

Valued Quality. Delivered.

EVSE Certification – Finding Cost-Effective, timely Solutions in Advance of Full Certification

November 2012

Rich Byczek, Global Technical Lead – EV and Energy Storage



www.intertek.com



Understand the Electric Vehicle-related certification requirements and process for North America

- Identify relevant standards for Electric Vehicle Supply Equipment
- Identify component specific requirements

Review alternative certification methods for EVSE.



Who are the governing bodies?

In the United States – NFPA

- •NFPA National Fire Protection Association
- •Develops Standards, including NFPA 70
 - •NFPA 70 is The U.S. National Electric Code (NEC)
 - •Adopted within local U.S. building and construction codes

Article 625 of the U.S. National Electric Code indicates that all Electric Vehicle Supply Equipment (EVSE) materials, devices, fittings and associated equipment shall be **listed or labeled**







Valued Quality. Delivered.

What is a product listing? Who is the AHJ? Do I need "UL Approval?"



What is a product listing?

- -3rd party certification of compliance to applicable safety standards
- -Includes follow-up services (continuous conformance testing)
- -Accepted by AHJ

Who is the AHJ?

Do I need "UL Approval?"



Product Listings



-What is a product listing?

- -Who is the AHJ?
 - -"Authority Having Jurisdiction"
 - -Electrical Inspectors
 - -Fire Marshalls
 - -Landlords/ Building Owner
 - -Insurance Providers
- -Do I need "UL Approval?





Aren't manufacturers required to use UL for their compliance testing? Isn't this mandated by the standards themselves?

- The simple answer to both questions is "no"
- To satisfy the prerequisite of having your products tested by an independent organization, the true legal requirement is that the laboratory which performs the testing be a Nationally Recognized Testing Laboratory (NRTL) recognized by OSHA



In the United States – OSHA

- •OSHA (U.S. Department of Labor: Occupational Safety & Health Administration) oversees workplace safety regulations, which are US law and contain requirements for "approval" (i.e. testing & certification) of certain products by an NRTL – Nationally Recognized Testing Laboratory
- •Requirements are found in Title 29 of the U.S. Code of Federal Regulations and the provisions for NRTL certification are generally in Part 1910 (29 CFR Part 1910)





An NRTL is an organization that OSHA has "recognized"

- An NRTL is authorized to provide an independent evaluation, testing and certification of electrically operated or gas- and oil-fired products based on standards developed by U.S.-consensus standards organizations such as the American National Standards Institute (ANSI) and Underwriters Laboratories (UL)
- "Recognition" includes demonstrating to OSHA the capability, control programs, independence, reporting and complaint handling procedures to test and certify specific types of products for workplace safety



NRTL under OSHA





www.osha.gov/dts/otpca/nrtl/index.html



What does a safety mark tell me?

- Safety marks such as ETL, UL, and CSA signify that the product has been tested to, and found to comply with, national safety standards by a qualified, independent testing laboratory
- The presence of a safety mark also means the product is 'listed' in the NRTL's "directory" – public record.
- And, is part of an on-going follow-up program that ensures the products continuously comply with the applicable standards











Valued Quality. Delivered.

Standards Council Canada

Similar to OSHA NRTL program.

SCC accredits Certification and Inspection organizations.

Listing marks in common with US NRTL







Standards Council of Canada Conseil canadien des normes



FOLLOW UP SERVICES / INSPECTIONS

Applies to all NRTL's, all certified products (OSHA Requirement):

Initial Factory Inspection: Similar to ISO Quality Audit, but focus on the Safety Aspects of your product.

Follow-up Inspections: All Certified products or Components must submit to a Follow-Up service (Inspection) Program.

Typical:

Quarterly: Onsite Factory Inspections Annually: Unlisted/Non-Recognized Component Submission, may be increased or decreased due to system complexity or production rate.





What about "CE Mark", or equipment certified by foreign testing organizations?

- The CE mark is a generic mark used in the European Union (EU) to indicate that a manufacturer has declared that the product meets EU safety requirements
- CE is unrelated to the requirements in the US
- In the US, the product must have the specific mark of a recognized NRTL
- However, data used to attain NRTL certification, may be applicable to declaration of compliance for CE marking
- CE marking is based on compliance with EU direct product standards.
- Also applies to CHADEMO-certified DC Chargers. US-safety listing





What other "international" requirements exist?

IEC

•The International Electrotechnical Commission (IEC) is a non-profit standards organization that writes International Standards for all electrical, electronic and related technologies

IECEE

•IEC System for Conformity Testing and Certification of Electrotechnical Equipment and Components), known as the **CB Scheme**





CB Scheme?

- •The CB Scheme is an international program (under IECEE) for the exchange and acceptance of product safety test results among participating laboratories and certification organizations around the world
- •The CB Scheme offers manufacturers a simplified way of obtaining multiple national safety certifications for their products providing entry into over 45 countries





CB Scheme, continued...

Category ELVH

- This new category includes Electric Vehicle Supply Equipment, Cables and Connectors
- IEC 61851-1 is the relevant main standard for EVSE in this category.
- IEC 62196 (EVSE Connectors) are included in this category
- * NOTE: these are not currently harmonized with US standards.

IEC 60950 (Telecommunications Equipment) may be included to cover installed credit card readers, bluetooth devices, or Wi-Fi options within EVSE.



Self Declaration vs. Product Safety Listing



- In the U.S. most **onboard vehicle** components are certified through a "self-declaration" process

- Manufacturer or Supplier performs required testing in-house, or through a 3rd party laboratory organization, with compliance determined by the Automotive OEM.

Product Safety Listing:

- **Off the vehicle** – EV Charge Stations & Components require "Listing" to applicable national or international standards

Component Recognition:



Intertek

Valued Quality. Delivered.

- Components within listed products: may have specific requirements
- Similar to Product listing, but denotes an incomplete product or specific usage limits.







EVSE – APPLICABLE STANDARDS



Charging Station (EVSE)

UL Subject 2594, IEC 61851

Personnel Protection Circuitry

UL 2231-1 and UL 2231-2





Charging Plug / Outlet **UL 2251, IEC 62196,**

SAE J1772



1-800-WORLDLA

www.intertek.com



Valued Quality. Delivered.

Charge Stations – AC Output

UL Subject 2594

OUTLINE OF INVESTIGATION FOR Electric Vehicle Supply Equipment

This outline covers electric vehicle (EV) supply equipment, rated at a maximum of 250 V ac with a frequency of 60 Hz and intended to provide power to an electric vehicle with onboard charging unit.



Wall Mount Charge Station for homeowners – typically mounted in the homeowner's garage and connected to 240VAC 60Hz source for high amperage charging.





Travel Cordset Charge Station for homeowners – device is typically carried in the vehicle for charging while on the road. Typically connects to 120VAC 60Hz source. Lower amperage charging.

Municipal Charge Station – can be provided with both 120VAC 60Hz and 240VAC 60 Hz sources. Can be mounted anywhere: parking lots, hotels, etc. May be provided with a variety of options for things such as credit card readers, I/O ports for recording data etc.





Valued Quality. Delivered.

Battery Chargers – DC Output

UL 2202 UL Standard for Electric Vehicle (EV) Charging System Equipment

Supplied by circuit of 600Volt or less For recharging batteries over the road EV's On-board or Off-board the vehicle "Chademo" / SAE "COMBO" Quick Chargers fall under this standard









CCID – Charge Circuit Interrupting Device

Devices covered by UL 2231-1 and UL 2231-2 are typically control circuits that are not complete products but are circuit boards to be fitted into a Charging Station.

* Often certified as "recognized components", rather than listed products

UL 2231-1

Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits

These requirements cover devices and systems intended for use in accordance with the National Electrical Code (NEC), ANSI/NFPA 70, Article 625, to reduce the risk of electric shock to the user from accessible parts, in grounded or isolated circuits for charging electric vehicles. These circuits are extended to, or on-board, the vehicle.



Valued Quality. Delivered.

UL 2231-2

UL Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems

This standard is intended to be read together with the Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements, UL 2231-1. The requirements of UL 2231-1 apply unless modified by this standard. This Part contains the construction and performance requirements that are applied to a device that is intended to become an integral part of an overall device or charging system.

- CCID: Charge Current Interrupt Device
- Isolation Monitors



Valued Quality. Delivered.

Charge Connectors

* Often certified as "recognized components", rather than listed products

UL 2251

UL Standard for Safety for Plugs, Receptacles and Couplers for Electric Vehicles

These requirements cover plugs, receptacles, vehicle inlets and connectors, rated up to 800 amperes and up to 600 volts ac or dc

Intended for conductive connection systems



Vehicle Coupler – Coupler for providing power to the on-board charger. Typically, part of the EVSE, but may an "extension cord" with coupler on both ends. SAE/ IEC/ CHADEMO



Vehicle Inlet - Standard power inlet on vehicle

Charging Performance



Valued Quality. Delivered.

SAE J1772: AC Level 1 and Level 2 DC Level 1 and Level 2 incorporated IEC 62196: Single and 3phase AC adapters CHADEMO: Japanese DC adapter and protocol









DC Quick Charging: CHADEMO



Uses CAN (Controller Area Network) Bus interface

Battery direct communication to Control Charge Current

Max power: 50kW

Max Voltage: 500VDC

Maximum Charge Current: 125ADC

US Certification: UL 2202, 2231-1,2, 2251





Valued Quality. Delivered.

Intertek



DC Quick Charging: SAE COMBO

New revision of SAE J 1772 released October 2012 Uses PLC (Power Line Communication) over Pilot Signal Battery direct communication to Control Charge Current True "combo AC+DC" must be certified to combination f UL 2594 and 2202..

DC Level 1:

up to 80 amps, using standard SAE J1772 connector

DC Level 2:

28

greater than 80 amps, using "combo Connector"







EVSE CERTIFICATION OPTIONS



USA:

Product listing to above noted standards

CANADA:

EVSE: C22.2 #107-1: General Use Power Supplies

CONNECTORS: C22.2 #182.1: Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type



How'd they do that?



Nation's first public quick-charge station opens up in Portland, OR [w/video]

Posted Aug 9th 2010 6:01PM by Autoblog Staff Filed under: <u>Government/Legal</u>, <u>Electric</u>



EVSE CERTIFICATION OPTIONS



CERTIFICATION PROCESS:

- Full evaluation to the product standard and all critical component standards.
- Typical EVSE: may take 8-12 weeks.
- Design changes may require re-test, re-certification
- Factory Inspections
- Preferred method for mass production
- Can cover multiple variants/ manufacturers/ brands

In the United States – NFPA

- •NFPA National Fire Protection Association
- •Develops Standards, including NFPA 70
 - •NFPA 70 is The U.S. National Electric Code (NEC)
 - •Adopted within local U.S. building and construction codes

32

Article 625 of the U.S. National Electric Code indicates that all Electric Vehicle Supply Equipment (EVSE) materials, devices, fittings and

associated equipment shall be listed or labeled







For Custom-built systems (one-of-a-kind or few-of-a-kind), or unlisted products that are "red-tagged" by the Local Inspector.

Field Label Program: An NRTL Engineer will evaluate the product in its installed location, to the appropriate safety standard and applicable NEC/NFPA requirements.

Example:

- Japanese CHADEMO product installed in US facility,
- Demonstration model/prototype installed at client location.
- Model undergoing certification: Early deliveries



US Field Labels



NRTL's can perform the inspection and issue NRTL mark

- Serialized labels
- Report directly to the local AHJ

FOCUS on:

- NFPA 70 : National Electric Code
- As Installed
- "Core" clauses of the relevant product safety standards



What about Canada??



Valued Quality. Delivered.

Canadian Field Labels

aka: Special Inspections (SI)



SPE-1000 : Model code for the field evaluation of electrical equipment

C22.1: Canadian electrical Code

Accredited by Standards Council Canada

When used in conjunction with the requirements of the Canadian Electrical Code, Part I, this Model Code addresses the minimum requirements for equipment as they pertain to electrical safety.

...addresses the essential construction, marking, and test requirements that equipment must meet before it can be labeled.



Standards Council of Canada Conseil canadien des normes

www.intertek.com

- 1. Authority Having Jurisdiction (AHJ) 'Tags' equipment (pre-permit or postpermit)
- 2. Manufacturer contacts the AHJ approved test lab
- 3. Applicable requirements/specifications are determined
- 4. Quote issued to the client
- 5. Manufacturer accepts and signs quote
- 6. Evaluation date is scheduled and conducted
- 7. Nonconformances (if any)identified on-site
- 8. Manufacturer corrects no-conformances
- 9. Label is applied









- 1. Manufacturer attends this seminar
- 2. Manufacturer PRO-ACTIVELY contacts the test lab prior to shipping the unit
- 3. Applicable requirements/specifications are determined
- 4. Quote issued to the client
- 5. Manufacturer accepts and signs quote
- 6. PDR : Preliminary Design Review conducted at Manufacturer site (prior to Installation)
- 7. Final inspection scheduled at installation site
- 8. AHJ Approves the installation the first time!!!

Field Label Process





- Proper design/construction/voltage
- Properly sized components
- Appropriate non-combustible enclosures
- Over-current/Overload protection & sizing



Risk of Shock

- 30Vrms/60Vdc
- Protection against accessibility
- Appropriate enclosures
- Articulated Finger Probe
- Grounding



Field Label Process



Risk of Mechanical Hazards

- Pinch points/sharp points/Tip Hazard
- Accessibility to moving parts Crushing and Tearing Hazards
- Appropriate Enclosures/Guards
- Appropriate warnings and labels
- Risk of High Current/Energy

Markings

- Manufacturer/Model No./Electrical Ratings
- Caution markings
- Risk of Fire/Shock/Mechanical Hazards
- Caution markings relevant to hazards within the installation site

Compliance to applicable electrical, technical, and mechanical safety standards

- National Electric Code
- Key Component Safety Standards
- Local Building/ Electrical Codes



It All Began With Thomas Edison...





Initially part of the Edison Illuminating Company, Intertek began testing light bulbs in 1896.

Over 110 years later, we have the world's largest network of product safety, performance and EMC testing laboratories.

Acquisitions Include:

- Sagentia Catella, renowned energy storage / battery testing & advisory services group in Sweden
- Entela, experts in safety, performance and certification for the automotive industry in Michigan





An Extensive Global Network





Intertek Energy Storage Lab Locations







World Leading Independent Advisory, Testing & Certification Services in Power Source Technologies

50+ year track record in power sources – from uninterruptable power supplies and electric vehicles to cellular phones and medical devices

Our expertise covers:



Batteries & Chargers





Competitive Differentiators



Experienced Team

200+ years of collective experience and academic advanced degrees in the field of battery technology and applied electrochemistry

Combination of advisory and testing experience

World-Class Test Facilities

Unique scope and breadth of testing capabilities

We assess over 20,000 batteries each year, covering all chemistries and sizes

Independently accredited laboratories

Global reputation recognized for uncompromised independence and well-founded advice– the "Sagentia Catella" brand

Global Network contacts in the battery industry and among leading research institutions

Thank You!



Valued Quality. Delivered.



Please let us know of any questions you have at this time.

SEE US AT BOOTH B428

Booth # B428





www.intertek.com

Contact Intertek:

1.800.WORLDLAB

icenter@intertek.com

www.intertek.com/automotive/ev

Rich Byczek: <u>rich.byczek@intertek.com</u> Intertek Global Technical Lead Electric Vehicle & Energy Storage Tel: 734-582-2900

Intertek

Valued Quality. Delivered.

Valued Quality. Delivered.





