TSVG Operation and Maintenance manual

TBEA product and solution team
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Preface

Thank you for using SVG series high voltage static var generator products of TBEA Xi'an Electric Technology CO., LTD..

This manual provides you with product overview, transportation and installation, basic operation, troubleshooting and routine maintenance related content and matters needing attention. In order to ensure that you can operate this product correctly, please read this manual carefully before operation, especially the safety requirements and safety instructions.

This manual is shipped with SVG series high voltage static var generator equipment. Please use and maintain this product with this manual as your standard. TBEA Xi'an Electric Technology CO., LTD. reserves the right to further upgrade and improve the follow-up products. The contents of the manual are subject to change without notice.

Safety Requirements

Important hints

Please read the relevant chapters of this manual carefully before setting up the operation.

The SVG series high-voltage static var generator equipment must be commissioned by engineers authorized by TBEA Xi'an Electric Technology CO., LTD. before it can be used. Otherwise, the damage caused by this does not fall within the scope of warranty.

Safety instructions

In order to better use this manual and understand the product, please read the following symbolic instructions carefully:

Warning!

If the content of this symbol sign does not comply with the relevant requirements or take corresponding measures, there is a potential risk of death or serious personal injury.

Attention!

If the content of this symbol sign does not comply with the relevant requirements or take corresponding measures, there is a potential danger that may lead to minor or moderate personal injury.

Electric shock!

All the places marked by this symbol are dangerous parts of electric shock. If the relevant requirements are not complied with or corresponding measures are not taken, death or serious personal injury will be caused.

Earthing!

This symbol is the protection grounding mark.

- Before installing and operating SVG series high voltage static var generator, you should read this user manual carefully. The manual contains the necessary information for the equipment to perform well and avoid misoperation.
- This safety instruction is applicable to all operations of SVG series high voltage static var generators. Ignoring them can cause bodily injury or even death.
- This safety instruction is applicable to all operations of SVG series high voltage static var generators. Ignoring them can cause bodily injury or even death.
- Familiar with electrical regulations, professional electrical work, and certified personnel are allowed to install and maintain the equipment. The content of the user manual describes the characteristics of the product, but it is usually not a guarantee of the product. If there is any doubt in use,

please submit it to TBEA Xi'an Electric Technology CO., LTD. in time.

Conventional correlation

Warning!

- This equipment is equipped with dangerous high voltage. If it does not comply with the "warning" regulations or operate according to the requirements of this manual, it may cause death, serious personal injury or major property loss.
- Only certified and qualified professionals are allowed to operate the equipment and be familiar with all the safety instructions and installation, operation and maintenance requirements in this manual before using the equipment. Correct handling, loading and unloading, positioning, installation and operation and maintenance are reliable guarantees for the safe and successful operation of the equipment.

- This equipment is a high-voltage equipment, high-voltage operation must be carried out according to the correct voltage, the site designated by the user special high- voltage operators, safety personnel, otherwise it may cause death, serious personal injury or major property losses.
- Pay attention to the danger of electric shock. Even if the high-voltage power supply has been cut off, dangerous DC voltage still remains on the DC bus and DC capacitor of the power unit of SVG series

high-voltage static var generator. Therefore, it is not allowed to open SVG series high-voltage static var generator until 30 minutes after the high-voltage power cut-off is completed and the main cutter of isolation switch is disconnected and the grounding switch is closed. The cabinet door of the bio-appliances.

- Pay attention to the danger of electric shock. If the grounding failure occurs, the connected part or system failure may result in a voltage difference of all phase voltages between the housing and the grounding. At this time, if the shell and ground contact at the same time may lead to serious injury, or even death.

Attention!

- Prevent children and the public from contacting or approaching the equipment!
- This equipment can only be used for the purposes specified by the manufacturer. Unauthorized modification or use of spare parts not sold or recommended by the equipment manufacturer may result in fire, electric shock or other injury.
- Please put this manual in an easy-to-find place near the equipment to ensure that all users are easy to use.
- If you want to measure or test live equipment in operation, you must

abide by the safety regulations of VBG 4.0, especially section 8 on "Safety Distance Permitted to Work on Live Parts". In practice, appropriate electronic devices should be used.

- Before installing and debugging SVG series high voltage static var generators, please read these safety rules and warnings carefully, as well as all warning signs pasted on the equipment. Make sure that the warning signs are placed in a wake-up place and replace the lost or damaged ones.

Transport and storage-related

Warning!

- Correct transportation, storage, positioning and installation, as well as careful operation and maintenance are essential for the normal and safe operation of SVG series high voltage static var generators.

Attention!

- During transportation and storage, to ensure that SVG series high-voltage static var generators do not suffer physical shock and vibration, it is also necessary to ensure that they are not rained and stored in places where the ambient temperature is too high.

Warning!

- Untrained and qualified personnel working on the devices/systems of the equipment or failing to comply with the relevant provisions of the "Warning" may cause serious personal injury or major property losses. Only those who have been trained in the design, installation, commissioning and operation of the equipment are allowed to work on the device/system of the equipment by certified and qualified professionals.
- The input power cord only permits permanent tightening. Equipment must be grounded (according to IEC 536 Class 1, NEC and other applicable standards).
- Even if the high voltage static var generator is not working, the following terminals may still have dangerous voltage:
  - —— High Voltage Power Supply Input Terminal
  - —— DC bus and connected DC capacitors inside cabinet

Attention!

- Power cables and control cables connected with the equipment must be connected in accordance with the relevant graphics in this manual to avoid interference caused by the operation of SVG series high voltage static var generators.

Operational correlation

Warning!

- SVG series high voltage static var generator operates under high voltage.
- During the operation of SVG series high voltage static var generators, dangerous voltage inevitably exists in some parts of them.
- In order to ensure that SVG series high voltage static var generators can achieve good compensation effect, it is necessary to input the parameters of the operation site through the operation touch screen, which must be fully consistent with the actual situation.
- The site ventilation is good, and the fan of SVG series high-voltage static var generator starts normally, which makes SVG series high-voltage static var generator achieve good heat dissipation effect

and prevent system from overheating or even ignition.

Maintenance related

Warning!

- Maintenance-related equipment maintenance can only be carried out by the service department of TBEA Xi'an Electric Technology CO., LTD., the authorized maintenance center of TBEA Xi'an Electric Technology CO., LTD. or the certified qualified and authorized personnel. These personnel should be very familiar with all the warnings in this manual and the correct operating procedures.
- Any defective parts and devices must be replaced with the same components.
- Before opening the cabinet door of STSTCOM series high voltage static var generator for maintenance, it is necessary to disconnect the high voltage and then the control system; the cabinet door can not be opened for maintenance until at least 30 minutes after the power unit is disconnected until the residual capacitance energy of DC side is released.

Content

Chapter I Product Overview

SVG series high voltage static var generator is a static synchronous compensator based on IGBT chain converter. It is the development direction of reactive power compensation technology in AC power network. It can provide capacitive and inductive reactive power rapidly and continuously, realize reactive power and voltage control, ensure the stability, safety and economic operation of power grid, or improve the connection point between load and public power grid. Power quality (improving power factor, compensating three-phase unbalance, eliminating voltage flicker and voltage fluctuation, restraining harmonic pollution) and saving power.

1.1 Model Naming Rules

The model naming method of SVG series products is shown in Figure 1-1.s

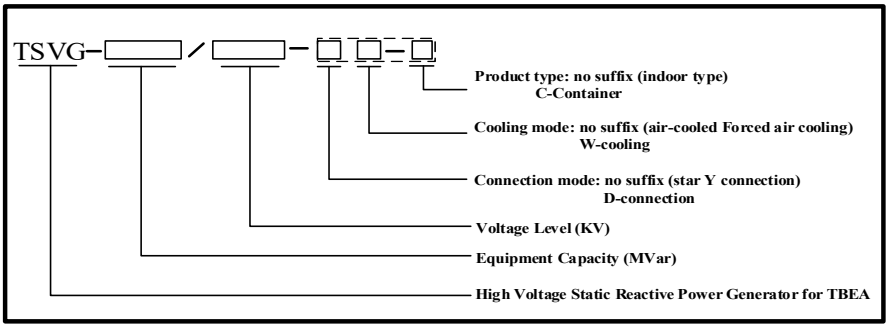


Figure 1-1 Type Naming of SVG Series Products

1.2 Specification Model

This project we use outdoor water cooling type SVG, name is TSVG-30&40&50/33-W-C, output capacity is 30&40&50Mvar.

1.3 Layout and Appearance

1.3.1 Appearance

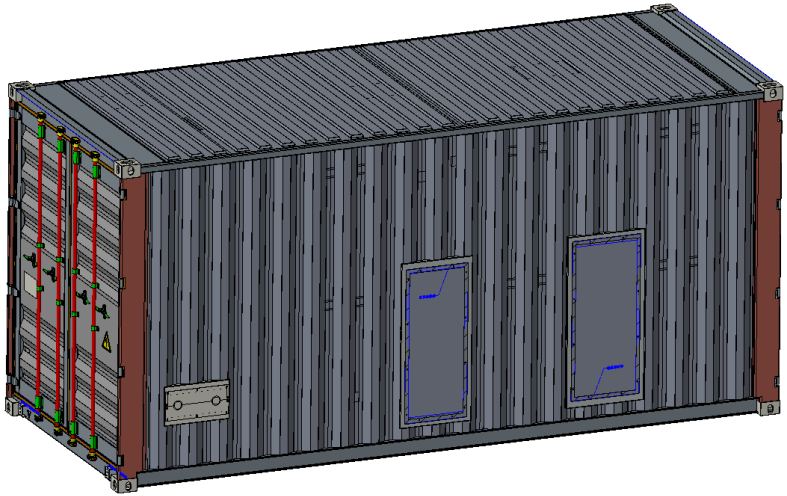


Figure 1-2 TSVG appearance

Table 1-3 TSVG layout instruction

No.	Name
①	Liquid- air heat exchanger
②	Pipelines
③	Power room gate
④	Power cable bushing
⑤	Air conditioner

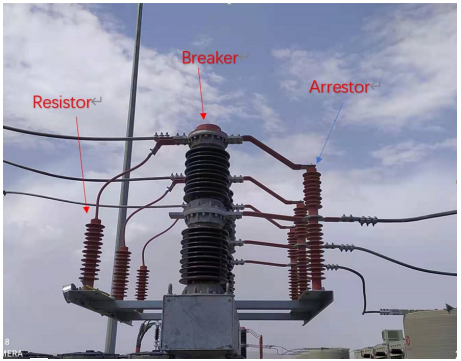
1.3.2 System constitution

TSVG series high voltage static reactive power generator mainly consists of five parts: starting device, control cabinet, power room, connecting reactor (or connecting transformer) and water-cooling system.

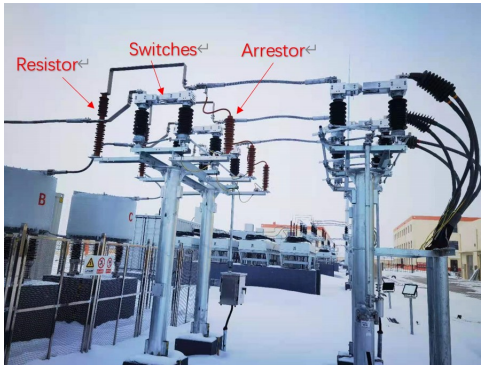
(1) Start-up cabinet

The starting device consists of a starting switch, a starting resistor, a lightning arrester, etc.

TSVG series of high voltage static reactive power generators are started by self-excitation. After the main switch is closed, the system voltage starts the DC capacity of the power unit through the starting resistance. When the starting voltage reaches 80% of the rated value, the control system closes the starting switch to start the resistance bypass. At present, there are isolation knife solutions and sulfur hexafluoride circuit breaker solutions used in the field. The details are shown in the figure below:



Sulfur hexafluoride circuit breaker



Disconnecting switch

2) Control cabinet

The control cabinet is composed of a controller, a touch screen, a control power supply, a relay and an air switch.

The control power supply consists of four switching power supply, two DC24V power supply systems, which use redundancy mode to supply power for touch screen and relay operation, and two DC12V power supply systems, which use redundancy mode to supply power for main controller chassis. The main control panel consists of power supply, operation and fault lights, touch screen and emergency stop switch.

Touch screen includes start, stop, reset, local and remote functions. See Chapter 3 for specific functions.

(3) Power cabinet

The main component of power cabinet is power module (also known as chain).

The 11kV power chamber is composed of 30 power modules in a three-phase system, with 10 modules in each phase cascaded successively. The 33kV power chamber consists of 102 power link modules that form a

three-phase system, with 34 power link modules in each phase cascaded in turn.

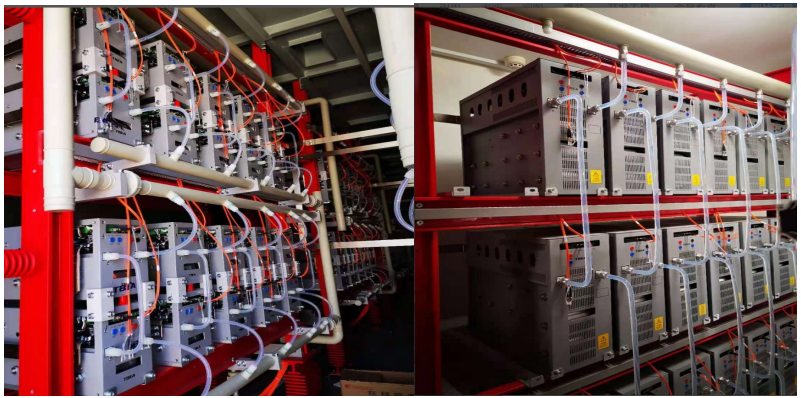


Figure 1-3 Power room

(4) Connect the reactor (or transformer)

The output of TSVG series high voltage static reactive power generators is connected in parallel to the

system side by connecting the reactor or connecting the transformer.

(5) Water cooling system

The water-cooling system mainly consists of four parts: water cooling plate, pipeline, water cooling main unit and outdoor water air heat exchanger The water-cooling plate in the power module absorbs the heat generated by IGBT in the power module. The liquid flowing through the water-cooling plate is heated, and the heated liquid flows into the water air heat exchanger through the pipeline and the water-cooling unit. The water air heat exchanger will radiate the heat from the heated liquid to the air. The temperature of the

liquid goes down. The water-cooling system has its own control system with independent control and protection functions, which can work independently. The controller in the water-cooling system communicates with the master control system of the high-pressure static reactive power generator through the communication interface. The operating parameters of the water-cooling system are transmitted to the main control system of the high pressure static reactive power generator.

1.4 Basic principle of the system

TSVG series of the principle of high voltage static reactive power generator wiring diagram as shown in figure 1-4, since the commutation voltage source inverter by transformer or reactor in parallel to the grid, by adjusting the voltage source inverter ac output voltage amplitude and phase can make the inverter output continuous variation of the capacitive and inductive reactive power current, achieve the purpose of reactive power compensation. The relationship between the output current, output voltage and system voltage of TSVG series high-voltage static reactive power generators under no-load, capacitive and

inductive operation modes is shown in Table 1-4 below

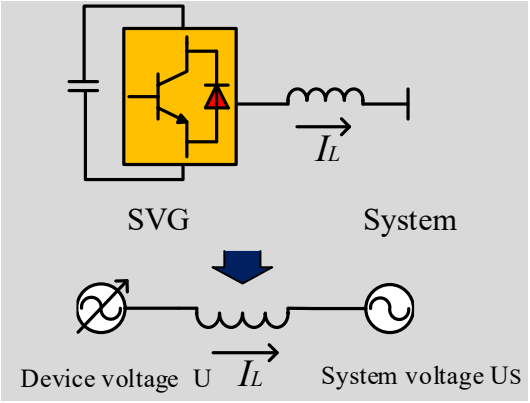
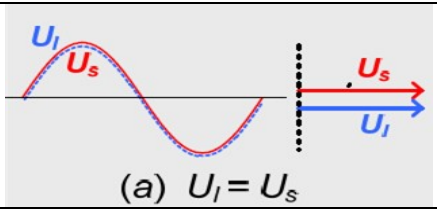
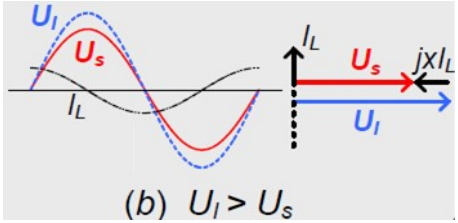
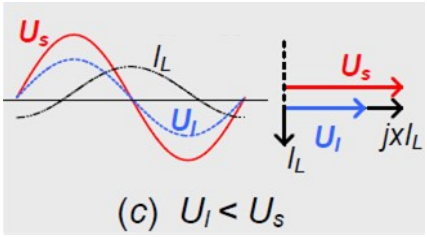


Fig 1-4 TSVG series principle

Table 1-4 TSVG TSVG series principle

Operation mode	Waveform and phasor diagram	Explain

No-load operation mode		a) At this point, I_L=0.
Capacitive operation mode		b) If Us<Uc, I_L is the leading current. The amplitude of the current can be continuously controlled by adjusting the Uc. SVG plays the role of adjustable capacitor, and its capacitance reactance can be continuously controlled.

Perceptual operation mode		c) If Us>Uc, I_L is a lagging current. SVG acts as an adjustable reactor and its inductance can be controlled continuously.

1.5 Main Technical Specifications

Table 1-5 Main Technical Specifications of SVG

Rated operating voltage	3kV-35kV
Operating voltage range (p.u.)	0.9 ~ 1.1 p.u.
Rated capacity	3 ~ 50MVar
Output reactive power range	Continuous Variation from Inductive Rating Reactive Power to Capacitive Rating Reactive Power

Controller response time	< 5ms
Total Harmonic Distortion Rate of Output Current	< 2.5%
Voltage fluctuation	≤2%
Converter chain efficiency	> 99.2%
Interface	Using English Display Operating Interface
Communication mode	485 communication signal *2: twisted pair shielding wire Ethernet Interface * 1; Time correction interface *1;

1.6 Environmental Requirements

1.6.1 Working Environment

The working environment reference standards IEC61800-4 and GB 4798.3-2007 are shown in Table 1-6 below.

Table 1-6 Working Environment

Project	Requirement
Ambient temperature	0℃～+51℃.
Relative humidity	5%～90%, no condensation
Atmospheric pressure	86kPa～106kPa
Altitude	It can satisfy the requirement of 2000m above sea level. It can be used at a reduced level of 2000m above sea level. It needs special customization at an altitude of 3000m above sea level.

1.6.2 Storage Environment

The storage environment reference standards IEC61800-4 and GB/ T47981-2005 are shown in Table 1-7 below.

Table 1-7 storage Environment Requirements

Project	Requirement
Ambient temperature	-25℃～70℃;
Relative humidity	≤95%, no condensation
Seismic fissure	Level 7
Storage time	Delivery and storage time not exceeding 6 months

Chapter II Transportation and Installation

Correct transportation, positioning and installation are essential for the normal and safe operation of SVG series high voltage static var generators.

2.1 Transportation matters needing attention

SVG series high voltage static var generators can be transported by vehicles, trains, ships, etc. In the course of transportation, products must be handled carefully and lightly. Rain and sun exposure are strictly prohibited. There should be no violent vibration, impact and inversion. Packing boxes on transport vehicles should be orderly, compact and reasonable, safe and reliable, so as to prevent cargo damage caused by shaking during transportation. Considering the complexity of the transportation, in order to ensure the safety of the goods, measures must be taken to prevent rain in the transportation process. When using

canopy cloth as rainproof measure, open vehicles must be tightly tied, and the doors must be closed, so as to prevent the vehicle from loosening and hurting people by throwing objects.

(1) Before transportation, the situation of the transportation road should be surveyed in advance, including the driving path, the height, width and carrying capacity of the bridge and culvert, and the condition of the traffic signal facilities along the road;

(2) Personnel should be arranged in advance to arrange and leveling the site. The entrance transport routes of cranes and cars should be filled and compacted. The floating soil at the crane fulcrum must be cleaned up and padded with logs.

(3) Before loading the equipment, it is necessary to check again whether the condition and fuel of the transportation and hoisting vehicles meet the requirements. Confirmation of weather conditions, in bad weather conditions, shall not be carried out;

(4) Equipment transportation shall be conducted according to the route investigated beforehand, and the speed of transportation shall not exceed the requirements.

2.2 Installation Notes

2.2.1 Installation environment requirements

In order to ensure the long-term stable and reliable operation of SVG series high voltage static var generator, the following requirements are made for the installation and operation environment of the device:

(1) The equipment shall be installed in the environment of non-corrosive gas, flammable gas, conductive dust, dripping water, salt spray and oil fume;

(2) Operating ambient temperature should be within the range of - 25 ~45 ~C. If ambient temperature exceeds the allowable value, safe and reliable ventilation heating or heat dissipation devices should be installed.

(3) The equipment site should have protective measures to prevent small animals such as snakes and rats from intruding, and the equipment damage caused by grounding short circuit caused by such animals'intrusion should be strictly avoided.

2.2.2 Mechanical Installation Requirements

SVG series high voltage static var generators should be installed in strict accordance with the site installation drawings. All cabinets or containers should be fixed on the channel steel base and connected to the system reliably. The shielding layer and grounding terminal of the transformer should also be connected to the earth of the system, and the cabinets should be connected to each other to form a whole.

During installation, the following points should be noted:

(1) The cabinet or container shall be installed to avoid strong vibration;

(2) Promote the car to move slowly. Attention should be paid to the moving direction of cabinets or

containers, and corrections should be made at any time to prevent inclination.

(3) When handling and installing cabinets or containers, extrusion of hands, feet and equipment on cabinets or containers should be prevented.

(4) The steel plate should be padded with cardboard or other soft articles between the indoor end and the floor to prevent the damage of the indoor floor caused by heavy bumping of equipment when the manual forklift truck transits from the iron plate to the floor.

(5) The cabinet or container shall have anti-overturning measures before it is fixed firmly.

2.2.3 Electrical Installation Requirements

Before wiring, confirm whether the conductor cross-section area and voltage level meet the requirements. Transformers and input and output high-voltage cables must also be tested for withstanding voltage. When testing, attention should be paid to not connecting power units.

During installation, the cabinet of SVG series high voltage static var generators should be kept reliably connected to the earth to ensure personal safety.

(1) The input and output cables must be wired separately to prevent mixing and dangerous insulation damage;

(2) Signal and power lines should not be long-distance parallel wiring, signal and communication lines must be shielded cable, shielding layer single-ended grounding;

(3) The controller should be equipped with a special grounding electrode, and the grounding resistance should not exceed 1.

(4) Bolt connection, insertion, welding or pressing between conductors and electrical components should be firm and reliable.

(5) There should be no joints for the wires in the cabinet body and no damage to the wires core.

(6) The circuit number shall be marked at the end of the cable core and the assigned conductor. The number should be correct, the handwriting should be clear and not fade easily.

(7) The wiring shall be neat, clear and beautiful, and the conductor shall be well insulated without damage;

(8) The cables introduced into the cabinet body should be arranged neatly, numbered clearly, avoid crossing, and should be fixed firmly, so that the terminals connected to the cabinet can not be subjected to mechanical stress;

(9) The same cable should not be used in the strong and weak circuit, and should be arranged separately in bundles, and strong insulated partitions should be installed when there are difficulties.

(10) Closed cabinets with lighting shall ensure good lighting;

(11) The terminal should be matched with the section of the conductor, and the small terminal should

not be matched with the large section conductor.

(12) AC and DC signal lines should be separated.

Detailed installation specifications can be found in Technical Document "On-site Installation Instructions".

Chapter III Operating Panel and Touch Screen Operating Instructions

3.1 Operating panel instructions

The device provides touch screen and remote background to operate the device. The touch screen is arranged on the door panel of the control cabinet, and the remote backstage is usually located in the remote monitoring room with a certain distance from the device. There is only one valid control command for the touch screen and remote background at any time. It is selected by the "local/remote" command of the touch screen.

Figure 1-1 front of control pannel

The display operation panel of the control cabinet consists of an indicator lamp, a touch screen and an emergency stop button. The detailed description of the elements on the control cabinet door is shown in Table 3-1.

Table 3-1 Instructions for Operating Panel Components

Category	**Explain**	**Function**
Indicator light	Power Indicator Lamp	Statues of the power supply of the control cabinet （AC415V） shine is normal.
	Running indicator	Indicating whether the device is in the state of grid-connected operation, after the device is connected to the grid, the running light will be on, and the light will be off when the device is out of operation.
	Failure indicator	Indicator lights will be on if there is a fault in the indicator, a serious fault occurs before the device is connected to the grid, or a trip occurs after the device is connected to the grid.

Touch screen	Interface	Users use touch screen when operating devices in local control room. Without keyboard, users can directly monitor status, set parameters, control operation and inquire about faults through touch screen.
Button	Emergency stop button	Emergency stop button for abnormal situation.

3.2 Touch screen operation instructions

3.2.1 Backlight

When the user does not do any operation on the touch screen within a certain time (10 minutes), the backlight of the touch screen will be extinguished, and the backlight will be activated by clicking on the screen again.

3.2.2 Touch screen

Touch screen is mainly composed of LED indicator and LCD display area. LCD display is divided into three parts: B, C and D. The LED indicator shows the current working state of the touch screen. Pressing any item in the navigation bar of area C in the LCD display area will switch to the corresponding display interface to realize the viewing and setting of relevant data and information, as shown in Figure 3-2 below.

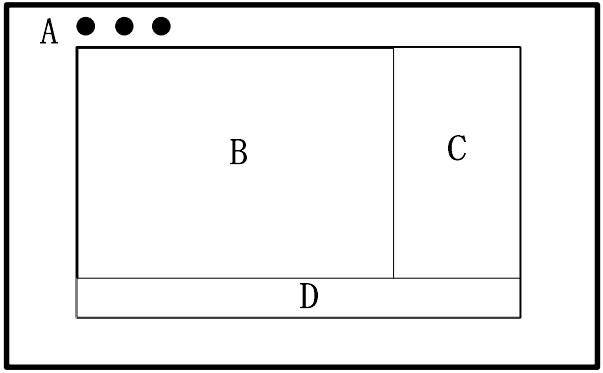


Figure 3-2 Touch screen

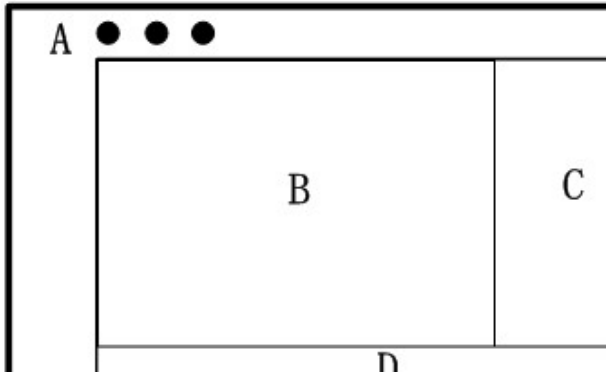
See Table 3-2 for detailed description of each region in Figure 3-2：

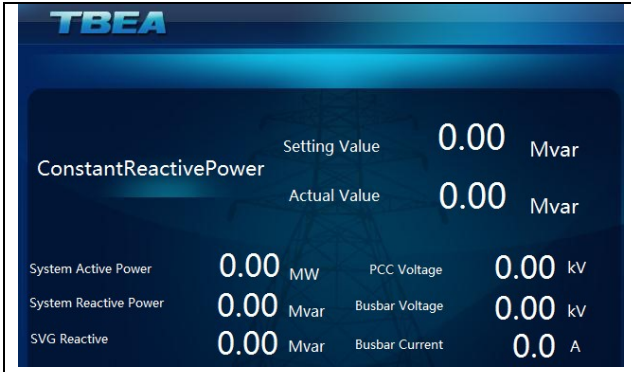
Table 3-2 Description of each area of touch screen

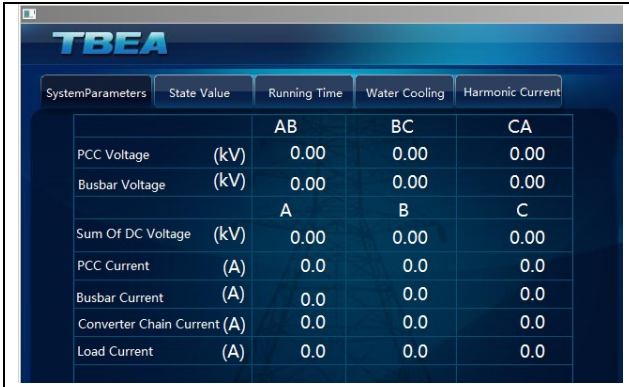
Number	Explain
A	LED indicator area

B	Data display area
C	Page navigation area
D	Status display area

3.2.3 Parameter display

Display	instruction
	**Touch screen** display area layout: A: LED indicator area B: Data display area C: Page navigation area D: Status display area

	**Home page**: The home page is displayed by default when the touch screen is powered on. Home page shows the current control mode and control objectives, the main operating parameters of SVG, etc.



Running data: including "system parameters", "state variables" and "commissioning time". Switch pages by clicking on the sub-navigation at the top of the page.

System parameters: mainly display parameters such as SVG and voltage and current of power grid. Switch by clicking "Next Page" and "Last Page".

State variables (on-load): mainly display circuit breakers, contactors, fan status and transformer protection signals.

State quantity (output quantity): It mainly displays the device state of SVG, fan control command, etc.

Operating time: Recorded the total running time, mode running time, standby time.


TBEA
SystemParameters
State Value
Running Time
Water Cooling
Harmonic Current
Input Volume
Output Volume
Control Command Of Fan / Air Conditioner Contact
Device Alarm
Device Ready For Closing
Device Block
Device Malfunction
Device Running
Dynamic Voltage Regulation Function Block

<table>
<tr>
<td> 
</td>
<td></td>
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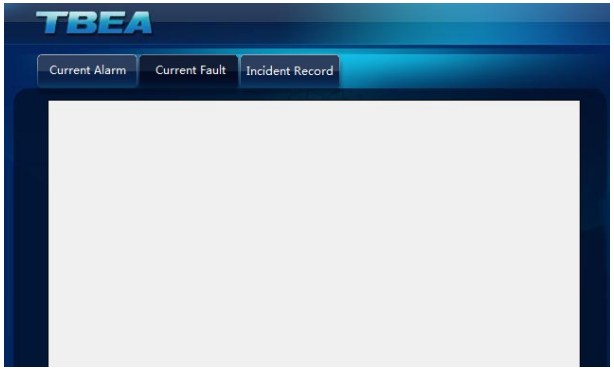
<tr>
<td> 
</td>
<td>Fault Information: It is divided into three parts: Current Alarm, Current Fault and Event Record. Switch through the top sub-navigation.
Current alarm: Display the alarm and blocking information that happened at present, and eliminate the alarm and blocking information.</td>
</tr>
</table>



Current faults: Show current faults that have been eliminated and not shown.

Event Records: Store 20 years of event records, each time showing a day of event records. The event record of

	the day is displayed by default on the entry page. ① You can switch dates by clicking on the calendar at the bottom of the page. ② Pages can be turned by arrows on both sides of the calendar.

Historical Records: They are divided into "historical curve" and "historical data". Switch through sub-navigation.

History curve: divided into "day curve", "month curve", "year curve" and "selection curve".

① The default display of the day/month/year curve is on the page. Click on the calendar below to switch dates.

② The daily curve keeps one month data, and the ANNUAL-MONTHLY curve keeps 20 years data.

③ The instantaneous values of parameters were recorded every 5 minutes on the daily curve.

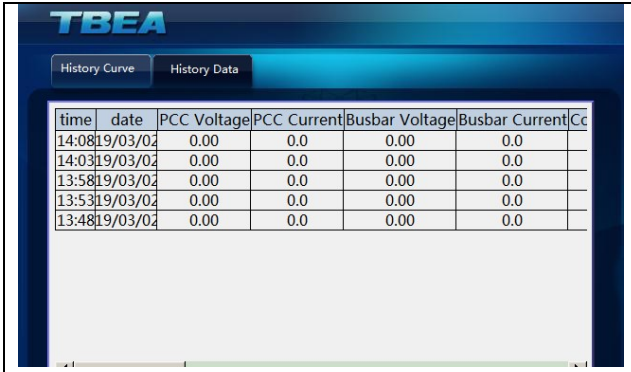
④ Click on the "Selection Curve" button to switch the curve. Reactive power, power factor, system voltage and SVG current can be selected.

⑤ The monthly/annual curve of the reactive power of the

device records the cumulative reactive power generation. The monthly/annual curve of the system voltage records the average voltage.

⑥ Power factor and SVG current do not record monthly/annual curves.


TBEA
History Curve
History Data
Day Curve
Month Curve
Year Curve
Selecting Curve
Current Curve:
Device Is Reacti
MVar·h×10
12
10
8
6
4
2
2019 — 2048
2019 2020 2021 2022 2023 2024
2025 2026 2027 2028 2029 2030
2031 2032 2033 2034 2035 2036
2037 2038 2039 2040 2041 2042
2043 2044 2045 2046 2047 2048



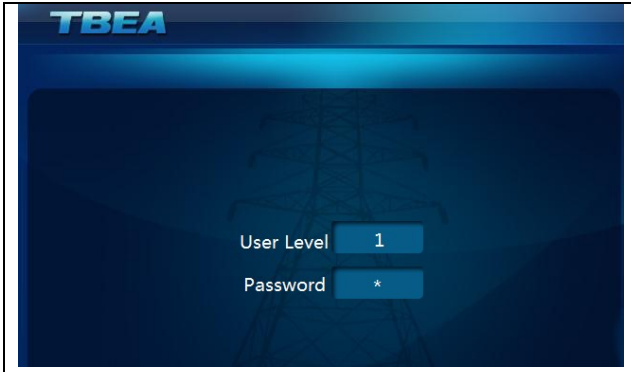
Historical data: Record the historical data of 20 channels, every 5 minutes.

① The data of touch screen with U disk can be saved for 20 years, but it can only be saved for one month without U disk.

② Display the data of the day by default and switch through the calendar below.

3.2.4 Parameter setting

Interface display	Explain

	**System settings**: Maintenance and operation personnel of the device can set the operation mode and operation parameters. Entering the system settings interface requires entering a password with a user level of 1 and an initial password of 11111.


TBEA
Input Range: 111111 ~ 999999
1
1 2 3 -
4 5 6 CR
7 8 9 ES
. 0 ENT

Control parameter setting: including four control modes of "constant reactive power", "constant power factor", "constant voltage" and "load compensation".

Constant reactive power:
This method is used to make the device output reactive power of constant size. By this way, the accuracy and step response speed of the device tracking reactive power can be measured.

Constant power factor:
This method is used to control the power factor of the system to a certain extent. The device stabilizes the reactive power output of the device with the power factor of the system as the target value set by the user. When the power factor of the system is lower than the lower limit of the power factor set by the user, the output capacitive reactive power of the device improves the power

factor; when the power factor of the system is higher than the upper limit set, the device outputs inductive reactive power to reduce the power factor.

Constant voltage:
This method is used to stabilize the voltage of the system at a certain level. The device regulates the reactive power output of the device with the voltage stability of the system as the target value set by the user. When the system voltage is lower than the voltage reference set by the user, the device outputs capacitive reactive power to increase the system voltage; when the system voltage is higher than that, the device outputs inductive reactive power to reduce the system voltage

Load compensation: When running in this mode, the

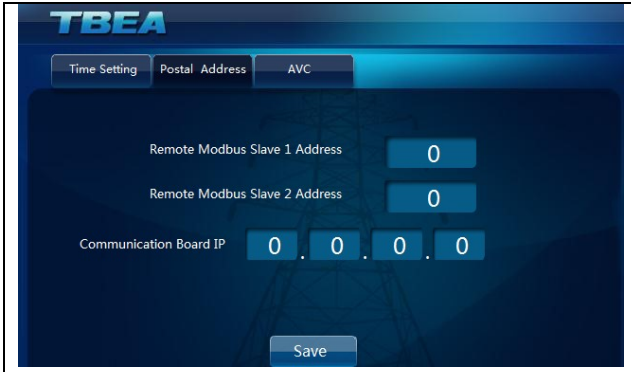
device automatically adjusts the current output by detecting the current on the load side to improve the power quality of the load current.

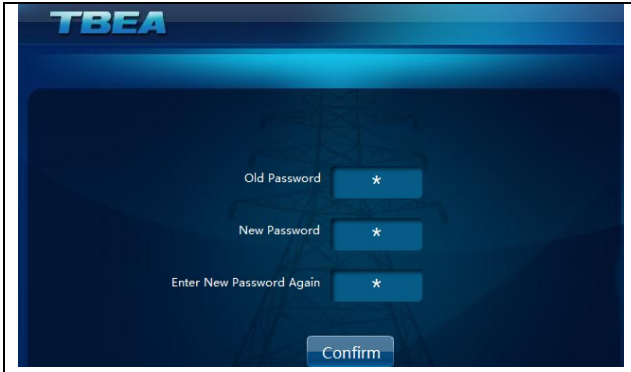
Note 1: When the status bar is displayed in remote mode, touch screen operation is prohibited, the same as below.

Note 2: Click "Save parameters" to send the parameters on the page to the controller only, click "Enter mode", then send the parameters on the page to the controller and enter the corresponding mode.


TBEA
ConstantReactivePower
ConstantPowerFactor
ConstantVoltage
LoadCompensation
Fundamental Wave
Negative Sequence
Second
Tenth
Third
Eleventh
Fourth
Twelfth
Fifth
Thirteen
Sixth
Seventh
Eighth
Ninth
TBEA
ConstantReactivePower
ConstantPowerFactor
ConstantVoltage
LoadCompensation
Fundamental Wave
Negative Sequence
Please confirm this operation!
Confirm
Cancel

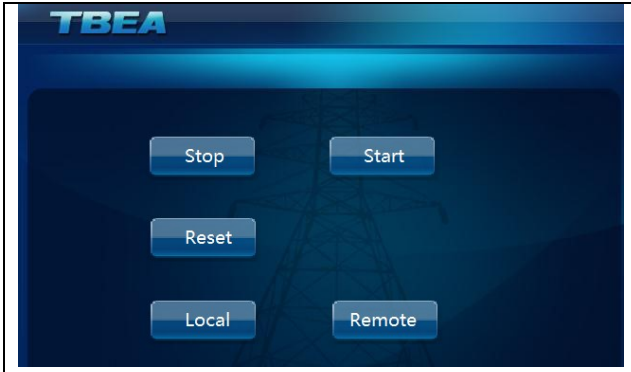
	**Time Settings**: Select "Local Settings" in the navigation bar, select "Time Settings" in the sub-navigation bar above the page, and enter the time settings interface to set the system time. **Communication Address**: Select "Local Settings" in the navigation bar, select "Communication Address" in the sub-navigation bar above the page, enter the slave address settings interface, you

	can set "Remote MODBUS slave address" and click to save the next parameters.

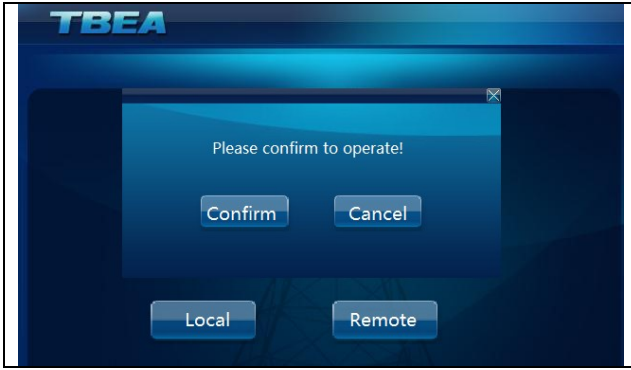
	**Change password**: Select "Change password" in the navigation bar, enter the password setting interface, enter password in the input area of "original password", "new password" and "re-enter new password", press "Confirm" to set up. Note: The user level of level 1 user is 1, and the initial password is 11111. Password can be changed by menu.

3.2.5 Control panel

Interface display	Explain



Control panel: Select "Control panel" in the navigation bar, enter the control interface, and select "Start", "Stop", "Reset", "Local", "Remote" commands for mode switching.
Note 1: The prompt window will pop up after clicking the button, and the corresponding operation will be carried out after confirmation.
Note 2: When the status bar is displayed in remote mode, touch screen operation is prohibited, but at this time the touch screen can issue "local" commands.

 TBEA Please confirm to operate! Confirm Cancel Local Remote	

Chapter IV Basic Operational Explanations

4.1 Prepare before power on

4.1.1 Visual inspection

(1) Check the appearance of the control cabinet, power cabinet and starter cabinet, and confirm that there is no scratch and deformation in the shell appearance of the chain SVG complete set of equipment;

(2) Cable fastening without loosening;

(3) The main control chassis boards and auxiliary control chassis boards are complete.

4.1.2 Inspection of cabinet body and wiring

(1) Check that the appearance of the fan is not deformed and the installation is firm. The wiring of the fan is in good conformity with the drawings and the wiring is firm.

(2) Check that the appearance and accessories of the arrester are well and firmly installed, the wiring is in conformity with the drawings, and the terminals are free of cracks;

(3) Check that the reactor fittings are complete, the appearance is intact and the installation is firm, the connection is correct and the bolts are tightened;

(4) Check that contactors (circuit breakers) are well installed and bolts are tightened;

(5) Check that the starting resistance is well and firmly installed, and the resistance surface is free of cracks. The deviation between the measured value of resistance and the nameplate (factory value) is not more than (+5%).

(6) Check that the wiring of secondary terminals is consistent with the drawings, and the wiring is neat and firm.

(7) Check that the opening sealing baffles in the starter cabinet are complete;

(8) Check the correct phase sequence of three-phase high-voltage wire and cable, and fasten the connection.

4.1.3 Inspection of Power Cabinet Components

(1) Check that the power unit is well installed and the bolts are tightened;

(2) Check that the power unit connection busbar has been installed and the bolts have been tightened;

(3) Check that the wiring inside the power cabinet is tidy and firm, and conforms to the drawings;

(4) Check that the wiring of secondary terminals is consistent with the drawings, and the wiring is neat and firm.

(5) Check the correctness and tightness of the optical fiber plug-in of the power module.

4.1.4 Control cabinet component inspection

(1) Check whether the insertion position of the main control box card is in accordance with the drawings and record the number, type and serial number of the internal board card of the main control box;

(2) Check whether the insertion position of the auxiliary control cabinet card is in accordance with the drawings and record the number, type and serial number of the auxiliary Cabinet Card (35kV type);

(3) Check that the switching power supply is installed correctly, the appearance is intact and the installation is firm;

(4) Check that the status indicator and emergency stop switch are installed well and correctly;

(5) Check that the wiring of secondary terminals is consistent with the drawings, and the wiring is neat and firm.

4.1.5 Inspection of cabinet (equipment) wiring

(1) Check that the cable wiring from the reactor output terminal to the power cabinet in the startup cabinet is in accordance with the drawings and the bolts are tightened;

(2) Check that the copper bars (cables) connected between power cabinet units are in accordance with the drawings and the bolts are tightened;

(3) Check that the connection of the user's AC380V control power supply cable is consistent with the

drawings and the connection is firm;

(4) Check that the connection between the control cabinet terminal row and the secondary terminal row of the starter cabinet is correct and firm, and the connection is in accordance with the drawings.

(5) Check that the PT signal connection of the control cabinet is correct and firm, and that the connection is in accordance with the drawings and the sequence is correct;

(6) Check that the CT signal connection of the control cabinet is correct and firm, the connection is consistent with the drawing and the same name end is correct;

(7) Check that the optical fiber connection between the optical fiber board and the corresponding unit is correct and firm, and the wiring and drawings are in phase.

(8) Check that the connection between the terminal of the control cabinet and Hall current sensor is correct and firm, and the connection is in accordance with the drawings.

4.2 Basic operation

Users can start, stop and reset the interface of the control panel through the touch screen on the control cabinet of SVG series high voltage static var generator device, and select local or remote operation mode through the touch screen. Users can set "two-key start" or "one-key start" by booting mode. See Section 3.2.6 for specific operation.

4.2.1 Starting machine

Table 4-1 Start-up operation flow of SVG device

Local control	Remote control
(1) To ensure the correct connection of cables between control cabinets, power cabinets and start cabinets. Ensure that SVG isolation knife is closed and SVG grounding knife is	(1) To ensure the correct connection of cables between control cabinets, power cabinets and start cabinets. Ensure that SVG isolation knife is closed and SVG grounding knife is

disconnected.	disconnected.
(2) Check the correct phase sequence of fan power supply wiring, verify that the direction of fan speed is consistent with the direction indicated.	(2) Check the correct phase sequence of fan power supply wiring, verify that the direction of fan speed is consistent with the direction indicated.
(3) Turn on the control cabinet power switch Q1, fan power switch Q2, 24V power supply switch Q4, socket power supply switch Q5, cabinet lighting switch Q6, controller power supply switch Q7, DC power supply switch Q8, PCC side PT detection switch Q9, system side PT detection switch Q10, panel	(3) Turn on the control cabinet power switch Q1, fan power switch Q2, 24V power supply switch Q4, socket power supply switch Q5, cabinet lighting switch Q6, controller power supply switch Q7, DC power supply switch Q8, PCC side PT detection switch Q9, system side PT detection switch Q10. If the

power supply indicator light. If the control cabinet self-check is successful, the high voltage circuit breaker can be closed. If the self-check is unsuccessful within the specified time, the overtime fault of the control cabinet self-check will be reported.	control cabinet self-check is successful, the high voltage circuit breaker can be closed. If the self-check is unsuccessful within the specified time, the overtime fault of the control cabinet self-check will be reported.
(4) Check that all parameters are set correctly by using the touch screen parameter panel.	(4) Make use of the background parameter page to check that all parameter settings are correct.
(5) Remote operation of high voltage switch "closing", touch screen SVG status bar	(5) Remote operation of high-voltage switch "closing", through the background operation

display "start", through the touch screen operation data page, detect the voltage display of each link, at this time, the measured link DC side voltage should gradually rise, and rise to about 80% of the link voltage after stability, if there is abnormal voltage should click the "emergency stop" button. Start successfully and the soft start switch will be closed automatically after the self-check of the link is completed. The soft start resistance will be dropped by the bypass. SVG will run	data page, to detect the voltage of each link shows that the measured link DC side voltage should gradually rise, and rise to about 80% of the link voltage after stability, if there is abnormal voltage should click the "emergency stop" button. Start successfully and the soft start switch will be closed automatically after the self-check of the link is completed. The soft start resistance will be dropped by the bypass. SVG will run automatically after 10 seconds standby if no fault occurs.

automatically after 10 seconds standby if no fault occurs.	

4.2.2 Shutdown

Notify the remote interruption of high voltage circuit breaker or the "emergency stop" button of the operation control panel, SVG will automatically interrupt the soft switch after the break of high voltage circuit breaker.

4.2.3 Reset

When SVG has resettable fault information, the reset operation can be accomplished remotely by clicking the “reset” button on the background operation panel.

Chapter V Fault Description and Treatment

5.1 Warning and fault description

The internal monitoring unit of SVG divides all information into two categories: alarm and fault.

- Warning (A)

Warning refers to the information that needs to be paid attention to by the maintenance personnel. The methods of dealing with the warning are as follows:

(1) SVG will continue to run when warning occurs;

(2) The alarm information is recorded and can be inquired through the touch screen of the machine.

The purpose of the alarm is to warn the potential risks of the machine and draw the attention of the maintenance personnel. It can be maintained at the right time without any need to deal with it for the time being.

- Fault (F)

Fault means that SVG will stop running automatically, and can not continue to run until the maintenance personnel remove the fault. The fault treatment methods are as follows:

(1) After the fault occurs, the blocking link is output and SVG interrupts the high voltage circuit breaker.

(2) The touch screen displays the fault and is recorded, and the fault indicator lights up (red);

(3) Automatic reset is not allowed for the fault. After the fault disappears, it can be reset by touch screen.

If the link failures need to be replaced or maintained, they need to be treated after the bus capacitance of the link is fully discharged.

5.2 Fault handling

No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

1	Power grid fault	Alarm of high voltage in power grid	A	Power grid voltage greater than set value	Pay attention to grid voltage
2		Overvoltage Fault Switching in Power Grid	F	Power grid voltage greater than set value	Check whether the grid voltage is abnormal
3		Alarm of low voltage in power grid	A	The grid voltage is less than the set value	Pay attention to grid voltage
4		Over-low Voltage Breakdown in Power Grid	F	The grid voltage is less than the set value	Check whether the grid voltage is abnormal
5		PT Phase Sequence Reverse Fault Switching	F	PT Phase Sequence Inverse	Check phase sequence

6		High Frequency Fault Switching in Power Grid	F	Frequency of power grid is greater than set value	Check whether the frequency of power grid is abnormal
7		Low Frequency Fault Switching in Power Grid	F	Power grid frequency less than set value	Check whether the frequency of power grid is abnormal
No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

8	STAT-COM System Failure	Output Overcurrent Fault Switching	F	1) The current of SVG device is larger than the set value. 2) Over-impact of system load 3) sudden change caused by system voltage failure	Check whether the sampling resistance of the signal board is correct, whether the current sampling is correct, whether the parameter setting is correct, and whether the output current sampling of the device is correct.
9		Output overload alarm	A	The output current of the device is more than 110% of the rated current.	Pay attention to whether the device load is greater than the rated capacity
10		Output Overload Fault Switching	F	The output current of the device is more than 120% of the rated current.	Check whether the load of the device is greater than the rated capacity

11		Phase Lock Failure Warning		Loss of Synchronization Signal	Check PT input signal
12		Failure of self-inspection of control cabinet	F	1) Problems in control chassis 2) Problems in Distribution Power Supply of Control Cabinet	1) Check control cabinet links 2) Check control chassis
13		Soft Start Overtime Fault Switching	F	1) Module may fail 2) Possible failure of fibre optic board in control chassis 3) Fiber failure	Inspection Module and Optical Fiber Board
No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

14	STAT-COM System Failure	Breakdown of Heavy Gas in Transformer	F	1) Heavy Gas Fault in Transformer Room 2) Failure of external given signal	1) Inspection of transformer room 2) Check the given cable
15		Switch-off of Overtemperature Fault with Variable Voltage	F	1) Transformer overtemperature fault 2) Failure of external given signal	1) Check transformer temperature 2) Check the given cable
16		Transformer Pressure Fault Switching	F	1) Transformer Pressure Fault 2) Failure of external given signal	1) Check transformer pressure 2) Check the given cable

17		Failure of High Voltage Circuit Breaker	F	1) Overcurrent of High Voltage Circuit Breaker 2) Abnormal operation of high voltage circuit breaker	1) Check setting value of high voltage circuit breaker protection 2) Check the opening circuit of high voltage circuit breaker
18		Failure of soft start switch closing	F	1) Soft-start switch may be damaged 2) Closing circuit may fail	1) Check the soft-start switch 2) Check the closing circuit
19		Soft start switch fails to open	F	1) Soft-start switch may be damaged 2) Faults may occur in the switching circuit	1) Check the soft-start switch 2) Check the opening circuit
No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

20	STAT-COM System Failure	Cabinet door interlock opening failure opening	F	1) The interlock switch may be damaged. 2) Failure may occur in a given interlocking signal loop	1) Check interlock switch 2) Check the chain of given signal circuits
21		Fault Switching of Contactor of Cooling Fan	F	1) The fan contactor may be damaged. 2) Probable faults in the detection circuit	1) Inspection of fan contactors 2) Inspection of fan contactor detection circuit
22		Overheated Fault Switching of Cooling Fan	F	1) fan overheating 2) Probable faults in the detection circuit	1) Check the state of cooling fan 2) Check the detection circuit of cooling fan
23		Emergency shutdown fault switch-off	F	Failure of closed circuit and state return	Check the return circuit and signal of the stop state

24		External Switching Fault Switching	F	1) Faults of High Voltage Circuit Breakers in Operation 2) Probable faults in the detection circuit	1) Inspection of high voltage circuit breakers 2) Check the state signal of high voltage circuit breaker
25	Control box failure	Uplink communication fault trip on AD board	F	AD board malfunction	Replacement of AD board
26		Breakdown of uplink communication on DI board	F	DI board malfunction	Replacement of DI board
No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

27	Control box failure	Breakdown of uplink communication on DO board	F	DO board malfunction	Replacement of DO board
28		Breakdown of uplink communication on communication board	F	Communication board malfunction	Replacement of communication board
29		Fault switching of uplink communication on optical fiber board	F	1) Fault of fiber optic plate 2) Fiber optic cable failure 3) Fault of optical fiber plug	1) Replacement of optical fibre board 2) Inspection of optical fibers and replacement of optical fibers 3) Inspection of optical fiber plugs

30		Breakdown of uplink communication on main control board	F	Main control board malfunction	Replacement of main control board
31		Fault switching of downlink communication on AD board	F	AD board malfunction	Replacement of AD board
32		Fault switching of downlink communication on DI board	F	DI board malfunction	Replacement of DI board
No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

33	Control box failure	Fault switching of downlink communication on DO board	F	DO board malfunction	Replacement of DO board
34		Fault switching of downlink communication on optical fiber board	F	1) Fault of fiber optic plate 2) Fiber optic cable failure 3) Fault of optical fiber plug	1) Replacement of optical fibre board 2) Inspection of optical fibers and replacement of optical fibers 3) Inspection of optical fiber plugs
35		Fault switching of downlink communication on main control board	F	Main control board malfunction	Replacement of main control board

36		Abnormal alarm of AC power supply in control cabinet	F	Failure of AC inlet power Supply	Check AC power supply line of control cabinet
37		Abnormal alarm of DC power supply in control cabinet	F	Failure of DC Inlet Power Supply	DC power supply for inspection control cabinet
38		Breakdown of Power Supply in Control Cabinet	F	AC and DC power supply of control cabinet are abnormal	AC and DC power supply for inspection control cabinet
No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

39	Control box failure	Fault Alarm of Communication Board FPGA Bus	F	Communication board malfunction	Check or replace the communication board
40		Communication board FLASH fault alarm	F	Communication board malfunction	Check or replace the communication board
41		Communication board SD card fault alarm	F	Communication board malfunction	Check or replace the communication board
42		Communication board downlink communication fault alarm	F	Communication board malfunction	Check or replace the communication board

43		Communication board RTC fault alarm	A	Communication board malfunction	Check or replace the communication board
44		EEPROM Writes Failure Alert	A	Communication board malfunction	Check or replace the communication board
45	Chain failure	Undervoltage Switching of Chain Bus	F	1) Chain module failure 2) Failure of chain control board	Check the link, or replace the link module
46		Overvoltage Switching of Chain Bus	F	1) Chain module failure 2) Failure of chain control board	Check the link, or replace the link module
No.	Fault source	Name	Fault type	Possible causes of failure	Treatment countermeasures

47	Chain failure	Overtemperature Switching of Chain Section IGBT	F	1) Chain module failure 2) Failure of chain control board 3) Fault of radiator fan	1) Check the link, or replace the link module 2) Inspection fan
48		Chain IGBT Fault Switching	F	1) Chain module failure 2) Failure of chain control board	Check the link, or replace the link module
49		Failure switching of uplink communication in chain section	F	1) Failure of chain control board 2) Fiber optic cable failure 3) Fault of optical fiber plug	1) Check the link, or replace the link module 2) Inspection of optical fibers and replacement of optical fibers 3) Inspection of optical fiber plugs

50		Fault switching of downlink communication in chain section	F	1) Failure of chain control board 2) Fiber optic cable failure 3) Fault of optical fiber plug	1) Check the link, or replace the link module 2) Inspection of optical fibers and replacement of optical fibers 3) Inspection of optical fiber plugs
51		Abnormal awitching of chain driving power supply voltage	F	Chain module failure	Inspection or replacement of chains

Chapter VI Maintenance and Maintenance

TBEA Xi'an Electric Technology CO., LTD. carries out the principle of quality first and user priority, and adopts strict quality standards for the design principle, device selection, manufacturing, factory testing, transportation and installation of the device, so as to ensure that the product can run continuously with high reliability under normal operating conditions.

In order to ensure that the device always operates under suitable conditions and avoid the influence of the change of operating conditions on its reliability, it is necessary to let users know the maintenance knowledge and do a good job in the maintenance of equipment. Especially the basic maintenance knowledge is briefly introduced.

6.1 Daily Maintenance

In operation, the state of the device should be inspected every day. If abnormal noise is emitted in the

device, and there is no air outlet or the air volume is smaller than usual, the fan should be stopped and replaced immediately. When the device has odor (especially ozone odor), the manufacturer should be notified immediately to deal with it.

Check all power cables and control cables regularly to see if they are damaged, whether the terminals of power cables are loose, and whether the heat shrinkable tubes of high voltage insulation are loose.

Indoors should be kept clean to avoid dust accumulation.

Attention should be paid to keeping the indoor temperature. When the indoor temperature is below - 25 C, heating treatment should be done as soon as possible. When the indoor temperature is above 45 C, cooling treatment should be done as soon as possible, such as opening heater, strengthening indoor and outdoor ventilation, opening air conditioning, etc.

6.2 Regular inspection and maintenance

SVG series high voltage static var generators are comprehensively maintained once a year.

(1) Before the maintenance of the equipment, the safety measures on the construction site should be checked comprehensively with reference to the relevant safety operation rules.

(2) The live equipment should cut off the power supply and hang up the grounding wire.

(3) When cleaning secondary wiring, the cleaning tools used should be dry, the metal parts should be insulated and cleaned carefully.

(4) It is forbidden to carry out any live operation on the internal circuit boards and equipment of each cabinet.

(5) Do not use highly corrosive reagents to clean cabinets, so as not to cause corrosion on the surface of cabinets and shorten their life; Do not use sharp objects to knock on cabinets to avoid harm to cabinets; Do not use highly corrosive reagents to clean touch screens; Do not use sharp objects to knock on touch screens to avoid affecting their life.

Table 6-1 Checklist

Inspection items		Inspection	Judgement	Processing	Period
Installation environment	Ambient temperature and humidity	Visual or instrumental	Qualified Unqualified	Increase ventilation and heat dissipation	Daily
	Are there any dust, oil and water droplets in the environment	Visual measurement	Qualified Unqualified	Clear	Daily
	Is there any combustible dangerous articles and other irrelevant articles in the room	Visual inspection	Qualified Unqualified	Clean up room debris	Daily
Power unit	Is the cooling passage blocked and the air passage unobstructed	Visual measurement	Qualified Unqualified	Dedust	3 months

Inspection items		Inspection	Judgement	Processing	Period
	Whether the optical fibers are loose or dirty	Visual observation, no abnormality	Qualified Unqualified	Reliable connection	3 months
	Clean condition, remove contamination in time	Visual measurement	Qualified Unqualified	Blower dust removal	3 months
	Whether the fixing screw is loosened or not	Visual inspection	Qualified Unqualified	Re fastening	6 months
Cabinet appearance	Whether the connecting bolt is loosened or not	Visual inspection	Qualified Unqualified	Maintenance and treatment	6 months
	Is there any dust and dirt on the top and appearance of cabinet	Visual inspection	Qualified Unqualified	Cleaning treatment	6 months
	Does the cabinet paint fall off and rust	Visual inspection	Qualified Unqualified	Antirust treatment	Daily

Inspection items		Inspection	Judgement	Processing	Period
	Is the cabinet discolored due to overheating	Visual inspection	Qualified Unqualified	Remove heat source	Daily
	Is there any loosening or burning marks on the access cables	Visual inspection	Qualified Unqualified	Maintenance and treatment	6 months
Conductor	Conductor with or without discoloration or deformation, with or without damage	Visual observation, no abnormality	Qualified Unqualified	Maintenance and treatment	3 months
	Tightness of all electrical connections	Visual observation, no abnormality	Qualified Unqualified	Re fastening	3 months
Control loop terminal	Is the terminal clamped	Shake slightly with your hand	Qualified Unqualified	Re-clamp on the guide rail	3 months
	Are terminals covered with dust	Visual inspection	Qualified Unqualified	Blower blows	3 months

Inspection items		Inspection	Judgement	Processing	Period
	Is the terminal deformed or discolored	Visual inspection	Qualified Unqualified	Replace	3 months
	Is the terminal cable tightened	Shake slightly with your hand	Qualified Unqualified	Fastening with screwdriver	3 months
Cooling fan	Is the fan in operation	Visual inspection	Qualified Unqualified	Maintenance replacement	Daily
	Whether the running sound is normal or not	Auditory judgement	Qualified Unqualified	Correction position or replacement	Daily
	Are there more ash deposits	Visual inspection	Qualified Unqualified	Wipe up	3 months
	Are there scratches on the fan blades	Visual inspection	Qualified Unqualified	Reasonable Fixation	3 months
	Whether the fixing screw is loosened or not	Visual inspection	Qualified Unqualified	Re fastening	3 months

Inspection items		Inspection	Judgement	Processing	Period
	Whether the connection of fan power supply is reliable	Shake slightly with your hand	Qualified Unqualified	Re fastening	3 months
Equipment air intake	Is the dust net in good condition	Visual inspection	Qualified Unqualified	Replacement of intact dust-proof net	3 months
	Is there any foreign matter on the dust-proof net	Visual inspection	Qualified Unqualified	Removal of foreign body	3 months
	Is the dust net blocked or not	Visual inspection	Qualified Unqualified	Remove the blockage	3 months
Touch screen	Is fixation normal	Visual inspection	Qualified Unqualified	Re fastening	3 months
	Is the display and click response normal	Visual inspection	Qualified Unqualified	Replacement of touch screen	3 months
	Is there any pollution or damage	Visual inspection	Qualified Unqualified	Clean or replace	3 months

6.3 Main Device Replacement

The main vulnerable parts of SVG series high voltage static var generator are power unit, cooling fan and dust-proof network. Its service life is closely related to the use environment and maintenance condition.

6.3.1 Replacement of Power Units

If the power unit is damaged, it is recommended to replace the power unit directly.

Specific replacement methods are detailed in the random technical document "Installation Instructions on Site".

6.3.2 Replacement of dustproof net

Dust-proof net is located on the door panel of the cabinet. Please shut down before replacing the dust-proof net. The steps for replacing the dust net are as follows:

Unscrew the fixing screw of the dust net and push the dust net cover upward so as to separate the hook on

the back of the dust net cover from the hole position of the door plate. Remove the dust-proof net between the door panel and the dust-proof net cover.

Install the new dust-proof net, install the dust-proof net cover on the door panel in reverse order according to step 1, tighten the fixing screw;

Clean the dustproof net carefully and dry it in reserve.

6.3.3 Replacement of Cooling Fan

The fan used for cooling the main circuit is the key equipment for heat dissipation. Therefore, for the equipment running for a long time, it is usually necessary to replace the cooling fan once every three years. In addition, if abnormal sounds and vibration are found during the inspection, it is also necessary to replace them. When replacing the fan, please contact the manufacturer or refer to the random technical document "On-site Installation Instruction".

Any defective parts and devices must be replaced with the same components.

6.4 Product warranty

Users buy this product within three year for the product warranty period, within the warranty period, we provide satisfactory answers to product quality questions within 24 hours, and can send maintenance technicians to the site according to the situation. However, even during the warranty period, the following cases are paid services:

(1) Faults caused by improper operation and improper repair and modification;

(2) Faults caused by the use of products beyond their scope of use;

(3) Artificial damage caused by external force after purchase, including damage during unloading and transportation and installation after unloading.

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