



CSD LIWP STANDARDS

FOR

CEILING INSULATION - DRAFT

Category	Criteria
1. MEASURE	<p>1.1. Ceiling and knee wall insulation reduces unwanted heat loss or gain and can decrease the energy demands of heating and cooling systems.</p> <p>1.2. This measure is classified as an Enhanced Measure requiring:</p> <ol style="list-style-type: none"> a. An energy audit when some insulation <u>is</u> present. b. No energy audit when insulation is <u>not</u> present. <p>1.3. The following requirements are in addition to all applicable requirements found in the General Installation Guidelines.</p>
2. LICENSING	<p>2.1. This measure requires a Class B General Building Contractor or C-2 Insulation and Acoustical Contractor license for purposes of the LIWP program.</p>
3. FEASIBILITY CRITERIA	<p>3.1. Install this measure when (<u>ALL</u> of the following shall apply):</p> <ol style="list-style-type: none"> a. The ceiling area separates conditioned and unconditioned space. b. At least 100 square feet of attic is feasible to insulate. c. Energy audit shows a SIR of 1.0 or greater (when energy audit is required) <p>3.2. Do <u>NOT</u> install this measure when:</p> <ol style="list-style-type: none"> a. Existing insulation level meets Title 24 requirement for new construction. b. Existing insulation is vermiculite material. c. An exhaust fan terminates in the attic and cannot be vented to the outdoors. d. An unsafe structural or electrical attic condition is present that cannot feasibly be corrected. e. Knob-and-Tube (K&T) wiring is present and energized. f. Roof leak is present. g. Structure is unsound and cannot support the weight of insulation. h. Required attic venting is not feasible to install.
4. ADDITIONAL ASSESSMENT CRITERIA	<p>4.1. Electrical Safety Requirements</p> <ol style="list-style-type: none"> a. Electrical hazards in the attic shall be corrected, if feasible, before insulation may be installed. <p>4.2. Knee Wall and Skylight Well Insulation: Uninsulated knee walls and skylight wells shall be insulated when ceiling insulation is installed.</p>
5. MINIMUM INSTALLATION GUIDELINES	<p>5.1. Measure shall be installed in accordance with manufacturer's instructions and specifications, local building code, the 2016 Title 24 requirements and the LIWP CAS Protocol.</p> <p>5.2. Ceiling Insulation Required R-Value:</p> <ol style="list-style-type: none"> a. Insulation for ceilings, knee walls, and skylight wells shall be installed to satisfy current Title 24 requirements for <u>new construction</u>. <ul style="list-style-type: none"> - R-30: Climate zones 1, 11-16 - R-38: Climate zones 2-10. - Uninsulated knee walls and skylight wells: R-19 flexible insulation shall be installed and secured in place. b. Access cover shall be insulated and weatherstripped per Item 5.8. <p>5.3. Attic Preparation</p> <ol style="list-style-type: none"> a. When the attic contains an HVAC unit and/or ducts, work on the appliance and duct testing/sealing shall be complete <u>before</u> insulation is installed.

- b. If required, additional attic ventilation shall be installed prior to insulation work and billed within this measure.
 - c. Care shall be taken to prevent damage to the home and furnishings by the insulation hose, ladders, etc.
 - d. Dwelling interior shall be protected with runners/drop cloths, when access is indoors.
 - e. All cutting of batts shall occur outside the living space or inside the attic.
 - f. One depth marker shall be installed for every 300 square feet of attic area, with the bottom of the marker at the air barrier, to determine where additional insulation is needed. Markers shall be left in place to aid in inspection.
- 5.4. Vapor Barrier (when required by the local jurisdiction)
- a. Vapor barrier criteria apply to flexible mineral fiber batts/blankets installed directly onto the attic floor, knee wall, or skylight well (not to batts installed for blocking purposes).
 - b. Vapor barrier shall not be installed over existing insulation (with the exception of batts used for blocking).
 - c. When installed, barrier is placed toward winter warm side (directly on attic floor).
- 5.5. Permanent Blocking of Vents and Heat-Producing Devices (HPDs)
- a. Insulation shall not be installed over energized wires that are not insulated or have frayed or decayed insulation or unsafe splices. When a hazard exists, hazard area shall be blocked as described in the following table.

Wire Hazard	ELECTRICAL WIRING REQUIREMENTS
Open Junction Boxes	<ul style="list-style-type: none"> • All electrical junctions will be flagged to be seen above the level of the insulation. • Protect box with a standard cover plate. When installed, it is acceptable to blow loose fill insulation over the box.
Wire Connections Protruding from a Junction Box	<ul style="list-style-type: none"> • Protect connections with a box extension AND standard cover plate. • Install mineral fiber blocking that exceeds the height of adjoining loose fill by 4", and extends away at least 14-1/2" x 12" in all directions.
Wire Connections without Junction Box (Spider Web)	<ul style="list-style-type: none"> • Protect connections with mineral fiber blocking that exceeds the height of adjoining loose fill by 4", and extends away at least 14-1/2" x 12" in all directions.
Knob-and-Tube	<ul style="list-style-type: none"> • Shall be treated in accordance with LIWP Standards Attachment B and CEC Article 394.

- b. Clearance zone shall provide a cleared space free of insulation surrounding a heat producing device (HPD) or vent, in accordance with the following table.
 - Note 1: No blocking is required where loose fill is not present or if the HPD is mounted above the top of the insulation.
 - Note 2: Local code may supersede these requirements.

GENERAL BLOCKING REQUIREMENTS FOR ALL HPD TYPES	
Loose Fill Insulation	<ul style="list-style-type: none"> • Minimum 3" clearance zone required in all directions around: <ul style="list-style-type: none"> - Recessed light fixtures ("IC" and "Non-IC" types) - Exposed fluorescent fixtures - Doorbell transformers - Motors for range hoods and exhaust fans - Appliance vent pipes made of metal - Masonry chimneys - Electric water heater - Combustion appliances • Flexible mineral fiber blocking shall extend at least an additional 14-1/2" from the clearance zone in all directions.

	<ul style="list-style-type: none"> • Non-combustible blocking materials are required. <ul style="list-style-type: none"> - Blocking shall extend from the attic floor to 4" above the insulation level. - Metal blocking (dam) shall be permanently attached to the ceiling/framing with staples, nails, or screws. - Baffles and chutes must be kept 3" away from HPDs, if non-metal. • If covered by a fire-rated, airtight enclosure instead of a dam, 24" minimum top clearance is required. <ul style="list-style-type: none"> - Top cover shall have an R-value of 0.50 or less. - Insulation must not cover the top of the enclosure. - Caulk, mastic, or foam will be used on all edges, gaps, cracks, holes, and penetrations of closure material. - <i>Note:</i> Gypsum enclosures that house fluorescent light fixtures do not require protection from loose fill insulation.
Flexible Insulation	<ul style="list-style-type: none"> • 3" clearance zone required for from HPD on all sides. • When flexible is installed over loose fill, blocking shall be used to prevent loose fill from entering the clearance zone.

c. Appliances Located in Attics: Additional clearance zones apply, as identified in the table below, or may be superseded by manufacturer specifications.

FURNACE/HEAT PUMP BLOCKING REQUIREMENTS	
Loose Fill	<ul style="list-style-type: none"> • 12" around back, sides, and top. • 24" clearance in front. • 3" clearance for vent pipes (6" if single-wall).
Flexible	<ul style="list-style-type: none"> • 12" on all sides. • 3" clearance for vent pipes (6" if single-wall). • 6" clearance below units drawing combustion air from bottom.
GAS WATER HEATER BLOCKING REQUIREMENTS	
Loose Fill	<ul style="list-style-type: none"> • 6" around back and sides. • 12" clearance in front. • 3" clearance for vent pipes (6" if single-wall).
Flexible	<ul style="list-style-type: none"> • 6" on all sides. • 3" clearance for vent pipes (6" if single-wall).
APPLIANCE PLATFORM AND CATWALK BLOCKING REQUIREMENTS	
All Insulation Types	<ul style="list-style-type: none"> • Install insulation underneath both, when accessible. • Insulation shall <u>not</u> be installed on top of platforms, unless clearances can be met.

5.6. Blocking of Building Cavities and Attic Ventilation

a. All vents, individual or continuous, shall be protected with blocking.

b. General Requirements

- Blocking shall conform to Item 5.8(b) and be installed to extend to the top plate.
- Metal, flexible mineral fiber (batts), and manufactured pre-cut cardboard and preformed plastic baffles/chutes (for eave vents) may be used.
 - *Note:* Nonmetallic baffles and chutes shall not be used to block HPDs.
- Rigid materials shall be permanently attached to the ceiling/framing with staples, nails, or screws.

5.7. Blocking at Attic Vent Locations

a. Minimum 1" clearance is required between roof sheathing and insulation.

b. Horizontal mineral fiber blocking may rest on existing loose fill, if no loose fill is exposed at the top plate.

- Blocking that extends inward 14-1/2" shall exceed height of loose fill by 4".
- Blocking that extends inward 24" shall equal or exceed height of loose fill.

c. Baffles and Chutes

- When attached to rafters, they shall begin at the top plate and extend above

	<p>loose fill by a minimum of 4" and a maximum of 12".</p> <ul style="list-style-type: none"> - Shall be permanently attached with 2+ mechanical fasteners per rafter. - Minimum air path is 1" x 12" for 16" OC rafters, or 1" x 18" for 24" OC. <p>5.8. Blocking, Insulation, and Weatherstripping of Attic Access</p> <p>a. When loose fill insulation is present, each functional/usable access shall be blocked.</p> <ul style="list-style-type: none"> - Batts shall extend from the attic floor to top of loose fill <u>and</u> extend at least 14-1/2" from access opening in all directions. - Metal barrier material shall <u>not</u> be installed. - When wood members (2-by framing, plywood, etc.) surround the access and extend from attic floor to top of loose fill, blocking is <u>not</u> required. - When wood members are present but do not extend to top of loose fill, batts (faced or unfaced) may be used in combination with wood members to achieve required blocking height. <p>b. All attic entry doors/covers accessed from conditioned space shall be insulated to the same R-value as the attic floor, and shall be non-compressed rigid or flexible material that is permanently attached.</p> <p>c. Access hatch frames shall be weatherstripped.</p>
<p>6. POST-INSTALLATION GUIDELINES</p>	<p>6.1. Operational Checks</p> <p>a. Installation shall be in accordance with manufacturer specifications, applied evenly with no gaps, voids, compressions, misalignments, or possible wind intrusions from lack of blocking.</p> <p>b. Insulation shall not be compressed or to impact the insulation R-value.</p> <p>c. Clearance zone for HPDs and vents shall be verified free of insulation overblow.</p>
<p>7. MATERIAL SPECIFICATIONS</p>	<p>7.1. All insulation types shall be certified to comply with CCR, Title 24, Part 12, Chapters 12-13, "Standards for Insulating Material", and to requirements by type:</p> <p>a. Mineral Fiber</p> <ul style="list-style-type: none"> - Flexible (Batts): Conformance to ASTM C665. - Loose Fill: Conformance to ASTM C764. <p>b. Cellulose, Loose Fill: Licensed for sale in California and listed in Department of Consumer Affairs "Directory of Certified Insulation Materials"</p> <p>c. Rigid:</p> <ul style="list-style-type: none"> - Preformed polyisocyanurate board foil-faced on both sides, in conformance with FS HH-1-1972. - High Density Fiberglass Board: Conformance to ASTM C726. <p>7.2. Vapor Barrier (when required): Maximum of 1 perm</p> <p>7.3. Blocking Materials</p> <p>a. Batts: Flexible mineral fiber (unfaced or faced).</p> <p>b. Metal: Corrosion-resistant, minimum 0.007" thick</p> <p>c. Eave Vent Chutes and Baffles: Commercially available plastic or cardboard.</p> <p>d. Wood: Framing members and attached sheathing (e.g., plywood).</p>
<p>8. WARRANTY</p>	<p>8.1. Manufacturer Warranty – 1 year</p>



CSD LIWP STANDARDS

FOR

COOLING REPLACEMENT (CENTRAL ONLY) - DRAFT

Category	Criteria
1. MEASURE	1.1 Installation of a new central cooling system (split or packaged unit and heat pumps). 1.2 This measure is classified as an Enhanced Measure requiring an energy audit. 1.3 The following requirements are in addition to all applicable requirements found in the General Installation Guidelines.
2. LICENSING	2.1 This measure requires a C-20 Warm-Air Heating, Ventilating and Air-Conditioning license for the purposes of the LIWP program.
3. FEASIBILITY CRITERIA	3.1 Replace this measure when (<u>ALL</u> of the following shall apply): a. The system provides cooling for the dwelling unit being weatherized/served. b. Replacement is justified by energy audit with a SIR of 1.0 or greater. 3.2 Do <u>NOT</u> install this measure when: a. Existing unit is installed in an inaccessible, unsafe or prohibited location. b. Access or clearance requirements cannot be met. c. Installation location is not structurally adequate to properly support installed equipment. d. Roofing materials are not in good condition and would require repair for appliance replacement to be feasible. e. Title 24 requirements cannot be met for the replacement appliance. f. Major alterations/repairs incidental to the cooling replacement would cause SIR to drop below 1.0. g. Required vent system pipe(s) and/or terminals cannot feasibly be installed. h. Electrical service or electrical safety requirements cannot feasibly be met. i. Mobile Home: HVAC system uses a belly-cavity return that cannot feasibly be abandoned and replaced with a new ducted central return.
4. ADDITIONAL ASSESSMENT CRITERIA	4.1 Operational and safety issues shall be diagnosed by a qualified technician and fully described in writing prior to replacement. 4.2 System Design and Performance: a. System components shall be properly sized per 2016 Title 24 specifications. 4.3 Equipment Accessibility and Clearances a. Equipment shall be accessible for replacement and inspection without removing/altering permanent construction. b. Equipment access, clearances, enclosures, and working space shall comply with local code and manufacturer specifications. c. Minimum clearances between equipment or electrical panels, and adjacent structure/wall/obstruction shall be: - 24" on side(s) containing service access panels, and - 12" on all other sides, or per manufacturer. d. Minimum clearances from condenser unit to: - Clothes dryer moisture exhaust: 5' - Overhead obstructions: per manufacturer's specifications.
5. MINIMUM INSTALLATION	5.1 Measure shall be in conformance with manufacturer's instructions and specifications, local building code, and 2016 Title 24 requirements.

<p>GUIDELINES</p>	<p>5.2 If not already present, a smart thermostat shall be installed in conjunction with the cooling appliance replacement (See LIWP standards for “Smart Thermostats”).</p> <p>5.3 Split System Platforms and Plenums</p> <ol style="list-style-type: none"> a. Return plenum shall be free of leaks that affect combustion air or draw in outside air (except economizer units). b. Platform bypasses (unlined cavities) shall be blocked/sealed with a liner of fiberglass duct board or sheet metal. c. Stud cavities sealed with metal shall be insulated with batts (R-13 for 2x4). d. Cooling housing shall be mechanically attached around the perimeter (e.g., housing-to-platform, housing-to-plenum) and properly sealed. e. Supply and return ductwork shall be securely attached to plenums. f. Wiring and plumbing penetrations shall be sealed (e.g., with cork tape). <p>5.4 Roof Mount Installations</p> <ol style="list-style-type: none"> a. Design and installation of support frame or curb, and installation cooling system equipment and applicable safety apparatus (e.g., guard-rail), shall be in conformance with manufacturer’s instructions and local building code. a. All roof penetrations shall be properly flashed and sealed watertight. b. Condensate drain line shall be: <ul style="list-style-type: none"> - Installed per manufacturer and local code. - Equipped with a trap, and run to a nearby gutter, when present. - Painted to resist UV degradation if PVC is used. <p>5.5 Ground Mount Installations</p> <ol style="list-style-type: none"> a. The unit shall rest on concrete or other approved base extending at least 3" above the adjoining ground level, and be protected from damage. b. Locking caps shall be installed on accessible refrigerant service valves. <p>5.6 Appliance Electrical System</p> <ol style="list-style-type: none"> a. Electrical defects shall be repaired (e.g., frayed or burned wires, loose, or improper connections, etc.) in conformance with the 2016 CEC. <p>5.7 Wall and floor repairs shall match plane and texture of adjacent material.</p> <p>5.8 Mobile Home Criteria</p> <ol style="list-style-type: none"> a. Mobile Home Self-Contained Cooling System <ul style="list-style-type: none"> - A self-contained cooling system sharing a common supply duct system with the heating shall have the following dampers: <ul style="list-style-type: none"> • Heating system shall have an automatic barometric damper that prevents cold air from entering the heater when system is in cooling mode. • Cooling system shall have an automatic damper that prevents hot air from entering the cooling unit when system is in heating mode. b. Controls shall prevent cooling and heating from turning on at the same time.
<p>6. POST-INSTALLATION GUIDELINES</p>	<p>6.1 Operational Checks</p> <ol style="list-style-type: none"> a. Installed unit, including thermostat, shall be tested for proper operation. <ul style="list-style-type: none"> - If the system does not operate as designed, manufacturer’s troubleshooting procedures shall be followed. - Installation is not complete until the system operates properly. b. All HERS verifications required by Title 24 shall be performed, and copies of the documentation maintained in the client file. <p>6.2 Client Education—In addition to the General Installation Guidelines section, the following shall be explained to the client:</p> <ol style="list-style-type: none"> a. Proper operation and programming to achieve desired temperature regulation. b. Reduced efficiency from closing supply registers and interior doors. c. Routine maintenance, including <ul style="list-style-type: none"> - Proper filter selection and how to change the filter. - Importance of cleaning dust and debris from return grilles.

	<ul style="list-style-type: none"> - For ground-mount package unit, the importance of keeping outside unit clear of debris, vegetation, etc. d. Importance of professional maintenance at regular intervals <u>and</u> correction of nonconforming conditions.
<p>7. MATERIAL SPECIFICATIONS</p>	<p>7.1 All Units</p> <ul style="list-style-type: none"> a. Appliance must meet Title 20 efficiency standards, as verified by inclusion in the California Energy Commission (CEC) database of certified appliances at: http://www.energy.ca.gov/appliances/ b. Replacement cooling system and components shall be UL listed or equivalent, such as one of the following certifications: CSA or ETL. <p>7.2 Heat Pumps</p> <ul style="list-style-type: none"> a. Package Units: HSPF \geq 8; SEER \geq 14 b. Split Systems (including mini-split systems): HSPF \geq 8.2; SEER \geq 14; <p>7.3 Package Units</p> <ul style="list-style-type: none"> a. Cooling: SEER \geq 14; EER \geq 11.0 b. Heating: AFUE \geq 81% <p>7.4 Split Systems</p> <ul style="list-style-type: none"> a. Cooling: SEER \geq 14 with a thermostatic expansion valve (TXV). b. Heating, if replaced in conjunction with cooling, shall be in conformance with LIWP standard for "Heating Replacement (Central)". <p>7.5 Air Filters</p> <ul style="list-style-type: none"> a. Shall be rated MERV 6 or better, UL listed Class 2 filter material, and in conformance to AHRI 680 or AHRI 681 (SI), and UL-900. <p>7.6 Wall Thermostats</p> <ul style="list-style-type: none"> a. Shall be in compliance with LIWP standards for "Smart Thermostats". <p>7.7 Thermostats for Heat Pumps</p> <ul style="list-style-type: none"> a. Shall prevent supplementary electric resistance heater operation when the heat pump alone can meet the heating load. b. May be a "smart thermostat" with intelligent recovery, staging, ramping, or control that prevents unnecessary use of electric resistance heating. <p>7.8 Ducts and Sealants</p> <ul style="list-style-type: none"> a. Materials shall be in compliance with LIWP standard for "Duct Repair and Replacement".
<p>8. WARRANTY</p>	<p>8.1 Manufacturer Warranty – 3 years</p>



CSD LIWP STANDARDS

FOR

DUCT REPAIR AND REPLACEMENT - DRAFT

Category	Criteria
1. MEASURE	1.1. Repair and/or replacement of central HVAC system air ducts enhance the performance of the existing HVAC system. <ol style="list-style-type: none"> a. Repair applies primarily to disconnections and damaged components, and unlined platform returns. b. Replacement applies primarily to flexible metallic and nonmetallic ducts, rigid metal ducts when extensive damage renders repair unfeasible, and mobile home belly cavity returns (considered excessively leaky). 1.2. This measure is classified as an Enhanced Measure requiring an energy audit. 1.3. The following requirements are in addition to all applicable requirements found in the General Installation Guidelines.
2. LICENSING	2.1. This measure requires a C-20 Warm-Air Heating, Ventilating, and Air-Conditioning Contractor license for purposes of the LIWP program.
3. FEASIBILITY CRITERIA	3.1. Install this measure when (<u>ALL</u> of the following shall apply): <ol style="list-style-type: none"> a. Justified by energy audit with a SIR of 1.0 or greater. b. Necessary to meet Title 24 duct leakage maximum for heating, cooling or heat pump replacement. c. The existing duct system has excessive leakage due to degradation of, or damage to, the ductwork. 3.2. Do <u>NOT</u> install this measure when: <ol style="list-style-type: none"> a. Ducts are inaccessible (located in an attic or crawlspace that has inadequate crawl clearance), pest/insect infested, or other unsafe condition. b. A combustion appliance safety or indoor air quality hazard exists that cannot be corrected.
4. ADDITIONAL ASSESSMENT CRITERIA	4.1. Platform Return: If there is an unlined platform return, the condition shall be noted by the contractor as a required correction (sealing location). 4.2. Shared Duct: Contractor shall verify that when an FAU and evaporative cooler share a supply duct system, a functioning damper is present that isolates the FAU during cooling season, and isolates the cooler during heating season. <ol style="list-style-type: none"> a. <u>Note</u>: If a damper is missing and one cannot be installed, duct sealing is <u>not</u> feasible.
5. MINIMUM INSTALLATION GUIDELINES	5.1. Measure shall be installed in accordance with manufacturer’s instructions and specifications, local building code, 2016 CEC Title 24 requirements, LIWP Duct Testing Protocol and LIWP CAS Protocol. 5.2. Duct repair, replacement, and sealing shall be performed in conformance with Title 24 2016 Residential Compliance Manual, Chapter 4, Subsection 4.4.4, “Duct Installation Standards” <ol style="list-style-type: none"> a. Title 24 requires contractors to certify duct leakage to be an acceptable percentage of fan flow, with a sampling of jobs subject to inspection and verification by a HERS Rater. <ul style="list-style-type: none"> - Link to standards page: http://www.energy.ca.gov/title24/2016standards/ - Link to Chapter 4: http://www.energy.ca.gov/2015publications/CEC-400-2015-032/chapters/chapter_4-Building_HVAC_Requirements.pdf

	<p>b. When impossible to reduce to an acceptable level, all <u>accessible</u> ducts must be sealed in accordance with Title 24. 100% of those jobs are subject to HERS Rater inspection and certification.</p> <p>5.3. Duct system replacement:</p> <p>a. Consists of replacing only damaged/degraded flexible ducting, when rigid components are intact.</p> <p>b. Components (wyes, elbows, start collars, etc.) are replaced when they are in unsatisfactory condition.</p> <p>5.4. Duct system sealing shall meet the requirements stated in Title 24 2016 Residential Compliance Manual, Chapter 9, Subsection 9.6.2.1, "HVAC Changeouts" and the following headings:</p> <p>a. "A. Entirely New or Complete Space Conditioning Systems"</p> <p>b. "B. Altered Duct Systems—Duct Insulation and Sealing Requirements"</p> <p>c. "C. Altered Space Conditioning Systems—Duct Sealing"</p> <p>d. "D. Accessible Ducts"</p>
<p>6. POST-INSTALLATION GUIDELINES</p>	<p>6.1. Operational Checks</p> <p>a. Duct system leakage shall be verified to meet Title 24 requirements.</p> <ul style="list-style-type: none"> - At a minimum, duct system Total Leakage shall be sealed to, or below, 15% of system airflow (or $\leq 10\%$ of Leakage to Outside).
<p>7. MATERIAL SPECIFICATIONS</p>	<p>7.1. Duct Sealing Tapes and Mastics:</p> <p>a. All products: Listed/marked UL 181A and/or 181B</p> <p>b. Tapes for sealing metallic and nonmetallic flexible ducts:</p> <ul style="list-style-type: none"> - Marked "181B-FX" - Cloth-back <i>butyl</i>-adhesive tapes ("butyl tape") allowed only if CEC-approved for use in California (indicated by "CA" in the product number). <p>c. Tapes for sealing rigid metal ducts and components:</p> <ul style="list-style-type: none"> - Metallic tapes marked "181A-P" and/or "181B-FX". - <u>Exception</u>: "Butyl tape" with UL 723, ASTM E84, or NFPA 255 markings. <p>7.2. Other Duct Sealing Materials</p> <p>a. Drawbands: Listed/marked "181B-C"</p> <p>b. Tensioning Tool: Manufacturer-approved adjustable tensioning tool for tightening</p> <p>c. Cork tape: Non-toxic and non-corrosive to copper</p> <p>d. Caulking materials: Non-toxic, including:</p> <ul style="list-style-type: none"> - Latex sealing compounds: ASTM C834 - Butyl rubber sealants: F.S. A-A-272A - Elastomeric joint sealants (silicone, polyurethane, polysulfide): ASTM C920 or F.S. A-A-1556A <p>e. Clamps: Stainless steel worm-drive</p> <p>7.3. Materials for Building Cavities: Duct Liner (aka "Duct Board")</p> <p>a. Foil-faced Rigid Fiberglass Insulation Board: ASTM C726</p> <p>b. Foil-faced Fiberglass Duct Board: UL 181A</p> <p>c. Sheet metal (steel or aluminum) and plywood (exterior grade)</p> <p>7.4. Materials <u>not</u> allowed as barrier material or sealant in the repair of building cavities used as ducts, platforms, or other duct system components: foam board, foam sealant, drywall.</p> <p>7.5. Duct Supports—Nonmetallic Ducts</p> <p>a. All: Corrosion-resistant and conforming with duct manufacturer's instructions.</p> <p>b. Non-Metallic:</p> <ul style="list-style-type: none"> - Polypropylene monofilament, woven polyester, polyester scrim reinforced vinyl laminate, or equivalent - Width: $\geq 1\text{-}3/4\text{'}$, and tensile strength: $\geq 70\text{ lbs./inch}$ of width

	<ul style="list-style-type: none"> c. Sheet Metal Straps and Saddles, $\geq 1\text{-}1/2\text{'}$ wide, ≥ 26 gage <p>7.6. Duct Supports—<u>Horizontal</u> Rigid Round Metal Ducts</p> <ul style="list-style-type: none"> a. Up to 10" Diameter: Galvanized steel straps of the same gage as duct (with 1" minimum width), or 18 gage galvanized steel wire. b. 11" to 40" Diameter: Galvanized steel straps of the same gage as duct (with 1" minimum width), or 8 gage galvanized steel wire tied to a galvanized steel band of 1" minimum width, surrounding the duct. <p>7.7. Duct Supports—<u>Vertical</u> Rigid Round Metal Ducts</p> <ul style="list-style-type: none"> a. Up to 10" Diameter <ul style="list-style-type: none"> - 18 gage galvanized steel straps, 2" minimum width. b. 11" to 20" Diameter c. 16 gage galvanized steel straps, 2" minimum width. <p>7.8. Fittings (New) Used with Flexible Non-Metallic</p> <ul style="list-style-type: none"> a. Duct Start Collars <ul style="list-style-type: none"> - 4" installed length (6" recommended). - 26 gage galvanized steel up to 14" diameter. b. Splicing Sleeves <ul style="list-style-type: none"> - 6" length (8" recommended). - 26 gage galvanized steel up to 14" diameter. c. Bead: All fittings shall be beaded at each core connection (e.g., both ends of a sleeve) when flexible non-metallic ducts are attached. <p>7.9. Flexible Ducts:</p> <ul style="list-style-type: none"> a. NFPA 90B and UL 181 Class 1. b. Non-metallic insulated ducts with air-permeable core <u>not</u> allowed. c. Minimum insulation as indicated below: <ul style="list-style-type: none"> - R-6: Climate Zones 1-10, 12, 13 - R-8: Climate Zones 11, 14-16 d. Degradation Protection: UV-resistant material (e.g., silver metalized polyester jacket). e. Additional requirements for mobile home crossover ducts: <ul style="list-style-type: none"> - Conform to NFPA 90B and UL 181 Class 1. - Vapor barrier rated for mobile home use (e.g. with HUD markings on the jacket).
<p>8. WARRANTY</p>	<p>8.1. Manufacturer Warranty – 1 year</p>



CSD LIWP STANDARDS

FOR

FLOOR INSULATION - DRAFT

Category	Criteria
1. MEASURE	1.1. Floor insulation reduces unwanted heat loss or gain and can decrease the energy demands of heating and cooling systems. 1.2. This measure is classified as an Enhanced Measure requiring: <ol style="list-style-type: none"> a. An energy audit when some insulation <u>is</u> present. b. No energy audit when insulation is <u>not</u> present. 1.3. The following requirements are in addition to all applicable requirements found in the General Installation Guidelines.
2. LICENSING	2.1. This measure requires a Class B General Building Contractor or C-2 Insulation and Acoustical Contractor license for purposes of the LIWP program.
3. FEASIBILITY CRITERIA	3.1. Install this measure when (<u>ALL</u> of the following shall apply): <ol style="list-style-type: none"> a. The floor separates conditioned and unconditioned space. b. At least 100 square feet of floor is feasible to insulate. c. Energy audit shows a SIR of 1.0 or greater (when energy audit is required). 3.2. Do <u>NOT</u> install this measure when: <ol style="list-style-type: none"> a. Existing insulation level meets Title 24 requirement for new construction. b. One or more unsafe condition(s) is present and cannot be corrected. <ul style="list-style-type: none"> - Unsafe electrical conditions are present and correction is not feasible. - Knob-and-tube (K&T) wiring is present and energized. - Deteriorated or substandard floor sheathing is present. - Safe physical access is not feasible. - Required crawlspace ventilation cannot be installed, when required. c. Underfloor insulation would be installed but no foundation wall exists (allowing exposure to precipitation, wind, or animals).
4. ADDITIONAL ASSESSMENT CRITERIA	4.1. Electrical Safety Requirements <ol style="list-style-type: none"> a. Electrical hazards in the crawlspace shall be corrected, if feasible, before insulation may be installed.
5. MINIMUM INSTALLATION GUIDELINES	5.1. Measure shall be installed in accordance with manufacturer's instructions and specifications, local building code the 2016 Title 24 requirements and the LIWP CAS Protocol. 5.2. R-Value <ol style="list-style-type: none"> a. When no insulation is present (or when existing insulation is damaged/degraded), floor insulation shall be installed to a R-Value of R-19. b. Interior crawlspace access in a horizontal floor assembly: <ul style="list-style-type: none"> - Access cover shall be insulated to R-19. - Access cover/door shall be weatherstripped with self-adhesive foam tape. 5.3. Crawlspace Preparation <ol style="list-style-type: none"> a. All cutting of fiberglass batts and blankets shall occur outside the living space or inside the crawlspace 5.4. Required Venting <ol style="list-style-type: none"> a. Required crawlspace cross-ventilation shall be installed prior to insulation work and billed within the measure. b. Crawlspace ventilation shall conform to local building code requirements.

- c. Required NFVA shall be evenly distributed along the lengths of opposite sides.
 - d. Ventilation for each separate space is required.
 - e. Foundation vents shall not be obstructed by insulation.
- 5.5. Insulation Location and Coverage
- a. In locations with freezing temperatures, insulation shall be placed between pipes and cold side.
 - b. Water valves covered by insulation shall be tagged.
 - c. Installation of water pipe heaters is not allowed within the program.
- 5.6. Placement of Floor Insulation (All Types)
- a. Insulation shall be in substantial contact with subfloor without gaps, voids, compressions, misalignments, or wind intrusions.
 - b. If kraft-faced batts are used, facing shall be against the subfloor.
 - c. Minimum 3" clearance shall be between insulation and heat producing devices.
 - d. Insulation shall not block combustion air supply openings or foundation vents with 3" clearance.
- 5.7. Placement of Insulation Supports
- a. Insulation shall not be compressed by supports more than 10% overall.
 - b. Flexible insulation supports shall be sized/spaced in conformance with these requirements:

SUPPORT TYPE	MAXIMUM SPACING	ADDITIONAL REQUIREMENTS
1. Wood Lath	Lath spaced 18" OC maximum.	Attached with galvanized nails or corrosion-resistant staples
2. Wire Span		
• Joists ≤24" OC	Wire span twice in 18". Anchor points maximum 18" apart.	Facing shall be stapled to subfloor.
• 25" – 48" OC	Wire span twice in 12". Anchor points maximum 12" apart.	
3. Woven Wire/Netting	Support shall be anchored to joist every 12".	Support shall <u>not</u> sag more than 1" per 24" of span in any direction.

6. POST-INSTALLATION GUIDELINES

- 6.1. Operational Checks
- a. Installation shall be in accordance with manufacturer specifications, applied evenly and with no gaps, voids, compressions, misalignments, or possible wind intrusions from lack of blocking
 - b. Insulation shall not be compressed to impact the efficiency of the insulation.
 - c. 3" clearance zone for HPDs and crawlspace ventilation shall be verified.

7. MATERIAL SPECIFICATIONS

- 7.1. All floor insulation material shall be certified to comply with the CCR, Title 24, Part 12, Chapters 12-13, "Standards for Insulating Material".
- 7.2. All support and anchor materials shall have a minimum service life of 10 years.
- a. Staples:
 - Zinc-coated, stainless steel, or similar corrosion-resistant material.
 - Minimum 18 gauge diameter with 5/8" joist penetration.
 - b. Nails: Galvanized nails with 5/8" minimum joist penetration.
 - c. Wire Supports:
 - Shall be zinc-coated, stainless, or similar corrosion-resistant material.
 - Minimum 20 gauge.
 - d. Netting for Flexible Insulation Type
 - Woven wire shall be galvanized.
 - Netting shall be propylene or equivalent. Minimum 75 pound breaking strength.

8. WARRANTY

8.1. Manufacturer Warranty – 1 year



CSD LIWP STANDARDS

FOR

HEATING REPLACEMENT (CENTRAL ONLY) - DRAFT

Category	Criteria
1. MEASURE	1.1. Installation of a new central heating system (split or packaged unit) to replace an existing, low-efficiency heating system. 1.2. This measure is classified as an Enhanced Measure requiring an energy audit. 1.3. The following requirements are in addition to all applicable requirements found in the General Installation Guidelines.
2. LICENSING	2.1. This measure requires a C-20 Warm-Air Heating, Ventilating and Air-Conditioning license for the purposes of the LIWP program.
3. FEASIBILITY CRITERIA	3.1. Install this measure when (<u>ALL</u> of the following shall apply): a. The system provides heat for the dwelling unit being served. b. Replacement is justified by energy audit with a SIR of 1.0 or greater. 3.2. Do <u>NOT</u> install this measure when: a. Existing unit is installed in an inaccessible, unsafe or prohibited location. b. Access or clearance requirements cannot be met. c. Installation location is not structurally adequate to support installed equipment, d. Roofing materials are not in good condition and would require repair for appliance replacement to be feasible. e. Title 24 requirements cannot be met for the replacement appliance. f. Major alterations/repairs incidental to the heating replacement would cause SIR to drop below 1.0. g. Required vent system pipe(s) and/or terminals cannot feasibly be installed. h. An acceptable gas line is not present, and correction is not feasible. i. Electrical service or electrical safety requirements cannot feasibly be met. j. CVA is not adequate, and correction is not feasible. k. Mobile Home: HVAC system uses a belly-cavity return that cannot feasibly be abandoned and replaced with a new ducted central return.
4. ADDITIONAL ASSESSMENT CRITERIA	4.1. LIWP CAS Protocol Compliance a. The heater shall be checked for evidence of appliance hazards and fails (see the LIWP CAS Protocol). b. Operational and safety issues shall be diagnosed by a qualified technician and fully described in writing prior to replacement. 4.2. System Design and Performance: a. System components shall be properly sized per Title 24 specifications. 4.3. NOx Rod Furnace Recall a. Certain NOx Rod furnaces have been identified by the Consumer Products Safety Commission (CPSC) as being dangerous and have been recalled. - For recall information, go to: http://www.cpsc.gov/Recalls/2001/CPSC-Announces-Recall-of-Furnaces-in-California/ - Manufacturers are required to replace the potentially dangerous units. b. When a recalled FAU is replaced by the manufacturer at no cost: - Reimbursement is limited to costs incurred (typically ancillary components and installation labor). - Costs for the unit itself shall <u>not</u> be billed to the weatherization program, when the unit is replaced by the manufacturer.

	<p>4.4. Prohibited Locations</p> <p>a. Installation of an open combustion replacement gas forced air heating system is prohibited in a bedroom or bathroom.</p> <p>4.5. Equipment Accessibility and Clearances</p> <p>a. Equipment shall be accessible for replacement and inspection without removing/altering permanent construction.</p> <p>b. Equipment clearances, access, enclosures, and working space shall be verified and shall comply with manufacturer specifications.</p> <p>c. Minimum clearances between equipment or electrical panels, and adjacent structure/wall/obstruction shall be:</p> <ul style="list-style-type: none"> - 24" on side(s) containing service access panels, and - 12" on all other sides, or per manufacturer. <p>d. Minimum clearance from package unit to:</p> <ul style="list-style-type: none"> - Clothes dryer moisture exhaust: 5' - Overhead obstructions: per manufacturer's specifications.
<p>5. MINIMUM INSTALLATION GUIDELINES</p>	<p>5.1. Measure shall be installed in accordance with manufacturer's instructions and specifications, local building code, 2016 CEC Title 24 requirements, and the LIWP CAS Protocol.</p> <p>a. CMC and local code requirements shall be followed for:</p> <ul style="list-style-type: none"> - Combustion and ventilation air - Approved base for ground-mount and safety frames for roof-mount units - Heating vent systems and terminations - Gas lines, fittings, and valves - Heating electrical systems <p>5.2. If not already present, a smart thermostat shall be installed (See LIWP standards for "Smart Thermostats").</p> <p>5.3. Split System Platforms and Plenums</p> <p>a. Return plenum shall be free of leaks that affect combustion air or draw in outside air (except economizer units).</p> <p>b. Platform bypasses (unlined cavities) shall be blocked/sealed with a liner of fiberglass duct board or sheet metal.</p> <p>c. Stud cavities sealed with metal shall be insulated with batts (R-13 for 2x4).</p> <p>d. Heating housing shall be mechanically attached around the perimeter (e.g., housing-to-platform, housing-to-plenum) and properly sealed.</p> <p>e. Supply and return ductwork shall be securely attached to plenums.</p> <p>f. Wiring and plumbing penetrations shall be sealed (e.g., with cork tape).</p> <p>5.4. Roof Mount Installations</p> <p>a. All roof penetrations shall be properly flashed and sealed watertight.</p> <p>b. Condensate drain line shall be:</p> <ul style="list-style-type: none"> - Installed per manufacturer and local code. - Equipped with a trap, and run to a nearby gutter, when present. - Painted to resist UV degradation if PVC is used. <p>5.5. Ground Mount Installations</p> <p>a. The unit shall rest on concrete or other approved base extending at least 3" above the adjoining ground level, and be protected from damage.</p> <p>b. Locking caps shall be installed on accessible refrigerant service valves.</p> <p>5.6. CVA Requirements for Open Combustion Replacement Heating Systems:</p> <p>a. All Units</p> <ul style="list-style-type: none"> - Existing combustion air vents shall be free of obstructions (e.g., over-blown ceiling insulation, duct insulation, etc.). - Return air shall be isolated from combustion air. <p>b. Units Inside the Home</p> <ul style="list-style-type: none"> - Combustion air shall be obtained entirely from either outdoors or conditioned

	<p>space, but <i>not</i> both.</p> <ul style="list-style-type: none"> - CVA venting shall be to outdoors whenever possible. <p>c. Units Inside an Unconditioned Garage</p> <ul style="list-style-type: none"> - Combustion air may be obtained from indoors, outdoors, or a combination of indoors and outdoors. <p>5.7. Appliance Gas Vent System</p> <ul style="list-style-type: none"> a. Reusing the existing vent system is allowed only if it is in good condition <u>and</u> it meets the requirements of the FAU manufacturer and local code. b. Contractor shall ensure both appliances are venting/drafting properly, when an FAU is replaced that shares a common vent with another appliance. <p>5.8. Gas Lines, Fittings and Valves</p> <ul style="list-style-type: none"> a. Flexible gas connectors, fittings, and the shut-off valve shall be replaced when a replacement heating system is installed (existing parts shall <u>not</u> be reused). <p>5.9. Appliance Electrical System</p> <ul style="list-style-type: none"> a. Electrical defects shall be repaired (e.g., frayed or burned wires, loose, or improper connections, etc.) in conformance with the 2016 CEC. <p>5.10. Wall and floor repairs shall match plane and texture of adjacent material.</p> <p>5.11. Mobile Home Criteria</p> <ul style="list-style-type: none"> a. LIWP CAS Protocol shall be followed. b. Isolation of return air shall be intact and functioning properly for non-ducted FAU next to a water heater in an adjoining enclosure. c. Mobile Home Self-Contained Heating System <ul style="list-style-type: none"> - A heating system sharing a common supply duct system with a self-contained cooling unit shall have the following dampers: <ul style="list-style-type: none"> • Heating system shall have an automatic barometric damper that prevents cold air from entering the furnace when system is in cooling mode. • Heating system shall have an automatic damper that prevents hot air from entering the heating unit when system is in cooling mode. - Controls shall prevent cooling and heating from turning on at the same time.
<p>6. POST-INSTALLATION</p>	<p>6.1. Operational Checks</p> <ul style="list-style-type: none"> a. Installed unit, including thermostat, shall be tested for proper operation. <ul style="list-style-type: none"> - If the system does not operate as designed, manufacturer's troubleshooting procedures shall be followed. - Installation is not complete until the system operates properly. b. All HERS verifications required by Title 24 shall be performed, and copies of the documentation maintained in the client file. <p>6.2. Post-Installation CAS Testing</p> <ul style="list-style-type: none"> a. Visual examinations, CO measurements, and draft test shall be conducted in accordance with the LIWP CAS Protocol. <p>6.3. Client Education—In addition to the General Installation Guidelines section, the following shall be explained to the client:</p> <ul style="list-style-type: none"> b. Proper operation and programming to achieve desired temperature regulation. c. Reduced efficiency from closing supply registers and interior doors. d. Routine maintenance, including <ul style="list-style-type: none"> - Proper filter selection and how to change the filter. - Importance of cleaning dust and debris from return grilles. - For ground-mount package unit, importance of keeping outside unit clear of debris, vegetation, etc. e. Importance of professional maintenance at regular intervals <u>and</u> correction of nonconforming conditions.
<p>7. MATERIAL SPECIFICATIONS</p>	<p>7.1. All Units</p> <ul style="list-style-type: none"> a. Appliances must meet Title 24 efficiency standards, as verified by inclusion in

	<p>the California Energy Commission (CEC) database of certified appliances at: http://www.energy.ca.gov/appliances/</p> <p>b. Heating system and components shall be UL Listed or equivalent, such as one of the following certifications: CSA, AGA, or GAMA.</p> <p>7.2. Package Units:</p> <p>a. Heating: AFUE \geq 81%;</p> <p>b. Cooling: SEER \geq 14</p> <p>7.3. Split Systems</p> <p>a. Heating AFUE: \geq 80% (package unit or split system heating).</p> <ul style="list-style-type: none"> - Mobile Home: Furnace shall be listed for use in a Mobile Home, and inside the living space shall be closed combustion. <p>b. Cooling, if replaced in conjunction with heating, shall be in compliance with LIWP standard for Cooling Replacement (Central).</p> <p>7.4. Air Filters</p> <p>a. Shall be rated MERV 6 or better, UL listed Class 2 filter material, and in conformance to AHRI 680 or AHRI 681 (SI), and UL-900.</p> <p>7.5. Wall Thermostats</p> <p>a. Shall be in compliance with LIWP standards for "Smart Thermostats".</p> <p>7.6. Ducts and Sealants</p> <p>a. Materials shall be in compliance with LIWP standards for "Duct Repair and Replacement".</p> <p>7.7. Gas Pipes and Valves</p> <p>a. Risers, flexible connectors, fittings, and valves shall be NEW and in conformance with manufacturer's specifications and HCD or the local jurisdiction. (Note: Re-use of existing materials shall not be allowed).</p> <p>b. Gas valves: UL Listed and AGA or CSA certified.</p> <p>c. Gas flexible connectors: IAPMO Listed epoxy-coated or stainless steel units.</p> <p>d. Fuel-gas piping: Selected, sized, and installed per the CMC, Chapter 13.</p> <p>7.8. Vent Systems</p> <p>a. Metal vent pipes, vent connectors, and components shall be UL listed.</p> <ul style="list-style-type: none"> - Gas vent pipe shall be Type B double-wall. - Vent connectors may be single-wall. <p>b. Non-metallic Combustion Air and Vent Pipes</p> <ul style="list-style-type: none"> - Pipes and fittings shall conform to ASTM D 1785 and D 2665. <p>7.9. Pipe cement and primer shall conform to ASTM D 2564.</p>
8. WARRANTY	8.1. Manufacturer Warranty – 3 years



CSD LIWP STANDARDS

FOR

WATER HEATER REPLACEMENT (GAS) - DRAFT

Category	Criteria
1. MEASURE	1.1. Replace older inefficient water heater with new energy-efficient water heater with a minimum efficiency based on Title 24 requirements. 1.2. This measure is classified as an Enhanced Measure requiring an energy audit. 1.3. The following requirements are in addition to all applicable requirements found in the General Installation Guidelines.
2. LICENSING	2.1. This measure requires a C-36 Plumbing Contractor license for purposes of the LIWP program.
3. FEASIBILITY CRITERIA	3.1. Install this measure when: <ul style="list-style-type: none"> a. Water heater upgrade has an SIR of 1.0 or greater by energy audit. 3.2. Do NOT install this measure when: <ul style="list-style-type: none"> a. Major structural or appliance alteration, concrete work, painting, or hazardous material abatement would be required in order to bring the appliance to code. b. Existing plumbing does not allow crew to achieve satisfactory water pipe connections. c. Combustion ventilation air is not adequate, and cannot be made available. d. Required access, clearances, and elevation above the floor cannot be met. e. Existing appliance is in prohibited location, and relocation to an approved location is not feasible. f. Appliance platform is structurally unsound. g. No suitable mounting locations for seismic bracing are available. h. Proper gas line or electrical circuit/wiring is not present, and correction is not feasible. i. The return air system has leaks that can draw in combustion gases from the water heater and a direct vent unit cannot be installed.. j. Temperature and Pressure (T&P) protection cannot be met. k. <u>Mobile Home</u>: An open combustion water heater and an FAU with non-ducted return are in adjacent enclosures, and proper isolation of return air cannot be achieved.
4. ADDITIONAL ASSESSMENT CRITERIA	4.1. Location Considerations <ul style="list-style-type: none"> a. An open combustion water heater shall <u>not</u> be installed in a bedroom or bathroom, unless it is installed in an enclosure with a self-closing, weatherstripped door. All combustion air shall be drawn from outdoors. b. When a whole-house fan is vented through the attic, a replacement gas water heater in the attic shall be <u>closed</u> combustion. 4.2. House Line Water Pressure <ul style="list-style-type: none"> a. House line pressure shall be checked to be in compliance with manufacturer's specifications. b. When water pressure to the home exceeds manufacturer's specifications, a house line pressure regulator shall be installed or replaced to reduce the pressure reaching the water heater to below the specified maximum.
5. MINIMUM INSTALLATION	5.1. Measure shall be installed in accordance with manufacturer's instructions and specifications, local building code and the LIWP CAS Protocol.

GUIDELINES

- 5.2. Burner orifice shall be verified to be appropriate for type of fuel gas used.
- 5.3. Appliance Sizing
 - a. Unit shall comply with the greater of manufacturer’s sizing recommendations, or applicable code requirements.
 - b. Storage unit capacity shall be *no less than* the California Plumbing Code (CPC) minimum “First Hour Rating” guidelines, as shown in the following table.
 - c. When enclosure size limitations restrict the replacement unit’s capacity, a CSD waiver and documentation of the condition is required.

MINIMUM CAPACITY FOR WATER HEATERS (FIRST HOUR RATING) *											
# Bathrooms	1 to 1.5			2 to 2.5				3 to 3.5			
# Bedrooms	1	2	3	2	3	4	5	3	4	5	6
First Hour Rating*	42	54	54	54	67	67	80	67	80	80	80

* “First Hour Rating” is water heating capacity expressed in gallons, found on the yellow EnergyGuide label. It is the amount of hot water the heater can supply per hour (starting with a tank full of hot water).

- 5.4. Location
 - a. Water heater stand and floor or platform shall be structurally sized/constructed to support the weight of the tank safely and in a level position.
 - b. Units supported on the ground shall rest on a level code-compliant base, which extends at least 3" above grade.
 - c. When installed in a garage, unit shall be elevated so that the combustion burner is at least 18" above the finished floor, *unless* it is an FVIR unit and elevation is not required by manufacturer’s instructions or local code.
 - Units in locations subject to damage (e.g. by an automobile) shall be protected by being elevated, with barriers, or as prescribed by local code.
- 5.5. Water Pipe Insulation
 - a. Insulation shall be installed on the first 5' of both hot and cold pipes (rigid and flexible) connected to the water heater. Pipes shall be free of leaks.
 - b. The pipe insulation shall:
 - Have ID appropriate for the size pipe being insulated.
 - Minimum 1" wall thickness (for pipe diameters <1").
- 5.6. Installations shall be in accordance with local code for:
 - a. Drain pan
 - b. Seismic (earthquake) straps
 - c. Temperature and pressure protection
 - d. Gas lines, fittings, and valves
 - e. Appliance gas vents
- 5.7. Gas Lines, Fittings, and Valves
 - a. Nonconforming items, such as rigid or flexible copper connector, shall be replaced with code-compliant materials.
 - b. Manual gas shutoff valve shall be within 3' of the appliance and in the same room where the appliance is located.
- 5.8. Conventional Home Appliance Gas Vent
 - a. Appliance venting shall be in conformance with manufacturer’s instructions, CMC, and local code.
 - b. Vent terminations within 10' of forced-air/cooler inlet shall terminate at least 3' above the inlet.
- 5.9. Mobile Home Installation Requirements
 - a. Appliance installation shall be in conformance with manufacturer’s instructions.
 - b. Drip Pan and Lower CVA Vent

	<ul style="list-style-type: none"> - A drip pan shall be installed and drained per HCD regulations. - If the drip pan covers existing CVA venting in the floor, a new lower CVA vent shall be installed within 12" of the compartment floor. <p>c. Vent pipes shall <u>not</u> terminate under the mobile home.</p> <p>d. A water heater vent pipe located near an evaporative cooler shall terminate at least 3' from the cooler intake.</p>										
<p>6. POST-INSTALLATION GUIDELINES</p>	<p>6.1. Operational Checks</p> <ul style="list-style-type: none"> a. The water heater shall operate properly with no leaks and safely in compliance with manufacturer specifications and industry standards. b. All new and affected gas lines, flexible gas connectors, fittings, and valves shall be checked for gas leaks. c. Obstructions in existing combustion air vents (e.g., overblown insulation on upper vents, and household items covering lower vents) shall be cleared as needed to provide required net free venting area. d. Thermostat shall be set at 120°F, <i>unless</i> higher temperature is requested or is required for medical reasons. e. Unused penetrations to the exterior created by the installation shall be sealed. <p>6.2. Client Education: Clients shall be educated on the safe and efficient operation and maintenance of the water heater, including:</p> <ul style="list-style-type: none"> a. Importance of keeping combustibles away from the tank, and keeping combustion air vents and openings clear. b. How to adjust water temperature and restart the burner. c. Manufacturer's recommended care and maintenance. 										
<p>7. MATERIAL SPECIFICATIONS</p>	<p>7.1. All installed tanks, valves, flexible connectors, and plumbing components, shall be <u>new</u> parts.</p> <p>7.2. Gas Piping and Valves</p> <ul style="list-style-type: none"> a. Gas valves shall be listed (UL or equivalent) and AGA or CSA certified. b. Flexible connectors shall be listed (e.g., by IAPMO) epoxy-coated or stainless steel units. c. Fuel-gas gas piping shall comply with CMC. d. Flexible gas connectors with butt-soldered joints and copper gas lines are <u>not</u> allowed. <p>7.3. Storage Water Heaters shall be:</p> <ul style="list-style-type: none"> a. ENERGY STAR® certified and manufactured to ANSI Z21.10.1. b. Low NOx type, when required by local code. c. In conformance with CEC energy efficiency standards, as verified by inclusion in the CEC's database of certified appliances. d. Listed and labeled in conformance with local code. e. Minimum Energy Factor (EF) shall be in compliance with Title 24 energy efficiency requirements, per the following table. <table border="1"> <thead> <tr> <th colspan="2">MINIMUM EF FOR STORAGE GAS WATER HEATERS*</th> </tr> <tr> <th>Tank Volume (Gallons)</th> <th>Minimum Energy Factor (EF)</th> </tr> </thead> <tbody> <tr> <td>30</td> <td>0.63</td> </tr> <tr> <td>40</td> <td>0.62</td> </tr> <tr> <td>50</td> <td>0.60</td> </tr> </tbody> </table> <p>*Based on Table F-3 in the CEC Appliance Efficiency Regulations.</p> <ul style="list-style-type: none"> f. Open combustion replacement water heaters shall be Flammable Vapor Ignition Resistant (FVIR). <p>7.4. Mobile Home/Manufactured Housing Water Heater Installations: Must be selected in compliance with requirements of the California Department of Housing and Community Development (HCD).</p>	MINIMUM EF FOR STORAGE GAS WATER HEATERS*		Tank Volume (Gallons)	Minimum Energy Factor (EF)	30	0.63	40	0.62	50	0.60
MINIMUM EF FOR STORAGE GAS WATER HEATERS*											
Tank Volume (Gallons)	Minimum Energy Factor (EF)										
30	0.63										
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	<p>7.5. Seismic (Earthquake) Strap Kits</p> <ul style="list-style-type: none"> a. Shall be an approved bracing system (strap kit) certified by the California Division of the State Architect's (will have the stamp of approval on the box) and comply with California Health and Safety Code Section 19211. b. Shall meet or exceed bracing requirements for the tank's size. <p>7.6. T&P Valves: Shall be listed and manufactured to ANSI Z21.22, and meet sizing/pressure requirements of the water heater tank listing.</p> <p>7.7. Vents</p> <ul style="list-style-type: none"> a. Shall be UL listed vent connectors, components, and Type B vent pipes. b. Non-metallic systems shall conform to ASTM D 1785 and D 2665.
<p>8. WARRANTY</p>	<p>8.1. Manufacturer Warranty – 5 years (tank) / 1 year (ancillary materials)</p>



CSD LIWP STANDARDS

FOR

WINDOW REPLACEMENT – DRAFT

Category	Criteria
1. MEASURE	1.1. Replace single-pane windows and sliding glass doors (SGD) with Title-24 compliant high performance units. 1.2. This measure is classified as an Enhanced Measure requiring an energy audit. 1.3. The following requirements are in addition to all applicable requirements found in the General Installation Guidelines.
2. LICENSING	2.1. This measure requires a Class B General Building Contractor or C-17 Glazing Contractor license for purposes of the LIWP program.
3. FEASIBILITY CRITERIA	3.1. Install this measure when: <ul style="list-style-type: none"> a. Replacement (upgrade) of all windows and/or sliding glass doors in the dwelling is justified by energy audit with a SIR of 1.0 or greater. 3.2. Do <u>NOT</u> install this measure when: <ul style="list-style-type: none"> a. Excessive degradation or damage is present in window location(s) that requires structural repairs. b. In a pre-1978 dwelling, extensive amounts of lead-based paint (or presumed lead-based paint) is deteriorated, and requires abatement before upgrade work may be performed. c. A combustion appliance or indoor air quality (IAQ) hazard is known to exist, and cannot be corrected. d. Asbestos in siding would be made friable. e. Requirement for safety glazing cannot be met in accordance with the 2016 California Residential Code. f. Unsafe access or working conditions exist.
4. ADDITIONAL ASSESSMENT CRITERIA	4.1. Replacements shall be sized to original window or SGD width, height, and depth (except when the opening is enlarged to meet egress requirements). 4.2. Storm windows shall <u>not</u> be installed as a substitute for replacement (upgrade) of existing windows.
5. MINIMUM INSTALLATION GUIDELINES	5.1. Measure shall be installed in accordance with manufacturer's instructions and specifications, local building code, 2016 Title 24 requirements. 5.2. Window and SGD replacements shall be installed: <ul style="list-style-type: none"> - Plumb, level, and square, with edge of the operable sash/panel parallel to frame edge (reveal shall be equal along the entire edge). - With interior and exterior fin/trim/casing that provides barrier to water and air infiltration and a finished appearance. 5.3. Cavity Insulation for Wood Framing <ul style="list-style-type: none"> a. Open cavities between rough framing and window jamb shall be insulated and sealed. <ul style="list-style-type: none"> - <i>Note:</i> Insulation is not required in small openings if they are completely filled with caulk. b. Mineral fiber and backer rod are standard materials. c. <i>Non-expanding</i> injectable foam is allowed; however, it shall be installed strictly in accordance with manufacturer's instructions, <u>and</u> it shall <u>not</u> distort the window frame nor interfere with proper operation of sashes and locks.

	<p>5.4. Re-Installing Casing/Trim</p> <ol style="list-style-type: none"> a. Casing and trim removed to replace window shall be reused and reinstalled when possible and the material is in good condition. b. Casing/trim shall be installed on interior, and on exterior (except on flush fin retrofit windows). <ul style="list-style-type: none"> - For wood, paint grade is acceptable <i>unless</i> existing jamb has natural finish. - Exterior grade required in all exterior locations. c. Existing casing and miters shall be matched. d. Nail Requirements: <ul style="list-style-type: none"> - Finishing or casing nails shall be used on the <u>interior</u>. - Galvanized casing nails shall be used on the <u>exterior</u>. <p>5.5. Priming/Painting of Bare Wood</p> <ol style="list-style-type: none"> a. <u>Exterior</u> Locations: All bare wood on the exterior shall be primed and/or painted per manufacturer's instructions to prevent moisture damage. <ul style="list-style-type: none"> - Finish coat on wood sashes shall lap 1/16" onto glass for proper moisture seal. - Acceptable sealers include exterior grade paint, urethane, and varnish. - Sealers shall be applied with sashes open or removed. - <u>Note</u>: Paint shall <u>not</u> be applied to weatherstripping, vinyl, plastic, and other non-wood parts <i>unless</i> specified by the manufacturer. b. <u>Interior</u> bare wood surfaces shall, at a minimum, be primed or stained. <p>5.6. Finishing Requirements for SGDs</p> <ol style="list-style-type: none"> a. Replacement SGD mounting flange shall be positioned to cover holes left by removal of previous door. b. Sill and threshold shall be supported from end to end to prevent sagging or twisting during door operation. c. Perimeter sealing shall conform with manufacturer specifications. d. All bare wood, whether exposed or added, shall be sealed to preserve integrity of the wood in accordance with Item 5.5. 											
<p>6. POST-INSTALLATION</p>	<p>6.1. Operational Checks</p> <ol style="list-style-type: none"> a. Burs, sharp corners and edges, and other such hazards shall be removed or corrected following installation. b. Openable window and SGD units shall operate smoothly. c. Frame shall be square, and sashes/panels shall close properly at all corners and edges (reveal shall be even along the entire edge of the slider). d. Interlocks and latches shall function properly. e. Replacement windows and SGD shall be cleaned. <ul style="list-style-type: none"> - Glass shall be cleaned inside and out. - Frames/sashes shall be cleaned with non-abrasive cleaner (<i>not</i> a solvent). <p>6.2. Client Education: Clients shall also be instructed to maintain weatherstripping and caulk around the replaced unit and trim to prevent future moisture intrusion.</p>											
<p>7. MATERIAL SPECIFICATIONS</p>	<p>7.1. Windows and SGD shall be/have:</p> <ol style="list-style-type: none"> a. ENERGY STAR[®] certified and bear an NFRC temporary label, and must comply Title 24 energy efficiency standards, as listed below. b. Compliant with local code. c. Insect screens for the openable panel. <table border="1"> <thead> <tr> <th>Efficiency Factor</th> <th>CEC Climate Zone</th> <th>Maximum Value</th> </tr> </thead> <tbody> <tr> <td>U-Factor</td> <td>All Climate Zones</td> <td>0.32</td> </tr> <tr> <td rowspan="2">Solar Heat Gain Coefficient (SHGC)</td> <td>Climate Zones 1, 3, 5</td> <td>No Requirement</td> </tr> <tr> <td>Climate Zones 2, 4, 6– 16</td> <td>0.25</td> </tr> </tbody> </table> <p>d. Replacement windows shall be selected by type, in accordance with this table:</p>	Efficiency Factor	CEC Climate Zone	Maximum Value	U-Factor	All Climate Zones	0.32	Solar Heat Gain Coefficient (SHGC)	Climate Zones 1, 3, 5	No Requirement	Climate Zones 2, 4, 6– 16	0.25
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	Existing Window Type	Replacement Window Type	
	Horizontal Slider	Horizontal Slider	
	Vertical Slider	Vertical or Horizontal Slider	
	Picture Window	Picture or Sliding Window	
	Jalousie Window	Vertical or Horizontal Slider	
	<p>7.2. SGD Requirements: In addition to the requirements in Item 7.1, all SGDs shall be equipped with:</p> <ol style="list-style-type: none"> a. Mechanical interlock at the meeting rails. b. Safety glazing with permanent marking. <p>7.3. Window and SGD Sealants – per manufacturer’s requirements.</p> <ol style="list-style-type: none"> a. Caulking/sealants for interior application shall be: <ul style="list-style-type: none"> - In compliance with Proposition 65 requirements. - Non-toxic and paintable. - Clear when dry, or coordinated with surrounding color. <p>7.4. Flashing Materials: 30 lb. felt, bituminous impregnated craft paper, aluminum, or galvanized sheet metal, minimum 6" wide (9" recommended).</p> <p>7.5. Primer and Paint:</p> <ol style="list-style-type: none"> a. Exterior: High quality primer and oil base or latex paint. b. Interior: Primer and paint or stain compliant with manufacturer’s instructions. 		
8. WARRANTY	8.1. Manufacturer Warranty – 10 yrs (IGU)/ 3 years (other)		