



ENERGY STORAGE SYSTEMS (ESS) SUBMITTAL GUIDELINES FOR SYSTEMS EXCEEDING VALUES IN CFC TABLE 608.1

SCOPE: RESIDENTIAL

CODES ENFORCED: 2016 CBC, CRC, CPC, CMC, CEC, CALGreen, CEnC, and PAMC

The information provided in this document is general and intended as a guide only. Each project is unique and additional requirements may be enforced as deemed appropriate.

This checklist contains the recommended minimum submittal requirements for electrical and structural plan review of new energy storage systems (ESSs) for one- and two-family dwellings with or without a solar photovoltaic (PV) system. This list is not intended for integration with bipolar or hybrid PV systems. Systems must be in compliance with current California Building Standards Codes and local amendments made by the City of Palo Alto. Plans should be clear and legible.

GENERAL REQUIREMENTS

- Minimum plan size is 11"x17" with a minimum font size of 10.
 - Please include 4 full sets of plans and 2 sets of supporting documents.
- If a photovoltaic system is also part of the installation, please refer to CPA's "PV – Residential Submittal" checklist.
- Include the applicable codes on the cover sheet for the project.
- Include a complete scope of work (SOW) on the cover sheet for the project. Identify if the system is to be used as a partial home backup or a whole home backup.
- Denote whether the ESS is ac-coupled or dc-coupled.
 - If system is dc-coupled, show that the rapid shutdown functionality for controlled conductors of a roof-mounted PV system remains unaffected by dc-coupled energy storage battery circuit(s).

FIRE

- Stationary storage battery systems (i.e., energy storage systems (ESS)) having capacities exceeding the values shown in CFC Table 608.1) shall comply with CFC sections 608.1.2 through 608.6.6, as applicable (CFC 608.1) and shall be routed to Fire Department for review. For example, installing two Tesla Powerwalls would trigger a review for compliance with the applicable code sections since they are lithium-ion and are a rated at 13.5 kWh.

**TABLE 608.1
BATTERY STORAGE SYSTEM THRESHOLD QUANTITIES**

BATTERY TECHNOLOGY	CAPACITY^a
<i>Lead acid, all types</i>	<i>70 kWh (252 Megajoules)</i>
<i>Nickel cadmium (Ni-Cd)</i>	<i>70 kWh (252 Megajoules)</i>
<i>Lithium, all types</i>	<i>20 kWh (72 Megajoules)</i>
<i>Sodium, all types</i>	<i>20 kWh (72 Megajoules)^c</i>
<i>Flow batteries^b</i>	<i>20 kWh (72 Megajoules)</i>
<i>Other battery technologies</i>	<i>10 kWh (36 Megajoules)</i>

- a. For batteries rated in amp-hours, kWh shall equal rated voltage times amp-hour rating divided by 1000.
- b. Shall include vanadium, zinc-bromine, polysulfide-bromide, and other flowing electrolyte type technologies.
- c. 70 kWh (252 Megajoules) for sodium-ion technologies.

IF THE ESS IS INSTALLED INDOORS

- Include a legend or key for the site and floor plan with equipment symbols.
- The site plan shall include (CFC 608.1.2, CFC 608.2.2):
 - o Quantities and types of ESS
 - o Manufacturer’s specifications, ratings, and listings of ESS
 - o Details on energy management system
 - o Location and content of signage
 - o Show conduit/cable routing of ESS, PV, and related circuits
 - o Show required working clearances for all existing/new electrical equipment.
 - o Show method and location of required ventilation for equipment
 - o Show method of protection against physical damage (e.g., bollards for vehicular impact in an attached garage) for the ESS
 - o Show means of access to ESS

IF THE ESS IS INSTALLED OUTDOORS

- Include a legend or key for the site and floor plan with equipment symbols.

- The site plan shall include (CFC 608.1.2, CFC 608.2.7):
 - Location and layout diagram of the room in which the ESS is to be installed
 - Quantities and types of ESS
 - Manufacturer's specifications, ratings, and listings of ESS
 - Details on energy management system
 - Location and content of signage
 - Installations in outdoor enclosures or containers shall be treated as battery storage rooms. Show this on the plans.
 - Stationary battery arrays in noncombustible containers shall not be required to be spaced 3' from the container walls
 - Show minimum 5' separations from:
 - Lot lines
 - Public ways
 - Buildings
 - Stored combustible materials
 - Hazardous materials
 - High-piled stock
 - Other exposed hazard
 - Exception: When authorized by fire code official, the separation may be less than 5'
 - Show minimum 10' separation from any means of egress required by the fire code official
 - Show conduit/cable routing of ESS, PV, and related circuits
 - Show required working clearances for all existing/new electrical equipment.
 - Show method and location of required ventilation for equipment
 - Show method of protection against physical damage (e.g., bollards for vehicular impact in an attached garage) for the ESS
 - Show means of access to ESS

- Provide an elevation drawing of the system equipment.
 - If the house is in a flood zone, it shall be above the base flood elevation (BFE).

- If equipment is subject to physical damage (e.g., motor vehicles, forklifts, etc.), it shall be protected by its construction, approved barriers, or other approved methods. Where protected by its construction, provide supporting documents from the manufacturer. (CEC 110.27, CRC R327.6, CFC 608.1.5)

OTHER FIRE REQUIREMENTS

- Provide copies of the failure modes and effects analysis (FMEA) for review by Fire Department. (CFC 608.1.3)

- Rooms containing an ESS shall be equipped with an automatic sprinkler system, smoke detection system, ventilation, and gas detection systems. Please submit adequate information for review by Fire Department. (CFC 608.5)
 - Indoor installations of ESS that produce hydrogen or other flammable gases during charging shall be provided with ventilation in accordance with the California Mechanical Code. (CRC R327.5)

- Where required by CFC 608.6, provide spill control and neutralization information for review by Fire Department. (CFC 608.5.5)

- Show on the plans a warning sign with the following information (see example plaque that follows this checklist):
 - 8" x 10" plaque on or adjacent to the main disconnect to state the number of energy sources (e.g., utility power, PV panels and energy storage system) along with shut-off instructions.
 - Include a map or schematic to indicate the location of the power sources and disconnects. The map or schematic shall be in the correct orientation when one is standing in front of the main disconnect.
 - The plaque shall be on an .080 aluminum backer with white lettering on red vinyl on 3M Schotchlite reflective vinyl (or equivalent). Letter shall be Helvetica Med Compact or Calibri or equivalent.

- Show on the plans that signage shall be provided on all the disconnects to properly identify them.

- Show on the plans that warning signage shall be installed on the energy storage systems to indicate that there are energized lithium storage batteries within the unit. The signage shall read: "Energy Storage System (Lithium Batteries)"

- For commercial interior installations with lithium ion batteries greater than 20kWh, provide separation from other areas of the building in accordance of CFC 608.2.2 (see requirements in previous section) and CBC 509.1. Fire sprinklers and smoke alarms shall be required.

- For residential interior installations, a home-grade smoke alarm without central station monitoring is acceptable. New fire sprinklers require separate installation permit from the Fire Department.

ELECTRICAL**GENERAL REQUIREMENTS**

- Energy storage systems (ESS) shall be listed and labeled for residential use in accordance with UL 9540. For exceptions, see CRC R327.2. (CRC R327.2, CFC 608.4.1)
- Systems connected to the utility grid shall use inverters listed for utility interaction (i.e., UL 1741, or provided as part of the UL 9540 listing). (CRC R327.4, CFC 608.4.5)
- ESS shall be installed in accordance with the manufacturer's installation instructions and their listings, if applicable, and shall not be installed within a habitable space of a dwelling. (CRC R327.3)
 - A space in a building for living, sleeping, eating or cooking is considered habitable. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces. (CRC R202)
- All ESS equipment shall be listed by a Nationally Recognized Testing Laboratory (NRTL) either individually or as a complete, self-contained system according to a recognized standard. Provide supporting documentation that verifies certification of the equipment. (CEC 110.2, CFC 608.4.2)
- When a PV system is part of the ESS, show the location and/or method of rapid shutdown (initiation for the ESS is not required.) (CEC 690.12) and the point of interconnection between the ESS and other power production sources.
- For the ESS, include a note, on the plans, that a plug-in type back-fed circuit breakers connected to an interconnected supply shall be secured in accordance with 408.36(D).
- Provide a permanent plaque or directory denoting all electric power sources on or in the premises, which shall be installed at the main service panel and at all locations of all electric power production sources capable of being interconnected. (CEC 705.10, CFC 608.2.6.1)
- Where a PV system is installed, each system shall have its own ac disconnect. The two ac disconnects shall not be combined into a single ac disconnect. (CEC 690.17, NEC 706.7(A))
- Labels shall be per "Energy Storage Systems (ESS)" inspection checklist.

CALCULATIONS

- Show calculations for:
 - Sizing of new conductors
 - Overcurrent protection ratings
 - Open circuit voltage calculations
 - Point of connection to service
 - New panelboards with loads (CEC 220)
A label shall be installed at the subpanel that reads: NO BRANCH CIRCUIT LOADS LARGER THAN XX AMPS TO BE INSTALLED IN THIS SUBPANEL. (The “XX” values are based on the ESS manufacturer’s installation instructions.)

THREE-LINE DIAGRAM

- Show grounding and bonding for the ESS and PV (if installed), including the ground return path.
- Show method of interconnection.
- Show overcurrent protection method and rating when required.
- Include detailed wiring information for all new circuits, including:
 - Conductor size/type
 - Number of conductors
 - Conduit size
 - Conduit type
 - Show all disconnecting means.
 - Show ratings (voltage, ampacity, environmental, etc.) for new and existing service equipment.

SPECIFICATIONS AND INSTALLATION INSTRUCTIONS

- Provide specification sheets and installation instructions for the following equipment (PDFs and/or links to the material is permitted):
 - Inverter
 - Transformer or autotransformer
 - Transfer switch(es)
 - ESS
 - ESS support or racking
 - Converters
 - Combiner
 - Interconnecting cables and connectors
 - Recombiner
 - Charge controller

STRUCTURAL REQUIREMENTS

- Identify if the ESS will be wall- or floor-mounted.
- If the ESS is wall-mounted and its weight is 200 lbs. (or more), you must provide structural details in the drawings and calculations as a separate document. (PAMC 16.04.275, CFC 608.1.4)
- If multiple ESSs are installed and the combined weight is 400 lbs. (or more), provide structural details in the drawings and calculations as a separate document. (CBC 1616.10.15, CFC 608.1.4)

CPAU ELECTRICAL ENGINEERING REQUIREMENTS

- An AC disconnect is required for the ESS within 10' and within sight of the main service panel. (Utilities Rules and Regulation 27(D)(1)(d))
- For services greater than 200 amps, contact Utilities Engineering for the available fault current at the service.
- For overhead services, per CPAU's standard drawing SR-CN-O-1009, meter-main combos (i.e., the meter mounting device shall have a main disconnect in the same cabinet) are required.
- For underground services, per CPAU's standard drawing SR-CN-U-1010, meter-main combos (i.e., the meter mounting device shall have a main disconnect in the same cabinet) are required.
- Per CPAU, photovoltaic systems and energy storage system submittal are required to:
 - Have a completed interconnection agreement
 - Have a completed PV/ESS electric load sheet.
 - Both are required to be submitted to Building Department along with the plans for the system(s).
 - NOTE: CPAU will not perform required inspections without both completed forms on file. If a site has both systems, then one interconnection agreement and PV/ESS electric load sheet may be used provided that all information for both systems are included in the documents. If the permits are applied for at different times, then multiple forms will be required.