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**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

DL/T 294.4-2019

**Specification for equipment of de-excitation and overvoltage
protection for generators - Part 4: De-excitation capacity
calculation**

(English Translation)

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Foreword

This standard was formulated in accordance with the provisions of GB/T 1.1-2009 "Guidelines for Standardization Work Part 1: Standard Structure and Compilation".

Please note that certain contents of this document may involve patents. The issuing agency of this document is not responsible for identifying these patents.

This standard was proposed by the Standardization Management Center of the China Electricity Council.

This standard is under the jurisdiction of the Electric Power Industry Hydropower Station Automation Standardization Technical Committee.

The "Technical Conditions for Generator De-excitation and Rotor Overvoltage Protection Device" is divided into four parts.

Technical requirements for generator de-excitation and rotor overvoltage protection device
Part 1: Field circuit breaker;

Technical requirements for generator demagnetization and rotor overvoltage protection device. Part 2: Non-linear resistance;

Technical requirements for generator demagnetization and rotor overvoltage protection device. Part 3: Rotor overvoltage protection device;

Technical requirements for generator de-excitation and rotor overvoltage protection device. Part 4: Calculation of de-excitation capacity;

This standard is part 4.

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Ming, Wu Kuayu, Xie Yanjun, Yuan Yazhou, Xu Zaide, Deng Xiaojun, Geng Minbiao, Wei Wei, Wang Kun for comments and suggestions during the implementation of this standard, please feedback to the Standardization Management Center of China Electricity Council (Baiguang, Xicheng District, Beijing) Lu Er Tiao No. 1, 100761).

This standard is issued for the first time.

Technical conditions of generator de-excitation and rotor overvoltage protection device Part 4 Calculation of Demagnetization Capacity

1 Scope

This standard specifies the demagnetization capacity of synchronous generators (hereinafter referred to as generators) and rotor overvoltage protection devices the calculation principle and method are the basis for selecting the demagnetization resistance capacity.

This standard is applicable to the calculation of demagnetization capacity of salient pole and recessed pole generators with damping windings with a single unit capacity of 10MW and above.

Refer to the implementation for generators below 10MW.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version is suitable Used in this document. For undated references, the latest version (including all amendments) applies to this document.

DL/T 294.2 Technical conditions of generator demagnetization and rotor overvoltage protection device Part 2: Non-linear resistance DL/T 583 Technical conditions of static rectification excitation system and device for large and medium hydro-generator

3 Terms and definitions

The following terms and definitions apply to this document.

De-excitation

Refers to the process of transferring and consuming the magnetic field energy in the stator and rotor of a generator. The methods of demagnetization mainly include. demagnetization Turn-off de-excitation, freewheeling de-excitation, inverter de-excitation, linear de-excitation, nonlinear de-excitation, combined de-excitation, etc.

De-excitation capacity Refers to the energy transferred and consumed in the de-excitation process, including consumption in the rotor de-excitation circuit, damping winding and stator winding in the energy.

4.1 Demagnetization simulation calculation model

4.1.1

The schematic diagram shown in Figure 1 should be used for the calculation of generator de-excitation capacity.

4.2 Deexcitation simulation parameters

4.2.1

The generator model provided by the OEM shall include the parameters listed in Table 1.

4.2.2 Calculation method of saturation coefficient a, b, n

From the saturation period of the generator no-load characteristics to 1.3 times the rated voltage, m ($m > 3$) points are uniformly selected according to the no-load characteristics Curve and equation (5) are fitted to determine a, b, and n. See Appendix A for the simulation method of generator saturation.

4.2.3 The parameters c and alpha of nonlinear demagnetization resistance should be calculated according to the following method

- a) Obtain the demagnetization resistance parameter alpha according to the number of series and parallel groups of demagnetization resistance and the nonlinear coefficient of zinc oxide and silicon carbide;
- b) According to the most severe de-excitation condition, the initial de-excitation current I_{fdmax} (generally 3 times the rated excitation current) and the maximum de-excitation the control voltage u_{de_max} calculates c.

4.2.4 The resistance value of the linear resistor should meet the requirements of DL/T 583.

4.3 De-excitation capacity calculation conditions

Simulation calculation conditions. a single machine is connected to the infinite system through the main transformer.

a) No-load false force excitation

- 1) For the salient pole generator, the rectifier bridge control angle is 0° , the generator stator voltage is 1.3 times the rated value, and the delay is 0.5s.

Jump field circuit breaker.

- 2) For salient pole generators, the rectifier bridge control angle is 0° , the generator stator voltage is 1.3 times the rated value, and the delay is 0.3s.

Jump field circuit breaker.

b) Misforced excitation of load when the load is running under rated conditions, the excitation control angle suddenly becomes 0° , and the stator overvoltage protection or stator overload protection or rotation Sub-overload protection action is divided into field circuit breaker.

Note: (1) For hidden pole generators, when the generator stator voltage reaches 1.3 times the rated value, the protection action will be delayed 0.5s;

For salient pole generators, the generator stator voltage reaches 1.3 times the rated value, and the protection action is delayed 0.3s;

4.4.2 According to formula (1), (2), (3) and (4), establish the generator model, and then establish the capacity calculation according to formula (9) Model.

4.4.3 Set working conditions and other conditions according to 4.3.

4.4.4 Obtain U_f -de, I_f -de and demagnetization capacity during demagnetization by simulation. The calculated capacity of demagnetization resistance is calculated from the above working conditions Calculate the maximum value in the result. The actual capacity of the demagnetization resistor is 1.25 times the calculated value.

4.5 Estimation of demagnetization resistance capacity

When the generator parameters are uncertain in the early stage of the project, formula (10) can be used to simplify the calculation.

Appendix A

(Informative appendix) Typical simulation method of generator saturation There is a nonlinear relationship between the excitation current and the no-load potential of the synchronous motor due to the saturation of the iron core. This nonlinear relationship can it is expressed by the motor no-load saturation characteristic curve. The shape of the curve is shown in Figure A.1.