Electrical Vehicle Charging Systems

NEC Article 625 & Applicable UL Standards

The Future is Here

Projections for the market size of electric vehicles have shown that by 2015, there may be approximately 1 million EV's on the road in the United States and approximately 5 million by 2020.

References:

Electric Vehicles on the Grid: Residential, Public, Private and Workplace Charging Stations, EV Charging Business Models, and Vehicle to Grid Technology. A Pike Research Extract, Document, June, 2009.

Washington is putting considerable money into the effort, including billions of dollars in loans to Ford, Nissan and Tesla Motors.

Under last year's stimulus package, nearly $200 million will support Nissan's introduction of the Leaf by permitting the installation of 13,000 charging stations around cities in Oregon, Washington, California, Arizona and Tennessee in the next year or so.

(Nissan plans to build the Leaf in Tennessee eventually.)

The New York Times: February 14, 2010

Coming to a School near you!

Eleven states are the first states in the nation to receive Plug-In Hybrid Electric School Buses:

New York, California, Texas, Florida, Pennsylvania, Virginia, North Carolina, South Carolina, Arkansas, Iowa and Washington

IC Corporation, the nation's largest school bus manufacturer, is delivering the first plug-in hybrid school buses.

The buses according to IC Corporation can improve fuel efficiency by 70-100 percent and reduce diesel emissions by up to 90 percent.

Motivations for installing EV Charging Stations

Be more “Green”

Generate revenue

Reduce foreign oil dependence

Government incentives (tax credits and grants)

Attract and retain tenants/employees /customers

Industry Terms

Battery Electric Vehicle - This vehicle has one energy storage system - a battery.

- No on-board means of generating electricity.
- Transfer energy to the vehicle by plugging it in to an electricity supply or by exchanging the battery for a charged one.

Plug-In Hybrid Electric Vehicle - These vehicles have a battery.

- Recharged with power from either an on-board generating device (for example, a small internal-combustion engine) or
- Plugged into a receptacle

Hybrid-Electric Vehicle - This vehicle has two or more energy storage systems, both of which provide propulsion power, together or independently.

- The internal combustion engine is the primary system,
- An on-board electric motor is used to power the vehicle for short distances or to support the main engine.

Intent of Article 625

Throughout Article 625, the intent is to prevent the users of electrical equipment associated with the EV charging system from being exposed to energized live parts and to provide for a safe EV charging environment.

The use and proper installation of UL Listed or Classified equipment will comply with this intent.

ARTICLE 625
Electric Vehicle Charging System

625.1 Scope

- The provisions of this article cover the electrical conductors and equipment external to an electric vehicle that connect an electric vehicle to a supply of electricity by conductive or inductive means, and
- the installation of equipment and devices related to electric vehicle charging.
- FPN: For industrial trucks, see NFPA 505-2006, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation.

625.2 Definitions.

- **Electric Vehicle. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current.**


zero Emission


PLUG-IN
HYBRID


HYBRID-ELECTRIC
POWERED
302
SEATS 65C 43A
DIESEL ELECTRIC
HYBRID
BROWN TRANSPORTATION, INC.
Hybrid Electric Vehicle
LEONARD BUS
DANGER
HIGH VOLTAGE
Advanced
NYSERDA
New York Power
Authority

Smith electric delivery vehicles are capable of carrying up to 16,060 lbs. and traveling up to 100+ miles on one charge. Using the latest in Lithium-Ion battery technology, and very few moving parts, these should make for some reliable delivery vehicles


FedEx
Express
ZERO
EMISSIONS
The World On Time


ups
Low Emission
Hybrid Electric Vehicle
666143

625.2 Definitions.

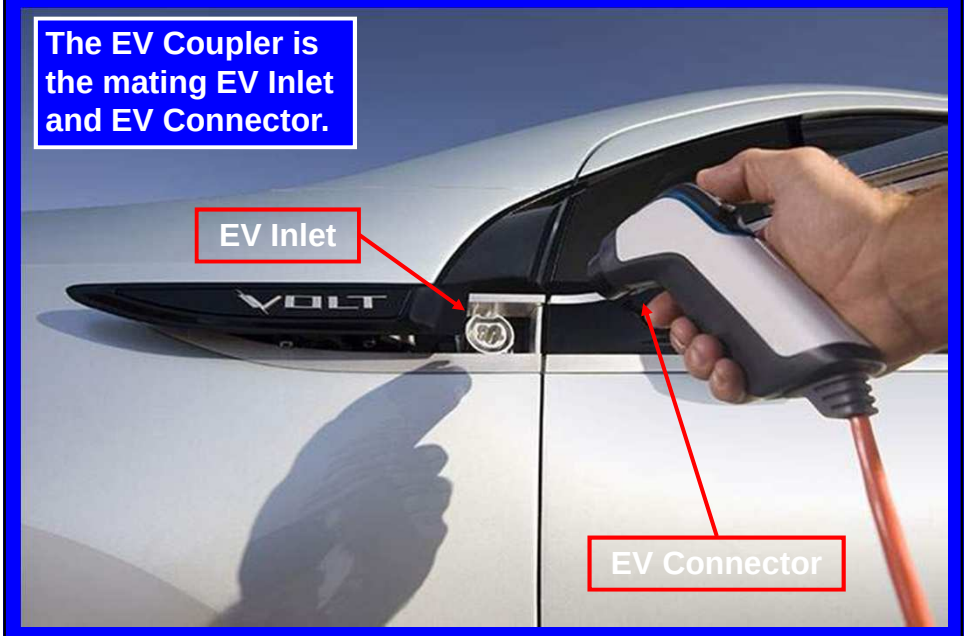
- For the purpose of this article, electric motorcycles and similar type vehicles and off-road, self-propelled electric vehicles,
  - such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like,
- are not included.


AT0979

625.2 Definitions.

- **Electric Vehicle Connector.**
- **A device that, by insertion into an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of charging and information exchange.**
- **This device is part of the electric vehicle coupler.**

- **Electric Vehicle Coupler. A mating electric vehicle inlet and electric vehicle connector set.**



625.2 Definitions.

- **Electric Vehicle Inlet.**
- **The device on the electric vehicle into which the electric vehicle connector is inserted for charging and information exchange.**
- **This device is part of the electric vehicle coupler.**
- **For the purposes of this Code, the electric vehicle inlet is considered to be part of the electric vehicle and not part of the electric vehicle supply equipment.**

625.2 Definitions.

- Electric Vehicle Nonvented Storage Battery.

- A hermetically sealed battery, comprised of one or more rechargeable electrochemical cells,
- that has no provision for the release of excessive gas pressure, or
- for the addition of water or electrolyte, or
- for external measurements of electrolyte specific gravity.

Non-Vented Electrical Vehicle Batteries

625.2 Definitions.

- Electric Vehicle Supply Equipment.
- The conductors,
- including the ungrounded, grounded, and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and
- all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle.

625.2 Definitions.

- Personnel Protection System.
- A system of personnel protection devices and constructional features that when used together provide protection against electric shock of personnel.

Personnel Protection system

625.3 Other Articles.

- Wherever the requirements of other articles of this Code and Article 625 differ, the requirements of Article 625 shall apply.

625.4 Voltages.

- Unless other voltages are specified, the nominal ac system voltages of 120, 120/240, 208Y/120, 240, 480Y/277, 480, 600Y/347, and 600 volts shall be used to supply equipment covered by this article.

EV Supply Equipment Typical Types

EV Cord sets.

These are devices that are typically 120 V up to 16 A, they can be transported from location to location and are used to plug the car into any available receptacle.

EV Supply Equipment Typical Types

EV Charging Stations.

These are products that are typically permanently connected, provide power to an on-board charger and used to provide power to an electric vehicle.

EV Power Outlets.

These are essentially the same as EV Charging Stations, except they terminate in a normal NEMA type receptacle and are intended to be used with the EV Power Cord Set which is then plugged into the EV receptacle Inlet.

Exhibit 625.1 Example of electric vehicle supply equipment. (Courtesy of Ford Motor Co.)

625.5 Listed or Labeled

All electrical materials, devices, fittings, and associated equipment shall be listed or labeled.

UL LISTED
NO. XX 000000

Charging System Equipment

II. Wiring Methods

625.9 Electric Vehicle Coupler.

- The electric vehicle coupler shall comply with 625.9(A) through (F).

- (A) Polarization. The electric vehicle coupler shall be polarized unless part of a system identified and listed as suitable for the purpose.

625.9 Electric Vehicle Coupler.

- (B) Noninterchangeability.
- The electric vehicle coupler shall have a configuration that is noninterchangeable with wiring devices in other electrical systems.

- Nongrounding-type electric vehicle couplers shall not be interchangeable with grounding-type electric vehicle couplers.

625.9 Electric Vehicle Coupler.

- (C) Construction and Installation.
- The electric vehicle coupler shall be constructed and installed so as to guard against inadvertent contact by persons with parts made live from the electric vehicle supply equipment or the electric vehicle battery.

- (D) Unintentional Disconnection.
- The electric vehicle coupler shall be provided with a positive means to prevent unintentional disconnection.

625.9 Electric Vehicle Coupler.

- (E) Grounding Pole.
- The electric vehicle coupler shall be provided with a grounding pole, unless part of a system identified and listed as suitable for the purpose in accordance with Article 250.

- (F) Grounding Pole Requirements.

- If a grounding pole is provided, the electric vehicle coupler shall be so designed that the grounding pole connection is the first to make and the last to break contact.

III. Equipment Construction

625.13 Electric Vehicle Supply Equipment.

- Electric vehicle supply equipment rated at 125 volts, single phase, 15 or 20 amperes or part of a system identified and listed as suitable for the purpose and meeting the requirements of 625.18, 625.19, and 625.29 shall be permitted to be cord-and-plug-connected.
- All other electric vehicle supply equipment shall be permanently connected and fastened in place.
- This equipment shall have no exposed live parts.

EV Plugs, Receptacles and Couplers – Component (FFVI2)

This category covers plugs, receptacles, vehicle inlets, and connectors, rated up to 800 A and up to 600 V ac or dc.

These products are intended for conductive connection systems for use with EV's in accordance with the NEC. These products are intended for indoor or outdoor applications.

These devices are not intended for connection to branch circuit receptacle outlets.

EV Plugs, Receptacles and Couplers – Component (FFVI2)

Devices covered under this category are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field.

The basic standard to investigate products in this category is UL 2251, "Plugs, Receptacles, and Couplers for Electric Vehicles."

EV CHARGING SYSTEM EQUIPMENT (FFTG)

This category covers charging system equipment, either conductive or inductive, intended for use with electric vehicles.

The equipment can be located on or off board the vehicle.

Off-board equipment is intended for indoor or outdoor use.

EV CHARGING SYSTEM EQUIPMENT (FFTG)

This equipment is rated 600 V or less.

The equipment is intended to be connected to the vehicle by means of a flexible cord and an electric vehicle connector, and intended for installation in accordance with the NEC.

The basic standard used to investigate products in this category is UL 2202, "Electric Vehicle (EV) Charging System Equipment."

New SAE International Standard Defines Electric-Vehicle Charging Coupler

SAE J1772 was adopted on January 14, 2010 by the SAE Motor Vehicle Council.

The companies participating in or supporting the standard include GM, Chrysler, Ford, Toyota, Honda, Nissan and Tesla.

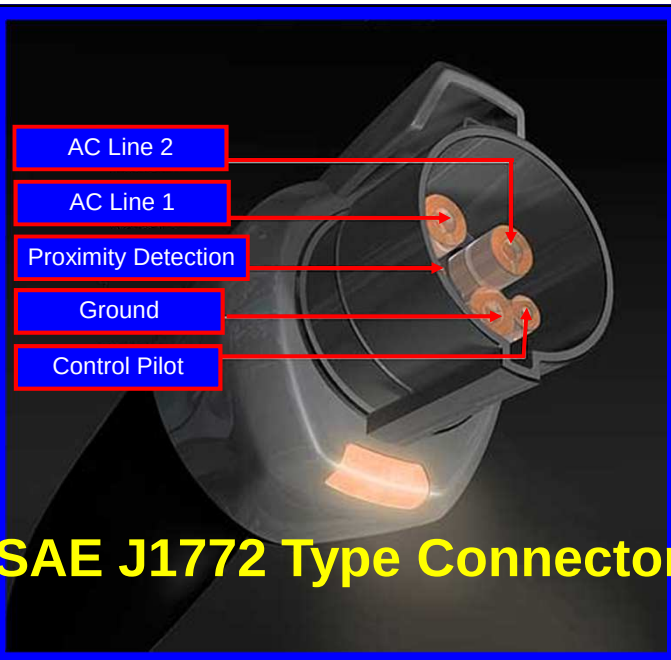
The J1772 standard includes several levels of shock protection, ensuring the safety of charging even in wet conditions.

Physically, the connection pins are isolated on the interior of the connector when mated, ensuring no physical access to those pins.

When not mated, J1772 connectors have no voltage at the pins.

In the process of SAE J1772 development, a production tooled coupler passed UL 2251 testing by Underwriters Laboratories.

SAE J1772 Type Connector & Inlet



SAE J1772 Type Connector

625.13 Electric Vehicle Supply Equipment

Rated at 125 volts, single phase, 15 or 20 amperes or part of a system identified and listed as suitable for the purpose and meeting the requirements of 625.18, 625.19, and 625.29 shall be permitted to be cord-and-plug-connected. All other electric vehicle supply equipment shall be permanently connected and fastened in place. This equipment shall have no exposed live parts.

EV CHARGING SYSTEM EQUIPMENT (FFTG)

Portable type equipment with parts that are considered arcing or sparking, such as switches, relays, etc., are marked with the word "WARNING" and the following or equivalent:

"This equipment employs parts, such as switches and relays, that tend to produce arcs or sparks and therefore, when used in a garage, locate in a room or enclosure provided for the purpose or not less than 450 mm (18 inches) above the floor."

The basic standard used to investigate products in this category is UL 2202, "Electric Vehicle (EV) Charging System Equipment."

625.14 Rating.

- Electric vehicle supply equipment shall have sufficient rating to supply the load served.
- For the purposes of this article, electric vehicle charging loads shall be considered to be continuous loads.

625.15 Markings.

- The electric vehicle supply equipment shall comply with 625.15(A) through (C).
- (A) General. All electric vehicle supply equipment shall be marked by the manufacturer as follows:
- FOR USE WITH ELECTRIC VEHICLES

625.15 Markings.

- (B) Ventilation Not Required.
- Where marking is required by 625.29(C), the electric vehicle supply equipment shall be clearly marked by the manufacturer as follows:
- VENTILATION NOT REQUIRED
- The marking shall be located so as to be clearly visible after installation.

625.15 Markings.

- (C) Ventilation Required.
- Where marking is required by 625.29(D), the electric vehicle supply equipment shall be clearly marked by the manufacturer, “Ventilation Required.”
- The marking shall be located so as to be clearly visible after installation.

625.16 Means of Coupling.

- The means of coupling to the electric vehicle shall be either conductive or inductive.
- Attachment plugs, electric vehicle connectors, and electric vehicle inlets shall be listed or labeled for the purpose.

UL 2251.

- UL Evaluates EV connectors and EV inlets to UL 2251.
- This standard covers plugs, receptacles, EV inlets, and EV connectors,
  - rated up to 800 amperes and
  - up to 600 volts ac or dc,
  - intended for conductive connection systems,
- for use with EV's in accordance with the NEC for either indoor or outdoor nonhazardous locations.
- UL 2251 does not have provisions to evaluate inductive systems.

ELECTRIC VEHICLE POWER OUTLETS (FFWA)

This category covers electric vehicle supply equipment rated 600 V or less,

intended for indoor or outdoor use where power is required for the recharging of EV storage batteries.

These products are intended to provide power to an on-board charger.

ELECTRIC VEHICLE POWER OUTLETS (FFWA)

These products include EV charging stations, EV power outlets and EV cord sets for use with electric vehicles in accordance with Article 625 of the NEC.

The basic requirements used to investigate products in this category are contained in UL Subject 2594, "Outline of Investigation for Electric Vehicle Supply Equipment."

625.17 Cable

Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable.

Ampacities shall be as specified in Table 400.5(A) for 10 AWG and smaller, and in Table 400.5(B) for 8 AWG and larger.

Overall length of the cable shall not exceed 7.5 m (25 ft) unless equipped with a cable management system that is listed as suitable for the purpose.

Other cable types and assemblies listed as being suitable for the purpose.

625.17 Cable.

- **The electric vehicle supply equipment cable shall be Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable as specified in Article 400 and Table 400.4.**

- **Ampacities shall be as specified in Table 400.5(A) for 10 AWG and smaller, and in Table 400.5(B) for 8 AWG and larger.**

625.17 Cable.

- The overall length of the cable shall not exceed 7.5 m (25 ft)
- unless equipped with a cable management system that is listed as suitable for the purpose.

- Other cable types and assemblies listed as being suitable for the purpose,
  - including optional hybrid communications, signal, and optical fiber cables,
- shall be permitted.

EV CABLE (FFSO)

This category covers EV cable constructed and Listed for use in accordance with Article 400 of the NEC.

The insulation and jacket are both thermoset on Types EVJ and EV, thermoplastic elastomer (TPE) on Types EVJE and EVE, and thermoplastic (PVC) on Types EVJT and EVT.

The cable is used to supply power, signal, and control to EV's during the charging process.

EV CABLE (FFSO)

The term "wet" indicates that the cable is acceptable for immersion in water.

The basic standards used to investigate products in this category are ANSI/UL 62, "Flexible Cord and Fixture Wire," and ANSI/UL 1581, "Reference Standard for Electrical Wires, Cables, and Flexible Cords."

625.18 Interlock.

- Electric vehicle supply equipment shall be provided with an interlock that de-energizes the electric vehicle connector and its cable
- whenever the electrical connector is uncoupled from the electric vehicle.

- An interlock shall not be required for portable cord-and-plug-connected electric vehicle supply equipment intended for connection to receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes.

- (UL 2202 "Electric Vehicle (EV) Charging System Equipment" requires that external connections of a unit shall be protected by a mechanical interlock or other means so that the connection is not energized unless it is coupled to the EV.)

625.19 Automatic De-Energization of Cable.

- The electric vehicle supply equipment or the cable-connector combination of the equipment
- shall be provided with an automatic means to de-energize the cable conductors and electric vehicle connector
- upon exposure to strain that could result in either cable rupture or
- separation of the cable from the electric connector and exposure of live parts.

UL 2202 "Electric Vehicle (EV) Charging System Equipment”

UL 2202 "Electric Vehicle (EV) Charging System Equipment” requires that external connections of a unit

shall be protected by a means that de-energizes the cable conductors and connector upon exposure to a strain

which results in either cable rupture or separation of the cable from the connector and exposure of live parts.

625.19 Automatic De-Energization of Cable.

- Automatic means to de-energize the cable conductors and electric vehicle connector shall not be required

- for portable cord-and-plug-connected electric vehicle supply equipment intended for connection to receptacle outlets rated at 125 volts, single phase, 15 and 20 amperes.

IV. Control and Protection

625.21 Overcurrent Protection.

- Overcurrent protection for feeders and branch circuits supplying electric vehicle supply equipment shall be sized for continuous duty and shall have a rating of not less than 125 percent of the maximum load of the electric vehicle supply equipment.

- Where noncontinuous loads are supplied from the same feeder or branch circuit, the overcurrent device shall have a rating of not less than the sum of the noncontinuous loads plus 125 percent of the continuous loads.

625.22 Personnel Protection System.

- The electric vehicle supply equipment shall have a listed system of protection against electric shock of personnel.
- (This system is required to be Listed and is specifically not GFCI protection.)

- The personnel protection system shall be composed of listed personnel protection devices and constructional features.

625.22 Personnel Protection System.

- Where cord-and-plug-connected electric vehicle supply equipment is used,
- the interrupting device of a listed personnel protection system shall be provided and
- shall be an integral part of the attachment plug or
- shall be located in the power supply cable not more than 300 mm (12 in.) from the attachment plug.

625.23 Disconnecting Means.

- For electric vehicle supply equipment rated more than 60 amperes or more than 150 volts to ground,
- the disconnecting means shall be provided and installed in a readily accessible location.

- The disconnecting means shall be capable of being locked in the open position.

625.23 Disconnecting Means.

- The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and

- shall remain in place with or without the lock installed.

- Portable means for adding a lock to the switch or circuit breaker shall not be permitted.

625.25 Loss of Primary Source.

- Means shall be provided such that,
- upon loss of voltage from the utility or other electrical system(s),
- energy cannot be back fed through the electric vehicle and the supply equipment to the premises wiring system
- unless permitted by 625.26. (covers interactive systems and requires compliance with Article 702 and 705.)

EV Charging System Equipment
UL 2202

UL Listed EV Charging System Equipment, through the use of a control pilot signal will prevent a back fed power source.

When power is lost, the control pilot signal would be lost and simultaneously open the relays.

These open relays would then prevent feedback onto the premises wiring system by default.

625.26 Interactive Systems.

- Electric vehicle supply equipment and other parts of a system,
  - either on-board or off-board the vehicle,
- that are identified for and intended to be interconnected to a vehicle and also serve as an optional standby system or an electric power production source or provide for bi-directional power feed shall be listed as suitable for that purpose.

- When used as an optional standby system, the requirements of Article 702 shall apply, and when used as an electric power production source, the requirements of Article 705 shall apply.

625.29 Indoor Sites

- Indoor sites shall include, but not be limited to,
  - integral, attached, and detached residential garages;
  - enclosed and underground parking structures;
  - repair and nonrepair commercial garages; and
  - agricultural buildings.

- (A) Location
- The electric vehicle supply equipment shall be located to permit direct connection to the electric vehicle.

625.29 Indoor Sites

- (B) Height.
- Unless specifically listed for the purpose and location,

- the coupling means of the electric vehicle supply equipment shall be stored or located at a height of not less than 450 mm (18 in.) and

- not more than 1.2 m (4 ft) above the floor level.

625.29 Indoor Sites

- (C) Ventilation Not Required.
- Where electric vehicle nonvented storage batteries are used or where the electric vehicle supply equipment is listed or labeled as suitable for charging electric vehicles indoors without ventilation and marked in accordance with 625.15(B),
- mechanical ventilation shall not be required.

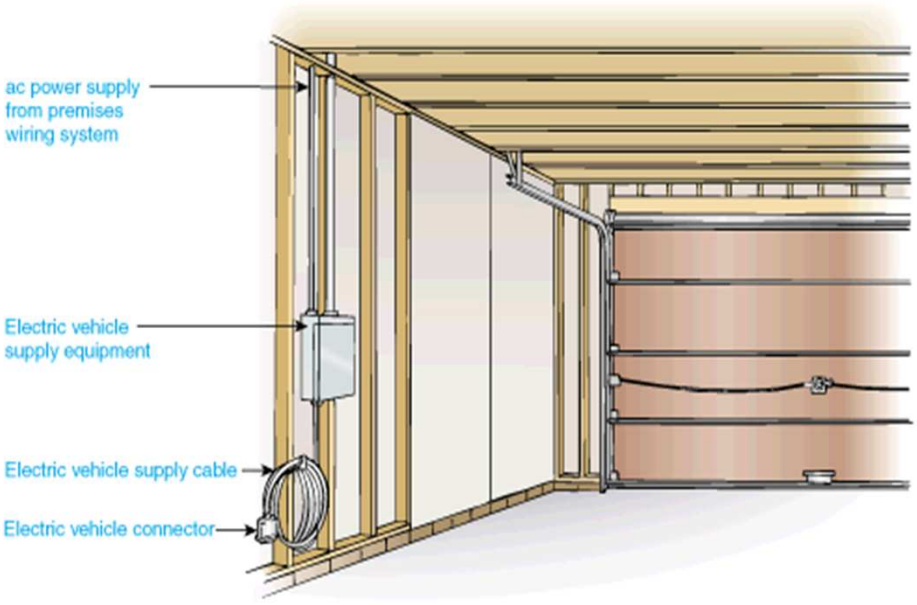


Exhibit 625.2 Garage interior with electric vehicle supply equipment where ventilation is not required.

EV Charging System Equipment UL 2202

A component of a fixed unit, that produces arcs or sparks, such as a snap switch, a relay, or a receptacle, shall be located at least 18 inches above the floor.

A portable unit containing components that produce arcing or sparking such as a snap switch, relay receptacle or similar device shall be marked:

"WARNING"

"This equipment employs parts, such as switches and relays, that tend to produce arcs or sparks and therefore, when used in a garage, locate in a room or enclosure provided for the purpose or not less than 18 inches above the floor."

EV Charging System Equipment
UL 2202

A fixed unit intended for indoor charging of electric vehicles rated as requiring ventilation during charging shall be provided with connections for electrically interlocking with the mechanical ventilation system during charging shall be marked:

"WARNING"

"Proper Ventilation is required to reduce the Risk of Hazardous or Explosive gas build up during indoor charging. See Owners Manual."

625.29 Indoor Sites

- **(1) Table Values.**
- **For supply voltages and currents specified in Table 625.29(D)(1) or Table 625.29(D)(2),**
- **the minimum ventilation requirements shall be as specified in Table 625.29(D)(1) or Table 625.29(D)(2)**
- **for each of the total number of electric vehicles that can be charged at one time.**

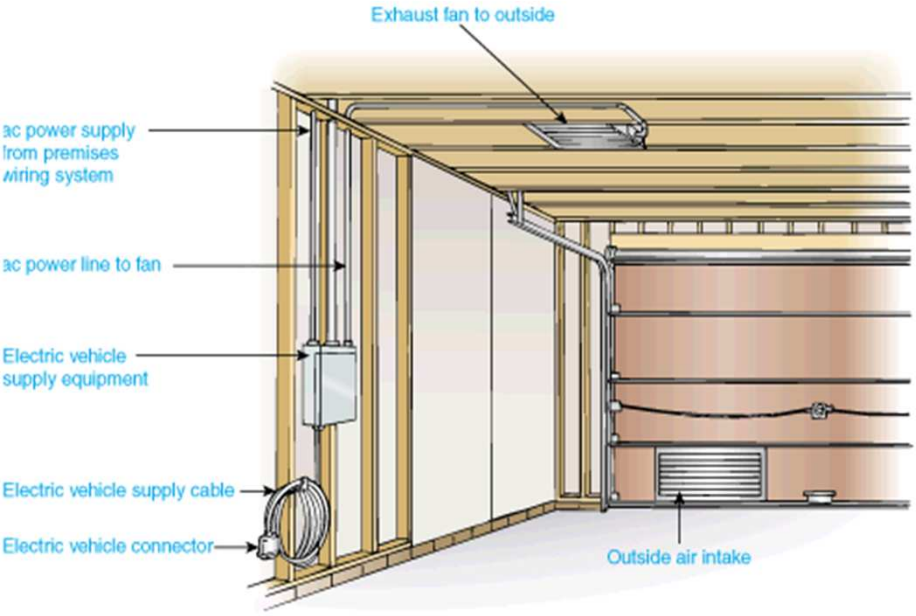


Exhibit 625.3 Garage interior with electric vehicle supply equipment and interlocked ventilation.

Table 625.29(D)(1) Minimum Ventilation Required in Cubic Meters per Minute (m^3/min) for Each of the Total Number of Electric Vehicles That Can Be Charged at One Time

Branch-Circuit Ampere Rating	Branch-Circuit Voltage						
	Single Phase			3 Phase			
	120 V	208 V	240 V or 120/240 V	208 V or 208Y/120 V	240 V	480 V or 480Y/277 V	600 V or 600Y/347 V
15	1.1	1.8	2.1	—	—	—	—
20	1.4	2.4	2.8	4.2	4.8	9.7	12
30	2.1	3.6	4.2	6.3	7.2	15	18
40	2.8	4.8	5.6	8.4	9.7	19	24
50	3.5	6.1	7.0	10	12	24	30
60	4.2	7.3	8.4	13	15	29	36
100	7.0	12	14	21	24	48	60
150	—	—	—	31	36	73	91
200	—	—	—	42	48	97	120
250	—	—	—	52	60	120	150
300	—	—	—	63	73	145	180
350	—	—	—	73	85	170	210
400	—	—	—	84	97	195	240

Table 625.29(D)(2) Minimum Ventilation Required in Cubic Feet per Minute (cfm) for Each of the Total Number of Electric Vehicles That Can Be Charged at One Time

Branch-Circuit Ampere Rating	Branch-Circuit Voltage						
	Single Phase			3 Phase			
	120 V	208 V	240 V or 120/240 V	208 V or 208Y/120 V	240 V	480 V or 480Y/277 V	600 V or 600Y/347 V
15	37	64	74	—	—	—	—
20	49	85	99	148	171	342	427
30	74	128	148	222	256	512	641
40	99	171	197	296	342	683	854
50	123	214	246	370	427	854	1066
60	148	256	296	444	512	1025	1281
100	246	427	493	740	854	1708	2135
150	—	—	—	1110	1281	2562	3203
200	—	—	—	1480	1708	3416	4270
250	—	—	—	1850	2135	4270	5338
300	—	—	—	2221	2562	5125	6406
350	—	—	—	2591	2989	5979	7473
400	—	—	—	2961	3416	6832	8541

625.29 Indoor Sites

- (2) Other Values. For supply voltages and currents other than specified in Table 625.29(D)(1) or Table 625.29(D)(2),
- the minimum ventilation requirements shall be calculated by means of the following general formulas as applicable:
- (1) Single phase:
- Ventilation single phase in meters^3 per minute (m^3/min) = $\frac{(\text{volts})(\text{amperes})}{1718}$

625.29 Indoor Sites

- Ventilation single phase in cubic feet per minute (cfm) = $\frac{(\text{volts})(\text{amperes})}{48.7}$
-
- (2) Three phase:
- Ventilation three phase in cubic meters per minute (m3/min) = $\frac{1.732(\text{volts})(\text{amperes})}{1718}$
- Ventilationthree phase in cubic feet per minute (cfm) = $\frac{1.732(\text{volts})(\text{amperes})}{48.7}$

625.29 Indoor Sites

- (3) Engineered Systems.
- For an electric vehicle supply equipment ventilation system designed by a person qualified to perform such calculations as an integral part of a building's total ventilation system,

- the minimum ventilation requirements shall be permitted to be determined per calculations specified in the engineering study.

625.29 Indoor Sites

- (4) Supply Circuits.
- The supply circuit to the mechanical ventilation equipment shall be electrically interlocked with the electric vehicle supply equipment and
- shall remain energized during the entire electric vehicle charging cycle.
- Electric vehicle supply equipment shall be marked in accordance with 625.15.

625.29 Indoor Sites

- Electric vehicle supply equipment receptacles rated at 125 volts, single phase, 15 and 20 amperes shall be marked in accordance with 625.15(C) and
- shall be switched, and the
- mechanical ventilation system shall be electrically interlocked through the switch supply power to the receptacle.

ELECTRIC VEHICLE BATTERY PACKS (FFRW)

This category covers battery packs investigated in accordance with the NEC, to determine whether or not a forced-air ventilation system is required when a particular EV battery pack is charged using the specified charging system of the EV.

EV battery packs employing non-vented batteries or batteries whose chemistry cannot produce hydrogen are investigated by inspection of the manufacturer's product.

EV battery packs employing batteries that can emit hydrogen are subjected to investigation in accordance with SAE Recommended Practice J1718 (1994), "Measurement of Hydrogen Gas Emission From Battery-Powered Cars and Light Trucks During Battery Charging."

This was the UL Category used for EV's manufactured by Ford, GM, Honda, Nissan and Toyota from 1996 – 2003.

FFRW Products are Classified

NO. XX 000000

ELECTRIC VEHICLE BATTERY PACK

FOR CHARGING INDOORS WITHOUT MECHANICAL BUILDING VENTILATION IN [COMPANY NAME] ELECTRIC VEHICLE [MODEL, NAME]


CLASSIFIED
UL
ELECTRIC VEHICLE CHARGING SYSTEM
CLASSIFIED BY UNDERWRITERS LABORATORIES INC.®
FOR INDOOR CHARGING WITHOUT FORCED AIR
BUILDING VENTILATION IN ACCORDANCE WITH THE
NATIONAL ELECTRIC CODE (1994) (NFPA-70-1996)
ARTICLE 625 AND SAE RECOMMENDED PRACTICE J-1718 WHEN EQUIPPED
WITH A UL CLASSIFIED ELECTRIC VEHICLE BATTERY PACK MARKED FOR
USE WITH THE "HONDA EV PLUS" ELECTRIC VEHICLE.
3S44

Batteries for Use in EV's (BBAS)

This category covers battery packs intended for use in EV's. These battery packs are ready for installation into an EV and consist of component cell models contained in a supplemental rigid enclosure, with battery-protective devices that may be located either within the battery pack enclosure or provided with their own enclosure and located external to the battery pack. The battery packs are rechargeable type and range in size and shape and are suitable for various EV, Hybrid EV, and plug-in hybrid EV applications. Various battery chemistries are included, such as lithium-ion, nickel-metal hydride, lead acid, etc.

These batteries have been investigated for potential electric shock, fire and explosion hazard.

The basic requirements used to investigate products in this category are contained in UL Subject 2580, "Outline of Investigation for Batteries for Use in EV's."

This is the UL Category for batteries being used by EV manufacturer's today.

625.30 Outdoor Sites.

- **Outdoor sites shall include but not be limited to residential carports and driveways, curbside, open parking structures, parking lots, and commercial charging facilities.**
- **(A) Location.**
- **The electric vehicle supply equipment shall be located to permit direct connection to the electric vehicle.**

625.30 Outdoor Sites.

- (B) Height.
- Unless specifically listed for the purpose and location,
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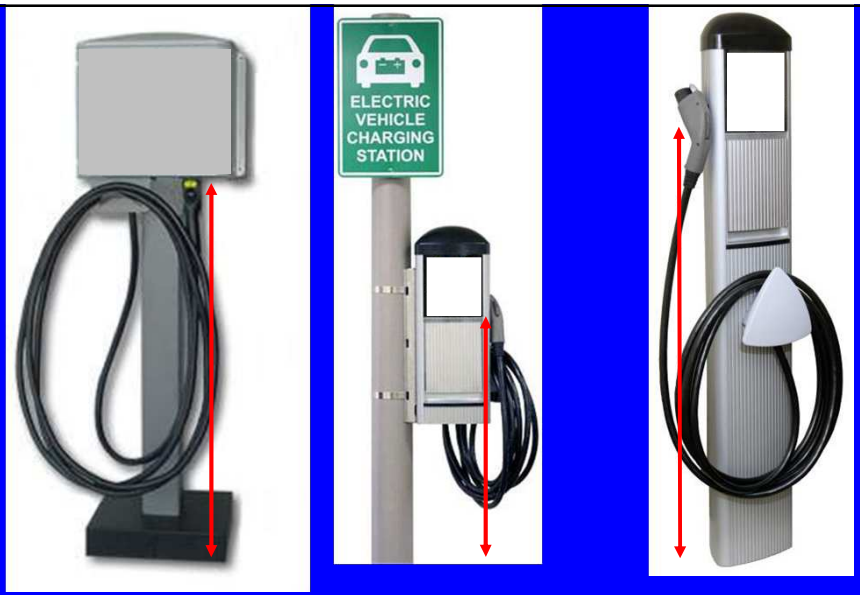
- the coupling means of electric vehicle supply equipment shall be stored or located at a height of not less than 600 mm (24 in.) and

- not more than 1.2 m (4 ft) above the parking surface.



Minimum storage height above parking surface of 600 mm (24 in.) and a maximum 1.2 m (4 ft.) unless specifically listed for the purpose and location.