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APEC Roadmap for International Electric Vehicle Standards

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20th Automotive Dialogue
Beijing, China
22-25 April 2014

APEC ROADMAP FOR INTERNATIONAL ELECTRIC VEHICLE STANDARDS

**20th APEC Automotive Dialogue
Beijing, China
22-25 April 2014**

Presentation by the U.S. Government

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APEC ROADMAP FOR INTERNATIONAL ELECTRIC VEHICLE STANDARDS

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OVERVIEW

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GOALS

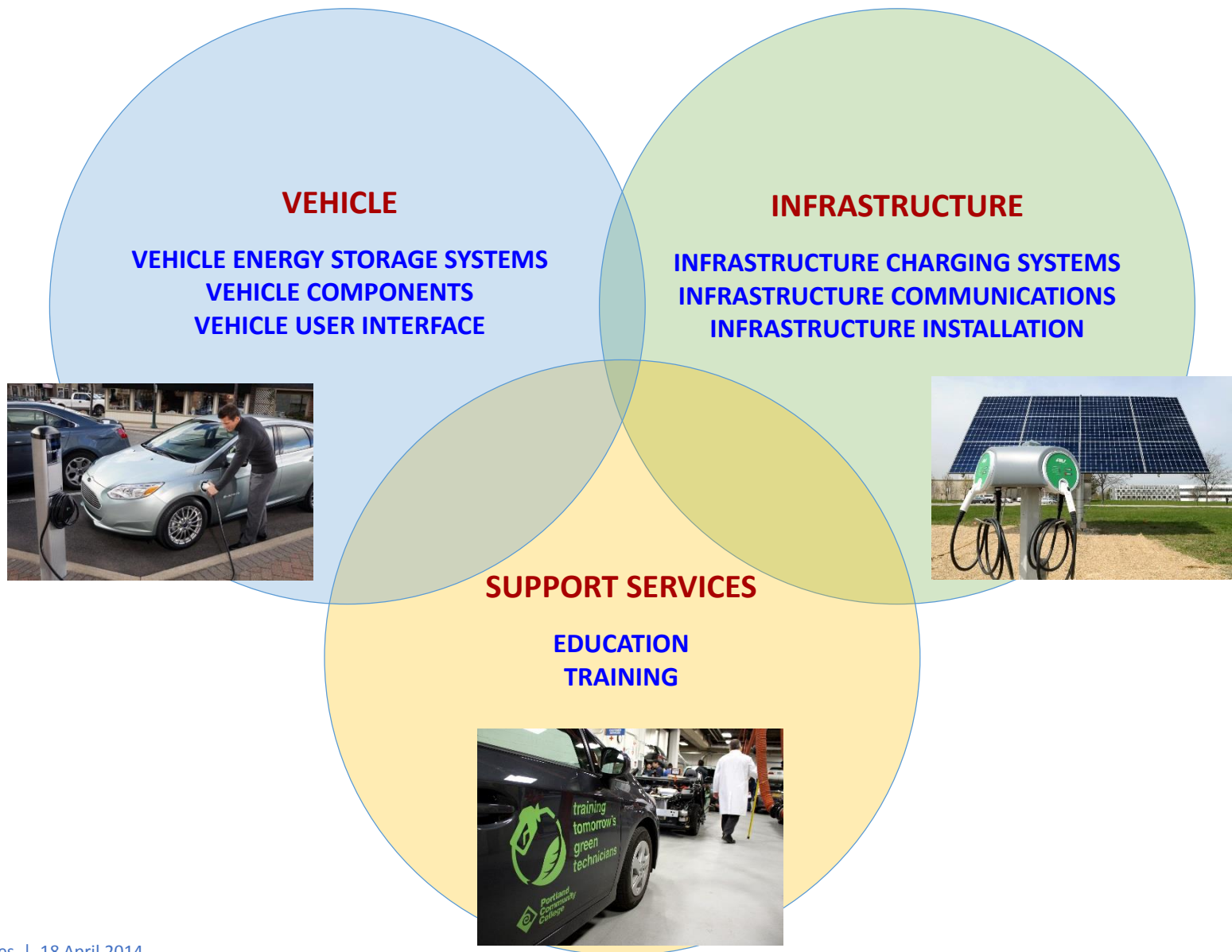
- *Recognizing the need for greater regulatory cooperation and regulatory alignment on Electric Vehicle (EV) standards*
- *Building on discussions and recommendations from the 2011 ARCAM, specifically:*
 - *Promoting Regulatory Convergence and Cooperation*
 - *Promoting Green Growth*
 - *Smart Grid Interoperability Standards*
- *Taking into account previous studies and progress in ongoing work in other international fora, such as the United Nations' global harmonization efforts and in the private sector*

-
- Enhance regulatory cooperation among APEC economies
 - Promote international standards as the basis for EV regulations, if an economy chooses to regulate
 - Provide greater certainty and predictability for trade and investment in EVs in order to promote EV use, production, and trade.
 - Support greater collaboration and partnerships with industry
 - Encourage APEC economies' active participation in the WP.29 1998 Agreement process for developing EV standards
 - Support the work of the APEC Regulatory Cooperation Advancement Mechanism (ARCAM) on Electric Vehicle Standards

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ELECTRIC VEHICLE DOMAINS



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ELECTRIC VEHICLE DOMAINS

VEHICLE

VEHICLE ENERGY STORAGE SYSTEMS

- Power Rating Method
- Battery Safety
- Battery Testing
- Battery Storage, Packaging, Transport and Handling
- Battery Recycling
- Crash Testing

VEHICLE COMPONENTS

- Internal High-voltage Cables, Wiring, Charging Accessories
- Vehicle Diagnostics – Emissions
- Audible Warning Systems

VEHICLE USER INTERFACE

- Graphical Symbols
- Telematics – Driver Distraction
- Fuel Efficiency, Emissions, and Labeling



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ELECTRIC VEHICLE DOMAINS

INFRASTRUCTURE

INFRASTRUCTURE CHARGING SYSTEMS

- Wireless Charging
- Battery Swapping
- Electric Vehicle Supply Equipment
- Electromagnetic Compatibility
- Vehicle as Power Source for Non-vehicle Applications
- Use of Alternative Power Sources



INFRASTRUCTURE COMMUNICATIONS

- Communications Architecture for EV Charging
- Communications Requirements for EV Charging Scenarios
- Communication & Measurement of EV Energy Consumption
- Cyber Security and Data Privacy
- Telematics Smart Grid Communications

INFRASTRUCTURE INSTALLATION

- Site Assessment / Power Capacity Assessment
- EV Charging – Signage and Parking
- Charging Station Permitting
- Environmental and Use Conditions
- Ventilation – Multiple Charging Vehicles
- Physical and Security Protection
- Accessibility for Persons with Disabilities
- Cable Management
- EV Supply Equipment Maintenance
- Workplace Safety

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ELECTRIC VEHICLE DOMAINS

SUPPORT SERVICES

EDUCATION AND TRAINING

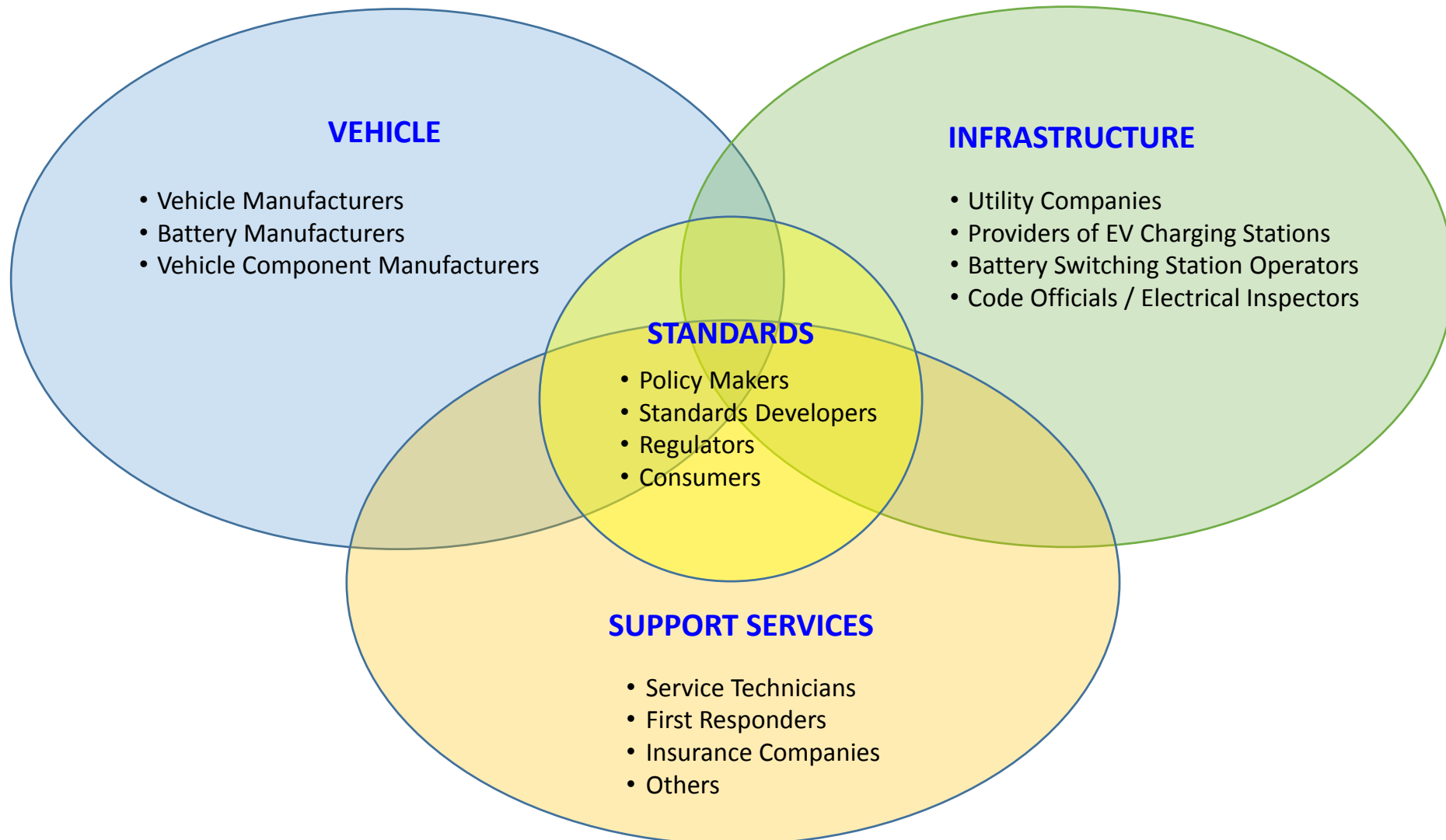
- EV Emergency Shut Off
- Labeling for Emergency Situations
- OEM Emergency Response Guides
- Battery Assessment and Safe Discharge
- Emergency Evacuations Involving EVs
- Workforce Training



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ELECTRIC VEHICLE STAKEHOLDERS



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ELECTRIC VEHICLE INTERNATIONAL STANDARDS DEVELOPMENT ORGANIZATIONS

SDOs	Web Site	Standards	Comments
	World Forum for Harmonization of Vehicle Regulations (WP.29)	3	See list of standards in Annex 1 Slide A-2
	International Electrotechnical Commission	26	See list of standards in Annex 1 Slide A-3
	Institute of Electrical and Electronics Engineers	16	See list of standards in Annex 1 Slide A-7
	International Organization for Standardization	49	See list of standards in Annex 1 Slide A-11
	ISO/IEC	11	See list of standards in Annex 1 Slide A-17
	SAE International	72	See list of standards in Annex 1 Slide A-19
	Underwriters Laboratories	22	See list of standards in Annex 1 Slide A-28

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DRAFT ELECTRIC VEHICLE STANDARDS ROADMAP

Technical Areas	International Technical Standards	Comments
Charging infrastructure and harmonized communications protocols		
Interaction of EVs and renewable generation and storage		
Battery safety <i>including storage, operational and disposal</i>		
Packaging and transport of batteries and battery waste		
Vehicle safety <i>including visual and audible warning systems, labelling, emergency disconnects, and safe battery handling and discharging</i>		
Vehicle charging <i>such as coupler, wireless, and battery swapping safety and interoperability</i>		
Power supply <i>including communications, bi-directional supply, sub-metering, access control and roaming</i>		

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DRAFT RECOMMENDATIONS

- Adopt the EV Standards Roadmap – Use standards in the Roadmap as a basis for regulations regarding EVs, if an economy chooses to regulate
- Avoid regulatory divergences and adoption of unique EV standards or regulations for both vehicles and parts
- Participate to the greatest extent possible in EVs standards harmonization efforts in international SDOs:
 - World Forum for Harmonization of Vehicle Regulations (WP.29)
 - International Electrotechnical Commission (IEC)
 - Institute of Electrical and Electronics Engineers (IEEE)
 - International Organization for Standardization (ISO)
 - ISO/IEC
 - SAE International
 - Underwriters Laboratories
- Develop further regulatory cooperation activities in APEC, including regulators, industries, and SDOs
- Actively participate in the WP.29 1998 Agreement process in order to achieve a Global Technical Regulation on EV safety as soon as possible
- Promote efforts in APEC to assist economies in using renewable sources of energy for powering EVs
- Establish an APEC EV Interoperability Center to assist economies in ensuring that EVs can interface with electrical and charging infrastructure in as many economies as possible

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REFERENCES

[ANSI Standardization Road Map for Electric Vehicles 2.0 \(May 2013\)](#)

[ANSI Electric Vehicle Standards Roadmap v2.0 \(May 2013\)](#)

[ANSI Electric Drive Vehicles Workshop \(April 2011\)](#)

[ANSI Workshop Report: Standards and Codes for Electric Drive Vehicles \(April 2011\)](#)

[ANSI EVSP Roadmap Standards Compendium](#)

[UNECE Working Party on Pollution and Energy – World Forum for Harmonization of Vehicle Regulations \(WP.29\)](#)

[UNECE WP.29 Global Technical Regulations \(GTRs\)](#)

[IEEE Transportation Electrification Standards](#)

[Electrification Coalition: Electrification Roadmap](#)

[U.S. Department of Energy: Alternative Fuels Data Center – All-Electric Vehicles](#)

[U.S. Department of Energy – Office of Energy Efficiency & Renewable Energy – Vehicles Technologies Office: DOE's 10-Year Vision for Plug-In Electric Vehicles](#)

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ANNEX 1: COMPENDIUM OF INTERNATIONAL ELECTRIC VEHICLE STANDARDS



World Forum for Harmonization of Vehicle Regulations (WP.29) [3 standards] [A-2](#)



International Electrotechnical Commission (IEC) [26 standards] [A-3](#)



Institute of Electrical and Electronics Engineers (IEEE) [16 standards] [A-7](#)



International Organization for Standardization (ISO) [49 standards] [A-11](#)



ISO/IEC [11 standards] [A-17](#)



SAE International [72 standards] [A-19](#)



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World Forum for Harmonization of Vehicle Regulations (WP.29)

Designation	Title	Description / Scope	Committee	Publication Date / Target Date
WP.29 EVS-IWG	Proposal to Develop a Global Technical Regulation Concerning Electrical Vehicle Safety		Informal Working Group on Electrical Vehicle Safety	
WP.29 Working Party on Noise (GRB)	Proposal to Develop a Global Technical Regulation Concerning Quiet Vehicles		Informal Group on Quiet Road Transport Vehicles (QRTV)	
WP.29 Working Party on Pollution and Energy (GRPE)	Proposal to Develop a Global Technical Regulation Concerning Pollution and Energy Efficiency	This effort aims to develop a test cycle and test procedures to measure the emissions (including off-cycle) and fuel efficiency of light-duty vehicles by the end of 2013. The initial WLTP working group has been divided into two subgroups for developing the test procedure (DTP) and the harmonized drive cycle (DHC). Subsequently, the DTP subgroup set up five of its own subgroups to address new additional pollutants (AP), PM/PN measurement procedures (PMPN), laboratory procedures (LAB), hybrid and electric vehicle requirements (E-Lab), and reference fuels (RF). A second phase is expected to address low ambient temperature, high altitude test procedures, and possibly durability and conformity issues. A third phase would eventually include the addition of reference fuels, correlation across existing regional/national cycles, and introduction of emissions limits.	Informal working group on Worldwide harmonized Light vehicles Test Procedures (WLTP) Subgroup on Electric and Hybrid Vehicle Requirements (WLTP-DTP-E-Lab)	2013-12

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International Electrotechnical Commission (IEC) – Part 1 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
TR 60783	Wiring and connectors for electric road vehicles	Provides general rules for all external wiring and connectors which are used for interconnecting the traction components and sub-systems. The rules are applicable to the heavy current, the light current and the signal harnesses	TC 69	1984
TR 60785	Rotating machines for electric road vehicles	Lays down general rules for the design, installation and testing of traction motors and auxiliary motors which are mounted on electric road vehicles, and indicates the technical requirements and testing conditions for them.	TC 69	1984
TR 60786	Controllers for electric road vehicles	Applies to the equipment on the electric vehicle which controls the rate of energy transfer between the traction battery or batteries and the motor or motors. Outlines the minimum recommended requirements for the construction and performance of electric vehicle traction controllers.	TC 69	1984
61851-1 Ed. 2.0	Electric vehicle conductive charging system - Part 1: General requirements	Applies to on-board and off-board equipment for charging electric road vehicles at standard a.c. supply voltages (as per IEC 60038) up to 1 000 V and at d.c. voltages up to 1 500 V, and for providing electrical power for any additional services on the vehicle if required when connected to the supply network.	TC 69	2010 / 2014-03 Ed. 3.0
61851-3-1 Ed. 1.0	Electric Vehicles conductive power supply system - Part 3-1: General Requirements for Light Electric Vehicles (LEV) AC and DC conductive power supply systems	Will specify the requirements for Light Electric Vehicles (LEV) AC and DC conductive power supply systems including the control communication in a general way. It will make reference to the IEC 61851-1 general requirements standard for electric vehicles	TC 69	2015-07
61851-3-2 Ed. 1.0	Electric Vehicles conductive power supply system - Part 3-2: Requirements for Light Electric Vehicles (LEV) DC off-board conductive power supply systems	Will specify requirements for Light Electric Vehicles (LEV) DC off-board conductive power supply systems	TC 69	2015-07
61851-3-3 Ed. 1.0	Electric Vehicles conductive power supply system - Part 3-3: Requirements for Light Electric Vehicles (LEV) battery swap systems	Will specify requirements for Light Electric Vehicles (LEV) battery swap systems	TC 69	2015-07
61851-3-4 Ed 1.0	Electric Vehicles conductive power supply system - Part 3-4: Requirements for Light Electric Vehicles (LEV) communication	Will specify requirements for the communication	TC 69	2015-07

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International Electrotechnical Commission (IEC) – Part 2 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
61851-21 Ed. 1.0	Electric vehicle conductive charging system - Part 21: Electric vehicle requirements for conductive connection to an a.c./d.c. supply	This part of IEC 61851 together with part 1 gives the electric vehicle requirements for conductive connection to an a.c. or d.c. supply, for a.c. voltages according to IEC 60038 up to 690 V and for d.c. voltages up to 1 000 V, when the electric vehicle is connected to the supply network. This standard does not cover class II vehicles. NOTE Class II vehicles are not excluded, but the lack of information on this type of vehicle means that the requirements for the standard are unavailable at present. This standard does not cover all safety aspects related to maintenance. This standard is not applicable to trolley buses, rail vehicles, industrial trucks and vehicles designed primarily to be used off-road. Will be withdrawn and replaced by subparts 1 and 2	TC 69	2001
61851-21-1 Ed. 1.0	Electric vehicle conductive charging system - Part 21-1 Electric vehicle onboard charger EMC requirements for conductive connection to an a.c./d.c. supply	This part of IEC 61851 together with Part 1 give requirements for conductive connection of an electric vehicle (EV) to an a.c. or d.c. supply. It applies only to on-board charging units either tested on the complete vehicle or tested on the charging system component level (ESA - electronic sub assembly).	TC 69	2015-01
61851-21-2 Ed. 1.0	Electric vehicle conductive charging system - Part 21-2: EMC requirements for off-board electric vehicle charging systems	This part of IEC 61851, defines the EMC requirements for any off board components or equipment of systems that are used to supply or charge electric vehicles with electric power by conductive power transfer (CPT), with a rated input voltage, according to IEC 60038, up to 1000V a.c. or 1500V d.c. and an output voltage up to 1000V a.c. or 1500V d.c., or by wireless power transfer (WPT).	TC 69	2014-03
61851-22 Ed. 1.0	Electric vehicle conductive charging system - Part 22: AC electric vehicle charging station	Together with Part 1, gives the requirements for a.c. electric vehicle charging stations for conductive connection to an electric vehicle, with a.c. supply voltages according to IEC 60038 up to 690 V. Note: to be withdrawn upon publication of IEC 61851-1, 3rd edition.	TC 69	2001
61851-23 Ed. 1.0	Electric vehicle conductive charging system- Part 23: DC electric vehicle charging station	IEC 61851-23:2014, together with IEC 61851-1, gives the requirements for d.c. electric vehicle (EV) charging stations, herein also referred to as "DC charger", for conductive connection to the vehicle, with an a.c. or d.c. input voltage up to 1 000 V a.c. and up to 1 500 V d.c. according to IEC 60038. It provides the general requirements for the control communication between a d.c. EV charging station and an EV. The requirements for digital communication between d.c. EV charging station and electric vehicle for control of d.c. charging are defined in IEC 61851-24.	TC 69	2014-03

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International Electrotechnical Commission (IEC) – Part 3 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
61851-24 Ed. 1.0	Electric vehicle conductive charging system - Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging	IEC 61851-24:2014, together with IEC 61851-23, applies to digital communication between a d.c. EV charging station and an electric road vehicle (EV) for control of d.c. charging, with an a.c. or d.c. input voltage up to 1 000 V a.c. and up to 1 500 V d.c. for the conductive charging procedure. The EV charging mode is mode 4, according to IEC 61851-23. Annexes A, B, and C give descriptions of digital communications for control of d.c. charging specific to d.c. EV charging systems A, B and C as defined in Part 23.	TC 69	2014-03
61980-1 Ed. 1.0	Electric vehicle wireless power transfer systems (WPT) - Part 1: General requirements	This standard applies to the equipment for the wireless transfer of electric power from the supply network to electric road vehicles for purposes of supplying electric energy to the RESS (Rechargeable energy storage system) and/or other on-board electrical systems in an operational state when connected to the supply network, at standard a.c. supply voltages per IEC 60038 up to 1000V a.c. and up to 1500 V d.c.	TC 69	2014-12
61980-2	Electric vehicle wireless power transfer (WPT) systems - Part 2 specific requirements for communication between electric road vehicle (EV) and infrastructure with respect to wireless power transfer (WPT) systems		TC 69	
61980-3	Electric vehicle wireless power transfer (WPT) systems - Part 3 specific requirements for the magnetic field power transfer systems		TC 69	
61981	On board electric power equipment for electric road vehicles		TC 69	
61982	Secondary batteries (except lithium) for the propulsion of electric road vehicles- Part 1: Test parameters	This standard specifies the values of the various parameters such as voltage, current, power and temperature to be used in the testing of battery cells, monoblocs and modules used for the propulsion of electric road vehicles.	TC 21	2012

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International Electrotechnical Commission (IEC) – Part 4 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
62196-1 Ed. 2.0	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles - Part 1: General requirements	This part of IEC 62196 is applicable to plugs, socket-outlets, vehicle connectors, vehicle inlets and cable assemblies for electric vehicles, herein referred to as “accessories”, intended for use in conductive charging systems which incorporate control means, with a rated operating voltage not exceeding – 690V a.c. 50Hz to 60 Hz, at a rated current not exceeding 250 A, –1 500 V d.c. at a rated current not exceeding 400 A.	SC 23H	2011 / 2014-06 Ed. 3.0
62196-2 Ed. 1.0	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles - Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories	IEC 62196-2:2011 applies to plugs, socket-outlets, vehicle connectors and vehicle inlets with pins and contact-tubes of standardized configurations, herein referred to as accessories. They have a nominal rated operating voltage not exceeding 500 V a.c., 50 to 60 Hz, and a rated current not exceeding 63 A three-phase or 70 A single phase, for use in conductive charging of electric vehicles.	SC 23 H	2011 / 2015-05 Ed. 2.0
62196-3 Ed. 1.0	Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles - Part 3: Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers	This part of IEC 62196 is applicable to vehicle couplers with pins and contact-tubes of standardized configuration, herein also referred to as “accessories”, intended for use in electric vehicle conductive charging systems which incorporate control means, with rated operating voltage up to 1500V d.c. and rated current up to 250 A, and 1000 V a.c. and rated current up to 250 A.	SC 23 H	2014-06
62660-1	Secondary batteries for the propulsion of electric road vehicles - Performance testing for lithium-ion cells and batteries	Specifies performance and life testing of secondary lithium-ion cells used for propulsion of electric vehicles including battery electric vehicles (BEV) and hybrid electric vehicles (HEV).	TC 21	2010
62660-2	Secondary batteries for the propulsion of electric road vehicles - Reliability and abuse testing for lithium-ion cells	Specifies test procedures to observe the reliability and abuse behavior of secondary lithium-ion cells used for propulsion of electric vehicles including battery electric vehicles (BEV) and hybrid electric vehicles (HEV).	TC 21	2010
62840-1 Ed. 1.0	Electric vehicle battery swap system Part 1: System description and general requirements	This standard gives the general requirements for battery swap system, which is for the purposes of swapping batteries of electric vehicles in a non-operational state when the battery swap system connected to the supply network. The power supply is up to 1000V a.c. or up to 1500V d.c., according to IEC 60038.	TC 69	2015-12
62840-2 Ed. 1.0	Electric Vehicles Battery Swap System - Part 2: Safety requirements	This standard provides the safety requirements for a battery swap system for the purposes of swapping batteries of electric vehicles in a non-operational state, when the battery swap system is connected to the supply network, at standard supply voltages per IEC 60038 is up to 1000V a.c. or up to 1500V d.c.	TC 69	2015-06

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Institute of Electrical and Electronics Engineers (IEEE) – Part 1 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
519	IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems	Establishes goals for the design of electrical systems that include both linear and nonlinear loads. The voltage and current waveforms that may exist throughout the system are summarized and waveform distortion goals for the system designer are established. The interface between sources and loads is described as the point of common coupling; and observance of the design goals will minimize interference between electrical equipment. This recommended practice addresses steady-state limitation. Transient conditions exceeding these limitations may be encountered.	PE/T&D/PQ-519_WG/519	1992
802.20	Standard for Local and Metropolitan Area Networks - Standard Air Interface for Mobile Broadband Wireless Access Systems Supporting Vehicular Mobility - Physical and Media Access Control Layer Specification	The technical requirements of this standard form a compatibility standard for mobile broadband wireless access systems. The standard ensures that a compliant access terminal (AT) or user terminal (UT) can obtain service through any access node (AN) or base station (BS) conforming to properly selected modes of this standard, consistent with equipment and operator requirements, thus providing a framework for the rapid development of cost-effective, multivendor mobile broadband wireless access systems.	C/LM/WG802.20/802.20	2008
1547 Series*	Standard for Interconnecting Distributed Resources with Electric Power Systems	This standard establishes criteria and requirements for interconnection of distributed resources (DR) with electric power systems (EPS).	Standards Coordinating Committee 21	various dates
P1609.0	Guide for Wireless Access in Vehicular Environments (WAVE) - Architecture	This guide describes the Wireless Access in Vehicular Environments (WAVE/DSRC) architecture and services necessary for multi-channel DSRC/WAVE devices to communicate in a mobile vehicular environment.	Dedicated Short Range Communication Working Group	
P1609.2	IEEE Draft Standard for Wireless Access in Vehicular Environments - Security Services for Applications and Management Messages	This standard defines secure message formats and processing for use by Wireless Access in Vehicular Environments (WAVE) devices, including methods to secure WAVE management messages and methods to secure application messages. It also describes administrative functions necessary to support the core security functions.	Dedicated Short Range Communication Working Group	2006
1609.3	IEEE Standard for Wireless Access in Vehicular Environments (WAVE) - Networking Services	The scope of this standard is the specification of network and transport layer protocols and services that support multi-channel wireless connectivity between IEEE 802.11 Wireless Access in Vehicular Environments (WAVE) devices.	Dedicated Short Range Communication Working Group	2010

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Institute of Electrical and Electronics Engineers (IEEE) – Part 2 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
1609.4	IEEE Standard for Wireless Access in Vehicular Environments (WAVE)--Multi-channel Operation	The scope of this standard is the specification of medium access control (MAC) sub-layer functions and services that support multi-channel wireless connectivity between IEEE 802.11 Wireless Access in Vehicular Environments (WAVE) devices.	Dedicated Short Range Communication Working Group	2010
P1609.5	Standard for Wireless Access in Vehicular Environments (WAVE) - Communication Manager	This standard specifies communication management services for Wireless Access in Vehicular Environments (WAVE). This standard defines communication management services in support of wireless connectivity among vehicle-based devices, and between fixed roadside devices and vehicle-based devices for Wireless Access in Vehicular Environments.	Standard for Wireless Access in Vehicular Environments (WAVE) - Communication Manager	
1609.11	IEEE Standard for Wireless Access in Vehicular Environments (WAVE)-- Over-the-Air Electronic Payment Data Exchange Protocol for Intelligent Transportation Systems (ITS)	This standard specifies the application service layer and profile for Payment and Identity authentication, and Payment Data transfer for Dedicated Short Range Communication (DSRC) based applications using IEEE Std. 802.11(TM) and IEEE 1609 protocols in Wireless Access in Vehicular Environments. This standard defines a basic level of technical interoperability for electronic payment equipment.	Dedicated Short Range Communication Working Group	2010
P1609.12	IEEE Draft Standard for Wireless Access in Vehicular Environments (WAVE) - Identifier Allocations	This standard specifies allocations of WAVE identifiers defined in the IEEE 1609(TM) series of standards.	Dedicated Short Range Communication Working Group	
P1901.2	Draft Standard for Low Frequency (less than 500kHz) Narrow Band Power Line Communications for Smart Grid Applications	Defines low bandwidth PLC at low frequency that includes the CENELEC and FCC bands below 500 kHz. It also includes coexistence support for other PLC technologies including PRIME and G3	P1901.2 WG	2012

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Institute of Electrical and Electronics Engineers (IEEE) – Part 3 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
P2030	Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS), End-Use Applications, and Loads	IEEE Std. 2030 provides alternative approaches and best practices for achieving smart grid interoperability. It is the first all-encompassing IEEE standard on smart grid interoperability providing a roadmap directed at establishing the framework in developing an IEEE national and international body of standards based on cross-cutting technical disciplines in power applications and information exchange and control through communications. IEEE Std. 2030 establishes the smart grid interoperability reference model (SGIRM) and provides a knowledge base addressing terminology, characteristics, functional performance and evaluation criteria, and the application of engineering principles for smart grid interoperability of the electric power system with end-use applications and loads. A system of systems approach to smart grid interoperability lays the foundation on which IEEE Std. 2030 establishes the SGIRM as a design tool that inherently allows for extensibility, scalability, and upgradeability. The IEEE 2030 SGIRM defines three integrated architectural perspectives: power systems, communications technology, and information technology. Additionally, it defines design tables and the classification of data flow characteristics necessary for interoperability. Guidelines for smart grid interoperability, design criteria, and reference model applications are addressed with emphasis on functional interface identification, logical connections and data flows, communications and linkages, digital information management, and power generation usage.	Standards Coordinating Committee 21	2011
P2030.1	Draft Guide for Electric-Sourced Transportation Infrastructure	Provides guidelines that can be used by utilities, manufacturers, transportation providers, infrastructure developers and end users of electric-sourced vehicles and related support infrastructure in addressing applications for road-based personal and mass transportation. This guide provides a knowledge base addressing terminology, methods, equipment, and planning requirements for such transportation and its impacts on commercial and industrial systems including, for example, generation, transmission, and distribution systems of electrical power. This guide provides a roadmap for users to plan for short, medium, and long-term systems.	P2030.1 WG	

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Institute of Electrical and Electronics Engineers (IEEE) – Part 4 of 4

Designation	Title	Description / Scope	Committee	Publication Date Target Date
P2030.2	Guide for the Interoperability of Energy Storage Systems Integrated with the Electric Power Infrastructure	This document provides guidelines for discrete and hybrid energy storage systems that are integrated with the electric power infrastructure, including end-use applications and loads. This guide builds upon IEEE Standard 2030 Guide for Smart Grid Interoperability of Energy Technology and Information Technology Operation With The Electric Power System (EPS), and End-Use Applications and Loads.	P2030.2 WG	
P2030.3	Standard for Test Procedures for Electric Energy Storage Equipment and Systems for Electric Power Systems Applications	This standard establishes test procedures for electric energy storage equipment and systems for electric power systems (EPS) applications. It is recognized that an electric energy storage equipment or systems can be a single device providing all required functions or an assembly of components, each having limited functions. Components having limited functions shall be tested for those functions in accordance with this standard. Conformance may be established through combination of type, production, and commissioning tests. Additionally, requirements on installation evaluation and periodic tests are included in this standard.	P2030.3 WG	
C2	National Electrical Safety Code®	The ground rules for practical safeguarding of persons during the installation, operation, or maintenance of electric supply and communication lines and associated equipment. The NESC contains the basic provisions that are considered necessary for the safety of employees and the public under the specified conditions.	IEEE (ASC C2)	2012

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International Organization for Standardization (ISO) – Part 1 of 6

Designation	Title	Description / Scope	Committee	Publication Date Target Date
6469-1	Electric road vehicles - Safety specifications - Part 1: On-board rechargeable energy storage system (RESS)	Specifies requirements for the on-board rechargeable energy storage systems (RESS) of electrically propelled road vehicles, including battery-electric vehicles (BEVs), fuel-cell vehicles (FCVs) and hybrid electric vehicles (HEVs), for the protection of persons inside and outside the vehicle and the vehicle environment.	TC 22/SC 21	2009
6469-2	Electric Road Vehicles—Safety specifications—Part 2: Functional safety means and protection against failures.	Specifies requirements for operational safety means and protection against failures related to hazards specific to electrically propelled road vehicles, including battery-electric vehicles (BEVs), fuel-cell vehicles (FCVs) and hybrid electric vehicles (HEVs), for the protection of persons inside and outside the vehicle and the vehicle environment.	TC 22/SC 21	2009
6469-3	Electric road vehicles—Safety Specifications—Part 3: Protection of users against electrical hazards.	Specifies requirements for the electric propulsion systems and conductively connected auxiliary electric systems, if any, of electrically propelled road vehicles for the protection of persons inside and outside the vehicle against electric shock.	TC 22/SC 21	2011
6469-4	Electrically propelled road vehicles -- Safety specifications -- Part 4: Post crash electrical safety requirements	Specifies safety requirements for the electric propulsion systems and conductively connected auxiliary electric systems of electrically propelled road vehicles for the protection of persons inside and outside the vehicle.	TC 22/SC 21	2014
7637-1	Road vehicles -- Electrical disturbances from conduction and coupling -- Part 1: Definitions and general considerations	Defines the basic terms relating to electrical disturbances from conduction and coupling used in its other parts, and gives general information on the whole of ISO 7637 and common to all parts	TC 22/SC 3	2002
7637-2	Road vehicles -- Electrical disturbances from conduction and coupling -- Part 2: Electrical transient conduction along supply lines only	Specifies test methods and procedures to ensure the compatibility to conducted electrical transients of equipment installed on passenger cars and commercial vehicles fitted with 12 V or 24 V electrical systems.	TC 22/SC 3	2011
7637-3	Road vehicles -- Electrical disturbances from conduction and coupling -- Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines	Establishes a bench top test for the evaluation of the immunity of devices under test (DUTs) to transient transmission by coupling via lines other than supply lines. The test transient pulses simulate both fast and slow transient disturbances, such as those caused by the switching of inductive loads and relay contact bounce.	TC 22/SC 3	2007
8713	Electric road vehicles -- Vocabulary	Establishes a vocabulary of terms used in International Standards generally in relation to electric road vehicles. It is not intended to give definitions of all parts within a vehicle, but focuses on terms specific to electric road vehicles.	TC 22/SC 21	2012

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
8714	Electric road vehicles -- Reference energy consumption and range -- Test procedures for passenger cars and light commercial vehicles	Specifies test procedures for measuring the reference energy consumption and reference range of purely electrically propelled passenger cars and commercial vehicles of a maximum authorized total mass of 3 500 kg and maximum speed greater than or equal to 70 km/h.	TC 22/SC 21	2002
8715	Electric road vehicles — Road operating characteristics	Specifies the procedures for measuring the road performance of purely electrically propelled passenger cars and commercial vehicles of a maximum authorized total mass of 3 500 kg ¹ . The road performance comprises road operating characteristics such as speed, acceleration and hill climbing ability.	TC 22/SC 21	2001
8820-1	Road vehicles -- Fuse-links -- Part 1: Definitions and general test requirements	Defines terms and specifies general test requirements for fuse-links for electrical systems of road vehicles.	TC 22/SC 3	2008
8820-2	Road vehicles -- Fuse-links -- Part 2: User's guide	Gives guidance for the choice and application of automotive fuse-links. It describes the various parameters which have to be taken into account when selecting fuse-links.	TC 22/SC 3	2005
8820-3	Road vehicles -- Fuse-links -- Part 3: Fuse-links with tabs (blade type) Type C (medium), Type E (high current) and Type F (miniature)	Specifies fuse-links with tabs (blade-type) Type C (medium), Type E (high current) and Type F (miniature) for use in road vehicles. It establishes, for these fuse-link types, the rated current, test procedures, performance requirements and dimensions.	TC 22/SC 3	2010
8820-4	Road vehicles -- Fuse-links -- Part 4: Fuse-links with female contacts (type A) and bolt-in contacts (type B) and their test fixtures	Specifies fuse-links with female contacts (type A) and bolt-in contacts (type B) for use in road vehicles. It establishes, for these fuse-link types, the rated current, test procedures, performance requirements and dimensions.	TC 22/SC 3	2010
8820-5	Road vehicles -- Fuse-links -- Part 5: Fuse-links with axial terminals (Strip fuse-links) Types SF 30 and SF 51 and test fixtures	Specifies fuse-links with axial terminals (Strip fuse-links) Type SF30 and SF51 and test fixtures for fuses in road vehicles. It establishes, for these fuse-link types, the rated current, test procedures, performance requirements and dimensions.	TC 22/SC 3	2007
8820-6	Road vehicles -- Fuse-links -- Part 6: Single-bolt fuse-links	Specifies single-bolt fuse-links in road vehicles. It establishes, for this fuse-link type, the rated current, test procedures, performance requirements and dimensions.	TC 22/SC 3	2007
8820-7	Road vehicles -- Fuse-links -- Part 7: Fuse-links with tabs (Type G) with rated voltage of 450 V	Specifies fuse-links with tabs (Type G) in road vehicles. This type of fuse-link is basically designed for use in fuel-cell applications. ISO 8820-7:2007 establishes, for this fuse-link type, the rated current, test procedures, performance requirements and dimensions.	TC 22/SC 3	2007

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International Organization for Standardization (ISO) – Part 3 of 6

Designation	Title	Description / Scope	Committee	Publication Date Target Date
10605	Road vehicles -- Test methods for electrical disturbances from electrostatic discharge	Specifies the electrostatic discharge (ESD) test methods necessary to evaluate electronic modules intended for vehicle use	TC 22/SC 3	2008
11451-1	Road vehicles -- Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy -- Part 1: General principles and terminology	Specifies general conditions, defines terms, gives practical guidelines and establishes the basic principles of the vehicle tests used in the other parts of ISO 11451 for determining the immunity of passenger cars and commercial vehicles to electrical disturbances from narrowband radiated electromagnetic energy, regardless of the vehicle propulsion system	TC 22/SC 3	2005
11451-2	Road vehicles -- Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy -- Part 2: Off-vehicle radiation sources	Specifies a vehicle test method for determining the immunity of passenger cars and commercial vehicles to electrical disturbances from off-vehicle radiation sources, regardless of the vehicle propulsion system	TC 22/SC 3	2005
11451-3	Road vehicles -- Electrical disturbances by narrowband radiated electromagnetic energy -- Vehicle test methods -- Part 3: On-board transmitter simulation	Specifies methods for testing the immunity of passenger cars and commercial vehicles to electromagnetic disturbances from on-board transmitters connected to an external antenna and portable transmitters with integral antennas, regardless of the vehicle propulsion system (e.g. spark ignition engine, diesel engine, electric motor).	TC 22/SC 3	2007 / 2014
11451-4	Road vehicles -- Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy -- Part 4: Bulk current injection (BCI)	Specifies bulk current injection (BCI) test methods and procedures for testing the electromagnetic immunity of electronic components for passenger cars and commercial vehicles regardless of the propulsion system	TC 22/SC 3	2006
11452 series	Road vehicles -- Component test methods for electrical disturbances from narrowband radiated electromagnetic energy	There are numerous parts to this standard, please review on the link provided	TC 22/SC 3	various dates
TR 11954	Fuel cell road vehicles -- Maximum speed measurement	Describes test procedures for measuring the maximum road speed of fuel cell passenger cars and light duty trucks which use compressed hydrogen and which are not externally chargeable, in accordance with national or regional standards or legal requirements.	TC 22/SC 21	2008
TR 11955	Hybrid-electric road vehicles -- Guidelines for charge balance measurement	Describes procedures of charge balance measurement to ensure necessary and sufficient accuracy of a fuel consumption test on hybrid-electric vehicles (HEV) with batteries, which is conducted based on ISO 23274.	TC 22/SC 21	2008

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International Organization for Standardization (ISO) – Part 4 of 6

Designation	Title	Description / Scope	Committee	Publication Date Target Date
12405-1	Electrically propelled road vehicles — Test specification for lithium-ion traction battery packs and systems — Part 1: High power applications	Specifies test procedures for lithium-ion battery packs and systems, to be used in electrically propelled road vehicles	TC 22/SC 21	2011
12405-2	Electrically propelled road vehicles -- Test specification for lithium-ion traction battery packs and systems -- Part 2: High energy application	Specifies the tests for high energy battery packs and systems.	TC 22/SC 21	2012
12405-3	Electrically propelled road vehicles - Test specification for Lithium-ion traction battery packs and systems -- Part 3: Safety performance requirements	Specifies test procedures and provides acceptable safety criteria for voltage class B lithium-ion battery packs and systems, to be used as traction batteries in electrically propelled road vehicles.	TC 22/SC 21	2014-01
13064-1	Battery-electric mopeds and motorcycles -- Performance -- Part 1: Reference energy consumption and range	Specifies test procedures for measuring the reference energy consumption and reference range of electric motorcycles and mopeds with only a traction battery(ies) as power source for vehicle propulsion	TC 22/SC 23	2012
13064-2	Battery-electric mopeds and motorcycles -- Performance -- Part 2: Road operating characteristics	Specifies the procedures for measuring the road performance of electric motorcycles and mopeds with only a traction battery(ies) as power source for vehicle propulsion. The road performance comprises road operating characteristics such as speed, acceleration and hill climbing ability	TC 22/SC 23	2012
14001	Environmental management systems - Requirements with guidance for use	Specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects.	TC 207/SC 2	2004
16254	Measurement of minimum noise emitted by road vehicles	A method to measure the minimum noise emission of road vehicles and external sound generation systems intended for the purpose to provide acoustic information to pedestrians.	TC 43/SC1	2014-04
16750-1	Environmental conditions and testing for electrical and electronic equipment – Part 1: General	Applies to electric and electronic systems/components for vehicles. It describes the potential environmental stresses and specifies tests and requirements recommended for the specific mounting location on/in the vehicle.	TC 22/SC 3	2006

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International Organization for Standardization (ISO) – Part 5 of 6

Designation	Title	Description / Scope	Committee	Publication Date Target Date
16750-2	Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 2: Electrical loads	Describes the potential environmental stresses and specifies tests and requirements recommended for the specific mounting location on/in the road vehicle.	TC 22/SC 3	2012
16750-3	Environmental conditions and testing for electrical and electronic equipment – Part 3: Mechanical loads	Describes the potential environmental stresses, and specifies tests and requirements recommended for the specific mounting location on/in the vehicle.	TC 22/SC 3	2012
16750-4	Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 4: Climatic loads	Describes the potential environmental stresses and specifies tests and requirements recommended for the specific mounting location on/in the road vehicle.	TC 22/SC 3	2010
16750-5	ISO 16750-5 Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 5: Chemical loads	Describes the potential environmental stresses and specifies tests and requirements recommended for the specific mounting location on/in the road vehicle.	TC 22/SC 3	2010
18300	Electrically propelled road vehicles -- Specifications for lithium-ion cell and battery coupled with other types of battery and capacitor	specifies classification, definition, designation, test method and requirements for lithium-ion hybrid cell and battery consisted of other type of battery or capacitor for vehicle propulsion. The project defines requirements and test procedures for battery systems in which lithium ion cells are combined with ultracapacitors.	TC 22/SC 21	2016
19092	Financial services -- Biometrics -- Security framework	Describes the security framework for using biometrics for authentication of individuals in financial services. It introduces the types of biometric technologies and addresses issues concerning their application	TC 68/SC2	2008
20653	Road Vehicles – Degrees of Protection (IP-Code) – Protection of electrical equipment against foreign objects, water and access.	Applies to degrees of protection (IP-Code) provided by enclosures of the electrical equipment of road vehicles.	TC 22/SC 3	2006 / 2014-01
23273-1	Fuel cell road vehicles -- Safety specifications -- Part 1: Vehicle functional safety	Specifies the essential requirements for the functional safety of fuel cell (FCV) with respect to hazards to persons and the environment inside and outside of the vehicles caused by the operational characteristics of the fuel cell power system.	TC 22/SC 21	2006
23273-2	Fuel cell road vehicles -- Safety specifications -- Part 2: Protection against hydrogen hazards for vehicles fuelled with compressed hydrogen	Specifies the essential requirements for fuel cell vehicles (FCV) with respect to the protection of persons and the environment inside and outside the vehicle against hydrogen related hazards.	TC 22/SC 21	2006 / 2013

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
23273-3	Fuel cell road vehicles -- Safety specifications -- Part 3: Protection of persons against electric shock	Specifies the essential requirements of fuel cell vehicles (FCV) for the protection of persons and the environment inside and outside the vehicles against electric shock	TC 22/SC 21	2006
23274-1	Hybrid-electric road vehicles — Exhaust emissions and fuel consumption measurements — Part 2: Externally chargeable vehicles	Specifies a chassis dynamometer test procedure to measure the exhaust emissions and the electric energy and fuel consumption for the vehicles.	TC 22/SC 21	2013-07
23274-2	Hybrid-electric road vehicles -- Exhaust emissions and fuel consumption measurements -- Part 2: Externally chargeable vehicles	Applies for the vehicles that are hybrid-electric road vehicles (HEV) with an internal combustion engine (ICE) and the onboard rechargeable energy storage system (RESS) for vehicle propulsion in which electricity is supplied from the stationary external power source;	TC 22/SC 21	2012
26262	Road vehicles -- Functional safety	There are numerous parts to this standard, please review on the link provided	TC 22/SC 3	various dates
62752	In cable control and protective device for mode 2 charging of electric road vehicles -- (IC-RCD)	Applies to In-Cable Control and Protection Device including cables and vehicle connectors for mode 2 power supply of electric road vehicles (hereafter referred to as IC-CPD). This standard applies to portable devices performing simultaneously the functions of detection of the residual current, of comparison of the value of this current with the residual operating value and of opening of the protected circuit when the residual current exceeds this value.	TC 22/SC 21	2014
80416-2	Basic principles for graphical symbols for use on equipment - Part 2: Form and use of arrows	Basic principles and the proportions for arrows used to indicate various elements, forces, functions or dimensions. The arrows defined in ISO 80416-2 are used as graphical symbols or graphical symbol elements. When new symbol originals are created or graphical symbols in current use are revised, the principles established in ISO 80416-2 are applicable.	TC 145/SC 3	2001
80416-4	Basic principles for graphical symbols for use on equipment -- Part 4: Guidelines for the adaptation of graphical symbols for use on screens and displays (icons)	Provides guidelines for the adaptation of graphical symbols for use on screens and displays (icons) on a wide range of equipment, such as photocopiers, vehicle dashboards and home appliances. It also provides principles for maintaining the fidelity of icons to the original graphical symbols.	TC 145/SC 3	2005

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ISO/IEC – Part 1 of 2

Designation	Title	Description / Scope	Committee	Publication Date Target Date
TR 11581-1	Information technology - User interface icons - Part 1: Introduction to and overview of icon standards	Provides developers and other icon standards users with an overview of currently available and future anticipated icon standards.	JTC 1/SC 35	2011
12139-1	Information technology -- Telecommunications and information exchange between systems -- Powerline communication (PLC) -- High speed PLC medium access control (MAC) and physical layer (PHY) -- Part 1: General requirements	Physical and medium access control layer specification with respect to the connectivity for In-home and Access network high speed power line communication stations.	JTC 1/SC 6	2009
15118-1	Road vehicles — Vehicle to grid communication interface Part 1: General information and use-case definition	Specifies the communication between electric vehicles (EV), (this term includes Battery Electric Vehicles as well as Plug-In Hybrid Electric Vehicles) and the electric vehicle supply equipment (EVSE).	TC 22/SC 3	2013-04
15118-2	Road vehicles -- Vehicle to grid Communication Interface -- Part 2: Technical protocol description and open systems interconnections (OSI) requirements	Specifies the communication between battery electric vehicles (BEV) or plug-in hybrid electric vehicles (PHEV) and the Electric Vehicle Supply Equipment (EVSE, also known as charge spot). It covers the overall information exchange between all actors involved in the electrical energy exchange. This International Standard is applicable for (manually) connected conductive charging.	TC 22/SC 3	2013-09
15118-3	Road vehicles -- Vehicle to grid Communication Interface -- Part 3: Physical and data link layer requirements	Specifies the physical and data link layer for a high level communication, directly between battery electric vehicles (BEV) or plug-in hybrid electric vehicles (PHEV), and the fixed electrical charging installation (Electric Vehicle Supply Equipment (EVSE)), used in addition to the Basic Signaling, as described in IEC 61851. It covers the overall information exchange between all actors involved in the electrical energy exchange.	TC 22/SC 3	2013-12
15118-4	Road vehicles -- Vehicle to grid communication interface -- Part 4: Network and application protocol conformance test	Specify test cases to be applied to and correctly handled by EVs (EVCC) and EVSEs (SECC) implementing ISO/IEC15118-2	TC 22/SC 3	2015

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ISO/IEC – Part 2 of 2

Designation	Title	Description / Scope	Committee	Publication Date Target Date
15118-5	Road vehicles -- Vehicle to grid communication interface -- Part 5: Physical layer and data link layer conformance test	Specify test cases to be applied to and correctly handled by EVs (EVCC) and EVSEs (SECC) implementing ISO/IEC15118-3	TC 22/SC 3	2015
PAS 16898	Electrically propelled road vehicles -- Dimensions and designation of secondary lithium-ion cells	Specifies a designation system as well as the shapes and dimensions for secondary lithium-ion cells for integration into battery packs and systems used in electrically propelled road vehicles including the position of the terminals and any over-pressure safety device (OPSD). It is related to cylindrical, prismatic and pouch cells.	TC 22/SC 21	2012 / 2013-03
17409 Ed. 1.0	Electrically propelled road vehicles - Connection to an external electric power supply - Safety requirements	Specifies electric safety requirements for conductive connection of electrically propelled road vehicles to an external electric power supply	IEC/TC 69, ISO/TC 22/SC 21	2014-07
27001	Information technology -- Security techniques -- Information security management systems -- Requirements	Specifies the requirements for establishing, implementing, operating, monitoring, reviewing, maintaining and improving a documented Information Security Management System within the context of the organization's overall business risks. It specifies requirements for the implementation of security controls customized to the needs of individual organizations or parts thereof.	JTC 1/SC 27	2005 / 2013
Guide 74	Graphical symbols - Technical guidelines for the consideration of consumers' needs	ISO/IEC Guide 74:2004 gives procedures for the development of graphical symbols for public information, use in safety signs and product safety labels, and use on equipment and products.	COPOLCO	2004

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
2000-05-0356	Design and Safety Considerations for Automated Battery Exchange Electric Vehicles	The exchange of the energy storage unit from an electric vehicle is considered an alternative to in-vehicle battery charging. If the exchange process is mechanically assisted or automated, the exchange can potentially be accomplished in much less time than that required for in-vehicle charging. Many means for accomplishing battery exchange have been proposed or attempted, with various degrees of success, from the late 1800's through the present. In recent years, battery exchange methods have not been embraced by the electric vehicle industry, in deference to fast in-vehicle battery charging. Only a small number of semi-automated mechanizations have actually been demonstrated.		2000
J240	Life Test for Automotive Storage Batteries	This life test simulates automotive service when the battery operates in a voltage regulated charging system	Battery Standards Starter Battery Committee	2012
J537	Storage Batteries	Serves as a guide for testing procedures of automotive 12 V storage batteries and as a publication providing information on container hold down configuration and terminal geometry.	Battery Standards Starter Battery Committee	2011
J551-1	Performance Levels and Methods of Measurement of Electromagnetic Compatibility of Vehicles, Boats (up to 15 m) and Machines (16.6 Hz to 18 GHz)	Covers the measurement of radio frequency radiated emissions and immunity. Each part details the requirements for a specific type of electromagnetic compatibility (EMC) test and the applicable frequency range of the test method.	Electromagnetic Compatibility (Emc) Standards	2010
J551-5	Performance Levels and Methods of Measurement of Magnetic and Electric Field Strength from Electric Vehicles, Broadband, 9 kHz to 30 MHz	Covers the measurement of magnetic and electric field strengths over the frequency range 9 kHz to 30 MHz and conducted emissions over the frequency range of 450 kHz to 30 MHz.	Electromagnetic Compatibility (Emc) Standards	2012
J1113 series	EMC measurements	There are numerous parts to this standard, please review on the link provided	Electromagnetic Compatibility (Emc) Standards	various dates

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J1495	Test Procedure for Battery Flame Retardant Venting Systems	Details procedures for testing lead-acid SLI (starting, lighting, and ignition), Heavy-Duty, EV (electric vehicle) and RV (recreational vehicle) batteries to determine the effectiveness of the battery venting system to retard the propagation of an externally ignited flame of battery gas into the interior of the battery where an explosive mixture is usually present.	Battery Standards Starter Battery Committee	2012
J1634	Battery Electric Vehicle Energy Consumption and Range Test Procedure	Establishes uniform procedures for testing battery electric vehicles (BEV's) which are capable of being operated on public and private roads. The procedure applies only to vehicles using batteries as their sole source of power.	Light Duty Vehicle Performance And Economy Measure Committee	2012
J1654	High Voltage Primary Cable	Covers cable intended for use at a nominal system voltage higher than those in SAE J1127, SAE J1128, or SAE J1560 but less than or equal to 600 V rms. It is intended for use in surface vehicle electrical systems.	Cable Standards Committee	2012
J1673	High Voltage Wiring	Covers the design and application of primary on-board wiring distribution system harnesses to road vehicles	Electrical Distribution Systems Steering Committee	2012
J1711	Recommended Practice for Measuring the Exhaust Emissions and Fuel Economy of Hybrid-Electric Vehicles, Including Plug-in Hybrid Vehicles	Provides instructions for measuring and calculating the exhaust emissions and fuel economy of HEV's driven on the Urban Dynamometer Driving Schedule (UDDS) and the Highway Fuel Economy Driving Schedule (HFEDS), as well as the exhaust emissions of HEVs driven on the US06 Driving Schedule (US06) and the SC03 Driving Schedule (SC03).	Hybrid Committee	2010
J1715	Hybrid Electric Vehicle (HEV) & Electric Vehicle (EV) Terminology	Contains definitions for HEV and EV terminology. It is intended that this document be a resource for those writing other HEV and EV documents, specifications, standards, or recommended practices.	Hybrid Committee	2008
1718	Measurement of Hydrogen Gas Emission from Battery-Powered Passenger Cars and Light Trucks During Battery Charging	Describes a procedure for measuring gaseous hydrogen emissions from the aqueous battery system of a battery-powered passenger car or light truck. The purpose of this procedure is to determine what concentrations of hydrogen gas an electric vehicle together with its charger will generate while being charged in a residential garage.	Hybrid Committee	1997

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J1739	Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Design FMEA)	Assists users in the identification and mitigation of risk by providing appropriate terms, requirements, ranking charts, and worksheets.	Automotive Quality And Process Improvement Committee	2009
J1742	Connections for High Voltage On-Board Road Vehicle Electrical Wiring Harnesses - Test Methods and General Performance Requirements	Covers performance testing at all phases of development, production, and field analysis of electrical terminals, connectors, and components that constitute the electrical connection systems in high power (20 V to 600 V and/or >80 A) road vehicle applications	Connector Systems Standards Committee	2010
J1766	Recommended Practice for Electric and Hybrid Electric Vehicle Battery Systems Crash Integrity Testing	Defines test methods and performance criteria which evaluate battery system spillage, battery retention, and electrical system isolation in Electric and Hybrid Electric Vehicles during specified crash tests.	Fuel Cell Standards Committee	2005
J1772 TM	SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler	This SAE Recommended Practice covers the general physical, electrical, functional and performance requirements to facilitate conductive charging of EV/PHEV vehicles in North America	Hybrid Committee	2012
J1773	Electric Vehicle Inductively Coupled Charging	Establishes the minimum interface compatibility requirements for electric vehicle (EV) inductively coupled charging for North America.	Hybrid Committee	2009
J1797	Recommended Practice for Packaging of Electric Vehicle Battery	Provides for common battery designs through the description of dimensions, termination, retention, venting system, and other features required in an electric vehicle application.	Battery Size Standardization Committee	2008
J1798	Recommended Practice for Performance Rating of Electric Vehicle	Provides for common test and verification methods to determine Electric Vehicle battery module performance.	Battery Standards Testing Committee	2008
J1850	Class B Data Communications Network Interface	Establishes the requirements for a Class B Data Communication Network Interface applicable to all On- and Off-Road Land-Based Vehicles	Vehicle Architecture For Data Communications Standards	2006

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J2183	60 V and 600 V Single-Core Cables	Specifies the test methods, dimensions, and requirements for single-core 60 V cables intended for use in road vehicle applications where the nominal system voltage is 60 V DC (25 V AC). It also specifies additional test methods and/or requirements for 600 V cables intended for use in road vehicle applications where the nominal system voltage is > 60 V DC (25 V AC) to 600 V DC (600 V AC).	Cable Standards Committee	2012
J2185	Life Test for Heavy-Duty Storage Batteries	Applies to 12 V storage batteries which operate in a voltage regulated charging system.	Battery Standards Starter Battery Committee	2012
J2288	Life Cycle Testing of Electric Vehicle Battery Modules	Defines a standardized test method to determine the expected service life, in cycles, of electric vehicle battery modules.	Battery Standards Testing Committee	2008
J2289	Vehicle Sound Measurement at Low Speeds	Describes common practices for design of battery systems for vehicles that utilize a rechargeable battery to provide or recover all or some traction energy for an electric drive system.	Battery Standards Testing Committee	2008
J2293/1	Energy Transfer System for Electric Vehicles-- Part 1: Functional Requirements and System Architectures	Establishes requirements for Electric Vehicles (EV) and the off-board Electric Vehicle Supply Equipment (EVSE) used to transfer electrical energy to an EV from an Electric Utility Power System (Utility) in North America	Hybrid Committee	2008
J2293/2	Energy Transfer System for Electric Vehicles - Part 2: Communication Requirements and Network Architecture	Establishes requirements for Electric Vehicles (EV) and the off-board Electric Vehicle Supply Equipment (EVSE) used to transfer electrical energy to an EV from an electric Utility Power System (Utility) in North America	Hybrid Committee	2008
J2344	Guidelines for Electric Vehicle Safety	Identifies and defines the preferred technical guidelines relating to safety for Electric Vehicles (EVs) during normal operation and charging.	Hybrid Committee	2010
J2380	Vibration Testing of Electric Vehicle Batteries	Describes the vibration durability testing of a single battery (test unit) consisting of either an electric vehicle battery module or an electric vehicle battery pack.	Battery Standards Testing Committee	2009

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J2464	Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing	Describes a body of tests which may be used as needed for abuse testing of electric or hybrid electric vehicle batteries to determine the response of such batteries to conditions or events which are beyond their normal operating range.	Battery Standards Testing Committee	2009
J2497	Power Line Carrier Communications for Commercial Vehicles	Defines a method for implementing a bidirectional, serial communications link over the vehicle power supply line among modules containing microcomputers. This document defines those parameters of the serial link that relate primarily to hardware and software compatibility such as interface requirements, system protocol, and message format that pertain to Power Line Communications (PLC) between Tractors and Trailers.	Truck And Bus Low Speed Communication Network Committee	2012
J2501	Round, Screened and Unscreened, 60 V and 600 V Multi-Core Sheathed Cables	Specifies basic and high performance test methods and requirements for round, unscreened, multicore sheathed cables intended for use in road vehicle applications.	Cable Standards Committee	2012
J2572	Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fuelled by Compressed Gaseous Hydrogen	Establishes uniform procedures for testing fuel cell and hybrid fuel cell electric vehicles, excluding low speed vehicles, designed primarily for operation on the public streets, road and highways.	Fuel Cell Standards Committee	2008
J2711	Determination of the Maximum Available Power from a Rechargeable Energy Storage System on a Hybrid Electric Vehicle	Establishes an accurate, uniform and reproducible procedure for simulating use of heavy-duty hybrid- electric vehicles (HEVs) and conventional vehicles on dynamometers for the purpose of measuring emissions and fuel economy.	Truck And Bus Advanced And Hybrid Powertrain Steering Cmte.	2002
J2735	Dedicated Short Range Communications (DSRC) Message Set Dictionary	Specifies a message set, and its data frames and data elements specifically for use by applications intended to utilize the 5.9 GHz Dedicated Short Range Communications for Wireless Access in Vehicular Environments (DSRC/WAVE, referenced in this document simply as 'DSRC'), communications systems.	DSRC (Dedicated Short Range Communication) Tech Cmte.	2009
J2758	Determination of the Maximum Available Power from a Rechargeable Energy Storage System on a Hybrid Electric Vehicle	Describes a test procedure for rating peak power of the Rechargeable Energy Storage System (RESS) used in a combustion engine Hybrid Electric Vehicle (HEV).	Battery Standards Testing Committee	2007

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J2801	Comprehensive Life Test for 12 V Automotive Storage Batteries	This life test is considered to be comprehensive in terms of battery manufacturing technology; applicable to lead-acid batteries containing wrought or cast positive grid manufacturing technology and providing a reasonable correlation for hot climate applications.	Battery Standards Starter Battery Committee	2007
J2836/1 TM V1	Use Cases for Communication Between Plug-in Vehicles and the Utility Grid	This SAE Information Report establishes use cases for communication between plug-in electric vehicles and the electric power grid, for energy transfer and other applications.	Hybrid Committee	2010-04
J2836/2 TM V1	Use Cases for Communication between Plug-in Vehicles and the Supply Equipment (EVSE)TM	This SAE Information Report J2836/2 TM establishes use cases and general information for communication between plug-in electric vehicles and the DC Off-board charger.	Hybrid committee	2011-09
J2836/3 TM V1	Use Cases for Plug-in Vehicle Communication as a Distributed Energy Resource	This SAE Information Report establishes use cases for a Plug-in Electric Vehicle (PEV) communicating with an Energy Management System (EMS) as a Distributed Energy Resource (DER).	Hybrid committee	2013-01
J2836/4 TM V1	Use Cases for Diagnostic Communication for Plug-in Vehicles	This SAE Information Report establishes diagnostic use cases between plug-in electric vehicles and the EV Supply Equipment (EVSE).	Hybrid Committee	2014
J2836/5 TM V1	Use Cases for Communication between Plug-in Vehicles and their customers	This SAE Information Report J2836/5 TM establishes use cases between Plug-In Vehicles (PEV) and their customer.	Hybrid committee	2014
J2836/6 TM V1	Use Cases for Wireless Charging Communication for Plug-in Electric Vehicles	This SAE Information Report SAE J2836-6 establishes use cases for communication between plug-in electric vehicles and the EVSE, for wireless energy transfer as specified in SAE J2954.	Hybrid Committee	2013-05
J2841	Utility Factor Definitions for Plug-In Hybrid Electric Vehicles Using Travel Survey Data	Establishes a 'Utility Factor' (UF) curve and the method of generating these curves. The UF is used when combining test results from battery charge-depleting and charge-sustaining modes of a Plug-in Hybrid Electric Vehicle (PHEV).	Hybrid Committee	2010
J2847/1 V4	Communication for Smart Charging of Plug-in Electric Vehicles using Smart Energy Profile 2.0	This document describes the details of the Smart Energy Profile 2.0 (SEP2.0) communication used to implement the functionality described in the SAE J2836/1 TM use cases	Hybrid committee	2013-11
J2847/2 V2	Communication between Plug-in Vehicles and Off-Board DC Chargers	This SAE Recommended Practice establishes requirements and specifications for communication between plug-in electric vehicles and the DC Off-board charger.	Hybrid Committee	2012-08 / 2014
J2847/3 V1	Communication for Plug-in Vehicles as a Distributed Energy Resource	This document applies to a Plug-in Electric Vehicle (PEV) which is equipped with an onboard inverter and communicates using the Smart Energy Profile 2.0 Application Protocol (SEP2).	Hybrid Committee	2013

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J2847/4 V1	Diagnostic Communication for Plug-in Vehicles	This SAE Recommended Practice J2847/4 establishes the communication requirements for diagnostics between plug-in electric vehicles and the EV Supply Equipment (EVSE) for charge or discharge sessions	Hybrid Committee	2014
J2847/5 V1	Communication between Plug-in Vehicles and Their Customers	This SAE Recommended Practice J2847/5 establishes the communication requirements between plug-in electric vehicles and their customers for charge or discharge sessions.	Hybrid Committee	2014
J2847/6 V1	Wireless Charging Communication between Plug-in Electric Vehicles and the Utility Grid	This SAE Recommended Practice J2847/6 establishes signals and messages for communication between plug-in electric vehicles and the electric power grid, for wireless energy transfer.	Hybrid Committee	2014
J2889-1	Measurement of Minimum Noise Emitted by Road Vehicles	Provides a method to measure the minimum noise emission of road vehicles and external sound generation systems intended for the purpose to provide acoustic information to pedestrians.	Safety And Human Factors Steering Committee	2012
J2894/1	Power Quality Requirements for Plug In Vehicle Chargers - Part 1: Requirements	Develop a recommended practice based on EPRI's TR-109023 EV Charging Equipment Operational Recommendations for Power Quality that will enable vehicle manufacturers, charging equipment manufacturers, electric utilities and others to make reasonable design decisions regarding power quality	Hybrid Committee	2011
J2894/2	Power Quality Requirements for Plug In Vehicle Chargers - Part 2: Test Methods	The document will enable vehicle manufacturers, charging equipment manufacturers, electric utilities and others to make reasonable design decisions regarding power quality that are technically feasible and cost effective to implement.	Hybrid Committee	2013-06
J2910	Design and Test of Hybrid Electric Trucks and Buses for Electrical Safety	Covers the aspects of the design and test of class 4 through 8 hybrid electric trucks and buses.	Truck And Bus Hybrid Safety Committee	2013
J2929	Safety Standard for Electric and Hybrid Vehicle Propulsion Battery Systems Utilizing Lithium-based Rechargeable Cells	Defines a minimum set of acceptable safety criteria for a lithium-based rechargeable battery system to be considered for use in a vehicle propulsion application as an energy storage system connected to a high voltage power train	Battery Standards Testing Committee	2013
J2931/1 V2	Digital Communications for Plug-in Electric Vehicles	This SAE Information Report SAE J2931 establishes the requirements for digital communication between Plug-in Vehicles (PEV), the Electric Vehicle Supply Equipment (EVSE) and the utility or service provider, Energy Services Interface (ESI), Advanced Metering Infrastructure (AMI) and Home Area Network (HAN).	Hybrid Committee	2012-09

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J2931/2	Inband Signaling Communication for Plug-in Electric Vehicles	Establishes the requirements for physical layer communications using Inband Signaling between Plug-In Vehicles (PEV) and the EVSE.	Hybrid Committee	2014
J2931/3	PLC Communication for Plug-in Electric Vehicles	Establishes the requirements for physical layer communications using Power Line Carrier (PLC) between Plug-In Vehicles (PEV) and the EVSE.	Hybrid Committee	2014
J2931/4 V1	Broadband PLC Communication for Plug-in Electric Vehicles	This SAE Technical Information Report SAE J2931/4 establishes the specifications for physical and data-link layer communications using broadband Power Line Communications (PLC) between the Plug-In Vehicle (PEV) and the Electric Vehicle Supply Equipment (EVSE) DC off-board-charger.	Hybrid Committee	2012-07 / 2014
J2931/5 V1	Telematics Smart Grid Communications between Customers, Plug-In Electric Vehicles (PEV), Energy Service Providers (ESP) and Home Area Networks (HAN)	This SAE Recommended Practice J2931/5 establishes the security requirements for digital communication between Plug-In Electric Vehicles (PEV), the Electric Vehicle Supply Equipment (EVSE) and the utility, ESI, Advanced Metering Infrastructure (AMI) and/or Home Area Network (HAN).	Hybrid Committee	2014
J2931/6 V1	Digital Communication for Wireless Charging Plug-in Electric Vehicles	This SAE Recommended Practice J2931/6 establishes the digital communication protocol requirements for wireless charging between Plug-In Vehicles (PEV), the Electric Vehicle Supply Equipment (EVSE) and the utility, ESI, Advanced Metering Infrastructure (AMI) and/or Home Area Network (HAN).	Hybrid Committee	2014
J2931/7 V1	Security for Plug-in Electric Vehicle Communications	Develop and document the functional and technical requirements for a standard telematics application programming interface that facilitates two way communications between the PEV telematics service provider and the Energy Services Provider.	Hybrid Committee	2014
J2936	Vehicle Battery Labeling Guidelines	This SAE Recommended Practice provides for labeling guidelines for any electrical storage device at all levels of sub-component, component, subsystem and system level architectures describing content, placement and durability requirements of labels.	Battery Standards Labeling Committee	2012
J2946	Battery Electronic Fuel Gauging Recommended Practices	Covers the recommended practices associated with reporting the vehicle's (hybrid and pure electric) battery pack performance details to the automobile user.	Battery Standards Electronic Fuel Gauge Committee	2013

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
J2950	Recommended Practices (RP) for Transportation and Handling of Automotive-type Rechargeable Energy Storage Systems (RESS)	Covers the recommended practices associated with identification, handling, and shipping of un-installed RESSs to/from specified locations (types) required for the appropriate disposition of new and used items	Battery Transportation Committee	2012
J2953/1 V1	Plug-In Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)	This SAE Recommended Practice J2953/1 establishes requirements and specification by which a specific Plug-In Electric Vehicle (PEV) and Electric Vehicle Supply Equipment (EVSE) pair can be considered interoperable	Hybrid Committee	2013-10 / 2014
J2953/2 V1	Test Procedures for the Plug-In Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)	This SAE Recommended Practice SAE J2953/2 establishes the test procedures to ensure the interoperability of Plug-In Vehicles (PEV) and Electric Vehicle Supply Equipment (EVSE) for multiple suppliers.	Hybrid Committee	2014 / 2014
J2954	Wireless Charging of Electric and Plug-in Hybrid Vehicles	Establishes minimum performance and safety criteria for wireless charging of electric and plug-in vehicles	Hybrid Committee	2015
J2974	Technical Information Report on Automotive Battery Recycling	Provides information on Automotive Battery Recycling. This document provides a compilation of current recycling definitions, technologies and flow sheets and their application to different battery chemistries.	Battery Standards Recycling Committee	2013-12
J2984	Identification of Transportation Battery Systems for Recycling Recommended Practice	Intended to support the proper and efficient recycling of rechargeable battery systems used in transportation applications with a maximum voltage greater than 12V (including SLI batteries). Other battery systems such as non-rechargeable batteries, batteries contained in electronics, and telecom/utility batteries are not considered in the development of this specification.	Battery Standards Recycling Committee	2012 / 2013-06
J2990	Hybrid and EV First and Second Responder Recommended Practice	This RP aims to describe the potential consequences associated with hazards from xEVs and suggest common procedures to help protect emergency responders, tow and/or recovery, storage, repair, and salvage personnel after an incident has occurred with an electrified vehicle. Industry design standards and tools were studied and where appropriate, suggested for responsible organizations to implement	Hybrid - EV Committee	2012
J3009	Stranded Energy -- Reporting and Extraction from Vehicle Electrochemical Storage Systems	The intent of this document is to consider the type of information reported by the battery management system (BMS) and recommended discharge level dependent on a collision or vehicle fire. The document does not describe how the energy should be extracted.	Battery Standards Electronic Fuel Gauge Committee	

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
50E	Enclosures for Electrical Equipment, Environmental Considerations	This standard applies to enclosures for electrical equipment intended to be installed and used in non-hazardous locations	Enclosures for Electrical Equipment	2007
62	Flexible Cords and Cables	This Standard covers electric vehicle cable constructed as described in, and Listed for use in accordance with Article 400 of ANSI/NFPA 70, "National Electrical Code." The cable is used to supply power, signal, and control to electric vehicles during the charging process. Electric vehicle cable consists of two or more insulated conductors, with or without grounding conductors, with an overall jacket.	Cords and Fixture Wire	2010
355	Cord Reels	These requirements cover cord reels for general use, as well as cord reels - herein referred to as special-use cord reels - intended to be mounted on or in electrical utilization equipment such as appliances, portable lamps, or similar equipment.	Cord Reels	2004
458A	Safety of Power Converters/Inverters for Electric Land Vehicles	Covers power converters and power inverters intended for use in electric vehicles.	Power Converters/Inverters and Power Converter/Inverter Systems for Land Vehicles and Marine Crafts	2006
991	Tests for Safety-Related Controls Employing Solid-State Devices	These requirements apply to controls that employ solid-state devices and are intended for specified safety-related protective functions	Safety-Related Controls Employing Solid-State Devices	2004
1004-1	Safety of On-board Electric Vehicle Equipment Traction Motors	Used to evaluate both motors intended to be field installed as well as those intended to be factory installed.	Motors	2008
1642	Safety of Lithium-Ion Batteries – Testing	These requirements cover primary (non-rechargeable) and secondary (rechargeable) lithium batteries for use as power sources in products.	Lithium, Household and Commercial Batteries	2012

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
1703	Standard for Flat-Plate Photovoltaic Modules and Panels	The standard for safety of photovoltaic (PV) equipment, addresses safety of PV modules		2002
1741	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy	These requirements cover inverters, converters, charge controllers, and interconnection system equipment (ISE) intended for use in stand-alone (not grid-connected) or utility-interactive (grid-connected) power systems.	Inverters, Converters, and Controllers for Use in Independent Power Systems	2010
1998	Standards for software in programmable components	These requirements apply to non-networked embedded microprocessor software whose failure is capable of resulting in a risk of fire, electric shock, or injury to persons.	Software	1998
2202	Safety of Electric Vehicle (EV) Charging System Equipment	Covers charging system equipment, either conductive or inductive, intended for use with electric vehicles.	Electric Vehicle Charging System Equipment	2009
NMX-J-668/1-ANCE / CSA C22.2 No. 281.1 / UL 2231-1	Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements	Covers devices and systems intended for use in accordance with the electrical codes of Canada, Mexico and the United States to reduce the risk of electric shock to the user from accessible parts, in grounded or isolated circuits for charging electric vehicles.		2012
NMX-J-668/2-ANCE / CSA C22.2 No. 281.2 / UL 2231-2	Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems	Intended to be read together with NMX-J-668/1-ANCE / CSA C22.2 No. 281.1 / UL 2231-1 Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements, UL 2231-1. The requirements of NMX-J-668/1-ANCE / CSA C22.2 No. 281.1 / UL 2231-1 apply unless modified by this standard.		2012
NMX-J-678-ANCE/CSA C22.2 No. 282-13/UL 2251	Standard for Plugs, Receptacles, and Couplers for Electric Vehicles	Covers plugs, receptacles, vehicle inlets, vehicle connectors, and breakaway couplings, rated up to 800 amperes and up to 600 volts ac or dc, intended for conductive connection systems, for use with electric vehicles. These devices are for use in either indoor or outdoor nonhazardous locations in accordance with the electrical codes of Canada, Mexico and the United States.		2013
2271	Batteries and Battery Packs for Use in Light Electric Vehicles	These requirements cover nickel, lithium ion and lithium ion polymer batteries and battery packs for use in light electric vehicles (LEVs) as defined in this standard.	Batteries for Use in Electric Vehicles	2010

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Designation	Title	Description / Scope	Committee	Publication Date Target Date
2580	Batteries for Use in Electric Vehicles	This standard evaluates the cells, cell modules and battery pack's ability to safely withstand simulated abuse conditions	Batteries for Use in Electric Vehicles	2011
NMX-J-677-ANCE/CSA C22.2 NO. 280-13/UL 2594	Standard for Electric Vehicle Supply Equipment	Covers conductive electric vehicle (EV) supply equipment with a primary source voltage of 600 V ac or less, with a frequency of 60 Hz, and intended to provide ac power to an electric vehicle with an on-board charging unit. This Standard covers electric vehicle supply equipment intended for use where ventilation is not required.		2013
2733	Surface Vehicle and On-Board Cable	Covers the requirements for single conductor cables for use in on-board surface vehicles.		2010
2734	Safety of Connectors for Use with On-Board Electrical Vehicle (EV) Charging Systems	Covers component connectors intended to interconnect both communication and power-circuit conductors rated up to 30 A and up to 600 V ac or dc within an on-board electric vehicle charging system.		2011
2735	Electric Utility (Smart) Meters	Covers electric utility meters which measure, monitor, record, transmit, or receive electrical energy generation or consumption information. Meters covered by this outline of investigation may be provided with one or two-way communication, by means of power line carrier signals, telephone, cable, wireless communication, or other methods. These meters may be intended to be used as a standalone device or as part of an overall system such as an electric vehicle charging station.		2010
2748	Electric Vehicle Power Supplies	Covers power supplies originally evaluated to the regular power supply standard that are intended to be installed permanently on a vehicle		2011
2750	Wireless Charging Systems for Electric Vehicles	Covers wireless charging systems consisting of a power unit, a primary coil and a secondary coil (on board)		2012