STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

May 2018
Log No. __________

1. State Building Code to be Amended:

- ☐ International Building Code
- ☐ ICC ANSI A117.1 Accessibility Code
- ☐ International Existing Building Code
- ☐ International Residential Code
- ☒ International Fire Code
- ☐ Uniform Plumbing Code
- ☐ International Mechanical Code
- ☐ International Fuel Gas Code
- ☐ NFPA 54 National Fuel Gas Code
- ☐ NFPA 58 Liquefied Petroleum Gas Code
- ☐ Wildland Urban Interface Code

For the Washington State Energy Code, please see specialized energy code forms

Section(s):
202

Title:
GENERAL DEFINITIONS

2. Proponent Name (Specific local government, organization or individual):

Proponent: Ken Brouillette
Title: Code Development Coordinator
Date: June 21, 2024

3. Designated Contact Person:

Name: Ken Brouillette
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4. Proposed Code Amendment. Reproduce the section to be amended by underlining all added language, striking through all deleted language. Insert new sections in the appropriate place in the code in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code, additional pages may be attached.

Clearly state if the proposal modifies an existing amendment or if a new amendment is needed. If the proposal modifies an **existing amendment**, show the modifications to the existing amendment by underlining all added language and striking through all deleted language. If a new amendment is needed, show the modifications to the **model code** by underlining all added language and striking through all deleted language.

Code(s) 2024 IFC **Section(s)** 202

Enforceable code language must be used.
Amend section to read as follows:

SECTION 202
GENERAL DEFINITIONS

BATTERY TYPES. For the purposes of this code, certain types are defined as follows:

Revise **model code** language as follows:

Flow battery. A type of storage battery that includes chemical components dissolved in two different liquids. Ion exchange, which provides the flow of electrical current, occurs through the membrane while both liquids circulate in their respective spaces. (Includes vanadium redox, zinc-bromine, polysulfide-bromide, and other flowing electrolyte-type technologies).

Revise **existing amendment** as follows:

Lead-acid battery. ~~A~~ An aqueous storage battery that is comprised of lead electrodes, (lead dioxide Is the active material for the positive anode and metallic lead is the active material for the negative cathode), immersed in a solution of water and sulfuric acid electrolyte. Common major classification distinctions (i.e., types) include, vented lead-acid (VLA), and valve-regulated lead-acid (VRLA). The VRLA is further subdivided into two types representing the method in which the electrolyte is immobilized: either gelled (gel cell) or absorbed in finely-woven porous fiberglass mat (AGM) separators inside the battery between the electrodes.

Revise **model code** language as follows:

~~**Lithium metal polymer**~~ **Lithium-sulfur rechargeable battery.** A storage battery that is similar to the lithium-ion battery except that it has a lithium metal anode in the place of the traditional carbon or graphite anode. A lithium-sulfur battery is a secondary (rechargeable) battery that has lithium metal at the anode, sulfur at the cathode, and the electrolyte is nonaqueous.

Lithium-ion battery. A storage battery with lithium ions serving as the charge carriers of the battery. The electrolyte is a polymer mixture of carbonates with ~~an inorganic~~ flammable organic salt ~~and can be~~ in a liquid ~~or a gelled polymer~~ form. Lithiated metal or mixed metal oxides (e.g. cobalt [LCO], manganese [LMO], nickel-manganese-cobalt [NMC or NCM], nickel-cobalt-aluminum [NCA] or iron phosphate [LFP]) i~~s~~ typically ~~a~~ make up the cathode and forms of carbon or graphite (or lithium titanate oxide [LTO]) typically form the anode. Each of these different types of cathodes and anode combinations produce different energy densities, different lifetimes, differing fast charge abilities, and differing safety characteristics, among many other things. The choice of Li-ion chemistry is often driven by whichever of these factors or best mix of factors is/are most important for the application.

Revise **existing amendment** as follows:

Nickel-cadmium (Ni-Cd) battery. An alkaline storage battery in which the positive active material is nickel oxide, the negative electrode contains cadmium and the electrolyte is a solution of water and potassium hydroxide. They lose less life at high temperatures and have better capacity at low temperatures than most other battery technologies, and have a long life if not cycled too much.

Delete **model code** language without substitution as follows:

~~**Stationary storage battery.** A group of electrochemical cells interconnected to supply a nominal voltage of DC power to a suitably connected electrical load, designed for service in a permanent location.~~

Add **new** definition as follows:

BATTERY. A class of devices which contain materials that convert chemical energy into electrical energy which then can be used as a power source. There are several technologies that utilize a variety of materials and chemistries for the purpose of storing this electro- chemical energy for use when required.

Electrochemical double layer capacitors (EDLCs). These devices are usually built up from an electrolyte, a separator, and two carbon-based electrodes Also referred to as supercapacitors, they store energy using either ion adsorption (electrochemical double layer capacitors) or fast surface redox reactions (pseudo- capacitors). They are commonly also called “supercapacitors” or the trademarked “ultracapacitor™” because they store orders of magnitude more power and energy for the same unit mass or volume as a traditional electrolytic capacitor. They can release power and accept charge much faster than batteries for the same footprint, but store much less energy.

Hybrid supercapacitor Battery (Lithium-ion capacitor (LIC). The lithium-ion capacitor (LIC or LiC) is a hybrid type of capacitor classified as a type of supercapacitor. It combines lithium-ion technology and electric double layer capacitor (EDLC) construction. It is called a hybrid because the anode is the same as those used in lithium-ion batteries and the cathode is the same as those used in supercapacitors. Activated carbon is typically used as the cathode. The anode of the LIC consists of carbon material which is often pre-doped with lithium ions.

Iron-air aqueous battery. The battery includes iron and air electrodes. Each of the cells are filled with water-based, non-flammable alkaline electrolyte (which functions partially like the anolytes and catholytes of flow batteries battery. The battery does not present the risk of thermal runaway. Like the Ni-Fe battery they are relatively coulombically inefficient on float charge, and thus are usually disconnected from the charge bus when at or nearing full charge.

Nickel Iron (Ni-Fe). The battery has nickel(III) oxide-hydroxide positive plates and iron negative plates, with an electrolyte of potassium hydroxide. The active materials are held in nickel-plated steel tubes or perforated pockets. Nickel-iron batteries do not cause spill concerns since there is no acid in the component. They are capable of tens of thousands of cycles and have calendar lifetimes of well over 50 years. However, they are highly coulombically inefficient (with the inefficiency coming from high percentages of water electrolysis from the charging current) when at or near full state-of-charge (SOC). As such, they are usually equipped with catalytic recombiner vents and automatic watering systems.

Nickel-hydrogen (NiH_2). The cells are a hybrid technology, combining elements from both batteries and fuel cells. The battery differs from a nickel–metal hydride (NiMH) battery by the use of hydrogen in gaseous form The nickel–hydrogen cells utilize the nickel hydroxide electrode from nickel–cadmium cells and a platinum hydrogen electrode from fuel cell technology to create a chemistry without the issues and limitations inherent with the cadmium electrode. The cell is contained within a hermetically sealed pressure vessel that envelopes the electrodes and accommodates the pressurized hydrogen.

Nickel-Zinc (Ni-Zn). A battery that is chemically similar to the nickel-metal hydride battery. Nickel and zinc have low toxicity, the battery is non-flammable, and presents no threat to the environment. The Ni-Zn battery uses an alkaline electrolyte (potassium hydroxide, KOH) and zinc acts as the negative electrode while nickel hydroxide is the positive electrode.

Sodium nickel chloride (NaNiCl). This battery is a member of the ‘high temperature’ family. which works at typical temperature scope of 270°C–350°C. Its cell contains sodium and nickel chloride electrodes, isolated by a beta-alumina electrolyte, which can conduct sodium particles yet not electrons. This chemistry is much safer than most battery chemistries with far fewer toxic materials involved in its production, but it does not have the cycling ability or energy density of most of the Li-ion chemistries.

Zinc-air aqueous battery. A zinc–air battery contains a zinc electrode and porous air electrode separated by a membrane and an aqueous alkaline electrolyte that is used in a manner similar to the catholytes and anolytes of a flow battery. The cathode is a bi- functional air electrode which features one or more catalysts that can perform the oxygen reduction reaction (ORR) during discharging and the oxygen evolution reaction (OER) during charging.

Zinc bromide. In zinc bromide batteries, the cathode is made using zinc instead of lithium. The electrolyte is water-based and, therefore, does not pose a fire risk.

Zinc manganese dioxide (Zn-MnO_2). The battery features a Zinc (Zn) anode and a dioxide (MnO_2) cathode with a strongly basic electrolyte (typically potassium hydroxide, KOH), The battery does not present environmental hazards and is EPA-certified for landfill disposal in the United States, and the aqueous electrolyte is non-flammable.

5. **Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.**

Over several cycles, and in the current code writing cycle for ICC and NFPA 855, new battery types have been vetted and added to provisions addressing energy storage systems. This proposal updates the existing definitions under the subheading of "BATTERY TYPES", adds ten new sub-definitions of recognized battery types, and adds a generic definition for a "battery" due to the additional areas of the IFC that now regulates batteries of various types.

The sub-definition of "stationary storage battery" is proposed for deletion as the portion of the code that applied to that term was eliminated when the energy storage system requirements were added which captured that type of installation.

This proposal is F11-24 for the 2027 IFC and it was Approved as Submitted at the first committee meeting.

6. **Specify what criteria this proposal meets.** You may select more than one.

☐ The amendment is needed to address a critical life/safety need.
☒ The amendment clarifies the intent or application of the code.
☐ The amendment is needed to address a specific state policy or statute.
☐ The amendment is needed for consistency with state or federal regulations.
☐ The amendment is needed to address a unique character of the state.
☐ The amendment corrects errors and omissions.

7. **Is there an economic impact:** ☐ Yes ☒ No

If no, state reason: This proposal editorial updates the definitions related to batteries to correlate with current IFC and NFPA 855 requirements addressing the batteries. Existing definitions have been modified to correlate with current scientific descriptions and new battery types have been added. There are no technical requirements that increase cost associated with these updated definitions. The modifications and additions will increase understanding of the application of the code requirements to these technologies.

If yes, provide economic impact, costs and benefits as noted below in items a – f.

a. ***Life Cycle Cost.*** Use the OFM Life Cycle Cost **Analysis tool** to estimate the life cycle cost of the proposal using one or more typical examples. Reference these **Instructions;** use these **Inputs.** Webinars on the tool can be found **Here** and **Here**). If the tool is used, submit a copy of the excel file with your proposal submission. If preferred, you may submit an alternate life cycle cost analysis.

b. ***Construction Cost.*** Provide your best estimate of the construction cost (or cost savings) of your code change proposal.

$Click here to enter text./square foot

(For residential projects, also provide $Click here to enter text./ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

c. ***Code Enforcement.*** List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

d. ***Small Business Impact.*** Describe economic impacts to small businesses:

e. ***Housing Affordability.*** Describe economic impacts on housing affordability:

f. ***Other.*** Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

Please send your completed proposal to: sbcc@des.wa.gov

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.