IEC TR 63575

Edition 1.0 2025-07

TECHNICAL REPORT

Performance of power electronic reactive power shunt compensators in high voltage alternating current (HVAC) systems

ICS 29.240.99

ISBN 978-2-8327-0594-0

IEC TR 63575:2025-07(en)

CONTENTS

FOREWORD 3
1 Scope 5
2 Normative references 5
3 Terms and definitions 5
4 Overview of reactive power shunt compensators 6
5 Applications 7
5.1 General 7
5.2 Power generation plant 8
5.3 Transmission network 8
5.4 Distribution network and industry plant 9
6 Performance 9
6.1 Step response 9
6.2 Operation on weak system 11
6.3 Fault ride-through 13
6.4 Coordination with other electrically close reactive power devices 15
6.5 Negative-sequence control 16
6.6 Subsynchronous resonance and oscillation 16
6.7 Power oscillation damping (POD) 17
6.8 Geomagnetically induced currents (GIC) 18
6.9 Harmonic interaction 19
Annex A (informative) Application of power electronic reactive power shunt compensators 20
A.1 SVC application 20
A.1.1 General 20
A.1.2 SVC in Ethiopia 20
A.1.3 SVC in Norway 22
A.1.4 SVC in France 23
A.2 STATCOM application 24
A.2.1 General 24
A.2.2 STATCOM in China 24
A.2.3 STATCOM in Chile 26
A.2.4 STATCOM in England 27
A.2.5 STATCOM in Germany 29
Bibliography 31

Figure 1 – Example configuration of an SVC 6
Figure 2 – Example configuration of an STATCOM 7
Figure 3 – A typical configuration example of static var system 7
Figure 4 – A typical configuration example of shunt compensators for integration of a power plant and industry plant 8
Figure 5 – Definition of response and settling time 10
Figure 6 – Basic block diagram of STATCOM system terminal voltage regulation 12
Figure 7 – Power system overvoltage range 14
Figure 8 – Power system undervoltage range 14
Figure 9 – Structure of the sub-synchronous damping controller of SVC 17

Figure 10 – Structure of the sub-synchronous damping controller of STATCOM 17
Figure 11 – Example of the POD controller 18
Figure A.1 – The SLD of 900 Mvar SVC in Ethiopia 20
Figure A.2 – The site view of 900 Mvar SVC in Ethiopia 21
Figure A.3 – The SLD of ±250 Mvar SVC 22
Figure A.4 – The site view of ±250 Mvar SVC in Norway 22
Figure A.5 – The SLD of ±250 Mvar SVC in France 23
Figure A.6 – The site view of ±250 Mvar SVC in France 24
Figure A.7 – The SLD of ± 300 Mvar STATCOM in China 25
Figure A.8 – The SLD of 140 Mvar STATCOM in Chile 26
Figure A.9 – The site view of 140 Mvar STATCOM in Chile 27
Figure A.10 – The SLD of ±300 Mvar STATCOM in England 28
Figure A.11 – The site view of 225 Mvar STATCOM in England 29
Figure A.12 – The SLD of ±300 Mvar STATCOM in Germany 30

Table A.1 – The characteristics of the SVC in Ethiopia 21
Table A.2 – The characteristics of ±250 Mvar SVC in Norway 23
Table A.3 – The characteristics of ±250 Mvar SVC in France 24
Table A.4 – The characteristics of the STATCOM in China 25
Table A.5 – The characteristics of the STATCOM in Chile 27
Table A.6 – The characteristics of the STATCOM in England 29
Table A.7 – The characteristics of the STATCOM in Germany 30

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Performance of power electronic reactive power shunt compensators in high voltage alternating current (HVAC) systems

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 TR 65535 has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronic systems and equipment. It is a Technical Report.

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

Draft	Report on voting
22F/823/DTR	22F/829/RVDTR

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 Report 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 document provides general guidelines on the performance of power electronic reactive power shunt compensators in high voltage alternating current systems. It includes terms, definitions, symbols and abbreviated terms, introduction, applications and performance.

2 Normative references

There are no normative references in this document.