

Electric Vehicle Charging Standards and Facilities Workshop

電動車充電標準及設施工作坊

Mr. Karl Lau, Operation Manager

13 September 2022



About DEKRA

Established in 1925 to ensure road safety in connection with rapidly developing mobility, today DEKRA stands for safety on the road, at work, and at home and offers a broad service portfolio, including qualified and independent expert services in more than 60 countries.

We will be the
global partner
for a **safe, secure**
sustainable
world



Our History

**Founded in Berlin
as a registered
association**

Establishment
of the industrial
inspection business

Entry into product
certification market

Entry into EMC/
wireless testing
market

**Investment in the largest
cross- manufacturer testing
center for autonomous and
connected driving in Europe**

**Cooperating with
Argus to extend the
Cyber Security
Service**

Strategic goal:
CO₂-neutral by 2025



1925



1960



Approved as a
vehicle testing
organization

2005



Entry into energy
and process
industry markets

2007



2009



Expansion of consulting
for organizational and
process safety

2012



2015

**Combining testing
expertise, automated
driving, and connected
mobility**

2016



2017



Founding of DEKRA
Digital GmbH to develop
new, digital business
models

2018



2019



Establishment of the EMC/
wireless testing in South
Korea

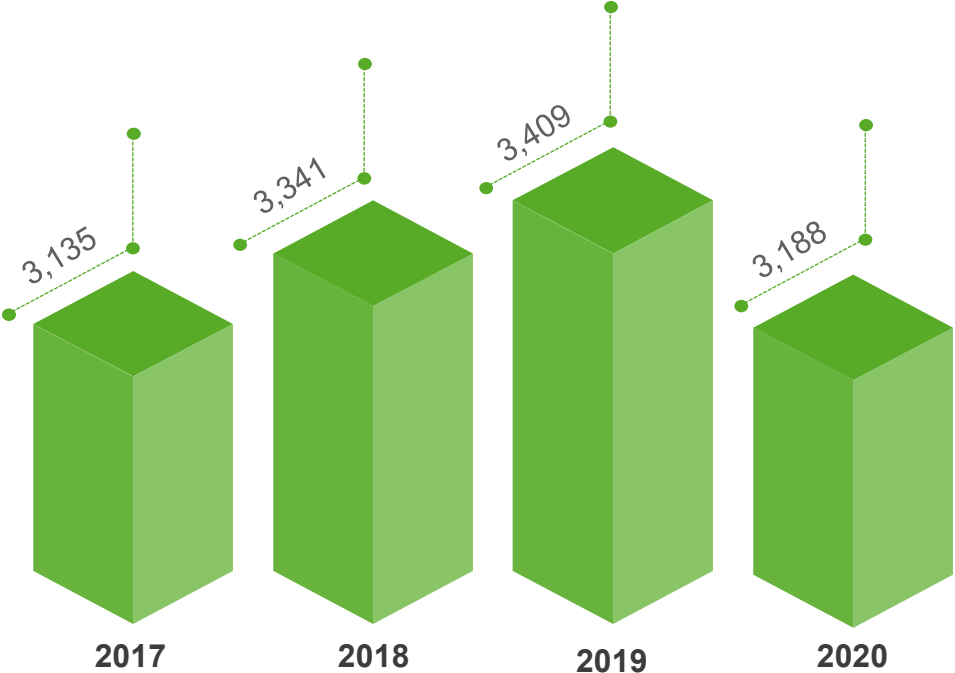
2020



2021

Our growing foundation for success

Total Revenue | in Million Euros



Revenue | predicted for 2021/12/31



44,057 45,197 44,714 43,990

Employees | as of 2020/12/31 on all continents in 60 countries

46,500

Employees |
predicted for 2021/12/31

18

Acquisitions
over the past 3 years

20


Countries
accredited us as a Certification Authority


27

Mio.
Vehicle
Inspections in 2020

Safety experts in 6 Regions


Services

 Vehicle Inspection

 Claims & Expertise


 Product Testing

 Industrial Inspection

 Consulting

 Audit

 Training

 Temp Work

Germany

21,031 employees

Central East Europe & Middle East

7,217 employees

North-West Europe

3,163 employees

South-West Europe

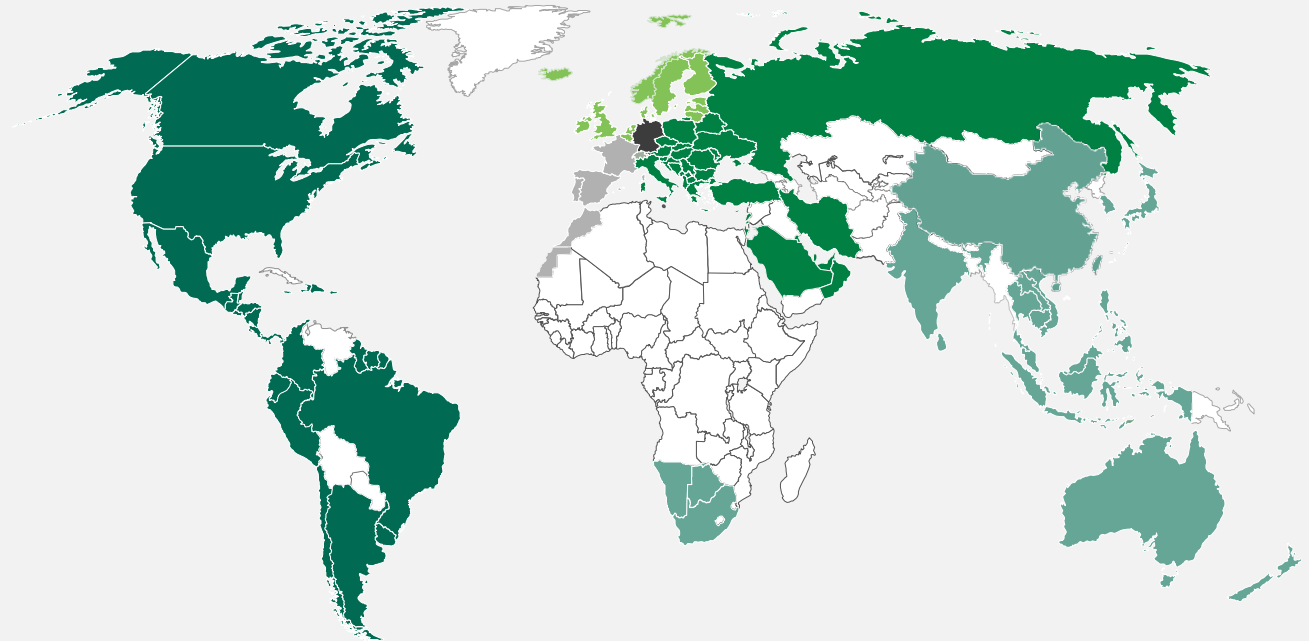
8,148 employees

APAC

3,446 employees

Americas

896 employees





Service

Product Testing

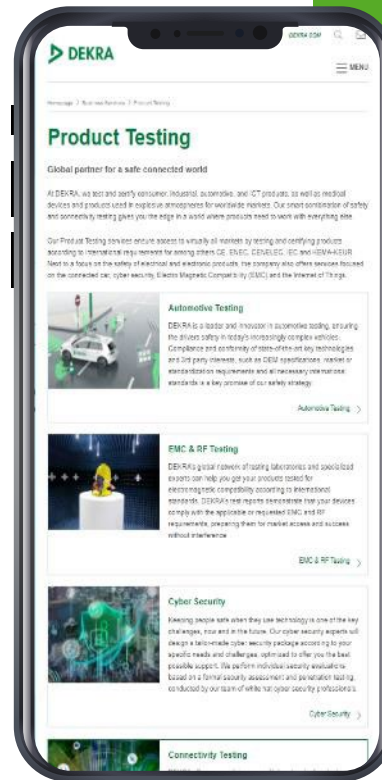




Product Testing in DEKRA Hong Kong

We test and certify consumer, industrial, ICT, medical, automotive and railway products, among others. Our wide scope of services for global markets include safety, cybersecurity, connectivity and electromagnetic compatibility testing and certification.

Furthermore, through a global network of state-of-the-art test laboratories, we offer a broad portfolio of product testing services based on national and international standards as well as industry and customer requirements



Cybersecurity Testing

EV charger and EV
Inspection Services

EMC & RF Testing

Medical Device
Services

Product Safety Testing
and Certification

Connectivity Testing

Testing and certification of a wide range of products such as consumer, industrial, automotive, medical and ICT, among others, through a global network of state of art laboratories.

EV Charging System

EV Charging System Category

Charger type*	Power (kW)	Km per 10min charging	Distribution
AC – slow charging	max 19.4 kW	< 3.2	Private, working space, public
AC – fast charging	22 kW or 43 kW	21	Private, public
DC – fast charging	20 - 50 kW	64	
DC – High Power Charging	100 - >350 kW	90	Public, Highway

Source: IEC 61851, Research for TRAN Committee - Charging infrastructure for electric road vehicles



Our advantage

High power capability;

High voltage capability, up to 1kV AC/DC;

Coolant system for HPC system with -40°C;

Communication protocol testing capability

Mode 2 Charging Cable

Plug	Cord	Adaptor	IC-CPD	Charging cable	Output
CEE-7	PVC cord	Pluggable	Type A RCD	EN Standards	T1
IEC type	Rubber cord	Fixed	Type B RCD	IEC Standards	T2
Industrial plug	EV cable			K Standards	GB

- 1 IEC 61851-1:2017
- 2 IEC 62752: 2018
- 3 IEC 61851-21-2: 2018
- 4 IEC 61543: 1996



Charging Cord Set (EVSE)

Our advantage

- Full components testing capability;
- Solid overseas certification experience;
- Correct OEM standard understanding

Mode 3 Charger

RCD	Electric shock	Metering	Cloud service	RED
Type A+6mA	Relay Gap	MID	Cyber security	WIFI
Type B	Shutter		ISO 15118	4G/3G
Type A	Dry contact		OCPP 1.6	RFID
				BT

- 1 IEC 61851-1:2010
- 2 IEC 61851-1:2017
- 3 IEC 61851-21-2: 2018
- 4 IEC 61851-22: 2001
- 5 IEC 62955: 2018



1. OCPP will be allied in IEC 63110-1
2. Cyber security according to IEC 63119-4



Our advantage

Full components testing capability;

Solid overseas certification experience;

Correct OEM standard understanding

Mode 4 Charger

RCD	Grid	Metering	Communication	Cooling	Output
Type B	AC LV	MID	PLC	Liquid	CHAdeMO
Type A	AC MV	Eichenrecht	CAN	Airforced	GB CCS1 CCS2

- 1 IEC 61851-1:2010
- 2 IEC 61851-1:2017
- 3 IEC 61851-21-2: 2018
- 4 IEC 61851-22: 2001
- 5 IEC 61851-23: 2014
- 6 IEC 61851-24: 2014



Our advantage

Full components testing capability;

Solid overseas certification experience

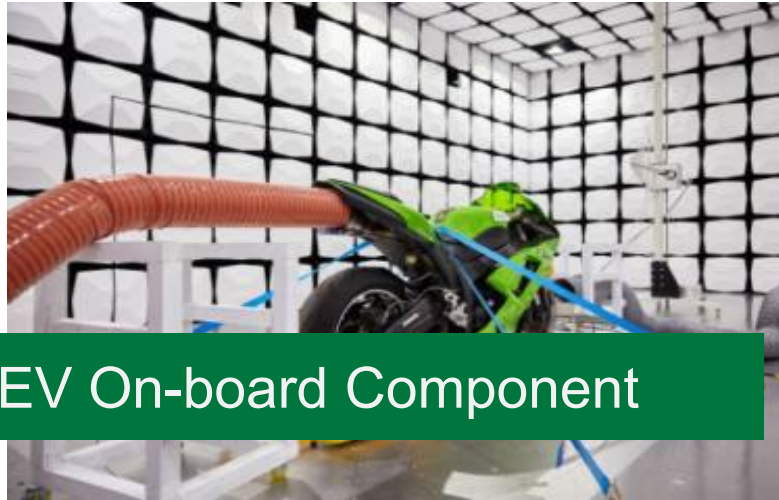
Correct OEM standard understanding

What We Do – Service Portfolio for Automotive



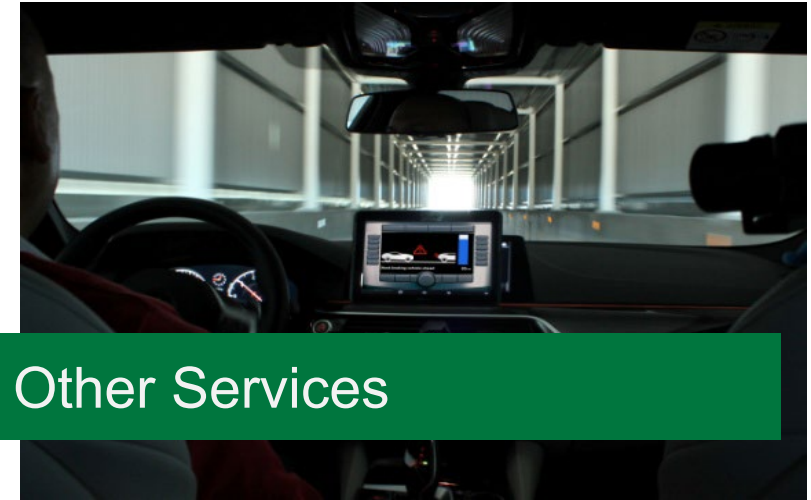
EV Charging System

- EV off-board charger
- EV Charger interoperability tests
- EV Communication protocol evaluation
- Charging infrastructure installation-related service
- EV charging couplers
- EV charger components
- EV Battery swap system
- Automated Connection Device system
- V2X EV charger
- Wireless charger testing



EV On-board Component

- EV power traction system
- EV traction motor
- EV wiring harness and wiring
- BMS
- EV on-board converter



Other Services

- Homologation
- Road test
- R & D service
- Functional Safety
- Cyber Security

DEKRA Qualification

Home & office charging



1.4 – 22 kW AC/DC

Metropolitan infrastructure



up to 50 kW AC/DC

Highway infrastructure



150 – 350 kW DC

E-bus infrastructure



≥ 600 kW DC

DEKRA affiliation



EV Charging System Standard Matrix

Low Voltage Directive (2014/35/EU)

- **IEC/EN 61851-1/-22**
- **IEC/EN 61851-23/-24;**
- ISO 15118 series;
- DIN SPEC 70121 & 70122;
- IEC/EN 62752;
- IEC/EN 62955;
- IEC/EN 62196-1 & -2 & -3;
- EN 61439
- EN 50620 & IEC 62893
- GB/T 18487.1/2/3
- GB/T 20234.1/2/3
- GB/T 34657.1/2
- IEC/EN 62477-1/-2
- IEC/EN 62909-1/-2
-

ElectroMagnetic Compatibility (2014/30/EU)

- **IEC/EN 61851-21-1**
- **IEC/EN 61851-21-2**
- **IEC/EN 61851-22;**
- IEC/EN 61439-1;
- IEC/EN 61000 series



DUTCH ACCREDITATION COUNCIL

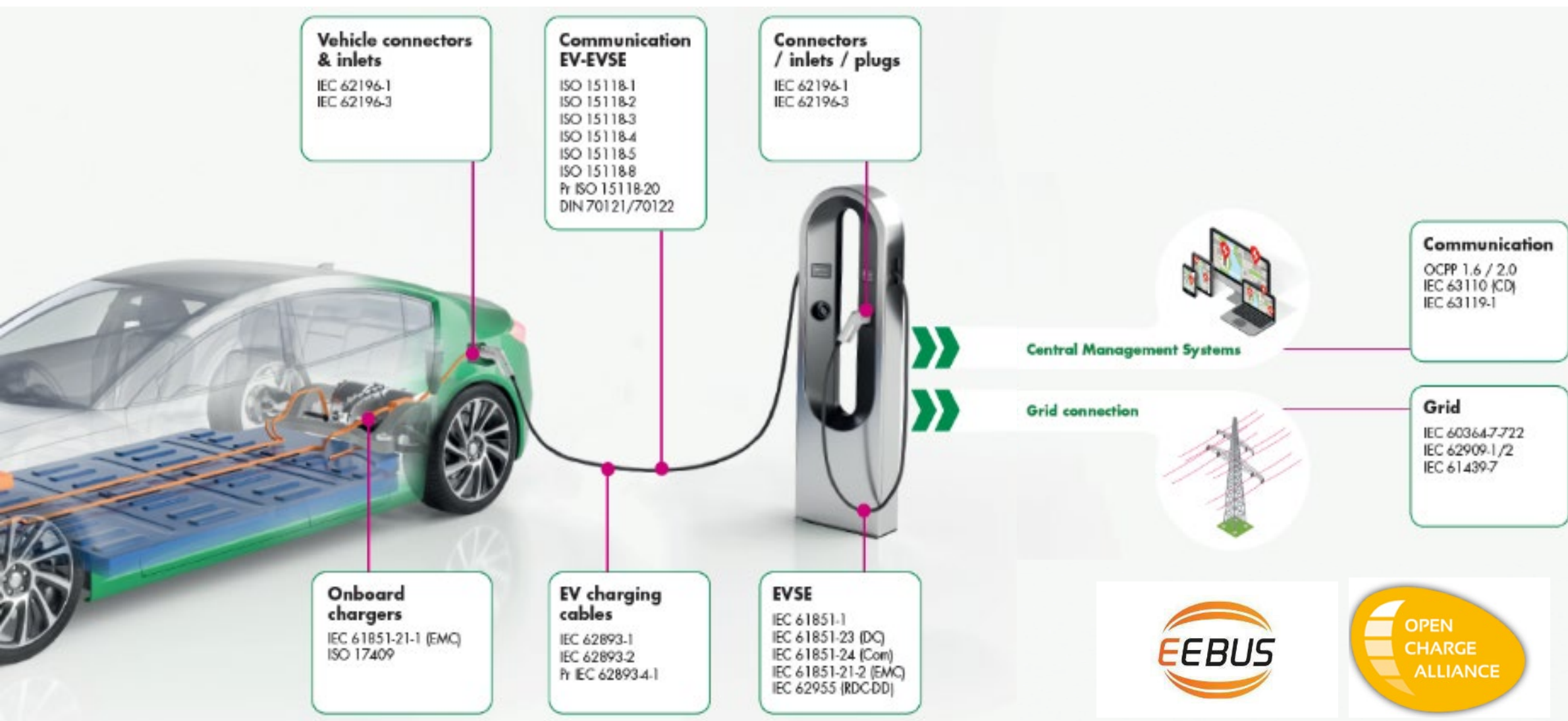
Radio Equipment Directive (2014/53/EU)

- **EN 300328**
- EN 301511
- EN 301908
- EN 303413
- EN 300330
- EN 301489
- EN 62479
- EN 62311
- EN 50385
- FCC Part 15B

OEM Standards

- ISO 6469-3
- ISO 16750-1/-2/-3/-4/-5
- ISO 19453-4/-5
- GB/T 24347
- VW 80000/GS 95024-3-1
- MBN LV124-2
- QC/T 895
- GB/T 2423 series
- GB/T 28046.1/2/3/4/5
-

EV Communication Testing



IEC/EN 61851 Scope

Scope

IEC 61851-1: Electric vehicle conductive charging system – Part 1: General requirements

- *This part of IEC 61851 applies to EV supply equipment for charging electric road vehicles, with a rated supply voltage up to 1 000 V AC or up to 1 500 V DC. and a rated output voltage up to 1 000 V AC. or up to 1 500 V DC.*

IEC 61851-21-2: Electric vehicle conductive charging system – Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply – EMC requirements for off-board electric vehicle charging systems

- *This part of IEC 61851 defines the **EMC requirements for any off-board components or equipment** of such systems used to supply or charge electric vehicles with electric power by conductive power transfer (CPT), with a rated input voltage, according to IEC 60038:2009, up to 1 000 V AC or 1 500 V DC and an output voltage up to 1 000 V AC or 1 500 V DC.*

IEC 61851-23: Electric vehicle conductive charging system – Part 23: DC electric vehicle charging station

- *This part of IEC 61851, together with IEC 61851-1:2010, gives the requirements for d.c. electric vehicle (EV) charging stations, herein also referred to as **"DC charger"**, for **conductive connection to the vehicle**, with an a.c. or d.c. input voltage up to 1 000 V a.c. and up to 1 500 V d.c. according to IEC 60038*

IEC 61851-24: Electric vehicle conductive charging system – Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging

- *This part of IEC 61851, together with IEC 61851-23, applies to **digital communication between a d.c. EV charging station and an electric road vehicle (EV) for control of d.c. charging**, with an a.c. or d.c. input voltage up to 1 000 V a.c. and up to 1 500 V d.c. for the conductive charging procedure.*

IEC/EN 61851-1 Test Clause

Test Clause:	
4	General requirements
5	Classification
6	Charging modes and functions
7	Communications
8	Protection against electric shock
9	Conductive electrical interface requirements
10	Requirements for adaptors
11	Cable assembly requirements
12	EV supply equipment constructional requirements and tests
13	Overload and short-circuit protection
14	Automatic reclosing of protective devices
15	Emergency switching or disconnect (optional)
16	Marking and instructions

IEC/EN 61851-21-2 Test Clause

Test Clause	
5	<p>Immunity requirements</p> <ul style="list-style-type: none">• Electrostatic discharge (ESD)• Radiated RF fields• Magnetic fields• Electrical fast transients/ bursts• Voltage surges• Conducted RF fields• Voltage dips and interruptions
6	<p>Emission requirements</p> <ul style="list-style-type: none">• Harmonic currents• Voltage fluctuations and flicker• Conducted disturbances (150 kHz to 30 MHz)• Radiated disturbances (2 kHz to 185 kHz) (above 30 MHz)• Transient emissions

Safety/Performance Test according to OEM Standards

▪ Technical Component Requirement Specifications Wallbox AC

▪ Product Requirements Specification Modular Group Wallbox AC

LV standards

- LV 124;

VW

- VW 80000;

Daimler

- MBN LV 124;

BMW

- GS 95024

Environment condition

- K-01 High-/low-temperature aging
- K-02 Incremental temperature test
- K-03 Low-temperature operation
- K-04 Repainting temperature
- K-05 Thermal shock (component)
- K-08 Damp heat, cyclic
- K-09 Damp heat, cyclic (with frost)
- K-10 Water protection-IPX0-IP6K
- K-11 High-pressure cleaning/pressure washing
- K-12 Thermal shock with splash water
- K-13 Thermal shock-immersion
- K-14 Damp heat, constant
- K-15 Condensation and climate test
- K-16 Thermal shock (without housing)
- K-17 Solar radiation

Corrosion condition

- K-06 Salt spray test with operation, exterior
- K-07 Salt spray test with operation, interior
- K-18 Harmful gas test

Mechanical condition

- M-01 Free fall
- M-02 Stone impact test
- M-03 Dust test
- M-04 Vibration test
- M-05 Mechanical shock
- M-06 Continuous mechanical shock
- M-07 Coolant circuit pressure pulsation test

Chemical condition

C-01 Chemical tests

Life cycle condition

- L-01 Service life test -Mechanical/hydraulic durability testing
- L-02 HTOE Endurance test
- L-03 PTCE Endurance test

Electrical Testing Facilities

- Technical Component Requirement Specifications Wallbox AC

- Product Requirements Specification Modular Group Wallbox AC

LV standards

- LV 124;

VW

- VW 80000;

Daimler

- MBN LV 124;

BMW

- GS 95024



Environment Testing Facilities

- Technical Component Requirement Specifications Wallbox AC

- Product Requirements Specification Modular Group Wallbox AC

LV standards

- LV 124;

VW

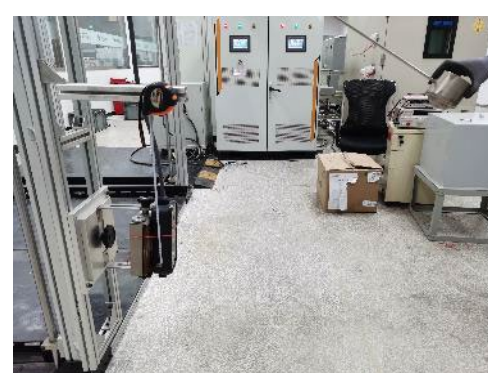
- VW 80000;

Daimler

- MBN LV 124;

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- GS 95024



DEKRA Shanghai Jiading LAB

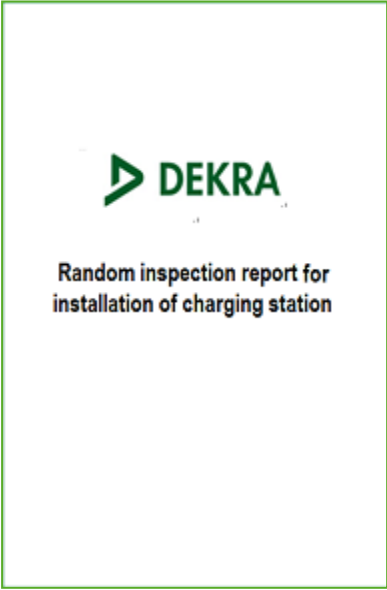
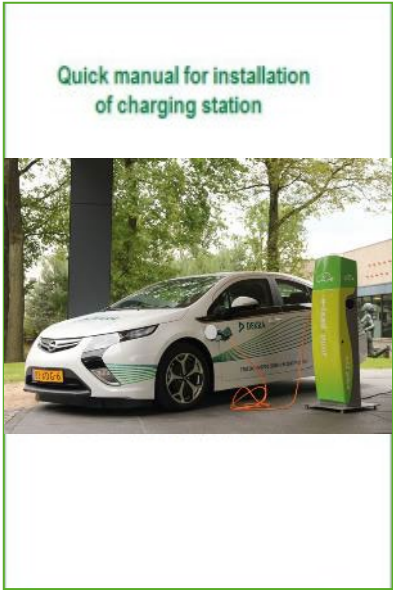
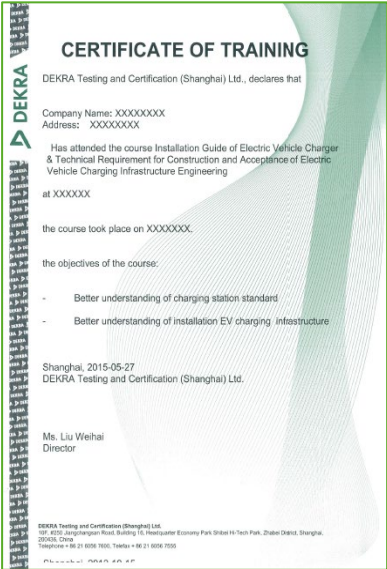
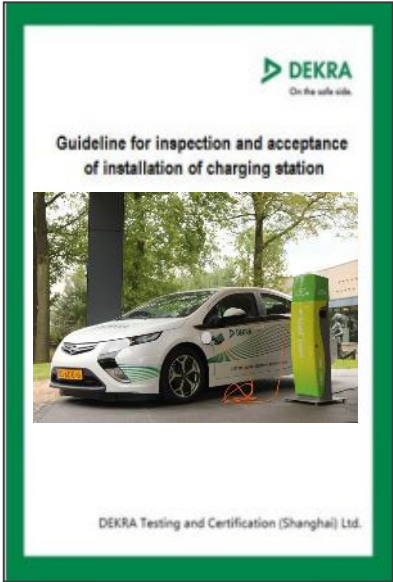
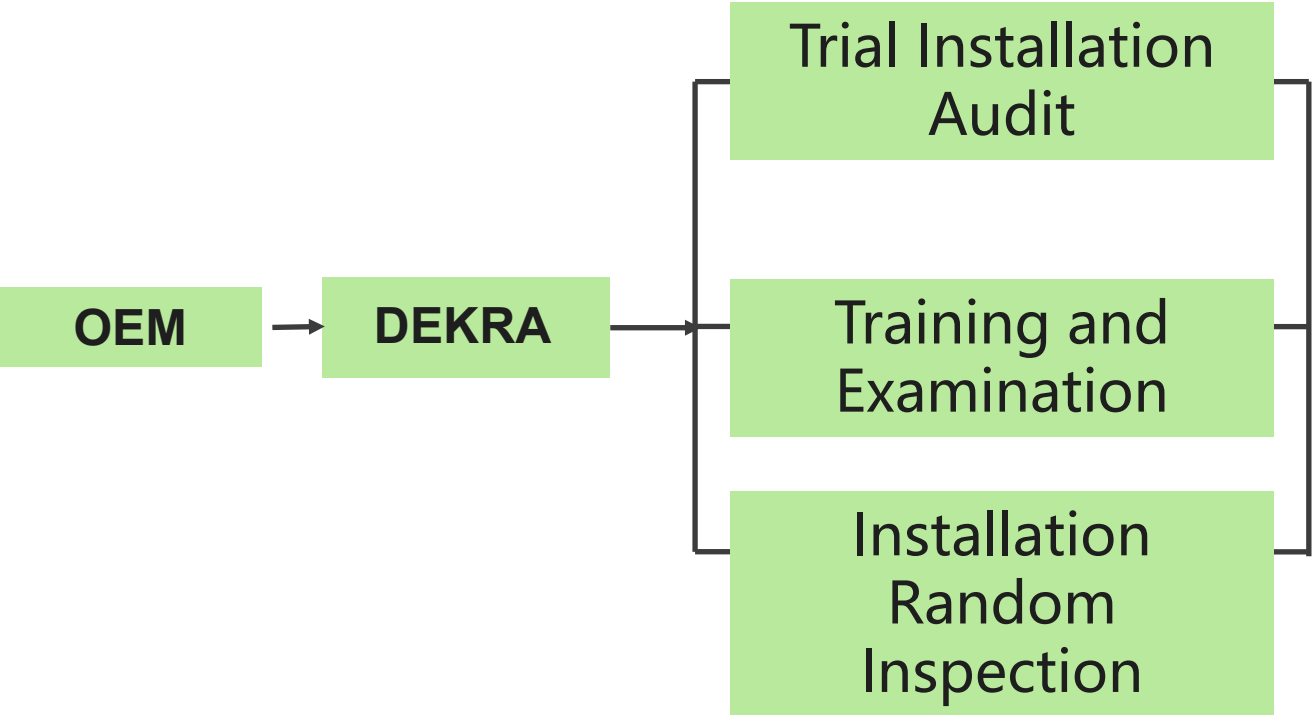
- Setup from 2016 Sep
- LAB area phase I about 5000m², Electricity power: >1MW; including EV components, EMC, Reliability, Chemical
- Jiading Lab, we finished 600kw DC charger and 350kW liquid coolant DC charger
- Daimler AC wallbox DV/PV project, VW wallbox DV/PV project, BMW flexcharger DV/PV project
- EV components testing and certification revenue over 30M yearly. Team member over 38 people



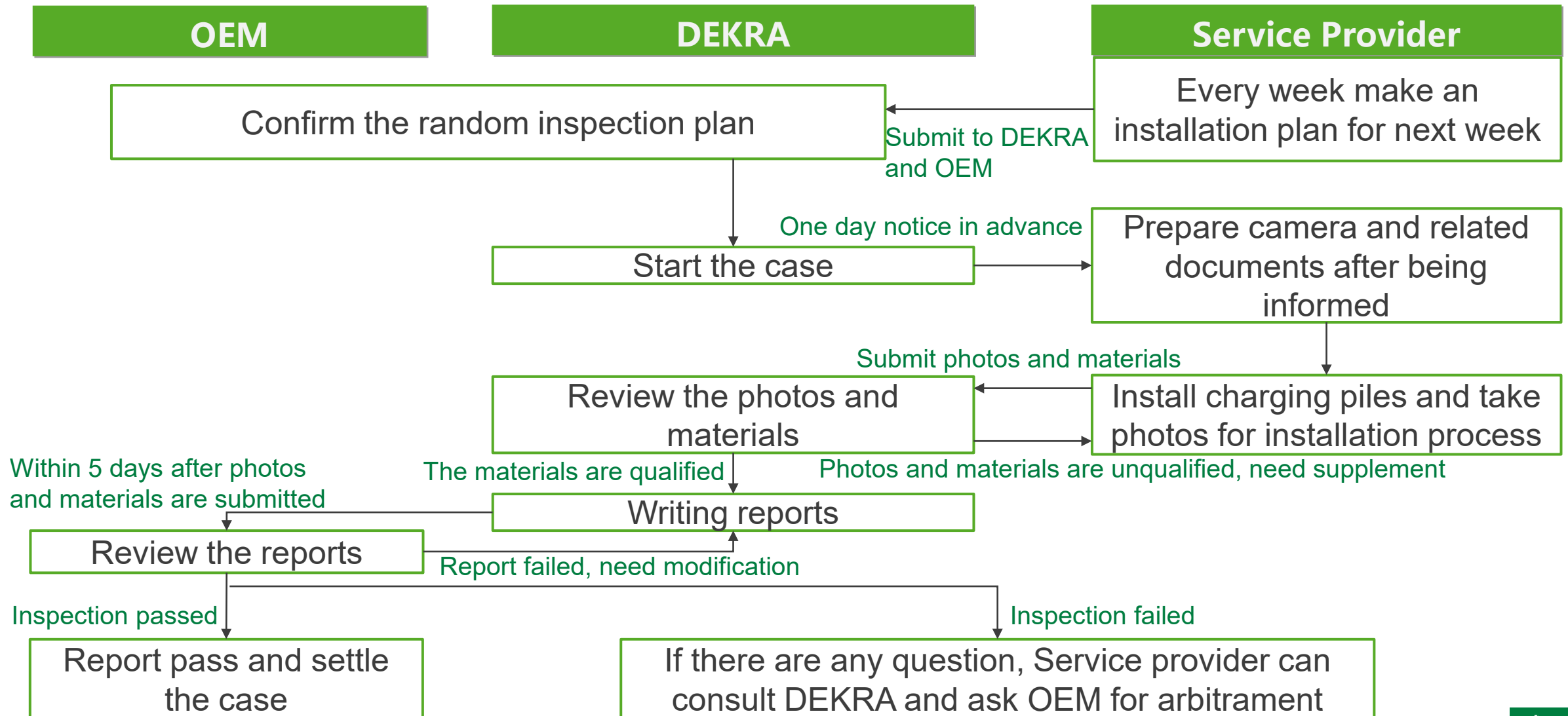


Training , Audit and Inspection Service

Cooperation between DEKRA and OEM



Process of Installation Random Inspection (Sample)



Features

Guideline and Standard

- Authority, professional, practical, pay attention to the process
- Quick guide based on the installation specification for reference

Training

- Easy to understand, increase interactive content
- Combine training material with training tools; pay equal attention to theory and practice

Radom Inspection

- Non-onsite inspection, to avoid disturb the user, and save time and effort
- Can truly reflect the problem

Report

- A new and more reasonable way of grading
- Issue quarterly summary analysis report, to indicating the most frequent problems

Summary of Charging Pile Pre-Installation Projects – Frequently Asked Questions

Wrong cable color



The cable with the green-yellow wire should be selected

The IP rating of the distribution box does not meet the requirements



The distribution box with outdoor IP54 and indoor IP32 should be used, the nameplate is marked on the distribution box, and the distribution box is certified

Circuit diagram missing








The circuit diagram should be pasted in a conspicuous place inside the distribution box

Summary of Charging Pile Pre-Installation Projects – Problems and Suggestions

Problem	Suggestion
The auditor arrives at the site, but the charging pile has not been installed	Pre-installation should be reviewed after the installation company has pre-installed it. In future projects, the installation company should confirm in advance whether the installation is complete, and then make an appointment to go to the site for review.
In order to cope with the review, the installation company specially sent trained personnel from other cities to perform installation or guide pre-installation locally, which is contrary to the original intention of the pre-installation review.	The installation company should stipulate that trained personnel are not allowed to participate in pre-installation works in other cities
The local installers are not employees of the designated installation company, there may be subcontracting, and the future installation quality cannot be guaranteed	All installers must be employees of OEM's designated installation company and must have undergone DEKRA's training or transfer training from the installation company. The rest of the personnel are not allowed to participate in the installation.

Examples of Frequently Occurring Problems in Installation Spot Checks

Problem		Suggestion
Cables and some components are not certified		Suggestion: When purchasing, you should choose certified products; when installing self-acceptance, you should add the content of checking the certification mark of components.
Type A leakage protector is not selected		Suggestion: The installation company should centrally purchase A-type leakage protectors, and at the same time strengthen training and teach installation personnel to identify.
Wireless signs or signs are not strong		Suggestion: Mark the line in strict accordance with the line diagram and use a reliable fixing method such as a number tube.
The cable duct is too thin and there is a danger of overheating when energized		Suggestion: strengthen training, learn to calculate the cable cross section and the inner cross section of the conduit, and record it on the acceptance sheet.
Missing or incorrect ground resistance test		Suggestion: Purchase a standard grounding resistance tester that meets the regulations, learn to use it and record the test data in the acceptance sheet.

Key Take Away

5 Common Risks for Electric Vehicle Users at Charging Stations

- Electric shocks
- High-voltage fires related to lithium-ion batteries
- Cyber attacks
- Collisions with pedestrians and vehicles
- Tripping on charging cables





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DEKRA News

Battery Test for Electric Cars – DEKRA

<https://www.dekra.com/en/battery-test-for-electric-cars/>



Thank you,
for taking care of
SAFETY

