



# **TYD Capacitor Voltage Transformer**

## **Installation and Operation Instruction**

**Shandong Taikai Instrument Transformer Co., Ltd**

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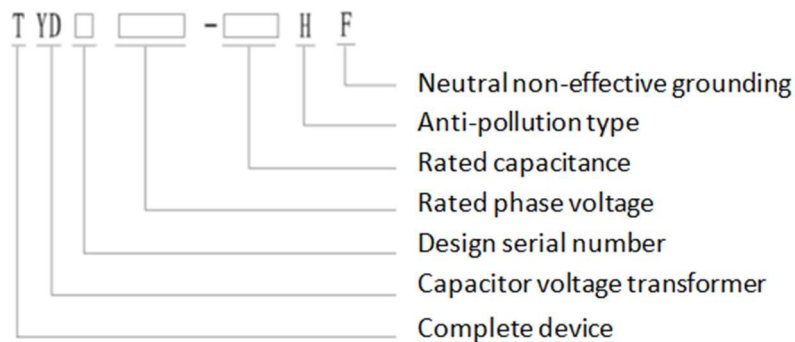
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# 1 Product description

## 1.1 Product application

Capacitor voltage transformer, applicable to power system with rated voltage from 35kV to 500kV and rated frequency 50Hz, is used to transmit voltage signal to measuring instruments, meters and protective or control devices, and can also be used as coupling capacitor for power line carrier systems.

## 1.2 Model designation

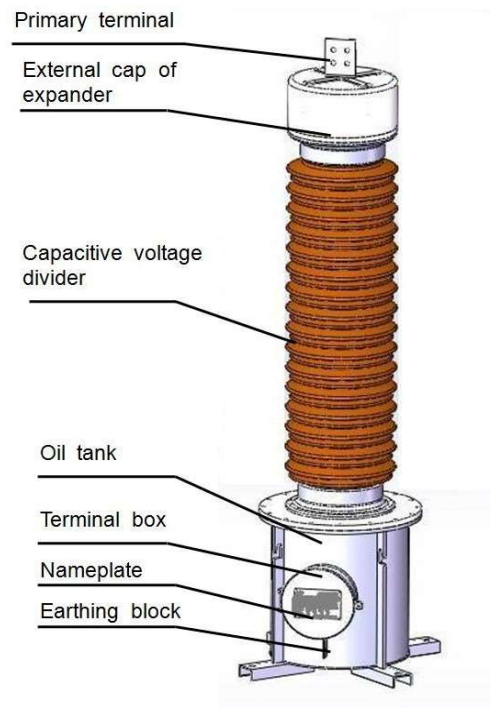


## 1.3 Product

- 1) Capacitor voltage transformer is composed of capacitor divider and electromagnetic unit, stacked type.
- 2) Capacitor divider is comprised of one or several sections of capacitors in series. The primary terminal is at the top of the capacitor divider, and its installation direction can be rotated according to the needs of the site. Capacitor voltage divider adopts external expander to control the oil volume change due to temperature changes.
- 3) Electromagnetic unit is composed of intermediate transformer, compensation reactor, damping device and oil tank.
- 4) The earthing plate and oil drain valve is at the low section of the oil tank.
- 5) The secondary terminal and carrier communication terminal are led out from wiring box (LV terminal

$X_L$  and error adjustment terminal of 500kV capacitor voltage transformer are led out from terminal box at side of tank)

## construction



## 2 Service condition

Max temperature: +40°C

Daily average temperature: not exceeding: +35°C

Min. temperature:-40°C

The monthly maximum value of relative humidity: 95% (at 25°C)

Maximum wind velocity: 34 m/s

There is no contamination and corrosive and explosive media in the atmosphere that seriously affect the insulation of the transformer.

The product is used in areas where the seismic intensity is not greater than 8 degrees.

## 3 Storage and transportation

### 3.1 Storage

- 1) The product shall be stored in ventilated condition, without flammable, explosive and corrosive gases.
- 2) The product shall be stored in vertical state. Long-term storage needs to be packaged to avoid product damage.

### 3.2 Transportation

- 1) The product should be packed and transported in a vertical state, and it is strictly forbidden to lie down. Meanwhile prevent collision and other mechanical damage.
- 2) The on-site handling should adopt the protective measures required for transportation. It is recommended to keep the original package of the transformer or repackage it in the original form.

## 4 Installation

### 4.1 Check before installation

- 1) Check the shipping list whether the product, accessories and the documents are complete. The accessories include one set of filling device. The documents include installation instruction and the qualification certificate.
- 2) Check whether the package of the product is intact without damage and deformation
- 3) Check whether the product appearance is intact without damage. **Then dismantle the M12\*60 hot-dip galvanized hex head bolt (shown in Fig.4) between the expander cover and the flange at the top of each capacitor divider, remove the expander cover and the protective baffle surrounding the expander, finally recovery the expander cover, which requiring the nameplate direction to be consistent with the direction before the removal.**
- 4) For any question, please contact the service department of the manufacturer.

## 4.2 Hoisting

After unpacking, place hoisting appliance at the position of lifting lugs of tank side and hoist slowly and steadily (See Fig.1). **No hoisting from capacitor upside (See Fig.2).** For multi sections capacitor divider, **it must be single-section hoisting, it is forbidden to hoist after stacked.** Use special hoisting rings provided to hoist the single-section capacitor.

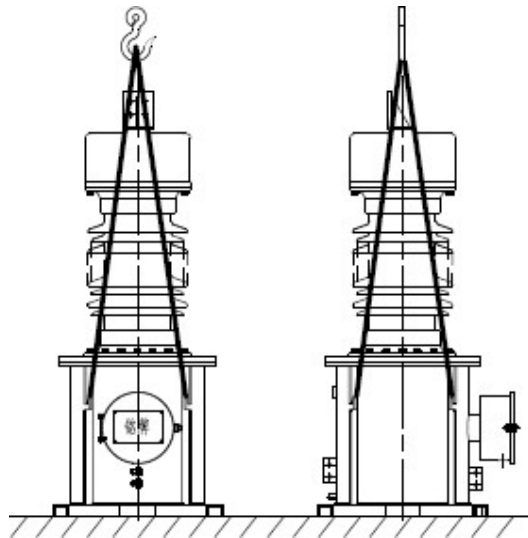


Fig.1 Hoisting illustration

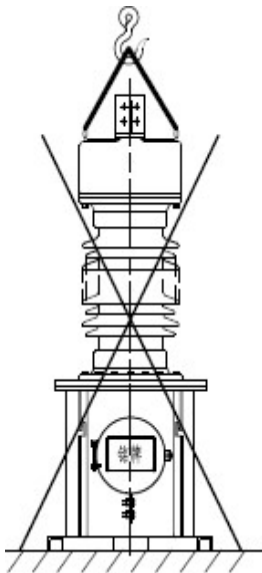


Fig.2 Wrong hoisting

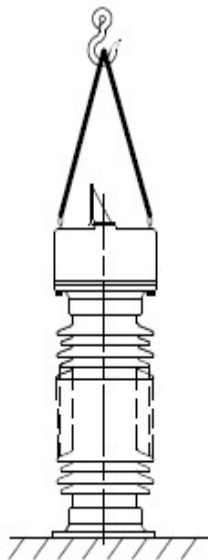


Fig.3 hoisting illustration of the divider

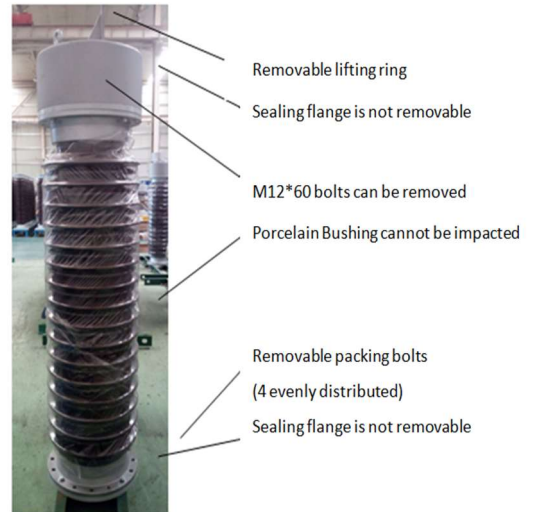


Fig. 4 Photo of the upper capacitor divider

## 4.2 Product installation

- 1) The product shall be installed vertically on a smooth and horizontal platform. **It is recommended to tighten the bolts as per the torque value of 220N•m for base installation.**

2) The earthing plate on the oil tank must be effectively earthed.

3) For the transformer with multi-section capacitor voltage divider, the divider shall be used with electromagnetic units (Refer to the serial number of capacitor divider to install). **It is strictly forbidden to install the capacitor voltage divider of the upper and lower sections and different products interchangeably. For the connection between the voltage dividers, it is recommended to tighten the bolts as per the torque value of 50N•m.**

4) For transformers with multi-sections capacitor divider, only allow to remove the connecting bolts and packing bolts between the capacitor dividers (see Fig. 4), and the remaining fixing bolts should not be loose. **Specially: Do not loosen the sealing bolt of the capacitor divider itself, the lower capacitor divider and the electromagnetic unit connection bolt.**

5) The transformer with MV earthing switch, the switch is mainly used for short circuit connection of MV terminal to the earth when the transformer is in the field test. When the unit is running, the switch handle is placed at the “running” mark. Otherwise, the transformer may have no secondary output or abnormal output. It is forbidden to operate the switch with power. When switching from “Run” to “Test” position, only remove the limit bolt 2 & 3 and turn the switch handle counterclockwise to the horizontal “test” position. When the unit is running, restore the switch handle and install the limit bolt 2 & 3. The schematic diagram of MV earthing switch is shown in Fig 5.

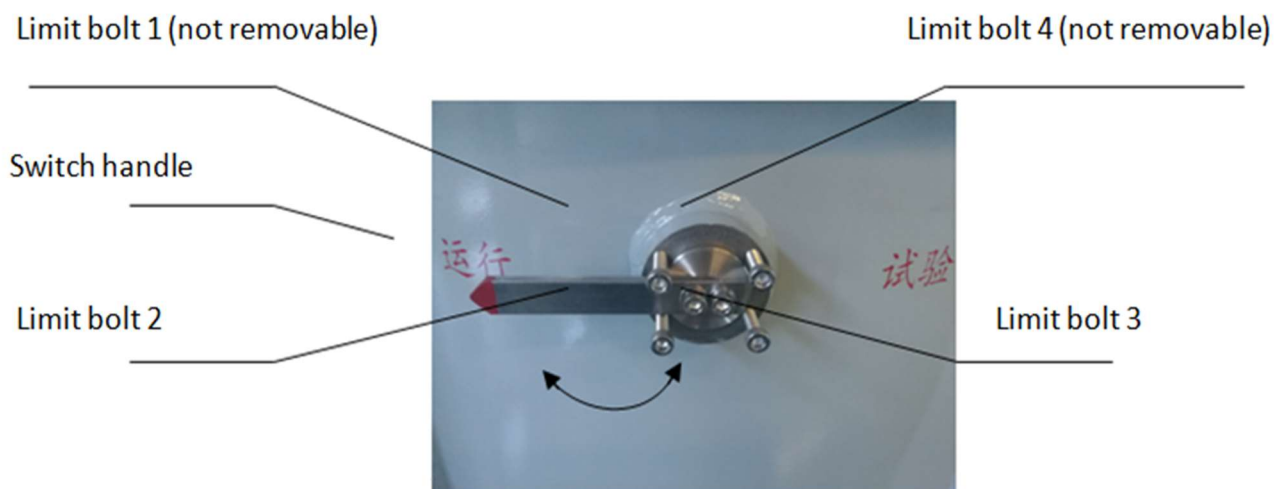


Fig 5 Diagram of handle position on MV earthing switch

### 4.3 Primary wiring

Dirt part and oxide layer shall be cleaned up before the wiring connected with primary terminal to ensure the good electrical contact. **It is recommended to tighten the bolts according to the torque value of 120N•m for the primary terminal installation.**

**Note: The tensile force of the primary terminal should be within the static load range which it can bear.**

Tab 1 Torque recommended value

Bolt size, mm	Torque recommended value	
	N · m	kgf · m
M12	50 ± 10	5 ± 1
M16	120 ± 10	12 ± 1
M20	220 ± 10	22 ± 1

#### 4.5 Secondary connection

Connect the secondary terminals according to the nameplate and label. **No short circuit on secondary terminal.**

**Note: Terminal "N" is the end of the capacitor divider and "XL" is the end of the electromagnetic unit. When CVT is not used for carrier communication, the "N" and "XL" terminals must be directly earthed, and open circuits are not allowed. When CVT is used for carrier communication, "N" terminal is earthed by the combined filter and "XL" terminal is directly earthed.**

### 5 Check before operation

Before operation, the unit should be inspected thoroughly. Particular attention should be paid to the quality of all electrical connections

#### 5.1 Measurement for capacitance and dielectric loss factor of capacitor voltage divider

##### 5.1.1 Measurement methods and requirements

In order to accurately reflect the true dielectric dissipation factor ( $\tan \delta$ ) of the capacitor divider, according to GB/T 20840.5 "Instrument Transformer Part 5: Supplementary Technical Requirements for Capacitor Voltage Transformers", the capacitance and dielectric loss factor ( $\tan \delta$ ) are measured under (0.9 ~ 1.1) Upr voltage, using methods that eliminate errors due to harmonics and measurement circuit accessories.

Considering the actual situation on site, the capacitor voltage divider section can be measured separately. The upper and middle section of multi-section capacitor voltage dividers are measured by positive connection method with  $\geq 10\text{kV}$  voltage; the lower section of multi-section capacitor divider products or single-cell capacitor dividers are connected to the electromagnetic unit. It can not be disassembled, and tested as the following two cases:

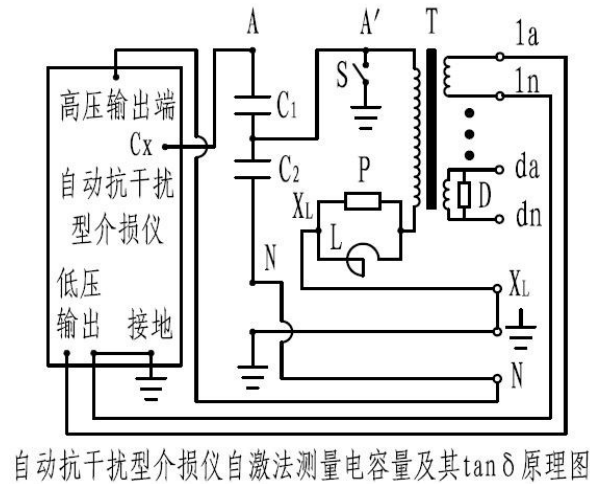
- (1) When the electromagnetic unit without MV earthing switch, the lower section capacitor is measured by self-excitation method, and its test principle diagram is shown in Fig. 6.
- (2) When the electromagnetic unit with MV earthing switch, the lower section capacitor is measured by self-excitation or reverse connection. When measuring by self-excitation method, the switch S must be placed in the "running" position, and the test principle is same

as (1). When measuring by reverse connection method, the switch S must be placed in the "test" position, and the reverse connection test principle diagram is shown in Fig 7.

When testing, it must be carried out in strict accordance with the requirements of the corresponding test equipment.

### 5.1.2 Judgments of result

The capacitance value of the measured unit shall not deviate from the factory value by more than  $\pm 2\%$ , and the capacitor dielectric dissipation factor ( $\tan \delta$ ) shall meet the requirements of the corresponding standard.

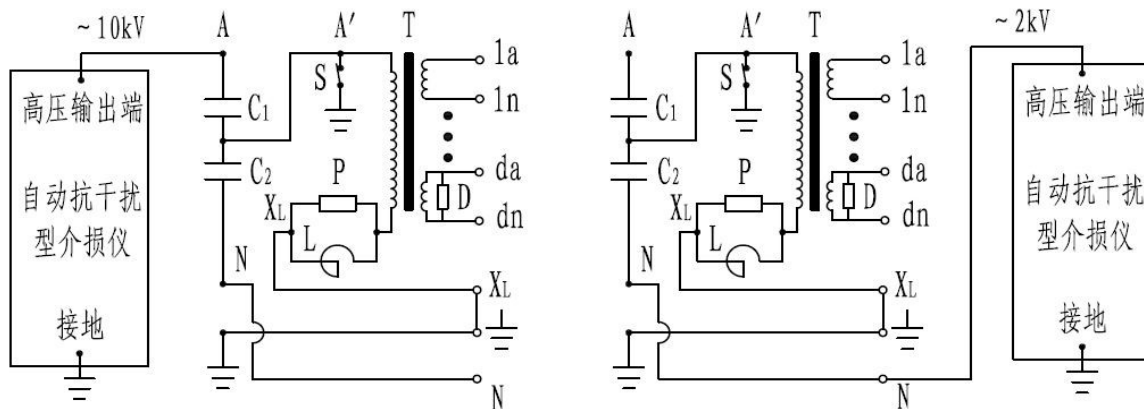


Measurement instructions:

1. "XL" terminal must be earthed, and the measured voltage is generally 2kV.
2. HV line and Cx test line should be suspended and keep space with the ground.
3. If there is MV earthing switch, it must be placed in "Runing" position.
4. When the self-excitation method is used, the test voltage is low, and the dielectric dissipation factor ( $\tan \delta$ ) is larger than the positive connection method. When the dielectric loss factor ( $\tan \delta$ ) is  $>0.25\%$ , treat according to Item 6 in Table 2.
5. The dielectric loss measurement of C1 and C2 is completed and qualified, and the dielectric loss measurement of the total capacitance (C1, C2 series capacitance) is not required.

Fig.6 - Self-excitation method of automatic anti-interference dielectric loss meter to measure capacitance and  $\tan \delta$  diagram





自动抗干扰型介损仪反接法测量 $C_1$ 及其 $\tan \delta$ 原理图 自动抗干扰型介损仪反接法测量 $C_2$ 及其 $\tan \delta$ 原理图

### Measurement instructions:

1. MV earthing switch S must be placed in the "test" position.
2. Take AI6000 as an example: reverse connection method, internal standard, internal high voltage, 50Hz, measuring  $C_1$  and  $\tan \delta$  is generally 10kV, measuring  $C_2$  and  $\tan \delta$  is generally 5kV (when the capacity of the test equipment is insufficient, the test voltage is reduced to 4kV).
3. The dielectric loss measurement of  $C_1$  and  $C_2$  is completed and qualified, and the dielectric loss measurement of the total capacitance ( $C_1$ ,  $C_2$  series capacitance) is not required.

Fig.7 - Principle diagram of the reverse connection method of the automatic anti-interference dielectric loss meter to measure the capacitance and  $\tan \delta$

## 5.2 Voltage withstand test

- (1) It is strictly forbidden to connect the capacitor divider to the electromagnetic unit for voltage withstand test.
- (2) For transformers with MV earthing switch, when the capacitor divider is connected with the electromagnetic unit for voltage withstand test, the switch must be placed in the "test" position.

## 5.3 Accuracy test

When the accuracy test is carried out on site, HV lead is too close to the unit to cause interference to the test. It is recommended that the lead be pulled as far as possible during the test, and the lead wire should be pulled apart to reduce the lead interference.

## 6 Handling of common exception

Handling of common exception sees Tab 2.

Tab 2 Table of common exception handling

Ser No.	Descriptions	Approaches	Measures
1	The oil tank partially leaks oil and the oil level is visible.	Handling on site	Check for leaks, plugging, and replenishing.
2	Electromagnetic unit oil level exceeds the upper limit.	Handling on site	If the secondary voltage of running units fluctuates at the same time, contact the manufacturer's service department; For units to run, remove the lower section divider expander cover and check that the expander is in normal extension. Contact the manufacturer's service department if any problems.
3	The device has abnormal noise, odor or vibration, and there is abnormal voltage display.	Handling on site	Check the secondary connection to ensure that the secondary wiring is not short-circuited, and "N" and "XL" are reliably earthed.
4	Insulation resistance of secondary winding drop	Handling on site	Remove the contamination at the secondary wiring board and wipe off with alcohol. If it cannot be recovered, please contact the manufacturer's service department.
5	Abnormal capacitance test	Handling on site	Check the test methods, wiring, and instrumentation, and contact the manufacturer's service department if it is confirmed that there is no abnormality in the test.
6	Dielectric dissipation factor of self-excitation test test( $\tan \delta$ ) is too large	Handling on site	Method 1: Apply the rated voltage to the capacitor voltage divider, maintain for not less than 5min, and then use the self-excitation method to re-measure the dielectric loss factor ( $\tan \delta$ ); Method 2: Disassemble the divider from the electromagnetic unit, and use the positive connection method to re-measure the dielectric loss factor ( $\tan \delta$ ) according to the standard requirements.
7	Others	/	Contact the service department of the manufacturer

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Edition: 2022, First Printing.