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BSI Standards Publication

Energy efficiency of Industrial trucks — Test methods

Part 2: Operator controlled self-propelled trucks, towing tractors and burden-carrier trucks

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National foreword

This British Standard is the UK implementation of EN 16796-2:2016.

The UK participation in its preparation was entrusted to Technical Committee MHE/7, Industrial trucks.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Energy efficiency of Industrial trucks - Test methods - Part 2: Operator controlled self-propelled trucks, towing tractors and burden-carrier trucks

Efficacité énergétique des chariots de manutention - Méthodes d'essai - Partie 2 : Chariots automoteurs commandés par l'opérateur, tracteurs et chariots transporteurs de charge

Energieeffizienz von Flurförderzeuge, - Testmethoden - Teil 2: Bedienergeführte selbstangetriebene Flurförderzeuge, Schlepper und Lastentransportfahrzeuge

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 16796-2:2016) 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of an identical text or by endorsement, at the latest by May 2017, and conflicting national standards shall be withdrawn at the latest May 2017.

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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*.

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1 Scope

This European Standard specifies the method of energy consumption measurement for the following types of industrial trucks as defined in 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);

— lateral-stacking truck (both sides);

— lateral-stacking truck (three sides);

— non-stacking low-lift straddle carrier;

— multi-directional lift truck.

This part is intended to be used in conjunction with EN 16796-1.

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 16796-1:2016, *Energy efficiency of Industrial trucks — Test methods — Part 1: General*

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)*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5053-1 and EN 16796-1 apply.

4 Test conditions

The test conditions are given in EN 16796-1:2016, Clause 4.

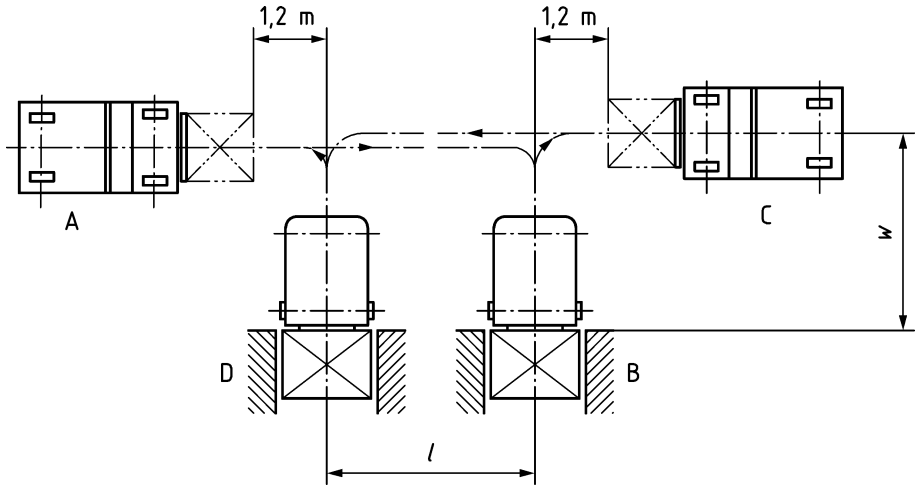
5 Measurement procedure

5.1 General

EN 16796-1 applies together with the following sub-clauses that are describing specific information for the respective truck type.

5.2 Test layout

Figure 1 shows the general test layout to perform the consumption test-cycle for self-propelled trucks within the scope of this standard. Figure 2 shows the cycle for towing tractors and burden carriers.

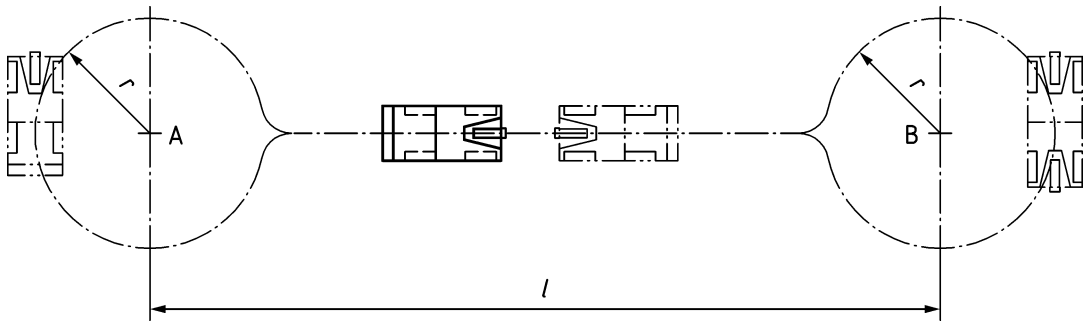


Key

w distance between the longitudinal centre plane of the truck and the simulated leading edge of the rack

l distance

Figure 1 — Cycle for energy consumption test of self-propelled trucks



Key

r minimum turning radius

A,B midpoint r

l distance

Figure 2 — Cycle for energy consumption test of towing tractors and burden carriers

5.3 Operating requirements and sequence for counterbalance lift trucks and comparable truck designs

For counterbalance trucks, lorry-mounted trucks, multi-directional forklift trucks and articulated counterbalance lift trucks the cycle shall be performed according to Figure 1 and Table 1 and shall start at position “A”.

While travelling the load shall be at a lift height defined by the manufacturer, typically 300 mm. The mast or the fork carriage shall be tilted to the maximum backwards tilt.

Simultaneous operation is not permissible, travelling is not permitted while lift/lowering, or tilt operations.

The test duration shall be 1 h and the speed shall be adapted to reach the number of cycles per hour as defined in Table 1.

At position “B” and “D”, the load shall be lifted and lowered without depositing the load.

The sequence of the cycle shall be carried out with the following actions:

— start at position “A”,

— travel in forward direction to position “B” by turning through 90°,

— return the backward tilt to the vertical position,

— lift the load with the lift as specified in Table 1,

— lower to the lift height for travelling (300 mm),

— tilt back to maximum,

— drive backwards to position “C”,

— drive forward to position “D”,

— repeat the procedure as on position “B”,

— drive backwards to position “A”,

— end of cycle.

Table 1 — Test specification for counterbalanced trucks

Rated capacity Q, rated voltage U and type	Q ≤ 5 t and U ≤ 36 V (electric)	Q ≤ 5 t (all other)	Q = 5 t [a]	5 t < Q ≤ 10 t	10 t < Q ≤ 18 t	Q > 18 t
Test load	0,7 Q	0,7 Q	0,7 Q	0,7 Q	0,7 Q	0,7 Q
No. of cycles [1/h]	45	60	60 or 45 [a]	45	40	25
Distance l [m]	30	30	30	30	50	100
Distance w [m]	3	3	3 or 4 [a]	4	5	8
Lift at B and D [m]	2	2	2	2	3	3

[a] The truck manufacturer may decide to test according to the test for trucks with Q ≤ 5 t or Q > 5t. For this capacity the selected No. of cycles and distance w shall be documented and published.

5.4 Operating requirements for other types of self-propelled trucks

5.4.1 General

For other truck types within the scope of this standard the cycle shall be performed according to Figure 1 and Table 2.

NOTE For types of trucks not covered by this standard or other parts of the standard series one of the specific measurement procedures can be chosen and used as a guideline.

At position “B” and “D”, the load shall be lifted and lowered without depositing the load.

The test duration shall be 1 h and the speed shall be adapted to reach the number of cycles per hour as defined in Table 2.

Simultaneous operation is not permissible, travelling is not permitted while lift/lowering, reach or tilt operations.

While travelling the load shall be at a lift height defined by the manufacturer, typically 300 mm.

Table 2 — Test specification for other types of trucks

Type	Reach truck	Straddle trucks, pallet stacking trucks	Pallet and stillage trucks, pallet trucks end controlled, centre controlled order picking trucks	Towing tractors and burden carriers	
				rated voltage U < 80 V	rated voltage U ≥ 80 V and IC-trucks
Test load	0,7 Q	0,7 Q	0,7 Q	0,7 Q	0,7 Q
No. of cycles [1/h]	35	20	20	40	60
Distance l [m]	30	30	30	50	50
Distance w/ Radius *r* [m]	3	3	3	r_{min}	r_{min}
Lift at B and D [m]	4	2	0,15 or max.[a]	-	-

[a] Whichever is lower.

5.4.2 Operating sequence for reach trucks

For reach trucks the cycle shall be performed according to Figure 1 and Table 2 and shall start at position “D”.

The mast or the fork carriage shall be tilted 6° backwards or to the maximum backwards tilt, whichever is the least. The reach mechanism shall be retracted.

At position “B” and “D”, the load shall be lifted, lowered and shifted without depositing the load.

The sequence of the cycle shall be carried out with the following actions:

— start at position “D”, load at 300 mm, mast or the fork carriage tilted to the backwards tilt, reach mechanism in travelling position,

— move the backward tilt to the vertical position,

— extend the reach mechanism until maximum reach,

— lift the load as specified in Table 2,

— lower to the lift height for travelling (300 mm),

— retract the reach mechanism in travelling position,

— tilt to the backwards tilt,

— drive forward to position “C”,

— drive backwards to position “B” by turning through 90°,

— repeat the procedure as on position “D”,

— drive forward to position “A”,

— drive backwards to position “D”,

— end of cycle.

5.4.3 Operating sequence of straddle trucks and pallet stacking trucks

For straddle trucks and pallet stacking trucks the cycle shall to be performed according to Figure 1 and Table 2 and shall start at position “D”.

The sequence of the cycle shall be carried out with the following actions:

— start at position “D”, load at 300 mm,

— lift the load as specified in Table 2,

— lower to the lift height for travelling (300 mm),

— drive forward to position “C”,

— drive backwards to position “B” by turning through 90°,

— repeat the procedure as on position “D”,

— drive forward to position “A”,

— drive backwards to position “D”,

— end of cycle.

Double stackers and stacking tractors should be tested according to 5.4.3.

5.4.4 Operating sequence for pallet and stillage trucks, pallet trucks end controlled, centre controlled order picking trucks

The start position of those trucks is depending on the forward-driving direction as defined in EN ISO 3691-1:2015, Annex A.

At position “B” and “D”, the load shall be lifted and fully lowered. While travelling the load shall be at 150 mm or the maximum height, whichever is lower (transport height). The sequence of the cycle for trucks where load-trailing is defined as forward-driving direction shall be carried out with the following actions:

— start at position “D”, load at 150 mm or the maximum height, whichever is lower,

— lower the load carriage to the floor,

— lift the load to the transport height,

— drive forward to position “C”,

— drive backwards to position “B” by turning through 90°,

— repeat the procedure as on position “D”,

— drive forward to position “A”,

— drive backwards to position “D”,

— end of cycle

The sequence of the cycle for trucks where load-leading is defined as forward-driving direction shall be carried out with the following actions:

— start at position “A”, load at 150 mm or the maximum height, whichever is lower,

— travel in forward direction to position “B” by turning through 90°,

— lower the load carriage to the floor,

— lift the load to the transport height,

— drive backwards to position “C”,

— drive forward to position “D”,

— repeat the procedure as on position “B”,

— drive backwards to position “A”,

— end of cycle

5.4.5 Operating sequence for towing tractors and burden carriers

For towing tractors and burden carriers the cycle shall be performed according to Figure 2 and Table 2.

For towing tractors and burden carriers with trailer(s) *r* is the minimum turning radius including the trailer(s).

For burden carriers without trailer *r* is the minimum turning radius.

The cycle shall start at position “A” by travelling in direction position “B”, turning with the minimum turning radius *r* and travel back to position “A”, turning there and continue.

The test duration shall be 1 h and the speed of the tractor/carrier shall be adapted to reach the number of cycles per hour as defined in Table 2.

The trailer specification (number of trailers, type (dimension, material) and number of castors) shall be documented and reported.

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