
**Electrically propelled road vehicles —
Test specification for electric
propulsion components —**

**Part 1:
General test conditions and
definitions**

*Véhicules routiers à propulsion électrique — Spécification d'essai
pour les composants de propulsion électrique —*

Partie 1: Conditions générales et définitions



This document is a preview generated by EUS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms	3
5 General test conditions	4
5.1 Operating points.....	4
5.1.1 Operating points for motor, inverter and motor system.....	4
5.1.2 Operating points for DC/DC converter.....	7
5.2 Methods for determining the rank for operating load test.....	8
5.2.1 Target rank verification method.....	8
5.2.2 Rank search method.....	9
5.3 Provision for current, voltage and power measurement.....	9
5.4 DC input voltage.....	11
5.5 Temperature and humidity.....	11
5.6 Measurement accuracy.....	12
Annex A (informative) Formula of power	13
Bibliography	18

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 37, *Electrically propelled vehicles*.

This second edition cancels and replaces the first edition (ISO 21782-1:2019), which has been technically revised.

The main changes are as follows:

- addition of ISO 21782-4, ISO 21782-5 and ISO 21782-7 general specifications and requirements to this document;
- correction of the subclause numbers cited in the Terms and definitions clause.

A list of all parts in the ISO 21782 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Until now, there was no international standardized test procedure for the motor system including motors, inverters DC/DC converters and their combinations for electric propulsion systems of electrically propelled road vehicles available. There are some International Standards for industrial use which consider the steady/constant running of motors and inverters but do not consider the dynamic operation (acceleration/deceleration).

The ISO 21782 series was prepared aiming at the reproducibility of test results which will enable to compare and evaluate fairly the performance and reliability of electric propulsion system components such as the motor system (the motor, inverter, DC/DC converter and their combinations).

The overview of the ISO 21782 series is in [Tables 1](#) to [7](#) shown below.

Table 1 — Contents of this document: General test conditions and definitions

Item of this document	Description
Introduction	Background and purpose of the ISO 21782 series
Terms and definitions	Terms to use in the ISO 21782 series
Abbreviated terms	Abbreviated terms to use in the ISO 21782 series
General test conditions	Definition of general condition: — operating point, — methods for determining the rank for operating load test, — current, voltage and power, — DC input voltage, — temperature and humidity, — measurement accuracy.

Table 2 — Contents of ISO 21782-2: Performance testing of the motor system

Item of ISO 21782-2	Description	Motor	Inverter	Chopper	Motor system	DC/DC converter
Measurement of total loss and total efficiency	This test measures total loss and total efficiency between the input power of inverter and the output power of the motor.				5.1	
Temperature rise test	This test investigates the temperature rise characteristics of each part of the motor system within the specified range.				5.2	
Torque characteristic test	This test measures the torque characteristics specified in the specifications of the motor system.				5.3	
Torque ripple test	This test measures the torque ripple of the motor.				5.4	

Table 3 — Contents of ISO 21782-3: Performance testing of the motor and the inverter

Item of ISO 21782-3	Description	Motor	Inverter	Chopper	Motor system	DC/DC converter
Measurement of loss and efficiency	This test measures loss and efficiency between the input power and the output power.	5.1.1	5.2.1	5.3.1		
	This test measures conversion rate between the input power and the output power.		5.2.1	5.3.1		
Temperature rise test	This test investigates the temperature rise characteristics of each part of the component within the specified range.	5.1.2	5.2.2	5.3.2		
Torque characteristic test	This test measures the torque characteristics specified in the specifications of the motor.	5.1.3				
Cogging torque test	This test measures the cogging torque of the permanent magnetic motor.	5.1.4				

Table 4 — Contents of ISO 21782-4: Performance testing of the DC/DC converter

Item of ISO 21782-4	Description	Motor	Inverter	Chopper	Motor system	DC/DC converter
Measurement of loss and efficiency	This test measures loss and efficiency between the input power and the output power.					5.1
Temperature rise test	This test investigates the temperature rise characteristics of each part of the DC/DC converter within the specified range.					5.2

Table 5 — Contents of ISO 21782-5: Operating load testing of the motor system

Item of ISO 21782-5	Description	Motor	Inverter	Chopper	Motor system	DC/DC converter
Endurance test	Cyclic test of output torque pattern endurance including maximum torque and maximum speed				5.1	
Surge voltage measurement test	This test measures the surge voltage applied to the input terminals of the motor.				5.2	
Over speed test	The test verifies the no control failure according to the over speed and gives the corresponding rank.				5.3	

Table 6 — Contents of ISO 21782-6: Operating load testing of the motor and the inverter

Item of ISO 21782-6	Description	Motor	Inverter	Chopper	Motor system	DC/DC converter
Operation endurance tests of motor	Cyclic test of high acceleration/deceleration endurance	4.1.1				
	Cyclic test of torque pattern endurance including maximum torque	4.1.2				
	Over speed test	4.1.3				

Table 6 (continued)

Item of ISO 21782-6	Description	Motor	Inverter	Chopper	Motor system	DC/DC converter
Operation endurance tests of inverter	Cyclic test of output current pattern endurance including maximum current		4.2.1			
Breakdown strength verification test	Contents of this test are mainly spin test, data acquisition of mechanical strength of the motor.	4.3.1				

Table 7 — Contents of ISO 21782-7: Operating load testing of the DC/DC converter

Item of ISO 21782-7	Description	Motor	Inverter	Chopper	Motor system	DC/DC converter
Operation endurance test	Cyclic test of output current pattern endurance including maximum current					5

Electrically propelled road vehicles — Test specification for electric propulsion components —

Part 1: General test conditions and definitions

1 Scope

This document specifies the test procedures for performance and operating load for voltage class B electric propulsion components (motor, inverter, DC/DC converter) and their combinations (motor system) of electrically propelled road vehicles.

This document specifies the terms and definitions used in the ISO 21782 series and general test conditions.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

chopper

DC electronic *power converter* (3.19) without an intermediate AC link giving a variable output voltage by varying the periods of conduction and non-conduction in an adjustable ratio

[SOURCE: IEC 60050-811:2017, 811-19-11, modified — The phrase "electronic power DC convertor" was modified to "DC electronic power converter".]

3.2

conversion rate

ratio of output base wave power or output DC power to input DC power

3.3

DC/DC converter

DC electric *power converter* (3.19) with an intermediate AC link transferring electric power between a voltage class B electric circuit and a voltage class A insulated electric circuit

3.4

DC link inductor

component boosted by the *chopper* (3.1) circuit, a magnetic energy storage and released in response to actuation of the switching element