Quality Infrastructure for Electromobility

Charging infrastructure, battery safety and disposal

GPQI

Dialogues for Innovation and Trade

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Text
Global Project Quality Infrastructure

The German Federal Ministry for Economic Affairs and Climate Action (BMWK) has commissioned the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH to implement the Global Project Quality Infrastructure (GPQI).

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About this publication

This publication was developed under the framework of the German-Mexican Dialogue on Quality Infrastructure, established between the German Federal Ministry for Economic Affairs and Climate Action (BMWK) and the Mexican Ministry of Economy. This bilateral dialogue is a platform that brings together representatives from relevant ministries, quality infrastructure institutions, companies as well as industry associations and chambers from both countries to address cooperation topics of mutual interest regarding quality infrastructure.

In the Global Project Quality Infrastructure (GPQI), BMWK engages in technical policy dialogues with important trading partners worldwide. In cooperation with Brazil, China, India, Indonesia and Mexico, the project is implemented with the support of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. This publication is the result of a collaboration since 2019 between stakeholders of the bilateral expert group within the project line 'Strategic cooperation on electromobility: standardisation, certification and technical regulation', which was agreed in the joint work plan of the German-Mexican Dialogue on Quality Infrastructure.

It is the first of four volumes in the series of white papers on quality infrastructure in the field of electromobility. This series will address four priority topics: 1) charging infrastructure and battery safety and disposal; 2) public transport and heavy-duty vehicles; 3) personal and fleet vehicles for passenger transportation; and 4) micromobility (two-wheelers).

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List of abbreviations

AC	**alternating current**
ANCE	**Asociación de Normalización y Certificación A.C.** *Standardisation and Certification Association in Mexico*
BMWK	**Bundesministerium für Wirtschaft und Klimaschutz** *German Federal Ministry for Economic Affairs and Climate Action*
CAP	**Conformity Assessment Procedure**
CB	**Certification Body**
CSA	**Canadian Standards Association**
DC	**direct current**
DIN	**Deutsches Institut für Normung** *German Institute for Standardization*
DKE	**Deutsche Kommission Elektrotechnik** **Elektronik Informationstechnik in DIN und VDE** *German Commission for Electrical, Electronic &* *Information Technologies of DIN and VDE*
EV	**electric vehicles**
EU	**European Union**
EU COM	**European Commission**
EUR	**Euro**
EVS	**Electric vehicle safety**
FMVSS	**Federal Motor Vehicle Safety Standards**
GIZ	**Deutsche Gesellschaft für Internationale Zusammenarbeit**
GTR	**Global technical regulations**
IEC	**International Electrotechnical Commission**
IECEE	**IEC System for Conformity Assessment Schemes** **for Electrotechnical Equipment and Components**
IMNC	**Instituto Mexicano de Normalización y Certificación A.C.** *Mexican Institute of Standardisation and Certification*
ISO	**International Organization for Standardization**
kW	**kilowatt**
LGPGIR	**Ley General para la Prevención y Gestión Integral de los Residuos General** *General Law for the Prevention and Integral Management of Waste*
LEV	**light electric vehicle**

NCB	**National Certification Body**
NOM	**Norma Oficial Mexicana** *Mexican technical regulation*
NMX	**Norma Mexicana** *Mexican Standard*
NHTSA	**National Highway Traffic Safety Administration**
NYCE	**Normalización y Certificación NYCE S.C.** *Conformity Assessment and Standardisation body in Mexico*
OEM	**Original equipment manufacturer**
PRODESEN	**Programa para el Desarrollo del Sistema Eléctrico Nacional** *Mexican Program for the Development of the National Electric System*
QI	**Quality infrastructure**
RESS	**Rechargeable Energy Storage System**
RRF	**Recovery and Resilience Facility**
SAE	**Society of Automotive Engineers**
SEMARNAT	**Secretaría de Medio Ambiente y Recursos Naturales** *Mexican Ministry for the Environment and Natural Resources*
SICT	**Secretaría de Infraestructura, Comunicaciones y Transportes** *Mexican Ministry of Infrastructure, Communications and Transport*
SME(s)	**small and medium-sized enterprise(s)**
UNECE	**United Nations Economic Commission for Europe**
UL	**Underwriters Laboratories**
US	**United States**
VDE	**Verband der Elektrotechnik Elektronik Informationstechnik e.V.** *Association for Electrical, Electronic & Information Technologies*

1. Introduction

For both Germany and Mexico, the automotive industry is one of the most important economic sectors. In Germany it is the largest industrial sector, representing around 20% of total German industry revenue in 2020.[1] Similarly, the automotive industry in Mexico contributes 18.9% of the manufacturing Gross Domestic Product.[2] Both Germany and Mexico are among the top 10 global vehicle producers and exporters.[3]

Influenced and propelled by technological developments and the sustainable development agenda, mobility is undergoing a transformation towards new trends such as electromobility, which has grown continuously at a global level for several years. In contrast to the 16% contraction of the global automobile market in 2020 owing to the Covid-19 pandemic, global sales of electric vehicles (EVs) increased by 41%, reaching 3 million vehicles.[4] In the same year in Europe, new electric car registrations more than doubled to 1.4 million, overtaking China as the world's largest buyer of EVs.[5] In Mexico, sales of hybrid and EVs almost doubled compared to the previous year, reaching more than 43,000 in 2021.[6]

Although these numbers show a positive trend, expansion of the charging infrastructure is fundamental to a further acceleration of the development of electromobility across different vehicle segments, such as passenger cars, heavy-duty and light-duty vehicles. Thus, it is also important to consider differences in the characteristics and requirements of the charging infrastructure in line with the type of vehicle for which it is intended.

At the international level, there are several examples of countries and regions that have implemented relevant policies and strategies to support the expansion of charging infrastructure, including the European Union (EU) and the United States (US), which are top trading partners for Mexico. As part of the European Green Deal,[7] for instance, the EU aims to make available one million public charging and refuelling stations by 2025. To support this deployment, the long-term EU budget 2021-2027 provided EUR 503 billion to the European Green Deal Investment Plan.[8] Additionally, the Recovery and Resilience Facility (RRF) programme was created as part of NextGenerationEU, the temporary recovery instrument. The RRF program will provide EUR 338 billion in the form of grants and EUR 385.5 billion in loans as financial support to public investment in different areas.[9] These areas include sustainable transport and charging stations. For its part, an example of public measures in the United States is Public Law 117-58[10] – also known as the Infrastructure Investment and Jobs Act – which appropriated an investment of USD 7.5 billion in EV charging.[11]

Electric vehicle tail light. © InstaWalli/Pexels

As EV sales continue to grow and technologies advance, guaranteeing product quality and safety throughout the entire value chain is fundamental to boosting the development of electromobility in emerging markets such as Mexico. The system that ensures safe, high-quality products and services put to market is known as quality infrastructure (QI). Its six pillars are technical regulations, standardisation, conformity assessment, accreditation, metrology and market surveillance.

In addition, an internationally harmonised QI facilitates trade and helps companies to remain competitive and be part of global value chains. International trade is smoother when technical and legal requirements that must be complied with are concordant between countries. Standards developed at the international level create a common language by integrating the knowledge and experience of expert stakeholders from all around the world. Complying with internationally harmonised standards is particularly beneficial for small and medium-sized enterprises (SMEs) seeking to expand sales to foreign markets. Around 99% of Mexican businesses are SMEs. Their global competitiveness is therefore improved by a national QI that is harmonised at the international level and which proves product compliance. In addition, by internationally recognising accreditation, trust in conformity assessment is increased, thus eliminating the need for double testing or certification.

A robust and internationally harmonised QI system is essential if the automotive sector is to maintain its global relevance, competitiveness and achieve a successful transition to electromobility. Although all six pillars of QI are fundamental for the system to function efficiently and guarantee both product safety and quality, this white paper focuses on technical regulation, standardisation and conformity assessment. In this regard, the scope and aspects covered by this publication were discussed and agreed within the bilateral expert group involved in this project line.

Figure 1: The pillars of QI

2. Scope

This first volume in the series of white papers in the field of electromobility focuses on charging infrastructure and battery safety and disposal. The **objectives** of this white paper are to:

- present (in a non-exhaustive manner) standards, technical regulations and conformity assessment schemes for EV charging infrastructure and battery safety and disposal in Mexico, Germany, the European Union, the United States and at the international level, deemed as relevant by the bilateral expert group;
- identify opportunities to harmonise Mexican standards, technical regulations and conformity assessment procedures with international standards and conformity assessment schemes, with a view to promoting competitiveness and innovation in the field of electromobility in Mexico;
- offer joint recommendations for the adoption of internationally harmonised standards, technical regulations and conformity assessment schemes in Mexico.

EV charging infrastructure. © PhonlamaiPhoto/iStock

For the purposes of this white paper, **charging infrastructure** is understood as the set of technical means, services, facilities and spaces necessary to provide electrical energy to an EV that is connected to the supply network. The term **EV battery** refers to the 'rechargeable system that stores energy for delivery of electric energy for the electric drive'.[12] **Safety** shall be understood as 'freedom from risk which is not tolerable'[13] and **disposal** means 'any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy'.[14]

3. Technical regulations

A quality infrastructure framework is fundamental to safeguarding people, health and the environment, among other legitimate objectives of public interest. As part of the QI system, technical regulations set essential public interest protection goals by laying down characteristics for products, processes, production methods or services, including the applicable administrative provisions with which compliance is mandatory.[15] In this way, product safety and quality are ensured.

3.1 Mexico

In Mexico, the **Quality Infrastructure Law** prescribes how its QI system is organised and implemented, as well as the roles and responsibilities of stakeholders. In compliance with this law, Mexican regulatory authorities are obliged to foster an adequate quality infrastructure, including development of Mexican technical regulations (Norma Oficial Mexicana – NOM) in their respective fields of competence. In the case of electromobility, the competent regulatory authorities are the Ministry of Economy (Secretaría de Economía), the Ministry of Energy (Secretaría de Energía – SENER), the Ministry of Infrastructure, Communications and Transports (Secretaría de Infraestructura, Comunicaciones y Transportes – SICT) and the Ministry for the Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales – SEMARNAT).

As electromobility is at an early stage in the Mexican market, there are currently no NOMs specifically concerning EV charging infrastructure and batteries. Thus, it is deemed necessary to develop the regulatory framework that establishes minimum requirements for these core elements of this type of mobility. That way, both user and electricity grid protection can be ensured through safe and high-quality products.

With regard to EV charging infrastructure, the technical regulation NOM-001-SEDE-2012[16] establishes the technical specifications and guidelines that must be met by electrical installations to be safe for people and their property. This NOM considers EV charging equipment in its article 625. It covers the electrical conductors and external electrical equipment which serve to connect the EV to an electricity supply by conductive or inductive means. It also establishes provisions for the installation of equipment and devices relating to the charging of EVs.

In the case of batteries, there are environmental regulations in place for their management at the end of their life cycle, such as the General Law for the Prevention and Integral Management of Waste (LGPGIR).[17] Additionally, NOM-052-SEMARNAT-2005[18] establishes characteristics, identification processes, classification and a listing of hazardous waste. Under their general scope, these regulations are also applicable to batteries for electromobility systems, even though they do not mention them explicitly. Other legal efforts aimed at reducing the environmental impact of EVs include the draft decree of the Circular Economy Law – approved by the Mexican Senate on 18 November 2021[19] and currently in line to be reviewed by the Chamber of Deputies.

3.2 International

With the increasingly rapid growth of electromobility worldwide, several countries have already developed a national regulatory framework in this field. The examples of **Germany**, the **EU** and **United States** are chosen as references because of the context in which this white paper was developed and their role as major trading partners for Mexico.

At the international level, however, there exists the **United Nations 1998 Agreement on Global Technical Regulations for Wheeled Vehicles, Equipment and Parts**.[20] The framework for this agreement is the **World Forum for Harmonisa-**

tion of Vehicle Regulations (WP.29) under the **United Nations Economic Commission for Europe (UNECE)**.[21] As part of UNECE, the World Forum provides a unique multilateral platform for the harmonisation or development of international technical regulations for vehicles. In particular, the purpose of the UN 1998 Agreement is to establish a global process to jointly develop **global technical regulations (GTR)** 'ensuring high levels of safety, environmental protection, energy efficiency and anti-theft performance of wheeled vehicles, equipment and parts', as well as reducing technical barriers to trade through the harmonisation of existing technical regulations for wheeled vehicles.

With regard to EVs, the **Global Technical Regulation No. 20** on Electric Vehicle Safety (EVS)[22] – ECE /TRANS/180/add.20 – was established on 14 March 2018. This regulation specifies the safety-related performance of electrically propelled road vehicles and their rechargeable electric energy storage systems.

Germany/European Union

With regard to charging infrastructure, **European Directive 2014/94/EU** establishes 'measures for the deployment of alternative fuels infrastructure in the Union'. It sets out 'minimum requirements for the building-up of alternative fuels infrastructure, including recharging points for electric vehicles', among other refuelling points, as well as 'common technical specifications for such recharging and refuelling points and user information requirements'. For instance, this Directive establishes the **labelling requirements** for both the charging infrastructure and EVs. It also provides **technical specifications** for charging points, taking into consideration the socket outlets and plugs that will be equipped for interoperability purposes, referencing the European standards EN 62196-2 and EN 62196-3, both equivalent to the international standards IEC 62196-2:2016 and IEC 62196-3:2014 respectively. A proposal for a regulation of the European Parliament and of the Council on the deployment of alternative fuels infrastructure is currently under development.[24] It will repeal Directive 2014/94/EU of the European Parliament and of the Council.

With regard to batteries, **Regulation No. 100** of the Economic Commission for Europe of the United Nations (UNECE)[25] stipulates specific requirements for safe **electric powertrains**, necessary for the vehicle type approval. These include the requirements of a vehicle and of a **Rechargeable Energy Storage System (RESS)**. It also describes RESS **test methods** to verify safety performance under conditions that may arise during a vehicle crash.

A proposal from the European Commission (EU COM) for a **new regulation concerning batteries and waste**[26] was published on 10 December 2020. This regulation is set to repeal Directive 2006/66/EC[27] on batteries and accumulators and waste batteries and accumulators and amend Regulation EU No 2019/1020[28] on market surveillance and compliance of products. This follows EU COM's interest in setting requirements for the sustainability and safety of the batteries, including those for EVs. Relevant aspects considered in the regulation include, but are not limited to, requirements of sustainability and safety, labelling and information, and supply chain due diligence. In addition, measures for the end-of-life management of batteries are set out. According to a briefing from the European Parliament on the 'New EU regulatory framework for batteries',[29] published in July 2021, the legal process for the development of this regulation is still in progress.

United States

Concerning EV charging infrastructure, **Public Law No. 114-94**[30] directed the US Department of Transport to designate national corridors for EVs and alternative fuels. This law aims to identify the need for electric vehicle charging and other fuelling infrastructures (hydrogen, propane, natural gas, etc.) at strategic locations along major national highways.

In **Title 16 of the Code of Federal Registrations, Part 309**[31] establishes **labelling requirements** for non-liquid alternative vehicle fuels, and for certain vehicles powered in whole or in part by alternative fuels, including electric vehicles. According to this regulation, information that must be disclosed includes: kilowatt (kW) capacity, voltage, type of current (alternating current (AC) or direct current (DC)), electric current limits and charging mode (conductive or inductive).

Federal Motor Vehicle Safety Standards (FMVSS) is another regulatory scheme which aims to prevent and reduce vehicle crashes. **FMVSS No. 35** 'Electric-powered vehicles: Electrolyte spillage and electrical shock protection'[32] sets down electrical safety requirements harmonised with GTR No. 13, 'Hydrogen and fuel cell vehicles,' among other sources.

4. Standards

Similar to technical regulations, standards provide, 'for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods' . Generally, they are developed by consensus among international experts and their compliance is voluntary. However, they may become mandatory if referenced directly in a technical regulation. They ensure certain levels of uniformity and consistency through the use of a common technical language, as well as compatibility, quality and safety criteria. This helps to build trust among market participants and reduce transaction costs. Standards also support innovation by spreading best practices and state-of-the-art procedures.

4.1 Mexico

In Mexico, the national standardisation bodies with competence to develop technical documents of voluntary compliance, known as NMX, in the automotive field are **ANCE** (Asociación de Normalización y Certificación A.C.), **IMNC** (Instituto Mexicano de Normalización y Certificación, A.C.) and **NYCE** (Normalización y Certificación NYCE, S.C.).

A series of NMX for EVs covers technical specifications for several components, including personnel protection systems and supply equipment. The relevant NMX that were identified by the bilateral expert group are listed below.

Table 1: Mexican standards applicable to charging infrastructure and batteries for EVs

Theme	Mexican Standard	Concordance with international standards
	Charging Infrastructure	
Personnel protection systems for supply circuits	NMX-J-668/1-ANCE-2013 Electric Vehicles (EV) – Personnel protection systems for supply circuits – Part 1: General requirements	Non concordant with international standards. It is harmonised regionally with standards from the United States (UL 2231-1) and Canada (CSA C22.2 No. 281.1), developed within the Council for Harmonization of Electrotechnical Standards of the Nations in the Americas.
	NMX-J-668/2-ANCE-2013 Electric Vehicles (EV) – Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits – Part 2: Particular Requirements for Protection Devices for Use in Charging Systems	Non concordant with international standards. It is harmonised regionally with standards from the United States (UL 2231-2) and Canada (CSA C22.2 No. 281.2), developed within the Council for Harmonization of Electrotechnical Standards of the Nations in the Americas.

Theme	Mexican Standard	Concordance with international standards
	Charging Infrastructure	
Supply equipment	NMX-J-677-ANCE-2020 Electric Vehicles – Supply equipment	Non concordant with international standards. It is harmonised regionally with standards from the United States (UL 2594) and Canada (CSA C22.2 No. 280), developed within the Council for Harmonization of Electrotechnical Standards of the Nations in the Americas.
Plugs, socket outlets and couplers	NMX-J-678-ANCE-2020 Electric vehicle – Plugs, socket outlets and couplers	Non concordant with international standards. It is harmonised regionally with standards from the United States (UL 2251) and Canada (CSA C22.2 No. 282), developed within the Council for Harmonization of Electrotechnical Standards of the Nations in the Americas.
	NMX-J-683-1-ANCE-2020 Electric vehicle – Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements	Modified concordance with international standard IEC 62196-1 Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements, ed3.0 (2014-06). (Note on status: updated to ed 4.0 in May 2022) Deviation from international standard is due to adjustments in the operating or test frequency at 60 Hz, which is used in Mexico, as well as in the designation of the conductor size according to local technical regulations (NOM). Also due to substitutions of references to international standards for local standards (NMX).

Theme	Mexican Standard	Concordance with international standards
	Charging Infrastructure	
Plugs, socket outlets and couplers	NMX-J-683-2-ANCE-2020 Electric vehicles – Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 2: Dimensional compatibility and interchangeability require-ments for AC pin and con-tact-tube accessories	Modified concordance with international standard IEC 62196-2 Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 2: Dimen-sional compatibility and in-ter-changeability requirements for AC pin and contact-tube accessories, ed2.0 (2016-02). Deviation from international standard is due to adjustments in the operating or test frequen-cy at 60 Hz and volt-age used in Mexico, as well as in the desig-nation of the conductor size according to local technical regula-tions (NOM). Also due to substitu-tions of references to international standards for local standards (NMX).
	NMX-J-683-3-ANCE-2020 Electric vehicles – Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3: Dimensional compatibility and interchangeability require-ments for DC and AC/DC pin and contact- tube vehicle couplers	Modified concordance with international standard IEC 62196-3 Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3: Dimensional compatibility and interchangeability require-ments for DC and AC/DC pin and contact-tube vehicle couplers, ed1.0 (2014-06). Deviation from international standard is due to adjustments in the operating or test frequen-cy at 60 Hz, which is used in Mexico. Also due to substitutions of references to international standards for local standards (NMX).

Theme	Mexican Standard	Concordance with international standards
	Charging Infrastructure	
Electric vehicle conductive charging system	NMX-J-684-1-ANCE-2021 Electric vehicle conductive charging system – Part 1: General requirements	Modified concordance with international standard IEC 61851-1 Electric vehicle conductive charging system – Part 1: General requirements, ed3.0 (2017-02). Deviation from international standard is due to adjustments in the operating or test frequency at 60 Hz, which is used in Mexico. Also due to substitutions of references to international standards for local standards (NMX) and the use of standard voltages for Mexico.
Electric vehicles – inductive charging systems	NMX-J-725-1-ANCE-2016 Electric vehicles – Inductive charging systems – Part 1: General requirements	Modified concordance with international standard IEC 61980-1, Electric vehicle wireless power transfer (WPT) systems – Part 1: General requirements, ed1.0 (2015-07). (Note on status: updated to ed 2.0 in November 2020) Deviation from international standard is due to adjustments in the operating or test frequency at 60 Hz, which is used in Mexico. Also due to substitutions of references to international standards for local standards (NMX).
Cybersecurity	NMX-I-27032-NYCE-2018 Information Technologies – security techniques – Guidelines for cybersecurity	Identical to ISO/IEC 27032:2012 Information technology – Security techniques – Guidelines for cybersecurity
	Battery	
	No local standards for EV batteries were identified.	

The following NMX is also currently applicable to EV charging infrastructure. However, in 2017 the IEC withdrew the international standard with which the NMX has modified concordance. Thus, it should be noted that withdrawal of this NMX could be expected in the near future.

Table 2: Mexican standard applicable to charging infrastructure for EVs that is expected to be withdrawn

Theme	Mexican Standard	Concordance with international standards
	Charging Infrastructure	
Electric vehicle conductive charging system	NMX-J-684/22-ANCE-2014 Electric vehicle conductive charging system – Part 22: AC charging station for electric vehicles (Note on status: Due to the withdrawal of IEC 61851-22 in 2017, the withdrawal of this NMX could be expected for the next revision of this standard no later than 2024.	Modified concordance with international standard IEC 61851-22, Electric vehicle conductive charging system – Part 22: AC electric vehicle charging station, ed1.0 (2001-05). (Note on status: withdrawn in 2017. All requirements of this standard were moved to IEC 61851-1:2017 ED3.) Deviation from international standard is due to adjustments in the operating or test frequency at 60 Hz, which is used in Mexico. Also due to substitutions of references to international standards for local standards (NMX) and the use of standard voltages for Mexico.

4.2 International

At the international level, the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC) are two leading standardisation organisations which have published several standards in the field of electromobility. The standards that were identified as most relevant in terms of the scope of this white paper are listed below.

Table 3: Identified international standards applicable to charging infrastructure and batteries for EVs

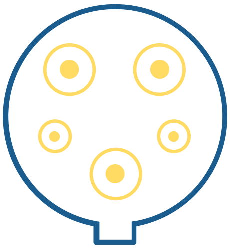
Theme	International standard
	Charging Infrastructure
Communication protocols	ISO/IEC 15118 series – Road vehicles – Vehicle to grid communication interface • ISO 15118-1:2019 Part 1: General information and use case definition • ISO 15118-2:2014 Part 2: Network and application protocol requirements • ISO 15118-3:2015 Part 3: Physical and data link layer requirements • ISO 15118-4:2018 Part 4: Network and application protocol conformance test • ISO 15118-5:2018 Part 5: Physical and data link layer conformance tests • ISO 15118-8:2020 Part 8: Physical layer and data link layer requirements for wireless communication • ISO 15118-20:2022 Part 20: Network and application protocol requirements
	IEC 61850 series – Communication networks and systems for power utility automation
Cybersecurity	ISO/IEC 27000:2018 Information technology – Security techniques – Information security management systems
	ISO/SAE 21434:2021 Road vehicles – Cybersecurity engineering
Electrical installations	IEC 60364-7-722:2018 RLV Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supplies for electric vehicles
Electric vehicle conductive charging system	IEC 61851 series – Electric vehicle conductive charging system • IEC 61851-1:2017 Part 1: General requirements • IEC 61851-24:2014 Part 24: Digital communication between a DC EV charging station and an electric vehicle for control of DC charging.

Theme	International standard
	Charging Infrastructure
Information exchange for electric vehicle charging roaming service	IEC 63119-1:2019 Information exchange for electric vehicle charging roaming service – Part 1: General. IEC 63119-2 (first edition) Information exchange for Electric Vehicle charging roaming service – Part 2: Use cases. Note on current status: Preparation of report of voting on committee draft for vote. The publication date is forecast for February 2023.
Plugs, socket outlets, vehicle connectors and inlets	IEC 62196 series – Plugs, socket outlets, vehicle connect-ors and vehicle inlets – Conductive charging of electric ve-hicles • IEC 62196-2:2016 Part 2: Dimensional compatibility and interchangeability requirements for AC pin and contact-tube accessories • IEC 62196-3:2014 Part 3: Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers
Protection against electric shock	IEC 61140:2016 Protection against electric shock – Common aspects for installation and equipment
Protocol for Management of Electric Vehicles charging and discharging infrastructures	IEC 63110 series (under development) – Protocol for Management of Electric Vehicles charging and discharging infrastructures: • IEC 63110-1 (first edition) Part 1: Basic Definitions, Use Cases and architectures. • IEC 63110-2 (first edition) Part 2: Technical protocol specifications and requirements. • IEC 63110-3 (first edition) Part 3: Requirements for conformance tests.
	Battery
Batteries and high-voltage systems	ISO 6469-1:2019 – Part 1: Rechargeable energy storage system (RESS)
Environmental conditions and testing for electrical and electronic equipment	ISO 16750 series – Road vehicles – Environmental conditions and testing for electrical and electronic equipment • ISO 16750 -1:2018 Part 1: General • ISO 16750-2:2012 Part 2: Electrical loads • ISO 16750-3:2012 Part 3: Mechanical loads • ISO 16750-4:2010 Part 4: Climatic loads

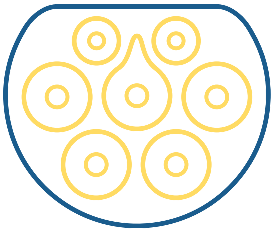
Theme	International standard
	Battery
Electric propulsion components	ISO 21498 series - Electrically propelled road vehicles – Electrical specifications and tests for voltage class B systems and components • ISO 21498-1:2021 Part 1: Voltage sub-classes and characteristics • ISO 21498-2:2021 Part 2: Electrical tests for components ISO 21782 series Electrically propelled road vehicles — Test specification for electric propulsion components
Environmental testing	IEC 60068-2-30:2005 Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
	IEC 60068-2-47:2005 Environmental testing – Part 2-47: Test – Mounting of specimens for vibration, impact and similar dynamic tests
	IEC 60068-2-64:2008/AMD1:2019 Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance
EV battery disposal	No international standards for the disposal of EV batteries were identified
Lithium-ion battery packs and systems	ISO 12405-4:2018 Electrically propelled road vehicles – Test specification for lithium-ion traction battery packs and systems – Part 4: Performance testing
Secondary batteries testing	IEC 61982:2012 Secondary batteries (except lithium) for the propulsion of electric road vehicles – Performance and endurance tests
Secondary lithium-ion cells	IEC 62660-1:2018 RLV Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 1: Performance testing
	IEC 62660-2:2018 RLV Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 2: Reliability and abuse testing
	IEC 62660-3:2022 RLV Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 3: Safety

Figure 2: Types of EV connectors, charging modes and current type according to IEC 62196

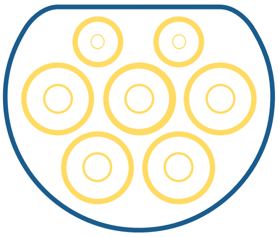
IEC 62196 / Plugs, socket -outlets, vehicle connectors and vehicle inlets



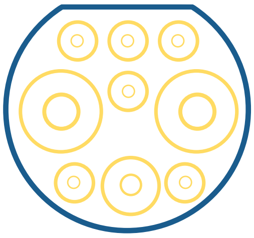
Type 1 connector (SAE J1772)
Charging mode: AC
Used in: United States



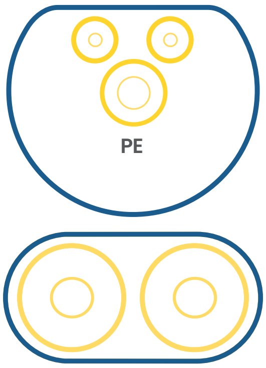
Type 2
Charging mode: AC
Used in: European Union



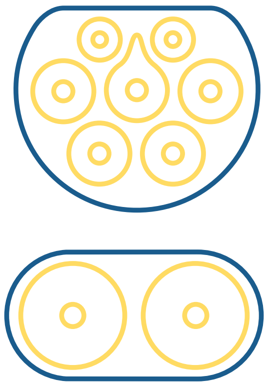
GB/T mode 2
Charging mode: AC
Used in: China



GB/T mode 4
Charging mode: DC
Used in: China



Type 2 Combined Charging System connector (CCS 1)
Charging mode: DC
Used in: United States



CCS 2
Charging mode: DC
Used in: European Union

Germany/European Union

Based on the principles of the EU harmonisation legislation, numerous European and German standards are based on international standards. In Germany, the national standardisation bodies are the **German Institute for Standardization (DIN)** and the **German Commission for Electrical, Electronic & Information Technologies of DIN and VDE (DKE)**. In that sense, the following table displays a comparative overview of harmonised German standards based on the international standards listed above.

Table 4: Internationally harmonised German standards applicable to charging infrastructure and batteries for EVs

Theme	International Standard	Harmonised German / European standard
	Charging infrastructure	
Communication pro-tocols	ISO/IEC 15118 Road vehicles – Vehicle to grid communication interface	DIN EN ISO 15118-1:2019-08 Road vehicles – Vehicle to grid communication interface
	IEC 61850 series – Communication networks and systems for power utility automation	DIN EN 61850 series – Communication networks and systems for power utility automation
Cybersecurity	ISO/IEC 27000:2018 Information technology – Security techniques – Information security management systems	DIN EN ISO/IEC 27000:2020-06 Information technology – Security techniques – Information security management systems
Electrical installtions	IEC 60364-7-722 Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supplies for electric vehicles	DIN VDE 0100-722:2019-06 Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supplies for electric vehicles
Electric vehicle conductive charging system	IEC 61851-1:2017 Electric vehicle conductive charging system – Part 1: General requirements	DIN EN IEC 61851-1 Berichtigung 1:2021-06 VDE 0122-1 Berichtigung 1:2021-06 Electric vehicle conductive charging system – Part 1: General requirements
	IEC 61851-24:2014 Electric vehicle conductive charging system – Part 24: Digital communication between a DC EV charging station and an electric vehicle for control of DC charging. Note on current status: preparation of the report on the committee voting of the draft. The publication date of edition 2.0 is forecast for 10 January 2023.	DIN EN 61851-24:2014-11 VDE 0122-2-4:2014-11 Electric vehicle conductive charging system – Part 24: Digital communication between a DC EV charging station and an electric vehicle for control of DC charging. Note on current status: in force. DIN EN 61851-24:2017-04 - Draft VDE 0122-2-4:2017-04 Electric vehi-cle conductive charging system – Part 24: Digital communication be-tween a DC EV charging station and an electric vehicle for control of DC charging Note on current status: draft of up-dated standard.

Theme	International Standard	Harmonised German / European standard
	Charging infrastructure	
Information exchange for electric vehicle charging roaming service	IEC 63119-1:2019 Information exchange for electric vehicle charging roaming service – Part 1: General.	DIN EN IEC 63119-1:2020-03 VDE 0122-19-1:2020-03 Information exchange for electric vehicle charging roaming service – Part 1: General (IEC 63119-1:2019).
	IEC 63119-2 (first edition) Information exchange for Electric Vehicle charging roaming service – Part 2: Use cases Note on current status: preparation of the report on the committee voting of the draft. The publication date of edition 2.0 is forecast for February 2023.	DIN EN IEC 63119-2:2021-08 - Draft VDE 0122-19-2:2021-08 Information exchange for Electric Vehicle charging roaming service – Part 2: Use cases Note on current status: draft.
Plugs, socket outlets, vehicle connectors and vehicle inlets	IEC 62196-2:2016 Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 2: Dimensional compatibility and interchangeability requirements for AC pin and contact-tube accessories Note on current status: preparation of the report on the voting of the international standard final draft. The publication date is forecast for 20 May 2022.	DIN EN 62196-2:2017-11 VDE 0623-5-2:2017-11 Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 2: Dimen-sional compatibility and interchange-ability requirements for AC pin and contact-tube accessories Note on current status: in force. DIN EN IEC 62196-2:2020-02 - Draft VDE 0623-5-2:2020-02 Plugs, socket outlets, vehicle connectors and vehi-cle inlets – Conductive charging of electric vehicles – Part 2: Dimen-sional compatibility and interchange-ability requirements for AC pin and contact-tube accessories Note on current status: draft of up-dated standard.

Theme	International Standard	Harmonised German / European standard
	Charging infrastructure	
Plugs, socket outlets, vehicle connectors and vehicle inlets	IEC 62196-3:2014 Plugs, socket outlets, vehicle connectors and vehicle inlets – Conductive char-ging of electric vehicles – Part 3: Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and con-tact-tube vehicle couplers Note on current status: prepara-tion of the report on the voting of the international standard final draft. The publication date is forecast for 20 May 2022.	DIN EN 62196-3:2015-05 VDE 0623-5-3:2015-05 Plugs, so-cket outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3: Dimensional compa-tibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers Note on current status: in force.
		DIN EN IEC 62196-3:2020-03 - Draft VDE 0623-5-3:2020-03 Note on current status: draft of updated standard.
Protection against electric shock	IEC 61140:2016 Protection against electric shock – Common aspects for installation and equipment	DIN EN 61140:2016-11 Protection against electric shock – Common aspects for installation and equipment
Protocol for Management of Electric Vehicles charging and discharging infrastructures	Project IEC 63110-1 (first edition) Protocol for management of elec-tric vehicles charging and dis-charging infrastructures – Part 1: Basic definitions, use cases and architectures	DIN EN 63110-1:2019-02 - Draft VDE 0122-110-1:2019-02 Protocol for Management of Electric Vehicles charging and discharging infrastructures – Part 1: Basic definitions, use cases and architectures
	Battery	
Environmental testing	IEC 60068-2-30:2005 Environ-mental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)	DIN EN 60068-2-30:2006-06 Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
	IEC 60068-2-47:2005 Environ-mental testing – Part 2-47: Test – Mounting of specimens for vibra-tion, impact and similar dynamic tests	DIN EN 60068-2-47:2006-03 Environmental testing – Part 2-47: Test – Mounting of specimens for vibration, impact, and similar dynamic tests
	IEC 60068-2-64:2008/AMD1:2019 Environ-mental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance	DIN EN 60068-2-64:2020-09 VDE 0468-2-64:2020-09 Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance

Theme	International Standard	Harmonised German / European standard
	Battery	
Secondary batteries testing	IEC 61982:2012 Secondary batteries (except lithium) for the propulsion of electric road vehicles – Performance and endurance tests	DIN EN 61982:2013-04 VDE 0510-32:2013-04 Secondary batteries (except lithium) for the propulsion of electric road vehicles – Performance and endurance tests
Secondary lithium-ion cells	IEC 62660-1:2018 Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 1: Performance testing	DIN EN IEC 62660-1:2020-07 VDE 0510-33:2020-07 Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 1: Performance testing
	IEC 62660-2:2018 Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 2: Reliability and abuse testing	DIN EN IEC 62660-2:2020-07 VDE 0510-34:2020-07 Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 2: Reliability and abuse testing
	IEC 62660-3:2016 Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 3: Safety requirements	DIN EN IEC 62660-3:2021-08 - Draft VDE 0510-49:2021-08 Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 3: Safety requirements

Another European standard considered as relevant, but which does not have international equivalence, is the following:

Table 5: German/European standard applicable to charging infrastructure for EVs

Theme	German / European standard
	Charging infrastructure
Consumer information	DIN EN 17186:2019-10 Identification of vehicles and infrastructures compatibility – Graphical expression for consumer information on EV power supply.

United States

In the United States, the **Society of Automotive Engineers (SAE) International** and **Underwriters Laboratories (UL)** are two standardisation bodies that develop voluntary standards used for industries such as the automotive. The following standards used in the US were selected as relevant references:

Table 6: US standards applicable to charging infrastructure and batteries for EVs

Theme	US standard
	Charging infrastructure
Communication protocols	SAE J2847/2_201504 Communication Between Plug-In Vehicles and Off-Board DC Chargers SAE J2931/1_201412 Protection requirements for digital communication between equipment
Personnel Protection Systems	UL 2231-1 Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Require-ments UL 2231-2 Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Require-ments for Protection Devices for Use in Charging Systems
Plugs and couplers	SAE J1772_201710 Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler SAE J3068_201804 Electric Vehicle Power Transfer System Using a Three-Phase Capable Coupler UL 2251 Standard for Plugs, Receptacles, and Couplers for Electric Vehicles
Supply equipment	UL 2594 Standard for Electric Vehicle Supply Equipment
	Battery
Disposal	No standards were identified
Performance of modules	SAE J1798_201911 Recommended Practice for Performance Rating of Electric Vehicle Battery Modules
Requirements for electrical energy storage assemblies	UL 2580 Batteries for Use in Electric Vehicles
Safety criteria for a lithium-based rechargeable battery system	SAE J2929_201302 Safety Standard for Electric and Hybrid Vehicle Propulsion Battery Systems Utilizing Lithium-based Rechargeable Cells
Testing	SAE J1766_201401 Recommended Practice for Electric, Fuel Cell and Hybrid Electric Vehicle Crash Integrity Testing

Additional UL standards for EVs that were not reviewed in detail for this publication, but which are relevant to note, are the following:

Table 7: Additional identified UL standards applicable to charging infrastructure and batteries for EVs

Theme	US standard
	Charging infrastructure
Charging system equipment	UL 2202 Standard for Electric Vehicle (EV) Charging System Equipment
	UL 9741 Outline for Bidirectional Electric Vehicle (EV) Charging System Equipment
Power supply	UL 2747 Outline for Electric Vehicle Power Supplies
Cable	UL 2263 Electric Vehicle Cable
Wireless power transfer	UL 2750 Outline of Investigation for Wireless Power Transfer Equipment for Electric Vehicles
Service and production chargers	UL 2871 Outline for Electric Vehicle (EV) Service and Production Chargers
	Battery
Repurposing batteries	UL 1974 Standard for Evaluation for Repurposing Batteries
Electrical energy storage assemblies (EESAs) and subassembly/modules	UL 2271 Standard for Batteries for Use In Light Electric Vehicle (LEV) Applications
	UL 2580 Standard for Batteries for Use In Electric Vehicles

5. Conformity assessment procedures

Conformity assessment procedures (CAPs) consist of a set of actions 'used, directly or indirectly, to determine that the relevant requirements in technical regulations or standards are fulfilled'. [34] These procedures include sampling, testing and inspection, evaluation, verification and assurance of conformity, as well as approval, among others.

Connecting to EV charging infrastructure. © kckate16/iStock

5.1 Mexico

In Mexico, CAPs are defined within the NOMs and NMX. As there are no Mexican technical regulations specifically for charging infrastructure or batteries for electric vehicles, there are no national mandatory CAPs for these products. As for the NMX listed previously in this paper, each of those standards outline their corresponding CAP.

5.2 International

Harmonised CAPs help to reduce trade barriers, as they increase reliability and objectivity with regard to the safety and quality of products and services. Thus, the acceptance of foreign conformity assessment results and certificates can be increased, helping to reduce costs and facilitating international trade. Conformity assessment standards and guides developed by ISO and IEC are an example of the efforts being made to promote the harmonisation of CAPs.

The IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components (IECEE) Certification Body (CB) Scheme is a multilateral agreement between member countries and certification organisations 'for mutual acceptance of test reports and certificates dealing with the safety of electrical and electronic components, equipment and products'. [35] Through the **IECEE CB Scheme**, products can be certified only once by an accepted National Certification Body (NCB) for test results to be internationally accepted by others without the need for additional assessments. In the field of electromobility, the IECEE programme 'covers the testing and certification for safety and performance of batteries and charging stations'.

Germany/European Union

In the case of the EU, the corresponding procedures according to the conformity assessment modules are determined by the applicable legislation.

For the automotive field, there exists '**Regulation (EU) 2018/858** on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles'.[36] This regulation establishes 'the administrative provisions and technical requirements for the type-approval and placing on the market of all new vehicles, systems, components and separate technical units'.[37] It also lays down provisions for the placing on the market and the entry into service of parts and motor vehicles intended to be used on public roads, among other requirements.

As for batteries, the proposal from EU COM for a new regulation concerning batteries and waste contains the rules on the conformity assessment of batteries and their CAP.[38]

United States

In the United States, motor vehicles and vehicle equipment manufactured for sale in the US must be certified to comply with applicable **Federal Motor Vehicle Safety Standards (FMVSS).** For motor vehicles and motor vehicle equipment sold in the US, the manufacturer is required to carry out a **'self-certification'** to certify the compliant vehicle or equipment according to the corresponding FMVSS.[39] Original equipment manufacturers (OEMs) who have facilities with the necessary capabilities can carry out self-certifications on their own. Otherwise, they may hire national or foreign third-party conformity assessment bodies, such as laboratories or proving grounds, to obtain the corresponding certificates and test results which prove compliance with regulations. OEMs must submit to the National Highway Traffic Safety Administration (NHTSA) the required documentation in a certificate issued by the OEM or other conformity assessment bodies to indicate that their motor vehicles and/or items of motor vehicle equipment are in full compliance with all federal laws, standards and regulations pertinent to vehicle safety and consumer information.

6. Recommendations

The technical regulations and standards presented in the previous sections of this paper offer international best practices from a QI perspective in the electromobility field. As electromobility continues to develop and evolve worldwide, the harmonisation of regulatory and standardisation frameworks is imperative in order to maintain competitiveness and participation throughout global value chains. Mexico has the opportunity to cooperate early on internationally harmonised approaches and to achieve a successful transition into electromobility, guaranteeing a level playing field with safe and high-quality products.

In this regard, the following table shows the regulatory and standardisation requirements in Mexico – for key aspects of charging infrastructure and batteries for EVs – that were identified by the bilateral expert group.

Table 7: Regulatory and standardisation requirements for EV charging infrastructure and batteries identified by the expert group

	Charging infrastructure
Regulatory requirements	1. Electrical safety of chargers and electric grid installations with regard to: • electromagnetic compatibility and power quality between the charging technologies and power supply systems (e.g. voltage and electrical current harmonics, fluctuations of power, protection schemes at distribution level).
	2. Communication protocol between charging infrastructure and vehicle with regard to: • charge control unit for controlling and monitoring the charging process of an EV.
	3. Labelling with information for consumers (e.g. type of connectors available, nominal voltage and current) and instructions on use of the infrastructure for consumers.
Standardisation requirements	1. Classification of the type of electric vehicle charging technology, its use and safety criteria.
	2. Type of plugs available depending on the type of charge to guarantee interoperability.
	3. Pantograph charging for the implementation of fast charging.
	4. Cybersecurity to protect the software of the infrastructure and data it obtains from users and vehicles.

Battery	
Regulatory requirements	1. Safety and protection of electric drivetrain (traction motors, power electronics and battery) to guarantee protection of the user, including: • devices or controls for thermal runaway to avoid overheating; • electrolyte containment to avoid acid spills.
	2. Recycling of components to comply with circular economy principles.
	3. Testing methods to maintain reliability and prevent failures.

Based on the aforementioned regulatory and standardisation requirements, the following **recommendations** are ordered according to the priority with which they should be addressed. Firstly, it is recommended that **NOMs** are developed for the aspects listed below:

Charging infrastructure

1. Minimum requirements for the **stable supply of current** without voltage spikes, as well as for the integrity of the electric grid. **IEC 60364-7-722** can be used as a reference. A reliable electricity supply for the charging infrastructure, regardless of location, is fundamental if strategies of expansion are to be successful. Increasing the efficiency of electric energy distribution and enhancing the quality, reliability and safety of distribution networks are also part of the objectives within the Program for the Development of the National Electric System (PRODESEN)[40] 2021-2035, which details annual planning of the Mexican National Electric System. Thus, it is suggested that this recommendation is addressed as a number one priority.

2. **Communication protocol** between the charging infrastructure and the vehicle, taking into account different types of charging – including fast charge –, wired and wireless, as well as pantographs. International standards **ISO/IEC 15118, IEC 61850 series, and IEC 61851-24:2014** should be considered as a basis. Interoperable communication is necessary to reduce operational costs and facilitate access for EV users to all different charging networks.

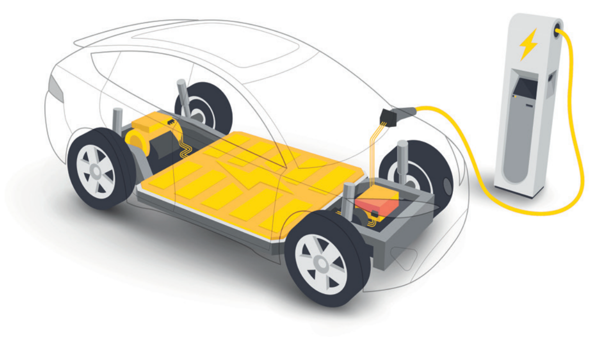
3. **Labelling requirements** to provide crucial information (e.g. type of connectors available, nominal voltage and current) and instructions on use of the infrastructure for consumers. This way consumers can consult information on the type of connectors available and nominal voltage and current, among other relevant data. It will also help to avoid possible damage to the vehicle, the charging infrastructure or the electric grid caused by inappropriate use. It is suggested that **Title 16 of the US Code of Federal Registrations, Part 309**, is used as a reference for this NOM, as it specifies in more detail the characteristics of the labelling and information it must provide. For example, its positioning in a legible location and display of kilowatt (kW) capacity, voltage value and type (DC or AC), amperage and whether the system is conductive or inductive.

EV batteries

1. **Electric drivetrain safety** and protection against electric shock and liquid leakage in case of impact and during normal operation of the vehicle. This should be applicable for both new and retrofitted vehicles to ensure protection of users, charging infrastructure and the electric grid. **UNECE R100** is proposed as a reference.

2. **Disposal process for batteries** to avoid environmental impact, as well as requirements for the **recycling of its components** to protect the environment and avoid release of hazardous waste. Since no current standards for the disposal of electric batteries were identified at the international level, Mexico should play an active part on the international technical committees for standardisation to support the development and adoption of an internationally harmonised standard for the disposal of EV batteries. Examples of this may include **IEC technical committees (TC) 21** for secondary cells and batteries, **TC 111** for environmental standardisation of electrical and electronic products and systems, and the **CEN Committee CEN/CLC/JTC 10** for material efficiency aspects for products in scope of Ecodesign legislation. Furthermore, once the proposal for a regulation of the European Parliament and of the Council concerning batteries and waste batteries is approved and officially published by the EU COM, it can be used as a reference.

Figure 3: Electric vehicle charging battery. © Peter Varga/AdobeStock



Secondly, with regard to the **standardisation requirements**, the recommendations are:

Charging infrastructure

1. Use harmonised standards for the characteristics, operating conditions of the **EV supply equipment** and its requirements for electrical safety, such as **IEC 61851** and **IEC 62196** series.

2. Using **IEC 62196** as a reference, define and standardise which **type of plugs** should be available in the charging infrastructure, depending on the type of charge, to guarantee **interoperability.**

3. Promote the implementation of harmonised **cybersecurity** standards based on **ISO/IEC 27000:2018** and **ISO/SAE 21434:2021** to protect both the integrity of the charging infrastructure and the sensitive data of users.

EV batteries

- Use harmonised standards for **testing EV batteries** and electric propulsion components in order to guarantee their quality and safety, e.g. the **series ISO 16750, ISO 21498, ISO 21782, IEC 60068** and **ISO 12405-4:2018.**

With regard to **conformity assessment procedures** in Mexico, the international **IECEE CB scheme** should be used as a reference. The acceptance of certificates of origin is also deemed necessary to assure that products entering the Mexican market are compliant, while at the same time facilitating trade.

7. Conclusion

A robust QI system for electromobility in Mexico is essential to boost its development, maintain competitiveness of the industry and ensure safe, high-quality products. This white paper therefore provides an overview of technical regulations, standards and conformity assessment procedures in Mexico, Germany/European Union and the United States, considered by the bilateral expert group as relevant for charging infrastructure and batteries for electric vehicles. International best practices regarding regulatory procedures, standardisation and conformity assessment presented in this paper offer consensus-based and cutting-edge knowledge from experts all around the world. The joint recommendations are based on the regulatory and standardisation needs identified by the bilateral expert group. They suggest internationally harmonised technical regulations, standards and conformity assessment procedures that should be developed in Mexico. This way, consumer confidence and protection can be strengthened and international trade can be facilitated.

The aim of this work is to support the development of a robust and internationally harmonised QI system in Mexico. This will also help promote competitiveness and innovation in the field of electromobility and achieve a successful transition to mobility of the future. This white paper provides inputs for further discussion on aspects of electromobility. For this reason, further cooperation topics may arise and can be proposed to the German-Mexican Dialogue on Quality Infrastructure.

8. Acknowledgements

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9. Footnotes

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