

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) AND ELECTRIC VEHICLE ENERGY MANAGEMENT SYSTEMS (EVEMS)

Date of Issue: June 20th, 2023

No: IB-EL 2023-05

Topic: Requirements for Electric Vehicle Supply Equipment (EVSE) and Electric Vehicle Energy Management Systems (EVEMS)

The purpose of this bulletin is to provide clarity on:

1. Select BC Electrical Code (BCEC) installation requirements
2. Load calculation requirements
3. Technical Safety BC Requirements for approval and acceptance of EVEMS equipment

Definitions from the BC Electrical Code and Product Standards

Electric Vehicle Supply Equipment (EVSE) – A complete assembly consisting of cables, connectors, devices, apparatus, and fittings installed for the purpose of power transfer and information exchange between the branch circuit and the electric vehicle.

Electric Vehicle Energy Management System (EVEMS) - A means used to control electric vehicle supply equipment loads through the process of connecting, disconnecting, increasing, or reducing electric power to the loads and consisting of any of the following: monitor(s), communications equipment, controller(s), timer(s), and any other applicable device(s)

Fail-safe (Safe State) — a state where any or all of the following conditions apply:

- the actual load does not exceed the ampere rating of the circuit; and/or
- at the EVSE level, or another level, a pre-configured (default) state that prevents the actual load exceeding the ampere rating of the circuit(s).

*Industry terminology varies amongst manufacturers. This is a “state” or, “mode-of-operation” where the system changes the level of current applied to the circuit depending on pre-set parameters.

EVSE

Installation Requirements

When EVSE is part of the permit scope, plans, and specifications including load calculations by a qualified person must be included with all permit applications. For EVSE that is part of a EVEMS or contains a built-in EVEMS, refer to the “**Requirements for Acceptance of EVEMS Equipment**” within this bulletin for additional conditions.

Markings

BC Electrical Code (BCEC) Rule 2-100 n) requires equipment to have markings necessary to ensure safe and proper operation. EVSE may be designed with adjustable field settings that can vary the maximum output current to the electric vehicle.

While the nameplate will show the maximum current rating, the adjustable ampere setting for fixed-in-place supply equipment is acceptable to be used as the basis for load calculation, sizing of disconnecting means, receptacle configuration, conductor size, etc. when:

1. Manufacturer instructions have been followed to adjust the field settings

And

2. The adjustable settings are not accessible to the user. The means considered to prevent access to the user are:
 - a. Enclosures that require the use of a tool to open
 - b. Locked doors accessible only to qualified persons
 - c. Password protected software used only by a qualified installer

And

3. The equipment is marked with a warning label in a conspicuous, permanent, and legible manner to indicate that the maximum charging current is not to be adjusted. The label will contain the maximum rating or setting of the charging current, the ampere rating of the overcurrent device supplying the EVSE, and the installed conductor size.

Warning: Fire Hazard

Do not adjust maximum charging current setting.

Maximum charging current: _____ amps.

Installed overcurrent size: _____ amps.

Installed conductor size: _____ AWG.

Mechanical Protection

BCEC rule 2-200 requires EVSE equipment to be installed and guarded to prevent potential mechanical damage. Examples of common practices that protect EVSE from mechanical damage from vehicles are but not limited to:

1. Installing the EVSE out of the of vehicular path (i.e., sidewall of garage).
2. Mounting the EVSE at a height where it is unlikely to be struck by a vehicle.
3. Installing bollards or guards to protect the EVSE.
4. Install EVSE a sufficient distance back from raised curbs, sidewalks, or parking stops.

Note: There may also be additional BCEC and manufacturers' requirements to protect the cable or conduit feeds that provide power to the EVSE.

Overcurrent and Receptacle Requirements for EVSE

Installations that include the use of a 50 A receptacle configuration of either 14-50R or 6-50R for a cord connected EVSE will be required to be protected with a 50 A rated overcurrent device in accordance with Rule 26-700 as per Diagram B5. Installations requiring a 40A overcurrent device shall be hard-wired.

Some manufacturer instructions have provided direction to install a 40 A overcurrent device to protect their equipment. Currently there is no receptacle available for a 40 A configuration and as such, a 14-50R or 6-50R receptacle is typically installed. This is contradictory to Rule 26-700 2) which requires receptacles with configurations in accordance to Diagrams 1 and 2 of the BCEC to be matched with their corresponding voltage and current rating.

Load Calculation Requirements for Systems Without EVEMS

New and existing Single Dwellings

BCEC rule 8-200 1) a) vi) requires EVSE equipment loads to be added with a demand factor of 100% when calculating the service for installations. When EVSE equipment loads are added to an existing service, rule 8-106 8) permits additional loads to be added to the existing maximum demand load (peak demand) providing that the utility that has measured the existing demand over the last 12 or more

months. Currently, most utilities only provide their residential customers with the kilowatt-hour (kWh) readings which is a unit of energy and not the peak demand. Information bulletin NO: IB-EL 2023-01 “DEMAND FACTORS AND USE OF RULE 8-106 FOR SINGLE DWELLINGS” provides a safety factor for the maximum kWh reading.

New and Existing Multi-Unit Residential Buildings

As per rule 8-202 3) d), where EVSE loads are not located in dwelling units, demand factors as specified in Table 38 shall be used in load calculations for:

- row housing in accordance with BCEC rule 8-200 2)
- apartments and similar buildings in accordance with BCEC rule 8-202

Note: in the next edition of the CEC C22.1-24, Table 38 has been deleted and EVSE demand factor will be 100%.

EVSE loads supplied from a dwelling unit's panelboard shall be added with a 100% demand factor. EVSE loads must be excluded from the demand factors applied in rule 8-200 2) a) and 8-202 3) a) (similar to the electric space-heating and any air-conditioning loads) and added back into the load calculation with the correct demand factor of a 100% in 8-202 3). Although BCEC Rule 8-200 2) and 8-202 1) a) were not clear on EVSE demand requirements when calculating the load for consumer service or feeder as per rule 8-202 3), clarification was provided by CSA regarding the demand requirements for EVSE loads and is further supported with the upcoming changes to the 2024 CEC code.

When EVSE loads are added to an existing consumer's service, maximum demand load information supplied by the utility may be permitted to be used as the basis for calculating augmented load in accordance with 8-106 8), provided no new loads have been added to the installation over the most recent 12-month period. The qualified person requesting the maximum demand load from the utility is responsible to verify the information and account for any unknowns such as vacant or unoccupied units during the recent 12-month period. Use of kilowatt-hour (kWh) readings is not permitted and may only be considered when submitted by the Registered Professional of Record under a variance.

The service will be required to be labelled with the new kW load calculation as per rule 2-100 n). The label must indicate that the newly determined kW load calculation was based on rule 8-106 8) and historical data. The label must also include the date the calculation was performed. Any further additions in load(s) will require a new 12-month period of historical information before the addition of the new load(s). When new EVSE loads are to be added to an existing service or feeder, in accordance with BCEC Rule 8-106 8) (use of historical peak demand) use of Table 38 is not permitted.

When EVSE loads are added to a building, the duty holder must ensure that the load on all branch circuit, feeder, and service conductors does not exceed the requirements of 8-104 5) or 6). This may require load calculations to be performed for a dwelling unit feeder, the overall service, and any interconnecting feeders such as those supplying meter centres or sub-distribution equipment.

Note: Owners, councils, and contractors must be aware of the process to plan and install electrical infrastructure for EVSE in strata housing. In strata corporations for buildings such as duplexes, condominiums, and townhouses, the Strata Property Act - Standard Bylaws require an owner, occupant, or tenant to obtain written approval of the strata corporation before making an alteration to a strata lot or the common property. This includes approval for the installation of EVSE equipment due to bylaws about alterations and laws regarding insurance. The Vancouver Island Strata Owners Association (VISOA) is an example of one of the organizations that has been sharing resources and links to assist strata owners and councils in the steps for installing EVSE.

Electric Vehicle Charging for Stratas: https://www.visoa.bc.ca/?page_id=10774
How to Get EV Ready: <https://www.visoa.bc.ca/wp-content/uploads/2021/12/Stratas-How-to-Get-EV-Ready.pdf>

EVEMS

The BC Electrical Code (BCEC) definition of EVEMS in 8-002 is broad and includes a wide variety of components and arrangements of electrical equipment to control EVSE loads. Electrical equipment installed under provisions of the BC Electrical Code is required to be approved in accordance with Rule 2-024. Currently, a certification / product standard does not exist for EVEMS.

Standalone equipment certified to other standards, such as C22.2 No. 14 – Industrial Control Equipment standard, may be acceptable when used as EVEMS when installed in accordance with manufacturer's instructions and acceptable conditions of use.

A field assembled EVEMS and its components are also required to be approved/certified. Assembled equipment that has been installed as per manufacturer's instructions and has an overall approval for use as an EVEMS and with approved/certified EVSE may be accepted. The responsibility falls on the Registered Professional of Record for review and sign off of the design, performance values, commissioning, and maintenance requirements of the EVEMS. Guidance in the design, construction, and testing of electrical equipment that comprises or forms part of an electric vehicle energy management system can be found in the CSA SPE-343:21 Electric vehicle energy management systems.

Field assembled equipment that does not have an overall approval in accordance with Rule 2-024 Use of Approved Equipment, as an EVEMS will only be considered under a variance. The assembled EVEMS equipment will still require a field evaluation or special inspection process by a certification agency as part of the variance. Refer to **Appendix A** for variance requirements.

Requirements for Acceptance of EVEMS Equipment

Sealed engineering drawings shall be submitted as part of the electrical permit submission for all installations other than single dwellings calculated under rule 8-200 1). The Registered Professional of Record will be responsible for the verification and testing of the EVEMS for correct operation and establishment of a fail-safe state to ensure that the actual loads are in compliance with BC Electrical Code Rule 8-104 5) and/or 6).

For the purpose of installing an EVEMS certified to other product standards in a single dwelling, a load calculation is required to be submitted by a qualified person as part of permit submission. The qualified person will be responsible for the verification and testing of the EVEMS for correct operation and that the EVEMS will establish a fail-safe state to ensure that the actual loads are in compliance with BC Electrical Code.

Documents must be submitted before final inspection as a record that the commissioning and testing have been completed.

For a building requiring an electrical operating permit (See Information Bulletin IB-EL 2015-03), original documentation provided by a qualified person including installation and maintenance instructions, plans and specifications, commissioning reports and other documentation associated with the EVEMS and the EVSE must be included in the permit holder's log. Any maintenance, repairs, or changes to the EVEMS or EVSE must also be included in the permit holder's log.

Note: Other authorities having jurisdiction may have additional requirements for operating permits for EVEMS and EVSE.

Load Calculation Requirements for Systems With EVEMS

Definitions for control configurations of EVEMS have not been developed because currently there is not an EVEMS standard therefore the qualified person performing load calculation must fully understand the various energy management schemes and how the EVEMS to be installed relates to the BCEC. Some of the common schemes are:

- Load switching: Where current transformers from the EVEMS monitor the load at a branch circuit, feeder or service and disconnects the EVSE when total power consumption

exceeds a fixed amount of available capacity. Load switching may also occur at the branch circuit level where two loads are installed where only one can be on at the same time when controlled by an EVEMS.

- Load sharing: Where all EVSE connected on one branch circuit communicates and allocates equal power to chargers depending on the number of electric vehicles connected.

More complex systems may also perform load management or dynamic load management by monitoring the capacity of an electrical circuit, panel, or switchboard and allocate available power to EVSE depending on the charging requirements of the connected electric vehicles.

1) When adding a switching type EVEMS to an existing circuit or feeder to apply 8-106 10), two load calculations (one with the EVSE and one with the existing load) will be required to determine the greatest demand on the service.

2) BCEC Rule 8-202 1) a) does not specify requirements where EVSE loads are supplied from a dwelling unit's panelboard. Upcoming changes to the 2024 CEC code have clarified the requirements for EVSE loads. To support this upcoming change, the application of the BCEC Rule 8-202 1) a), any EVSE loads supplied from a dwelling unit's panelboard shall be added with a 100% demand factor, except as permitted by Rule 8-106 11). **Note:** The relaxation of 8-106 11) would not apply if the EVEMS did not monitor the consumer's service, feeders, and branch circuits and control the electric vehicle supply equipment loads in accordance with Rule 8-500.

3) BCEC Rule 8-202 3) d) does not specify requirements where EVSE loads are controlled by an EVEMS in accordance with Rule 8-106 10) or Rule 86-300 2). For application of the BCEC 8-202 3) d), 8-204 1) d), 8-206 1) d), 8-208 1) d), and 8-210 c), the demand load for EVSE allowed by any EVEMS is in accordance with Rule 8-106 10) and shall be added with a 100% demand factor; except as permitted by Rule 8-106 11).

Note: Utility equipment is not regulated by the BC Electrical Code but may be affected by the use of these systems. The electrical utility should be consulted and notified of all EVEMS when installation of EVSE and EVEMS is being considered.

Appendix A Link

Provincial Safety Manager

References:

Safety Standards Act
Electrical Safety Regulation
Safety Standards General Regulation