

ICS 29.240.01

CCS P 62



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

GB/T 51420-2020

**Smart substation engineering commissioning and acceptance
standards**

Issued on: January 16, 2020

Implemented on: October 1, 2020

**Issued by: Ministry of Housing and Urban-Rural Development of the
People's Republic of China;
State Administration for Market Regulation**

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1 General

1.0.1 This standard is formulated in order to standardize the commissioning and acceptance of smart substation projects, improve the quality of commissioning and the level of handover.

1.0.2 This standard is applicable to new construction, renovation and expansion projects of intelligent substations with voltage levels of 110kV (66kV) and above.

1.0.3 The commissioning and acceptance of smart substations shall not only comply with this standard, but also comply with the current relevant national standards.

2.1.1 configuration configuration

A step of engineering debugging, including selection of functional units, positioning of functional units and establishment of connections between them, etc.

2.1.2 single commissioning single commissioning

The test carried out to ensure the correctness of the function and configuration of individual equipment and devices.

2.1.3 sub-system commissioning

To ensure the correctness of subsystem functions and configurations, the test is carried out

on multiple devices associated with the subsystem.

2.1.4 start-up and trial operation

In order to ensure the normal commissioning of new equipment in substations, the start-up power receiving and load tests of the entire system are carried out.

2.1.5 system dynamic test

A dynamic simulation test to verify the performance and reliability of the overall system such as relay protection.

2.1.6 Factory acceptance factory acceptance

After the intelligent equipment completes the factory test, it is accepted before leaving the factory.

2.1.7 site acceptance

During the on-site commissioning of the equipment, the acceptance before the trial operation starts, including intermediate acceptance and completion pre-acceptance.

2.1.8 start acceptance

After the on-site acceptance is completed and the relevant problems have been dealt with, the inspection and acceptance of the new equipment is carried out before the start-up.

2.2 Abbreviations

APPID (Application Identifier) application identifier CAL (China Accredited Laboratory) China Accredited Inspection Laboratory CID (Configured IED Description) IED instance configuration file CMA (China Metrology Accreditation) China Metrology Accreditation CNAS (China National Accreditation Service for Conformity Assessment) China National Accreditation Service for Conformity Assessment CPU (Central Processing Unit) central processing unit GOOSE (Generic Object Oriented Substation Events) Generic Object Oriented Substation Events GPS (Global Positioning System) Global Positioning System ICD (IED Capability Description) IED capability description file IED (Intelligent Electronic Device) intelligent electronic device INV (Inverter for Power System) inverter power supply for electric power IP (Internet Protocol) protocol for interconnection between networks MAC (Media Access Control) media access control MMS (Manufacturing Message Specification) manufacturing message specification PMU (Phasor Measurement Unit) Phasor Measurement Unit PPS (Pulse Per Second) second pulse SCD (Substation Configuration Description) total station system configuration file SCL (Substation Configuration Description Language) substation configuration description language SOE (Sequence Of Event) event sequence record SV (Sampled Value) sampled value UPS (Uninterruptible

Power System) uninterruptible power supply VLAN (Virtual Local Area Network) virtual local area network VQC (Voltage Quality Control) voltage reactive power control

3 basic rules

3.0.1 The scope of commissioning and acceptance specified in this standard is the electrical equipment and systems of smart substations.

3.0.2 The basic process of commissioning and acceptance of smart substations should meet the following requirements.

1 The commissioning sequence of the smart substation should be carried out according to the configuration configuration, single unit commissioning, sub-system commissioning, and start-up trial operation. When the system structure is the first application or is significantly different from previous projects, the system dynamic model test should be carried out. The system dynamic model test should be carried out according to the two Normal and abnormal conditions of secondary equipment;

2 The acceptance sequence of smart substation commissioning should be carried out according to factory acceptance, on-site acceptance, and start-up acceptance.

3.0.3 The equipment (device) to be debugged and accepted shall pass the type test of the unit with testing qualification.

3.0.4 The test instruments and meters for commissioning and acceptance should pass the inspection and be within the validity period.

3.0.5 The routine test of the main body of electrical primary equipment shall comply with the current national standards "Electrical Installation Engineering Electrical Equipment Handover Test Standard" GB 50150, "Electrical Installation Engineering Power Transformer, Oil Immersed Reactor, Transformer Construction and Acceptance Specification" GB 50148, "Code for Construction and Acceptance of High-Voltage Electrical Apparatus for Electrical Installation Engineering" GB 50147 and relevant provisions of related standards.

3.0.6 The routine test of electrical secondary equipment shall comply with the current national standard "Electrical Measurement Transmitter for Converting AC Power into Analog or Digital Signal" GB/T 13850, the current industry standard "Inspection Regulations for Relay Protection and Power Grid Safety Automatic Devices" "DL/T 995 and the relevant provisions of related standards.

3.0.7 The routine acceptance of electrical equipment shall comply with the relevant provisions of the current industry standard "Quality Inspection and Evaluation Regulations for Electrical Equipment in Electrical Installation Engineering" DL/T 5161.1~17 and related standards.

3.0.8 The commissioning and acceptance of smart substations should comply with the

current national standard "Electricity Safety Work Regulations" (electrical parts of power plants and substations) GB 26860, as well as the provisions of safety production laws and regulations, and do a good job in hazard analysis and prevention, commissioning and acceptance Plan and safety disclosure work.

4.0.1 The configuration and configuration of the smart substation should include the generation of the SCD file of the whole station, the configuration of the station control layer equipment, IED configuration, network and switch configuration.

4.0.2 The following conditions should be met before the entire site SCD file configuration.

- 1 The equipment (device) should pass the communication consistency test of a testing agency with CNAS accreditation, CMA certification, CAL accreditation and other qualifications, and the test results should comply with the current industry standard "Substation Communication Network and System Part 10.Consistency Test" DL/ Relevant provisions of T 860.10;
- 2 The supplier provides the ICD file consistent with the device version;
- 3 The design drawings meet the engineering requirements, including virtual terminal wiring diagrams, network configuration diagrams, optical port allocation diagrams, etc.

4.0.3 After generating the SCD file of the whole site, the following checks should be carried out.

- 1 Document SCL syntax legality;
- 2 File model instance and data set correctness;
- 3 Data type template and extended modeling consistency;
- 4 IED naming standardization;
- 5 Uniqueness of IP address, multicast MAC address, GOID, SMVID, APPID;
- 6 The correctness of communication parameters such as VLAN and priority;
- 7 The correctness and completeness of virtual terminal connection and description.

4.0.4 When importing the SCD file into the station control layer equipment, check the correctness of the downloaded configuration of the station control layer equipment.

4.0.5 Export the information related to a single IED from the SCD file to form the CID file and process layer configuration file required by the device and download it to the device. Check the correctness of the configuration of each IED.

4.0.6 Complete the network and switch configuration according to the design and user requirements, and check the correctness of the corresponding configuration and