

DC Charging System Standardization Progress

CHAdeMO – 2nd North America Meeting

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Novi, MI

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CHAdeMO Association

The International Electrotechnical Commission (IEC)

- Leading global electric standardization organization
- IEC International standards serve:
 - as a basis for national standardization,
 - as references when drafting international tenders and contracts.
- 150 developed and developing countries have formed an IEC National Committee.

IEC Standards for EVs – 2010/2015

- IEC TC 69 and SC23H have initiated revision of the published standards for EV charging.
- Revisions of IEC 61851 Part 1, Part 21 and Part 22, as well as IEC 62196 Part 1 and Part 2 (*Dimensional interchangeability requirements for a.c. pin and contact-tube accessories - new*), should be completed and published soon.
- These standards cover only a.c. supply to the EV (charger is on-board).

New Standards Development Proposal

Japan recently proposed 3 new work items to IEC, covering all aspects of d.c. charging system for EVs:

1. IEC/TC69/PT61851-23: d.c. electric vehicle charging station,
2. IEC/SC23H/PT62196-3: dimensional interchangeability requirements for pin and contact-tube coupler for dedicated d.c. charging,
3. IEC/TC69/PT61851-24: control communication protocol between off-board d.c. charger and electric vehicle.

IEC / TC 69 / PT61851-23

- Requirements (together with part 1) for d.c. electric vehicle charging stations for conductive connection to the vehicle,
- With an a.c. supply input voltages, up to 1000 V and d.c. output voltages up to 1500 V;
- The EV charging mode is mode 4, according to part 1.

IEC / TC 69 / PT61851-24

- Applies (together with part 23) to charging control communication protocol between off-board d.c. charging system and electric road vehicle,
- With an a.c. supply input voltages up to 1000 V and d.c. output voltages up to 1500 V for the conductive charging procedure,
- This standard covers the physical layer, the data link layer, the application layer and other layers if needed.

IEC / SC23H / PT62196-3

- Vehicle couplers with pins and contact-tubes of standardized configuration for dedicated d.c. charging of electric vehicles,
- With rated operating voltage up to 1 000 V d.c. and rated current up to 400 A,
- Applies to a high power d.c. interface of vehicle couplers specified in IEC 62196-1, and intended for use in conductive charging systems for circuits specified in IEC 61851-1 and IEC 61851-23;
- The vehicle couplers covered by this standard shall be used only in charging mode 4, according to IEC 61851-1

DC charging system options

	Charging Mode	Charging Control Communication	Coupler Type
In use: Japan (based on CHAdeMO System)	Regulated	CAN	DC only - Type 1
Adopted: China GB/T	Regulated	CAN	DC only - Type 2
In development: US (SAE)	Regulated	PLC or In-Band Signaling	Combo Coupler - Type 1 <ul style="list-style-type: none"> • Low power: DC on AC pins • Medium power: add. DC pins High power: DC only - Type ?
Proposed: Germany (DKE)	Regulated	PLC on unused AC pins	Combo Coupler - Type 2 <ul style="list-style-type: none"> • additional DC pins

DC Charging IS Timeline

- All 3 proposals were accepted.
- Publication of the three IS (International Standards) planned before end of 2012.
- Work has started:
 - PT61851-23: July (Brussels), September (Osaka);
Next: June 2011 / Beijing, China;
 - PT62196-3: September (Osaka);
Next: April 2011 / US
 - PT61851-24: November AdHoc (Hong Kong);
Quick-off: March / Paris.

IEC 61851-23 Schedule

WD	2010-10-08	Revised 2nd WD circulated
	2010-11-01	Additional proposals on draft to be submitted <u>=> No proposals submitted</u>
CD [At the latest: 2011-03]	JP prepares <u>draft CD including without</u> additional proposals	
	2010-12-01	<u>Tentative draft CD to be sent to PT members for reference</u>
	2011-01-14	<u>Additional proposals on draft CD to be submitted</u>
	2011-02-07	<u>JP will prepare CD including additional proposals and submit to IEC/TC69</u>
	2010-12-1– 2011-02-15	CD circulated for 3-month comment
	2011-05-11+12+13– 2011-06-06+07+08	3rd PT meeting@Beijing, China
CDV [At the latest: 2011-10]	2011-06	CDV for 5-month voting and comment
	2011-12	4th PT meeting
FDIS [At the latest: 2012-07]	2012-01	FDIS for 2-month voting
IS [At the latest: 2012-11]	2012-05	Publication of IS

IEC 61851-24 Schedule

WD	2010-11-10+11	Ad-hoc PT61851-24 meeting in Hong Kong - Understand the 4 proposals: - Agree on WD preparation process.
	2010-11-22	JP provides PT members with a template for sequence and message details in terms of different DC charge control communication protocols. Tentative WD sent for reference.
	2010-12-10	Filled templates submitted for each protocol proposal, by US, DE, CN and JP.
	2010-12-17	1 st WD for 2-month comment.
	2011-02-21	NC comments on WD to be submitted.
	2011-03-10+11	The 1st PT 61851-24 meeting in Paris (TBC) NC comments discussed
	2011-03	2 nd WD for comments
	2011-06-09+10	2 nd PT 61851-24 meeting in Beijing (TBD)
CD [2011-10 at the latest]		
CDV [2012-05 at the latest]		
FDIS [2012-09 at the latest]		
IS [2012-11 at the latest]		

IEC 62196-3 Schedule

NP	2010-03-19/06-25 (APPROVED)
WD	2010-7-30: 1st WD circulated 2010-9-28+29: 1st PT @Osaka 2011-01-14: NC proposals for revised WD to be submitted (specifications and standard sheets of each configuration type to be included in WD) 2011-01-31: Circulation of revised WD for comments 2011-02-28: NC comments on revised WD to be submitted 2011-04-06 (Wed) + 07 (Thu): 2nd PT @U.S. (TBD) (or 2011-week of May 16 following MT8&PT62196)
CD	2011-06: CD 2011-10: 3rd PT
CDV	2012-1/5: CDV 2012-6: 4th PT
FDIS	2012-7/9: FDIS
IS	2012-11: IS

SAE J1772™

Proposed DC Configurations

- ▶ **AC L1:** 120V AC single phase
 - Configuration current 12, 16 amp
 - Configuration power 1.44, 1.92kw
- ▶ **AC L2:** 240V AC single phase
 - Rated Current \leq 80 amp
 - Rated Power \leq 19.2kw
- ▶ **AC L3:**TBD
 - AC single or 3 ϕ ?
- ▶ **DC L1:** 200 – 450V DC
 - Rated Current \leq 80 amp
 - Rated Power \leq 19.2kw
- ▶ **DC L2:** 200 – 450V DC
 - Rated Current \leq 200 amp
 - Rated Power \leq 90kw
- ▶ **DC L3:** TBD
 - 200 – 600V DC ?
 - Rated Current \leq 400 amp?
 - Rated Power \leq 240kw?

Source: EPRI IWC, Gery Kissel Dec. 2010

SAE J1772™ Revision Plan

- Revision to include:
 - Editorial corrections
 - Technical corrections
 - Charging configurations and ratings definitions
 - EVSE compatibility test (new Appendix)
 - DC L1 charging

Requires concurrent approval of SAE J2847/2 and successful demonstration of system

Source: EPRI IWC, Gery Kissel Dec. 2010

J1772 Coupler Usage Summary

- PHEV / EREV - C1 coupler as standard
 - AC L1 & L2, DC L1
 - Largest vehicle volume (90%?), smallest inlet
 - Coupler C2 as option
- BEVs - C2 “Hybrid” coupler as standard
 - Single vehicle charge inlet for AC L1 & L2, DC L1 & L2
 - *Coupler C3 as option*
- Commercial / Fleet Vehicles –C3 coupler as standard
 - ACL3, DCL3
 - Optional for BEVs

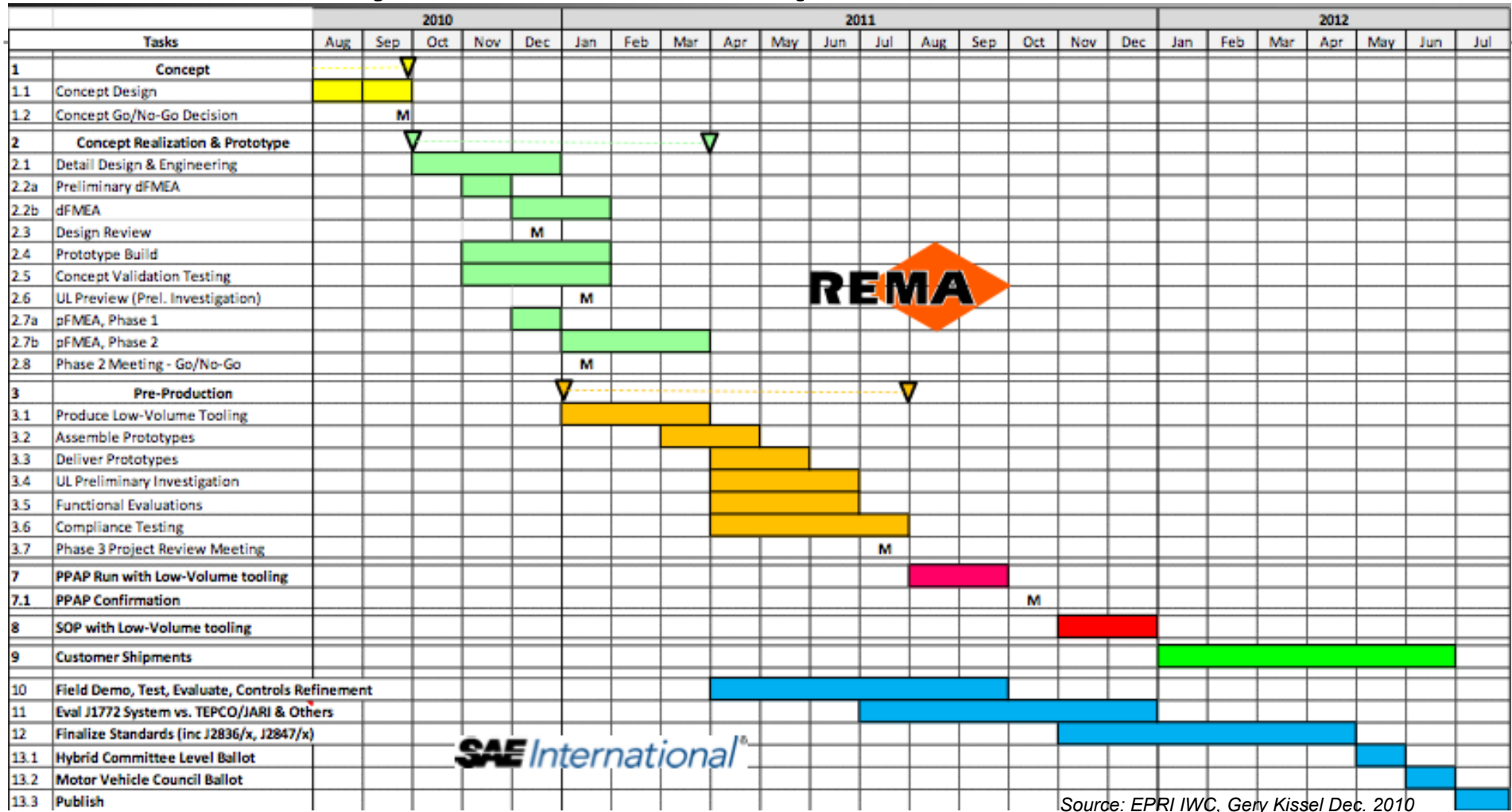
Source: EPRI IWC, Gery Kissel Dec. 2010

“Hybrid” Coupler Design

- Working with CARMEQ:
Audi, BMW, Daimler, Porsche, Volkswagen
 - Combine AC L1, L2 and DC L1, L2 in one coupler.
 - Add DC pins, 200 amp capacity
 - Provide provision for 2 optional data pins (plan to remove once communications strategy is resolved)
 - Reuse ground, control pilot and proximity circuit pins from AC L1, L2

Source: EPRI IWC, Gery Kissel Dec. 2010

« Hybrid » Coupler Timeline



SAE Communication Documents

J2836™ – General info (use cases)

Dash 1 – Utility programs *

Dash 2 – Off-board charger communications †

Dash 3 – Reverse Energy Flow

Dash 4 – Diagnostics

Dash 5 – Customer and HAN



J2847– Detailed info (messages)

Dash 1 – Utility programs *

Dash 2 – Off-board charger communications **

Dash 3 – Reverse Energy Flow

Dash 4 – Diagnostics

Dash 5 – Customer and HAN

J2931– Protocol (Requirements)

Dash 1 – General Requirements **

Dash 2 – InBand Signaling (control Pilot) **

Dash 3 – PLC over mains **

Dash 4 – Wireless ??

J2953– Interoperability

Dash 1 – General Requirements

Dash 2 – Testing and Cert

Dash 3 –

† * Two have initial versions published

‡ ** Five are expected to ballot 4Q 2010

Source: EPRI IWC, Rich Scholer, Dec. 2010

SAE Communication Documents planned for ballot in 2011

- J2836/2TM - DC Use cases and general info
- J2847/2 – DC Messages and detail info
 - Messages and signals mature, finalizing sequence and state diagrams
- J2931/1 - Digital Communications for Plug-in Electric Vehicles
 - Communication requirements and protocol (AC & DC)
- J2931/2 - Inband Signaling Communication for Plug-in Electric Vehicles
- J2931/3 - PLC Communication for Plug-in Electric Vehicles

Source: EPRI IWC, Rich Scholer, Dec. 2010