# CVT

# Dry Type Vacuum On Load Tap Changer

# Operation Instructions

HM 0.460.3301

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# 1. General

CVT dry type vacuum on load tap changer consists of a tap selector and a diverter switch. First the tap selector selects the adjacent tap without load, then the diverter switch makes the switching with load. The current switching is carried out in the vacuum interrupter of the diverter switch, hence it features in high reliability and long operation life.

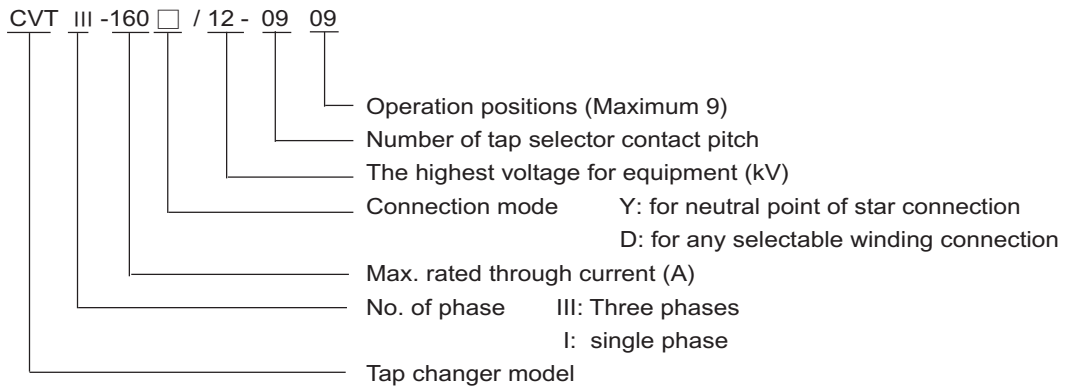
CVT dry type vacuum on load tap changer is applicable for dry transformer with voltage up to 12kV, the maximum rated through current of the tap changer can be reached to 160A and maximum operation position is 9.

CVT tap changer is equipped with HMJK-10Z automatic voltage regulator to realize the manual and automatic control.

# 2. Application condition and requirement

- Indoor
- Environment temperature: -25 ℃~ 45℃
- Atmosphere humidity: not higher than 95% at 25 ℃
- There shall be no gas, steam or chemical dust which may seriously affect the insulation of the tap changer on site, or any explosives as well as electrical conductors.
- There shall be no serious vibrations on site.

# 3. Type description



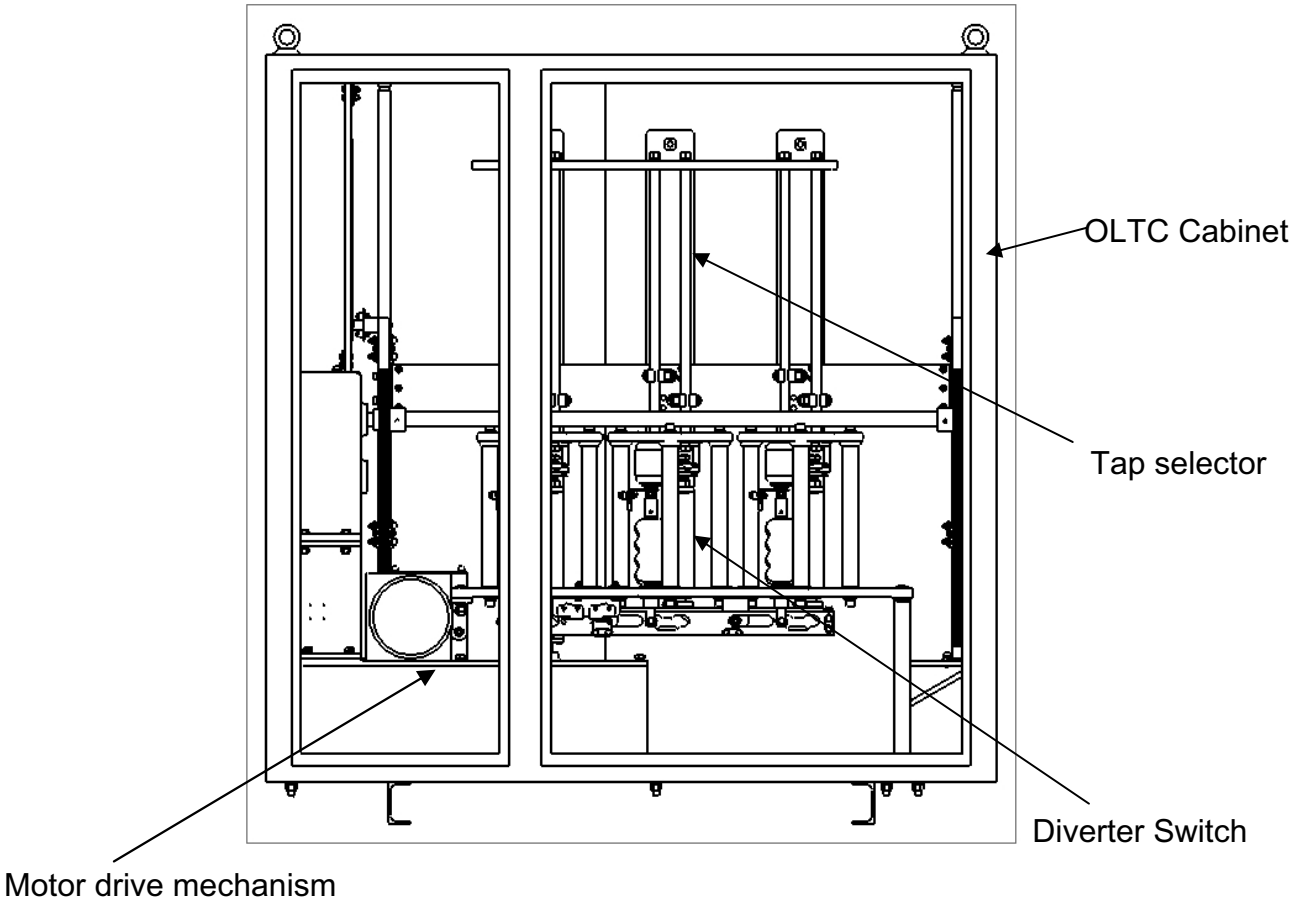
## 4. Main technical data

| No. | Type | | | CVT |
|---|---|---|---|---|
| 1 | Number of phase | | | 3-phase, 1-phase |
| 2 | Maximum rated through current (A) | | | 160 |
| 3 | Short-circuit current test (kA) | | Thermal stability (3s) | 3 |
| | | | Dynamic stability (peak value) | 7.5 |
| 4 | Connection | | | Y- neutral point<br>D-any connection |
| 5 | Maximum step voltage (V) | | | 500 |
| 6 | Rated step capacity (kVA) | | | 80 |
| 7 | Rated frequency (Hz) | | | 50/60 |
| 8 | Max. operation positions | | | 9 |
| 9 | Insulation level (kV) | To ground | The highest voltage for equipment | 12 |
| | | To ground and between phases | Rated separate source AC withstand voltage(kV/50Hz,1min) | 35 |
| | | | Rated lightning impulse withstand voltage (kV,1.2/50μs) | 85 |
| | | Between adjacent taps | Rated separate source AC withstand voltage(kV/50Hz,1min) | 5 |
| | | | Rated lightning impulse withstand voltage (kV,1.2/50μs) | 20 |
| | | Across the tap winding | Rated separate source AC withstand voltage(kV/50Hz,1min) | 15 |
| | | | Rated lightning impulse withstand voltage (kV,1.2/50μs) | 50 |
| 10 | Motor | | Power (kW) | 0.37 |
| | | | Voltage (V) | 220V AC |
| | | | Rated current (A) | 2.68 |
| | | | Rated frequency (Hz) | 50 or 60 |
| 11 | Time for one operation (second) | | | 4.4 |
| 12 | Electrical life (operations) | | | Not less than 300,000 |
| 13 | Mechanical life (operations) | | | Not less than 800,000 |
| 14 | Overall dimensions (length × height × width) (mm) | | | 1400 × 1475 × 475 |
| 15 | Net weight (kg) approx. | | | 200 |

**Note: Please contact with us for special requirement.**

## 5. Structure and working principle

The tap changer is of cabinet structure. It consists of tap selector, diverter switch, motor drive system and automatic voltage regulator. When the tap changer is delivered, the tap selector, diverter switch and motor drive system have already been optimally connected. It's not necessary for the user to adjust.




### 5.1 Tap selector

Tap selector contacts are divided into odd set of contacts and even set of contacts. When the even set of contacts are under working status, the odd set of contacts can select the taps. Vice versa, the even set of contacts can also select the taps. In this way, the tap changer contacts can switch from one position to an adjacent position without carrying current. The moving contacts of the tap selector are driven by a step-by-step moving mechanism, which is to ensure that the diverter switch will only activate after the tap is selected and when it is in the right position.

There are both electrical and mechanical limits for the tap selector. When the tap changer is at the limit positions, it can only be operated in the back direction.

## 5.2 Diverter switch

The contact system comprises two vacuum interrupters and a set of off circuit contacts. The transition circuit adopts single resistor asymmetrical pennant cycling circuit. The making and breaking of the vacuum interrupters and off circuit contacts are controlled by a cam switch. The movement of the cam board is driven by a spring mechanism. Once the mechanism is released, it will complete the switching without any outside intervention.

## 5.3 Motor drive system

HMJK-10Z automatic voltage regulator controls the back and forth rotation of the motor drive. It is by the position signals of the tap changer that the voltage regulator operates. For operation of the voltage regulator, please refer to HMJK-10Z Operation Instructions.

### 5.3.1 Step by step control

The electrical and mechanical system of the tap changer will stop automatically after one tap change, which is to ensure that after receiving a tap change order, the tap change will be completed without outside intervention.

### 5.3.2 Emergency stop

If the tap changer is to be suspended during the operation, please press the “STOP” button.

### 5.3.3 Over current lock

When required by the user, the tap changer can be equipped with an over current device. Once there is over current in the transformer, the device will be activated to lock the operation of the tap changer.

# 6. Lifting and installation

## 6.1 Lifting

The following methods can be adopted to lift up the tap changer (max.200 kgs):

Method 1: lift up by crane, lift the tap changer by holding four lifting lugs simultaneously at the top of tap changer cabinet as in Fig 6.1. The force applied on each hook should be distributed evenly.

Method 2: use forklift to lift up from bottom of tap changer (Fig. 6.2).

***Notice: Whichever method is taken, any inclination and severe vibration should be avoided during lifting-up.***

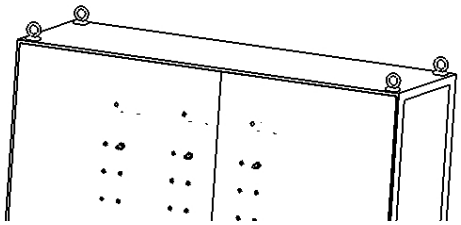


Fig 6.1 lift up by crane

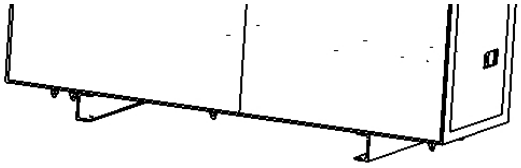


Fig 6.2 use forklift to lift up from bottom of tap changer

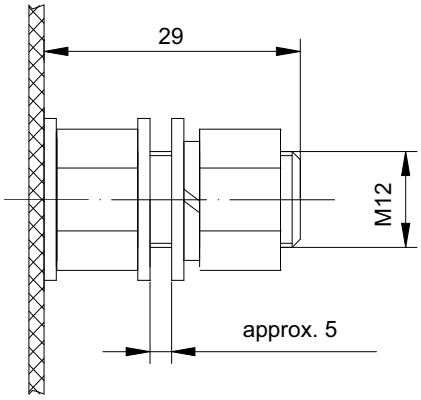



Fig 6.3 The terminals of tap changer

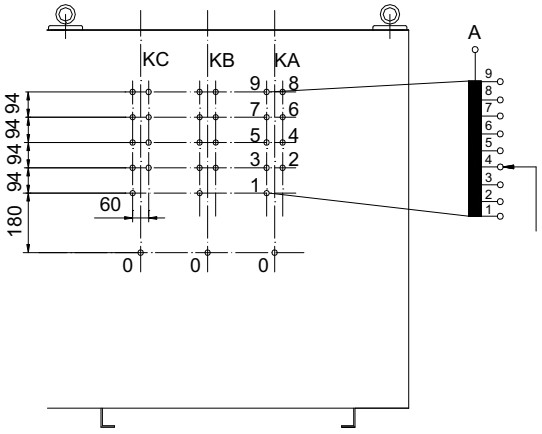



Fig 6.4 connection diagram

## 6.2 Installation

The tap changer should be securely fixed by four M12 bolts at the bottom before putting into operation. Please refer to appendix for Installation dimension drawing.

### 6.3 Leads connection between tap changer and transformer

The terminals of tap changer should be connected by leads to transformer taps phase by phase (Fig. 6.3).

Connection should follow connection diagram (Fig 6.4), please pay attention that a suitable length of cable is necessary, which can avoid stretching force against tap changer, and enough insulation distance should be reserved between leads.

### 6.4 Electrical connection

Connect the tap changer with AVR HMJK-10Z by using the cable which is provided along with product (Appendix Fig.3).

### 6.5 After connection

The tap changer should be performed for one full operation cycle without load, then measure direct current resistance of the winding and perform transforming ratio test. During the test, confirm whether displaying positions are identical to actual positions of tap changer.

***Notice: If transformer is required to be dried, the tap changer should be removed from the transformer. The tap changer must NOT be dried.***

## 7. Function test before operation

Mechanical function test should be carried out before tap changer putting into service, and it should operate continuously from one end limit position to the other end limit position, and then change back to set position.

# 8. Maintenance and inspection

## 8.1 Maintenance intervals

After first 5,000 operations or/and first year's operation; and after that each 50,000 or each two year's operation.

## 8.2 Maintenance items

8.2.1 Clean up all surfaces of parts inside cabinet.

8.2.2 Tighten all fasteners.

8.2.3 Lubricate all movable parts, including moving and stationary contacts of tap selector as in fig 8.1; transmission gear in fig 8.2; cam of diverter switch in fig 8.3; turning arm of diverter switch in fig 8.4; mechanical contacts of diverter switch in fig 8.5.

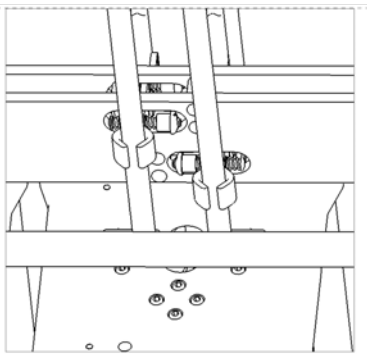


Fig 8.1 Moving and stationary contacts of tap selector

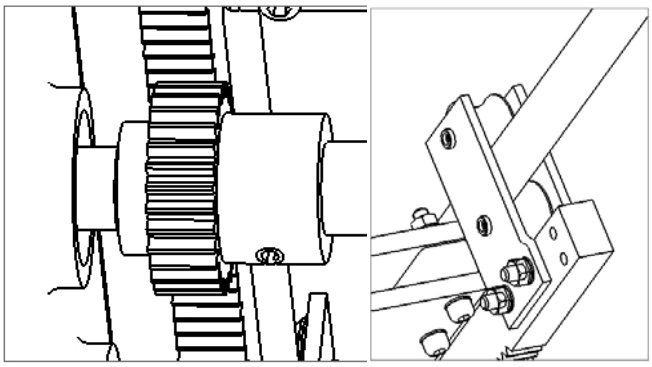


Fig 8.2 Transmission gear

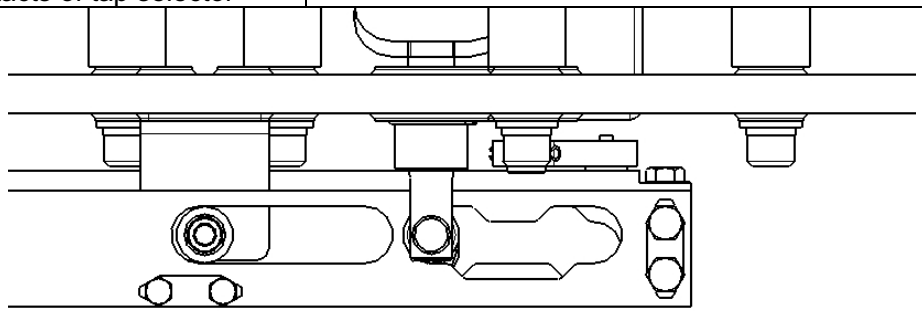


Fig 8.3 Cam of diverter switch

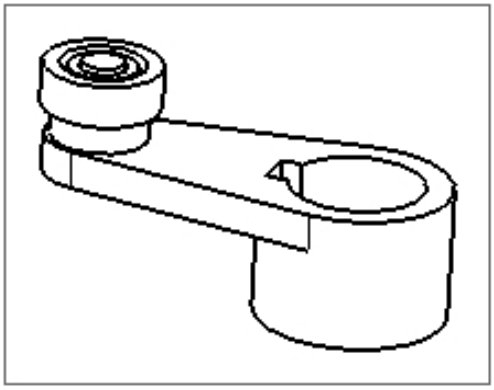


Fig 8.4 Turning arm of diverter switch

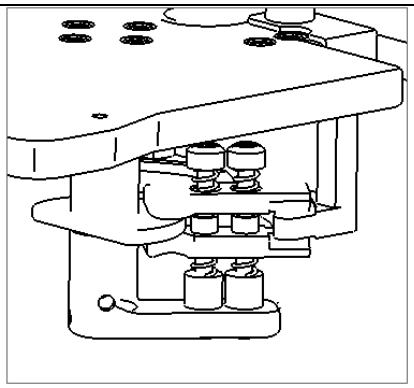


Fig 8.5 Mechanical contacts

8.2.4 Check vacuum degree of vacuum interrupter (only by Huaming-trained personnel): perform power frequency withstand voltage test by applying 3kV, 1 minute on vacuum interrupter when electrode separation is 3 mm.

8.2.5 Check operation sequence (only by Huaming-trained personnel)
Use On-load tap changer oscilloscope to check whether making and breaking sequence are in conformity with standard values.

8.2.6 Measure transition resistor resistance, actual value should be in conformity with those in nameplate, and deviations should be less than±10%.

8.2.7 Check whether all leads are securely connected by measuring the direct current resistance of whole circuit.

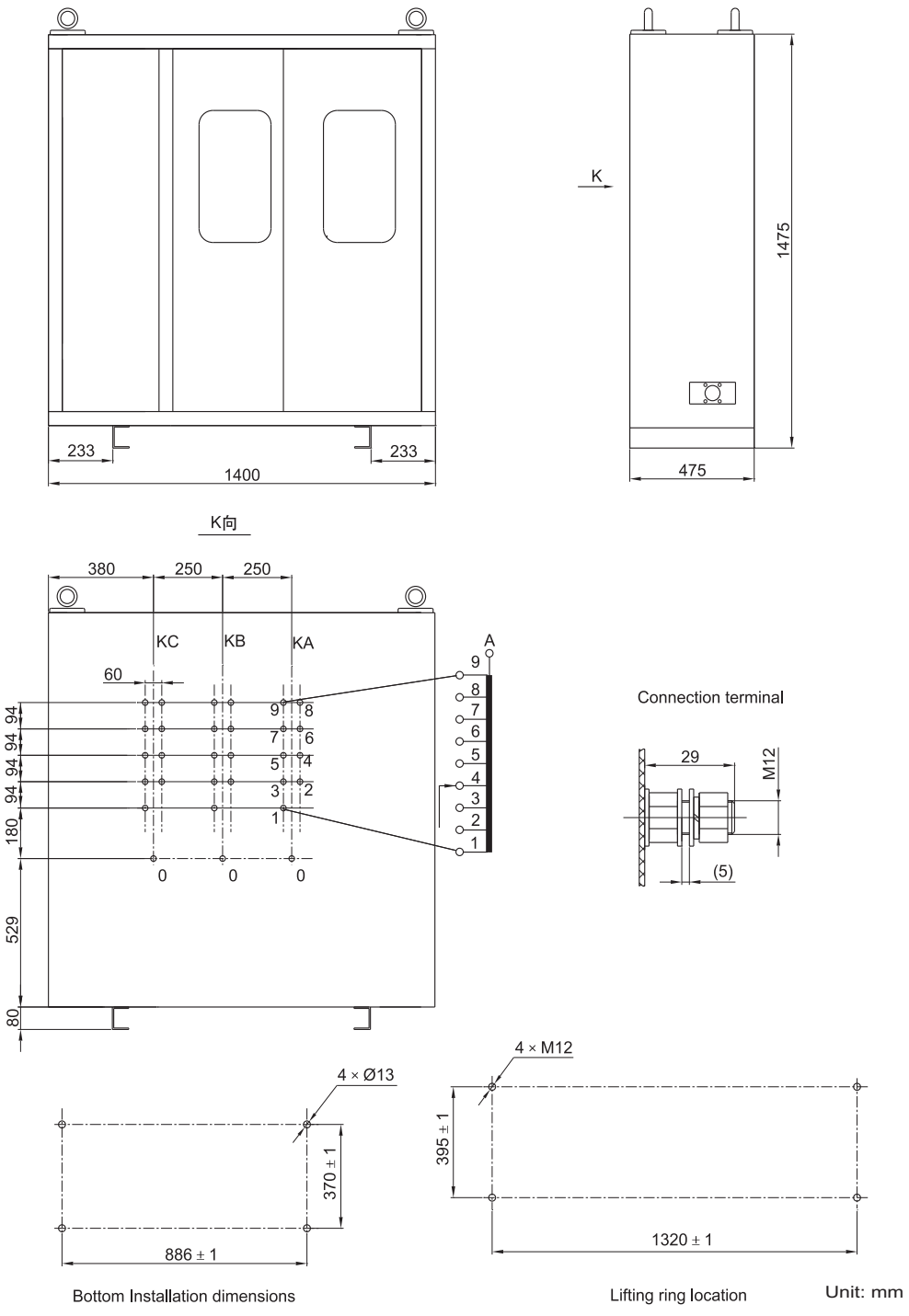
8.2.8 After the above maintenances, at least 10 mechanical operation cycles should be performed to verify selecting and switching sequences; verify the functions of motor drive and indication of positions are in normal condition.

## 9. Trouble shooting of common failures

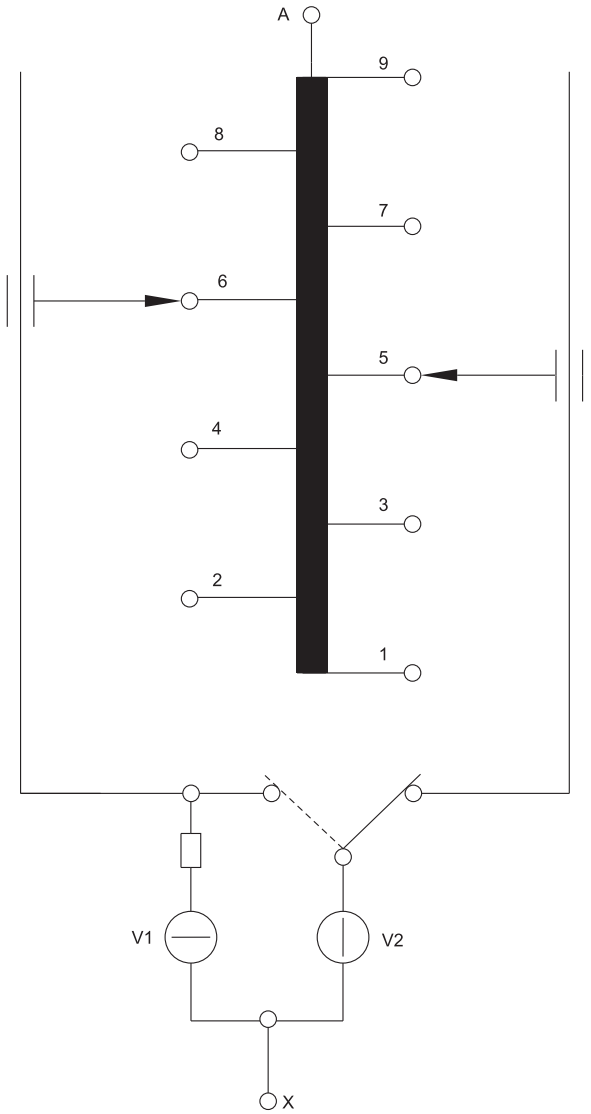
| Failure | Cause | Solution |
|---|---|---|
| Remote indication doesn't work | Plug of the voltage regulator is not well connected, power and operation terminal is not well connected. | Plug again, connect the operation terminals according to the voltage regulator operation instructions. |
| Electricity discharge phenomenon | Vacuum interrupter damaged | Replace interrupter |
| | Insulation parts is too dirty | Clean insulation parts with silk cloth |
| | Insulation parts are damaged | Replace insulation part |
| Mechanical blocking | Not well lubricated | Re-apply lubrication oil or grease |
| | Mechanical part damaged | Contact with the manufacturer |

## 10. Appendix

# Appendix 1: Overall dimension of the tap changer

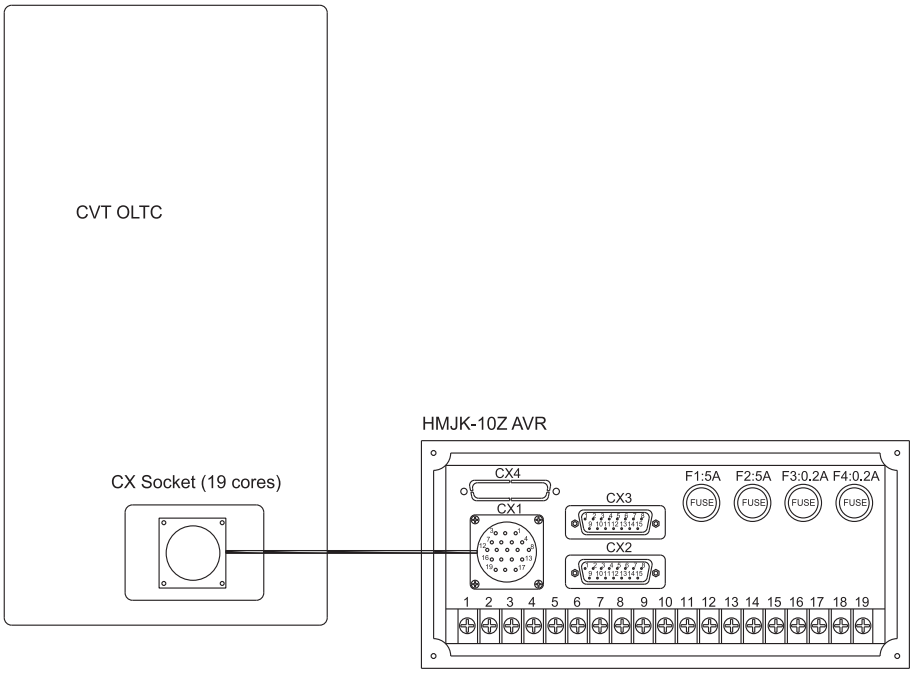


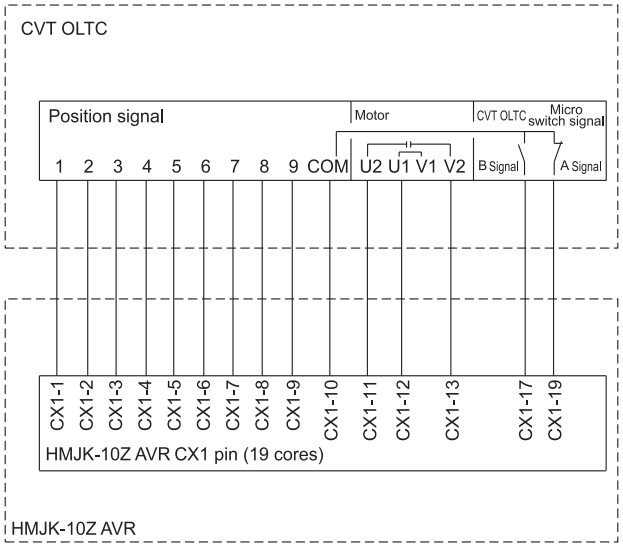
# Appendix 2: Tap changer connection diagram



# Appendix 3:

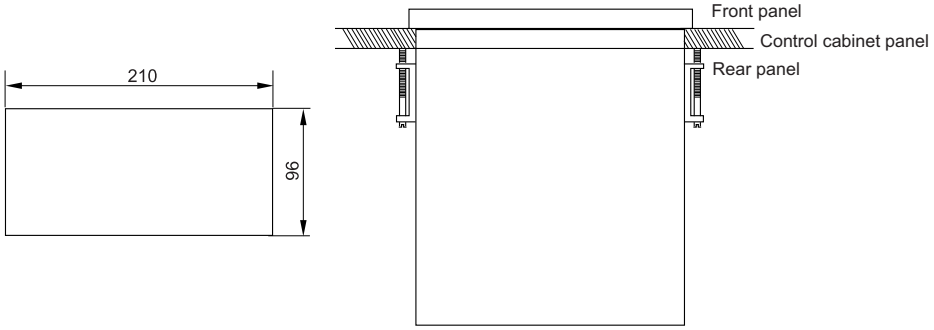
# Connection diagram between the tap changer and the AVR




Note: Please refer to HMJK-10Z automatic voltage regulator manual for details.

# Appendix 4. HMJK-10Z AVR dimensions




Unit: mm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