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Road vehicles — Environmental conditions and testing for electrical and electronic equipment for drive system of electric propulsion vehicles —

Part 5: Chemical loads

Véhicules routiers — Spécifications d'environnement et essais de l'équipement électrique et électronique pour les véhicules à propulsion électrique —

Partie 5: Contraintes chimiques

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Foreword

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

A list of all parts in the ISO 19453 series can be found on the ISO website.

Road vehicles — Environmental conditions and testing for electrical and electronic equipment for drive system of electric propulsion vehicles —

Part 5: Chemical loads

1 Scope

This document specifies requirements for the electric propulsion systems and components with maximum working voltages according to voltage class B. It does not apply to high voltage battery packs (e.g. for traction) and systems and components inside. It describes the potential environmental stresses and specifies tests and requirements recommended for different stress levels on/in the vehicle.

This document describes chemical loads.

NOTE Conditions and testing for a continuous contact can be determined from other standards or agreed upon between the customer and the supplier.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19453-1, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment for drive system of electric propulsion vehicles — Part 1: General*

ISO 19453-4, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment for drive system of electric propulsion vehicles — Part 4: Climatic loads*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19453-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

4 Tests

4.1 General

Components and associated parts that can come into contact with the specified chemical agents shall be resistant to those agents. The components and associated parts shall be tested with all agents they are likely to come into contact with, except for those materials which can be shown by documentary evidence to be immune to the contaminant and which need not be tested.

A material is considered to be immune to a contaminant if there is no change in properties sufficient to affect material performances over the time and at the temperature specified in this clause.

The supplier and vehicle manufacturer shall agree on the manufacturer and type of chemical agents.

Resistance to the specified chemical agents shall be considered as early as possible during the material selection process.

4.2 Purpose

The purpose of the test is to determine whether the device under test (DUT) is unacceptably affected by temporary exposure to contaminating agents.

NOTE This test is not intended to be a life test.

4.3 General test conditions

Chemical agents shall be selected as defined in Table 1, depending on the mounting location of the DUT.

Unless otherwise specified, one DUT per test agent shall be used.

The following tests describe one test cycle. Unless otherwise specified, one test cycle with one agent per DUT shall be performed. Any other number of cycles may be agreed between the customer and the supplier.

NOTE If the size of the DUT is sufficient, multiple test agents can be applied partially on one DUT provided that these do not have any influence on each other.

4.4 DUT conditioning

Unless otherwise specified, the DUT shall be stored at a room temperature (RT) of (23 ± 5) °C and a relative humidity (RH) of between 25 % and 75 % until temperature and humidity are stabilized.

The DUT shall be tested under conditions of normal use. If necessary, and unless otherwise specified, unrepresentative coatings or contaminations of the DUT shall be removed.

If a cleaning procedure is needed, the customer and the supplier shall agree on the methodology.

4.5 Test agent conditioning

Unless otherwise specified, all test agents shall be stabilized at an RT of (23 ± 5) °C when applied on the DUT.

4.6 Application method

Unless otherwise specified, application shall be performed at an RT of (23 ± 5) °C and an RH of between 25 % and 75 %.

The application method shall be such that the DUT is sufficiently wetted by the test agent in the areas to be tested. The application method shall be chosen as defined in Table 2, depending on the agent and the mounting location of the DUT.

The preferred application methods are given in Table 1.

4.7 Test conditions

Unless otherwise specified, the exposure of the DUT to the agent applied shall be performed at the temperature and for the duration specified in Table 1.

Table 1 — Chemical loads for equipment depending on the mounting location and test conditions

ID	Chemical agent	Mounting location (code)[a]				Exposure conditions	
		Powertrain [A][b]	Passenger compartment [B][b]	Luggage compartment [C][b]	Mounting on the exterior [D][b]	Test temperature °C	Test duration
AA	Diesel fuel	I, II, III, IV	C	C	C	T_{max}[d]	22 h
AB	"Bio" diesel	I, II, III, IV	C	C	C	T_{max}[d]	22 h
AC	Petrol/gasoline unleaded	II, III, IV	C	C	C	RT	10 min
AD	Kerosene	C	C	II, III, IV	C	RT	10 min
AE	Methanol	II, III, IV, V	C	C	C	RT	10 min
BA	Engine oil	II, III, IV	C	C	C	T_{max}[d]	22 h
BB	Differential oil	II, III, IV, V	C	C	C	T_{max}[d]	22 h
BC	Transmission fluid	II, III, IV, V	C	C	C	T_{max}[d]	22 h
BD	Hydraulic fluid	II, III, IV	C	C	C	T_{max}[d]	22 h
BE	Greases	II	C	C	C	T_{max}[d]	22 h
BF	Silicone oil	I, II, IV	I, II, IV	I, II, IV	C	T_{max}[d]	22 h
CA	Battery fluid	II, IV	II, IV	II, IV	C	RT	22 h
CB	Brake fluid	II, IV	C	C	C	T_{max}[d]	22 h
CC	Antifreeze fluid	I, II, III, IV, V	C	C	C	T_{max}[d]	22 h
CD	Urea	II, IV	C	C	II, IV	T_{max}[d]	22 h
CE	Cavity protection	C	C	C	II	RT	22 h
CF	Protective lacquer	I	C	C	I	RT	22 h
CG	Protective lacquer remover	I, II, III, IV	C	C	I, II, III, IV	T_{max}[d]	22 h
DA	Windscreen washer fluid	II, III, IV	C	II, III, IV	II, III, IV	RT	2 h
DB	Vehicle washing chemicals	I, II, III, IV	C	C	I, II, III, IV	RT	2 h
DC	Interior cleaner	C	I, II	I, II	c	RT	2 h
DD	Glass cleaner	C	I, II	I, II	I, II	RT	2 h
DE	Wheel cleaner	C	C	C	I, II, III	RT	2 h
DF	Cold cleaning agent	I, II, III, IV, V	C	I, II, III, IV, V	I, II, III, IV, V	RT	22 h
DG	Acetone	C	I, II	C	C	RT	10 min
DH	Cleaning solvent	I, II	C	C	C	RT	10 min
DJ	Ammonium-containing cleaner	C	II, IV	II, IV	II, IV	RT	22 h
DK	Denatured alcohol	I, II, III, IV	I, II, III, IV	I, II, III, IV	I, II, III, IV	RT	10 min
DL	Alkaline detergent	III, IV, V	C	C	II, III, IV	RT	22 h
EA	Contact spray	I, II	C	C	C	T_{max}[d]	22 h
EB	Transpiration	C	II, IV	C	C	RT	22 h

[a] See Table 2 for the preferred application method of agents (I, II, III, IV and V).

[b] Depending on the mounting location, choose code A, B, C or D. Chemical loading can vary significantly depending on the type and use of the vehicle. For other requirements agreed between the customer and the supplier, choose code Z and mark all agents to be tested. Additional agents may be agreed between the customer and the supplier.

[c] Chemical agents are not applied.

[d] Test temperature: the maximum operating temperature, T_{max}, shall be in accordance with ISO 19453-4.

Table 1 *(continued)*

ID	Chemical agent	Mounting location (code)[a]				Exposure conditions	
		Powertrain [A][b]	Passenger compartment [B][b]	Luggage compartment [C][b]	Mounting on the exterior [D][b]	Test temperature °C	Test duration
EC	Cosmetic products, e.g. creams	C	II	II	C	RT	22 h
ED	Refreshment containing caffeine and sugar	C	II, III	C	C	RT	22 h
EE	Runway de-icer	I, III	C	C	I, III	RT	2 h
EF	Cream, coffee whitener	C	II, III	C	C	RT	22 h
YY	Additional agents	C	C	C	C	—	—

[a] See Table 2 for the preferred application method of agents (I, II, III, IV and V).

[b] Depending on the mounting location, choose code A, B, C or D. Chemical loading can vary significantly depending on the type and use of the vehicle. For other requirements agreed between the customer and the supplier, choose code Z and mark all agents to be tested. Additional agents may be agreed between the customer and the supplier.

[c] Chemical agents are not applied.

[d] Test temperature: the maximum operating temperature, T_{max}, shall be in accordance with ISO 19453-4.

Table 2 — Application methods

Code	Method
I	Spraying
II	Wiping (e.g. cotton cloth)
III	Pouring
IV	Dipping
V	Immersing

4.8 Procedure

The DUT shall be exposed to the agent (see Table 3) as defined in the application methods (see Table 2) at RT. The DUT shall then be stored in a suitable chamber at the temperature and for the duration specified in Table 1. If required, the DUT shall be cooled down to RT after storage and tested as specified below.

a) Perform a visual check and, if appropriate, a functional check and record data for comparison with post-test data.

b) Condition the DUT (see 4.4).

c) Place the DUT in its specified test setup. The configuration may include appropriate electrical or mechanical connections.

d) Stabilize the temperature of the specified agent(s) (see 4.5). Apply the specified agent(s) as defined in Table 1 and 4.6 to the surface of the DUT that is likely to be exposed.

e) Allow the DUT to drain naturally. Shaking or wiping is not permitted. However, if representative of service conditions, it may be turned about any axis to allow for drainage from different positions.

f) Maintain the DUT at the temperature and for the duration specified in Table 1.

g) Stabilize the DUT at RT.

h) For more than 1 cycle, repeat steps d) to g).

i) Examine the DUT immediately as defined in the requirements in 4.9.

Any safety and warning notes shall be observed.

4.9 Requirements

The minimum functional status shall be class C as defined in ISO 19453-1. If necessary, other requirements shall be agreed between the customer and the supplier.

Marking and labelling shall remain visible and legible.

5 Documentation

For documentation, Table 1 specifies the codes for chemical load and the designations outlined in ISO 19453-1 shall be used.

Table 3 — Chemical agents

Group	ID	Chemical agent	Description of active substance[a]
Fuels	AA	Diesel fuel	See EN 590
	AB	"Bio" diesel	See EN 14214
	AC	Petrol/gasoline unleaded	See EN 228
	AD	Kerosene	See ASTM D 1655[b]
	AE	Methanol	CAS 67-56-1[c]
Oils and lubricants	BA	Engine oil	Multigrade oil (SAE 0W40[d], API SL/CF[e]/SAE 5W30, SAE 0W20)
	BB	Differential oil	Hypoid gear oil (SAE 75W140, API GL-5)
	BC	Transmission fluid	ATF Dexron III
	BD	Hydraulic fluid	See DIN 51524-3 (HVLP ISO VG 46)
	BE	Greases	See DIN 51502 (KP2K-30)
	BF	Silicone oil	CAS 63148-58-3 (AP 100)
Other operating agents	CA	Battery fluid	37 % H_2SO_4
	CB	Brake fluid	See ISO 4926
	CC	Antifreeze fluid	Ethylene glycol ($C_2H_6O_2$) – Water mixture 1:1
	CD	Urea NO_x (reduction agent)[f]	See ISO 22241-1
	CE	Cavity protection	e.g. Teroson Underbody Coating Spray™[g h]
	CF	Protective lacquer	e.g. W550™ (supplied by Pfinder Chemie)[g h]
	CG	Protective lacquer remover	e.g. Friapol 750™ (supplied by Pfinder Chemie)[g h]

a Suppliers or trademarks are given for certain chemical agents in this table.

b ASTM: American Society for Testing and Materials.

c CAS: Chemical Abstract Service.

d SAE: Society of Automotive Engineers.

e API: American Petroleum Institute.

f Also known as "ad blue".

g The referenced agent can be used or an agent shall be agreed between the customer and the supplier.

h These products are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.