IX. Grounding

620.81 Metal Raceways Attached to Cars

Metal raceways, Type MC cable, Type MI cable, or Type AC cable attached to elevator cars shall be bonded to metal parts of the car that are bonded to the equipment grounding conductor.

620.82 Electric Elevators

For electric elevators, the frames of all motors, elevator machines, controllers, and the metal enclosures for all electrical equipment in or on the car or in the hoistway shall be bonded in accordance with Article 250, Parts V and VII.

620.83 Nonelectric Elevators

For elevators other than electric having any electrical conductors attached to the car, the metal frame of the car, where normally accessible to persons, shall be bonded in accordance with Article 250, Parts V and VII.

620.84 Escalators, Moving Walks, Platform Lifts, and Stairway Chairlifts

Escalators, moving walks, platform lifts, and stairway chairlifts shall comply with Article 250.

620.85 Ground-Fault Circuit-Interrupter Protection for Personnel

Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on elevator car tops, and in escalator and moving walk wellways shall be of the ground-fault circuit-interrupter type.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms and machinery spaces shall have ground-fault circuit-interrupter protection for personnel.

A single receptacle supplying a permanently installed sump pump shall not require ground-fault circuit-interrupter protection.

The GFCI requirements of 620.85 are intended to reduce the shock hazard to maintenance personnel who service elevator equipment using portable hand tools and temporary lighting.

The first paragraph of 620.85 requires a GFCI-type receptacle for each 15- and 20-ampere receptacle installed in pits, on elevator car tops, and in escalator and moving-walk wellways. This requirement is based on the premise that the reset pushbutton for a tripped GFCI receptacle should be within easy reach of an elevator mechanic working in confined spaces.

The second paragraph of 620.85 requires that all 15- and 20-ampere receptacles installed in machine rooms and machinery spaces have GFCI protection for personnel. This protection can be afforded by either a GFCI-type circuit breaker or a GFCI-type receptacle because machine spaces usually do not cause access hazards for service personnel.

X. Emergency and Standby Power Systems

620.91 Emergency and Standby Power Systems

An elevator(s) shall be permitted to be powered by an emergency or standby power system.

FPN: See ASME A17.1-2004, *Safety Code for Elevators and Escalators*, and CSA B44-04, *Elevator and Escalator Electrical Equipment Certification Standard 2.27.2*, for additional information.

(A) Regenerative Power. For elevator systems that regenerate power back into the power source that is unable to absorb the regenerative power under overhauling elevator load conditions, a means shall be provided to absorb this power.

(B) Other Building Loads. Other building loads, such as power and lighting, shall be permitted as the energy absorption means required in 620.91(A), provided that such loads are automatically connected to the emergency or standby power system operating the elevators and are large enough to absorb the elevator regenerative power.

(C) Disconnecting Means. The disconnecting means required by 620.51 shall disconnect the elevator from both the emergency or standby power system and the normal power system.

Where an additional power source is connected to the load side of the disconnecting means, the disconnecting means required in 620.51 shall be provided with an auxiliary contact that is positively opened mechanically, and the opening shall not be solely dependent on springs. This contact shall cause the additional power source to be disconnected from its load when the disconnecting means is in the open position.

ARTICLE 625
Electric Vehicle Charging System

Summary of Changes

- **625.2, Electric Vehicle:** Revised definition to correlate with restrictions against the use of neighborhood electric vehicles (NEVs) on highways.
- **625.23:** Added requirement on the type of locking provision to be provided as part of the installed equipment.

Contents

I. General

A variety of street- and highway-worthy electric and combination electric/fossil fuel vehicles are becoming available to consumers. New and proposed legislation in several regions around the United States calls for increasing deployment of electric vehicles as a way to reduce air pollution. Other states have adopted similar requirements. In addition, the Clean Air Act Amendments of 1990 and the National Energy Policy Act of 1992 regulate public and private purchases of clean-fuel vehicles and alternatively fueled vehicles, respectively. Electric vehicles fulfill both of those requirements. It is apparent that electric vehicle charging will be occurring in all occupancies, including residential, commercial, retail, and public sites.

Article 625 sets forth installation safety requirements for typical hard-wired conductive connections of battery charging equipment, as well as the safety concerns of the new "smart" inductive coupling connections of battery charging equipment. In particular, this article covers the wiring methods, equipment construction, control and protection, and equipment locations for automotive-type vehicle charging equipment. Throughout Article 625, the intent is to prevent the users of electrical equipment associated with the vehicle charging system from being exposed to energized live parts and to provide for a safe vehicle charging environment.

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.*

The scope of Article 625 is intended to cover all electrical wiring and equipment installed between the service point and the skin of the automotive-type electric vehicle. Automotive-type electric vehicles are emphasized because they are much different from other electric vehicles commonly used today. Most existing electric vehicles are off-road types, such as industrial forklifts, hoists, lifts, transports, golf carts, and airport personnel trams. The charging requirements and other exterior electrical connections are usually serviced and maintained by trained mechanics or technicians. The *NEC* has adequate provisions to allow the authority having jurisdiction to make interpretations that provide the safety levels needed for these installations.

Article 625 specifically excludes off-road vehicles, to avoid conflict with existing articles. Motorcycles are not covered by Article 625 because motorcycles typically have smaller propulsion systems that operate at lower voltages, 12 to 24 volts dc versus 100 to 350 volts dc for electric automotive vehicles. Typically, motorcycles are charged from standard 120-volt, 15-ampere receptacles due to lower

battery capacity. GFCI protection is not mandatory for charging electric motorcycles. However, 210.8(A)(2) and (A)(3) require GFCI protection of receptacles in the locations where an electric motorcycle would typically be charged.

625.2 Definitions

Several of the definitions in 625.2 correlate with industry standards such as those from the Society of Automotive Engineers, SAE J1772, *SAE Electric Vehicle Conductive Charge Coupler*, and SAE J1773, *SAE Electric Vehicle Inductively Coupled Charging*; and from Underwriters Laboratories, UL 2231-1, *Standard for Personnel Protection Systems for Electric Vehicle Supply Circuits: General Requirements*, and UL 2231-2, *Standard for Personnel Protection Systems for Electric Vehicle Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems*.

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. 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.

The primary difference between electric vehicles as defined in Article 625 and electric vehicles covered by other sections in the *NEC* is in their road and highway worthiness. The automotive electric vehicles under consideration are comparable in performance and function to the conventional automobiles and light trucks in use today. The automotive electric vehicles under development must be capable of complying with the Federal Motor Vehicle Safety Standards and other Department of Transportation, National Highway Traffic Safety Administration, and U.S. Environmental Protection Agency requirements.

The definition of *electric vehicle* was revised for the 2005 *Code* to include neighborhood electric vehicles, which are low-speed, limited-use electric vehicles similar to golf carts but provided with automotive-grade headlights, seat belts, windshields, brakes, and other safety equipment. Neighborhood electric vehicles are increasing in popularity as low-cost, energy-efficient, zero-polluting alternatives to traditional automobiles. Under National Highway Traffic Safety Administration guidelines, the intended use for these vehicles is shopping and recreation in inner-city areas and planned and retirement communities where the street speed limit is 35 mph or less. Electric vehicles such as lift trucks and golf carts are not covered by Article 625.

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.

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.

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.

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.

Electric vehicle supply equipment, as illustrated in Exhibit 625.1, comprises the components between the skin of the electric vehicle and the premises wiring, including any flexible cable, disconnecting means, enclosures, power outlet, and electric vehicle connector. The definition of *electric vehicle* includes all off-vehicle charging equipment and does not include charging equipment installed on the vehicle.

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

625.3 Other Articles

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

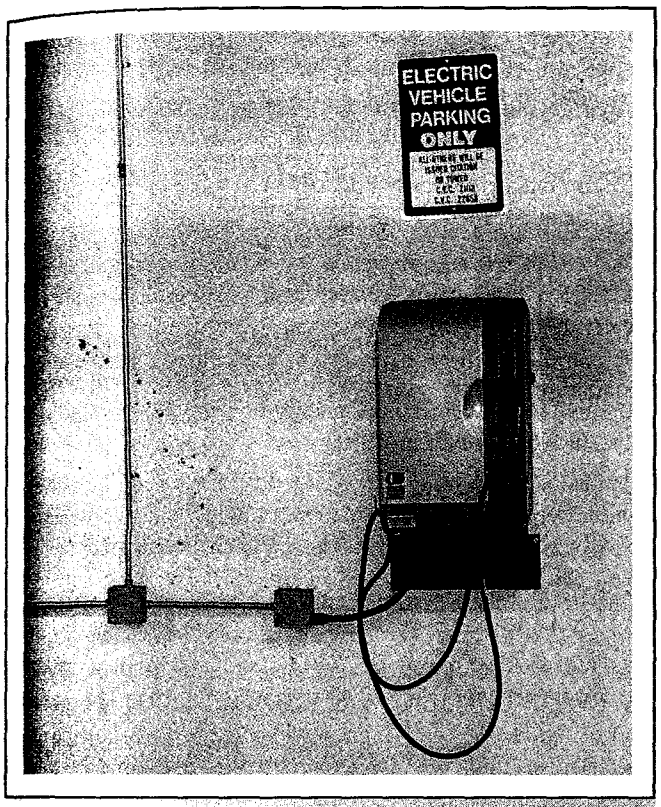


Exhibit 625.1 Parking space equipped with electric vehicle supply equipment. (Courtesy of the International Association of Electrical Inspectors)

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.

625.5 Listed or Labeled

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

II. Wiring Methods

625.9 Electric Vehicle Coupler

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

The electric vehicle connector is the device that inserts into the electric vehicle inlet (charge port) of the vehicle. The electric vehicle inlet is not a premises wiring receptacle or an attachment cap. An electric vehicle coupler is the mating set of the electric vehicle connector and electric vehicle inlet. The coupler is required to be noninterchangeable, to prevent equipment damage or personal injury, and is not permitted to be a standard NEMA-configuration wiring device.

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

(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.

(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.

The requirements for coupler construction in 625.9(C) provide a safe interface component for persons connecting the vehicle to or disconnecting the vehicle from the charging system. This type of activity generally is performed daily by persons who typically do not have any knowledge of the equipment operation and its associated hazards.

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

(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.

Some manufacturers produce 125-volt, single-phase, 15- or 20-ampere portable charging units for convenience charging. These charging units may be stored in the vehicle. However,

625.13 makes it clear that nonportable equipment must be mounted and permanently wired. This equipment may be physically attached to the wall, floor, or ceiling. The provision for no exposed live parts is a safety concern for the general public.

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.

Considering both near-term and long-term requirements for electric vehicle (EV) charging, three methods have been identified for recommended development. Referred to as Level 1, Level 2, and Level 3 EV charging, they cover the range of power levels anticipated for charging EVs.

Level 1. This method, which allows broad access to charge an EV, permits plugging into a common, grounded 120-volt electrical receptacle (NEMA 5-15R or 5-20R). The maximum load on this receptacle is 12 amperes or 1.4 kVA. The minimum circuit and overcurrent rating for this connection is 15 amperes for a 15-ampere receptacle and 20 amperes for a 20-ampere receptacle.

Level 2. This is the primary and preferred method of EV charging at both private and public facilities. It requires special equipment and connection to an electric power supply dedicated to EV charging. The voltage of this connection is either 240 volts or 208 volts. The maximum load is 32 amperes (7.7 kVA at 240 volts or 6.7 kVA at 208 volts). The minimum circuit and overcurrent rating for this connection is 40 amperes (32 × 1.25 = 40 amperes). Electric vehicles are treated as continuous loads. See 625.21 for sizing overcurrent protection devices.

Level 3. The EV equivalent of a commercial gasoline dispensing station, this high-speed, high-power method charges an EV in about the same time it takes to refuel a conventional vehicle. Because of individual supply requirements and available source voltages, exact voltage and load specifications for Level 3 charging have not been defined as in Level 1 and Level 2. These power requirements are specified by the equipment manufacturer.

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

(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.

(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.

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. 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.

The 25-ft cable length is established by adding the 15-ft car length to the 7-ft car width, plus 3 ft to the power outlet securement point. This requirement limits excessive cable lengths, which may be exposed to damage. To use a single electric vehicle charging system for multiple electric vehicles, the *Code* permits cable lengths in excess of 25 ft where provided with a listed cable management system. For commercial parking areas, this change allows flexibility in site planning and meeting any legislated requirements that may be in place on the number of charging spaces that must be provided.

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.

To reduce shock hazard, a pilot or communications interlock establishes power through the electric vehicle supply equipment. Loss of the pilot or communications circuit locks out power, isolating possible hazardous situations in the electric vehicle supply equipment. See 625.29(D) for mechanical ventilation interlock requirements.

For ventilation interlock, see 625.29(D)(3) for 125-volt receptacles intended to charge electric vehicles.

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

The personnel protection system may consist of one or more components that provide protection against electric shock for different portions of the electric vehicle supply equipment circuitry, which may be operating at frequencies other than 50/60 Hz, at direct-current potentials, and/or voltages above 150 volts to ground.

Standard GFCI devices do not provide the range of protection needed for the various types of charging systems being developed. Devices or methods that may be used include basic insulation, double insulation, grounding monitors, insulation monitors with interrupters, and leakage current monitors. Many combinations and variations of these devices can be used to provide the personnel protection required. For systems operating above 150 volts to ground, the protective system may include monitoring systems to ensure that proper grounding is provided and maintained during charging.

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. 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.

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.

The on-board power production system of some electric vehicles is capable of operating as a stand-alone or interactive power supply for premises wiring systems. Such systems are required to be listed for this type of use, and 625.26 requires compliance with the provisions of Article 702 or Article 705, depending on how the system connects to premises wiring system and/or the primary source of electricity.

V. Electric Vehicle Supply Equipment Locations

625.28 Hazardous (Classified) Locations

Where electric vehicle supply equipment or wiring is installed in a hazardous (classified) location, the requirements of Articles 500 through 516 shall apply.

The installation of EV charging equipment is permitted in hazardous locations where the installation is made in accordance with the requirements of Chapter 5. The increased use of electric vehicles makes this provision necessary to cover installations at commercial repair garages and combination gasoline/EV charging stations (see 511.10).

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.

(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.

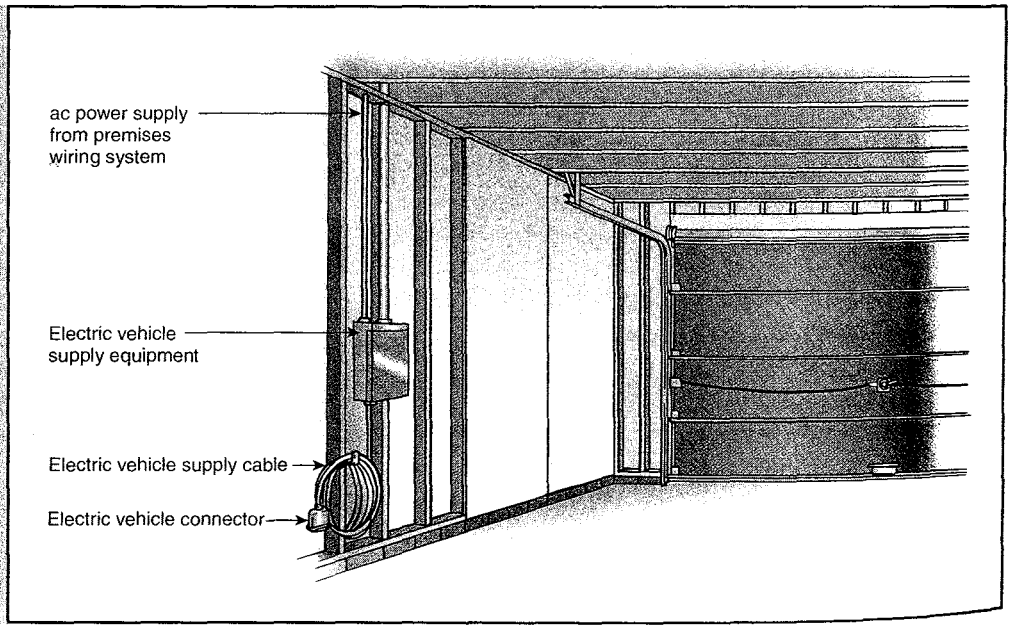
(C) Ventilation Not Required. Where electric vehicle nonvented storage batteries are used or where the electric vehicle supply equipment is listed or labeled as suitable for charging electric vehicles indoors without ventilation and marked in accordance with 625.15(B), mechanical ventilation shall not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

Major auto manufacturers are taking the necessary steps to make electric vehicle systems safe. Most batteries used in electric vehicles manufactured by major automakers do not emit hydrogen gas in quantities that could cause an explosion. Preventive measures such as mechanical or passive ventilation are not required, because the electric vehicle batteries and charging systems are designed to prevent or limit the emission of hydrogen during charging. The Society of Automotive Engineers recommended practice SAE J-1718, *Measurement of Hydrogen Gas Emission from Battery-Powered Passenger Cars and Light Trucks During Battery Charging*, can be used to assess suitability for indoor charging. This standard includes provisions for tests during normal charging operations and potential equipment failure modes.

See Exhibit 625.2 for an illustration of a garage without ventilation. In this application, when the electric vehicle is connected to the charging equipment, a signal is received at the electric vehicle charging equipment. The signal indicates that the electric vehicle either is equipped with a nonvented storage battery or is listed or labeled as suitable to be charged indoors. Failure to receive a verification signal from the vehicle prevents initiation of the charging operation. The electric vehicle supply equipment is required to be marked in accordance with 625.15(B).

(D) Ventilation Required. Where the electric vehicle supply equipment is listed or labeled as suitable for charging electric vehicles that require ventilation for indoor charging.

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



and is marked in accordance with 625.15(C), mechanical ventilation, such as a fan, shall be provided. The ventilation shall include both supply and exhaust equipment and shall be permanently installed and located to intake from, and vent directly to, the outdoors. Positive pressure ventilation systems shall be permitted only in buildings or areas that have been specifically designed and approved for that application. Mechanical ventilation requirements shall be determined by one of the methods specified in 625.29(D)(1) through (D)(4).

The interlock described in 625.29(D) prevents a vehicle requiring ventilation from being charged unless ventilation is provided. This interlock feature is included in the pilot connection of the standard electric vehicle supply equipment connection. See Exhibit 625.3 for an illustration of electric vehicle supply equipment with interlocked ventilation.

(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.

(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 $_{\text{single phase}}$ in cubic meters per minute (m^3/min) =

$$\frac{(\text{volts})(\text{amperes})}{1718}$$

Ventilation $_{\text{single phase}}$ in cubic feet per minute (cfm) =

$$\frac{(\text{volts})(\text{amperes})}{48.7}$$

(2) Three phase: Ventilation $_{\text{three phase}}$ in cubic meters per minute (m^3/min) =

$$\frac{1.732(\text{volts})(\text{amperes})}{1718}$$

Ventilation$_{\text{three phase}}$ in cubic feet per minute (cfm) =

$$\frac{1.732(\text{volts})(\text{amperes})}{48.7}$$

(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.

(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. 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.

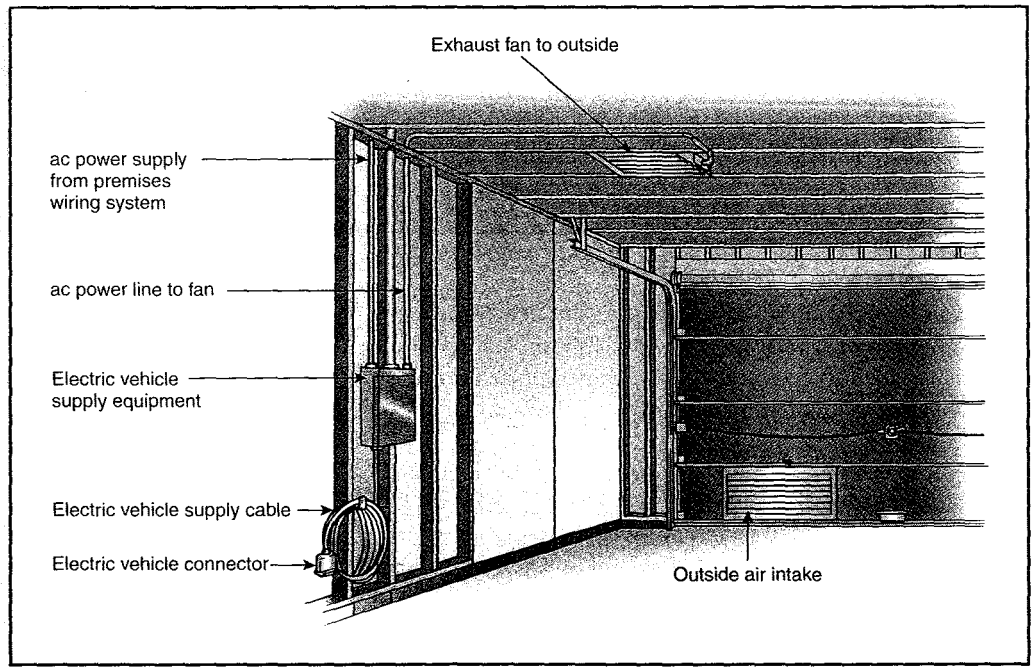


Exhibit 625.3 Garage interior with electric vehicle supply equipment and interlocked ventilation.

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 Voltage						
	Single Phase			3 Phase			
Branch-Circuit Ampere Rating	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 Voltage						
	Single Phase			3 Phase			
Branch-Circuit Ampere Rating	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

The intent of 625.29(D) is to ensure sufficient diffusion and dilution of hydrogen gas from gas-emitting batteries to prevent a hazardous condition. Certain batteries used in some electric vehicles emit hydrogen gas during the charging process.

Hydrogen is a colorless, odorless, tasteless, nontoxic flammable gas. At atmospheric pressure, the flammable range for hydrogen is 4 to 75 percent by volume in air.

NFPA 69, *Standard on Explosion Prevention Systems*, establishes requirements to ensure safety with flammable mixtures. The provisions of Section 6.3, Design and Operating Requirements, of NFPA 69-2002 specify that combustible gas concentrations be restricted to 25 percent of the lower flammable limit. This design criterion provides a safety margin for personnel working with atmospheres containing hydrogen. Safety is accomplished by keeping the concentration of hydrogen below 25 percent of the lower flammability limit, or 1 percent (25 percent × 4 percent = 1 percent) hydrogen by volume in air, that is, below 10,000 ppm hydrogen.

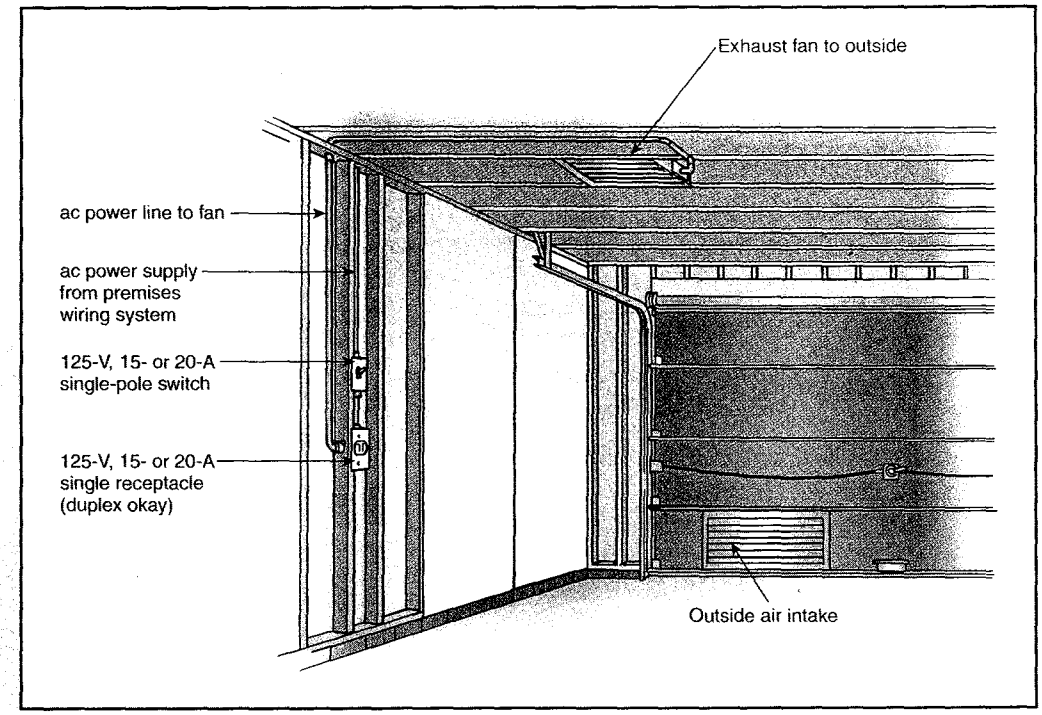


Exhibit 625.4 An example of ventilation equipment electrically interlocked with the electric vehicle charging equipment receptacle.

A ventilation system for a typical residential-type garage includes both supply and mechanical exhaust equipment and is permanently installed. The equipment is located in the space such that it takes in air from outdoors to the space, circulates the air through the space, and exhausts the air directly to the outdoors. Typically, the equipment includes a passive vent for intake on one side of the enclosed space and an exhaust fan vented to the outside on the other side of the space.

In enclosed commercial garages and other structures, additional ventilation is not required if the exhaust, as required by the building code for carbon monoxide or other purposes, is greater than the quantity listed in the table. Other engineered electric vehicle ventilation systems are allowed, provided they are designed properly. The electric vehicle charging area is permitted to be ventilated by the building ventilation system. The ventilation system and the charging system must be interlocked to prevent charging if the ventilation is not operating, as shown in Exhibit 625.4. This charging arrangement can be used with electric vehicles equipped with a self-contained charging system in which activation of the charging system does not depend on a signal from the electric vehicle. A manually operated switch controls the receptacle used to supply the vehicle charging system, and it is also interlocked with the power supply to the ventilation fan. This arrangement ensures that the ventilation fan is operating whenever the vehicle charging receptacle is energized. A qualified person must perform the calculation of the ventilation requirements.

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.

Where the charging operation is conducted in outdoor or open locations, the off-gassing of hydrogen resulting from battery charging does not pose the same risk of creating an ignitible environment compared to indoor locations. The lighter-than-air hydrogen readily diffuses into the atmosphere. In addition to driveways and parking lots, structures with adequate natural ventilation, such as carports and open parking structures, do not require mechanical ventilation. NFPA 88A, *Standard for Parking Structures*, provides a quantifiable definition of the term *open parking structure*.

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

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

ARTICLE 626
Electrified Truck Parking Spaces

Summary of Change

- **Article 626, Electrified Truck Parking Spaces:** Added article to provide requirements for electrical installations to connect trucks or transport refrigerated units to a supply of electricity within an electrified truck parking space.

Contents

I. General

626.1 Scope

The provisions of this article cover the electrical conductors and equipment external to the truck or transport refrigerated unit that connect trucks or transport refrigerated units to a supply of electricity, and the installation of equipment and devices related to electrical installations within an electrified truck parking space.

As more stringent federal and state mandates to reduce diesel engine emissions are enacted into law, there is a call for electric power to allow for operation of transport truck heating and refrigeration equipment while the truck is parked. Because much of the transport industry is interstate commerce, this new article provides for standardization of truck parking space equipment so that driver interface with electrical connection devices can be safely accomplished from coast to coast.

626.2 Definitions

Cable Management System. An apparatus designed to control and organize unused lengths of cable or cord at electrified truck parking spaces.

Cord Connector. A device that, by inserting it into a truck flanged surface inlet, establishes an electrical connection to the truck for the purpose of providing power for the on-board electric loads and may provide a means for information exchange. This device is part of the truck coupler.

Disconnecting Means, Parking Space. The necessary equipment usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors in an electrified truck parking space and intended to constitute the means of cutoff for the supply to that truck.

Electrified Truck Parking Space. A truck parking space that has been provided with an electrical system that allows truck operators to connect their vehicles while stopped and to use off-board power sources in order to operate on-board systems such as air conditioning, heating, and appliances, without any engine idling.

FPN: An electrified truck parking space also includes dedicated parking areas for heavy-duty trucks at travel plazas, warehouses, shipper and consignee yards, depot facilities, and border crossings. It does not include areas such as the shoulders of highway ramps and access roads, camping and recreational vehicle sites, residential and commercial parking areas used for automotive parking or other areas where ac power is provided solely for the purpose of connecting automotive and other light electrical loads, such as engine block heaters, and at private residences.

Electrified Truck Parking Space Wiring Systems. All of the electrical wiring, equipment, and appurtenances related to electrical installations within an electrified truck parking space, including the electrified parking space supply equipment.

Overhead Gantry. A structure consisting of horizontal framework, supported by vertical columns spanning above electrified truck parking spaces, that supports equipment, appliances, raceway, and other necessary components for the purpose of supplying electrical, HVAC, internet, communications, and other services to the spaces.

Separable Power Supply Cable Assembly. A flexible cord or cable, including ungrounded, grounded, and equipment grounding conductors, provided with a cord connector, an attachment plug, and all other fittings, grommets, or devices installed for the purpose of delivering energy from the source of electrical supply to the truck or TRU flanged surface inlet.

Transport Refrigerated Unit (TRU). A trailer or container, with integrated cooling or heating, or both, used for the purpose of maintaining the desired environment of temperature-sensitive goods or products.

Truck. A motor vehicle designed for the transportation of goods, services, and equipment.

Truck Coupler. A truck flanged surface inlet and mating cord connector.

Truck Flanged Surface Inlet. The device(s) on the truck into which the connector(s) is inserted to provide electric energy and other services. This device is part of the truck coupler. For the purposes of this article, the truck flanged surface inlet is considered to be part of the truck and not part of the electrified truck parking space supply equipment.

626.3 Other Articles

Wherever the requirements of other articles of this *Code* and Article 626 differ, the requirements of Article 626 shall apply. Unless electrified truck parking space wiring systems are supported or arranged in such a manner that they cannot be used in or above locations classified in 511.3 or 514.3, or both, they shall comply with 626.3(A) and (B) in addition to the requirements of this article.

(A) Vehicle Repair and Storage Facilities. Electrified truck parking space electrical wiring systems located at facilities for the repair or storage of self-propelled vehicles that use volatile flammable liquids or flammable gases for fuel or power shall comply with Article 511.

(B) Motor Fuel Dispensing Stations. Electrified truck parking space electrical wiring systems located at or serving motor fuel dispensing stations shall comply with Article 514.

FPN: For additional information, see NFPA 88A-2007, *Standard for Parking Structures* and NFPA 30A-2008, *Code for Fuel Dispensing Facilities and Repair Garages.*

626.4 General Requirements

(A) Not Covered. The provisions of this article shall not apply to that portion of other equipment in residential, commercial, or industrial facilities that require electric power for devices used to load and unload cargo and equipment, operate conveyors and for other devices used on the site or truck.

(B) Distribution System Voltages. Unless other voltages are specified, the nominal ac system voltages of 120, 120/240, 208Y/120, 240, or 480Y/277 shall be used to supply equipment covered by this article.

(C) Connection to Wiring System. The provisions of this article shall apply to the electrified truck parking space supply equipment intended for connection to a wiring system as defined in 626.4(B).

II. Electrified Truck Parking Space Electrical Wiring Systems

626.10 Branch Circuits

Electrified truck parking space single-phase branch circuits shall be derived from a 208Y/120-volt, 3-phase, 4-wire system or a 120/240-volt, single-phase, 3-wire system.

Exception: A 120-volt distribution system shall be permitted to supply existing electrified truck parking spaces.

626.11 Feeder and Service Load Calculations

(A) Parking Space Load. The calculated load of a feeder or service shall be not less than the sum of the loads on the branch circuits. Electrical service and feeders shall be calculated on the basis of not less than 11 kVA per electrified truck parking space.

(B) Demand Factors. Electrified truck parking space electrical wiring system demand factors shall be based upon the climatic temperature zone in which the equipment is installed. The demand factors set forth in Table 626.11(B) shall be the minimum allowable demand factors that shall be permitted for calculating load for service and feeders. No demand factor shall be allowed for any other load, except as provided in this article.

Table 626.11(B) Demand Factors for Services and Feeders

Climatic Temperature Zone (USDA Hardiness Zone) See Note	Demand Factor (%)
1	70%
2a	67%
2b	62%
3a	59%
3b	57%
4a	55%
4b	51%
5a	47%
5b	43%
6a	39%
6b	34%
7a	29%
7b	24%
8a	21%
8b	20%
9a	20%
9b	20%
10a	21%
10b	23%
11	24%

Note: The climatic temperature zones shown in Table 626.11(B) correlate with those found on the "USDA Plant Hardiness Zone Map," and the climatic temperature zone selected for use with the table shall be determined through the use of this map based on the installation location.

FPN: The U.S. Department of Agriculture (USDA) has developed a commonly used "Plant Hardiness Zone" map that is publicly available. The map provides guidance for determining the Climatic Temperature Zone. Data indicate that the HVAC has the highest power requirement in cold climates, with the heating demand representing the greatest load, which in turn is dependent on outside temperature. In very warm climates, where no heating load is necessary, the cooling load increases as the outdoor temperature rises.

(C) Two or More Electrified Truck Parking Spaces. Where the electrified truck parking space wiring system is in a location that serves two or more electrified truck parking spaces, the equipment for each space shall comply with 626.11(A) and the calculated load shall be computed on the basis of each parking space.

(D) Conductor Rating. Truck space branch-circuit conductors shall have an ampacity not less than the loads supplied.

III. Electrified Truck Parking Space Supply Equipment

626.22 Wiring Methods and Materials

(A) Electrified Truck Parking Space Supply Equipment Type. The electrified truck parking space supply equipment shall be provided in one of the following forms:

(1) Pedestal
(2) Overhead gantry
(3) Raised concrete pad

(B) Mounting Height. Post, pedestal, and raised concrete pad types of electrified truck parking space supply equipment shall be not less than 600 mm (2 ft) aboveground or above the point identified as the prevailing highest water level mark or an equivalent benchmark based on seasonal or storm-driven flooding from the authority having jurisdiction.

(C) Access and Working Space. All electrified truck parking space supply equipment shall be accessible by an unobstructed entrance or passageway not less than 600 mm (2 ft) wide and not more than 2.0 m (6 ft 6 in.) high.

(D) Disconnecting Means. A disconnecting switch or circuit breaker shall be provided to disconnect one or more electrified truck parking space supply equipment sites from a remote location. The disconnecting means shall be provided and installed in a readily accessible location and shall be capable of being locked in the open position. Portable means for adding a lock to the switch or circuit breaker shall not be permitted as the means required to be installed at and remain with the equipment.

626.23 Overhead Gantry or Cable Management System

(A) Cable Management. Electrified truck parking space equipment provided from either overhead gantry or cable management systems shall utilize a permanently attached power supply cable in electrified truck parking space supply equipment. Other cable types and assemblies listed as being suitable for the purpose, including optional hybrid communications, signal, and optical fiber cables, shall be permitted.

(B) Strain Relief. Means to prevent strain from being transmitted to the wiring terminals shall be provided. Permanently attached power supply cable(s) shall be provided with a means to de-energize the cable conductors and power service delivery device upon exposure to strain that could result in either cable damage or separation from the power service delivery device and exposure of live parts.

626.24 Electrified Truck Parking Space Supply Equipment Connection Means

(A) General. Each truck shall be supplied from electrified truck parking space supply equipment through suitable extra-hard service cables or cords. Each connection to the equipment shall be by a single separable power supply cable assembly.

(B) Receptacle. All receptacles shall be listed and of the grounding type. Every truck parking space with electrical supply shall be equipped with (B)(1) and (B)(2).

(1) Two single receptacles, each 2-pole, 3-wire grounding type, rated 20 amperes, 125 volts, and connected to an individual branch circuit.

FPN: For the nonlocking-type and grounding-type 20-ampere receptacle configuration, see ANSI/NEMA WD6-2002, *Standard for Dimensions of Attachment Plugs and Receptacles*, Figure 5-20.

(2) One single receptacle, 3-pole, 4-wire grounding-type, single-phase rated either 30 amperes 208Y/120 volts or 125/250 volts. The 125/250-volt receptacle shall be permitted to be used on a 208Y/120-volt, single-phase circuit.

FPN: For various configurations of 30-ampere pin and sleeve receptacles, see ANSI/UL1686, *Standard for Pin and Sleeve Configurations*, Figure C2.9 or Part C3.

Exception: Where electrified truck parking space supply equipment provides the air-conditioning and comfort cooling function without requiring a direct electrical connection at the truck, only the two receptacles identified in 626.24(B)(1) shall be required.

(C) Disconnecting Means, Parking Space. The electrified truck parking space supply equipment shall be provided with a switch or circuit breaker for disconnecting the power supply to the electrified truck parking space. A disconnecting means shall be provided and installed in a readily accessible location and shall be capable of being locked in the open position. Portable means for adding a lock to the switch or circuit breaker shall not be permitted as the means required to be installed at and remain with the equipment.

(D) Ground-Fault Circuit-Interrupter Protection for Personnel. The electrified truck parking space equipment shall be designed and constructed such that all receptacle outlets in 626.24 are provided with ground-fault circuit-interrupter protection for personnel.

626.25 Separable Power-Supply Cable Assembly

A separable power-supply cable assembly, consisting of a power-supply cord, a cord connector, and an attachment plug intended for connection with a truck flanged surface inlet, shall be of a listed type. The power-supply cable assembly or assemblies shall be identified and be one of the types and ratings specified in 626.25(A) and (B). Cords with adapters and pigtail ends, extension cords, and similar items shall not be used.

(A) Rating(s).

(1) Twenty-Ampere Power-Supply Cable Assembly. Equipment with a 20-ampere, 125-volt receptacle, in accordance with 626.24(B)(1), shall use a listed 20-ampere power-supply cable assembly.

Exception: It shall be permitted to use a listed separable power-supply cable assembly, either hard service or extra-hard service and rated 15 amperes, 125 volts for connection to an engine block heater for existing vehicles.

(2) Thirty-Ampere Power-Supply Cable Assembly. Equipment with a 30-ampere, 208Y/120-volt or 125/250-volt receptacle, in accordance with 626.24(B)(2), shall use a listed 30-ampere main power-supply cable assembly.

(B) Power-Supply Cord.

(1) Conductors. The cord shall be a listed type with three or four conductors, for single-phase connection, one conductor of which shall be identified in accordance with 400.23.

Exception: It shall be permitted to use a separate listed three-conductor separable power-supply cable assembly, one conductor of which shall be identified in accordance with 400.23 and rated 15 amperes, 125 volts for connection to an engine block heater for existing vehicles.

(2) Cord. Extra-hard usage flexible cords and cables rated not less than 90°C (194°F), 600 volts; listed for both wet locations and sunlight resistance; and having an outer jacket rated to be resistant to temperature extremes, oil, gasoline, ozone, abrasion, acids, and chemicals shall be permitted where flexibility is necessary between the electrified truck parking space supply equipment, the panel board and flanged surface inlet(s) on the truck.

Exception: Cords for the separable power supply cable assembly for 15- and 20-ampere connections shall be permitted to be a hard service type.

(3) Cord Overall Length. The exposed cord length shall be measured from the face of the attachment plug to the point of entrance to the truck or the face of the flanged surface inlet or to the point where the cord enters the truck. 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.

(4) Attachment Plug. The attachment plug(s) shall be listed, by itself or as part of a cord set, for the purpose and

shall be molded to or installed on the flexible cord so that it is secured tightly to the cord at the point where the cord enters the attachment plug. If a right-angle cap is used, the configuration shall be oriented so that the grounding member is farthest from the cord. Where a flexible cord is provided, the attachment plug shall comply with 250.138(A).

(a) Connection to a 20-Ampere Receptacle. A separable power-supply cable assembly for connection to a truck flanged surface inlet, rated at 20 amperes, shall have a nonlocking-type attachment plug that shall be 2-pole, 3-wire grounding type rated 20 amperes, 125 volts and intended for use with the 20-ampere, 125-volt receptacle.

Exception: A separable power-supply cable assembly, rated 15 amperes, provided for the connection of an engine block heater, only, shall have an attachment plug that shall be 2-pole, 3-wire grounding type rated 15 amperes, 125 volts.

FPN: For nonlocking- and grounding-type 15- or 20-ampere plug and receptacle configurations, see ANSI/NEMA WD6-2002, *Standard for Dimensions of Attachment Plugs and Receptacles*, Figure 5-15 or 5-20.

(b) Connection to a 30-Ampere Receptacle. A separable power-supply cable assembly for connection to a truck flanged surface inlet, rated at 30 amperes, shall have an attachment plug that shall be 3-pole, 4-wire grounding type rated 30-amperes, 208Y/120 volts or 125/250 volts, and intended for use with the receptacle in accordance with 626.24(B)(2). The 125/250-volt attachment plug shall be permitted to be used on a 208Y/120-volt, single-phase circuit.

FPN: For various configurations of 30-ampere pin and sleeve plugs, see ANSI/UL1686, *Standard for Pin and Sleeve Configurations*, Figure C2.10 or Part C3.

(5) Cord Connector. The cord connector for a separable power-supply cable assembly, as specified in 626.25(A)(1), shall be a 2-pole, 3-wire grounding type rated 20 amperes, 125 volts. The cord connector for a separable power-supply cable assembly, as specified in 626.25(A)(2), shall be a 3-pole, 4-wire grounding type rated 30 amperes, 208Y/120 volts or 125/250 volts. The 125/250-volt cord connector shall be permitted to be used on a 208Y/120-volt, single-phase circuit.

Exception: The cord connector for a separable power supply cable assembly, rated 15 amperes, provided for the connection of an engine block heater for existing vehicles, shall have an attachment plug that shall be 2-pole, 3-wire grounding type rated 15 amperes, 125 volts.

FPN: For various configurations of 30-ampere cord connectors, see ANSI/UL1686 *Standard for Pin and Sleeve Configurations*, Figure C2.9 or Part C3.

626.26 Loss of Primary Power

Means shall be provided such that, upon loss of voltage from the utility or other electric supply system(s), energy cannot be back-fed through the truck and the truck supply equipment to the electrified truck parking space wiring system unless permitted by 626.27.

626.27 Interactive Systems

Electrified truck parking space 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.

IV. Transport Refrigerated Units (TRUs)

626.30 Transport Refrigerated Units

Electrified truck parking spaces intended to supply transport refrigerated units (TRUs) shall include an individual branch circuit and receptacle for operation of the refrigeration/heating units. The receptacle associated with the TRUs shall be provided in addition to the receptacles required in 626.24(B).

(A) Branch Circuits. TRU spaces shall be supplied from 208-volt, 3-phase or 480-volt, 3-phase branch circuits and with an equipment grounding conductor in accordance with 250.118.

(B) Electrified Truck Parking Space Supply Equipment. The electrified truck parking space supply equipment, or portion thereof, providing electric power for the operation of TRUs shall be independent of the loads in Part III of Article 626.

626.31 Disconnecting Means and Receptacles

(A) Disconnecting Means. Disconnecting means shall be provided to isolate each refrigerated unit from its supply connection. A disconnecting means shall be provided and installed in a readily accessible location and shall be capable of being locked in the open position. Portable means for adding a lock to the switch or circuit breaker shall not be permitted as the means required to be installed at and remain with the equipment.

(B) Location. The disconnecting means shall be readily accessible, located not more than 750 mm (30 in.) from the receptacle it controls, and located in the supply circuit ahead of the receptacle. Circuit breakers or switches located in

power outlets complying with this section shall be permitted as the disconnecting means.

(C) **Receptacles.** All receptacles shall be listed and of the grounding type. Every electrified truck parking space intended to provide an electrical supply for transport refrigerated units shall be equipped with one or both of the following:

(1) A 30-ampere, 480-volt, 3-phase, 3-pole, 4-wire receptacle
(2) A 60-ampere, 208-volt, 3-phase, 3-pole, 4-wire receptacle

FPN: Complete details of the 30-ampere pin and sleeve receptacle configuration for refrigerated containers (transport refrigerated units) can be found in ANSI/UL1686, *Standard for Pin and Sleeve Configurations*, Figure C2.11. For various configurations of 60-ampere pin and sleeve receptacles, see ANSI/UL1686.

626.32 Separable Power Supply Cable Assembly

A separable power supply cable assembly, consisting of a cord with an attachment plug and cord connector, shall be one of the types and ratings specified in 626.32(A), (B), and (C). Cords with adapters and pigtail ends, extension cords, and similar items shall not be used.

(A) **Rating(s).** The power supply cable assembly shall be listed and be rated in accordance with (1) or (2).

(1) 30 ampere, 480-volt, 3-phase
(2) 60 ampere, 208-volt, 3-phase

(B) **Cord Assemblies.** The cord shall be a listed type with four conductors, for 3-phase connection, one of which shall be identified in accordance with 400.23 for use as the equipment grounding conductor. Extra-hard usage cables rated not less than 90°C (194°F), 600 volts, listed for both wet locations and sunlight resistance, and having an outer jacket rated to be resistant to temperature extremes, oil, gasoline, ozone, abrasion, acids, and chemicals, shall be permitted where flexibility is necessary between the electrified truck parking space supply equipment and the inlet(s) on the TRU.

(C) **Attachment Plug(s) and Cord Connector(s).** Where a flexible cord is provided with an attachment plug and cord connector, they shall comply with 250.138(A). The attachment plug(s) and cord connector(s) shall be listed, by itself or as part of the power-supply cable assembly, for the purpose and shall be molded to or installed on the flexible cord so that it is secured tightly to the cord at the point where the cord enters the attachment plug or cord connector. If a right-angle cap is used, the configuration shall be oriented so that the grounding member is farthest from the cord. An attachment plug and cord connector for the connection of a truck or trailer shall be rated in accordance with (1) or (2) as follows:

(1) 30-ampere, 480-volt, 3-phase, 3-pole, 4-wire and intended for use with a 30-ampere 480-volt, 3-phase, 3-pole, 4-wire receptacles and inlets, respectively, or
(2) 60-ampere, 208-volt, 3-phase, 3-pole, 4-wire and intended for use with a 60-ampere, 208-volt, 3-phase, 3-pole, 4-wire receptacles and inlets, respectively.

FPN: Complete details of the 30-ampere pin and sleeve attachment plug and cord connector configurations for refrigerated containers (transport refrigerated units) can be found in ANSI/UL1686, *Standard for Pin and Sleeve Configurations*, Figures C2.12 and C2.11. For various configurations of 60-ampere pin and sleeve attachment plugs and cord connectors, see ANSI/UL1686.

ARTICLE 630
Electric Welders

Contents

I. General

630.1 Scope

This article covers apparatus for electric arc welding, resistance welding, plasma cutting, and other similar welding and