BRITISH STANDARD

BS EN
1987-2 : 1997

Electrically propelled road vehicles —

Specific requirements for safety

Part 2. Functional safety means and protection against failures

The European Standard EN 1987-2 : 1997 has the status of a British Standard

ICS 43.120

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

National foreword

This British Standard is the English language version of EN 1987-2 : 1997.

The UK participation in its preparation was entrusted to Technical Committee AUE/19, Electric vehicle, 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.

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

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 4, an inside back cover and a back cover.

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 September 1997

© BSI 1997

ISBN 0 580 28374 7

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1987-2

June 1997

ICS 43.120

Descriptors: Road vehicles, electric vehicles, safety requirements, accident prevention, design, performance evaluation, hazards, safety measures, failure, protection, specifications, utilization, information

English version

Electrically propelled road vehicles — Specific requirements for safety — Part 2 : Functional safety means and protection against failures

Véhicules routiers à propulsion électrique — Prescriptions particulières pour la sécurité — Partie 2 : Mesures de sécurité fonctionnelle et protection contre les défaillances

Elektrisch angetriebene Straßenfahrzeuge — Besondere Festlegungen für die Sicherheit — Teil 2: Funktionelle Sicherheitsvorkehrungen und Schutz gegen Fehler

This European Standard was approved by CEN on 1997-05-23. 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 Central Secretariat 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 Central Secretariat 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.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

© CEN — All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN 1987-2 : 1997 E

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 December 1997, and conflicting national standards shall be withdrawn at the latest by December 1997.

EN 1987 consists of the following Parts, under the general title *Electrically propelled road vehicles — Specific prescriptions for safety*:

– Part 1: *On board energy storage*;

– Part 2: *Functional safety means and protection against failure*;

– Part 3: *Protection of users against electrical hazards*.

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.

Contents

© BSI 1997

1 Scope

This European Standard specifies all requirements specific to electrically propelled vehicles in order that they remain safe both for the users of the vehicle and for the environment of the vehicle (pedestrian, protection of nature against pollution etc.). This standard does not apply to maintenance operations and specific requirements for vehicles connected to an external power supply.

This Part deals with functional safety means and protection against failures, thus defining the minimum rules to follow in the design of the electric vehicle and the specific hazards to avoid due to the electrical drive aspects of the vehicle.

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.

ISO 11451 *Road vehicles — Electrical disturbances by narrowband radiated electromagnetic energy — Vehicle test methods.*

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1 drive system

The drive system includes all electric traction motors and the power control units for these motors; not the on-board electric power source, e.g. the traction battery, and not auxiliary electronic devices and converters, e.g. d.c./d.c./-converter, on-board charger (unless it is common with the inverter/motor controller).

3.2 drive direction control

The drive direction control is a specific device physically actuated by the driver in order to select the drive direction of the vehicle (forwards or backwards). Examples are lever or push-button switch.

3.3 auxiliary functions

The auxiliary functions are those which are common between internal combustion engine and electric vehicles, for instance lighting.

3.4 auxiliary network

The auxiliary network is the electrical circuit of lower working voltage than the power circuit, supplying the auxiliary functions of the vehicle (lighting, warning, windscreen motor, etc.), and its nominal voltage is usually 12 V or 24 V.

4 General and environmental conditions

As installed in the vehicle, the components specific for an electric road vehicle shall be designed and constructed so as to operate under the same conditions for which the whole vehicle is designed.

5 Operational safety

5.1 Power on procedure

The power on procedure is applied via the key-switch with a minimum of two key positions:

– Position 1: 'Off'

Drive system off, no active driving possible. Only in this position can the key be inserted and removed;

– Position 2: 'Operation'

Active driving possible after at least one additional voluntary action, e.g. a change in the drive mode switch from 'neutral, park' to 'drive' or 'neutral, park' to 'reverse' or a third key position. In the latter case, no unintentional movement of the vehicle shall occur.

Power on or movement of the vehicle by its own drive system shall not be possible when the vehicle is physically connected to an external electric network (e.g. mains, off-board charger).

Exception : specially designed connecting devices for automatic operation.

After an automatic or manual turn-off of the drive system, it shall only be possible to reactivate it by normal power on procedure.

An obvious device shall indicate permanently or temporarily that the drive system is in the mode 'active driving possible'.

5.2 Driving

5.2.1 *Indication of reduced power*

If drive power is automatically reduced significantly (e.g. by high temperature of drive system or power source components), this shall be indicated by an obvious device.

5.2.2 *Indication of low state of charge level of the traction battery*

The low state of charge level of the traction battery shall be indicated by an obvious device, e.g. state-of-charge meter. Level to be decided by manufacturers, but shall satisfy special safety requirements, e.g.:

– it shall be possible to move out of the traffic area using the drive system;

– a minimum energy reserve for the safety lighting system, in accordance with current regulations, shall be provided, if the traction battery is the direct power source for the auxiliary electrical network.

© BSI 1997

5.3 Driving backwards

If driving backwards is achieved by reversing the rotational direction of the electric motor, the following specifications shall be met:

a) the state of the drive direction control shall be identifiable;

b) the capital letter 'R' shall identify reverse mode;

c) to avoid the danger of unintentionally switching to reverse when the vehicle is moving, the actuation of the drive direction control shall require:

1) either the combination of two different, consecutive movements; or

2) a safety device which allows reverse to be engaged only when the vehicle is stationary or moving at a slow speed, in which case actuation of the drive direction control shall be indicated obviously.

The maximum reverse speed shall be limited (speed limit left to manufacturer's decision).

If driving backwards is not achieved by reversing the rotational direction of the electric motor, the current regulations on vehicles with internal combustion engine apply on the electric vehicle.

5.4 Parking

When leaving the vehicle, the driver shall be informed by an obvious signal (e.g. acoustic or optical signal) if the drive system is still in the mode 'active driving possible'.

If the traction motor continues to turn in a stationary vehicle, the user's manual shall point out that the vehicle is liable to move if a gear is engaged.

5.5 Master switch

A master switch shall make it possible to disconnect at least one pole of the electric power source (e.g. traction battery) from the drive system at any time.

The master switch shall be activated (on and off) by a manual device within reach of the driver's hand (e.g. key-switch). Additional disconnection via an electronic safety device is possible.

After each disconnection, it shall only be possible to reactivate the drive system by the power on procedure (see **5.1**).

5.6 Electromagnetic susceptibility

The electric vehicle shall be tested in accordance with ISO 11451. The field strength reference level shall be 30 V/m r.m.s[1)].

5.7 Auxiliary function

During operation of the electric vehicle, all auxiliary functions shall meet the requirements of relevant EU-Directives, in particular lighting, signalling and safety functions.

6 Protection against failures

This clause deals with a safety concept to counter hazardous effects of failures in systems and components specific to electric road vehicles. (Other systems and components are dealt with as for conventional vehicles).

The safety concept comprises measures and design principles to be taken to ensure sufficient safety from injuries to persons and material damage in the event of failures.

In particular the following potential hazards have to be avoided.

6.1 Unintentional vehicle behaviour

Unintentional acceleration, deceleration and reversal of the drive systems shall be prevented. In particular, a failure (e.g. in the power control unit) shall not cause more than 0,1 m movement of a standing, unbraked vehicle.

Unintentional steering effects shall not occur from different torques while driving or braking greater than those of conventional vehicles, especially in case of multiple motors.

6.2 Connections

Any miss of connection or any unexpected disconnection of electrical connectors shall not lead to hazardous behaviour of the vehicle.

6.3 Auxiliary network

For vehicles without galvanic isolation of the power circuits from the auxiliary network there shall be some other means of protecting the auxiliary network from over-voltage.

6.4 Over-current cut-off device

A circuit breaker, cut-off device or fuse shall disconnect at least one pole of the electric power source (e.g. traction battery) in case of over-current. This device can be the same as the over-current battery switch (see clause **7** in EN 1987-1 : 1997).

After each disconnection it shall not be possible to reactivate the drive system without going through the power on procedure (see **5.1**).

7 User's manual

Special attention shall be drawn in the user's manual to aspects specific to electrical vehicles: the following topics especially shall be addressed:

– general operating instructions (especially power on procedure);

– operating functions (e.g. driving, parking, charging);

– road performances (e.g. hill climbing ability);

– service and maintenance;

– safety instructions;

– environmental restrictions of use, if any.

[1)] r.m.s = root mean square.

© BSI 1997

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.

BSI
389 Chiswick High Road
London
W4 4AL