中美电动汽车技术与标准交流会
会议指南

U.S.-China Workshop on Electric Vehicle Technology and Standardization

Guide

中国 • 北京

Beijing, China

2015 年 6 月 9 日

June 9th, 2015

会议须知

1. 会场位于北京市中国科技会堂 B-103 会议室，请与会代表提前 5 分钟入场；
2. 会议期间请将手机置于静音状态；
3. 用餐安排：会议期间安排中午自助餐，时间：12:20-13:30，地点：宴会厅；
4. 会务组联系电话：

中国汽车技术研究中心	陆　春	18222838087
	李金玉	13652103095
美国国家标准协会	许　方	13901879678
	陆　一	13916668070

Notice

1. The conference will be held in meeting room B-103 at China Hall of Science and Technology, please enter the conference room five minutes in advance;
2. Please silence your cell phone during the conference;
3. Buffet is provided for lunch during 12:20-13:30 at banquet hall;
4. Contact:

CATARC	Mr. Lu Chun	18222838087
	Ms. Li Jinyu	13652103095
ANSI	Mr. Xu Fang	13901879678
	Ms. Lu Yi	13916668070

议程

时间	内容
上午会议主持：中方 CATARC	
9:00-9:45	致辞（10 分钟/人） — 中方：科技部、国标委各一人 — 美方：美国大使馆商务参赞 Val Huston、美国国家标准协会总裁
9:45-10:15	CATARC：中国电动汽车标准化路线图介绍-吴志新-CATARC
10:15-10:45	ANSI：EVSP 进展报告- Jim McCabe, ANSI
10:45-11:00	茶歇
11:00-11:20	中方代表演讲 1：电动汽车动力蓄电池标准-孟祥峰，CATARC
11:20-11:40	美方代表演讲 1：电池安全- Bob Galyen, CATL
11:40-12:00	美方代表演讲 2：交通电气化- Yu Yuan, IEEE
12:00-12:15	Q&A
12:20-13:30	午餐
下午会议主持：美方 ANSI	
13:30-13:50	美方代表演讲 3：无线充电- Kunihiko Kumita, 丰田 (SAE International)
13:50-14:10	美方代表演讲 4：无线充电- Mark Klerer, 高通
14:10-14:30	中方代表演讲 2：无线充电-田峰，中兴通讯
14:30-14:50	美方代表演讲 5：电动汽车充电设施- Joe Bablo, UL
14:50-15:10	中方代表演讲 3：充电设施建设-刘永东，中电联
15:10-15:25	Q&A
15:25-15:40	茶歇
15:40-16:00	美方代表演讲 6：互换性测试- Rich Byczek, Intertek
16:0:0-16:20	中方代表演讲 4：电动汽车整车安全-王洪军，比亚迪
16:20-16:40	美方代表演讲 7：紧急救援- Liu, Yuanjing,美国国家防火协会
16:40-17:00	中方代表演讲 5：电动汽车消防与救护-黄昊，上海消防所
17:00-17:15	Q&A
17:15-17:30	会议总结（CATARC 和 ANSI）

Agenda

Time	Events
Morning session to be moderated by CATARC	
9:00-9:45	Opening Remarks - Representatives from Ministry of Science and Technology (MOST) and Standardization Administration of China (SAC), People's Republic of China - Joe Bhatia, President and CEO, American National Standards Institute (ANSI) - Val Huston, Principal Commercial Officer, U.S. Embassy, Beijing, China
9:45-10:15	Development of China EV Standard - China Automotive Technology and Research Center (CATARC)
10:15-10:45	Standardization Roadmap for Electric Vehicles – Jim McCabe, Senior Director, Standards Facilitation, ANSI
10:45-11:00	Coffee Break
11:00-11:20	EV Battery Standards – Dr. Meng Xiangfeng CATARC
11:20-11:40	Battery Safety – Robert (Bob) L. Galyen, Chief Technology Officer, Contemporary Amperex Technology Limited (CATL) and President, Business Development, Amperex Technology Limited (ATL)
11:40-12:00	Transportation Electrification – Dr. Yu Yuan, Secretary & Standards Chair, IEEE Transportation Electrification Community
12:00-12:15	Q&A
12:20-13:30	Lunch
Afternoon session to be moderated by ANSI	
13:30-13:50	Wireless EV Charging – Kunihiko Kumita, Toyota (for SAE International)
13:50-14:10	Unleashing the Potential of Electric Mobility: Standardization of Wireless EV Charging – Mark Klerer, Senior Director – Technology, Qualcomm
14:10-14:30	Wireless EV Charging – Tianfeng, ZTE
14:30-14:50	Electric Vehicle Supply Equipment Standards – Joe Bablo, Principal Engineer – Automotive Equipment and Associated Technologies, Underwriters Laboratories (UL), and Eric Zhang, Standards Manager, UL
14:50-15:10	Construction of Charging Infrastructure – Liu Yongdong, China Electricity Council
15:10-15:25	Q&A
15:25-15:40	Coffee Break
15:40-16:00	Interoperability – Rich Byczek, Global Technical Lead, Intertek Transportation

	Technologies
16:0:0-16:20	Electric Vehicle Safety-Wang Hongjun, BYD
16:20-16:40	National Fire Protection Association (NFPA) Electric / Hybrid Vehicle Safety Training for Emergency Responders – Joe Bablo, UL and Yuanjing Liu, Regional Director for China, NFPA
16:40-17:00	Fire Protection and Rescue - Shanghai Fire Protection Research Institute
17:00-17:15	Q&A
17:15-17:30	Closing Remarks - CATARC and ANSI

Val Huston

美国驻华大使馆商务参赞 Val Huston 先生带领着由贸易专家组成的团队致力于增进中美贸易关系，通过商务外交把美国产品和服务出口到中国，包括帮助美国公司寻求市场机遇、寻找中国贸易合作伙伴，协助中国公司赴美投资、促进美国教育旅游机会和倡导美国经济和贸易利益。

2008 年至 2012 年期间，Huston 先生曾在比利时布鲁塞尔的美国驻欧盟使团担任副高级商务官员一职，他非常胜任这一覆盖整个欧盟及 27 个成员国的独特贸易政策的职务，为美国和欧盟机构建设跨大西洋伙伴关系，寻找新的商业机遇和消除贸易壁垒做出了贡献。例如，他促进绿色环保技术跨大西洋紧密合作。如电动汽车、智能电网和能源效率。他在跨大西洋经济委员会的电动交通工作计划中起着主导作用。

Huston 先生于 1993 年 1 月加入总部位于华盛顿特区的美国商务部国际贸易局 (ITA)。在他任职的六年里，他处理过对韩工作事务，并担任国际运营-东南亚地区副局长。

1999-2002， 被委派到菲律宾首都马尼拉担任商务官员，处理由美国商务部和美国国际开发总署共同出资的美国与亚洲环境合作方案。

2002-2004，任职于美国印第安纳州首府印第安纳波利斯的美国出口援助中心，协助印第安纳州的出口商进入全球市场和扩大对全球市场出口，尤其是北美自由贸易协定的成员国加拿大和墨西哥。

2004-2008，任职于美国驻华大使馆商务官员，负责关于环境、能源效率、建设、工程和交通有关的工作。任职期间，成功协助了十次美国商务部长访华团，六次州长访华贸易团。

在二十世纪 80 年代，他为美国海军核动力项目效力六年。

Huston 先生先后获得乔治梅森大学硕士学位及美国欧道明大学学士学位。他的妻子来自于中国上海—Juliana Zhuan，他们现有三个孩子。

Val Huston

Mr. Val Huston is the Principal Commercial Officer at the U.S. Embassy in Beijing, China, leading a team of dedicated trade professionals increase commercial ties between the U.S. and China. Conducting U.S. commercial diplomacy to increase U.S. product and service exports to China includes: helping U.S. companies find market opportunities and Chinese trading partners; assisting Chinese firms find investment opportunities in the United States; promoting U.S. education and tourism opportunities; and advocating for U.S. national economic and trade interests.

Previously serving as the Deputy Senior Commercial Officer at the U.S. Mission to the European Union in Brussels, Belgium (2008-2012), Mr. Huston managed this unique trade policy post covering the European Union and its 27 member states and engaged EU institutions in advancing transatlantic commercial relations by identifying new commercial opportunities and removing obstacles to trade. For example, he fostered close transatlantic cooperation in green technologies such as electric vehicles, smart grids and energy efficiency and played a leading role in the formulation and launch of the Transatlantic Economic Council's e-mobility work program.

Mr. Huston joined the Department of Commerce's International Trade Administration (ITA) in January 1993. During his six-year tenure at ITA headquarters in Washington, D.C., he worked on the Korea Desk, in the Assignments Office, and as the Associate Director for International Operations for Southeast Asia.

From 1999-2002, Mr. Huston served abroad as a commercial officer in Manila, the Philippines, where he managed the U.S.-Asia Environmental Partnership Program -- a program jointly funded by USDOC and USAID.

From 2002-2004, Mr. Huston served in the U.S. Export Assistance Center in Indianapolis, and assisted Indiana exporters to enter and expand their markets around the world, especially to the NAFTA countries of Canada and Mexico.

From 2004-2008, he served as a commercial officer in Beijing, China and was responsible for the environment, energy and energy efficiency, construction, engineering, and transportation sectors. During his tenure in Beijing, he supported ten Secretary of Commerce visits and/or trade missions and six Governor-led trade missions.

In the 1980s, he served six years in the U.S. Navy's Nuclear Power Program.

Mr. Huston holds a MA from George Mason University and a BA from Old Dominion University. He is married to Juliana Zhuang from Shanghai, China, and they have three children.

S. JOE BHATIA

总裁及首席执行官
美国国家标准协会(ANSI)

巴提亚先生于 2006 年 1 月 1 日担任美国国家标准协会(ANSI)总裁兼首席执行官。

在加入 ANSI 之前，他曾就职于美国保险商实验室(UL)担任国际事务执行副总裁和首席运营官。30 多年的任期中，Bhatia 先生积极地推动全球业务发展，主要负责工程、政府关系、外交事务、UL 认证服务以及管理 3 亿美金以上的国际项目。

曾担任泛美标准化委员会(COPANT)副主席四年的巴提亚先生于 2013 年当选为委员会主席。他还担任过产业贸易咨询委员会--贸易壁垒标准和技术(ITAC 16)的副委员长，ITAC 16 是美国商务部和美国贸易代表办公室的联合项目。巴提亚先生还是是国际标准化组织(ISO)理事会及其策略常务委员会的成员，并在美国欧克顿社区学院教育基金理事会占有一席，最近还退休成为美国消防协会董事会成员之一。

因巴提亚先生有着众多的专业背景，他时常在美国和世界各地展开关于国际贸易、技术性发展、商业市场准入以及卫生、安全和环境问题的演讲。

巴提亚先生先后获得电气工程学士学位和工商管理硕士学位。他和妻子普提娜共有两个儿子。

ANSI 是由公司、政府和其他成员组成的志愿性非盈利组织，并努力提高美国在国际标准化组织中的地位。ANSI 负责协商与标准相关的活动，审议美国国家标准。ANSI 与各类认证和验证机构共同积极推动标准化认证程序，其中包括产品、服务、人员和温室气体排放。ANSI 是唯一美国国家委员会承认的国际标准化组织(ISO)、国际电工委员会(IEC)的美国代表。ANSI 同时也是国际认可论坛、太平洋地区标准大会和泛美标准化委员会的成员。

2015 年 4 月

S. JOE BHATIA

President and Chief Executive Officer
American National Standards Institute (ANSI)

S. Joe Bhatia began his tenure as president and chief executive officer of the American National Standards Institute (ANSI) on January 1, 2006.

Prior to joining ANSI, Mr. Bhatia held the position of executive vice president and chief operating officer of the international group at Underwriters Laboratories Inc. (UL). During his 30-plus-year tenure with the organization Mr. Bhatia assumed positions of progressive leadership in global business operations. His areas of responsibility included engineering, governmental and congressional liaisons, external affairs, follow-up (certification) services and direction of UL's $300+ million international operations.

In 2013, Mr. Bhatia was elected to serve as president for the Pan American Standards Commission (COPANT); he previously served as COPANT vice president for four years. He also serves as vice chairman of the Industry Trade Advisory Committee on Standards and Technical Trade Barriers (ITAC 16), a joint program of theU.S. Department of Commerce and U.S. Trade Representative.A member of the International Organization for Standardization (ISO) Council and its Standing Committee on Strategies,Mr. Bhatiaalso holds a seat on the Oakton Community College Education Foundation Board and recently retired as a member of the National Fire Protection Association Board of Directors.In addition to his numerous professional affiliations, Mr. Bhatia is a frequent lecturer in the U.S. and around the world on topics such as international trade, technical developments, commercial market access, and health, safety and environmental concerns.

Mr. Bhatia holds a Bachelor of Science in electrical engineering and a Master of Science in business management. He and his wife, Punita, have two sons.

ANSI is a not-for-profit membership organization that brings together organizations from both the private and public sectors dedicated to furthering U.S. and international voluntary consensus standards and conformity assessments. ANSI accredits national standards developing organizations and approves American National Standards. ANSI is also actively engaged in accrediting programs that assess conformance to standards, with programs for all types of certification and verification bodies, including those for products/products/services, personnel, and greenhouse gas emissions. It is the sole U.S. representative to the International Organization for Standardization (ISO) and, via the U.S. National Committee, the International Electrotechnical Commission (IEC). ANSI is also a member of the International Accreditation Forum, the Pacific Area Standards Congress, and the Pan American Standards Commission.

April 2015

吴志新　　博士, 教授级高工，博士生导师

- 中国汽车技术研究中心副主任
- 全国汽车标准化技术委员会电动汽车分技术委员会主任委员，国家科技部 863 计划“节能与新能源汽车”重大项目总体组专家，中国汽车工程学会电动汽车分会副主任，汽车工程学会特聘专家。
- 2005 年被评为天津市电动汽车领域授衔专家，2008 年被聘为天津大学博士生导师，2008 年被授予“改革开放 30 年中国汽车工业杰出人物”，2011 年被联合国工业发展组织授予“卓越领导力奖”。
- 近年来主持完成了与清洁汽车、电动汽车相关的国家和省部级以及国外基金项目科研课题 20 余项。

Dr. Wu Zhixin　　Professor Senior Engineer, Doctoral Supervisor

- **Vice-president of CATARC**
- Chairman of EV sub-committee of NTCAS, Specialist of major projects “Energy saving and new energy vehicles” of the “863 Project” of the Ministry of Science and Technology, Deputy director of EV sub-committee of SAE of China and distinguished professor of SAE.
- Specialist of EV field in Tianjin, 2005;Doctoral Supervisor of Tianjin University, 2008;“Outstanding person in China’s auto industry” since 30 years of the reform and opening up policy,2008;“Excellent leadership” by UNIDO,2011.Direct and complete more than 20 scientific research projects of clean energy vehicles and electric vehicles in recent years.

中国电动汽车标准化工作路线图
Standardization Roadmap of Electric Vehicle in China

吴志新
Zhixin Wu

中国汽车技术研究中心

目 录
Content

目 录
Content

中国汽车技术研究中心
China Automotive Technology & Research Center

研究背景 Research Background

➢ 标准法规是保证电动汽车产品的质量、促进技术水平提升的重要途径。
Standards and regulations are playing an important role in leading the development of technologies



➢ 国内外电动汽车领域标准的研究制定日趋活跃
Standardization activities of electric vehicles have grown locally or overseas.

➢ 中国积极参与电动汽车国际标准化工作
China has actively participated into international EV standardization affairs.

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研究背景 Research Background

德国于2014发布了《德国电动汽车标准路线图》(ver 3)；美国于2014年11月发布了《美国电动汽车标准路线图进展报告》(ver 2)。

German Standardization Roadmap for Electromobility (ver 3) has been finished in 2014. US Standardization Roadmap for Electric Vehicles Progress Report (ver 2) has been finished in 2014.

中国汽车技术研究中心 China Automotive Technology & Research Center

目 录
Content

1，研究背景 Research Background

2，编制思路 Methodology

3，技术内容 Technology Related Content

4，相关交流合作 Communication and Cooperation

5，下阶段计划 Plan of Next Phase

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编制思路 Methodology

2.1 路线图定位与计划 Orientation and Plan

定位 Orientation	原则 Principle	计划 Plan
电动汽车标准工作的目标、计划说明文件 Prescriptive document containing specific goals and work plans for EV standardization	用清晰易懂的方式使参与者、利益相关方理解中国电动汽车标准化工作目标、计划 Using simple and vivid words to elaborate specific goals and work plans for EV standardization in China	时间范围： 2014~2025 紧急（2014-2015）、短期（2016-2017）、中期（2018-2020）、长期（2021-2025）共4个阶段。 The term of roadmap is 2014~2025. Divided into 4 stages: urgent(2014~ 2015), short(2016~2017), medium(2018~ 2020), long(2021~ 2025).

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编制思路 Methodology

2.2 路线图的范围和覆盖类别 Scope of Roadmap and Categories Involved

范围
Scope

电动车辆 Electric vehicle

- BEV、HEV、FCEV、电摩及零部件等；
- BEV, HEV, FCEV, electric motor cycles and EV parts, etc.;

基础设施 Infrastructure

- 充电桩、充电站和换电站、加氢站等；
- charging piles, charging stations, battery replacement stations, hydrogen refueling station, etc.;

相关产业 Relevant industries

- 运输、回收利用、教育培训、抢险救援等.
- transportation, recycling, educational training and emergency rescue related to EV and battery;

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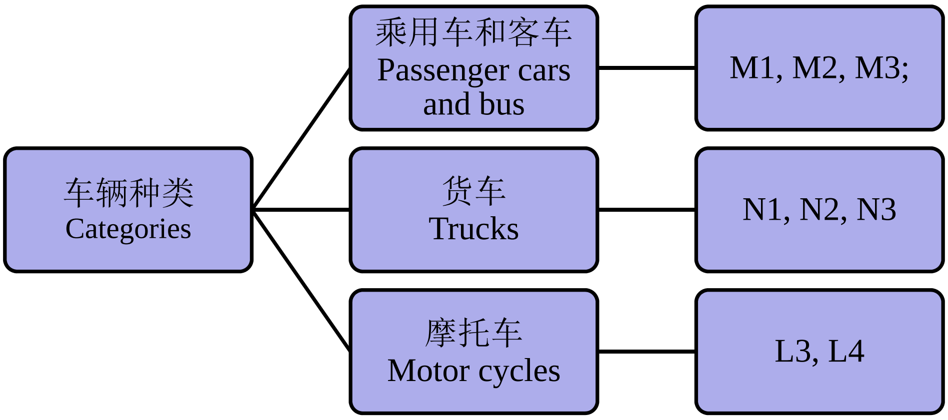
编制思路 Methodology

2.2 路线图的范围和覆盖类别 Range of Roadmap and Categories Involved



不包括电动自行车、低速电动车、电动高尔夫球车、电动场地车等没有获得国家公告、不能合法上路行驶的二轮、三轮和四轮及多轮的电动车辆。
Two-wheel, three-wheel, four-wheel and multi-wheel electric vehicles that are not permitted to run on highways, such as electric bicycles, low-speed electric vehicles, electric golf vehicles and electric tracked vehicles;)

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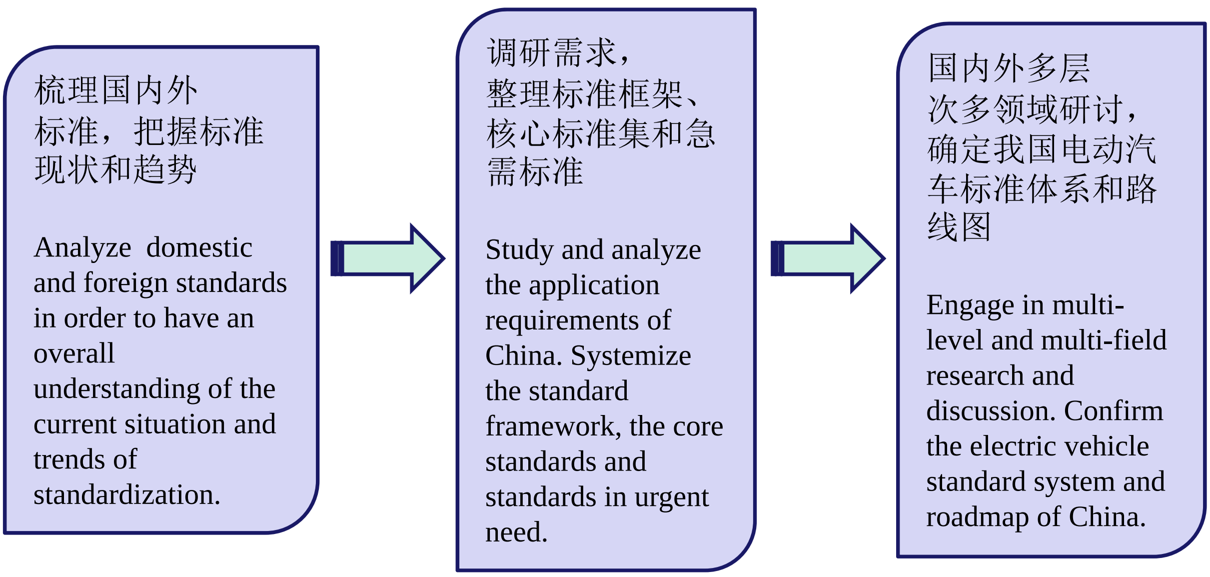
编制思路 Methodology

2.3 研究过程 Research Process



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编制思路 Methodology

2.4 路线图的目标 Objectives of Roadmap

I

提出系统、科学的EV标准体系与发展计划

Build systematic and scientific EV standard system and developing plan

II

满足科研、产业化、商业化运行和政府管理的需要;

Meet requirements of scientific research, industrialization, commercialized operation and government management

III

促进国际标准化工作，推动中国标准走向世界

Support international standardization work. help Chinese standards accepted by the world

目 录
Content

中国汽车技术研究中心 China Automotive Technology & Research Center

技术内容 Technology Related Content

四个主要领域:
Four main aspects:

电动车辆
Electric vehicle

相关产业
Related Industries

1. Current situation
2. Standards in need
3. Priority

界面与通信
Interface and Communication

基础设施
Infrastructure

中国汽车技术研究中心
China Automotive Technology & Research Center

技术内容 Technology Related Content

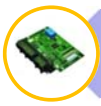
3.1 电动车辆 Electric Vehicle


基础通用
Basic Standard


整车
Whole Vehicle


电动汽车可充电储能系统
Electric Vehicle Rechargeable Energy Storage System


电驱动系统
Electric Drive System


控制系统
Control System


其他总成和零部件
Other Assemblies and Parts

技术内容 Technology Related Content

3.2 界面与通信 Interface and Communication

界面与通信 Interface and Communication

- 电动汽车充电 Electric vehicle Charging
- 换电 Battery Replacement
- 加氢 Hydrogen Refueling
- 智能交通系统 Intelligent Transportation System
- 智能电网及微电网 Infrastructure Information Network
- 数据安全 Data Security
- 应急救援通信 Emergency Response Communication
- 智慧城市相关体系信息网络 Information Networks of Smart City
- 。。。

技术内容 Technology Related Content

3.3 基础设施 Infrastructure

- 充电设施关键设备
  Key Devices of the Charging Facility
- 充电站建设规划
  Charging Station Construction Planning
- 充换电站服务网络
  Service Network of Charging and Battery Replacing
- 换电标准
  Standard for Battery Replacement

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技术内容 Technology Related Content

3.4 电动汽车相关产业 Electric vehicle Related Industries

电动汽车相关产业 Electric vehicle Related Industries			
紧急救援及培训 Emergency Rescue and Training	回收利用 Recycling	运营 Operation	包装、存储、运输 Packaging, Storage and Transportation

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技术内容 Technology Related Content

研究示例：
Research Example

电动汽车一般安全 EV General safety

电动汽车的一般安全包含REESS与整车的关系、整车功能安全要求和整车触电防护三部分。国际上也基本按此三个层次设置相关标准。

General safety of electric vehicles includes relations between REESS and vehicles, functional safety requirements of vehicles and electric shock prevention of vehicles. Internationally, relevant standards are established based on these three aspects.

该领域国内标准现状：
Current situation of standards for this field in China:

我国的GB/T18384-1、2、3-2001电动汽车安全要求分别包含REESS与整车的关系、整车功能安全要求和整车触电防护三部分，是我国最早发布的电动汽车标准，它来自ISO6469-1、2、3系列的早期版本。目前，中国的GB/T18384-1、2、3-2015已经等效采用ISO6469-1、2、3最新版本修订完成，已结发布。

GB/T18384-1, 2, 3-2001, Electric vehicle Safety Requirements have three parts, namely relations between REESS and vehicles, functional safety requirements of vehicles and electric shock prevention of vehicles. It is the earliest automobile standard of China. It derives from early version of ISO6469-1, 2, 3 series. At present, GB/T18384-1, 2, 3-2015 has already been revised based on latest version of ISO6469-1, 2, 3 and have already been released.

技术内容 Technology Related Content

研究示例：
Research Example

碰撞安全要求：Post crash safety requirement

电动汽车的碰撞安全要求主要考核高压电路和REESS在碰撞后的安全状态。

该领域国内标准现状：Current situation of standards for this field in China:

在我国GB/T18384/1-2001电动汽车安全要求标准中的8部分，包含了电动汽车车载储能装置的碰撞要求，中国的电动汽车科研与准入一直使用这个碰撞要求。目前中国已制定独立的电动汽车碰撞后安全要求标准，2015年5月已经发布GB/T31498-2015电动汽车碰撞后安全要求。

该领域国外标准现状：Current international situation of standards for this field:

ECE-R94/95法规在传统汽车正碰和侧碰要求基础上，增加了电动汽车碰撞后安全要求，主要考核高压电路和REESS在碰撞后的安全状态。美国的FMVSS 305法规标准也主要针对电动汽车碰撞后安全要求。

ISO6469-4电动汽车碰撞后安全要求已经完成了相关内容的制定。

技术内容 Technology Related Content

研究成果：
Research Achievement

	Urgent（2015.1-2015.12）	Short Term（2016.1-2017.12）	Middle Term（2018.1-2020.12）	Long Term（2021.1-2025.12）
Related Industries	1.3,2	1.1,3.1,3.2	1.2,1.4,1.5	
Infrastructure				
Interface and Communications	1.A	C,1.D,12,13,14,16	1.B,2,3,4,5,6,7,8,9 10,11,12,13,14,16	4,5,6,7,8,9,10,11 12,13,14,15,16
Others		6.1,6.2		
Control System	5.1	5.1,5.2	5.2,5.3	5.3
Electric Drive System	4.1.A,4.1.B,4.1.C,4 .2	4.1.D,4.1.E,4.1.F	4.1.G	4.1.H,4.1.I,4.1.J
REESS	3.1.A,3.1.B	3.1.C	3.1.C	3.2
Whole Vehicle	2.1.A,2.1.B,2.2.A, 2.2.B	2.1.C,2.2.C,2.3.B,2.4	2.2.D,2.3.C	2.3.A
Basic Standards	1.1,1.2,1.5,1.7.A	1.4	1.3,1.6,1.7.B,1.7.C	1.7.B,1.7.C

Technical Roadmap

目 录
Content

相关交流合作 Related Communication

中德电动汽车标准路线图合作
Sino-Germany EV Roadmap Cooperation

牵头政府部门：
Government Department：

中华人民共和国工业和信息化部
Ministry of Industry and Information Technology

德国联邦经济和技术部
Federal Ministry of Economics and Technology

执行机构：
Executive Organization：

中国汽车技术研究中心
CATARC

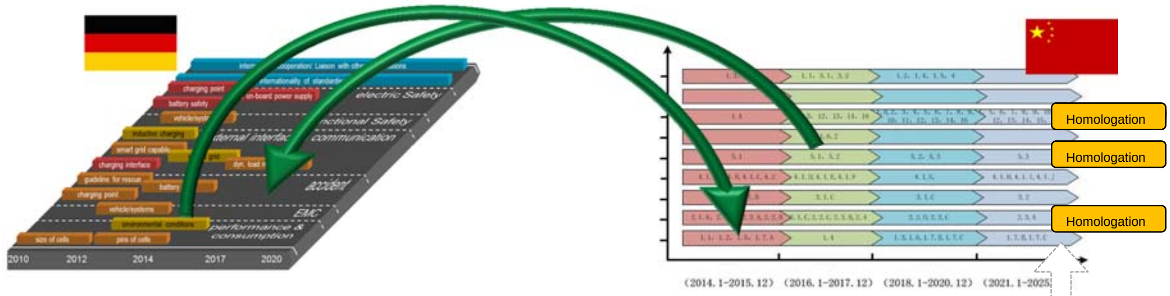
德国标准化研究所
Normalization Institute of Germany

德国汽车工业协会
Association of the automotive industry

相关交流合作 Related Communication

中德电动汽车标准路线图合作
Sino-Germany EV Roadmap Cooperation

- 中德《路线图》文本对比
Comparison between German and Chinese Roadmap



- 确定后续标准协调的大体方向、相关方等宏观思路
Identification of topics for future harmonization including involvement of relevant partners
- 确定标准协调技术层面思路
Identification of mandatory topics/ Homologation

目 录
Content

下阶段计划 **Plan of Next Phase**

1

- 完善第二版草案，补充电动汽车基础设施部分路线图；
- Add roadmap of infrastructure part as supplement;

2

- 在国内通过电动汽车分标委的平台征求意见、讨论完善；
- Utilize the platform of electric vehicle standardization sub-committee for wider discussion

3

- 通过国际双、多边合作及“电动汽车标准法规国际研讨会”等平台讨论。
- Internationally, further discuss Roadmap under the frame of bi-lateral and multilateral cooperation and “International Symposium of Electric Vehicle Standards and Regulation”

感谢聆听
Thanks For Attention

Jim McCabe
Senior Director, Standards Facilitation
American National Standards Institute (ANSI)

Jim McCabe serves as senior director, standards facilitation, at the American National Standards Institute, where he oversees domestic and international standards coordination activities. Recent projects have included: establishing a network to discuss standards activities for smart and sustainable cities; developing and maintaining a standardization roadmap to facilitate the safe, mass deployment of electric vehicles and charging infrastructure in the United States; and organizing workshops with partners in the U.S., Europe and China to facilitate cooperation on electric vehicle standardization.

Mr. McCabe joined ANSI in 1995. Other standards coordination areas of focus have included identity theft prevention, protection of personal data and privacy, occupational safety and health management, consumer affairs, government relations and public policy, and corporate member services. Projects have included developing reports on: the financial impact of breached protected health information to enable businesses to build a case for enhanced PHI security; preventing the theft and misuse of personal financial information; the need for a national identity verification standard; and the methodologies used by research companies to measure identity crime. Mr. McCabe also served as convenor of an international working group on consumer participation in standards-setting.

In August 2013, Mr. McCabe was recognized by SES – the Society of Standards Professionals with its Honorary Life Member award. Prior to joining ANSI, Mr. McCabe served as director of arbitration for the Municipal Securities Rulemaking Board in Washington, DC. He is a graduate of The Catholic University of America.

Jim McCabe
标准促进资深总监
美国国家标准协会(ANSI)

Jim McCabe 先生是 ANSI 负责标准促进工作的资深总监，主要监管国内和国际标准的协调工作。近期的项目包括：建立工作网络贯彻落实智慧和可持续城市标准化活动、开展和维护标准化发展蓝图、在美国实行大规模开发电动汽车和充电基础设施以及与美国、欧洲和中国的合作伙伴共同合作组织研讨会，促进电动汽车标准化合作。

McCabe 先生于 1995 年加入 ANSI。其他标准协调的重点领域包括预防身份盗窃、个人数据和隐私保护、职业安全和卫生管理、消费者事务、政府关系和国家政策、和企业会员服务。项目包括为受保护的健康信息受侵后造成的经济影响会促使行业提高 PHI 安全；防止个人金融信息被盗用和误用；国家身份认证标准的需求以及调查公司鉴别身份犯罪的方法等提供发展报告他还是国际工作组召集人主要负责消费者参与国际标准制定工作。2013 年 8 月 McCabe 先生被“标准工作者学会”SES 授予终身荣誉会员称号。他毕业于美国天主教大学，在加入 ANSI 之前，曾在华盛顿特区担任市政证券规则制定委员会的仲裁主任。

电动汽车的标准化路线图

Jim McCabe
美国国家标准协会
标准促进高级总监

中美电动汽车标准化研讨会
2015 年 6 月 9 日

为什么制定一个电动汽车（EV）美国标准化路线图？

- 在最大程度上促进标准发展组织之间的协调
- 在过程中发挥作用，并针对标准组织向利益相关方提供指导。
- 使美国在有关电动汽车的政策和技术讨论方面能更好地与国际贸易伙伴协商
- 促进电动汽车及充电基础设施的技术传播
- 回应消费者对安全、互操作性、性能、成本以及环境方面的关切
- 公共政策的驱动因素：减少石油消耗和温室气体排放、实现能源独立、安全及经济增长

为什么是美国国家标准协会?

- 经由美国国家委员会，代表美国参加ISO 和IEC
  - 认可并批准 ISO/IEC 的美国技术归口单位（TAG）
- 太平洋沿岸和美洲地区的区域论坛成员
- 与欧洲标准机构建立联络关系
- 与其他国家标准机构的双边关系

是一个可以解决标准组织之间协调问题的中立论坛

ANSI EVSP

- 2011 年 3 月 ANSI 成立了电动汽车标准小组 (ANSI EVSP)
- 目的：通过国际间的协调，适应和参与，制定出一个标准合规的路线图以保证美国电动汽车和充电设施的安全性和认知度
- 严格的说一个协调机构不是一个用来开发标准的机构。
- 涉及100多家民间和公共部门组织，包括：汽车制造商、公用事业、电工行业、标准开发组织（SDO）、政府机构

ANSI EVSP 参与者

- 汽车联盟
- Argonne 国家实验室
- 全球汽车制造商协会
- 奥迪公司
- ChargePoint, Inc.
- 克莱斯勒
- 康宁公司
- 杜克能源
- 电力研究所
- Energetics
- 通用电气
- 通用汽车公司
- Hubbell
- IEEE
- Int’l Assn of Electrical Inspectors
- 国际编码理事会
- 天祥集团
- 三菱电机研究实验室
- 国家电业承办商协会
- 国家电气制造商协会
- 国家防火协会
- 美国国家公路交通安全管理
- 美国国家标准和技术
- 美国日产
- 太平洋西北国家实验室
- 高通公司
- 国际汽车工程师学会
- 施耐德电气
- 西门子
- 南加州爱迪生电力公司
- TUV SUD
- 美国保险商实验室的公司
- 美国能源部
- 等等。..

电动汽车标准小组可交付成果

- *电动汽车的标准化路线图*
  - *版本 1.0（2012 年 4 月）*
  - *版本 2.0（2013 年 5 月）*
  - *进度报告 （2014 年 11 月）*
- *ANSI EVSP 标准汇编*
  - 中问题相关标准的电子表格，（2014 年 11 月更新）可搜索到路线图
- 通过以上链接进行免费下载 www.ansi.org/evsp

路线图概述

- 确认问题以及现有或正在制订中的可解决这些问题的标准、规范和法规
- 建议在必要时制订出新的标准或修订现有的标准、合规的培训方案
- 建议能够标准开发何执行该工作的组织优先制定时间表
- 重点是美国市场，其在关键领域中强调了国际协调问题
- 主要涉及道路插电式电动车（PEV）、电池供电的纯电动车和插件混合动力车、充电基础设施以及相关的支持服务

路线图结论

- 40 多个组织对400 多项标准已进行了认定
- 许多 SDO（位于美国或美国之外）以开放的、基于普遍共识的方式制订全球相关标准
  - SAE、UL、NFPA、IEEE、IEC、ISO 等等
- 已对61 个问题进行了探讨
- 在 44 个案例中确认了差距
  - “差距”意指目前还没有发布的标准、规定或合规项目
- 随后的幻灯片中将重点说明路线图。

美国的监管体系

- 在美国，汽车安全是由美国运输部（DOT）的国家公路交通安全管理局 (NHTSA) 和联邦机动车安全标准 (FMVSS) 负责的。
  - 汽车的大多数组件均由制造商或供应商或第三方实验室进行了内部测试，汽车制造商给出合格评定自我声明。
- 基础设施安全必须遵守当地、州和国家法规和条例。
  - NFPA 70 ®第 625 条，国家电气规程® (NEC®)，提出了电动车供电设备(EVSE)、充电系统和耦合器的安全要求，必须在经过测试并确定适合于第 625 条中所述的用途之后列入以符合适于该管辖权（AHJ）组织的要求。

一般 / 车辆安全

- 术语
  - SAE J1715，第 1 和 2 部分
- 功率标定方法
  - SAE J2907 和 J2908 正在制订中
- 碰撞试验实验室的安全准则
  - SAE J3040 是一个正在开发中的信息报告
- 发声预警系统（“安静车厢”)
  - SAE J2889-1 和ISO 16254 将符合国家公路交通安全管理局(NHTSA) 的规定
  - 世界车辆法规协调论坛（第 29 工作组）正在制订全球技术条例（GTR）

电池 / 可充电的能源存储系统（RESS）的安全

- 充电系统的功能安全性/ 电池过热延迟事件
  - NHTSA 资助的 SAE 合作研究项目的主题
  - 未来的 NHTSA 规定和/或 SAE J2929 的修订版将考虑这项研究的成果
  - 第 29 工作小组研发GTR安全风险
- NHTSA / Argonne 国家实验室正在研究滞留在损坏或无法操作的 RESS 中的电能
  - 需要标准来评估 RESS 的状态和稳定性，并消除滞留的能源
  - 已完成SAE J3009,阐明了相同的范围

电池系统的安全（续）

- 蓄电池储能和应急反应
  - 电动汽车电池中锂离子的安全存储需要标准
  - NFPA 消防研究基金会报告论述了如何存储损坏的电动汽车蓄电池
  - 可能需要 对SAE J2990 的进一步指导，为反应者提供最佳的做法
  - NFPA EV 安全培训项目包含了反应者的问题
- 电池的包装、运输、处理
  - 有关电池开关站的安全操作的 IEC 62840 第 1 和 2 部分正在制订中
  - 关于废旧电池包装 / 运输的新的联合国规定于 2015 年生效

其他电池标准

- 电池性能参数和耐久性试验
  - SAE J1798 正在制订中
  - 考虑与 ISO 12405-2 的协调
- 电池回收
  - SAE J2974 和 J2984
- 电池的二次利用
  - UL 1974 正在制订中

传导式充电：耦合器的安全 / 互操作性

- IEC 61851 系列（IEC/TC 69）介绍了充电模式（级别）、安全方面及 EV 供电设备 (EVSE)
- IEC 62196 系列（IEC/SC 23 H）涉及连接器的安全、尺寸兼容性和互换性
- SAE J1772™ 涉及所有这一切，并在 IEC 标准中加以引用
  - 耦合器配置由于电气系统的不同而略微呈现地区差异，但在 SAE / IEC 文件中对车辆和充电系统之间的通信 / 控制接口的要求则基本上相同。
  - SAE 允许 AC / DC 充电在相同触针上进行；IEC 采用单独的触针进行交流 / 直流充电
  - SAE J1772™ 组合耦合器集成了 AC / DC 充电

耦合器的安全 / 互操作性（续）

- 美国、加拿大和墨西哥之间的北美协调产生了基于 UL 2251 的三国标准
  - 把握机会，努力协调与 IEC 62196 系列的差异
- 建设充电基础设施，以根据需要容纳耦合器配置的各种变化（例如，直流充电）

最近的发展

- 该领域的几种 SDO 出现过连接器过热现象
- SAE J3068 是一个正在制订中的三相交流耦合器标准，可用于商业和工业应用
- IEEE P2030.1.1 是直流快速充电器标准，正在制订中

充电基础设施的安全

非车载充电站和便携式电动汽车电线组件

- 美国、加拿大和墨西哥之间的协调导致产生了基于 UL 2594 的北美三国标准

人员保护设备（在 UL 2594 中引用）

- 北美三国标准基于 UL 2231-1 和 2
  - 努力协调与 IEC 61851 系列的分歧

非车载充电机

- 需要类似的三国倡议，以便协调北美地区UL 2202的要求

PEV / EVSE 之间的互操作性

- SAE J2953 涵盖了基础设施和使用 SAE J1772TM 耦合器的车辆间的硬件和通信互操作性。

无线充电

- 正在制定的标准
  - SAE J2954 车辆及基础设施的性能和安全规范，适用于与 UL 相关的无线充电；计划覆盖将来的动态充电
  - IEC 61980 系列
  - ISO PAS 19363
  - UL 2750 安全方面
  - 道路电气化 IEEE 预标准化工作
- 通讯方面
  - SAE J2836/6™ 和 J2847/6
  - IEC 61980-2
  - ISO 15118, 第 6 – 8 部分
- 需要协调

通讯

- 电动汽车与 EVSE 之间的充电相关通信包含在 SAE J1772TM 和 IEC 61851 系列中
- 涵盖了其他通信功能（智能充电、直流充电， PEV作为分布式能源资源 (DER) 、诊断程序、客户 PEV 及 HAN/NAN，无线功率流）的标准在许多情况下仍正在制订当中。
  - SAE J2836™ 系列（用例）
  - SAE J2847 系列（应用程序和信号）
  - SAE J2931 系列（协议）加（安全性 / 7）
  - SAE J2953 系列（测试程序的互操作性标准）
  - ISO/IEC 15118 系列映射到以上（ISO/IEC 联合工作组）

通讯 （续）

- 其它标准针对诸如能源服务供应商 (如，公用事业) 和电动汽车服务提供商（如，充电网络运营商）之类的参与者之间的通信来实现各种功能（如，定价、计量、计费等）
  - IEEE P2030.5、IEEE 采纳了由 ZigBee 联盟 / 家庭插电联盟制订的智能能源规范（SEP）2.0
  - IEEE 1901：IEEE 1901 的子集在 SAE J2931 系列中被采纳
  - 由北美能源标准委员会（NAESB）制订的能源服务提供商接口（ESPI）以及 ESPI 的绿色按钮分项计量简况
  - 开放式智能电网用户的小组制订的开放自动化需求响应 (OpenADR)

通讯 （续）

- 国家电气制造商协会(NEMA) 制订多个部分的标准，NEMA EVSE 1，以解决 EV 跨多个充电网络和服务提供商漫游的互操作性
  - 第 2 部分：身份验证的非接触式 RFID 凭据已进行了最终确定
- NEMA EVSE 1 的另外两个部分正在起草阶段
  - 身份验证、授权和计费会话数据交换
  - 配电站总监的数据模型和协议
- RFID 也适用于 IEC 62831
- 其他 SDO（欧洲的 eMI^3 、开放收费联盟、ETSI）适用于类似的范围
  - NEMA 和 eMI3 正在实现统一

电动汽车能耗的测量

- 美国国家标准与技术研究院（NIST）已制订出商业电力测量设备的要求
- NEMA 嵌入式计量指南已纳入两个计量认证标准草案中
  - NEMA EVSE 2 商业 EVSE 嵌入式计量标准，将补充NIST 手册 44条要求
  - NEMA EVSE 3 非商业性 EVSE 嵌入式计量标准，主要侧重于住宅应用（扣除计费）
- 智能电网互操作性小组 (SGIP）与 NEMA 和 NIST 合作以整合和调整 EV 辅助计量要求

其他路线图问题

- 内部高压线缆、车载布线、部件额定值、充电配件
- 车辆诊断和排放
- 图形符号
- 远程信息处理及驾驶分心
- 燃料效率、排放和标签
- 电磁兼容性
- 汽车到电网的应用程序（EV / EVSE 按分布式能源资源 (DER)，包括车载逆变器）
- 为电动汽车提供动力的备用电源
- 智能电网通信中的网络安全和数据保密
- 客户与 PEV 的通信
- EVSE 现场安装评估 / 功率容量评估
- 电动汽车的充电标志和停车
- 允许充电站
- EVSE 和环境/使用条件
- 为多个充电车通风
- EVSE 的物理 / 安全保护
- 针对残疾人使用 EVSE
- EVSE 缆线管理
- EVSE 维护
- 工作场所安全
- EVSE 标签和负荷管理因紧急情况断开连接
- 应急预案指导
- 灾害规划
- 员工培训

合作的机会

- 就车辆的降噪、安全和环境参加 WP.29 的与电动汽车有关的工作
- 参与 ISO 和 IEC 标准化制定
- 遵守世界贸易组织原则的机构制定的全球标准的基本标准和规章
- 如果有多个标准涵盖同一主题，则在可能的情况下，对技术要求协调/调整
  - 在工作小组层面上进行合作，以取得切实的成果
  - 这将促进在中国市场经营的美国公司和在美国市场经营的中国公司的贸易

机遇（续）

- 参加由美国能源部（DOE）赞助的半年度美中电动汽车及电池技术讲习班
- 与 DOE 共同讨论有关建立类似于美欧之间所设立的中国和亚太经合组织区域的互操作性中心
  - 共享数据，协调测试程序及设备，以指导标准化工作并促进互操作性
- 您合作的其他建议。

更多信息

Jim McCabe
标准促进高级总监
jmccabe@ansi.org
T:1-212-642-8921
www.ansi.org/evsp

谢谢!

美国国家标准学会

总部	纽约办事处
1899 L Street, NW Street	25 West 43rd
11th Floor	4th Floor
Washington, DC 20036	New York, NY 10036
T:202.293.8020	T: 212.642.4900
F:202.293.9287	F: 212.398.0023

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ANSI American National Standards Institute

Standardization Roadmap for Electric Vehicles

Jim McCabe
Senior Director, Standards Facilitation
American National Standards Institute

Sino – U.S. Workshop on EV Standardization
9 June 2015

ANSI American National Standards Institute

Why a U.S. Standardization Roadmap for Electric Vehicles (EVs)?

EVSP

- Maximize coordination among standards developing organizations
- Capture work in progress and provide guidance on standards participation to other stakeholders
- Enable the U.S. to speak more coherently with international trading partners in policy and technical discussions regarding EVs
- Foster technology dissemination for EVs and charging infrastructure
- Respond to consumer concerns regarding safety, interoperability, performance, cost, and environmental impact
- Public policy drivers: reduce petroleum consumption and greenhouse gas emissions, achieve energy independence and security, and economic growth

Why ANSI?

- U.S. member of ISO and, via U.S. National Committee, IEC
  - Accredits and approves U.S. mirror committees (TAGs) to ISO/IEC
- member of regional forums in the Pacific Rim and the Americas
- liaise with European standards bodies
- bilateral relationships with other national standards bodies

A neutral forum where standards coordination issues can be addressed

ANSI EVSP

- In March 2011 ANSI formed the Electric Vehicles Standards Panel (ANSI EVSP)
- Purpose: To develop a roadmap of the standards and conformance programs needed to facilitate the safe, mass deployment of electric vehicles and charging infrastructure in the United States, with international coordination, adaptability and engagement
- Strictly a coordinating body; it was <u>not</u> formed to develop standards
- 100+ private and public sector organizations involved: automakers, utilities, electrotechnical industry, standards developing organizations (SDOs), government agencies

ANSI EVSP Participants

- AutoAlliance
- Argonne National Laboratory
- Association of Global Automakers
- Audi AG
- ChargePoint, Inc.
- Chrysler
- Corning
- Duke Energy
- Electric Power Research Institute
- Energetics
- General Electric
- General Motors
- Hubbell
- IEEE
- Int'l Assn of Electrical Inspectors
- International Code Council
- Intertek
- Mitsubishi Electric Research Labs
- National Electrical Contractors Assn
- National Electrical Manufacturers Assn
- National Fire Protection Association
- National Highway Traffic Safety Admin
- National Institute of Standards and Technology
- Nissan USA
- Pacific Northwest National Laboratory
- Qualcomm
- SAE International
- Schneider Electric
- Siemens
- Southern California Edison
- TÜV SÜD
- Underwriters Laboratories, Inc
- U.S. Department of Energy
- And Many Others . . .

ANSI EVSP Deliverables

- *Standardization Roadmap for Electric Vehicles*
  - *Version 1.0 (April 2012)*
  - *Version 2.0 (May 2013)*
  - *Progress Report (November 2014)*
- *ANSI EVSP Standards Compendium*
  - a searchable spreadsheet of standards related to issues identified in the roadmap (updated November 2014)
- All available as free downloads at links above and at www.ansi.org/evsp

Roadmap Overview

- Identifies issues as well as standards, codes, and regulations that exist or that are in development to address those issues
- Recommends development of new or revised standards, conformance and training programs, where needed
- Suggests prioritized timeframes for standards development and organizations that may be able to perform the work
- Focus is U.S. market with international harmonization issues emphasized in key areas
- Primarily concerned with on-road plug-in EVs (PEVs), both battery-powered all electric and plug-in hybrids, charging infrastructure, and associated support services

Roadmap Conclusions

- Over 400 standards identified from more than 40 organizations
- Many SDOs (both U.S. based and non-U.S. based) produce globally relevant standards following an open, consensus-based process
  - SAE, UL, NFPA, IEEE, IEC, ISO and others
- 61 issues were explored
- In 44 cases, gaps were identified
  - A “gap” means no published standard, regulation, or conformance program exists
- Roadmap highlights are captured on subsequent slides

U.S. Regulatory Framework

- **Vehicle safety** in the U.S. is regulated by the U.S. Department of Transportation's (DOT) National Highway Traffic Safety Administration (NHTSA) and the Federal Motor Vehicle Safety Standards (FMVSS)
  - Most on-board vehicle components are tested in-house by the manufacturer or supplier, or by a third-party laboratory, and the automaker makes a self-declaration of compliance
- **Infrastructure safety** is governed by local, state and national codes and regulations
  - Article 625 of NFPA 70®, the National Electrical Code® (NEC®), sets forth safety requirements for Electric Vehicle Supply Equipment (EVSE), charging systems and couplers, which must be listed as compliant by an organization suitable to the Authority Having Jurisdiction (AHJ) after having been tested and found suitable for use as described in Article 625

General / Vehicle Safety

- Terminology
  - SAE J1715, Parts 1 and 2
- Power Rating Methods
  - SAE J2907 and J2908 under development
- Crash Test Laboratory Safety Guidelines
  - SAE J3040 is an information report under development
- Audible Warning Systems ("Quiet Car")
  - SAE J2889-1 and equivalent ISO 16254 will inform National Highway Traffic Safety Administration (NHTSA) regulation
  - World Forum for Harmonization of Vehicle Regulations (WP.29) working a Global Technical Regulation (GTR)

Batteries / Rechargeable Energy Storage System (RESS) Safety

- Functional Safety of Charging System / Delayed Battery Overheating Events
  - Subject of NHTSA-funded SAE Cooperative Research Project
  - Future NHTSA regulation and/or revisions of SAE J2929 will consider results of this research
  - WP.29 developing a GTR on safety risks
- NHTSA / Argonne National Laboratory researching electrical energy stranded in a damaged or inoperable RESS
  - Standards are needed to assess RESS condition and stability, and to remove stranded energy
  - Complete work on SAE J3009 to address a similar scope

Battery System Safety (contd.)

- Battery Storage and Emergency Response
  - Need standards for safe storage of lithium-ion EV batteries
  - NFPA Fire Protection Research Foundation report discusses storage of damaged EV batteries
  - Potential need for further guidance in SAE J2990 which provides best practices for emergency responders
  - NFPA EV Safety Training Project covers responder issues
- Battery Packaging, Transport, Handling
  - IEC 62840, Parts 1 and 2, on safe operation of battery switching stations is under development
  - New United Nations regulation on packaging / transport of waste batteries went into effect in 2015

Other Battery Standards

- Battery Performance Parameters and Durability Testing
  - SAE J1798 under development
  - Consider harmonization with ISO 12405-2
- Battery Recycling
  - SAE J2974 and J2984
- Battery Secondary Uses
  - UL 1974 under development

Conductive Charging: Coupler Safety / Interoperability

- IEC 61851 series (IEC/TC 69) describes charging modes (levels), safety aspects, and EV supply equipment (EVSE)
- IEC 62196 series (IEC/SC 23H) addresses the safety, dimensional compatibility and interchangeability of the connectors
- SAE J1772™ addresses all of this, is referenced in the IEC standards
  - Coupler configurations differ slightly by region due to differing electrical systems, but requirements for communications / control interface between vehicle and charging system is generally the same in SAE / IEC documents
  - SAE allows AC / DC charging to occur on same contact pins; IEC uses separate pins for AC / DC charging
  - SAE J1772™ combo coupler integrates AC / DC charging

Coupler Safety / Interoperability (contd.)

- North American harmonization between U.S., Canada and Mexico resulted in tri-national standard based on UL 2251
  - Work to harmonize differences with IEC 62196 series as opportunities arise
- Build out charging infrastructure to accommodate variations in coupler configurations as needed (e.g., DC charging)

Recent developments

- Several SDOs looking at connectors overheating in the field
- SAE J3068 is a three-phase AC coupler standard under development for commercial and industrial applications
- IEEE P2030.1.1 is a DC quick charger standard under development

Charging Infrastructure Safety

Off-board charging stations and portable EV cord sets

- Harmonization between U.S., Canada and Mexico resulted in North American tri-national standard based on UL 2594

Personnel protection equipment (referenced in UL 2594)

- North American tri-national standard is based on UL 2231-1 & 2
  - Work to harmonize differences with the IEC 61851 series

Off-board chargers

- Need a similar tri-national initiative to harmonize requirements in North America based on UL 2202

Interoperability between PEVs / EVSE

- SAE J2953 covers hardware and communications interoperability between infrastructure and vehicles that use the SAE J1772™ coupler

Wireless Charging

- Standards in development
  - SAE J2954 vehicle and infrastructure performance and safety specification for wireless charging in conjunction with UL; plans to cover dynamic charging in the future
  - IEC 61980 series
  - ISO PAS 19363
  - UL 2750 safety aspects
  - IEEE pre-standardization work on road electrification
- Communications aspects
  - SAE J2836/6™ and J2847/6
  - IEC 61980-2
  - ISO 15118, Parts 6 – 8
- Coordination is needed

Communications

- Charging related communications between EV and EVSE covered in SAE J1772™ and IEC 61851 series

- Standards covering other communications functions (smart charging, DC charging, PEV as a distributed energy resource (DER), diagnostics, customer to PEV and HAN/NAN, wireless power flow) in many cases are still being developed
  - SAE J2836™ series (uses cases)
  - SAE J2847 series (applications & signals)
  - SAE J2931 series (protocols) plus (security /7)
  - SAE J2953 series (interoperability criteria, test procedures)
  - ISO/IEC 15118 series maps to above (ISO/IEC Joint Working Group)

Communications (contd.)

- Other standards address communications between actors such as energy service providers (e.g., utilities) and EV service providers (e.g., charging network operators) for various functions (e.g., pricing, metering, billing, etc.)
  - IEEE P2030.5, IEEE Adoption of Smart Energy Profile (SEP) 2.0 developed by ZigBee Alliance / HomePlug Powerline Alliance
  - IEEE 1901: a subset of IEEE 1901 was adopted in the SAE J2931 series
  - Energy Services Provider Interface (ESPI) developed by the North American Energy Standards Board (NAESB) and Green Button Sub-metering Profile of ESPI
  - Open Automated Demand Response (OpenADR) 2.0 developed by Open Smart Grid User's Group

Communications (contd.)

- National Electrical Manufacturers Assn (NEMA) developing a multi-part standard, NEMA EVSE 1, to address interoperability of EVs roaming across multiple charging networks and service providers
  - Part 2: Contactless RFID Credential for Authentication is finalized
- Two other parts of NEMA EVSE 1 are in advanced drafting stage
  - Authentication, Authorization and Charging Session Data Exchange
  - Data Model and Protocols for Distribution Station Directors
- RFID also being worked on in IEC 62831
- Other SDOs (eMI^3 in Europe, Open Charge Alliance, ETSI) working on similar scopes
  - NEMA and eMI3 are working toward harmonization

Measurement of EV Energy Consumption

- National Institute of Standards and Technology (NIST) has developed requirements for commercial electricity-measuring devices
- NEMA embedded metering guide has migrated into two draft metrological certification standards
  - NEMA EVSE 2 Commercial EVSE Embedded Metering Standard, which will complement NIST Handbook 44 requirements
  - NEMA EVSE 3 Non-Commercial EVSE Embedded Metering Standard, focused primarily on residential applications (subtractive billing)
- Smart Grid Interoperability Panel (SGIP) working with NEMA and NIST to integrate and harmonize EV sub-metering requirements

Other Roadmap Issues

- Internal high voltage cables, on-board wiring, component ratings, charging accessories
- Vehicle diagnostics and emissions
- Graphical symbols
- Telematics and driver distraction
- Fuel efficiency, emissions and labeling
- Electromagnetic compatibility
- Vehicle-to-Grid applications (EV / EVSE as distributed energy resource (DER) including on-board inverters)
- Alternate sources to power an EV
- Cyber security and data privacy in smart grid communications
- Customer to PEV communications
- EVSE site installation assessment / power capacity assessment
- EV charging signage and parking
- Charging station permitting
- EVSE and environmental / use conditions
- Ventilation with multiple charging vehicles
- Physical / security protection of EVSE
- Accessibility for persons with disabilities to EVSE
- EVSE cable management
- EVSE maintenance
- Workplace safety
- Labeling of EVSE and load management disconnects for emergency situations
- Emergency response guides
- Disaster planning
- Workforce training

Opportunities for Cooperation

- Participate in EV-related work of WP.29 on quiet vehicle, safety, and the environment
- Participate in ISO and IEC standardization
- Base standards and regulations on globally relevant standards developed by bodies that adhere to World Trade Organization principles
- Harmonize / align technical requirements where possible when more than one standard covers the same subject
  - Cooperate at working group level to achieve tangible results
  - This will facilitate trade for U.S. companies operating in China market and Chinese companies operating in U.S. market

Opportunities (contd.)

- Participate in semi-annual U.S.-China EV and battery technology workshops facilitated by U.S. Department of Energy (DOE)
- Participate in discussions with DOE on establishing interoperability centers for China and APEC region similar to those set up between U.S. and Europe
  - Share data, harmonize test procedures and equipment, to guide standardization work and facilitate interoperability

- Your other suggestions on paths for cooperation . . .

for more information

Jim McCabe
Senior Director,
Standards Facilitation
jmccabe@ansi.org
T: 1-212-642-8921
www.ansi.org/evsp

Thank You!

American National Standards Institute

Headquarters
1899 L Street, NW
11th Floor
Washington, DC 20036

T: 202.293.8020
F: 202.293.9287

New York Office
25 West 43rd Street
4th Floor
New York, NY 10036

T: 212.642.4900
F: 212.398.0023

www.ansi.org
webstore.ansi.org
www.nssn.org

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电动汽车动力蓄电池标准

Standardization of RESS for xEVs

中国汽车技术研究中心标准所
全国汽标委电动车辆分标委

孟祥峰
Dr. Meng Xiangfeng

2015年6月9日，北京
9th Jun, 2015. Beijing

孟祥峰博士，高级工程师

- 现职：
  - 中国汽车技术研究中心标准化所四室（新能源汽车）主任
- 目前负责工作：
  - 新能源汽车领域标准化工作的组织协调，标准体系规划和具体标准制修订。
  - 作为主要协调人，参与国际标准法规制定，并在电动汽车直流充电、动力电池、整车安全等领域提出基于中国标准的多项国际标准法规提案，部分内容已成为国际标准的重要组成部分。

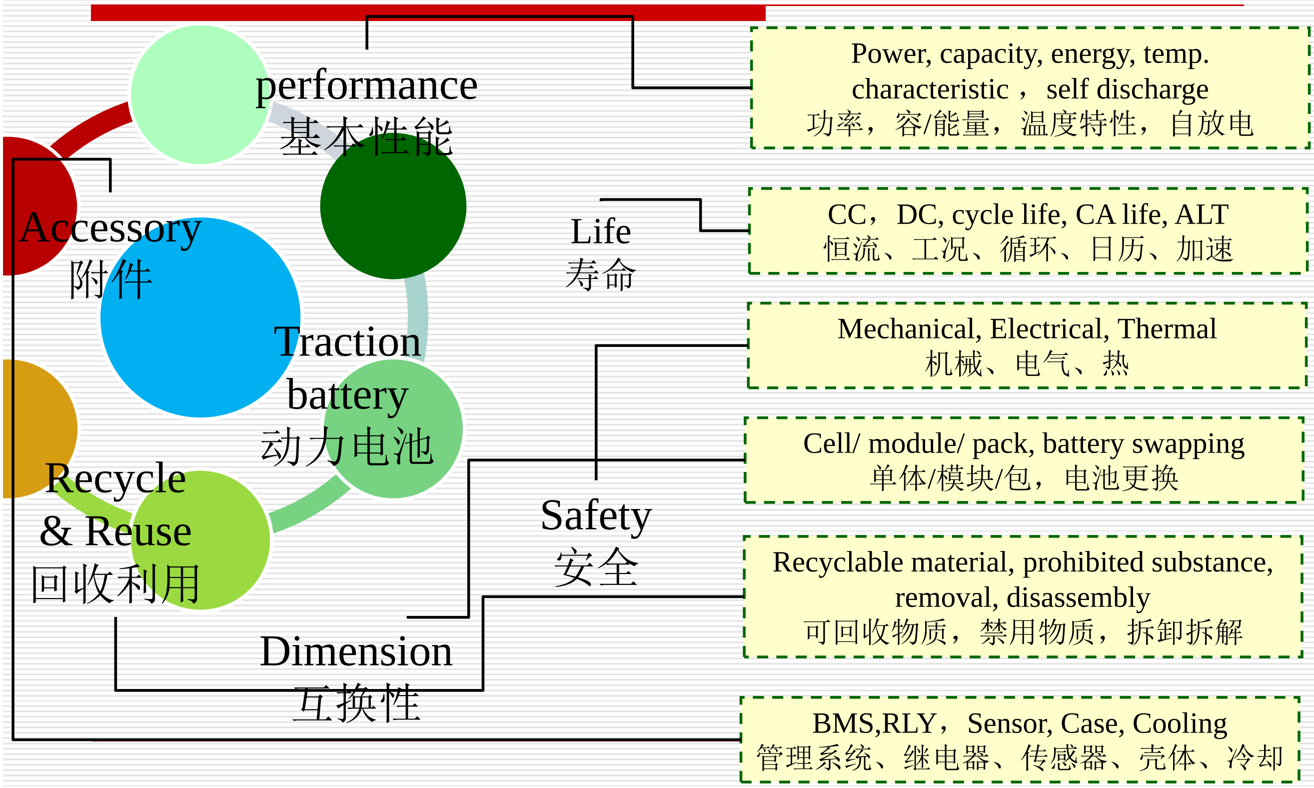
内容提纲Outlines

- 动力蓄电池标准体系
- 电池单体模块标准介绍
- 电池系统标准介绍
- 总结与展望

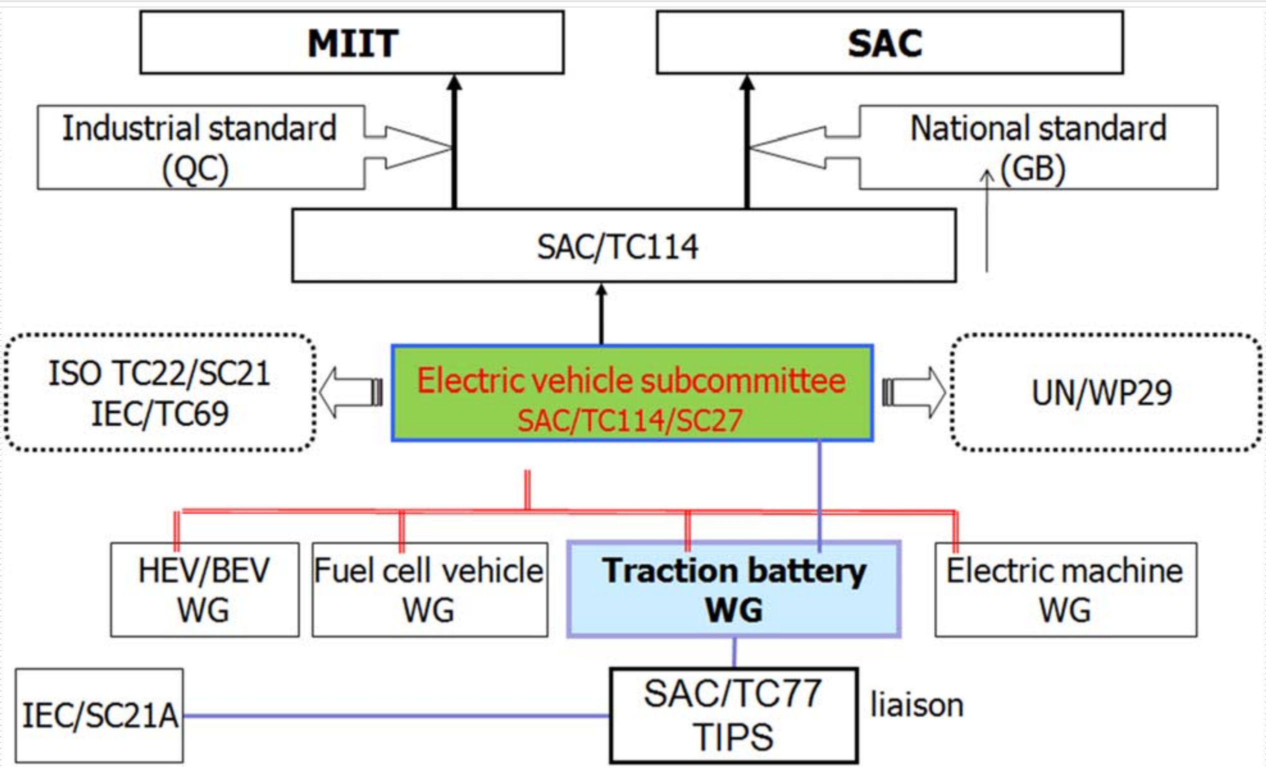
动力蓄电池标准化涉及的内容
Scope of standardization for traction battery

电池材料 material → 生产设备 cell level → 电池单体 cell level → 电池模块/包module &pack → 电池系统 system

动力蓄电池标准化涉及的内容
Scope of standardization for traction battery

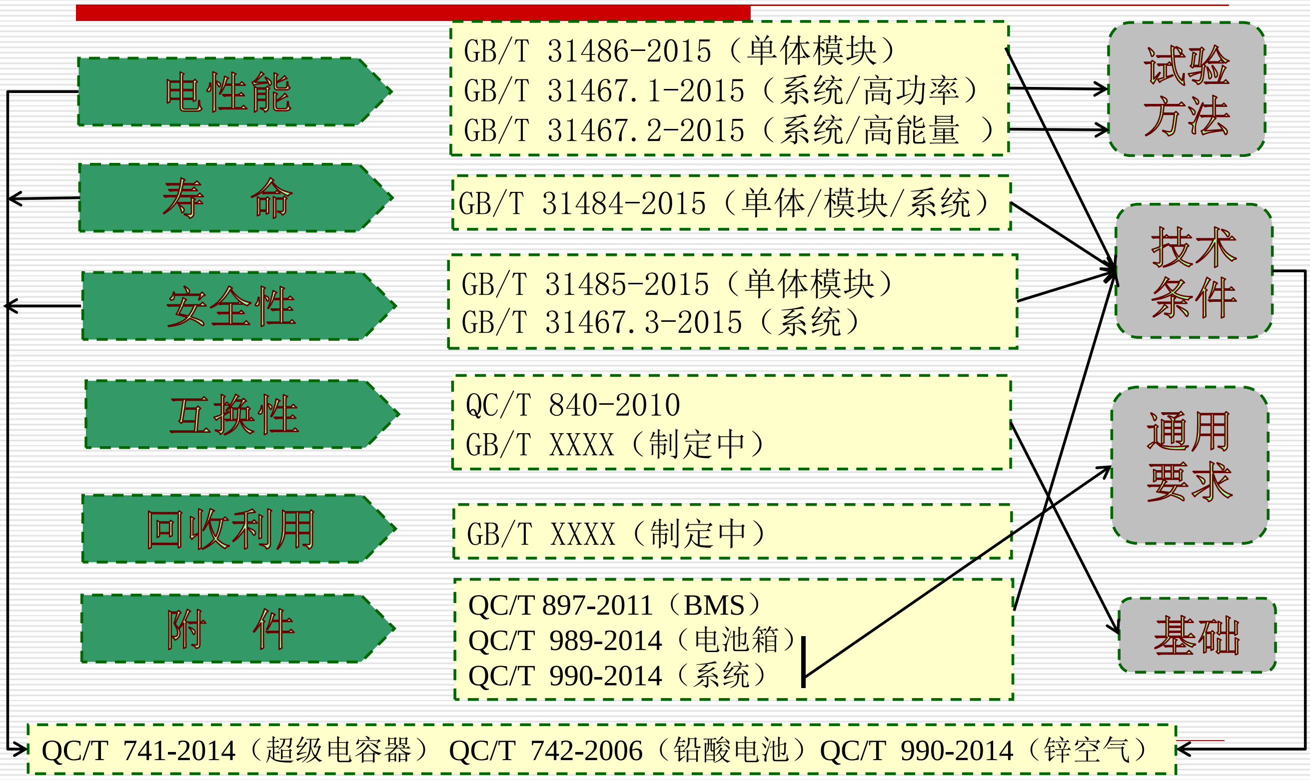


全国汽标委电动车分标委电池工作组
SAC/TC114/SC27/Battery WG



动力蓄电池标准体系
Scope of standardization for traction battery

Microsoft Office Excel 工作表



内容提纲Outlines

- 动力蓄电池标准体系
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- 总结与展望

GB/T 31486-2015

电动汽车用动力蓄电池电性能要求及试验方法

标准适用范围

本标准规定了电动汽车用动力蓄电池的电性能要求、试验方法、检验规则。

本标准适用于装载在电动汽车上的锂离子蓄电池和金属氢化物镍蓄电池单体和模块，其他类型蓄电池参照执行。

GB/T 31486-2015

电动汽车用动力蓄电池电性能要求及试验方法

单体

序号	检验项目	判定标准	检验方法
1	外观	符合要求	6.2.1
2	极性	符合要求	6.2.2
3	外形尺寸和质量	符合技术条件	6.2.3
4	室温放电容量	100%~110%，5%	6.2.5

模块

序号	检验项目	判定标准	检验方法
1	外观	符合要求	6.3.1
2	极性	符合要求	6.3.2
3	外形尺寸及质量	符合技术条件	6.3.3
4	室温放电容量	100%~110%，7%	6.3.5
5	室温倍率放电容量	90%或80%	6.3.6
6	室温倍率充电性能	80%	6.3.7
7	低温放电容量	70%或80%	6.3.8
8	高温放电容量	90%	6.3.9
9	荷电保持与容量恢复能力	85%、90% 85%/70%、95%	6.3.10
10	耐振动	符合要求	6.3.11
11	储存	90%	6.3.12

GB/T 31485-2015
电动汽车用动力蓄电池安全要求及试验方法

标准适用范围

本标准规定了电动汽车用动力蓄电池的安全要求、试验方法、检验规则。

本标准适用于装载在电动汽车上的锂离子蓄电池和金属氢化物镍蓄电池单体和模块，其他类型蓄电池参照执行。

GB/T 31485-2015
电动汽车用动力蓄电池安全要求及试验方法

序号	检验项目	判定标准	检验方法
1	过放电	不起火、不爆炸、不漏液	6.2.2/6.3.2
2	过充电	不起火、不爆炸	6.2.3/6.3.3
3	短路	不起火、不爆炸	6.2.4/6.3.4
4	跌落	不起火、不爆炸、不漏液	6.2.5/6.3.5
5	加热	不起火、不爆炸	6.2.6/6.3.6
6	挤压	不起火、不爆炸	6.2.7/6.3.7
7	针刺	不起火、不爆炸	6.2.8/6.3.8
8	海水浸泡	不起火、不爆炸	6.2.9/6.3.9
9	温度循环	不起火、不爆炸、不漏液	6.2.10/6.3.10
10	低气压	不起火、不爆炸、不漏液	6.2.11/6.3.11

GB/T 31484-2015
电动汽车用动力蓄电池循环寿命要求及试验方法

标准适用范围

本标准规定了电动汽车用动力蓄电池的标准循环寿命的要求、试验方法、检验规则和工况循环寿命的试验方法、检验规则。

本标准适用于装载在电动汽车上的动力蓄电池。

GB/T 31484-2015
电动汽车用动力蓄电池循环寿命要求及试验方法

序号	检验项目	判定标准	检验方法
1	室温容量和能量	100%~110%，5% 100%~110%，7%	6.2
2	室温功率	无	6.3
3	标准循环寿命	500次或1000次	6.4
4	HEV乘用车用功率型蓄电池工况寿命	500倍	6.5.1
5	HEV商用车用功率型蓄电池工况寿命	500倍	6.5.2
6	BEV乘用车用能量型蓄电池工况寿命	500倍	6.5.3
7	BEV商用车用能量型蓄电池工况寿命	500倍	6.5.4
8	PHEV电动汽车用蓄电池工况寿命	500倍	6.5.3或 6.5.4

内容提纲Outlines

- 动力蓄电池标准体系
- 电池单体模块标准介绍
- 电池系统标准介绍
- 总结与展望

GB/T 31467.1-2015电动汽车用锂离子动力蓄电池包和系统 第1部分：高功率应用测试规程

标准适用范围

本部分规定了电动汽车用高功率锂离子动力蓄电池包和系统电性能的测试方法。

本部分适用于装载在电动汽车上，主要以高功率应用为目的的锂离子动力蓄电池包和蓄电池系统，以高功率应用为目的的镍氢动力蓄电池包和系统等参照执行。

GB/T 31467.1-2015电动汽车用锂离子动力蓄电池包和系统 第1部分：高功率应用测试规程

	试验项目		适用范围	试验方法章条号	试验条件
基本性能	能量和容量测试	室温	蓄电池包，蓄电池系统	7.1.2	RT，1C，$I_{max}(T)$
		高温		7.1.3	40℃，1C，$I_{max}(T)$
		低温		7.1.4	0℃，-20℃，1C，$I_{max}(T)$
	功率和内阻测试		蓄电池包，蓄电池系统	7.2	RT，40℃、0℃、-20℃ SOC:80%（或由供应商和客户商定），50%，20%（或由供应商和客户商定）。
	无负载容量损失		蓄电池系统	7.3	SOC，满电态，40℃，RT， 168 小时（7 天），720 小时（30 天）
	存储容量损失			7.4	45℃，50%SOC（或由供应商和客户商定），720 小时，BCU 不工作
	高低温启动功率测试			7.5	20%SOC，-20℃，40℃。
	能量效率测试			7.6	RT，40℃，0℃，-20℃， SOC 65%，50%，35%

GB/T 31467.2-2015电动汽车用锂离子动力蓄电池包和系统 第2部分：高能量应用测试规程

标准适用范围

本部分规定了电动汽车用高能量锂离子动力蓄电池包和系统电性能的测试方法。

本部分适用于装载在电动汽车上，主要以高能量应用为目的的锂离子动力蓄电池包和蓄电池系统，以高能量应用为目的的镍氢动力蓄电池包和系统等参照执行。

GB/T 31467.2-2015电动汽车用锂离子动力蓄电池包和系统 第2部分：高能量应用测试规程

	试验项目		适用范围	试验方法章条号	试验条件
基本性能试验	能量和容量测试	室温	蓄电池包，蓄电池系统	7.1.1	RT， 1C, $I_{max}(T)$
		高温	蓄电池包，蓄电池系统	7.1.2	40℃， 1C，$I_{max}(T)$
		低温	蓄电池包，蓄电池系统	7.1.3	0℃，-20℃， 1/3C, 1C，$I_{max}(T)$
	功率和内阻测试		蓄电池包，蓄电池系统	7.2	40℃、RT、0℃、-20℃， SOC，90%（或由供应商和客户商定）、50%、20%（或由供应商和客户商定）
	无负载容量损失		蓄电池系统	7.3	SOC，满电态，40℃，RT， 168小时（7天），720小时（30天）
	储存中容量损失		蓄电池系统	7.4	SOC 50%（或由供应商和客户商定）， 45℃，720小时，BCU不工作
	能量效率测试		蓄电池系统	7.5	RT，0℃，Tmin（由供应商和客户商定）；1C，$I_{max}(T)$

GB/T 31467.3-2015电动汽车用锂离子动力蓄电池包和系统 第3部分：安全性要求与测试方法

标准适用范围

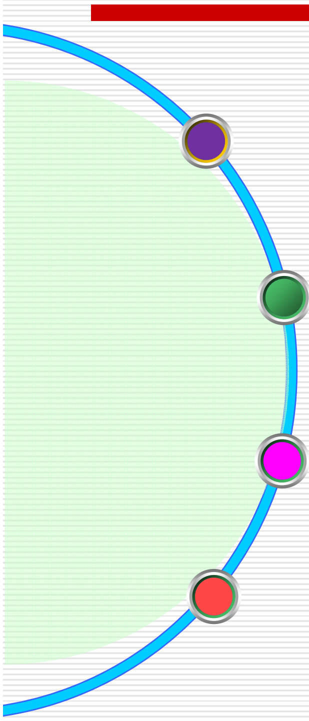
本部分规定了电动汽车用锂离子动力蓄电池包和系统安全性的要求和测试方法。

本部分适用于装载在电动汽车上的锂离子动力蓄电池包和系统，镍氢动力蓄电池包和系统等参照执行。

GB/T 31467.3-2015电动汽车用锂离子动力蓄电池包和系统 第3部分：安全性要求与测试方法

序号	测试项目	适用范围	试验方法章条号	
1	振动试验	包或系统 包或系统的电子装置	7.1.1 7.1.2	机械安全性
2	机械冲击	包或系统	7.2	
3	跌落	包或系统	7.3	
4	翻转	包或系统	7.4	
5	模拟碰撞	包或系统	7.5	
6	挤压	包或系统	7.6	
7	温度冲击	包或系统	7.7	环境安全性
8	湿热循环	包或系统	7.8	
9	海水浸泡	包或系统	7.9	
10	外部火烧	包或系统	7.10	
11	盐雾	包或系统	7.11	
12	高海拔	包或系统	7.12	
13	过温保护	系统	7.13	电气安全性
14	短路保护	系统	7.14	
15	过充电保护	系统	7.15	
16	过放电保护	系统	7.16	

内容提纲Outlines



动力蓄电池标准体系

电池单体模块标准介绍

电池系统标准介绍

总结与展望

总结与展望
Summary and prospect

- 汽车应用环境复杂，动力电池应适用于电池各种应用环境。
- 电池安全涉及到从单体到整车的各个层面，电池单体制造商、系统集成商、整车企业应该通力协作，才能保证最终产品的安全性。制定各级别层面的电池安全标准都非常重要。
- 中国的动力电池标准已初步建立。随着标准应用、数据的积累、技术的进步，标准需要不断修订和完善。

Thank you for your attention!

感谢聆听！

U.S.-China Workshop on Electric Vehicle Technology and Standardization

Standardization of RESS for xEVs

Auto Standardization Research Institute, CATARC
EV Subcommittee of National Technical Committee of Automotive Standardization

Dr. Meng Xiangfeng

9th Jun, 2015. Beijing

Dr. Meng Xiangfeng, Senior Engineer

Manager, Standard & Regulation Research Division 4

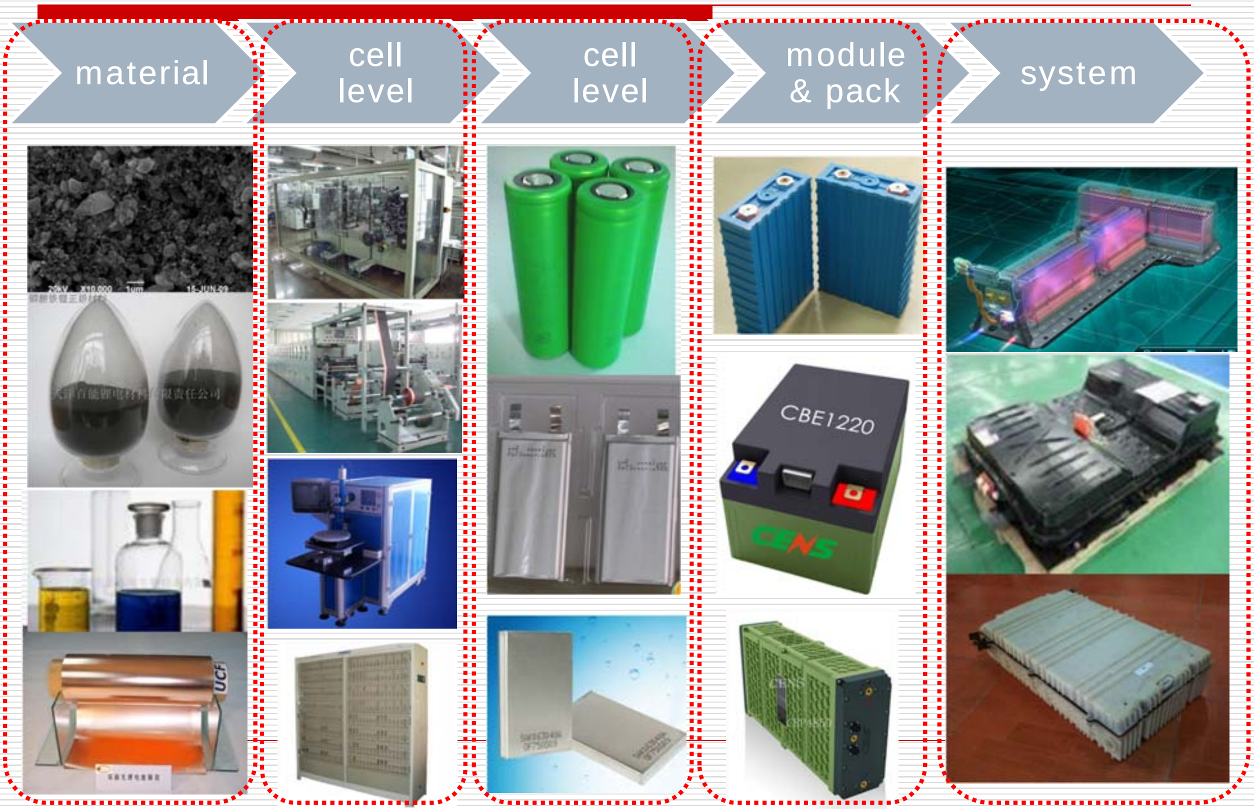
Auto Standard Research Institute，CATARC

In charging of organization and coordination of standardization in the field of New Energy Vehicles, standardization system planning, development and revision.

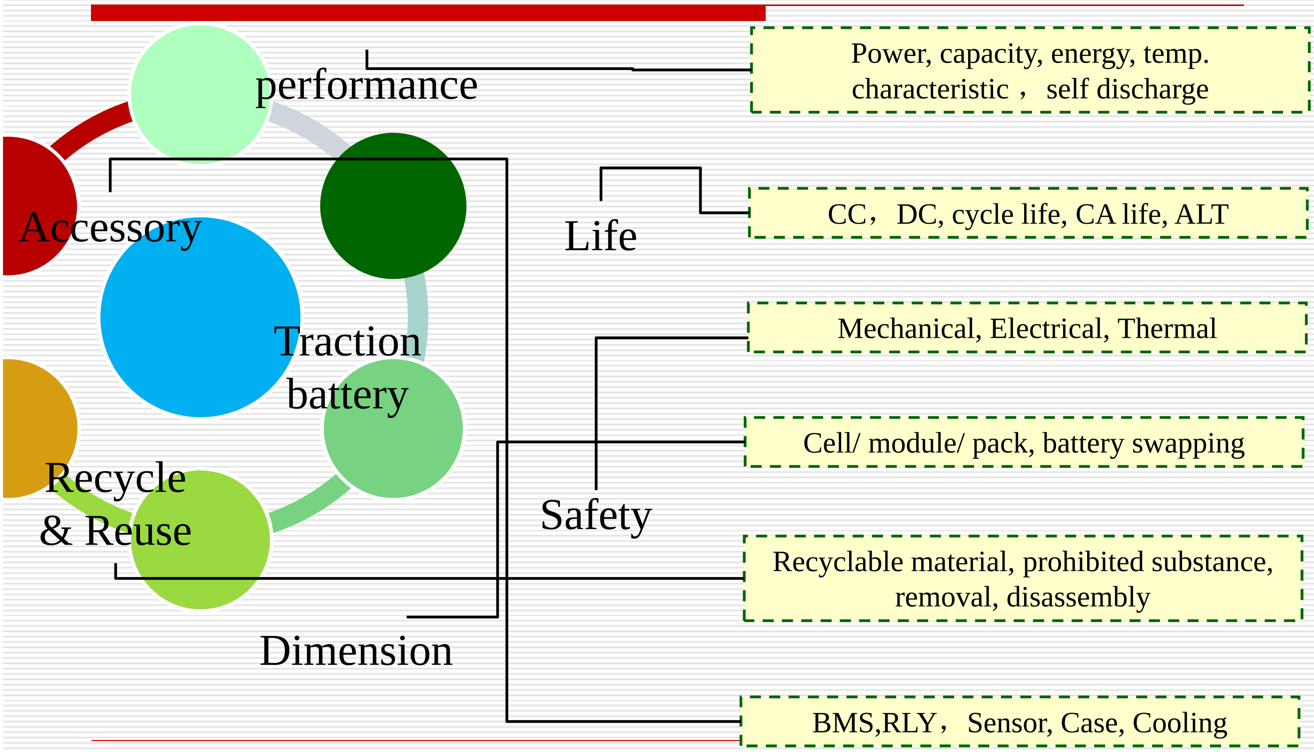
Outlines

- **Standardization System for Traction Battery**
- **Standardization for Battery cells and Modules**
- **Standardization for Battery System**
- **Summary and Prospect**

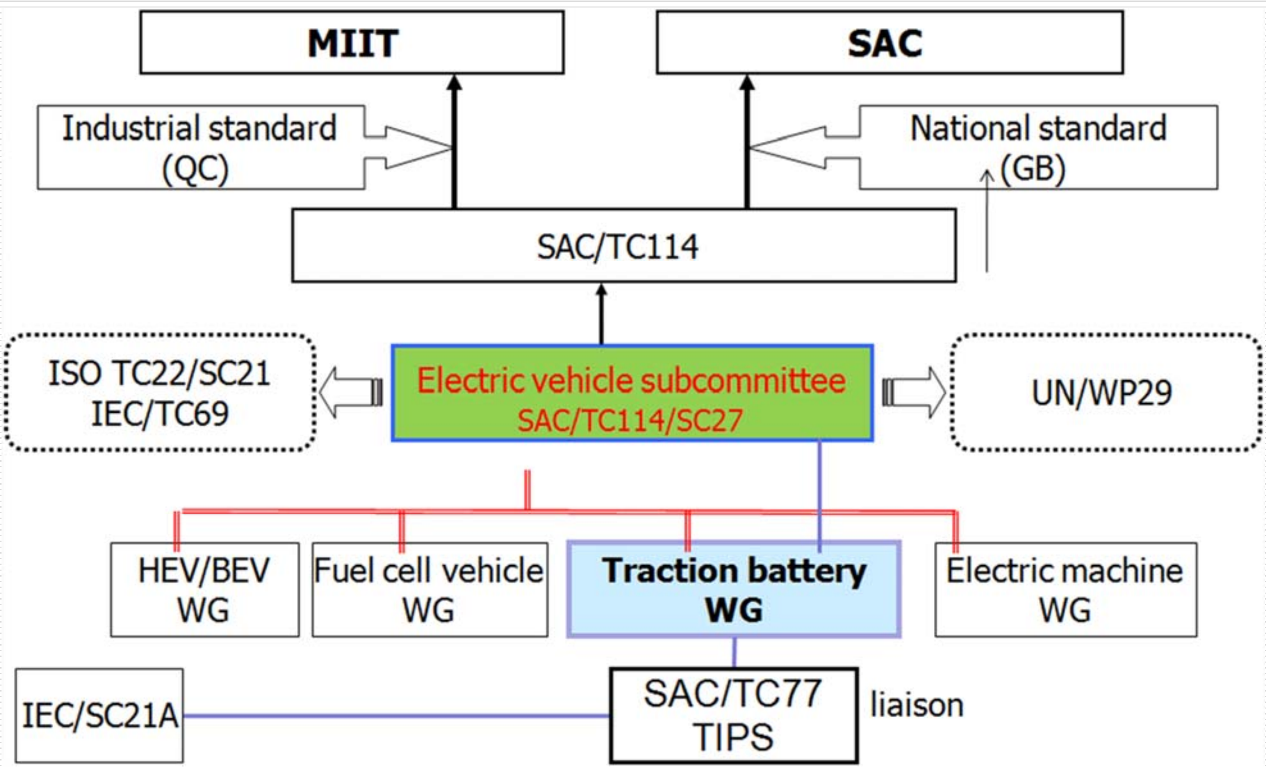
Scope of standardization for traction battery



Scope of standardization for traction battery



SAC/TC114/SC27/Battery WG



Scope of standardization for traction battery

licrosoft Office Excel 工作表

Electrical performance
- GB/T 31486-2015 (cell & module)
- GB/T 31467.1-2015 (system/high power)
- GB/T 31467.2-2015 (system/high energy)

Cycle life
- GB/T 31484-2015 (cell/module/system)

Safety
- GB/T 31485-2015 (cell & module)
- GB/T 31467.3-2015 (system)

Interchangeability
- QC/T 840-2010
- GB/T XXXX (within formulation)

Recycle and Recuse
- GB/T XXXX (within formulation)

Accessaries
- QC/T 897-2011 (BMS)
- QC/T 989-2014 (battery box)
- QC/T 990-2014 (system)

QC/T 741-2014 (supercapacitor) QC/T 742-2006 (lead-acid cell) QC/T 990-2014 (zinc-air battery)

Test method

Specification

General requirements

Basic

Outlines

- **Standardization System for Traction Battery**
- **Standardization for Battery cells and Modules**
- **Standardization for Battery System**
- **Summary and Prospect**

GB/T 31486-2015 Technical requirements and test methods for traction battery of electric vehicle Electrical performance

Range of application

This standard specifies the Electrical performance requirement, test method and inspection rules for EV traction battery.

This standard applies to Li-ion and NiMH cells and modules used for EV ,other types of batteries implement this standard by reference.

GB/T 31486-2015 Technical requirements and test methods for traction battery of electric vehicle-Electrical performance

cell

No.	Test Item	requirement	Test method
1	Appearance	Meet the requirement	6.2.1
2	Polarity	Meet the requirement	6.2.2
3	Dimension and weight	Meet the requirement	6.2.3
4	Discharge capacity at room temp	100%~110%，5%	6.2.5

Module

No.	Test Item	requirement	Test method
1	appearance	Meet the requirement	6.3.1
2	polarity	Meet the requirement	6.3.2
3	Dimension and weight	Meet the requirement	6.3.3
4	Discharge capacity at RT	100%~110%，7%	6.3.5
5	Rate discharge capacity at RT	90%or80%	6.3.6
6	Rate charge capacity at RT	80%	6.3.7
7	Discharge capacity at low temperature	70%or80%	6.3.8
8	Discharge capacity at high temperature	90%	6.3.9
9	charge maintenance and charge recovery	85%/90% 85%/70%/95%	6.3.10
10	vibration resistance	Meet the requirement	6.3.11
11	Storage	90%	6.3.12

GB/T 31485-2015 Technical requirements and test methods for traction battery of electric vehicle-Safety

Range of application

This standard specifies the safety requirement， test method and inspection rules for EV traction battery.

This standard applies to Li-ion and NiMH cells and modules used for EV ,other types of batteries implement this standard by reference.

GB/T 31485-2015 Technical requirements and test methods for traction battery of electric vehicle-Safety

No.	Test Item	requirement	Test method
1	Over discharge	no fire, no explosion, no leakage	6.2.2/6.3.2
2	Over charge	no fire, no explosion	6.2.3/6.3.3
3	Short circuit	no fire, no explosion	6.2.4/6.3.4
4	Fall off	no fire, no explosion, no leakage	6.2.5/6.3.5
5	Over heat	no fire, no explosion	6.2.6/6.3.6
6	Extrusion	no fire, no explosion	6.2.7/6.3.7
7	Nail penetration	no fire, no explosion	6.2.8/6.3.8
8	Seawater immersion	no fire, no explosion	6.2.9/6.3.9
9	Temp cycle	no fire, no explosion, no leakage	6.2.10/6.3.10
10	Low-pressure	no fire, no explosion, no leakage	6.2.11/6.3.11

GB/T 31484-2015 Technical requirements and test methods for traction battery of electric vehicle-Cycle life

Range of application

This standard specifies the standard cycle life requirement， test method, inspection rules and working conditions for EV traction battery.

This standard applies to traction batteries for EV

GB/T 31484-2015 Technical requirements and test methods for traction battery of electric vehicle-Cycle life

No.	Test Item	requirement	Test method
1	Capacity and energy at RT	100%~110%，5% 100%~110%，7%	6.2
2	Power at RT	/	6.3
3	Standard cycle life	500 or 1000cycles	6.4
4	Cycle life tested by working conditions for power batteries used for commercial HEV	500 cycles	6.5.1
5	Cycle life tested by working conditions for power batteries used for commercial HEV	500 cycles	6.5.2
6	Cycle life tested by working conditions for energy batteries for BEV passenger cars	500 cycles	6.5.3
7	Cycle life tested by working conditions for energy batteries used for commercial BEV	500 cycles	6.5.4
8	Cycle life tested by working conditions for PHEV batteries	500 cycles	6.5.3 or 6.5.4

Outlines

- **Standardization System for Traction Battery**
- **Standardization for Battery cells and Modules**
- **Standardization for Battery System**
- **Summary and Prospect**

GB/T 31467.1-2015 Electrically propelled road vehicles — Test specification for Lithium-ion traction battery packs and systems — Part 1: test method for high-power applications

Range of application

This standard specifies the electric performance requirement and test method for high-power EV li-ion battery packs and systems.

This standard applies high-power EV li-ion battery packs and systems, high-power NiMH battery packs and systems implement this standard by reference.

GB/T 31467.1-2015 Electrically propelled road vehicles — Test specification for Lithium-ion traction battery packs and systems — Part 1: test method for high-power applications

	Test Item		Range for application	Test method	Test conditions
Basic requirement	Capacity and energy test	Room temp	Pack and system	7.1.2	RT,1C,Imax(T)
		Hi temp		7.1.3	40°C,1C,Imax(T)
		Low temp		7.1.4	0°C, −20°C,1/3C,1C, Imax(T)
	Power and internal resistance test		Pack and system	7.2	40°C, RT, 0°C, −20°C, SOC 80%,50%,20%(or TBD),
	Capacity lost while no load		System	7.3	SOC 100%, 40°C, RT, 168h(7d),720h(30d)
	Storage capacity lost			7.4	SOC 50%(or TBD), 45°C, RT, 720h(30d),BCU not work
	Starting power at High temp and low temp			7.5	20% SOC,-20°C,40°C
	Power efficient test			7.6	40°C, RT, 0°C, −20°C, SOC 65%, 50%, 35%

GB/T 31467.2-2015 Electrically propelled road vehicles — Test specification for Lithium-ion traction battery packs and systems — Part 2: test method for high-energy applications

Range of application

This standard specifies the electric performance requirement and test method for high-energy EV li-ion battery packs and systems.

This standard applies high-energy EV li-ion battery packs and systems, high-energy NiMH battery packs and systems implement this standard by reference.

GB/T 31467.2-2015 Electrically propelled road vehicles — Test specification for Lithium-ion traction battery packs and systems — Part 2: test method for high-energy applications

	Test Item		Range for application	Test method	Test conditions
Basic performance test	Capacity and energy test	Room temp	Pack and system	7.1.1	RT,1C,Imax(T)
		Hi temp		7.1.2	40°C,1C,Imax(T)
		Low temp		7.1.3	0°C, −20°C,1/3C,1C, Imax(T)
	Power and internal resistance test		Pack and system	7.2	40°C, RT, 0°C, −20°C, SOC90%(or TBD), 50%,20%
	Capacity lost while no load		System	7.3	SOC 100%, 40°C, RT, 168h(7d),720h(30d)
	Storage capacity lost			7.4	SOC 50% (or TBD), 45°C, RT, 720h(30d),BCU not work
	Power efficient test			7.5	RT, 0° C, Tmin (TBD) 1C,Imax(T)

GB/T 31467.3-2015Electrically propelled road vehicles — Test specification for Lithium-ion traction battery packs and systems — Part 3: Safety

Range of application

This standard specifies the safety requirement， test method for EV li-ion battery packs and systems.

This standard applies to Li-ion battery packs and systems, NiMH battery packs and systems implement this standard by reference.

GB/T 31467.3-2015Electrically propelled road vehicles — Test specification for Lithium-ion traction battery packs and systems — Part 3: Safety

No.	Test Item	requirement	Test method	
1	Vibration test	Pack or system	7.1.1	**Machinery safety**
		Electric device for pack or system	7.1.2	
2	Mechanical shock	Pack or system	7.2	
3	Fall off	Pack or system	7.3	
4	Overturn	Pack or system	7.4	
5	Crash simulation	Pack or system	7.5	
6	Extrusion	Pack or system	7.6	
7	Temperature shock	Pack or system	7.7	**Environmental safety**
8	Humidity thermal cycle	Pack or system	7.8	
9	Seawater immersion	Pack or system	7.9	
10	External fire	Pack or system	7.10	
11	Salt mist	Pack or system	7.11	
12	High altitude	Pack or system	7.12	
13	Over temp protection	System	7.13	**Electric safety**
14	Short circuit protection	System	7.14	
15	Over charge protection	System	7.15	
16	Over discharge protection	System	7.16	

Outlines

- **Standardization System for Traction Battery**
- **Standardization for Battery cells and Modules**
- **Standardization for Battery System**
- **Summary and Prospect**

Summary and prospect

- EV traction battery should be able to be suitable for the different and complicated application conditions.
- As the cell level to vehicle level are all involved with the battery safety, it needs a concerted effort among cell manufactures, system integrator and car companies in order to guarantee the safety of the final product. Formulate the safety standards for batteries at different levels are all very important.
- As the development of standard application, data accumulation, and technology, the standards needs to be revised and improved constantly.

Thank you for your attention!

Robert (Bob) L. Galyen

Chief Technical Officer
Contemporary Amperex Technology Limited

President Business Development
Amperex Technology Limited

“National Distinguished Expert” China 1000 Program
SAE Chairman Battery Standards Steering Committee
President Elect NAATBatt for 2016
Dean’s Executive Advisory Board Ball State University

Robert (Bob) L. Galyen, age 60, is recognized as one of the top executives in the energy storage world with experience in technology and business operations of small and large corporations. He currently holds the position of President of Global Business Development for Amperex Technology Limited and Chief Technical Officer of Contemporary Amperex Technology Limited, both located in Ning De City, Fujian Province in The People’s Republic of China. Bob is the Chairman of the SAE International Battery Standards Steering Committee with 21 Committees reporting to him. He also serves as Liaison to the MVC and China Automotive Advisory Councils for SAE International. He serves on two non-profit organizations including Lugar Center for Renewable Energy Advisory Board at IUPUI and the Dean’s Executive Advisory Council of Ball State University. Bob’s education includes a Master’s degree in Chemistry, with Bachelor’s degrees in Chemistry and Biology from Ball State University. His 38 years’ work experience in battery technology, manufacturing and management has given him unique perspective on worldwide business, making him uniquely qualified as an energy storage spokesperson globally. Bob sits on 5 Board of Directors of corporations within the USA. He is the recipient of numerous awards including; the Automotive News “Electrifying 100”, the SAE International Technical Standards Board “Outstanding Contribution Award”, Ball State University “Circle of Excellence Award”, the NFPA Fire Protection Research Foundation’s “Foundation Medal”, General Motors “Best of the Best” award and most recently the prestigious Chinese “1000 Talent Plan Award”. Bob’s expertise has afforded him many public speaking opportunities worldwide. He was the first person to have been featured on the front cover of Batteries International.

Brief Bio: May2015

博阁仁

时代新能源科技有限公司首席技术官
新能源科技有限公司业务发展总裁

中国1000名人才计划“国家特聘专家”
国际自动机工程师学会电池标准委员会主席
2016年国家先进技术电池联盟总裁
鲍尔州立大学教务执行委员会顾问

Robert（Bob）L. Galyen，60 岁，以其在中小型企业的业务运营和技术经验被公认为能源存储界的世界级高管之一。他目前在中国福建省宁德市新能源科技有限公司担任全球业务发展总裁，同时身兼当代新能源科技有限公司首席技术官的职务。Bob 还是国际自动机工程师学会国际电池标准委员会主席，21 个委员会向他汇报。他还是国际自动机工程师学会与机动车委员会（MVC）和中国汽车咨询委员会的联络官。同时还有两个非营利组织的职务，包括在 IUPUI 卢格中心可再生能源委员会顾问和鲍尔州立大学教务执行委员会顾问。Bob 拥有鲍尔州立大学化学和生物学双学士学位和化学硕士学位。38 年来在电池技术、制造和管理方面的经验给予了他对全球商业的独特视角，使他成为能量储存界全球独树一帜的发言人。Bob 是五家美国公司的董事会成员。并且囊获许多奖项，包括；汽车新闻“电气化 100 强”，国际自动机工程师学会技术标准委员会“突出贡献奖”， 鲍尔州立大学“卓越奖”， 美国消防协会消防研究基金会“基金会奖章”，通用汽车“最佳奖”，以及最近颇具声望的中国“1000 名人才计划奖”。Bob 丰富的经验给予他许多在国际舞台上的演讲计划。他是登上“国际电池“封面的第一人。

2015年5月

Contemporary Amperex Technology Limited

美中标准和符合性计划（SCCP）
2015 年 6 月 9 日在北京由 CATARC 和 ANSI 主办
演讲者：Bob Galyen，首席技术官

产品安全概况

1 安全的定义

2 安全法规和标准

3 产品安全的发展

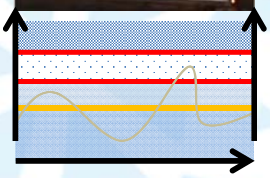
4 安全验证

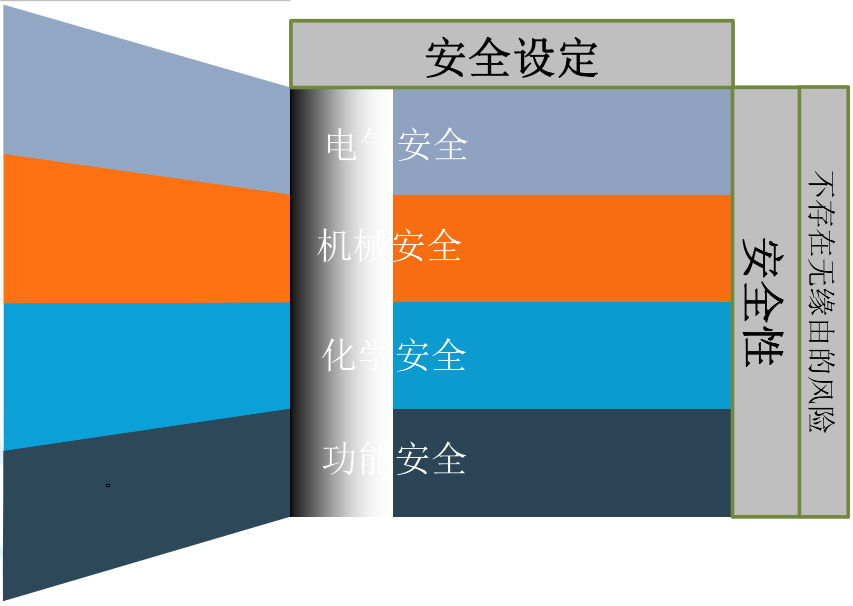
5 项目安全组织

1、安全的定义

安全 不存在无缘由的风险。 参考编号 ISO 26262

侵入、偷窃、污染、破坏......





2.安全法规和标准

根据以下要求进行产品安全设计与验证：

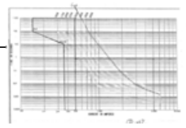
- 用电 安全
- 机械 安全
- 化学品安全
- 功能 安全

- GB/T 18384 电动汽车 安全要求 (Safety requirements for electric vehicles)
- GB/T 19751 混合动力汽车安全要求 (Hybrid cars-safety requirements)
- ISO 6469 电动道路车辆安全规范
- QC/T 743 电动汽车用锂离子电池 (Electric cars with lithium-ion batteries)
- UN38.3 金属锂及锂离子电池
- ISO 12405 电动道路车辆安全规范
- FreedomCAR 电动汽车电能存储系统和电动及混合动力汽车（蓄电池）滥用测试手册

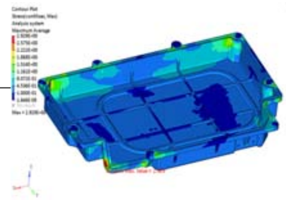
- ECE R100 关于核准车辆的电动动力总成具体要求的统一规定
- SAE J2464 电动汽车和混合动力电动汽车充电能源存储系统（RESS） 安全和滥用测试
- ISO 26262 道路车辆 —— 功能安全
- 及其他......

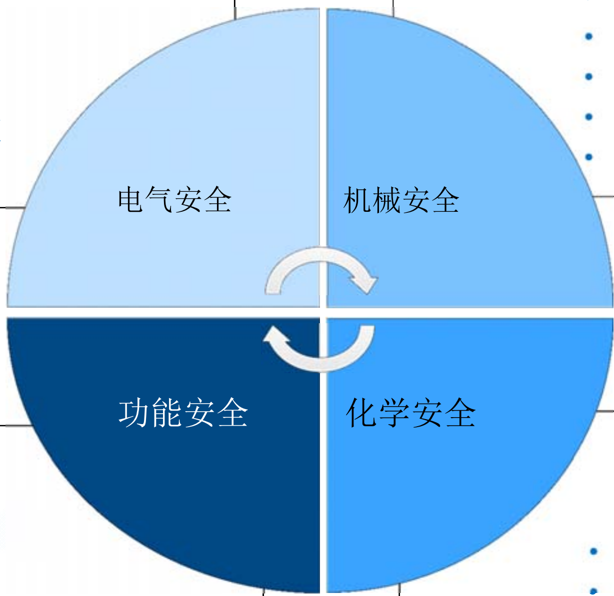
3. 产品安全的发展

- 防缠绕
- 电位均衡
- IPXXD 与 IPXXB
- 高电压标志
- 绝缘电阻和介电强度



- 冲击和振动
- 倾翻
- 猛击
- 浸渍
- 除气
- 石击





- 过压/欠压监测
- 过流监测
- 过温监测
- 碰撞断开

- 抗化学品腐蚀
- 燃料耐火性
- 冷却器故障
- 电解质渗漏

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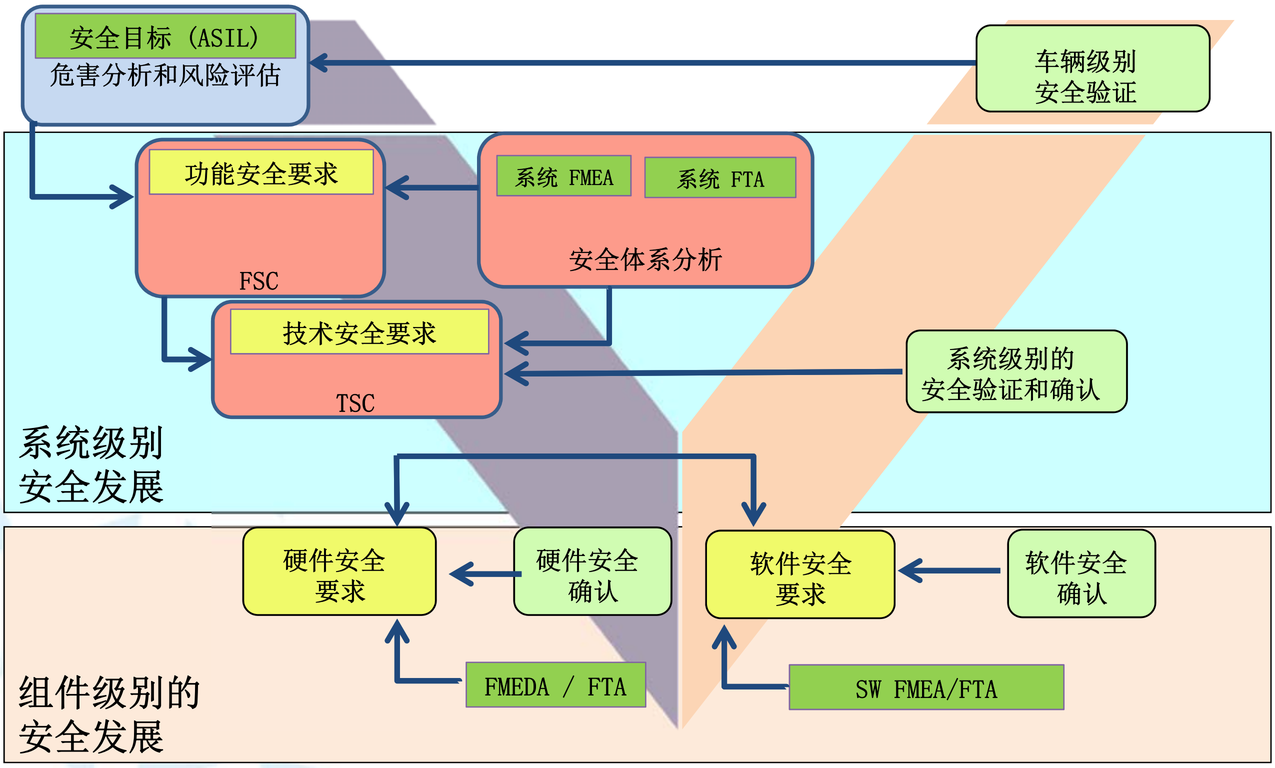
3.1 功能安全的发展



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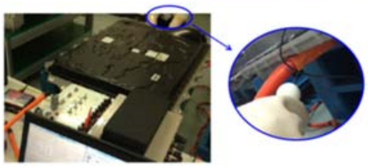
4.安全验证 – 电气安全

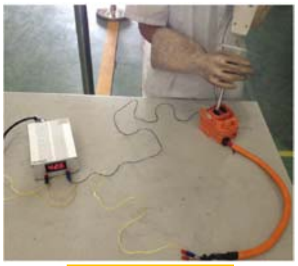
防缠绕

电位均衡

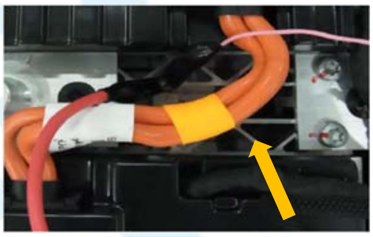


IPXXD 测试

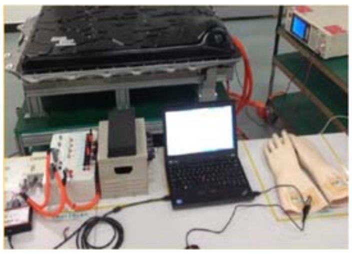
用电安全



IPXXB 测试



高压电缆的颜色



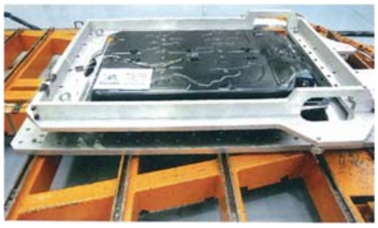
绝缘电阻和介电强度

高电压标志

4.安全验证 – 机械安全

冲击与振动测试

倾翻试验



猛击测试

机械安全

浸泡测试

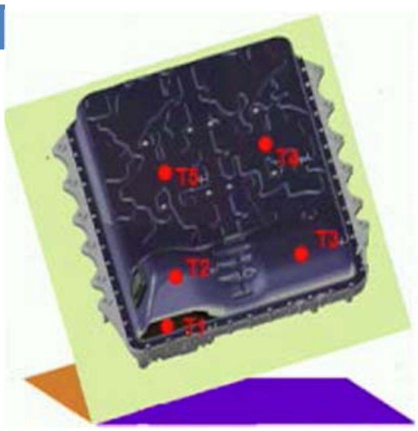
石击测试

4. 安全验证 – 化学安全

耐化学性测试

化学安全

燃料燃烧测试



冷却器故障测试

4. 安全验证 – 功能安全

概念阶段

- 创建设计备选方案
- 所选设计的验证

产品开发阶段

- 设计迭代评估
- 按需求进行测试

生产运行阶段

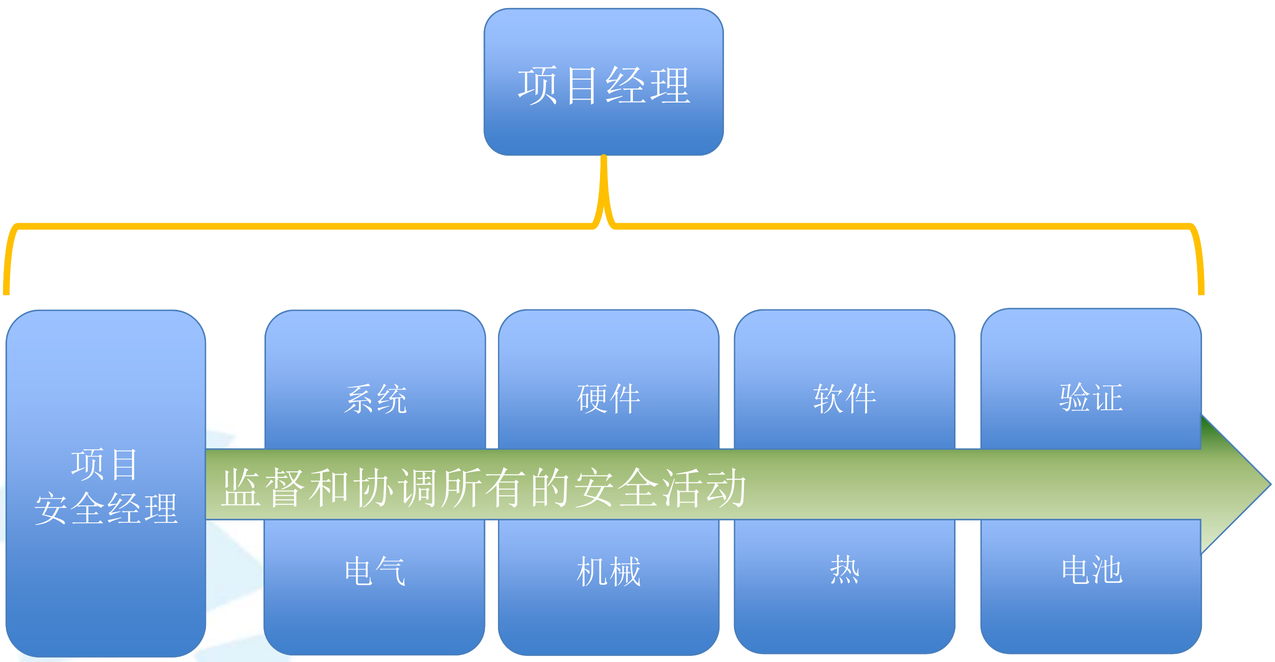
- 生产工艺规程
- 用户手册
- 维修维护说明书……

测试策略	系统测试
	系统集成
	硬件/软件集成
	软件集成
	软件单元测试

4.1 安全验证 — — 功能安全 测试方法

项目		方法	ASIL			
			A	B	C	D
导出集成测试用例的测试方法	1a	需求分析	++	++	++	++
	1b	内部和外部接口分析	+	++	++	++
	1c	生成和分析硬件/软件的等价类	+	+	++	++
	1d	边界值分析	+	+	++	++
	1e	基于知识或经验的错误猜测	+	+	++	++
	1f	功能分析	+	+	++	++
	1g	常见的限制条件、序列和依赖性来源的分析	+	+	++	++
	1h	环境条件和作业用例分析	+	++	++	++
	1i	实地经验分析	+	++	++	++
正确执行系统的功能性安全和安全技术要求	1a	基于需求的测试	++	++	++	++
	1b	故障注入测试	+	+	++	++
	1c	背靠背测试	o	+	+	++
系统安全机制正确的功能性能、准确性和定时	1a	背靠背测试	o	+	+	++
	1b	性能测试	o	+	+	++
系统内外部接口一致、正确的执行	1a	外部接口的测试	+	++	++	++
	1b	内部接口的测试	+	++	++	++
	1c	接口一致性检查	o	+	++	++
	1d	互动/沟通测试	++	++	++	++
系统安全机制的有效故障覆盖率	1a	故障注入测试	+	+	++	++
	1b	错误猜测测试	+	+	++	++
	1c	从现场经验中得出的	o	+	++	++
系统级稳健性水平	1a	资源利用测试	o	+	++	++
	1b	压力测试	o	+	++	++
	1c	在一定环境下的抗干扰性和稳健性测试	++	++	++	++

5.项目安全组织



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Contemporary Amperex Technology Limited

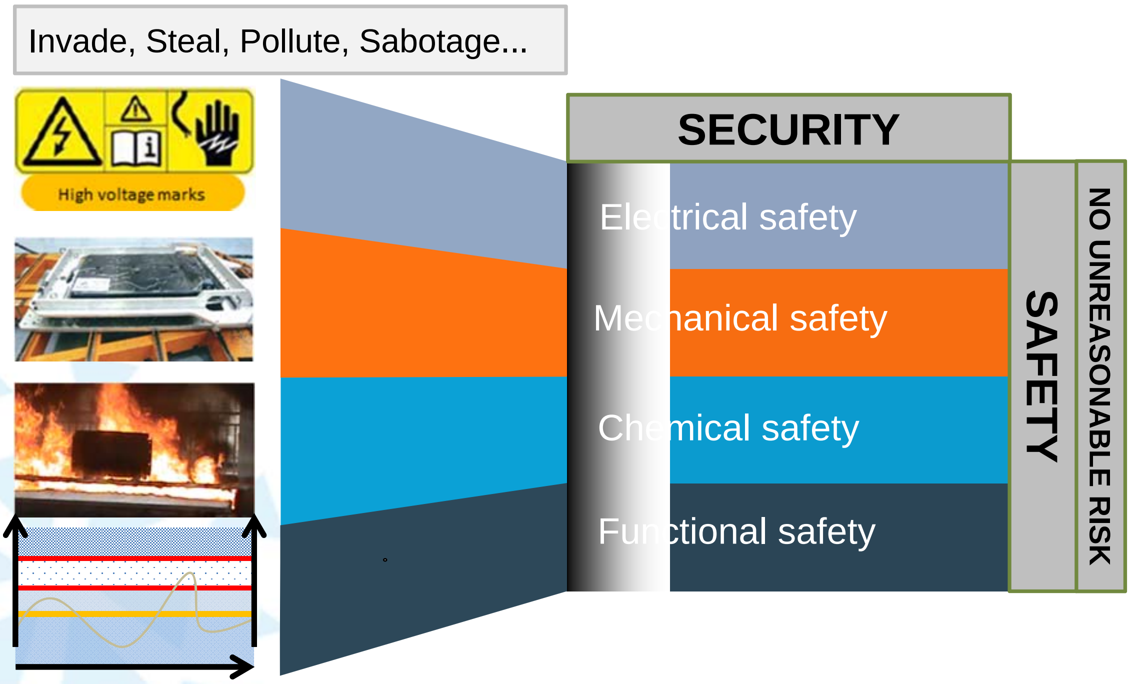
U.S. – China Standards and Conformity Program (SCCP)
Hosted by CATARC and ANSI in Beijing June 9, 2015
Presented by: Bob Galyen, CTO

Outline of Product Safety

1. **Safety Definition**
2. **Safety Regulations and Standards**
3. **Product Safety development**
4. **Safety Validation**
5. **Project Safety Organization**

1.Safety Definition

Safety is absence of unreasonable risk. Ref. ISO 26262



2. Safety Regulations and Standards

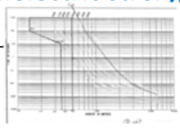
Product safety design & verification according to :

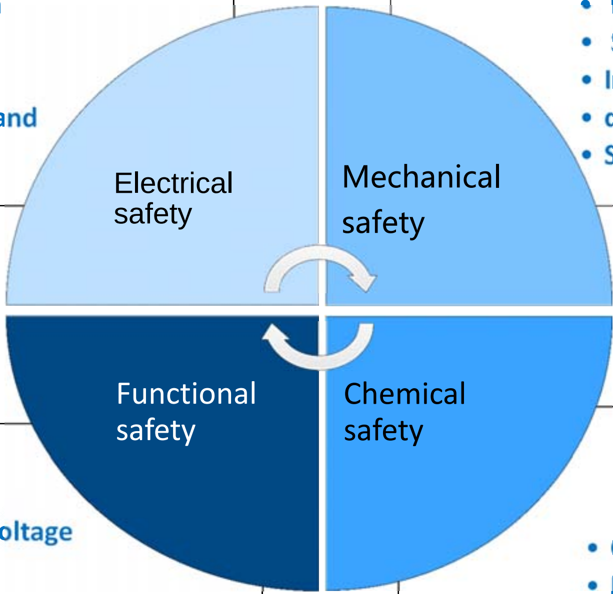
- Electrical Safety
- Mechanical Safety
- Chemical Safety
- Functional Safety

- **GB/T 18384** 电动汽车 安全要求 (Safety requirements for electric vehicles)
- **GB/T 19751** 混合动力汽车安全要求 (Hybrid cars-safety requirements)
- **ISO 6469** Electrically propelled road vehicles safety specifications
- **QC/T 743** 电动汽车用锂离子电池 (Electric cars with lithium-ion batteries)
- **UN38.3** Lithium metal and lithium ion battery
- **ISO 12405** Electrically propelled road vehicles safety specifications
- **FreedomCAR** Electrical Energy Storage System Abuse Test Manual for Electric and Hybrid Electric Vehicle Applications
- **ECE R100** Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric powertrain
- **SAE J2464** Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing
- **ISO 26262** Road vehicles -- Functional safety
- And many more………

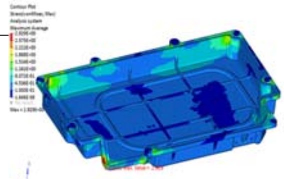
3. Product Safety Development

- Safe against twisting
- Potential equalization
- IPXXD & IPXXB
- High voltage marks
- Insulation resistance and dielectric strength





- Shock and vibration
- Roll-over
- Sledge
- Immersion
- degassing
- Stone chipping



- Over voltage/under voltage monitor
- Over current monitor
- Over Temperature monitor
- Crash disconnection

- Chemical resistance
- Fuel fire resistance
- Cooler failure
- Electrolyte leakage

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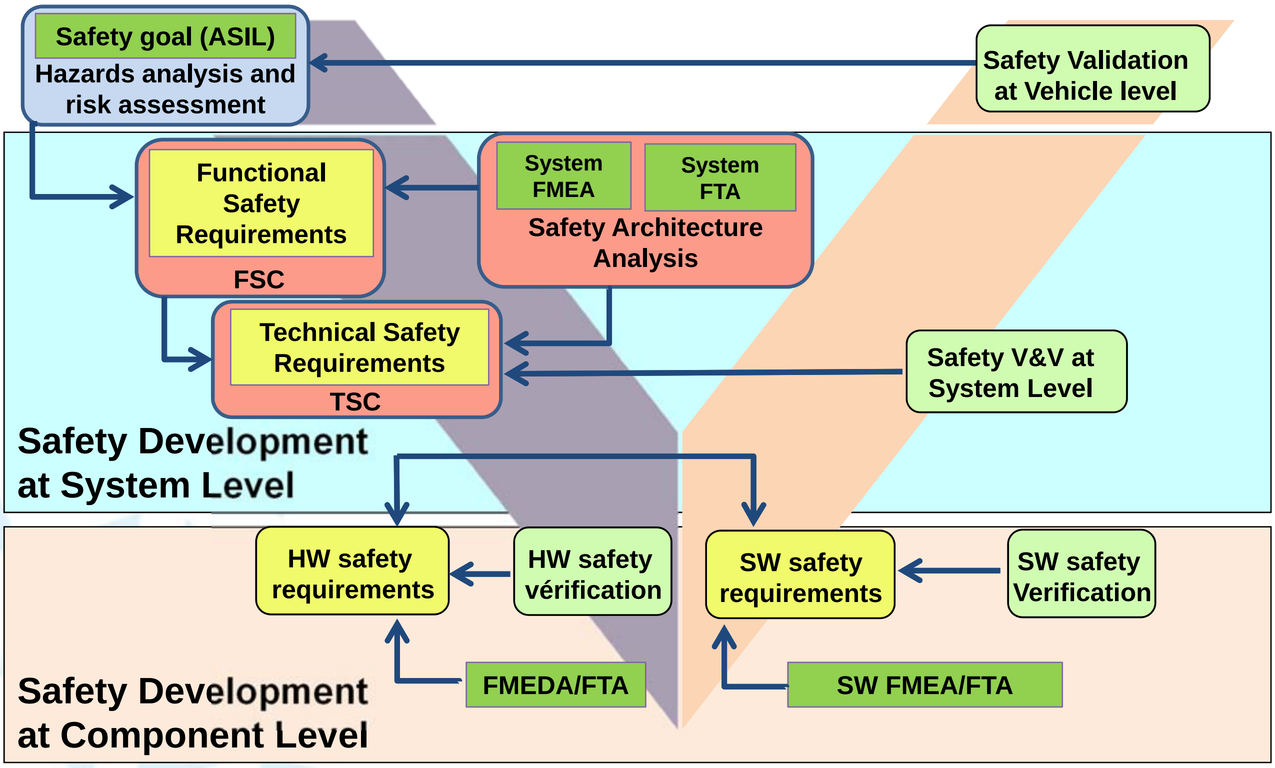
3.1 Functional Safety Development



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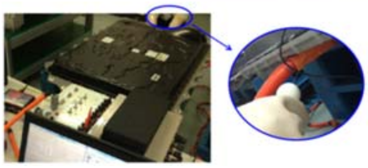
4. Safety Validation- Electrical Safety

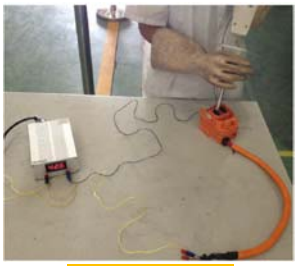
Safe Against Twisting

Potential Equalization

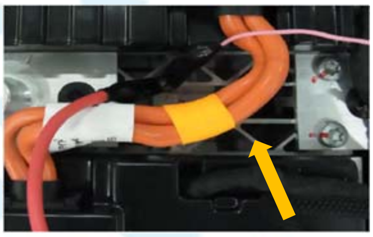


IPXXD Test

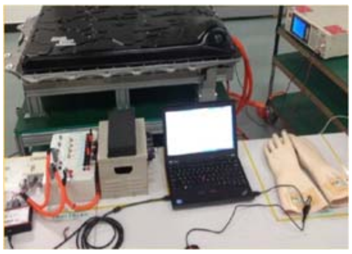
Electrical Safety



IPXXB Test



High Voltage Cable Color



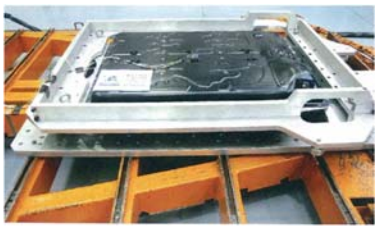
Insulation Resistance and Dielectric Strength

High Voltage Marks

4. Safety Validation- Mechanical Safety

Shock and Vibration Test

Roll-over Test



Sledge Test

Mechanical Safety

Immersion Test

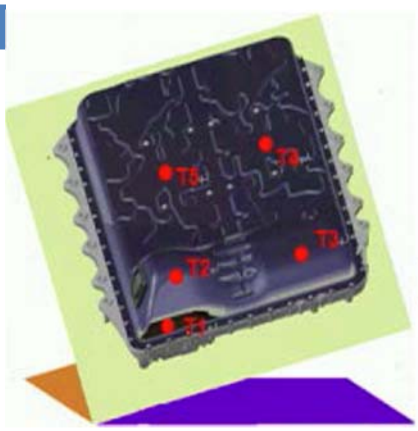
Stone Chipping Test

4. Safety Validation- Chemical Safety

Chemical Safety

Chemical Resistance Test

Fuel Fire Test



Cooler Failure Test

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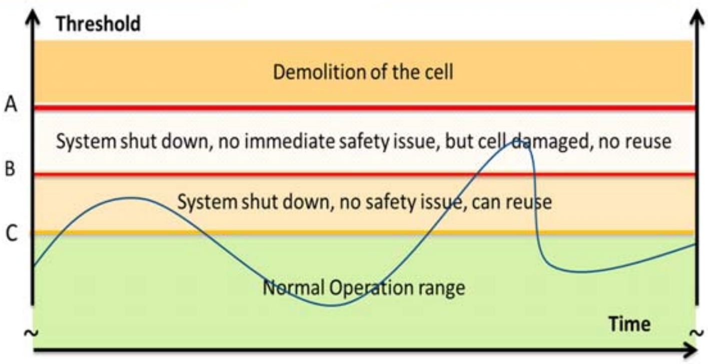
4. Safety Validation- Functional Safety

Concept Phase
- Create design alternatives
- Verification of the chosen design

Product Development Phase
- Evaluation of the design iterations
- Tests based on requirements

Production and Operation Phase
- Production instructions
- User manuals
- Repair ,maintenance instructions...

Test Strategy	System Test
	System Integration
	HW/SW Integration
	SW Integration
	SW Unit Test



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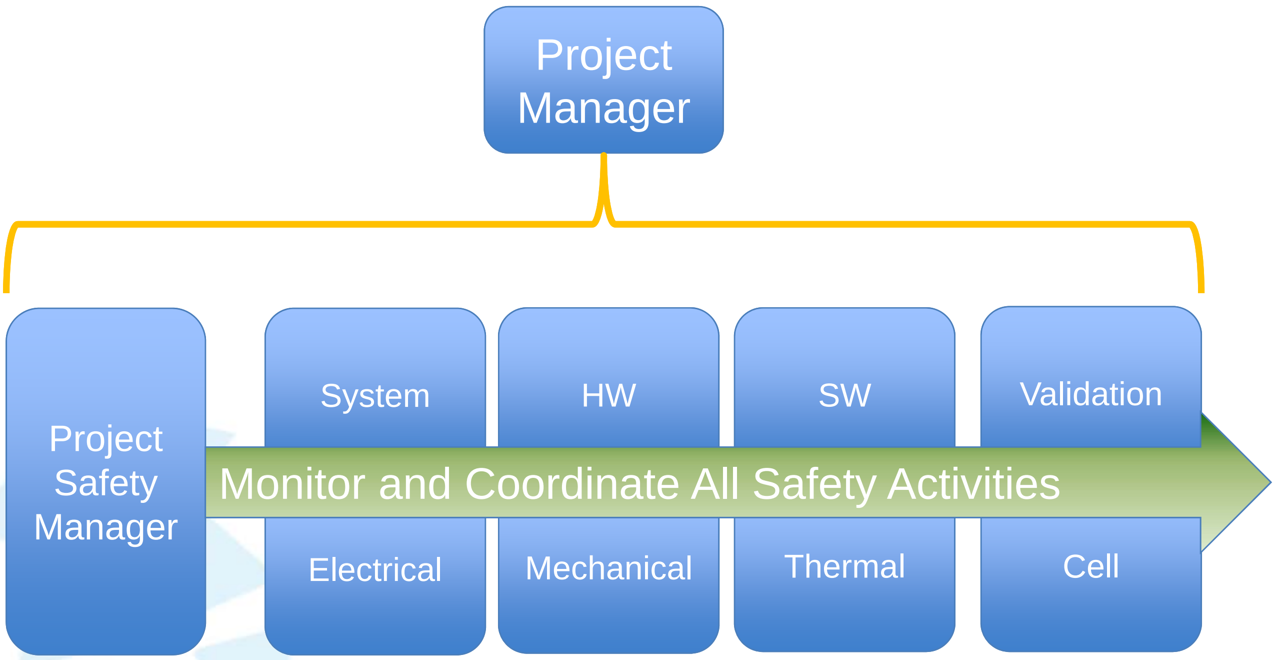
4.1 Safety Validation– Functional Safety test method

Item		Methods	ASIL A	ASIL B	ASIL C	ASIL D
Methods for deriving test cases for integration testing	1a	Analysis of requirements	++	++	++	++
	1b	Analysis of external and internal interfaces	+	++	++	++
	1c	Generation and analysis of equivalence classes for hardware-software	+	+	++	++
	1d	Analysis of boundary values	+	+	++	++
	1e	Error guessing based on knowledge or experience	+	+	++	++
	1f	Analysis of functional depen	+	+	++	++
	1g	Analysis of common limit conditions, sequences, and sources of	+	+	++	++
	1h	Analysis of environmental conditions and operational use cases	+	++	++	++
	1i	Analysis of field experience	+	++	++	++
Correct implementation of functional safety and technical safety requirements at the system level	1a	Requirement-based test	++	++	++	++
	1b	Fault injection test	+	+	++	++
	1c	Back-to-back test	o	+	+	++
Correct functional performance ,accuracy and timing of safety mechanisms at the	1a	Back-to-back test	o	+	+	++
	1b	Performance test	o	+	+	++
Consistent and correct implementation of external and internal interfaces at the system level	1a	Test of external interfaces	+	++	++	++
	1b	Test of internal interfaces	+	++	++	++
	1c	Interface consistency check	o	+	++	++
	1d	Test of interaction/communication	++	++	++	++
Effectiveness of a safety mechanism's failure coverage at the system level	1a	Fault injection test	+	+	++	++
	1b	Error guessing test	+	+	++	++
	1c	Test derived from field experience	o	+	++	++
Level of robustness at the system level	1a	Resource usage test	o	+	++	++
	1b	Stress test	o	+	++	++
	1c	Test for interference resistance and robustness under certain	++	++	++	++

5. Project Safety Organization



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袁昱 博士

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Yu Yuan, PhD

Secretary & Standards Chair, IEEE Transportation Electrification Community
Chair, IEEE SCC42 Transportation
Board Member & SCC Coordinator, IEEE Standards Association Standards Board
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袁昱博士担任 IEEE 交通电气化联盟秘书长兼标准主席，IEEE 交通标准指导委员会主席，IEEE 2040 车联网与无人驾驶标准工作组主席，IEEE 消费电子学会标准主席，IEEE 标准协会理事兼 SCC 总负责人，IEEE 消费电子学会中国区主席。他是交通运输，消费电子和物联网领域研究与实践的资深专家。

Dr. Yu Yuan is serving as the Secretary & Standards Chair of IEEE Transportation Electrification Community, the Chair of IEEE SCC42 Transportation, the Chair of IEEE 2040 Working Group, the Standards Chair of IEEE Consumer Electronics Society, a Board Member and the SCC Coordinator of IEEE-SA Standards Board, and the Chair of China Operations at IEEE Consumer Electronics Society. He is a veteran researcher and practitioner in the areas of Transportation, Consumer Electronics, and Internet of Things.

Transportation Electrification

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IEEE 交通电气化联盟秘书长
Secretary, IEEE Transportation Electrification Community
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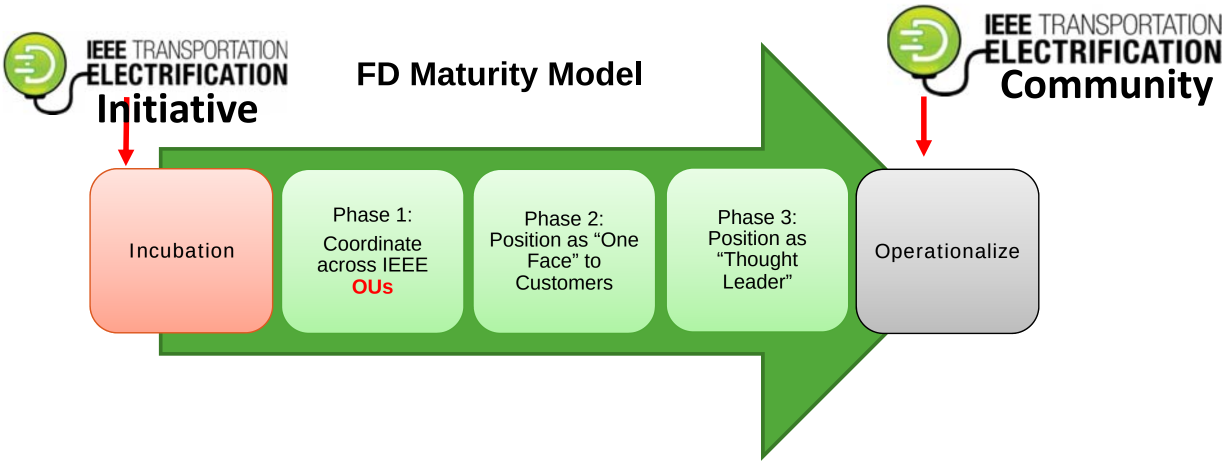

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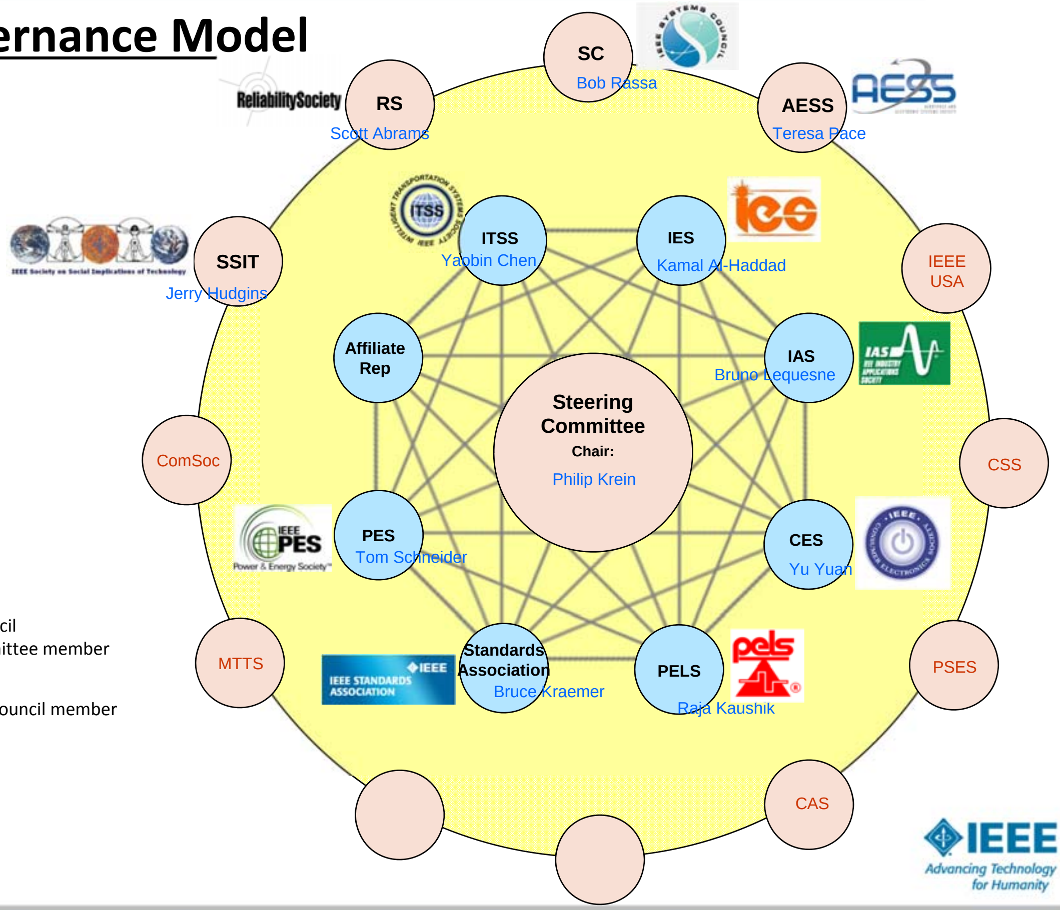

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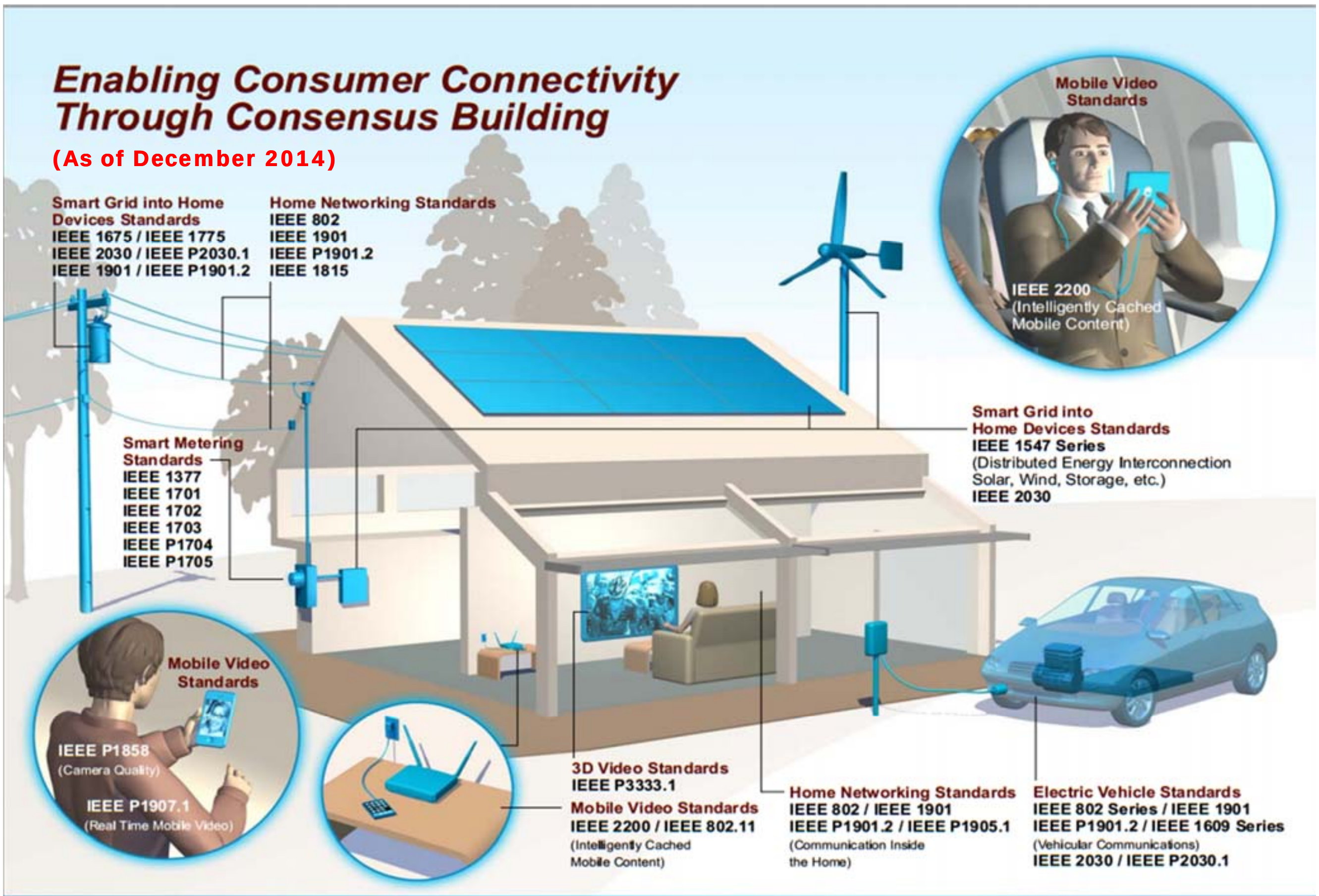

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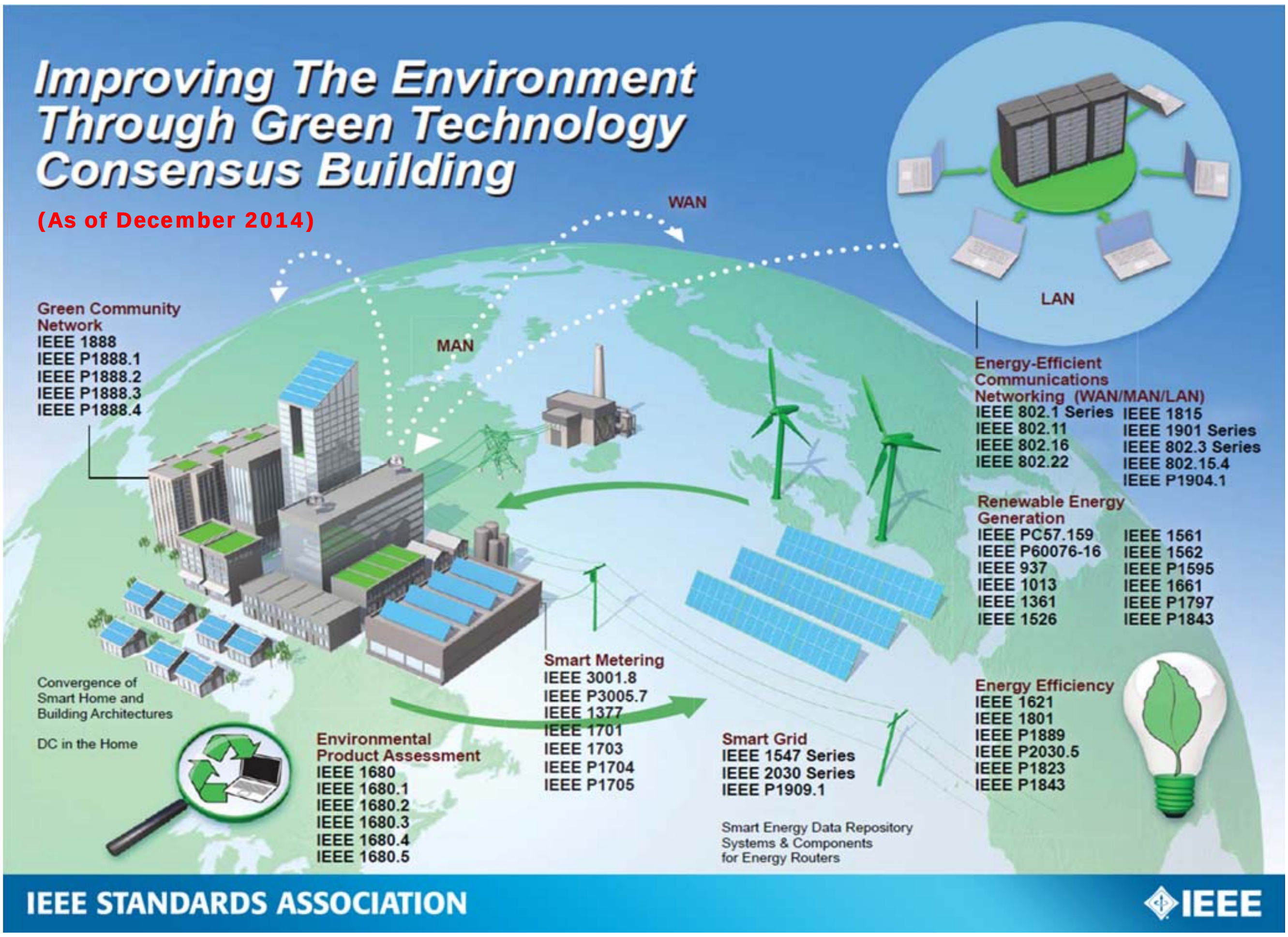

Improving The Environment Through Green Technology Consensus Building
(As of December 2014)
WAN
MAN
LAN
Green Community Network
IEEE 1888
IEEE P1888.1
IEEE P1888.2
IEEE P1888.3
IEEE P1888.4
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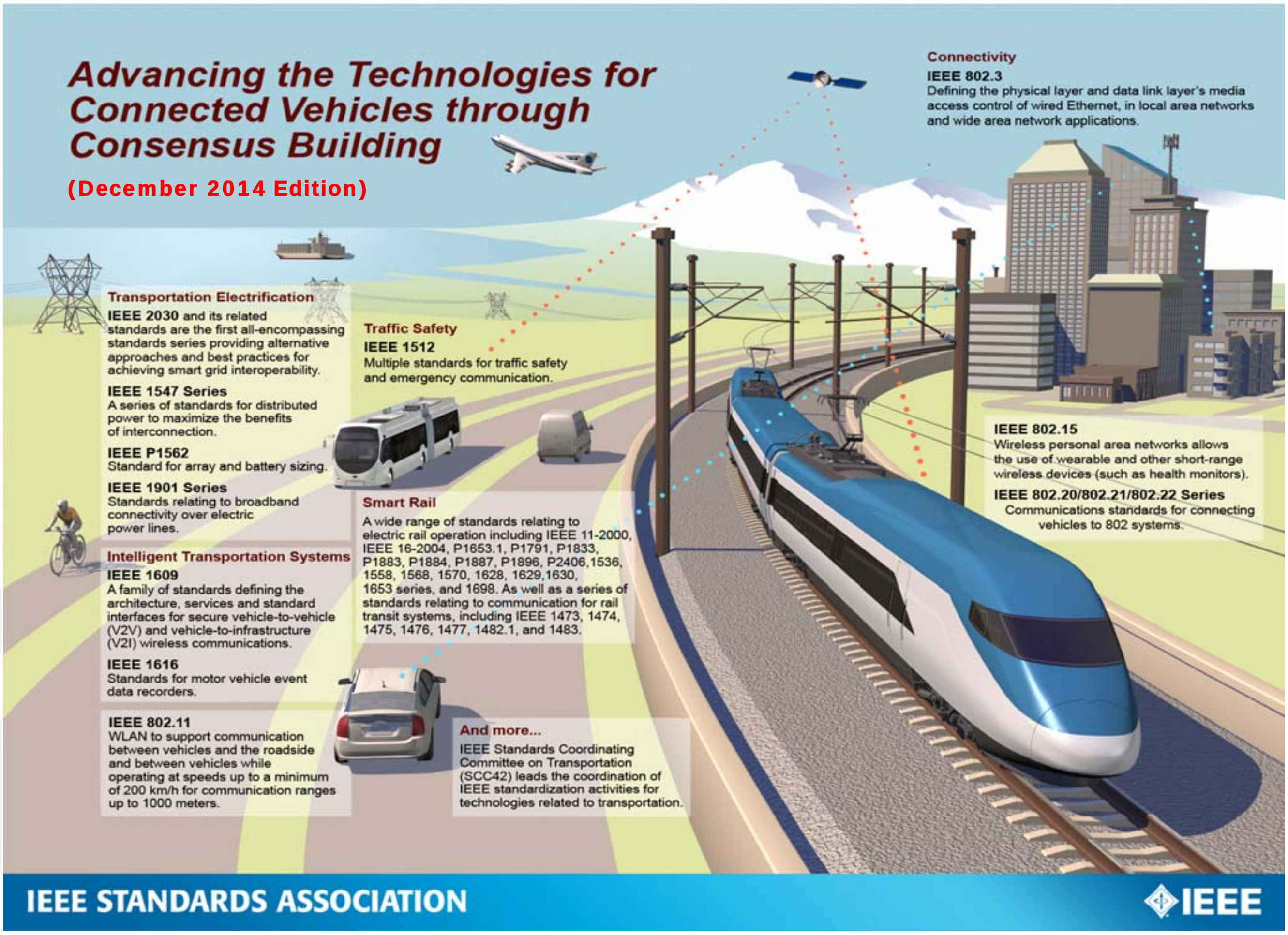

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Defining the physical layer and data link layer's media access control of wired Ethernet, in local area networks and wide area network applications.
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IEEE 802.15
Wireless personal area networks allows the use of wearable and other short-range wireless devices (such as health monitors).
IEEE 802.20/802.21/802.22 Series
Communications standards for connecting vehicles to 802 systems.
IEEE 802.11
WLAN to support communication between vehicles and the roadside and between vehicles while operating at speeds up to a minimum of 200 km/h for communication ranges up to 1000 meters.
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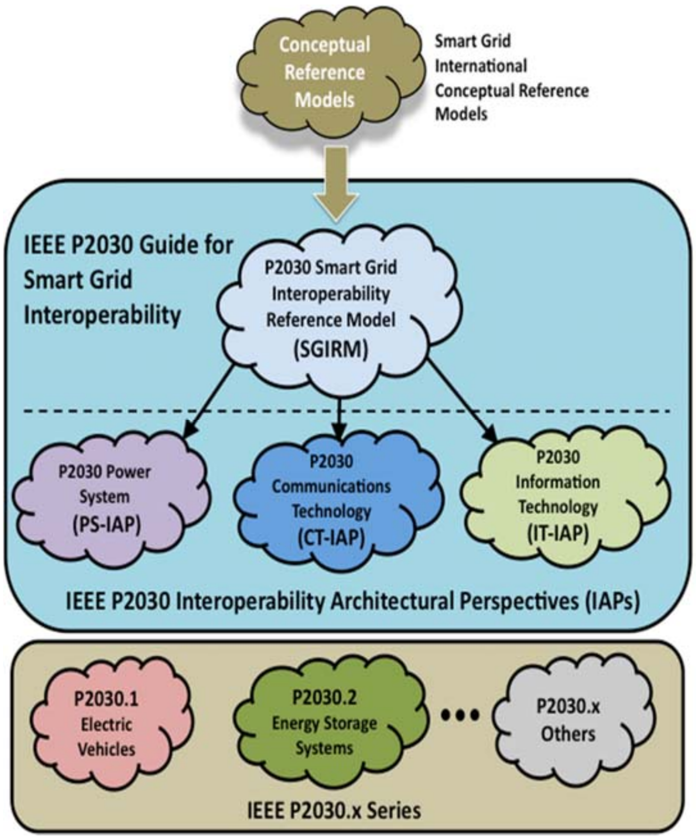
Methodological Interoperability Framework composed of:

- **Three Interoperability Architecture Perspectives (IAP):**
  - **Power System (PS)**
  - **Communications Technology (CT)**
  - **Information Technology (IT)**
- **IAPs Interoperability Tables**



IEEE P2030.1™ – Guide for Electric-Sourced Transportation Infrastructure

- Addresses applications for road-based personal and mass transportation
- 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
- Designed to benefit:
  - Utilities,
  - Manufacturers
  - Transportation providers
  - Infrastructure developers, and
  - End users of electric-sourced vehicles (EVs)

IEEE P2030.1.1 - IEEE Draft Standard Technical Specifications of a DC Quick Charger for Use with Electric Vehicles

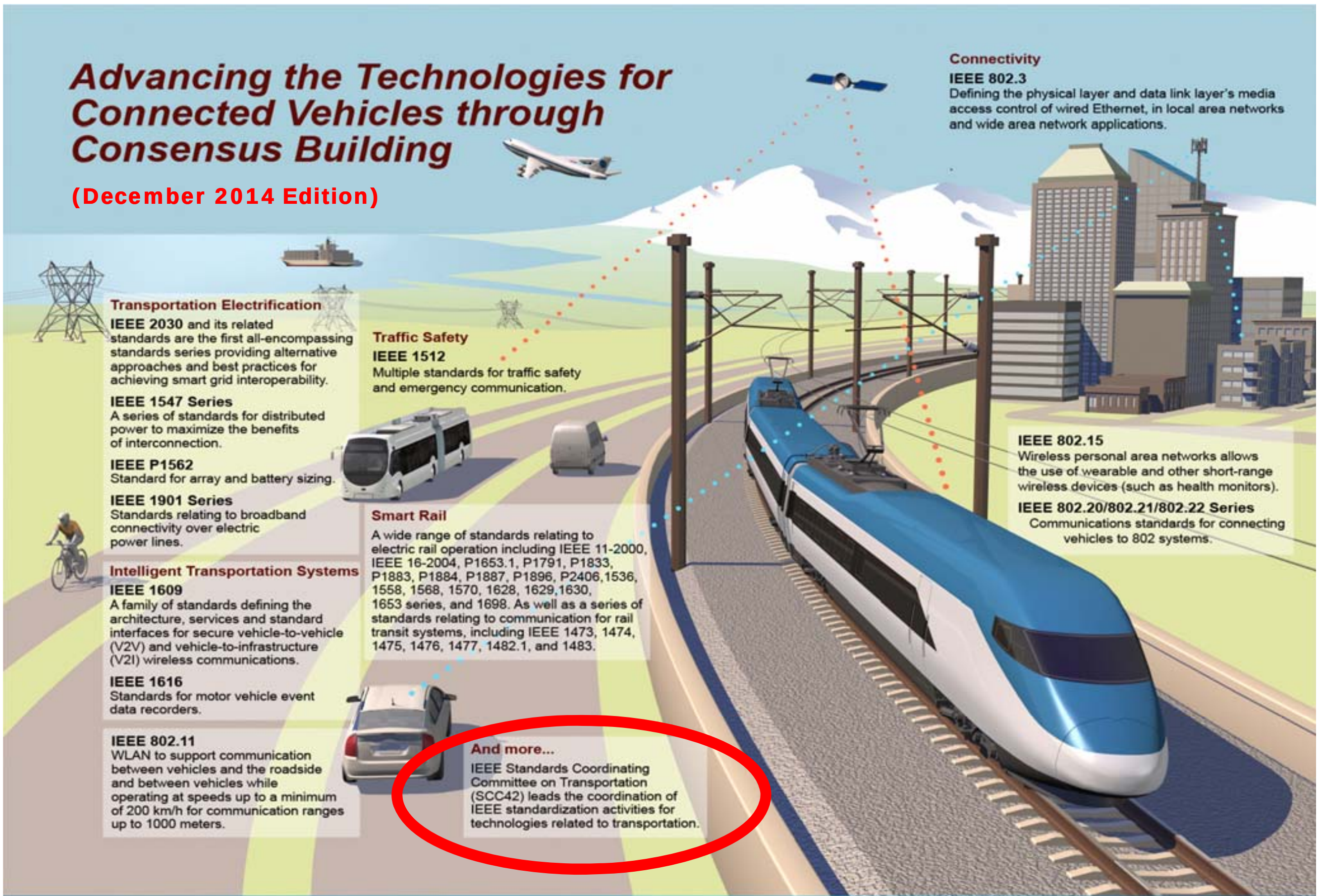
- This standard defines requirements for the designs of electric vehicles and DC quick chargers that promotes safe and rapid charging between electric vehicles and DC quick chargers. This document defines requirements pertaining to collaborative actions between electric vehicles and quick chargers. Design firms and manufacturers shall undertake detailed design work to promote safe and efficient charging circuits in line with relevant international specifications.

IEEE 11 - IEEE Standard for Rotating Electric Machinery for Rail and Road Vehicles

- This standard applies to rotating electric machinery which forms part of the propulsion and major auxiliary equipment on internally and externally powered electrically propelled rail and road vehicles and similar large transport and haulage vehicles and their trailers where specified in the contract.
- IEEE std 11, Rotating Electric Machinery for Rail and Road Vehicles, is up for revision and update, and a working group was recently approved to that effect. The standard was first developed when the only traction motors where large DC or induction machines for trains and ships, and significant work is needed to include smaller automotive motors, as well as permanent magnet machines. The Electric Machines Committees of the IAS and PES are starting to work together on this revision. The first working group teleconference meeting will take place on June 24th. If interested or if you have questions, contact the working group chair, Tim Burress, at: buressta@ornl.gov. The group is looking for additional members to help with this crucial task for the transportation industry.

IEEE 1901 - IEEE Standard for Broadband over Power Line Networks: Medium Access Control and Physical Layer Specifications

- A standard for high-speed communication devices via electric power lines, so called broadband over power line (BPL) devices, is defined. Transmission frequencies below 100 MHz are used. All classes of BPL devices can use this standard, including BPL devices used for the first-mile/last-mile connection to broadband services as well as BPL devices used in buildings for local area networks (LANs), Smart Energy applications, transportation platforms (vehicle) applications, and other data distribution. The balanced and efficient use of the power line communications channel by all classes of BPL devices is the main focus of this standard, defining detailed mechanisms for coexistence and interoperability between different BPL devices, and ensuring that desired bandwidth and quality of service may be delivered. The necessary security questions are addressed to ensure the privacy of communications between users and to allow the use of BPL for security sensitive services.
- A subset of IEEE 1901 was adopted in the SAE J2931 series Broadband PLC Communication for Plug-in Electric Vehicles



IEEE Standards Coordinating Committees (SCCs)

- Established by the IEEE-SA Standards Board, SCCs provide a valuable mechanism to oversee the development of standards that are beyond the scopes of individual technical committees within IEEE societies.
- Active IEEE SCCs as of May 2015:
  - SCC4 Electrical Insulation
  - SCC14 Quantities, Units and Letter Symbols
  - SCC18 National Fire Protection Association Standards
  - SCC20 Test and Diagnosis for Electronic Systems
  - SCC21 Fuel Cells, Photovoltaics, Dispersed Generation, and Energy Storage
  - SCC22 Power Quality
  - SCC31 Automatic Meter Reading and Energy Management
  - SCC39 International Committee on Electromagnetic Safety
  - SCC40 Earth Observation
  - SCC42 Transportation
- For more information, visit http://standards.ieee.org/about/sasb/scc.html

IEEE SCC42 Transportation

(IEEE Standards Coordinating Committee on Transportation)

On Aug 21, 2014, the IEEE-SA Standards Board established a new standards coordinating committee -- **IEEE SCC42 Transportation**, supported by over 30 IEEE Societies and Councils.

IEEE SCC42 Scope

Leads the coordination of IEEE standardization activities for technologies related to transportation, especially in the areas of connected vehicles, autonomous/automated vehicles, inter- and intra-vehicle communications, and other types of transportation electrification. These technologies include but are not limited to Mobile Apps, Sensor Networks, and Communications that allow human to vehicle, vehicle to vehicle, vehicle to infrastructure, vehicle to platform, and vehicle to everything exchange of information and data. Where standardization needs exist, the SCC will develop guides, recommended practices, standards, and common definitions of terms.

IEEE-SA press release on Oct 14, 2014:
http://standards.ieee.org/news/2014/ieee_scc42_transportation.html

IEEE SCC42 Transportation

Committee Roster (as of May 2015)

Report to IEEE-SA Standards Board

Collaboration with other IEEE Standards Sponsors

Liaison with external SDOs (ISO/TC 204, SAE, etc.)

IEEE SCC42 Transportation
(SCC Type 2 -- a Sponsor for standards projects)

Collaboration with other IEEE units (IEEE TEC, IEEE-USA CTAP, etc.)

Collaboration with other external entities (industry, government, academia)

Yu Yuan ---------- Chair
Lee Stogner ---------- Co-Chair & Secretary
Stephen Dukes ---------- Co-Chair & Treasurer
Paul Nikolich ---------- Designated Representative of **IEEE Computer Society**
Alexander Gelman ---------- Designated Representative of **IEEE Communications Society**
Thomas Coughlin ---------- Designated Representative of **IEEE Consumer Electronics Society**
Carole Carey ---------- Designated Representative of **IEEE Engineering in Medicine and Biology Society**
Victor Huang ---------- Designated Representative of **IEEE Industrial Electronics Society**
Christoph Stiller ---------- Designated Representative of **IEEE Intelligent Transportation Systems Society**
Bill Kirkwood ---------- Designated Representative of **IEEE Oceanic Engineering Society**
Otman Basir / Javier Gozalvez - Designated Representative/Alternate of **IEEE Vehicular Technology Society**
William Lumpkins ---------- Designated Representative of **IEEE Technical Committee on RFID**
Bob Heile ---------- Member-At-Large
Gregory Krueger ---------- Member-At-Large
Joachim Taiber ---------- Member-At-Large
Kevin Lu ---------- Member-At-Large
Tom Kurihara ---------- Member-At-Large
Jeffrey Katz ---------- Member-At-Large
Michael Janezic ---------- Member-At-Large & NIST Representative
Michael Schagrin ---------- Member-At-Large
Michael Kipness ---------- IEEE-SA Program Manager

IEEE SCC42 Transportation

Subgroups and Projects (as of May 2015)

Subgroup Code	Subgroup Name	Subgroup Chair	Subgroup Formation Date	PAR Number	PAR Approval Date
WG2040	**Standard for Connected, Automated and Intelligent Vehicles: Overview and Architecture** Working Group	Yu Yuan	13-Feb-2015	P2040	26-Mar-2015
WG2040.1	**Standard for Connected, Automated and Intelligent Vehicles: Taxonomy and Definitions** Working Group	Yu Yuan	13-Feb-2015	P2040.1	26-Mar-2015
WG2040.2	**Standard for Connected, Automated and Intelligent Vehicles: Testing and Verification** Working Group	Gregory Krueger	13-Feb-2015	P2040.2	Pending
TF1	**Cybersecurity in Transportation** Task Force	Joachim Taiber	30-Apr-2015	N/A	N/A
TF2	**Road Electrification** Task Force	Joachim Taiber	30-Apr-2015	N/A	N/A
TF3	**Unmanned Airborne Vehicles in Transportation** Task Force	Otman Basir	Pending	N/A	N/A
AG1	**Global Policy** Advisory Group	Michael Schagrin	30-Apr-2015	N/A	N/A

IEEE seeks to provide a unique value in the domain of transportation, based on IEEE's depth and breadth of technical expertise. We are interested in collaborating with other organizations in this area.

ICCVE 2015

The 4th International Conference on Connected Vehicles and Expo

19-23 Oct 2015, Shenzhen, China

www.iccve.org

- **About the conference**
  - The world's most searched connected vehicles conference on Google
  - Cosponsored by over 20 organizations including multiple IEEE Societies and Councils, TRB, SAE, ACM, IFAC, etc.
  - Enjoy and benefit from the cross-disciplinary community that ICCVE conferences uniquely offer: civil engineers meet with computer scientists, mechanical engineers talk to electronic engineers, ...
  - IEEE SCC42's face-to-face committee and working group meetings will be held in conjunction with the conference
- **About the Shenzhen city**
  - The capital of electronics industry in China
  - One of the four Tier-1 modern cities in China
    - Modern infrastructure and facilities
    - Convenient transportation to/from all major cities in China
  - Authentic dim sum and Cantonese cuisine
  - Adjoins Hong Kong and Macau
    - Attendees can visit three famous cities and experience diverse cultures in one trip

IEEE STANDARDS ASSOCIATION

IEEE

IEEE TRANSPORTATION ELECTRIFICATION COMMUNITY

IEEE

Advancing Technology for Humanity

Biograph

Kunihiko (Frank) Kumita

Project General Manager, R&D Management Div. Toyota

Graduated Nagoya Institute of Technology and joined Toyota

Toyota Motor Europe

Toyota Motor Engineering and Manufacturing, USA

Currently in charge of global standardization of e-Mobility at Toyota

-Contributed establishing SAE J1772 (conductive charging) and acting committee

member of SAE J2954 (inductive charging)

简历

汲田邦彦

汲田先生就职于丰田汽车公司在丰田研发管理部担任项目总经理。他毕业于名古屋工业大学继而加入丰田汽车公司，包括丰田汽车欧洲公司和丰田汽车工程与制造公司美国公司。

目前，汲田先生在丰田汽车公司负责电动汽车全球标准化的工作。制定了 SAE J-1772(传导式充电系统)，并担任 J2954(非接触供电标准)工作组执行委员会的会员。

SAE 国际

SAE J2954 概况与范围介绍

演讲者:
KUNIHIKO (FRANK) KUMITA
研发管理部
丰田汽车公司

联络人:
JESSE SCHNEIDER (宝马)
J2954 工作组主席
无线电力传输

概述: SAE J2954

- SAE 混合动力 / 电动汽车委员会结构及 J2954 工作组结构
- 标准性质: 技术信息报告 / 标准
- SAE J2954 范围
- SAE J2954 内容
  - 安全限制
  - 性能指标
  - 测试
  - 互操作性
- 目标

SAE 电动汽车, 混合动力及燃料电池汽车标准起草

SAE 电动汽车 / 混合动力车筹划指导委员会

- 开始 – 2005
- 当前委员会成员构成
  - >1100 个人
  - >500 家公司

    整车厂

    供应商

    政府机构

    学术组织
- 12 个电动汽车 / 混合动力车分委会
- 7个燃料电池汽车标准分委会

SAE J2954工作组结构

J2954汽车整车厂
顾问团队

J2954工作组主席
(Jesse Schneider)

通信与校准	安全性可靠性检测与验证	磁场互操作性	**UL2750 / SAE J2954** 验证测试	无线电传输电磁兼容性/电磁场	母线充电 **SAEJ2954-2 (series with J2954)**
M. Klerer- Qualcomm K. Sealy– Witricity	M. Abdul-Hak – Daimler, Jeff White- 电装	Co-Chairs: I-Teerlinck – Toyota G. Covic – 奥克兰大学	J.Bablo –UL J. Sirota –Witricity	R. Boyer-Delphi R. Kautz-Ford P. Anderson R. Sutton-TDK-rf	A. Safaee, Bombardier R. Burns OLEV Technologies

<u>联络:</u>
ISO/IEC : Jon Sirota (Witricity)/ Ivo Teerlinck (丰田)
SAE EMC Committee: Richard Kautz (Ford)
CISPR 11: Rich Boyer (Delphi)
ANSI: Kautz (Ford) / Sutton (TDK)

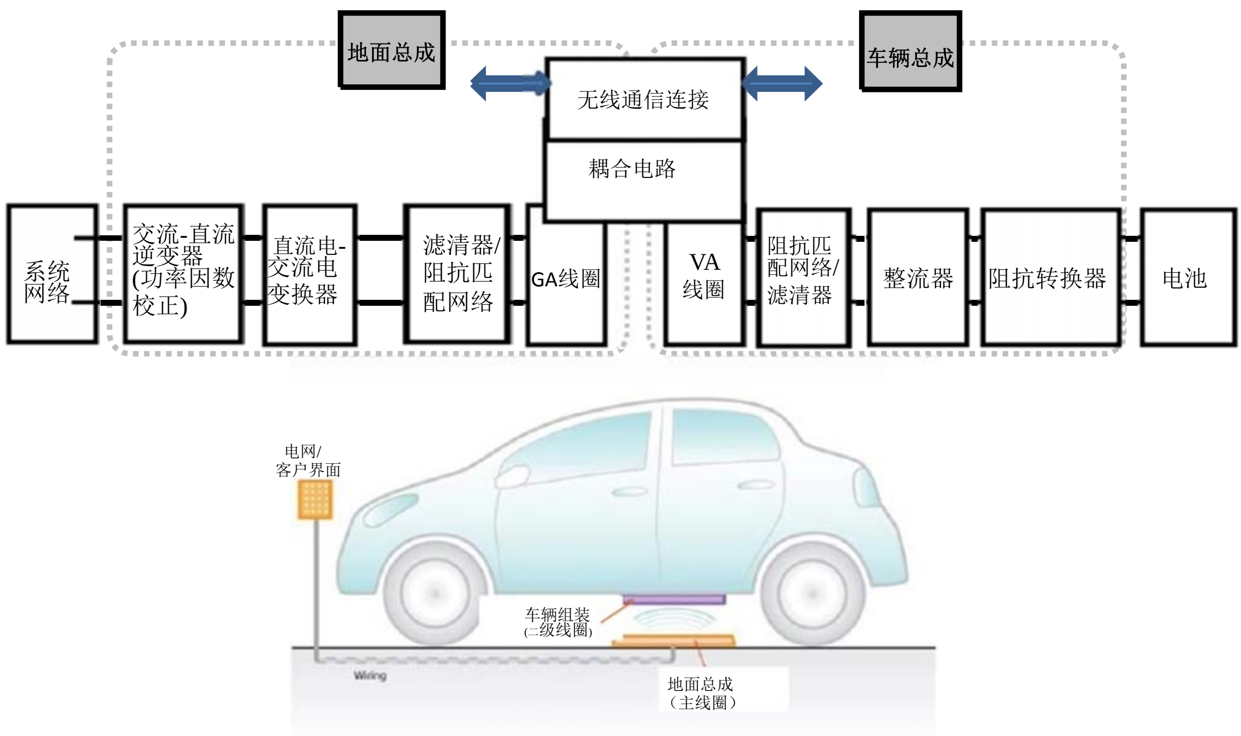
* 与SAE 混合动力通信与专用短程通信技术委员会合作

SAE J2954 范围

SAE J2954 将建立轻型混合动力汽车和插电式混合动力汽车无线充电最低性能，互操作性与安全标准

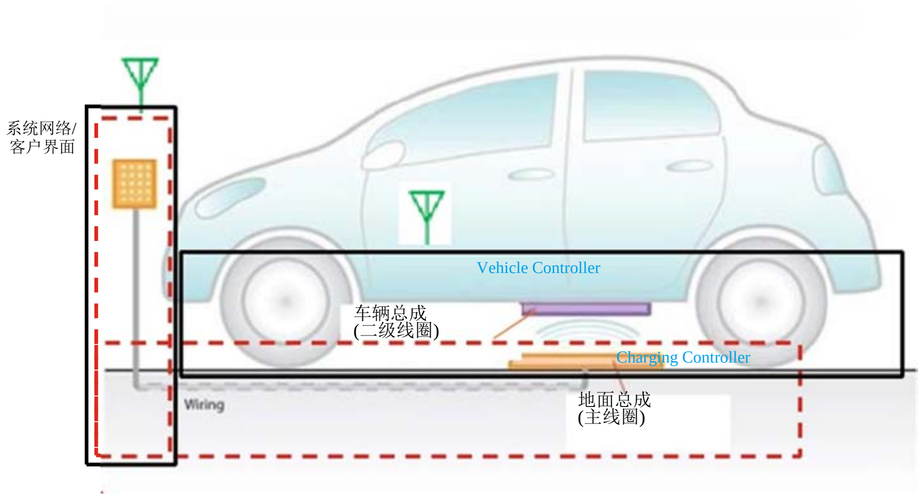
标准规定的范围包括家庭用停车场(A)，停车场（B）及路面充电桩（C）与无线电传输充电功率1、2、3三个等级。

J2954 地面与车辆装配无线电传输电路原理图



车辆无线充电标准概述
SAE J2954、SAE J2836/6、UL 2750内容

SAE J2836/6: 应用事例与通信
SAE J2847/6: 无线电传输通信混合动力汽车与公用电网
SAE J2931/6: 插电式混合动力汽车无线电传输数码通信

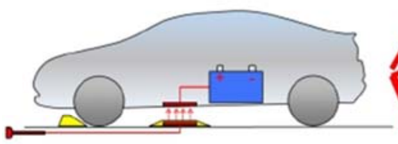


UL 2750: 无线充电安全检验

SAE 与 UL合作备忘录

SAE J2954: 无线充电与校准

J2954 测试范围



电动领域

ICNIRP + Pacemaker Limits

性能

- 位置 / 定位
- 优化性能
- 性能 -5%, -10%

耐久性

- SAE J1211
- ISO 16750
- USCAR 37

安全性

- 目标检测
- 由于感应电流/电压产生的温度上升

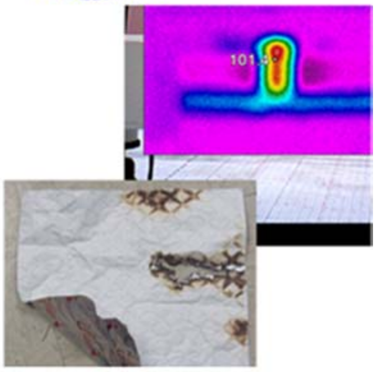
J2954 Safety Limits and Testing安全范围与检测

安全限值

J2954 主要内容

安全
障碍检测（无机）
磁场 国际非电离无线电保护委员会
充电电池转换脉冲起始通信，温度与充电率问题
温度显影测试
电击

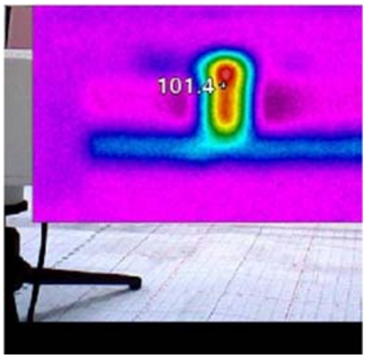
INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION PROTECTION ICNIRP



对其他物体影响

温度测试:
安全限值

箔纸



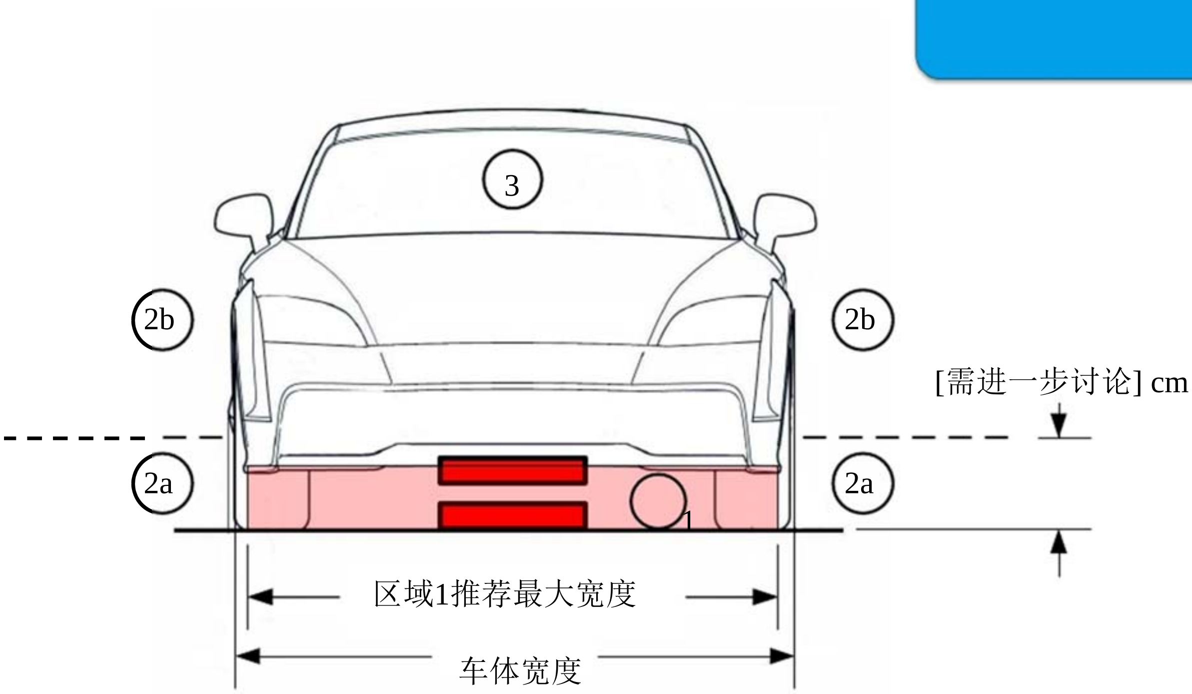
汽水罐

其他电子设备

延长线

SAE J2954 电磁场区域, 正面图

电磁场



SAE J2954 工作组
无线电传输功率级别

互操作性:
功率级别

分级 功率因数(最小85%)	无线充电功率等级		
	1	**2**	**3**
最大无线电传输功率	3.7千瓦	7.7千瓦	22kW

性能指标

无线电传输频率确定
SAE J2954 轻型车频率确定

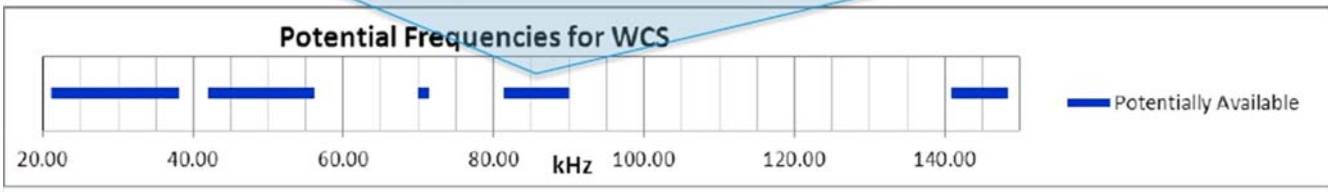
互操作性:

频率

SAE J2954“85千赫兹”频带设定:

基于工业企业全球频率配置搜索 (联邦电信委员会)

	频带始（kHz）	频带末（kHz）
轻型车	81.38	90.00



无线控制系统可能的频率范围

SAE J2954 2015年状态与目标 -

- 为2015年第一阶段小排量汽车检测发布J2954LD技术信息报告指导意见
  - 确定基础性能，安全性与互操作性说明
  - 创建无线电传输主线圈与参考线圈列表以确保其互操作性
- 与美国能源部，汽车生产商，供应商及政府创建SAE J2954 互操作性与性能检测共同体。
- 未来规划:
  - 与国际标准化组织及国际电工委员会协调一致
  - **2018年发布SAE J2954标准**

谢谢

提问请发送至:

JESSE.SCHNEIDER@WEB.DE

SAE INTERNATIONAL

SAE J2954 OVERVIEW AND SCOPE PRESENTATION

PRESENTED FROM:
KUNIHIKO (FRANK) KUMITA
R&D MANAGEMENT DIV
TOYOTA MOTOR CORPORATION

QUESTIONS:
JESSE SCHNEIDER (BMW)
TASKFORCE CHAIR J2954
WIRELESS POWER TRANSFER

OVERVIEW: SAE J2954

- SAE Hybrid / EV Committee Structure & J2954 Task Force Structure
- Standardization Philosophy: Technical Information Report / Standard
- SAE J2954 Scope
- SAE J2954 Content
  - Safety Limits
  - Performance Targets
  - Testing
  - Interoperability
- Goals

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
- **12 EV / Hybrid Vehicle Subcommittees**
- **7 Fuel Cell Standards Subcommittees**

SAE J2954 Taskforce Structure

J2954 OEM Advisory Team

J2954 Taskforce Chair
(Jesse Schneider)

Communication& Alignment Methods*
M. Klerer - Qualcomm
K. Sealy – Witricity

Safety, Performance, Robustness Testing & Validation
M. Abdul-Hak – Daimler, Jeff White- Denso

Magnetic Field Interoperability
Co-Chairs:
I-Teerlinck –Toyota
G. Covic – University of Aukland

UL 2750 / SAE J2954 Verification Testing
J.Bablo –UL
J. Sirota –Witricity

WPT
EMC /EMF
R. Boyer-Delphi
R. Kautz-Ford P. Anderson
R. Sutton-TDK-rf

Bus Charging
SAE J2954-2 (series with J2954)
A. Safaee, Bombardier
R. Burns OLEV Technologies

Liaisons:
ISO/IEC : Jon Sirota (Witricity)/ Ivo Teerlinck (Toyota)
SAE EMC Committee: Richard Kautz (Ford)
CISPR 11: Rich Boyer (Delphi)
ANSI: Kautz (Ford) / Sutton (TDK)
IEEE: Grant Covic/ Jesse Schneider

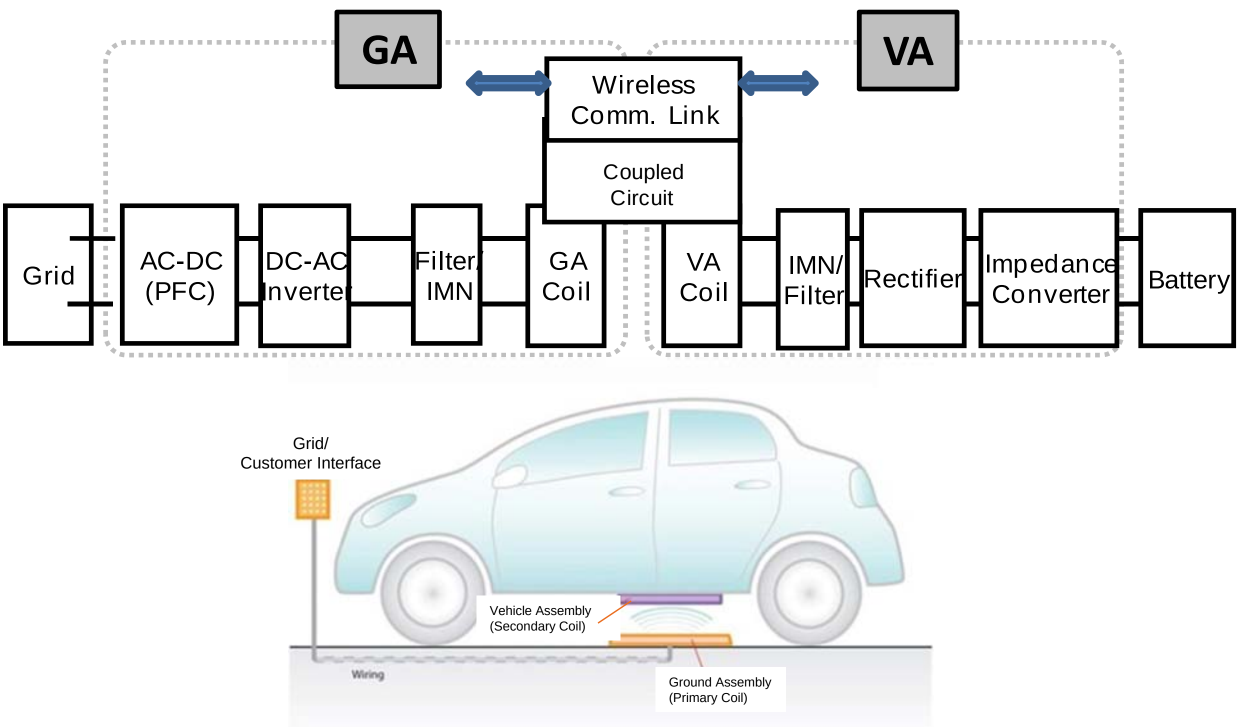
* In Coordination with SAE Hybrid Communications & DSRC Committees

SAE J2954 SCOPE

SAE J2954 will establish minimum performance, interoperability and safety criteria for wireless charging of light duty PEVs / PHEVs.

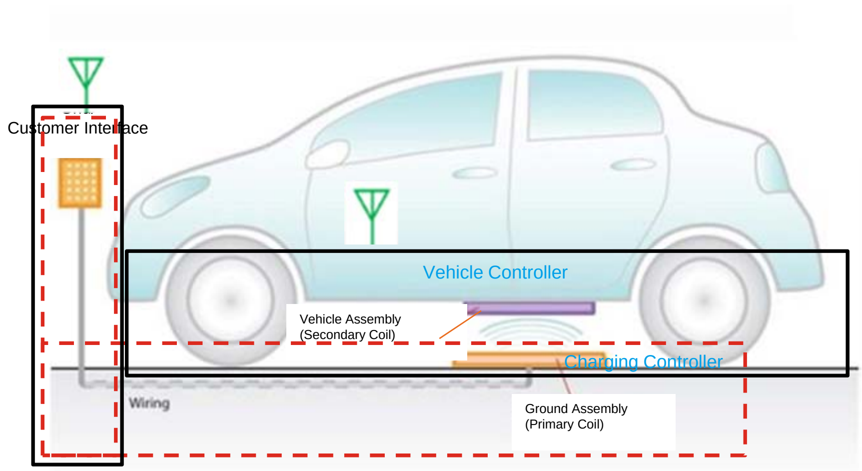
The document scope includes residential and parking garage (A), parking lot (B) and roadway charging (C) locations and Wireless Power Transfer (WPT) charging levels 1,2 & 3.

J2954 Wireless Power Transfer Schematic between the Ground and Vehicle Assemblies



Vehicle Wireless Charging Standards Overview
Overlap SAE J2954, SAE J2836/6 UL 2750

SAE J2836/6: Use Cases and Communications
SAE J2847/6: WPT Communication PHEV and the Utility Grid
SAE J2931/6: Digital Communication for WPT for PHEV

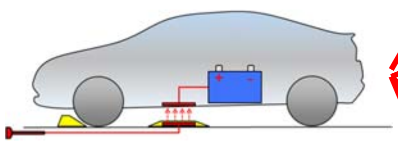


UL 2750: Verification of Wireless Charging Base Safety

MOU Between SAE and UL

SAE J2954: Wireless Charging and Alignment

J2954 Testing Scope



EM Field

ICNIRP + Pacemaker Limits

Performance

- Positions / Orientations
- Optimal Performance
- Performance -5%, -10%

Durability

- SAE J1211
- ISO 16750
- USCAR 37

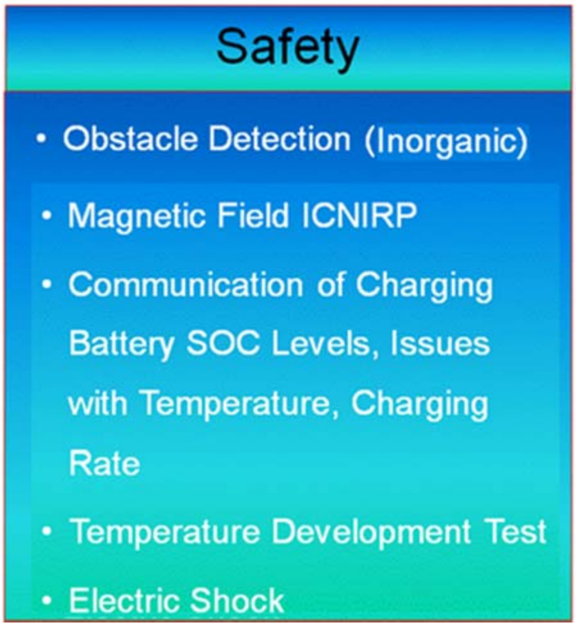
Safety

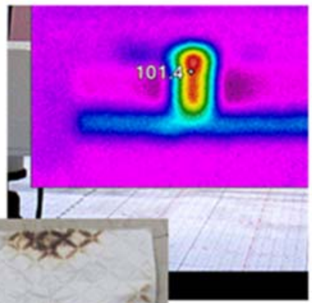
- Object Detection
- Temperature due to induced current / voltage

J2954 Safety Limits and Testing

Safety Limits

TOPICS FOR J2954

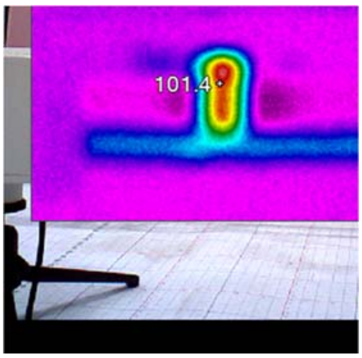




Effects on Other Objects

Thermal Testing:
Safety Limits


Foil Paper



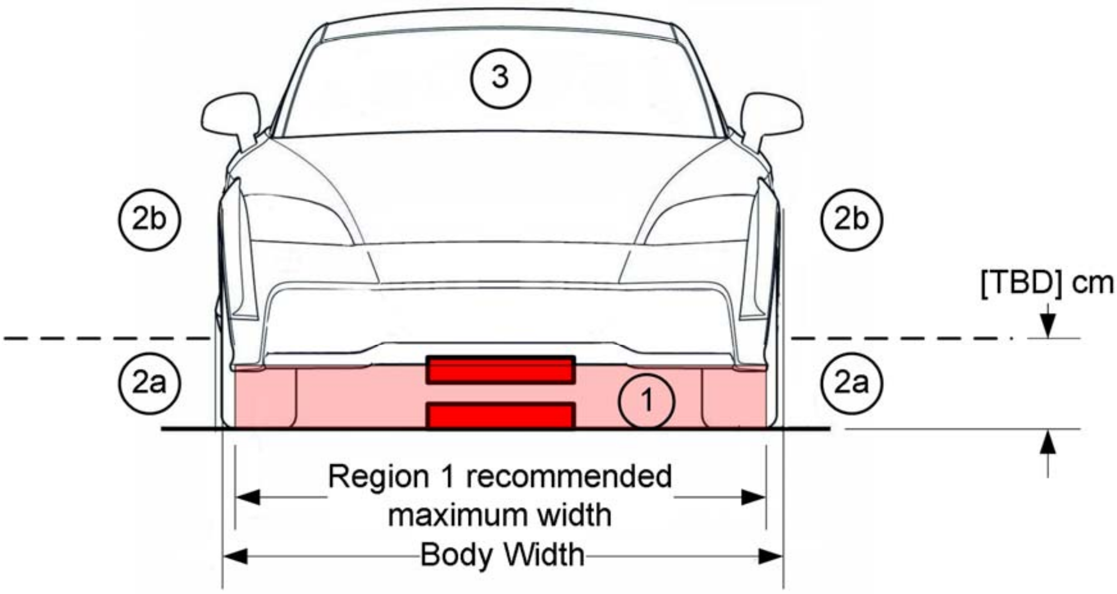
Soda Can


Other Electronics


Extension Cord

SAE J2954 EMF Regions, Front View

EM Field



SAE J2954 Taskforce WPT Power Classes

Interoperability: Power Class

Classification	WPT Power Class		
	WPT1	WPT2	WPT3
Efficiency Rating Target (min. 85%)			
Maximum WPT Power	3.7 kW	7.7 kW	22 kW

Performance Target

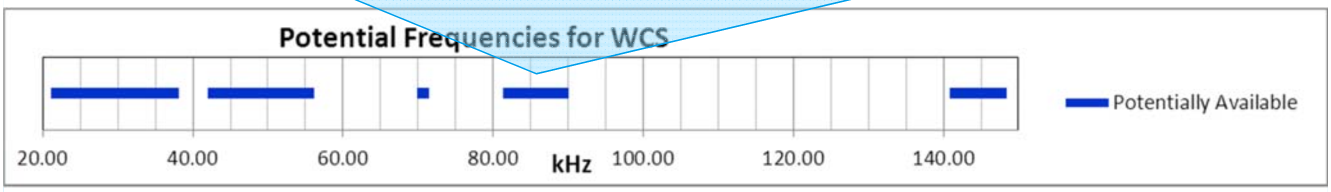
WPT Frequency Determination
SAE J2954 Decision for Light Duty

Interoperability: Frequency

“85kHz”Frequency Band Decision for SAE J2954 :

Based on worldwide frequency allocation search from industry members (also with FCC)

	Start of Band (kHz)	End of Band (kHz)
Light Duty Vehicles	81.38	90.00



SAE J2954 Status and Goals in 2015 -

- **Publish TIR J2954 LD (Technical Information Report) Guideline for purposes of first phase of small volume vehicle testing in 2015**
  - Determine baseline performance, safety and interoperability specification.
  - Create a „Master and Reference Coil“ List to ensure interoperability for WPT

- **Create an SAE J2954 Testing Consortium with the US DOE with Automakers, Suppliers, Government for interoperability and performance testing.**

- **Future Plans:**
  - **Harmonization with ISO and IEC (TBD)**
  - **SAE J2954 Standard in 2018.**

THANK YOU

QUESTIONS?:

JESSE.SCHNEIDER@WEB.DE

MARK KLERER

Senior Director, Technology

Mark Klerer is a Senior Director of Technology at Qualcomm Incorporated where he shares in the responsibilities of the standardization of wireless technologies, smart grid activities and wireless electric vehicle charging technologies. His current responsibilities include standardization activities dealing with wireless charging of EVs.

Mark was a board member the US Smart Grid Interoperability Panel (SGIP) and also a sub-task-force leader on communications in support of Wireless Charging of Electric vehicles in the SAE J2954 Task Force as well as the J2836 Task Force.

Mark is also a member of IEC TC 69 and the steering committee of the ANSI EVSP. Mark, and his group in Qualcomm, are actively engaged in the activities of the IEC 61980 and 15118, ISO 19363 and CISPR.

Mark has a BS degree in Electrical Engineering from the City College of New York, a Master’s degree in Systems Engineering from Stanford University and a Master’s degree in Business Administration from Pace University.

MARK KLERER

高级技术总监

Mark Klerer 在美国高通公司任高级技术总监，协同负责无线技术、智能电网和无线电动汽车充电技术的标准化职责。他负责处理电动汽车无线充电标准化的工作。

Mark 曾是美国智能电网互操作工作组（SGIP）的董事会成员，同时也是 SAE J2954 和 J2836 工作组中关于在电动汽车无线充电技术的工作组组长。他还是 IEC/TC69（国际电工委员会/电动道路车辆和电动载货车）和 ANSI 电动汽车标准小组（EVSP）筹划指导委员会的会员。Mark 和他在高通公司的工作团队积极地着手于 IEC 61980 和 15118、ISO 19363 及 CISPR。

Mark 先后获得纽约市立大学电气工程学士学位、斯坦福大学系统工程硕士学位以及佩斯大学工商管理硕士学位。

Mark Klerer,技术部高级总监
高通
2015年6月9日

电动汽车无线充电标准化带来电动出行的巨大潜力

中美电动汽车技术与标准交流会

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挑战与方案

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社会发展概览

全球城市化

到2050年，全球70%的人口将生活在城市中

（世界卫生组织2014）

基础设施压力

到2050年，全球汽车保有量将从目前的11亿增加到25亿。

（经济合作与发展组织2012报告）

空气污染

将通过立法和经济手段治理污染

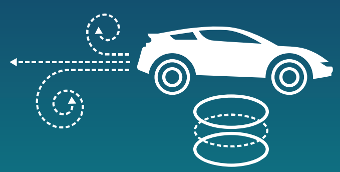
（欧洲委员会-环保署）

医疗成本

城市空气污染预计导致全球每年130万人死亡

（世界卫生组织）

电动汽车是一种解决方案，伴随动力电池的大规模应用



优势

- 更高的能源经济性
- 无污染
- 低噪声
- 安静清洁的道路

挑战

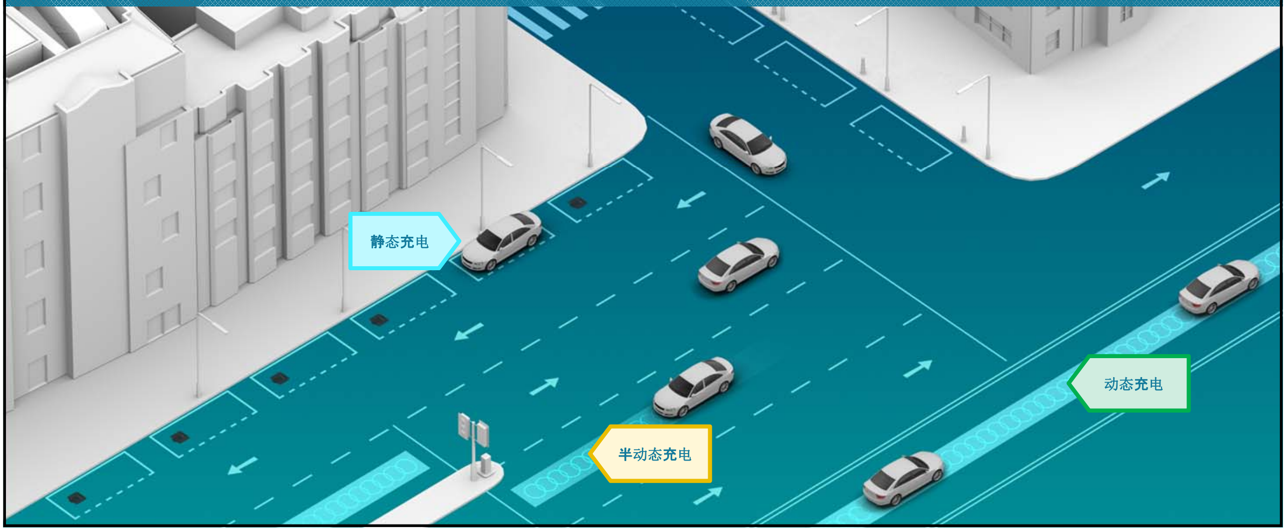
- 标准缺乏
- 行驶里程有限
- 充电时间长
- 充电不便利

便捷充电

- 基础设施空缺
- 充电桩
- 拖拽电缆
- 设备安全

电动汽车市场增长的利因-使用的便利性

- 无线充电可以满足我们的需求
  - 简单、容易以及便捷
- 充电方式的多样化
  - 短时、多次以及随处充电



标准化活动

QUALCOMM HALO

标准存在的难题

提供互操作性

并且

为创新留有空间

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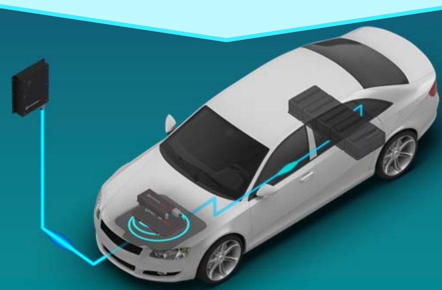
标准化领域与限制条件

互操作性要求 -
- 常规操作频率
- 车辆总成与地面总成之间的磁互操作性
- 车辆与充电机的通讯
- 默认的校准机制
- 车辆总成与地面总成在停车场的布置协议

安全条件 -
温度与无线电频率
- 外部对象监测
- 活动物体的保护
- 电路保护层
- 系统控制



性能
- 功率等级：3.3kW、6.6kW和22kW
- 效率
- 空气间隙(范围) [Z1、Z2、Z3]
- 定位公差
- 静态、半动态和动态充电

无线电频率与电磁兼容法规的共存
- 车辆系统
- 植入式医疗设施
- 通讯设施

互操作性

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与电动汽车无线充电相关的主要标准化组织和标准

标准化委员会	功率转换	通讯	校准	备注
SAE J2954	4		4	包括了车辆和充电设施两端
IEC 61980	4	4	4	只规定充电设施一侧 61980-1 无线功率传输一般要求 61980-2 无线功率传输的操作与控制 61980-3 无线功率传输磁场要求
ISO 19363	4	4	4	只规定了车辆一侧 参考IEC通讯要求
IEC 15118		4		包括了传导式充电与无线充电高层通讯的内容，15118-6,7,8 指出了无线充电的特殊要求。
SAE 混合通讯工作组		4		J2836/6 无线应用场合 J2847/6 信息与参数 J2931/6 物理层/测量与控制 J2931/7 安全
IEC国际无线电干扰特别委员会				电磁兼容污染限值 CISPR 11: 高压设备与电力拖动之间的干扰

支持电动汽车无线充电的实施方案

要求	实施方案
高效的功率传输	优化磁性和电气设计将损失降到最低
适应不同的车辆行驶高度	优化线圈和电子设计从而适应路面起伏和不同的线圈间距
避免无线功率传输装置的过热	优化的散热设计（能保证最低的损耗）
避免操作人员灼伤	可靠的防护系统能够监测到过热目标并采取正确措施（优化的散热设计）
针对电磁场的人员防护	可靠的检测系统能够判断人员是否进入了高电磁污染区域
校准/高精度定位	附属引导系统具有高精度的分辨率，能够实现精准停车
功率传输过程控制	可靠的通讯连接

关键参数

目前关于无线充电的标准都还在进行过程中，最终的参数都还没有确定。

参数	数值			备注
标称频率	乘用车：85 kHz			更功率的车辆正在考虑使用更低的频率范围，在IEC某个标准附件中提供了可供选择的频率。
功率等级	截至目前，确定的三个功率等级			
	WPT1: 3.7 kW	WPT2: 7.7 kW	WPT3: 22kW	
Z 间距	截至目前，确定的三个Z间距			这里给出的数字是车辆的地面磁场间隙。
	Z1: 95-155mm	Z2: 145-210mm	Z3: 175 – 55mm	
校准公差	x/y 公差 ±75/±100mm			

符合性验证与互操作性展示

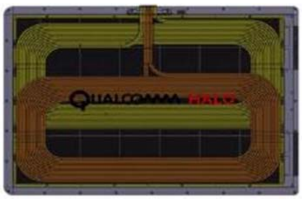
- 通过以下方式来实现磁性互操作性标准
  - 为特定的一款车载充电总成选择一款或多款地面充电总成并且验证这一组合能够满足标准中所有的要求；
  - 为特定的一款地面充电总成选择一款或多款车辆充电总成并且验证这一组合能够满足标准中所有的要求；
- 地面充电总成和车辆充电总成参照提案的状态
  - 为了允许将来无线功率传输技术的发展，高通主张在标准中纳入多个地面充电总成和车辆充电总成参照的设计；
  - 目前有两个地面充电总成和车辆充电总成设计类型：
    - 车辆充电总成：圆形和双D形线圈结构
    - 地面充电总成：圆形和两极结构

高通建议的线圈提案

- 车上充电板(与圆形线圈的比较)：

地面间隙[mm]	功率等级	高通双D性线圈尺寸[mm]	圆形线圈尺寸[mm]	体积差异[圆形 → 双D形]
Z1=100 .. 160	WPT1	250 x 170 x 20	280 x 280 x 20	-46%
Z1=100 .. 160	WPT2	250 x 260 x 20	250 x 400 x 20	-35%
Z2=160 .. 220	WPT1	340 x 200 x 20	380 x 380 x 20	-53%
Z2=160 .. 220	WPT2	340 x 260 x 20	250 x 500 x 20	-29%

- 基板：




可互换操作的两极基板(575 x 765 x 50)

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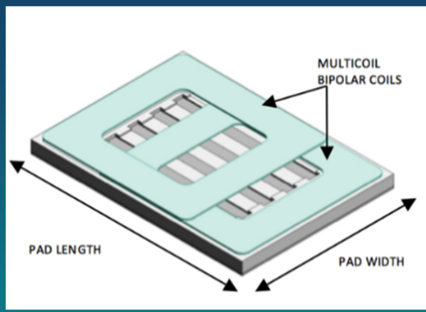
先进的设计保证了优异的性能

双极性与双D性设计、圆形设计和螺线管设计的车辆充电板可以互换操作

- 低漏磁场排放
- 高品质因数
- 高耦合因子
- 宽泛的Z间距区间
- 宽泛的x/y公差
- 高效设计
- 轻量化、紧凑设计
- 与单线圈充电板可以互操作



整车厂选择的二次充电板结构与植入地面的充电设施之间的互操作性

互操作性表现		车辆充电板(VP)		
		圆形	螺线管	双D形
基板(BP)	圆形	✓	×	✓
	螺线管	×	✓	✓
	双极型	✓	✓	✓

安全与法规的符合性

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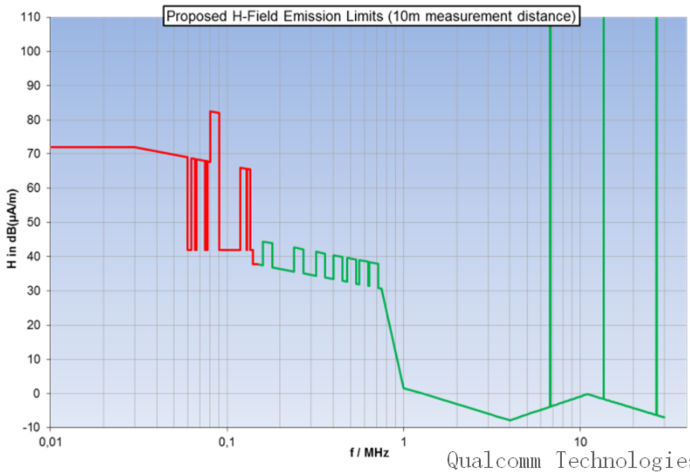
为85kHz的无线功率传输装置设计的辐射掩蔽方案

- 为了消除随基础辐射排放引起的大于150kHz的辐射排放，提出了对CISPR11中B级限值的修改，涵盖了从150kHz到1MHz（绿线部分）的1到7级谐波



（提示：CISPR/1302/INF 明确提出CISPR/B 应该同时考虑频率低于150 kHz和大于150 kHz的情况:CISPR 主管委员会推荐在对无线功率传输中的功率电子设备功能进行型式试验时有限参考CISPR/B 的要求，特别是频率范围在9kHz到30MHz的范围内。）

电磁场 - 射频辐射方法提案

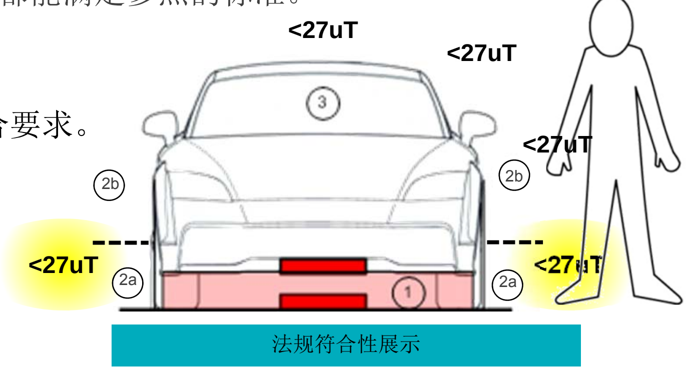
法规符合性要求

- 这项要求需要与ICNIRP 2010的基本要求项相协调。

法规符合性展示

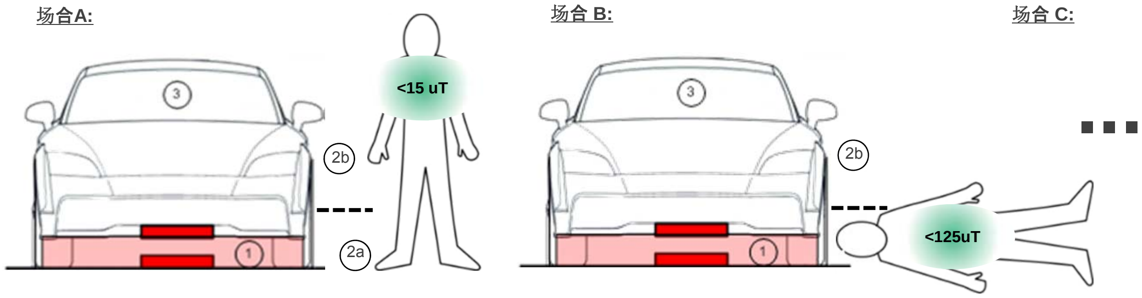
- 一个展示法规符合性比较简便的方式是说明在区域2a和2b的任何部位（例如图中的黄色区域，这是辐射最强的部分）都能满足参照的标准。

- 同时需要明确的是：
  超过参考标准并不意味着系统不符合要求。



电磁场 – 提案

- 进行一个考虑了各种使用情况的风险评估
  - 例子：站立人员紧靠车辆可以是所有系统都必须满足的标准应用场合；
  - 但是根据不同的整车厂要求，可能其他使用场合也都必须满足（例如：测试模型躺在车辆边上）。



Note: 15 uT is the limit for „safe“ IMD operation from ISO 14117, height of separation line between region 2a and 2b is TBD (proposal: 30cm)

Thank you

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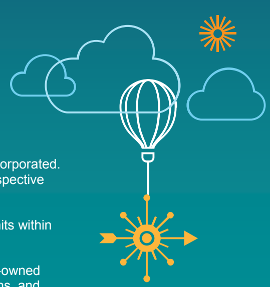
www.qualcomm.com & www.qualcommhalo.com



Mark Klerer, Senior Director – Technology
Qualcomm Incorporated
9 June 2015

Unleashing the Potential of Electric Mobility Standardization of Wireless EV Charging

Sino - U.S. Workshop on EV Standardization

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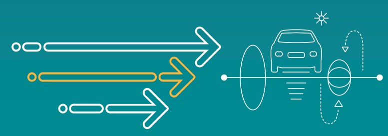

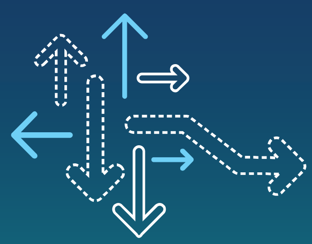

Challenges & Solutions

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Overview of Societal Trends

Global urbanisation

70% of world’s population will live in cities by 2050

(World Health Organization 2014)

Infrastructure strain

Total global vehicles increasing from 1.1bn today to 2.5bn by 2050

(OECD Report 2012)

Air pollution

Legislation and fines for pollution

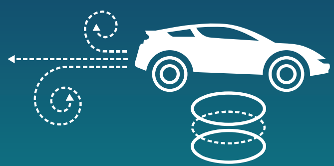
(Environmental Protection Agency – European Commissions)

Health costs

Urban outdoor air pollution is estimated to cause 1.3 million deaths worldwide per year

(World Health Organization)

EVs a Solution but with Barriers to Mass Adoption



Benefits

- Better Energy Economy
- Non-polluting
- Less Noise
- Clean Streets

Challenges

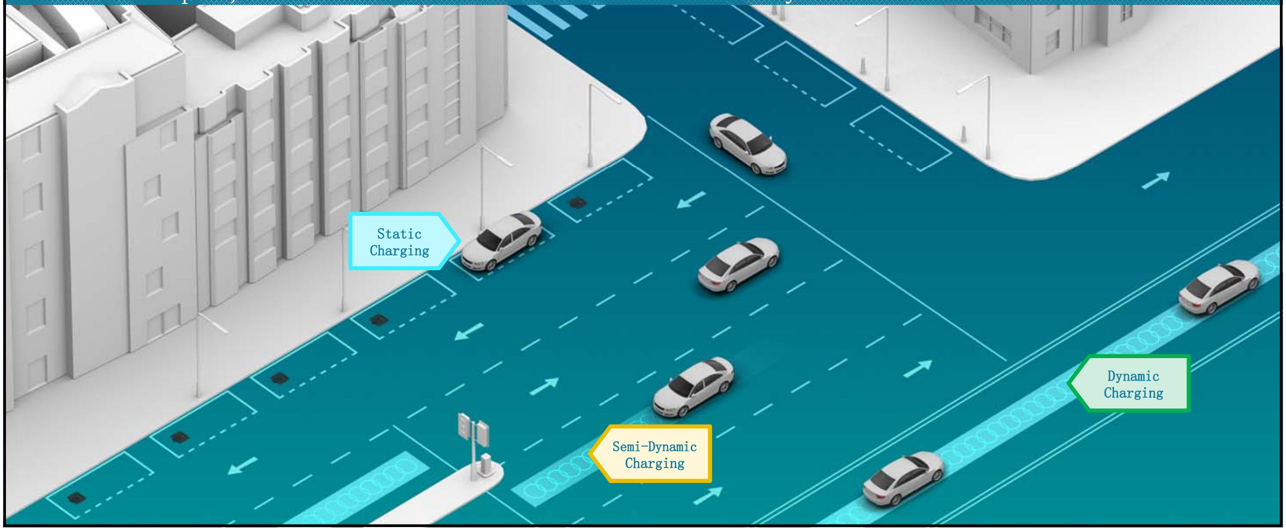
- Lack of Standards
- Limited Range
- Time to Charge
- Ease of Charging

Charging Ubiquity

- Infrastructure Lag
- Charging Posts
- Trailing Cables
- Vandalism

Factors for EV Market Growth – Ease of use

- Wireless EV Charging meets our needs
  - Simple, effortless & convenient
- Multiplicity of charging opportunities
  - Charge little, often and everywhere



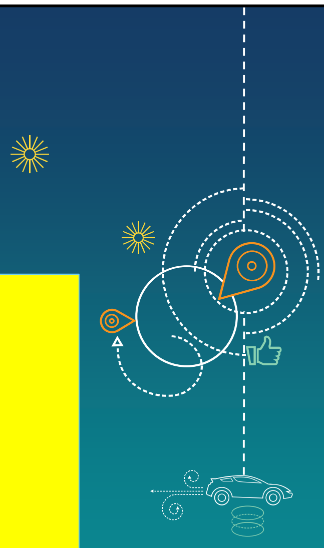
Standardization Activities

The Standards Conundrum

Provide for interoperability

and ……

Allow for innovation



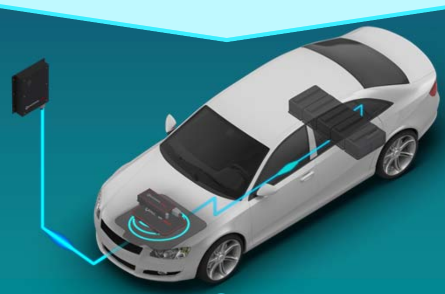
Standardization Areas and Constraints

INTEROPERABILTY REQUIREMENTS–

- Common Operating Frequency
- Magnetic interoperability between vehicle assembly (VA) and ground assembly (GA)
- Vehicle to charger communications
- Default alignment mechanism
- Agreement on VA and GA positioning in parking bay

SAFETY CONSTRAINTS -
Thermal and RF

- Foreign Object Detection
- Living Object Protection
- Circuit protection layers
- System control



PERFORMANCE

- Power Levels (3.3, 6.6, 22kW)
- Efficiency
- Air gap (absolute and range) [Z1, Z2, Z3}
- Alignment tolerance
- Stationary, Semi-dynamic, Dynamic

COEXISTENCE -
RF and EMC regulations

- Vehicle Systems
- Implantable Medical Devices
- Communication Services

Interoperability

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Key SDOs and Standards Dealing with WEVC

SDO Committee	Power Transfer	Communications	Alignment	Comments
SAE J2954	4		4	Covers both the Vehicle and Infrastructure side
IEC 61980	4	4	4	Covers Infrastructure side only 61980-1 General Requirements for WPT 61980-2 Commend and Control for WPT 61980-3 Magnetic Field WPT
ISO 19363	4	4	4	Covers Vehicle side only Relies on IEC for communications
IEC 15118		4		Covers high level communications for conductive and wireless charging. 15118-6,7,8 address the specific needs of wireless charging
SAE Hybrid Communications TF		4		J2836/6 Wireless Use Cases J2847/6 Messages & Parameters J2931/6 Phy/MAC J2931/7 Security
IEC CISPR/B (Focus on TF WPT)				EMC Emission Limits CISPR 11: Interference relating to high voltage equipment and to electric traction

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Implementation solutions in support of WEVC requirements

Requirement	Implementation Solution
Efficient power transfer	Optimized magnetic and electronic design to minimize losses
Accommodation of different vehicle ride heights	Optimized coil and electronic designs that can accommodate fluctuation and variability in coil-to-coil separation
Avoidance of overheating of WPT system	Optimized thermal design (minimization of losses)
Avoidance of human burn and ignition hazards	Robust FOD system that can detect objects subject to heating and take corrective action. (Optimized thermal design).
Protection of humans against EMF	Robust LOP system that can detect humans entering a high emission zone
Alignment/Fine Positioning precision	Auxiliary guidance system with adequate reach and resolution to facilitate precise parking
Control of power transfer process	Robust communication link

Emergence of Consensus on Key Parameters

All standards are still in various states of development and final values may change!

<table>
<tr><th>Parameter</th><th colspan="3">Value(s)</th><th>Comment</th></tr>
<tr><td>Nominal Frequency</td><td colspan="3">85 kHz for Passenger Vehicles</td><td>Lower frequencies under consideration for higher power vehicles. Alternate frequency specified in one of the IEC annexes</td></tr>
<tr><td rowspan="2">Power Levels</td><td colspan="3">Three Power Levels defined to-date</td><td rowspan="2"></td></tr>
<tr><td>WPT1: 3.7 kW</td><td>WPT2: 7.7 kW</td><td>WPT3: 22kW</td></tr>
<tr><td rowspan="2">Z Gap</td><td colspan="3">Three Z-Gap ranges defined to date</td><td rowspan="2">Numbers given are vehicle magnetic ground clearance</td></tr>
<tr><td>Z1: 95-155mm</td><td>Z2: 145-210mm</td><td>Z3: 175 - 255mm</td></tr>
<tr><td>Alignment tolerance</td><td colspan="3">x/y Tolerance ±75/±100</td><td></td></tr>
</table>

Verifying compliance and demonstrating interoperability

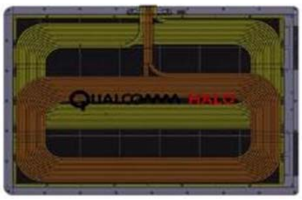
- Compliance to the standard for magnetic interoperability will be done by
  - Specifying one or more reference Ground Assemblies (GA) against which a specific Vehicle Assembly (VA) can be tested and verifying that this combination meets all the requirements specified in the standard
  - Specifying one or more reference VAs against which a specific GA design can be tested and verifying that this combination meets all requirements specified in the standard
- Status of Reference GA/VA Proposals
  - To allow for future evolution of the WPT technology Qualcomm advocates that multiple VA and GA reference designs be included in the standard
  - Currently two design types have been proposed for the VA and GA:
    - VA: Circular and Double-D (DD) Coil Topologies
    - GA: Circular and Bipolar (BP) Topologies

Qualcomm Reference Coil Proposal

- Vehicle pads (incl. comparison to circular pads):

Ground Clearance [mm]	Power Class	Qualcomm DD Size [mm]	Circular Size [mm]	Volume Difference [Circular → DD]
Z1=100 .. 160	WPT1	250 x 170 x 20	280 x 280 x 20	-46%
Z1=100 .. 160	WPT2	250 x 260 x 20	250 x 400 x 20	-35%
Z2=160 .. 220	WPT1	340 x 200 x 20	380 x 380 x 20	-53%
Z2=160 .. 220	WPT2	340 x 260 x 20	250 x 500 x 20	-29%

- Base pad:

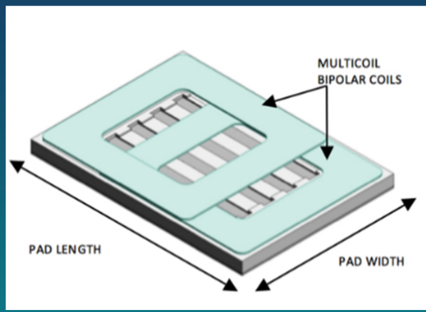


Interoperable BiPolar (575 x 765 x 50) base pad

Advanced Magnetics Offers Superior Performance

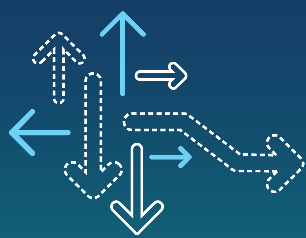
Bi-Polar is interoperable with DD, circular and solenoid Vehicle Pads

- Low stray field emissions
- High Quality factor
- Good coupling factor
- Superior z- gap range
- Superior x/y tolerance
- Efficient design
- Lower mass/packaging volume
- Interoperability with single coil pads



Interoperability between OEM' s choice of secondary pad topology and embedded infrastructure

Interoperability Capabilities		Vehicle Pad (VP)		
		Circular	Solenoid	Double D
Base Pad (BP)	Circular	✓	✗	✓
	Solenoid	✗	✓	✓
	Bi-polar	✓	✓	✓



Safety & Regulatory Compliance

QUALCOMM HALO™

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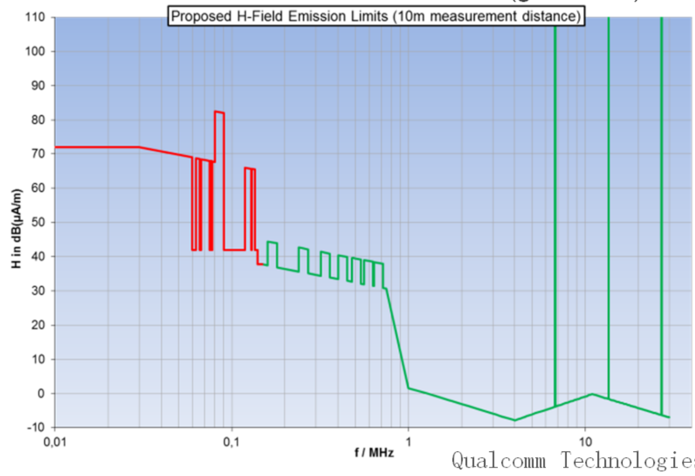
Proposed Emission Mask for WPT 85 kHz Systems

- To cover the unwanted (spurious) emissions at f>150 kHz – which will rise when the fundamental emissions rise – a modification of the limits given in CISPR 11 Class B is proposed for the 1st-7th harmonics between 150 kHz and 1 MHz (green line)



Proposal for f<150 kHz (wanted emissions)

Proposal for f>150 kHz (unwanted emissions)

(Note: CISPR/1302/INF clearly recommends that CISPR/B should consider both f<150 kHz and f>150 kHz: "The CISPR Steering Committee recommends that CISPR/B takes the lead in establishing the basic emission requirements for type tests on power electronic equipment with WPT function, in particular in the frequency range 9 kHz to 30 MHz.")

EMF – Proposed Approach for RF Exposure

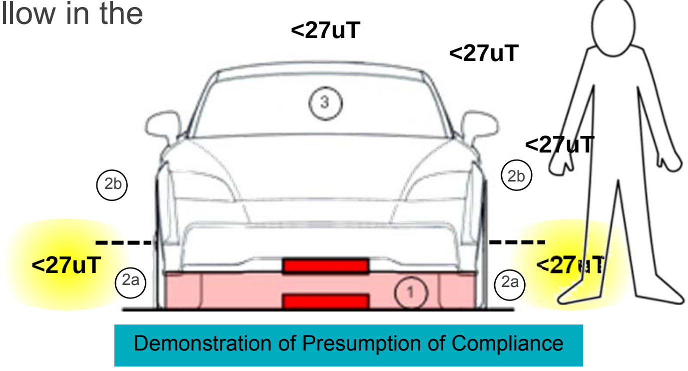
Compliance Requirement

- The requirement is to be compliant with Basic Restrictions in ICNIRP 2010

Demonstration of Presumption of Compliance

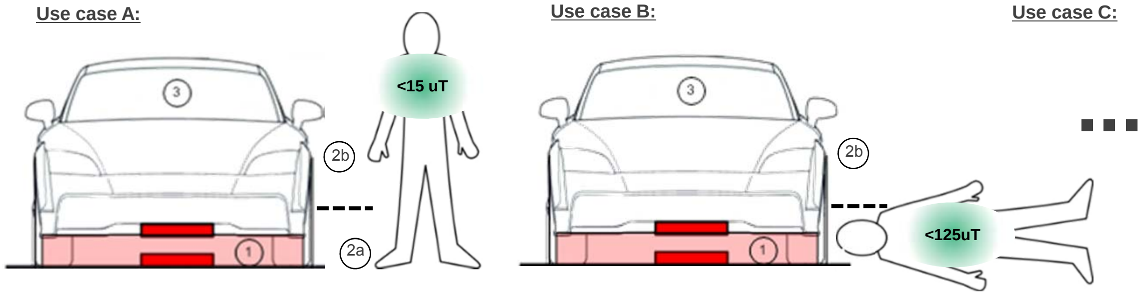
- A convenient way of establishing the presumption of compliance is to show that Reference Levels (i.e. 27uT @85kHz) are met *everywhere* in Region 2a and 2b (i.e. also in the region highlighted yellow in the picture below, where most likely the greatest emissions will occur!)

- It is important to note that exceeding the Reference Levels, therefore, *does not* mean that the system is non-compliant!



EMF – Proposed Approach for Immunity of IMD

- Make a risk assessment which considers various use cases
  - Example: „Standing person directly next to the car“ could be a standard use case that must be met by all systems
  - However, depending on individual OEM requirements, probably also other use cases (e.g. pacemaker wearer lying next to the car) must be met, too



IMD: - Implantable Medical Device

Note: 15 uT is the limit for „safe“ IMD operation from ISO 14117, height of separation line between region 2a and 2b is TBD (proposal: 30cm)

Qualcomm Technologies, Inc.

Thank you

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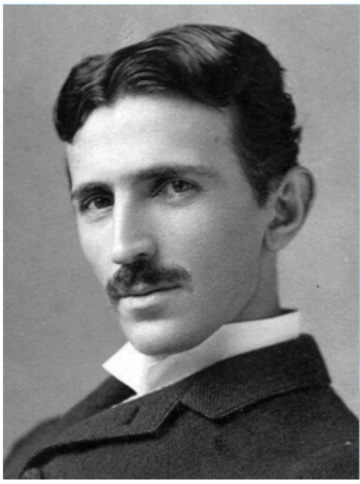
创新的汽车无线充电方案

- 田锋 **Academus Tian**
- ZTE New energy VP, ZTEV VP

- 现任中兴新能源汽车有限公司执行副总，主管战略、市场和销售；中兴通讯集团 新能源副总裁。

- 拥有16年IT行业的丰富工作经验，从事过研发，市场，销售，管理等岗位，工作经历深度涉及电信行业的多个领域，包括互联网、无线网络、有线网络、骨干光传输、移动终端、网络运营和运维托管等，负责过多个重大国际国内通讯网络项目（如尼泊尔Ncell珠穆朗玛峰绿色3G/4G无线覆盖等），对现代通信市场全价值链有丰富的实践和深度理解。在工信部电信研究院主办的核心期刊发表多篇论文。中兴通讯集团战略与技术专家委员会专家委员；深圳市云计算产业协会 专家委员会 专家委员；《IT时代周刊》专栏作家。

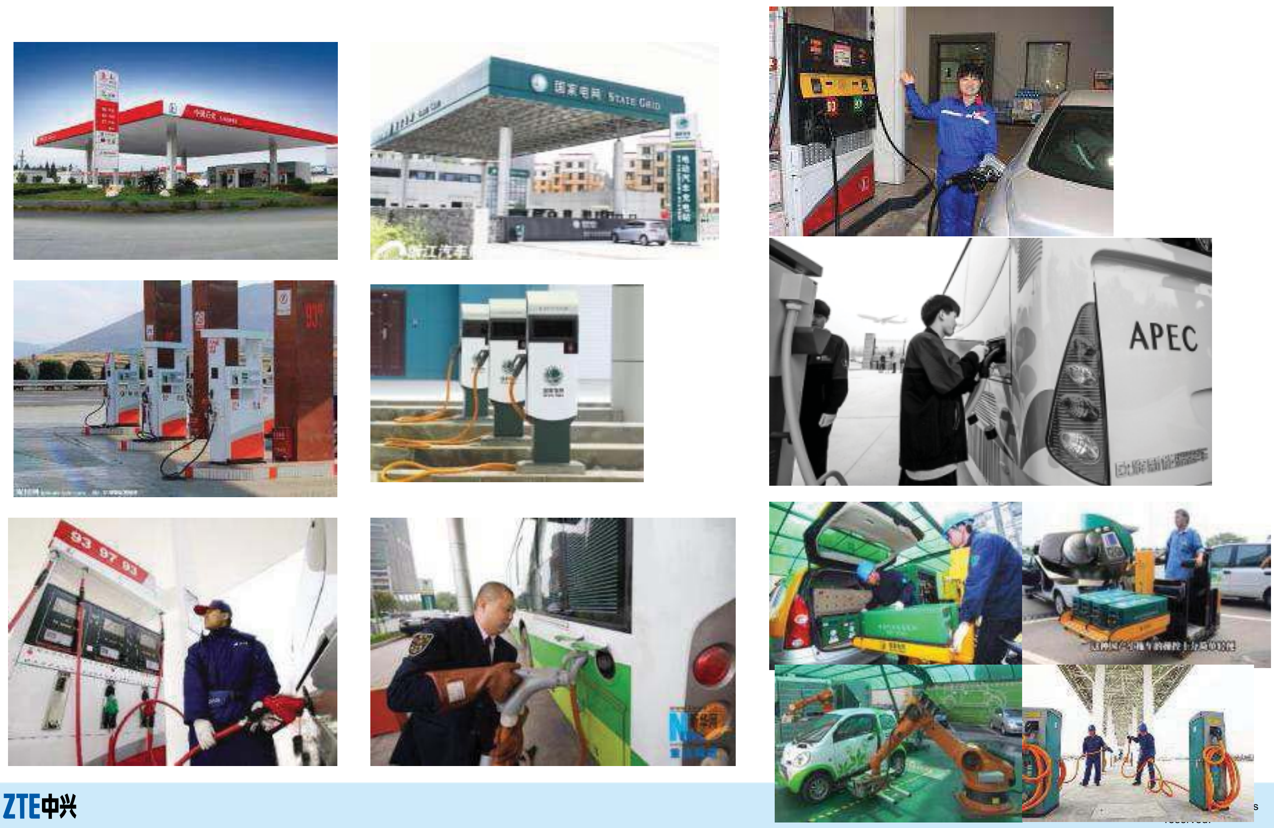
创新的中兴汽车无线充电解决方案

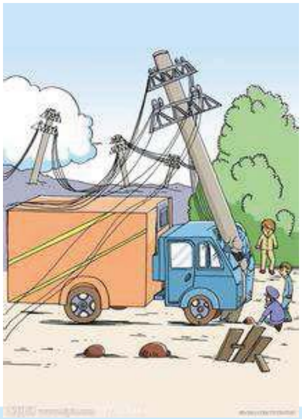


中兴通讯
中兴新能源汽车有限公司

在中兴通讯眼里，
新能源汽车是带车轮的一种智能移动终端

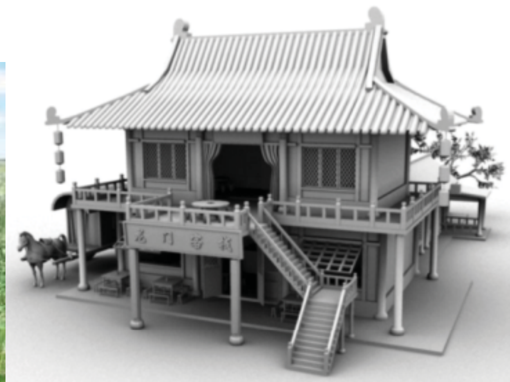
我们是否深陷“定势思维”？





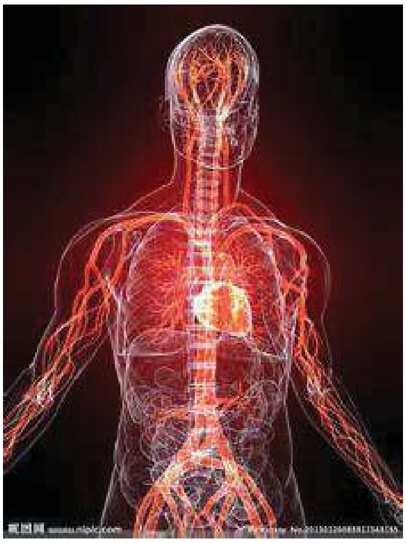
ZTE中兴

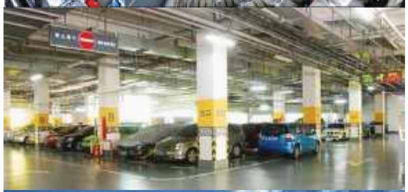
马车的时代是“目的地吃草”



ZTE中兴

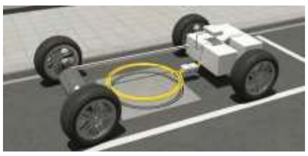
中兴认为“目的地充电”将是未来最值得推荐充电模式

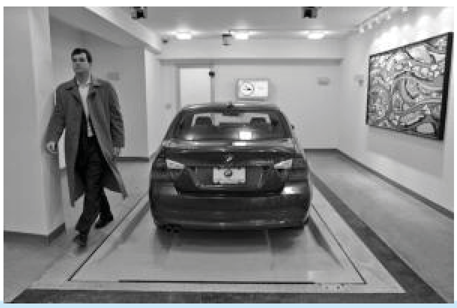




无线充电最佳匹配“目的地充电”

- 创新的无线充电设备地埋，安全可靠；具有更强防盗防损特性，抵御户外恶劣环境与天气，设备使用维护成本低；
- 无线充电无需人手参与，支持全自助模式。男女老少会泊车就会充电；
- 无线充电能够在所有电网支持的目的地进行快速低成本建设；
- 可以不征地，节省政府手中宝贵的都市核心区土地资源；





陈清泉院士高度评价中兴无线充电产品

- “中兴大功率无线充电商业化方案世界领先”

> 内部公开

王秉刚主任考察中兴成都无线充电示范线

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15时30分10秒


热烈欢迎陈清泰主任一行莅临中兴通讯！
ZTE中兴 中兴通讯股份有限公司
ZTE CORPORATION

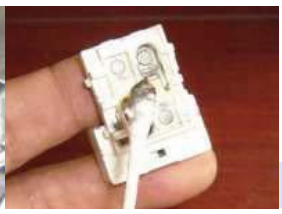
> 内部公开

ZTE中兴

深圳市委书记王荣考察

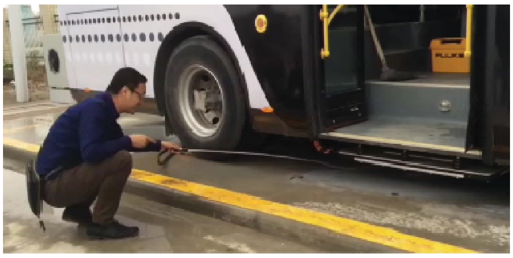
传统充电技术分析

- 传统有线充电与换电技术优势：
  - 最大的优势是易于理解；
  - 产品化难度相对不高；
- 传统充电技术当前暂时囧境的分析：
  - 征地难度大、代价高，系统投资大：
    - 传统充电设备不贵，但充电站建设代价大、征地不易；
    - 换电要求配置电池总数更大；
  - 日常运营与维护开支大：
    - 运营成本高，要求专业人员操作与日夜值守；防盗防损压力大；
    - 金属触点有机械接插运动，设备需要定期清理，脏与积尘会影响设备可靠性；
  - 对运行环境要求高：
    - 大雨、尘土堆积、水浸对传统充电方案可靠性影响较大；



创新无线充电带来的新特性

- “金属介质接触导电”到“电磁感应非接触无线输电”，短短20cm乃是对大功率输电产业化的大变革:
  - 无金属接插触点，无触点间机械运动。
  - 无“充电枪”这样易损易盗器件；
  - 可靠性高，维护成本数量级极低。系统可靠性与充电次数相关性数量级的降低——固态硬盘与传统机械硬盘；
- 输电设施安全性革命性提升，具有很强的恶劣环境耐受力:
  - 充电设施地埋；
  - 充电过程中不惧水侵、水淹、积雪、泥泞、沙石、粉尘；
  - 特别适合粉尘降落严重的城市；



无线充电地面设施建设过程

- 相对有线充电站、换电站，无线充电位建设投资少，建设周期短，只需不到1月：
  - 全模块化设计，一般工程队即可完成所有工作。支持OTA远程云调试与开通；
  - 一个月内即可完工投入使用（含2周水泥凝固时间）；
  - 最终成为路面一部分，类似一个路面井盖；

无线充电大幅度提升充电的经济性

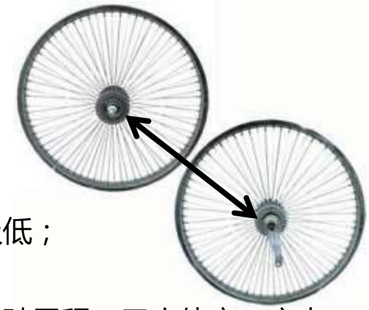
- 相比传统充电技术，充同样数量汽车，新无线充电系统的总投资可以低至传统充电技术的1/10；
  - 都市核心区可以不再需要征地，无地面凸起，干净整洁；
    - 路边停车位，路边临时停车位；
    - 现有户外室内大小车停车位；
    - 现有小区停车位；
  - 无线充电建设周期短，缩短5/6以上(6个月vs1个月)；
- 运营成本大幅降低；
  - 无线充电天然无需人手操作，实现完全无人值守；
  - 基于无线移动网络的充电车联网，运营、维护、监控绝大部分工作远程完成；
  - 对司机和管理者提供智能手机APP，方便了解车辆、充电位等全方位信息；
- 大幅度提升车辆充电便利性，可减少单车电池装载数，降低单车价格，增加车内空间并让提升运力；

公交车在线“无线目的地充电”的经济性

- 在线路目的地两端或一端进行补电；
  - 单程运行之后，司机休息时间进行补电；
  - 电力100%利用率
- 可以降低公交单车采购价格，提升节能、环保特性；
  - 单程15KM，日行驶8个来回，至少可以补充10×16=160度电。考虑电池的30%保护容量限制，相当于单车可以减配228Kwh电池容量；
  - 公交车重大幅度降低，每公里电耗减少约10%；
  - 公交车内空间明显提升，载客数量增加20%以上，盈利能力提升；
  - 没有往返充电站的空驶耗电，司机驾驶疲劳减小；
  - 司机停车即充电，无需充电操作员，充电运营成本几乎为零；

传统燃油公交车内部空间　　第一代新能源纯电动公交车内部空间　　新模式纯电动公交车内部空间

无线充电系统应用与公交的模式与经济性



- “轮辐~干线”模型；
- 轮辐中心大站采用集中式建设(经济性四星)；
  - 在现有大场站内进行大规模集中改建；
  - 对电网需求同传统充电模式，属于较大或很大；
  - 无需看管，对站内行人乘客安全，防盗防损特性显著；
  - 运营经济性较高：无空驶里程，无人值守，充电运营成本极低；
- 轮辐边沿采用分布式建设(经济性五星)；
  - 投资与运营经济性最高。在目的地终点站不征地建设，无空驶里程，无人值守，充电运营成本极低；
  - 就近引电，分布式建设充电位对电网压力小；
  - 不征地，建设手续简单，只需要交管、路政部门同意即可；
- 混合式建设(经济性四星半)；
  - 在首末站周边1KM范围内，找引电便利，施工方便的地方分布式建设无线充电位；
  - 投资与运营经济性很高。车辆充电方便，有少量空驶里程；无人值守，充电运营成本极低；
- 夜间路边停泊充电模式(经济性五星)；
  - 集中或分布建设于市政规划的夜间公交停泊路面，白天类似井盖不影响路面通行，晚上对归位休息的车辆利用夜间低谷电进行100%满充电；
  - 投资与运营经济性（较）高。夜间停泊与充电同时进行，无人值守，充电运营成本极低；有少量空驶里程；

无线充电公交经济性最佳

以一条线路30辆车为假设，单向20km，运营8年				
	项目（万元）	普通燃油大巴	有线纯电动大巴	无线纯电动大巴
车（含电池）	车辆单价	57.00	180.00	138.00
	车辆无线充电模块（60kw）			25.00
	线路车辆数	30	30	30
	线路车辆总价（不计算补贴）	1,710.00	5,400.00	4,890.00
	国家采购补贴	-	50.00	50.00
	地方采购补贴	-	50.00	50.00
	补贴之后的车辆单价	57.00	80.00	38.00
	线路车辆总价（计算全部补贴）	1,710.00	2,400.00	1,890.00
			21%	

	项目（万元）	普通燃油大巴	有线纯电动大巴	无线纯电动大巴
一辆车运营费用	每年油、气、电费	24.79	7.32	6.20
	往返充电站、加气站费用	-	0.51	-
	车辆维护费	3.38	2.50	2.50
	合计	28.16	10.33	8.70
未包含燃油补贴	一辆车运营费用	28.16	10.33	8.70
	一条线30辆车运营费用	844.87	310.02	260.90
	与无线充电相比	583.97	49.13	
	与无线充电相比节省比率	69.12%	15.85%	
包含燃油补贴	国家燃油补贴	10.00		
	一辆车运营费用	18.16	10.33	8.70
	一条线30辆车运营费用	544.87	310.02	260.90
	与无线充电相比	283.97	49.13	-
	与无线充电相比节省比率	52.12%	15.85%	

- 用实际数据对比可见，无线充电的出电动公交最经济。

无线充电公交经济环保性最佳

表6 新能源公交车燃料消耗与污染物排放情况

序号	类　型	发动机形式	百公里燃料消耗实物量	热量消耗量 MJ/km	运行阶段g/km			
					HC	CO	NOx	PM
1	汽油车	点燃式	汽油55L	17.53	9.26	93.72	8.51	0.13
2	柴油车	压燃式	柴油45L	16.12	1.58	7.20	21.33	0.82
3	CNG车	点燃式	CNG45kg	16.02	9.83	79.96	8.79	0.07
4	LPG车	点燃式	LPG30kg	15.56	18.73	87.13	6.93	0.08
5	DME车	压燃式	DME80L	15.18	4.74	4.32	10.67	0.14
6	M100车	点燃式	混合燃料90L	16.23	5.56	56.23	4.26	0.13
7	HEV车	压燃式	柴油40 L	14.33	1.19	5.40	16.00	0.61
8	超级电容车	EV	电140kWh	5.04	0.00	0.00	0.00	0.00
9	纯电动车	EV	电150 kWh	5.40	0.00	0.00	0.00	0.00
10	燃料电池车	FCV	氢10.76kg	13.02	0.00	0.00	0.00	0.00

注：1.车辆标准统一为：12m车长、额定载客量70人；2. M100混合燃料中汽油：甲醇体积比为1：9；3. HEV车为柴油、电轻度混合。

对比可见，纯电动公交可以明显减小导致都市核心区PM2.5的废气排放；

燃油被盗是公交行业长期难以解决的不大不小的问题；

无线充电防盗防损压力最小；

		普通燃油大巴	普通燃气大巴	有线纯电动大巴	无线纯电动大巴
	CO g/km	7.20	79.96	0	0
	NOx g/km	21.33	8.79	0	0
	每年行驶里程 km	75,250	75,250	75,250	75,250
一辆车一年污染排放	在都市核心区二氧化碳排放（吨）	1.69	1.69		
	在都市核心区CO+NOx 一氧化碳氮氧化合物排放（吨），主要PM2.5贡献来源	2.15	6.68	-	-
一条线一年污染排放	在都市核心区二氧化碳排放（吨）	50.70	50.70		
	在都市核心区CO+NOx 一氧化碳氮氧化合物排放（吨），主要PM2.5贡献来源	64.41	200.35		
燃油被盗损失（万元）	平均每年每车	0.05			
	平均每年一条线	1.50			
设备防盗防损（万元）	平均每年每车			0.05	
	平均每年一条线			1.50	

无线充电能够与电网协调同发展

- 上一阶段发展充电设施被充电站位置制约：
  - 都市核心区土地价格高，难以获取；
  - 电网要被迫去适应特定位置充电站；
    - 改变特定时空电网的供电能力的代价往往巨大，甚至是不可能;
- 创新的无线充电充电设施规划建设可以反过来主动适应当前电网能力，让充电设施建设的可行性与经济性大增：
  - 充分利用都市核心区现有电网富余容量，边边角角亦可利用；
  - 所有无线充电网元无线联网，集中智能充电管理、调度和控制，与智能电网无缝对接；
  - 与都市核心区电网同步发展。随电网能力提升而不断增加都市中无线充电充电位的密度和数量；

依托科技部王秉刚老师的公交可持续发展评估模型分析

安全性：
对司乘人员安全；防盗防损；防水防尘；

环境友好性：
设备地埋，融入路面和停车位；少用电池

评价原则

经济性：
不征地；减少电网增容要求；全无人值守；

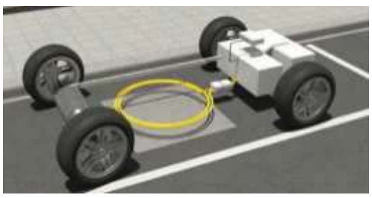
使用方便性：
男女老少会停车就自动充电，无需人手干预；

中兴大功率无线输电方案处于世界领先位置

如何量化评价一个大功率无线输电系统的三要素：

- 输电功率
- 输电效率
- 输电距离

中兴提供三点兼顾的解决方案



输电功率

安全

输电距离　　输电效率

我们的技术指标处于全球领先位置：
充电功率：30kW
充电距离：20cm
充电效率：90%
尺寸控制：一平方米以内
频率：45Khz

我们已经推出的30kW大功率单体与现行大巴充电站50A、100A充电桩可以方便的做1：1替换
系统单车充电能力N×30kW，最大300kW

国内外多家汽车厂家(如奇瑞、比亚迪、宝马、特斯拉、沃尔沃等)很早就开始了无线充电技术研发，但都受制于上述三个中某一个要素，都只是规划了未来的远期商业发布。

有线无线充电对比——基础设施

基础设施	有线充电	无线充电
占地	大城市征地困难；核心区已无地可征，地方政府也不愿意用于充电场站建设	不必征地，优势是可以依托现有停车场和道路就地进行改造
电网改造	集中式充电需要电网改造	分布式充电对电网压力小
单位投资效益	2000万投资，仅能提供4—8个充电位，支撑40辆左右大巴	十倍效率。同样2000万投资，可以改造80个大功率无线充电位，支持400台大巴充电；或1000个乘用车充电位
运营人力需求	大功率需要有人值守 设备与线缆防盗压力大	全部地埋，全过程无人值守

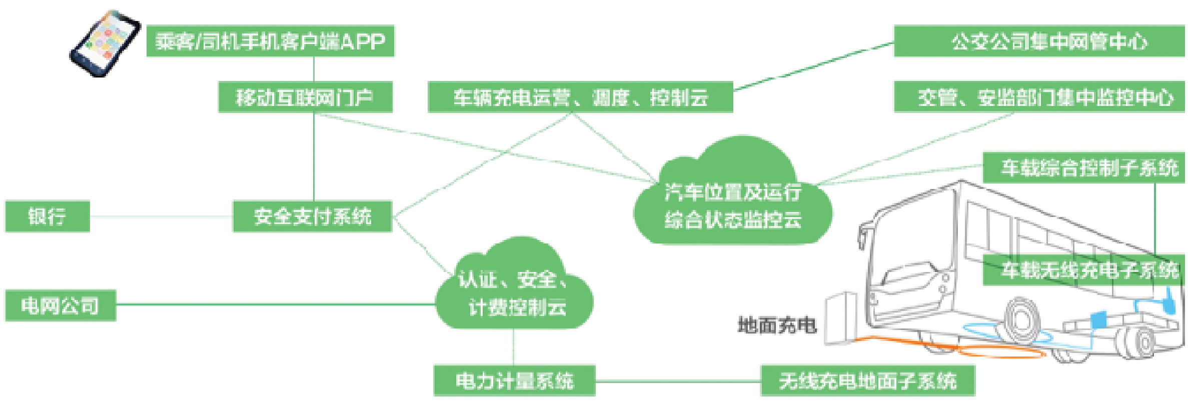
有线无线充电对比——对汽车产业的影响

汽车产业	有线充电	大功率无线充电
整车成本	充电装置略便宜，电池成本高	充电装置略贵，电池成本大幅节省
节能效果	背大电池，重、贵，影响节能效率	大幅（30－70％）减少电池重量，提升节能效率
国家标准	有国家标准	暂时无国家和国际标准，有望成为国际事实标准；
国际领先性	有一定的优势	有较大的先发优势
国际市场影响力	对国际市场影响力中	在国家政策支持下，有很强影响力
产业影响力	对国际老牌车企影响力小	在国家政策支持下，有很强影响力

有线无线充电对比——用户体验

用户体验	有线充电	无线充电
电池寿命	“猛吃一顿，尽可能跑很远”，暴饮暴食类型。电池深充深放，寿命循环1000－2000次	随时停靠随时充，“少食多餐”模式，让电池处于浅充浅放的有利工作模式
购置成本	背大电池，贵	可减少电池配置，降低购置成本
使用便利性	需要手动操作，费时费事。线缆脏、硬、重，难操作；	全自动无人值守，无需手动操作。车主体验佳；停车即是充电；
使用可靠性	户外受天气影响强烈。接触可靠性随使用次数增加而降低	不受风雨气温、水浸水淹影响。非接触充电，可靠性始终如一

中兴无线充电系统解决方案



- 在中兴眼里“把新能源车看作带车轮子的联网（智能）手机”。中兴通讯**现有电信级**解决方案提供高可靠且高性能的运营支撑系统，可以轻松支持每天几亿次服务活动交易；
- 基于云计算、车联网、移动支付等面向未来的高并发、大容量、高可靠技术架构；
- 全面支持用户自助我服务的模式——余额宝模式；对司机与管理者提供智能手机安全管理APP；

2014年1月 完成国家科技成果鉴定

与东风2014合作完成的最新款无线充电纯电动高端商务车

2014年9月17日中兴东风全国第一条无线充电公交商业示范线启动

中兴通讯开启无线能源新时代

全球首例新能源汽车大功率无线充电公交商用示范线启动

2014西博会发布与成都客车集团合作发布全球首台无线充电社区巴士

无线充电同样是乘用车的最佳选择

- 易于车主使用，无需操作，会停车即可充电，男女老少皆可便捷全自助完成充电，手干净；
- 设备地埋，安全性高，恶意破坏也难导致人身危险；
- 与自动泊车、自动驾驶完美匹配；防盗防损性强，无需小区和户外停车场增加值守人员；
- 超强抵御恶劣环境，尤其适合户外商用停车场改建；
- 无线目的地充电可以让拥车者"充电不用钱"；

Bringing you Closer

Thanks!

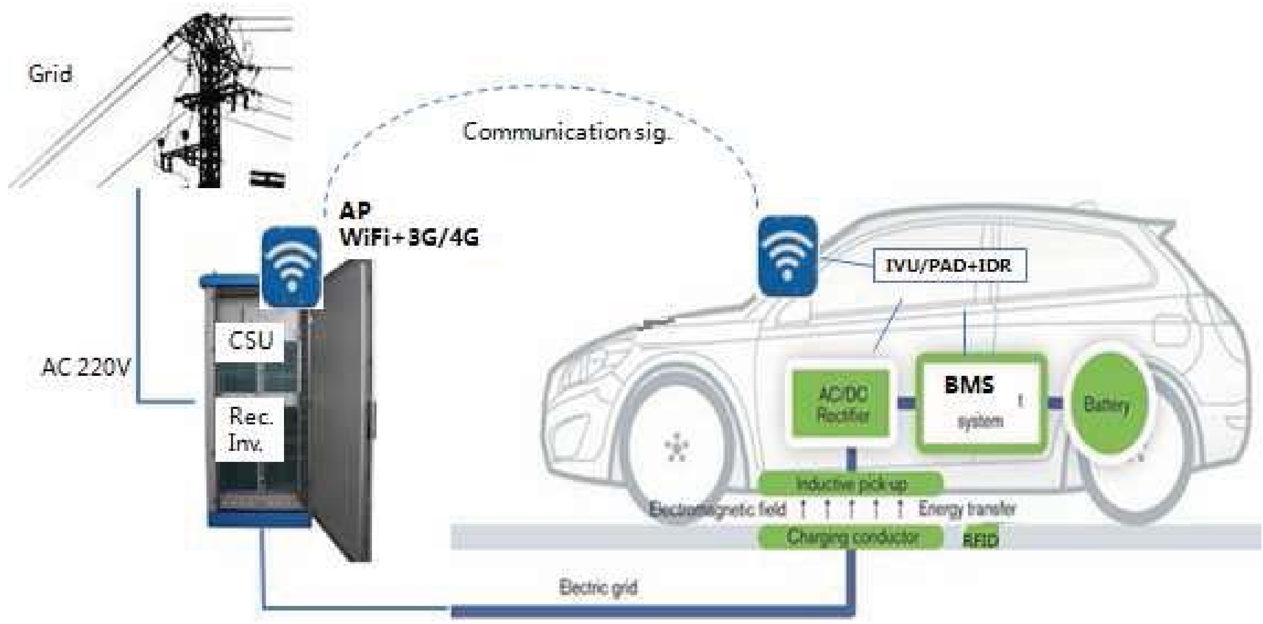
ZTE Wireless Power Transmission (WPT) Solution for EV Charging

Academus Tian
VP
ZTE New Energy Vehicle co., LTD

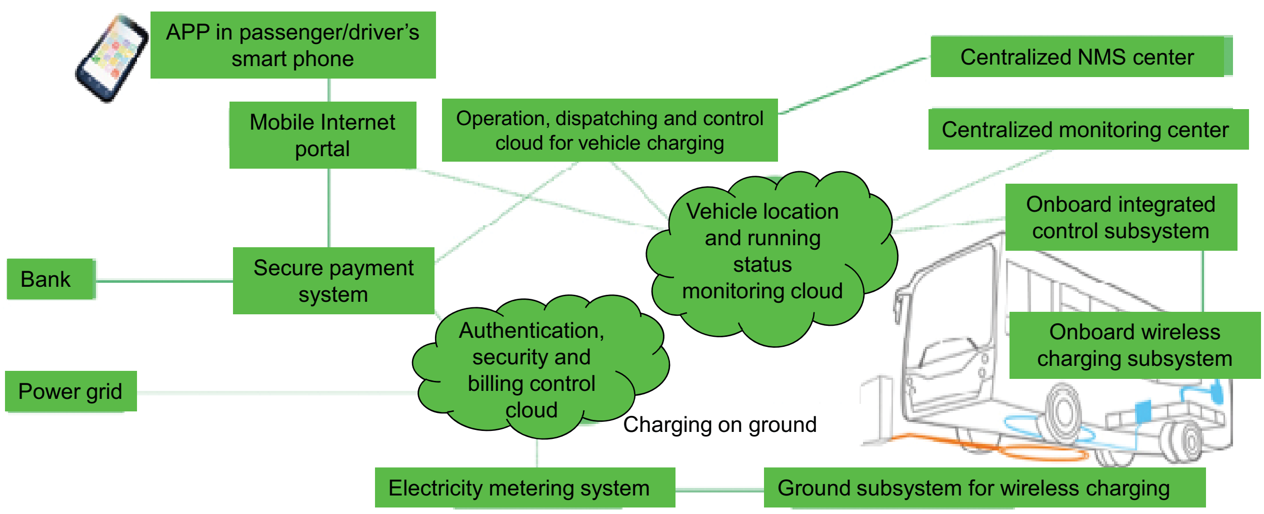
Agenda

- ZTE WPT Solution for Passenger Vehicle
- ZTE WPT Advantages
- Successful Cases

General Principle of WPT Charging



ZTE WPT Solution Overview



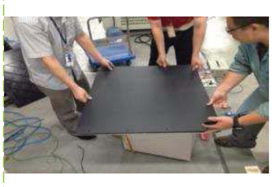
new energy vehicles: Intelligent mobile terminals with wheels

WPT Advantages

- **Safe and reliable**: has the strong anti-theft features, can be used in outdoor environment and bad weather, maintenance cost is low;
- **Good user experience**: wireless charging support the self-service pattern. ease of use, just parking and charging;
- **Save space**: support the destination charging, save precious land/space resource.

ZTE WPT Industrialization Progress

06.11 project kickoff 06.12 first 3.3kw prototype	07.13 Dongfeng mid bus integration	01.14 certification	06.14 first WPT bus with commercial application
Start	On-board	Certification	demonstration



Product Specification-6.6KW

performance	Now（Jun. 15）	planning（Dec. 15）
Input voltage	187Vac~253Vac	187Vac~253Vac
Input frequency	45HZ~66HZ	45HZ~66HZ
PuC dimension	600*600*35mm	400mm*400mm*20mm
PrC dimension	600*600*55mm	600mm*600mm*40mm
Air gap	70mm~130mm	90mm~130mm
Y tolerance	15cm@13cm gap	15cm@13cm gap
X tolerance	7.5cm@13cm gap	7.5cm@13cm gap
Output voltage	280Vdc~420Vdc	280Vdc~420Vdc
Peak efficiency	90%	90%

Product Specification-3.3KW

performance	Now（06. 15）	planning（Dec.15）
Input voltage	187Vac~253Vac	187Vac~253Vac
Input frequency	45HZ~66HZ	45HZ~66HZ
PuC dimension	500*500*30mm	250mm*250mm*20mm
PrC dimension	500*500*30mm	600mm*600mm*40mm
Air gap	80mm~140mm	90mm~130mm
Y tolerance	15cm@14cm gap	15cm@13cm gap
X tolerance	7.5cm@14cm gap	7.5cm@13cm gap
Output voltage	280Vdc~420Vdc	280Vdc~420Vdc
Peak efficiency	90%	90%

ZTE中兴
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System Interworking with Chery and ChangAn

- Aug, 2013, ZTE signed strategic cooperation agreement with Chery Auto;
- Mar, 2014, system interworking finished;
- Chery eQ EV，up to 250KM;

- Aug, 2013, ZTE signed strategic cooperation agreement with ChangAn Auto;
- July, 2014, system interworking finished by joint R&D;
- ChangAn Jiayue EV，Max power upto 107kw;

Interworking with Beijing vehicle

passenger load(KG)	Cargo load(KG)	Rear gap(cm)	Gap change (cm)
0	0	37.2	0
185	0	33.9	3.3
185	65	31.8	5.4
0	95	34	3.2

passenger load(KG)	Cargo load(KG)	middle gap(cm)	Gap change (cm)
0	0	20	0
185	0	18.2	1.8
185	65	18	2
0	95	19.5	0.5

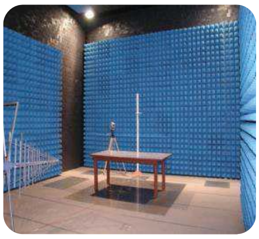
Agenda

- ZTE WPT Solution for Passenger Vehicle
- ZTE WPT Advantages
- Successful Cases

ZTE Provides Products and Service in 160+ Countries

- Founded at 1985, 2014 revenue: 84.7 billion RMB, main product is wireless communication；
- ~60,000 staff, 80% of them with master/doctor degree；
- 107 global branches ,18 global R&D centers；
- 7+1 global logistics centers, 15 global training centers
- More than 10,000 after-sales staff, 3,000+ local partners
- 10% of revenue on research and development
- From 2011 to 2013, PCT patent NO.1 in the world
- Energy product line founded at 1988, No.1 in china
- wireless + energy → wireless charging

Advanced R&D Facilities and Strict Certification



EMC Lab

Surge and Lightning Lab

Environment Lab

Safety Testing Lab

HALT Testing Lab

Fault Analysis Lab

ZTE provides advanced R&D facilities and strict certification to assure the high quality .

ZTE WPT Leading Technology in the world

Capacity

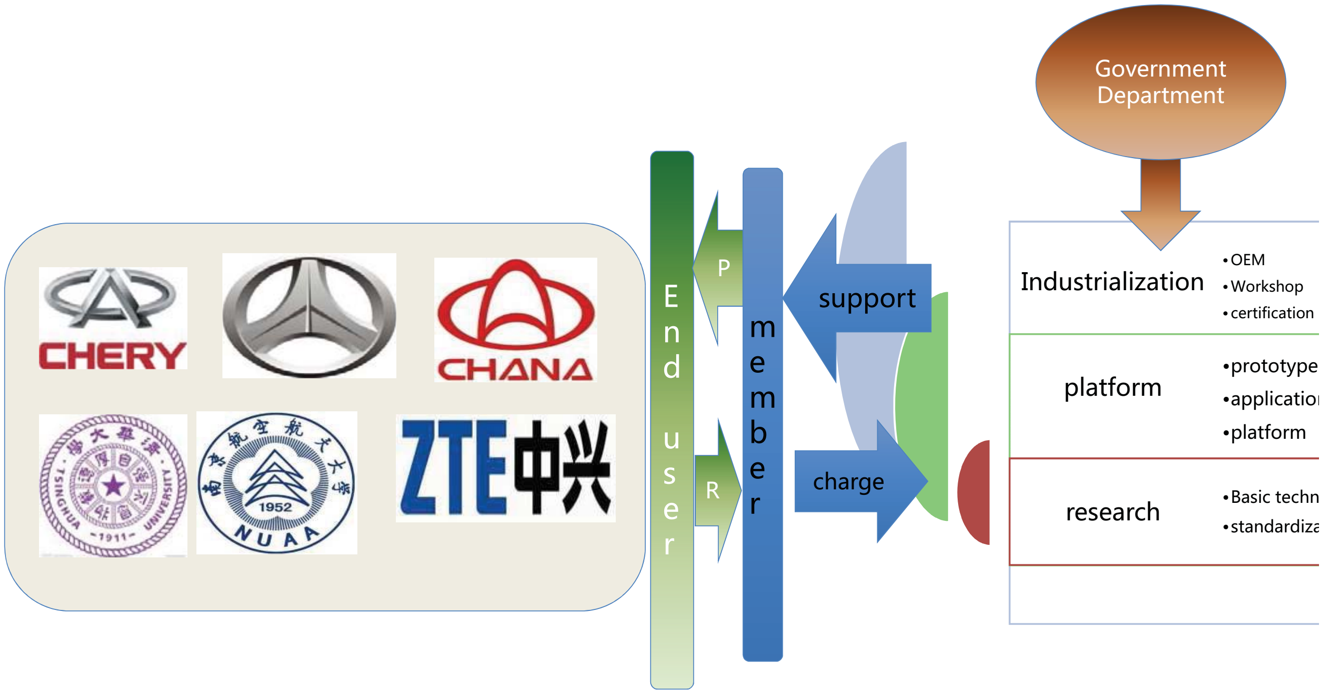
Gap

Efficiency

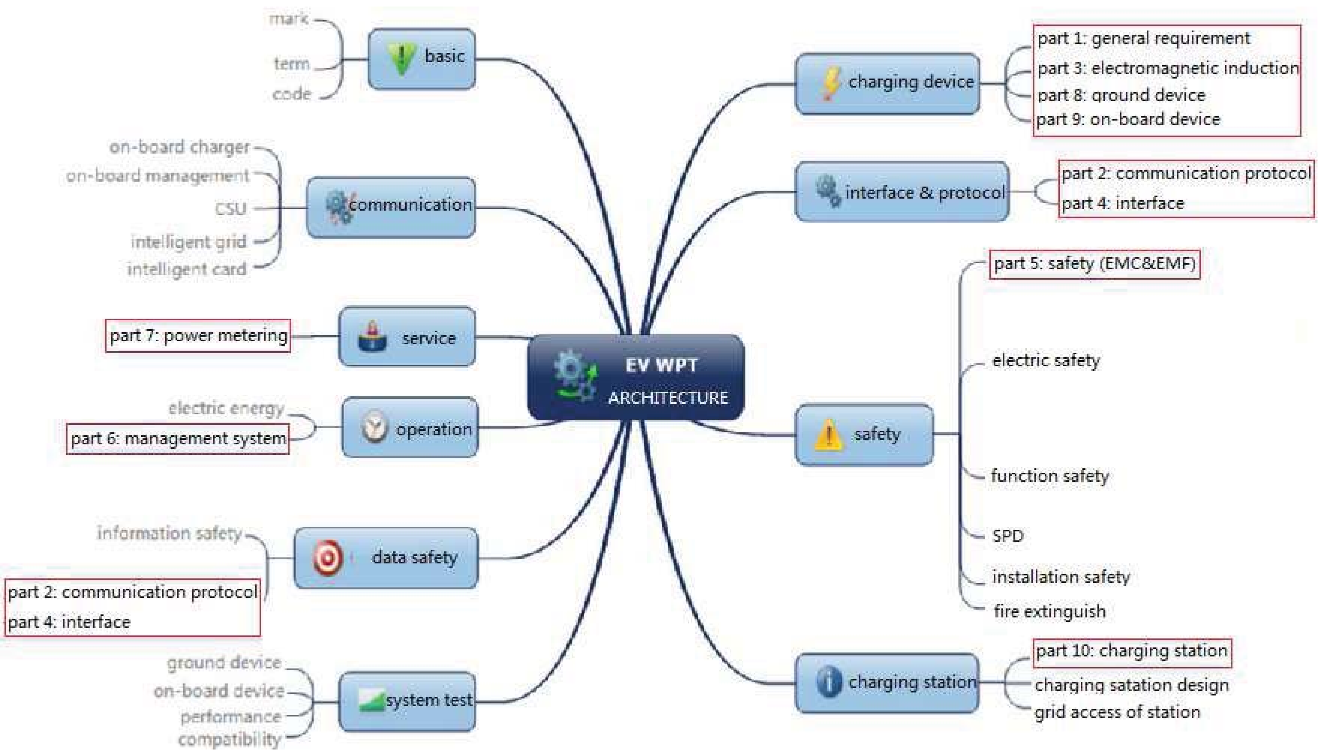
3 key factors to evaluate WPT:
Capacity
Efficiency
Distance

ZTE WPT performance：
Capacity：**30kW**
Gap：**20cm**
Efficiency：up to **90%**
Dimension：less than 1 square meter
Frequency：85Khz

Launch WPT Industrialization alliance



WPT Standard Architecture



Focusing on Public Charging Infrastructure

Vs

Low population in the European and American, house with a garage is common, suitable for self-built charging infrastructure.

dense population in China, most are public parking space, suitable for the construction of public charging infrastructure.

ZTE is currently working with government together to deploy charging infrastructure in some major cities.

Agenda

- ZTE WPT Solution for Passenger Vehicle
- ZTE WPT Advantages
- **Successful Cases**
- Open Discussion

Xiangyang: First Wireless charging demonstration bus line in China, in Sep. 17th. 2014

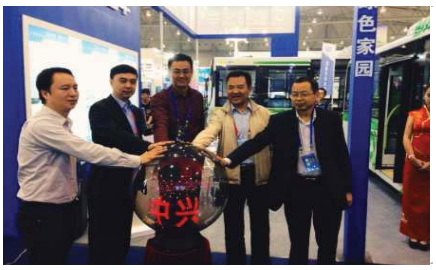

中兴通讯开启无线能源新时代

全球首例新能源汽车大功率无线充电公交商用示范线启动

The first wireless charging demonstration bus line where ZTE cooperated with DongFeng corporation was launched in China.

Case study: Chengdu Community Bus

The **first** wireless charging community bus line of the world



Launch Date： Feb, 2015

Vehicle Partner： Shudu Group

Bus Line： No.1058 line, length: 5km

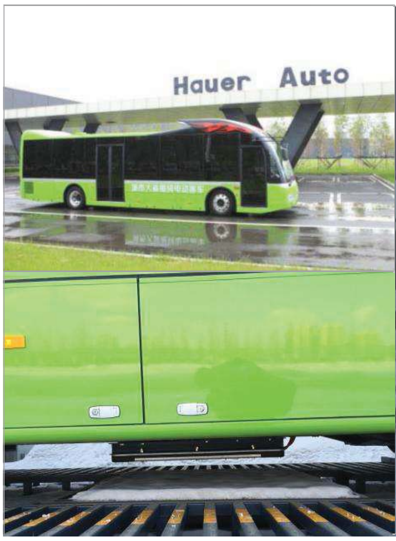
Qty of Charging system： 2

Bus model： community bus(18 seats)

System efficiency： 90%

Case study: Changchun Wireless Charging Bus Line

The first wireless charging system working in frigid climate



Launch Date： Mar, 2015

Vehicle Partner： Hauer Auto

Bus Line： No.4 line, length: 15.6km

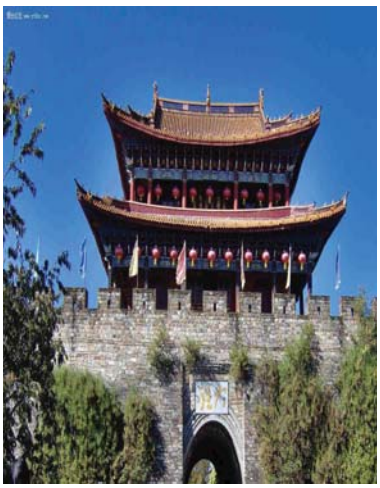
Qty of Charging system： 3

Bus model： City bus(45 seats)

Working Temp： **-26** ℃

Case study: Dali, Yunnan Wireless Charging Scenic Spots Shuttle Bus Line

The first wireless charging tourist bus line in scenic spots (environment-friendly)



Launch Date： Feb, 2015

Vehicle Partner： Shenzhou Auto

Bus Line： No.2 line, length: 8km

Qty of Charging system： 2

Bus model： YH6660BEV-A

System Efficiency： 90%

Case study: Zhengzhou Wireless Charging Bus Line

The largest capacity of wireless charging system for bus line

Launch Date： Mar, 2015

Vehicle Partner： Yutong Vehicle

Bus Line： B26 line, length: 12.5km

Qty of Charging system： **20**

Bus model： City bus(12.5Meter)

System Capacity： up to **100** bus

Case study: Wireless Charging Shuttle Bus Line at ZTE HQ

The first wireless charging shuttle bus line for enterprise/campus zone

Launch Date： Mar, 2015(under deployment)

Vehicle Partner： Wuzhoulong Vehicle

Bus Line： HQ-R&D line, length: 12km

Qty of Charging system： 2

Bus model： Mini bus(6.6Meter)

System Efficiency： 90%

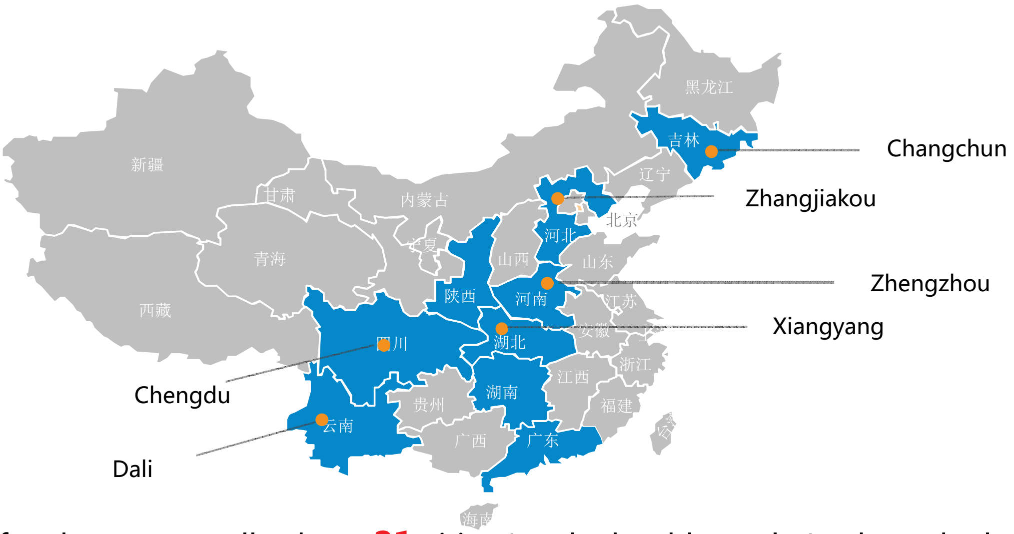
Prof. Cheng appraised ZTE

- “ZTE high power WPT advance in the world”

Interest and Support from China Government

Li lanqing--vice premier;
WanGang--Minister of science and technology

Very Fast Growing Market of Commercial Launch over China



- So far, there are totally about **21** cities (marked as blue color), where the local government has signed MOU to deploy wireless charging solution for public transportation (city bus line);
- There are about **6** cities, where wireless charging bus line has been commercially launched;

Bringing you Closer

Thanks!

Joe Bablo is a Primary Designated Engineer (PDE) with Underwriters Laboratories (UL). Joe is the PDE for Automotive Equipment and Associated Technologies, which spans products in the Electric Vehicle and Charging Equipment areas. Joe has been with UL for20 years, the last 12 in his current role. In addition, Joe serves on various committees as a member for the Society of Automotive Engineers (SAE) as well as a committee member in IEC committees under TC69 for conductive charging and wireless charging of electric vehicles, TC23 for IC-CPDs and EV connectors. Additionally, Joe serves as the US Technical Advisor for the USTAG to TC69. Joe also serves as an alternate to Code Making Panel 12 as a technical expert for Article 625 of the National Electrical Code. Joe holds a Bachelor of Science in Electrical Engineering from the Milwaukee School of Engineering.

Joe Bablo 就职于美国保险商实验室(UL)担任汽车设备和相关技术的首席指定工程师，负责的产品涵盖电动汽车和充电设备领域。他在 UL 工作已有 20 年，担任现职务已有 12 年。他是美国机动车工程师学会(SAE) 委员会成员和国际电工委员会(IEC)下属电动道路车辆和电动商用卡车技术委员会(TC69)成员，负责电动车辆传导充电和无线充电，TC23 集成电路电脑绘制和电动汽车连接器。Bablo 先生还任美国技术咨询小组(USTAG)的美国技术顾问参加 TC69 大会。同时,身兼美国国家电气法规 625 条制定专家组成员和技术专家。他毕业于密尔沃基工程学院获得电子工程学士学位。

电动汽车供电设备标准

中美电动汽车标准化研讨会
中国北京

2015 年 6 月 9 日

电动汽车供电设备标准的当前状态

电动汽车供电设备标准的新发展
和未来发展

推广使用电动汽车

当前状态

电动汽车供电设备

- 美国、加拿大和墨西哥三个国家之间统一的标准；并且是美国的 ANSI 标准。

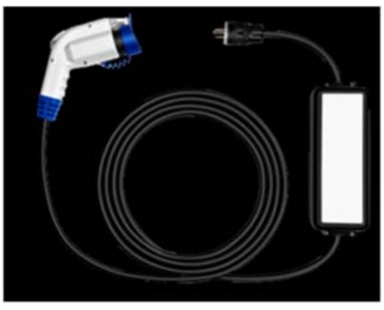
- UL 2594/CSA 280/NMX-J-677-ANCE

- 包含带交流输出电压的基础设施

- 本标准涵盖的不同类型的产品

包括：

  - 便携式电动汽车供电设备
  - 移动式电动汽车供电设备
  - 永久型电动汽车供电设备



- 目前处在更新周期以解决更新问题

电动汽车充电器

- UL 2202 是美国的 ANSI 标准。其并未列入统一的第一阶段。
- 涵盖带直流输出电压的基础设施
- 本标准涵盖的不同类型的产品：
  - 移动式电动汽车供电设备
  - 永久型电动汽车供电设备

车辆耦合器、电动汽车插头、EV 插座

- 美国、加拿大和墨西哥三个国家之间统一的标准；并且是美国的 ANSI 标准。
- UL 2251/CSA 282/NMX-J-678-ANCE
- 包括车辆耦合器（入口和连接器）以及基础设施输出（EV 插座和 EV 插头）处的配套装置
- 目前处在更新周期以解决更新问题

SAE J1772™

- 这是SAE针对车辆耦合器推荐的做法
- 封面设计、配置和通信
- 本文档中所述产品的不同类型包括：
  - 交流连接器和入口
  - 直流组合耦合器
- 目前处在更新周期以解决更新问题

国家电气规范（NEC）

EVSE 须符合 NEC 的安装要求。这是由具有司法管辖权（AHJ）的当地规管人员实施的。

NEC 每三年公布一次。

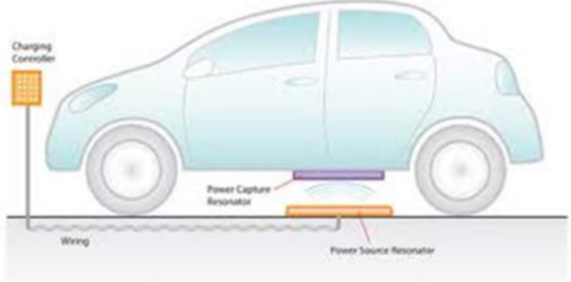
目前正处于更新周期，
预期将于 2016 年 9 月出版。

对规范的更改可能会影响标准，未来需要更多的更改。

新的发展和未来的发展

无线充电

- 这一标准目前在制订中。
- 将涵盖无线充电系统，其中至少应包括电源和初级线圈。



- 目前的市场只有售后市场型系统。美国汽车制造商还不太习惯对他们的汽车提供售后市场系统。报告表明，第一批要使用这项技术的车辆预计于 2016 年推出最新型号。

无线充电的危害

由于缺乏车辆的物理连接，这些问题可能会显著地影响到安全性：

- 人体暴露于充电场
- 车辆的充电器失调
- 可能会构成火灾或健康危害的插入对象

对这些问题及安全减灾的响应均有可能通过车载系统和车载充电器通信解决

UL 正在与行业合作，开发解决这些问题的安全性方案。

供应的车辆

- UL 9741 标准目前是作为调查大纲发布的。

- 涉及到供应车辆时使用的设备。此中包括带/不带充电功能的 V2X 型设备

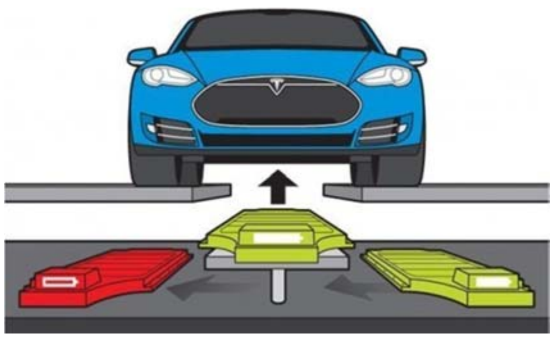
- 电网交互要求已列入电脑文件中，其系统已绑定到电网上。

重载充电

- 对公共汽车和卡车进行定义
- 可能或不可能利用市场上现有的类似技术。
- 使用的电压和电流的较高输出值
- 可能包括导电、无线或龙门（导电）式充电。

电池更换

- 今天，美国电池更换潜力较低。
- 特斯拉已经表示希望利用此项技术。
- 一些车队的使用可能会受益于这种交换技术。
- 作为一项公共驱动的解决方案，这并未讨论太多。
- 参与美国 IEC 开发并监控标准化的需要



推广电动汽车

相互可操作性

- EVSE 在现实生活中的使用案例涉及到在许多不同的公共场所进行充电的众多不同的车辆。
- 充电期间的正常运作就是推广使用电动汽车的一个重要方面。
- 用户必须熟悉不同的设备以及使用这些不同设备的方法。
- 在美国进行了一些测试，可提供一些有关今天的技术互操作性的数据，这将在接下来的演示文稿中加以讨论。
- 此时，类似的测试正处在无线充电互操作性的规划阶段。

中国的 UL 公司

- 2013 年，UL 与中国国家电网电力科学研究院 （CEPRI）签署了一项谅解备忘录，以创建一个平台，让中国的公用设施更深入地了解 EVSE 对电网的可能影响。

- 2014 年，UL 将国家电网电力科学研究院（SGEPRI）认证为见证实验室，以为中国当地的中国制造商进行 UL 测试。

中国的 UL 公司

- UL与 SGPRI 联合举办了公共研讨会和技术讲习班，使更多的中国制造商能更好地了解北美市场 EVSE 标准和规范的要求。

二次生命 – 电池

- 需要电池再利用（重用）的方法或回收电池材料的途径。

- 二次生命可能会产生建立标准的需要，例如管理电池状态、先前的电池滥用及其对未来运作的影响、可能重建一部分电池组等等。

- 可用于各种应用的存储需要

。

提问时间

Electric Vehicle Supply Equipment Standards

Sino-U.S. Workshop on Electric Vehicle Standardization
Beijing, China

9 June, 2015

Current Status of EV Supply Equipment Standards

New and Future Development of EV Supply Equipment Standards

Promoting the use of EVs

Current Status

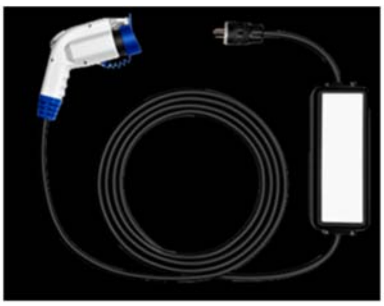
EV Supply Equipment

- Tri-Nationally harmonized standard between the US, Canada and Mexico; and is the ANSI standard in the US.

- UL 2594/CSA 280/NMX-J-677-ANCE

- Covers infrastructure with an AC output voltage

- The different types of products covered by this standard include:
  - Portable EV Supply Equipment
  - Movable EV Supply Equipment
  - Permanent EV Supply Equipment



- Currently in a revision cycle to address updates

EV Chargers

- UL 2202 is the ANSI standard in the US. It was not included in the first phase of harmonization.
- Covers infrastructure with an DC output voltage
- The different types of products covered by this standard include:
  - Movable EV Supply Equipment
  - Permanent EV Supply Equipment

Vehicle Couplers, EV Plugs, EV Socket Outlets

- Tri-Nationally harmonized standard between the US, Canada and Mexico; and is the ANSI standard in the US.
- UL 2251/CSA 282/NMX-J-678-ANCE
- Covers the vehicle coupler (inlet and connector) as well as the mating devices at the infrastructure output (EV socket and EV plug)
- Currently in a revision cycle to address updates

SAE J1772™

- This is an SAE Recommended Practice for the vehicle coupler
- Covers design, configuration and communication
- The different types of products described by this document include:
  - AC Connector and Inlet
  - DC Combo Coupler
- Currently in a revision cycle to address updates

National Electrical Code (NEC)

EVSE is required to be in compliance with the installation requirements in the NEC. This is enforced by the local regulatory personnel having jurisdiction (AHJ).

The NEC is published every three years.

Currently in a revision cycle which is anticipated to be published in September of 2016.

NFPA®

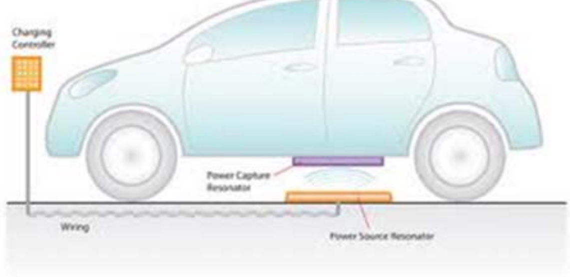
Changes to the code could affect standards and create the need for revisions in the future.

New and Future Development

Wireless Charging

- This standard is in development.

- Will cover the wireless charging system which includes the power source and the primary coil as a minimum.



- None on the market yet other than after-market type systems. U.S. auto makers are not comfortable with after-market systems on their vehicles. Reports indicate first vehicles to use this technology are anticipated in late model 2016.

Wireless Charging Hazards

Due to the lack of physical connection to the vehicle, these issues may significantly affect safety:

- Human exposure to charging field
- Vehicle misalignment to charger
- Interposed objects which may be a fire or health hazard

Responses to these issues and safety mitigation are likely to be addressed by on-board vehicle systems and vehicle-to-charger communication

UL is working with industry to develop safety solutions for these issues.

Vehicle as Supply

- The UL 9741 standard is currently published as an outline of investigation.

- Covers the equipment that is used when the vehicle is the supply. This includes V2X type equipment with and without charging capability.

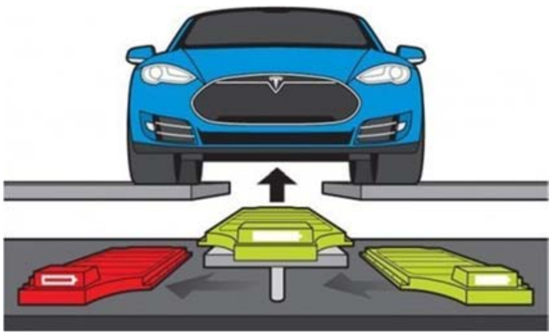
- Grid interaction requirements are included in the document for systems that are tied to the grid.

Heavy Duty Charging

- Defined for buses and trucks
- May or may not utilize similar technology to what is already on the market.
- Higher output values of voltage and current to be used
- Could include conductive, wireless or gantry (conductive) type charging.

Battery Swapping

- The potential for battery swapping is low in the U.S., today.
- Tesla has indicated a desire to utilize this technology.
- Some fleet use may benefit from swapping technologies.
- As a solution for public driving, this is not discussed much.
- Participating in IEC development in this area and monitoring the need for standardization in the U.S.



Promoting EVs

Interoperability

- Real life use cases for EVSE involve many different vehicles charging at many different public sites.
- Proper functioning during the charging event is an important aspect of promoting the use of EVs.
- The user must be familiar with different equipment and how to use this different equipment.
- In the US, there was a testing effort performed to provide some data as to the interoperability of today's technology, this will be discussed in an upcoming presentation.
- Similar testing is in the planning stages for wireless charging interoperability at this time.

UL corporation in China

- In 2013, UL had signed a MOU with State Grid China Electric Power Research Institute (CEPRI) to create a platform to allow China utility to more understand how EVSE may affect the power grid.

  在2013年，UL与国家电网中国电力科学研究院（CEPRI）签署谅解备忘录，创建一个交流平台，让与国网更加了解电动汽车充电设备对电网可能的影响性。

- In 2014, UL certified the State Grid Electric Power Research Institute (SGEPRI) as a witness lab to perform UL testing for Chinese manufacturers locally in China

  在2014年，UL认可国家电网电力科学研究院（SGEPRI）作为UL外包合作实验室为中国本地制造商进行UL认证测试。

UL corporation in China

- Jointly held public seminar and technical workshop with SGPRI had been held since then to allow more Chinese manufacturers to better understand the EVSE standard and code requirement of North American market.

  UL与国家电网中国电力科学研究院一直以来联合举行公共研讨会和技术研讨会，让更多的中国企业更好地了解电动汽车充电设备的标准规范和北美市场的要求。

Second Life - Batteries

- The need for a way to re-use (repurpose) batteries or a way to reclaim battery materials is needed.

- Second Life could result in the need for standards to govern battery conditions, previous abuse and its affect on future operation, possible rebuilding a portion of the battery pack, etc.

- Could be used for storage needs for a variety of applications.

Questions?

我国电动汽车充换电设施标准情况介绍

Development and Standardization of EV and EVSE in China

中国电力企业联合会 China Electricity Council
刘永东 Liu Yongdong
2015年6月

刘永东 高工

中国电力企业联合会标准化中心副主任
能源行业电动汽车充电设施标准化技术委员会 秘书长

Liu Yongdong Senior Engineer

Deputy Director General, Standardization Centre of China Electricity Council,
General secretary, Standardization Technical Committee 3 on electric vehicle charging infrastructure of National Energy Administration

主要内容

1. 我国充换电设施标准体系
standard system construction

2. 我国充换电设施标准进展
Achievement

3. 我国充换电设施标准展望
Next step of standardization

1.1 能源行业电动汽车充电设施标委会

我国政府高度关注

- 马凯副总理调研中明确提到加强充电设施标准。
- 住房和城乡建设部支持充电设施建设标准。
- 国家标准委、工信部、能源局和科技部成立充电技术及设施标准推进组。

成立能源行业电动汽车充电设施标准化技术委员会

Standardization Technical Committee 3 on electric vehicle charging infrastructure of National Energy Administration NEA/TC3

由国家能源局批准，第一届能源行业电动汽车充电设施标准化技术委员会于2010年6月成立。已经召开了一届五次会议，2015年将进行换届。

1.1 能源行业电动汽车充电设施标委会

国家能源局
National Energy Administration

中国国家标准化管理委员会
STANDARDIZATION ADMINISTRATION OF THE PEOPLE'S REPUBLIC OF CHINA

能源行业电动汽车充电设施标准化技术委员会 NEA/TC3

全国汽车标委会电动车辆分技术委员会（**SAC/TC114/SC27**）

中国电力企业联合会
CHINA ELECTRICITY COUNCIL

CATARC

充换电设施标准

1.2 电动汽车充换电设施分类

充换电设施主要类型 Main Types

公交车 Bus

充电站 Charging station

换电站
Battery-swap station

出租车 Taxi

充电站

换电站

环卫车 Sanitation truck

充电站

换电站

1.2 电动汽车充换电设施分类

充换电设施主要类型 Main types


城际快充站 Intercity


私人专用充电桩 Private

城市公共充电网络

公共充电桩
Public charging Spot

充电塔
Charging tower

立体充电车库
Stereo garage

无线充电
Inductive Charging

1.3 电动汽车充换电设施标准体系

充换电设施标准体系8个部分

- 术语与基础 terminology
- 接口与互换性 interface
- 充电系统与设备 charging system and equipment
- 换电系统与设备 battery swap system and equipment
- 充换电站建设与运行 construction and operation
- 充电计量 Metering
- 充换电站服务网络 charging station and service network
- 相关电气设备及其他 auxiliary

基本建成了电动汽车充电设施的标准体系，包含58项标准（国标（GB）、能源行业标准（NB）），包括充电和换电标准。

1.4 电动汽车充放电设施标准体系框架

充放电设施标准体系框架

- 基础
  Base
- 充放电设备
  charging and discharging equipment
- 充放电设备接口
  interface
- 充放电站建设运行
  construction and operation
- 与电网互动
  interactive with the Grid

对电动汽车充放电设施标准体系框架进行了初步探讨，涉及到放电的标准内容分为5个部分，共约20个标准。

主要内容

1. 我国充电设施标准体系

2. 我国充电设施标准进展

3. 我国充电设施标准展望

2.1 电动汽车充换电设施标准发布情况

在过去的五年中，电动汽车充电设施已颁标准共29项，其中，国标12项，行业标准17项；在编计划26项，完成标准编制，形成报批稿共13项，公开征求意见标准共6项。

- GB/T 29317-2012 电动汽车充换电设施术语
- **GB/T18487系列 电动车辆传导充电系统**
- **GB/T 20234系列 电动汽车传导充电用连接装置**
- **GB/T 27930-2011 电动汽车非车载传导式充电机与电池管理系统之间的通信协议**
- **GB/T 28569-2012 电动汽车交流充电桩电能计量**
- **GB/T 29316-2012 电动汽车充换电设施电能质量技术要求**
- **GB/T 29318-2012 电动汽车非车载充电机电能计量**
- GB/T 29781-2013 电动汽车充电站通用要求
- GB/T 29772-2013 电动汽车电池更换站通用技术要求
- **NB/T 33008系列 电动汽车充电设备检验试验规范**

2.2 重点标准

（1）充电接口及通讯协议标准 interface and communication

GB/T 20234.1-2011	*Connection set of conductive charging for electric vehicles-Part 1:General requirements* *电动汽车传导充电连接装置 第一部分 通用要求*
GB/T 20234.2-2011	*Connection set of conductive charging for electric vehicles-Part2:AC charging coupler* *电动汽车传导充电连接装置 第二部分 交流充电接口*
GB/T 20234.3-2011	*Connection set of conductive charging for electric vehicles-Part3:DC charging coupler* *电动汽车传导充电连接装置 第三部分 直流充电接口*
GB/T 27930-2011	*Communication protocols between off-board conductive charger and battery management system for electric vehicle* *非车载充电机和电池管理系统间的通信协议*

- 目前正在开展GB/T 20234.1、GB/T 20234.2、GB/T 20234.3系列标准和GB/T 27930直流充电通讯协议标准的修订工作，现已进入送审稿编制阶段。
- ✓ Currently, GB/T 20234.1, GB/T 20234.2, GB/T 20234.3 series standards and GB/T 27930 DC charging communications protocol standards revision, has now entered the manuscript preparation stage.

- 为保证标准实施，解决充电接口兼容性，实现电动汽车与充电设施充电互操作，现正在开展制定《电动汽车充电系统互操作性测试规范》编制，将组织汽车厂家、充电设施企业以及检测机构开展充电接口互操作验证工作。
- ✓ In order to ensure the implementation of standards, solve the charging interface compatibility, realization of electric vehicle and charging infrastructure charging interoperability, now the ongoing development of the electric car charging system interoperability test norms, "the preparation of, will organize car manufacturers, charging facilities and testing agencies to carry out the charging interface interoperability verification.

（2）充电设施关键设备标准 charging equipment。

NB/T 33001-2010	*Specification for electric vehicle off-board conductive charger* *电动汽车非车载充电机技术规范*
NB/T 33002-2010	*Specification for electric vehicle A.C. charging point* *电动汽车交流充电桩技术规范*
NB/T 33008.1-2013	*Inspection and test specifications for electric vehicle charging equipment Part 1：off-board charger* *电动汽车充电设备检验与测试规范 第一部分 非车载充电机*
NB/T 33008.2-2013	*Inspection and test specifications for electric vehicle charging equipment Part2: AC charging spot* *电动汽车充电设备检验与测试规范 第二部分 交流充电桩*

- 根据近两年来的发展，正在开展交流充电桩、直流充电机设备标准的修订工作，编制《电动汽车传导式充电设备安全性测试规范》，以进一步加强安全性要求。

- According to nearly two years of development, is to carry out AC charging spot, DC charger equipment standards revision work, the preparation of the electric vehicle conductive charging equipment safety test specification to further strengthen safety requirements.

（3）充电站建设标准 charging station construction

GB/T 29781-2013	*General requirements for electric vehicle charging station* *电动汽车充电站通用要求*
GB 50966-2014	*Design specification for electric vehicle charging station* *电动汽车充电站设计规范*
NB/T 33004-2013	*Code for construction and completion acceptance of electric vehicle charging/battery swap infrastructure* *电动汽车充换电设施施工与竣工验收规范*

◆ 为推动分散式充电设施建设，启动了国家标准《电动汽车分散充电设施技术规范》的编制

✓ In order to promote the construction of decentralized charging facilities, 《Specification for decentralized charging facilities for electric vehicles》

◆ 启动《城市公共设施 电动汽车充电设施安全技术防范系统要求》

✓ 《Safety technology of the electric vehicle charging facilities for the urban public facilities》

（4）换电标准 battery swap

GB/T 29772-2013	*General requirements for electric vehicle battery swap station* *电动汽车电池更换站通用要求*
NB/T 33006-2013	*General requirements for electric vehicle battery-pack-swap device* *电动汽车电池更换设备通用要求*
	General requirements for the connection set of battery pack 电动汽车电池更换用电池箱电联接器通用技术要求
	General requirements for battery pack 电动汽车快速更换电池箱通用要求

（5）计量及其它运行维护标准 metering and operation

GB/T 29318-2012	*Electric energy metering for electric vehicle off-board charger* *电动汽车非车载充电机计量要求*
GB/T 28569-2012	*Electric energy metering for electric vehicle AC charging spot* *电动汽车交流充电桩计量要求*
	Communication protocols between EV terminal and operation and management system 电动汽车车载终端与运营管理系统间通信协议
	Operation and management specification of charging infrastructure 电动汽车充电设施运行管理规范
	Signs for charging infrastructure 充电设施标志与设置

2.3 国际合作

1. 中国专家参加国际标准化组织

已经选派中国专家参加了IEC/TC69(电动汽车)、IEC/TC23（电器附件）、ISO/TC22（电动汽车通讯协议）的有关工作组的工作。成为IEC电动汽车战略组(SG6)成员。

IEC/TC69(电动汽车)、 **IEC/TC23**（电器附件）、**ISO/TC22**（电动汽车通讯协议）、**IEC**电动汽车战略组**(SG6)**

— IEC/TC69 Electric road vehicles and industrial trucks

— IEC/TC23 Electrical accessories

— ISO/TC22 Road vehicles

— IEC/SG6 Electrotechnology for Mobility

2.开展中德电动汽车标准化工作组工作

Sino-German Standardization Working Plan for Electromobility

充电系统	电动汽车 与供电系统间的通信	车辆安全	与智能电网互动
Expert Group 1: Electric Vehicle Charging System	**Expert Group 2:** Communication EV and EVSE	**Expert Group 3:** Safety Aspects for Vehicles	**Expert Group 4:** Safety of Charging Station and Data Exchange with Smart Grid
Coordination: DKE / CATARC	**Coordination:** NAAuto (VDA) / CEC	**Coordination:** NAAuto (VDA) / CATARC	**Coordination:** DKE / CEC

3.国际标准提案工作取得突破

Chinese proposal in the international standard

- 直流充电标准 DC charging system

直流充电接口（IEC 62196-3 **Annex BB** ）

直流充电导引电路与控制时序（IEC 61851-23 **Annex BB** ）

直流充电通讯协议（IEC 61851-24 **Annex BB**）。

- 换电国际标准 battery swap system

✓IEC 62840-1《电动汽车电池更换系统 第一部分 系统描述和通用要求》CD

IEC 62840-1 battery swap system Part1: General requirements

✓IEC 62840-2《电动汽车电池更换系统 第二部分 安全要求》CD

IEC 62840-2 battery swap system Part2: Safety requirements

.3.展望 Next step of standardization

1.加快标准制定步伐，完善充电接口及协议标准
Proceed on the development of standard, especially improve the interface and communication standard

- 完善标准体系，补充充换电站充电安全、消防等环节的标准
  Improve the standard system, new proposal on safety aspects
- 开展无线充电技术、电动汽车传导充电系统一致性测试等方面标准研究
  Standard development on wireless charging and compliance test
- 完成《电动汽车传导充电用连接装置》充电接口系列标准和《电动汽车非车载传导式充电机与电池管理系统之间的通信协议》直流充电通讯协议标准修订工作。
  Maintenance on GB/T 20234 and GB/T 27930

2.与智慧城市、智能电网发展相协调
Harmony Development with Smart City and Smart Grid

电动汽车充电是智能电网智能用电的一部分，实现与电力用户的电力流、信息流、业务流的双向互动”。

In the plan of Smart Grid in China, 2011-2015 is the period of *Improve the standard system, support the comprehensive construction*. EV charging infrastructure construction should be in harmony with the Grid, and serve for the EV.

3.国际标准化工作的需求
Activation in international standardization

电动汽车及充电设施国际标准化活动十分活跃，国际电工委员会（IEC）、国际标准化组织(ISO)的相关技术委员会启动了一系列国际标准制修订工作。能源行业电动汽车充电设施标委会加强参与国际标准活动，紧紧跟上国际标准化工作的步伐。

It is very active in international standardization activities, especially in the field of EVs and infrastructures, NEA/TC3 will pay attention on the latest standard development and follow the step of international standardization.

谢 谢！

Rich Byczek is the global technical lead for electric vehicle and energy storage at Intertek.

He has 20 years of experience in product development and validation testing, 11of which have been spent at Intertek. Rich is also an expert in the areas of energy storage, audio equipment and EMC. Rich sits on several SAE, IEC, UL and ANSI standards panels.

He holds a Bachelor of Science in Electrical Engineering from Lawrence Technological University in Southfield, Michigan, and is based at the Intertek facility located in Plymouth, Michigan.

Rich Byczek – Global Technical Lead, Electric Vehicle & Energy Storage

Rich Byczek 任职于于天祥集团担任电动汽车和能量储备的全球技术总监。

他获得位于密歇根州南田的美国劳伦斯理工大学电机工程科学学士学位，目前就职于位于密歇根州普利茅斯的天祥公司。他有着 20 年的产品开发和验证试验的工作经验，其中有 11 年就任于天祥集团。他还是能量储备、音频设备及 EMC 领域的专家，参加了若干 SAC,IEC,UL 及 ANSI 标准小组工作。

#

相互可操作性

SAE 标准 J1772/ J2953/ J2954

Rich Byczek，2015 年 6 月 9 日

广泛的全球网络

我们能为您做什么

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- 检查
- 认证
- 审计
- 外包
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- 培训
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- 支持服务部门的 FTSE 100 公司
- 市场资本化：2014 年 71 亿美元（48 亿英镑）
- 产生收入：2014 年 32 亿美元（21 亿英镑）

我们的创始人

托马斯-爱迪生于 1896 年的 ETL 测试实验室。今天，差不多过了 120 年，Intertek 成为测试、检验和认证需求方面的值得信赖的行业合作伙伴。

电动汽车......并不是普通的新能源汽车

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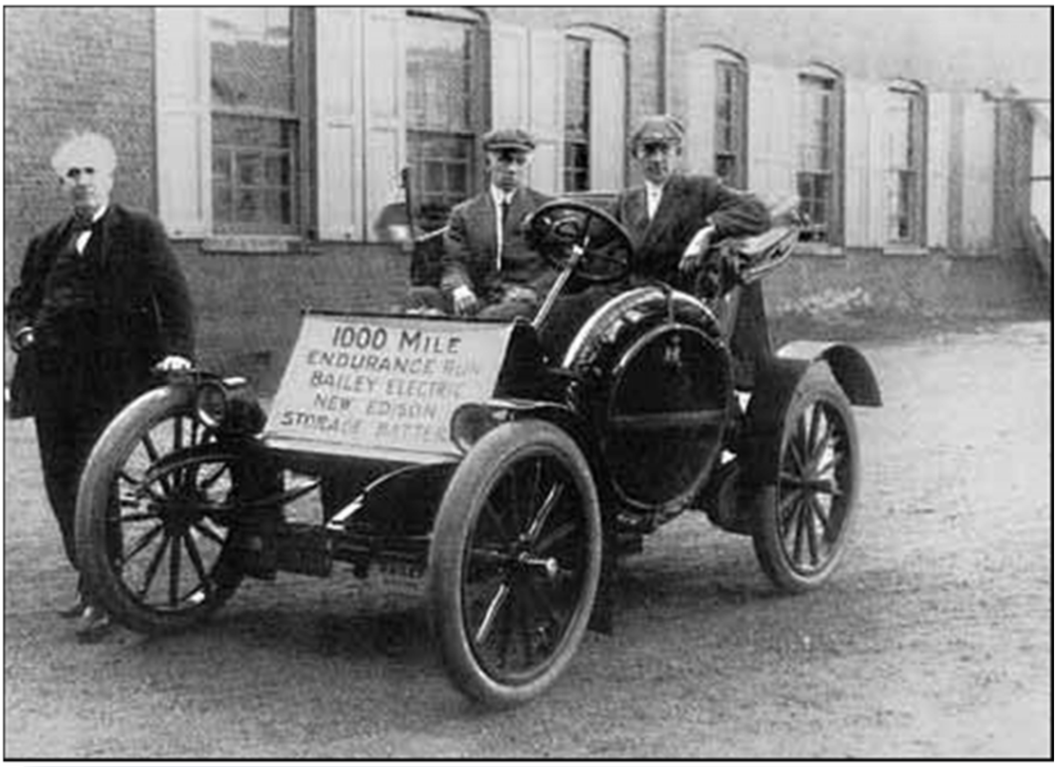
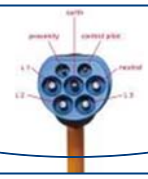


充电连接器

		中国	美国	欧洲	日本
交流	1 相				
	3 相				
					
直流					

充电协议 SAE J1772

交流：“点滴式充电器”

120V/单相，12/16 安培，NEMA 5-15R 或 5/20R

交流 2 级充电：壁挂式或市政充电器

208-240V/单相，达 80 安培，直接线或电源线/插头

直流快速充电：SAE COMBO

新版SAE J 1772 于 2012 年 10 月发布

通过导频信号使用 PLC（电力线通信）

电池指挥通信来控制充电电流

直流 1 级：

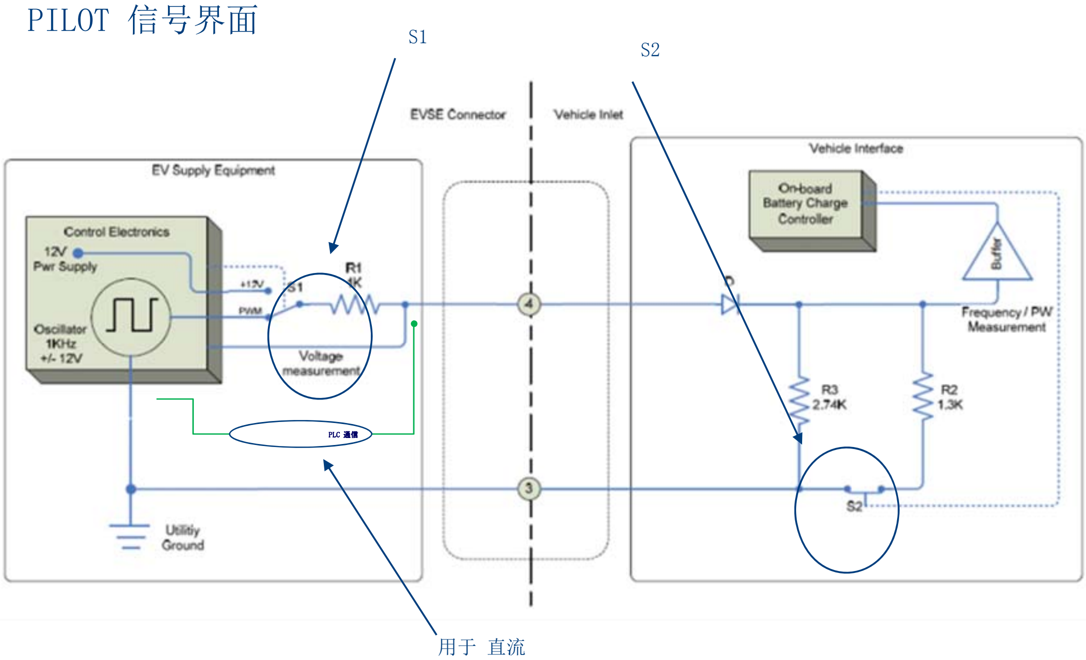
达 80 安培，采用标准的 SAE J1772 连接器

直流 2 级：

大于 80 安培，采用“组合连接器”

充电协议 SAE J1772

PILOT 信号界面



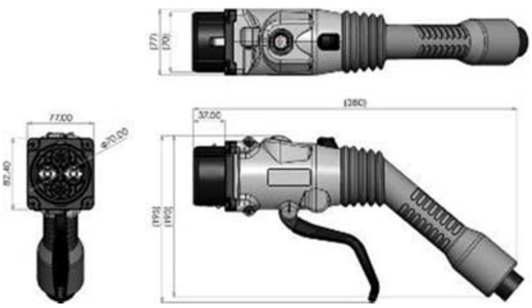
直流快速充电：CHADEMO

目前在 日本/韩国 OEM领域中，使用 CAN 界面

电池指挥通信来控制充电电流

不直接与 SAE J1772 DC L1 和 L2兼容

- 最大功率：50kW
- 最大电压：500VDC
- 最大充电电流：125ADC



其将对每台 EV 都有效？？？

启动序列要求(SAE J1772)

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4.1.1 启动时间

在将 EVSE 插入 PEV 中后，EVSE 和 PEV 开始启动序列建立充电会话。EVSE 向 PEV 发出指令，不开启振荡器不供应能源和维护状态 B1。在超负荷管理、费用交易或其他事件期间，状态 B1 可被 EVSE 用来维持当前的充电会话。EVSE 向 PEV 指示其已通过打开振荡器提供能量，并提供方波信号；进入状态 B2。

PEV 解释了因EVSE 发出方波脉冲占空比的信号而产生的电流限制。然后 PEV 指示其已准备通过关闭开关 S2 接受EVSE 的能量。一旦 PEV 关闭了开关 S2 来接受能源，则 EVSE 必须关闭交流接触器，并在 3.0 秒以内向 PEV 提供能量。

启动序列的要求			
#	规格	验收标准	操作
4.1.1.1	从状态 B1 转换到 B2 状态	无	从插入到 EVSE PWM 振荡器打开的定时
4.1.1.2	状态 B2 到状态 C 或 D 的定时	无	从 PWM 打开到 PEV S2 关闭的定时
4.1.1.3	状态 C 或 D 到电源电压的产生	≤ 3.0 秒	从 PEV S2 关闭到 EVSE 交流接触器关闭的定时

SAE 国际 J2953 标准

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J2953 具有三个层次的互操作性测试：

第一级
- 机械互操作性
- 充电功能
- 安全功能

第二级
- 无限网格事件
- 动态网格事件

第 3 级（不是所有的 EVSE 都可以）
- 载流量控制
- 定时充电
- 交错进行定时充电
- 充电中断/恢复

标准电压要求(SAE J1772)

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4.1.2 标准电压

标准线路电压是指充电系统的状态。这些状态可用于：来实现PEV 和 EVSE 的系统连接，PEV 可用于传递充电准备就绪的信息，EVSE 能传递充可用的电能。

标准电压要求			
#	规格	验收标准	注释
4.1.2.1	状态A电压	11.40V ≤ V ≤ 12.60V	静态电压
4.1.2.2	状态 B 电压	8.36V ≤ V ≤ 9.56V	已完全转换之后有可能是静态电压或是 PWM 信号的正级部分
4.1.2.3	状态 C 电压	5.48V ≤ V ≤ 6.49V	充分完成转换之后 PWM 的正级部分
4.1.2.4	状态 D 电压	2.62V ≤ V ≤ 3.25V	充分完成转换之后 PWM 的正级部分
4.1.2.5	状态 E 电压	---	由于电力不足或断电的无源故障模式； 标称 0.0 伏
4.1.2.6	状态 F 电压	-11.40V ≤ V ≤ -12.60V	有源故障模式
4.1.2.7	状态 A-D、F 低端电压	-11.40V ≤ V ≤ -12.60V	振荡中试运行时所有状态下 PWM 信号的负极部分

控制试验波形的要求

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4.1.3控制试验波形及解释

SAE J1772 使状态电压的范围具体化了，PWM 发生器的上升/下降时间和稳定时间的要求以及控制电路电容的要求。由此产生的电路在最坏的情况下进行测试；进行了上升/下降时间和稳定时间的测量，并被视为控制试验波形要求的验收条件。

控制试验波形要求			
#	规格	验收标准	注释
4.1.3.1	PWM 占空比	8% < 占空比 ≤ 97%	告知最大连续电流容量
4.1.3.2	PWM 频率	980 Hz ≤ 频率≤ 1020 Hz	振荡时进行连续的监测
4.1.3.3	状态 B 上升时间	≤ 9.624μs	10% 至 90% 转换
4.1.3.4	状态 B 下降时间	≤ 12.479 μs	90% 至 10% 转换
4.1.3.5	状态 C 上升时间	≤ 6.937 μs	10% 至 90% 转换
4.1.3.6	状态 C 下降时间	≤ 12.508 μs	90% 至 10% 转换
4.1.3.7	状态 D 上升时间	≤ 4.689 μs	10% 至 90% 转换
4.1.3.8	状态 D 下降时间	≤ 12.655 μs	90% 至 10% 转换
4.1.3.9	状态 B 调节时间	≤ 17.660 μs	0% 至 95% 转换
4.1.3.10	状态 C 调节时间	≤ 13.191 μs	0% 至 95% 转换
4.1.3.11	状态 D 调节时间	≤ 8.625 μs	0% 至 95% 转换
4.1.3.12	PEV 交流电流消耗	≤ EVSE 告知的最大电流容量	参见 SAE J1772 表 4.6 中可用的电流方程 例外情况：充电会话期间 PWM 占空比的变化允许在 5 秒钟之内进行适当的电流消耗的变化。

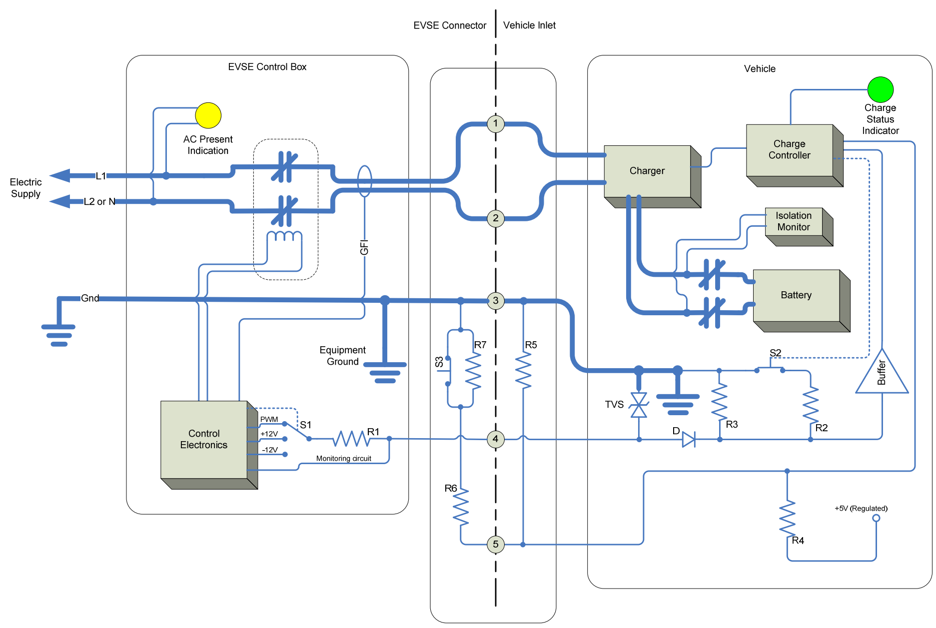
关机序列要求

4.1.4 关机转换

在充电周期内，通过打开 S2 开关，PEV 能够从状态 C 或 D（准备接受充电）转换到状态 B（不准备接受充电）。这种转换可能因众多原因发生，包括 PEV 被充足了电。按照 J1772 的要求，从 S2 的开关到 EVSE 打开交流触点的定时应为 3 秒以下。

关机序列的要求			
#	规格	验收标准	注释
4.1.4.1	状态 C 或 D转换到状态 B2	≤ 3 秒	从交流接触器打开以响应 S2 打开的定时

交流 2 级系统配置



4.3.2 断接装置

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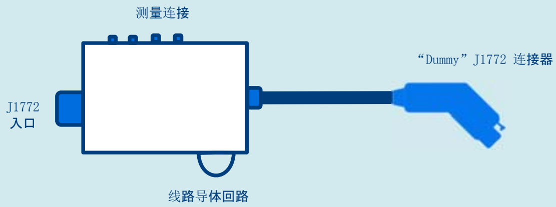
断接装置是一种用于所有级别测试的工具。其必须进行自定义，以适应将在测试过程中操作员所用的测量设备。该工具的目的是在通过 EVSE 和 PEV 之间的所有线路和信号导体的同时，又能够断接导体节点，以通过数据采集和数据记录系统进行测量。该装置不得断开测量设备的任何线路或信号电路；即测量必须平行进行而不是串联进行。



所需的功能包括 UL 中列出的 SAE J1772 入口和连接器。入口、连接器及所有的导体均须规定电压和电流限制，以防止超出所有 EVSE 和 PEV 待测试项的功能。SAE J1772 连接器需要进行修改，使之不断接近电路，而不是通过断接装置通到临近导体上，并最终通到 EVSE 连接器实现端接。

4.3.2 断接装置

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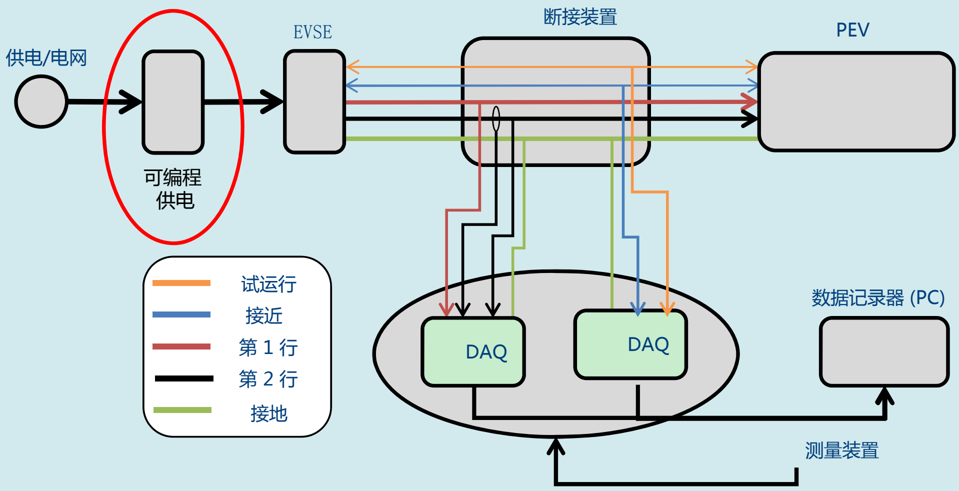
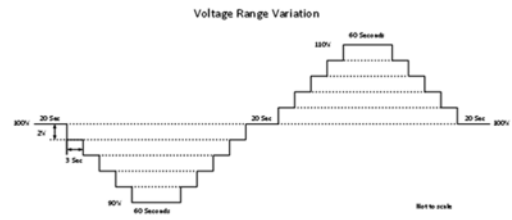
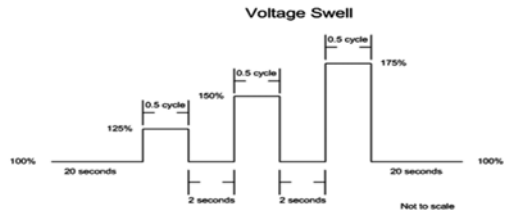
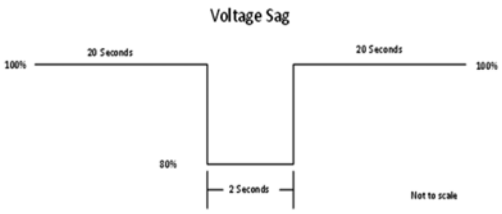


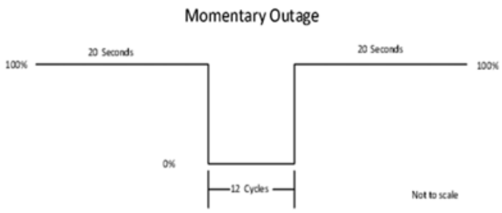
可编程的供电将用于看似合理的静态和动态功率的修改，以测试充电系统的稳健性。

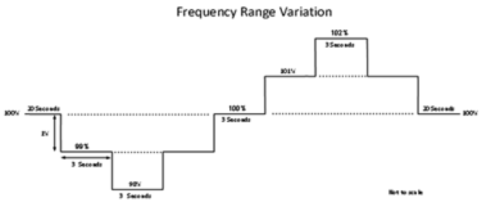
第 2 级测试

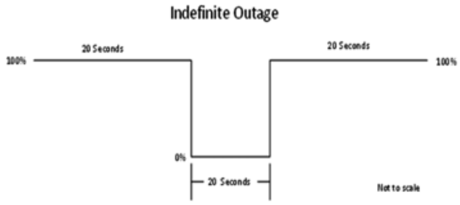












INTERTEK 位于普利茅斯的 J2953 检测中心

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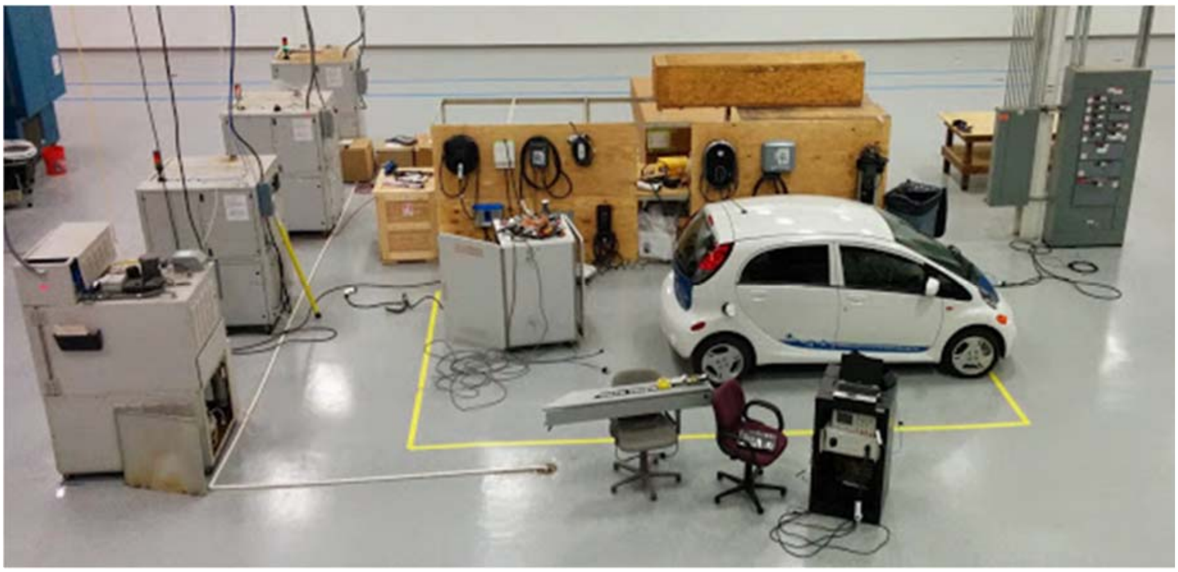

EVSE WALL

SAE J2953 直流充电互操作性

- SAE J2953 程序 2 级直流部分目前正在研发中。
- 一旦程序更新为 2 级直流测试，则进行计划采用 CHAdeMO 和 SAE 组合连接器继续进行类似的循环测试法。
- 计划采用 CHAdeMO 与 SAE 组合连接器进行 J2953 2 级直流互操作性测试。

SAE J2954 充电互操作性

- 无线充电的 SAE J2954 标准正在制订中。
- 一旦车辆配备无线充电和兼容装置，则将进行互操作性测试。

有问题？

谢谢！

Rich Byczek
全球的技术领先者 Intertek Transportation Technologies
rich.byczek@intertek.com
+ 1 248 219 1099

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INTEROPERABILITY

SAE Standards J1772/ J2953/ J2954

June 9, 2015 Rich Byczek

An Extensive Global Network

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What We Do for You

- Testing
- Inspection
- Certification
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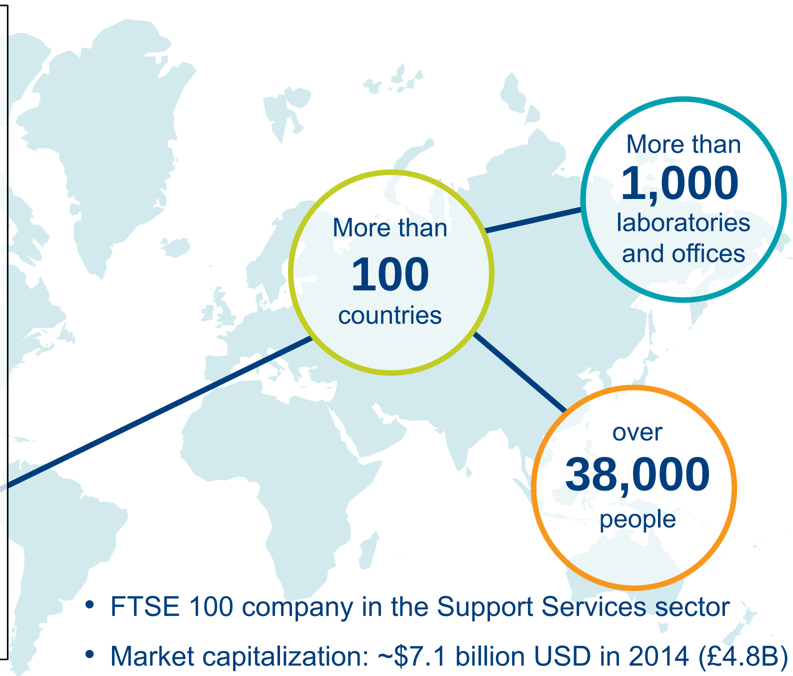
- Training
- Quality Assurance



- FTSE 100 company in the Support Services sector
- Market capitalization: ~$7.1 billion USD in 2014 (£4.8B)
- Revenue generation: ~$3.2 billion USD in 2014 (£2.1B)

Our Founding Father

Thomas Edison founded ETL Testing Laboratories in 1896. Today, almost 120 years later, Intertek is a trusted Industry Partner for testing, inspection and certification needs.

EV's… Not so NEW Energy Vehicles

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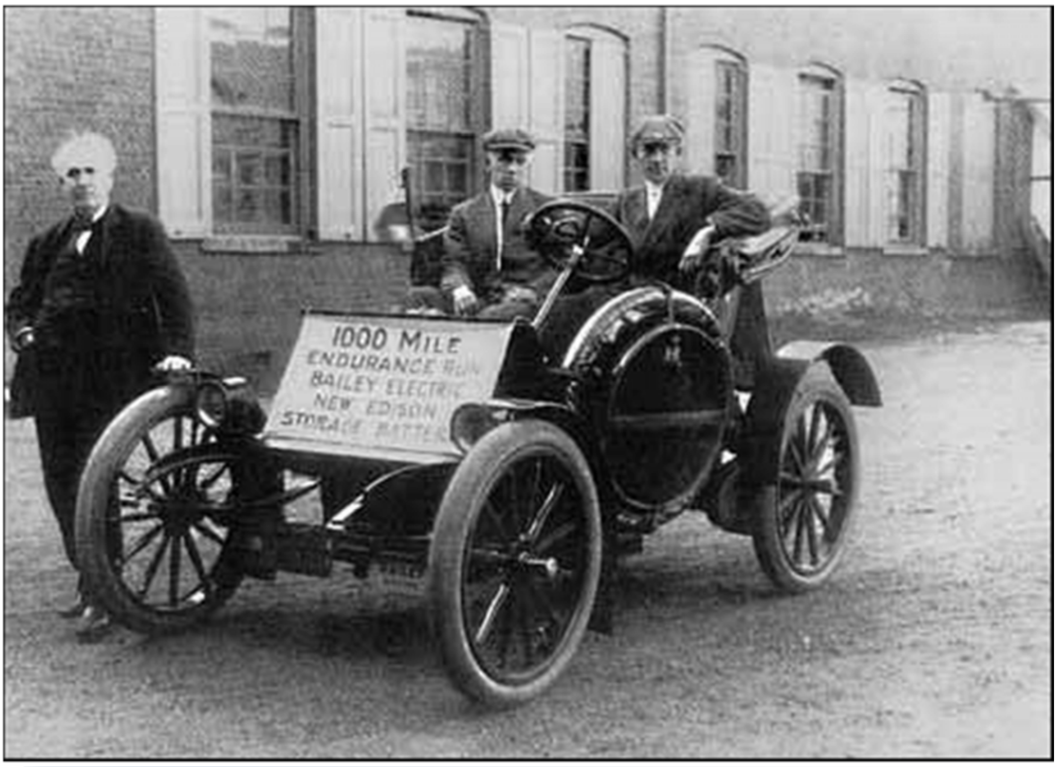

Charging Connectors

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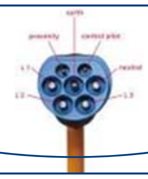
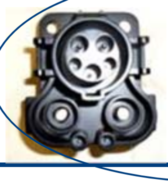
		China	US	EU	JAPAN
AC	1Phase				
	3phase				
					
DC					

Charging Protocols SAE J1772

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AC Level 1 Charging: “Trickle Charger”

120V/1phase, 12/16 amp, NEMA 5-15R or 5/20R

AC Level 2 Charging: Wall-mount or Municipal chargers

208-240V/1phase, up to 80 amp, direct wire or cord/plug

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

DC Level 1:

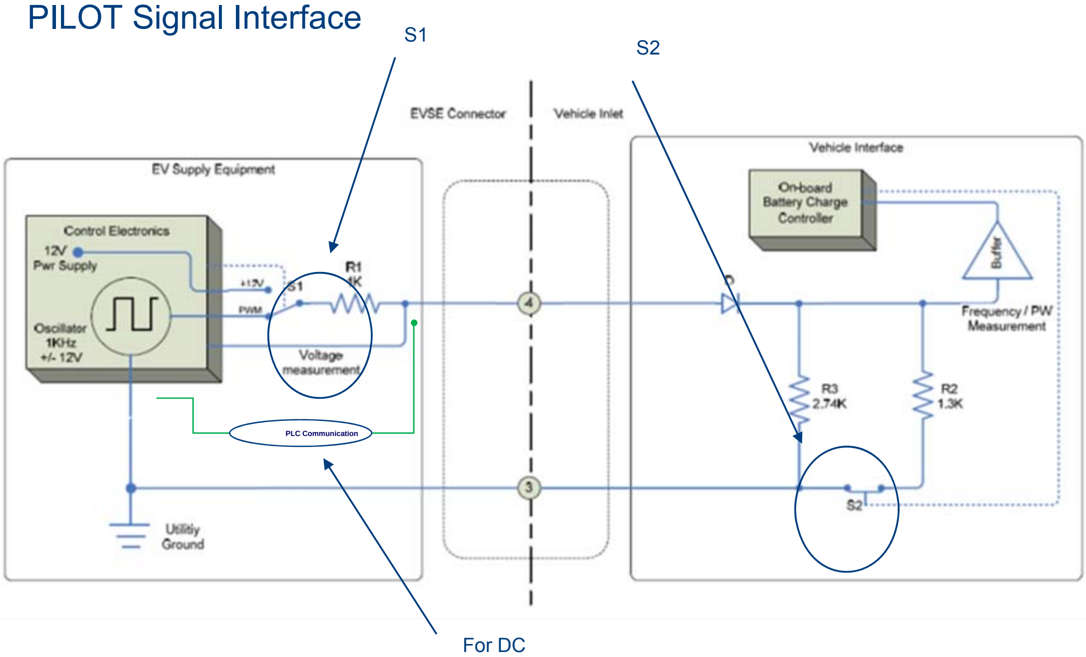
up to 80 amps, using standard SAE J1772 connector

DC Level 2:

greater than 80 amps, using “combo Connector”

Charging Protocols SAE J1772

PILOT Signal Interface



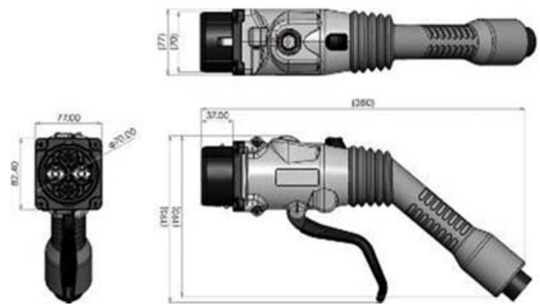
DC Quick Charging: CHADEMO

Currently in field Japan/Korean OEM, Uses CAN interface

Battery direct communication to Control Charge Current

Not directly compatible with SAE J1772 DC L1 and L2

- Max power: 50kW
- Max Voltage: 500VDC
- Maximum Charge Current: 125ADC



Will they work with every EV ????

SAE INTERNATIONAL J2953 STANDARD

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J2953 has three levels of interoperability testing:

Tier 1
- Mechanical Interoperability
- Charge Functionality
- Safety Feature Functionality

Tier 2
- Indefinite Grid Events
- Dynamic Grid Events

Tier 3 (Not all EVSE are capable)
- Ampacity Control
- Scheduled Charge
- Staggered Scheduled Charge
- Charge Interrupt/Resume

START-UP SEQUENCE REQUIREMENTS (SAE J1772)

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4.1.1 Start-up Timing

When the EVSE is plugged into a PEV, the EVSE and PEV begin a startup sequence to establish a charge session. The EVSE indicates to the PEV that it is not ready to supply energy by not turning on the oscillator and maintaining State B1. State B1 may be used by the EVSE to maintain the current charge session during load management, fee transaction, or other events. The EVSE indicates to the PEV that it is ready to supply energy by turning on the oscillator and providing the square wave signal; entering State B2.

The PEV interprets the current limit based upon the square wave duty cycle signaled by the EVSE. The PEV then indicates that it is ready to accept energy from the EVSE by closing switch S2. Once the PEV closes switch S2 to accept energy the EVSE must close the AC contactors and supply energy to the PEV within a maximum of 3.0 seconds.

Start-up Sequence Requirements			
#	Specification	Acceptance Criteria	Action
4.1.1.1	State B1 to State B2 transition	None	Timing from plug-in to EVSE PWM oscillator on
4.1.1.2	State B2 to State C or D timing	None	Timing from PWM on to PEV S2 closed
4.1.1.3	State C or D to mains voltage present	≤ 3.0 seconds	Timing from PEV S2 closed to EVSE AC contactors close

PILOT VOLTAGE REQUIREMENTS (SAE J1772)

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4.1.2 Pilot Voltage

Pilot Line Voltage defines charge system states. Those states are used for: both the PEV and EVSE to realize system connection, PEV to communicate charge readiness, and for the EVSE to communicate availability of charge energy.

Pilot Voltage Requirements			
#	Specification	Acceptance Criteria	Comment
4.1.2.1	State A Voltage	11.40V ≤ V ≤ 12.60V	Static Voltage
4.1.2.2	State B Voltage	8.36V ≤ V ≤ 9.56V	May be static voltage or positive portion of PWM signal after transition has fully settled
4.1.2.3	State C Voltage	5.48V ≤ V ≤ 6.49V	Positive portion of PWM after transition has fully settled
4.1.2.4	State D Voltage	2.62V ≤ V ≤ 3.25V	Positive portion of PWM after transition has fully settled
4.1.2.5	State E Voltage	---	Passive fault mode due to short or loss of power; 0.0 Volts nominal
4.1.2.6	State F Voltage	-11.40V ≤ V ≤ -12.60V	Active fault mode
4.1.2.7	State A-D, F Low-Side Voltage	-11.40V ≤ V ≤ -12.60V	Negative portion of PWM signal in all states when pilot in oscillation

CONTROL PILOT WAVEFORM REQUIREMENTS

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4.1.3 Control Pilot Waveform and Interpretation

SAE J1772 specifies state voltage ranges, PWM generator rise /fall time and settling time requirements, and pilot circuit capacitance requirements. The resulting circuits are simulated in worst case scenario; rise/fall times and settling time measurements are made and are considered the acceptance criteria for control pilot waveform requirements.

Control Pilot Waveform Requirements			
#	Specification	Acceptance Criteria	Comment
4.1.3.1	PWM Duty Cycle	8% < Duty Cycle ≤ 97%	Communicates maximum continuous current capacity
4.1.3.2	PWM Frequency	980 Hz ≤ Freq. ≤ 1020 Hz	Continuously monitored when oscillating
4.1.3.3	State B Rise Time	≤ 9.624μs	10% to 90% transition
4.1.3.4	State B Fall Time	≤ 12.479 μs	90% to 10% transition
4.1.3.5	State C Rise Time	≤ 6.937 μs	10% to 90% transition
4.1.3.6	State C Fall Time	≤ 12.508 μs	90% to 10% transition
4.1.3.7	State D Rise Time	≤ 4.689 μs	10% to 90% transition
4.1.3.8	State D Fall Time	≤ 12.655 μs	90% to 10% transition
4.1.3.9	State B Settling Time	≤ 17.660 μs	0% to 95% transition
4.1.3.10	State C Settling Time	≤ 13.191 μs	0% to 95% transition
4.1.3.11	State D Settling Time	≤ 8.625 μs	0% to 95% transition
4.1.3.12	PEV AC Current Draw	≤ maximum current capacity communicated by EVSE	See SAE J1772 Table 4.6 for available current equations Exception: Change in PWM duty cycle during charge session allows for appropriate current draw change within 5 seconds.

SHUTDOWN SEQUENCE REQUIREMENTS

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4.1.4 Shutdown Transition

During the charge cycle the PEV has the ability to transition from State C or D (ready to accept charge) to State B (not ready to accept charge) by opening the S2 switch. This transition can occur for a number of reasons including the PEV being completely charged. Per J1772 it is required that the timing from switch of S2 to the EVSE opening the AC contacts shall be 3 seconds or less.

Shutdown Sequence Requirements			
#	Specification	Acceptance Criteria	Comment
4.1.4.1	State C or D to State B2 transition	≤ 3 seconds	Timing from AC contactors open in response to S2 open

AC LEVEL 2 SYSTEM CONFIGURATION

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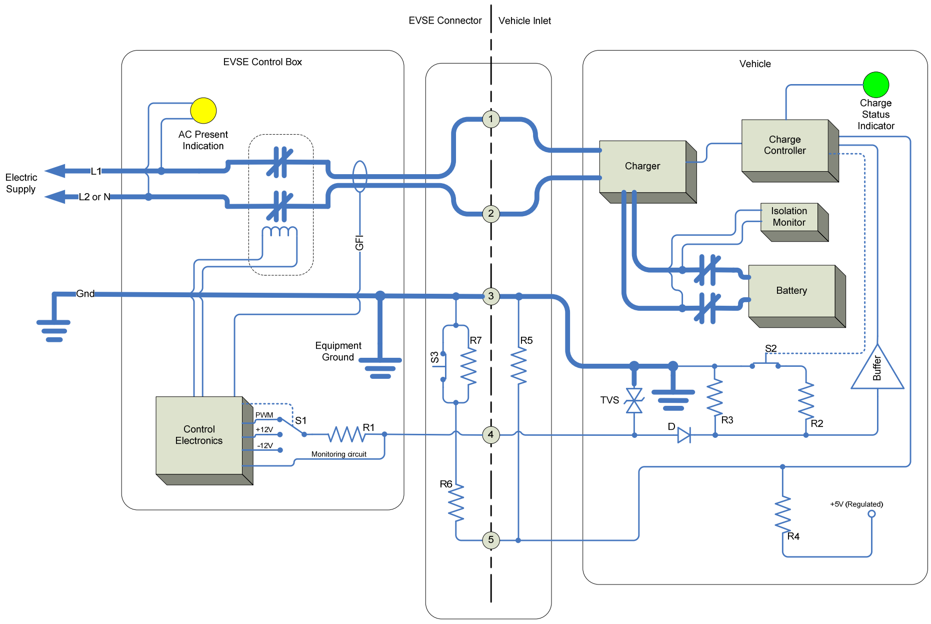
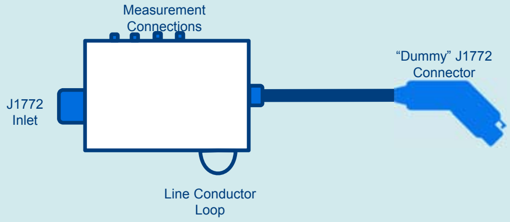


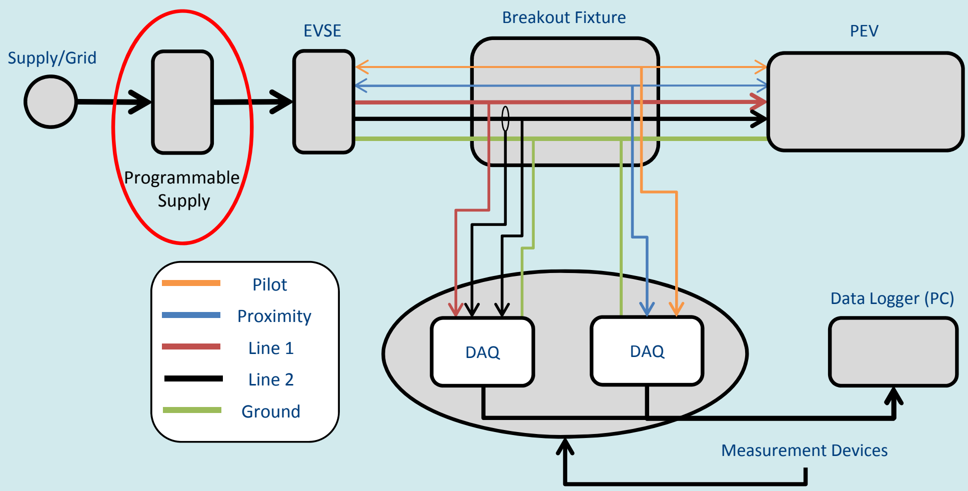
4.3.2 BREAKOUT FIXTURE

The breakout fixture is a tool used for all tiers of testing. It must be made custom to accommodate measurement devices that will be used by the operator during testing. The tool is designed to pass through all line and signaling conductors between the EVSE and PEV while being able to breakout the conductor nodes for measuring by the data acquisition and data logging system. It is required that the fixture does not break any of the line or signaling circuits to the measurement equipment; i.e. the measurements must be in parallel, not series.



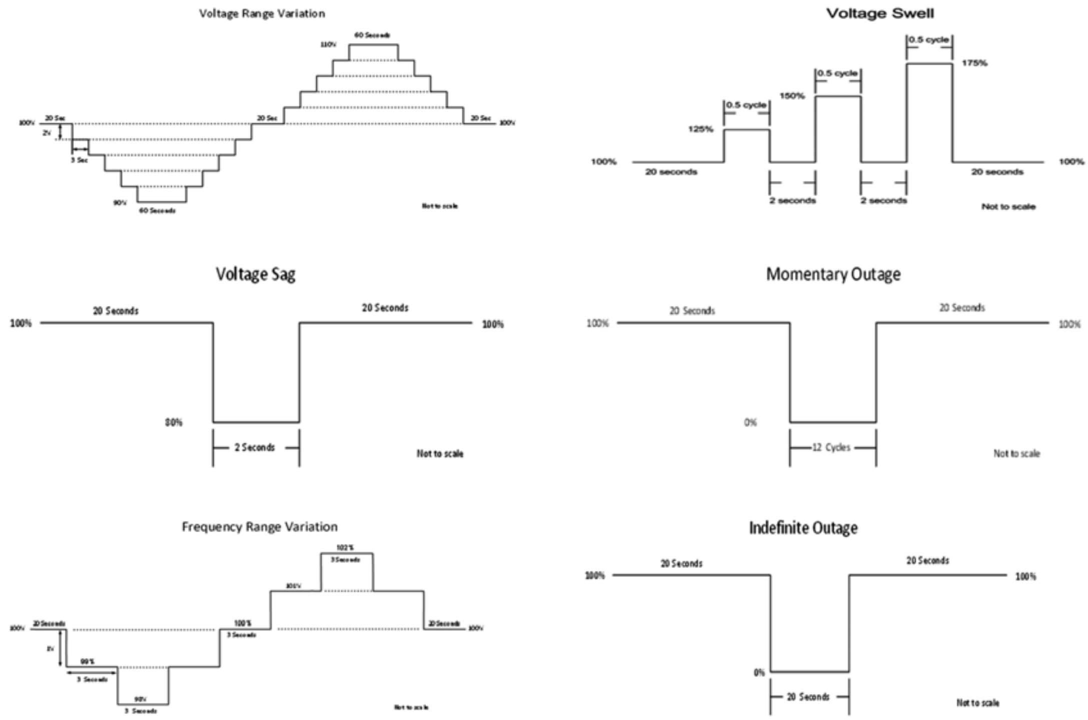
Required features include UL listed SAE J1772 inlet and connector. Inlet, connector and all conductors must be rated for voltage and current limits exceeding the capabilities of all EVSE and PEV articles to be tested. The SAE J1772 connector requires modification such that it does not terminate the proximity circuit, rather it is to pass the proximity conductor through the breakout fixture and ultimately to the EVSE connector for termination.

4.3.2 BREAKOUT FIXTURE



The programmable supply will be used for plausible real-world static and dynamic power modifications to test robustness of the charging system.

TIER 2 TESTING



INTERTEK PLYMOUTH J2953 TEST CENTER

EVSE WALL

SAE J2953 DC CHARGING INTEROPERABILITY

- The SAE J2953 procedure Level 2 DC section is currently under development.
- Planning to continue a similar method of round-robin testing with both CHAdeMO and The SAE Combo Connector once the procedure is updated for Level 2 DC testing.
- Planning for J2953 Level 2 DC Interoperability testing with both CHAdeMO and SAE Combo Connector.

SAE J2954 CHARGING INTEROPERABILITY

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- The SAE J2954 standard is under development for wireless charging.
- Once wireless charging units and compatible production vehicles are available, planning for Interoperability testing will take place.

QUESTIONS?

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THANK YOU

Rich Byczek
Global Technical Lead,
Intertek Transportation Technologies
rich.byczek@intertek.com
+1 248 219 1099

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Welcome to BYD

电动车高压安全设计

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BYD

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经理

部门：比亚迪汽车工业有限公司汽车工程研究院EV电器部

工作：比亚迪新能源车高压系统负责人

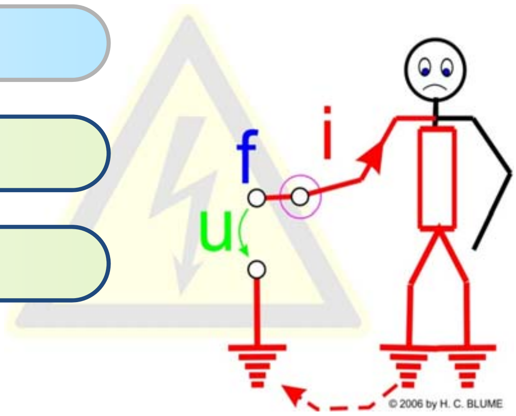
一、高压布置安全

二、高压结构安全

三、高压电路安全

四、高压性能安全

五、高压功能安全



一、高压布置安全

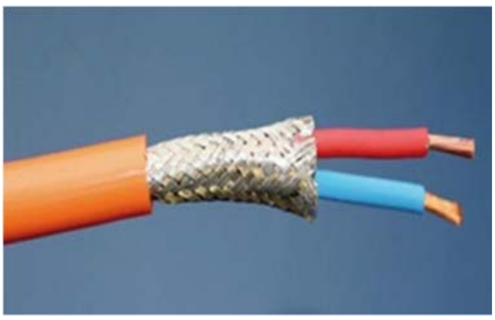
1、高压线束布置

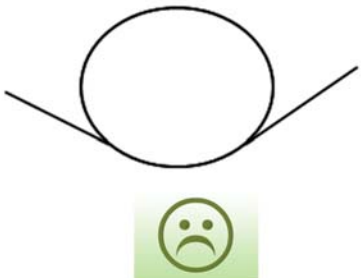
▸高压器件外部的高压线束含有屏蔽层，高压接插件在对接状态下须达到360°屏蔽。

▸高压器件外部的高压线束外部包裹波纹管或防磨布以保护高压线束。

▸高压线走线顺畅并固定，与低压线束的空间距离不小于100mm。

▸高压线束正负极线应紧贴在一起走线，并且高压线束走线时不能形成圆环。





一、高压布置安全

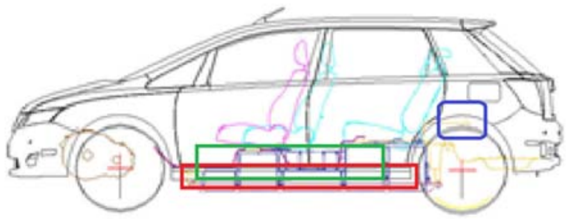
2、动力电池布置

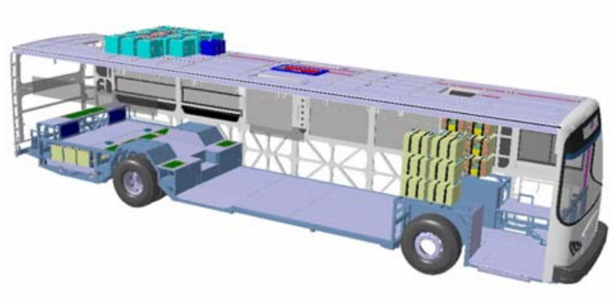
▸动力电池的布置应充分考虑车辆碰撞情况下的防护问题，避免轻微碰撞下的电池损伤。

▸动力电池应周边宜采用防火等级高的材料。

▸动力电池应尽可能集中布置，减少PACK内单体的温差。

▸动力电池应避免布置在高温区域。





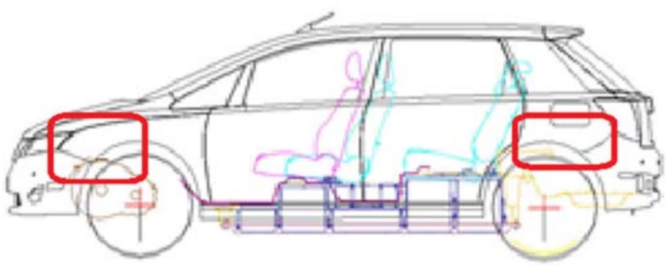
一、高压布置安全

3、动力控制模块布置

▸动力控制模块应尽量集中布置，并且动力控制模块舱应做好防火措施。

▸动力控制模块的布置应考虑在轻微碰撞时不被损坏。

▸动力控制模块的布置应充分考虑如何减少高压线束长度。



二、高压结构安全

BYD

1、高压安全标识

▸高压零部件外面的高压电缆以橙色做为标记。

▸高压零部件和可拆除的盖子均贴有高压标识，且高压标识清晰可见。

▸整车高压器件标识如下，实际生产中，可适当根据产品以及客户要求进行等比例缩放。

▸动力电池标识清晰可见的注明电池的化学类型以便识别。

二、高压结构安全

BYD

2、防直触保护

▸应防止人员与高压电路的带电部分直接接触。

应通过以下两种方式或其中一种来实现防护：

——带电部分的基本绝缘；

——遮挡/外壳，防止接近带电部分。

遮挡和外壳可以是导体也可以是绝缘体。

▸高压零部件的遮挡/外壳只有通过专业的工具才能移除。

通电导体的基本保护，绝缘、覆盖、缠绕

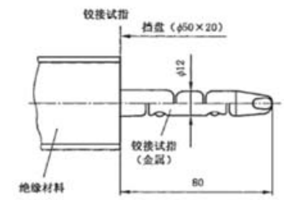
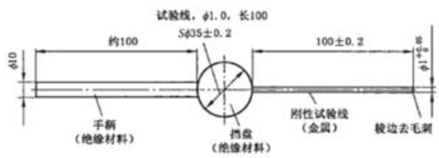
二、高压结构安全

BYD

2、防直触保护

▸对于不用断开高压连接线就可以打开外壳的高压器件，应增加开盖检测，开盖断高压电。

▸高压产品防护等级应达到IP67D，高压接插件应达到IPXXB（防触指）。

附加字母	试具	试验用力/N
B		10±1
D		1±0.1

二、高压结构安全

BYD

3、电气间隙

外露极柱的最小电气间隙为2.5mm

4、爬电距离

▸两个外露极柱间的爬电距离：d≥0.25U+5，单位：mm

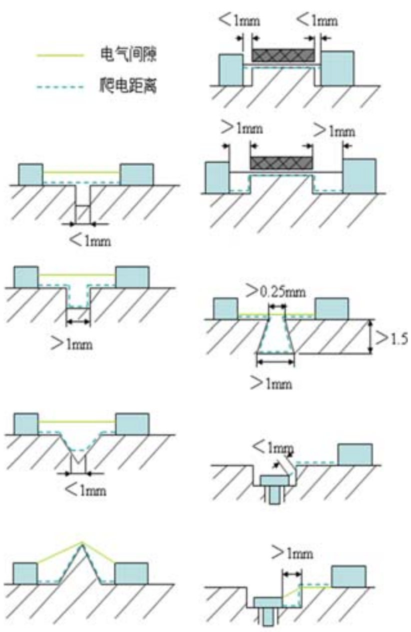
式中：d—被测外露极柱间的爬电距离，mm；

U—最大工作电压，V。

▸带电部件与电底盘之间的爬电距离：d≥0.125U+5，单位：mm

式中：d—被测外露极柱间的爬电距离，mm；

U—最大工作电压，V。

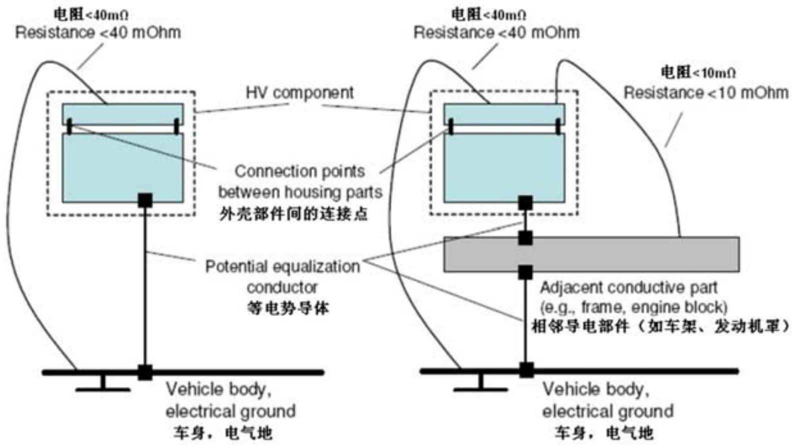


二、高压结构安全

5、等电势

▸高压器件及车身间的等电势电阻应小于40mΩ；

▸对于人员可同时触及的或车内距离可到2米的两个高压器件间的等电势电阻应小于100mΩ。



三、高压电路安全

1、短路过流保护

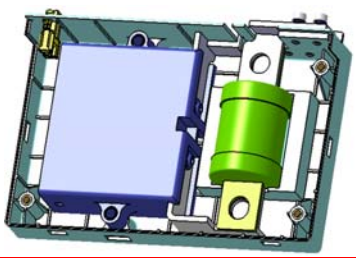
▸高压保险与高压线束要合理匹配，要求在发生短路时熔断保险以保护高压线束不发生熔断起火。

▸当过电流被切断时，非短路的高压零部件和高压线不应该受到损坏。

▸高压零部件应采用耐火、耐高温材料，应具有防爆功能。即高压零部件发生内部短路时，不能威胁到此零件以外的产品或人。

▸高压零部件本身需具有一定的过电流能力，短时过流时应具有自保护能力。

▸高压回路应合理设置接触器，以保证车辆维修时的人员安全。



三、高压电路安全

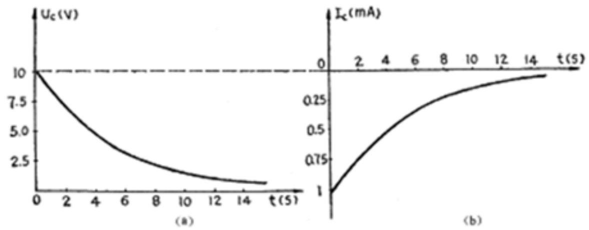
2、危险电能泄放

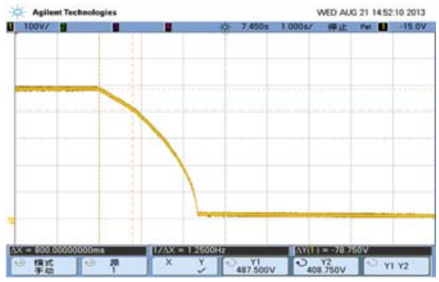
能容大于0.2J的电容，有可能会对人体造成伤害。对于还有这样电容的高压器件或高压系统，应增加电能泄放措施。

危险电能泄放要求车辆在断电或发生危险后，满足下列条件之一：

——电路电压应降低到 30V A.C.或60V D.C.；

——电路存储的总能量小于 0.2J。





三、高压电路安全

3、高压互锁

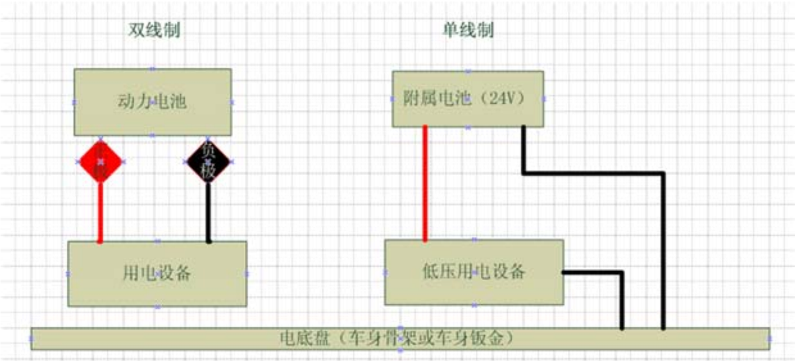
▸危险电压互锁回路，在连接导体和连接器且存在危险电压的回路中使用（无危险的）小信号对电连续性进行检查。一旦出现高压回路断开，自动断开装置就会启动，以清除潜在暴露点处的危险电压。

▸互锁失效事件发生后，应触发危险电能泄放。

三、高压电路安全

4、双线制保护

高压电路应采用双线制电路。这样可以有效的减少了高压电路短路和高压触电的风险。



四、高压性能安全

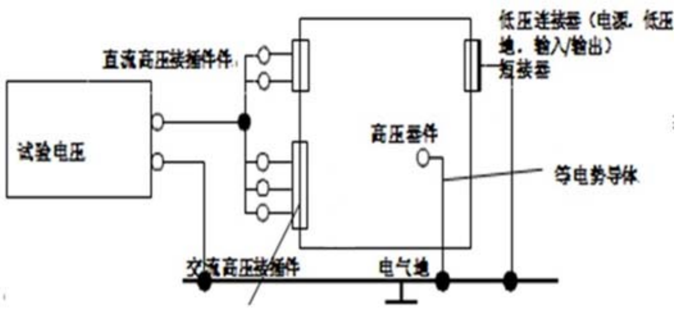
1、绝缘监测

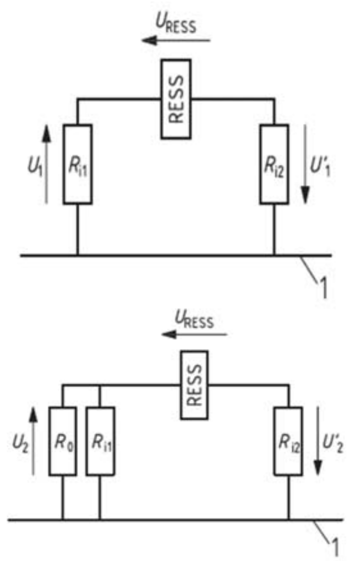
▸对于高压零部件，绝缘电阻的值应不低于10MΩ。

▸整车绝缘电阻值应大于100Ω/V 。

▸测量： 电池包绝缘电阻测试如下。

▸车辆配有绝缘电阻监控系统，在车辆运行时，整个高压系统的绝缘电阻被实时监测。





$$R_i = R_0\left(\frac{U'_2}{U_2} - \frac{U'_1}{U_1}\right)$$

2、耐压

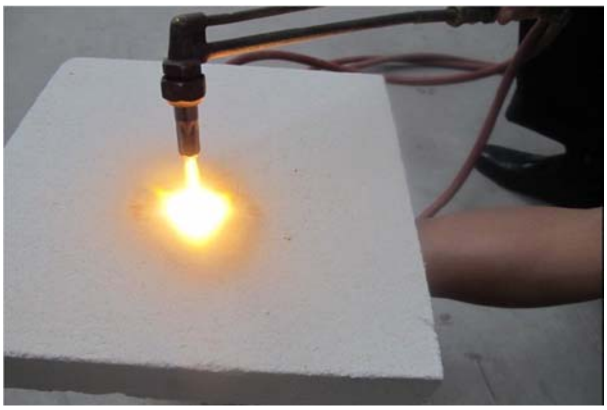
每一个高压零部件应该有足够的耐压等级，包括高压电路于低压网络之间，和高压电路与车身地之间。

高压零部件耐压分为两个设备等级要求：

零部件种类	试验电压
基本绝缘	2U+1000(交流电压 有效值)
双重绝缘和加强绝缘	2U+3250(交流电压 有效值)
注：1.此处，U 为最大工作电压。 2.也可选择交流电压有效值的1.414倍的直流电压做为试验电压。	

3、防火

应充分考虑电池或高压零部件绝缘击穿后的防火特性，因此建议在此类系统或零件里面或周边尽量采用防火等级高的材料，如V-0等级材料。



四、高压性能安全

4、EMC

整体屏蔽及接地处理

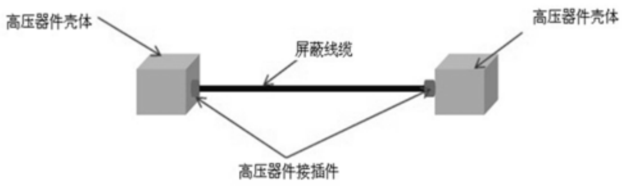
目标：通过连续的导体将高压部分完整屏蔽，并做好良好接地处理。

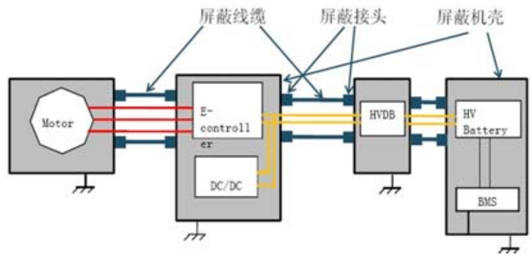
➢高压部件的金属壳体屏蔽；

➢高压接插件保证高压线屏蔽层与金属壳体的良好连接；

➢屏蔽高压线；

➢高压件金属壳体良好接地。





四、高压性能安全

5、电磁波辐射

高压系统零件应考虑减少电磁波对外辐射的设计，从整体的屏蔽设计到零部件的具体选型。

整车辐射标准应满足

ICNIRP-2010《限制时变电磁场暴露导则**2010**》

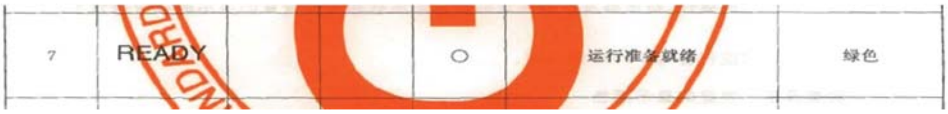
五、高压功能安全

1、驱动系统、电源接通程序

▸当车辆与外部电路(例如:电网、外部充电器)连接时，不能通过其自身的驱动系统使车辆移动，以保护车辆和外部电路。

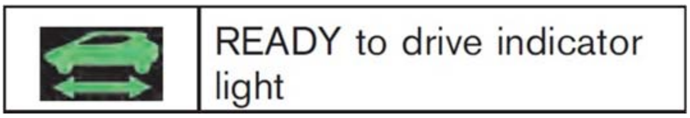
▸驱动系统经自动或手动关闭后，只能通过正常的电源接通程序重新启动;

▸使用一个明显的信号装置(例如：声或光信号)持久或间歇地显示驱动系统已处于准备工作状态。



GBT 4094.2（2005）电动汽车 操纵件、指示器及信号装置的标志

BYD



LEAF

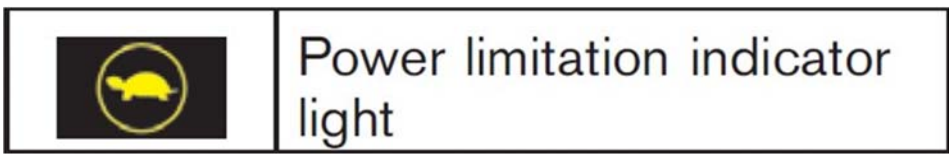
五、高压功能安全

2、紧急情况下动力的下降

如果车辆装有紧急情况时（例如某部件过热）可限制操作的装置，则应通过一个明显的信号通知车辆使用者。

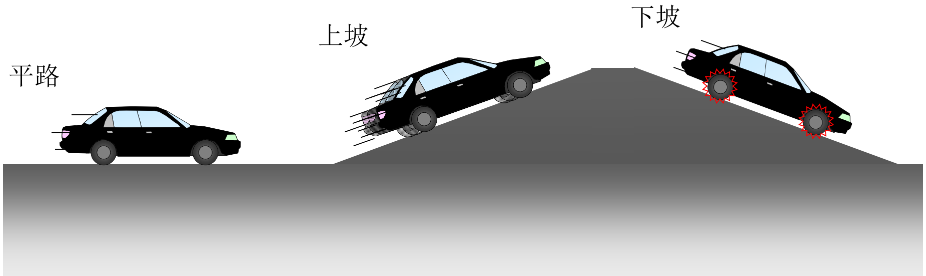
功率降低显示

如果功率自动大幅度降低(例如：由于驱动系统或动力源零部件的高温)，应通过明显的装置显示这一状态。



3、辅助制动

车辆的电机应具备辅助制动功能，用于在基础制动失效情况下的补偿驾驶员制动需求，降低车速，减少意外发生。



4、单点失效防护

车辆的应充分考虑单点失效情况下的故障保护，尽可能较少由于出现单点失效而使车辆产生不期望的移动，如加速、减速、倒车等。

五、高压功能安全

5、充电车辆锁止

当充电枪连接到车辆时，车辆不能通过其自身的动力系统进行驱动，以保护设备和人员安全。

五、高压功能安全

车辆碰撞的特殊要求

乘员保护

1、如果车载储能装置安装在乘客舱的外部，进行碰撞试验中和试验后，动力蓄电池包及其部件（动力蓄电池、蓄电池模块、电解液）不得穿入乘客舱内。

2、如果车载储能装置安装在乘客舱内，车载储能装置的任何移动应确保乘客的安全。

3、进行碰撞试验中和试验后均不能有电解液进入乘客舱。

4、进行碰撞试验中和试验后储能装置不能出现爆炸、着火。

五、高压功能安全

车辆碰撞的特殊要求

第三方保护

进行碰撞试验时，动力蓄电池包及其部件（动力蓄电池、蓄电池模块、电解液）或超级电容器等储能装置不能由于碰撞而从车上甩出。

防止短路

进行碰撞试验时，应防止造成动力回路的短路。

绝缘电阻的测量

碰撞试验结束后，按照GB/T 18384.3-2001中的6.2.2的要求（不需进行准备阶段）进行绝缘电阻的测量，并满足绝缘电阻的要求。

用户手册、服务手册

Thank you!

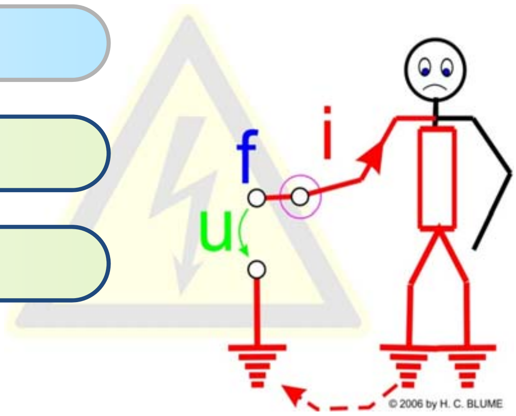
BYD

Wang Hong Jun
Department Manager

Department: EV Department, Automotive engineering research institute of BYD Auto industry company , Ltd.

Job: Responsible officer of BYD EV high-voltage system.

- 一 HV Placement Safety
- 二 HV Structure Safety
- 三 HV Circuit Safety
- 四 HV Performance Safety
- 五 HV Function Safety



一、HV Placement Safety

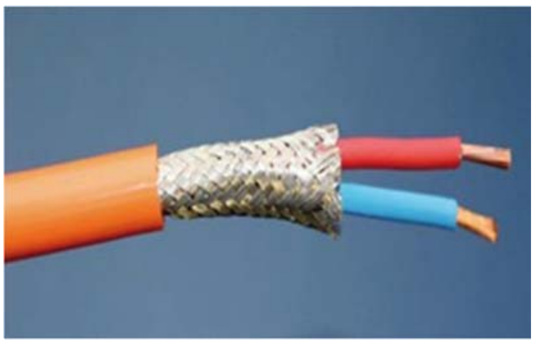
HV Wires Placement

1、HV wires out side the HV devices must be covered with shielding layer, and it must reach 360° shielding when it's docked;

2、 HV wires out side the HV devices must wear bellows or cloth to prevent abrasion；

3、HV wires go smoothly and fixed, keep the distance more than 100mm from low voltage wires;

4、The positive and negative wire of the HV should be placed close to each other, and High voltage circuit are not allowed to form a circle .



一、HV Placement Safety

BYD

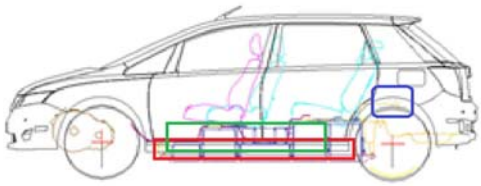
Placement of Power-Batteries

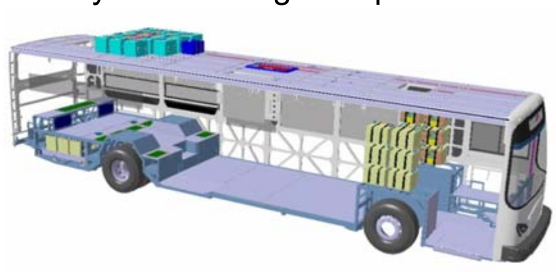
1、The layout of the batteries should consider the protection problems under the collision cases， and we must avoid batteries' damage under slight crash.

2、Around the Power batteries，we must use the high-level fire prevention materials

3、Power batteries should be placed together, as far as to reduce the difference in cell's temperature.

4、Power batteries should be placed far away from the high temperature





一、 HV Placement Safety

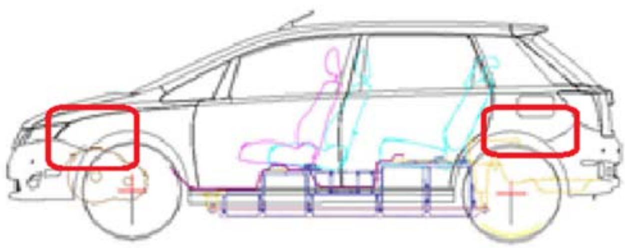
BYD

Power control module layout

1、 Power control module should be placed together，and do some fire prevention measures.

2、Power control module also avoid damage under slight crash.

3、Fully consider how to reduce the high voltage wire length when placing the power control module.



High voltage security identity

1、the HV cables outside of the HV devices should be colored orange.

2、there must be HV labels on the HV devices or the covers, and the logo must be clearly identified.

3、HV devices' labels are as follows，and it could be scaled appropriately as need;

4、chemical type of the batteries should be visible signed on the label.

Protection against direct contact

1、 should prevent direct contact with high voltage charged devices.
Chose either method to realize it:

——basic insulation of the live part；

——shell or cover, protect against direct contact.

They could be conductors or insulators.

2. cover/shell of the HV part can be only removed through professional tools.

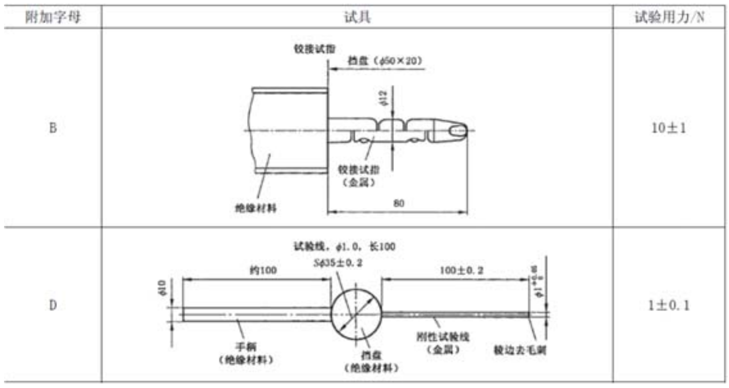
Basic protection of electric conductor, insulation, coverage, winding

Protection against direct contact

3、if the shell could be removed without cutting off the high voltage，we must add the function to cut off the high voltage when removing the cover.

4、 protection level of HV productions must reach IP67，and HV connectors must reach IPXXB（protect figure touch).

5、HV part should equipped with interlock device.



附加字母	试具	试验用力/N
B		10±1
D		1±0.1

二、HV Structure Safety

The clearance

the minimum clearance of the leakage columns is 2.5 mm

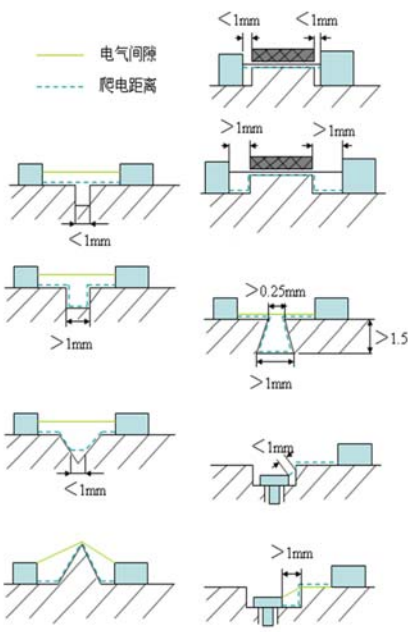
Creepage distance

1、the creepage distance between the two exposed columns: ：d≥0.25U+5，unit：mm

d - the measured creepage distance between the columns, mm;
U - maximum working voltage, V.

2、creepage distances between live parts and electrical chassis: d ≥ 0.125 U + 5, unit: mm

d - the measured creepage distance between the columns, mm;
U - maximum working voltage, V.

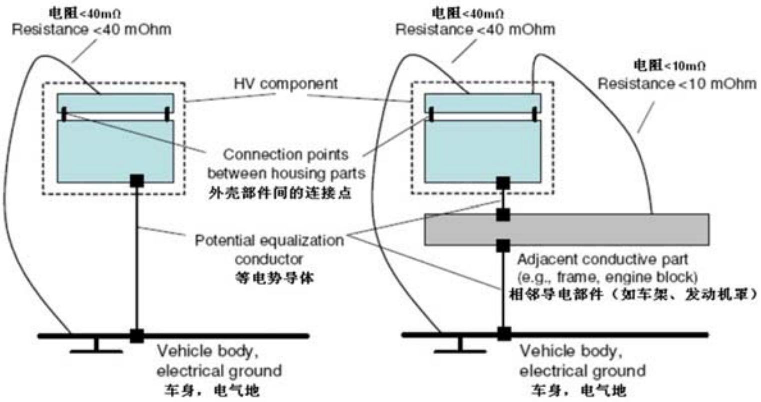


二、HV Structure Safety

Equal Voltage

1、the resistance of equal voltage HV live parts and chassis should be less than 40 mΩ ；

2、 if these two lives could be touched by person at the same time or the distance of them are less than 2meters in vehicle, the equal voltage resistance of them should be less than 100 mΩ .



三、HV Circuit Safety

Short Circuit and Overcurrent Protection

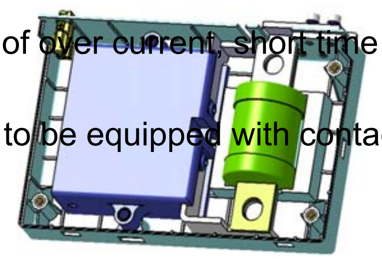
1、the HV fuses and the HV wired should be reasonable matched，and the fuse would break off when short circuit to protect the wires from catching fire.

2、when the over current have been cut off，the live part and wires which are not short circuited should not be damaged.

3、the live part should use fire and high temperature resistant materials, and have explosion-proof function.it won’t have threat to other parts or persons when short circuit.

4、HV parts itself needs to have certain ability of over current, short-time over current won’t harm the live part.

5、High pressure circuit should be reasonable to be equipped with contactor to ensure the safety of maintenance person.



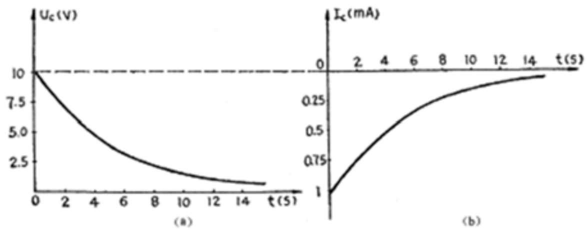
Dangerous Electric Energy Discharge

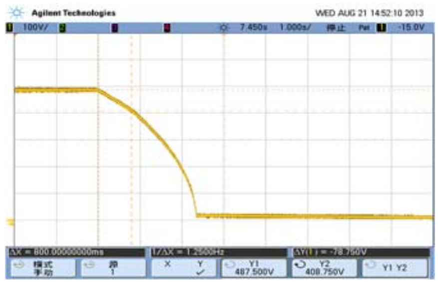
The capacitor with 0.2J energy is dangerous to human, and we could add discharge method to these HV parts or system

It must meet one of the following conditions after cut off the power or have an accident：

——the voltage of the circuit decrease to 30V AC or 60V DC.；

——the energy stored in the circuit is less than 0.2J。





HV interlock

Mechanical interlock

1、Dangerous voltage interlock circuit，using a low voltage signal to inspect the connection of the conductors with dangerous voltage，once the conductor exposes to human，the high voltage will cut off .

2、interlock failure after the incident should trigger dangerous electricity discharge.

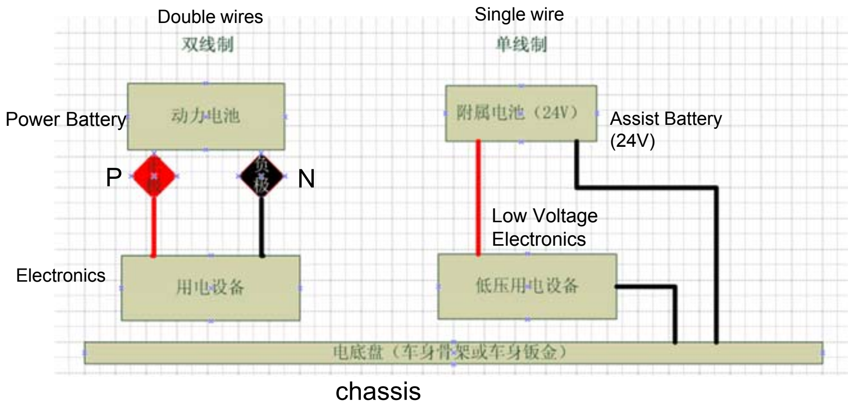
Function interlock

when the charging gun is connected with the vehicle, it couldn’t be driven for protect the human and device.

三、HV Circuit Safety

Double wires system protection

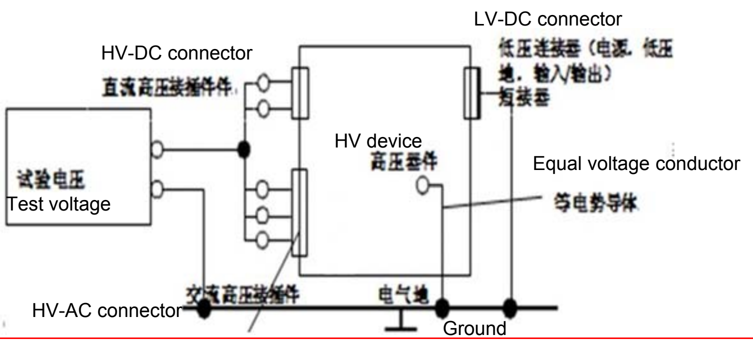
Double wires circuit should be adopted in HV circuit. This could effectively reduce the risk of HV short circuit or HV electric shock.

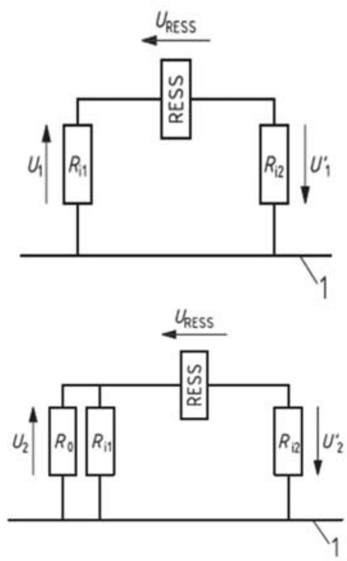


四、HV Performance Safety

Insulation monitoring

1, for HV parts, the value of insulation resistance shall be not less than 10 MΩ.
2, the vehicle insulation resistance value should be more than 100 Ω/V.
3, measurement: batteries pack insulation resistance tests are as follows.
4, vehicles equipped with insulation resistance monitoring system, As the vehicle is running, the high voltage insulation resistance of the system should be real-time monitored.





$$R_i = R_0\left(\frac{U'_2}{U_2} - \frac{U'_1}{U_1}\right)$$

Voltage withstand ability

each live part should have voltage withstand level，include the voltage between high voltage circuit and low voltage circuit and the voltage between the live part and the chassis.

HV live parts have two requirement in component level;

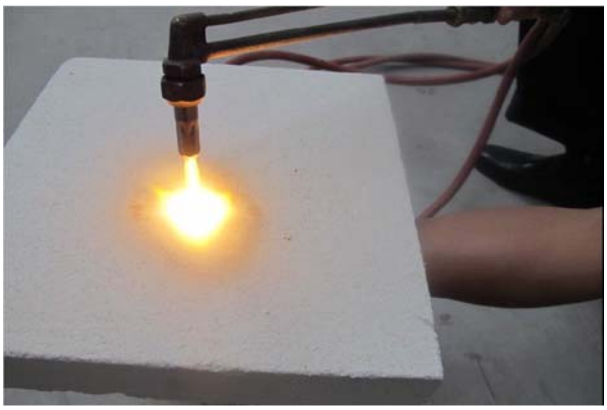
type	Test voltage
Basic insulation	2U+1000(AC RMS)
Double insulation or reinforced insulation	2U+3250(AC RMS)

注：1. U - max work voltage;
2 .You can also choose the DC with the value 1.414times of the AC RMS;

四、HV Performance Safety

fire resistance

The fire resistance should be fully considered after the HV insulation break down. So it's recommended to use the high level fire resistance materials in or around the live part or system , such as A0 level material.



四、HV Performance Safety

EMC

The shielding and grounding

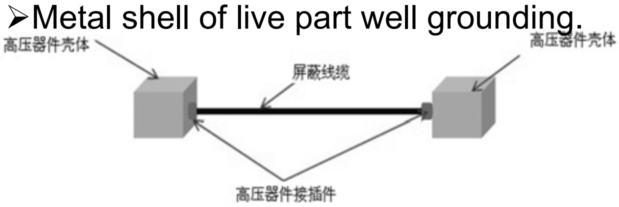
Goal： complete shielding high voltage part through continuous conductor , and make good ground handling.

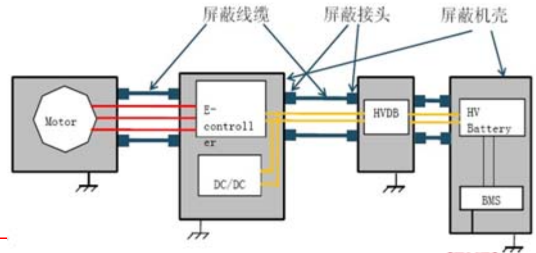
➢Shielding the live part with metal shell.

➢High-voltage connectors assure HV shield layer good connection with metal shell;

➢； Shielding the HV;

➢Metal shell of live part well grounding.





四、HV Performance Safety

Electromagnetic radiation

HV system design should consider reducing electromagnetic radiation design. from whole block design to specific selection of parts and components.
The vehicle radiation standards should satisfy
ICNIRP - 2010 "limits of time-varying electromagnetic field exposure guidelines 2010"

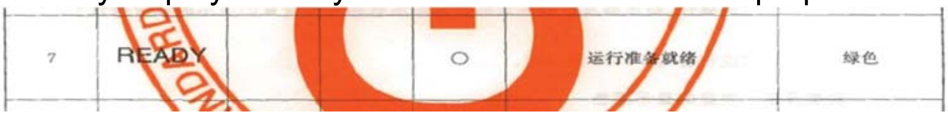
Drive system, the power on procedure

1、when the vehicle is connected to external circuit (external charger, power grid) it's not allowed to be driven in order to protect the vehicle and the external circuit.

2、after manually or automatically powered off, the program could restart only by powered on again;

3、use an obvious signal device (such as sound or light signal) persistent or intermittently display drive system has been in a state of preparation.

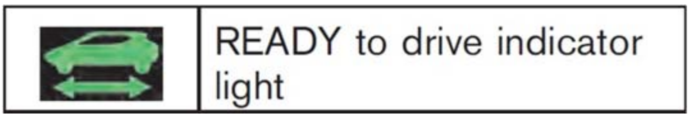
。



7	READY	○	运行准备就绪	绿色

GBT 4094.2（2005）电动汽车 操纵件、指示器及信号装置的标志

BYD



LEAF

五、HV Function Safety

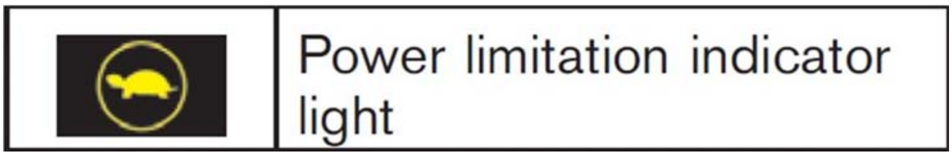
BYD

Emergency power

If the vehicle is equipped with an emergency (such as a live part is overheating) operation limit device, it should inform users of that through a clear signal.

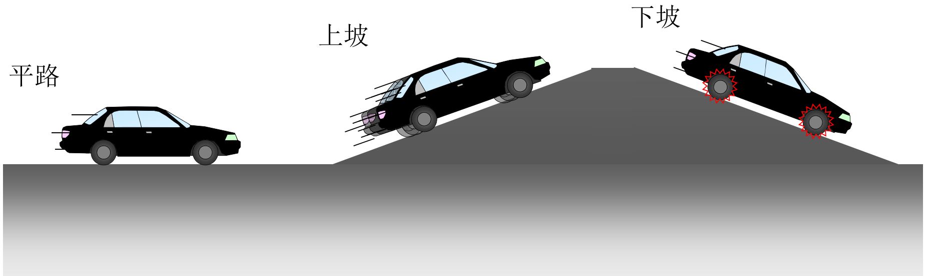
Power reduction signal

If the power automatic slash (for example: the drive system or power source are over temperature),it should obviously show this state.



Assistant brake system

Vehicle motor should be equipped with assistant brake system, which is used to compensate the driver braking requirements when braking failure, In order to reduce the speed, avoid the accident.



single point failure protection

Fault protection design should be fully aware the cases of single point failure ,reduce the possibility of the unexpected moves for the single point failure, such as acceleration, deceleration, reversing, etc.

五、HV Function Safety

BYD

charging vehicle lock

when the charging gun is connected to the vehicles, the vehicles can't move driven by its own system, in order to protect the persons and equipment.

五、HV Function Safety

BYD

Special Requirement After Crash

Passenger protection

1、if the REESS is placed outside of the passenger cabin，the batteries PACK and components (power battery, battery module, electrolyte) shall not go into the passenger cabin.

2、if the REESS is stored in the passenger cabin, any movement of the REESS shouldn't hurt human.

3、No REESS electrolyte spill into the passenger compartment during or after the crash.

4、No exploit or fire is allowed during or after the crash.

五、HV Function Safety

The special requirements of vehicle collision

The third part to protect

In the collision test, the power batteries pack and components (power battery, battery module, electrolyte) and super capacitor energy or any other storage device cannot be thrown out from the vehicle due to collision.

prevent short circuit

We should prevent the short circuit of power circuit during the collision test.

measurement of insulation resistance

After the crash test, (don't need a preparation phase) measure the insulation resistance as it’s required in the GB/T 18384.3 2001 in 6.2.2, and meet the requirements of insulation resistance.

User manual, service manual

Thank you!

国家防火协会

为应急者提供 NFPA 电动车 / 混合动力车辆安全培训

4380 万辆替代燃料车就在全世界的道路上驰行。

您准备好作出回应了吗？

国家防火协会

应急响应者的替代燃料车辆安全

NFPA 标准的调整

- NFPA 2:　氢技术规范
- NFPA 30A: 电机燃料分配设备
- NFPA 52:　车辆气体燃料系统规范
- NFPA 1500:消防员职业安全和卫生标准
- NFPA 1001:消防员专业资格系列
- NFPA 1600:防灾规划和紧急备灾
- NFPA 472: 响应者处理有害物质的能力
- NFPA 1670:技术救援事件标准
- NFPA 921: 火灾调查

国家电气规程®

- 第 625 条:　电动汽车充电站
- 第 220 条:　居民用电以及电动汽车充电设施将如何影响功耗及紧急情况

国家防火协会
应急响应者的替代燃料车辆安全

对由电动汽车、混合动力车电池引起的灾害进行应急响应研究

1）就电动汽车知识进行了 16 次圆桌会
进行讨论并做了425 次调查
消防培训主管

2）研究项目：
电动汽车事故
的应急措施。
电池危害
（消防设备研究
基金会与 NFPA）

范围：学习并将 7 个 EV HV 电池全部燃烧的消防战术和战略
纳入电动汽车/混合动力车/燃料电池车培训计划

可交付成果：更新的消防战术训练、最前沿的视频及动画、新情景演习

战略联盟伙伴关系

- DOE、DOT、NHTSA、SAE、ANSI、清洁城市、清洁汽车教育基金会
- 消防与执法
  - 国际消防长官协会（IAFC）
  - 国际消防战斗员协会（IAFF）
  - 全国消防业志愿者协会（NVFC）
  - 国际消防警察协会（IFMA）
  - 全国州级防火长官协会（NASFM）
  - 都市消防长官
  - 美国消防管理局 （USFA）
  - 北美消防培训主管（NAFTD）
  - 国际警察首长协会（IACP）
  - 全国警长协会（NSA）
  - 美国牵引和修复协会（TRAA）
  - 12 名消防主题专家
- 汽车制造商联盟
- 24 汽车制造商的伙伴关系


国家防火协会
应急响应者的替代燃料车辆安全
NFPA 电动汽车、混合动力车和燃料电池车安全的培训
插电式混合动力车
电气
混合动力车
燃料电池
紧急行动 程序
高电压汽车安全系统
交直流充电站


国家防火协会
应急响应者的替代燃料车辆安全
准备响应 EV/混合动力安全视频及
消防战术视频
• 优质
• 分阶段碰撞
• 专业
旁白
Identify
Immobilize
Disable
• 工作室制作自定义动画
•
更新最新的消防战术
最佳做法


国家防火协会
应急响应者的替代燃料车辆安全
NFPA EV / 混合动力安全教室课程
Electric, Hybrid and Fuel Cell
Vehicle Safety Training Program
INSTRUCTOR'S GUIDE
www.evsafetytraining.org


国家防火协会
应急响应者的替代燃料车辆安全
电动汽车 / 混合动力乘用车和卡车/公共汽车在线课程
要培训无法参加课堂培训方案的应急者
与课堂课程相同的材料 使用一对一教学的课堂模式
高质量的图形、动画、视频和模拟。
包括涉及到电动汽车电池危害的应急响应事件的最新的 消防战术 。
包括将追踪、记录和报告学员学业完成情况的 学习管理系统 。

国家防火协会

应急响应者的替代燃料车辆安全

确定了应急响应者的 P/ HEV 风险

1）未预料到的车辆运动

2）推车超过 8 英里/小时

3）有毒 / 可燃气体积聚

4）触电危险

5）皮肤接触电解质

6）锂离子火灾及重新点燃

7）浸入水中

推车超过 8 英里/小时

再生制动

用来捕捉制动能量的过程，有助于给高电压电池充电。

- 刹车时，车轮带动电动马达，使其变成了一台发电机并发电。
- 电传送到高压电池中，以提高充电量。

如果在驱动轮旋转时推动或拖曳，则可能会损坏高压系统并产生过热。

有毒 /
可燃气体
积聚

NHTSA 电动汽车锂电池暂行准则

- 警惕异常的气味或对眼睛、鼻子、喉咙或皮肤产生刺激的物质。如果检测到异常，则隐藏并撤离。
- 显示器高压电池有无泄漏、火花、烟雾、火焰或气过水声。
- 如果暴露于电解质或烟雾中，请遵循当地的医疗协议。

电解液接触
皮肤

电池破裂

- 由于位置和保护罩的缘故不太可能发生电池破裂的现象
- 电池均为干电池。如果压碎，只会渗出少量电解液。
- 某些型号将漏出冷却液。
- 如果电池损坏，会有高压电击的危险。
- 与电解液发生接触时请遵循当地的医疗协议并将之作为腐蚀性物质处理。


国家防火协会
应急响应者的替代燃料车辆安全
2014 NFPA 应急现场指南及应用程序
HOW TO USE THIS GUIDE
Immobilization
How to Determine if Vehicle is ON / OFF
Primary Disabling Procedure
Alternate Disabling Procedures
Disabling Procedure Supporting Diagrams
WARNINGS
Vehicle Photo
Manufacturer Badge
Model Year Range
Vehicle Badging
Make and Model Tab
System Diagrams (High Voltage, Airbags, SRS—if Available)
NISSAN
LEAF
National Fire Protection Association
2014 Hybrid and Electric Vehicle Emergency Field Guide
NFPA


国家防火协会
应急响应者的替代燃料车辆安全
用于在线培训的三维虚拟解救模型

国家防火协会

应急响应者的替代燃料车辆安全

提问时间

请访问 NFPA 的电动汽车安全网站：

EVSafetyTraining.org

National Fire Protection Association

NFPA ELECTRIC/HYBRID VEHICLE SAFETY TRAINING FOR EMERGENCY RESPONDERS

43.8 Million Alternative Fuel Vehicles are on our World's roadways.

Are you Prepared to Respond?

National Fire Protection Association

ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS

NFPA Standards Alignment

- NFPA 2: Hydrogen Technologies Code
- NFPA 30A: Motor Fuel Dispensing Facilities
- NFPA 52: Vehicle Gaseous Fuel Systems Code
- NFPA 1500: Occupational Safety & Health Standards for Fire Fighters
- NFPA 1001: Fire Fighter Professional Qualifications Series
- NFPA 1600: Disaster Planning and Emergency Preparedness
- NFPA 472: Competence of Responders to Hazardous Materials
- NFPA 1670: Standards for Technical Rescue Incidents
- NFPA 921: Fire Investigation

National Electrical Code®

- Article 625: Electric Vehicle Charging Stations
- Article 220: Residential power consumption and how EV charging infrastructure will effect power consumption and emergency

National Fire Protection Association

ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS

NFPA

Emergency Response Research Conducted for Incidents Involving Electric/Hybrid Battery Hazards

1) **Performed 16 Round Table Discussions & 425 Surveys of Fire Service training officers concerning EV knowledge**

2) **Research Project: Emergency Response to Incidents Involving EV Battery Hazards**
(Fire Protection Research Foundation & NFPA)

- Scope: **Learn & Incorporate Latest Firefighting Tactics & Strategy from Full Scale Burns of 7 EV HV Batteries into EV/Hybrid/Fuel Cell Training Programs**
- Deliverables: **Updated fire tactics training, cutting edge videos & animations, new scenario exercises**

Strategic Alliance Partnerships

- DOE, DOT, NHTSA, SAE, ANSI, Clean Cities, Clean Vehicle Education Foundation
- Fire Service and Law Enforcement
  - **International Association of Fire Chiefs (IAFC)**
  - **International Association of Fire Fighters (IAFF)**
  - **National Volunteer Fire Council (NVFC)**
  - **International Fire Marshals Association (IFMA)**
  - **National Association of State Fire Marshals (NASFM)**
  - **Metropolitan Fire Chiefs**
  - **U.S. Fire Administration (USFA)**
  - **North American Fire Training Directors (NAFTD)**
  - **International Association of Chiefs of Police (IACP)**
  - **National Sheriffs' Association (NSA)**
  - **Towing and Recovery Association of America (TRAA)**
  - **12 Fire Service Subject Matter Experts**
- Alliance of Auto Manufacturers
- 24 Auto Manufacturer Partnerships


National Fire Protection Association
ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS
ELECTRIC VEHICLE SAFETY TRAINING
NFPA EV, Hybrid and Fuel Cell Safety Trainings Scope
Plug in Hybrids
Electric
Hybrids
Fuel Cell
Emergency Operation Procedures
High Voltage Vehicle Safety Systems
AC & DC Charging Stations


National Fire Protection Association
ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS
ELECTRIC VEHICLE SAFETY TRAINING
Prepare to Respond EV/Hybrid Safety Video & Fire Tactics Video
• High Quality
• Staged Crashes
• Professional Narration
Identify
Immobilize
Disable
• Studio Production
• Customized Animations
Updated with latest Fire Tactics Best Practices
Capacitors

National Fire Protection Association

ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS

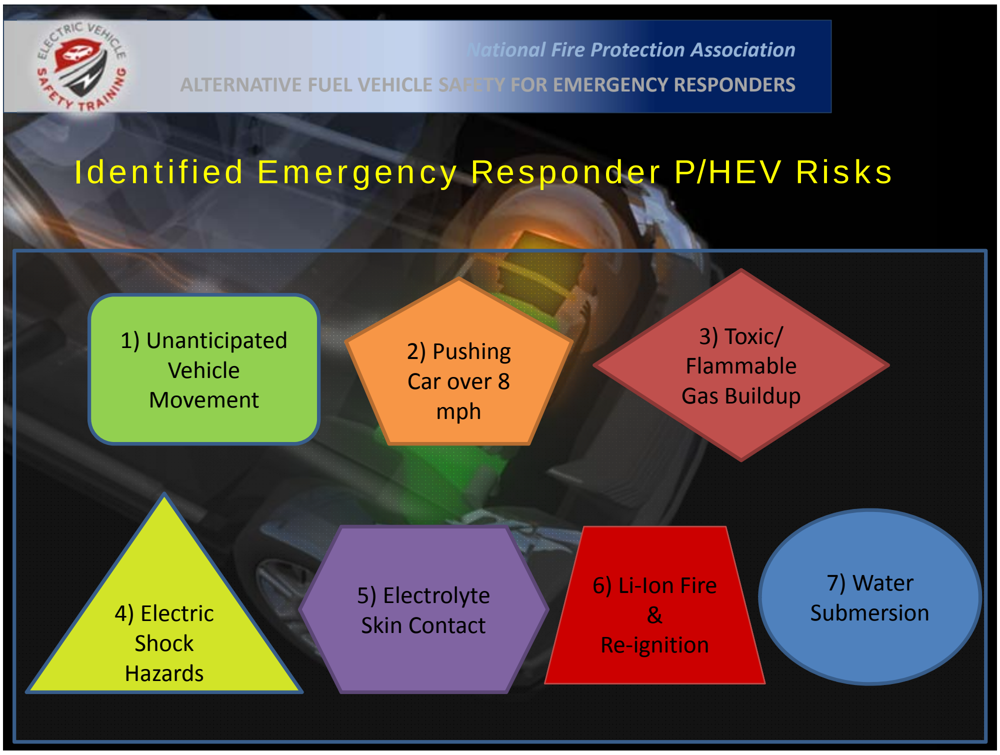
NFPA EV / Hybrid Safety Classroom Course

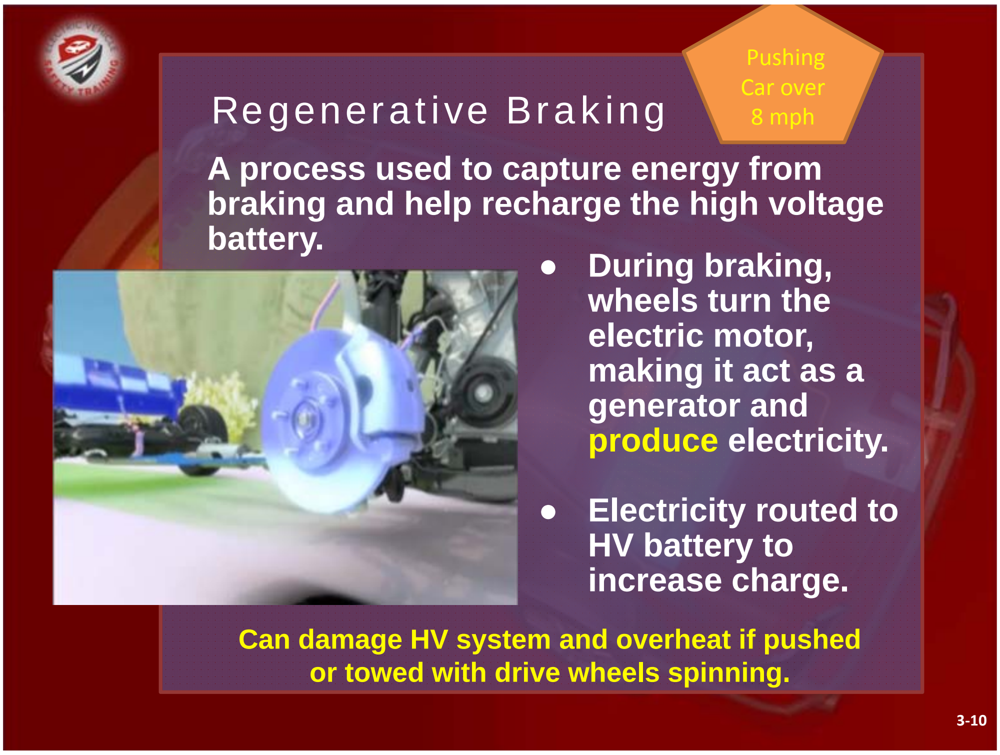
National Fire Protection Association

ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS

EV / Hybrid Passenger Vehicle & Trucks/Buses Online Courses

- To reach Emergency Responders who do not have easy access to classroom training programs
- Covers the same material as the classroom course with one for one match to classroom units
- High Quality graphics, animations, video and simulations.
- Includes latest fire tactics from Emergency Response to Incidents Involving Electric Battery Hazards.
- Includes Learning Management System that will track, record and report on student completions.


National Fire Protection Association
ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS
Identified Emergency Responder P/HEV Risks
1) Unanticipated Vehicle Movement
2) Pushing Car over 8 mph
3) Toxic/ Flammable Gas Buildup
4) Electric Shock Hazards
5) Electrolyte Skin Contact
6) Li-Ion Fire & Re-ignition
7) Water Submersion


Pushing Car over 8 mph
Regenerative Braking
A process used to capture energy from braking and help recharge the high voltage battery.
During braking, wheels turn the electric motor, making it act as a generator and produce electricity.
Electricity routed to HV battery to increase charge.
Can damage HV system and overheat if pushed or towed with drive wheels spinning.
3-10

Toxic / Flammable Gas Buildup

NHTSA Interim Guidelines for Li-Ion Vehicles

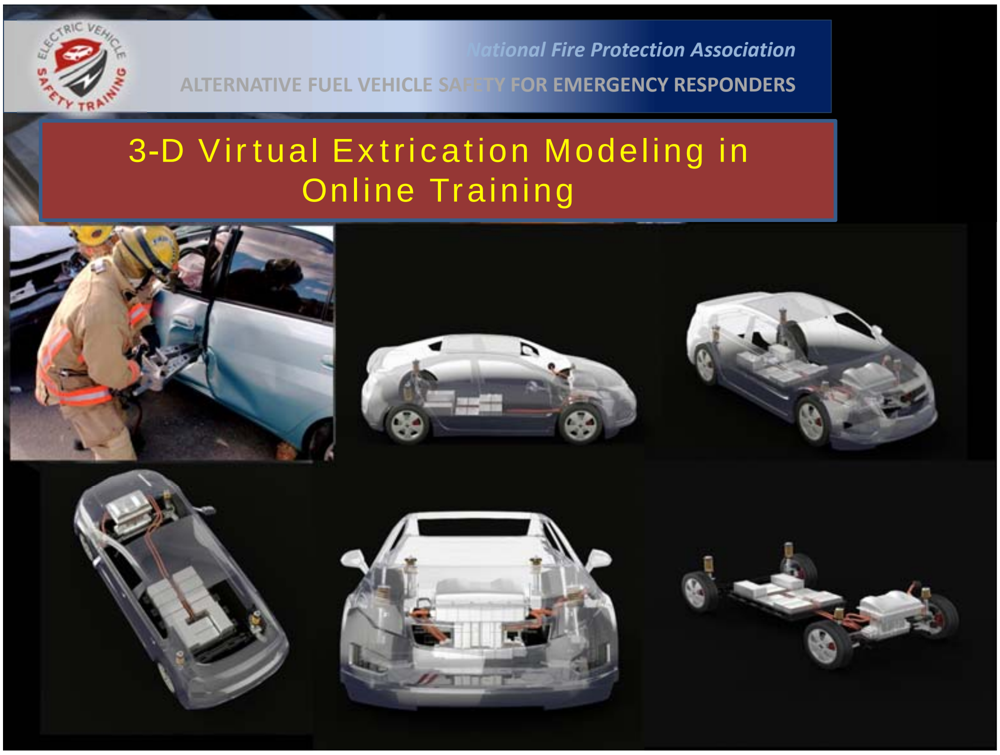
- Watch for unusual odors or eye, nose, throat, or skin irritation. If detected, limit exposure and evacuate.
- Monitor HV battery for leaks, sparks, smoke, flames or gurgling sounds.
- Follow local medical protocols in the event of exposure to electrolyte or fumes.

Electrolyte Skin Contact

Battery Breach

- Unlikely due to location and protective cases.
- Batteries are dry cell. Only a small amount of electrolyte would leak if crushed.
- Some models will leak liquid coolant.
- There is high voltage electrical shock hazard if a battery is breached.
- Follow local medical protocols & treat as caustic substance in the event of exposure.


National Fire Protection Association
ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS
2014 NFPA Emergency Field Guide & APP
HOW TO USE THIS GUIDE
Immobilization
How to Determine if Vehicle is ON / OFF
Primary Disabling Procedure
Alternate Disabling Procedures
Disabling Procedure Supporting Diagrams
WARNINGS
Vehicle Photo
Manufacturer Badge
Model Year Range
Vehicle Badging
Make and Model Tab
System Diagrams (High Voltage, Airbags, SRS—if Available)
NISSAN
LEAF
2014 Hybrid and Electric Vehicle Emergency Field Guide


National Fire Protection Association
ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS
3-D Virtual Extrication Modeling in Online Training


National Fire Protection Association
ALTERNATIVE FUEL VEHICLE SAFETY FOR EMERGENCY RESPONDERS
ELECTRIC VEHICLE SAFETY TRAINING
Questions?
Please Visit NFPA's EV Safety Website:
EVSafetyTraining.org
Excellence Through Knowledge

黄昊，男，1982 年生，工学硕士，副研究员，现担任公安部上海消防研究所火灾鉴定业务部部长，第四届中国消防协会电气防火专业委员会委员。

主要的研究方向为消防安全、火灾物证鉴定技术和汽车火灾调查与防控的研究，作为项目负责人或主要完成人完成了公安部和上海市科委等省部级科研项目 14 项，发表学术论文 20 余篇。作为主编出版了专著《我国汽车火灾现状分析及对策研究》（上海科技出版社，2014）。

在火灾物证鉴定和消防安全理论研究中取得了多项研究成果，获公安部科技进步奖三等奖 1 项、广东省科学技术奖三等奖 1 项，公安部上海消防研究所科技进步奖一等奖 1 项。

Mr. Hao Huang is an associate professor of Shanghai Fire Research Institute of MPS, he got his master's degree in Engineering from Nanjing Science and technology University, and currently serves as the director of fire material evidence identification department, and act as a member of the fourth Chinese Electrical Fire Protection Committee of CFPA.

His research work including fire safety, fire material evidence identification technology and fire investigation & prevention of vehicle. He completed 14 projects from Ministry of public security and Shanghai Science and Technology Commission, published more than 20 papers and acted as the chief editor of the book "Chinese automobile fire situation analysis and countermeasure research" (Pressed by Shanghai science and Technology, 2014).

He has made a lot of achievements by in charging some scientific research work, and got several rewards, such as the third prize of science and technology progress award of MPS, the third prize of Science and technology progress award of Guangdong Province, the first prize of science and technology progress award of Shanghai Fire Research Institute of MPS.

中国电动汽车消防安全及救援研究

Fire Protection and Rescue

公安部上海消防研究所
黄昊 副研究员

Speaker: Huang Hao,
Associate Professor from
Shanghai Fire Research Institute of MPS

主要内容 Contents

一、电动汽车行业消防安全技术规范体系研究

Research on Fire Safety Codes System for EV Industry

背景 Background

电动汽车、动力电池生产企业火灾事故
Fire accidents of EV and Battery factories

➢ 2013年7月25日，中国消防协会与中国汽车工程学会签署了 “汽车消防安全战略合作”备忘录，重点关注电动汽车的消防安全。

Chinese Fire Protection Association(CFPA) and SAE-China signed a strategic cooperation memorandum of auto fire safety in July 25, 2013, which focus on fire safety of electric vehicle.

签约仪式
Signing ceremony

➢中国汽车行业和消防行业都还未有专门针对电动汽车消防安全的标准及规范。

➢**There isn't any specific fire safety standard or code for EV in either automobile industry, or fire fighting industry in China.**

➢在中国汽车工程学会和中国消防协会支持下，公安部上海消防研究所开展了“电动汽车行业消防安全技术规范体系”的研究。

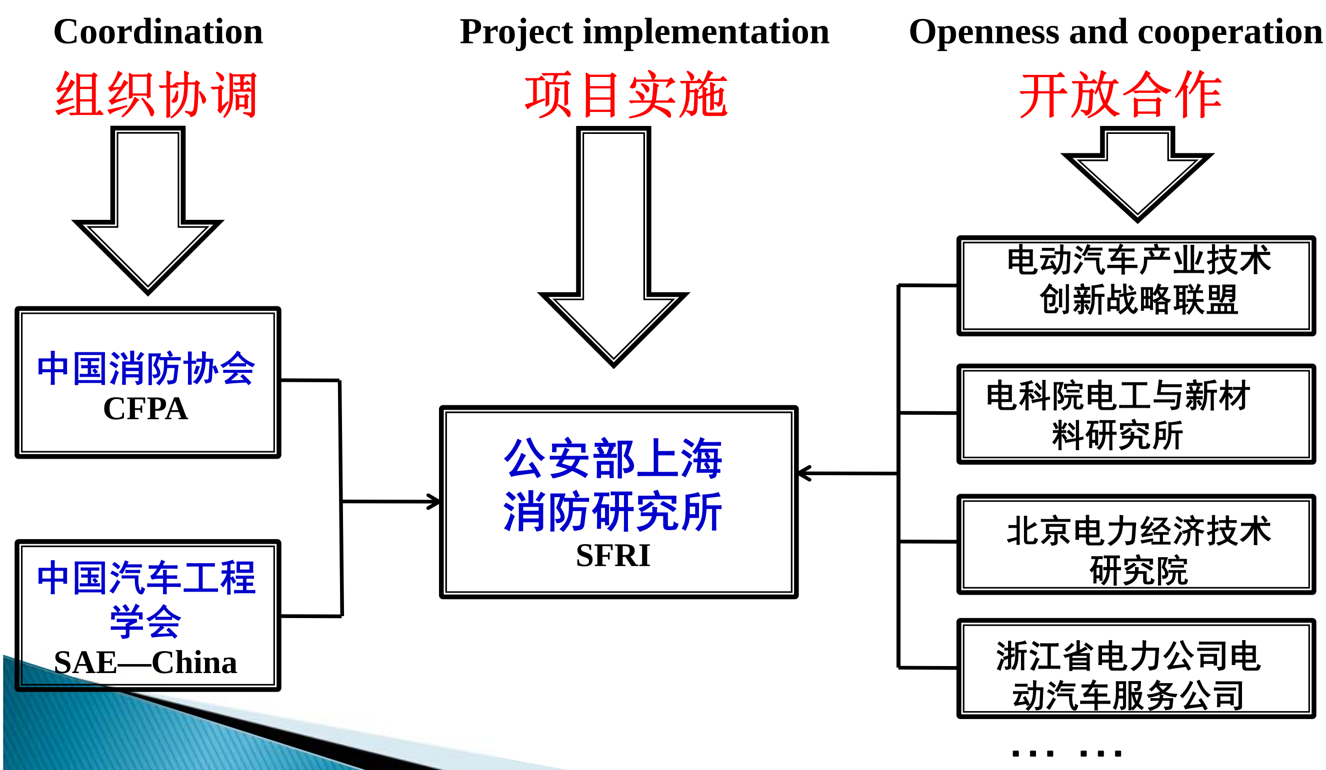
➢**With the support of SAE-China and CFPA, Shanghai Fire Research Institute of the MPS have carried out some researches on the technical code system of fire safety for EV industry .**

总体思路 General idea

➢以动力电池安全防控为核心，围绕动力电池生产储运、充换电站、电动车辆三条主线，从火灾防控和灭火与救援两方面，构建电动汽车消防安全技术规范体系。

➢**Taking the battery safety as the core task, the production, storage , transportation of battery , the charging / battery swap stations and the EV as three main lines, the technical code system for fire safety of electric vehicle has been built, which includes two aspects of fire prevention and fire rescue.**

组织形式 Organizational forms



➢ 电动汽车行业消防安全技术规范体系框架广泛征求了行业意见，并通过了专家评审。

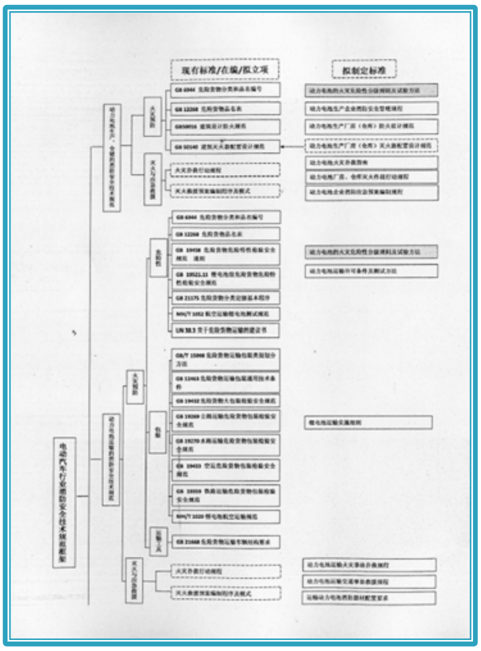
➢ **The frame of fire safety technical code system for EV industry was asked for criticisms and passed the expert review.**

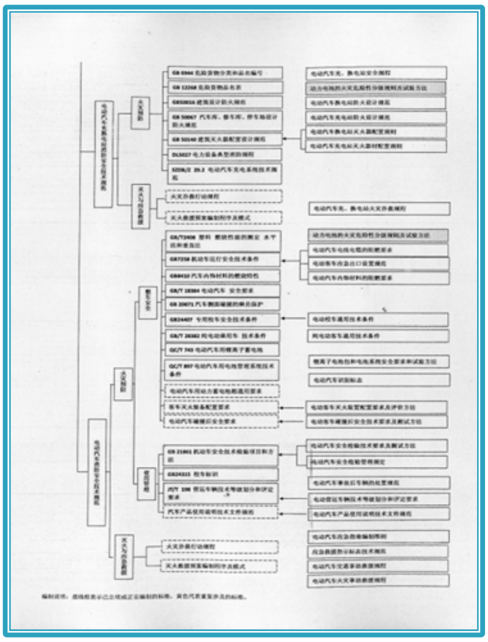
征求意见 **Comments Meeting**

专家评审 **Expert Review Meeting**

电动汽车行业消防安全技术规范体系框架

The frame of fire safety technical code system for EV industry





二、电动汽车消防安全

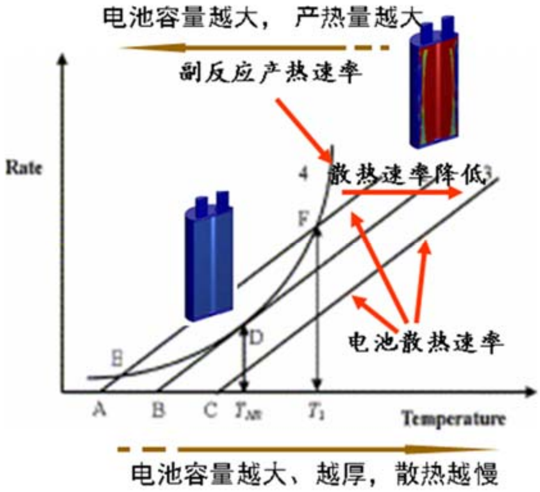
Fire Safety of EV

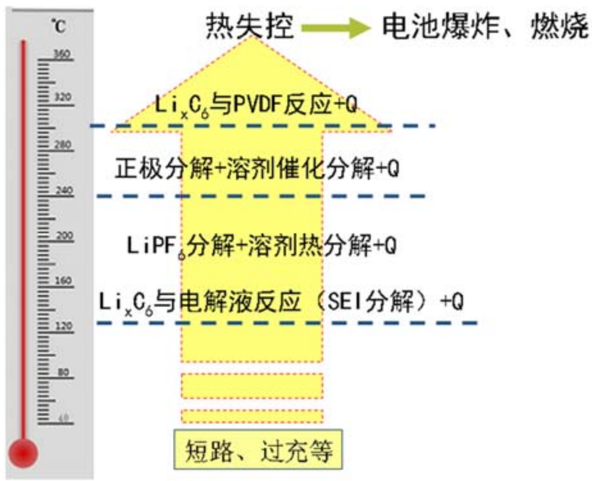
- 动力电池的火灾危险性
- The fire risk of battery
- 电动汽车防火
- The fire protection of EV
- 灭火与应急救援
- Fire fighting and emergency rescue

动力电池的火灾危险性
The fire risk of battery

- GB 6944 《危险货物分类和品名编号》，**锂电池及电池组属于第九类危险化学品**，但其火灾危险性还不明确。
- According to GB 6944 “Classification and code of dangerous goods”, lithium batteries and battery packs belong to the ninth class of dangerous chemicals, its fire risk is unclear.

动力电池的火灾危险性
The fire risk of battery





动力电池燃烧特性
The combustion characteristics of the battery

过充着火实验
The fire test of overcharge

外火引燃实验
The test of ignition

动力电池燃烧特性
The combustion characteristics of the battery

过充着火实验　The fire test of overcharge

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动力电池燃烧特性
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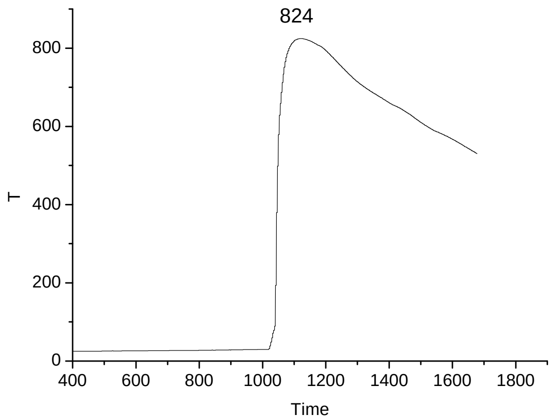
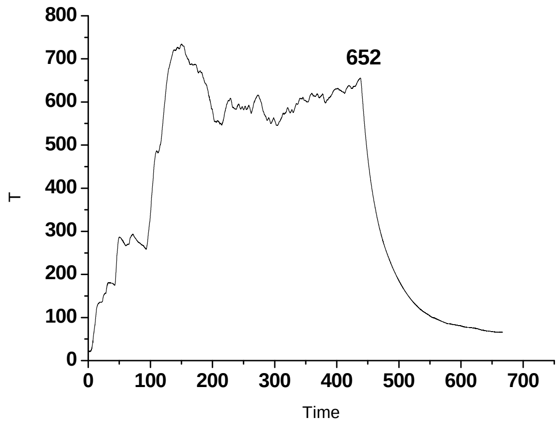


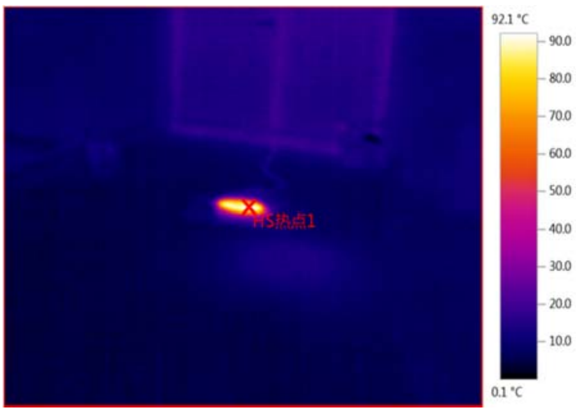
过充着火实验
The fire test of overcharge



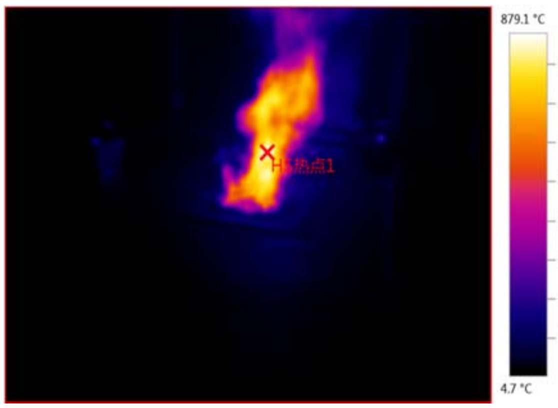
外火引燃实验
The test of ignition

动力电池燃烧特性
The combustion characteristics of the battery

动力电池燃烧的红外热像图
Infrared thermal image of battery combustion

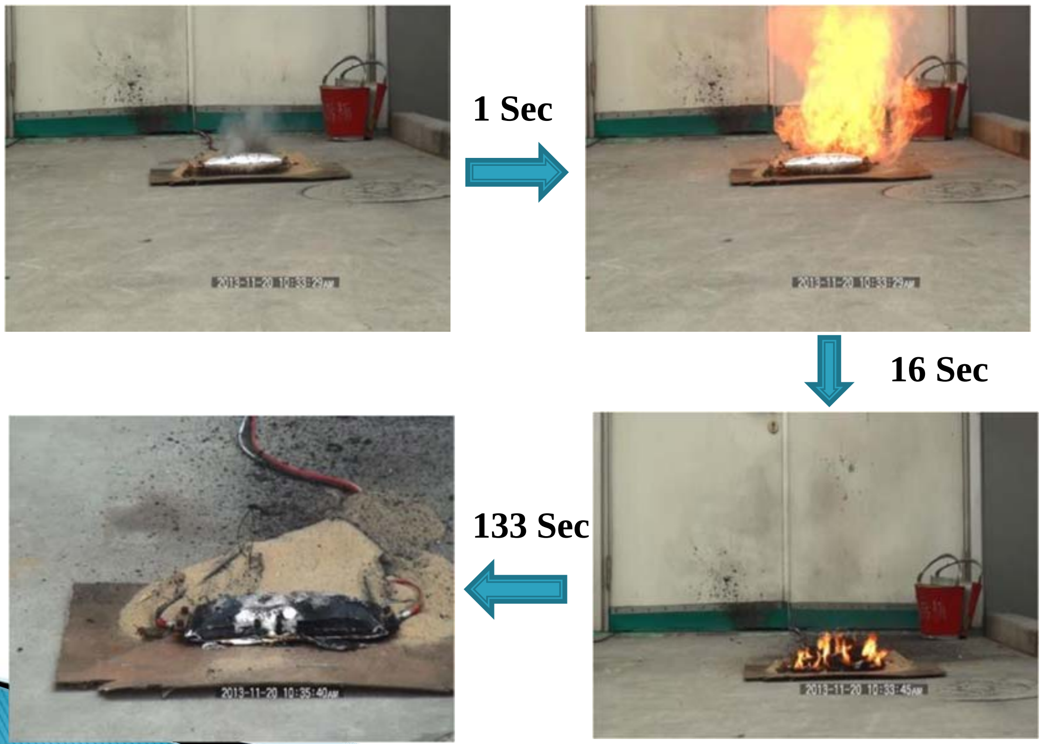


着火临界状态
Critical state of Ignition



最高温度
Maximum temperature

动力电池燃烧特性
The combustion characteristics of the battery



动力电池燃烧特性
The combustion characteristics of the battery

动力电池燃烧的火焰形状

The flame shape of battery combustion

动力电池燃烧特性
The combustion characteristics of the battery

动力电池燃烧特性
The combustion characteristics of the battery

- 燃烧温度高；
- 燃烧速度快；
- 不同体系电池燃烧差异大；
- 火灾扑救困难。

- **High combustion temperature ;**
- **Rapid combustion speed;**
- **Large combustion differences between different battery system;**
- **High difficulty to fight the fire.**

从消防部门的角度，电动汽车的消防安全主要考虑：

From the point of fire departments, Below are the main consideration on EV fire safety：

- 碰撞防护 **Collision protection**
- 安全出口 **Safety export**
- 自动灭火系统 **Automatic fire extinguishing system**
- 识别标志 **Identification marking**
- 应急救援 **Emergency Rescue**

电动汽车防火
The fire protection of EV

中国已建立了与国际接轨的电动汽车安全要求的系列技术标准：

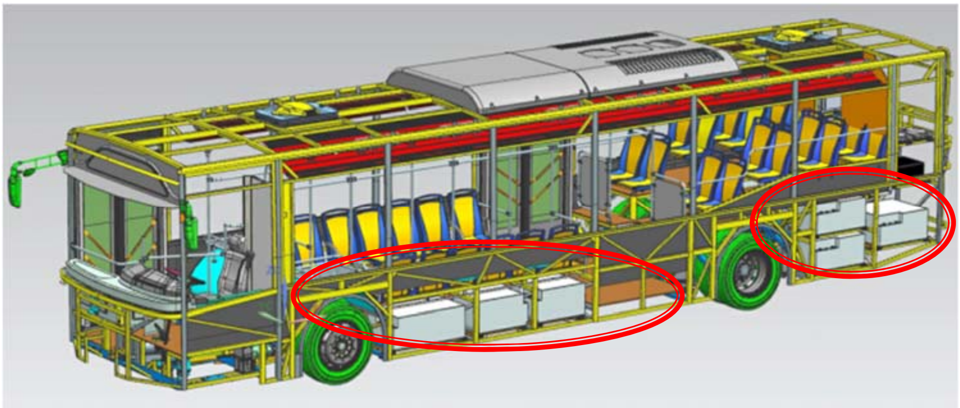
China has established series of technical standards on safety specification of EV .

- **GB/T 18384.1-2001** 电动汽车 安全要求 第1部分 车载储能装置
- **Electric vehicles- Safety specification. Part 1:On-borad energy storage**
- **GB/T 18384.2-2001** 电动汽车 安全要求 第2部分 功能安全方式和防失效
- **Electric vehicles- Safety specification. Part 2:Function safety means and protection against failures**
- **GB/T 18384.3-2001** 电动汽车 安全要求 第3部分 人员触电防护
- **Electric vehicles- Safety specification. Part 3:Protection of persons against electric hazards**

碰撞防护 Collision protection

中国发布了国家标准电动汽车碰撞后安全要求的征求意见稿，但没有涉及电动商用车。

China issued national standard “The Safety Requirement of Electric Vehicle Post Crash（the draft edition）”，but electric buses was not involved.



应急疏散Collision protection

安全出口 Safety export

电动商用车安全出口位置易受动力电池的影响
The safety export of electric buses will be affected by the battery

自动灭火系统 Automatic fire extinguishing system

国家标准客车灭火装备配置要求（报批稿）中要求电动客车配备自动灭火装置

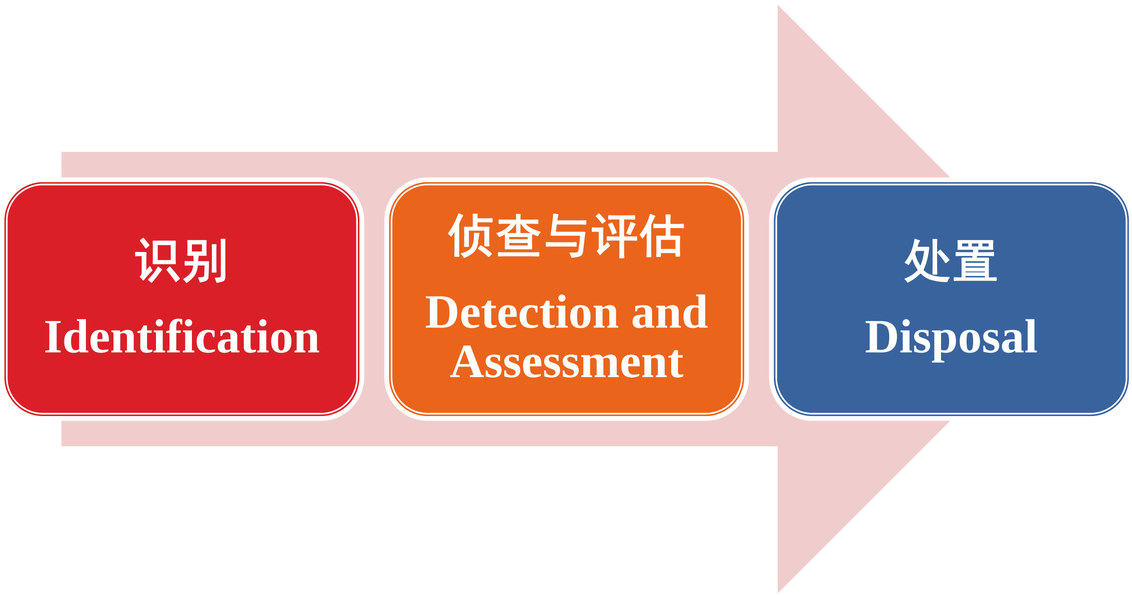
Automatic fire extinguishing system was required to install at EV in the national standard “Specification for extinguishing equipment distribution in bus (standard draft for approval)”

电池仓的自动灭火系统
Automatic fire extinguishing system for battery repertory

灭火与应急救援 Fire fighting and emergency rescue

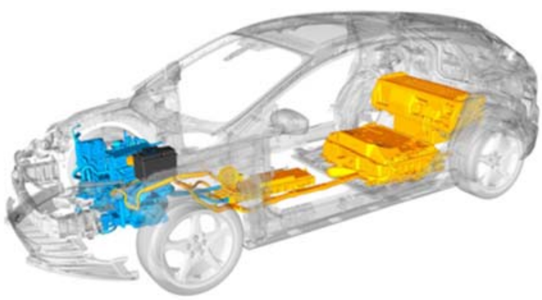
灭火与应急救援 Fire fighting and emergency rescue

灭火与应急救援 Fire fighting and emergency rescue



灭火与应急救援 Fire fighting and emergency rescue

- 在中国，消防部门正积极开展相关研究，重点关注动力电池、高压电系统对灭火和应急救援的影响。
- In China, the fire department is actively carrying out relevant researches which focusing on the effects of battery and high voltage electrical system to the fire fighting and emergency rescue.



识别标志 Identification marking

识别标志 Identification marking

北京市地方标准：DB11/T862-2012《电动汽车识别标志》

The local standard in Beijing：DB11/T862-2012 Electric vehicle identification marking

h） 车体两侧设置位置示意图

c） 轿车设置位置示意图

识别标志 Identification marking

灭火与应急救援 Fire fighting and emergency rescue

灭火与应急救援 Fire fighting and emergency rescue

三、下一步工作

Further work

- 动力电池燃烧特性与灭火规程是电动汽车行业消防安全标准的基础，中国将系统开展动力电池燃烧与火灾扑救实验。
- **Battery combustion characteristics and fire fighting procedures are the basic of fire safety standards for electric vehicle industry。**

动力电池燃烧与灭火专家论证会
Expert meeting for battery combustion and fire fighting

全国汽车标准化技术委员会
National Technology committee of auto standardization

全国消防标准化技术委员会
National Technology committee of fire standardization

中国汽车工程学会（SAE-China）

中国消防协会（CFPA）

整车企业
Automobile companies

消防企业
Fire prevention companies

———————

公安部上海消防研究所（SFRI）

中国汽车技术研究中心（CRTARC）

国家科技支撑计划的支持
Support from National Science and Technology project

- 《电动汽车及基础设施标准规范和测试技术研究》
- “Standards and testing technology of EV and Infrastructure”
- 《电池成组及消防安全技术研究》
- “Research on battery pack and fire safety technology”
- 《电动汽车火灾基础数据库研究》
- “Research on the database for EV fire”
- 公安部消防局项目《电动汽车充换电站消防安全关键技术研究》
- The fire department of MPS project“Research on the key technology of Fire safety of charging and battery swap station for EV”

2015~2016年将制定的标准
Standards will be developed from 2015 to 2016

- 动力电池火灾危险性分级标准
- Fire hazard classification rules and test methods for Battery
- 充换电站防火设计规范
- Code of fire protection and prevention Design on charging and battery swap station
- 应急救援指示标志技术规范
- Code for emergency rescue indication mark
- 电动汽车灭火装置评价标准
- Fire extinguishing device evaluation criteria of Electric vehicle
- 电动汽车应急救援规程
- Emergency rescue procedures for Electric vehicle
- 电动汽车火灾事故救援规程
- Fire fighting Guide for Electric vehicle

Thank you for your attention!

感谢聆听！