用户手册
USER MANUAL

CVT 运输、安装、维护使用说明书
CVT Transportation, Installation and Maintenance Manual
M020002428

Sieyuan® 思源电气

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适用范围/Application Scope

CN/本使用说明书适用于户外型、电容式电压互感器 CVT 的运输、安装、维护及常见异常处理的要求。

EN/This manual is applicable to the transportation, installation, maintenance and common abnormal treatment of external and capacitive voltage transformers CVT.

CVT 说明/Introductions to CVT

CN/ CVT 结构简介

电容式电压互感器（以下简称 CVT）包括电容分压器和电磁单元。CVT 由一个或多个电容分压器安装在一个油箱(电磁单元)上组成，油箱（电磁单元）中装有中间变压器，补偿电抗器，保护装置和阻尼器等零件。二次端子盒内装有二次接线端子及辅助器件。一次接线端子位于上节电容分压器的顶端。

EN/ Introductions to CVT Structure

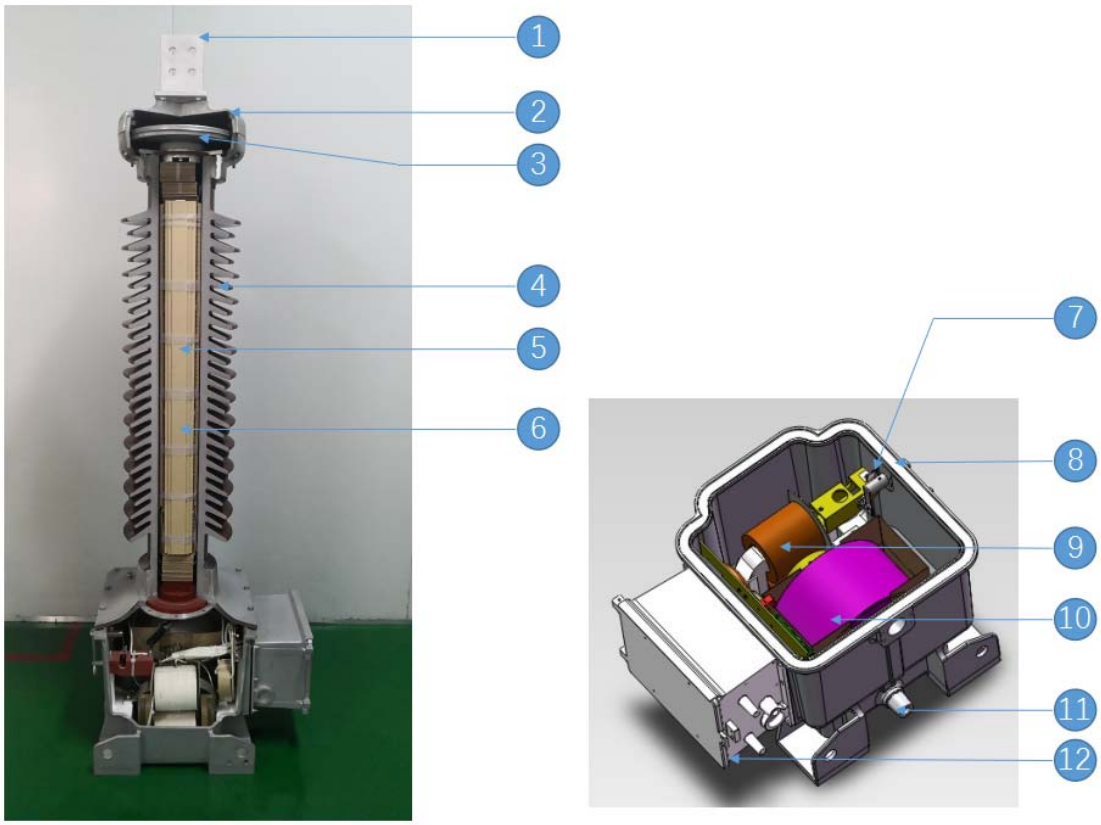
Capacitive voltage transformer (CVT) includes capacitive divider and electromagnetic unit. CVT is composed of one or more capacitors and installed on oil tank. Intermediate transformer, compensation reactor, protective device, damper and other parts are contained in the oil tank. Secondary terminal and auxiliary accessories are installed in the secondary terminal box，The primary terminal is located at the top of the power-saving voltage divider.

CN/典型电容式电压互感器的剖面图详见图 2.1。（根据项目需要配置序 7）

1.高压接线端子
2.膨胀器外罩
3.膨胀器
4.电容器套管
5. 电容分压器芯子
6. 电容器 PEPE 油
7.中压隔离刀
8.油箱
9.电抗器
10.中间变压器
11.放油阀
12.二次出线盒

EN/ See Fig. 2.1 for the profile of typical capacitive voltage transformer for details. (configure item 7 according to project needs)

1.High voltage wiring terminal
2. Expander housing
3. Expander
4. Capacitor sleeve
5. Capacitive voltage divider core
6. Capacitor PEPE oil
7. Intermediate voltage isolatingswitch
8. Oil tank
9. Reactor
10. Intermediate transformer
11. Oil drain valve
12. Secondary outlet box

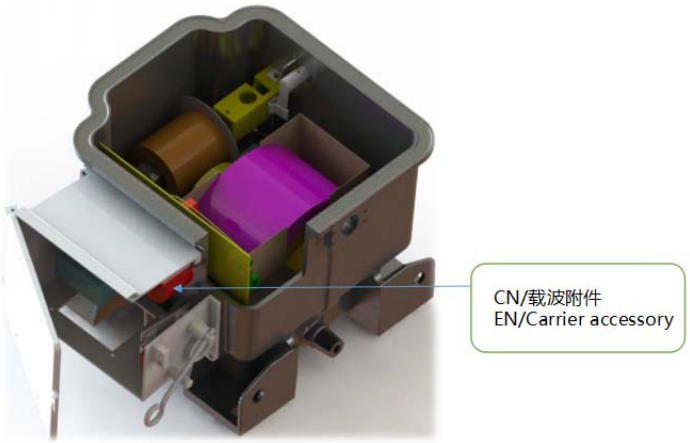


CN/图 2.1 典型 CVT 剖面图

EN/Fig. 2.1 Profiles of Typical CVT

CN/若有需要，可提供载波附件（CCVT）；

EN/Carrier accessories are available upon request (CCVT) ;

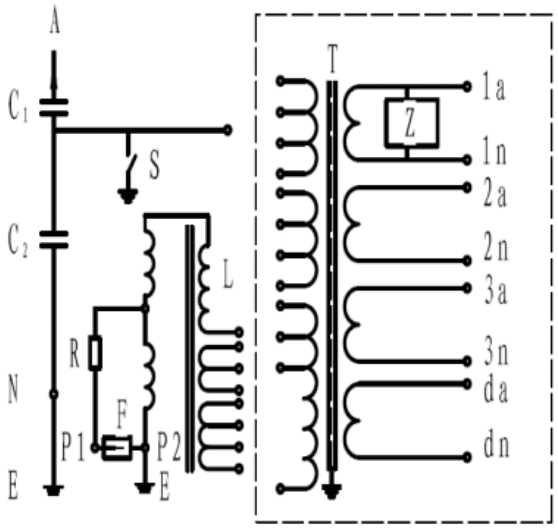


CN/图 2.2 典型 CCVT 油箱图

EN/Fig. 2.2 Fuel tankof Typical CCVT

CN/典型电容式电压互感器的原理图详见图 2.3。
A：高电压端子
C1：高压电容器
C2：中间电压电容器
N：电容分压器低压端子
E：接地端子
F：保护间隙
L：补偿电抗器
T：中间变压器
P1、P2：保护间隙接线端
R：保护电阻
S：中压隔离刀
Z：阻尼线圈

EN/See Fig. 2.3For Schematic of Typical CVT
A:High voltage terminal
C1:High voltage capacitor
C2:Intermediate voltage capacitor
N:Low voltage terminal
E:Earthed terminal
F:Protective gap
L:Compensating reactor
T:Intermediate transformer
P1 P2:Protective gap terminal
R:Protective resistance
S:Intermediate voltage isolatingswitch
Z:Damping device



CN/图 2.3 典型 CVT 原理图

EN/Fig. 2.3Schematic of Typical CVT

工作条件/Operation conditions

CN/环境条件

最高气温：40 ℃

日平均气温不超过：35 ℃

最低温度： -40 ℃

月平均最大相对湿度：95 %（25℃）

⚠ **注意：以上温度为常规使用温度等级，当该说明书上的使用温度与铭牌不一致时，以铭牌为准。**

EN/Environmental Conditions

Maximum temperature:40 ℃

Daily average temperature no more than:35℃

Minimum Temperature: -40 ℃

Monthly average maximum relative humidity:95% (25℃)

⚠ **Attention:The following temperatures are normal service temperature grades, If the operating temperature in this manual is inconsistent with the nameplate, the nameplate shall prevail.**

CN/海拔高度

互感器实际应用海拔详见互感器的铭牌。

安装处海拔超过 1000m 时，其外绝缘的绝缘水平按 IEC 60071 进行修正。

⚠ **注意：未经我公司允许，不得将互感器用到其他高海拔地区（超过互感器铭牌上的海拔）。**

EN/Altitude

The actual application altitude of the transformer is shown in the nameplate on the transformer.

When the altitude of the installation location exceeds 1000m, the insulation level of the external insulation shall be modified according to IEC 60071.

⚠ **Attention:Without the permission of our company, it is not allowed to divert the transformer to other high-altitude areas (higher than the altitude on the nameplate of the transformer).**

运输/Transportation

CN/CVT 运输方式：

1.长距离转运时，建议使用互感器的原有包装箱，并按原有形式重新装箱；

2.短程流转时，采用吊运方式，使用柔性软吊具，单根吊带长度不小于 2.5m。包装箱如图 4.1 所示。

⚠ 注意：CVT（包括电容分压器）在任何需要起吊、运输时必须保持直立，禁止躺倒。

EN/Mode of transport

1.For long-distance transportation, it is suggested to use the original packing box of the transformer and repack it according to the original form.

2.For short-range circulation, the method of lifting and flexible lifting tools shall be adopted, and the length of a single sling shall not less than 2.5m. See Fig. 4.1 for packing box.

⚠ **Attention:CVT (including capacitive voltage divider) must be kept upright during lifting and transportation, and no lying down is allowed.**

CN/图 4.1　CVT 包装箱示意图

EN/Fig. 4.1 Schematic Diagram of CVT Packing Box

存储/Storage

CN/互感器按原有包装形式，储存在干燥通风，无腐蚀的环境中，一年期内存放包装箱加盖防雨材料，做好防潮措施，一年期外存放，加防雨棚，不允许露天存放。互感器堆放不允许超过包装箱表面堆层标识要求。

互感器存储再次转运前，应检查包装箱外表有无腐蚀现象；若因存储不当，遭虫食或潮湿，造成包装箱腐蚀，转运前需加固。

EN/The transformer shall be packed in the original form and stored in a dry, ventilated and non-corrosive environment. It is not allowed to be stored in the open air and moisture-proof measures shall be adopted. The stacking of transformers shall not exceed the stacking marking requirements on the surface of packing box.

Before the transformer is transferred again, the appearance of the packing box should be checked for corrosion. If the container is corroded, bitten by insects or damped due to improper storage, it should be reinforced before transportation.

签收及拆箱检查/Receiving and Unpacking Inspection

CN/1.互感器签收前，核实 CVT 规格、参数及配件数量是否与订货一致（与麦头对比）。

2.检查包装箱外观是否有损坏、油渍等异常；

3.开箱时先拆包装箱顶盖，再拆侧板，不允许碰损产品任何部位

4.互感器开箱后，检查互感器外观有无磕碰、损坏或漏油等异常，资料是否齐全。

EN/1.Before receiving the transformer, check whether the quantity of CVT and accessories is consistent with the order;

2.Check the appearance of the packing box to ensure there is no damage, oil stains and other abnormalities;

3.When unpacking, first remove the top of the packing box and then remove the side plate. No damage to any part of the product is allowed

4.Before unpacking and lifting the transformer, check whether the transformer is bumped, damaged or leaking oil.

Lifting /吊装

CN/1.起吊 CVT 时应使用油箱上的四个吊攀，用四根同样长度的吊缆置于起吊钩上，慢慢吊起 CVT，如图 7.1 所示。

2.起吊和移动 CVT 时，用另一根绳子或带子将这四根吊缆和电容器捆在一起，以免 CVT 颠覆。

3.起吊时吊缆与 CVT 的顶端接触处应加毡圈或橡皮垫，以免吊缆损坏 CVT 的膨胀器金属罩。

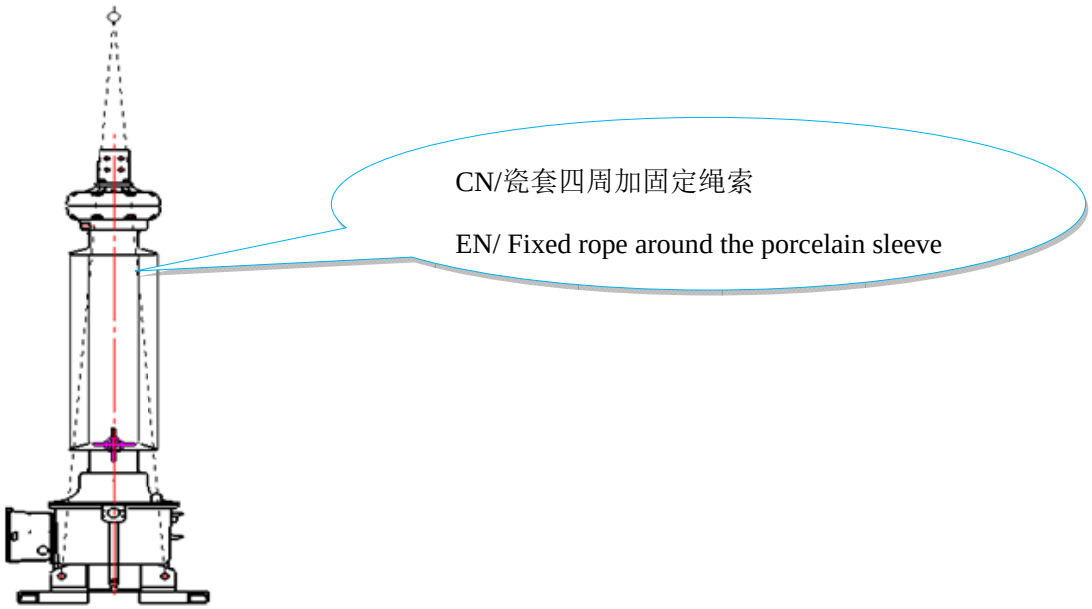
⚠ **注意:防止 CVT 翻倒或损坏绝缘子，不允许用电容分压器顶端的法兰或绝缘子的伞裙起吊 CVT。**

EN/1. When lifting the CVT, use the four slings on the oil tank and place four cables of the same length on the lifting hook to slowly lift the CVT, as shown in the Fig. 7.1. Take care not to tip the CVT over or damage the insulator.

2.When lifting and moving the CVT, tie the four cables and the capacitor together with another rope or strap to prevent the CVT from overturning.

3.The cable and the top contact position of CVT shall be added the felt ring or rubber pad to prevent the cable from damaging the metal cover of the CVT expander.

⚠ **Attention:Do not lift the CVT with the flange on the top of the capacitor voltage divider or the umbrella skirt of the insulator.**



CN/图 7.1　CVT 的起吊（由箱体吊攀起吊）
EN/ Fig. 7.1 CVT Lifting (lifting the joint hinges on box body)

⚠ **注意:如果 CVT 有多节电容分压器，起吊时用有吊环扣的绳索扣住电容分压器上方的金属法兰进行起吊。不允许将绳索捆绑在绝缘子的伞裙上。**

⚠ **Attention:If the CVT contains multiple capacitive voltage dividers, it would be an effective lifting method by using the sling with lifting buckles to fasten the metal flange at the top.**

CN/图 7.2　CVT 多节电容器的起吊
EN/ Fig. 7.2CVT Lifting of multi-section capacitors

Installation /安装

CN/互感器的安装固定

对于 220kV 以上带多节电容器的 CVT，先吊装本体（油箱及下节电容器），用螺栓将本体与安装支架固定牢靠，再吊装上节电容器，上节电容器在支架上与下节组装固定，两节电容分压器间用螺栓直接连接紧固，安装步骤参考图 8.1

均压环（如有）：安装时大环向下（查看产品配置外形图）

⚠**注意：**

1.采用合适长度的吊具。

2.每台 CVT 的电容器编号必须与 CVT 铭牌规定一致，上、中、下节电容分压器编号一致（220kV 以上），每台产品电容分压器不能互换。

3. 不允许电容分压器叠装后再吊装到安装支架上。

EN/Transformer Installation and Fixation

For CVTs with multi-section capacitors above 220kV, first hoist the body (oil tank and lower section capacitor), fix the body with the mounting bracket with bolts, then hoist the upper section capacitor, the upper section capacitor is assembled and fixed on the bracket with the lower section, two The capacitor voltage divider is directly connected and fastened with bolts. For installation steps, refer to Figure 8.1

Pressure equalizing ring (if any): Large ring downwards during installation (see product configuration outline drawing)

⚠**Attention:**

1.Use proper length spreader.

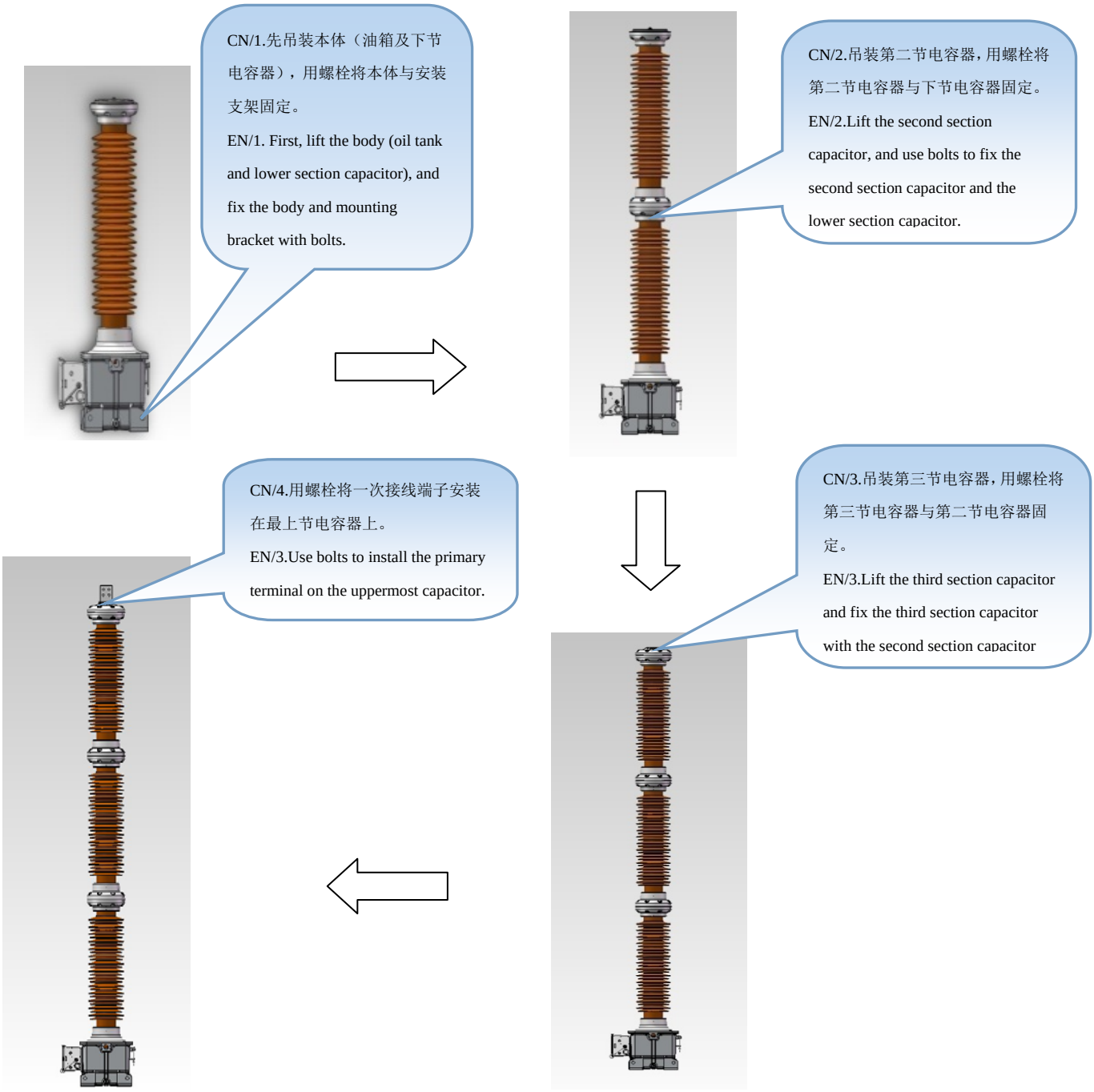
2.The capacitor number of each CVT must be consistent with the CVT nameplate. The upper, middle and lower power-saving capacity voltage dividers shall have the same number (above 220kV). Each product capacitor voltage dividers shall not be interchangeable.

3.The capacitive voltage divider is not allowed to be mounted on the mounting bracket after stacking.

CN/若 CVT 需配合阻波器，阻波器需满足如下条件：

EN/If the CVT needs to be combined with a wave stopper, the wave stopper shall meet the following conditions:

CN/产品型号 **EN/**Product model	**CN/**阻波器最大重量，kg **EN/**Maximum weight of wave stopper(kg)	**CN/**阻波器最大高度(含安装支架),mm **EN/**Maximum height of wave stopper (including mounting bracket)mm	**CN/**工况 **EN/**Workingcondition
TYD220/ √3-0.01	400	1900	0.3g-5%-10m/s
TYD220/ √3-0.005	200	1900	0.3g-5%-10m/s
TYD132/ √3-0.02	635	1900	0.3g-5%-10m/s
TYD132/ √3-0.01	345	1900	0.3g-5%-10m/s



CN/图 8.1　CVT 多节电容器的安装步骤（以三节为例）

EN/ Fig. 8.1CVT Multi-section capacitor installation steps (take three sections as an example)

CN/一次接线端子

一次端子连接前，对接触面进行清理，保证接触面无锈蚀氧化现象；接触面可涂适量导电膏，连接紧固件力矩 60N·m，保证接触面无缝隙。

一次引线宜采用软母线；一次接线端子可根据需要拆卸固定的四个螺栓旋转方向；线路引线的拉力及重力不能超过产品一次导排机械承受力。（为满足运输高度，一次接线端子运输时可能会拆卸下来，现场可通过螺栓将一次接线端子固定在电容分压器顶端）

EN/ Primary wiring terminal

Before the primary terminal connection, clean the contact surface to ensure that there is no corrosion and oxidation on the contact surface; the contact surface can be coated with an appropriate amount of conductive paste, and the torque of connecting fasteners is 60N · m to ensure that there is no gap in the contact surface.

Soft bus should be used for primary leads.The primary terminal row can be disassembled and unmounted according to the rotation direction;The tensile force and gravity of the line lead cannot exceed the mechanical bearing capacity of the product once. (In order to meet the transportation height, the primary terminals may be disassembled during transportation. The primary terminals can be fixed on the top of the capacitor voltage divider by bolts on site)

CN/二次端子连接

在连接二次端子前，应确保系统处于未通电状态。

（1）按照互感器铭牌或说明牌的示意图、现场安装图进行二次回路引线的连接，不允许松动，如图 8.2。

（2）二次绕组不允许短路，运行时，N 端子必须可靠接地。

（3）电磁单元的尾端 P2 必须接地可靠，二次电缆要远离过电压保护器，P1 端子必须紧固。

（4）过电压保护器两端接触良好（如有异常可更换）。

（5）若实际供货 CVT 二次端子可能与本说明书不同，以实物为准。

⚠ **注意:试验后需确保 N、P2 接地可靠。**

EN/二次端子连接

Make sure that the system is not energized, and pay attention to the free electromagnetic field caused by the nearby electric equipment before connecting the secondary terminal.

（1）Connect the secondary terminal according to the schematic diagram of the transformer nameplate or instruction plate, and check whether it is loose as shown in the Fig. 8.2.

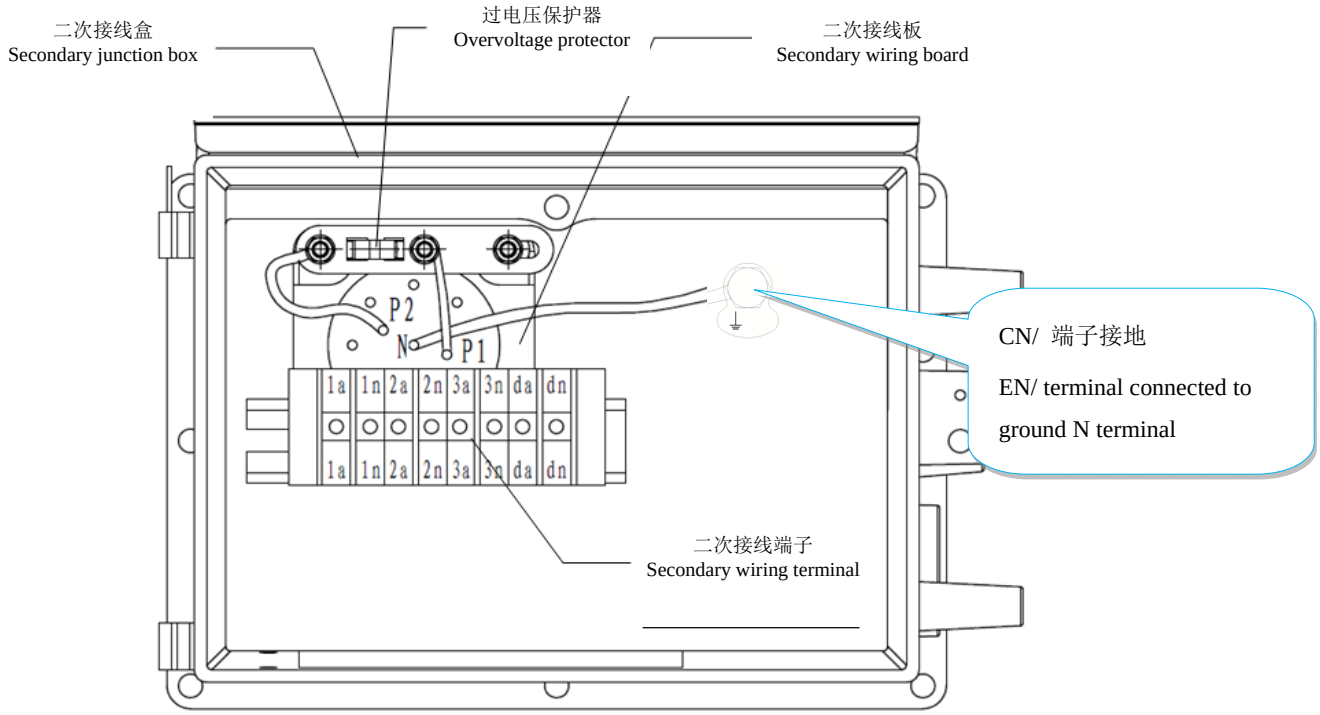
（2）Short circuit is not allowed for secondary winding; Terminal N must be grounded while running.

（3）No open circuit is allowed for the grounding terminal P2 of the electromagnetic unit. Make sure that the nut is firmly fastened and the secondary cable is far away from the discharge tube.

（4）Good contact between both ends of overvoltage protector (replaceable if abnormal)

（5）If the actual supply of CVT secondary terminals may be different from this manual, the physical shall prevail.

⚠ **Attention:N and P2 should be firmly grounded after the test.**



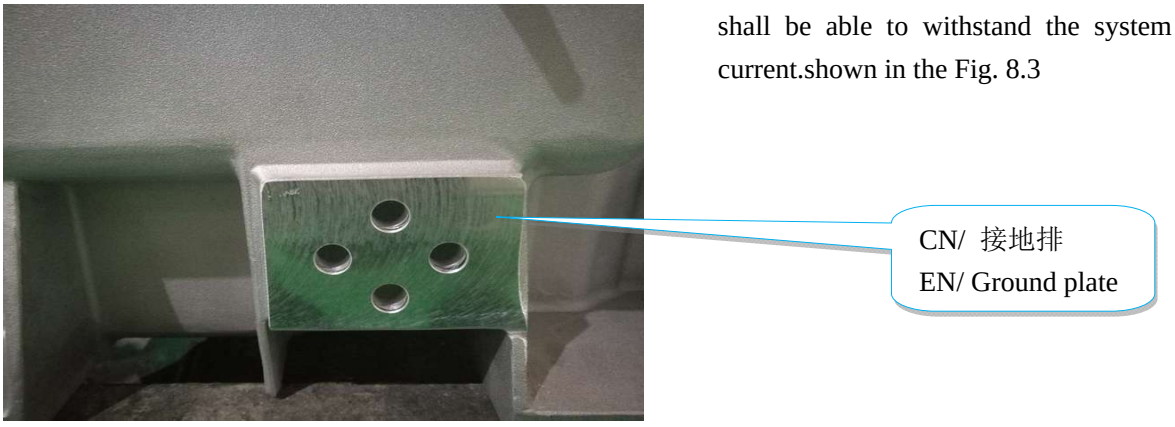
CN/图 8.2 CVT 二次端子盒
EN/Fig. 8.2 Secondary Terminal Box of CVT

CN/接地端子连接

CVT 的接地端子位于底座下方，平板结构，该接地点应与电站地网可靠连接。接地线应能承受系统短路电流（按现场要求）。如图 8.3。

EN/ Grounding Terminal Connection

The grounding terminal of the CVT is located under the base and is of flat plate structure. The grounding point should be reliably connected to the ground grid of the power station. The grounding wire shall be able to withstand the system short-circuit current.shown in the Fig. 8.3



CN/图 8.3 CVT 接地端子示意图
EN/Fig. 8.3CVT ground terminal connection diagram

Operation and Maintenance /投运及维护

CN/投运前检查

1.CVT 安装固定后，至少静置 24h 后再投运；

2.确认三相互感器油位高度基本一致，油位在最高与最低线之间（见下图表 2）；

3.检查 CVT 有无漏油异常；

4.确认二次绕组接线正确、紧固, N、P2 端子可靠接地。

EN/ Inspection before Operation

1.After the CVT is installed and fixed, it should be kept stand still for at least 24h before being put into operation;

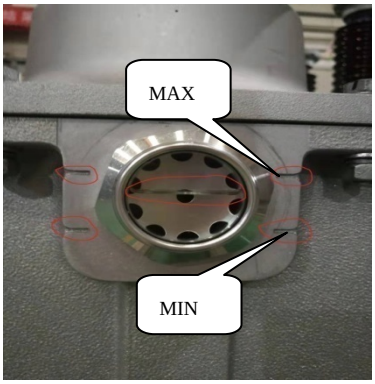
2.Confirm the oil level of the three-phase transformer is consistent,The oil level is between the highest and lowest line.

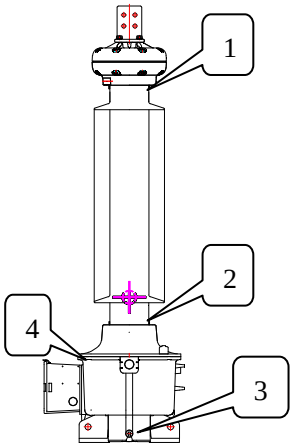
3.Check whether there is any oil leakage for the CVT;

4.Make sure the connection of the secondary winding and the terminal N、P2 is reliable

CN/日常巡查项目

EN/ Routine Inspection Items

CN/序号 EN/No.	CN/检查项目 EN/Check ítems		CN/合格要求 EN/Requirements	CN/巡查时间 EN/Inspection time
1	**CN/**运行状态 **EN/**Operating condition	**CN/**仪表指示 **EN/**Instrument indication	**CN/**仪表指示正常 **EN/**Instrument indicates normally	**CN/**投运运行期间 **EN/**During the operating period
2	**CN/**油位观察窗 **EN/**Observation window of oil level	**CN/**油位 **EN/**Oil level 	**CN/**1.三相CVT的油位指示高度基本一致； 2. 油位标识线在MAX与MIN之间。 3. 油色清澈 **EN/**1.The oil level indication height of three-phase CVT shall be basically consistent; 2.The mark line of the oil level shall be between MAX and MIN, and be clearly visible. 3.Oil color clear	**CN/**投运运行期间 **EN/**Duringthe operating period

3	**CN/**连接部位/油阀口 **EN/**Connecting position/oil valve inlet		**EN/**There shall be no oil stain on the four positions **CN/**四个位置无油迹	**CN/**运行期间 **EN/**During the operation
4	**CN/**一次接线端子 **EN/**Primary wiring terminal	**CN/**一次接线端子连接有无扭曲变形，连接处有无变色。 **EN/**Connection of primary airing terminal has no distortion, and the color of connection position shall not be changed.	**CN/**一次接线端子连接无扭曲变形，连接处颜色没有变黑。 **EN/**Connection of primary airing terminal has no distortion, and the color of connection position shall not be black.	**CN/**验收时 投运前 运行期间 **EN/**During acceptance Before operation During operation
5	**CN/**瓷套 **EN/**Insulator	**CN/**瓷套伞裙有无破损、裂纹、严重油污、放电痕迹及其它异常情况。 **EN/**Check where there are damage, cracks, serious oil stains, electric discharging trace and other abnormal conditions for the insulator skirt.	**CN/**瓷套伞裙无破损、裂纹，无严重油污，无放电痕迹及其它异常情况 **EN/**There is no damage, cracks, serious oil stains, electric discharging trace or other abnormal conditions for the insulator skirt	**CN/**运行期间 **EN/**During the operation
6	**CN/**红外热成像测试。 **EN/**Infrared thermal imaging test	**CN/**油箱部位、导排及法兰处 **EN/**Oil tank, guide and flange	**CN/**油箱各部位温度一致（小于 5K），产品同组基本一致、法兰及导排处没有明显发热情况 **EN/** The temperature of all parts of the oil tank is consistent (less than 5K), the products are basically the same in the same group, and there is no obvious heating at the flange and guide exhaust	**CN/**运行期间 **EN/**During the operation

⚠ **注意:1.在接触 CVT 前，须将 CVT 从线路断开，再将 CVT 的导电部位通过接地棒多次放电；**

2.产品油箱箱盖上的注油孔必须保持密封状态，如打开必须随时恢复原样，防止密封不良导致电磁单元雨天进水受潮。

3.对于大气腐蚀等级 C5、CX（工业地区、沿海地区）的地区，因环境恶劣易造成绝缘子积污后发生沿面放电或闪络，需对绝缘进行定期清洗，具体清洗方式见附录 B。

⚠ **Attention: 1.Before touching the CVT, it needs to disconnect the CVT from the circuit and discharge the conductive parts of the CVT for multiple times via ground rod;**

2.The oil filling hole on the cover of the oil tank must be kept sealed. If it is opened, it must be restored to its original state at any time to prevent the electromagnetic unit from water and moisture in rainy days due to poor sealing.

3.For areas with atmospheric corrosion levels of C5 and CX (industrial areas, coastal areas), because of the harsh environment, it is easy to cause surface discharge or flashover after the insulator is fouled. Regular cleaning of the insulation is required. See Appendix B for specific cleaning methods

回收处置/Recovery and Disposal

CN/此 CVT 主要组成材料成分包含：金属铜、铁、铝，变压器油及陶瓷；在正常工况条件下，互感器使用寿命为 30 年。互感器到期报废或不再使用后，金属铜、铁、铝，变压器油及陶瓷应集中交给具有资质的单位回收处理，以避免对环境的污染影响。

EN/The main components of the CVT include copper, iron, aluminum, transformer oil and ceramics. Under normal working conditions, the service life of the transformer is 30 years. When the transformer is scrapped or no longer in use, the copper, iron, aluminum, transformer oil and ceramics shall be collectively handed over to the qualified unit for recycling and processing, so as to avoid the pollution and impact on the environment.

常见异常处理/Common exception handling

CN/序号 EN/No.	CN/故障模式 EN/Fault mode	CN/异常原因描述 EN/Description of abnormal phenomena	CN/处理措施 EN/Treatment measure
1	CN/运行有异响 EN/There is abnormal sound in operation	CN/1.产品发生铁磁谐振； 2.产品过载，铁芯饱和； 3.二次接触不良； 4.二次引线破损，对地放电。 EN/1.Ferromagnetic resonance occurs in the product 2.Product overload, iron core saturation 3.Poor secondary contact 4.The secondary lead is damaged and discharged to ground	CN/1.重新投运或观察； 2.降低负载； 3.紧固引线； 4.更换二次引线。 EN/1.Re-operation or observation 2.Reduce load 3.Fasten the leads 4.Replace secondary lead
2	CN/运行时电压不稳定 EN/Unstable voltage during operation	CN/1.产品发生铁磁谐振； 2.二次回路线有轻微的短路情况，各二次绕组 a 端通地。 EN/1.Ferromagnetic resonance occurs in the product. 2.There is a slight short circuit in the secondary circuit line，the A terminal of each secondary winding is grounded.	CN/1.消除谐振现象； 2.检查二次回路；（包含汇控柜） EN/1. Eliminate the resonance phenomenon 2.Check the secondary circuit (including the control cabinet)
3	CN/运行时油箱发热 EN/Fuel tank heats up during operation	CN/1.二次短路； 2.内部绝缘故障。 EN/1.Secondary short circuit. 2.Internal insulation failure.	CN/1.检查二次回路。 2.更换产品。 EN/1. Check the secondary circuit. 2.Replace product.
4	CN/过电压保护器损坏 EN/Damaged overvoltage protector	CN/1.试验接线或电压错误 2.产品二次绝缘破损短路 3.P1、P2 松动 EN/1.Test wiring or voltage error 2.Product secondary insulation damaged short circuit 3.Loose on P1 and P2 sides	CN/更换过电压保护器 EN/Replace the overvoltage protector

附录 A /Appendix A /

CN /附录 A 测电容及介损试验方法（正接法）

1、试验时请先拆除 P2 端及放电管 F 后再进行正接法试验；

2、CVT 外壳及短接的二次绕组均需可靠接地，施加电压 10kV，测得下节电容器的 C；

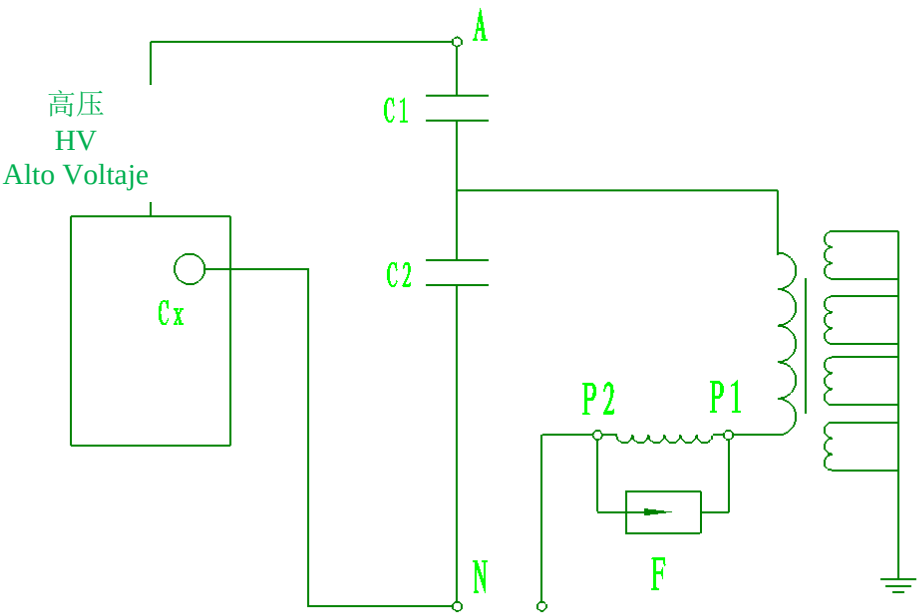
3、P2 端及放电管 F 在 CVT 出线盒中，试验完成后请将 P2 及放电管恢复原位。

EN/ Test Method for Measuring Capacitance and Dielectric Loss（The positive connection)

1. Forward connection test shall be carried out after removing end P2 and discharge tube F;

2. Shell of CVT and short-circuited secondary winding shall be reliably grounded and 10kV voltage shall be applied to measure the C of lower capacitor;

3. End P2 and discharge tube F are in CVT outlet box, which shall be restore in normal position after test.



CN/下节电容器正接法测试原理

EN/Forward Connection Testing Principles of Lower Capacitor

附录 B /Appendix B/

CN /附录 B 绝缘子清洗方法

1.清洁周期：建议一年左右进行一次绝缘子表面清洁，或根据相关停电计划适当改变。

2.清洁方法：

I.擦洗和刷洗法：可用干布沾清洗剂（或清水）对绝缘子进行擦洗或用刷子刷洗，洗后自然晾干。

II.喷洗法：用带电清洗设备进行高压喷洗清除绝缘子上的灰尘、油污、湿气、碳粉、金属粉末等有害物，洗后自然晾干。

⚠ **注意：**清洗前需确认现场已停电

EN /Appendix B Insulator cleaning method

1.Cleaning cycle: It is recommended to clean the surface of the insulators once about half a year, or change appropriately according to the relevant power outage plan.

2. Cleaning method:

I.Scrubbing and scrubbing method: use a dry cloth dipped in cleaning agent (or clean water) to scrub the insulator or scrub with a brush, and then dry naturally after washing ;

II.Spray washing method: high-pressure spray washing with live cleaning equipment to remove dust, oil, moisture, carbonpowder, metal powder and other harmful substances on the insulator, and then dry naturally after washing.

⚠ **Attention:** Before cleaning, please confirm that the power has been cut off.