Bulletin 86-1-6
Electric vehicle charging systems
Rules 8-106, 8-202, 8-210, 86-300, 86-302, 86-304, 86-306, and 86-308

Issued May 2024
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Scope

1) Electric Vehicle Energy Management Systems (EVEMS)
2) Electric Vehicle Supply Equipment (EVSE) demand factors without EVEMS
3) Calculation of the minimum ampacity of service or feeder conductors for dwellings without EVEMS
4) Adjustable EVSE
5) *Protection of EVSE from mechanical damage*
6) HV requirements for EVSE exceeding 750 V dc
7) Overcurrent and receptacle requirements for EVSE
    a) 50 A receptacles used for EVSE
    b) AFCI, GFCI and TR requirements for dwelling units
8) Bi-directional charging

1) Electric Vehicle Energy Management Systems (EVEMS)

Rule 8-500 permits Electrical Vehicle Energy Management Systems (EVEMS) to monitor loads and automatically control Electric Vehicle Supply Equipment (EVSE) loads. EVEMS is defined as a means used to control electric vehicle supply equipment loads through the process of connecting, disconnecting, increasing, or reducing electric power to the loads. The system may consist of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), and other applicable devices.

Rule 86-300 1) requires EVSE to be supplied by a separate branch circuit. Rule 86-300 2) permits electric vehicle supply equipment to be supplied from a branch circuit supplying other loads, provided that an EVEMS is installed.

EVEMS is permitted to be used in *any type of occupancy or building*.

As per Rules 8-106 10) and 11), when electrical vehicle supply equipment is controlled by EVEMS:

- The demand load for the EVSE shall be limited to the maximum load allowed by the EVEMS, as per Diagram B1 and B2.
- Where an EVEMS monitors the consumer's service and feeders and controls the EVSE, the demand load for the EVSE shall not be required to be considered in the determination of the calculated load, as per Diagram B2.

Diagram B1 – CTs monitor branch

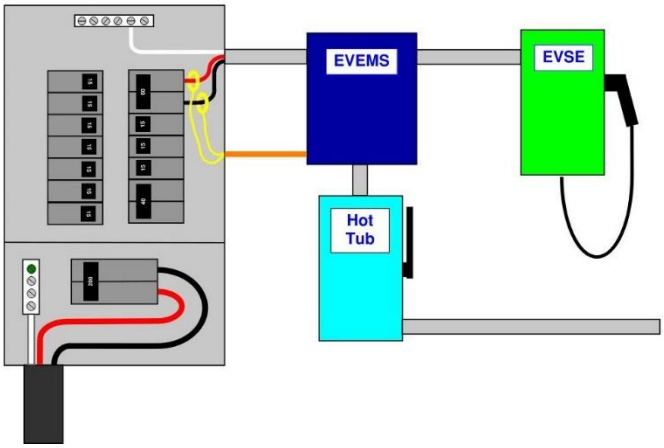
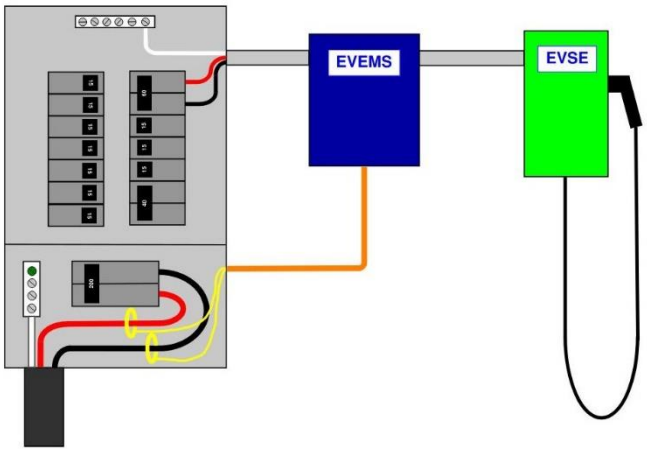


Diagram B2 – CTs monitor service conductors



2) EVSE demand factors without EVEMS

When EVEMS is not provided, any EVSE loads are permitted to be added with demand factors as specified in Table 38, which is applicable to Rules 8-202 to 8-210 that includes apartment buildings, schools, hospitals, hotels, motels, and dormitories.

3) Calculation of the minimum ampacity of service or feeder conductors for dwellings without EVEMS

Examples of calculations of the minimum ampacity of service or feeder conductors supplying single dwellings and two or more dwelling units that include EVSE (without EVEMS) is provided in Bulletin 8-3-*.

Questions have been asked if a service upgrade is required when EVSE is added to the existing single dwelling service. In order to calculate the new service rating and determine if a service upgrade is required, a calculation is permitted to be done in

accordance with Rule 8-106 8). See Bulletin 8-3-* about calculation example based on the demonstrated load.

4) Adjustable EVSE

As technology advances so has the evolution of the EVSE. EVSEs now have the capability of adjustable amperage settings. These adjustments can be accomplished through internally mounted dip or rotary style switches or through internal and external software. Software and application based EVSEs are capable of connecting to the internet via an Ethernet, Bluetooth, or Wi-Fi connection. These chargers provide the user with increased control over the charging of their EV. Many allow access and control through a smart phone or computer, providing the user access to modifying EVSE functionality such as, setting the time of day charging will occur, the maximum charge current and source type (grid, PV, and ESS).

Question 1
Is it permitted to base the rating of EVSE on the adjustable field settings, which may include software, commissioning apps, dip switches, rotary dials, etc, that are part of the equipment, for the purposes of maximum circuit loading? (Rules 86-302, 86-304, and 86-306)

Answer 1
Yes, adjustable amperage settings which include commissioning apps, software, dip switches, rotary dials, etc, are permitted on fixed-in-place* equipment only, provided the manufacturer's instructions are followed, and the following conditions are met;

- A permanent legible marking (see Diagram B3) in accordance to Rule 2-100 is posted on or adjacent to the EVSE when set below the nameplate maximum rating with the minimum information shown in the example, and
- Access to the adjusting means is restricted.

Restricted access shall prevent the user from gaining access to the adjusting means and shall be accomplished by at least one of the following:

- A cover or door that requires the use of a tool to access the adjustments,
- Unique password protected commissioning apps,
- Software that has a unique password for that site to the adjusting means, or
- The manufacturer can prove restricted access

Note *
Definitions from CSA C22.2 No. 280

- **Fixed-in-place** - is a mounting means for EVSE that requires a tool to remove the EVSE from its mounted position.
- **Fastened-in-place** - is a mounting means for EVSE for relocation, interchangeability, maintenance or repair without the use of a tool.

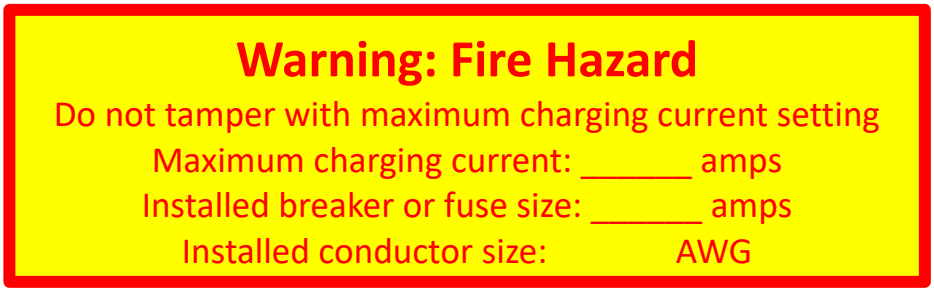
For example, see Table B1, when the dip switch is set to limit the output to 48 A and is connected to a 60 A branch circuit, a disconnecting means is not required. Rule 86-304 1) requires a separate disconnecting means for each installation of EVSE rated more

than 60 A or than 150 volts to ground. When the dip switch is set to limit the current to 64 A with an 80 A branch circuit, a disconnecting means is required.

Table B1 – Example of a dip switch setting for an EVSE as per manufacturer instructions

Rotary Switch Position	Maximum Output Current	Circuit Breaker
0	Test mode	N/A
1	12A	15A
2	16A	20A
3	20A	25A
4	24A	30A
5	28A	35A
6	32A	40A
7	36A	45A
8	40A	50A
9	48A	60A

Diagram B3 – Example of EVSE label when set below nameplate maximum setting



Question 2
Can an EVSE be used as an EVEMS?

Answer 2
No, unless it has features which allow it to function as an EVEMS (see Diagram B4).

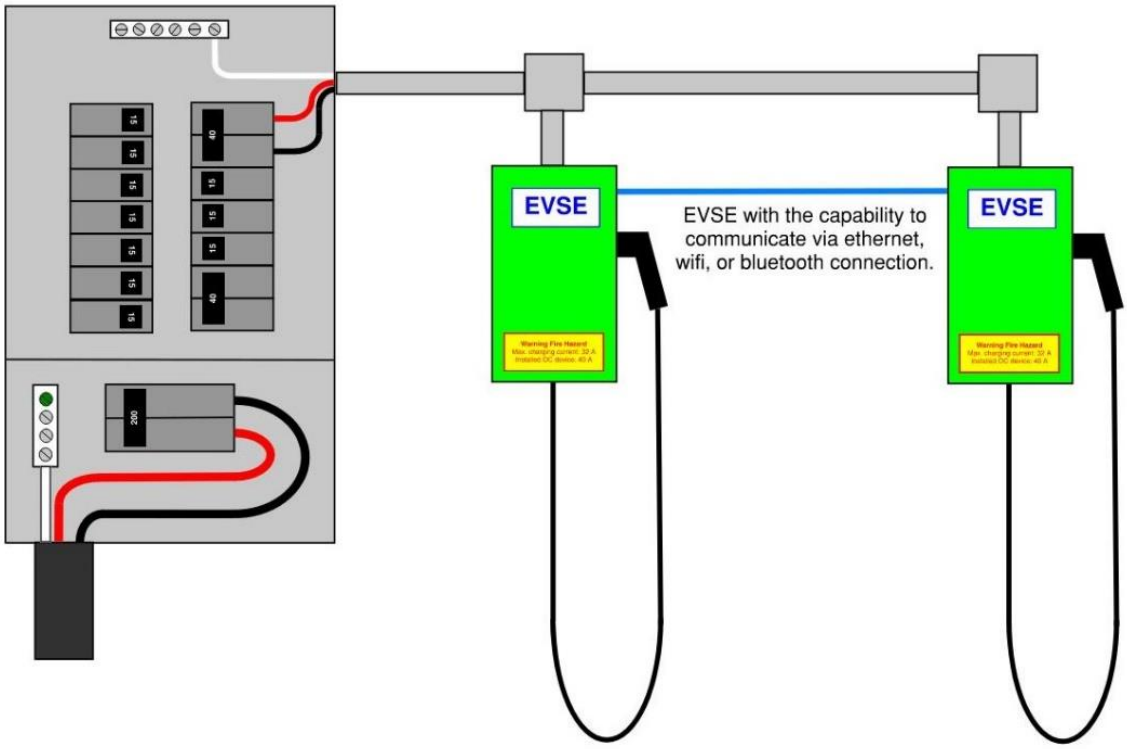
Rationale:
An EVEMS is defined as a means used to control EVSE loads through the process of connecting, disconnecting, increasing, or reducing electric power to the loads and consisting of any of the following: a monitor(s), communications equipment, a controller(s), a timer(s), and other applicable device(s).

Rule 8-106 10) allows the EVSE loads controlled by the EVEMS to equal the maximum load allowed by the EVEMS. Therefore, if we consider adjustable EVSE to function as

EVEMS, the maximum allowed load should be based on the setting of the load/current output of the adjustable EVSE.

Subrule 11) clarifies that where an EVEMS, as described in Subrule 10), monitors the consumer's service and feeders and controls the EVSE, the demand load for the EVSE shall not be required to be considered in the determination of the calculated load.

Diagram B4 – Multiple EVSEs with communication capabilities (load sharing)



5) Protection of EVSE from mechanical damage

Question 3
Does EVSE and mounting pedestals containing supply conductors require protection from mechanical damage as per Rule 2-200?

Answer 3
Yes. EVSE and mounting pedestals containing supply conductors are typically subject to mechanical damage (Photo B1) and protection is required.

Photo B1 – Damage to EVSE without mechanical protection

Direction

Protection of EVSE can be achieved by locating the EVSE at minimum of 1m away from vehicles, or by elevation or behind a physical barrier (mechanical protection) meeting the below requirements:

- *Protected by curb (e.g. Photo B2) such that EVSE is installed on a raised curb or sidewalk and is installed 1 m back from the front of the curb.*
- *Protected by curb stops (e.g. Photo B3) provided it won't interfere with snow removal and the stops are a minimum of 10cm tall and 15cm wide and mechanically secured in place with a suitable fastening product. These would be suitable for underground or covered parking to keep vehicles 1m away from the EVSE.*

Notes:

- *Special consideration shall be given when charging stations are to be used for larger vehicles (e.g. delivery trucks) other than passenger vehicles and 1 m might not be sufficient.*
- *This applies to all parking spots including parallel parking.*

Photo B2 – EVSE Protected by curb

Photo B3 – EVSE protected by curb stop

- *Protected by Elevation (e.g. Photo B4) such that:*
  - *EVSE is installed such that the bottom of the EVSE and electrical wiring is 1m above grade.*

  Notes:
  - *Special consideration shall be given when charging stations are for larger vehicles (e.g. delivery trucks) other than passenger vehicles and 1 m might not be sufficient.*
  - *This applies to all parking spots including parallel parking.*
  - *Mechanical protection applies to the structure supporting an elevated EVSE.*

B4 – EVSE protected by elevation

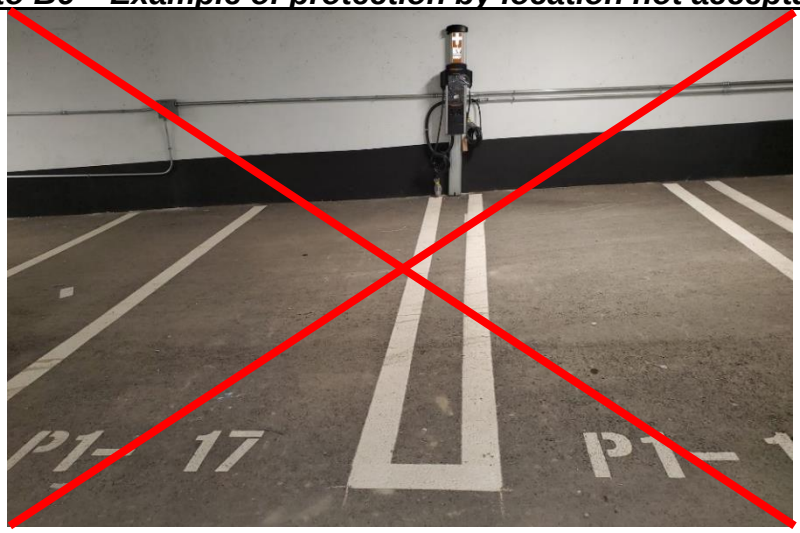
- *Protected by physical barrier (e.g. Photo B5) such as:*
  - *Steel bollard installed at least 1.5m below grade.*
  - *Manufactured bollards installed at least 1.5m below grade.*
  - *6”x6” pressure treated wood installed to a minimum 1.5m below grade.*
  - *Posts bolted to a concrete sono tube installed at a minimum 1.5m below grade. Min ½” bolts, the types used for light standards*
  - *Posts secured to a concrete slab with minimum ½” lag bolts or similar type fastener. Asphalt only, would not be acceptable.*

  Note: Where multiple bollards or equivalent physical barrier is used, shall not be spaced more than 1.5m (centre to centre) apart.

Photo B5 – EVSE protected by bollards


Note: protection by location that does not meet any of the above requirements is not acceptable to ESA (e.g. Photo B6)

Photo B6 – Example of protection by location not acceptable.



6) HV requirements for EVSE exceeding 750 V dc

Question 4
Where the interconnected dc wiring between EVSE exceeds 750 volts, do the requirements of Section 36 apply?

Answer 4
Yes; However the following direction is provided by ESA for EV installers

Direction
Notwithstanding the requirements of Rule 36-204 (overcurrent and load-break switch), Rule 36-208 (interlocking of fuse compartment) and Rule 36-214 (visible isolation),

where the dc voltage for EVSE installations exceeds 750 volts dc but does not exceed 1000 volts dc, it shall be permitted to be exempt from these requirements provided that:

1) The installation is serviced by only qualified persons; and
2) Enclosures in which circuits exceeding 750 V dc are present are marked with the word “DANGER” followed by the maximum rated circuit voltage of the equipment.

7) Overcurrent and receptacle requirements for EVSE

a) 50 A receptacles used for EVSE

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 OESC to be matched with their corresponding voltage and current rating.

In the past, under special circumstances ESA has allowed a 40 A breaker to supply a 50 A EVSE receptacle when instructed by the manufacturers’ installation instructions (or marking). This is no longer the case, this special circumstance has been revoked based on a submitted code proposal being defeated.

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 to Rule 26-700 as per Diagram B5.

Diagram B5 – 50 A receptacle with 50 A overcurrent device

b) AFCI, GFCI, and TR requirements for dwelling units

For installations where branch circuits for dwelling units supplying a CSA configuration 5-20R receptacle that will be used for the purpose of the connection of an EVSE, the applicable Rules 26-658, 26-704 2) and 26-706 1) d) with regards to AFCI, GFCI, and TR protection shall apply.

8) Bi-directional charging

Bi-directional charging is essentially 2-way charging. In conventional unidirectional charging, the EV takes power from the grid or home or another electrical source to charge the EV's onboard batteries. With bi-directional charging, current can now flow in the opposite direction allowing the EV's battery to supply power back into the grid, home, or appliance.

When the EV becomes the electrical power source and is capable of running in parallel with the supply grid, the system is considered to be interconnected with grid. The Section 84 rules for the interconnection of electric power production sources will apply. Since the EV is essentially a large battery (ESS) that will have its dc current inverted to ac current, the applicable rules from Section 64 will also apply.

Rule 86-308 requires electric vehicle supply equipment that provides bi-directional power to be marked.

Bulletin 2-11-* outlines the requirements for submitting plans for bi-directional EVSE to ESA for plan review.