

SAE's Fuel Cell Vehicle Standards Activities – Current Status

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Adelphi, Maryland**

SAE Fuel Cell Standards Forum

Chairman: Ron Sims, SAE Staffer: Jane Lewis

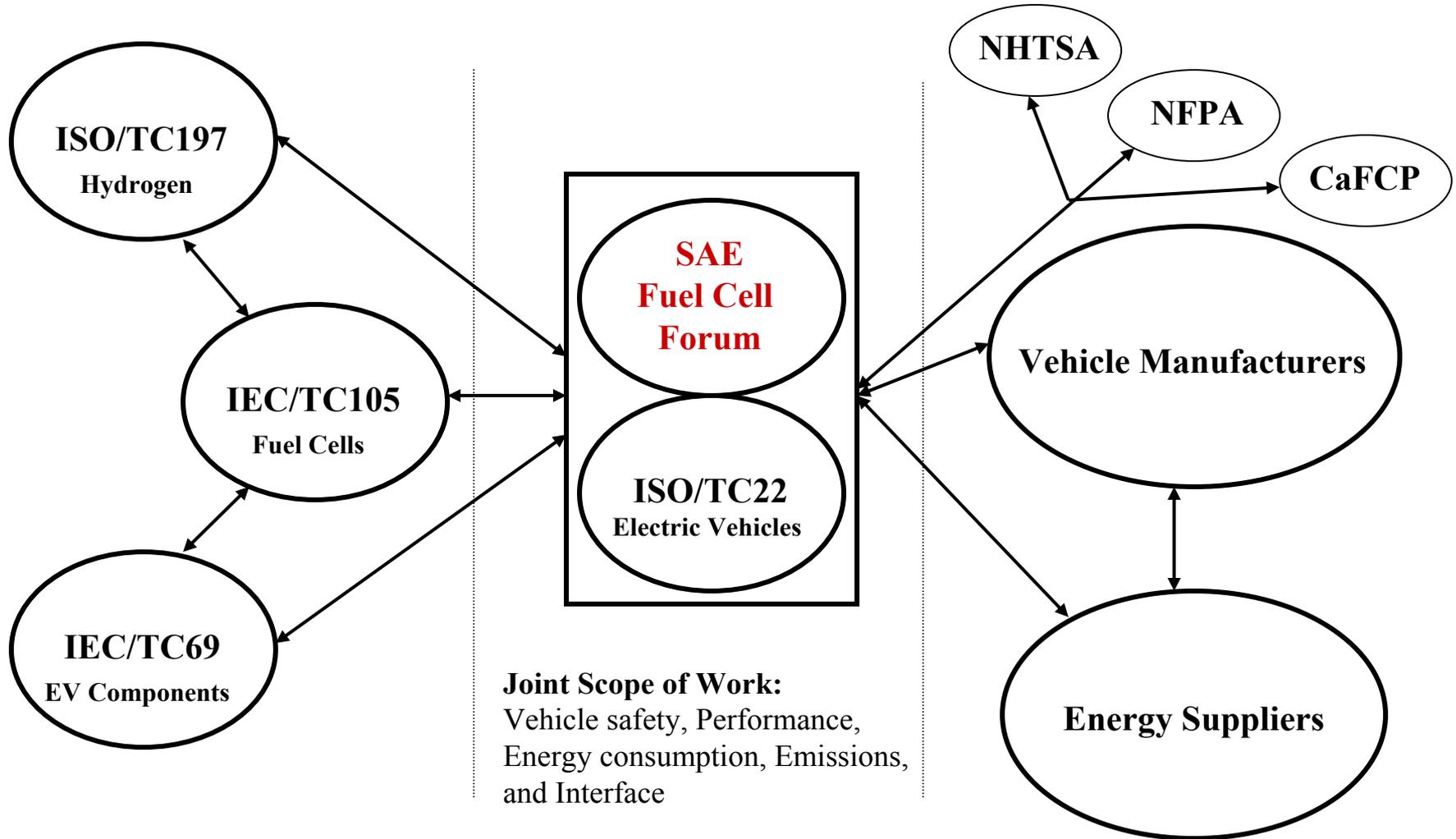
Committee & Working Groups meet monthly at SAE, Troy

Working Groups:

- **Safety (G. Scheffler, UTFC)**
- **Fuel Economy & Emissions (E.Kulik, Ford)**
- **Performance & Reliability (S. Hirano, Ford)**
- **Recyclability (S. Pappasava, GM)**
- **Fueling Interface (F. Niezabytowski, Ford)**
- **Terminology – currently passive**

Mobility Industry Representation to IEC/TC105 US TAG

FCEV Industry Standards Interface



SAE FCEV Standards – Current Status

Standards Published during 2002:

J2574: FCEV Terminology

J2600: Compressed Hydrogen Refueling Connection Devices

J2578: General FCEV Safety

Recommended Practice Awaiting Publication:

J2594: Recyclability of FC Systems

Standard just Balloted:

J2616: Performance – Fuel Processor Subsystem Testing

Standards Awaiting Ballot:

J2572: Hydrogen FCEV Fuel Economy Measurement

J2615: Performance – Fuel Cell System Testing

J2617: Performance – Fuel Cell Stack Testing

SAE FCEV Standards – Current Status

Continued

Standards Targeted for Autumn Ballot:

J2579: FCEV Fuel System Safety

J2601: Refueling Communication Device/Protocol

New Standard Project Group:

Hydrogen Purity Specification

SAE FCEV C&S Work Groups:

Liaison & Support of NFPA Codes 52/57 Rewrite

Liaison with NHTSA on FMVSSs for H₂ Vehicles

Proposed Collaboration with CaFCP

SAE FCEV Standards – Testing, Validation, and R&D Needs

1. Vehicle Refueling Interface (J2600/J2601) Development & Validation

- **Development of vehicle-side prototype hardware**
- **Development of station-side hardware**
- **Development of testing requirements to validate interface system**
- **Construction of specialized test fixtures and chambers**
- **Conduct laboratory bench top testing of individual components.**

SAE FCEV Standards – Testing, Validation, and R&D Needs

1. Vehicle Refueling Interface (J2600/J2601) Development & Validation Continued . . .

- **Installation of prototypes in OEM vehicles.**
- **Installation and integration of prototype hardware in fueling stations including integration with compressed hydrogen refueling nozzles & vehicle receptacles in an intrinsically safe environment (Class 1 Division 2 Group B).**
- **Execution of vehicle level testing.**
- **Real-world tests at a Hydrogen Refueling Station.**
- **Demonstrate/validate the communication system.**

SAE FCEV Standards – Testing, Validation, and R&D Needs

2. Vehicle Fuel Consumption (J2572)

Test Procedure Verification

- Third party lab testing.
- Verification of fuel correction factor.

3. Vehicle Recyclability (J2594)

Recommended Practice Validation

- OEM Workshop appraisal.
- Verification of design practice.

SAE FCEV Standards – Testing, Validation, and R&D Needs

- 4. FCEV General Safety (J2578)**
- 5. Hydrogen Fuel System Safety (J2579)**
- 6. Fuel Cell System Performance Testing (J2615)**
- 7. Fuel Processor Performance Testing (J2616)**
- 8. Fuel Cell Stack Performance Testing (J2617)**

Test Procedure Verification

- Third party lab testing.**
- Revisions to test methods and calculation of results.**

Backup Information – Standards Summaries

Fuel Cell Vehicle Terminology

SAE Information Report – **J2574**

- **Scope**
- **Applicable Documents**
- **Basic Fuel Cell Description**
- **Fuel Cell Vehicle Terminology**
 - ✓ **Fuel Cell Types**
 - ✓ **Fuels**
 - ✓ **Fuel Cell Components**
 - ✓ **Fuel Cell Systems**
 - ✓ **Fuel Cell Vehicle Systems**
 - ✓ **Infrastructure**

General Fuel Cell Vehicle Safety - **SAE J2578**

- **GUIDELINES FOR DESIGN AND CONSTRUCTION**
 - General Vehicle Safety
 - Fuel System Safety
 - Fuel Cell System Safety
 - Electrical System System
 - Mechanical Safety
 - Fail-Safe Procedures
 - Safety Labeling
- **OPERATION**
 - Operating Manual
 - Fuel Gauges
 - Fuel Releases During Normal Operation
- **EMERGENCY PROCEDURES**
- **MAINTENANCE**

Fuel Systems Safety in H₂ Fueled Vehicles

SAE J2579

- **DESIGN AND CONSTRUCTION**
 - General Mechanical Requirements
 - Fuel Storage
 - Safety Relief Devices
 - Fuel Shutoffs
 - Excess Flow Valves and Flow Limiters
 - Pressure Regulators
 - Fueling Connections
 - Design of Fuel Exhausts and Vents of Vehicles
 - Gas Detectors
 - Management of Potential Ignition Sources
 - Fault Monitoring and Warning
 - Marking and Labeling
- **OPERATION**
- **EMERGENCY PROCEDURES**
- **MAINTENANCE**

Compressed Hydrogen Vehicle Fueling Connection Devices – **SAE J 2600**

- **Common geometry of fuelling receptacle selected (Weh geometry, currently being used by CaFCP).**
- **Pressure levels considered by geometry coding: 250 bar, 350 bar and 700 bar.**
- **Safe interconnectibility of different pressure levels.**
- **J2600 submitted to ISO.**

Compressed Hydrogen Vehicle Fueling Communication Devices – **SAE J2601**

- **Vehicle/Refueling station wireless communication targeted for safety enhancement and achievement of a 100% fast fill (< 3 min)**
- **Vehicle or vehicle/station control of the refueling process is proposed**
- **CNG Vehicle refueling as default with no communication**
- **Optional strategy: no communication, slow underfill**
- **Request for Design Proposals from suppliers**

Recommended Practice for Measuring the Fuel Consumption & Range of Fuel Cell Vehicles – **SAE J2572**

- **Scope**
- **References**
- **Test Conditions & Instrumentation**
- **Required Data**
- **Test Cycles**
- **Vehicle Consumption Determination**
- **Vehicle Range Determination**

Fuel Cell System Performance Testing – SAE J2615

- **Facilities & Test Equipment**
- **Description of Performance Parameters & Required Measurement Accuracy**
- **Scope & Limitations of Test Procedures**
- **Pre-Test Conditions**
- **Test Procedures**
- **Data Acquisitions & Calculations**
- **Reporting of Test Results**

Fuel Processor Subsystem Performance Testing – **SAE J2616**

- **Scope of Test**
- **Facilities & Test Equipment**
- **Description of Performance Parameters & Required Measurement Accuracy**
- **Scope & Limitations of Test Procedures**
- **Pre-Test Conditions**
- **Test Procedures**
- **Data Acquisitions**
- **Computation of Subsystem Parameters**
- **Reporting of Test Results**

Fuel Cell Stack Subsystem Performance Testing – SAE J2617

- **Scope of Test**
- **Facilities & Test Equipment**
- **Description of Performance Parameters & Required Measurement Accuracy**
- **Purity of Stack Inputs e.g. Fuel & Water**
- **Pre-Test Conditions**
- **Test Procedures: Polarization Measurement, Anode/Cathode Stoichiometries, Power Profiles, and Stack Temp.**
- **Computation of Subsystem Parameters**
- **Reporting of Test Results**

PEM Fuel Cell System Recyclability Design Guidelines – SAE J2594

- **Scope**
- **Background: Vehicle Recyclability Calculations**
- **Design for Disassembly**
- **Design for Recyclability Guidelines**
- **Fuel Cell System Recyclability/Sustainability Aspects**
- **Subsystems: Fuel Storage, Fuel Processor, & Stack**
- **End-of-Life Environmental Issues**