

INTERNATIONAL STANDARD

**Railway applications - Hydrogen and fuel cell systems for rolling stock -
Part 3: Performance test methods for fuel cell power system**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Railway applications -
Hydrogen and fuel cell systems for rolling stock -
Part 3: Performance test methods for fuel cell power system

FOREWORD

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IEC 63341-3 has been prepared by IEC Technical Committee 105: Fuel cell technologies. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
105/1113/FDIS	105/1145/RVD

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 International Standard 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.

A list of all parts in the IEC 63341 series, published under the general title *Railway applications – Fuel cell systems for rolling stock*, can be found on the IEC website.

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- withdrawn, or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

The scope of the IEC 63341 series encompasses categories such as fuel cell power systems, hydrogen fuel systems, and performance test methods for fuel cell power systems.

This part of IEC 63341 establishes uniform and replicable testing methodologies for the electrical and environmental performance of fuel cell power systems employed in rolling stock. It is important to note that this document does not specify or categorise the tests in any particular way, nor does it establish performance targets.

Fuel cells utilised in rolling stock, including light rail vehicles, trams, streetcars, metros, commuter trains, regional trains, high-speed trains, and locomotives, are classified as hybrid systems, thereby operating in multiple modes. A similar observation can be made about rolling stock, which also operates in different modes. The purpose of this document is to evaluate the fuel cell system in the different combinations of fuel cell modes and rolling stock operating modes.

It is anticipated that this document will be utilised by manufacturers of fuel cell power systems employed in rolling stock, as well as those engaged in the evaluation of the performance of their systems.

Users of this document are at liberty to select test items from those described herein that are appropriate for their purposes. It is important to note that the present document does not seek to exclude the utilisation of alternative methods.

The hierarchical structure of standards is illustrated in Figure 1. It should be noted that the standards enumerated in Figure 1 are not exhaustive.

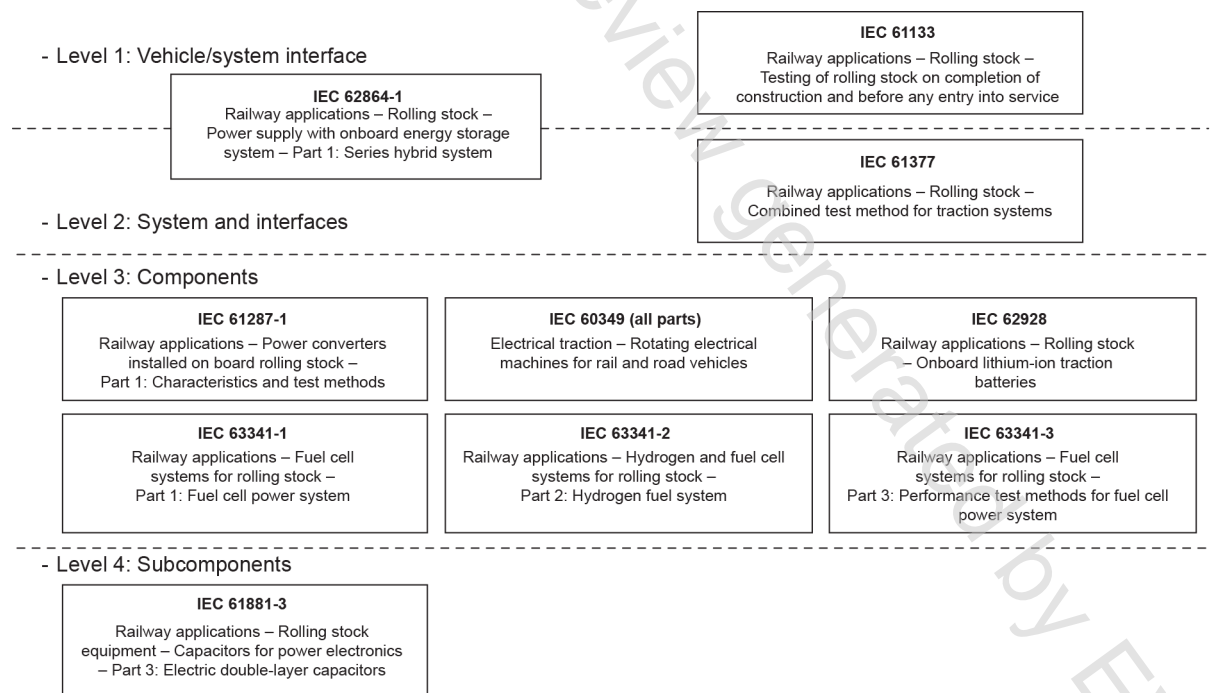


Figure 1 – Hierarchy of standards related to IEC 63341

The decision was taken by TC 105 to initiate a project on generic fuel cell technologies, with a view to covering different industrial sectors:

- IEC 62282 (all parts): Fuel cell technologies:
 - IEC 62282-2-100: Fuel cell modules
 - IEC 62282-3-100: Stationary fuel cell power systems – Safety
 - IEC 62282-4-101: Fuel cell power systems for electrically powered industrial trucks – Safety

It is evident that these standards are frequently generic in nature and therefore not specific to the requirements of railway applications.

The IEC 63341 series *Railway applications – Fuel cell systems for rolling stock* is divided into several parts as outlined below:

- IEC 63341-1: Fuel cell power system
- IEC 63341-2: Hydrogen fuel system
- IEC 63341-3: Performance tests methods for fuel cell power system

1 Scope

This part of IEC 63341 specifies the performance evaluation methodologies for fuel cell power systems that are designed for utilisation in electrically propelled rolling stock.

The scope of this document concerns itself exclusively with electrically powered rolling stock. Internal combustion engines utilising hydrogen are not encompassed within the scope of this document.

This document is applicable to hydrogen fuel cell power systems for electrically propelled rolling stock.

This document does not apply to reformer-equipped fuel cell power systems.

This document does not cover the hydrogen fuel systems that are permanently or separately attached to either the rolling stock or the fuel cell power system. These systems are addressed in IEC 63341-2.

The fundamental system overview, incorporating the interrelationships between the primary functions and the connections to the external system, is delineated in IEC 63341-1:2025, Figure 4.

The relevant standards are comprehensively delineated in IEC 63341-1. The performance targets for fuel cell power systems are agreed upon between the user and the manufacturer.

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 60571, *Railway applications - Electronic equipment used on rolling stock*

IEC 61287-1, *Railway applications - Power converters installed on board rolling stock - Part 1: Characteristics and test methods*

IEC 62236-3-1, *Railway applications - Electromagnetic compatibility - Part 3-1: Rolling stock - Train and complete vehicle*

IEC 62236-3-2, *Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus*

IEC 62498-1, *Railway applications - Environmental conditions for equipment - Part 1: Equipment on board rolling stock*

ISO 3744, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane*

ISO 3746, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane*

ISO 9614-1, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points*

ISO 9614-2, *Acoustics - Determination of sound power levels of noise sources using sound intensity - part 2: Measurement by scanning*

ISO 14687:2019, *Hydrogen fuel quality - Product specification*

3 Terms, definitions and abbreviated term

3.1 Terms and definition

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

fuel cell power system

FCPS

generator system that uses one or more fuel cell power modules to generate electric power and heat

Note 1 to entry: This system typically includes the following subsystems: fuel cell power module, oxidant management system, fuel management system, thermal management system, exhaust management system, electrical and power management system, and their monitoring and control system.

[SOURCE: IEC 60050-485:2020, 485-09-01, modified – "fuel cell modules" has been replaced with "fuel cell power modules"; Note 1 to entry has been added.]

3.1.2

fuel cell stack

FCS

equipment assembly of two or more cells, separators, cooling plates, manifolds and a support structure that electrochemically converts, typically, hydrogen rich gas and air reactants to electric power, heat and other reactant bi-products

[SOURCE: IEC 60050-485:2020 485-06-01, modified – "equipment", "two or more", and "bi-" have been added; "supporting" has been replaced with "support"; "hydrogen-rich" has been replaced with "hydrogen rich"; "DC" has been replaced with "electric" and "reaction" has been replaced with "reactant".]

3.1.3

fuel cell power module

fuel cell module

FCPM

assembly incorporating one or more fuel cell stacks and other main and, if applicable, additional components, which is intended to be integrated into a power system

Note 1 to entry: A fuel cell module can contain the following equipment: its control system and, optionally, the cell voltage monitoring device, the fuel recirculation device, the humidification device for reactants, sensors, valves and actuators. This subsystem is a part of the fuel cell power system.

[SOURCE: IEC 60050-485:2020, 485-09-03, modified – "fuel cell power module" has been added as the first preferred term. In the definition, "other main and" has been added, "that" has been replaced with "which", and "or a vehicle" has been deleted. Note 1 to entry has been modified.]