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Status Summary
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Purpose

The purpose of this document is to identify and provide an update on the status of development of codes and standards for fuel cells in the United States and within the IEC and ISO.

Scope

The information on the status of codes and standards provided in the matrix covers stationary fuel cell applications as well as non-stationary fuel cell applications (e.g. portable and vehicular).

TITLE AND CONTACT	STATUS	DESCRIPTION
ANSI Z 21.83-1998 Fuel Cell Power Plants (to become ANSI/CSA FC 1) Steven E. Kazubski Project Manager, Standards CSA International 8501 E. Pleasant Valley Rd. Cleveland, OH 44131-5575 216-524-4990 x 8303 steve.kazubski@csa-international.org www.csa-international.org	At their April 17-18, 2002 meeting, the CSA America Fuel Cell Technical Advisory Committee prepared final proposed revisions to the Standard on *Fuel Cell Power Plants, ANSI Z21.83*, in preparation of the standard going out for ballot to a CSA America Fuel Cell Canvass. As part of the proposed revisions, the standard is now being revised to more adequately cover more types of fuel cells and the fuels that they will utilize. When approved, the next edition of ANSI Z21.83 will be renumbered ANSI/CSA FC 1. As to date, four CSA America fuel cell standards projects have been initiated with ANSI: ▪ CSA FC 1, Fuel Cell Power Plants (revise and re-designation of ANSI Z21.83-1998), *project is active*	ANSI Z 21.83 applies to packaged, self-contained or factory matched packages of integrated systems of fuel cell power plants for use with natural or LP gas and having a maximum output voltage of 600 VAC and power output of 1,000 kW operating at no less than –20F (-29C). Criteria are provided for both construction and performance of applicable fuel cell power plants. For construction the following are addressed: • Materials • General construction and assembly • Enclosures and associated construction • Heaters and vessels • Piping systems • Drain, venting, and ventilation exhaust systems • Automatic ignition systems and gas-air control • Flame safeguards • Fuel gas controls and equipment • Air/fluid handling and moving equipment • Electrical equipment and wiring • Protection of service personnel • Safety circuit analysis • Instructions and marking

ANSI Z 21.83-1998 Fuel Cell Power Plants (cont.)	▪ CSA FC 2, Residential Fuel Cell Power Generators (new standard) which is now part of CSA FC 1 above, *anticipated future project* ▪ CSA FC 3, Portable Fuel Cell Power Generators (new standard), *project is active* ▪ CSA FC 4, Fuel Cell Modules (new standard), *anticipated future project* The CSA Fuel Cell Technical Advisory Committee, chaired by Kelvin Hecht, that covers CSA FC 1 and CSA FC 3 met April 17 to 19, 2002 in Las Vegas. A draft of CSA FC 1 is to be released for public review after the April 2002 meeting. Proposed changes to the CSA FC 1 draft were solicited from the advisory committee in advance of the April 2002 meeting. A synopsis of changes considered is provided in the third column. At the April meeting the draft was further revised and drafting of additional text assigned. With the completion of that text and some staff editing the document should be ready for a canvass vote in the near future. After public review of the draft later this year it is hoped that CSA FC 1 can be approved and published.	For performance, issues such as ultimate strength, allowable leakage, protection, emissions, burner operation, automatic ignition, exhaust gas and surface and component temperatures, electrical tests, rain and wind, and adhesion/legibility of markings are addressed. Revisions to ANSI Z 21.83 being considered in CSA FC 1 include the following (which will be subject to an upcoming public review and comment): • Revisions to the scope to reference more fuel sources and increase the size of power plants within the scope of the standard • Additional guidance on fuel cell enclosures • Performance guidance on materials used in fuel cell power plants • Addition of reference standards for certain components in the power plant • Referring to the energy source for the power plant as fuel instead of fuel gas or gas • Addition of provisions to cover catalytic fuel oxidation • Allowing a percentage of LFL to be used as an automatic ignition shutdown in lieu of a set shutdown time period • Addition of provisions for fuel pumps • Added provisions for a users information manual that is to accompany the power plant • Included consideration of liquid fuels throughout the standard • Added more specific criteria to cover when automatic shutdown is to occur by anomaly and fuel cell type • Reduced the wind speed governing design from 40 mph to 31 mph • Considered adding requirements for Electrical Insulation (Clause 2.9) and Electrical Strength (Clause 5.2) from CSA C22.2 No. 60950-00 Information Technology (also UL 60950-00 and IEC 60950) • Enhanced provisions governing enclosures of all types of materials • Inclusion of additional criteria governing venting and exhaust of indoor power plant installations • Enhancement of criteria covering assembling and installing integrated systems of the power plant to prevent hazards associated with flammable atmosphere accumulations within the power plant or its surroundings

CSA CAS No.33 (CSA Component Acceptance Service No. 33 for PEM Fuel Cell Modules) Todd Strothers CSA International Manager, Charlotte Office 5970 Fairview Road #416 Charlotte, NC 28210 (704) 552-5125 todd.strothers@csa-international.org www.csa-international.org	This is a 'Component Acceptance' document and not a 'Requirements' document, as a fuel cell module is not an appliance but only a component. Published September 20, 2000, this document is currently being used by the U.S. and Canadian CSA Certification and Testing Departments for listing Fuel Cell Modules. This document will be used as a seed document for the creation of a U.S and Canadian national standard for *Fuel Cell Modules, ANSI/CSA FC 4*. To order or submit comments contact Bill Shao at bill.shao@csa-international.org	This document contains requirements for providing CSA International component acceptance service for Proton Exchange Membrane (PEM) fuel cell stacks (modules) using hydrogen as the fuel source. The end product in which the fuel cell stack will be incorporated must be evaluated to additional requirements. Contents: Definitions - Cell reversal - Fuel cell - Fuel cell stack - Maximum operating pressure - Allowable working pressure Monitoring Systems - Temperature monitoring - Voltage monitoring - Gas leakage rate Verifications and tests - Specification verification - Gas leakage rate - Ultimate strength - Pressure withstanding test of cooling system - Abnormal test - Dielectric strength - Vibration - Marking
CSA U.S. Requirements No. 1.01, Residential Fuel Cell Power Generators Todd Strothers CSA International Manager, Charlotte Office 5970 Fairview Road #416 Charlotte, NC 28210 (704) 552-5125 todd.strothers@csa-international.org www.csa-international.org Order from Dena Stilla 216-524-4990 x 8263	This supplemental guide to ANSI Z21.83-1998 mirrors much of the proposed coverage that the CSA Fuel Cell Working Group has been developing for updating the Z21.83 standard as such coverage pertains to residential fuel cell power generators. As it will take time for the next version of ANSI Z21.83 to be approved as CSA FC 1. In the interim CSA is issuing this supplemental standard to better provide coverage for residential fuel cells. As ANSI Z21.83 has yet to be fully approved in Canada, this CSA Requirements document is being developed only for the U.S. at this time. Used in conjunction with ANSI Z21.83, CSA FC 1 contains additional markings and manual requirements for	CSA U.S. Requirements No. 1.01 supplements the provisions contained in ANSI Z21.83-1998. This document applies to packaged, self-contained residential fuel cell power generators for outdoor installation. The document defines a residential fuel cell power generator as a unit serving a single family or two family dwelling not exceeding 50 kW in total AC power output. Light commercial installations such as professional offices, shops, etc. which can be adequately powered by units not exceeding 50kW are also to be considered residential applications. Provisions are listed for a user's information manual and appliance markings. When certifying a residential fuel cell power generator design, CSA will use ANSI Z21.83-1998 and the CSA U.S. Requirements No. 1.01 as a supplemental standard. Once ANSI Z21.83-1998 is updated with specific provisions for residential fuel cells or

CSA U.S. Requirements No. 1.01, Residential Fuel Cell Power Generators (cont.)	residential applications. When complete CSA FC 1 will cover residential fuel cell power plants and eliminate the need for CSA U.S. Requirements No. 1.01	CSA FC 1 is developed and approved as an ANSI standard, CSA U.S. Requirements No. 1.01 will be withdrawn.
CSA Requirements No. 3.01, Portable Fuel Cell Appliances (to be revised as CSA FC 3) Todd Strothers CSA International Manager, Charlotte Office 5970 Fairview Road #416 Charlotte, NC 28210 (704) 552-5125 todd.strothers@csa-international.org www.csa-international.org	A preliminary draft of CSA Requirements No. 3.01 was made available for public review on August 20, 2001. Comments were due by September 24, 2001. A November 1, 2001 draft was circulated and a CSA portable working group on CSA FC 3 has been having discussions on the draft via conference calls. When completed, this document will be used as a seed document for the creation of a U.S and Canadian national standard for *Portable Fuel Cell Power Generators, ANSI/CSA FC 3*. A draft of CSA 3 has been prepared and was discussed during a February 12, 2002 conference call with a March 1, 2002 follow up conference call. A meeting of the technical committee was held April 19, 2002 in Las Vegas with a revised draft available in advance of that meeting. At that meeting additional work was done on a draft standard. A follow up conference call is scheduled for June 6, 2002 where specific text assignments are to be discussed. With this input and some staff editing the document should be available for a canvass vote in the near future.	It is the intent that this joint U.S. and Canadian standard will cover portable fuel cell power generators that incorporate various fuel cell technologies. CSA 3 applies to ac and dc type portable fuel cell power generators (covered in Parts III and subsequent Parts), with a rated output voltage not exceeding 600 V, for commercial, industrial, and residential indoor and outdoor use in non-hazardous locations, in accordance with the Rules of the *Canadian Electrical Code, Part I, or the National Electric Code ANSI/NFPA 70, as appropriate*
CSA Requirement No. 5.99 U.S., Hydrogen Generators CSA International Dena Stilla 216-524-4990 x 8263	Published July 2001. Comments can be made to Robert DeRemer, chair of the CSA US Requirements Committee at bob.deremer@csa-international.org	
NFPA 853, Standard for the Installation of Stationary Fuel Cell Power Plants Richard P. Bielen, PE NFPA International 1 Batterymarch Park	NFPA 853 was developed over a 3-year period and was completed in May 2000. The standard is available from the NFPA. The next revision of the standard will	The scope of the standard is the design, construction, and installation of stationary (non-portable) fuel cell power plants with a gross electrical generation that exceeds 50 kW; including (1) A singular prepackaged, self-contained power plant unit (2) Any combination of prepackaged,

Quincy, MA 02669 617-770-3000 rbielen@nfpa.org www.nfpa.org Mr. Donald Drewry (Chair of Task Group on Fuel Cells) Hartford Steam Boiler don_drewry@hsb.com	be completed by May 2003. The committee accepted public proposals until December 28, 2001 and met in February 2002 to consider proposals that were submitted in addition to input from the committee. The standard is proposed for revision to increase the scope to include units below 50 kW capacity. A meeting to discuss this issue, public comment and task group input was held January 23 and 24, 2002 to develop materials for presentation to the 853 Committee at their meeting February 19 to 21, 2002. The NFPA Committee on Electric Generating Plants met February 19 to 21, 2002 to consider changes to NFPA 853 proposed for the 2003 NFPA change cycle. The task group on fuel cells met on February 19 with the full committee meeting February 20 and 21. Proposed changes must be accepted by the committee (ballot was due April 9, 2002) with public comment on those changes accepted by the committee conducted between July and October 2002. A meeting of the committee has been scheduled for November 21 and 22, 2002 to review the public comments received. Final voting on the revised version of NFPA 853 will occur in at the NFPA annual meeting in May 2003.	self-contained power plant units (3) Power plant units comprised of two or more factory matched modular components intended to be assembled in the field and (4) Engineered and field-constructed power plants that employ Fuel cells. Chapter 2 provides a description of various configurations of fuel cells, to which various criteria are applied. These configurations include pre-packaged self-contained, pre-engineered, and engineered and field constructed fuel cell power plants. Chapter 3 provides criteria related to the siting of fuel cells in all locations as well as specific indoor, outdoor, and rooftop installations and interconnections with other building systems. Chapter 4 covers fuel supplies including natural gas, LPG, biogas, fuel oil, and hydrogen. Chapter 5 addresses ventilation and exhaust of the installation. Chapter 6 covers fire protection. Chapter 7 lists other referenced publications. These include other NFPA standards, ANSI Z21.83, and certain ASME pressure and process piping standards. Proposals to revise NFPA 853 include: • Change in terminology from fuel cell power plants to fuel cell power systems • Restructuring the document to follow the 2000 NFPA Style Manual • Increase the scope to include units less that 50 kW (the current minimum scope limit) • Add a definition of portable fuel cells and exclude them from the standard • Revise the scope of fuel sources covered to be consistent with CSA FC1 revisions (e.g. all fuels not just natural and LP gas) • Require an NFPA 72 automatic fire detection and alarm system under certain conditions • Add a new Chapter 7 covering units <= 50kW that revises provisions of the rest of the standard and provides additional provisions for such smaller units.

NFPA Building Code IAPMO Plumbing and Mechanical Codes WFCA Uniform Fire Code	The 2000 UPC, UMC and UFC are published. Provisions in these documents could impact the acceptance of fuel cells and/or necessitate testing, certification and evaluation of fuel cells by IAPMO. A draft NFPA Building Code has been. Public comments (1487) were acted upon by the building code technical committees in April and the NFPA membership had the opportunity to vote on the document in May 2002. The NFPA Standards Council will then act to approve the document and then it will be published.	The Building-Industrial Committee was requested to include fuel cells in their chapter for industrial occupancies during the comment stage on the draft Building Code. It was determined that the appropriate location to reference NFPA 853 was in Chapter 49 on Mechanical Systems and Section 6.4 of the Building Code for Special Operations. This action was done in a coordinated fashion with the affected technical committees and technical correlating committee.
NFPA [TBD] National Fire Protection Association 1 Batterymarch Park Quincy, MA 02269-9101	The NFPA Standards Council received requests in 2001 to establish two new projects related to fuel cells. One request was to establish a new project on hydrogen fuel systems. The other was to establish a new project on the installation of individual fuel cells not covered by NFPA 853. Comments on these proposals were accepted by NFPA until September 4, 2001. The Standards Council considered these requests and the comments received. The Standards Council reviewed the project on hydrogen fuel systems in April 2002. A decision is forthcoming. The Standards Council decided a new project addressing fuel cells not covered by NFPA 853 was not necessary as all stationary fuel cells are addressed within the scope of the TC on Electrical Generating Plants.	
NFPA 70 National Electric Code National Fire Protection Association 1 Batterymarch Park Quincy, MA 02269-9101	A proposal to add a new Article 692 to the NEC dealing with fuel cells was submitted to NFPA for consideration in the NEC and approved in principal in 2000.	The NEC provides criteria that would apply to certain electrical installations related to fuel cell power plants.

Jean O'Conner Phone: 617-984-7421 Fax: 617-984-7070 joconner@nfpa.org www.nfpa.org	At a December 2000 meeting the article was titled Fuel Cell Systems. Public comment was solicited on the proposal and 5 comments were received. It was considered for final action in May 2001 by the NFPA and was published as part of the 2002 NEC. Existing NEC / NFPA 70 Article 705. The report on proposals came out in July 2000. Public comment on proposals was accepted until October 2000. At the Annual Meeting in May 2001 nothing further happened regarding fuel cells on the floor of the Technical Session on the adoption of the NEC. Article 705 remained as proposed in the draft and was published as part of the 2002 NEC.	Article 692 covering self-contained fuel cells addresses the following: • Installation requirements • Circuit requirements • Overcurrent protection • Wiring requirements associated with and outside the fuel cell • Grounding • Marking • Connections to other systems Fuel cells with outputs over 600 volts ac are required to meet Article 490 of the NEC.
UL 1741 , Standard for Inverters Converters and Controllers for use in Independent Power Systems Tim Zgonena (UL) 847-272-8800 x 43051 timothy.p.zgonena@us.ul.com	UL 1741 has been harmonized with IEEE 929. Utility Interactive products listed to the published UL 1741 are being accepted by many utilities across the nation for utility grid interconnection. UL 1741 is slated for harmonization with IEEE P1547, Distributed Resources Interconnected with Electric Power Systems, once IEEE 1547 is published. This harmonization will allow manufacturers to have their products evaluated once, to comply with the necessary national electrical safety and utility interconnection performance requirements.	
UL 2264 and UL 2265 Harry Jones Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, Illinois 60062 Phone 847-664-2948 Fax 847-313-2948 Harry.P.Jones@us.ul.com	UL plans to develop new standards that relate to fuel cells: UL2264 - Gaseous Hydrogen Generating Appliances. TC membership is being finalized with no meeting dates set. UL2265 - Replacement Fuel Cell Power Units For Appliances	UL 2264 is intended to cover portable, stationary and fixed gaseous hydrogen generating appliances rated at >=120 V. Scope will include water electrolysis and other hydrogen generation methods as well as dispensing and reformation, with and without storage. TC membership is being finalized. UL 2265 covers stand-alone fuel cell power units that may be connected within the enclosure of appliances by a flexible cord and plug arrangement or other connection means. These devices

UL (cont.)	UL 2262 – Outline of Investigation for portable PEM with or without uninterruptable power and for factory installation in OEM equipment for indoor use.	provide DC power for powering the appliance and may be used to replace existing batteries. UL 2262 will be used to certify products in the interim until and perhaps beyond CSA FC 3 development.
ASME PTC 50 Performance Test Code for Fuel Cell Power System Performance Jack Karian ASME staff 212-705-8552 karianj@asme.org Tony Leo FuelCell Energy Inc. 3 Great Pasture Road Danbury, CT 06813-6135 Work Phone: 203-825-6068 Fax: 203-825-6135 E-mail: tleo@fce.com	The Object and Scope were completed and approved by ASME. A first draft was completed in April 1999. Work continued with a targeted date of 2002 for completion and publication. PTC 50 compiled a list of potential reviewers for a draft of the standard. A meeting of PTC 50 was held June 12 and 13, 2001. ASME PTC-50 was submitted for public review in September 2001. Comments were received and the committee met in late January 2002 to review those comments. A draft was submitted to ANSI on March 13, 2002 and a 60-day public review period began on March 29, 2002. The draft was also submitted in early April to the ASTM Board for approval. ANSI approval is expected in mid-2002 and the document published by 2003.	An outline of the standard is as follows: 1. Object, Scope 2. Definitions and Descriptions of Terms 3. Guiding Principles (guidance on the conduct of the power system testing, and the steps required to plan, conduct, and evaluate a PTC 50 test of fuel cell power system performance) 4. Instruments and Methods of Measurement 5. Computation of Results (Power output, electrical conversion efficiency, and thermal effectiveness at specified operating conditions are the primary objectives. Electrical conversion efficiency can also be expressed as specific fuel consumption (heat rate) or fuel chargeable to power.) 6. Test Report Requirements Appendix – Uncertainty Analysis and Sample Calculations PTC 50 covers PA, PEM, MC and SO fuel cells for all applications. Test procedures, methods, and definitions are provided to address the performance characterization of fuel cell power systems (overall) with respect to rated inputs and outputs or any other steady state conditions. Performance is to be determined at +/- 2% absolute uncertainty at a 95% confidence level.

2000 International Mechanical, Fuel Gas, and Residential Code International Code Council 5203 Leesburg Pike Suite 708 Falls Church, VA 22041 703-931-4533 www.intlcode.org	The 2000 International Mechanical Code (IMC) has been published and provides criteria for the installation and use of mechanical equipment and appliances. Revisions to the 2000 International Fuel Gas Code (IFGC) were made in 2000 to include similar language to that in the IMC. The ICC AHC (see below) submitted proposals (M1-01, FG4-01, and RM9-01) in 2001 that define the terms STATIONARY FUEL CELL POWER PLANT and PORTABLE FUEL CELL APPLIANCE in the International Codes, while adding coverage for stationary fuel cell power plants in the International Residential Code by way of reference to ANSI Z21.83-1989. Those changes were recommended for approval at March 2001 hearings. Final disposition of the changes was addressed in the Fall of 2001at hearings held in conjunction with the BOCA/ICBO and SBCCI annual business meetings. Proposed changes submitted to the ICC codes were published on March 1, 2002 and were considered at public hearings April 8 to 19, 2002. A synopsis of those changes and disposition is shown in the third column. Final action on these changes will occur September 29 to October 4, 2002.	Section 924 of the IMC covers stationary fuel cell power plants as follows: "924.1 General. Stationary fuel cell power plants having a power output not exceeding 1,000 kW, shall be tested in accordance with ANSI Z21.83 and shall be installed in accordance with the manufacturer's installation instructions." Fuel cell power plant installations greater than 1,000 kW output would have to be approved under a section of the IMC on alternative methods and materials wherein the technology proponent would have to provide test data, calculations, and other documentation showing that what they proposed was "equivalent in performance from a safety and health standpoint" to other technologies specifically provided for in the code. The following proposals were considered at the April 2002 code change hearings: FG 02 to exempt portable fuel cells from the scope of the IFGC – denied by the committee but approved as submitted by floor vote FG 40 to clarify the limitation of 1000 kW to the reference of ANSI Z 21.83 and add a reference to NFPA 853 – approved as modified to cover only the former revision FG 41 to add a new chapter on gaseous hydrogen systems – denied by the committee but approved as submitted by floor vote FG 48 to add a new chapter on liquid hydrogen systems – denied by the committee but approved as submitted by floor vote M 77 to reference NFPA 853 – see FG 40 above
Evaluation Protocol for Stationary Fuel Cell Power Plants National Evaluation Service 5203 Leesburg Pike, Suite 600 Falls Church, VA 22041 David Conover 703-931-2187 dconover@nateval.org www.nateval.org	The NES developed the evaluation protocol with the assistance of an expert panel comprised of individuals familiar with fuel cell technology and health and life-safety issues. The protocol was published in May 2001 and is available for use by fuel cell proponents who want to determine what information and documentation they may	The Protocol is for use by the National Evaluation Service to facilitate the process of evaluating stationary fuel cell power plant technology for compliance with the above codes. The protocol sets forth general criteria for testing and evaluation of the covered technology and its installation and integration with the built environment. Manufacturers and users of the technology can use it as a roadmap to testing, calculations, documentation and other supporting information necessary for obtaining

Darren Meyers 708-799-2300 x 307 dmeyers@bocai.org	need to verify their compliance with the U.S. model codes. If they desire an evaluation report from NES supporting their claim of compliance, NES staff will also use the protocol as a guide in performing the evaluation and issuing an NES evaluation report.	approval for a particular installation under the codes above. An outline of the protocol is as follows: • Scope • Intent • Reference Standards ▪ Product Evaluation Criteria ▪ In-situ evaluation criteria • Definitions • Evidence required • General • Conditions of Use
IEEE Standards Coordinating Committee (SCC) 21 IEEE Standards Department 445 Hoes Lane, P.O. Box 1331 Piscataway, NJ 08855-1331, USA Richard DeBlasio (Chair SCC 21) National Renewable Energy Lab 303-275-4333 deblasid@tcplink.nrel.gov T. Basso (Secretary of P1547 Working Group) National Renewable Energy Laboratory – MS1614 1617 Cole Blvd Golden, CO, 80401-3393 303-275-3753 thomas_basso@nrel.gov P1547 website and archives http://grouper.ieee.org/groups/scc21/1547 http://grouper.ieee.org/groups/scc21/1547/archives/	The IEEE SCC has a number of projects underway and is responsible for standards associated with fuel cells, photovoltaics, dispersed generation and energy storage. SCC 21 reports directly to IEEE Standards Board. The *P1547 Draft Standard for Interconnecting Distributed Resources With Electric Power Systems* is a very active and fuel cell-relevant activity. Draft 7 of that standard was balloted, ending March 28, 2001 and did not receive the 75% affirmative vote required by IEEE. The April 18 to 20, 2001 meeting of P1547 addressed ballot resolution and was attended by 88 individuals. A ballot resolution writing group met June 5 to 8 and August 15 to 17, 2001 to re-word draft 7 to address negative comments. The resultant re-worded draft was recirculated in September 2001. The P1547 working group has met about every 2 months for 2-1/2 years and met October 17 to 19, 2001 and January 31 to February 1, 2002 as well as in March and April 2002. Work on the standard continues with a meeting of the full committee scheduled for June 4 to 7, 2002 to review a 9th draft of the standard that has been under development subsequent to the ballot on the 7th draft that did not reach consensus. The new P1547 draft documents the mandatory, minimum functional technical	Chapter 1 of the P1547 draft standard provides an introduction including scope and purpose. The standard establishes criteria and requirements for interconnection of distributed resources with electric power systems. The purpose of P1547 is to provide a uniform standard for interconnection of distributed resources with electric power systems, and requirements relevant to the performance, operation, testing, safety considerations, and maintenance of the interconnection. The criteria and requirements in P1547 are applicable to all distributed resource (DR) technologies and to the primary and secondary voltages of the electric power distribution systems. Installation of DRs on radial primary and secondary distribution systems are the main emphasis, although primary and secondary network distribution systems are considered. The requirements of P1547 are to be met at the point of common coupling, although the location of the protective devices may not necessarily be at that point. Chapter 2 lists references required to be used in conjunction with P1547 to meet the standard. Chapter 3 provides definitions and terminology pertinent to P1547 that is not already included in the IEEE Standard 100 Dictionary. Chapter 4 covers technical requirements and specifications associated with items such as voltage regulation, power quality, and abnormal operation. Chapter 5 provides test specifications and requirements, including interconnection tests, production tests, interconnection installation evaluation, commissioning tests, and periodic tests. There also are informative annexes on testing, and a bibliography.

IEEE Standards Coordinating Committee (SCC) 21 (con't)	requirements that are universally needed to help assure a technically sound interconnection. The plan after the June 2002 meeting is to secure ballot action by IEEE on the standard later in summer of 2002. Six prospective new IEEE distributed resources activities were identified and discussed for consideration by the SCC21/P1547 members at their January and April 2001 meetings. Some of those activities include aspects directly pertinent to all dispersed generation including fuel cells. At that time a project Authorization Requests (PAR) was established for a Standard for Testing Interconnected Systems for Distributed Resources. PARs are under development for: 1. Application Guide for Distributed Resources 2. Recommended Practice for Monitoring and Control of Distributed Resources 3. Certification of DR and interconnection equipment The following standards activities are getting underway: P1589 Draft Standard For Conformance Test Procedures for Equipment Interconnecting Distributed Resources With Electric Power Systems P1608 Draft Application Guide for IEEE Std. 1547 Standard for Interconnecting Distributed Resources With Electric Power Systems Proposed P1614 Draft Guide for Monitoring, Information Exchange, and Control of Distributed Resources Interconnected With Electric Power Systems	

Society of Automotive Engineers (SAE) SAE International 400 Commonwealth Drive Warrendale, PA 15096 Jane Hock 202-962-8684 jhock@sae.org	The Society of Automotive Engineers has established a very broad base Fuel Cell Standards Committee that addresses the needs of the producer, user, consumer, and regulator in regards to fuel cells for transportation applications. The SAE Technical Standards Board is currently addressing passenger vehicle applications. Because of the broad application potential of fuel cell technology, work is being identified by the Aerospace Council, ConAg Council, Truck & Bus Council, ITS Division, Manufacturing Division, and the Fuels & Lubricants Division. In addition the Service Technicians Society (STS) is identifying servicing and maintenance need sand the Performance Review Institute (PRI) is exploring certification requirements.	The SAE Fuel Cell Standards Committee has established the following living scope of work and mission statement: "To establish standards and test procedures for fuel cell powered vehicles. The standards will cover the safety, performance, reliability, and recyclability of fuel cell systems in vehicles with emphasis on efficiency and environmental impact. The standards will also establish test procedures for uniformity in test results for the vehicles/systems/components performance, and define interface requirements of the systems to the vehicles." The Committee has established the following Working Groups as covered below and has 10 draft documents in process. They last met on April 9 to10, 2002. ▪ Safety ▪ Terminology ▪ Performance ▪ Recyclability ▪ Interface ▪ Emissions & Fuel Economy
SAE Fuel Cell Standards Committee Safety Working Group Jane Hock 202-962-8684 jhock@sae.org	J2578 has gone to committee ballot. The document is in the pre-publication stage and is expected to be published by the fall of 2002. J2579 is in drafting and is expected to be available in the late summer or early fall of 2002.	J2578 Recommended Practices for General Fuel Cell Vehicle Safety J2579 Recommended Practice for Hazardous Fluid Systems in Fuel Cell Vehicles
SAE Fuel Cell Standards Committee Terminology Working Group Jane Hock 202-962-8684 jhock@sae.org	J2574 has been published and is on sale. The Committee is discussing a revision to harmonize it with IEC TC 105 and ISO TC 22/SC21 terminology documents.	J2574 Fuel Cell Electric Vehicle Terminology (Developed jointly with JEVA, JAMA)
SAE Fuel Cell Standards Committee Performance Working Group Jane Hock 202-962-8684 jhock@sae.org	The Performance Working Group will develop procedures for testing the Proton Exchange Membrane (PEM) fuel cell system and its major subsystems for automotive applications. The Working Group has defined performance and measured parameters for three test subjects: PEM fuel cell system, fuel processor and PEM fuel cell stack. J2615: The Working Group is slated to complete this	J2615 Performance Test Procedures of Fuel Cell Systems for Automotive

	document and send it to committee ballot in the late summer of 2002. J2616: This document is in the final stages of completion and will be sent to committee ballot in early summer of 2002. J2617: The Working Group is slated to complete this document and send it to committee ballot in the late summer of 2002.	Applications J2616 Performance Test Procedures for Fuel Processor Subsystems of Automotive Fuel Cell Systems J2617 Performance Test Procedures of PEM Fuel Cell Stack Subsystems for Automotive Applications
SAE Fuel Cell Standards Committee Recyclability Working Group Jane Hock 202-962-8684 jhock@sae.org	The working group will develop guidance document that incorporates and summarizes with existing recyclability issues associated fuel cells in End Life Vehicles (ELVs). The recyclability guidelines will cover PEM FC stack and ancillary components only. J2594 The working group is slated to complete this document and send it to committee ballot in the early summer of 2002.	J2594 Fuel Cell Recyclability Guidelines
SAE Fuel Cell Standards Committee Interface, Working Group Jane Hock 202-962-8684 jhock@sae.org	The working group will develop standards to coordinate between fuel suppliers and vehicle manufacturers to ensure safe, efficient and customer friendly delivery of fuel to fuel cell powered vehicles. J2600 will define the geometries of the receptacles for the different pressure levels. The Working Group has sent the document to committee ballot. It was approved and is in the pre-publication phase. J2600 is expected to be on sale in the early winter of 2002. J2601 will define the different fueling strategies and document their advantages and disadvantages with respect to type III and IV tanks. It will also develop the strategies and protocols for what refueling with and without communications should look like. The	Several workshops have been conducted bringing together OEMs, plumbing and connector manufacturers, along with communications (RF, IR, and Default) protocol experts. These are focused on ensuring globally harmonized standards for compatible refueling activities. J2600 Compressed Hydrogen Vehicle Fueling Connection Devices J2601 Compressed Hydrogen Vehicle Fueling Communication Devices

	Working Group is targeting to complete the document in the summer of 2003 and send it to committee ballot.	
SAE Fuel Cell Standards Committee Emissions & Fuel Consumption Working Group Jane Hock 202-962-8684 jhock@sae.org	The working group will establish standards and test procedures for measuring emissions and fuel consumption for fuel cell powered vehicles. The standards and test procedures will provide methods for measuring exhaust and evaporative emissions from the total fuel cell vehicle, plus the fuel consumption in measurement for the fuel cell vehicle. The goal of the test procedures is to establish methodology for uniformity in test results for all designs of fuel cell vehicles, and allow a comparison with conventional vehicles. J2572 covers fuel cell vehicles using compressed hydrogen gas supplied by an off-board reformer. The test procedure includes hybrid (use of a storage battery for traction power) versions of this type of fuel cell vehicle. The Working Group is slated to complete this document and send it to committee ballot in the early summer of 2002.	J2572 Recommended Practice for Measuring the Exhaust Emissions, Energy Consumption and Range of Fuel Cell Powered Electric Vehicles Using Compressed Gaseous Hydrogen
ICC Ad Hoc Committee (AHC) for Hydrogen Gas Darren Meyers, Secretariat BOCA International 4051 East Flossmoor Road Country Club Hills, IL 60478 708-799-2300 x 307 dmeyers@bocai.org	The AHC (balanced membership of hydrogen users, producers, manufacturers and regulator interests) undertook a review of current codes and standards applicable to the vehicular and portable hydrogen infrastructure in buildings. They focused on the acceptance and safe deployment of portable and vehicular hydrogen-based technologies in the built environment. Six (6) subcommittee working groups were established and worked closely with the AHC during the draft development stages of proposed changes to the ICC International Codes:	Preliminary conclusions regarding hydrogen fire impingement tests and hydrogen gas dispersion characteristics as they pertain to home-based refueling of hydrogen vehicles were presented at the AHC meeting in March 2001. An effort to promote a joint U.S. Canadian, harmonized standard for portable fuel cell power plants was also discussed at that meeting. Dr. Mike Swain, University of Miami, conducted a variety of tests to establish ventilation and fire protection needs and design parameters for residential garages and presented the results of his research at the March meeting. The AHC remains focused on current and anticipated topics involving the acceptance and safe deployment of portable and vehicular hydrogen-based technologies in the built environment.

ICC AHC (cont.)	WG1 Private Garages WG2 Public Garages WG3 Hydrogen Refueling and Generating Stations WG4 Portable Hydrogen Appliances WG5 Integrating hydrogen as a fuel into IFGC WG6 Standards The AHC met June 4 and 5, 2001. The AHC prepared changes to the ICC codes and submitted them in late 2001 for consideration during the 2002 ICC code change process. The results to date on those code changes is shown above under the ICC.	The AHC has also developed definitions for portable and stationary fuel cell power plants to help differentiate between a consumer product that may be addressed by building codes differently than a more stationary piece of equipment.
National Hydrogen Association 1800 M Street NW, Suite 300 Washington, DC 20036-5802 Karen Miller, Vice President phone: (202) 223-5547 fax: (202) 223-5537 email: kmiller@ttcorp.com www.HydrogenUS.com	NHA creates draft standards for hydrogen systems and components using the expertise of the NHA membership. NHA identifies areas where codes and standards for the safe use of hydrogen energy systems are needed and coordinate their being addressed. When hydrogen safety issues are not being properly addressed the NHA may initiate new standards. NHA is active in ISO TC 197 (hydrogen) and IEC TC 105 (fuel cells) as well as a number of national efforts. NHA has working groups, in various stages of activity. WG1: Connectors WG2: a. Containers; b. Hydrides WG3: Refueling Stations WG4: Safe use of electrolyzers in customer sites, including homes. WG5 & 6: Coordination with the SAE and ICC efforts on hydrogen safety issues. WG7: Maritime applications of hydrogen (identify unique applications).	A draft standard has been developed by WG1 for gaseous hydrogen connectors. It was accepted by ISO/TC-197 and is undergoing international development. Related to WG2, the initial NHA draft standard for tanks included only materials used in CNG that were compatible with hydrogen. The international standard does not exclude composites and other materials, as long as they meet a stated performance standard. The NHA encourages members to join the ISO/TC-197 WG 5 and continue to advance the item internationally. The international working group is a joint working group with ISO TC 197 and ISO TC 58. WG 2 also has a Hydrides activity. This WG has prepared a NWIP for ISO TC 197 on charged metal hydrides. The U.S. TAG of ISO TC 197 is considering submittal of the item. Under WG 3 the NHA developed a draft standard on hydrogen refueling stations for ISO TC 197. This work item was accepted by ISO TC 197, and is advancing slowly, using input from national experiences with natural gas refueling stations, combined with hydrogen-specific expertise. The scope of WG 4 was to develop a standard for installation, safety and use of electrolyzer hydrogen generators in end use applications, including the residential, commercial and industrial sectors. Activities included identifying appropriate group participants in addition to NHA members, assessing the existing relevant codes; establishing parameters and developing a technical envelope for the WG. This work item was proposed to

NHA (cont.)		ISO TC 197 in 2001 as a new work item and was accepted. The Scope of WG 7 is to identify maritime-unique applications of hydrogen. This was done in cooperation with the Maritime Hydrogen Technology Development Group as well as other interested standards bodies. The MHTDG has published a report on the subject.
IEC TC 105 on Fuel Cells John Bossert, Canada (Chair) Werner Tillmetz, Germany (Secretary) Andreas Piepereit, Germany (Asst. Secretary) Kelvin Hecht (US Technical Advisory Group [TAG] Technical Advisor) International Fuel Cells 127 Craigemore Circle Avon, CT 06001 860-673-9181 kelvinhecht@attbi.com David Conover (US TAG Deputy Technical Advisor) NES, Inc. 5203 Leesburg Pike Suite 600 Falls Church, VA 22041 703-931-2187 dconover@nateval.org CSA America, Inc. U.S. TAG Administrator Steve Kazubski (Secretary) 8501 E. Pleasant Valley Rd. Cleveland, OH 44131-5575 216-524-4990 x 8303 steve.kazubski@csa-international.org	IEC TC 105 has a scope to prepare international fuel cell standards for all fuel cell applications such as stationary, transportation and portable applications. Membership is from CA, CN, FR, DE, IT, JP, NL, CH, GB, US, SP, DN, AU and KR. Liaisons have been established with IEC TC 69 (electric vehicles), ISO TC 22 SC 21 (electric road vehicles), ISO TC 197 (Hydrogen technologies) and IES TC 31 (electrical apparatus in explosive atmospheres). SAE and IEC TC 105 have agreed to support each other's activities. IEC TC 105 had their first meeting February 23 and 24, 2000 and second meeting September 6 and 7, 2001.Their third meeting will take place June 13 and 14, 2002. Working groups of IEC TC 105 have had meetings to prepare committee drafts of their standards. The US TAG had their first meeting on March 13, 2001. WG 1 has had a technical report out for committee review from March 8 to June 7, 2002. WG 2 has had numerous meetings. A committee draft dated January 2002 was available for committee review February 8 to May 10, 2002. The WG will meet June 17 and 18, 2002 to discuss committee comments. WG 3 has had two meetings	The IEC TC 105 membership have developed the following program of work that is being conducted by various working groups who are lead by specific country convenors. WG 1 – Terminology (US) - a technical report that provides standard terms, equations and diagrams that other working groups can use. WG 2 – Fuel Cell Module (DE) – a standard that will address safety and performance of fuel cell modules. WG 3 – Safety of Stationary Fuel Cell Power Plants (US) - a standard that will address safety requirements (design and performance). It will parallel ANSI Z21.83, ISO, IEC and EN standards. WG 4 – Performance of Stationary Fuel Cell Power Plants (JP) – a standard to describe how to measure performance from an operational and environmental standpoint. WG 5 – Installation of Stationary Fuel Cell Power Plants (US) - a standard covering the installation and integration with the surrounding built environment paralleling NFPA. WG 6 – Fuel cell Systems for Propulsion and Auxiliary Power Units (DE) – a standard for safety and performance of fuel cells used in automotive applications, as auxiliary power units for automobiles and in non-automotive propulsion applications. WG 7 – Portable Fuel Cell Appliances, Safety and Performance (CA) – a standard covering the safety and performance of portable ac and dc appliances including handheld units, rated up to 600 V in non-hazardous locations. TC 105 has also identified work needing to be done on fuel cell system integration

	and anticipate a committee draft by October 2002. WG 4 met in January 2002 and had a committee draft out for comment from February 8 to May 10, 2002. They plan to meet June 19 and 2, 2002 to discuss committee comments. WG 5 on stationary installations was established in early 2002, held its first meeting in April 2002 and anticipate a committee draft to be available in 2003. WG 6 was established in early 2002 and will meet in June 2002. A committee draft is anticipated by January 2003. WG 7 was established in early 2002 and will meet in June 2002. A committee draft is expected in October 2003. IEC and ISO also coordinate efforts between IEC TC 105 and ISO/TC 197.	into road vehicles (with ISO TC 22) but has yet to form a working group on this..