Transformer Comprehensive Test Bench

KVTESTER ELECTRONICS TECHNOLOGY CO.,LTD

Thank you for purchasing our products. Before you use the products for the first time, please read this instruction manual in detail, which will help you skillfully use the device.

Our aim is to continuously improve and perfect the company's products, so the products you use may be slightly different from the instructions. If there is any change, we will use the attached page to inform you, please understand! If you are not clear, please contact the company's after-sales service department, we will meet your requirements.

Because the input and output terminals, test columns, etc. may have voltage, when you plug and unplug the test cable, power socket, electrical spark will be generated, careful electric shock, avoid the risk of electric shock, pay attention to personal safety!

◆ Careful assurance

The products produced by the company, within one year (including one year) from the date of delivery of the product defects, the implementation of free maintenance. More than one year if the product defects, the implementation of paid lifelong maintenance.

◆ Safety requirements

Please read the following safety precautions to avoid personal injury and to prevent damage to this product or any other product connected to it. In order to avoid possible hazards, this product can only be used within the specified scope.

Only qualified technicians should carry out maintenance. Please do not open the instrument without authorization, otherwise you will not be able to get a variety of services, any problems, please call the after-sales service department first.

-To prevent fire and personal injury

Use the appropriate power cord: only the power cord that is dedicated to this product and meets the specifications of this product can be used.

Link and disconnect correctly: When the test wire is connected to a live terminal, do not arbitrarily connect or disconnect the test wire.

Product grounding: The product must be grounded except through the power cable grounding wire, and the grounding column of the product shell must be grounded. To prevent electric shocks, the ground conductor must be connected to the ground. Before connecting the product to the input or output terminal, ensure that the product is properly grounded. Please check whether the grounding cable is reliable.

Note all terminal ratings: To prevent fire or electric shock hazards, note all ratings and markings on this product. Before wiring, please read the product manual for further information about the rating.

Do not operate the device before it is installed: Do not operate the device if the cover plate or panel has been removed.

Use the appropriate fuse: Only fuse that meets the specified type and rating of this product can be used.

Avoid contact with exposed circuits and live metals: Do not touch exposed contacts and parts of the product when it is powered on.

If there is a suspected fault, do not operate: If you suspect that the product is damaged, please contact the company's maintenance personnel, do not continue to operate.

Do not operate in a humid or explosive environment, and keep the product clean and dry.

- Security term Warning:

Warning: Warning words indicate conditions or practices that may result in personal injury or death.

Caution: Caution indicates conditions or practices that may cause damage to the product or other property.

目录

I. Overview

The comprehensive test bench conforms to GB/T4776, GB/T5169, GB/4285-1993 and other relevant national standards.

The test bench is mainly used to test the no-load and load characteristics of power transformer and distribution transformer, and also to test the frequency doubling induction and power frequency voltage resistance of the transformer.

The measuring part of the device is controlled by high-end single chip microcomputer, digital display, no-load, short circuit and other test data are sampled synchronously by single chip microcomputer, avoiding the error caused by manual calculation in the traditional test method of voltage, ammeter and power meter reading respectively.

This set of equipment is suitable for power transformer production and maintenance department for 5000kVA/36-10KV and below capacity of three-phase transformer factory test and conventional test. Simple operation, accurate measurement, reliable operation.

（i）Test item

Dc resistance test, ratio test, no load & load test, AC voltage test, induction voltage test, temperature rise test.

（ii） Technical parameters

Items	Measurement range	relative error
Voltage	0.1～3KV	±（0.2%reading+0.1%range）
Current	0.1～200A	±（0.2%reading+0.1%range）
Power	U*I	±（0.2%reading+0.1%range）
Power factor	0.01～1.00	± 3 words
Power supply	AC380V±10%	50Hz±2%
Maximum capacity of transformer under test	5000kva	
Power frequency withstand voltage rated output	100KV 60HZ	
Inductive withstand voltage rated output	800V 180HZ	

（iii）Use environment

- The installation height shall not exceed 3000 meters above sea level.
- The temperature of the surrounding medium is not higher than +40 ℃, not lower than -10 ℃.
- The relative humidity of the air is not higher than 85%.
- Free of conductive dust and corrosive gases that destroy metal and insulation.
- There is no danger of explosion.
- A place with no vibration and a vertical tilt of no more than 5º.

II. Test system composition

The test system consists of the following parts:

1) Transformer comprehensive performance test bench;

2) High Voltage control cabinet;

3) Capacitance compensation cabinet;

4) Three-phase induction voltage regulator;

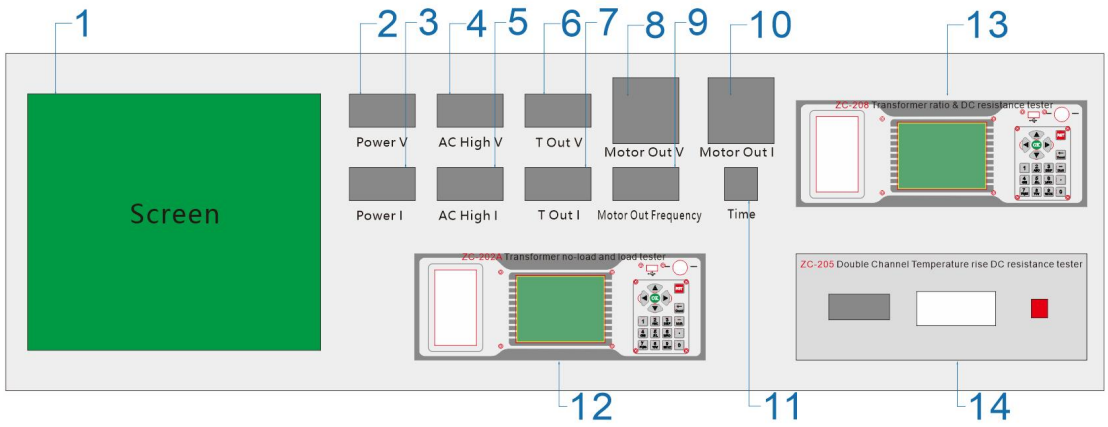
5) Three-phase double frequency generator set;

6) AC voltage test transformer;

7) Intermediate booster transformer

(i) Test bench components

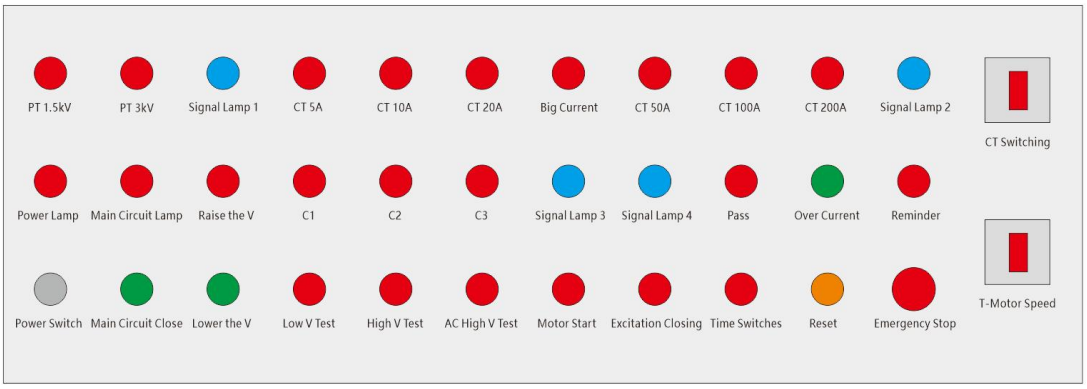
1.1 Test bench front panel



Test bench panel description:

1. Screen
2. Power V
3. Power I
4. AC High V
5. AC High I
6. T Out V
7. T Out I
8. Motor Out V
9. Motor Out Frequency
10. Motor Out
11. Time
12. ZC-202A Transformer no-load and load tester
13. ZC-208 Transformer Ratio & DC Resistance Tester
14. ZC-205 Double Channel Temperature Rise DC Resistance Tester

1.2 Test Bench button panel



Test bench buttons description:

1. 2 voltage gears: PT 1.5kV, PT 3kV.

2. 14 signal lights: Signal Lamp 1, Signal Lamp 2, Signal Lamp 3, Signal Lamp 4, Power Lamp, Main Circuit Lamp, Over Current, CT5A, CT10A, CT 20A, CT50A, CT100A, CT200A, Pass.

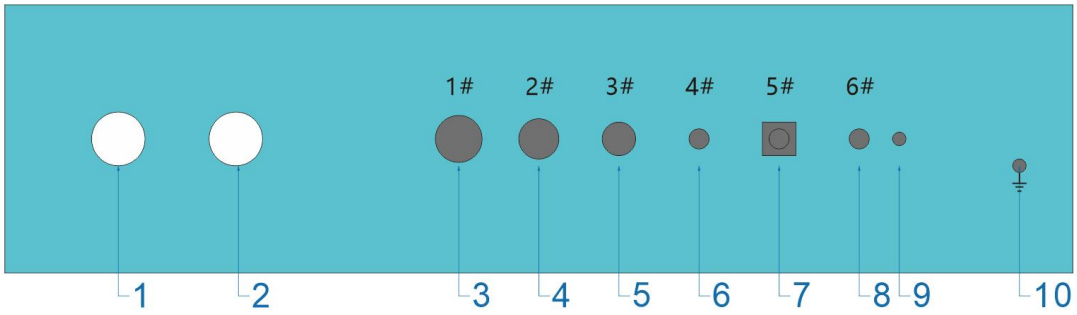
3. 6 Switches: Power Switch, Time Switches, Main Circuit Close, Motor Start, Excitation Closing, Reminder.

4. 3 Test buttons: Low V Test, High V Test, AC High V Test for frequency withstand voltage test.

5. 2 Adjusting buttons: CT Switching is used to adjust the Current gear. When the current is ≥50A, press the Big Current first to adjust it. T-Motor Speed is used to adjust the speed of voltage increase.

6. 8 Control keys: Raise the V for voltage increase, Lower the V for voltage reduction, Emergency Stop for emergency stop, Reset for reset, Big Current for high current selection, C1, C2, C3 for capacitor compensation.

1.3 Test bench back panel

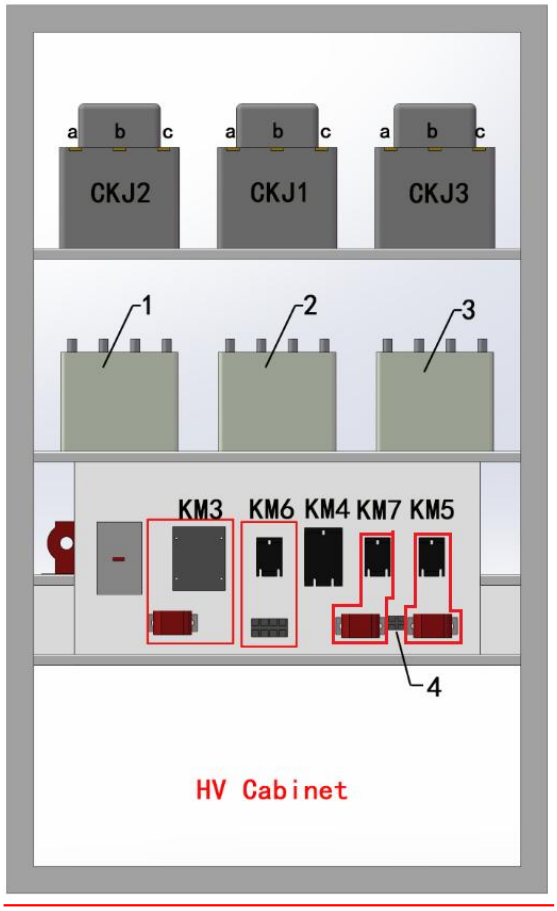


Test bench panel description:

1. Wire hole 1;
2. Wire hole 2;
3. Control cable socket 1#;
4. Control cable socket 2#;
5. Control cable socket 3#;
6. Control cable socket 4#;
7. Control cable socket 5#;
8. Control cable socket 6#;
9. Spare air plug;
10. Grounding column

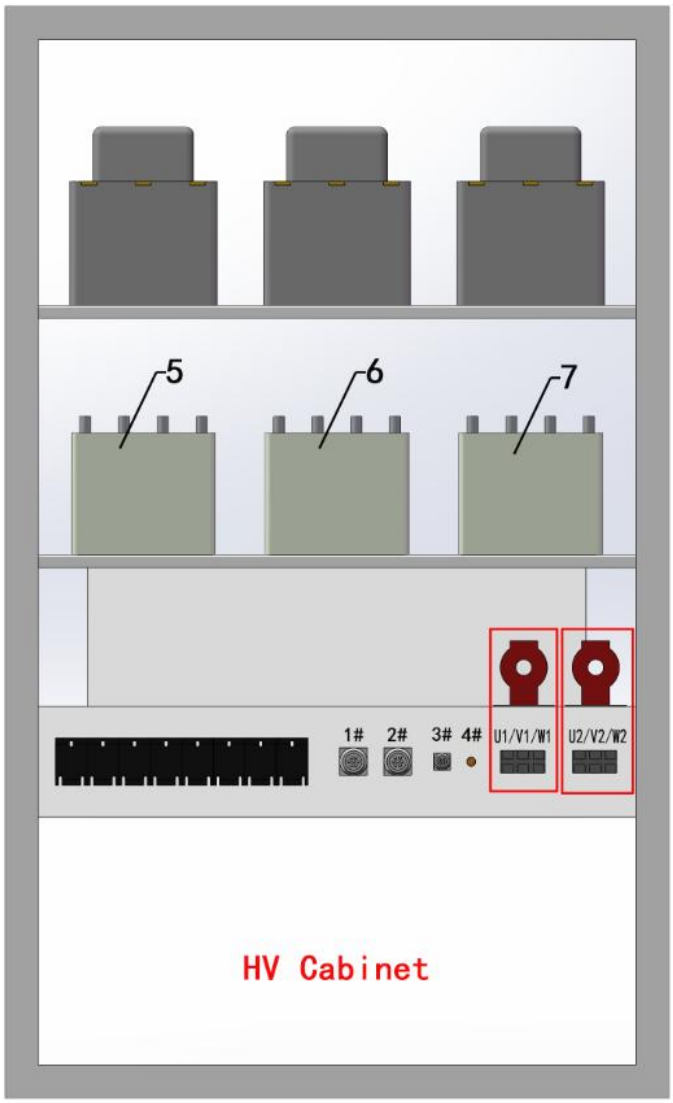
(ii) High Voltage cabinet components

2.1 High voltage cabinet front



CKJ2 is a contactor connected to the output of the intermediate transformer; CKJ1 is a contactor connected to the voltage regulator output; CKJ3 is a contactor to the test object in the load test; 1, 2 and 3 are current transformers; KM3 is a contactor connected to the voltage regulator input; KM6 is a contactor connected to the motor; KM4 is the contactor connected to the input of the intermediate transformer; KM7 is a contactor connected to the generator rotor; 4 is the contactor connected to the meter end of the test transformer.

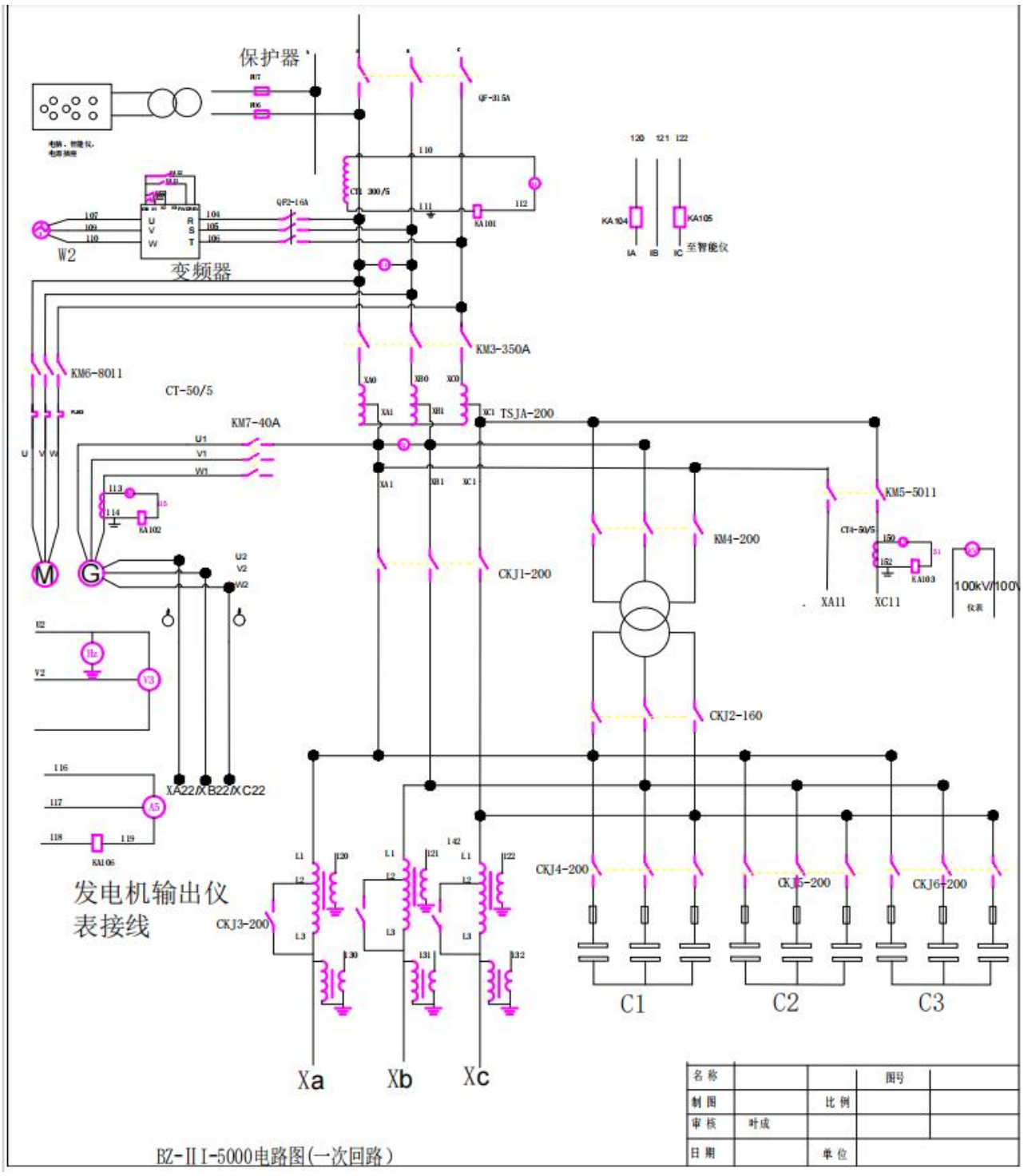
2.2 High voltage cabinet back



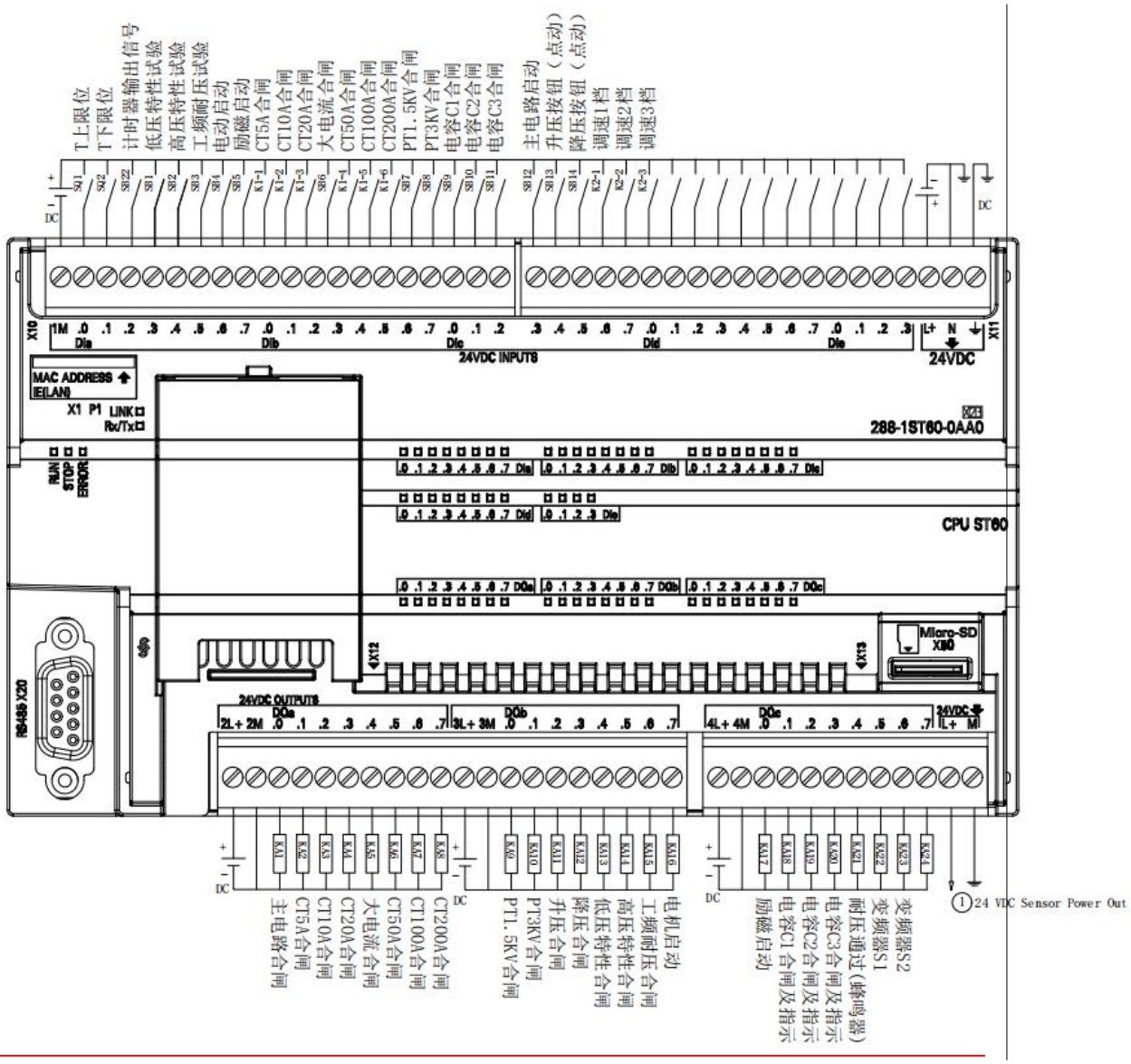
5, 6, 7 are voltage transformers; The 1#, 2#, 3# and 4# navigation slots are respectively connected to the 1#, 2#, 3# and 4# navigation slots of the high voltage cabinet; U1/V1/W1 is a contactor connected to the engine output; U2/V2/W2 is the contactor of the test object when connected to the induction withstand voltage test.

(iii) Wiring

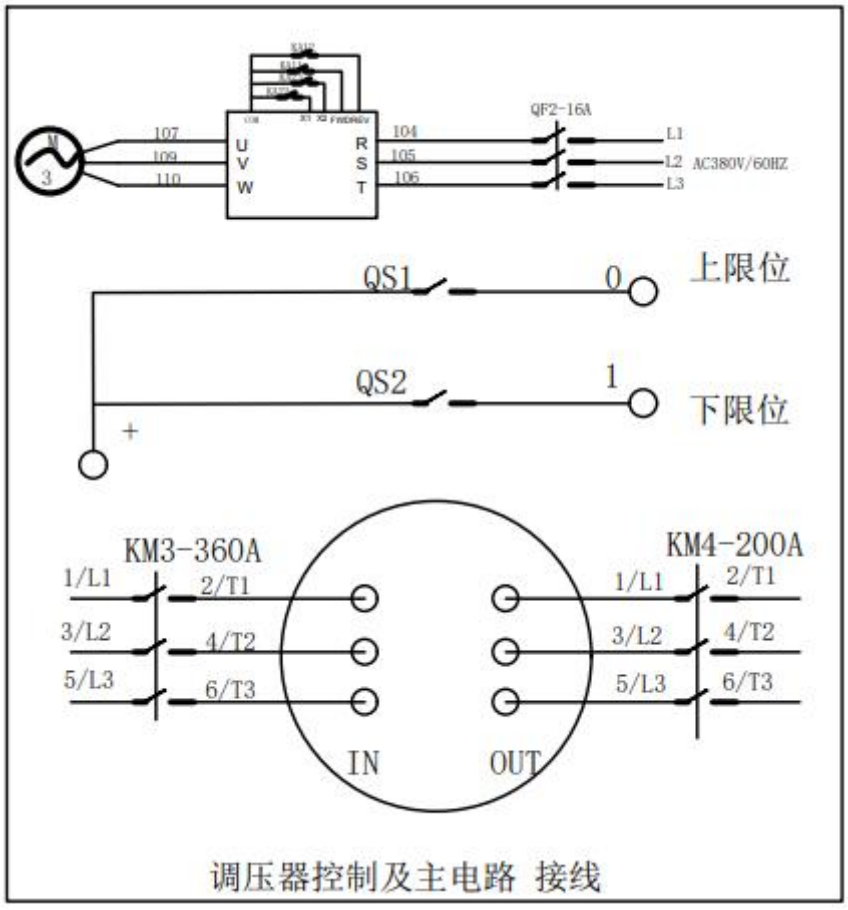
3.1 Main circuit wiring diagram



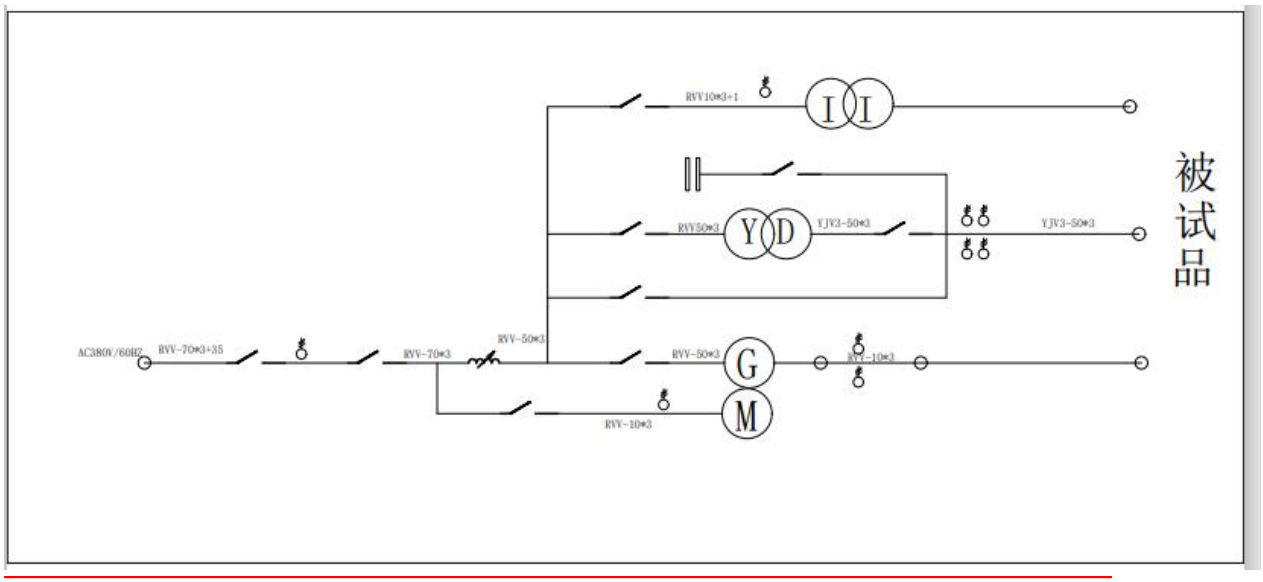
3.2 PLC wiring diagram



3.3 Voltage regulator wiring diagram



3.4 Test Object wiring diagram



III. Test system operation instructions

(i) Pretest preparation

Before the test, please read the instructions of DC resistance tester, ratio tester, transformer parameter tester, voltage regulator, intermediate frequency generator set, and temperature patrol instrument in detail, and wire in strict accordance with the wiring instructions, and finally carry out various tests.

After opening the "Power switch" on the operating station, the "Power Lamp" will light up. At this time, the secondary circuit power supply is connected. If the voltage regulator is not in the zero position, it will automatically return to zero. After the regulator returns to zero, subsequent tests can be carried out.

(ii) Test system hardware instructions

2.1 No-load Test

(1) Wiring: Make sure that the wiring is completed in strict accordance with the wiring instructions, the high voltage cabinet and the test object are connected according to the following figure 1, pay attention to the phase sequence must not be wrong.

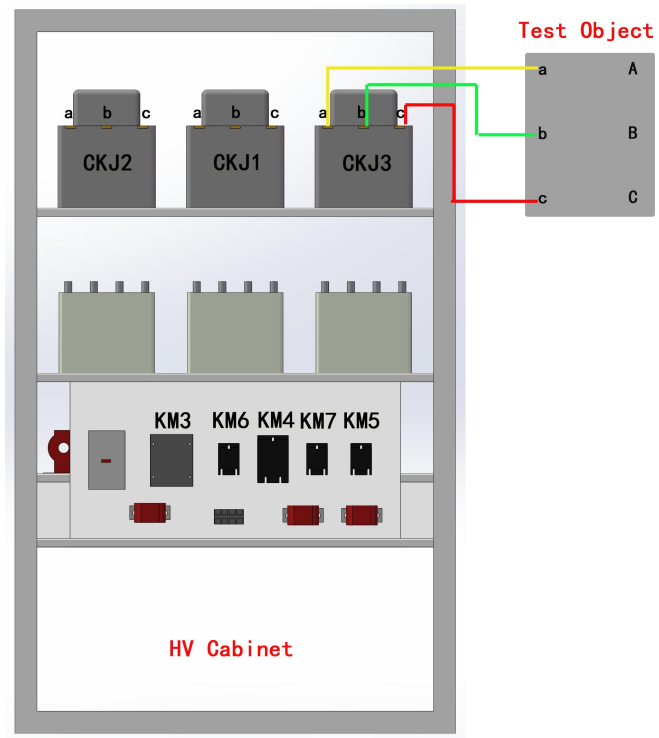


Figure 1 Connection between the high voltage cabinet and the test object

(2) Gear selection: Select the appropriate voltage and current gear according to the transformer capacity in Table 2 of Appendix 1 and Table 2 of Appendix 2. The current gear is adjusted by CT Switching, and the corresponding signal light will be on after selection.

Note: Select the low-voltage CT gear according to the rated current of the low-voltage side of the transformer under test. Its selection principle is: from small to large. Such as: S11 type 200kVA, 10kV/0.4kV transformer, the national standard stipulates that the percentage of no-load current is not more than 1.5%, the rated current of the low-voltage side I=288.7A, then no-load current I=4.33A, then the standard CT should choose a gear greater than 4.33A, optional 5A/1A. Set the current ratio I_K=5 in the screen, the voltage transformer select 1.5KV, and the voltage ratio Uk=15.

Note: Standard CT does not allow live switching, otherwise the device will be damaged.

(3) Closing: Press the “Main Circuit Closing” and “Low V Test” buttons to indicate

that the Main Circuit contactor of the no-load Test is closing and self-locking, and the “main circuit Lamp” and “Low V Test ” are on.

(4) Warning: press "Remind", light up, and non-test personnel evacuate the transformer under test.

(5) Boost voltage: Press the "Raise the V" button, the light is on, and the voltage regulator starts to boost. When the average output voltage of the regulator is displayed as the rated voltage of the low voltage side of the transformer under test 400V, the voltage boost stops. During the voltage boost process, the three-phase power supply must be closely monitored. When the rise difference between one or two phases of the three-phase current is large, it indicates that the transformer under test is abnormal (some inconsistency of the three-phase current is normal), and lower the voltage, check after the power off.

(6) Voltage reduction: Press the "Lower the V" button, light up, and make the voltage regulator return to zero.

(7) Opening: Press the “Low V Test ” and “Main Circuit Closing” buttons. Then the “Main Circuit Lamp” and “Low V Test” are off. The experiment is complete.

2.2 10KV Load Test

(1) Wiring: Make sure that the wiring is completed in strict accordance with the wiring instructions, the high voltage cabinet and the test object are connected according to the following figure, pay attention to the phase sequence must not be wrong.

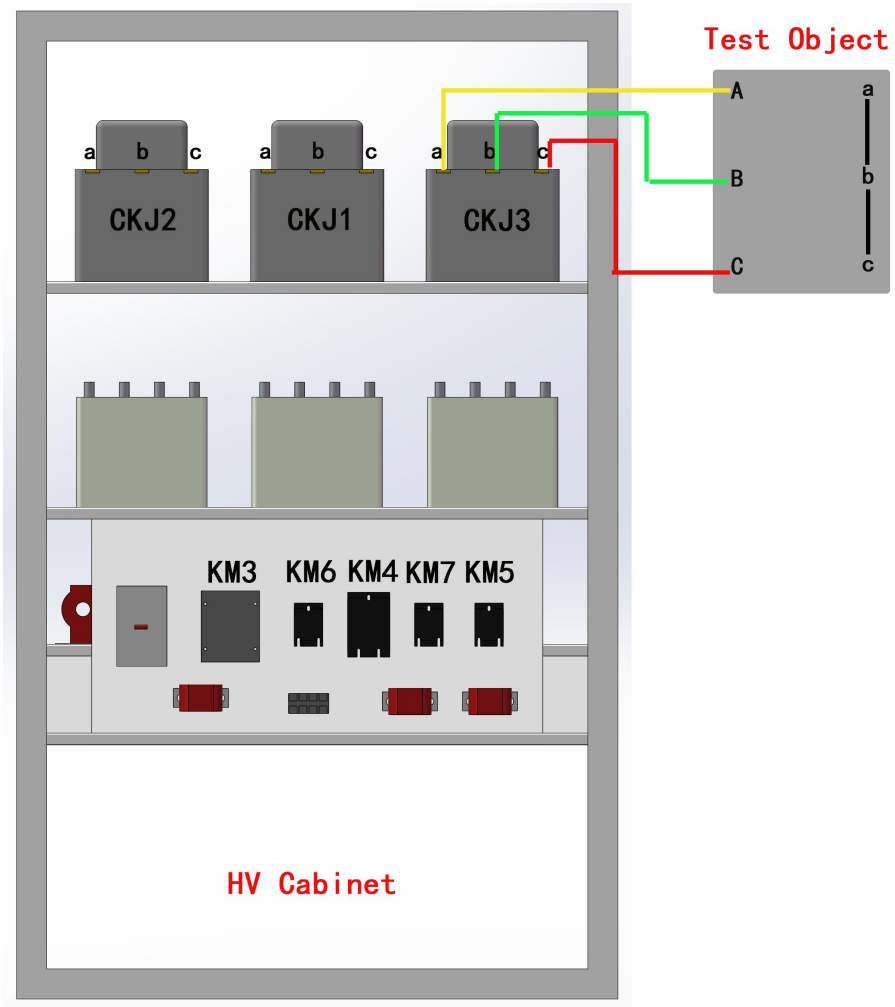


Figure 2 Connection between the high voltage cabinet and the test object

(2) Gear selection: Select the appropriate voltage and current gear according to the transformer capacity in Table 3 in Appendix 1. The current gear is adjusted by CT Switching, and the corresponding signal light will be on after selection.

Note: Select the low-voltage CT gear according to the rated current of the low-voltage side of the transformer under test. Its selection principle is: from small to large. Such as: S11 type 200kVA, 10kV/0.4kV transformer, the national standard stipulates that the percentage of no-load current is not more than 1.5%, the rated

current of the low-voltage side I=288.7A, then no-load current I=4.33A, then the standard CT should choose a gear greater than 4.33A, select 5A/1A. Set the current ratio I_K=5 in the screen, the voltage transformer select 1.5KV, and the voltage ratio Uk=15.

Note: Standard CT does not allow live switching, otherwise the device will be damaged.

(3) Closing: Press the “Main Circuit Closing” and “Low V Test” buttons to indicate that the Main Circuit contactor of the no-load Test is closing and self-locking, and the “main circuit Lamp” and “Low V Test ” are on.

(4) Warning: press "Remind", light up, and non-test personnel evacuate the transformer under test.

(5) Boost voltage: Press the "Raise the V" button, the light is on, and the voltage regulator starts to boost. When the average output current of the voltage regulator is displayed as the rated current of the low-voltage side of the transformer under test, the voltage boost stops. During the voltage boost process, the three-phase power supply must be closely monitored. When one or two phases of the three-phase current rise difference is large, it indicates that the transformer under test is abnormal (some inconsistency of the three-phase current is normal), and lower the voltage, check after the power off.

(6) Voltage reduction: Press the "Lower the V" button, light up, and make the voltage regulator return to zero.

(7) Opening: Press the “Low V Test ” and “Main Circuit Closing” buttons. Then the “Main Circuit Lamp” and “Low V Test” are off. The experiment is complete.

2.3 35KV Load Test

(1) Wiring: Make sure that the connection has been completed in strict accordance with the wiring instructions, the high voltage cabinet and the test object are connected according to Figure 2, and the intermediate transformer is connected according to the 3.0kV connection in Figure 2, and the phase sequence must be correct.

(2) Gear selection: Select the appropriate voltage and current gear according to the transformer capacity in Table 3 in Appendix 2. The current gear is adjusted by CT Switching, and the corresponding signal light will be on after selection

Note: Select the low-voltage CT gear according to the rated current of the low-voltage side of the transformer under test. Its selection principle is: from small to large. For example: S11 type 200kVA, 10kV/0.4kV transformer, rated current I=11.5A on the high voltage side, then the standard CT should choose a gear greater than 11.5A, select 20A/1A, set the current ratio in the screen IK=20, the voltage transformer select 3KV , voltage ratio UK=30.

Note: Standard CT does not allow live switching, otherwise the device will be damaged.

(3) Closing: Press the “Main Circuit Closing” and “High V Test” buttons to indicate that the Main Circuit contactor of the no-load Test is closing and self-locking, and the “main circuit Lamp” and “High V Test ” are on.

(4) Warning: press "Remind", light up, and non-test personnel evacuate the transformer under test.

(5) Voltage boost: Press the "Raise the V" button, the light is on, and the voltage regulator starts to boost. When the average output current of the voltage regulator is displayed as the rated current on the high voltage side of the transformer under test, the voltage boost stops. During the voltage boost process, the three-phase power supply must be closely monitored. When one or two phases of the three-phase current rise difference is large, it indicates that the transformer under test is abnormal (some inconsistency of the three-phase current is normal), and lower the voltage, check after the power off.

(6) Voltage reduction: Press the "Lower the V" button, light up, and make the voltage regulator return to zero.

(7) Opening: Press the “High V Test ” and “Main Circuit Closing” buttons. Then

the “Main Circuit Lamp” and “High V Test” are off. The experiment is complete.

2.4 AC withstand voltage Test

(1) Wiring: The test transformer and the test object are connected according to Figure 3, and the voltage withstand time is set to 60s. Non-test personnel are evacuated from the subject.

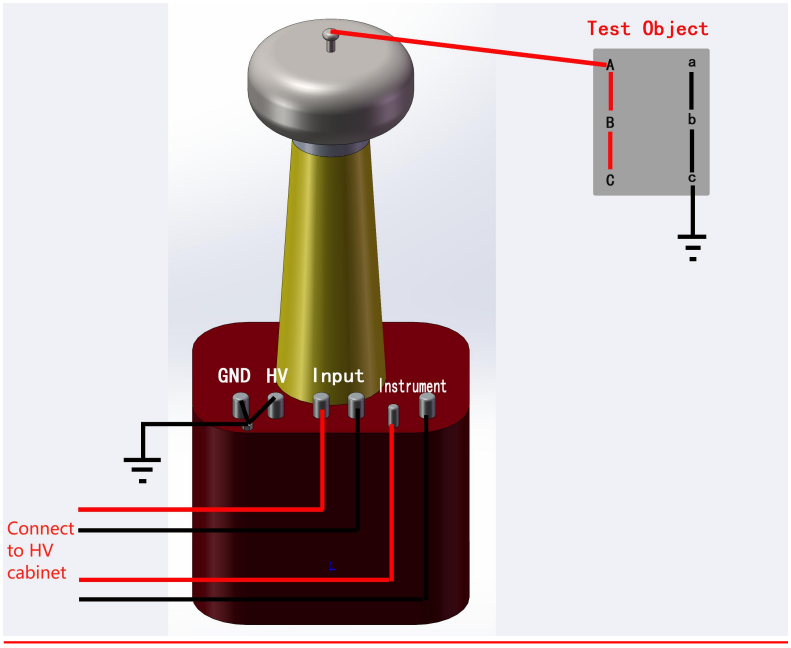


Figure 3 Connection between the test transformer and the test object

(2) Closing: Press the "Main Circuit Closing" button, and then press the "AC Test" button, and the main contactor of the test loop absorbs and self-locks.

(3) Press the "Raise the V" button, and pay close attention to the test transformer, withstand voltage output current, and withstand voltage output voltage during the voltage boost. Stop the voltage boost when the "withstand voltage meter voltage" rises to the specified value.

(4) Open the time relay, if normal, after 60 seconds, the voltage regulator will automatically return to zero.

(5) Press the “AC High V Test” and “Main Circuit Closing” buttons to close the voltage test.

2.5 Induced voltage withstand test

(1) Wiring: Connect the low voltage side (a, b, c) of the tested transformer according to the Figure 4, and open the high voltage side. Note that the phase sequence cannot be wrong.

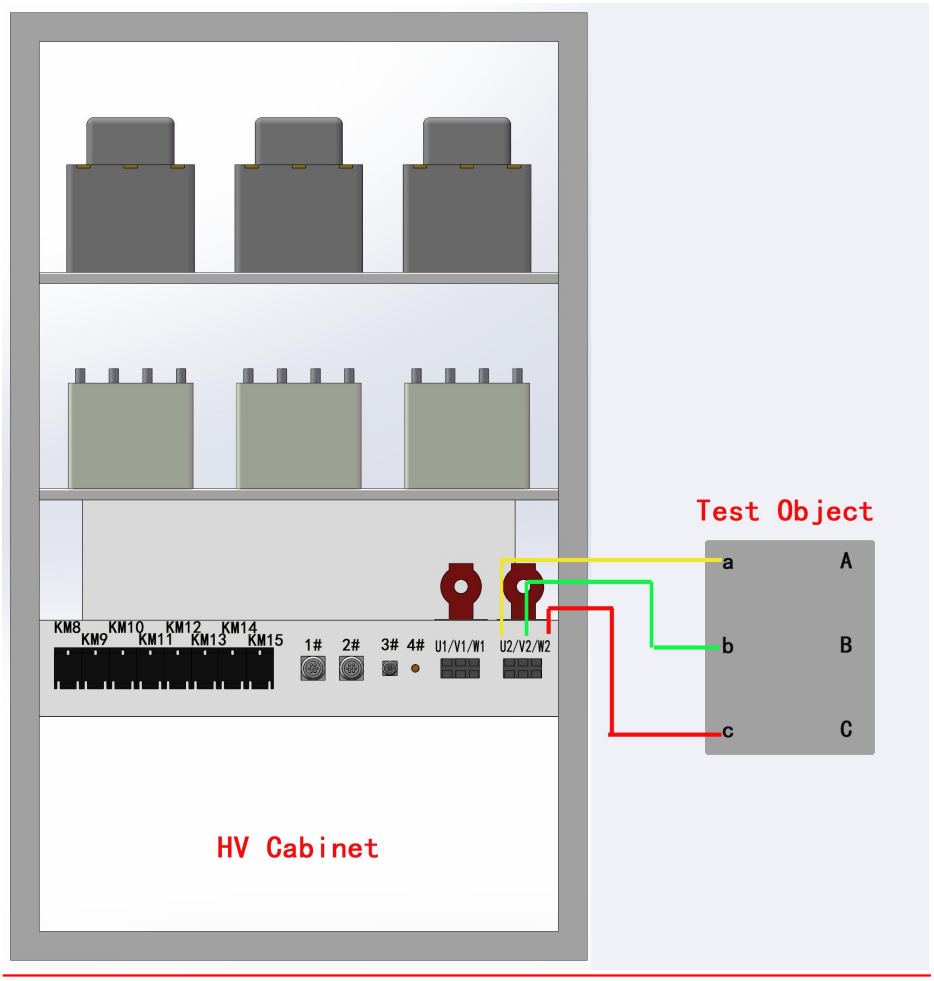
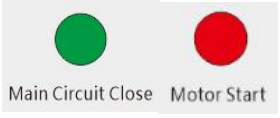


Figure 4 Connection between the high voltage cabinet and the test object

(2) Closing: Press the “Main Circuit Closing” button, and then press the “Moter Start” button.



(3) Excitation: Press the "Excitation Closing" button to input excitation current to the generator, monitor the excitation ammeter, generator output voltage and output current. When the low-voltage induction voltage meter reaches 800V, stop the boost

voltage, set the time to 40s, open the time relay, withstand voltage timing, when the time is up, the buzzer will call, the voltage regulator will automatically return to zero.

(4) The voltage withstand test of the second transformer can be carried out without stopping the motor by pressing the "Excitation Closing".

(iii) Test system software instructions

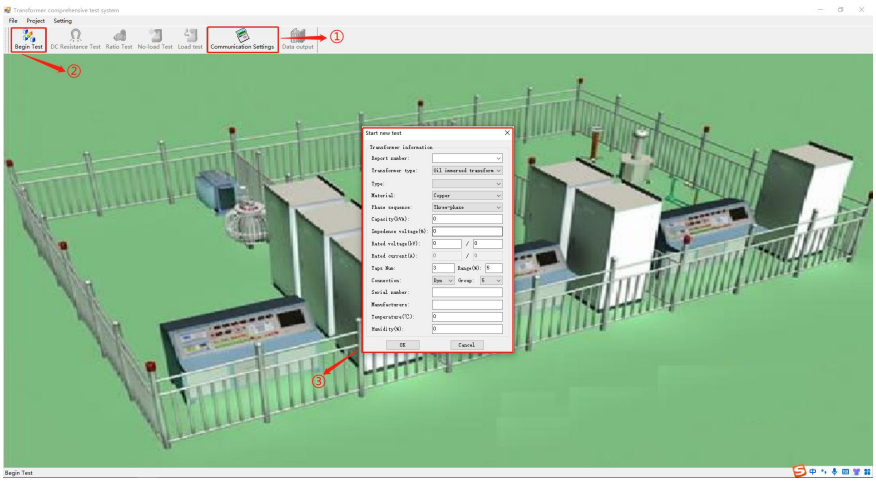
The on-line software can realize control test, data analysis and export through serial port connection, and automatically judge the winding test state, especially for multi-tap transformers.

First, Open the icon 

on the desktop to enter the testing interface;

Test software main interface

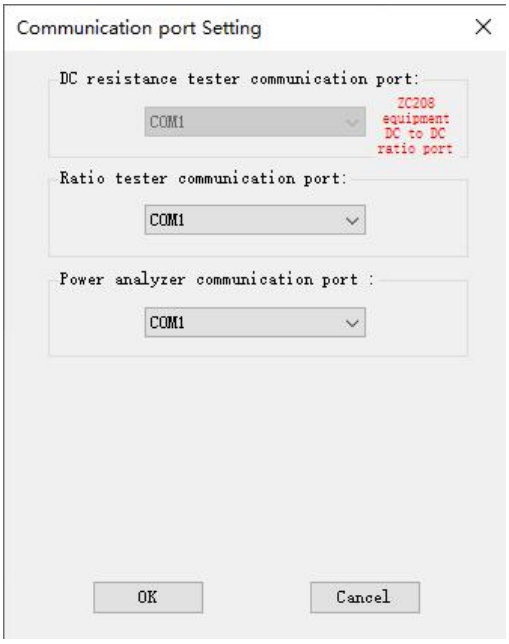
Then, Before starting the test, create the test file of the test object in the following order.



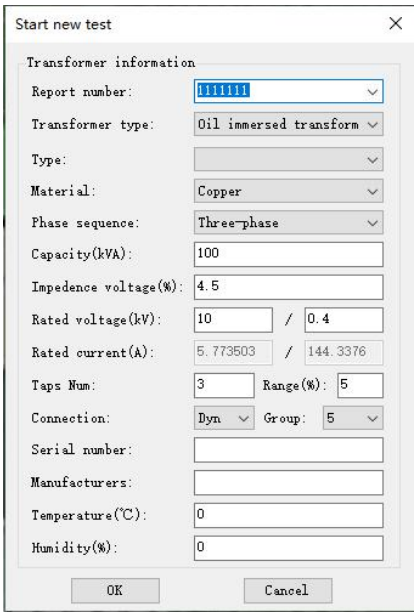
Configuring main interface

The first application of the software needs to connect the instrument by setting the serial port, as follows:

First: Click "Communication Settings" on the software interface (for example, ① of configuring main interface) and select the serial port number corresponding to the testing item to complete the communication Settings; As shown in the following picture.



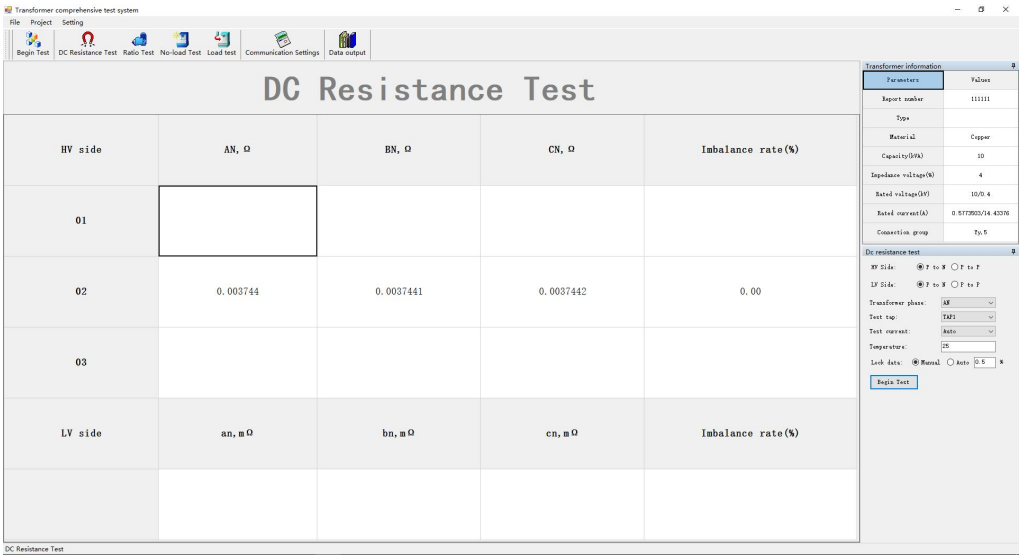
Then: Click 【Begin Test】 (as shown in ② of the main configuration interface) to enter the parameter Settings before the testing, as shown in the following figure:



Enter the corresponding parameters according to the actual parameter information of the test object. After entering the parameters of the test object, the menu of the test item on the main interface becomes editable, and the main interface is shown as follows.

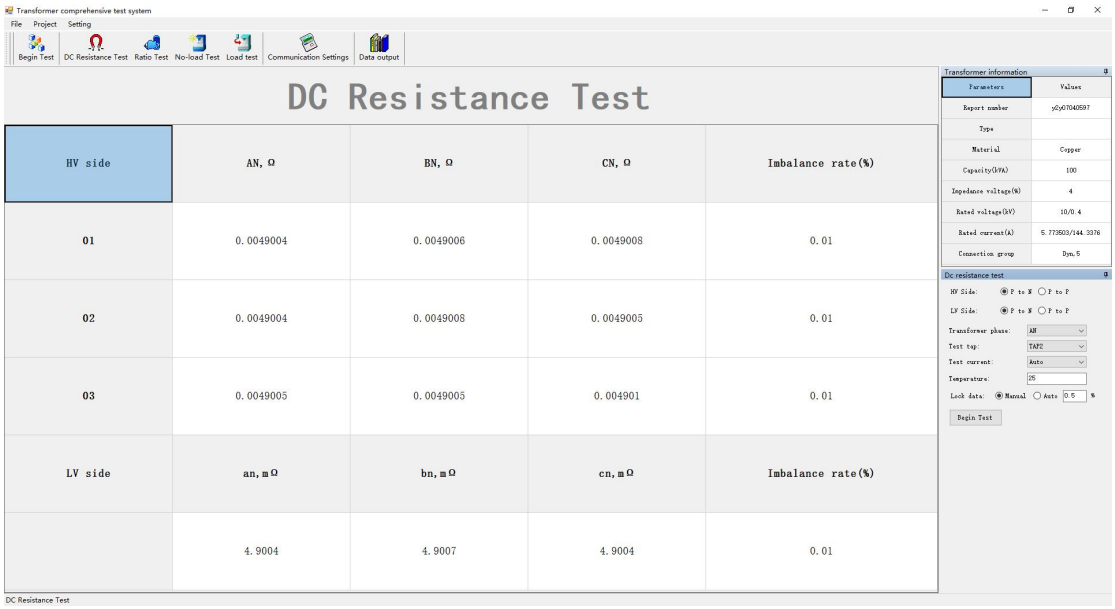
3.1 DC Resistance Test

After setting parameters to start the testing, click 【DC Resistance Test】to enter the DC resistance test interface as shown in the figure below.



Dc resistance test setting interface

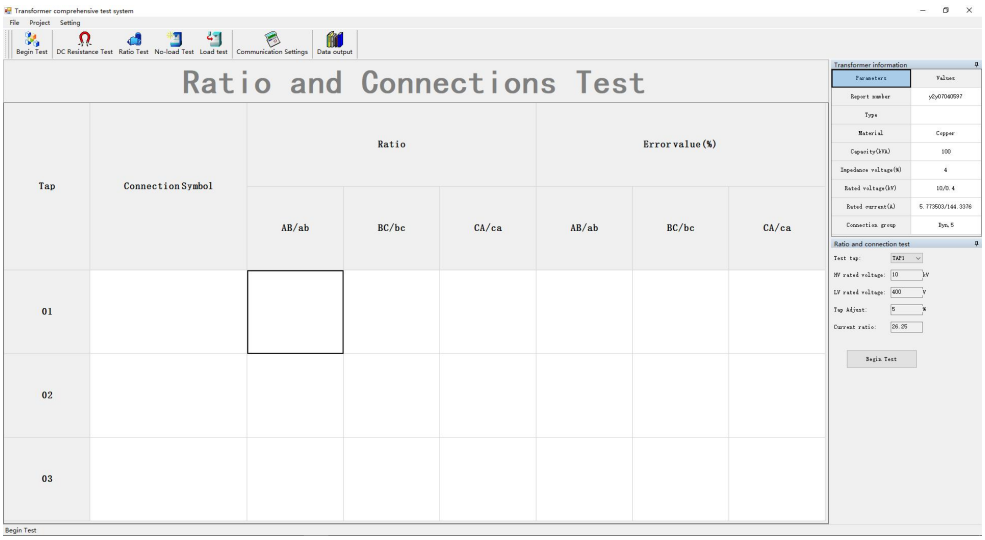
After confirming that the instrument wiring and software Settings are correct, click 【Begin Test】 to start the testing. Note: the testing gears Auto(automatic) and <2mA, 20mA, 200mA, 1A, 5A and 10A gears are available according to the corresponding range of each current gear. After the testing is completed, the measurement results of the current group will be displayed automatically. After adjusting the group, you can continue the test by clicking "Start Test" without changing any Settings. After the test is completed, the results as shown in the following figure will be displayed.



Dc resistance test results interface

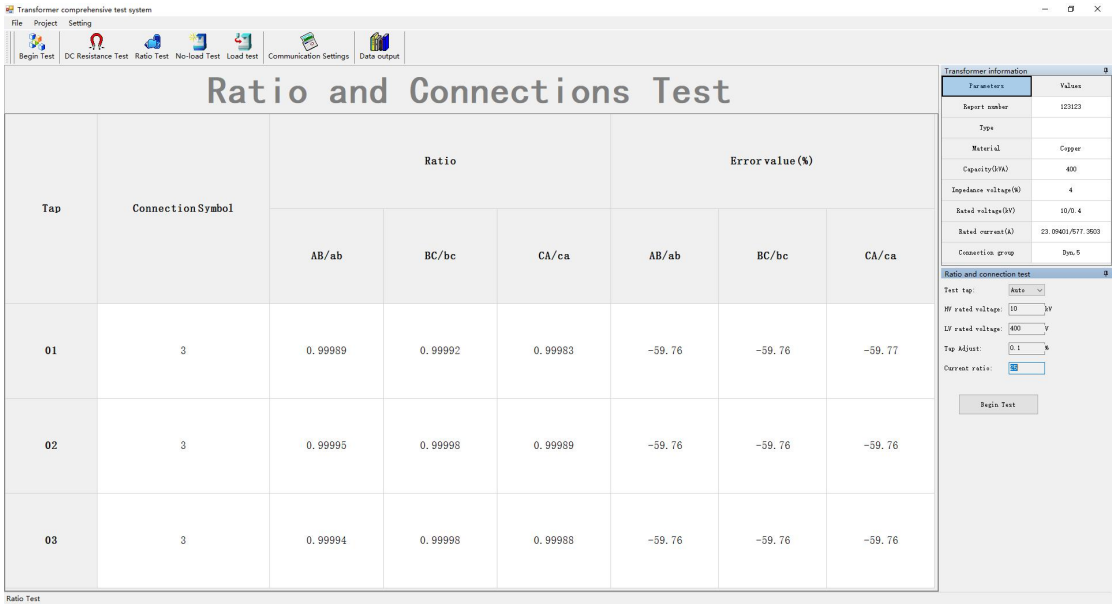
3.2 Ratio Test

Click 【Ratio Test】 on the main interface of the software to enter the ratio test interface as shown in the figure below.



Ratio test setting interface

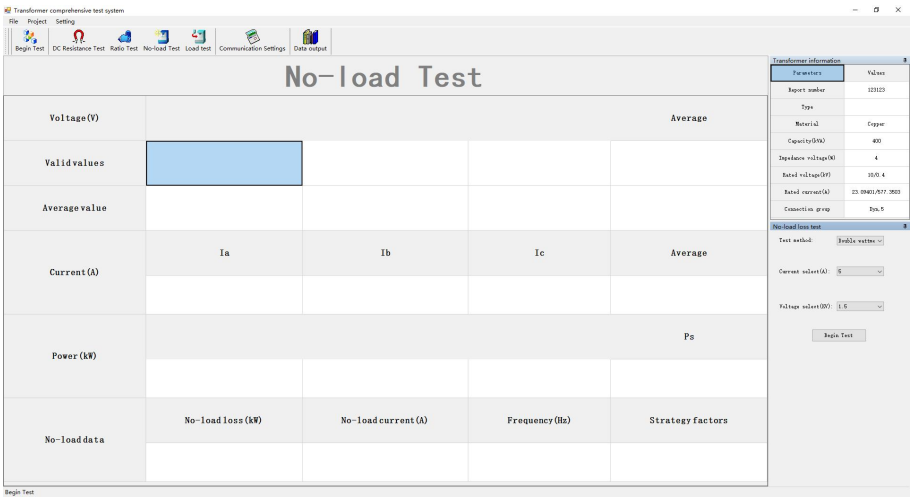
After confirming that the instrument wiring and software Settings are correct, click 【Begin Test】 to start the testing. After the testing is completed, the measurement results of the current group will be displayed automatically. After adjusting the group, you can simply click 【Begin Test】 to continue the testing without changing any Settings.



Ratio test results interface

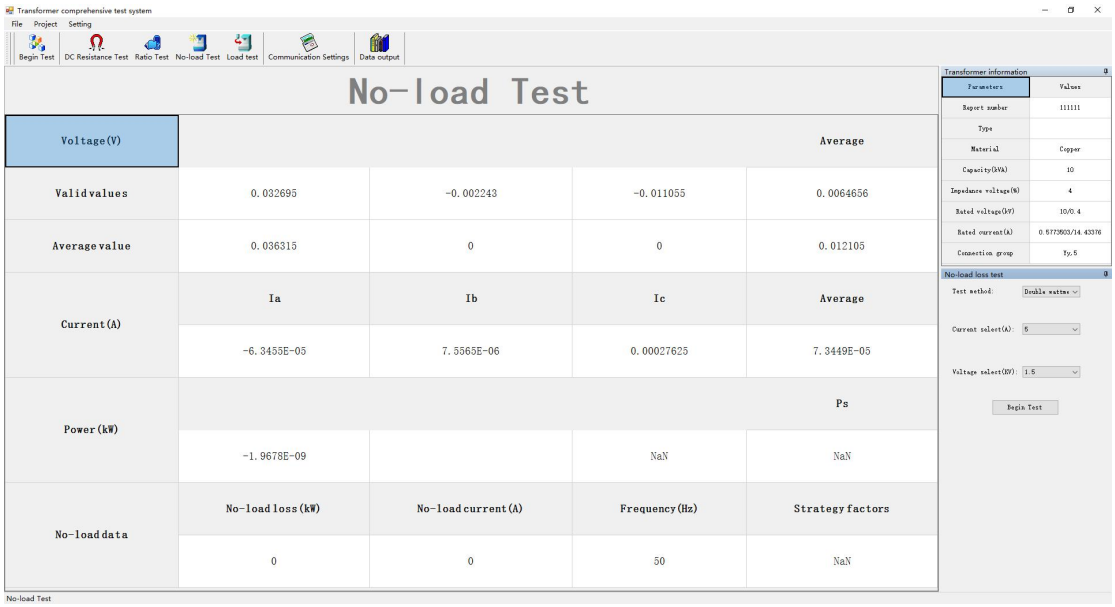
3.3 No-load Test

Click 【No-load Test】 in the main interface of the software to enter the no-load test interface as shown in the following picture.



No-load test setting interface

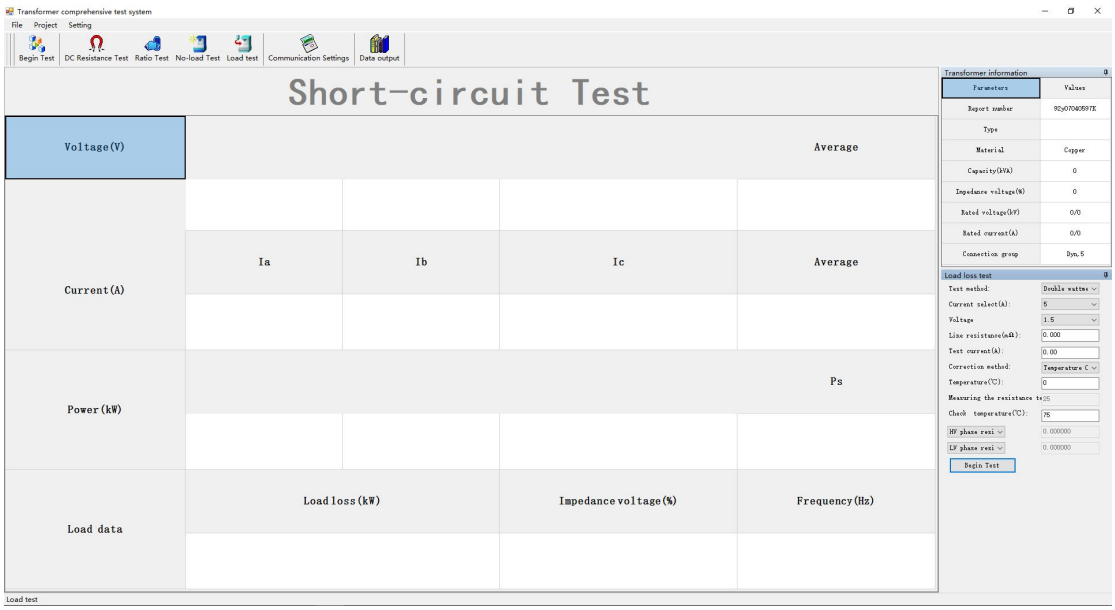
After confirming that the instrument wiring and software Settings are correct, click 【Begin Test】 to start the testing. Note: 【Current select(A)】 the gears are 5A, 10A, 20A, 50A, 100A and 200A. According to the range selection corresponding to each current gear, the gear is one-to-one corresponding to CT5A, CT10A, CT20A, CT50A, CT100A and CT200A on the test bench respectively. 【Voltage select(KV)】 There are 1.5KV and 3KV gears available. According to the corresponding range selection of each voltage gear, the gear is one-to-one corresponding to PT1.5KV and PT3KV on the test bench. After the testing is completed, the measurement results of the current group will be displayed automatically. After the test is completed, the results as shown in the following figure will be displayed.



No-load test test results interface

3.4 Load Test

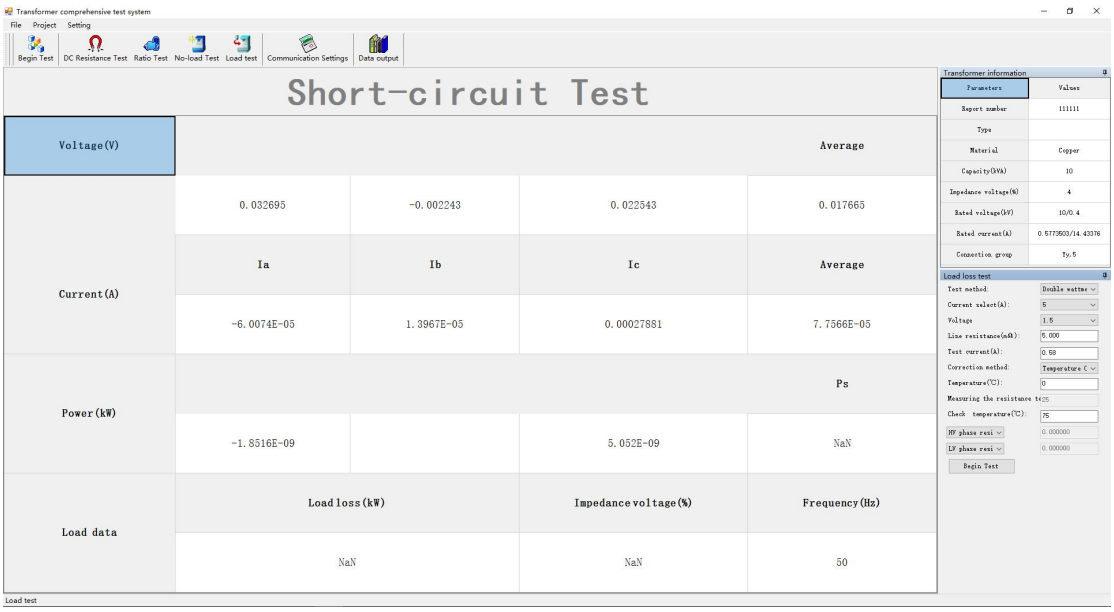
Click 【Load test】 in the main interface of the software to enter the load test interface as shown in the following picture.



Load test setting interface

After confirming that the instrument wiring and software Settings are correct, click 【Begin Test】 to start the testing. Note: 【Current select(A)】 the gears are 5A, 10A, 20A, 50A, 100A and 200A. According to the range selection corresponding to each current gear, the gear is one-to-one corresponding to CT5A, CT10A, CT20A,

CT50A, CT100A and CT200A on the test bench respectively. 【Voltage】 the gear is available at 1.5KV and 3KV. According to the corresponding range of each voltage gear, the gear is one-to-one corresponding to PT1.5KV and PT3KV on the test bench. After the testing is completed, the measurement results of the current group will be displayed automatically. After the testing is completed, the results as shown in the following figure will be displayed.



Load test test results interface

IV. Generator Set

(i) Precautions

4.1 Inspection

(1) Carefully check the nameplate data to confirm that the motor model meets the requirements for use.

(2) Use a 500V megohm meter to measure the insulation resistance of the motor winding to the housing, and the insulation resistance should be greater than 0.5MΩ.

4.2 Installation

(1) The motor is generally installed in a clean and dry place indoors, and must be well ventilated around it. The maximum temperature of the ambient air should not exceed 40 ° C, the minimum temperature should not be lower than -15 ° C, and strong thermal radiation should be prevented.

(2) Motor control appliances are equipped with phase loss protection and overload thermal protection devices, YA series of increased safety motor must choose the appropriate overload thermal protection device according to the nameplate tE time and starting current ratio IA/IN.

(3) Connect the power line according to the wiring diagram, the connector connection should be strong, the motor with leading cables and wires can be directly connected to the power line, and the junction should be insulated and sealed.

(4) When the phase sequence of the power line and the motor connector mark are connected, the motor rotates clockwise from the extension end of the shaft. If you need to change the direction, change the position of the two power cable connections.

(5） YD series and other variable pole multi-speed asynchronous motor is to use the method of changing the lead line to control the speed change, in order to ensure the reliability of multi-speed motor operation, the design and operation of the control device should pay attention to, in the high-speed switch to low speed, must be cut off the power at the same time disconnect the neutral point of the 2Y connection, so as not to cause the power short circuit when the low speed winding is connected. In the process of switching from high speed to low speed, the power supply of the low speed winding must be switched on after the motor stops, so as to reduce the impact on the motor and load. Speed switching should pay attention to the motor's steering.

（6） The motor can be equipped with coupling, gear, belt and load mechanical connection, more than 4kw 2-pole motor and more than 30kw 4-pole motor should not be driven by belt, and the second shaft extension of the two-shaft extension motor can only be driven by coupling. The coupling, belt shaft hole and motor shaft should be suitable for tightness, and it is forbidden to hit with a heavy hammer during installation.

(7) When coupling is used, the center line of the motor shaft and the center line of the load mechanical shaft should coincide, and the shaft of the coupling should retain 1PRI3mm clearance.

(8) When belt drive is used, the center line of the motor shaft should be parallel to the center line of the load mechanical shaft, and the center line of the belt and the center line of the shaft are perpendicular to each other.

4.3 Grounding

The motor must be reliably grounded. The grounding method and grounding resistance should comply with the electrical safety management regulations such as “Specification for grounding design of industrial and civil power installations” and “Technical specification for plant power design”. The grounding resistance should be less than 4Ω。

4.4 Starting

(1) The motor should start immediately after closing, reach the normal speed and run smoothly, otherwise the power should be cut off immediately, check and troubleshoot.

(2) After starting, pay attention to observe the motor, transmission device, load machinery, voltmeter and ammeter, and stop immediately if there is an abnormal phenomenon.

(3) The continuous start of the motor no load is generally not more than 4 times, and the continuous start shall not exceed 2 times after running to the hot state stop, otherwise it is easy to burn the motor.

(4) According to the power grid capacity, load size and motor power, reasonable selection of starting mode, more high-power motor should be started by star-delta connection or step-down mode.

4.5 Running

(1) The unit needs to confirm the steering without load and confirm the correct steering by detecting the output frequency. When the output frequency is 150HZ, the steering and rotor phase sequence are correct; when the output frequency is 50HZ, it must stop and adjust the prime mover phase sequence or the generator rotor phase

sequence, so that the output frequency is 150HZ before load operation, and 50HZ load operation is prohibited.

(2) The load of the unit must be slowly loaded, by adjusting the input voltage of the generator rotor loading, unloading must be slowly unloaded to the light load state, it is strictly prohibited to instantaneous loading or unloading heavy loads, resulting in torsional vibration of the machine group, endangering the main shaft system.

(3) The deviation between the source voltage and the rated voltage shall not exceed +5%, and the three-phase voltage imbalance shall not exceed 1.5%.

(4) The running current of the motor shall not exceed the rated current on the nameplate, and the unbalance of the three-phase current shall not exceed 5%, otherwise it will cause the motor to heat or even burn.

(5) The thermometer measuring the surface temperature of the motor housing should not exceed 80 ° C, and the temperature of the bearing should not exceed 95 ° C.

(6) The motor should always be kept clean, dry and well ventilated, and the air inlet and outlet must be kept unblocked.

(7) тhere is smoke, violent vibration, abnormal sound, special smell, and obvious reduction of speed in the motor, the load equipment fails; In case of electric shock, power off and stop immediately.

(8) It is strictly prohibited to overload operation for a long time.

4.6 Bearing lubrication

(1) Motor bearing lubrication should be good, generally run 3000~5000 hours, should be shut down maintenance or replacement of grease, grease brand ZLPRI3 lithium grease.

(2) The motor stored or deactivated for more than two years should be checked the lubrication of the bearing before use, and the grease should be added or replaced if necessary.

(3) Sealed bearings are used for motors with center height 132 and below, unsealed bearings are generally used for motors with center height 160 and above, and sealed bearings do not need to be replaced with grease during the use of the motor, and unsealed bearings should be regularly replaced with clean grease. Grease filling

should be appropriate, generally fill 1/3PRI1/2 of the cavity between the inner and outer rings of the bearing, the motor with grease injection device can be filled with 3PRI4, open the discharge hole or cover plate at the bottom of the bearing cover before filling, and then plug the discharge hole or cover plate after the motor runs for 20 minutes. Power off when disassembling discharge hole plug or cover plate.

4.7 Transportation and storage

In the process of transportation, the motor should not be damp, the shaft should not bump, and the parts should not be damaged. The storage place should be kept clean, dry, ventilated, free of corrosive gases, and avoid sharp changes in ambient temperature.

(ii) Quality assurance and maintenance

(1) Quality assurance and maintenance

In the case of correct use and storage of the user according to the provisions of the maintenance manual, the motor is damaged or cannot work normally due to manufacturing quality problems within one year from the date of purchase or within one year from the production date of our company, our company is responsible for repair and replacement.

Due to the motor failure caused by the user, our company can provide motor maintenance services, and charge a certain fee according to the regulations, generally including the following cases: the motor voltage exceeds the rated voltage +5% or overload operation, resulting in the burning of the electric; Due to the fault of the three-phase power supply line of the motor, the one-phase or two-phase winding of the motor stator winding is burned out. Equipment and personal injury accidents caused by failure to install, use and maintain according to the requirements of the operation and maintenance manual; Users disassemble, repair the motor, etc.

(2）Maintenance and repair

When maintaining and repairing the motor, pay attention to environmental protection, so that the maintenance site is pollution-free, and the motor coil must not

be removed by fire. When the motor is used for more than one year, it is necessary to pay attention to check whether the rubber parts such as the oil seal outside the motor end cover, the shaft seal ring, the junction box seat, the sealing ring on the junction box cover are cracked, deformed, seriously worn and other aging phenomena, and the parts that cannot meet the sealing performance and requirements should be replaced in time.

V. Intermediate transformer

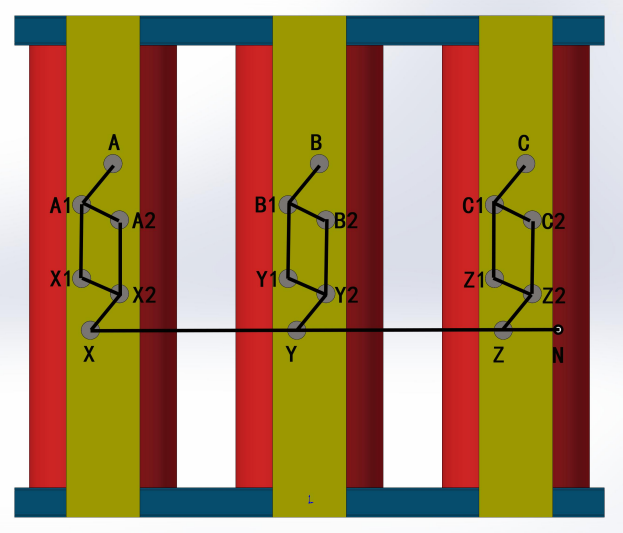
The intermediate transformer is a multi-winding output booster transformer, with two sets of 1.5kV output, the two sets of output can output 1.5kV in parallel, or can output 3.0kV in series, the physical picture is as follows.

Low Voltage Side

High Voltage Side

(i) 1.5kV connection mode

The paralleling method is as follows, and high voltage side output 1.5kV.



(ii) 3.0kV connection mode

The series connection is as follows, and the high voltage side outputs 3.0kV.

VI. Test Transformer

(i) Overview

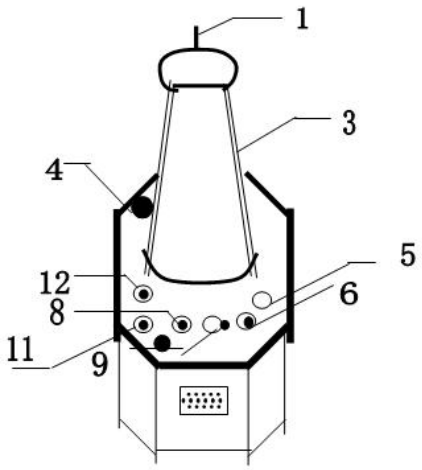
(1) Power frequency AC voltage withstand test is the most strict, effective and direct method to identify the insulation strength of power equipment. It can check the concentrated defects that are more dangerous, play a decisive role in judging whether the power equipment can continue to participate in the operation, and is an important means to ensure the insulation level of the equipment and avoid insulation accidents.

(2) The device is an advanced voltage test equipment designed according to the latest national power industry standards, used to test the insulation strength of various electrical products, electrical components and insulating materials under specified voltage, in order to evaluate the insulation level of the product, find the insulation defects of the tested product, and measure the ability of overvoltage.

(ii) Product Structure

High voltage test transformer adopts single frame core type iron structure. The primary winding is placed on the iron core and the high voltage winding is outside. This coaxial arrangement reduces the leakage flux and thus increases the coupling

between the windings. The shell of the product is made of an octagonal structure with a better match with the core, and the overall shape is beautiful and generous. The external structure diagram is shown in Figure 6.1, and the internal structure diagram is shown in Figure 6.2.



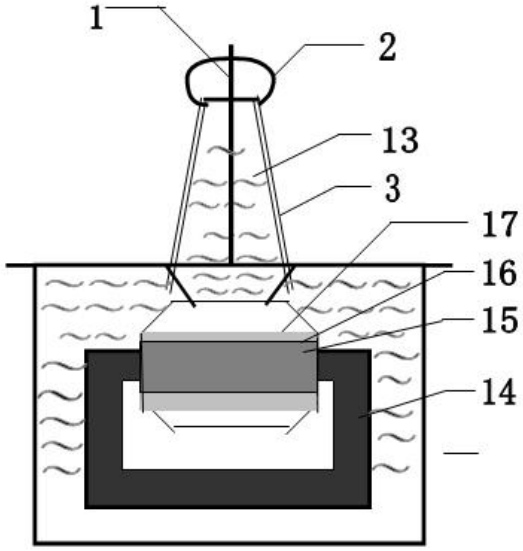


Fig 6.1 External structure diagram of test transformer Fig 6.2 Internal structure diagram of test transformer

1 - High voltage output 2 - Equalizing ball 3 - High voltage casing

4 - Oil drain valve 5, 6 - Voltage measuring terminals 8, 9 - primary input

10 - Transformer housing ground terminal 11 - High voltage tail X

12 - Output current measurement transformer 13 - Transformer oil 14 - Iron core

15- Primary low voltage winding 16 - Voltage measurement winding

17 - Secondary high voltage winding

(iii) Technical Parameters

Rated capacity: 30kVA

Input voltage: 600V

Output voltage: AC100kV

Impedance voltage: Rated capacity: 30kVA

Input voltage: 600V

Output voltage: AC100kV

Impedance voltage: Rated capacity: 30kVA

Input voltage: 600V

Output voltage: AC100kV

Impedance voltage: <10%

Ratio: 166.67

Input current: 50A

Output current: 300mA

No-load current: <5%

Measurement ratio: 1000

Connecting groups; I,I0

(iv) Working Principles

The power frequency AC withstand voltage test device is composed of a high voltage test transformer and a console, in which the console is an integrated device composed of voltage regulator, measurement, control, protection and signal. The high voltage test transformer adopts a single frame core type iron core, the primary winding is wound on the iron core, and the measuring winding and high voltage winding are wound with an insulated cylinder and sheathed outside the primary winding. By adjusting the output voltage of the regulator in the console and connecting to the primary winding of the high voltage test transformer, the required high voltage can be obtained according to the principle of electromagnetic induction.

The working principle diagram of the high voltage test transformer is shown in Figure 6.3.

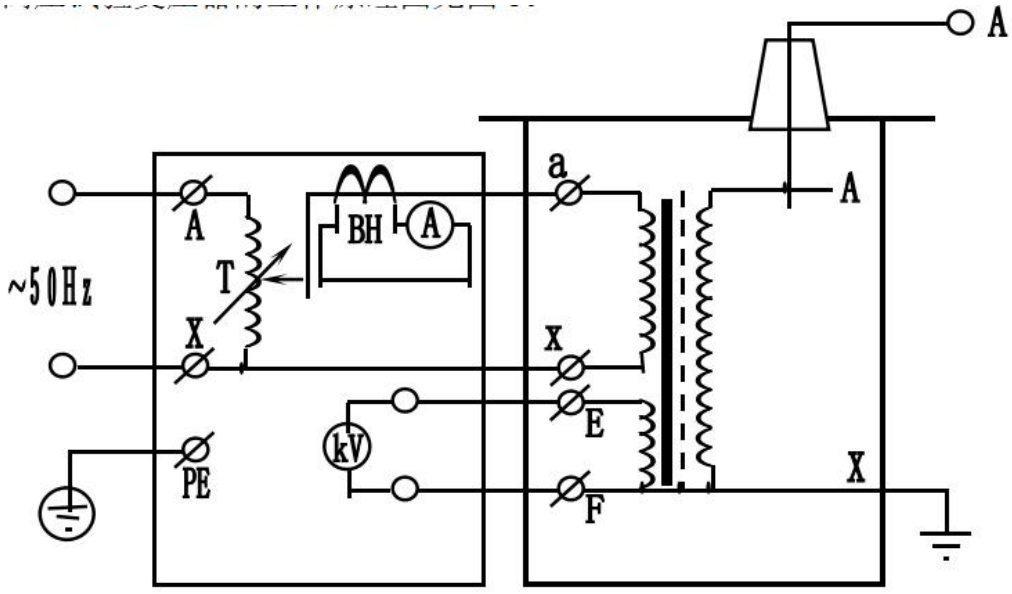
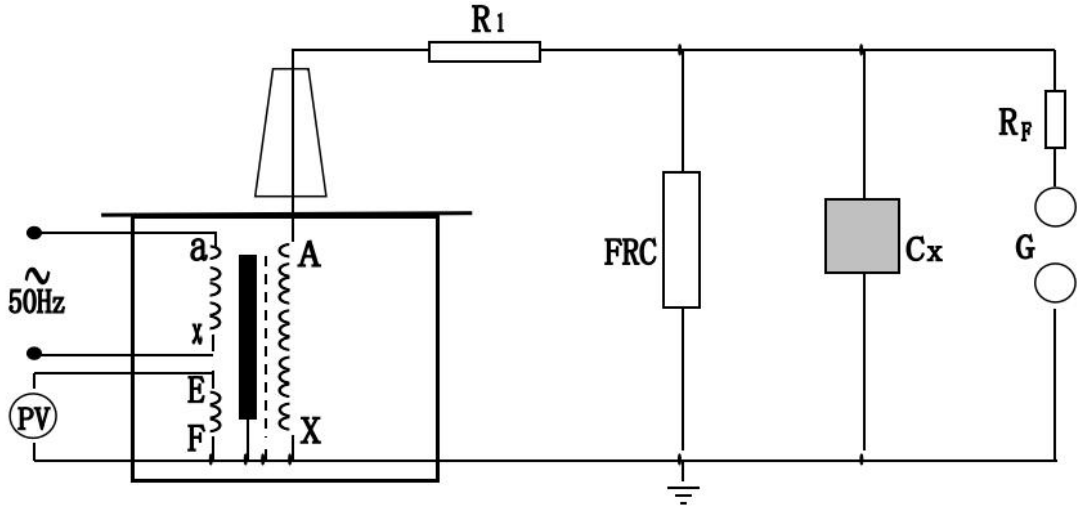


Figure 6.3 High voltage test transformer working principle diagram

(v) Usage Method

See Figure 6.5 for the wiring diagram of the test transformer for the power frequency voltage withstand test of the test object.



Test object power frequency withstand voltage test wiring diagram

R1 - Current limiting resistance FRC - resistance-capacitance divider

RF - ball gap protection resistance G - Ball gap CX - Test object

Note: The high voltage tail must be reliably grounded.

(1) In the power frequency voltage test, the current limiting resistor R1 should be selected according to the rated capacity of the test transformer. For example, when the rated output current of the high voltage side is 100~300mA, 0.5~1Ω/V(test voltage)

can be used; When the rated output current of the high voltage side is more than 1A, 1Ω/V(test voltage) is recommended. Water resistance is commonly used as a current limiting resistance (preparation method of water resistance: distilled water is added to an appropriate amount of edible salt to prepare various resistance values).

(2) Ball gap and protection resistance: When the voltage exceeds the ball gap setting value (generally take 110% to 120% of the test voltage), the ball gap discharge, which plays a protective role for the test object. Ball clearance protection resistance can be selected as 1Ω/V(test voltage).

(3) In the power frequency voltage withstand test, the measurement voltage (meter voltage) on the low voltage side is not very accurate, the reason is that there is a leakage reactance of the test transformer, and there must be a voltage drop or capacity rise on this leakage reactance, so that the voltage on the test product is lower or higher than the voltage reflected on the low voltage side of the measurement voltmeter. During the power frequency voltage withstand test, the voltage on the test object is higher than the output voltage of the test transformer, which is the so-called capacity rise phenomenon. There must be a voltage drop in the leakage reactance of the test transformer during the induction withstand voltage test. In order to accurately measure the voltage applied to the subject, the FRC resistance capacitance divider is often connected to the high voltage side to measure the voltage.

Power frequency withstand voltage test operation precautions:

(1) Test personnel should do a good job of division of labor, clear mutual contact methods. There are special people to monitor the safety of the site and observe the status of the test products. No personnel are allowed within a radius of 3 meters.

(2) The test object should be cleaned first and absolutely dry to avoid damage to the test object and error caused by the test.

(3) For large tests, no-load tests should generally be carried out first. That is, when the test product is not connected, the voltage is increased to the test voltage, proofread various meters, and adjust the ball clearance.

(4) The speed of voltage increase cannot be too fast, and sudden increase the voltage must be prevented. For example, when the voltage regulator is not in zero position, it

suddenly closes. Also can not suddenly cut off the power supply, generally should be pulled when the regulator drops to zero.

(5) When the voltage rises to the test voltage, start timing, after 1min, quickly step-down to 1/3 test voltage below, then close the circuit breaker.

(6) During the boost or withstand voltage test, if the following abnormal conditions are found, the voltage should be reduced immediately and the power supply should be cut off. Stop the test and find out the reasons: ① the voltmeter pointer swings greatly; ② Found that the insulation is burnt or smoking; ③ Abnormal sound in the test object.

(7) The insulation resistance should be measured before and after the voltage test to check the insulation condition.

(vi) Precautions

(1) Set the overcurrent and overvoltage action protection value of the measuring meter head, set the overvoltage protection value at 121kV when leaving the factory, set the overcurrent protection value at 135A, set according to the rated working voltage and current of the equipment, and reset it according to the user's test needs.

(2) Connect the working line according to the wiring diagram. The housing of the test transformer and the housing of the operating system must be reliably grounded. Test transformer high voltage winding X end (high voltage tail) and meter must be reliably grounded.

(3) Before switching on the power supply, the voltage regulator of the operating system must be adjusted to zero before switching on the power supply, closing the switch, and starting to boost the voltage.

(4) Press the boost button from zero. The voltage boost method is: rapid voltage boost method, that is, continuously press and hold the voltage boost button; Slow boost method, intermittent press the boost button; After the voltage rises from zero to 75% of the required rated test voltage according to a certain boost mode and speed, the required rated voltage is raised by the point boost method, and then the timing begins. During the voltage withstand process, pay close attention to the indication of the measuring meter and the condition of the test object and the field condition. In the

process of voltage boost or test, if the indication of the measuring meter and the condition of the test object are found abnormal, the voltage should be reduced immediately, and the power supply should be cut off to find out the situation.

(5) After the test is completed, the regulator should be returned to zero by pressing the button within a few seconds, and then cut off the power supply.

(6) This product shall not be used beyond the rated parameters. Full voltage power-on or power-off is never allowed except as necessary for testing.

(7) When using this product for high voltage test, in addition to being familiar with this manual, you must strictly follow the relevant national standards and operating procedures. Refer to GB311-83 "High voltage transmission equipment insulation coordination, high voltage test technology"; “Electrical equipment preventive test procedures”, etc.

Appendix 1 10kV Distribution Transformer

Table 1 10kV distribution transformer Parameters

rating capacity(kVA)	HV(kV)	LV(kV)	Io%	Uk%
30	10	0.4	1.5	4
50			1.3	
63			1.2	
80			1.2	
100			1.1	
125			1.1	
160			1.0	
200			1.0	
250			0.9	
315			0.9	
400			0.8	
500			0.8	

630			0.6	4.5
800			0.6	
1000			0.6	
1250			0.5	
1600			0.5	
2000			0.4	5
2500			0.4	
3150			0.4	5.5
4000			0.4	
5000			0.4	

Table 2 Recommended Settings for no-load test of 10kV distribution transformer

Rating capacity(kVA)	Testing Voltage (kV)	Testing current (A)	No-load capacity (kVA)	PT gear	CT gear	Intermediate transformer usage	Reactive power compensation usage
30	0.4	0.65	0.45	1.5kV	5A	no	no
50		0.94	0.65				
63		1.09	0.756				
80		1.39	0.96				
100		1.59	1.1				
125		1.98	1.375				
160		2.31	1.6				
200		2.89	2				
250		3.25	2.25				
315		4.09	2.835				
400		4.62	3.2				
500		5.77	4		10A		
630		5.46	3.78				
800		6.93	4.8				
1000		8.66	6				
1250		9.02	6.25				
1600		11.55	8		20A		
2000		11.55	8				
2500		14.43	10				
3150		18.19	12.6				
4000		23.09	16		50A		
5000		28.87	20				

Table 3 Recommended Settings for load test of 10kV distribution transformer

Rating capacity(kVA)	Testing Voltage (kV)	Testing current (A)	No-load capacity (kVA)	PT gear	CT gear	Intermediate transformer usage	Reactive power compensation usage
30	0.4	1.73	1.2	1.5kV	5A	NO	NO
50		2.89	2				
63		3.64	2.52				
80		4.62	3.2				
100		5.77	4		10A		
125		7.22	5				
160		9.24	6.4				
200		11.55	8		20A		
250		14.43	10				
315		18.19	12.6				
400		23.09	16		50A		
500		28.87	20				
630	0.45	36.37	28.35				
800		46.19	36				
1000		57.74	45		100A		
1250		72.17	56.25				
1600		92.38	72				
2000	0.5	115.47	100		200A		
2500		144.34	125				
3150	0.55	181.87	173.25				C3
4000		230.94	220				C1
5000		288.68	275				C1+C3

Appendix 2 35kV Distribution Transformer

Table 1 Parameters of 35kV distribution transformer

Rating capacity(kVA)	HV(kV)	LV(kV)	Io%	Uk%
50	35	0.4	1.3	6.5
100			1.1	
125			1.1	
160			1.0	
200			1.0	
250			0.95	
315			0.95	

400			0.85	
500			0.85	
630			0.65	
800			0.65	
1000			0.65	
1250			0.6	
1600			0.6	
2000			0.55	
2500			0.55	
3150			0.45	
4000			0.45	7
5000			0.45	

Table 2 Recommended Settings for no-load test of 35kV distribution transformer

Rating capacity(kVA)	Testing Voltage (kV)	Testing current (A)	No-load capacity (kVA)	PT gear	CT gear	Intermediate transformer usage	Reactive power compensation usage
50	0.4	0.94	0.65	1.5kV	5A	NO	NO
100		1.59	1.1				
125		1.98	1.375				
160		2.31	1.6				
200		2.89	2				
250		3.43	2.375				
315		4.32	2.9925				
400		4.91	3.4				
500		6.13	4.25		10A		
630		5.91	4.095				
800		7.51	5.2				
1000		9.38	6.5				
1250		10.83	7.5		20A		
1600		13.86	9.6				
2000		15.88	11				
2500		19.85	13.75				
3150		20.46	14.175		50A		
4000		25.98	18				
5000		32.48	22.5				

Table 3 Recommended Settings for no-load test of 35kV distribution transformer

Rating capacity(kVA)	Testing Voltage	Testing current (A)	No-load capacity	PT gear	CT gear	Intermediate transformer usage	Reactive power compensation usage

	(kV)		(kVA)				
50	2.275	0.82	3.25	3kV	5A	YES	NO
100		1.65	6.5				
125		2.06	8.125				
160		2.64	10.4				
200		3.30	13				
250		4.12	16.25				
315		5.20	20.475		10A		
400		6.60	26				
500		8.25	32.5				
630		10.39	40.95		20A		
800		13.20	52				
1000		16.50	65				
1250		20.62	81.25		50A		
1600		26.39	104				
2000		32.99	130				
2500		41.24	162.5				
3150	2.45	51.96	220.5		100A		C3
4000		65.98	280				C1
5000		82.48	350				C1+C3