



Electrical Connections

For regulatory authorities in the electrical inspection community.



Electric Vehicle Charging Systems

Coming to your city soon!

By the end of 2010, deployment of electric vehicle charging infrastructure will begin in major metro areas of Arizona, California, Oregon, Tennessee, Texas, Washington state, and Washington, D.C. Understanding the applicable UL standards, National Electrical Code requirements and industry terminology will be beneficial to Authorities Having Jurisdiction (AHJ's) that will be tasked to inspect and approve this new electric vehicle charging system equipment.

The National Electrical Code® (NEC®) Article 625 covers the installation of electric vehicle charging systems. Although Article 625 has been in the NEC since the 1996 edition, electrical vehicle charging systems have yet to be widely used or installed. That is about to change: research studies project that approximately 1 million electric vehicles will be on U.S. roads by 2015 and approximately 5 million by 2020. It is expected that there will be at least two electrical vehicle-charging systems installed for every electrical vehicle sold.

There are many reasons for the rapid expansion of electric vehicle charging systems; the U.S. federal governments push to reduce dependency on foreign oil, federal and state

tax incentives as well as utility rebates are pushing adoption of plug-in hybrid-electric vehicles and electric vehicles. States and cities also offer additional benefits for owners of electric vehicles such as use of car pool lanes without meeting the occupancy requirement and free parking at city parking meters.

National Electrical Code Requirements

NEC Article 625 contains several sections requiring listing for equipment used to charge plug-in hybrid-electric vehicles and electric vehicles. Some of the key sections include:

- **Section 625.5** — Requires listing of all electrical materials, devices, fittings and associated equipment.

- **Section 625.18** — Requires that EV supply equipment include an interlock that de-energizes an electric vehicle connector and its cable whenever a connector is uncoupled from an electric vehicle.
- **Section 625.19** — Requires that EV supply equipment have a means to automatically de-energize the cable conductors and electric vehicle connector upon exposure to strain that could result in cable rupture or separation of a cable from the electric connector and expose live parts.

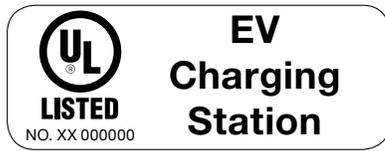
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Electric vehicle charging systems (continued)

- **Section 625.22** — Requires that the electric vehicle supply equipment have a listed system to protect users from electric shock.

UL Listings and Standards

Only those products bearing the appropriate UL Mark together with the word “Listed,” a control number and the product name should be considered as being covered by UL’s Listing service. The UL Mark provides the evidence of listing as required by the NEC.



UL Listed EV charging systems have been investigated to a comprehensive set of construction and performance requirements designed to reduce the risk of fire, shock and personal injury. The equipment has also been specifically investigated for installation in accordance with all the safety requirements of NEC Article 625.

UL Listed electric vehicle charging equipment is covered by two categories, UL category FFWA (electric vehicle supply equipment) that is evaluated to UL 2594 and UL category FFTG (electric vehicle charging system equipment) that is evaluated to UL 2202. UL category FFWA will cover a majority of the new installations being installed at dwelling and retail type occupancies. Electric vehicle supply equipment typically covered by this category will include level 1 and level 2 charging systems.



UL category FFTG will cover the installation of level 3 charging systems, or what industry is calling DC Fast Chargers. It is expected that level 3 charging systems will be installed along major highways that connect metropolitan areas together.

UL Listed Electric Vehicle Supply Equipment (FFWA) provides AC power to an on-board charger that powers an electric vehicle. This type of equipment is identified by one of the following product identities:

- **Electric vehicle cord set or EV cord set** — These devices are typically 120 V up to 16 amperes, and they come in two configurations:
 - A portable cord set is intended for indoor or outdoor use, is carried from charging location to another, and is transported in the vehicle when not being used.
 - A stationary cord set is intended for indoor or outdoor use and is intended for installation in a dedicated location used for vehicle charging. A stationary cord set can be routinely moved after installation and it may have provisions for removal from its installation without using a tool.

- **Electric vehicle power outlet or EV power outlet** — These are essentially the same as EV charging stations except that they terminate in a normal NEMA-type receptacle and are intended to be used with an EV power cord set that is then plugged into an EV receptacle inlet.
- **Electric vehicle charging station or EV charging station** — These are products that are typically permanently connected.

Ultimately, there are two things to keep in mind when inspecting the installation of electric vehicle charging systems covered by NEC Article 625:

1. The NEC requires this type of equipment to be listed.
2. UL Listed electric vehicle supply equipment (category FFWA) and UL Listed electric vehicle charging system

UL Product Categories correlated to NEC Article 625

2008 NEC Section	UL Category Code	UL Product Category
625.5	FFTG	Electric vehicle charging system equipment <i>(Supplies DC power to the vehicle)</i>
625.9		
625.13		
625.16		
625.18		
625.19		
625.22		
625.25		
625.29(C)		
625.29(D)		
625.5	FFWA	Electric vehicle supply equipment <i>(Supplies AC power to the vehicle)</i>
625.9		
625.13		
625.16		
625.18		
625.19		
625.22		
625.25		
625.29(C)		

equipment (category FFTG) when installed in accordance with the manufacturers installation instructions will be in compliance with all safety requirements of NEC Article 625.

For more information on either UL category FFWA or FFTG, please go to the **Online Certifications Directory**, enter the UL category code in the applicable box and search. This will provide a list of all current manufacturers of equipment covered by that specific UL category. To locate information on which models are UL Listed, click on the “link to file” located to the right of each manufacturers name. Finally, once at the link to file page, you can access the applicable UL Guide information by clicking on the **See General Information for Electric Vehicle Supply Equipment** link above a manufacturers name and address.

For more information on UL Listed electric vehicle supply equipment, please contact Jeff Fecteau at +1.952.838.5453 or Jeffrey.Fecteau@us.ul.com.