
**Vozila za talni transport - Energijska učinkovitost - Preskusne metode - 1. del:
Splošno**

Energy efficiency of industrial trucks - Test methods - Part 1 : General

Energieeffizienz von Flurförderzeugen - Testmethoden - Teil 1: Generelles

Efficacité énergétique des chariots de manutention - Méthodes d'essai - Partie 1 :
Généralités

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**Energy efficiency of Industrial trucks - Test methods - Part
1: General**

Efficacité énergétique des chariots de manutention -
Méthodes d'essai - Partie 1 : Généralités

Energieeffizienz von Flurförderzeugen - Testmethoden
- Teil 1: Generelles

This European Standard was approved by CEN on 13 August 2016.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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EN 16796-1:2016 (E)**European foreword**

This document (EN 16796-1:2016) has been prepared by Technical Committee CEN/TC 150 “Industrial Trucks - Safety”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2017, and conflicting national standards shall be withdrawn at the latest by May 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

EN 16796 consists of the following parts, under the general title *Energy efficiency of Industrial trucks — Test methods*:

- *Part 1: General;*
- *Part 2: Operator controlled self-propelled trucks, towing tractors and burden-carrier trucks;*
- *Part 3: Container handling lift trucks.*

The following parts are under preparation:

- *Part 4: Rough-terrain trucks;*
- *Part 5: Trucks with elevating operator position and trucks specifically designed to travel with elevated loads.*

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The EN 16796 series deals with the energy efficiency of industrial trucks and aligns with the New Approach Ecodesign Directive 2009/125/EC (ErP).

Part 1 contains the procedures to determine the efficiency of trucks, traction batteries and battery chargers. The other parts provide a specific test cycle for different truck types.

NOTE The test cycles are based on the VDI 2198 guideline. This guideline is widely accepted by industry and is used to measure the energy consumption of electric industrial trucks and internal combustion industrial trucks. The guideline is in place since 1996 and it is used broadly. This approach allows the evaluation of the energy efficiency of trucks by comparison.

The content of this document is of relevance for the following stakeholder groups:

- machine manufacturers (small, medium and large enterprises);
- market surveillance authorities;
- machine users (small, medium and large enterprises);
- service providers, e.g. for consulting activities.

The abovementioned stakeholder groups have been given the opportunity to participate at the drafting process of this document. The machines concerned are indicated in the Scope of this document.

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EN 16796-1:2016 (E)**1 Scope**

This European Standard specifies general test criteria and requirements to measure the energy consumption for self-propelled industrial trucks (hereafter referred to as trucks) during operation. For electric trucks, the efficiency of the battery and the battery charger is included.

This part of the EN 16796 series is intended to be used in conjunction with the corresponding EN 16796-2 to -5.

The truck specific requirements in EN 16796-2 to -5 take precedence over the respective requirements of EN 16796-1.

Of the product life cycle, EN 16796 is applicable to the in-use phase.

It applies to the following truck types according to ISO 5053-1:

- counterbalance lift truck;
- articulated counterbalance lift truck;
- lorry-mounted truck;
- reach truck (with retractable mast or fork arm carriage);
- straddle truck;
- pallet-stacking truck;
- pallet truck;
- platform and stillage truck;
- pallet truck end controlled;
- order-picking truck;
- centre-controlled order-picking truck;
- towing, pushing tractor and burden carrier;
- towing and stacking tractor;
- side-loading truck (one side only);
- rough-terrain truck;
- rough-terrain variable-reach truck;
- slewing rough-terrain variable-reach truck;
- variable-reach container handler;
- counterbalance container handler;
- lateral-stacking truck (both sides);

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- lateral-stacking truck (three sides);
- non-stacking low-lift straddle carrier;
- multi-directional lift truck.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 589, *Automotive fuels — LPG — Requirements and test methods*

EN 590, *Automotive fuels - Diesel - Requirements and test methods*

prEN 1459-1, *Rough terrain trucks — Safety requirements and verification — Part 1: Variable-reach trucks*

EN 1459-2, *Rough-terrain trucks - Safety requirements and verification - Part 2: Slewing variable-reach trucks*

EN 16796 (all parts), *Energy efficiency of Industrial trucks — Test methods*

EN 60254-1, *Lead acid traction batteries - Part 1: General requirements and methods of tests (IEC 60254-1)*

EN ISO 3691-1:2015, *Industrial trucks - Safety requirements and verification - Part 1: Self-propelled industrial trucks, other than driverless trucks, variable-reach trucks and burden-carrier trucks (ISO 3691-1:2011, including Cor 1:2013)*

EN ISO 3691-2, *Industrial trucks - Safety requirements and verification - Part 2: Self-propelled variable-reach trucks (ISO 3691-2)*

EN ISO 3691-6, *Industrial trucks - Safety requirements and verification - Part 6: Burden and personnel carriers (ISO 3691-6)*

ISO 5053-1:2015, *Industrial trucks — Terminology and classification — Part 1: Types of industrial trucks*

ISO 15500-1, *Road vehicles — Compressed natural gas (CNG) fuel system components — Part 1: General requirements and definitions*

EN 16796-1:2016 (E)**3 Terms and definitions**

For the purposes of this document, the terms and definitions given in ISO 5053-1 and the following apply.

**3.1
battery**
electrical power source consisting of battery cells, connectors of cells, battery controller (if applicable, e.g. controller for Li-Ion batteries) and battery enclosure that is ready to use in an industrial truck

**3.2
battery state of charge**
measured capacity (in Ampere hours [Ah]) of the battery divided by the maximum rated capacity [Ah], expressed as a percentage

**3.3
carbon dioxide equivalent
CDE**
quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO₂ that would have the same global warming potential (GWP)

**3.4
charging factor**
ratio between amount of Ah recharged into the battery and the prior discharged amount of Ah from the battery

Note 1 to entry: Typically the charge factor for lead acid batteries is in the range of 1,02 to 1,25.

**3.5
cycle time**
amount of time it takes a machine to perform a repetitive segment of an operation, typically measured as the time it takes a machine to return to the same position

**3.6
power battery factor
PBF**
factor that gives the ratio between the battery capacity and the electrical power taken from the battery

**3.7
synthetic discharge cycle**
typical battery discharge profile that mirrors the actual energy consumption of electric trucks during a test cycle

4 Test conditions

4.1 General

The following test conditions ensure that the measurement of power consumption is performed in a similar and comparable way.

4.2 Test equipment

4.2.1 Test area

The test area shall be a flat and smooth area with a hard, clean and dry surface made of concrete, asphalt or equivalent. The test course shall have no more than 2 % slope in any direction of travel.

4.2.2 Test track

For truck type specific information for a different truck type see the respective part of EN 16796.

4.2.3 Test load and/or towing capacity

Unless it is otherwise stated in the specific part of EN 16796, the test load shall be equal to 70 % of the rated load and standard load centre distance of the truck as defined in EN ISO 3691-1, EN ISO 3691-2, EN 1459-1 or EN 1459-2.

Tractors shall tow with a force according 70 % of the rated drawbar pull as defined in EN ISO 3691-1:2015, A.3.

Burden-carriers shall be laden with 70 % of the maximum load as defined in EN ISO 3691-6.

4.3 Truck conditions

The truck to be tested shall be a sample that is representative of series production. For all parts of the truck, with effect to the energy consumption, a run-in time of up to 100 h is permissible. The run-in time shall be documented.

The truck to be tested shall be in a safe and functional state. All equipment attached shall be in accordance to the specification of the manufacturer of the truck.

The set-up of the truck (e.g. software parameters) shall be available as per the manufacturer's specification. That requirement means that the truck performance as specified is achievable (e.g. driving and lifting speed, acceleration) and all software settings are commercially available to the customer.

NOTE For instance, the test driver can adapt the maximum driving speed to achieve the cycles / hour.

The test truck shall be fitted with new tyres (max. 10 % of tread wear) which shall comply with the specifications of the manufacturer of the truck. Pneumatic tyres shall be inflated to their correct pressure specified by the truck manufacturer or by default from the tire manufacturer.

The fuel tanks of internal combustion engine trucks shall be filled to the maximum specified level prior to the warm up period. All other tanks shall be filled to their correct operating levels, if applicable.

If the test is to be performed on a sample that is representative for a range of trucks with the same rated capacity but different lift heights, the test shall be carried out on the truck with the specification according to EN ISO 3691-1:2015, A.2.1. For trucks covered by prEN 1459-1, EN 1459-2 and EN ISO 3691-2 see the specific requirements of the applicable part of EN 16796.

For trucks covered by EN ISO 3691-1 the specified lift height shall be at least the standard lift height according to EN ISO 3691-1:2015, A.2.2. The truck's specified lift height shall allow the measurement procedures as defined in the specific part of the EN 16796 series.