OIML MetTalk
Electric Vehicle Supply Equipment

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outline

- **introduction and history**
- **part 1: requirements in OIML G 22**
- part 2: test procedures in OIML G 22
- future and conclusion

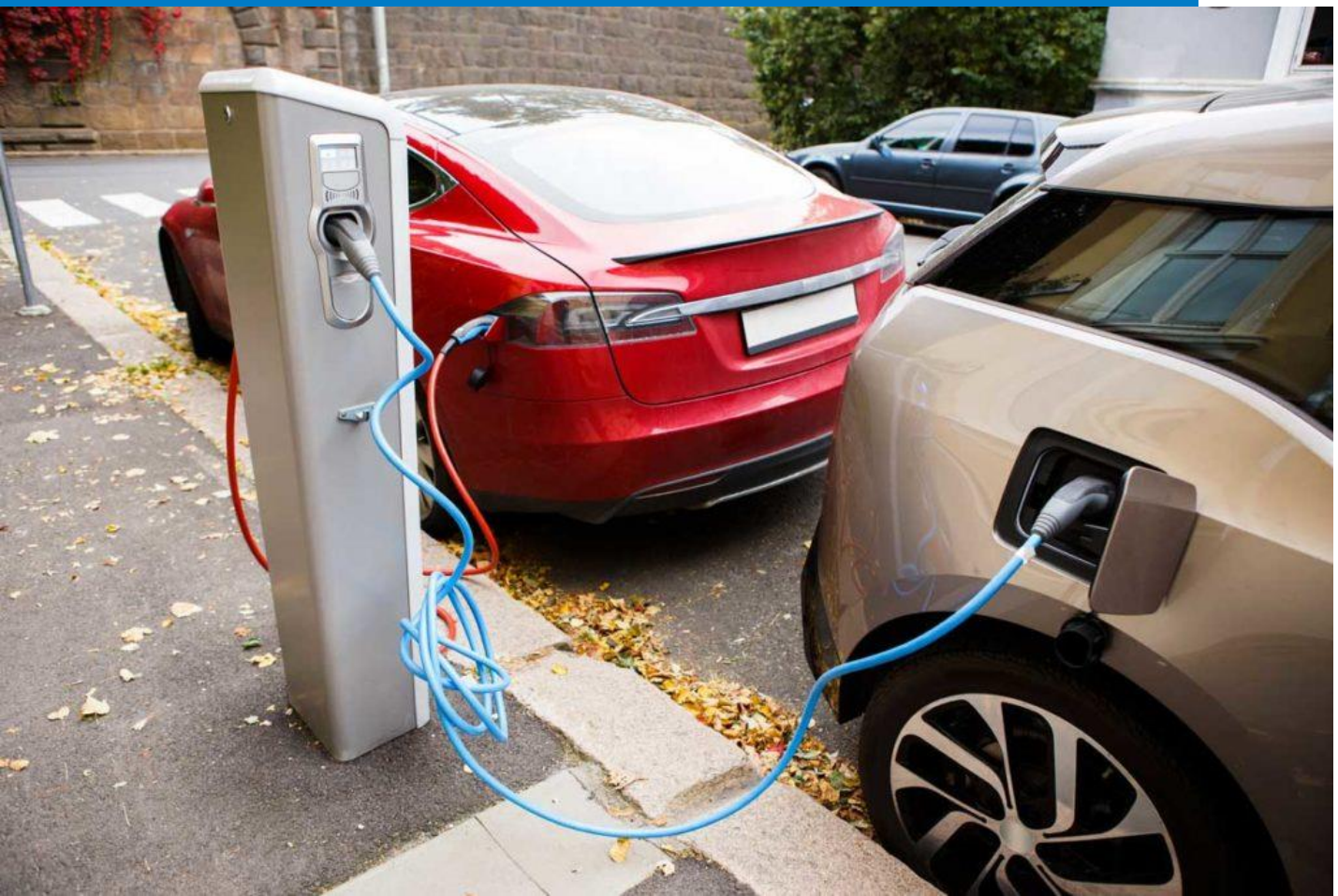
introduction

- broad sense of urgency to facilitate energy transition
- pressure from governments on rollout of EV charging infrastructure
- importance of reliable *metrology* in EV charging
- absence of international guidance and harmonization
- ⚠ risk: diverging regulation between countries

history of OIML EV charging project

- from 2016: EV charging in scope of OIML R46 revision project (TC12/p1)
- Apr 2021: EV charging ‘Annex’ chapter delivered to TC12/p1 by subgroup
- May 2021: realization that self-consistent, stand-alone document is needed for EVSE
- Oct 2021: new project ‘TC12/p3 EV charging stations’ instated by CIML:
  with mandate to produce a ‘Guide’ under considerable time pressure
  - Guide can be published faster than ‘R’ecommendation
  - speed is important: avoid diverging EVSE metrology regulation between OIML member states
- Dec 2021 – Feb 2022: consultation round on EVSE Guide draft text
- Jun/Jul 2022: five-day plenary meeting TC12/p3, consolidating Guide text
- Sep 2022: Guide text approved by CIML president and published

part 1: requirements



GUIDE

OIML G 22

Edition 2022 (E)

Electric Vehicle Supply Equipment (EVSE)

- Metrological and technical requirements
- Metrological controls and performance tests

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

Chapters 3 and 4: requirements

- part 1
  - chapter 1: scope
  - chapter 2: terms and definitions
  - chapter 3: metrological requirements
  - chapter 4: functional requirements

OIML G22: what it covers

- measurements at publicly accessible EVSE

  Electric Vehicle Supply Equipment (EVSE)
  device intended to supply or receive electrical energy to or from an electric vehicle and to measure that energy, store and report the measurement result to the customer, and if necessary, transmit the information to a billing system

- bidirectional: charging vehicle & vehicle-to-grid
- both AC and DC implementations
- EVSE with separately type-approved meter

  & with integrated measuring components

chapter 3: metrological requirements

- 3.3.1/3.3.3:

  MPE classes A (2%), B (1%), C (0.5%)
- 3.3.4: influence quantities – error shifts:
  - voltage/freq variations,
  - conducted/radiated disturbances
  - *.. and more*

Table 4 – Maximum permissible error shift due to influence quantities

Influence quantity	Value	Test	Current	Maximum permissible error shift (%) for EVSE of class		
				A (2 %)	B (1 %)	C (0.5 %)
Self-heating	Continuous current at I_{max}	7.3.2	I_{max}	±1	±0.5	±0.25
Voltage variation (AC EVSE only)	$0.9 \times U_{nom}$ to $1.1 \times$ highest U_{nom}	7.3.4 †	$I_{tr} \leq I \leq I_{max}$	±1.0	±0.7	±0.2
Frequency variation of mains AC EVSE only	Each $f_{nom} \pm 2$ %	7.3.5 †	$I_{tr} \leq I \leq I_{max}$	±0.8	±0.5	±0.2
Harmonics in voltage and current circuits(1)	$d < 5$ % I $d < 10$ % U	7.3.6	$I_{tr} \leq I \leq I_{max}$	±1.0	±0.6	±0.3

chapter 3: metrological requirements

- 3.3.1/3.3.3:

  MPE classes A (2%), B (1%), C (0.5%)
- 3.3.4: influence quantities – error shifts:
  - voltage/freq variations,
  - conducted/radiated disturbances
  - *.. and more*
- 3.3.5-3.3.6: disturbances – allowed effects:
  - electrostatic discharge,
  - voltage dips, overcurrents
  - heat, cold, water, dust, sunlight
  - vibrations and shocks
  - *.. and more*
- 3.4: durability

chapter 4: functional requirements (1 of 2)

- 4.1: markings
- 4.2.1.2: accuracy at *connection point*
- 4.2.1.5: bidirectional measurements
- 4.2.2: where and how to store legally relevant transaction data
- 4.3.1: how to convey transaction data to end user
  - A. local indicating device
  - B. remote indication, with adequate cryptographic protection of transmitted data

Decision to require option A, or option B, or both A and B is up to national legislator implementing this Guide.

chapter 4: functional requirements (2 of 2)

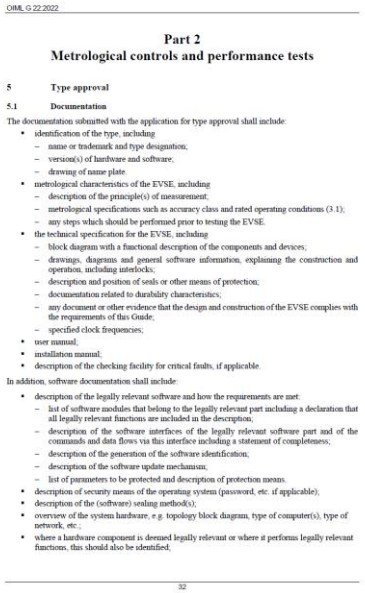
- 4.3.3: register
  - register large enough such that no rollover occurs during charging session
  - register for energy delivered to (and received from) EV shall be set to zero at start of transaction
  - additional totalizing register is allowed, but not required
- 4.4: protection of software and parameters against misuse and fraud
- 4.4.7: updates to EVSE software in the field
  - updates to legally relevant software follows strict procedures (either 'verified' or 'traced')
  - updates to non-legally relevant software allowed, **but only if separated** from legally relevant software

outline

- introduction and history
- part 1: requirements in OIML G 22
- **part 2:**
  metrological control and performance tests in OIML G 22
- **future and conclusion**

Part 2:

Metrological control and performance tests



OIML G 22:2022

Part 2
Metrological controls and performance tests

5 Type approval

5.1 Documentation

The documentation submitted with the application for type approval shall include:

- identification of the type, including
  - name or trademark and type designation;
  - version(s) of hardware and software;
  - drawing of name plate.
- metrological characteristics of the EVSE, including
  - description of the principle(s) of measurement;
  - metrological specifications such as accuracy class and rated operating conditions (3.1);
  - any steps which should be performed prior to testing the EVSE.
- the technical specification for the EVSE, including
  - block diagram with a functional description of the components and devices;
  - drawings, diagrams and general software information, explaining the construction and operation, including interlocks;
  - description and position of seals or other means of protection;
  - documentation related to durability characteristics;
  - any document or other evidence that the design and construction of the EVSE complies with the requirements of this Guide;
  - specified clock frequencies;
- user manual;
- installation manual;
- description of the checking facility for critical faults, if applicable.

In addition, software documentation shall include:

- description of the legally relevant software and how the requirements are met:
  - list of software modules that belong to the legally relevant part including a declaration that all legally relevant functions are included in the description;
  - description of the software interfaces of the legally relevant software part and of the commands and data flows via this interface including a statement of completeness;
  - description of the generation of the software identification;
  - description of the software update mechanism;
  - list of parameters to be protected and description of protection means.
- description of security means of the operating system (password, etc. if applicable);
- description of the (software) sealing method(s);
- overview of the system hardware, e.g. topology block diagram, type of computer(s), type of network, etc.;
- where a hardware component is deemed legally relevant or where it performs legally relevant functions, this should also be identified;

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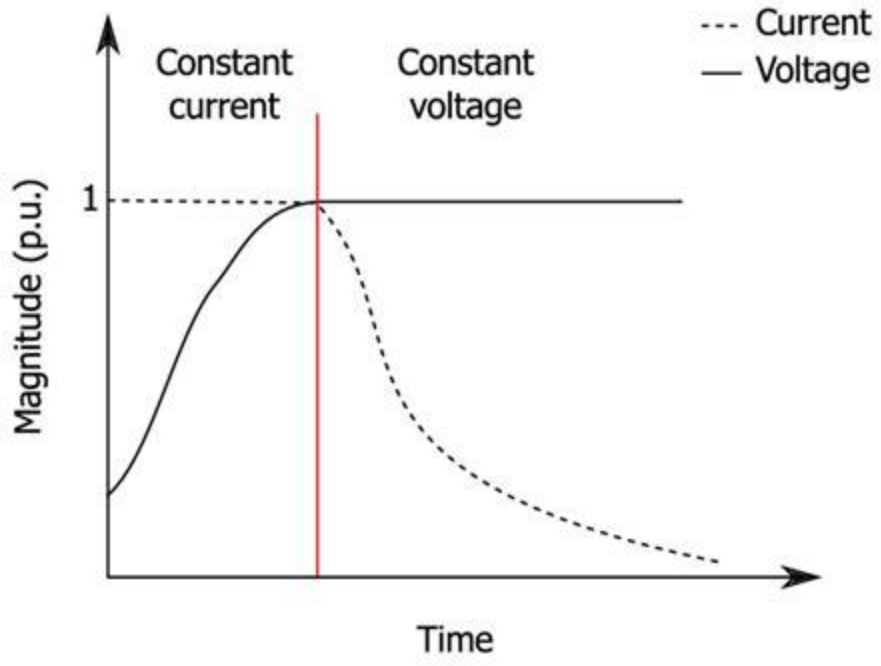
Chapter 6 – Test programme / test methods

- Investigation is based on the same transactional process as is used in normal operation



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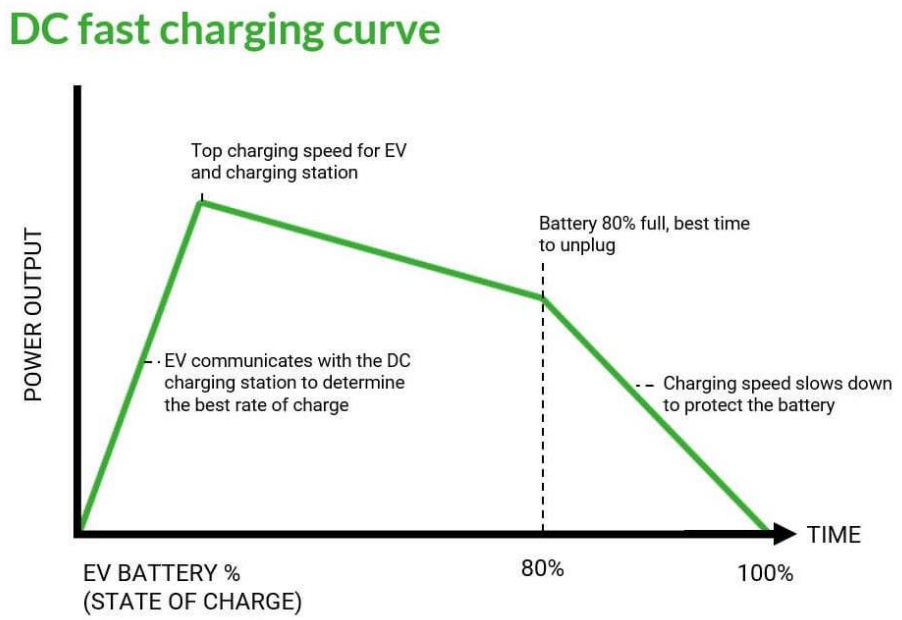

Chapter 6 – Test programme / test methods

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- Real load or phantom load
- AC and DC measurements
- Car simulator
- Automatic test sequences

  * Client identification

Chapter 7 – Test procedures for type approval

- Reference conditions

Table 10 – Reference conditions for type approval testing

Quantity	Reference conditions	Tolerance
Voltage(s)		
AC EVSE	Highest U_{nom}	±1 %
DC EVSE	375 ± 50 VDC and 750 ± 50 VDC	N/A

Chapter 7 – Test procedures for type approval

- Reference conditions
- Intrinsic error determination

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- Reference conditions
- Intrinsic error determination
- Starting current

Table 2 – Accuracy classes

Quantity		Base maximum permissible errors (%) for class		
Current, *I*	**Power factor**	**A (2 %)**	**B (1 %)**	**C (0.5 %)**
$I_{st} \leq I < I_{min}$	> 0.9	±25	±15	±10
$I_{min} \leq I < I_{tr}$	> 0.9	±2.5	±1.5	±1.0
$I_{tr} \leq I \leq I_{max}$	> 0.9	±2.0	±1.0	±0.5

2.3.2 starting current, I_{st}

lowest value of current specified at which the EVSE must register electrical energy at unity power factor and, for poly-phase EVSE, with balanced load

Chapter 7 – Test procedures for type approval

- Reference conditions
- Intrinsic error determination
- Starting current
- Tests for influence quantities
- Tests for disturbances

Chapter 9 – Verification and re-verification

- Conformity check
- Minimum test programme
- Starting current check
- Current dependence: I_{min}, I_{tr}, 50% I_{max}, I_{max}
- Sealing
- Statistical verifications (9.4)

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$I_{min} \leq I < I_{tr}$	> 0.9	±2.5	±1.5	±1.0
$I_{tr} \leq I \leq I_{max}$	> 0.9	±2.0	±1.0	±0.5

future

Source: EnBW /photographer: Endre Dulic

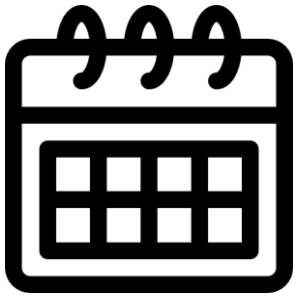
New standardization projects

Related developments in standardization

- IEC TC13: publication of IEC 62053-41 [2021] for DC meters
- CENELEC TC13: work on 50470-4 for DC meters, under the MID
- IEC TC13: revision of safety standard 62052-31, include DC meters
- German Application Rule: VDE-AR-E 2418-3-100 [2020]
- Proposal: MET4EVCS research program
- ....

Next actions for OIML TC12/p3

- develop Recommendation to eventually replace Guide G22
  - will use experience and new insights from the project group member’s networks



Conclusion

- OIML Guide 22 is published and freely available from oiml.org
- thanks to:
  - active, constructive participation from many TC12/p3 project members
  - BIML for editorial and other support