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DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 23AUB201 – AUTOMOTIVE ELECTRICAL DRIVES AND CONTROLS

II YEAR / III SEMESTER

Unit 2 –Charging and Starting Systems

Topic : EV Charging standards (Chademo, CCS) and Indian Standard

EV CHARGING STANDARD

- EV charging standards refer to protocols and specifications designed to ensure safe and efficient charging for electric vehicles (EVs).
- These standards cover aspects such as plug types, charging speeds, and communication between the vehicle and the charger.

CHAdeMO

- **CHAdeMO** (an abbreviation for "CHArge de MOve") is one of the most widely recognized DC fast-charging standards for electric vehicles (EVs), originally developed in Japan.
- It allows for fast, high-power DC charging, enabling EVs to recharge their batteries much more quickly than traditional AC charging system

KEY FEATURES

❖ **Power Levels**:

- Early CHAdeMO chargers provided power up to 50 kW.
- Newer versions (CHAdeMO 2.0) can deliver up to 400 kW, although typical deployments are often lower.
- Allows faster charging compared to Level 2 AC charging, significantly reducing charging time for long-distance travel.

KEY FEATURES

❖ **Connector**:

- CHAdeMO has a unique connector design that is different from other fast-charging standards like CCS.
- The connector includes two large pins for DC power delivery and smaller pins for communication between the charger and the vehicle.
- It is used exclusively for DC charging, requiring a separate AC charging port on the vehicle for slower, home-based charging.

KEY FEATURES

❖ **Communication Protocol**:

- CHAdeMO uses the **CAN bus** communication protocol, allowing for real-time communication between the EV and the charging station.
- This ensures safe charging by monitoring battery status and controlling power flow.

❖ **Geographical Use**:

- Widely used by Japanese automakers such as Nissan (for the Nissan Leaf) and Mitsubishi.
- It has been deployed in some regions, though CCS is more commonly used.
- Although present, the market is shifting more towards CCS, with some manufacturers like Nissan offering dual CHAdeMO/CCS options.

KEY FEATURES

❖ **Compatibility**:

- **Automakers**: CHAdeMO is primarily used by Japanese automakers like Nissan, Mitsubishi, and some early Kia models.
- **Vehicles**: EVs that utilize CHAdeMO include the Nissan Leaf, Mitsubishi Outlander PHEV, and some older models of Kia Soul EV.
- Newer EV models and regions outside Japan are increasingly adopting CCS for DC fast charging.

BENEFITS

- **Fast Charging**: Significantly reduces charging time compared to AC charging.
- **V2G Support**: CHAdeMO is designed with bidirectional charging capabilities, allowing for vehicle-to-grid power flow.
- **Global Reach**: Especially popular in Japan, with thousands of chargers worldwide, and continues to be relevant for Nissan EVs.

LIMITATION

- **Connector Exclusivity**: CHAdeMO requires a separate connector for AC and DC charging, unlike the CCS system that combines both in one connector.
- **Regional Popularity**: Its use is declining in regions like North America and Europe, as many new EVs are opting for CCS as the preferred standard.

CCS

- **CCS (Combined Charging System)** is a widely adopted standard for electric vehicle (EV) charging that supports both **AC (Alternating Current)** and **DC (Direct Current)** charging using a single connector.
- This versatility, along with its high-power fast-charging capabilities, has made CCS a preferred standard, especially in Europe and North America.

KEY FEATURES

❖ **Power Levels**:

- **AC Charging**: CCS supports up to 22 kW (in three-phase systems) for Level 2 AC charging.
- **DC Fast Charging**: The system allows for high-power DC charging, with the latest version (CCS 2.0) supporting power levels up to **350 kW**, enabling ultra-fast charging.
- These power levels mean that vehicles can add hundreds of kilometers of range in just minutes, making it ideal for long-distance travel.

KEY FEATURES

❖ **Connector Design**:

- **Combo Connector**: CCS is called the "Combined Charging System" because it combines **AC and DC charging** into a single connector.
- The upper part of the connector is used for AC charging, while the entire connector (including the lower two pins) is used for DC fast charging.
- **AC and DC Ports**: For AC charging, only the top portion of the connector is used, while for DC fast charging, both the upper and lower parts are engaged.

KEY FEATURES

❖ **Variants**:

- **CCS Type 1 (SAE J1772/Combo 1)**:
  - Used primarily in **North America.**
  - The connector has a single-phase AC section and the DC pins.
- **CCS Type 2 (IEC 62196/Combo 2)**:
  - Commonly used in **Europe.**
  - Includes a three-phase AC section along with the DC pins for fast charging.
  - Compatible with European EVs that require both single-phase and three-phase AC charging

KEY FEATURES

❖ **Charging Speeds**:

- The **CCS Type 2** connector allows vehicles to charge at much faster speeds than older standards.
- With **350 kW DC fast charging**, vehicles can be charged to 80% in as little as 15-20 minutes, depending on the battery capacity and the power capabilities of the charging station.

KEY FEATURES

❖ **Communication Protocol**:

- **Power Line Communication (PLC)**: CCS uses this protocol to communicate between the vehicle and the charger, ensuring safe and efficient charging.
- This communication allows for the negotiation of charging parameters, including current, voltage, and power levels, ensuring that the vehicle's battery is charged in the safest and most efficient manner possible.

KEY FEATURES

❖ **Geographical Use**:

- **Europe**: CCS Type 2 is the de facto standard across Europe and is widely adopted by European automakers like BMW, Volkswagen, Audi, and Mercedes-Benz.
- **North America**: CCS Type 1 is the primary standard in North America and is used by companies like GM, Ford, and Tesla (with an adapter).
- **Other regions**: CCS is also growing in popularity in regions like China and India, where it is being adopted as a fast-charging standard.

INDIAN STANDARDS

- The Indian standards for electric vehicle (EV) charging are largely guided by the Bharat standards, which align with international norms while catering to India's specific needs.

Bharat EV Charger Standards (Bharat AC-001 & DC-001):

- These were among the first standards developed for EV charging in India, aimed at addressing the charging infrastructure needs for both low- and medium-power electric vehicles like two-wheelers and three-wheelers.
- **Bharat AC-001**:
  - For **slow AC charging**.
  - Charging power: Up to 3.3 kW per vehicle.
  - Connector type: 3-pin, 15 A.
  - Suitable for smaller vehicles like two-wheelers and three-wheelers

Bharat EV Charger Standards (Bharat AC-001 & DC-001):

- **Bharat DC-001**:
  - For **DC fast charging**.
  - Charging power: 10 kW at 72V, 200V DC.
  - Connector type: GB/T.
  - Designed for vehicles like electric buses and larger electric cars.

AC and DC Charging Standards

- India has also adopted various international standards for charging infrastructure to cater to different types of EVs.
  - **Type I**:
    - Mostly used in North American regions but supported in some applications in India.
    - Single-phase AC charging with a connector rated at 120V.
  - **Type II** (Mennekes Connector):
    - The widely accepted standard in Europe and India for **AC charging**.
    - Supports both single-phase and three-phase charging.
    - Capable of delivering up to 22 kW for home and public charging stations.

AC and DC Charging Standards

- **CCS (Combined Charging System)**:
  - A globally recognized standard that is also supported in India.
  - Provides both **AC and DC fast charging**.
  - CCS2 is more prevalent in India, supporting up to 350 kW DC fast charging.
- **CHAdeMO**:
  - A Japanese fast-charging standard also available in India.
  - Supports DC charging at up to 62.5 kW.

INDIAN STANDARD

- The **IS:17017** series, issued by the Bureau of Indian Standards (BIS), governs EV charging stations and connectors.
  - **IS:17017 (Part 1) –** General requirements for charging stations.
  - **IS:17017 (Part 2) –** AC charging.
  - **IS:17017 (Part 23) –** DC charging, focusing on connectors like CCS and CHAdeMO.

- **DC Fast Charging in India:**
  - Indian standards also include provisions for **supercharging and ultra-fast DC charging**, with higher power levels (e.g., 100 kW and above) for applications like commercial EVs and intercity travel.
- **Charging Levels in India:**
  - **Level 1 (Slow Charging)**: Up to 2 kW, generally for home use.
  - **Level 2 (Moderate Charging)**: 7 to 22 kW, for home or public charging.
  - **Level 3 (Fast Charging)**: Over 50 kW, for public and highway charging stations.

THANK YOU !!!