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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Railway applications – Compatibility between rolling stock and train detection systems

Applications ferroviaires – Compatibilité entre matériel roulant et systèmes de détection de train

IEC 62427:2007

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS – COMPATIBILITY BETWEEN ROLLING STOCK AND TRAIN DETECTION SYSTEMS

FOREWORD

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International Standard IEC 62427 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

It was submitted to the National Committees for voting under the Fast Track Procedure as the following documents:

FDIS	Report on voting
9/1058/FDIS	9/1088/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This document is based on EN 50238.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This Standard defines a process to obtain the assurance that specific rolling stock operating on a specific route does not interfere with train detection systems installed on this route.

Compatibility problems between train detection systems and rolling stock are a significant obstacle to cross-acceptance of rolling stock in Europe. Unfortunately it is not possible to establish general rules for the maximum levels of interference allowed valid for every country. This is due to the great diversity of rolling stock, power supply and return current systems, and train detection systems installed in Europe. This diversity leads to consideration of the problem of compatibility of rolling stock and train detection systems for specific routes to avoid unnecessarily restrictive specifications.

Compatibility is determined by both physical and electromagnetic considerations. With regard to EMC, the need is not for general values for maximum levels of interference permitted, but for convenient methods by which to specify the level of interference allowed for operation on specific routes.

Interference may be caused by

– rail currents,
– electromagnetic fields,
– differential voltage between axles,

as shown in Figure 1.

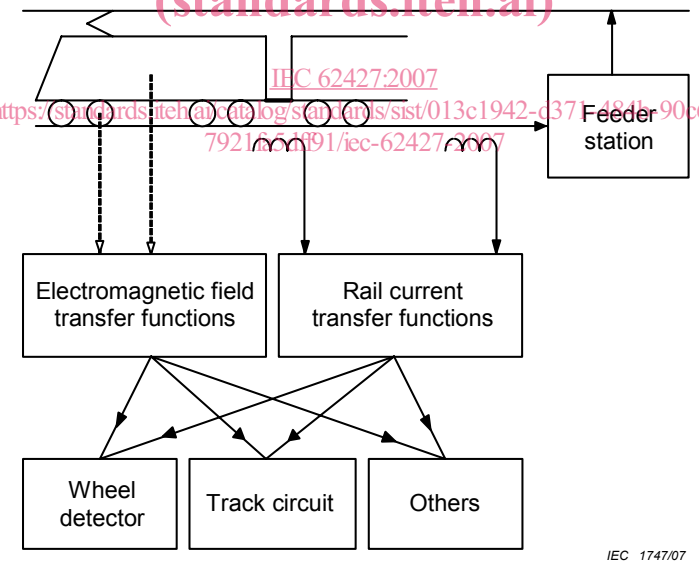

Figure 1 – Sources of electromagnetic interference

In practice, the susceptibility of the system is determined by

– the sensitivity of individual components of the system,

– the application of the components, i.e. the configuration of the system.

Therefore the problems concerning track circuits and axle counters or wheel detection systems will be considered separately.

For determining the susceptibility of train detection systems, laboratory/simulation testing methods as well as methods to conduct tests on the “real railway” are proposed. Modelling enables worst-case conditions to be simulated. In addition, particular test sites are used because, from experience, they are known to provide the test evidence required. Then, taking account of the experience of the railways, it is possible to establish a general method for determining the susceptibility of train detection systems, described in this Standard.

Before measuring the interference level on rolling stock, a sufficient knowledge of the electric circuit diagram of the power equipment is required, e.g. switching frequencies of on-board static converters, type of regulation used for power converters, resonant frequency of each filter, operating limits under high and low supply voltages, downgraded modes of operation, etc.

RAILWAY APPLICATIONS – COMPATIBILITY BETWEEN ROLLING STOCK AND TRAIN DETECTION SYSTEMS

1 Scope

This International Standard describes a procedure for mutual acceptance of rolling stock to run over specific routes. It describes the methods of measurement of interference currents, the methods of measurement of the susceptibility of train detection systems, the characterisation of traction power supplies and the procedure for acceptance. The result of the acceptance procedure is a structured justification document referred to as a "compatibility case", which documents the evidence that the conditions for compatibility have been satisfied.

The procedure is also applied to modifications of rolling stock, traction power supply or train detection systems which are considered to affect compatibility.

The scope of the compatibility case is restricted to the demonstration of compatibility of rolling stock with a train detection system's characterisation (e.g. gabarit). Train detection system in this standard refers only to a track circuit or those using wheel detector.

2 Normative references

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

IEC 62278, *Railway applications – Specification and demonstration of reliability, availability, maintainability and safety (RAMS)*

IEC 60850, *Railway applications – Supply voltages of traction systems*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

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

3.1
accepting body
body responsible for the evaluation of the compatibility case and the issue of a certificate of acceptance. The authority is assigned by National Law.

3.2
compatibility case
a set of documents which records the evidence demonstrating the degree of compatibility between rolling stock, traction power supplies and train detection systems for a specific route or specific railway network

3.3
certificate of acceptance
written autorisation from the accepting body that the compatibility case is acceptable to allow the new or modified systems to enter service. Relations with legislation should be determined nationally.

3.4
degraded modes
modes of operation in the presence of faults which have been anticipated in the design of the rolling stock. Degraded modes will normally allow the rolling stock to complete its journey

3.5
gabarit
the maximum permissible levels of interference signal, with respect to frequencies and duration, to which a train detection system may be exposed

3.6
railway infrastructure authority
the body responsible for the safety of the track and signalling systems

3.7
right side failure
failure of a signalling system which results in a more restrictive condition for the movement of traffic than is appropriate

3.8
rolling stock operator
body responsible for the operation and maintenance of the rolling stock

3.9
wheel detector
sensor which detects the passage of a wheel. It may be used as part of an axle counter system or as a treadle

3.10
wrong side failure
failure of a signalling system which results in a less restrictive condition for the movement of traffic than is appropriate

3.11
factor of safety
margin between the level of per train emissions and actual susceptibility of track circuit. It covers safety or availability depending on whether wrong side failure or right side failure mechanism is considered.

3.12
signalling system
assembly of sub-systems, and components connected together in an organised way to achieve specific signalling functionality, of which train detection is a particular sub-system, referred to as ‘system’ in the context of this standard

3.13
rolling stock
general term covering all vehicles with or without motors. For the purposes of this standard rolling stock is equivalent to influencing unit.

[IEV 811-02-01, modified]

3.14
traction power supply system

3.14.1
(traction) substation
installation the main function of which is to supply a contact line system and at which the voltage of a primary supply system, and in certain cases the frequency, is transformed to the voltage and the frequency of the contact line

[IEC 62128-1]

3.14.2
(traction) switching station
installation from which electrical energy can be distributed to different feeding sections or from which different feeding sections can be switched on and off or can be interconnected

[IEC 62128-1]

3.14.3
feeding section
section of the traction power supply system which may be isolated from other sections or feeders of the system by means of switching devices

[IEC 62128-1]

3.14.4
feeder
electrical connection between the contact line and a substation or a switching station

[IEC 62128-1]

3.14.5
feeding point
point at which the feeders or line feeders are connected to the contact line

[IEC 62128-1]

3.14.6
contact line
a conductor system for supplying electric energy to vehicles through current-collecting equipment

[IEV 811-33-01]

3.15
axle counter
a system using counting points with wheel detector and a counter which detects the occupancy of a section of track by comparing the number of axles which enter the section with the number of axles which leave the section, parity of the numbers being necessary to give a clear indication

[IEV 821-03-41, modified]

3.16
susceptibility
the inability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

[IEV 161-01-21, modified]

3.17
train detection
safe recognition of the presence or absence of any trains on a defined section of the track or at a given point

[IEC 62290-1]

3.18
track circuit
an electrical circuit of which the rails of a track section form a part, with usually a source of current connected at one end and a detection device at the other end for detecting whether this track section is clear or occupied by a vehicle

NOTE In a continuous signalling system, the track circuit may be used to transmit information between the ground and the train.

[IEV 821-03-01]

4 Acceptance process

4.1 Overview

The parties concerned in the acceptance process are shown in Figure 2.

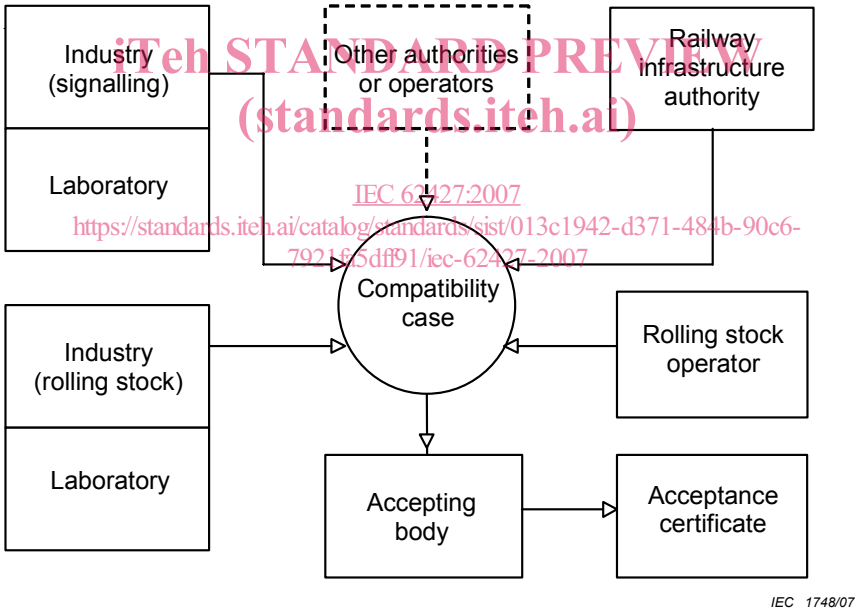

Figure 2 – Parties concerned in the acceptance process

4.2 Responsibilities

The responsibility for demonstrating compatibility between rolling stock, train detection and traction power supply systems, and for maintaining it over the full life cycle of the equipment, is shared between those parties responsible for the particular railway infrastructure and the particular rolling stock. Specific responsibilities for a given compatibility case, including the party taking the lead role, shall be assigned as per national practice. The documentation, in the form of a compatibility case, shall be submitted to an accepting body, and shall be reviewed when any modification is carried out.

4.2.1 Railway infrastructure authority

For a defined route (the application of interest), the railway infrastructure authority should characterise all train detection systems and the traction power supply system.

4.2.2 Rolling stock operator

The rolling stock operator should characterise the interference which may be generated and propagated by the rolling stock.

4.2.3 Accepting body

The accepting body shall review submitted documents and as a result issue a certificate of acceptance. As part of this process, the accepting body should ensure that the compatibility case is reviewed by experts who are qualified in accordance with national practice to assess and evaluate it.

4.3 Acceptance process

The acceptance process is summarised in Figure 3.

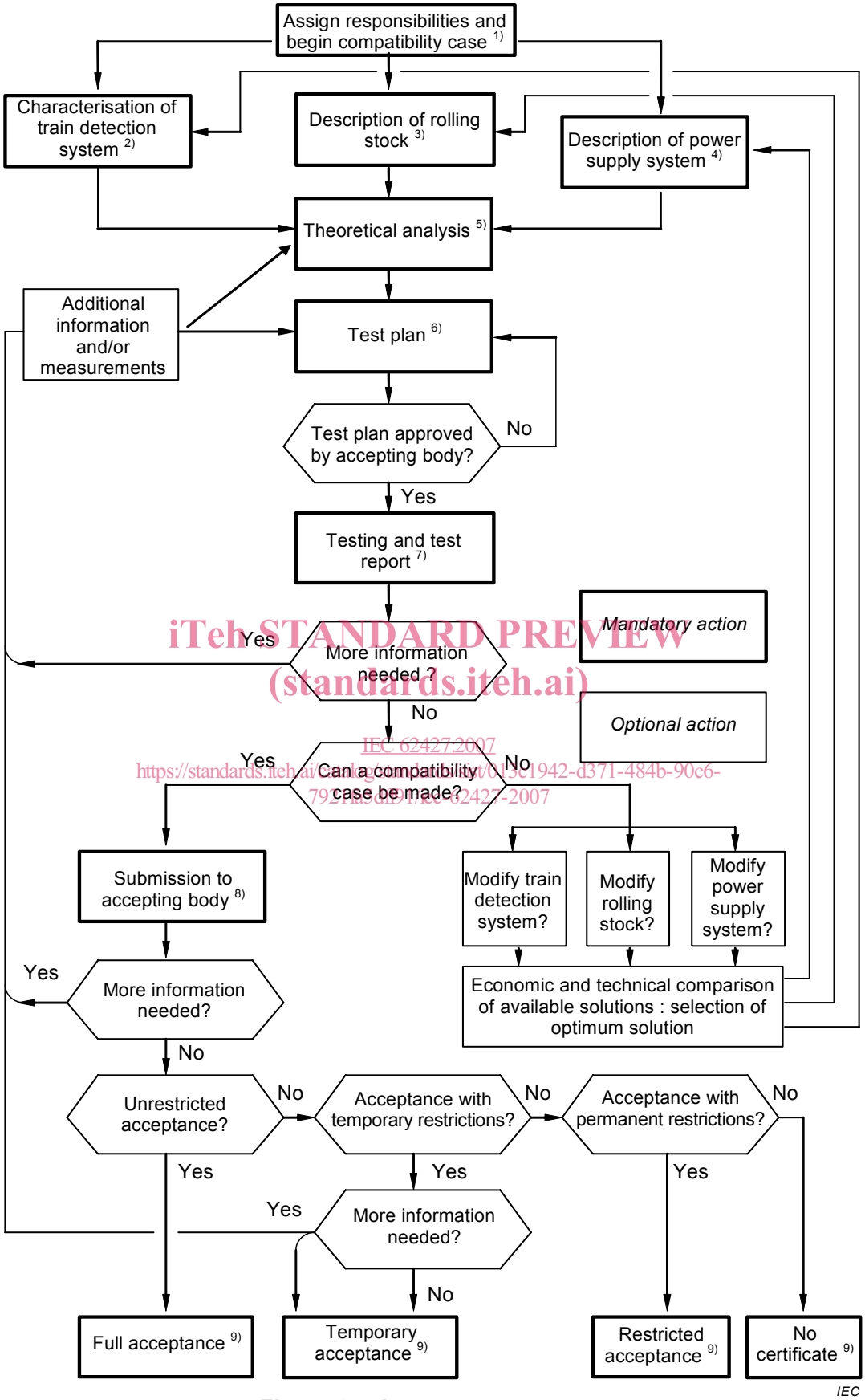

Figure 3 – Acceptance process