EVSE Standards Status
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Charging Configurations and Ratings

EVSE STANDARDS STATUS
Proposed SAE Charging Configurations and Ratings Terminology

- **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 ≤ 80 amp
  - Rated Power ≤ 19.2kw
- **AC L3:** TBD
  - AC single or 3φ?
- **DC L1:** 200 – 450V DC
  - Rated Current ≤ 80 amp
  - Rated Power ≤ 36kw
- **DC L2:** 200 – 450V DC
  - Rated Current ≤ 200 amp
  - Rated Power ≤ 90kw
- **DC L3:** TBD
  - 200 – 600V DC?
  - Rated Current ≤ 400 amp?
  - Rated Power ≤ 240kw?

Voltages are nominal configuration operating voltages, not coupler rating. Rated power is at nominal configuration operating voltage and coupler rated current.
Document Status

EVSE STANDARDS STATUS
J1772™ Revision Plan (No DC)

- Workgroup has been meeting via WebEx
- Workgroup has completed reviewing proposal list
- Draft document has been surveyed to obtain additional comments.
- Targeted publication, summer
J1772™ Revision Plan

- Revision to include:
  - Editorial corrections
  - Technical corrections
  - Charging configurations and ratings definitions
  - EVSE compatibility test (new Appendix)
J1772™ Revision Plan (w/ DC)

- Revision to include:
  - DC Charging configurations and ratings definitions
  - DC coupler dimensional information
  - Editorial corrections
  - Technical corrections

- Targeted publication December 2011
DC Fast Charge Standardization

EVSE STANDARDS STATUS
Charge Couplers

Configuration A

AC Connector:
Japan
SAE J1772™

DC Connector:
CHADEMO
Japan

Configuration B

AC Connector:
China

DC Connector:
China

Configuration C

AC/DC Connector:
IEC 62196-3
EU Combo 2

AC/DC Connector:
SAE J1772™
NA Combo 1

AC Connector:
China
DC Charging Configurations

- Configuration A (CHADEMO)
  - EVSE and vehicle share safety critical functions
  - EVSE performs isolation monitoring during charge
  - “Functional” earth concept used to reduce size of ground conductor
  - “Functional” earth requires EVSE listing as a system
  - Requires unique control and communications interfaces not compatible with current SAE J1772™
  - CAN communications for charge control
  - Requires additional communications for features such as V2H/G, and other customer value added features
  - Requires dedicated vehicle inlet in addition to AC charge inlet
DC Charging Configurations

- **Configuration B (China)**
  - Still working to understand system interfaces and control
  - Protective Earth grounding concept
  - Requires unique control and communications interfaces not compatible with current SAE J1772™ or IEC
  - CAN communications for charge control
  - Requires additional communications for features such as V2H/G, and other customer value added features
  - Requires dedicated vehicle inlet in addition to AC charge inlet
DC Charging Configurations

- Configuration C (Combo 1 (SAE) Combo 2 (IEC))
  - Vehicle controls all safety critical functions during charge
  - Protective Earth grounding concept
  - Compatible with current SAE J1772™ and IEC
  - Power Line Communications (PLC) for charge control and other features (V2H/G) offers “future proof” high bandwidth communications with vehicle
  - Combo inlets are compatible with SAE J1772™ and IEC AC charging
# DC Charging Configurations

<table>
<thead>
<tr>
<th>Configuration Characteristic</th>
<th>Configuration A CHADEMO</th>
<th>Configuration B China</th>
<th>Configuration C Combo 1 &amp; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Critical Functions During Charge</td>
<td>EVSE &amp; Vehicle</td>
<td>TBD</td>
<td>Vehicle</td>
</tr>
<tr>
<td>Ground Strategy</td>
<td>“Functional” Earth</td>
<td>Protective Earth</td>
<td>Protective Earth</td>
</tr>
<tr>
<td>Vehicle to EVSE Digital Communication</td>
<td>CAN</td>
<td>CAN</td>
<td>PLC</td>
</tr>
<tr>
<td>Control Interfaces</td>
<td>Unique</td>
<td>Unique</td>
<td>J1772™ Based</td>
</tr>
<tr>
<td>V2H/V2G/HAN Communication</td>
<td>Additional Communication Required</td>
<td>Additional Communication Required</td>
<td>Included in PLC</td>
</tr>
<tr>
<td>Total Number Of Inlets Required For AC &amp; DC Charge</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
DC Combo Goes On A Diet

January 2011

June 2011
Size Reduction Enablers

- Removed provision for CAN pins
- Reduced DC terminals from 8.5mm to 8.0mm
- Revised DC sealing strategy
- Integrated AC keyway into DC terminal outer ring
# Combo Coupler Power Levels

<table>
<thead>
<tr>
<th>Connectors</th>
<th>Charging options</th>
<th>Car equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>3,3kW</td>
<td>3,3kW on-board charger</td>
</tr>
<tr>
<td>Europe</td>
<td>3,3kW</td>
<td>Optional</td>
</tr>
<tr>
<td></td>
<td>30kW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100kW</td>
<td></td>
</tr>
</tbody>
</table>

- **AC 1-Phase:** (Japan, USA)
- **AC 3-Phase:** (w/ 22kW OBC or Inverter charging)
- **DC:** (w/ Type 1/2)
- **DC:** (Combo System w/ Type 1 or 2 AC kernel, dependent on country/region)
Other Items

EVSE STANDARDS STATUS
China Update

- State Grid Rationale for swapping
  - Charging at home is not possible
  - Since home charging is not possible, all charging would be DC fast charging resulting in 50% reduction in battery life
  - 20-30 minute charge time is not efficient from asset use or convenient for a customer as a primary means to charge
  - Fast charge has negative affects on the grid

- There are currently 87 swap stations
- Battery delivery vehicles can be used in remote or less populated areas and require no land purchase.
## Comparison of charging modes

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Battery Swapping</th>
<th>AC Charging</th>
<th>DC Charging</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charging time</td>
<td>3~5 minutes</td>
<td>6~12 hours</td>
<td>1~3 hours</td>
</tr>
<tr>
<td>2</td>
<td>Battery maintenance</td>
<td>Professional maintenance and management</td>
<td>Lack maintenance and management</td>
<td>Lack maintenance and management</td>
</tr>
<tr>
<td>3</td>
<td>Battery life</td>
<td>Relatively long</td>
<td>Relatively short</td>
<td>Shortened dramatically</td>
</tr>
<tr>
<td>4</td>
<td>Influence on power grid</td>
<td>Balancing peak and valley</td>
<td>Big influence on grid once in large scale</td>
<td>Big influence</td>
</tr>
<tr>
<td>5</td>
<td>Influence on customers</td>
<td>Resolve the concerns for battery life, cost and performance</td>
<td>Concerns for battery life, cost</td>
<td>Concerns for battery life, cost</td>
</tr>
</tbody>
</table>
China Update

Standardized battery pack

Universality, interchangeability and compatibility
China Update

Battery pack swapping equipment

Battery storage rack

Battery delivery vehicle