



SAE INTERNATIONAL – INDUSTRY & STANDARDS

Dante Rahdar



2003

Year founded

Not-for-profit

**Aerospace, Land-based,
Multi-sector
Vehicle, and Data-intensive**

**Industry conferences,
consortia program
administration.**



1905

Year founded

Not-for-profit

**Land-based and Aerospace,
Multi Mobility Sectors
(Vehicle/Commercial/Micro)**

**Develop the highest quality technical
standards and drive innovation through
products, people, and processes.**



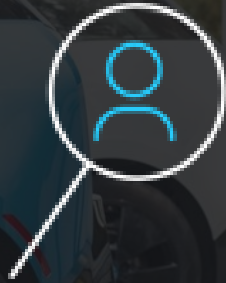
1990

Year founded

Not-for-profit

**Aerospace, and
Medical Device Industries
Management system auditing
and
certification**

Brief Industry Overview



Overview

- **Auto executives are more optimistic than in 2021 about the prospects for long-term, profitable growth. Eighty-three percent are confident of higher profits over the next five years, compared with 53 percent in 2021 (KPMG)**
- **New automotive/mobility age “High-Tech”**
 - **Sustainability – Circ. Economy**
 - **Environment (Global Climate)**
 - **Safety**
- **Regulatory/governments**
- **GEO political climate:**
 - **Raw Materials**
 - **Vulnerable supply Chain**



Global Industry Challenge's / Drivers -Influencers



Industry Focus:

- **Environment – Decarbonization**
 - EV / Hybrid Technology
 - Battery Tech / Traceability – “Battery Passport”
 - Alternative Propulsion i.e., Hydrogen
 - infrastructure
- **Safety**
 - ADAS / Automated / Connected Car / V2X
 - Infrastructure
 - Micromobility

Standards in Today's Mobility Revolution





MISSION: *To advance mobility knowledge and solutions for the **benefit of humanity***



NEUTRAL FORUMS

Address society's mobility needs



RESOURCES

Engineering resources to advance mobility



EDUCATION

STEM programs and professional courses, building the workforce



COMMUNITY

Global community pulling from each other's collective wisdom



STANDARDS

Consensus-based standards that advance quality, safety and innovation

ROLES IN INDUSTRY:

Professional Association, SDO, Publisher, STEM Educator, Professional Workforce Development, Knowledge & Networking Resource

118 Years of Advancing Mobility Internationally

SAEI 200,000+
members & volunteers

90 Countries
42 Sections
115 Student Chapters



118 Years
Ground Vehicle
Standards

2900+
Companies

11,000+
Participants

200,000+
Members



59+
Countries

9212
GGVS Published
Standards
1900+ Actively
Maintained

580+
Active WIPs

564
Committees

Standards?

Standards enable industry to advance technology to meet ambitious environmental and safety targets.

SAE develops voluntary consensus standards, which are standards developed or adopted by voluntary consensus standards bodies, domestic (national), regional, and international.

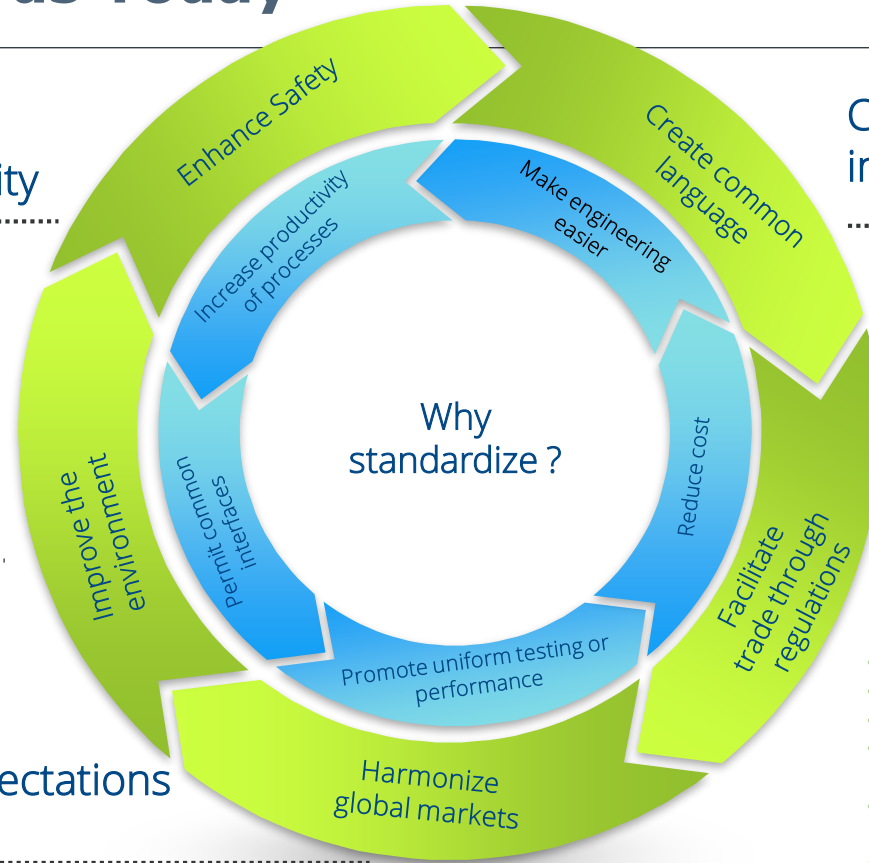
SAE International is the world's leading authority in mobility standards development.

Role of Standards Today

Consistent product quality

Regulatory compliance foundation

Consistent and clear expectations for product performance



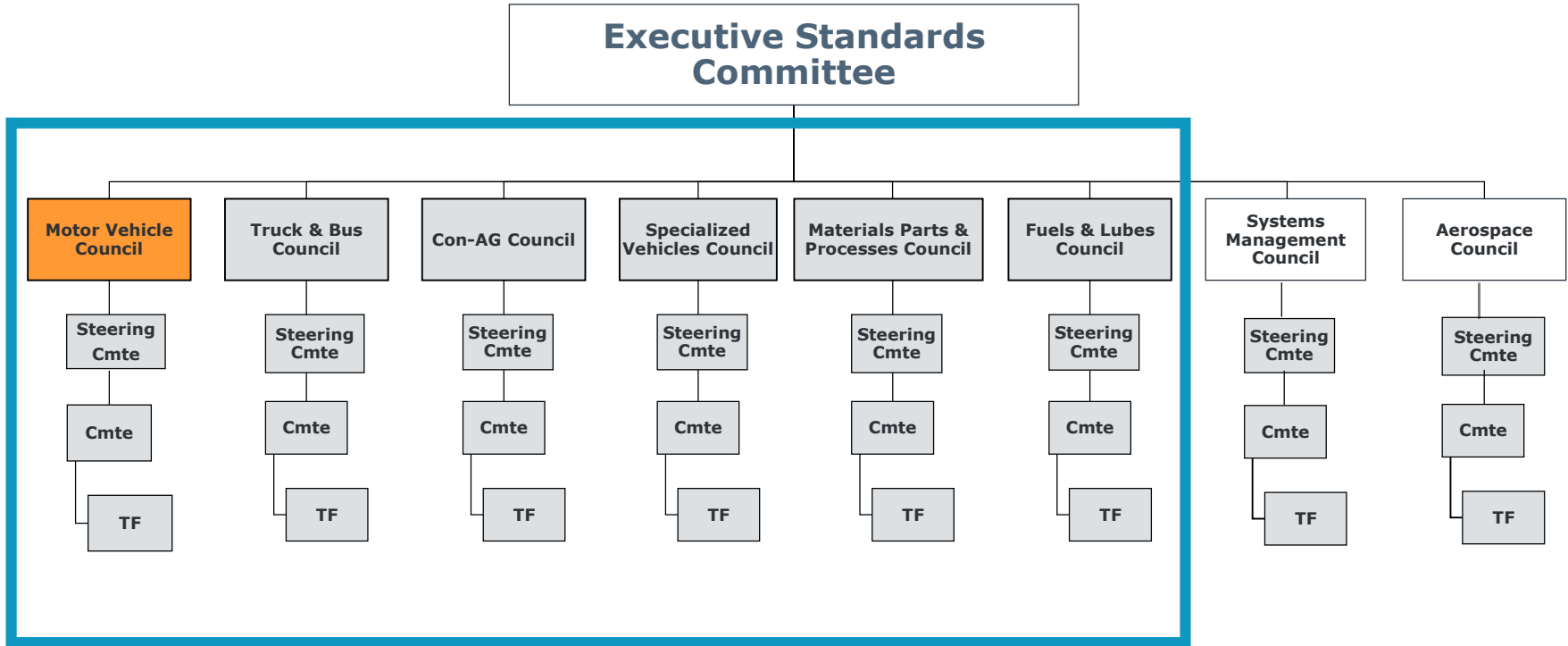
Compatibility and interoperability

More efficient procurement

- **Low**ers trade barriers
- **Low**ers purchasing costs
- **Decre**ases design time
- **In**creases new technology speed to market
- **Prom**otes innovation and fosters competition
- **Adv**ances the collective technology of industry

<https://www.sae.org/>

Global Ground Vehicle Standards Structure



Convening Government and Industry



SAE Government, Industry and Special Interest Collaboration

- Local, state, provincial, US, bilateral, and multi-lateral focused liaison with legislative, executive/ministerial, & judicial branches.
- Global: Technical participation at United Nations and specialized agencies in all ground vehicle / road safety, environment, and open trade forums.
 - Inland Transport Commission (WP.1 & .29), International Telecommunications Union, World Trade Organization
- Delegate to the Asia Pacific Economic Cooperation Automotive Dialog & Gulf States Cooperation Council (Vehicle) Standards Organization
- Liaison with other international non-government, standards development organizations, motorsports, trade, & consumer associations: IMSA, FIA, IEC, IIHS, ADAC, IEEE, ISO, AUTOSAR, Euro NCAP, APEC, OICA, CLEPA, CITA, AAMVA, ...
- Government Funded & Voluntary Projects & Tasks



1,000+ SAE Standards

currently cited in international regulations



232
SAE Standards



87
SAE Standards



42
SAE Standards



40
SAE Standards



21
SAE Standards



24
SAE Standards



3
SAE Standards



1
SAE Standards



1
SAE Standards



402
SAE Standards



150
SAE Standards



60
SAE Standards

| ICAO

Emerging High-Tech Product Focus



Advanced Technology Focus Areas



Mobility for Elderly and Persons with Disabilities



Driver-Vehicle Interface



Driving Automation Systems



EV/Hybrid/FC Vehicle
& Battery



Active & Passive Safety



Functional Safety

Advanced Technology Focus Areas



Wireless Charging



Electronics System Reliability



Vehicle Electronics Cyber Security



Connected Vehicles

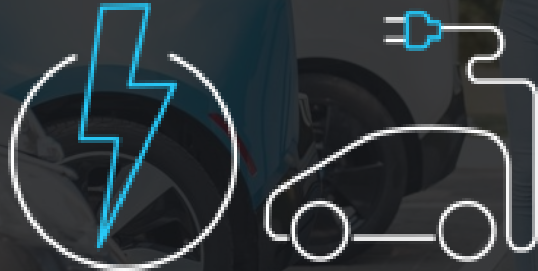


Micro & Shared Mobility

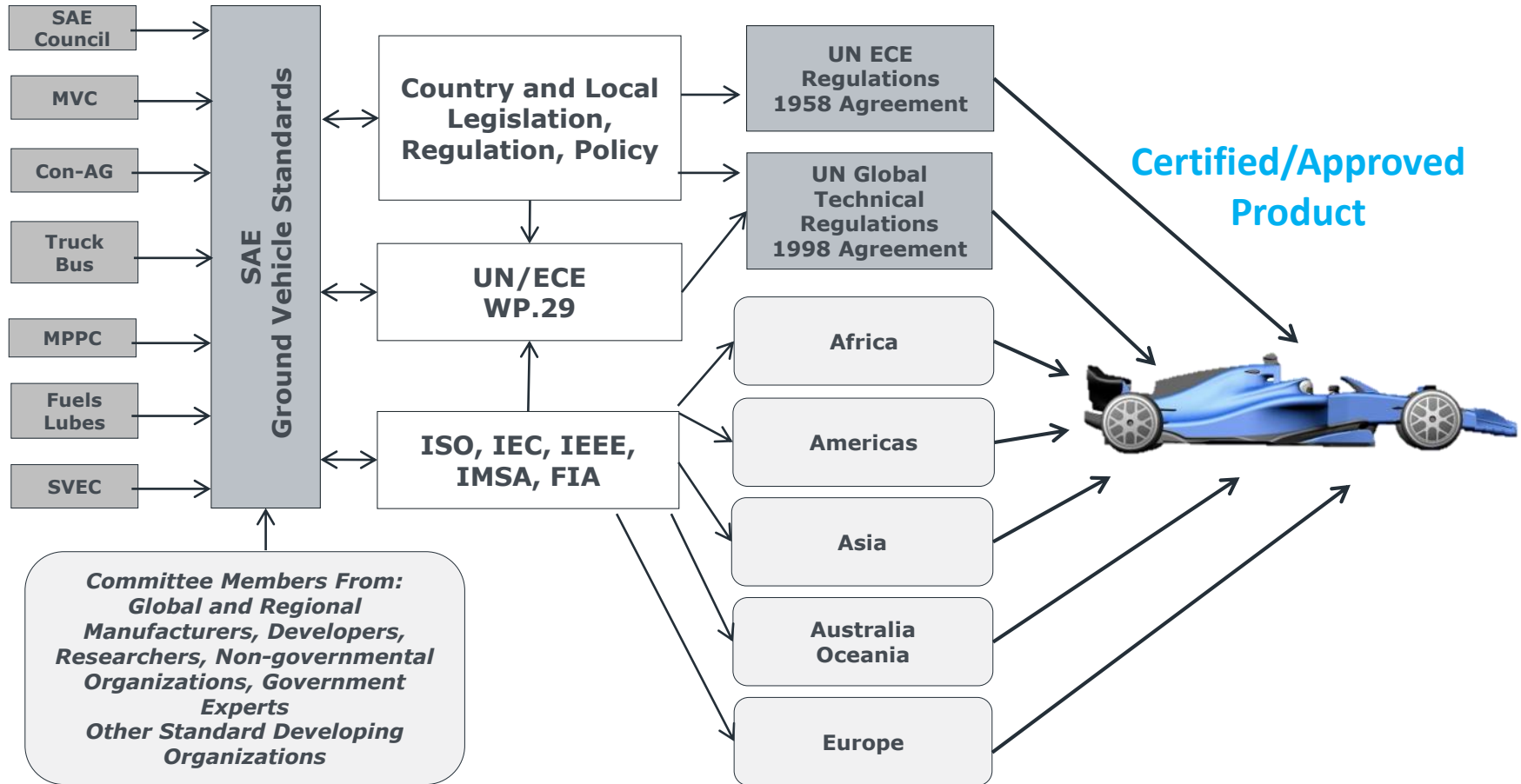


Intelligent Transport Systems

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



SAE Standards – Product Impact & Incorporation



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



98 SAE EV, Hybrid, and Fuel Cell Vehicle Published Documents

Mobility, Advanced™



Fuel Cell Fueling: J2600, J2601, J2601/1, J2601/2, J2601/3, J2601/4, J2601/5, J2719, J2719/1, J2799, J1766, J2578, J2579

Fuel Cell Testing: J2615, J2616, J2617, J3219

Fuel Cell Systems: J2579, J2594, J3089

EV Battery Recycling/Secondary Use: J2984, J2974, J3071, J2997

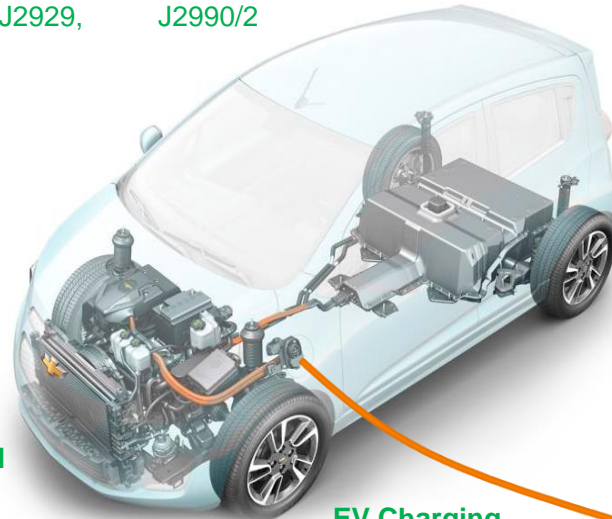
Energy Transfer Systems: J2293, J2293/1, J3072

EV, Hybrid, Fuel Cell Vehicle Safety: J1766, J2344, J2910, J2578, 3108, J3108/1, J3235, J2950, J3325, J2929, J2464

Battery Testing: J1798, J1798/1, J2288, J2289, J2380, J2758, J3220, J3277

EV, Hybrid, Fuel Cell Vehicle Terminology: J1715, J1715/2, J2574, J2760

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



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

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

EV Charging & Grid Communications:

J1772, J1773, J2293, J2836, J2841, J2847, J2894, J2931, J2954, J3068, J3105, J3105-1, J3105-2, J3105-3, J2799, J3271, J3400, J3400/1

<https://standardsworks.sae.org/standards-committees/hybrid-ev-committee>

<https://standardsworks.sae.org/standards-committees/fuel-cell-standards-committee>

<https://standardsworks.sae.org/standards-committees/vehicle-battery-standards-steering-committee>

SAE EV, Hybrid, Fuel Cell Vehicle Std's 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** - EV Labels to Assist First and Second Responders, and Others (high voltage safety info.)
- **J3108/1** - Standard Four-Letter Coding as an Identification Method for Alternative Fuel Vehicles
- **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_2024 (9th Revision)

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

- Auto OEMs supported moving to higher power levels for charging (9th 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



Status: Published

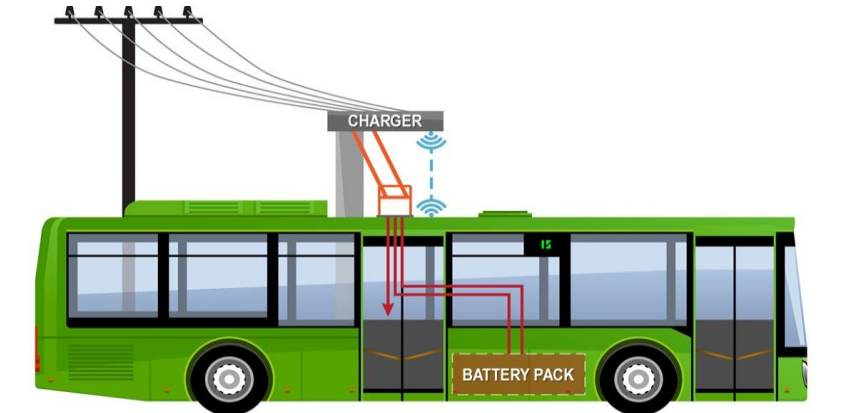
SAE J3400 – NACS Charging

- J3400 Status: TIR (Technical Information Report) Published December 19th, 2023.
- RP (Recommended practice WIP opened in the next gateway of developing the standard. Published in September of 2024.
- J3400 / 1: Adaptor's / coupler for 1772/J3400 chargers launched in Q4.



SAE J3105 Overhead & Portal Charging

- SAE J3105 Automated charging connection at high power
 - Document will standardize the interface between the infrastructure and the bus
 - Targeted towards in-route DC charging
 - DC Power Levels (Voltage Range: 250-1,000 DC Volts) up to 1MW
- SAE J3105/1 Electric Vehicle Power Transfer System Using Conductive Automated Connection Devices including Infrastructure-Mounted Pantograph (Cross-Rail) Connection
- SAE J3105/2 Vehicle Mounted Pantograph



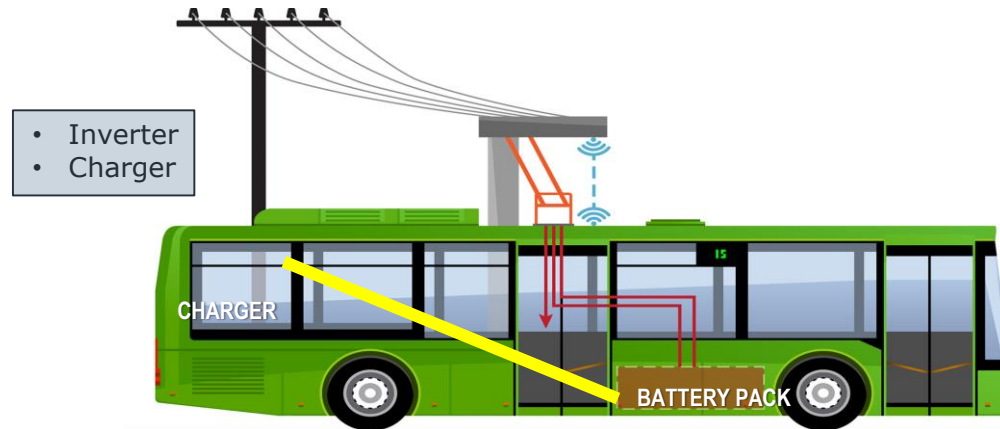
- **DC Power Levels**
- **Power Configurations**
- **Connection Points**
- **Communications**
- **Safety**
- **Alignment Protocol**

SAE J3068 AC Depot Conductive Charging

Depot Charging - 3 Phase AC (J3068) 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 3 ϕ = 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 J3068 3 phase AC



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



SAE J2954 Standard Development

- Inductive Charging Interoperability
- Automated Charging
- Power Transfer Communications
- Smart Grid Interoperability
- Automatic Shutdown Capability
- Automated Valet Parking / Charging

SAE J2954 Published
October 2020
Revised August 2024

Charging Locations:

Residential
Public
On-Road
Parking lots
Curb side

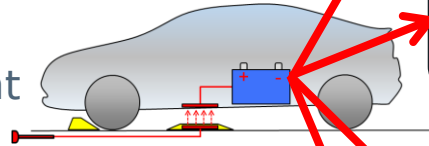
Key aspects:

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

SAE J2954 Task Force Testing Protocols

SAE Standard will Define:

- Performance
- Safety
- Testing Methodologies
- Charge Levels
- Location & Alignment
- Communications



SAE J2954 WPT Power Classes			
WPT1	WPT2	WPT3	WPT4
3.7 kW	7.7kW	11 kW	22 kW

EM Field

Performance

Durability

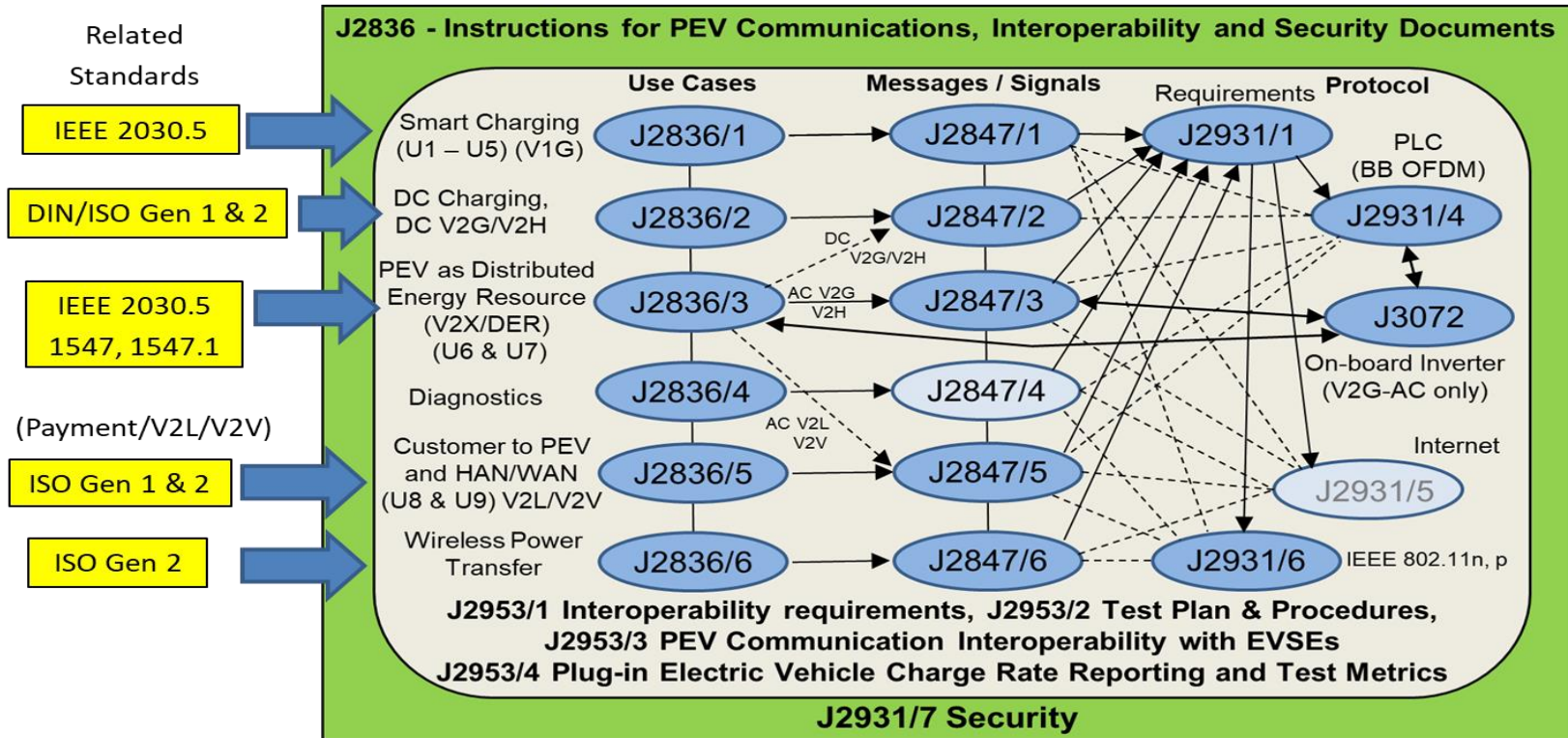
Safety

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 EV Charging Communication Standards

SAE Plug-In Electric Vehicle Grid Communication Standards



➤ Series of Standards defining Use Cases, Information Messages and Communication formats

Battery Standards Steering Committee and Technical Committees

- **Started – 2009**
- **Committee Membership**
 - >715 Individual Participants
 - >160 Companies
 - OEM's
 - Suppliers
 - Government
 - Academia
- **28 Subcommittees**

NEW COMMITTEES

- 25) Management Systems
- 26) Battery Pack Venting
- 27) Advanced Battery Concepts
- 28) Vehicle Platform Power Management

COMPONENTS & MATERIALS

23) Battery Systems Adhesives-Sealants-Heat Transfer Materials

21) Battery Thermal Management

19) Battery Systems Connectors

14) Battery Materials Testing

SUPPORT

4) Battery Transport

12) Battery Testing Equipment

13) Battery Terminology

3) Battery Labeling



LIFE MANAGEMENT

10) Battery Recycling

18) Battery Field Discharge & Disconnect

15) Secondary Use

11) Global Traceability

PRODUCT SPECIFIC

2) Battery Standards Testing

1) Battery Safety

16) Start-Stop Battery

17) Capacitive Energy Storage

9) Future Energy Storage Systems

5) Battery Size Standardization

6) Starter Battery

8) Electronic Fuel Gauge

INDUSTRY SPECIFIC

7) Truck Battery

26) Micro-mobility Battery

22) Bus Battery

2) CONAG

SAE Low-Speed Micromobility Devices Committee



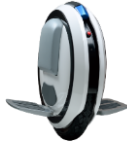
Electric Kick
Scooter



Electric
Skateboard



Segway



Electric Self-
Balancing
Unicycles

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.

The SAE Micromobility Battery Committee focuses specifically on battery and charging needs.

This committee focuses on low-speed personal, vocational, and delivery mobility devices and the technologies and systems that support them. These may be device-propelled or have propulsion assistance.



Find the “Right” EV Battery Cell for your Needs

Late launches, costly recalls, and uncompetitive batteries: billion-dollar mistakes for automakers

Mobility, Advanced™

For the engineers, finding and sourcing the “right” EV battery that meets the standards is a labyrinth.

New Platform Update: SAE is developing an [online platform to help battery engineers](#) overcome the challenges of sourcing EV battery cells. Engineers will be able to effortlessly search and access detailed specifications, enabling organizations to [save time and resources](#) while sourcing accurate cell information — allowing them to stay focused on innovation and design.

Benefits:

- [Reduce time spent](#) in sourcing the “right” EV cell with powerful, filter-based searches, advanced comparison, and an easy-to-use intuitive interface.
- Access detailed technical & regulatory specifications for [950+ cells](#) available from [80+ global cell suppliers](#) on the market.
- Gain a [competitive edge](#) by ensuring cells meet stringent performance requirements, using up-to-date, accurate information available quickly.
- [Streamline compliance](#) by ensuring key safety requirements and standards are met, with pre-validated, accurate information available through an enterprise platform.

Features:

- Effortlessly [search and filter](#) through cells by multiple key parameters through an intuitive user interface.
- [Compare](#) multiple EV cells side-by-side to make an informed decision to suit your program needs.
- Access detailed battery cell specifications and [data sheets](#) from suppliers, along with additional sources of critical information to streamline your decision-making.

Call for Action: The platform is currently under development and we are actively [looking for participants](#) willing to provide us feedback in exchange of a limited-time access to the Beta platform in late Q4 2024/early Q1 2025. If you are interested, please drop in an email with your name and contact details to:

Poojan.Chokshi@sae.org (Poojan Chokshi | Senior Product Manager | SAE International)



Thank you for your
time and attention.
Please contact me if
you'd like to get
involved regarding
SAE's standards
development
process.

Dante Rahdar

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Manager

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