Huazheng®

HZ-6300C
Transformer Capacity Testing Instrument

USER MANUAL

Huazheng Electric Manufacturing(Baoding) Co.,Ltd

Dear user:

Thank you for choosing HZ-6300C Transformer Capacity Testing Instrument.

We hope that this instrument can make your work easier and more enjoyable, so that you can get the feeling of office automation in the test and analysis work.

Before using the instrument, please read this manual, and operate and maintain the instrument according to the manual to prolong its service life. "Just a light press, the test will be completed automatically" is the operating characteristics of this instrument.

If you are satisfied with this instrument, please tell your colleagues; if you are not satisfied with this instrument, please call (0312) 6775656 to tell you to serve you at all times-Baoding Huazheng Electric Manufacturing Co., Ltd., our company will definitely make you satisfied !

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I.Introduction

Transformer Capacity Testing Instrument is specialized in bad power users evading basic electricity secretly adds capacity problems and is a high precision instrument specially used for the measurement of the transformer capacity and parameters. This product uses color LCD monitor, English display, simple and quick menu operation, man-machine interface is friendly. The internal of the instrument has a rechargeable battery and it can work without external power source. A fully charged battery can be continuously measured more than 100 sets. In addition, the instrument can provide three-phase precise 50Hz sine wave AC test power without the external three-phase test power, the pressure regulator, up flow reactor and other auxiliary equipment in measuring the capacity and transformer load loss, thus greatly improving the efficiency of the work.

This is a multi-functional measuring instrument, which is equivalent to two common devices: activity transformer capacity tester and transformer parameter tester. It can be used for test transformer capacity, model, no-load current, no-load loss, load loss, impendence voltage and so on.

This product has many advantages such as small, light , high accuracy, stability, simple operation and so on. It can replace the multi-meter method to measure the transformer loss and capacity with simple wiring and convenient testing so that the work efficiency can be greatly improved.

Function

- We can measure a variety of distribution transformer, power transformer capacity instead of the additional power. It is more convenient and efficient.
- Combined with the power, voltage, boost up flow and other equipment, it measures various transformer no-load current, no-load loss, impedance voltage, load loss and so on.
- All results are automatically carried out relevant correction. You only need to input the related parameters (such as temperature, load adjustment coefficients), then the instrument can automatically correct such as waveform deformity correction, temperature correction, correction of non rated voltage, rated current correction.
- The maximum voltage is up to 750V and the maximum current is up to 100A. It is equipped with protection circuit.
- The voltage and current range can be very flexible and easy to expand.
- It has large screen, high brightness LCD display, English menu and operation tips, friendly man-machine interface and wide temperature, brightness adjustable type LCD screen, which can adapt to the different temperature.
- According to the test results of no-load and load loss, it can automatic presume the three-phase oil immersed distribution transformer and power transformer's performance levels as the reference (this instrument is currently only available for three-phase oil immersed transformer and power transformer performance level code. Others are invalid.)

II.Definition of Testing Transformer

Transformer capacity and characteristic test is the professional test. There are many setting part and items of testing method.

1. Tap

In the transformer with topped winding, every tap in this winding stands for a fixed turn number of windings in this tap, which also means a fixed turn number of windings between this tap winding with other constant windings

2. Principal Tapping

Tap corresponds to the rated parameters. Attention: The data of load/no-load loss and no-load current is the data of transformer under the principal tapping (except for appointed other taps)

3. On-load Tap Charger

It is the device that is used to change the position of tap of transformer winding under operating with excitation or no-load.

4. Off-circuit Tap Charger

It is the device that is used to change the position of tap of transformer winding under operating without excitation.

5. No-load Loss (commonly known as: iron loss, iron loss)

When rated voltage (tapped voltage) under rated frequency is applied to terminal of one winding and open circuit of other windings, it is the active power.

6. No-load Current

When rated voltage (tapped voltage) under rated frequency is applied to terminal of one winding and open circuit of other windings, it is the root average of current.

Note 1: For three phase transformer, it is the average of current of three phase terminals.

Note 2: Generally use the percent of current to display. For the multi-winding transformer, it is based on the winding with max rated capacity.

$$z = \frac{Z}{Z_{ref}} \times 100$$

$$Z_{ref} = \frac{U^2}{S_r}$$

7. Load Loss (Short Circuit Loss/Copper Loss)

It is the active power in one pair of winding, when rated current flows through the line terminal and short circuit of the other terminal under the rated frequency and reference temperature. If it has other windings, please make them open circuit.

Note1: For the double winding of transformer, there is just one pair of windings and one value of load loss.
For multi-windings of transformer, there are multi pairs and value of loading loss.

Note2: When the capacity of the two windings, it should be based on the rated current of the windings with the lower rated capacity, and appointed to the reference capacity.

8. Total Loss

The sum of load loss and no-load loss.

9. Short Circuit Impedance

Generally, short circuit impedance is the impedance of the pair winding.

Under the rated frequency and reference temperature, the equivalent series impedance of one pair windings between the terminals of winding is Z=R+jX(Ω). Now, the terminal of the other one need to short circuit. If there are other windings, they need to open circuit.

Note1: For the transformer with tapped windings, short circuit impedance need to appoint the tap, if there is no special instruction, it is the principal tap. For the three phase transformer, it means the impedance of single phase.

Note 2: It can be represented using non-dimensional relative value that means fraction Z of reference impedance Zref in same winding of one pair windings, as follows:

Formula is suitable for the three phase and single phase transformer.

U——Voltage of Z and Z_{ref} in windings (rated voltage or tapped voltage)

Sr——Basic value of rated capacity.

The relative value is equal to the ratio between the voltage and rated

voltage (tapped voltage) when operator wants to get the rated current (tapped current) in short circuit test. This voltage also called the short-circuit voltage of this pair windings. It is generally expressed as a percentage.

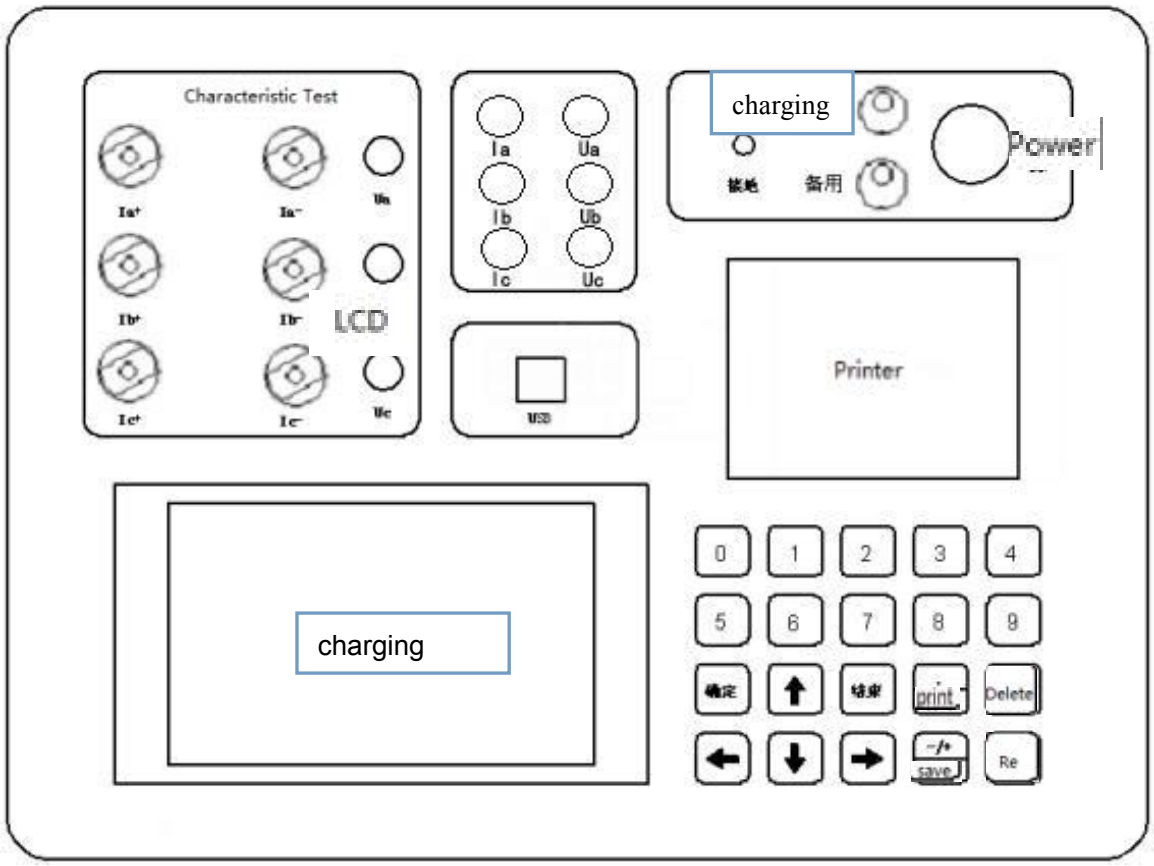
III.Technical Parameters

1. The output range of built-in battery
   Voltage：0～10V
   Current：0～10A
2. The output range of characteristic test battery
   Voltage：0～750V
   Current：0～100A
3. Accurate
   Voltage, current：±0.2%
   Power：±0.5%（CosΦ>0.1），±1.0%（0.02<CosΦ<0.1）
4. Working temperature
   -20℃～+60℃
5. The requirement of charger
   Electric supply AC160V～265V
6. Insulation
   ⑴ Insulation resistance between capacity , voltage, current and cover ≥100MΩ
   ⑵ Power frequency is 2KV(effective value) between the input power and cover, testing time is 1 minute.
7. Volume
   32cm×25cm×12cm
8. Weight
   2.5KGS

IV.Function of Interface

1. Operation panel diagram.

The operation panel like figure 1 : including printer , LCD, keyboard, the wiring hole of capacity test , binding post of characteristic test and communication interface.



2. Main Menu

After open the power switch, automatic enter into the main menu (Figure 2) Main Menu includes: "Transf. Power", "No - load loss", "Load loss", "Data Browser", "System Settings" and other five. You can use the "↑", "↓", key to select the desired function and click "OK" to enter.

At the same time, the instrument according to the system's internal clock chip, accurately display the current time.



3. Transf. Power

3.1 Transformer Power Testing Setup

In the main menu, select the "Transf.Power" item and click "OK", then it enter into parameter setting interface before the test, total are 10 items(Figure 3).

Primary U: Before making the determination of transformer Power, you need to input the working voltage of the transformer correctly, which is the transformer primary rated voltage. Enter directly through keyboard, Unit: KV.

Secondary U: Before making the determination of transformer Power, you need to input the working voltage of the transformer correctly, which is the transformer secondary rated voltage. Enter directly through keyboard, Unit: KV.

The input data of the primary voltage and secondary voltage are not higher than 500kv, and if the input data is not included in those following voltage levels, the instrument will change "Transformer Type" into "non-standard transformers." When testing "non-standard transformer," you need enter the measured transformer "impedance voltage" to measuring transformer capacity accurately. The following 12 transformer voltage levels is included by our instrument: 10kV / 0.4kV, 10kV / 3kV-6.3kV, 35kV / 0.4kV, 35kV / 3.5kV-11kV, 6kV / 0.4kV, 6kV / 3kV-3.15kV, 6.3kV / 0.4kV , 12 6.3kV / 3kV-3.15kV, 10.5kV / 0.4kV, 10.5kV / 3kV-6.3kV, 11kV / 0.4kV, 11kV / 3kV-6.3kV etc.(In front of “/ ” is the transformer primary rated voltage, after “ / “ is the secondary transformer rated voltage).

Transf. Types: Setting the type of transformer under test. Main parameters settings include "SJ (73) Transf.", "S7.S9 (11) Transf. ", "S7.S9 (11) Power", "S13 Transf.", "Coating CRDT", "unCoating CRDT", "NonStand. Transf."etc,7 alternatives. "Nonstand.Transf." includes non-distribution transformer special transformer and those transformers which their rated voltages are not within the voltage levels listed in above table. When selecting "S7.S9 (11) Transf." or "S7.S9 (11) Power", and when the capacity test is completed, the system will estimate the type of the measured transformer, depending on the load loss data measured by instrument. The determination result can be used for operator reference.

Nomial Uz(%): If you want to the accurate result of capacity When testing the "NonStand. Transf." , you should input impedance voltage accurately. You can enter data directly using the number keys. When testing the other transformers except "NonStand. Transf." type. The instrument will display impedance voltage according to the rated voltage and transformer type. Under normal circumstances, operators can carry out test without modify data except when the test impedance voltage has large difference with impedance voltage marked on the transformer nameplate, it is recommended to change its impedance voltage data, to make it closer to the marked "Nomial Uz(%)" data., better for transformer capacity testing.

Testing Temp.: Capacity test required temperature correction, so we need to input current temperature. Generally inputting data is the data of under test transformer's back side temperature add 10 ℃. You can enter the data directly via the numeric keys.

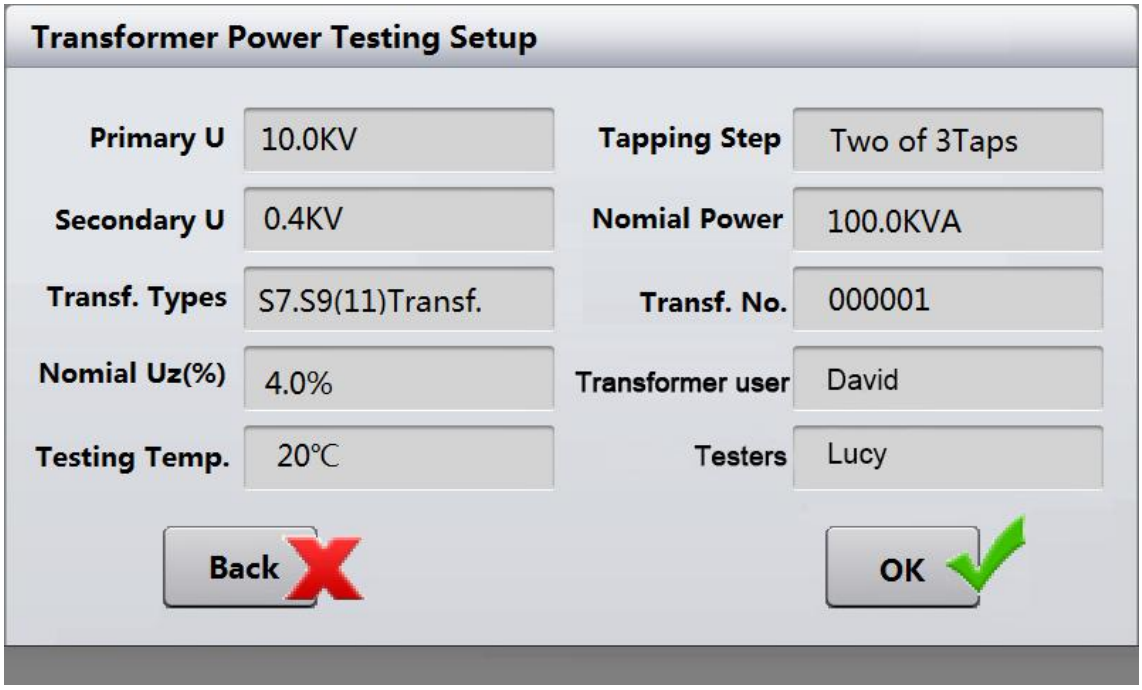


Figure 3 Transformer Power Testing Setup

Tapping Step: the tap-changer position of the transformer under test. Distribution transformers usually have three tap stalls; two of them are standard taps. When capacity measuring, please keep the tap-changer position of the transformer

under test same as the data set in this item. if under test transformer's tap position instead of three, please set this item to 2 tap position, at the same time change the transformer's tap-changer position to standard tap position before the capacity test. The data can be changed by clicking "←", "→" key.

Nominal Power: As a reference of the measurement result, here input the nominal capacity of the transformer measured, in order to compare with the measured capacity. This item can be input directly via the numeric keys.

Transf. No.: 6 digits of number in order to check and save, inputting through keyboard

The above items are set finished, and after the wiring is correct (see later for details), click "OK" button can perform capacity test.

3.2 Transformer Power Test Results

Test results screen shown in Figure 4. It includes the following:

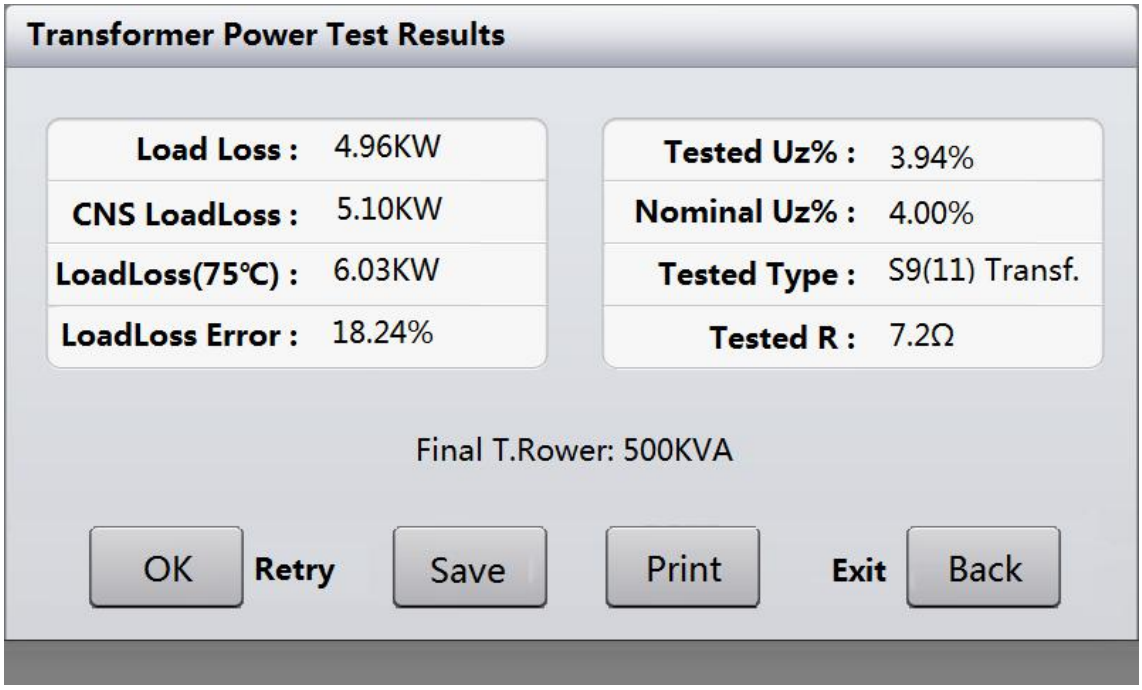


Figure 4 Transformer Power Test Results

Load Loss: under the current test conditions the actual measured load loss;
CNS LoadLoss: if archive measured capacity result, it will display the transformer load loss CNS(Chinese National Standard) data of archive position;
LoadLoss(75℃): the measured load loss correction to the rated load loss data obtained by rated experimental conditions;
LoadLoss Error :correction percentage of error between loss and GB loss;

Tested Uz(%): impedance voltage of measured transformer in the current test conditions;
Nominal Uz(%): impedance voltage data used during the capacity test;
Final T.Power: when measured transformer capacity can be archived, the item displays archived capacity data. When measured transformer capacity cannot be archived, the item is not displayed;
Tested Power: the item displays the actual measurement capacity of the transformer. When measured capacity can be archived, the item is not displayed;
Tested Type: When set the parameter before capacity test, transformer type is set to "SJ.S7.S9 (11) distribution transform " or "S7.S9 (11) power converter", the system will display the estimated type of transformer under test, such as SJ distribution transformer, or S7 distribution transformer (or power converter) or S9 (11) distribution transformer (or power converter). For tester reference. When the measured capacity can not be archived, will show "----."
Tested R: Displaying the short circuit resistance of testing transformer understand calibrating up to 75℃ rated condition.
After testing, Click “Save”, testing result can be saved in instrument in order to check in future; click “Print”, testing result can be printed; click “End”, Screen returns to the part of setting up parameter.

4. No-Load Loss.

Please choose “No-Load Loss“on the menu, and click “ok”, and then setup the no-load test. No-load test is the test of AC power (including boosting voltage, regulating voltage, boosting current)

4.1 Setting

Before testing, necessary parameters need to set up. Operator can set up the parameter by moving “↑” and“↓” on the screen.

Related parameter as follows: primary voltage, secondary voltage, nominal capacity, transformer model, transformer connection, testing model, voltage ratio, current ratio, and transformer No., operator and so on. ” Transformer model, connection of transformer, testing model can set up by moving “↑” and“↓” , other can input data.

Primary U: Inputting the working voltage before testing is the primary rated voltage, which can input directing by using keyboard. Unit is KV.

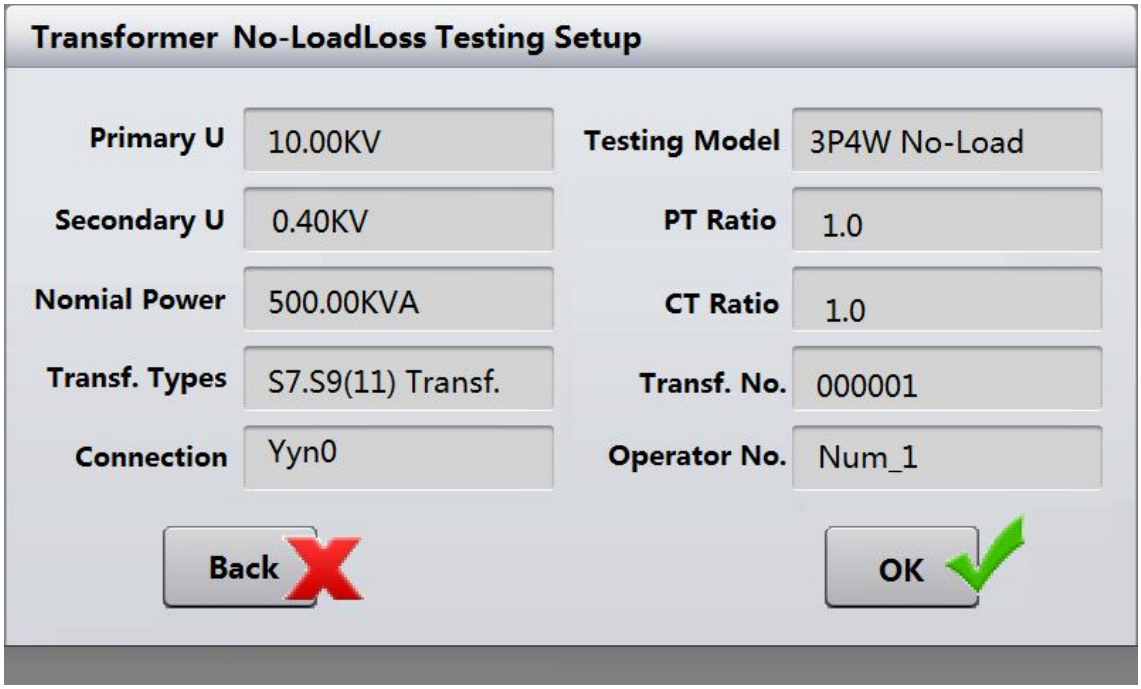


Fig5 Setting screen

Secondary U : Inputting the working voltage before testing is the secondary rated voltage, which can input directing by using keyboard. Unit is KV.

Nominal Power: Rated capacity of testing transformer

Transf. Types : Setting up the transformer model.

Main setting model: "SJ (73) Transf.", "S7.S9 (11) Transf. ", "S7.S9 (11) Power", "S13 Transf.", "Coating CRDT", "unCoating CRDT", "NonStand. Transf."

Connection : Testing model of connection of transformer , it can choose by using "←"、"→"according to nameplate

Testing Model: including "3P4W No-Load""1Phase No-Load", "3P3W No-Load"

PT Ratio: When testing voltage is over than the testing range of instrument, user can extend the voltage through connecting PT. This data is the ratio between the rated voltage and the connection PT(for example: 10KV/0.1KV PT =100). When it is not necessary to connect PT, the ratio is 1.

CT Ratio: same with Voltage ratio. When testing current is over than the testing range of instrument, user can extend the current through connecting CT. This data is the ratio between the rated current and the connection CT(for example: 10KV/0.1KV CT =100). When it is not necessary to connect CT, the ratio is 1.

Transf. No. : 6 digits of number in order to check and save.

Operator No.: Operator No. in order to check and save.

After inputting, Click "Save", data can be saved in instrument in order to check in future; click "End", cancel this operation, click "End" again, Screen returns to the part of setting up parameter.

4.2 3P4W No-LoadLossTesting

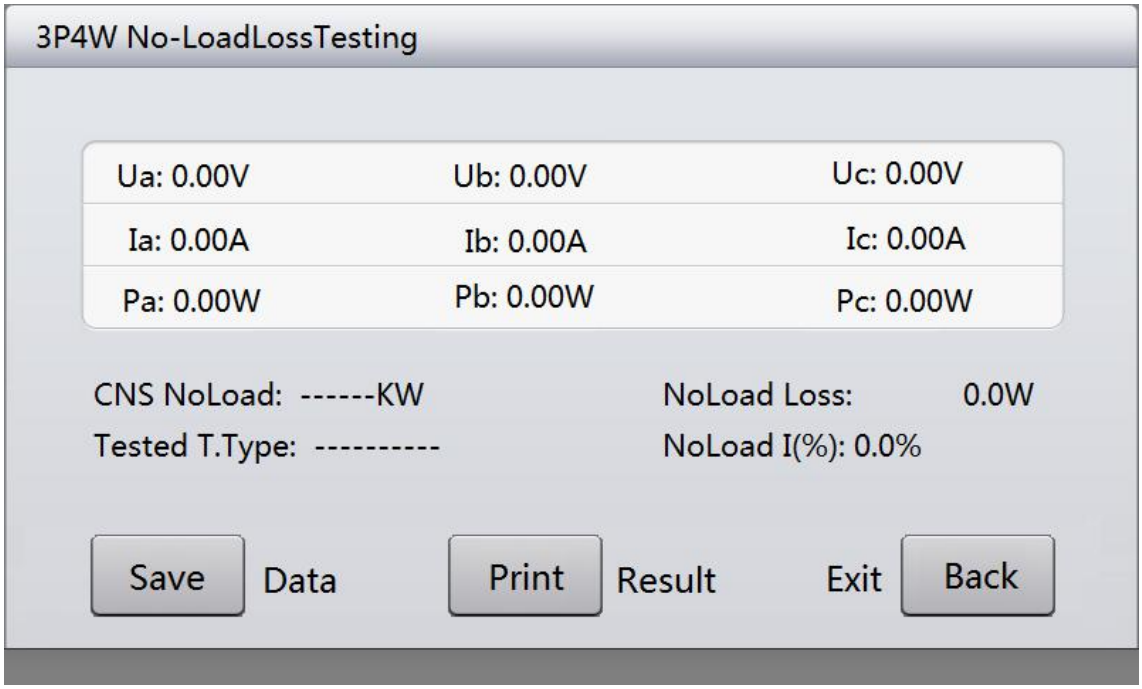


Fig6 3P4W No-LoadLossTesting

Changing the testing method to “3P4W No-Load” through moving the “↑”、“↓”、“←”、“→” on no-load test screen, and then beginning test(please see the following instruction)

Testing result shows Voltage(Ua、Ub、Uc); Current(Ia、Ib、Ic) ; Active loss (Pa、Pb、Pc). Other result is Io ,Po after calibrating and the level No. of transformer according to the test. Click “Print “to print , click “save “ to save.

The instrument will automatically save the result when the input voltage is up to rated voltage under 3 phase no-load test. Upon saving , power can cut off. Data also can be saved through clicking “enter” when the input power is not up to rated voltage.

4.3 3P3W No-Load

Changing the testing method to “3P3W No-Load” through moving the “↑”、“↓”、“←”、“→” on no-load test screen, and then beginning test(please see the following instruction)

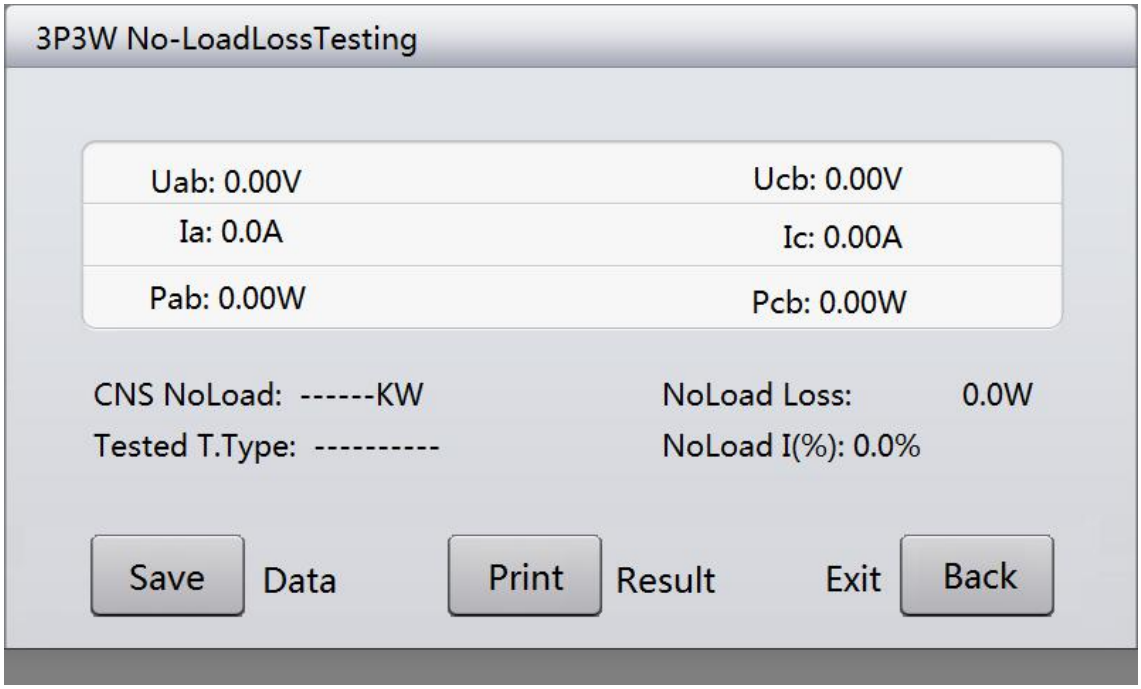


Fig7 3P3W No-Load

Testing result shows Voltage(Uab/Ucb); Current(Ia/Ic) ; Active loss (Pab、Pcb). Other result is Io ,Po after calibrating and the level No. of transformer according to the test. Click “Print “to print , click “save “ to save.

The instrument will automatically save the result when the input voltage is up to rated voltage under test. Upon saving , power can cut off. Data also can be saved through clicking “enter” when the input power is not up to rated voltage.

4.4 1Phase No-Load Test

Changing the testing method to “1Phase No-Load Test” through moving the “↑”、“↓”、“←”、“→” on no-load test screen, and then beginning test(please see the following instruction)

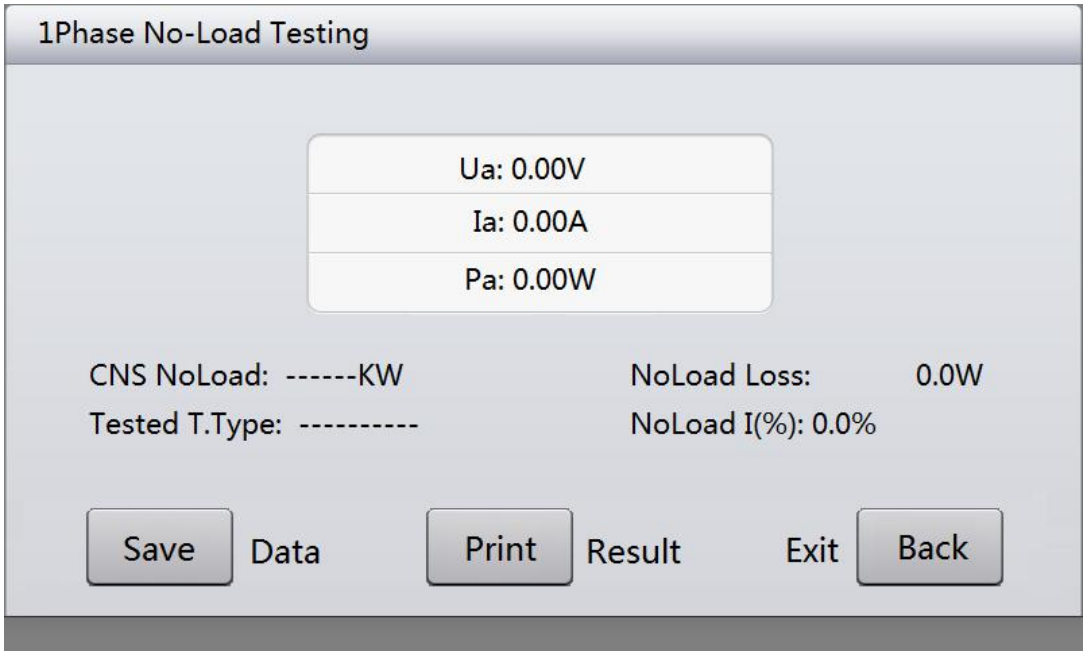


Fig8 1Phase No-Load Test

Testing result shows Voltage (Ua); Current (Ia) ; Active loss (Pa). Other result is Io, Po after calibrating and the level No. of transformer according to the test. Click “Print “to print, click “save “to save.

The instrument will automatically save the result when the input voltage is up to rated voltage under single phase no-load test. Upon saving , power can cut off. Data also can be saved through clicking “enter” when the input power is not up to rated voltage.

5 Load Loss

“Load Loss” and “No-Load Loss” have similar screens and operations. The difference as follows:

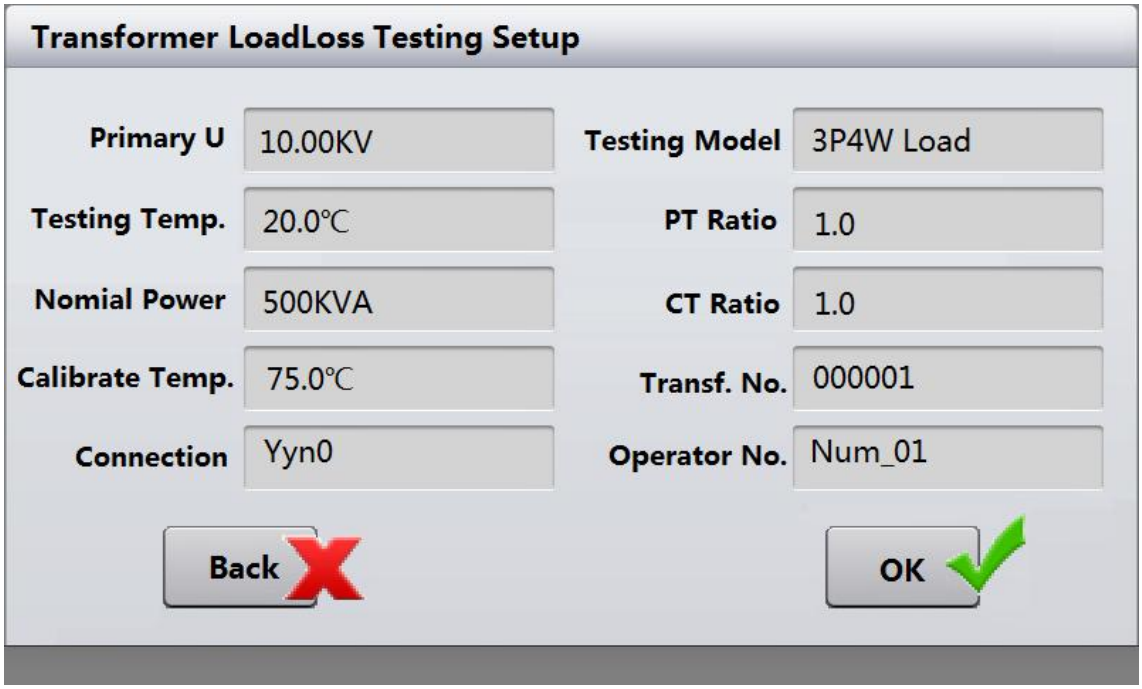


Figure 9 Parameter settings interface for the load test

5.1 Parameter setting

It needs to set some necessary parameters before the load test. On the interface of setting load test,moving cursor by the “↑”,“↓”,“←”,“→”keys, and enter "parameter Settings" interface.(Figure 9).

Primary voltage: Inputting the working voltage of the transformer correctly before the determination of the transformer capacity, this is a rated voltage of the transformer, which can be inputted directly through the digital keyboard. Unit: KV.

Testing Temp.: It is used to test the load loss correction to the standard load test conditions(Such as 75 ℃),the correction formula of load loss is $P_{k75} = K \times P_k$,K is temperature coefficient of resistance .The algorithm is $K = \frac{(235+75)}{(235+t)}$,T is the actual temperature when test. The temperature correction formula of impedance voltage is $Uk = \sqrt{U_{KT}^2 + (P_{KT}/10S_N)^2(K^2-1)}$, U_{KT} is the actual percentage of impedance voltage and temperature, P_{KT} is the actual load loss of the current temperature, S_N is the actual tested transformer rated capacity. Please use infrared thermometer to measure t

he current temperature of the transformer under test, and input through the digital key.

Nominal capacity: the participant rated capacity of transformer.

Calibrate Temp.: As mentioned in the "Testing Temp." item, load loss experiment results need to be checked, proofreading to uniform temperature range, this is the uniform temperature range. General calibration of oil-immersed transformer temperature is 75 ℃, while the dry type transformer has a variety of different temperature correction.

Connection: The test method of transformer connection group. Please accord to the nameplate to choose by press ,“←”,“→”button.

Testing Model :This project contains the content of four modes, they are "In3P4W Load", "3P4W Load", "1Phase Load", "3P3W Load”, the specific connection mode please refer to the state later.

PT Ratio: When the measured voltage value exceeds range after the instrument itself, users can extend the testing range by the external voltage transformer, This parameter is for outside enlarge voltage transformer ratio, (for example: 10 kV / 0.1 kV voltage transformer, should enter 100).When not use outside enlarge voltage transformer, please enter 1.

CT Ratio: same with Voltage ratio. When testing current is over than the testing range of instrument, user can extend the current through connecting CT. This data is the ratio between the rated current and the connection CT (for example: 10KV/0.1KV CT =100). When it is not necessary to connect CT, the ratio is 1.

Transf. No. : 6 digits of number in order to check and save.

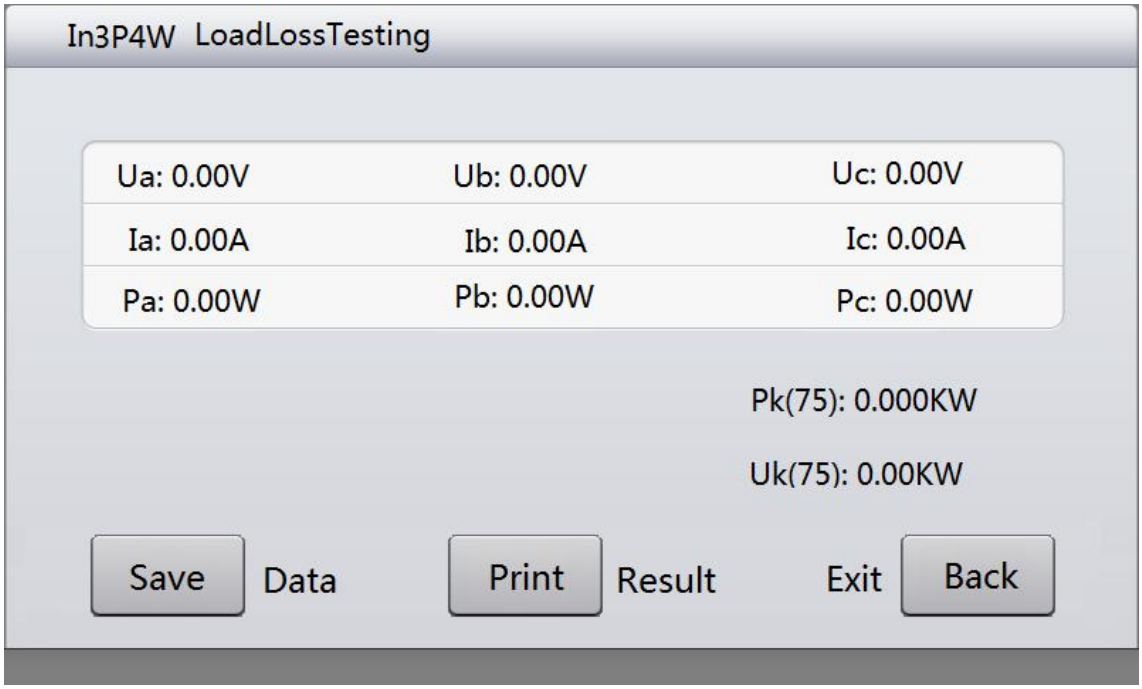
Operator No.: Operator No. in order to check and save.

When you input the correct data, you can click the "ok" button to save the data. Click the "end" button, you can cancel the input. Again, click the "end" button to return to main interface.

5.2 In3P4W Load Loss Testing(Active Three-phase Load Testing)

“In3P4W Load” approach is to use an instrument built-in three-phase power supply as a test power. Results show Uk, that is the after correction impedance voltage, adjusted the load loss Pk (75).The correction here refers to the value of the load voltage

and load loss which measured by the load test when not under the rated power, co rrect to the rated power, and at the meaning time, the temperature correct to the sta ndard test conditions (such as 75 ℃).the calibration of load test are all this mean, s o not repeat any more. Please see figure 10.



Figue 10 In3P4W LoadLossTesting

5.3 3P4W Load Loss Testing

The function is basically the same between the 3P4W Load Loss and the In3P4W L oad Loss, the only difference is the selection way of test power source, Active three-phase load test is to use an instrument built-in three-phase power supply as a test p ower, while the three-phase load test is the external power supply as a test power. Detailed wiring method, please refer to the back of the detailed description.

Test and the content display is the same with the active three-phase load test, Not r epeat description any more.

Note: The instrument will automatically latch the result if the short circuit current reac hes rated current of the transformer when testing. The testing power supply can be s topped once the test result is latched. In the process of test, you can also latch test results temporarily by clicking the "ok" button.

5.4 The other load testing

Wiring method is the main difference between 3P3W Load Loss and 1Phase Load; D etails please see the back of the specific wiring instructions.

The test results are the basic same. Refer to figure 11 and figure 12.

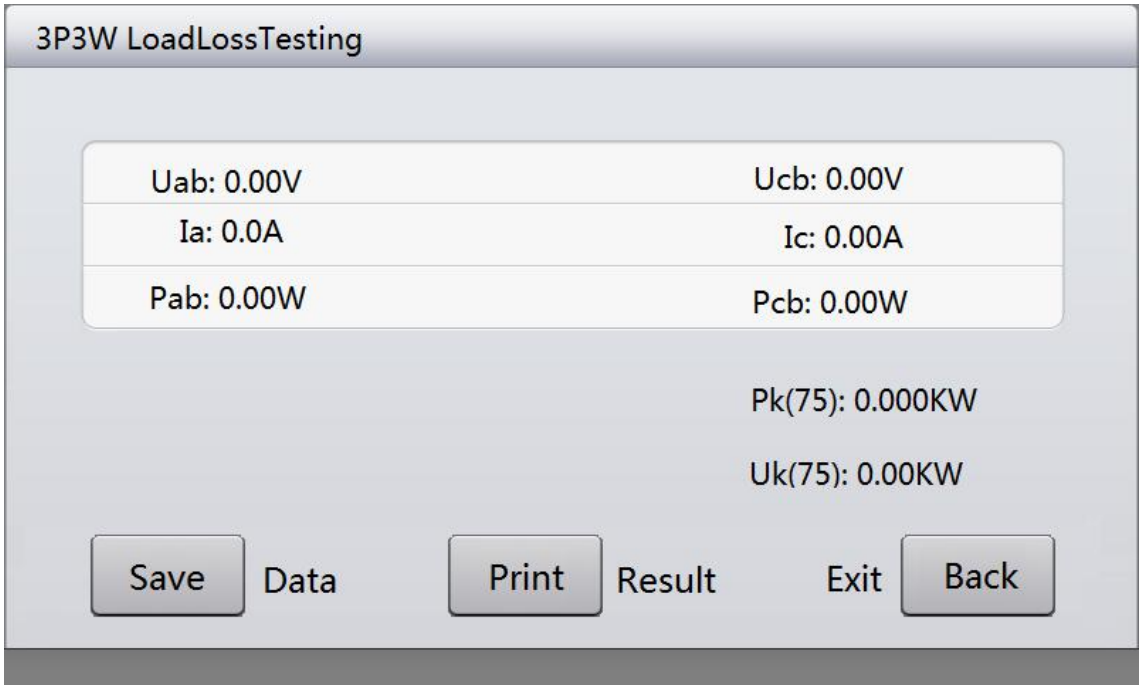


Figure 11 3P3W Load Loss

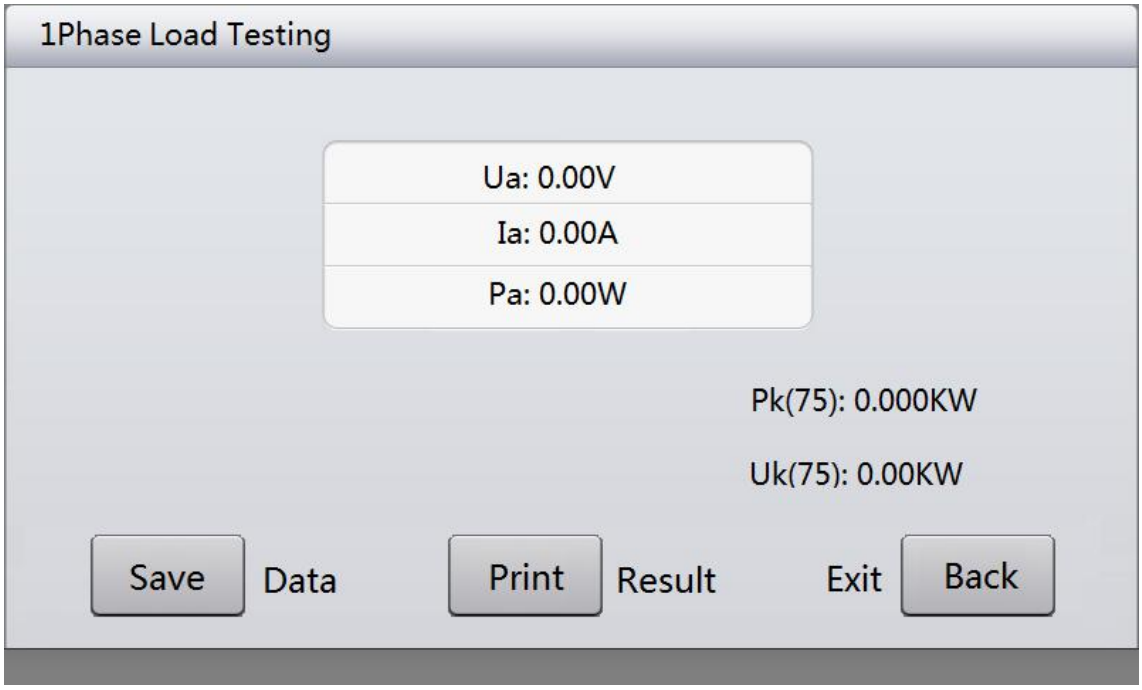


Figure 12 1Phase Load Testing

Note: The instrument will automatically latch the result if the short circuit current reaches rated current of the transformer when testing. The testing power supply can be stopped once the test result is latched. In the process of test, you can a lso latch test results temporarily by clicking the "ok" button.

6. Data Browser

Selected in the main menu interface "Data Browser", and click "ok" button and enter the data query interface (FIG. 13, 14)

Data shown here is the saving data of test result.When the preservation of "no-load test" or "load test" data,The lower right corner of figure 13 will display“→”，then,By pressing the “←”、“→” button to view the capacity test, no-load test, load test of the test results.Using "up", "down" to see other transformers storage page.Click "print" button to print the current page data.Click "delete" button, you can delete the current record or all of the records. Click the "end", that is, back to the main menu.

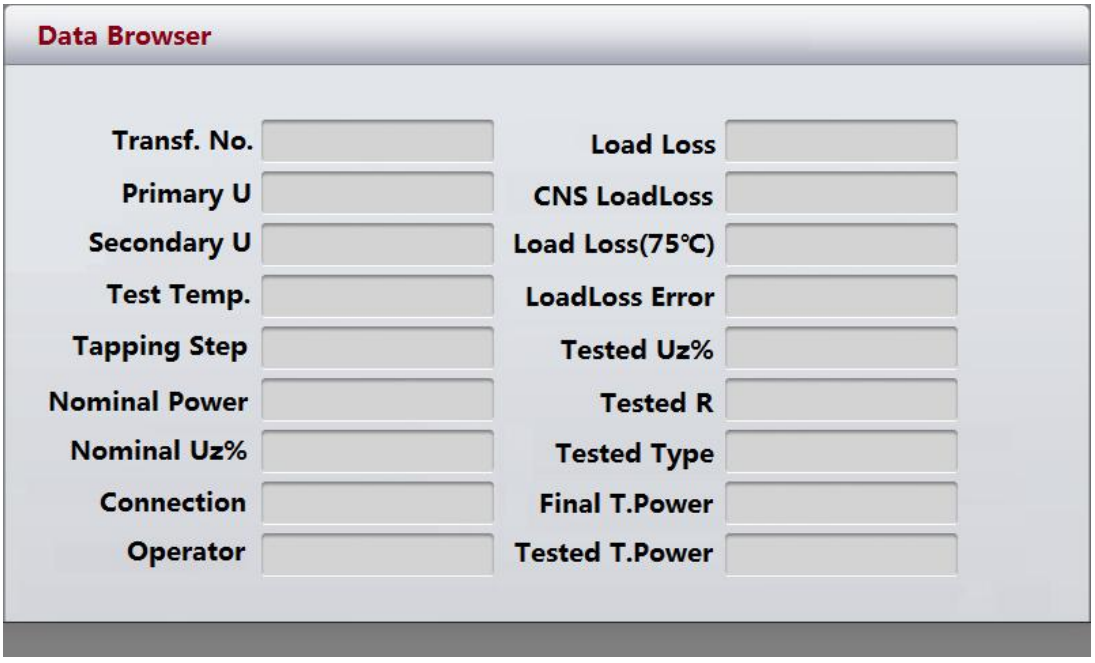


Figure 13　Store data browsing interface—1

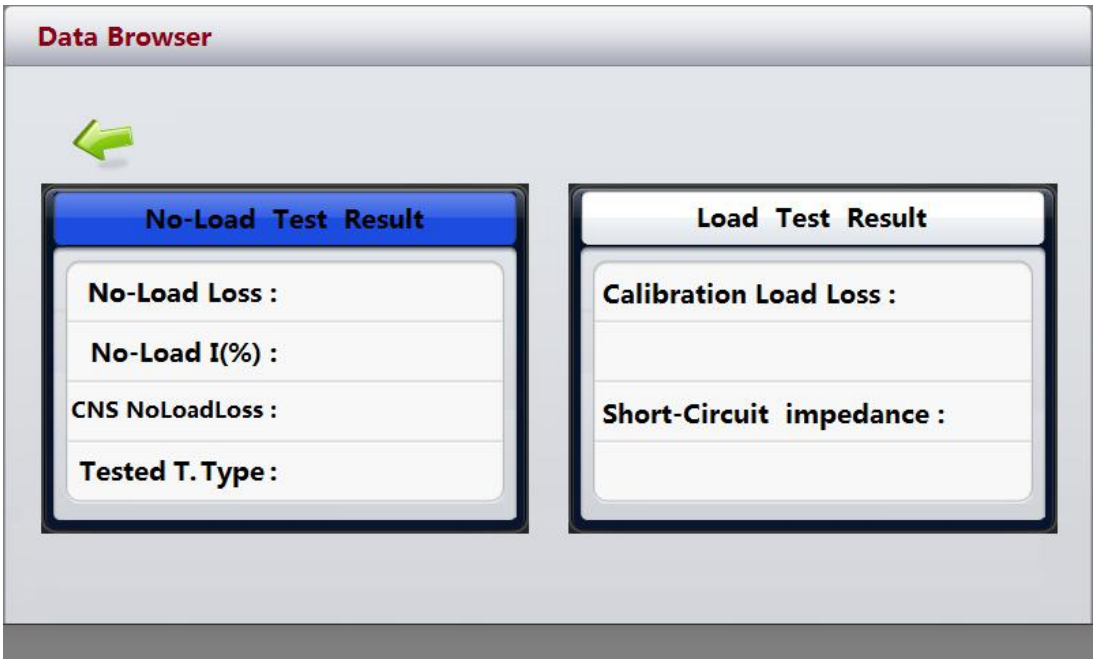


Figure 14 Store data browsing interface—2

7.Data upload

When you need to upload data to the host computer database, please open the instrument power, and then through the data line to connect the instrument with the computer correctly, according to the prompts to install the driver. Operation capacity of communication software, select the corresponding COM port and click on the Toolbar "Upload" button, open upload interface , click the "upload data", at this time, can be stored in the instrument of the previous test data uploaded to the computer. For the use of communication software of the capacity, please refer to the operation instruction.

V.wiring method

1. Concept Introduction

No load test: Please apply rated AC rated voltage under the rated frequency (usually the 50Hz sine wave) from one winding of transformer; other windings need to open circuit. The measurement result includes the no-load current and no-load loss.

If the test condition is limited, the power supply voltage is not up to the rated voltage, which can be tested under the condition of non-rated voltage. But the error of the measurement is relatively large, which is generally only used to check the transformer. Only when the test voltage is up to 70% of the rated voltage, it can be measured no-load current and no-load loss more accurately.

Load test: Please apply rated AC rated voltage under the rated frequency

(usually the 50Hz sine wave), this need to short circuit of one winding of transformer (generally the low voltage current side), and then access the Ac rated voltage from tap of coil (generally high voltage side), The current of testing terminal in winding need to up to the rated current, and then testing the load loss and load voltage

2. Wiring Method of Transformer Capacity Test and Active Load Test

As shown in figure 15. The “binding post “is just to facilitate your understanding. The actual wiring is a seven holes socket.

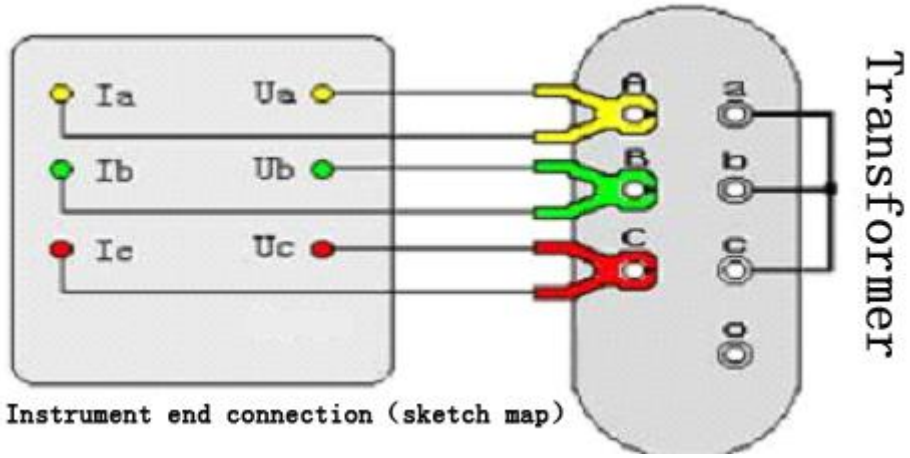


Figure 15 Capacity test and the connection method of active load test

3. Wiring Method of Single-Phase Transformer No-load Loss with Single-phase Power

When the voltage and current of the test are within the range of the instrument's measuring range, please apply the current and voltage directly to the instrument as shown in Figure 16. When the no-load loss is tested, the general low voltage side is the tested side. High voltage side is non-tested part which need to open circuit.

When the test voltage exceeds the voltage range of the instrument, please use the voltage transformer, current transformer, according to figure 17.

When the test current exceeds the test range of the instrument, but the voltage is not over, please use the current transformer to access the current, the voltage directly access, according to figure 18.

4. Wiring method of Single-phase Transformer Short-circuit Loss with Single-phase Power

It is similar with the wiring method of no-load loss test for single phase power and single phase transformer; please refer to figure 16, figure 17, figure 18. The difference is just that the short-circuit loss test, the general high voltage side for the tested side. The low pressure side is a non-tested end, in addition, the non-tested side needs to manually short circuit.

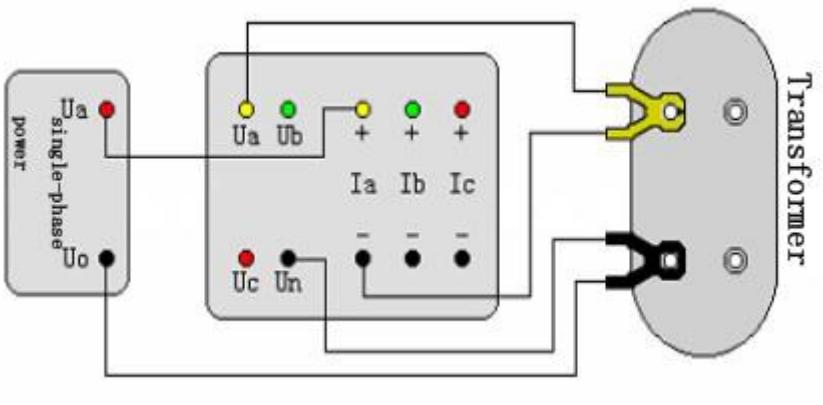


Figure 16 Direct access method for single phase load test

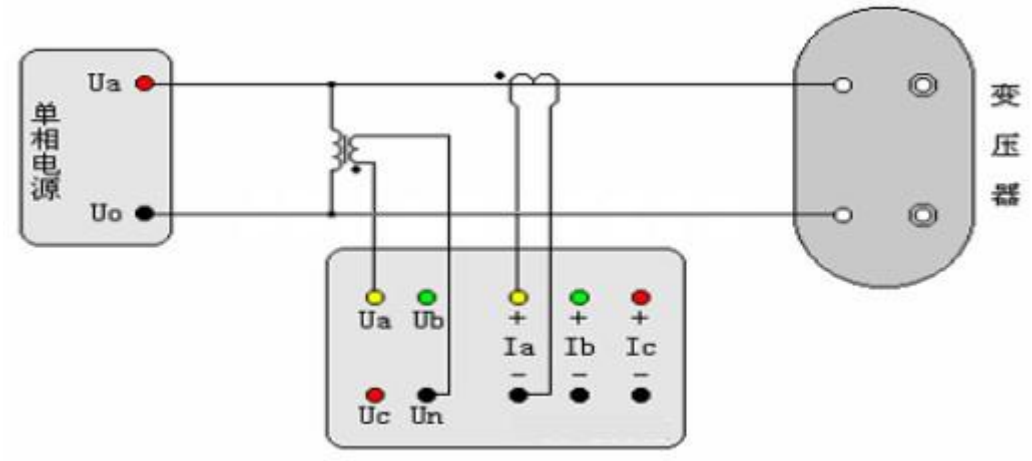


Figure 17 Single phase no-load test external PT and CT access method

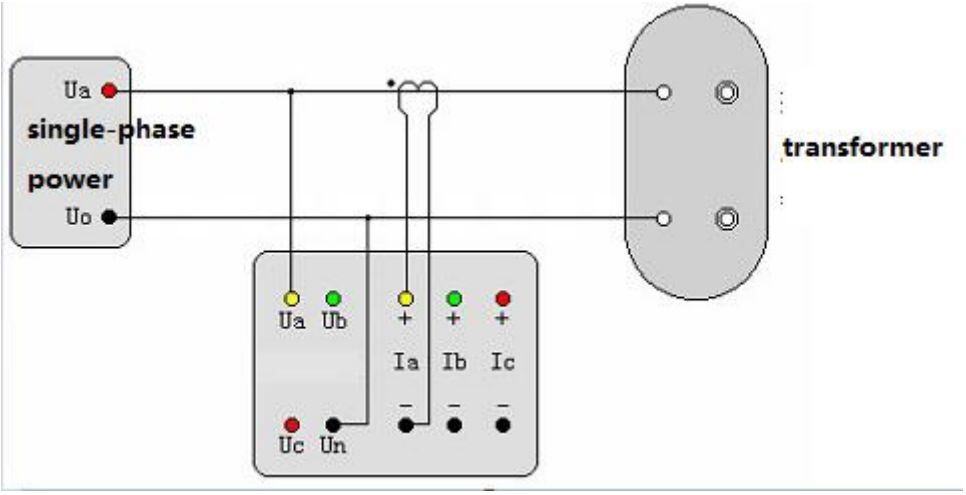


Figure 18 Single phase no-load test external CT access method

5. Wiring Method of Three-phase Transformer No-load Loss with Single-phase power

When finding the loss is over than the standard value after three phases no-load loss test, operator needs to test three losses, compare and analyze the no-load loss, observe the distributed situation of no-load loss in every phase, in order to check whether has shortage in every winding resistance. Basic method is to take the three phase transformer as three pieces separated transformers to add voltage. That means one phase of transformer need to be short circuit and then apply the voltage on the other two phases to test the no-load loss and no-load current Figure 19.20.21 are the different wiring methods according to winding resistance of tested transformer Figure 22, 23, 24 are the different methods according to the range of current and voltage.

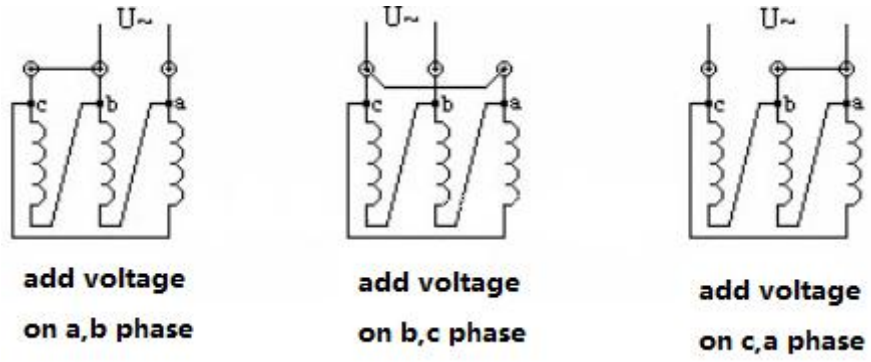


Figure 19 schematic diagram of △ Pressurized winding

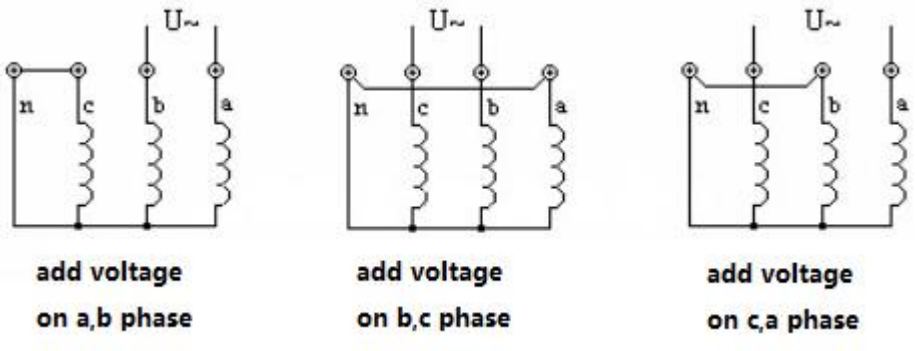


Figure 20 schematic diagram of neutral point Y Pressurized winding

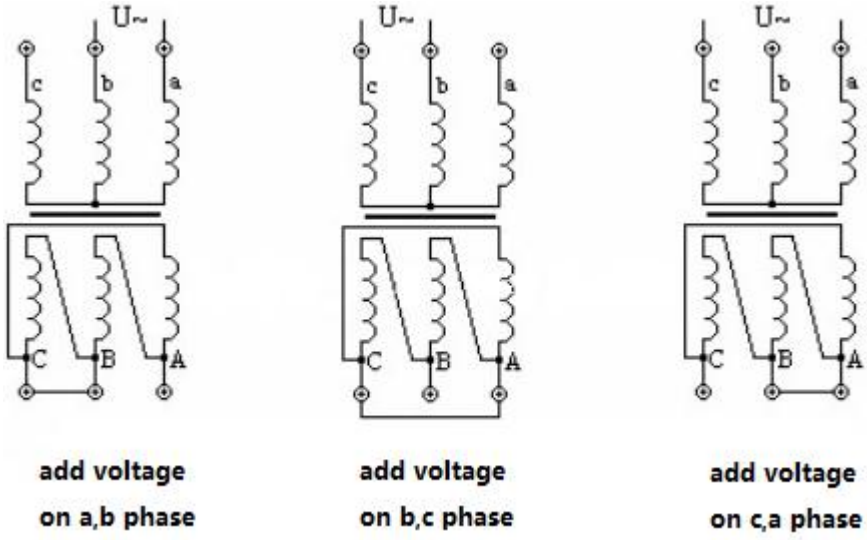


Figure 21 schematic diagram of Pressurized winding without neutral point Y

Attention: When the wiring method is the Y, please apply double voltage of phase voltage on product, When the wiring method without Y, operator should make the secondary winding resting short circuit because we can make non-pressurized winding resistance short circuit without the neural point ,

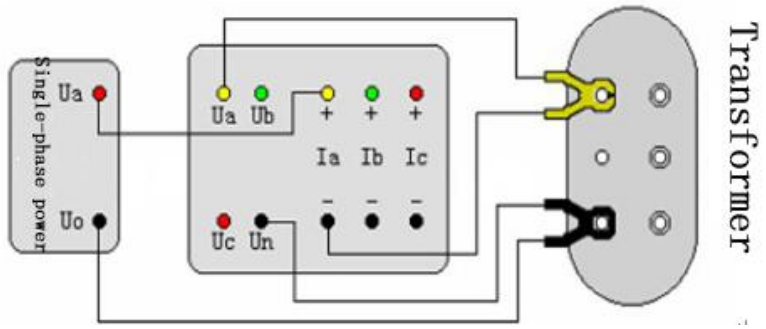


Figure22 Direct access method of single-phase power measurement of three-phase transformer with no-load loss

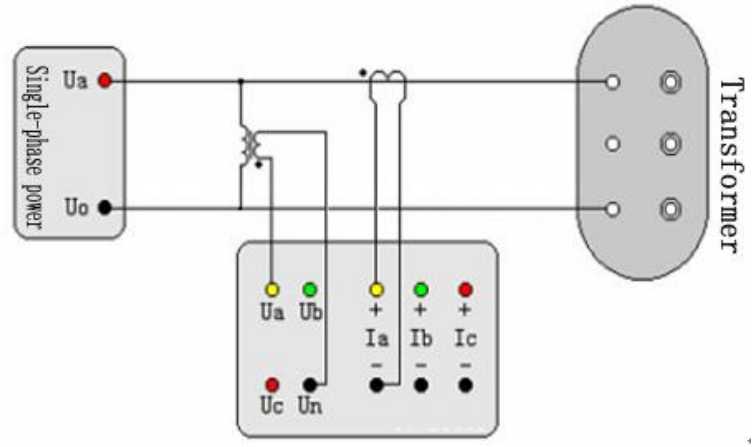


Figure 23 The single-phase power measurement of three-phase transformer no-load loss external PT and CT access method.

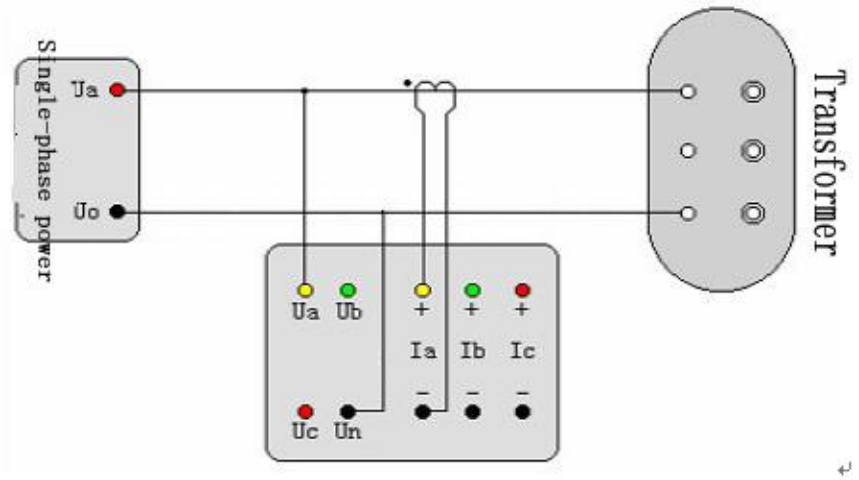


Figure 24 The single-phase power measurement of three-phase transformer no-load loss external CT access method

6. Wiring Method of Three-phase Transformer Short Circuit

Loss with Single-phase Power.

Under the influence of power (no three phase power supply or power supply capacity is small), or fault phase need to be checked during the producing process or operation, single-phase power can applied to short-circuit loss test. The test method is to make short circuit of three phase low voltage of transformer, and then test high voltage side. “Single phase test” in short circuit test of this instrument can directly test three phases without exiting current program, and then show the total result.

According to the winding connection mode of the tested transformer can be divided into two cases: A ,when the pressurized winding is type △ , please check figure 19. The difference is that the non pressurized side (usually for the low voltage side) of the three-phase outlet side need to short circuit manually. The current in the windings should be2/√3 times than the rated current of the transformer. B. When pressure winding is Y - type, the connection of the inflating is like picture 21, the difference is that the pressure side of the three-phase side need to be short circuit manually.

According to the measured voltage, current and the voltage of instrument and current measuring range, there are also three cases which is similar with the three types of no-load loss three phase transformer under single phase power, please refer to figure 22, 23, 24 shows the connection mode, difference is, the secondary side should short circuit.

7、Wiring method and two elements No-load Loss Test (three-phase three wire power)

Please let short circuit of non-tested terminal and refer to figure 25 when the voltage and current does not exceed the test range of the instrument, please refer to figure 25; when the voltage exceeds the test range of the instrument, please refer to figure 26 shows connection; when the test current exceeds the

instrument testing scope and voltage does not exceed the test range of the instrument, please refer to figure 27. When the no-load loss is tested, the general low voltage side is the tested side. High voltage side is non-tested end that need to open circuit

Note: this method is equivalent to the two power meter test method, only measuring Uab and Ubc phase voltage value result, the average value of the two; at the same time also only no-load loss measurement of Pab and Pcb phase loss, total loss is the sum of two phases.

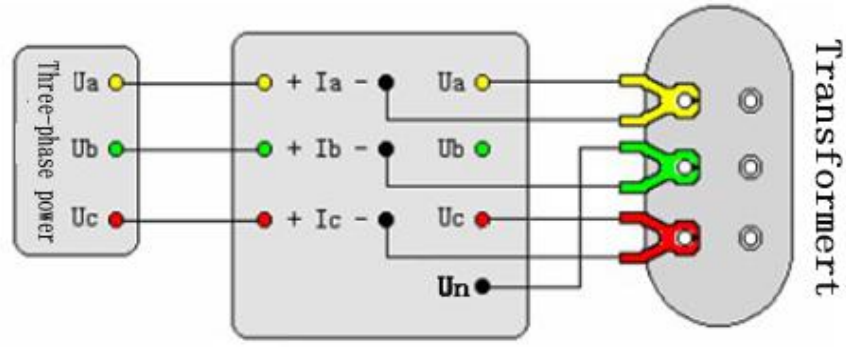


Figure25 Two components no-load loss test method of direct wiring diagram

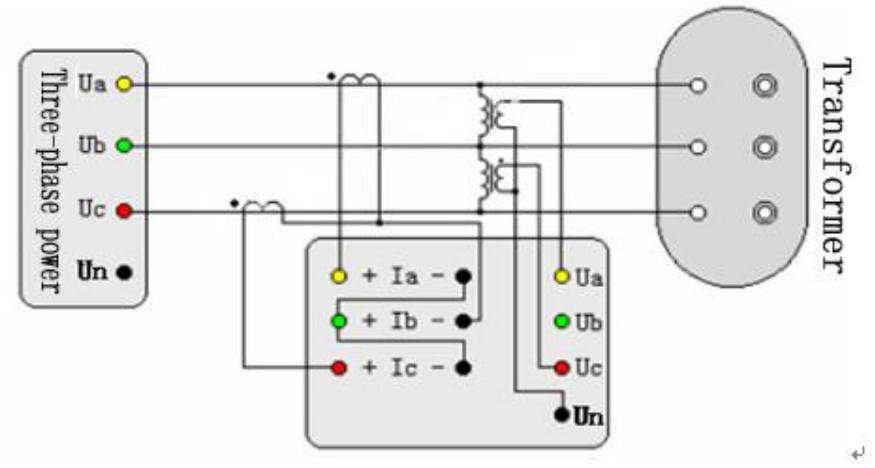


Figure26 No-load loss test method of two components of PT and CT wiring diagram

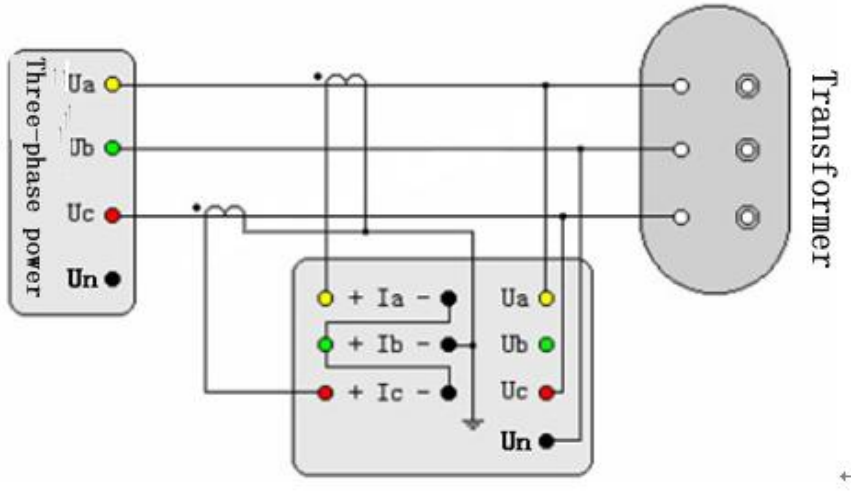


Figure27 Two components no-load loss test method of CT wiring diagram

8、Wiring method and two elements Load Loss Test (three-phase three wire power)

Basically similar with wiring mode of two element method of no-load loss can refer to figure 25, 26, and 27. The difference is the high-voltage side to test end. Low voltage side for the test side when test short circuit loss. In addition, the test need artificial nipple. Such as high or medium voltage side outlet casing containing the ring current transformer, prior to the test will be a good short circuit of current transformer secondary side.

9 、 Wiring method and Three phase No-load loss Test (three-phase four wire power)

Please let short circuit of non-tested terminal and refer to figure 25 when the voltage and current does not exceed the test range of the instrument, please refer to figure 28; when the voltage exceeds the test range of the instrument, please refer to figure 29 shows connection; when the test current exceeds the instrument testing scope and voltage does not exceed the test range of the instrument, please refer to figure 30. When the no-load loss is tested, the general low voltage side is the tested side. High voltage side is non-tested end that need to open circuit.

10 、 Wiring method and Three phase Load loss Test (three-phase four wire power)

Basically similar with wiring mode of two element method of no-load loss can refer to figure 28, 29, and 30. The difference is the high-voltage side to test end. Low voltage side for the test side when test no-load loss. In addition, the test need artificial nipple. Such as high or medium voltage side outlet casing containing the ring current transformer, prior to the test will be a good short

circuit of current transformer secondary side.

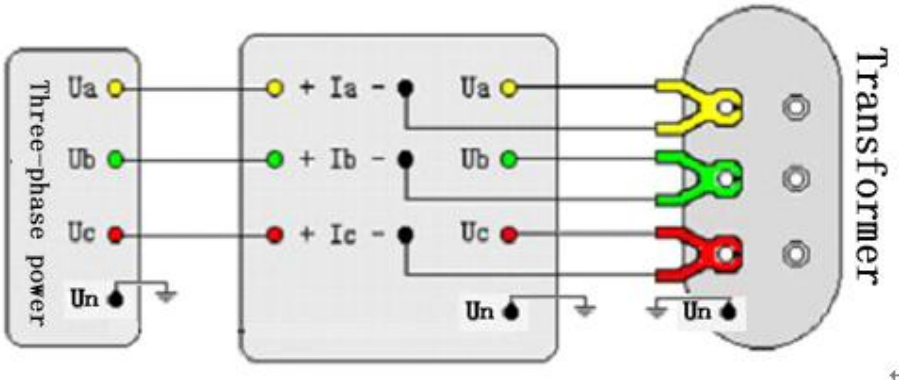


Figure28 Direct wiring diagram of three-phase no-load loss test

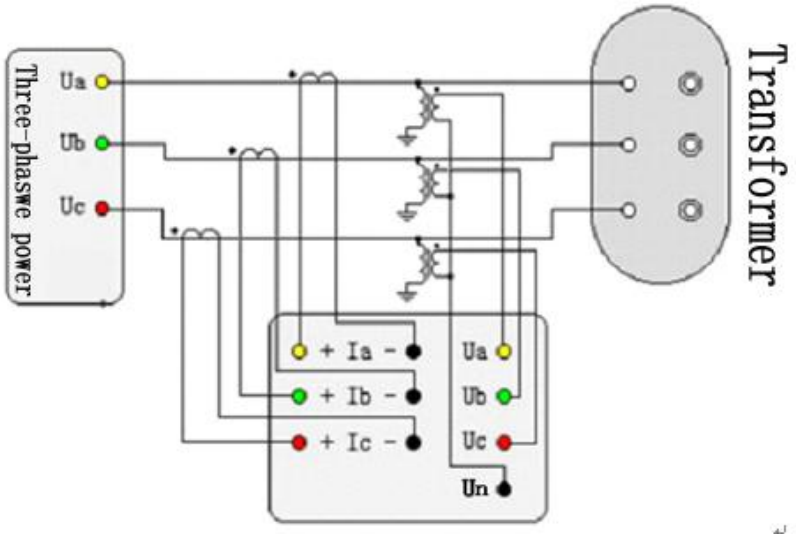


Figure29 Three-phase no-load loss test of PT and CT wiring diagram

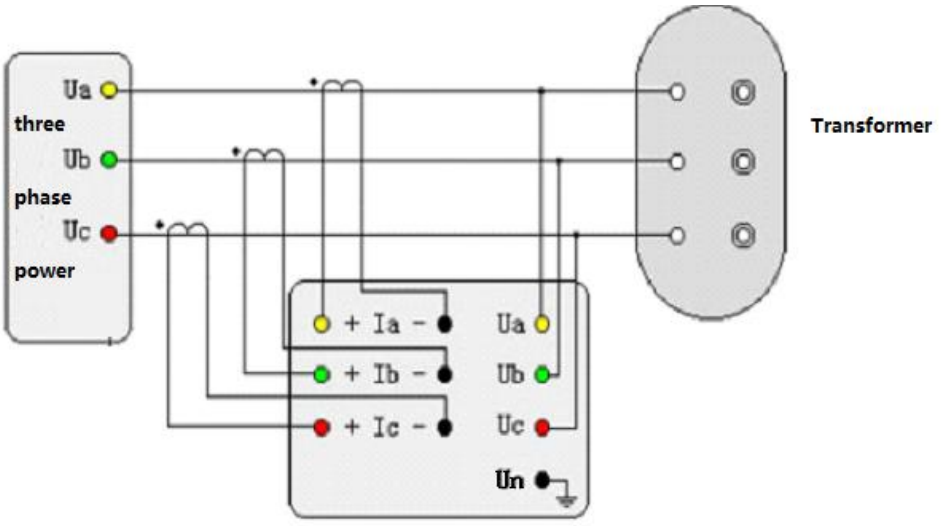


Figure29 Three-phase no-load loss test of CT wiring diagram

VI. Note

1、The connecting method of testing line should operate according to instruction, otherwise it will affect the result

2、 The wiring should be proceeded when the testing line has grounded in order to electric shock of induced voltage.

3、Please ensure the voltage ,current under the testing range. It need to connect with CT PT to expand the range , or testing result will not right.

4、When instrument do capacity test, active load test, load test,

Please ensure the short circuit of the no-pressure side, otherwise it will affect the result.

5、When doing the load test, if there is the power casing of HV LV side(Eg: CT), Please ensure short circuit of secondary winding of CT.

Appendix-Catalogue

A

The following is the rule of performance level code of 10KV,35KV oil transformer and the partial no-load loss of 10KV , 35KV, according to the JB/T3837-1996、GB/T 6451—1999 和 GB/T 10228—1997 and so on.

A1 the Provision of Performance Level of Three-phase Oil Power Transformer

performance level code	Voltage class (kV)	Parameter	
		no-load loss	
7	6、10	GB/T 6451 GroupII	GB/T 6451
	≥35	GB/T 6451	
8	6、10	GB/T 6451 GroupI	
	≥35	Less than GB/T 6451 10% on average	
9	6、10	Distribution TransformerA_2	
	6、10	Power transformer is less than GB/T 6451 Group I 10% on average	less thanGB/T 6451 on average10%
	≥35	Less than GB/T 6451 20% on average	
10	6、10	GB/T 6451 Group I 20% on average	less than GB/T 6451 10% on average
	≥35	less than GB/T 6451 30% on average	
11	6、10	less than GB/T 6451 Group I 30% on average	
	≥35	less than GB/T 645140% on average	

A2 S9-30~1600/6、10 Parameters of Distribution Transformer

Rated capacity kVA	No-load loss W	Load loss W
30	130	600
50	170	870
63	200	1040
80	250	1250
100	290	1500
125	340	1800
160	400	2200

200	480	2600
250	560	3050
315	670	3650
400	800	4300
500	960	5100
630	1200	6200
800	1400	7500
1000	1700	10300
1250	1950	12800
1600	2400	14500

A3 10kV Oil Testing Transformer No-load Loss with Different Levels

Transforme r capacity	S7	S8	S9power transformer	S9distribu tion transform er	S10	S11
30	0.15	0.14	0.126	0.13	0.112	0.098
50	0.19	0.19	0.171	0.17	0.152	0.133
63	0.22	0.22	0.198	0.2	0.176	0.154
80	0.27	0.25	0.225	0.25	0.2	0.175
100	0.32	0.29	0.261	0.29	0.232	0.203
125	0.37	0.34	0.306	0.34	0.272	0.238
160	0.46	0.39	0.351	0.4	0.312	0.273
200	0.54	0.47	0.423	0.48	0.376	0.329
250	0.64	0.57	0.513	0.56	0.456	0.399
315	0.76	0.68	0.612	0.67	0.544	0.476
400	0.92	0.81	0.729	0.8	0.648	0.567
500	1.08	0.97	0.873	0.96	0.776	0.679
630	1.3	1.15	1.035	1.2	0.92	0.805
800	1.54	1.4	1.26	1.4	1.12	0.98
1000	1.8	1.65	1.485	1.7	1.32	1.155
1250	2.2	1.95	1.755	1.95	1.56	1.365
1600	2.65	2.35	2.115	2.4	1.88	1.645

A4 35kV Oil Testing Transformer No-load Loss with Different Levels

Transformer	S7	S8	S9	S10	S11

capacity					
50	0.27	0.24	0.216	0.189	0.162
100	0.37	0.34	0.296	0.259	0.222
125	0.42	0.38	0.336	0.294	0.252
160	0.47	0.41	0.376	0.329	0.282
200	0.55	0.48	0.44	0.385	0.33
250	0.64	0.57	0.512	0.448	0.384
315	0.76	0.68	0.608	0.532	0.456
400	0.92	0.82	0.736	0.644	0.552
500	1.08	0.97	0.864	0.756	0.648
630	1.3	1.16	1.04	0.91	0.78
800	1.54	1.39	1.232	1.078	0.924
1000	1.8	1.65	1.44	1.26	1.08
1250	2.2	1.96	1.76	1.54	1.32
1600	2.65	2.37	2.12	1.855	1.59
2000	3.4	2.9	2.72	2.38	2.04
2500	4	3.5	3.2	2.8	2.4
3150	4.75	4.3	3.8	3.325	2.85
4000	5.65	5.15	4.52	3.955	3.39
5000	6.75	6.1	5.4	4.725	4.05
6300	8.2	7.3	6.56	5.74	4.92
8000	11.5	10	9.2	8.05	6.9
10000	13.6	11.8	10.88	9.52	8.16
12500	16	14	12.8	11.2	9.6
16000	19	17	15.2	13.3	11.4
20000	22.5	20.1	18	15.75	13.5
25000	26.6	23.9	21.28	18.62	15.96
31500	31.6	28.5	25.28	22.12	18.96

A5 10KV,35KV Dry Type Testing Transformer No-load Loss with Different Levels

Transformer capacity	10k(SC)dry type transformer				10kV (SG)dry type transformer				35kV(SC) dry type transformer		
	S7	S8	S9	S10	S7	S8	S9	S10	S8	S9	S10
30	0.27	0.24	0.216	0.192	0.31	0.28	0.252	0.224	0.4	0.36	0.32
50	0.37	0.34	0.306	0.272	0.39	0.36	0.324	0.288	0.5	0.45	0.4
80	0.5	0.46	0.414	0.368	0.49	0.46	0.414	0.368	0.578	0.52	0.462
100	0.59	0.5	0.45	0.4	0.54	0.51	0.459	0.408	0.733	0.66	0.586
125	0.69	0.59	0.531	0.472	0.63	0.6	0.54	0.48	0.844	0.76	0.675
160	0.82	0.68	0.612	0.544	0.74	0.7	0.63	0.56	0.956	0.86	0.765
200	0.93	0.78	0.702	0.624	0.86	0.82	0.738	0.656	1.067	0.96	0.854
250	1.1	0.9	0.81	0.72	1	0.95	0.855	0.76	1.2	1.08	0.96
315	1.3	1.1	0.99	0.88	1.2	1.1	0.99	0.88	1.45	1.3	1.16
400	1.59	1.22	1.098	0.976	1.4	1.3	1.17	1.04	1.7	1.53	1.36
500	1.85	1.45	1.305	1.16	1.65	1.5	1.35	1.2	2	1.8	1.6
630	2.1	1.68	1.512	1.344	1.9	1.75	1.575	1.4	2.3	2.07	1.84
800	2.3	1.9	1.71	1.52	2.35	2.12	1.908	1.696	2.7	2.43	2.16
1000	2.65	2.21	1.989	1.768	2.75	2.48	2.232	1.984	3	2.7	2.4
1250	3.28	2.61	2.349	2.088	3.3	2.98	2.682	2.384	3.5	3.15	2.8
1600	3.75	3.06	2.754	2.448	3.8	3.42	3.078	2.736	4	3.6	3.2
2000	4.7	4.15	3.735	3.32	4.6	4.15	3.735	3.32	4.7	4.23	3.76
2500	5.7	5	4.5	4	5.54	5	4.5	4	5.5	4.95	4.4
3150	——	——	——	——	——	——	——	——	6.5	5.85	5.2
4000	——	——	——	——	——	——	——	——	7.5	6.75	6

B GB/T 6451 and GB/T 10228 Appendix B GB/T 6451 and GB/T 10228

B1 10KV Double Winding Transformer with Off-circuit Tap Changing

Rated capacity kVA	Voltage and range of tap			Transf. connection	No-load loss kW	Load loss kW		No-load current %		Short circuit impedance %
	HV kV	Tapping range of HV %	LV kV			Yyn0	Dyn11/Yzn11	Yyn0	Dyn11/Yzn11	
30	6 6.3 10 10.5	±5	0.4	Yyn0	0.14	0.80	0.80	2.80	2.80	4.00
50				Yyn0 Dyn11 Yzn11	0.19	1.15	1.25	2.50	2.70	
63					0.22	1.40	1.50	2.40	2.60	
80					0.25	1.65	1.80	2.20	2.40	

100	11				0.29	2.00	2.15	2.10	2.30	
125					0.34	2.45	2.55	2.00	2.20	
160					0.39	2.85	3.10	1.90	2.10	
200					0.47	3.50	3.60	1.80	2.00	
250					0.57	4.00	4.10	1.70	1.90	
315					0.68	4.80	4.90	1.60	1.80	
400					0.81	5.80	6.00	1.50	1.70	
500					0.97	6.90	7.15	1.40	1.60	
630				Yyn0 Dyn11	1.15	8.10	8.50	1.30	1.50	4.50
800					1.40	9.90	10.40	1.20	1.40	
1000					1.65	11.60	12.20	1.10	1.30	
1250					1.95	13.80	14.50	1.00	1.20	
1600					2.35	16.50	17.30	0.90	1.10	

B2 35KV Double Winding Transformer with Off-circuit Tap Changing

Rated capacity kVA	Voltage and range of tap			Transf. connection	No-load loss kW	Load loss kW		No-load current %		Short circuit impedance %
	HV kV	Tapping range of HV %	LV kV			Group I	Group II	Group I	Group II	
50	35	±5	0.4	Yyn0	1.35	0.24	0.27	2.00	2.80	6.50
100					2.25	0.34	0.37	1.80	2.60	
125					2.65	0.38	0.42	1.75	2.50	
160					3.15	0.41	0.47	1.65	2.40	
200					3.70	0.48	0.55	1.55	2.20	
250					4.40	0.57	0.64	1.40	2.00	
315					5.30	0.68	0.76	1.40	2.00	
400					6.40	0.82	0.92	1.30	1.90	
500					7.70	0.97	1.08	1.30	1.90	
630					9.20	1.16	1.30	1.25	1.80	
800					11.00	1.39	1.54	1.05	1.50	
1000					13.50	1.65	1.80	1.00	1.40	
1250					16.30	1.96	2.20	0.85	1.20	
1600					19.50	2.37	2.65	0.75	1.10	

B3 Double Winding Regulating Transformer with Off-circuit Tap Changing

Rated capacity kVA	Voltage and range of tap			Transf. connection	Load loss kW	No-load loss kW		No-load current %		Short circuit impedance %
	HV kV	Tapping range of HV %	LV kV			Group I	Group II	Group I	Group II	
800	35	±5	3.15 6.3 10.5	Yd11	11.00	1.39	1.54	1.05	1.50	6.50
1000					13.50	1.65	1.80	1.00	1.40	
1250					16.30	1.96	2.20	0.90	1.30	
1600					19.50	2.37	2.65	0.85	1.20	
2000					21.50	2.90	3.40	0.75	1.10	
2500					23.00	3.50	4.00	0.75	1.10	
3150	35 38.5	±5	3.15 6.3 10.5	Yd11	27.00	4.30	4.75	0.70	1.00	7.00
4000					32.00	5.15	5.65	0.70	1.00	
5000					36.70	6.10	6.75	0.60	0.90	
6300					41.00	7.30	8.20	0.60	0.90	7.50
8000		±2×2.5	3.15 3.3 6.3 6.6 10.5 11	YNd11	45.00	10.00	11.50	0.55	0.80	
10000					53.00	11.80	13.60	0.55	0.80	
12500					63.00	14.00	16.00	0.50	0.70	8
16000					77.00	17.00	19.00	0.50	0.70	
20000					93.00	20.10	22.50	0.50	0.70	
25000					110.00	23.90	26.60	0.40	0.60	
31500					132.00	28.50	31.60	0.40	0.60	

B4 10KV Dry Type Distribution Transformer without Encapsulated Coil and Excitation

Rated capacity kVA	Voltage and range of tap			Transf. connection	Load loss under different insulation endurance class W			No-load loss W		No-load current %		Short circuit impedance %
	HV kV	Tapping range of HV %	LV kV		B(100℃)	F(120℃)	H(145℃)	Group I	Group II	Group I	Group II	
30	6 6.3 6.6 10 10.5 11	±5 or ±2×2.5	0.4	Yyn0 Dyn11	760	810	980	280	310	3.20	3.50	4.00
50					1100	1170	1490	360	390	2.80	3.00	
80					1590	1680	2150	460	490	2.60	2.80	
100					1850	1950	2550	510	540	2.40	2.60	
125					2150	2280	3050	600	630	2.20	2.40	
160					2500	2650	3650	700	740	2.20	2.40	

200					2950	3130	4680	820	860	2.00	2.20	
250					3450	3650	5500	950	1000	2.00	2.20	
315					4100	4340	6600	1100	1200	1.80	2.00	
400					4950	5250	7800	1300	1400	1.80	2.00	
500					6000	6360	9350	1500	1650	1.80	2.00	
630					7100	7500	10900	1750	1900	1.60	1.80	
630					8050	8550	11500	1680	1830	1.60	1.80	
800					9700	10300	13600	2120	2350	1.60	1.80	
1000					11600	12300	15700	2480	2750	1.40	1.60	
1250					13900	14700	18400	2980	3300	1.40	1.60	6
1600					16700	17700	21300	3420	3800	1.40	1.60	
2000					20000	21200	25000	4150	4600	1.20	1.40	
2500					24500	26000	29100	5000	5540	1.20	1.40	

B5 10KV Dry Type Power Transformer without Encapsulated Coil and Excitation

Rated capacity kVA	Voltage and range of tap			Transformer connection	Load loss under different insulation endurance class W			No-load loss W	No-load current %	Voltage and range of tap %
	HV kV	Tapping range of HV %	LV kV		B(100℃)	F(120℃)	H(145℃)			
630	6 6.3 6.6 10 10.5 11	±5 or ±2×2.5	3 3.15 6 6.3	Yyn0 Dyn11	8600	9100	12300	1850	1.80	6.00
800					10300	10900	14500	2250	1.80	
1000					12400	13100	16800	2650	1.80	
1250					14800	15700	19700	3180	1.60	
1600					17800	18900	22700	3650	1.60	
2000					21400	22600	26700	4400	1.40	
2500					26200	27800	3100	5350	1.40	
3150					31500	33400	35700	6420	1.20	7.00
4000	10 10.5 11				38400	40700	43600	7470	1.20	
5000					46500	49200	52700	8750	1.00	
6300					56700	60100	64300	10400	1.00	

B6 10kV Double Winding Regulating Transformer without Excitation

Rated capacity kVA	Voltage and range of tap			Transf. connection	No-load loss kW	Load loss kW	No-load current%	Short circuit impedance%
	HV kV	Tapping range of HV%	LV kV					
630	6 6.3	±5	3 3.15	Yd11	1.15	8.10	13.00	4.5
800					1.40	9.90	1.20	5.5

1000	10 10.5 11		6.3		1.65	11.60	1.10	
1250					1.95	13.80	1.00	
1600					2.35	16.50	0.90	
2000					2.80	19.80	0.90	
2500					3.30	23.00	0.80	
3150					3.90	27.00	0.80	
4000	10 10.5 11		3.15 6.3		4.80	32.00	0.70	
5000					5.70	36.70	0.70	
6300					6.80	41.00	0.60	

B7 10KV Encapsulated Coil Dry Type Distribution Transformer without Excitation

Rated capacity kVA	Voltage and range of tap			Transf. connection	Load loss under different insulation endurance class W			No-load loss W		No-load current %		Short circuit impedance %
	HV kV	Tapping range of HV%	LV kV		B(100℃)	F(120℃)	H(145℃)	Group I	Group II	Group I	Group II	
30	6 6.3 6.6 10 10.5 11	±5or ±2×2.5	0.4	Yyn0 Dyn11	780	830	890	240	270	3.20	3.50	4.00
50					1100	1170	1260	340	370	2.80	3.00	
80					1520	1620	1740	460	500	2.60	2.80	
100					1740	1850	1990	500	590	2.40	2.80	
125					2040	2170	2330	590	690	2.20	2.50	
160					2350	2500	2680	680	820	2.20	2.50	
200					2790	2970	3180	780	930	2.00	2.20	
250					3050	3240	3480	900	1100	2.00	2.20	
315					3840	4080	4380	1100	1300	1.80	2.00	
400					4410	4690	5030	1220	1590	1.80	2.00	
500					5400	5740	6150	1450	1850	1.80	2.00	
630					6500	6910	7400	1680	2100	1.60	1.80	
630					6600	7010	7520	1620	2000	1.60	1.80	6
800					7700	8180	8770	1900	2300	1.60	1.80	
1000					9000	9560	10300	2210	2650	1.40	1.60	
1250					10700	11400	12200	2610	3280	1.40	1.60	
1600					13000	13800	14800	3060	3750	1.40	1.60	
2000					16000	17000	18300	4150	4700	1.20	1.40	

2500					19000	20200	21700	500	5700	1.20	1.40	

B8 10KV Encapsulated Coil Dry Type Power Transformer without Excitation

Rated capacity kVA	Voltage and range of tap			Transf. connection	Load loss under different insulation endurance class W			No-load loss W	No-load current %	Short circuit impedance%
	HV kV	Tapping range of HV%	LV kV		B(100℃)	F(120℃)	H(145℃)			
630	6 6.3 6.6 10 10.5 11	±5or ±2×2.5	3 3.15 6 6.3	Yd11	7000	7440	7970	1750	1.80	6.00
800					8200	8710	9340	2000	1.80	
1000					9700	10300	11100	2400	1.80	
1250					11500	12300	13100	2800	1.60	
1600					14000	14900	16000	3300	1.60	
2000					16700	17800	19100	4500	1.40	
2500					19700	21000	22500	5300	1.40	
3150					23000	24500	26200	6300	1.20	
4000	10 10.5 11				27700	29500	31600	7500	1.20	7.00
5000					32800	34900	37400	8900	1.00	
6300					39000	41400	44400	10500	1.00	

B9 35KV Encapsulated Coil Dry Type Distribution Transformer without Excitation

Rated capacity kVA	Voltage and range of tap			Transf. connection	Load loss under different insulation endurance class W			No-load loss W	No-load current %	Short circuit impedance%
	HV kV	Tapping range of HV%	LV kV		B(100℃)	F(120℃)	H(145℃)			
315	35 38.5	±5or ±2×2.5	0.4	Yyn0 Dyn11	4620	4900	5240	1450	2.00	6.00
400					5950	6300	6750	1700	2.00	
500					7300	7750	8320	2000	2.00	

630					8500	9030	9680	2300	1.80	
800					10000	10700	11400	2700	1.80	
1000					11500	12300	13100	3000	1.80	
1250					14000	14900	16000	3500	1.60	
1600					17000	18100	19400	4000	1.60	
2000					20000	21300	22800	4700	1.40	
2500					24000	25500	27400	5500	1.40	

B10 35KV Encapsulated Coil Dry Type Power Transformer without Excitation

Rated capacity kVA	Voltage and range of tap			Transf. connection	Load loss under different insulation endurance class W			No-load loss W	No-load current %	Short circuit impedance%
	HV kV	Tapping range of HV%	LV kV		B(100℃)	F(120℃)	H(145℃)			
800	35 38.5	±5or ±2×2.5	3.15 3.3 6 6.3 10 10.5 11	Yyn0 Yd11	10300	11000	11800	2780	1.90	6.00
1000					12000	12800	13700	3300	1.90	
1250					14200	15100	16200	3870	1.70	
1600					17000	18100	19400	4560	1.70	
2000					20000	21300	22800	5250	1.50	7.00
2500					24000	25500	27400	6000	1.50	
31500					27000	28700	30800	7500	1.30	8.00
4000					32500	34500	37000	8700	1.30	
5000					38500	40900	43900	10400	1.10	
6300					45000	47800	51300	12300	1.10	
8000				Yd11 YNd11	50000	53000	56700	14000	1.00	9.00
10000					61300	65000	69500	16000	1.00	