

Translated English of Chinese Standard: GB/T40609-2021  
[www.ChineseStandard.net](http://www.ChineseStandard.net) → Buy True-PDF → Auto-delivery.  
[Sales@ChineseStandard.net](mailto:Sales@ChineseStandard.net)

**GB**

NATIONAL STANDARD OF THE  
PEOPLE'S REPUBLIC OF CHINA

ICS 29.020

CCS F 21

**GB/T 40609-2021**

---

**Technical specifications for operational security checking of  
power system**

电网运行安全校核技术规范

**Issued on: October 11, 2021**

**Implemented on: May 01, 2022**

---

**Issued by: State Administration for Market Regulation;  
Standardization Administration of the People's Republic of China.**

## Table of Contents

|                                                                              |    |
|------------------------------------------------------------------------------|----|
| Foreword .....                                                               | 3  |
| 1 Scope .....                                                                | 4  |
| 2 Normative references .....                                                 | 4  |
| 3 Terms and definitions .....                                                | 4  |
| 4 General requirements for operational security check for power system ..... | 5  |
| 5 Power flow calculation of power grid operational mode .....                | 5  |
| 6 Operational security check for power system .....                          | 7  |
| 7 Decision making for security check .....                                   | 11 |

# Technical specifications for operational security checking of power system

## 1 Scope

This document specifies the data input and output, calculation content and calculation requirements for operational security checking of power system.

This document applies to the day-ahead and intra-day operational security checking of power system, and guides the design, research, development and acceptance of the security check for power system at the provincial level and above. The power generation, transmission and supply enterprises and users at all levels shall refer to it for implementation.

## 2 Normative references

The following documents are normatively referenced in this document and are indispensable for its application. For dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB 38755, Code on security and stability for power system

DL/T 961, Power grid dispatching glossary

## 3 Terms and definitions

Terms and definitions determined by DL/T 961 and the following are applicable to this document.

### 3.1 Operational security check for power system

Security check carried out for the day-ahead and intra-day dispatching plans and electricity market transactions during the generation and operation of power grid dispatching.

**Note:** The check contents include base state power flow check, steady-state security check, short-circuit current check, short-circuit ratio check and stability check.

### 3.2 Steady-state security check

According to the operational mode data for power system, apply the N-1 principle and the specified fault set to disconnect the lines, transformers and other elements without fault one by one, and check whether other elements have equipment overload and voltage out-of-limit.

### **3.3 Stability check**

Evaluate the ability of the power system to maintain stable operation after small disturbances and large disturbances based on the operational mode data for power system.

### **3.4 Decision making for security check**

According to the calculation results of security check, for unsecure or unstable operational mode data for power system, provide sensitivity analysis information and adjustment suggestions for eliminating various security and stability problems.

## **4 General requirements for operational security check for power system**

In the power grid dispatching production and operation, the day-ahead and intra-day dispatching plan and the electricity market transaction results shall pass the security check. For the situation where the security and stability requirements of the power system are not satisfied, adjustment suggestions shall be given.

## **5 Power flow calculation of power grid operational mode**

### **5.1 Basic data**

**5.1.1** Obtain maintenance plan, power generation plan, electricity market transaction, equipment unplanned outage or abnormal outage information, and combine new energy power generation forecast, system load forecast and bus load forecast to provide a computational basis for subsequent calculations.

**5.1.2** The basic calculation data for security check shall include:

- a) forecast data, including bus load forecast, system load forecast, and new energy power generation forecast;
- b) dispatching plan data, including power generation plan, tie line plan, equipment maintenance plan;
- c) equipment unplanned outage or abnormal outage information;
- d) electricity market transaction data.

**5.4.3** The power flow calculation shall automatically adjust the reactive power compensation according to the change of the active power, so as to ensure that the voltage of each central point in the system meets the specified requirements:

- a) The converter station filter shall be automatically switched on and off according to the DC active power;
- b) Active power and voltage amplitude given (PV) node voltage can be determined according to historical operational data or manual experience;
- c) The reactive power of active power and reactive power given (PQ) nodes shall be set with reference to historical operational data;
- d) The grid reactive power shall be adjusted with the load changes – based on the principle of lay-dividing and zone-dividing and on-site balance – to avoid the transmission of reactive power through long-distance lines or multi-stage transformers.

## **5.5 Input and output**

**5.5.1** The input data of the power flow calculation of power grid operational mode shall include:

- a) load forecast and new energy power generation forecast data, dispatching plan data, equipment unplanned outage or abnormal outage information and electricity market transaction data;
- b) grid model;
- c) historical power grid operational data.

**5.5.2** The results of the power flow calculation of power grid operational mode shall include the power grid operational mode data converged by the power flow calculation.

## **6 Operational security check for power system**

### **6.1 Base state power flow check**

**6.1.1** The base state power flow check shall perform statistical analysis on the operational mode data for power system, to judge the overload and out-of-limit conditions of equipment under the base state power flow.

**6.1.2** The base state power flow check includes the following contents:

- a) It shall compare the operational mode data for power system with the equipment limit for out-of-limit check, including line current out-of-limit, transmission

section power flow out-of-limit, transformer power flow out-of-limit and bus voltage out-of-limit;

- b) It shall provide overload equipment and its overload degree, out-of-limit equipment and its out-of-limit degree, and shall sort the equipment according to the overload degree and out-of-limit degree.

**6.1.3** The input data of the base state power flow check calculation shall include:

- a) operational mode data for power system;
- b) equipment limit, including line current limit, transmission section composition and stability limit, transformer power flow limit and bus voltage limit.

**6.1.4** The calculation results of base state power flow check shall include: overload and out-of-limit equipment and overload and out-of-limit degree of operational mode data for power system under base state power flow.

## **6.2 Steady-state security check**

**6.2.1** The steady-state security check shall perform steady-state security analysis and calculation for the operational mode data of power system, and analyze the equipment overload and out-of-limit conditions under the N-1 fault and the specified fault set.

**6.2.2** The steady-state security check includes the following contents:

- a) The calculation range of steady-state security check can be determined according to equipment type, voltage level and partition;
- b) According to the N-1 principle, the entire network equipment shall be disconnected one by one, including line disconnection, main transformer disconnection, and DC single-pole blocking. If necessary, the DC bipolar blocking fault and the simultaneous fault of the same pole and parallel line shall be analyzed and calculated, and other elements shall be judged for exceeding the limit or not;
- c) The specified fault set shall be subject to steady-state security analysis and calculation, to judge whether other elements are out of limit;
- d) The action of the automatic security device shall be simulated; the strategy of the automatic security device can be automatically matched according to the power grid operational mode.

**6.2.3** The input data of the steady-state security check shall include:

- a) operational mode data for power system;

- a) operational mode data for power system;
- b) DC transmission short-circuit ratio, DC multi-feed short-circuit ratio, and new energy station short-circuit ratio threshold.

**6.4.4** The calculation results of the short-circuit ratio check shall include: DC and new energy stations that do not meet the short-circuit ratio requirements.

## **6.5 Stability check**

**6.5.1** The stability check shall perform static stability, transient power angle stability, dynamic power angle stability, voltage stability and frequency stability check according to the operational mode data for power system; the stability calculation results shall meet the requirements of GB 38755.

**6.5.2** The stability check shall include the following contents:

- a) The stability check shall perform static stability calculation on the operational mode data for power system, to check whether the static stability reserve of the operational mode data for power system meets the requirements;
- b) The transient power angle stability check shall perform electromechanical transient simulation under expected faults according to the operational mode data for power system, and check whether the given automatic relay protection and security device action strategies meet the requirements of the transient power angle stability criterion;
- c) The dynamic power angle stability check shall perform small disturbance stability analysis and electromechanical transient simulation of expected faults according to the operational mode data for power system, and verify whether the damping ratio meets the specified requirements;
- d) The voltage stability check shall perform static voltage stability and transient voltage stability calculation according to the operational mode data for power system, check whether the static voltage stability margin meets the requirements, and analyze whether the load bus voltage can recover to above the specified operating voltage level after the expected fault;
- e) The frequency stability check shall perform frequency stability calculation under expected faults according to the operational mode data for power system, and check whether the system frequency can quickly recover to the vicinity of the rated frequency under the given frequency stability control measures.

**6.5.3** The input data for the stability check shall include:

- a) operational mode data for power system;

- b) static stability, transient power angle stability, dynamic power angle stability, voltage stability and frequency stability calculation fault set;
- c) automatic security control device action strategy.

**6.5.4** The results of the stability check shall include:

- a) operational mode of power system, which does not meet the security and stability constraints;
- b) static stability, transient power angle stability, dynamic power angle stability, voltage stability and frequency stability check results.

## **7 Decision making for security check**

### **7.1 Sensitivity analysis**

**7.1.1** According to the calculation results of the operational security check of power system, conduct sensitivity analysis for equipment out-of-limit, short-circuit current exceeding the standard or operational mode data for power system dissatisfying security and stability requirements. Including the following:

- a) The sensitivity analysis of the active power injection of generator nodes and load nodes to the active power flow of branches or transmission channels shall be carried out;
- b) The sensitivity analysis of the reactive power injection of generator nodes and capacitor reactor nodes to the bus voltage, and the sensitivity analysis of the transformer ratio to the bus voltage shall be carried out;
- c) The branch circuit breaking distribution factor calculation shall be carried out, that is, the change of power of other lines or transformers after the line or transformer branch is broken shall be calculated;
- d) The sensitivity analysis of short-circuit current by adjustment measures such as switching on and off equipment, busbar separation and line out-of-line shall be carried out;
- e) The sensitivity analysis of the short-circuit ratio by the adjustment measures such as generator start-stop and DC power adjustment shall be carried out;
- f) The sensitivity analysis of the transient instability faults by adjustment measures such as generator start-stop, output adjustment, and DC power adjustment shall be carried out;



**This is an excerpt of the PDF (Some pages are marked off intentionally)**

**Full-copy PDF can be purchased from 1 of 2 websites:**

1. <https://www.ChineseStandard.us>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Select your country (currency), for example: USA (USD); Germany (Euro).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Tax invoice can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with download links).

2. <https://www.ChineseStandard.net>

- SEARCH the standard ID, such as GB 4943.1-2022.
- Add to cart. Only accept USD (other currencies - <https://www.ChineseStandard.us>).
- Full-copy of PDF (text-editable, true-PDF) can be downloaded in 9 seconds.
- Receiving emails in 9 seconds (with PDFs attached, invoice and download links).

Translated by: Field Test Asia Pte. Ltd. (Incorporated & taxed in Singapore. Tax ID: 201302277C)

About Us (Goodwill, Policies, Fair Trading...): <https://www.chinesestandard.net/AboutUs.aspx>

Contact: Wayne Zheng, [Sales@ChineseStandard.net](mailto:Sales@ChineseStandard.net)

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

**----- The End -----**