

Electrically propelled road vehicles — Measurement of energy performances —

Part 2: Thermal electric hybrid vehicles

The European Standard EN 1986-2:2001 has the status of a
British Standard

ICS 43.120

National foreword

This British Standard is the official English language version of EN 1986-2:2001.

The UK participation in its preparation was entrusted to Technical Committee PEL/69, Electric vehicles, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee on 21 September 2001

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 21 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

© BSI 21 September 2001

ISBN 0 580 38456 X

English version

Electrically propelled road vehicles — Measurement of energy performances — Part 2: Thermal electric hybrid vehicles

Véhicules routiers à propulsion électrique — Mesurage des performances énergétiques — Partie 2: Véhicules hybrides électriques thermiques

Elektrisch angetriebene Straßenfahrzeuge — Meßverfahren für Energieausnutzung — Teil 2: Thermische hybride Elektrofahrzeuge

This European Standard was approved by CEN on 8 March 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	Page
Foreword	3
1 Scope	4
2 Normative references	4
3 Terms and definitions	4
4 Measurement of the range in pure electric mode	6
5 Measurement of the electric energy consumption in pure electric mode	6
6 Measurement of the consumption	6
6.1 Principle	6
6.2 Cycle	6
6.3 Equipment	6
6.4 Fuel	7
6.5 Parameters, units and accuracy of measurements	7
6.6 Test conditions	7
6.7 Operation mode	8
6.8 Expressions of the result	8
Annex A (normative) Measurement of the consumption	9
A.1 General	9
A.2 Recorded values	9
A.3 Fuel consumption	10
A.4 Calculation of the electric consumption	14
A.5 Expressions of the result	14
Annex B (informative) Example of calculation of emission of gases with a continuous analysis method	15
B.1 General	15
B.2 Measured values for consumption	15
B.3 Calculation	16
B.4 Expression of the results	17
Annex C (informative) Energetic values of fuel	18
Annex D (informative) Technical information on the test thermal electric hybrid vehicle	19
Annex E (informative) Test report on energy performances of a thermal electric hybrid vehicle	20
Bibliography	21

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 301, Electrically propelled road vehicles, the Secretariat of which is held by AFNOR.

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 October 2001, and conflicting national standards shall be withdrawn at the latest by October 2001.

CEN TC301 is dealing with “Electrically propelled road vehicles”. This title includes, in fact, a wide range of electric road vehicles (see the definitions in EN 13447:2001) which can be divided as follows:

- pure electric vehicle: this is an electrically propelled and infrastructure independent exclusively electrically supplied road vehicle;
- road vehicle fitted with an electric transmission: this vehicle remains in the scope of CEN/TC301 but is considered as a conventional (e.g. an internal combustion engine vehicle) vehicle with a specific transmission (no standards to be developed);
- thermal electric hybrid vehicles where the thermal engine has such a low level of power¹⁾ compared to that of the power train may be treated as a pure electric vehicle from the measuring point of view;
- other infrastructure independent electric vehicles which are today called electric hybrid vehicles. These electric hybrid vehicles can run with a zero level pollutant emission;
- infrastructure dependent electrically propelled road vehicles are excluded from application of this standard.

A large amount of work has been undertaken on electric hybrid vehicles, and there is still a lot to discover on these vehicles which can, for instance, incorporate several driving modes (more than two);

To remain today within what is most common, the term thermal electric hybrid vehicle will be understood as an electric road vehicle fitted with a thermal machine (which is fed with fuel).

This European Standard EN 1986 consists of the following parts, under the general title, *Electrically propelled road vehicles — Measurement of energy performances*:

- *Part 1: Pure electric vehicles;*
- *Part 2: Thermal electric hybrid vehicles;*
- *Part 3: Other electric hybrid vehicles than those fitted with a thermal machine.*

Annex A forms an integral part of EN 1986-2.

Annex B to annex E are for information only.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

¹⁾ In order to be able to use existing measuring facilities.

1 Scope

This standard aims at defining the range in pure electric driving mode and the consumption measurements for a thermal electric hybrid road vehicle from M_1 , N_1 , or M_2 ²⁾ category, and for tricycles and quadricycles from the motorcycle types³⁾.

This standard applies to the above-mentioned vehicles whose range and consumption can be tested following the provisions already laid down for conventional vehicles (i.e. Internal Combustion Engine vehicle) from the equivalent categories.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1821-1	<i>Electrically propelled road vehicles — Measurement of road operating ability — Part 1: Pure electric vehicles.</i>
EN 1986-1:1997	<i>Electrically propelled road vehicles — Measurement of energy performances — Part 1: Pure electric vehicles.</i>
EN 13447:2001	<i>Electrically propelled road vehicles — Terminology.</i>
EN ISO 3675	<i>Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method (ISO 3675:1998).</i>

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply (see also EN 13447:2001).

3.1

electrically propelled road vehicle

road vehicle in which electric energy is transformed by electrical machine(s) into mechanical energy for traction purposes

NOTE Traction is the term used with the same meaning as propulsion, but for historical reasons, this is the most widely used term.

3.2

electric hybrid (road) vehicle

hybrid (road) vehicle in which one of the reversible energy source delivers electric energy

3.3

thermal electric hybrid vehicle

electric hybrid vehicle in which the traction system contains a thermal machine

NOTE Vehicle integrating electric machine(s) for functional assistance to the engine such as load levelling devices, starter, electrically driven auxiliary units, etc. should not be considered as electric hybrid vehicles, in so far they do not participate to the traction.

²⁾ Categories of vehicle M_1 , N_1 , and M_2 are defined in Directive 92/53/EEC. In practice, tricycles and quadricycles with a maximum speed over 45 km/h fall within the scope of this standard.

³⁾ Motor tricycles and quadricycles are defined in Directive 92/61/EEC.

3.4**pure electric mode**

driving mode when only the secondary on board electric energy source delivers energy for traction purpose. The pure electric mode can be either selected by the driver or automatically selected by the system

For definitions of primary or secondary on board electric energy source, refer to EN 13447:2001 (Terminology).

3.5**pure thermal mode**

for a thermal electric hybrid vehicle is the driving mode which can be selected by the driver when only the additional other kind of on board energy source (including the thermal machine) participates in the propulsion of the vehicle. In this case, the on board secondary electric energy source is not active even for energy recovery

3.6**hybrid mode (for an electric hybrid vehicle)**

another driving mode than the pure electric mode, if selected by the driver, or the pure thermal mode. All the on board energy sources can participate in the propulsion of the vehicle in accordance with the management system logic. The hybrid mode includes the pure electric mode when it is automatically selected by the system

3.7**series electric hybrid vehicle**

series hybrid vehicle in which all energy sources deliver electric energy

3.8**parallel electric hybrid vehicle**

electric hybrid vehicle for which the wheel propulsion is produced either by the electric drive train and/or by the additional form of on board energy source delivering mechanical power, both through a transmission which can be common or individual

3.9**on board energy source**

subsystem of the traction system consisting of a combination of at least storage(s) and possibly converter(s), transmission(s), ancillary device(s). The on-board energy source delivers energy to the power train for traction purpose

EXAMPLE 1

For a pure electric vehicle, the on-board energy source can be made of:

- for the storage: an electrochemical storage battery;
- for the energy delivery system: cables;
- for the ancillary devices: thermal management of the battery, on-board charger, protection devices.

EXAMPLE 2

For a series thermal electric hybrid vehicle, the additional other kind of on-board energy source can be made of:

- for the storage: a petrol tank;
- for the energy delivery system: a generating set including an IC engine plus an alternator and a rectifier;
- for the ancillary devices: electronic controllers and a cooling system.

4 Measurement of the range in pure electric mode

The measurement of the range, in pure electric mode, of a thermal electric hybrid vehicle is the same as that described in clause 6 of EN 1986-1:1997 for pure electric vehicles. The end of test criterion, as an alternative to that already provided by EN 1986-1:1997, is the switching-on of the thermal engine.

The test results can be given as in annex E.

5 Measurement of the electric energy consumption in pure electric mode

The measurement of the electric energy consumption in pure electric mode of a thermal electric hybrid vehicle is the same as that described in clause 5 of EN 1986-1:1997 for pure electric vehicles.

If the range in pure electric mode of the thermal electric hybrid vehicle is smaller than the required distance in clause 5 of EN 1986-1:1997 (i.e. seven times test sequence 1, about 28 km, or two times test sequence 2, about 22 km), then the test may be done with the highest possible whole number of cycles (sequence 1, about a multiple of 4 km, or sequence 2, about 11 km), compatible with the measured range.

If the range in pure electric mode of a thermal electric hybrid vehicle is smaller than one cycle of sequence 1, then the measurement procedure of the electric energy consumption is not applicable.

The test results can be given as in annex E.

6 Measurement of the consumption

6.1 Principle

If a pure thermal mode can be selected by the driver, the test of the consumption in hybrid mode shall be performed in pure thermal mode following strictly Directive 80/1268/EEC as amended⁴⁾. Then, the thermal electric hybrid vehicle behaves like a thermal engine vehicle, and no test procedure in hybrid mode is required.

Otherwise, the whole test procedure has to be fulfilled in hybrid mode (see 6.7).

The following test procedure ensures that the additional other form of on-board energy source participates to the propulsion of the vehicle (thermal engine). This is the reason why the total distance travelled shall exceed the range of the vehicle in pure electric mode, thus implying at least one cold start of the thermal engine.

Annex A completes the operation mode, defines the measurements to perform and the calculations.

6.2 Cycle

A cycle comprises four urban cycles followed by one extra-urban cycle (test sequence 2) as defined in 4.1 of EN 1986-1:1997.

6.3 Equipment

All the equipment requirements of Directive 70/220/EEC as amended⁵⁾ apply.

The calibration of the chassis dynamometer is carried out according to annex A of EN 1986-1:1997.

⁴⁾ At the time of the elaboration of this standard, Directive 80/1268/EEC was last amended by directive 93/116/EC. In the case of further amendments, a check of their compatibility with this standard should be undertaken.

⁵⁾ At the time of the elaboration of this standard, Directive 70/220/EEC was last amended by Directive 96/69/EC. In case of further amendments, a check of their compatibility with this standard should be undertaken.