IEC TS 63537

Edition 1.0 2026-06

TECHNICAL SPECIFICATION

Hardware-in-the-loop simulation test of power system stability control system

ICS 29.240; 29.240.30

ISBN 978-2-8327-1326-6

IEC TS 63537:2026-06(en)

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD 3
1 Scope 5
2 Normative references 5
3 Terms, definitions, and abbreviated terms 5
3.1 Terms and definitions 5
3.2 Abbreviated terms 6
4 General recommendations 6
4.1 Test scope 6
4.2 Test recommendations 7
5 Test system 7
5.1 Basic architecture 7
5.2 Simulation model for the testing system 7
5.3 Simulation interface 8
5.3.1 General 8
5.3.2 Analog value sampling interface 8
5.3.3 Discrete value sampling interface 8
5.3.4 Digital interface 9
5.4 Tested PSSC system 9
5.5 Other control and protection systems 9
6 Test contents 9
6.1 Interactive information effectiveness test 9
6.1.1 Interactive information test between PSSC device and CHIL digital simulator 9
6.1.2 Interactive information test of inter-substation communication 10
6.1.3 Interactive information test between PSSC device and HVDC control and protection system 10
6.1.4 Interactive information test between PSSC device and renewable energy controller 10
6.1.5 Other situations 10
6.2 Basic detection logic test 10
6.3 Functional strategy test 11
6.3.1 General 11
6.3.2 Lines/main transformers N-k(k ≥ 2) fault test 11
6.3.3 Lines/main transformers overload test 11
6.3.4 HVDC Converter blocking (power ramp-down) strategy test 11
6.3.5 Voltage/frequency control strategy test 12
6.3.6 Other related tests 12
6.4 Control strategy and configuration adaptability testing 13
6.4.1 General 13
6.4.2 Operation mode setting 13
6.4.3 Fault setting 13
6.4.4 Stability criteria 13
6.4.5 Configuration adaptability test 13
7 Test quality management 13
7.1 Version management of PSSC system 13
7.2 Test model and data management 14
7.3 Test report 14

Annex A (informative) Example of a typical CHIL simulation testing system for PSSC system 15
Bibliography 17

Figure A.1 – A typical example of the CHIL simulation test structure of a PSSC system based on a physical interface 15
Figure A.2 – A typical example of the CHIL simulation test structure of a PSSC system based on a digital interface 16

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Hardware-in-the-loop simulation test of power system stability control system

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, 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 63537 has been prepared by subcommittee 8C, Network management in interconnected electric power systems, of IEC technical committee 8: System aspects of electrical energy supply. It is a Technical Specification.

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

Draft	Report on voting
8C/157/DTS	8C/169A/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.

1 Scope

This Technical Specification (TS) addresses the requirements for hardware-in-the-loop (HIL) simulation test of power system stability control system (see definition in 3.1.2). Its purpose is to provide guidelines encompassing the use of terms and definitions, as well as the objective and general requirements for HIL simulation test. The TS covers the test requirements, test system, test contents, and test quality management.

This TS improves the safe and stable operation of the power system.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

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

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

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
power system stability control
<of an electric power system> control in power system which prevents system insecurity, instability and collapse caused by disturbances, and, to minimize further loss of power supply

Note 1 to entry: The Power System Stability Control is different than the Control and Protection System delivered by the manufacturer of an individual power system asset such as a generator or HVDC Control and Protection system. The power system stability control can interface with such individual control systems but is distinct from them.

Note 2 to entry: Special Protection System (SPS), Remedial Action Scheme (RAS), System Integrity Protection Schemes (SIPS), System Protection Schemes (SyPS), Special Protection Schemes (SpPS), Power System Stability Control (PSSC) system are typical examples of stability control implementation. Control and Protection Systems delivered with an individual power system asset, such as a dedicated generator control or HVDC Control and Protection System, are not examples of PSSC systems, although they can be responsible for implementing the decisions and actions decided by the PSSC.

3.1.2
power system stability control system
<of an electric power system> automatic system capable of implementing control schemes which detect contingency events or/and violations of key operating parameter limit in order to improve the stability and security of power systems

3.1.3
PSSC device
power system stability control device
<of an electric power system> type of equipment installed in power plants, transformer substations, converter stations, or renewable energy stations to ensure the stability of the power system when encountering large disturbances

Note 1 to entry: This device is designed to perform various functions such as generator tripping, load shedding, fast active power reduction, activating emergency control of HVDC, and providing rapid control for renewable energy resources such as wind power, photovoltaics, and energy storage. Its primary objective is to maintain the stability and reliability of the power system during significant fluctuations or disturbances.