

## **EV CHARGING COMPONENTS AND STANDARDIZATION**

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**Abstract** - Currently, infrastructure charging rates in India are similar to European conditions. In addition, the adoption of electric cars in India has been mainly in the category of light vehicles, with smaller battery packs and lower power requirements. Therefore, it is now time to specify the rates or charging modes for that type of vehicle. Normal positioning requires the links between EV and EVSE, as well as clarification of communication policies without specifying the voltage / power level. We look forward to deploying a modular charging infrastructure that offers all available options such as Bharat Charger, CCS, and CHAdeMO to the electric vehicle user applicant. So standardization is the most required concern at present which we need to address because for mass implementation it requires the address to be done in such front. If the standardization process is at loop hole, then cost and local manufacturing will not foster in India

- The charge station cable and connector plug into the target EV. These Element provide the conduit for a charge to be delivered

### **Electric Vehicle Supply Equipment (EVSE):**

This EVSE provisions electrical energy from an electricity source to charge Electric Vehicle battery. This EVSE assist and manage to make sure that proper and safe flow of electricity. In other word; we can say it conclude that EVSE is a charging station.

### **Some Basic Components of E-Vehicle**

The equipment, connected to the main electric supply that provide ac or dc for the charging of traction battery. EVSE charging capacity is the key factor as they have an interrelation on how fast the batteries can be recharged. As in additional proceeding theory we will come across how the level 2 EVSE is available in 20, 30, 40 amp capacities as advanced current rating is directly proportional to faster recharge time.

### **Electric vehicle connector:**

There are various typical type of connectors available in the market, like SAEJ1772 (USA developed), the CHAdeMO(japan developed connector and recently Tesla developed supercharger Tesla electric automobiles.

### **Electric Vehicle Inlet:**

This machine on the EV that offer the connection between the EV and EVSE connectors. EV has more than one inlets port and location & vary from one EV to another EV.

### **Battery Charger:**

Level 1 and 2 chargers uses the EV inside part of battery charger to convert the EVSE alternating current supply to the direct current. DCFC (dc fast charger) supply high current dc electricity directly to EV battery, the on board charger conversion ac to dc is not required and this function of the on board is by- passed when a DCFC is used. On board battery charger option are good parameter.

### **Ev chargers:**

EV chargers is also known as EVSE i.e. electric vehicle supply equipments ,different plug in is required for recharging the electric vehicle, as this in turn make us comprehend how to make it compatible on both ends .As we need to follow common specifications for various range of vehicle.]

### **Types of Chargers:**

EV charger can be classified based on:

**Keywords**—Charging, EV electric vehicle, EVSE

. Mobility,RE renewable energy,

### **Introduction**

The transportation component gives the crucial link between an Electric Vehicle with a depleted battery and the electrical source that will recharge those batteries is the Electric Vehicle Supply Equipment or EVSE delivers electrical energy from an electric source to charge an EV battery. The EVSE communicates with the different vehicle (EV) to sure that a proper and safe flow of electricity supplied. EVSE units are frequently referred to as charging stations.

Charge stations integrate large number of assemblies and controllers.

- The PE congregation is the guts of a charge station. Functionally, it supplies the power to the Electric vehicle onboard battery charger. It made up of wires, capacitors, transformers.
- The network controller provides the intellect of the charge station. It enables the station to converse with its network (via an on-board telecommunications device) so that managers can monitor it and review historical event data. It also controls user access to a charging station through a series of white (authorized) or black (unauthorized) lists.

- Ac and dc type
- Different Power level.
- Speed level of charging and communication system.
- Different types of Connector

**Interpretation:**

This gives the insight of different plugs, sockets-outlets & couplers for manufacturing purpose of the system only. It applies to small equipment i.e. plugs and socket-outlets, cables couplers and appliance couplers, with a higher operating voltage range which not beyond 690 Volt Direct Current / Alternating Current and 500 Hz Alternating Current , and the value of current not more than 250 Amp.It is primarily or soul designed as per technical specifications specially intended for industrials use, which can be applicable for either indoors or outdoors of industry and factory.

**Field of Scope:**

It has field with defined parameters for:

- Standard rating voltage and current range
- High Electric shock safety
- Earthings requirements
- restrictive s/c current(I) analysis
- Electromagnetic

**IEC 60309-2**

**Interpretation:**

The series of main criteria from the IEC for "plugs, sockets outlets and couplers for manufacturing purposes". highest voltage permissible is 1000 V DC or AC, and  $I_M$  is 125 Amp; and the greatest frequency,500 Hz. The ambient temperature range is -25 °C to 40°C. for 50–60 Hz AC power are yellow for 100–130 volts, blue for 200–250 volts, and red for 380–480 volts.

**Field of Scope:**

- Electric shock safety.
- Earthing requirements. .
- Current hauling parts & different connections.
- Restricted S/C current check

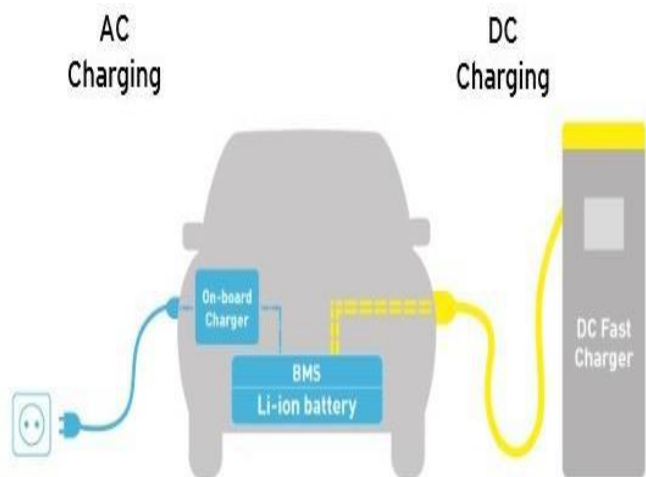
**SAE J 1772 (Type 1)**

**Interpretation:**

"J plug", is also defined as EV Conductive Charge Couplers and it is American standard for Electric -vehicles .The SAE J1772 group planed a DC connectors based on the SAE J1772-2009 AC connectors shape& size with other DC and ground pins to support charging at 200 v –450 V Direct Current and 80 A (36 kW) for DC Level 1 and highest up to 200 A (90 kW)

**DC Level 2**

once evaluating the J1772-2009 connectors beside different r designs with the JARI/TEPCO connectors using by the [CHAdEMO](#) DC very fast chargers protocol.



**Figure:- Mechanisms of EVSE and Charging**

From figure we know the basic mechanism of EVSE and charging as it depicts all the vital components of charging infrastructure .Here, we can comprehend that EV can be compatible with both type of supply at a time or simultaneously depends on the demand of usage and other factors

**Working of EVSE:**

In this, we have a provision of both dc and ac charging. The on board charger is connected to the ac supply which has an inbuilt rectifier /inverter circuit which in turns supply energy for recharging of the batteries. On the other hand, it has dc fast charging terminal, which is also connected to the battery for recharging it.

In this case, the type of battery, thermal management and other important factors like SOC (state of charge), DOD (depth of discharge) plays main role. BMS (battery management system) uses another communication interface, better network technologies (smart metering, remote control and automation system, smart sensor, optimization and aggregation technologies smart appliances and devices, IOT-internet- of- things).

Digitalization would be the best added value feature which would not only enhance the feature of end users but it also helps in better assessment of the power system, the Electric Vehicle Supply Equipment desires to communicate with BMS of battery pack in EV, so that it is charged with right rate with well-maintained SOH of batteries. Vehicle manufacturers in India use this physical layer for communication.

Communication among different EVSE and CMS in Utilities Company, this will bring a good reflection/resemblance of what rate to be maintain as per the grid supply or availability. As this would enable us to design and formulate metering at different rates, and to know- how to meet the large current demand during the charging and whether grid is able to supply for it.

**AC Charging and Connector Components:**

**IEC 60309-1**

Level	Voltage	Phase	Maximum current continuous
Level 1	120 volt AC	Single phase	12 and 16 AMP.

Level 2	208-240 Volt AC	Single phase	≤ 80 AMP
Level 3	208-600	3 phase	90–120 Amp.

**Field of Scope:**

Normally level 1 is conductive charge method of E –vehicle, to control and data managed of, normal Electric Vehicle and EVSE necessities, and couplers requirements, etc

**Direct current Charger level & Connector:**

**IEC-62196-3 model rating**

Dimensional compatibility & interchanges capacity need for Direct current and Alternating or Direct current pin and contact-tube vehicles and couplers planned for use in E- vehicle conductive charging systems which integrate control the system , with higher operation voltage level up to 1500 Volt Direct current and higher current up to 250 A, & 1000 V Alternating current and high current up to 250 A.

**Field of Scope:**

- Connections between E-VSE and Electric Vehicle.
- Designs & constructions of sockets outlets.
- Plugs, E-vehicles connector.
- Vehicles inlets system.
- Interlocking system
- Earthings’.
- Different Cables and their connections.
- S/C performance parameter

**GB/T 20234.3-2015 models**

**Interpretation:**

Connections sets to conduct charging of E-vehicles  
Part 3: Direct Current charger uses for couplers and It related to E-car couplers in mode 4 & connections mode C, of which the high voltage which not go higher up to 1,000 Volt direct current and the higher range current value which not beyond more than 250 A. direct current (DC).

**Field of Scope:**

- Normal need and operations ,
- Operational definitions for different parameters ,
- High direct current charger couplers,
- special Functions to the vehicles couplers,
- The Parametric value and different dimensional analysis of direct current charger couplers to conduct charger for electric vehicles,

**Vehicles to Grid Standards:**

**ISO 15118-1**

**Interpretations:**

Road vehicles and V to G communications line  
Part 1 : Normal information’s & description. It specify provisos & definition of need & uses on the source for the another part of standard 15118 modules. It gives a general overview and a frequent perceptive of aspect and influence on the charge process, payment & load leveling of the system.

**Field of Scope:**

- Need for information concept
- consumer oriented,
- OEM precise,
- Utility precise,
- For preparing charging progression,
- Different Cables and their connections.
- and charge arrangement,
- To stop charging process.

**ISO 15118-2**

Road vehicles & Vehicle to grid interface –  
Part 2: Network and their applications protocol needs

**Field of Scope:**

Basic requirement need for Vehicle to Grid communication, service primitive concept of OSI layered architecture, security concept, Vehicle to Grid communication and data link handling, data, network and transport layer, Vehicle to Grid transfer protocol, Vehicle to Grid message definition, Vehicle to Grid communications session and body element definitions, Vehicle to Grid communications timing, info. Sequencing and inaccuracy handling capacity.

**ISO 15118-3**

**Interpretation:**

Road vehicles - vehicle to grid communication interface  
-Part 3: physical and data link layer requirements.

**Field of Scope:**

- System architectures
- Electric car and supply system needs.
- Connections system
- Loss of communications for Electric Vehicle and EVSE side.
- Different Plug-out phase, timings and different constants.
- Identical Electric Vehicle – EVSE process.
- Signals coupling system

**ISO 15118-4**

**Interpretation:**

Road side E -Cars - V to G communications interface –  
P- 4: Networks & applications protocols insure test .

**Field of Scope:**

- Test architecture references structure, platform and SUT adapter’s interfaces.
- Test suite conventions.

- Test case descriptions for 15118- 2 V2GTP.
- SDP messages and V2G applications layer information.

#### ISO 15118-5

Road side vehicles - V - G communications interfaces –  
Part 5: physical & data link layer for communication insure

#### Field of Scope:

- Test architectures references models.
- EV and EVsystem needs.
- Checking of case descriptions for 15118- 3 signals for measurements
- Different Cables and their connections.
- Different Cables and their connections.

#### ISO 15118-8 standard

##### Interpretations:

Road side E -Cars – The V to G communications  
Interfaces –

Part 8: physical & data link layer for communication

##### Field of Scope:

- System architectures design ,
- Wireless communication need for SECC,
- EVCC and securities, etc.

#### Conclusion

It will give faster market access; standardization is importance for charging system, It Establish the relational between the vehicle and the chargers, standardization improve vehicle safety and safety of persons against electric shock. Standardization in Electric Vehicles is ensuring that there are no barriers from this point of view to the EVs massive spread as a sustainable mobility solution.

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#### Author profile

**Pawan Kumar Tiwari** was born in 1991 in India. He completed B.Tech first class in Electrical Engineering in 2013 and M. Tech (Hons) in Energy Engineering from Suresh Gyan Vihar University, Jaipur India. His research interested on solar photovoltaic, electric vehicle. At present He is working as a Assistant professor at SBCET, jaipur, rajasthan, india-302013.