Dear Client

Thank you for Purchasing our **XZB-H AC Resonant Test System for CVT**. Please read the manual in detail prior to first use, which will help you use the equipment skillfully.

Our aim is to improve and perfect the company's products continually, so there may be slight differences between your purchase equipment and its instruction manual. You can find the changes in the appendix. Sorry for the inconvenience. If you have further questions, welcome to contact with our service department.

The input/output terminals and the test column may bring voltage, when you plug/draw the test wire or power outlet, they will cause electric spark. PLEASE CAUTION RISK OF ELECTRICAL SHOCK!

Company Address:

- T4，No. 41, High-tech 2 Road，East Lake High-tech Development Zone，Wuhan
- Sales Hotline: 86-27- 87457960
- After Service Hotline**:** 86-27- 87459656
- Fax: 86-27- 87803129
- E-mail: qiao@hvtest.cc
- Website: www.hvtest.cc

◆ SERIOUS COMMITMENT

All products of our company carry one year limited warranty from the date of shipment. If any such product proves defective during this warranty period we will maintain it for free. Meanwhile we implement lifetime service. Except otherwise agreed by contract.

◆ SAFETY REQUIREMENTS

Please read the following safety precautions carefully to avoid body injury and prevent the product or other relevant subassembly to damage. In order to avoid possible danger, this product can only be used within the prescribed scope.

Only qualified technician can carry out maintenance or repair work.

--To avoid fire and personal injury:

Use Proper Power Cord

Only use the power wire supplied by the product or meet the specification of this produce.

Connect and Disconnect Correctly

When the test wire is connected to the live terminal, please do not connect or disconnect the test wire.

Grounding

The product is grounded through the power wire; besides, the ground pole of the shell must be grounded. To prevent electric shock,

the grounding conductor must be connected to the ground.

Make sure the product has been grounded correctly before connecting with the input/output port.

Pay Attention to the Ratings of All Terminals

To prevent the fire hazard or electric shock, please be care of all ratings and labels/marks of this product. Before connecting, please read the instruction manual to acquire information about the ratings.

Do Not Operate without Covers

Do not operate this product when covers or panels removed.

Use Proper Fuse

Only use the fuse with type and rating specified for the product.

Avoid Touching Bare Circuit and Charged Metal

Do not touch the bare connection points and parts of energized equipment.

Do Not Operate with Suspicious Failures

If you encounter operating failure, do not continue. Please contact with our maintenance staff.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in Explosive Atmospheres.

Ensure Product Surfaces Clean and Dry.

—Security Terms

Warning: indicates that death or severe personal injury may result if proper precautions are not taken

Caution: indicates that property damage may result if proper precautions are not taken.

Content

I Technical Parameters

Rated Capacity: 80 kVA Rated Frequency: 50 Hz

Rated voltage: 160 kV Rated current: 0.5 A

Adjustable inductance range :65 ~ 130H

Adjustable clearance range :0~300mm

II System Configuration

Excitation transformer: JLB-5kVA/10kV /0.2kV	1
Adjustable reactor DK-20kVA/40kV	4
Control cabinet XZB-5kVA/0.22kV	1
Compensation capacitor BC-160kV/5000pF	1

III Fundamental principle

Power frequency resonance is divided series resonance and parallel resonance, the two ways to take compensation effect of power capacity is basically the same, after reaching full compensation, the input capacity can be reduced to 1 / Q or less of test output capacity.

1. Series resonance

Series resonance schematic circuit diagram as shown in figure 1, the vector diagram as shown in figure 2

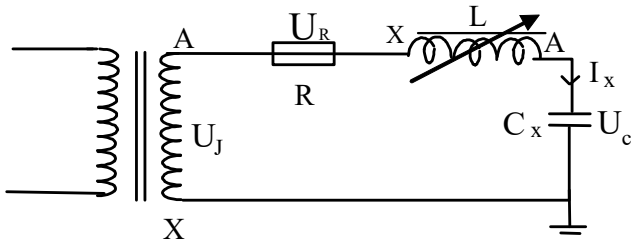


Figure 1 Series resonance schematic circuit diagram

L--- Adjustable reactor inductance

CX--- Capacity of tested object

R--- Adjustable reactor active loss and dielectric loss of tested object and circuit composite loss reduction equivalent series resistance.

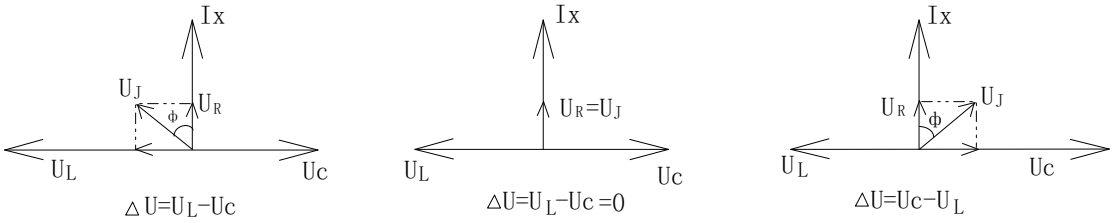


Figure 2 R, L, C series circuit vector diagram

Resonant characteristics curve of series circuit as shown in figure 3

$$\dot{U}_J = \dot{I}_X R + j\dot{I}(X_C - X_L) \qquad (1)$$

Adjust the adjustable reactor inductance in series circuit, make the inductive reactance X_L under the frequency f is equal to the capacitive impedance X_{CX} of load capacitance, at this time to achieve a complete resonance, the reactive inductance is the resonant point inductance L (see Figure 2), the resonance characteristic curve as shown in Figure 3. When circuit complex resonance,

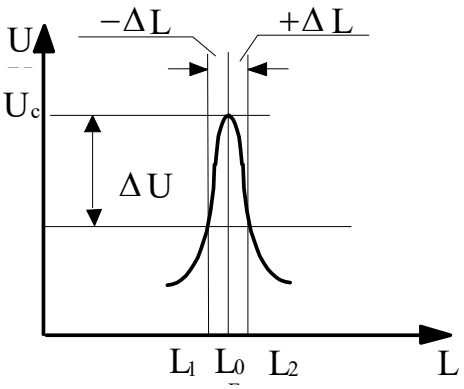


Figure 3 resonant characteristics curve

$$f = \frac{1}{2\pi\sqrt{L_0 Cx}} = \text{工频频率}, L_0 = \frac{1}{(2\pi f)^2 Cx} \qquad (2)$$

$$I_X = \frac{U_J}{R} \qquad (3)$$

$U_C = I_X X_{CX}$ (4)

In the formula (4), the load capacitance C_X is a constant, adjusted L to achieve complex resonant L_0, then adjust IX, actually adjust U_J in the formula (3), when reach the required U_C value, namely start to withstand voltage test.

Under complete series resonance, the power supply only provide I_J to produce I_X, provide COSΦ =1, the excitation power $P_J = U_J I_X$ ($=I_X^2 R$), stimulate and maintain stable resonance. Series resonance is the resonance of voltage compensation or LV excitation resonance.

Resonant circuit composite quality factor Q, also known as resonant circuit compensation efficiency:

$$Q = \frac{S_{CX}}{P_J} = \frac{I_X{}^2 X_{CX}}{I_X{}^2 R} = \frac{U_C}{U_J} \qquad (5)$$

Wherein: SCX – the power required to provide when tested object CX withstand voltage, which a large portion is reactive power component. The short circuit current IK after tested object flashover or breakdown during withstand voltage can be reduced to 1 / Q or less of test current IX before short circuit

$$\frac{I_K}{I_X} = \frac{R}{R + jX_L} < \frac{1}{Q} \qquad (6)$$

The main features of series resonant circuit as follows:

1) Since the resonant reactive full compensation, the power of power supply and equipment is only 1/10 or less (1 / Q> 10) of the tested object capacity; small volume and light weight, large output capacity but the device with configurable power supply capacity is small, easy and safe for operation;
2) Series resonant is actually current filter loop circuit, so the current through the tested object is basically fundamental current, the output voltage total harmonic distortion (THD) is extremely small, superior to all existing types of AC voltage equipment;
3) The short circuit current after tested object flashover or breakdown is only 1 / 10 or less(1 / Q) of test current before short circuit, can effectively prevent expanding fault point damage after breakdown;
4) After flashover then immediately automatically arc extinction, after arc extinction, the process of recovery resonant voltage is a steady process, without voltage overshot, no more worry the danger of transient (microsecond or millisecond) recovery overvoltage.

2. Parallel resonance

Parallel resonance schematic circuit diagram as shown in figure 4, the vector diagram as shown in figure 5

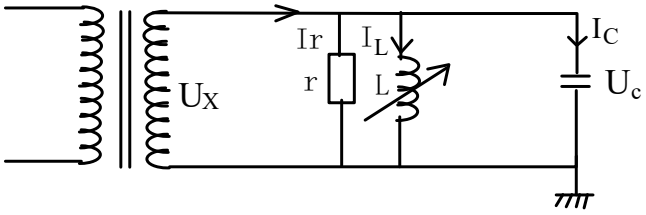
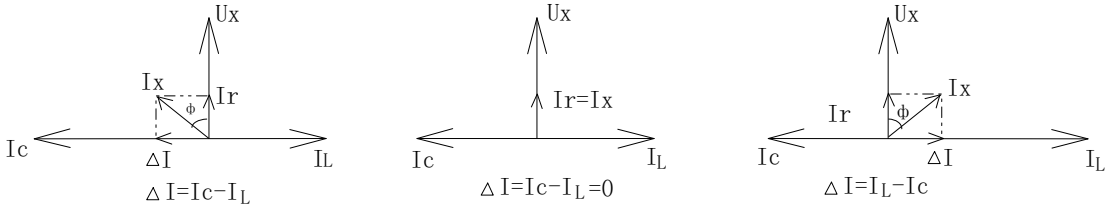


Figure 4 Parallel resonant schematic circuit diagram

L--- Adjustable reactor inductance

CX--- Capacity of tested object

R--- Adjustable reactor active loss and dielectric loss of tested object and circuit composite loss reduction equivalent shunt resistance.



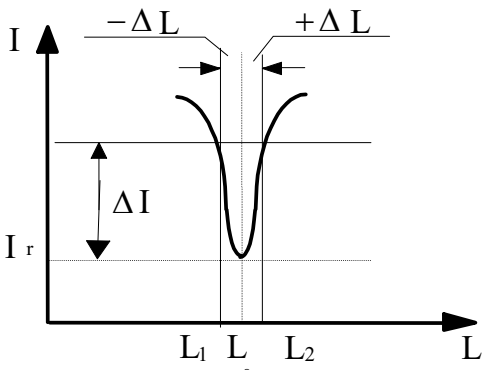
a. 容性 $X_L>X_c$ $I_c>I_L$　　b. 全谐振阻性 $X_L=X_c$ $I_c=I_L$　　c. 感性 $X_L<X_c$ $I_c<I_L$

Figure 5 r, L, C parallel circuit vector diagram

Parallel resonant is the current compensation mode, resonance characteristic curve as shown in Figure 6, the current in Figure 4:

$$\dot{I}_X = \frac{\dot{U}x}{r_L} + j\dot{U}_X\left(\frac{1}{X_L} - \frac{1}{Xc}\right) \qquad (7)$$

As in figure 4, when adjust L to the resonant point inductance L_0, $X_L = X_C$, $I_L = I_C$ at this time achieve complete parallel resonance, see Figure 6, L0 is the same with L0 of formula (2)



Parallel resonance, the voltage UX ¬ that the power supply provide is the same with the test voltage, because reactive current full compensation to offset, the power

Figure 6 Parallel resonance characteristic curve

supply only provide COSΦ = 1, I_X=Ir to compensate integrated power loss of the resonant circuit, can stimulate and maintain stable resonance .

Similarly, $Q = \frac{Scx}{P_J} = \frac{U^2{}_X / X_{CX}}{U^2{}_x / r} = \frac{I_C}{Ix}$ (8)

Parallel resonance with the advantage of reactive power compensation (same with series resonance), but cannot fully have other three characteristics that series resonance have. Usually use series resonant AC withstand voltage mode.

3. Tuning operation priority

In order to safety test, when conducting the series resonant withstand voltage test, must firstly under given lower initial excitation voltage U_{J0} (generally a few hundred volts), adjust L to reach full resonance L_0, within the range of the smaller off-tuning degree S_T to slowly boost, to UC reaches a predetermined withstand voltage value.

IV Frequency resonant test principle wiring diagram

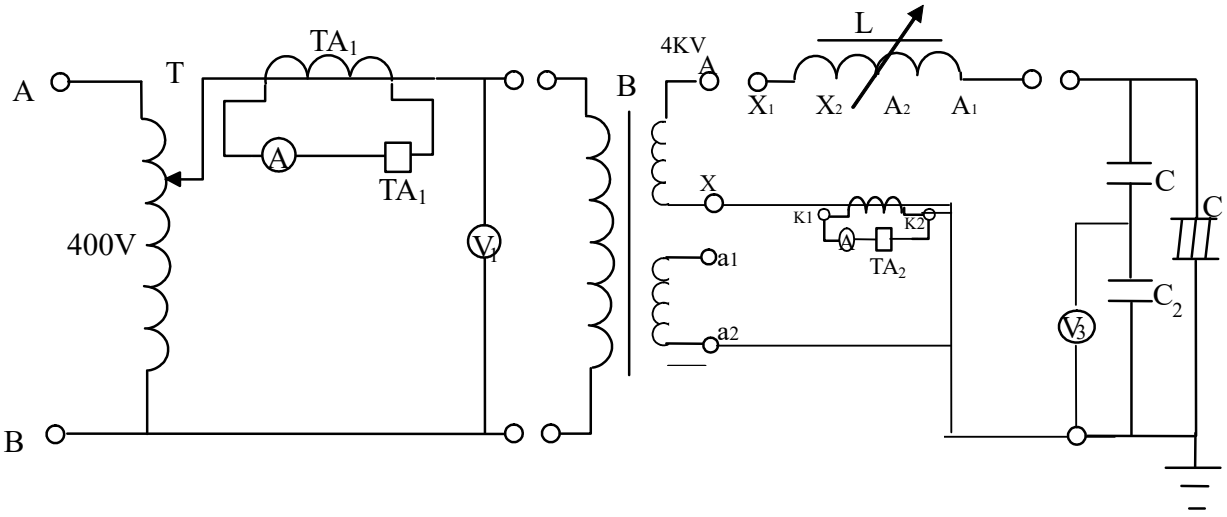


Figure 7 Series resonance test principle wiring diagram

V Resonance test actual connection diagram

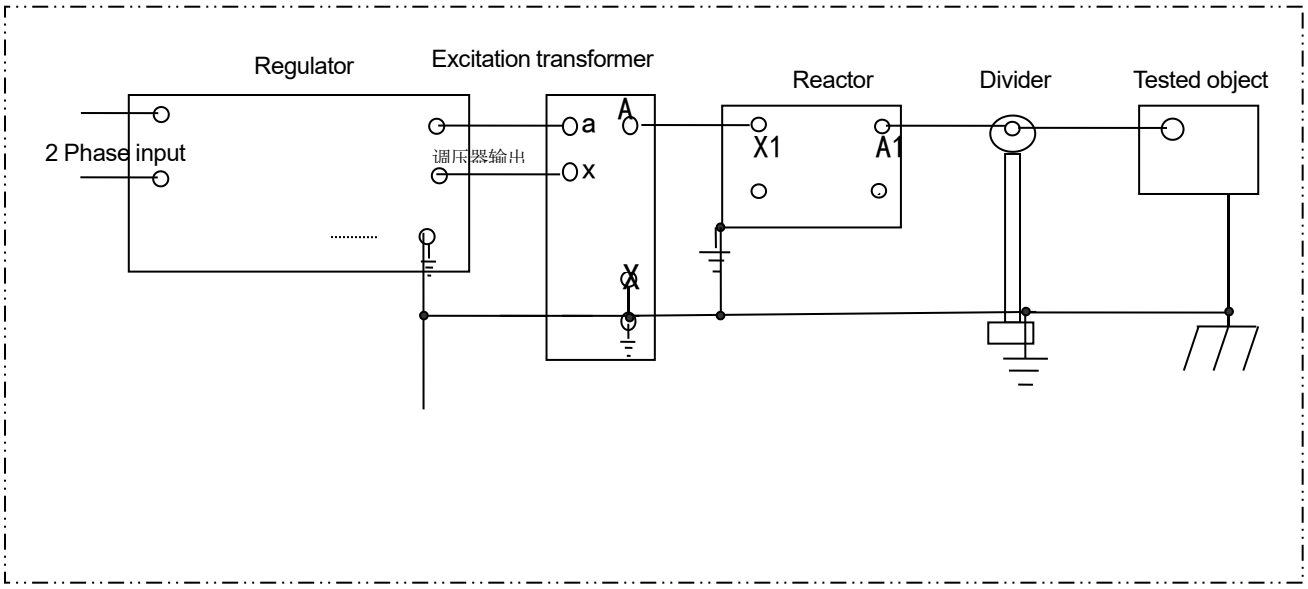


Figure 8 Series resonance test connection diagram

VI Operations

1. Over-current protection setting: 0.7 times of the rated current of the control unit. Example: the rated current of the control unit is 27A, the matched mutual inductor is 30/5, should adjust the current relay to be 3.3A.

2. Voltage withstanding time setting: set the time of the time relay to required time.

3. Connect and check test wires according the pictures, close the console breaker, adjust the regulator to 0 if it not at 0 position. Do not connect the main power, adjust the space of reactor iron core, check if the up-down and limit protection are normal.

4. Close main power, press “boost” button, the reactor get hundreds of voltage, tuned by changing the air gap to achieve the highest output voltage, tuning is completed at this time, you can boost voltage, it will auto time (voltage withstand time) after achieve the test voltage value, and will auto back to 0 after to voltage withstanding time.

5. Off the main power

During the test, relevant person should strengthen monitoring equipment under test, once there was abnormal phenomenon should quick buck regulator, and also disconnect the power.