An Overview of SAE International Standards Activities Related to Hybrid / Electric Vehicles

Keith Wilson
Technical Program Manager,
Ground Vehicle Standards
Global Ground Vehicle Standards Structure

- 145,000+ SAE members worldwide
- Representatives from 100 Countries
- 8,375 GV Standards Published
- 1,817 GV Standards Maintained
- 491 GV WIP Standards
- 564 GV Technical Committees
- 8,800 GV Committee Members
- 2,900 Companies
- Representatives from 50 Countries
SAE EV, Hybrid & Fuel Cell Vehicle Standards Development

SAE EV / Hybrid Vehicle Steering Committee

- Started – 2005
- Current Committee Membership
  - > 1100 Individual Participants
  - > 500 Companies
    - OEM’s
    - Suppliers
    - Government
    - Academia
- 10 EV / Hybrid Vehicle Subcommittees
- 4 Fuel Cell Standards Subcommittees
- 66 SAE EV, Hybrid, Fuel Cell Vehicle Standards Published to Date
61 SAE EV, Hybrid, Fuel Cell Vehicle Standards:

**Fuel Cell Fueling:** J2600, J2601, J2601/1, J2601/2, J2601/3, J2601/4, J2719, J2719/1, J2799, J1766, J2578, J2579

**Fuel Cell Systems:** J2579, J2594, J3089

**Fuel Cell Testing:** J2615, J2616, J2617

**EV Hybrid Vehicle Crash Safety:** J3040, J1766, J2990, J2990/2

**EV / Fuel Cell - Safety:** J1766, J2344, J2910, J2990, J2990/1, J3108, J2578, J3108

**EV / Fuel Cell Economy, Range / Power:** J2991, J1798, J2758, J2946, J2572, J2907, J2908, J1634, J1711, J2711

**Energy Transfer Systems:** J2293, J2293/1, J3072

**EV / Fuel Cell Terminology:** J1715, J2574, J2760

**EV Charging Safety:** J1718, J2953/1, J2953/2, J2953/3

**EV Charging & Grid Communications:** J1772, J1773, J2293, J2836, J2841, J2847, J2894, J2931, J2954, J3068, J3105

*Blue Font Denotes WIP*

SAE EV, Hybrid, Fuel Cell Vehicle Standards Focused on Vehicle Safety

**J2990 & J2990/1:**
- Emergency Response Guides (Immobilize, Disable, Warnings)
- Vehicle Type Identification (Badging)
- High Voltage Shutdown (Disconnects, Battery & Converter Cables)
- Tow & Inspection Guides (Recovery, Isolation, Inspection, Diagnostics)
- Hazard Communication

**J2990** - Hybrid and EV First and Second Responder Recommended Practice

**J2990/1** - Gaseous Hydrogen and Fuel Cell Vehicle First and Second Responder Recommended Practice

**J3108** - xEV Labels to Assist First and Second Responders, and Others (high voltage safety info.)

**J2344** - Guidelines for Electric Vehicle Safety (EV, HEV, PHEV and FCV high voltage systems)

**J2578** - Recommended Practice for General Fuel Cell Vehicle Safety (fuel cell system, storage & high voltage)

**J1766** - Recommended Practice for Electric, Fuel Cell and Hybrid Electric Vehicle Crash Integrity Testing

**J2910** - Recommended Practice for Design & Testing Hybrid Electric/Electric Trucks/Buses for Electrical Safety
SAE J1772 Revision 8

Manual AC & DC conductive connection for low and high power levels

Auto OEMs supported moving to higher power levels for charging (8th revision)

SAE J1772 Task Force has raised the voltage and current limit of the SAE Combo Connector

• Current limit from 200A to 350A
• Voltage limit from 500Vdc to 1000Vdc
• = 350kW Max Power

Publication completed: October 2017
SAE J3105 Overhead & Portal Charging

• Automated charging connection at high power- SAE J-3105
  • Document will standardize the interface between the infrastructure and the bus
  • Targeted towards in-route DC charging, for example to recharge at transit bus during a short stop
  • DC Power Levels (Voltage Range: 250-1,000 DC Volts) up to 1MW

- DC Power Levels
- Power Configurations
- Connection Points
- Communications
- Safety
- Alignment Protocol
SAE J3068 AC Depot Conductive Charging

Depot Charging - 3 Phase AC (J-3068) targeted towards charging at commercial and industrial locations or other places where three-phase AC power is available and preferred such as at commercial and industrial locations (160A 480VAC 3Ø = 133kW)

Defines a conductive power transfer method including the digital communication system. It also covers the functional and dimensional requirements for the vehicle inlet, supply equipment outlet, and mating housings and contacts.
SAE J2954 Wireless Power Transfer for Light-Duty Plug-In/Electric Vehicles

SAE J2954 establishes minimum performance, interoperability and safety criteria for wireless charging of EVs / PHEVs

Charging Locations:
- Residential
- Public
- On-Road
- Static (parking lots, curb side)

Key aspects:
- Static applications (currently)
- Efficiencies of over 85% (Aligned)
- Air gaps up to 25 cm
- Safety Limits
- Validation Tests

SAE J2954 Standard Development
- Inductive Charging Interoperability
- Automated Charging
- Power Transfer Communications
- Smart Grid Interoperability
- Automatic Shutdown Capability
- Autonomous Parking / Charging
SAE J2954 Task Force Testing Protocols

SAE Standard will Define:
- Performance
- Safety
- Testing Methodologies
- Charge Levels
- Location & Alignment
- Communications

SAE J2954 WPT Power Classes

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<tr>
<td>3.7 kW</td>
<td>7.7 kW</td>
<td>11 kW</td>
<td>22 kW</td>
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Safety Limits
- EMF Limits with AAMI
- EMC Limits
- Positions / Orientations
- Efficiency Power Transfer
- SAE J1211
- ISO 16750
- USCAR 37
- Object Detection
- Temperature Test
- Automatic Shutdown
# SAE Plug-In Electric Vehicle Grid Communication Standards

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➢ Series of Standards defining Use Cases, Information Messages and Communication formats
# SAE Grid Communication Standards

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Establishes the requirements for digital communication between Plug-In Vehicles (PEV), the Electric Vehicle Supply Equipment (EVSE) and the utility or service provider.
Battery Standards Steering Committee and Technical Committees

- Started – 2009
- Committee Membership
  - >290 Individual Participants
  - >160 Companies
    - OEM’s
    - Suppliers
    - Government
    - Academia
- 23 Subcommittees

NEW COMMITTEES

COMPONENTS & MATERIALS

| 23) Battery Systems Adhesives-Sealants-Heat Transfer Materials |
| 21) Battery Thermal Management |
| 19) Battery Systems Connectors |
| 14) Battery Materials Testing |

LIFE MANAGEMENT

| 10) Battery Recycling |
| 15) Secondary Use |
| 18) Battery Field Discharge & Disconnect |

SUPPORT

| 4) Battery Transport |
| 12) Battery Testing Equipment |
| 13) Battery Terminology |
| 3) Battery Labeling |

PRODUCT SPECIFIC

| 5) Battery Size Standardization |
| 6) Starter Battery |
| 16) Start-Stop Battery |
| 17) Capacitive Energy Storage |
| 9) Battery Standards Future Energy Storage Systems |
| 8) Battery Standards Electronic Fuel Gauge |

INDUSTRY SPECIFIC

| 11) Small Task Oriented Vehicle Batteries |
| 7) Truck Batteries |
| 22) Bus Battery |

Global Ground Vehicle Standards
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## 45 SAE Battery Standards Committee Documents

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* Green Font Denotes WIP
This committee will initially focus on low-speed personal mobility devices and the technology and systems that support them that are not normally subject to the United States Federal Motor Vehicle Safety Standards or similar regulations. These may be device-propelled or have propulsion assistance.

Emerging and innovative mobility vehicles and devices, sometimes referred to as micro-mobility, are proliferating in cities around the world.

These technologies have the potential to expand mobility options for a variety of people. Some of these technologies fall outside traditional definitions, standards, and regulations.
Questions?

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