IEC TS 63498

Edition 1.0 2026-10

TECHNICAL SPECIFICATION

Railway applications - System energy efficiency

ICS 45.020

ISBN 978-2-8327-1486-7

IEC TS 63498:2026-10 (en)

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms, definitions and abbreviated terms 6
3.1 Terms and definitions 7
3.2 Abbreviated terms 11
4 Definition of energy efficiency for electric railway systems 11
4.1 General description of energy efficiency of electric railway systems 11
4.2 Inputs and outputs of electric railway systems 14
4.2.1 General 14
4.2.2 Inputs and outputs 15
4.3 Identification of train operation parameters 15
4.3.1 General 15
4.3.2 Train-unit 16
4.3.3 Infrastructure conditions 16
4.3.4 Timetable and driving style 16
4.3.5 Energy supply network characteristics 17
4.3.6 Environmental conditions 17
4.4 KPIs 18
4.5 Boundaries 18
5 Definition of efficiency KPIs and boundaries 19
5.1 KPI 1 - Final energy consumption per mass transported (tkm) 19
5.2 KPI 2 - Final energy consumption per offered transport (ask) 19
5.3 KPI 3 – Final energy consumption per offered transport (vkm) 20
5.4 KPI 4 - Final energy consumption per actual traffic output (pkm) 20
6 Definition of characteristic KPIs and boundaries 20
6.1 KPI 5 - Share of energy consumption for parked trains 20
6.2 KPI 6 - Energy recuperation rate 21
6.3 KPI 7 - Efficiency of the railway power network 21
Annex A (informative) Train operation parameters which influence KPIs 23
A.1 General 23
A.2 Train operation parameters 23
A.2.1 Topography of the railway network 23
A.2.2 Density of trains (number of trains per time-interval) 23
A.2.3 Transportation capacity (tkm, pkm) 23
A.2.4 Passenger load factor 24
A.2.5 Comfort requirements 24
A.2.6 Speed requirements 24
A.2.7 Available energy-resources 24
A.2.8 Architecture of the energy supply system 24
A.2.9 Availability 25
A.2.10 Conformity to ambient requirements 26
A.2.11 Costs 26

A.2.12 Technical regulations and standards 27
A.2.13 Infrastructure properties that cannot be adapted 27
A.2.14 System boundary-parameters (system-exploitation, parameterization) 27
Annex B (informative) Example of traction loads and non-traction loads 28
Bibliography 29

Figure 1 – An example of physical boundaries for electric railway system 12
Figure 2 – Input, output and driving parameters of electric railway system 14

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Railway applications - System energy efficiency

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TS 63498 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
9/3352/DTS	9/3384/RVDTS

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

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

Energy efficiency is a key for preserving the environment and to save natural resources. Energy policies of railway stakeholders are supported.

This document on electric railway energy efficiency (EE) specifies key performance indicators and boundaries to assess the EE. This document establishes comparability between different (overall) railway systems based on the key performance indicators and the boundaries, which are defined in this document.

The purpose of this document is (in the following applications for energy efficiency in electric railways) to

– consider energy efficiency in standardization work;
– identify which aspects of energy efficiency are relevant for standardization;
– use a structured and harmonized approach when addressing energy efficiency;
– use a systematic approach when addressing energy efficiency.

1 Scope

This document harmonizes the requirements and criteria for Key Performance Indicators (KPIs) and specifies KPIs of energy efficiency for entire electric railway system and its subsystems such as trains, contact lines, substations, both single and combined, clarifying the boundaries to be considered. This document applies to entire electric railway systems including non-traction loads.

The purposes are:

a) to determine and to trace the energy efficiency for a specific railway system;

b) to enable comparability between the different electric railway systems (on overall system level) by means of harmonized KPIs and system boundaries concerning energy efficiency;

c) to overview the characteristics of the electric railway system on an overall level with the structure of the electric railway system (including type, hierarchy and number of substations) and the KPIs (including the ranking) for transportation quality;

d) identification of the key impacts for energy efficiency as there are system flexibility, system functions and system features as basic characteristics for the entire electric railway system;

e) definition of harmonized processes and procedures for the simulation or calculation and validation of the system specific energy consumption (including energy feedback);

f) presenting the related and referenced standards and regulations for the electric railway system and its subsystems and their possible contribution to the overall target of the energy efficiency.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60850:2014, *Railway applications - Supply voltages of traction systems*

IEC 62313:2009, *Railway applications - Power supply and rolling stock - Technical criteria for the coordination between power supply (substation) and rolling stock*

IEC 63593:20—, *Railway applications - Rolling stock - Specification and verification of energy consumption*[1]

Bibliography

IEC 60050-151:2001, *International Electrotechnical Vocabulary (IEV) - Part 151: Electrical and magnetic devices*

IEC 60050-192:2015, *International Electrotechnical Vocabulary (IEV) - Part 192: Dependability*

IEC 60050-614:2016, *International Electrotechnical Vocabulary (IEV) - Part 614: Generation, transmission and distribution of electricity - Operation*

IEC 60050-811:2017, *International Electrotechnical Vocabulary (IEV) - Part 811: Electric traction*

IEC 60050-901:2013, *International Electrotechnical Vocabulary (IEV) - Part 901: Standardization*

IEC 62864-1:2016, *Railway applications - Rolling stock - Power supply with onboard energy storage system - Part 1: Series hybrid system*

IEC 62924:2017, *Railway applications - Fixed installations - Stationary energy storage system for DC traction systems*

IEC Guide 118, *Preparation of basic and group energy efficiency publications including energy efficiency aspects*

ISO 19659 (all parts), *Railway applications - Heating, ventilation and air conditioning systems for rolling stock*

ISO 50001, *Energy management systems - Requirements with guidance for use*

ISO/TS 55010:2024, *Asset management - Guidance on the alignment of financial and non-financial functions in asset management*