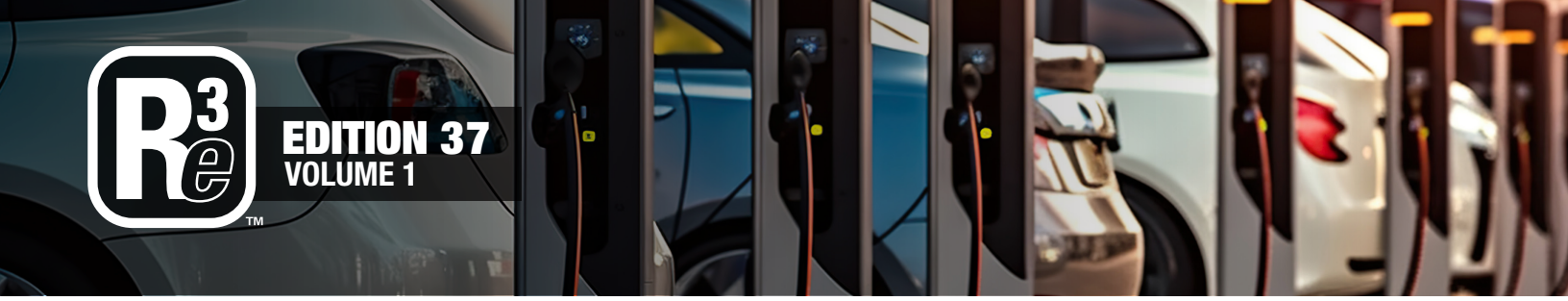

R3e EDITION 37 VOLUME 1™

10 KEY FACTS YOU NEED TO KNOW ABOUT EV CHARGING CABLES

US, CANADIAN, AND EUROPEAN OPTIONS: WHAT'S THE DIFFERENCE?

COMPOSED BY

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1. REGIONAL DIFFERENCES IN REGULATORY AGENCIES

In the United States, the main regulatory bodies affecting design and installation of Electrical Vehicle (EV) charging cables are Underwriters Laboratories (UL) for cable design and National Fire Protection Agency (NFPA) for installation. The Society of Automotive Engineers (SAE) has also published standards regarding guidelines for inter-operability and compatibility of components involved in vehicular charging. In the European Union (EU), the main regulatory standards that cable manufacturers follow are set by the International Electrotechnical Commission (IEC) and Euronorm (EN).

2. PRODUCT STANDARDS AND ELECTRICAL CODES

The current main applicable product standards in the US territory are UL 2263 for EV cables, SAE J1772 for electrical connectors used in EVs, and the National Electrical Code (NEC). In the EU, cable manufacturers follow IEC 61851-1 for EV conductive charging systems, IEC 62196-1 for EV charging infrastructure, and IEC 62893-1 for cable requirements. Additionally, they follow EN 61851-1 for EV conductive charging systems, EN 17186 for charging stations, EN 50620 for EV charging cables, and EN 60811 for cable requirements.

3. CRITICAL CABLE TESTS & RATINGS

Cables must undergo rigorous testing to ensure their suitability, ratings, and regulatory approvals for specific applications. Globally, many testing standards align, such as assessments for weather and sunlight resistance, cold bend and cold impact, direct current resistance (DCR), and flame resistance. These tests are typically reviewed by regulatory authorities like UL in North America (UL 2263 for US, CSA C22.2 No. 332:22 for Canada, ANCE NMX-J-738-ANCE for Mexico) or are conducted through self-testing or Nationally Recognized Test Laboratory (NRTL) certifications to meet international standards. However, there are key regional differences. For example, American regulations often require additional crush resistance testing, while many overseas installations demand low halogen content testing to enhance fire safety. These variations reflect the differing priorities and standards across markets.

4. CONDUCTOR SIZES AND STRANDING

Copper stranding in the US is significantly different from other global practices. In the US, American Wire Gauge (AWG) standards determine cable sizes, with specifications based on fixed diameter ranges defined by UL and ASTM requirements. Conversely, most of the world relies on metric stranding, which prioritizes cross-sectional area (measured in mm²) and maximum allowed DCR rather than fixed diameters. While AWG sizes adhere to set diameters and standardized stranding configurations, metric conductors are only required to meet the parameters of cross-sectional area and DCR. Consequently, the number of strands and the diameter of each strand for the same stranding classes can vary significantly between manufacturers.

Southwire CABLETECH SUPPORT™ Services

CABLETECHSUPPORT™ SERVICES

Southwire's CableTechSupport™ Services group includes experts with advanced degrees and certifications in electrical engineering. They fulfill over 15,000 technical requests each year to help end users, engineers, contractors, and installers meet project requirements, gain approvals from project owners or building inspectors, and respond to issues in the field. This team also produces white papers and online calculator tools that provide guidance for selecting products and solutions. Scan the QR code to access the comprehensive technical library.

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5. INSULATING MATERIALS & COMPOUNDS

US and Canadian Materials
In the US and Canada, UL/CSA standards commonly specify materials like PVC, TPE, TPE combined with nylon, EPDM, EPR, CPE , and other thermosets. Among these, most US cable manufacturers favor TPE for both insulation and jacket, often adding a nylon layer to the insulation for EV charging cables.

European Materials
In the EU, IEC and EN standards emphasize Halogen-Free (HF) insulation and jacketing compounds. To handle the demanding conditions EV charging cables face, many manufacturers use XLPE insulation and a PUR/TPU jacket. These HF materials are widely adopted in the EU and suit the growing EV market effectively.

6. CONNECTOR TYPES AVAILABLE IN THE MARKET


SAE J1772

Connector Type For AC Charging (Level 1 & Level 2)
The SAE J1772 (IEC 62196 Type 1) Connector is commonly used in US and Canada for 120V or 240V Single Phase AC Charging.

The IEC 62196 Type 2 Connector is commonly used throughout the EU for 230V Single or 400V Three Phase AC charging.


CCS1

Connector Type For DC Fast Charging
DC Fast Charging (DCFC) stations and compatible vehicles use the Combined Charging System (CCS) plug. The CCS standard was made in cooperation between the SAE and European Automobile Manufacturers Association resulting in two different plug types CCS1 and CCS2. These plugs offer backwards compatibility for vehicles with the AC connectors mentioned above. The CCS1 plug/connector is used in the US, whereas the CCS2 is used in the EU.


NACS

NACS Connector Type For AC and DC Charging
The North American Charging System (NACS) or SAE J3400 Connector can be used for Level 1, Level 2, and DC fast charging. This connector style was developed by one of the largest EV auto manufacturers in North America and will be the main standard used for all major US auto manufacturers going forward. This connector platform will not be used in the EU, at the time of this writing, the EU has decided to stay with the IEC Type 2 & CCS2 Connector standards for all new cars in the market.

7. PUBLIC CHARGING INSTALLATION

In the US and Canada, nearly all charging podiums have an attached charging cable. However, the connector available may not always be compatible with the vehicle. The solution to this is that many people also carry adapters with them, allowing them to use the charging station even if it was not designed for their car's charging plug. Similarly, in the EU, many charging stations also have an attached cable. However, one key difference is that there are many Level 2 public charging stations that do not come with an attached charging cable. In place of an adapter, this requires users to bring their own complete charging cable with them.

8. COLOR CODE

Typical color codes between US & EU for each conductor type are shown below:

US – The power conductors are black and (white or red), the ground conductor is green or green/yellow, and signal conductors are most commonly blue and orange.

EU – The neutral conductor is blue, the power conductors are brown, black, and gray, the ground is green/yellow, and the signal conductor colors vary depending on application requirements.

9. STANDARD PRODUCT OFFERING

Southwire® Southwire manufactures many types of EV charging cables, both standard and custom. Visit the specification library to see the full line of standard products and manufacturing capabilities for these cable types.

10. MADE IN AMERICA

We've got it MADE IN AMERICA™

All raw materials including metals,components, and compounds sourced for wire rawing, conductor stranding, tinning of copper, extrusion, taping, braiding, cabling, jacketing, printing, testing, and the final packaging of EV products, are produced in America. Southwire's EV product offering meets the Build America, Buy America (BABA) requirements and are fully compliant with 49 U.S.C. § 5323(j) regulation.

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