



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



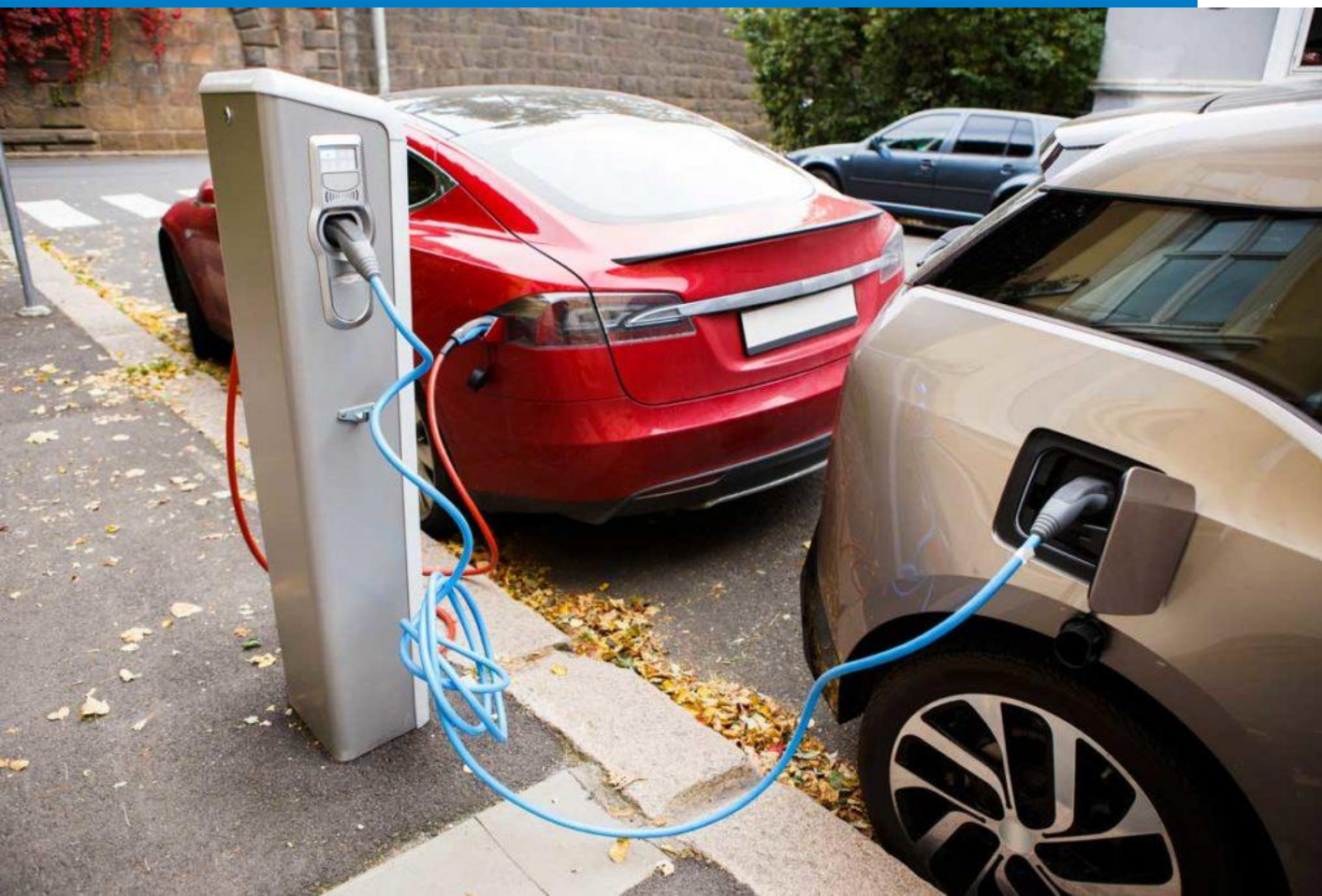
history of OIML EV charging project

- 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)	$0.9 \times U_{\text{nom}}$ to $1.1 \times \text{highest } U_{\text{nom}}$	7.3.4 †	$I_{\text{tr}} \leq I \leq I_{\max}$	±1.0	±0.7	±0.2
Frequency variation of mains AC EVSE only	Each $f_{\text{nom}} \pm 2 \%$	7.3.5 †	$I_{\text{tr}} \leq I \leq I_{\max}$	±0.8	±0.5	±0.2
Harmonics in voltage and current circuits ⁽¹⁾	$d < 5 \% I$ $d < 10 \% U$	7.3.6	$I_{\text{tr}} \leq I \leq I_{\max}$	±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

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- 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:

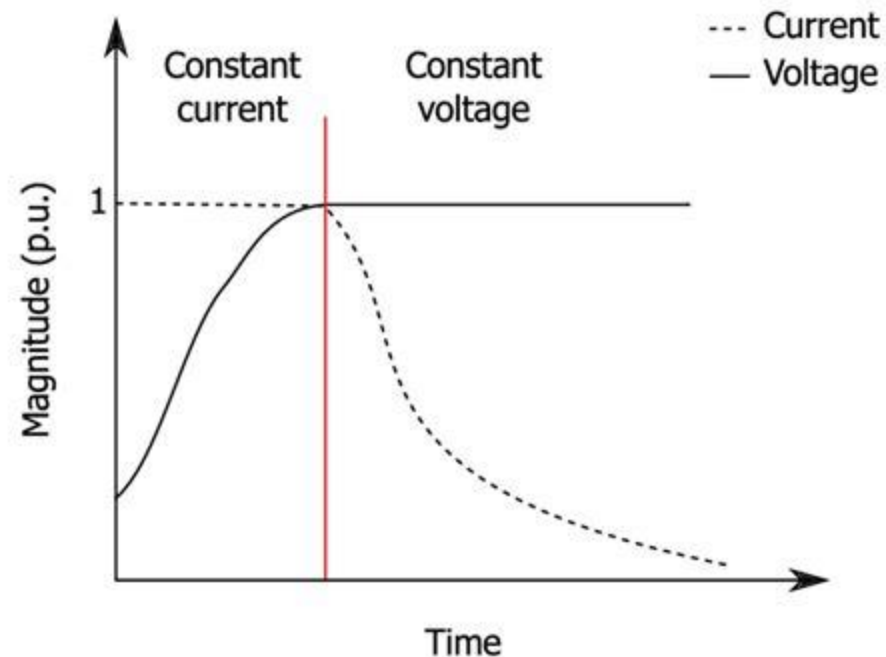
- description of the legally relevant software and how the requirements are met:
 - list of software modules that belong to the legally relevant part including a declaration that all legally relevant functions are included in the description;
 - description of the software interfaces of the legally relevant 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

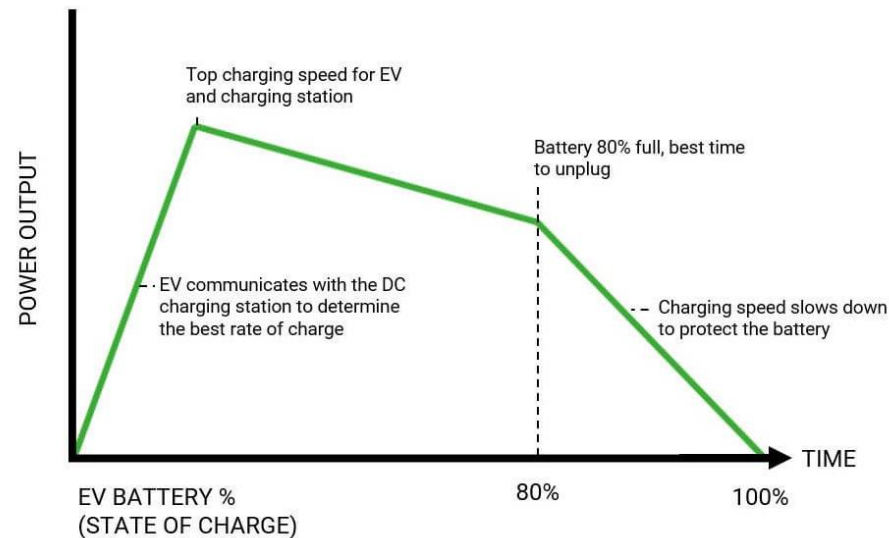




Chapter 6 – Test programme / test methods

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

DC fast charging curve





Chapter 6 – Test programme / test methods

- Investigation is based on the same transactional process as is used in normal operation
- Real load or phantom load





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- Investigation is based on the same transactional process as is used in normal operation
- Real load or phantom load
- AC and DC measurements





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Chapter 6 – Test programme / test methods

- Investigation is based on the same transactional process as is used in normal operation
- 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}	$\pm 1 \%$
DC EVSE	$375 \pm 50 \text{ VDC}$ and $750 \pm 50 \text{ VDC}$	N/A



Chapter 7 – Test procedures for type approval

- Reference conditions
- Intrinsic error determination



Chapter 7 – Test procedures for type approval

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



future

New standardization projects



Source: EnBW /photographer: Endre Dulic



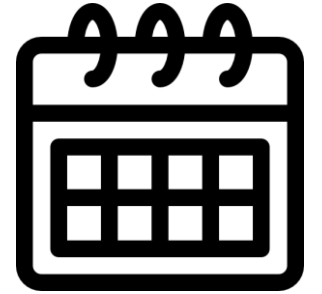
Related developments in standardization

- 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
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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

