.0

ADDITIONS, ALTERATIONS, AND REPAIRS – HIGH-RISE RESIDENTIAL, HOTEL/MOTEL, AND NONRESIDENTIAL OCCUPANCIES

§ 141.0(a) - Additions

a) Additions must meet 1 or 2

1. Prescriptive - §§ 110.1, 110.3, 120.3, 140.5.
2. Performance
   - A. New water-heating system serving the addition must meet §§ 110.1, 110.3, 120.3; and
   - B. Either
     - i. The addition alone must meet § 140.1; or
     - ii. Proposed energy use (unchanged existing features + altered features + proposed addition) ≤ standard energy use (unchanged existing features + existing/§ 141.0(b)2-compliant features to be altered [whichever is lower in TDV])+ (proposed addition)

- EXCEPTION 1: If water-heating is provided to an addition by expanding existing systems, the existing systems and equipment need not meet §§ 110.1, 110.3, 120.3, or 140.5.

§ 141.0(b) – Alterations

b) Alterations

2. Prescriptive – Altered components must meet §§ 110.1, 110.3, 120.3, and

   N. § 140.5 - except for solar water-heating requirements.

3. Performance – Altered components must meet

   A. §§ 110.1, 110.3, 120.3; and

   B. Standard design based on existing conditions, or § 140.5 (except solar water-heating requirements), whichever is more efficient

§ 141.0 - Summary

- **NOTE:** If expanding a system to serve an addition, existing system and equipment do not need to meet §§ 110.1, 110.3, 120.3, or 140.5

	§ 110.1	§ 110.3	§ 120.3	§ 140.5	§ 140.1	Notes
Additions (prescriptive)	X	X	X	X		
Additions (performance)	X	X	X		X*	* Addition alone; otherwise, apply E+A+A
Alterations (prescriptive)	X	X	X	X**		** Except solar water-heating req.'s
Alterations (performance)	X	X	X	X***		*** Standard design can match this, or existing conditions, whichever is better

§ 120.9 – Commercial Boilers

Newly-installed boilers…

a) That meet the following conditions must have combustion air positive shut-off:
   1. Input ≥ 2.5 million BTU/hr, and designed to operate with non-positive vent static pressure
   2. One stack serves two or more boilers, total combined input capacity per stack of 2.5 million BTU/hr

b) With combustion air fan motors ≥ 10 hp, fan motor must meet one of these conditions:
   1. Driven by a variable-speed drive; or
   2. Have controls limiting fan motor demand to ≤ 30% of total design wattage at 50% of design air volume

§ 120.9 – Commercial Boilers (cont'd)

Newly-installed boilers…

c) Input ≥ 5 million BTU/h must maintain excess O_2 ≤ 5.0% by volume, dry basis, over firing rates of 20-100%.

- Combustion air volume must be controlled via firing rate, or flue gas O_2 concentration
- No common gas and combustion air control linkage, or jack shaft allowed
- EXCEPTION: Boilers with steady state full-load thermal efficiency ≥ 85%

Forms & Enforcement

Compliance Documents Overview

Roles	Documents of Responsibility	What You Do
Approved Design Reviewer	• NRCC-CXR-E	• Fill out Design Review Kickoff and Construction Documents Design Review Checklist compliance certificates
Designers/ Document Authors	• Plans and specs • NRCC	• Draw plans and specifications • Fill out NRCC forms
Plan Reviewer	• NRCC • Plans and specs	• Ensure the NRCC matches the plans and specs • Ensure the NRCC has no errors • Issue building permits as appropriate
Builder(s)/ General Contractor(s)	• All	• Submit NRCCs and plans for plan check • Ensure contractors fill out NRCIs appropriately; ensure acceptance testing completed, with NRCAs filled out • Ensure all compliance documents are registered to a nonresidential registry/certified by ATTCP database • Provide copies of compliance documents to inspectors and owner(s) • Ensure HERS inspections are performed, as needed

Compliance Documents Overview (cont'd)

Roles	Documents of Responsibility	What You Do
Installers	• NRCI	• Fill out NRCIs matching installed energy features • Make corrections to installations and NRCIs, as needed
HERS Rater(s)	• NRCV	• Verify features and send test results to HERS provider registry to generate registered NRCV • Confirm NRCI(s) and NRCA(s) meet requirements on the plans and NRCC(s) • Confirm NRCA results match HERS results and meet the Energy Code
Building Inspector(s)	• All	• Verify all NRCCs, NRCIs, and NRCVs are complete and registered, as needed; NRCAs must be complete and certified by an ATTCP database • Verify building features

NRCC (Certificate of Compliance)

- Designers draw up the plans and fill out NRCC
  - Energy consultants or documentation authors can fill out these forms and/or suggest energy features
  - Consult with the building department about how to submit plans, specs, and NRCC with permit application; most require NRCC to be integrated into the plans
- Approved Design Reviewer must sign NRCC-CXR-E
- Builders submit the NRCC and plans for Plan Check
  - NRCCs must be registered with an approved nonresidential data registry, if one is approved
- Plan reviewers
  - If corrections are needed, they must be noted on the plans and NRCC and returned for corrections

Certificate of Compliance (NRCC) Forms for Water-Heating

- ***PLB-E: Domestic Water-Heating***
  - Unlike Residential, same form for NCBs, additions, and alterations
- ***CXR-E: Building Commissioning***
- ***PRF-E: Performance approach***
  - Generated by approved compliance software

Sample NRCC-PLB-01-E Form

STATE OF CALIFORNIA

Domestic Water Heating System

NRCC-PLB-E (Created 11/19) — CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF COMPLIANCE			NRCC-PLB-E
This document is used to demonstrate compliance for nonresidential occupancies with requirements in §110.1, §110.3, §120.3, and §140.5, and with requirements in §141.0 for additions and alterations, for domestic water heating scopes using the prescriptive path. For high-rise residential and hotel/motel occupancies, compliance is demonstrated with requirements in §110.1, §110.3, §120.3, §150.0 and §150.1(c)8, and with requirements in §150.2 for additions and alterations.			
Project Name:	Sanders & Co. Foods	Report Page:	Page 1 of 5
Project Address:	100 Acrewood Dr	Date Prepared:	2020-09-18

A. GENERAL INFORMATION

01	Project Location (city)	Sacramento	02 Climate Zone	12
03	Occupancy Types Within Project (select all that apply):			

☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/ Motel
☐ State Building	☐ Healthcare Facility	☐ Other (Write In):

B. PROJECT SCOPE

Table Instructions: Include any domestic water heating systems that are within the scope of the permit application and are demonstrating compliance using the prescriptive paths outlined in §140.5, §150.1(c)8, and §141.0(a), or §141.0(b)2N for additions or alterations. Solar water heating systems should be documented on the NRCC-SRA compliance document. Combined hydronic water heating systems should be documented on the NRCC-MCH compliance document.

01	02	03		
My project consists of (check all that apply):	System Type[1,2]	System Components		
☑ New System (DHW system being installed for the first time in newly constructed building)	Individual System (serving nonresidential spaces)[1]	☑ Equipment	☑ Distribution	☑ Controls
			Add New System	Remove Last
☐ System Alteration (equipment, distribution or controls)		☐ Equipment	☐ Distribution	☐ Controls
			Add Alteration	Remove Last

[1] *FOOTNOTE: Point of use water heaters, or other non-central systems used to serve nonresidential spaces, are considered individual systems.*
[2] *Dwelling units refers to hotel/ motel guest rooms and units in a high-rise residential occupancy.*

C. COMPLIANCE RESULTS

Table Instructions: Table C will indicate if the project data input into the compliance document is compliant with water heating requirements. This table is not editable by the user. If this table says "DOES NOT COMPLY" or "COMPLIES with Exceptional Conditions" refer to Table D., or the table indicated as not compliant for guidance.

01	02	03	04
Domestic Hot Water Equipment	Distribution Systems	Controls	Compliance Results
(See Table F)	(See Table G)	(See Table H)	
Yes	Yes	Yes	COMPLIES

- Tables A & B: General project info
- Table C: Compliance results

Sample NRCC-PLB-01-E, Tables F & G

D. EXCEPTIONAL CONDITIONS

This table is auto-filled with uneditable comments because of selections made or data entered in tables throughout the form.

No exceptional conditions apply to this project.

E. ADDITIONAL REMARKS

This table includes remarks made by the permit applicant to the Authority Having Jurisdiction.

F. DOMESTIC HOT WATER EQUIPMENT

Table Instructions: Complete the following table to demonstrate compliance with mandatory equipment requirements in §110.1 and §110.3. For high-rise residential and hotel/motel occupancies, compliance with prescriptive requirements in §150.1(c)8 must also be demonstrated and with §150.2 for addition and alteration scopes.

Equipment Schedule: Individual Systems

01	02	03	04	05	06
Name or Item Tag	Equipment Type	Volume (gal)	Max GPM/ First Hour Rating (FHR)	Rated Uniform Energy Factor (UEF)	Minimum Required Uniform Energy Factor (UEF)[1]
DHW01	Gas-Fired Instantaneous (50,000-200,000 BTUH)	≤2	GPM ≥ 4.0	0.83	0.81
			Reset	Add Row	Remove Last

[1] *FOOTNOTE: Compliant equipment may be found in the Modernized Appliance Efficiency Database System (MAEDBS) on the Energy Commission website: https://cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx*

Water Heating Equipment All Occupancies

	Yes	No	Not Applicable	Requirement
18	○	○	●	Unfired storage tank insulation shall have Internal + External ≥ R-16 OR External ≥ R-12. Label required per §110.3(c)3
19	○	○	●	New state buildings 60% of energy for service water heating from site solar energy or recovered energy per §110.3(c)5
20	●	○	○	Isolation valves for instantaneous water heater with input rating > 6.8 kBTUH or 2 kW has been specified per §110.3(c)6

Tables F & G: water-heater info and requirements

Sample NRCC-PLB-01-E, Tables G & H

Table Continued

Mandatory Pipe Insulation All Occupancies		
12	☑	For systems serving nonresidential spaces, pipe insulation for the following applications is specified to comply with Table 120.3-A (see below) per §120.3: - Recirculating system piping, including supply and return piping of the water heater - The first 8 ft of hot and cold outlet piping for a nonrecirculating storage system - Pipes that are externally heated
13	☑	Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. Insulation exposed to weather shall be installed with a cover suitable for outdoor service per §120.3(b) and §150.0(j)3

TABLE 120.3-A PIPE INSULATION THICKNESS

Fluid Temperature Range (°F)	Conductivity Range (Btu-in per hour per ft² per °F)	Insulation Mean Rating Temp (°F)	Nominal Pipe Diameter (in)		
			<1	1 to < 1.5	1.5 to < 4
			Minimum Insulation Required		
105-140	0.22-0.28	100	1.0 in or R-7.7	1.5 in or R-12.5	1.5 in or R-11

H. DOMESTIC HOT WATER SYSTEM CONTROLS				
Table Instructions: Complete the following table to demonstrate compliance with controls requirements in §110.3 for all occupancies. For high-rise residential and hotel/motel occupancies, compliance is demonstrated with requirements in §150.1(c)8.				
	Yes	No	Not Applicable	Requirement
01	◉	○	○	Construction documents require manufacturer certification that service water-heating systems are equipped with automatic temperature controls capable of adjusting temperature settings per §110.3(a)
02	○	○	◉	Systems with capacity > 167,000 BTUH equipped with outlet temperature controls per §110.3(c)1 unless covered by California Plumbing Code Section 613.0.
03	◉	○	○	Controls for circulating pumps or electrical heat trace systems are capable of automatically turning off the system per §110.3(c)2 unless system serves healthcare facility.
04	○	○	◉	For recirculation systems serving multiple dwelling units, design includes automatic pump controls per §150.1(c)8Bii, or §150.2 for additions or alterations
05	○	○	◉	For recirculation systems serving individual dwelling units, design includes manual on/off controls as specified in Reference Appendix RA 4.4.9 per §150.1(c)8.
06	○	○	◉	For replacement single heat pump water heaters serving individual dwelling units in climate zones 1-15, design includes communication interface that meets demand responsive control requirements of §110.12(a) per §150.2(b)1Hiii.

Pipe insulation requirements and water-heater controls

Sample NRCC-PLB-01-E, Tables I to K

I. DECLARATION OF REQUIRED CERTIFICATES OF INSTALLATION

Table Instructions: Selections have been made based on information provided in previous tables of this document. If any selection needs to be changed, please explain why in Table E. Additional Remarks. These documents must be provided to the building inspector during construction and can be found online at https://www.energy.ca.gov/title24/2019standards/2019_compliance_documents/Nonresidential_Documents/NRCI/

YES	NO	Form/Title	Field Inspector	
			Pass	Fail
●		NRCI-PLB-01-E - Must be submitted for all buildings	☐	☐
○	●	NRCI-PLB-02-E - Must be submitted for high-rise residential and hotel/ motel central hot water distribution systems to be recognized for compliance.	☐	☐
○	●	NRCI-PLB-03-E - Must be submitted for high-rise residential and hotel/ motel single dwelling unit hot water distribution systems to be recognized for compliance.	☐	☐

J. DECLARATION OF REQUIRED CERTIFICATES OF ACCEPTANCE

There are no Certificates of Acceptance applicable to service water heating requirements.

K. DECLARATION OF REQUIRED CERTIFICATES OF VERIFICATION

Table Instructions: Selections have been made based on information provided in previous tables of this document. If any selection needs to be changed, please explain why in Table E. Additional Remarks. These documents must be completed by a HERS Rater and provided to the building inspector during construction. The final documents must be created by a HERS Providers registry, but drafts can be found online at https://www.energy.ca.gov/title24/2019standards/2019_compliance_documents/Nonresidential_Documents/NRCV/

YES	NO	Form/Title	Field Inspector	
			Pass	Fail
○	●	NRCV-PLB-21-H High-rise Residential Central Hot Water Distribution HERS Verification	☐	☐
○	●	NRCV-PLB-22-H High-rise Residential Individual Dwelling Unit Hot Water Distribution HERS Verification	☐	☐

Required compliance documents

NRCI (Certificate of Installation)

- Builders/contractors
  - Stick to the plans and specs approved by the building department!
  - Any changes must be approved by the building department (make sure construction is still within code)
    - If needed, the builder/designer must update the NRCC and plans and resubmit
- Installers must fill out and sign NRCIs when installing energy features
  - Installers must ensure the data is sent to an approved nonresidential data registry, if one is approved
  - Post or provide them onsite for final inspection

Certificate of Installation (NRCI) Forms for Water-Heating

Non-HERS

- *PLB-01-E: Plumbing**
- *PLB-02-E: Central Hot Water Distribution System*
- *PLB-03-E: Hot Water Distribution System, Single Dwelling*

HERS

- *PLB-21-H: Central Hot Water Distribution System, Multifamily, HERS-verified*
- *PLB-22-H: Hot Water Distribution System, Single Dwelling, HERS-verified*

*Used for all nonresidential occupancies; all others are used for high-rise residential and hotel/motel only

Sample NRCI-PLB-01-E

STATE OF CALIFORNIA
PLUMBING
CEC-NRCI-PLB-01-E (Revised 01/20) CALIFORNIA ENERGY COMMISSION

CERTIFICATE OF INSTALLATION		NRCI-PLB-01-E
Plumbing		(Page 1 of 4)
Project Name: AR Test NR	Enforcement Agency: Sacramento, City of	Permit Number: 20-P
Project Address: 1516 9th St	City: Sacramento	Zip Code: 95814

A. GENERAL INFORMATION			
DATE OF BUILDING PERMIT:	8/29/20		
BUILDING TYPE	☑ Nonresidential	☐ High-Rise Residential	☐ Hotel/Motel
PHASE OF CONSTRUCTION	☑ New Construction	☐ Addition	☐ Alteration
If more than one person has responsibility for building construction, each person shall prepare and sign an Installation Certificate document applicable to the portion of construction for which they are responsible; alternatively, the person with chief responsibility for construction shall prepare and sign the Installation Certificate document(s) for the entire construction.			

B. SCOPE OF RESPONSIBILITY	
Date of approval by the enforcement agency of the Certificate of Compliance that provides the specifications for this Installation Certificate.	Date: 8/29/20

In the table below identify all applicable construction documents that specify the features, materials, components, manufactured devices, or system performance diagnostic results required for the scope of responsibility for this Installation Certificate.

Document Title or Description	Applicable Sheets or Pages, Tables, Schedules, etc.	Date Approved By the Enforcement Agency
Plans and Specificat	Plumbing Schedule, Pg 2	8/29/20
NRCC-PLB-01-E	N/A	8/29/20

- Table A: General Information
- Table B:
  - NRCC approval date
  - Documents with the water-heating features listed on the NRCI
  - Test results required for water-heating features listed on the NRCI

Sample NRCI-PLB-01-E, Table C

C. MANDATORY REQUIREMENTS FOR ALL CENTRAL DOMESTIC HOT WATER RECIRCULATION SYSTEMS	
01	On systems that have a total capacity greater than 167,000 Btu/hr, outlets that require higher than service water temperatures as listed in the ASHRAE Handbook have separate remote heaters, heat exchangers, or boosters to supply the outlet with the higher temperature. (Section 110.3 (c)1)
02	Systems with circulating pumps or with electrical heat trace systems shall be capable of automatically turning off the system. (Section 110.3(c)2).
05	Unfired storage tanks are insulated with an external R-12 or combination of R-16 internal and external insulation. Alternatively, the heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot. (Section 110.3(c)4).
06	All sections of the recirculation loop, and the first 5 feet of all branches off the loop are insulated, to the thicknesses required by Table 120.3A, except for the following: (RA4.4.1) • Piping installed in interior or exterior walls that is surrounded on all sides by at least 1inch of insulation. • Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top. • Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members. • Insulation is not required on the cold water line when it is used as the return.
07	Hot water pipes that are buried below grade are installed in a water proof and non-crushable casing or sleeve that allows for installation, removal, and replacement of the enclosed pipe and insulation. (RA4.4.1)
08	Insulation outside conditioned space is protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind. (RA4.4.1)
09	Pipe insulation fits tightly to the pipe. (RA4.4.1)
10	On insulated sections of pipe, no piping is visible due to insulation voids, and all elbows and tees are fully insulated. (RA4.4.1)
11	The recirculation pump is mounted on a vertical section of the return line, OR an automatic air release valve is installed on a riser at least 12 inches in length, on the inlet side of the recirculation pump, no more than 4 feet from the pump. (Section 110.3(c)5A).
12	A check valve is located between the recirculation pump and the water heater. (Section 110.3(c)5B).
13	A hose bibb is installed between the pump and the water heating equipment with an isolation valve between the hose bibb and the water heating equipment. (Section 110.3(c)5C).
14	Isolation valves are installed on both sides of the pump. One of the isolation valves may be the same isolation valve as in item 12 above. (Section 110.3(c)5D).
15	The cold water supply piping and the recirculation loop piping is not connected to the hot water storage tank drain port. (Section 110.3(c)5E).
16	A check valve is installed on the cold water supply line between the hot water system and the next closest tee on the cold water supply. (Section 110.3(c)5F).
17	The hot water distribution system piping from the water heater(s) to the fixtures and appliances takes the most direct path. (RA 4.4.7.1)
18	Installation and operation instructions that provide details of the operation of the pump and controls are available at the jobsite for inspection. (RA 4.4.7.1)

Mandatory Water-Heating Requirements

Sample NRCI-PLB-01-E, Table E

E. Mandatory Measures for all Domestic Hot Water Distribution Systems	
01	Equipment shall meet the applicable requirements of the Appliance Efficiency Regulations (Section 110.3(b)1).
02	Unfired Storage Tanks are insulated with an external R-12 or combination of R-16 internal and external Insulation. (Section 110.3(c)4).
03	• All domestic hot water piping shall be insulated as specified in Section 609.11 of the California Plumbing Code. In addition, the following piping conditions shall have a minimum insulation wall thickness of 1 inch or a minimum insulation R-value of 7.7: • The first 5 feet (1.5 meters) of cold water pipes from the storage tank. • All piping with a nominal diameter of 3/4 inch (19 millimeter) and less than 1 inch. • All hot water with a nominal diameter less than ¾ inch that is:. o Associated with a domestic hot water recirculation system. o From the heating source to the kitchen fixtures. o From the heating source to storage tank or between tanks. o Buried below grade. • Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members. • Piping installed in interior or exterior walls that is surrounded on all sides by at least 1 inch of insulation. • Piping installed in crawlspace with a minimum of 2 inches (5 cm) of crawlspace insulation above and below. • Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top
04	• Pipe insulation shall meet the insulation protection requirements of Section 120.3(b) o **Insulation exposed to weather shall be shielded from solar radiation.** o **Insulation on peps buried below grade must be installed in a water proof and non-crushable casing or sleeve.**
05	All elbows and tees shall be fully insulated. (RA4.4.1)
06	Where insulation is required, no piping shall be visible due to insulation voids, and all insulation shall fit tightly to the pipe. (RA4.4.1)
07	**For Gas or Propane Water Heaters:** Ensure the following are installed (Section 150.0(n)) 1. A dedicated 125V, 20A electrical receptacle connected to the electric panel with a 120/240V 3 conductor, 10 AWG copper branch circuit, within 3 feet from the water heater and accessible with no obstructions; a. The conductor shall be labeled with the work "Spare" on both ends; and b. A reserved single pole circuit breaker space next to the circuit breaker next to the branch circuit in A labeled "Future" 240V shall be provided. 2. A Category III or IV vent, or a Type B vent with straight pipe between outside and water heater 3. A condensate drain no more than 2 inches higher than the base on water heater for natural draining 4. A gas supply line with capacity of at least 200,000 Btu/hr
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.	

Mandatory Water-Heating Requirements

NRCV (Certificate of Verification)

- HERS testing
  - Features must meet the requirements listed on the NRCC *[for water-heating: high-rise residential hot water distribution – NRCV-PLB-21-H and -22-H]*
  - Installer's test results on NRCI forms must meet the Energy Code
  - Performance credits *[for water-heating: drain water heat recovery, compact distribution, pipe insulation]*
- HERS Raters test any features that need it (see NRCC)
  - Passing features get registered *NRCVs*; post these onsite for final inspection; failures must be corrected and retested. All results go into the HERS registry
  - NRCVs must be registered with a CEC-approved HERS registry

* There are no NRCA forms for water-heating

Certificate of Verification (NRCV) Forms for Water-Heating

- *PLB-21-H: Central Hot Water Distribution System, Multifamily, HERS-verified*
- *PLB-22-H: Hot Water Distribution System, Single Dwelling, HERS-verified*

Sample NRCV-PLB-22-H, Tables A to D

CERTIFICATE OF VERIFICATION					NRCV-PLB-21-H
HERS Verified High Rise Residential/Hotel/Motel Central Hot Water System Distribution					(Page 1 of 5)
Project Name:	AR Test NR	Enforcement Agency:	Sacramento, City of	Permit Number:	20-P
Dwelling Address:	1516 9th St	City:	Sacramento	Zip Code:	95814

A. General Information

01	Building Name	Building 001

B. Design HERS Verified Central Water Heating Systems Information
This table reports the water heating system features that were specified on the NRCC-PRF-01 compliance document for this project.

01	02	03	04	05	06	07	08	09	10	11	12
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in System	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value
DHW 1	Domestic Hot Water (DHW)	Residential-Duty Commercial Instantaneous	1	n/a	Electricity	kW	60	EF	0.8	n/a	2

C. Installed HERS Verified Central Water Heating Systems Information
This table reports the water heating system features that were installed in this project.

01	02	03	04	05	06	07	08	09	10	11	12
Water Heating System ID or Name	Water Heating System Type	Water Heater Type	# of Water Heaters in System	Water Heater Storage Volume (gal)	Fuel Type	Rated Input Type	Rated Input Value	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insul. R-Value
DHW 1	Domestic Hot Water (DHW)	Residential-Duty Commercial Instantaneous	1	n/a	Electricity	kW	60	EF	0.8	n/a	4

D. Design HERS Verified Water Heating Distribution Systems Information
This table reports the water heating system features that were specified on the NRCC-PRF-01 compliance document for this project.

01	02	03
Water Heating System ID or Name	Central DHW System Distribution Type	Dwelling Unit DHW System Distribution Type

Registration Number: PROJ20-02921611-000-001-B21000A-0000 Registration Date/Time: 2020-09-21 15:04:08 HERS Provider: CHEERS

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CA Building Energy Efficiency Standards - 2019 Nonresidential Compliance Report Version: 2019.1.003 Report Generated: 2020-09-21 15:06:31

- System information
- Should ALWAYS have a HERS watermark, HERS registration number, and authorized digital signature!

Sample NRCV-PLB-22-H, Tables E & F

E. Installed HERS Verified Water Heating Distribution Systems Information
Systems that utilize this distribution type shall comply with these requirements

01	02	03
Water Heating System ID or Name	**Central DHW System Distribution Type**	**Dwelling Unit DHW System Distribution Type**

F. Installed Water Heater Manufacturer Information

01	02	03
Water Heating System ID or Name	**Manufacturer**	**Model Number**
DHW 1	INstan	M60000

- System information

Sample NRCV-PLB-22-H, Tables G & I

G. Mandatory Requirements For All Central Domestic Hot Water Systems	
01	On systems that have a total capacity greater than 167,000 Btu/hr, outlets that require higher than service water temperatures as listed in the ASHRAE Handbook have separate remote heaters, heat exchangers, or boosters to supply the outlet with the higher temperature. (Section 110.3 (c)1)
02	Systems with circulating pumps or with electrical heat trace systems shall be capable of automatically turning off the system. (Section 110.3(c)2).
03	Unfired storage tanks are insulated with • External insulation of R-12, or • Internal insulation of R-16, or • The heat loss of the tank surface based on an 80 °F water-air temperature difference shall be less than 6.5 Btu/ft^2. (Section 110.3(c)3).
04	Recirculation loop shall meet the following requirements: • The recirculation pump is mounted on a vertical section of the return line, OR an automatic air release valve is installed on a riser at least 12 inches in length, on the inlet side of the recirculation pump, no more than 4 feet from the pump. (Section 110.3(c)4A). • A check valve is located between the recirculation pump and the water heater. (Section 110.3(c)4B). • A hose bibb is installed between the pump and the water heating equipment with an isolation valve between the hose bibb and the water heating equipment. (Section 110.3(c)4C). • Isolation valves are installed on both sides of the pump of which the valve required in (Section 110.3(c)4C can be one. (Section 110.3(c)4D). • The cold water supply piping and the recirculation loop piping is not connected to the hot water storage tank drain port. (Section 110.3(c)4E). • A check valve is installed on the cold water supply line between the hot water system and the next closest tee on the cold water supply. (Section 110.3(c)4F).
05	Instantaneous water heaters with an input greater than 6.8 kBtu/hr. (2kW) shall have isolation valves at both the cold water supply and the hot water line (110.3(c)6).

I. Determination of HERS Verification Compliance All applicable sections of this document shall indicate compliance with the specified verification protocol requirements in order for this Certificate of Verification as a whole to be determined to be in compliance.	
01	Complies: All specified verification protocol requirements on this document are met.

- Table G: Mandatory requirements
- Table I: HERS verification result

Sample NRCV-PLB-22-H, Tables G & H

G. Mandatory Requirements For All Central Domestic Hot Water Systems		
06	All domestic hot water piping shall be insulated as specified in Section 609.11 of the California Plumbing Code. In addition, the following piping conditions shall have a minimum insulation wall thickness of 1 inch or a minimum of insulation R-value of 7.7 (RA4.4.1) • The first 5 feet (1.5 meters) of hot and cold water pipes from the storage tank. • All piping with a nominal diameter of 3/4 inch (19 millimeter) and less than 1 inch. • All hot water pipes from the heating source to the kitchen fixtures. • Piping from the heating source to storage tank of between tanks. • All piping associated with a recirculation system • All underground piping. • Insulation buried below grade must be installed in a waterproof and non-crushable casing or sleeve. • Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members. • Piping installed in interior or exterior walls that is surrounded on all sides by at least 1 inch of insulation. • Piping installed in crawlspace with a minimum of 1 inch (5cm) of crawlspace insulation above and below. • Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top. • Pipe insulation shall fit tightly and all elbows and tees shall be fully insulated.	
07	Verification Status:	Pass - all applicable requirements are met.
08	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		

H. HERS Verified Multiple Recirculation Loops for DHW systems Serving Multiple Dwelling Units Requirements All distribution systems listed on this compliance document shall comply with these requirements.		
01	All buildings with 8 or more dwelling units have a minimum of 2 recirculation loops.	
02	Each loop roughly serves the same number of dwellings.	
03	Verification Status:	Pass - all applicable requirements are met.
04	Correction Notes:	
The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table.		

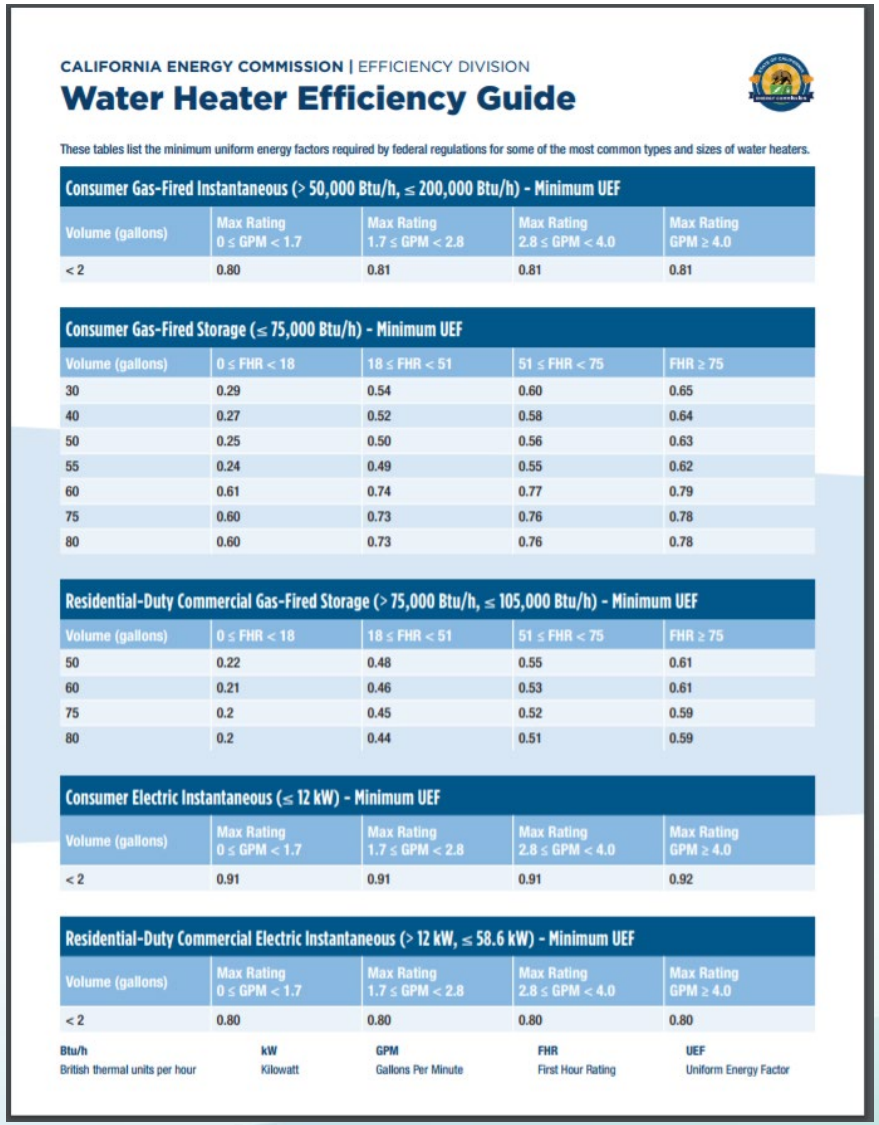
- Tables G & H: Mandatory requirements

Resources

Online Resource Center (ORC)

[Visit our Online Resources Center]

water-heater Efficiency Guide



CALIFORNIA ENERGY COMMISSION | EFFICIENCY DIVISION

Water Heater Efficiency Guide

These tables list the minimum uniform energy factors required by federal regulations for some of the most common types and sizes of water heaters.

Consumer Gas-Fired Instantaneous (> 50,000 Btu/h, ≤ 200,000 Btu/h) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
< 2	0.80	0.81	0.81	0.81

Consumer Gas-Fired Storage (≤ 75,000 Btu/h) - Minimum UEF

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
30	0.29	0.54	0.60	0.65
40	0.27	0.52	0.58	0.64
50	0.25	0.50	0.56	0.63
55	0.24	0.49	0.55	0.62
60	0.61	0.74	0.77	0.79
75	0.60	0.73	0.76	0.78
80	0.60	0.73	0.76	0.78

Residential-Duty Commercial Gas-Fired Storage (> 75,000 Btu/h, ≤ 105,000 Btu/h) - Minimum UEF

Volume (gallons)	0 ≤ FHR < 18	18 ≤ FHR < 51	51 ≤ FHR < 75	FHR ≥ 75
50	0.22	0.48	0.55	0.61
60	0.21	0.46	0.53	0.61
75	0.2	0.45	0.52	0.59
80	0.2	0.44	0.51	0.59

Consumer Electric Instantaneous (≤ 12 kW) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
< 2	0.91	0.91	0.91	0.92

Residential-Duty Commercial Electric Instantaneous (> 12 kW, ≤ 58.6 kW) - Minimum UEF

Volume (gallons)	Max Rating 0 ≤ GPM < 1.7	Max Rating 1.7 ≤ GPM < 2.8	Max Rating 2.8 ≤ GPM < 4.0	Max Rating GPM ≥ 4.0
< 2	0.80	0.80	0.80	0.80

Btu/h British thermal units per hour
kW Kilowatt
GPM Gallons Per Minute
FHR First Hour Rating
UEF Uniform Energy Factor

[Download the water-heater Efficiency Guide]

Blueprint

- Quarterly newsletter
- Clarifications on frequently asked questions
- Subscribe to the Blueprint

Issue 113 | March – April 2016

BLUEPRINT

California Energy Commission
Efficiency Division

In This Issue

New Mechanical Acceptance Test Technician Certification Provider

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

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

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

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

Small Duct High Velocity Space Conditioning Systems

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

Mandatory Requirements

United States Department of Energy Standards:

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

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

Energy Standards:

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

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

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

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

Prescriptive Requirements

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

1

Email Lists

Receive updates on the Energy Standards

Subscribe to the following Efficiency emails:

- Join the Building Standards email list
- Subscribe to the Blueprint

Respond to confirmation email within 24 hours

Approved Compliance Software

Used to show compliance with the Energy Code when using the performance approach

Residential

- CBECC-Res
- Energy Pro
- Wrightsoft Right-Energy

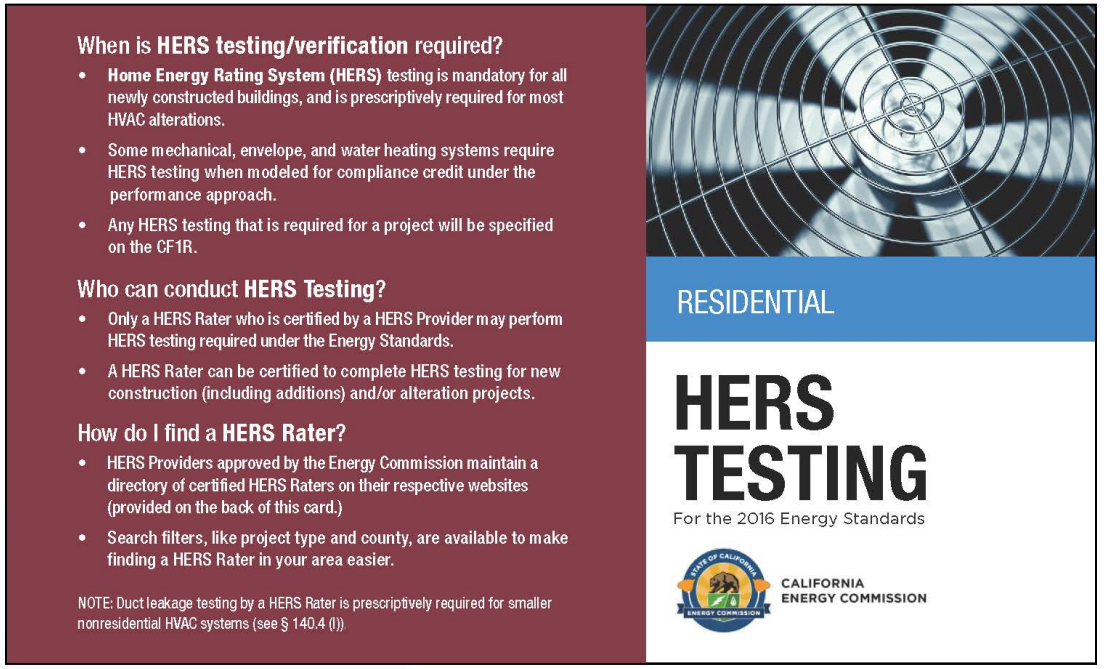
Nonresidential

- CBECC-Com
- Energy Pro

Download the compliance software

HERS Counter Card

- Available online
- Intended to assist counter staff
- Inform applicants about HERS testing and verification



Download the HERS Counter Card

Approved HERS Providers

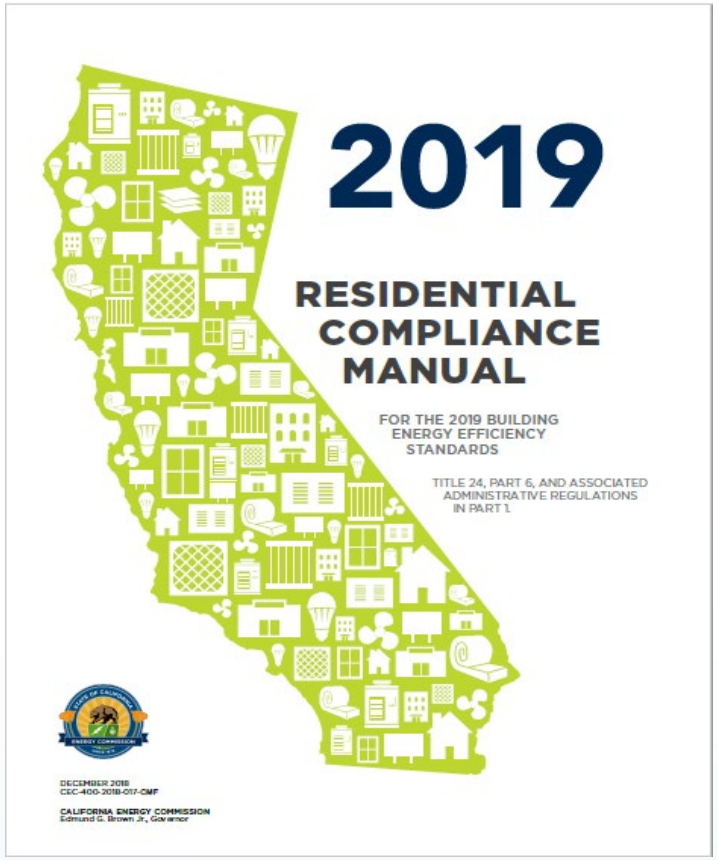
- CalCERTS – New construction, HVAC alterations, and whole-house ratings
- CHEERS – New construction and HVAC alterations

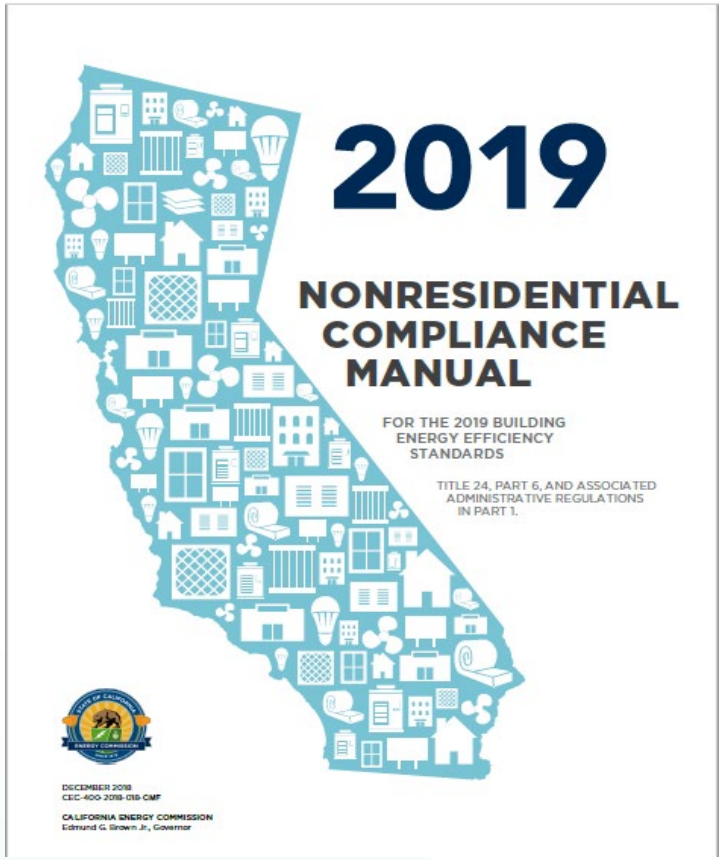
See approved HERS providers

Energy Standards Hotline

- Available to help with questions about Part 6
- Email your questions to the Hotline
- Call us!
  - 800-772-3300 from within California (toll free)
  - 916-654-5106 from outside California
  - Available 8am to 12pm, 1pm to 4:30pm

Compliance Manuals

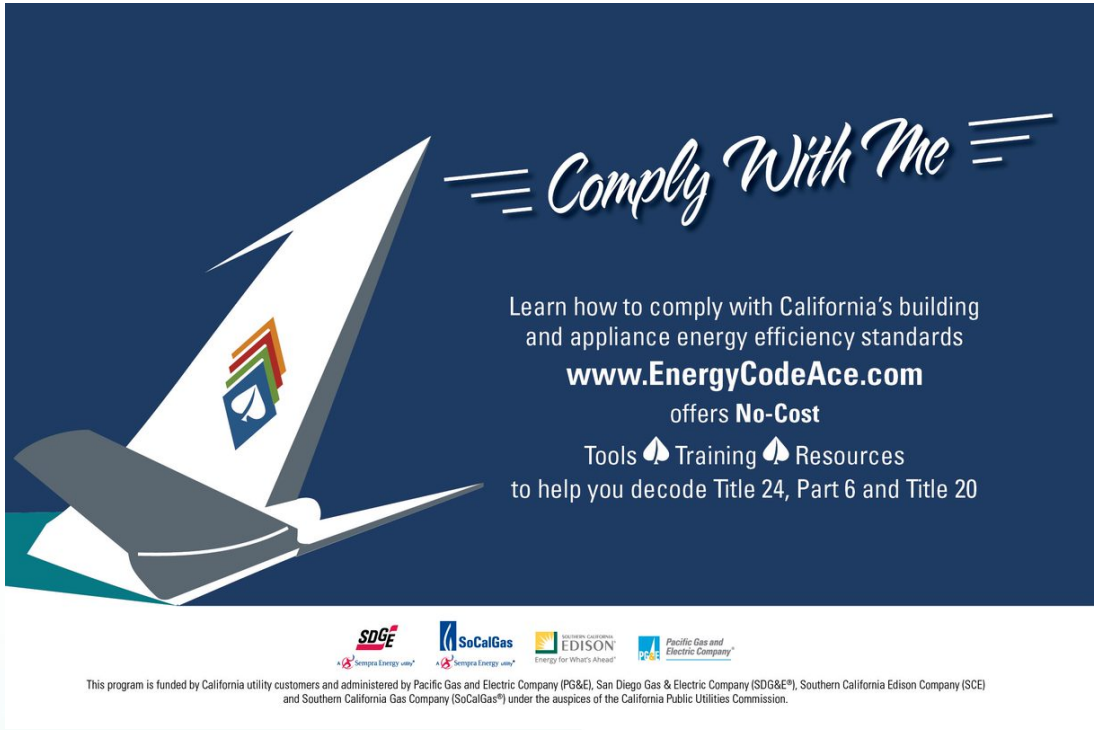




Download the 2019 Compliance Manuals

Energy Code Ace

- Forms and resources
- Free training (in-person and online)
- Checklists and trigger sheets



For more Energy Code resources, visit Energy Code Ace

Questions?