

TECHNICAL SPECIFICATION

UHV AC transmission systems –
Part 301: On-site acceptance tests

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.240.01

ISBN 978-2-8322-6297-9

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

UHV AC TRANSMISSION SYSTEMS –

Part 301: On-site acceptance tests

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 63042-301, which is a Technical Specification, has been prepared by IEC technical committee 122: UHV AC transmission systems.

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

Enquiry draft	Report on voting
122/57/DTS	122/65A/RVDTS

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

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

A list of all parts in the IEC 63042 series, published under the general title *UHV AC transmission systems*, 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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A bilingual version of this publication may be issued at a later date

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INTRODUCTION

With the increase in voltage levels, the reliability and safety of high-voltage electric equipment is facing new challenges. There is a need to have consensus on a series of technical criteria and requirements for on-site acceptance tests for electrical equipment of UHV AC transmission systems exceeding 800 kV to detect the damages or abnormal conditions that may occur during the transportation and installation processes and to determine whether equipment can be put into operation reliably and safely for power systems.

This Technical Specification proposes on-site acceptance tests, relevant test items, test methods, and evaluation criteria for transformers, circuit breakers, GIS, surge arresters, voltage and current transformers, shunt reactors, series compensators, insulators, disconnectors, earthing switches and high-speed earthing switches.

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UHV AC transmission systems –

Part 301: On-site acceptance tests

1 Scope

This part of IEC 63042, which is a technical specification, applies to on-site acceptance tests of electrical equipment with the highest voltages of AC transmission system exceeding 800 kV.

The electrical equipment exceeding 800 kV includes the following items:

- power transformers;
- circuit breakers;
- gas insulated switchgear (GIS);
- surge arresters;
- voltage and current transformers;
- shunt reactors;
- series compensators;
- insulators;
- disconnectors and earthing switches,
- high-speed earthing switches.

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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 60376, *Specification of technical grade sulfur hexafluoride (SF₆) for use in electrical equipment*

IEC 60480, *Guidelines for the checking and treatment of sulfur hexafluoride (SF₆) taken from electrical equipment and specification for its re-use*

IEC 62271-1:2017, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

IEC 62271-4, *High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur hexafluoride (SF₆) and its mixtures*

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers*

IEC 62271-102:2018, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

IEC 62271-112:2013, *High-voltage switchgear and controlgear – Part 112: Alternating current high-speed earthing switches for secondary arc extinction on transmission lines*

IEC 62271-203, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

3 Terms and definitions

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

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

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

3.1

on-site acceptance tests

inspections and tests performed (or checked) in order to verify the correct operation and dielectric integrity of the equipment after shipping and on-site installation

3.2

UHV AC

highest voltage of AC transmission system exceeding 800 kV

4 General

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On-site acceptance tests for newly installed electrical equipment are an important approach to judge whether equipment is normal or abnormal after transportation and installation. Repetition of the full programme of routine tests, already performed in the factory is not required; however some of the tests should be repeated for confirmation of the correct operation of the equipment taking into account the different conditions on-site.

On-site acceptance test results should be analysed and compared carefully with those from the factory test. The influence of different test conditions, such as humidity and the ambient temperature and pressure, should be taken into consideration when making comparisons.

5 Power transformers

5.1 General

UHV power transformers have very high level of voltage, large capacity and large size. If the UHV power transformer is adopted with split type installation on site, it is recommended to carry out separate tests on the main transformer and the voltage regulating and compensating transformer respectively.

NOTE For the procedure followed for on-site tests, the test method refers to the same kind of tests described in relevant publications for factory tests, such as IEC 60076 and/or the IEC 60599 series.

UHV power transformers should be subjected to on-site acceptance tests as specified below:

- Leak testing with pressure (tightness test)
- Winding resistance measurement
- Ratio test
- Polarity check
- Insulation resistance test on each winding to earth and between windings including bushings

- Dissipation factor ($\tan \delta$) and capacitance measurement on each winding to earth and between windings including bushings
- Core and frame insulation check
- Tests on bushings
- Insulating oil test
- Dissolved gas analysis (DGA) test
- Excitation current measurement at low voltage
- Frequency-response analysis (FRA)
- Short-circuit impedance measurement

The following items are optional:

- Induced voltage test with partial discharge measurement
- Applied voltage test

NOTE The above optional test items are based on agreement between purchaser and supplier.

5.2 Leak testing with pressure (tightness test)

The transformer main tank should withstand a pressure of 30 kPa or any specified value pressure applied on the top-level of oil in the oil conservator and maintained for 24 hours or any specified period without any leakage and damage.

5.3 Winding resistance measurement

Winding resistance measurement tests should include the following:

- Measurement should be performed for all windings at all tap positions (if any).
- Measured values should be compared with the factory test results. The deviation should be within ± 5 % or otherwise specified.
- Measured values should be compared with the average value of three phase windings. The deviation should be within ± 3 % or otherwise specified.

5.4 Ratio test

Ratio tests should include the following:

- The voltage ratio should be measured on each tap.
- Voltage ratio should correspond to the value on nameplate and the factory test result.

5.5 Polarity check

The polarity of single-phase transformers should be checked. The polarity should be the same as that identified on the nameplate.

5.6 Insulation resistance test on each winding to earth and between windings including bushings

Insulation resistance tests should be made for each winding with respect to earth and between windings.

5.7 Dissipation factor ($\tan \delta$) and capacitance measurement on each winding to earth and between windings

Dissipation factor ($\tan \delta$) and capacitance measurement on each winding to earth and between windings should include the following: