ANSI WORKSHOP
Standards and Codes for
Electric Drive Vehicles

ANSI
American National Standards Institute

National Electrical Code®

Electric Vehicle Charging System Requirements

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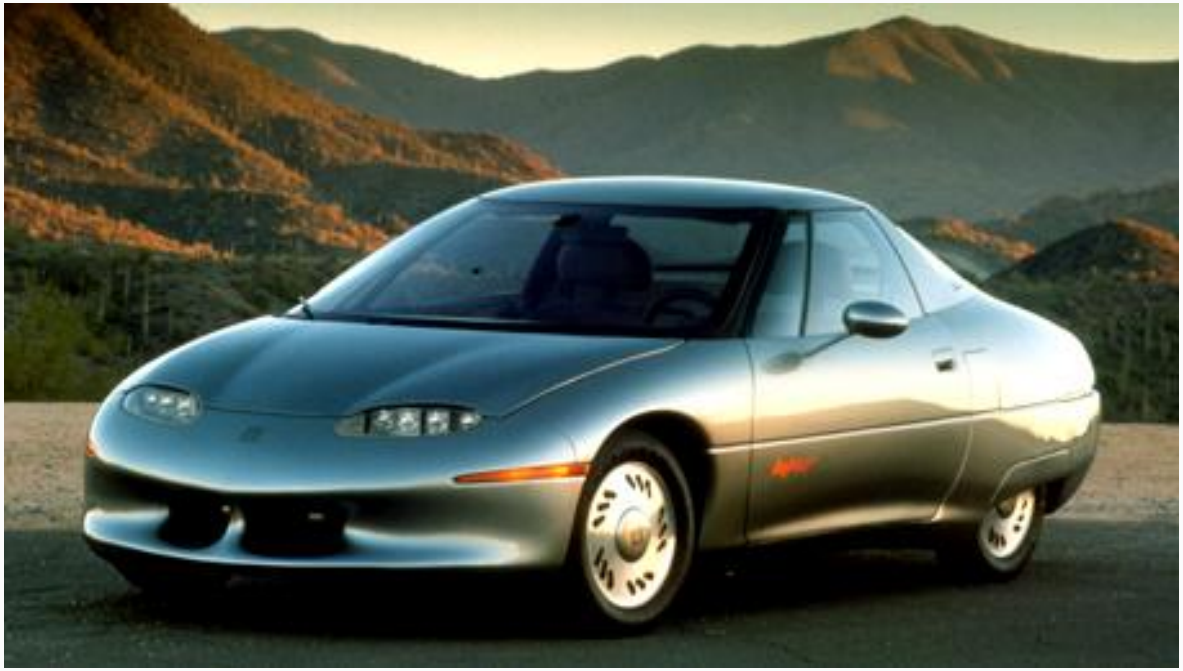
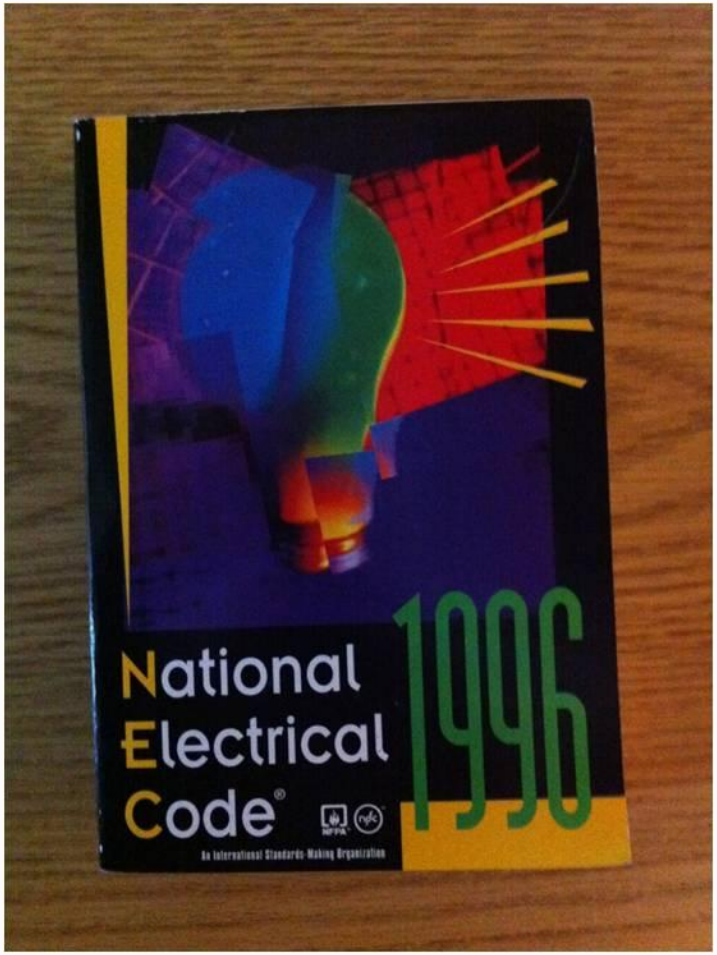
Is the Electrical Industry Ready for Electric Vehicles?

NEC® Meeting, January 1994-San Antonio, TX

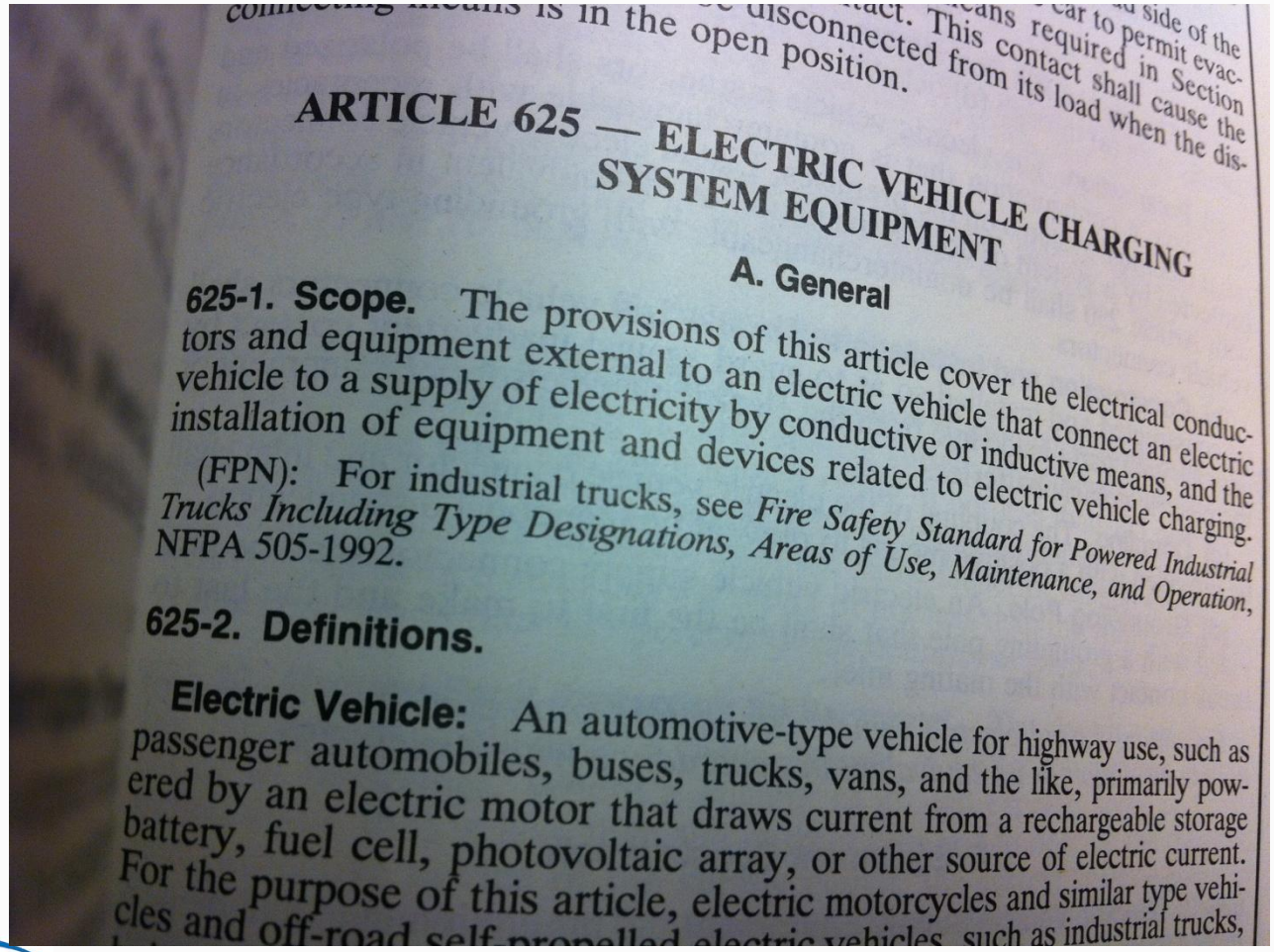


Created new requirements for vehicle charging

- SAE
- Virginia Power
- The SAE proposal was accepted in principle and became the key proposal.
- 11 public comments were received on the proposal



Article 625-Code-Making Panel 12



connecting means is in the open position. disconnected from its load when the dis- tact. This contact shall cause the ans required in Section car to permit evac- d side of the

ARTICLE 625 — ELECTRIC VEHICLE CHARGING SYSTEM EQUIPMENT

A. General

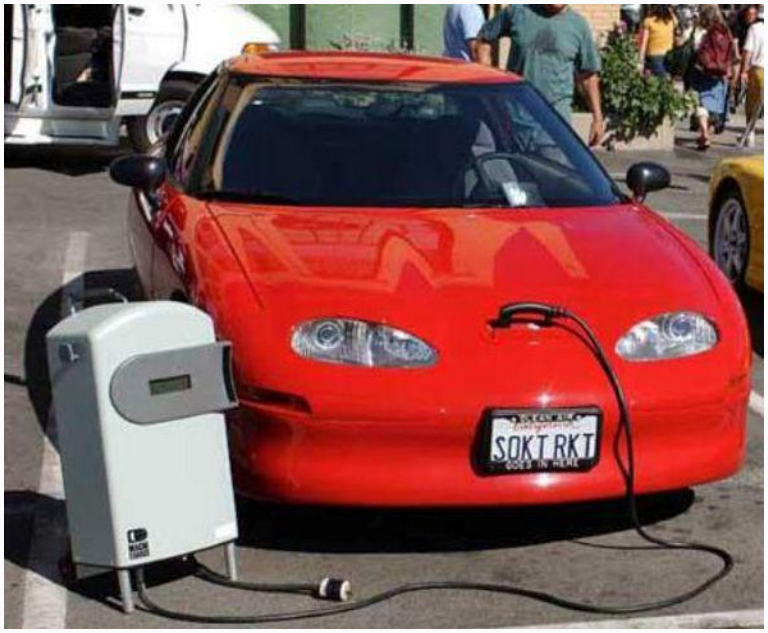
625-1. Scope. The provisions of this article cover the electrical conductors and equipment external to an electric vehicle that connect an electric vehicle to a supply of electricity by conductive or inductive means, and the installation of equipment and devices related to electric vehicle charging.

(FPN): For industrial trucks, see *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Maintenance, and Operation*, NFPA 505-1992.

625-2. Definitions.

Electric Vehicle: An automotive-type vehicle for highway use, such as passenger automobiles, buses, trucks, vans, 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,

Article 625-Electric Vehicles



- Applied to all-electric cars
- Did not apply to hybrids
- Applies only to supply for charging, not the vehicle itself
- Provides requirements for ventilation of the garage, where required
- Allows vehicles to be used in interactive electrical systems

Article 625

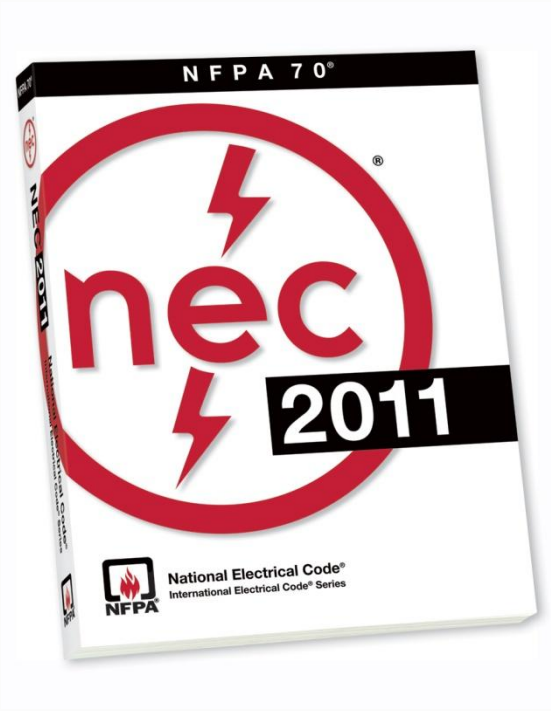
- Does not apply to
  - Golf carts
  - Industrial trucks

Article 625-Electric Vehicles-2011

- Definition changed to include electric motorcycles and plug-in hybrids as electric vehicles
- Definitions added for
  - rechargeable energy storage system
    - Anticipation of other storage technology
      - Capacitors
      - Flywheels
  - Plug-in hybrid electric vehicle

Fundamentals

- Standard nominal line voltages
  - 120/240 Volts single phase
  - 208Y/120 Volts three phase
  - 480Y/277 Volts three phase
- Continuous Load. A load where the maximum current is expected to continue for 3 hours or more.



Fundamentals

Residential Loads

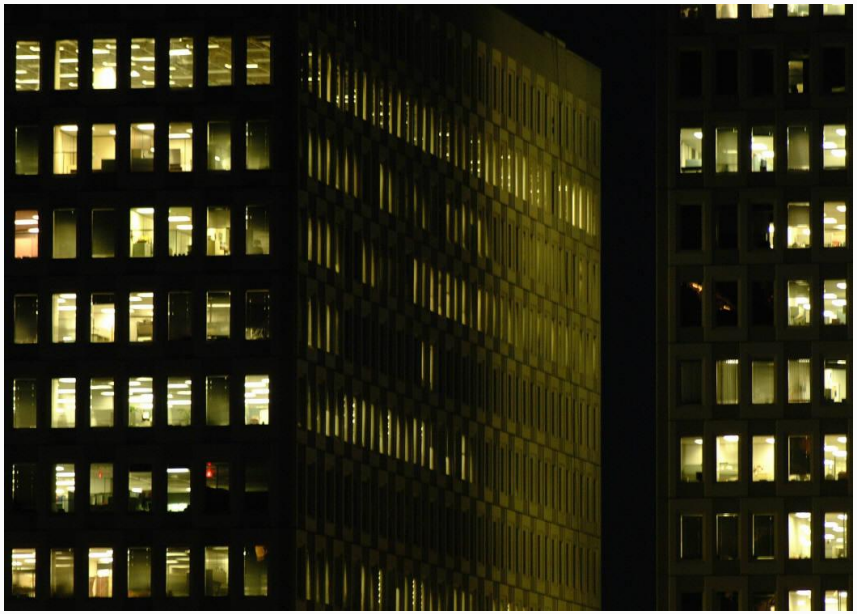
- Most residential loads are noncontinuous loads
  - Heating/air conditioning
  - Refrigeration
  - Washers/dryers
  - Ranges
  - Entertainment
  - Lighting
  - Small appliances

Single Family Homes

Fundamentals

Commercial/Industrial

- Many commercial/industrial loads are continuous
  - Lighting
  - Motors
  - Industrial processes
- Loads for Electric vehicle supply equipment are considered continuous loads. (625.14)



Fundamentals

- **Continuous and Noncontinuous Loads.** Where a branch circuit supplies continuous loads or any combination of continuous and noncontinuous loads, the rating of the overcurrent device shall not be less than the noncontinuous load plus 125 percent of the continuous load. (210.20(A))

Fundamentals

- You must know your enemy! For electrical systems, the enemy is heat!
  - Attics
  - Walls
  - Crawl spaces
  - Garages
  - Electrical sources
  - Industrial processes
- Must minimize heat in equipment

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Fundamentals

- Heat is dealt with in a number of places in the NEC including
  - 110.13-Mounting and Cooling of Equipment
  - 110.14-Electrical Connections
  - Article 240-Overcurrent Protection
  - Article 310-Conductor for General Wiring
  - Article 400-Flexible Cords and Cables
- Residential applications
  - Minimum insulation rating for Type NM Cable is 90 °C. (334.112)
  - Allowable ampacity is based on a maximum 60 °C. ampacity
  - Temperature adjustment factors also apply

Residential Requirements

- 100 Ampere minimum service
- Lighting and receptacle load (3 VA/Sq.ft)
- 2 Small appliance b/c
- 1 Laundry circuit
- Dryer circuit?
- HVAC circuit(s)?
- Electric heat?
- Bathroom circuit
- Does the home have the capacity for additional loads?

Residential Electrical Requirements

- New construction
- Renovations
- Additions

Adding Loads

- Loads for Additions to Existing Installations (220.16)
- Existing Dwelling Units (220.83)
- Determining Existing Loads (220.87)

Conclusion

- NEC provides requirements for
  - new construction
  - existing construction
    - Analysis needed
    - May need to upgrade installation due to capacity of existing installation
- Are we Ready?
  - Training
    - IAEI
    - NECA/IBEW
    - IECi
- NEC requirements are built on experience

The Road Ahead

Where we go from here

- Electric Vehicles Task Group Formed
  - Service/Feeder Loads
  - Diversity for larger customers
  - Branch circuits for residential garages and outdoor receptacles
    - Existing 15- or 20-ampere shared circuit
    - Need for dedicated circuit
    - Level 2-240 volt branch circuits
- Anticipate electric vehicles will be a major consideration of smart grid

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Thank You!