

---

---

**Road vehicles — Electrical  
performance of starter motors — Test  
methods and general requirements**

*Véhicules routiers — Caractéristiques électriques des démarreurs —  
Méthodes d'essai et conditions générales*

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 8856:2014](https://standards.iteh.ai/catalog/standards/sist/01978a4c-1e65-449c-b3a5-4f9c9c3e44c/iso-8856-2014)

<https://standards.iteh.ai/catalog/standards/sist/01978a4c-1e65-449c-b3a5-4f9c9c3e44c/iso-8856-2014>



**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 8856:2014](https://standards.iteh.ai/catalog/standards/sist/01978a4c-1e65-449c-b3a5-4f9c9c3e44c/iso-8856-2014)

<https://standards.iteh.ai/catalog/standards/sist/01978a4c-1e65-449c-b3a5-4f9c9c3e44c/iso-8856-2014>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2014

All rights reserved. Unless otherwise specified, 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  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Terms and definitions</b> .....	<b>1</b>
<b>3 Test conditions</b> .....	<b>2</b>
3.1 Temperature.....	2
3.2 Measurement accuracy.....	2
3.3 Voltage/current characteristic of starter motor power supply.....	2
3.4 Preparation of test samples.....	3
<b>4 Test benches</b> .....	<b>3</b>
4.1 General.....	3
4.2 Type 1 test bench.....	4
4.3 Type 2 test bench.....	4
<b>5 Test method</b> .....	<b>6</b>
5.1 General.....	6
5.2 Test procedure.....	6
<b>6 Measurement correction</b> .....	<b>7</b>
6.1 General.....	7
6.2 Correction of torque.....	7
6.3 Correction of rotational frequency with temperature.....	9
<b>7 Presentation of results</b> .....	<b>10</b>
7.1 Power output and efficiency calculation.....	10
7.2 Graphic presentation of starter motor characteristic curves.....	10
7.3 Change of voltage/current characteristic.....	10

<https://standards.iteh.ai/catalog/standards/sist/01978a4c-1e65-449c-b3a5-4f9c9c3e44c/iso-8856-2014>

## 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](http://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](http://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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

[ISO 8856:2014](#)

This third edition cancels and replaces the second edition (ISO 8856:1995), which has been technically revised. It also incorporates the Amendment ISO 8856:1995/Amd1:1997.

# Road vehicles — Electrical performance of starter motors — Test methods and general requirements

## 1 Scope

This International Standard lays down test methods and general requirements for the determination of the electrical characteristics of DC starter motors intended to start internal combustion engines of road vehicles.

## 2 Terms and definitions

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

### 2.1

#### lock torque

torque of starter motor at the pinion with the armature shaft locked (no rotation)

Note 1 to entry: It is expressed in Nm.

### 2.2

#### nominal power

$P_{\text{nom}}$

power declared by the starter motor manufacturer corresponding to the maximum power output at the reference temperature when determined in accordance with this International Standard

[ISO 8856:2014](https://www.iso.org/standard/54944.html)

Note 1 to entry: It is expressed in W. <https://www.iso.org/standard/54944.html>

### 2.3

#### power output

$P$

power derived from measurements of torque and rotational frequency of the motor pinion shaft

Note 1 to entry: It is expressed in W.

### 2.4

#### power supply

battery or battery simulation device which delivers a voltage/current characteristic as defined in this International Standard

### 2.5

#### reference temperature

temperature at which the performance curves and nominal power shall be reported

Note 1 to entry: Reference temperature is expressed in °C.

Note 2 to entry: It is equal to 20 °C.

### 2.6

#### total resistance of starter motor

$R_S$

resistance value of the terminal voltage, see [Figure 2](#), divided by the starter motor current (steady state current of solenoid included)

Note 1 to entry: It is expressed in  $\Omega$ .

**2.7 total resistance of power supply at starter motor terminals**

$R_{BL}$   
sum of power supply and external line resistance

Note 1 to entry: It is expressed in  $\Omega$ .

**3 Test conditions**

**3.1 Temperature**

**3.1.1 Test method A — Continuous mode method**

Ensure that all parts of the starter motor are at the same, registered temperature.

To avoid temperature corrections, the starter motor can be preconditioned at  $(20 \pm 2) ^\circ\text{C}$ .

**3.1.2 Test method B — Discrete point method**

Ensure that all parts of the starter motor are at the same, registered temperature.

To avoid temperature corrections, the starter motor can be preconditioned at  $(20 \pm 2) ^\circ\text{C}$ .

**3.1.3 Test method C — Continuous mode method at cold cranking temperature**

The starter motor shall be preconditioned at a specified cold cranking temperature as agreed between starter motor manufacturer and engine manufacturer (e.g.  $-25 ^\circ\text{C} \pm 2 ^\circ\text{C}$ ).

**3.2 Measurement accuracy**

The overall capability of the test equipment shall enable the parameters to be measured within the accuracy shown in [Table 1](#). This requirement shall be respected through the whole test procedure. The target accuracy should be used for new test equipment.

**Table 1 — Measurement accuracy**

Parameter	Accuracy	Target accuracy
Current	$\pm 1 \%$	$\pm 0,5 \%$
Voltage	$\pm 1 \%$	$\pm 0,5 \%$
Rotational frequency	$\pm 2 \%$	$\pm 1 \%$
Torque	$\pm 2 \%$	$\pm 1 \%$
Temperature	$\pm 2 \text{ K}$	$\pm 2 \text{ K}$

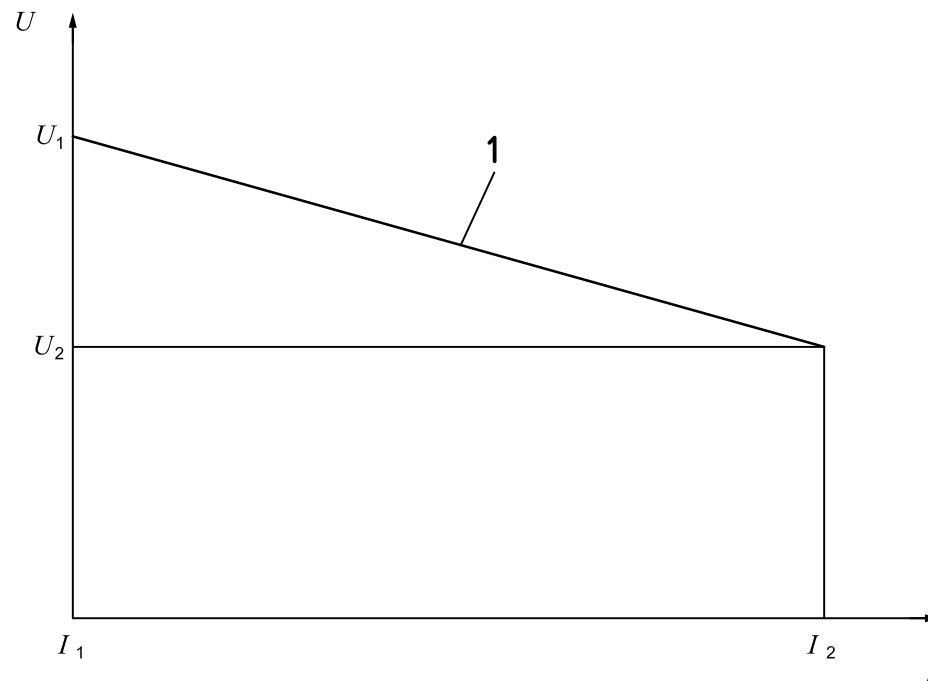
**3.3 Voltage/current characteristic of starter motor power supply**

The voltage/current characteristic of starter motor power supply is a sloping straight line (see [Figure 1](#)). The line is defined at  $20 ^\circ\text{C}$  either by two pairs of values  $[(U_1, I_1) \text{ and } (U_2, I_2)]$ , or by one pair of values  $(U, I)$  and the internal resistance of the starter motor power supply.

The voltage values  $(U_1 \text{ and } U_2)$  shall be measured at the starter motor terminals.

The voltage/current characteristic shall be selected from [Table 2](#) without exceeding the values stated by the starter motor manufacturer.

If required, other voltage/current characteristics can be used as agreed between the starter motor manufacturer and the vehicle manufacturer.

**Key**

1 at 20 °C

**iTeh STANDARD PREVIEW**  
 (standards.iteh.ai)  
**Figure 1 — Voltage/current characteristic of starter motor power supply**

**3.4 Preparation of test samples** [ISO 8856:2014](#)

<https://standards.iteh.ai/catalog/standards/sist/01978a4c-1e65-449c-b3a5-527c04e81856/iso-8856-2014>

For new starter motors, it is necessary to perform a run-in procedure in order to ensure a stable performance. One example for such a run-in procedure is described below.

Starter motor should be run-in with 40 cycles as follows:

- a) 2 s running at a torque equal to 25 % of the lock torque value;
- b) 13 s rest.

Cooling is permitted during this preparation. The lock torque shall be measured using an appropriate power supply (see [Table 2](#)).

Other preparation test conditions can be used if equivalent or better effect on stabilization of starter performance is confirmed.

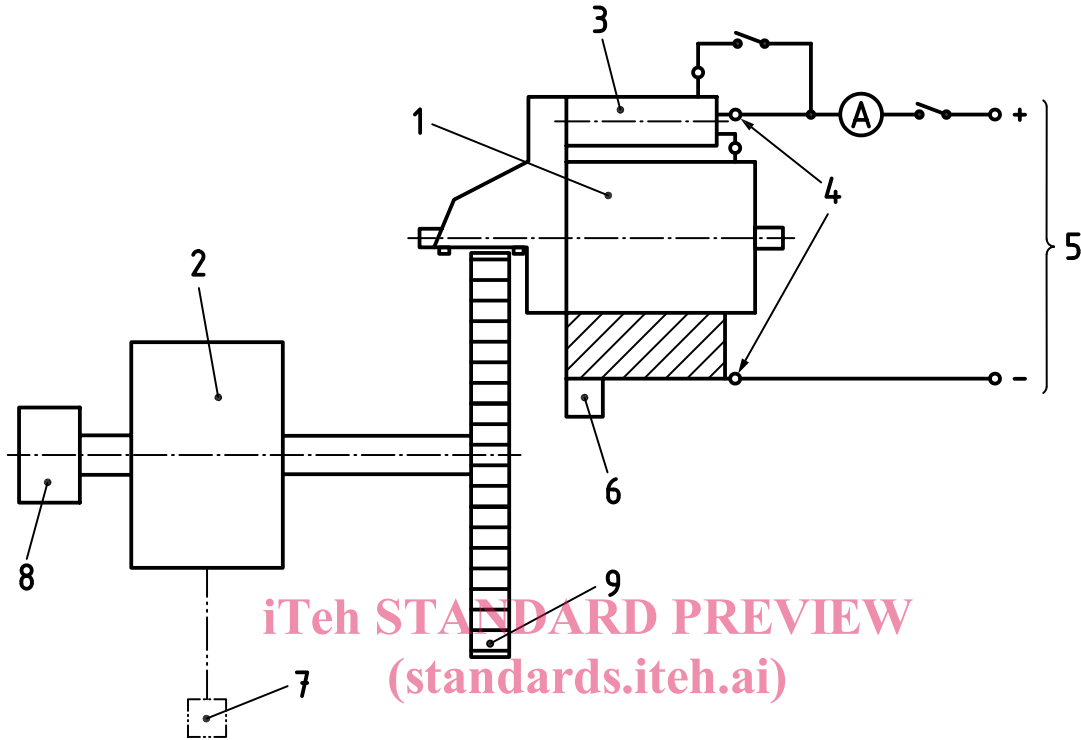
**4 Test benches****4.1 General**

There are two types of test bench which can be used.

On either type, torque shall be measured either directly as the reaction torque of the starter motor, or at the drive gear shaft.

4.2 Type 1 test bench

The test bench in Figure 2 allows performance measurements to be taken by engaging the pinion with a drive gear, either the ring gear assembly or suitable alternative. The backlash between the pinion and the drive gear teeth shall be in accordance with the starter motor manufacturer’s recommendations.



Key

- 1 starter motor
- 2 brake/variable load
- 3 solenoid
- 4 starter motor terminals
- 5 starter motor power supply
- 6, 7 torque measurement
- 8 rotational frequency measurement
- 9 drive gear

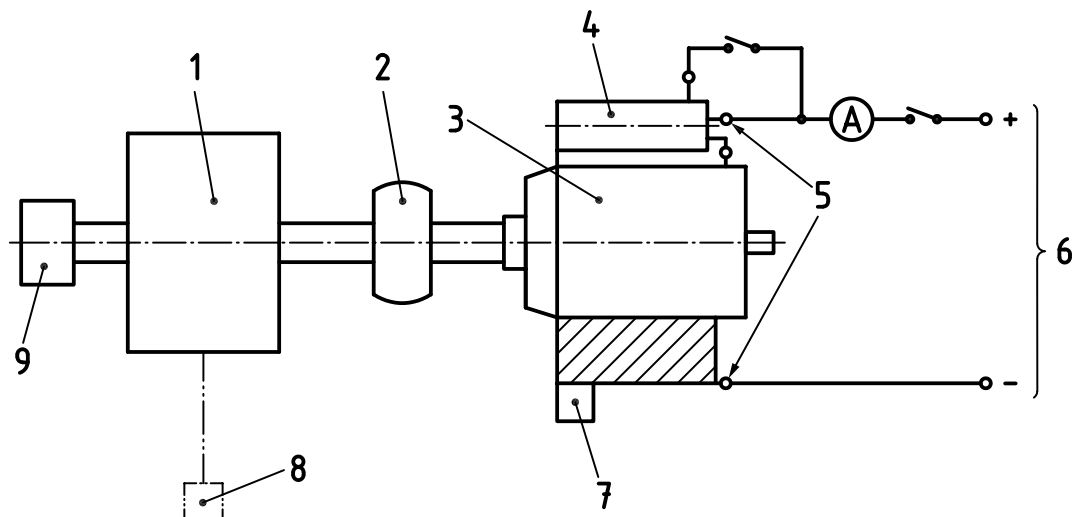
ISO 8856:2014  
<https://standards.iteh.ai/catalog/standards/sist/01978a4c-1e65-449c-b3a5-4f9c9c3e44c/iso-8856-2014>

Figure 2 — Type 1 test bench

4.3 Type 2 test bench

The test bench in Figure 3 permits direct measurement of the starter motor at the pinion or armature shaft. The starter motor shall be coupled to the test device coaxially through a suitable coupling. The drive end shield of a nose-type starter motor can be replaced by a special bearing bracket to permit coupling to the starter motor shaft.





**Key**

- 1 brake/variable load
- 2 coupling
- 3 starter motor
- 4 solenoid
- 5 starter motor terminals
- 6 starter motor power supply
- 7, 8 torque measurement
- 9 rotational frequency measurement

iTech STANDARD PREVIEW  
(standards.iteh.ai)  
 ISO 8856:2014  
**Figure 3 — Type 2 test bench**  
<https://standards.iteh.ai/catalog/standards/sist/61978a4c-1c03-449c-b3a5-4f9c9c3e44c/iso-8856-2014>