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Technical requirements and test methods for tap-changer for ultra high voltage transformers

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Foreword

This document has been drafted in accordance with the provisions specified in GB/T 1.1-2020 Guidelines for Standardization - Part 1: Structure and Drafting Rules for Standardization Documents

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Technical requirements and test methods for tap-changer for ultra high voltage transformers

1 Scope

This document specifies the basic requirements, parameter requirements, technical requirements, marking, packaging, transportation and storage for tap-changers used in 1000 kV AC transformers, and describes the corresponding test methods.

This document is applicable to the design and acceptance of tap-changers for 1000 kV AC transformers (including autotransformers and step-up transformers).

2 Normative References

The contents of the following documents are incorporated as indispensable provisions of this document through normative reference in the text. For dated referenced documents, only the edition corresponding to the specified date is applicable to this document; for undated referenced documents, the latest edition (including all amendments) applies to this document.

GB/T 2900.95 Electrical Terminology—Transformers, Voltage Regulators and Reactors

GB/T 4208 Degrees of Protection Provided by Enclosures (IP Code)

GB/T 4797.4 Classification of Environmental Conditions—Natural Environmental Conditions—Solar Radiation and Temperature

GB/T 10230.1-2019 Tap-changers—Part 1: Performance Requirements and Test Methods

GB/T 10230.2 Tap-changers—Part 2: Application Guidelines

GB/T 17623 Determination of Dissolved Gas Components in Insulating Oil by Gas Chromatography

GB/T 42558.1 Seismic Technology for Electrical Equipment in Converter Stations Used on Plateaus—Part 1: Guidelines for Seismic Tests and Evaluation

GB 50260 Code for Seismic Design of Electric Power Facilities

DL/T 722 Guide for Analysis and Judgment of Dissolved Gases in Transformer Oil

3 Terms and Definitions

The terms and definitions defined in GB/T 2900.95 and GB/T 10230.1-2019 shall apply to this document.

4 Basic Requirements

4.1 Environmental Requirements

4.1.1 The temperature range for on-load tap-changers operating in transformer oil shall be -25℃ ~ 105℃, and the ambient temperature range shall be -25℃ ~ 40℃. The temperature range for off-circuit tap-changers operating in transformer oil shall be -40℃ ~ 105℃, and the ambient temperature range shall be -40℃ ~ 40℃.

4.1.2 The electric operating mechanism shall be able to operate normally under conditions of outdoor condensation and precipitation.

4.1.3 The solar radiation in the service environment of the tap-changer shall comply with the relevant provisions of GB/T 4797.4.

4.1.4 The seismic fortification intensity of the tap-changer shall be consistent with that of the corresponding transformer.

4.2 Service Requirements

4.2.1 When the tap-changer is installed in the voltage regulation compensation transformer of a UHV step-up transformer or a UHV autotransformer, the inclination relative to the ground shall not exceed 2%.

4.2.2 The tap-changer may adopt the neutral point forward and reverse voltage regulation mode; the contact arrangement is specified in Annex A.

4.2.3 The tap-changer shall be equipped with both manual and electric adjustment functions.

4.2.4 After the tap-changer is installed in the voltage regulation compensation transformer of a UHV step-up transformer or a UHV autotransformer, the deviation of the resistance value of the off-circuit tap-changer (together with the transformer) from the design value shall not be greater than 2%; the operation of the on-load tap-changer together with the transformer shall be free of faults.

4.3 Special Requirements

Other special environmental and service requirements to be satisfied shall be specified in the order.

5 Parameter Requirements

5.1 Parameters of Tap-changers for UHV Autotransformers

The parameters of tap-changers for UHV autotransformers shall comply with the requirements specified in Table 1.

Table 1 Parameter Table of Tap-changers for UHV Autotransformers

Item	Parameter		Unit	Characteristic Values of Off-circuit Tap-changer	Characteristic Values of On-load Tap-changer
1	Voltage Regulation Position		—	Neutral Point	Neutral Point
2	Number of Phases		—	Single-phase	Single-phase
3	Maximum Rated Continuous Current Irm		A	2400	2000
4	Rated Step Voltage		kV	—	≥4
5	Rated Frequency		Hz	50	50
6	Maximum Equipment Voltage Um		kV	126	126
7	Rated Insulation Level	Rated Withstand Test Voltage (Root Mean Square)	kV	230	230
		Lightning Full-wave Impulse Voltage (Peak Value)	kV	550	550
8	Voltage Regulation Range		kV	$525/\sqrt{3} \pm 4 \times 1.25\%$	$525/\sqrt{3} \pm 10 \times 0.5\%$
9	Short-circuit Current Withstand Capability	Thermal Withstand Current (Root Mean Square) (3 s)	kA	30	24
		Dynamic Withstand Current (Peak Value) (0.25 s)	kA	75	60
10	Mechanical Life		Times	20,000	800,000
11	Electrical Life		Times	—	20,000
12	Core Lifting Maintenance Condition		—	—	Over 6 years of operation or over 100,000 operations
13	Partial Discharge		pC	10	10
14	Temperature Rise Limit of Contacts in Oil		K	15	15

	Under Temperature Rise Test Current			
Note: "—" indicates no content.				