

ICS 29.160.20  
CCS K 21

**DL**

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

**DL/T 2011-2019**

---

**Test procedure for on-site replacement of large generator stator  
windings**

**(English Translation)**

**Issued on: June 4, 2019**

**Implemented on: October 1, 2019**

---

**Issued by: National Energy Administration**

## Table of Contents

Preface

1 Scope

2 Normative Reference Documents

3 Terms and Definitions

4 General requirements

5 Test items and technical requirements

Appendix A (Informative Appendix) Measurement of Surface Resistance of Generator Stator Bars

Appendix B (informative appendix) AC withstand voltage test of generator stator bar

Appendix C (informative appendix) Generator stator winding slot potential measurement or contact resistance measurement

Appendix D (informative appendix) Check the tightness of the slot wedge of the generator stator bar

## Foreword

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

This standard was proposed by the China Electricity Council.

This standard is under the jurisdiction of the Electric Power Industry Standardization Technical Committee (DL/T C09).

Drafting organizations of this standard. Guangdong Electric Power Research Institute Energy Technology Co., Ltd., Shanghai Electric Power Station Equipment Co., Ltd. Shanghai Generator Factory, Dongfang Electric Group Dongfang Electric Co., Ltd., Harbin Electric Plant Co., Ltd., State Grid Hebei Electric Power Co., Ltd. Electric Power Research Institute, Northeast Branch of Huadian Electric Power Research Institute Co., Ltd., State Grid Shandong Electric Power Research Institute, State Grid Hubei Electric Power Co., Ltd. Electric Power Research Institute, State Grid Hunan Electric Power Research Institute, Guangdong Datang International Chaozhou Power Generation Co., Ltd.

The company, Chengdu Branch of Guodian Science and Technology Research Institute Co., Ltd., State Grid Shanghai Electric Power Research Institute.

## 1 Scope

This standard specifies the test items and technical requirements that should be carried out during the on-site replacement of large generator stator windings.

This standard applies to three-phase hidden pole synchronous generators with a capacity of 50MW and above, other types of generators and synchronous phase modulation the machine can be implemented with reference to this standard.

## 2 Normative references

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

GB/T 755 Rotating motor rating and performance GB/T 1029 Three-phase synchronous motor test method GB/T 2900.1 Basic terminology for electrical engineering GB/T 2900.25 Electrical terminology rotating electric machine GB/T 16927.1 High Voltage Test Technology Part 1: General Definition and Test Requirements GB/T.20140 The dynamic characteristics and vibration measurement method and evaluation of the stator winding end of the hidden pole synchronous generator GB/T.20160 Rotating motor insulation resistance test GB/T 20833.1 Stator winding insulation of rotating electrical machines Part 1: Offline partial discharge measurement GB/T 20835 Generator stator core magnetization test guide GB/T 21205 Specification for refurbishment of rotating electrical machines GB 26860 Electrical Safety Work Rules for Electrical Parts of Power Plants and Substations GB 50150 Electrical equipment installation engineering electrical equipment handover test standard DL/T 298 Guidelines for Detection and Evaluation of Corona at the End of Generator Stator Winding DL/T 492 Generator Epoxy Mica Stator Winding Insulation Appraisal Guidelines DL/T 596 Preventive test procedures for electrical equipment DL/T 801 Internal cooling water quality and system technical requirements for large generators DL/T 1522 Ultrasonic measurement method and evaluation guide for water flow of cooling water system in generator stator winding DL/T 1524 Generator infrared detection method and evaluation guide DL/T 1768 Preventive test procedures for rotating electrical machines JB/T 6204 High voltage AC motor stator coil and winding insulation withstand voltage test specification JB/T 6228 Inspection method and evaluation of internal water system of turbine generator winding JB/T 7608 Test method and limit for measuring the tangent of dielectric loss angle of high voltage AC motor coil

## 3 Terms and definitions

The following terms and definitions as defined in GB/T 2900.1 and GB/T 2900.25 apply to this document.

Stator bar embedding the process of embedding and fixing the stator bar in the stator slot of the generator.

New stator bar

Stator bars that have not been used after leaving the factory, including unused and well-preserved spare bars.

Reused stator bar

A stator bar that is removed from the generator stator slot and can be reused after treatment.

Remainder stator bar the unremoved wire rod in the generator stator slot.

Full replacement

All the wire rods in the generator stator slot are removed and replaced with new wire rods.

Partial replacement

Treatment methods other than replacement.

Stator core corresponding part of stator bar the stator bar corresponds to the length of the stator core.

Ending of stator bar the part of the stator winding that extends beyond the two ends of the stator core.

Overall heating

The baking process after the stator winding is assembled.

## **4 General requirements**

### **4.1**

During the insulation test, the ambient temperature should not be lower than 5°C, and the relative air humidity should not be higher than 80%. Measure and record at the same time during the test the temperature of the test product, the temperature and relative humidity of the surrounding air.

### **4.2**

When performing a high voltage test on a single stator bar, the surface of the bar should be covered with aluminum foil, tin foil and other metal materials as electrodes, and minimize the air gap between the electrode and the wire rod surface.

### **4.3**

When a single new stator bar is tested by sampling, for the hidden pole generator, the number of samples shall not be less than each set (or each batch) 10% of the total number

of stator bars. When the sampling measurement result is unqualified, the sampling test shall be doubled. If it is still unqualified after doubling the sampling test, then all stator bars shall be tested and inspected.

## 5 Test items and technical requirements

### 5.1

During the process of on-site replacement of stator windings, corresponding tests should be carried out in stages according to different cooling methods of the generator.

### 5.2

The test items for the on-site replacement of all the stator windings of the water-cooled generator are shown in Table 1.

#### Appendix B

(Informative appendix) AC withstand voltage test of generator stator bar B.1 Refer to GB/T 1029 and JB/T 6204 for general test methods and requirements.

B.2 The AC withstand voltage test of the stator bar core section shall meet the following requirements.

- a) Carry out before the stator bar is embedded;
- b) Wrap metal materials such as tin foil or aluminum foil as the ground electrode within a range of 20mm extension at both ends of the stator bar core section;
- c) During the AC withstand voltage test, use an infrared imager to check the temperature rise of the anti-corona layer, and the temperature should not exceed 100°C.

B.3 The AC withstand voltage test at the end of the stator bar shall meet the following requirements.

- a) It should be carried out after the anti-corona treatment and before the stator bar is embedded;
- b) The end of the stator bar should be covered with tin foil or aluminum foil as the ground electrode;
- c) The grounding electrode should be kept at a sufficient distance from the conductor at the nose of the stator bar to prevent the high voltage from the conductor at the nose of the stator bar during the test.

Creepage phenomenon generated from the surface of the bar to the ground electrode.

#### Appendix C

(Informative appendix) Generator stator winding slot potential measurement or contact resistance measurement C.1 Tank potential measurement the requirements for tank