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# **ON-LOAD TAP CHANGER TYPE CV/SV**

## **Operating Instruction**

**SHANGHAI HUAMING POWER EQUIPMENT CO.,LTD**

**Thank you very much for choosing HUAMING OLTC.**

**Please read the operation instruction before mounting and operation of CV on-load tap changer.**

**Please record the status of operation and inspection, and submit the records to Huaming in case of any recommendation required from the manufacturer for the operation and maintenance.**

**The warrant period of the OLTC is 18 month from date of delivery.**

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## 1. GENERAL

The tap changer type CV is representing a selector switch of tubular design. The switching principle combines operational features of a diverter switch and of a tap selector.

The tap changer will be fastened to the transformer tank cover by its tap changer head flange (which serves also for connecting the tap changer to the drive shaft and oil compartment to the oil conservator.)

If required, the tap changer may be equipped with a change-over selector. (The design of the tap changer and the nomenclature of its main parts can be seen from the installation drawings in the appendix.)

Tap changer models without change-over selector are available up to 14 and with change-over selector up to 27 operating positions.

These operating instructions contain all information to install and operate the following tap changer models (without/with change-over selector).

3-phase on-load tap changers for neutral point: CV III 350Y, SV III 500Y

3-phase on-load tap changers for any connection: CV III 350D, SV III 500D

Single-phase on-load tap changers: CV I 350, CV I 700.

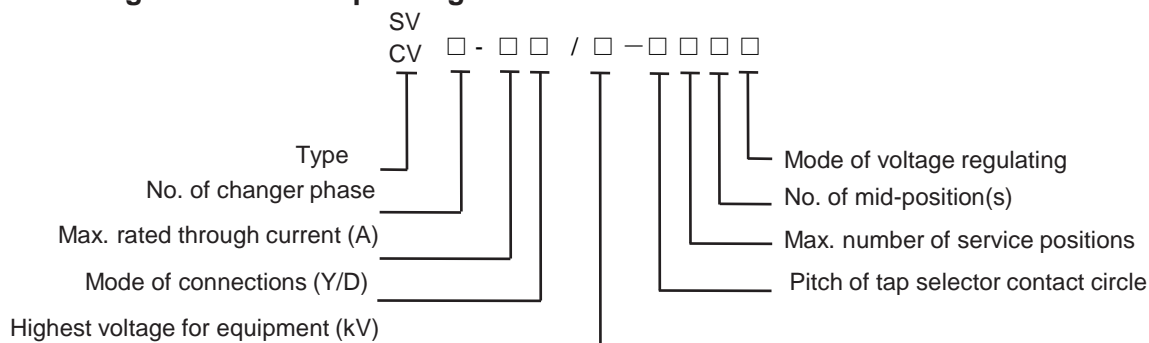
CV 350A



SV 500A



## 1.1 Designation of the tap changer model



Example: CV III-350Y/72.5-10193W

Tap changer type CV, three-phase, Max rated through current 350A, Y-connection, voltage class 72.5kV, 19 operating positions, 3 mid-position, with change-over selector.

1.1.2 Highest voltage for equipment : 40.5kV, 72.5 kV.

1.1.3 Number of operating positions for tap changer:

Without change-over selector, the number of operating position can be up to 10,12,14 contacts respectively; with change-over selector, it can be up to 19,23,27 contacts respectively.

1.1.4 There are two types of change-over selector, including reversing regulation represented by W and coarse/fine regulation represented by G, Mid position no. can be '0' for without change-over selector, '1' or '3' for with change-over selector.

## 1.2 Scope of application

The tap changer is used on power transformer, rectifier transformer and furnace transformer of rated voltage of 110kV and below, rated current up to 500 A, frequency 50 to 60 Hz. The taps of the transformer can be changed by the tap changer on load to regulate the output voltage, which is to ensure it is stabilized in the specified range. It is also used to increase or reduce output voltage according to the load requirement for the purpose of regulation line voltage.

## 1.3 Rated application conditions and requirement

1.3.1 The tap changer is used in oil, the temperature of the oil must not be higher than 100° C or lower than -25° C.

1.3.2 The environmental air temperature of the tap changer must not be higher than 40° C or lower than -25° C

1.3.3 When installing the tap changer on the transformer the perpendicularity with the ground level must not be bigger than 2%.

1.3.4 Any serious dust, explosive or corrosive gases must not be present at the installation site of the OLTC.

1.3.5 The storage place of the tap changer must be dry without moisture.



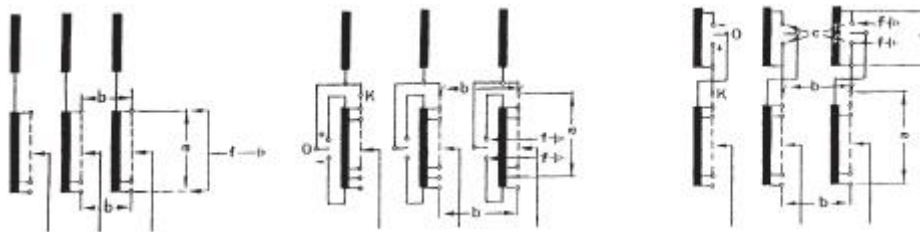
## 2. TECHNICAL DATA

### 2.1 Rated parameters of tap changers (see table 1)

Tap changer model		CV III 350Y		CV III 350D		CV I 350		SV III 500Y		SV III 500D		CV I 700	
Max. rated through-current (A)		350				500				700			
Number of poles		3		3		1		3		3		1	
Connection application		Y-in the neutral, D and single pole-in any part of the winding											
Short-circuit withstand current(kA)	Thermic (3 secs.)	5				7				10			
	Dynamic (peak)	12.5				17.5				25			
Max.Step voltage(V)	10 contacts	1500				1500				1500			
	12 contacts	1400				1400				1400			
	14 contacts	1000				-				1000			
Rated switching capacity(kVA)	10 contacts	525				400-525 <sup>1)</sup>				660			
	12 contacts	420				325-420 <sup>1)</sup>				520			
	14 contacts	350				-				450			
Rated frequency(Hz)		50~60											
Operating positions	Without change-over selector	Max.14				Max.12				Max.14			
	With change-over selector	Max.27				Max.23				Max.27			
Insulation to ground	Highest voltage for equipment Um(kV)	40.5 72.5											
	Rated power frequency withstand voltage (kV,50Hz,1min)	85 140											
	Rated lightning impulse withstand voltage (kV,1.2/50 μ s)	225 350											
Rated withstand voltages of the internal insulation		See section 2.7.2											
Mechanical life		Not less than 800,000 operations											
Electrical life		Not less than 200,000 operations											
Oil compartment	Operating pressure	0.03Mpa											
	Test pressure	0.08Mpa without any leakage for 24 hours											
	Over pressure protection	Bursting cap bursts at 300Pa±20% overpressure											
	Protection relay	Setting oil flow speed 1.0m/s ±10%											
Equipped with motor drive unit model		CMA9,CMA7 or SHM-1											
Tap changer model		CV III 350Y		CV III 350D		CV I 350		SV III 500Y		SV III 500D		CV I 700	
Weight(approx.kg)		140		150		120		190		200		130	
Oil displace-Ment volume (approx.dm3)	Without change-over selector	135		185		85		205		240		120	
	With change-over selector	165		220		115		235		275		150	
Volume of oil filling	Tap changer construction	Vs	V△	Vs	V△	Vs	V△	Vs	V△	Vs	V△	Vs	V△
Vs and oil conservator V△(approx.dm <sup>3</sup> )	Without change-over selector	105	14	165	21	60	10	160	20	200	21	85	12
	With change-over selector	130	17	180	22	85	12	185	22	225	26	108	15

Note:1)The max. through current should decreased to 350A and 300A, when the switching capacity are 525kVA and 420kVA

## 2.2 Insulation Levels on all insulation distance of CV type tap changer

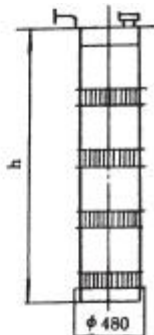
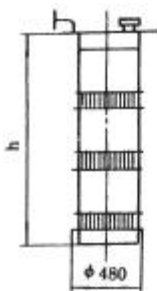


Insulation distance		Tolerating voltage	type of tap changer		
			CV III 350Y	CV III 350 D	CV I 350
			SV III 500Y	SV III 500 D	CV I 700
a	10 contacts	kV1.2/50	200		
		kV50Hz 1min	50		
	12 contacts	kV1.2/50	180		
		kV50Hz 1min	50		
	14 contacts	kV1.2/50	170		
		kV50Hz 1min	50		
b	35kV	kV1.2/50	200	225	—
		kV50Hz 1min	70	85	—
	63kV	kV1.2/50	200	350	—
		kV50Hz 1min	70	140	—
c	35kV	kV1.2/50	350	350	—
		kV50Hz 1min	140	140	—
	63kV	kV1.2/50	350	350	—
		kV50Hz 1min	140	140	—
d		kV1.2/50	200		
		kV50Hz 1min	53		
f	35kV	kV1.2/50	225		
		kV50Hz 1min	85		
	63kV	kV1.2/50	350		
		kV50Hz 1min	140		

## 2.3 Height of CV type tap changer

without change over selector      with change over selector

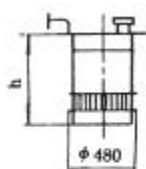
CV III 350Y  
SV III 500Y



CV III 350D  
SV III 500D

Model	voltage	dimension (h) (mm)	
		without change-over	with change-over
CV III 350Y	35kV	1150	1381
	63kV	1190	1381
SV III 500Y	35kV	1222	1430
	63kV	1262	1430
CV III 350D	35kV	1390	1621
	63kV	1510	1735
SV III 500D	35kV	1462	1670
	63kV	1582	1784

CV I 350  
CV I 700



Model	voltage	dimension (h) (mm)	
		without change-over	with change-over
CV I 350	35kV	670	901
	63kV	710	901
CV I 700	35kV	910	1141
	63kV	950	1141

## 2.4 Technical data of OLTC

2.4.1 The contact resistance of different kinds of contact is not greater than 500  $\mu\Omega$

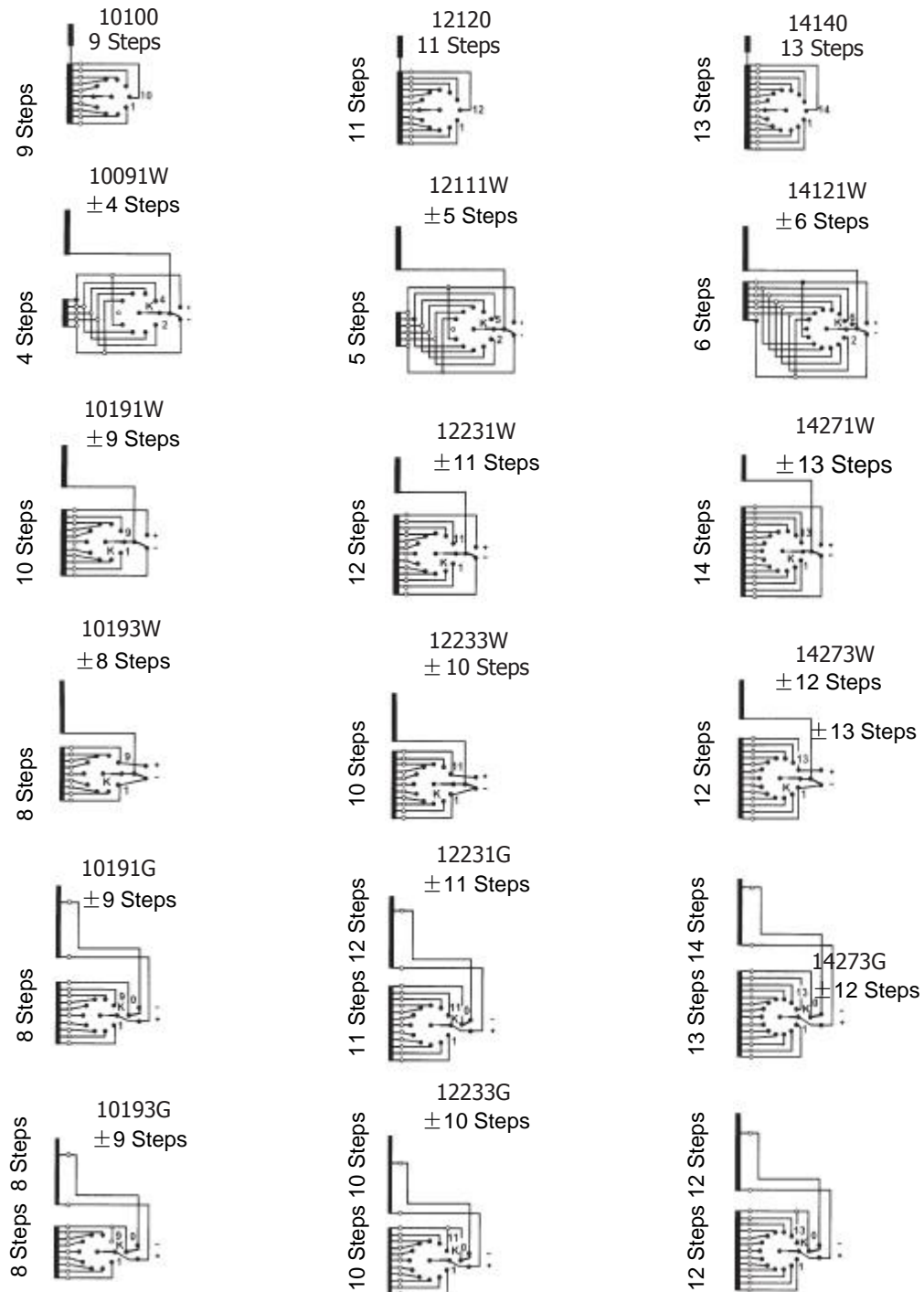
2.4.2 The time of each switching operation of OLTC is 4.4 sec.

2.4.3 OLTC can be operated by either SHM-1, or CMA7, and CMA9 motor drive mechanism.

2.4.4 Contact life of the OLTC at rated capacity could reach 200,000 operations. Mechanical operating life of the contact could reach 800,000 operations.



### 3. BASIC CIRCUIT DIAGRAMS OF TAP CHANGER



Basic circuit diagram

## 4. INTRODUCTION OF ON-LOAD TAP CHANGER

OLTC can be divided into 5 big components: the tap changer head cover, the gear mechanism, main shaft, the oil suction pipe and the oil compartment.

### 4.1 The tap changer head circular cover

The tap changer head cover is made of aluminium alloy by die casting. Gear actuating mechanism, inspection window, oil and gas drain valves, explosive-proof cover are all on the cover. Oil-resisting sealing ring is used for the connection between the cover and the flange (fig.1).

### 4.2 Spring energy-accumulating mechanism

In the flange to the bottom of the head cover there are gear, grooved wheel, groove shift element and springs combined up to form a separate mechanism. Its function is to actuate the movement from the motor drive into the movement of the contacts on the main shaft (fig.2)

### 4.3 Oil suction pipe

The oil suction pipe is located in the hollow center of main shaft, it can be seen when the gear mechanism is taken off. It plays a role as oil suction pipe and to act as the positioning fixture of the main shaft.

### 4.4 Moving contact insert

The basic element is the  $\phi 130$  mm insulating tube. There are two groups of contact on the tube. Change over contact group is at the top and the three identical moving contact groups are at the bottom. (fig.3)



Fig. 1



Fig.2



Fig.3

### 4.5 Oil Compartment

There is a die casting aluminium alloy flange at the compartment head. The middle is the  $\phi 395$  insulating cylinder and at the bottom is the bottom of the insulating cylinder. The oil-resisting rubber as sealing ring are used for the connections of these 3 parts. The function of the oil compartment is to support the fixed contacts of the tap changer, as well as to separate the OLTC oil from the transformer oil.

## 5.CONNECTING THE TAP WINDING AND TAP CHANGER CURRENT TAKE-OFF LEADS

The tap leads have to be connected to the tap changer according to the particular tap changer connection diagram which will be supplied together with the equipment.

**Note: All lead connections to the tap changer must be carried out carefully and fastened safely. The tap leads should be assembled in such a manner that allow for connecting all leads to the tap changer without force. If leads are to be arranged around the oil compartment, a minimum clearance of 50mm must be retained.**

All terminals are designated according to the connection diagram. The terminals have through-holes for the connection of cable shoes to one side of the terminals.

Change-over selector: 11mm diameter. M 10-screws.

Selector switch CV350 (fig.4) and SV 500 (fig.5): 11mm inner diameter M10-bolts.

Neutral connection lead with tap changers CV III 350Y, SV III 500Y: This lead acts as the neutral point of the tap changer and tap winding and must not be removed. The neutral bushing lead may be connected to any free terminal of both current take-off contact planes.



Fig.4



Fig.5

## 6. SWITCHING PROCESS OF SELECTOR SWITCH CONTACTS

### 6.1 Switching operation principle and time (fig.6)

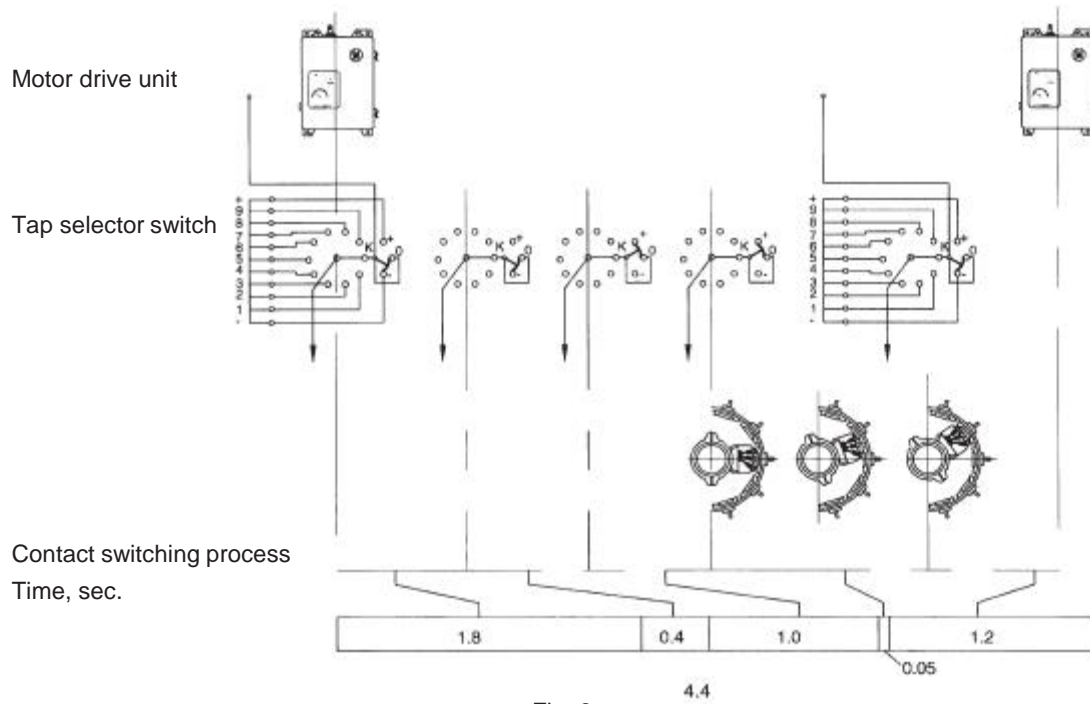


Fig. 6

### 6.2 Switching sequence of selector switch contacts (fig7)

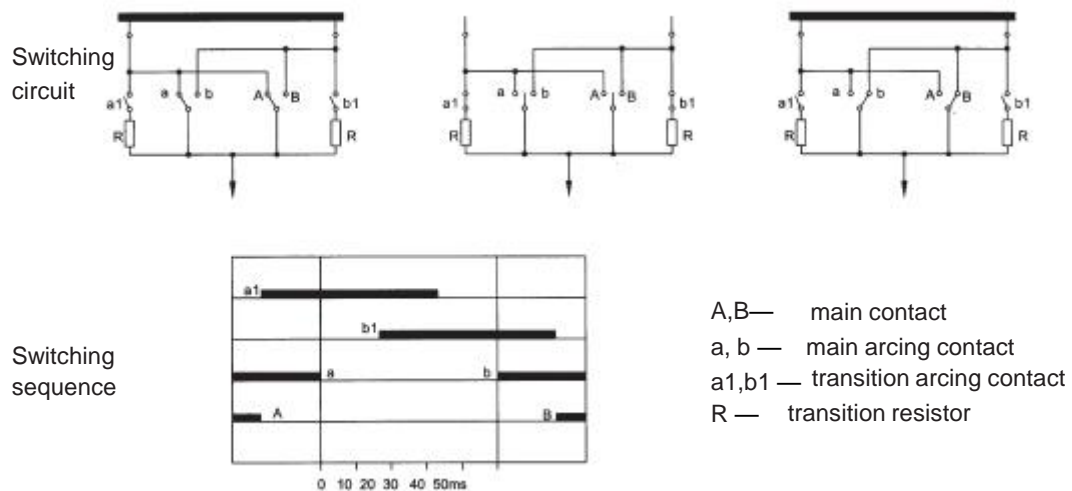


Fig.7

### 6.3 Oscillogram (fig.8) of switching sequence

The make/break of the main contact transition contact should comply to the procedure shown in the following diagram.

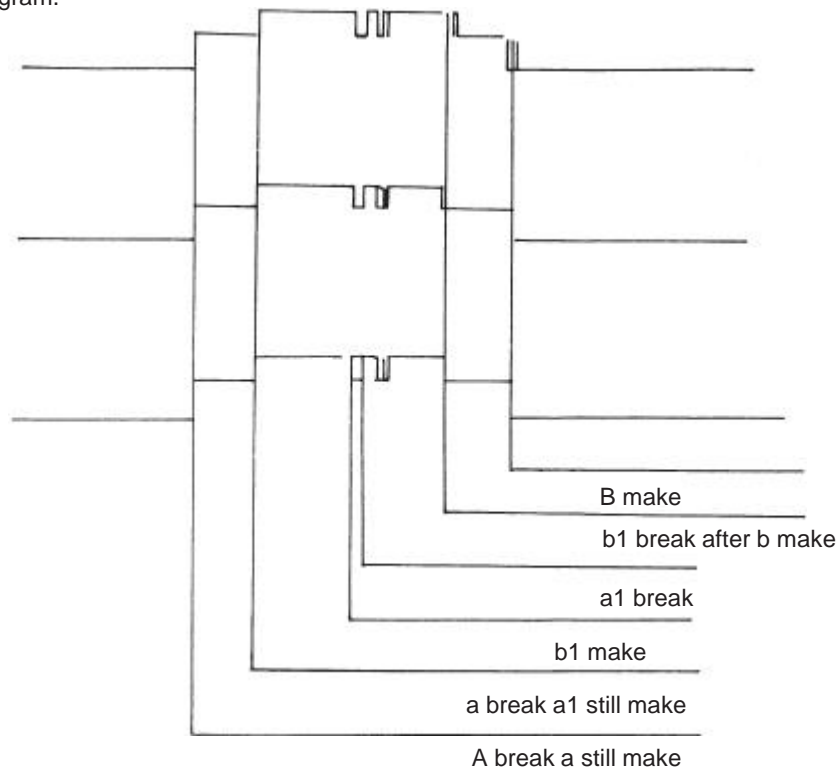


Fig.8

### 6.4 Switching sequence of contacts and the variation of output voltage (fig.9).

In the fig: A,B — Main contact  
 a,b — main arcing contact  
 a1,b1 — transition arcing contact  
 R — transition resistor  
 U<sub>a</sub>, U<sub>b</sub> — tap voltage  
 V<sub>st</sub> — step voltage  
 I — output current

## Description:

**Position 1:** Tap changer make at tap a, the load current is output by main contact A, the output voltage is the voltage on tap a  $U=U_a$

**Position 2:** Tap changer switch acts, main contact A break, transition contact a1 make, load current is output by main contact a. Output voltage remains unchanged.

**Position 3:** Main contact break to produce arc which will produce recovery voltage at the breaking point of a, after the arc gone is extinguishes. The load current is output by transition contact through resistance. Output voltage  $V=U_a - IR$

**Position 4:** Tap b transition contact b1 make, a1 and b1 make at the same time to form bridge, which produce cycling current  $I_c$ ,  $I_c=V_{st}/2R$ , load current is output via contact a1,  $I_m=(IR+V_{st})/2R$  output voltage  $V=U_a - (V_{st}+IR)/2$ .

**Position 5:** A1 break, the tap changer is switched to tap b, load current is output via b1, output voltage  $V=U_a - (IR+V_{st})$ , output voltage has been changed to another tap.

**Position 6:** Tap b main contact make, the load current is output via b.

**Position 7:** Tap b main contact make, transition contact b1 break, load current is output via B, output voltage  $V=U_a - V_{st}$ , switching is completed in one full operation.

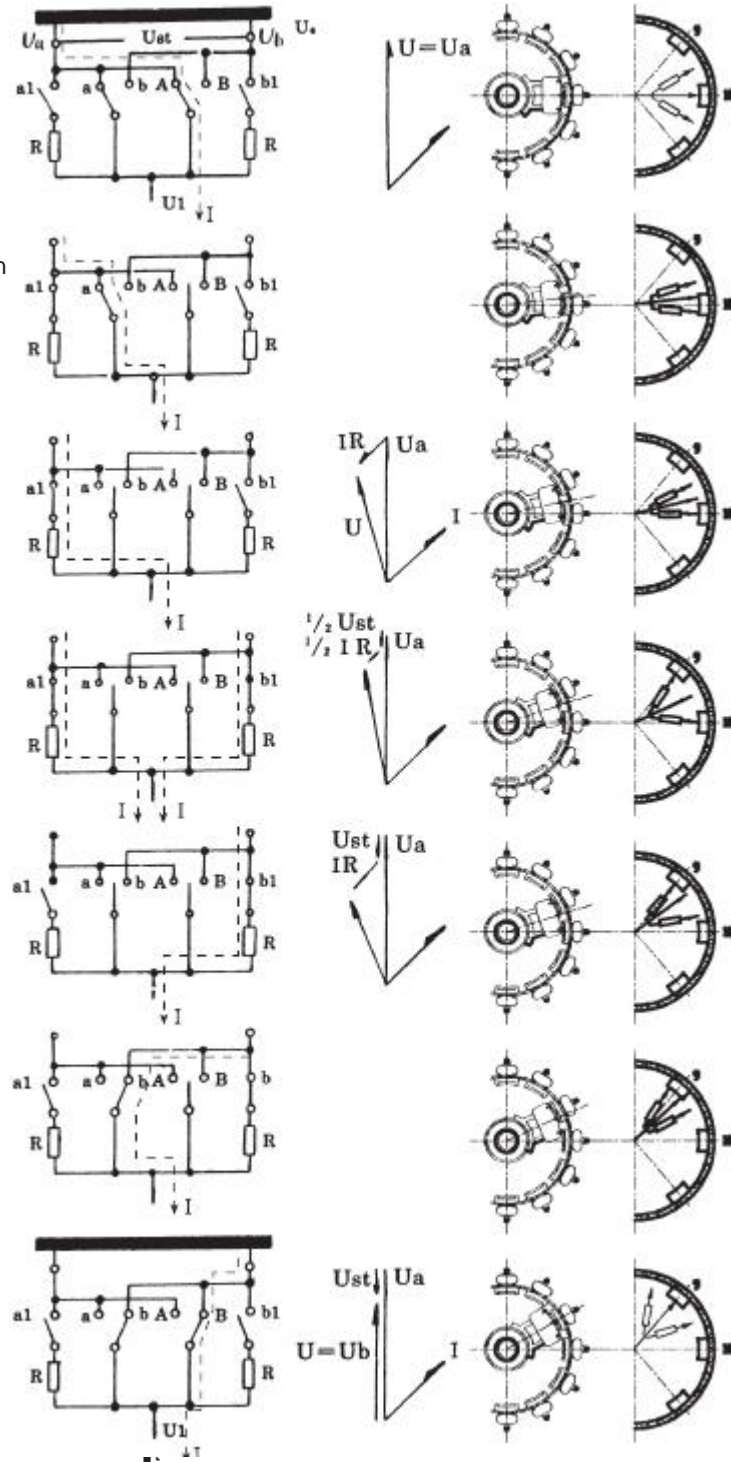


Fig.9

## 7. INSTALLATION OF THE TAP CHANGER

### 7.1 Installation of the tap changer into the standard-type transformer tank

#### 7.2 Mounting flange

For mounting the tap changer head to the transformer cover a mounting flange is recommended. This mounting flange

should meet the requirements of the tap changer head gasket surface(fig10).

For positioning the thread studs, we recommend to use the respective drilling template (see below figure and appendix 4)

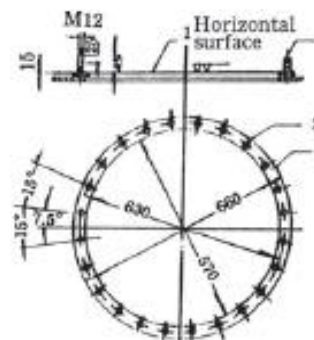


Fig.10

### 7.3 Installation of the tap changer head to the transformer cover

#### (See appendix 5)

Procedure are as follows:

- 1) Clean all sealing surfaces (tap changer head flange, mounting flange). Put an oil-proof gasket on the mounting flange of the transformer cover.
- 2) Lift the tap changer over the transformer cover and lower it carefully into the transformer. Be careful not to damage the tap changer terminals.
- 3) Check the position of the tap changer head and that of the completed tap changer.
- 4) Fasten the tap changer head to the mounting flange.



Fig.11

### 7.4 Installation of the tap changer into the bell-type tank (fig.11)

A supporting structure is necessary as a temporary supporting rack of the tap changer. The on-load tap changer will be supported by its supporting flange of the oil compartment (see appendix 6).

The tap changer is lifted into the supporting construction, fixed and connected there.

For the mounting of the tap changer head to the bell-type cover, we recommend the application of a mounting flange according to paragraph 7.2.

### 7.5 Installation of the tap changer to the transformer

Lift the tap changer into the temporary supporting structure. Check the installing position and fix the tap changer. Refer to the instruction in chapter 4 for the connection between the tap winding and the on-load tap changer current take-off leads.

The connected leads must not exercise any force to the tap changer. Moreover there must be sufficient clearance so that it will be possible to lift the tap changer to its final installing position after the bell-type tank has been mounted.

### 7.6 The drying procedure and the voltage transformer ratio test are to be performed in accordance with section 8.

#### 7.7 Preliminaries

Before installation, the tap changer head should be removed first. Remove the gear mechanism before removing the



tap changer head. Adjust the tap changer to its set position. For this set position of tap changer refer to inspection instructions.

#### **7.8 Detaching the tap changer head cover**

Unscrew 20 M 10 X35 bolts and washers on the cover, Then remove the tap changer head cover.

#### **7.9 Removing the energy-reserving mechanism**

The bottom plate of energy-accumulation mechanism is fastened by 5 screws M8 X20.

Record the positioning mark of energy-reserving mechanism. For details please see the inspection instructions.

#### **7.10 Detaching energy-reserving mechanism and oil suction pipe.**

#### **7.11 Separating the tap changer head flange from the oil compartment**

Unfasten the fixing bolts on the tap changer head, 9 M8 X25 hexagonal recess bolts and lock washers. Keep the unfastened parts for reinstallation. Lift the tap changer-head from the supporting flange, be careful with the head gasket of the supporting flange.

#### **7.12 Installation of the bell-type oil tank**

Prior to mount the bell-type cover, clean the sealing surface of the oil compartment supporting flange.

Lift the bell-type tank above the transformer active part and lower it slowly.

Before attaching the tap changer head, clean the sealing surfaces. Put an oil-proof gasket on the mounting flange and then put the tap changer head on the mounting flange.

Depending on the desired height, a distance of 5 to 15mm must be reserved between the changer head and the supporting flange. Check the installation position of the on-load tap changer head by means of the two guide bolts which is the only way to ensure the correct position in the supporting flange of the oil compartment.

Fasten the tap changer head on the mounting flange.

Put the lift under the flange of the tap changer head, lift the tap changer by slowly to attach to the oil compartment by 9 M8 hexagonal recess bolts and, lock washers. Tighten the nuts uniformly.

#### **7.13 Installation of the gear mechanism and attachment of the tap changer head cover.**

The reinstallation of the gear mechanism is performed in the reverse sequence of its removal. Set the gear mechanism to the set position. Only in this position it is possible to couple and install.

Install tap changer head cover and tighten uniformly 20 bolts M10X35 with lock washers.

Inspect the set position through inspection windows on tap changer head cover.

For motor drive type CMA9, 2 revolution of the drive shaft are necessary for one tap change operation. The selector switch action can be distinctly heard.

**If there is not any oil in tap changer, it can only be operated once at most, After transforming voltage ratio test, the tap changer must be set back to the set position.**

The tap changer limit positions must never be overrun. It is therefore necessary to check the operating positions during ratio test procedure which can be seen through the inspection window in the tap changer head cove.



## 8. DRYING PROCEDURE AND FILLING IN THE OIL

### 8.1 Drying treatment

The dielectric properties of the tap changer can be guaranteed by drying treatment according to the following instructions.

#### 8.1.1 Vacuum-drying process

#### 8.1.2 Drying inside vacuum baker

When drying the transformer in the baker, the tap changer head cover must be removed.

#### Heating up

The tap changer is under normal atmospheric pressure with a temperature rise rate of 20C /hour until a maximum final temperature of  $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$

#### Pre-drying

The tap changer stays in max.  $110^{\circ}\text{C} \pm 5^{\circ}\text{C}$  circulating air for a duration of 8 to 10 hours

#### Vacuum-drying

#### 8.1.3 Drying in the transformer oil tank

If the transformer should be dried in its tank, the interior of the tap changer must be vacuumed, as the tap changer head cover remains closed during the entire drying process.

The tap changer head cover can stand vacuum pressure.

To perform a sufficient rate of drying of the interior of the oil compartment and the tap changer insert itself a by-pass tube of at least 25mm in diameter should be connected between the transformer tank and a connecting flange open to the oil compartment. For easy handling, it is suggest to connect the by-pass tube between flange E2 and Q or E2 and R alternatively of the tap changer head (see fig.12 and appendix 2).

Refer to section 8.1.1 for the procedure, temperature, duration and pressure of the drying process,

#### 8.1.4 Vapor-phase drying process

Before starting the drying procedure, kerosene drain plug in the oil compartment

bottom must be opened to drain the kerosene condensate from the oil compartment.

The kerosene drain plug has a hexagon socket and can be unscrewed form the outside or from the inside.

The kerosene drain plug is leakage-proof and must be closed again after the drying procedure.

#### 8.1.5 Kerosene drying in the vacuum autoclave

When drying in the autoclave remove the tap changer cover first.

#### Heating up

by admitting kerosene vapor at a temperature of about 90 °C

Keep this temperature constant for about 3 to 4 hours.

#### Drying

by increasing the admitting kerosene vapor at a temperature of about 10°C per hour to the desired final temperature, but to max 125 °C for the tap changer.

The duration of the drying procedure is normally the same as that of the transformer.

#### 8.1.6 Vapor-phase drying in the transformer tank

If the transformer is to be vapor-phase treated in its own tank the kerosene drain plug must be opened from inside the oil compartment. The tap changer insert has to be withdrawn and reinserted. thereafter Please contact us for further instructions for removal and installation.

#### 8.1.7 Attention: after the drying process, the tap changer must not be operated without oil.

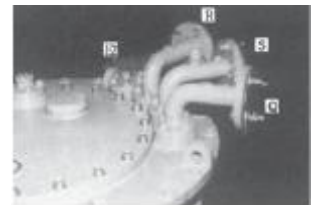


fig.12

### 8.2 Filling in the oil

Tap changer and transformer will be filled up with new oil under vacuum. For oil filling use the pipe connection S or R.

For applying vacuum to the changer a by-pass tube between connections E2 and Q is to be installed for evacuating both the oil compartment and the transformer simultaneously.

## 9. PIPE CONNECTIONS

The tap changer head is provided with 3 pipe connections. After unfastening flange (4 bolts M10), these pipe connections can be swiveled (Figure 14 in appendix 2 ).

### 9.1 Protective relay (refer to figure 13 and Appendix 5 on page 23)

Attention:

The relay is to be mounted as near the tap changer head as possible and in horizontal position.

The arrow on the relay should point towards the oil conservator when mounted.

The pipe should be inclined by at least 2% angle to the oil conservator .



fig.13

### 9.2 Pipe connection S for suction pipe

This connection is used for the feeding pipe of a stationary oil filter. If there is no filter, the pipe connection should be connected to oil discharge valve.

### 9.3 Pipe connection Q

This pipe connection can not be in use if there is no filter, but the cover must be sealed.

### 9.4 Connection of flange E2

Generally the flange is sealed by a dummy plug. This flange hole is directly to the transformer oil tank from the bottom of the tap changer head. If necessary this hole can be also connected to the gas collection pipe of the protective relay.

## 10. MOUNTING THE MOTOR DRIVE UNIT, THE BEVEL GEAR AND THE DRIVE SHAFT

### 10.1 Mounting the motor drive unit (see appendix 6,7)

For comprehensive information, please see our Operating Instructions for motor drive SHM-1 or CMA9. Here CMA9 as an example, if SHM-1 motor drive unit is needed, please see the detailed manual instructions.

Attention:

**The motor drive serial number has to be identical with that of the tap changer (Name plate). The motor drive has to be in the same operating position as that of the tap changer. The motor drive unit has to be attached vertical at the provided place on the transformer tank. Fixed support for installing motor drive unit must be horizontal and avoid excessive transformer vibrations.**

### 10.2 Mounting the bevel gear

The bevel gear is to be attached to a support on the transformer cover by means of 2 bolts (see appendix 10).

Attention:

**The horizontal part of the drive shaft must be in proper alignment with the trunnion in the tap changer head.**

**After loosening the thrust collar ,the upper gear unit can be swiveled (fig.14)**

**Adjustment the upper gear unit according to section 10.3. After adjusting the upper gear unit the thrust collar has to be re-tightened.**



fig.14

### 10.3 Mounting the drive shaft (square shaft )

Mounting procedure of the drive shaft is as follows: Firstly, the vertical part is to be mounted between motor drive unit and bevel gear, then the horizontal part between bevel gear and tap changer head. The drive shaft couplings are the same for both parts. Both ends of the square shaft are connected to the respective trunnion by 2 coupling brackets and 1 coupling bolt. The drive shaft (square shaft ), the coupling brackets, bolts, nuts and lock tabs are made of corrosion proof stainless steel.

Prior to final coupling of the tap changer head upper gear unit the correct set position has to be regained as follow:

a. For motor drive unit CMA9 (2 drive shaft revolutions per step )

The trunnion of the upper gear unit should be turned in both directions until you feel the spring energy accumulator being wound up slightly.

The middle of this rotation angle is the exact adjustment position (fig.15).

Perform coupling in this position. When coupling, square shaft and trunnion should be aligned together with a possibly small shifting angle (max.45° )for coupling purpose.

The square shaft is set 2 meter long, and the square shaft should be cut to the actual required length before mounting. Check finally the rotation lag between tap changer and motor drive unit being properly equalized according to Operating Instructions

b. Position adjustment of tap changer head cover flat gear box



fig.15

Unfasten the bolts of the tap changer head cover (20 screws M10) and lift the tap changer head cover for at least 15mm so that the upper gear unit disengages. The on-load tap changer head cover is to be supported in this position by suitable wooden rods.

Move the upper gear unit of the tap changer head cover to the desired position so that a proper coupling of the drive shaft becomes possible. Check the position of the drive torque at the outgoing side of the gear unit below the tap changer head cover and make coincide this gear unit with the coupling of the gear mechanism by turning the drive shaft by hand.

Remove the wooden rods and fasten again the tap changer head cover .

Finally, check the rotation lag between tap changer and motor drive unit being properly equalized according to Operation Instructions

## 11. PUTTING THE TAP CHANGER INTO OPERATION IN THE TRANSFORMER FACTORY

### 11.1 Operational tests

Before applying voltage to the transformer, the mechanical operation of tap changer and motor drive have to be checked. For these test operations, the tap changer has to be run through the total operating cycle.

Check that in each operating position, the position indicators of motor drive and tap changer head read the same position.

Check that in both limit positions the motor drive stop automatically and the electrical and mechanical limits function properly.

### 11.2 Final oil replenishment

The tap changer has to be completely filled with transformer oil via the oil conservator.

The height of oil level of transformer oil conservator and tap changer oil conservator should nearly equal.

Unfasten the air deflation nut (E1) on tap changer head cover and M30 screw nut, use a spanner to lift valve core to deflate the on-load tap changer head (fig.16)(fig.17)

Deflate the suction pipe (S) via the deflate screw of the elbow: cap nut M16, slotted deflation screw M6.



fig.16



fig.17

## 12. TRANSPORTING THE TRANSFORMER TO THE OPERATING SITE

If it should become necessary to dismount the motor drive from the transformer for transporting reasons, set the motor drive to the set position at which it is delivered. Uncouple the motor drive and lock the drive shaft system against unintentional twisting.

For remounting the motor drive unit follow the instruction according to section 10.

If the transformer should be stored or transported without oil conservator a by-pass must be installed between the interior of the tap changer and the transformer tank to allow for equalizing static pressure caused by expansion of oil. This by-pass is to be installed between pipe connections E2 and Q of the tap changer head.

For short-time conditions without oil conservator of 2 to 4 weeks lower the oil level by approx. 5 liters.

If it should become necessary to transport or store the transformer without oil filling, drain the switch oil of the tap changer completely. The interior of the tap changer should, however, be subject to the same conservative measures as the transformer itself. If it tends to be stored for a long time, the heater of motor drive should be powered.

## 13. PUTTING INTO OPERATION AT THE OPERATING SITE

Before putting the transformer into service, operational tests of the tap changer and motor drive have to be performed according to section 11.1. At the same time check the function of the protective relay which has to be inserted into the tripping circuit of the circuit breakers in a way that an energizing of the protective relay immediately switches of the transformer. Test the function of the circuit breakers by pushing button "Transformer off" on the protective relay.

Check whether all stop valves between oil conservator and tap changer head are open.

After switching on the transformer, on-load tap change operations can be performed. Switching gas accumulating under the cover of the tap changer head will cause a small oil displacement.

**It is necessary to have a periodical inspection on tap changer head cover, protective relay and motor drive unit**

## 14. SUPERVISION IN SERVICE

**Pay special attention to:**

**Oil tightness of sealing of the tap changer head, the protective relay and the pipe connections.**

**Tightness of the motor drive housing, the appearance of the control apparatus in the motor drive unit.**

**It is absolutely necessary to inspect the transformer and the tap changer when the protective relay operates.**

**The OLTC insert must be lifted up for inspection. Read carefully the operating instructions of protective relay.**

**Before putting the transformer into service again, the transformer and the tap changer must be inspected. The transformer should never be put into operation before being checked.**

In case of serious trouble with tap changer or motor drive or protective relay operates, while it is difficult to repair at the operating site, please contact the Service Department of Shanghai Huaming Power Equipment Co., Ltd.

We recommend a periodic inspection of the tap changer equipment to maintain a high reliability in service.

## 15. INSPECTIONS

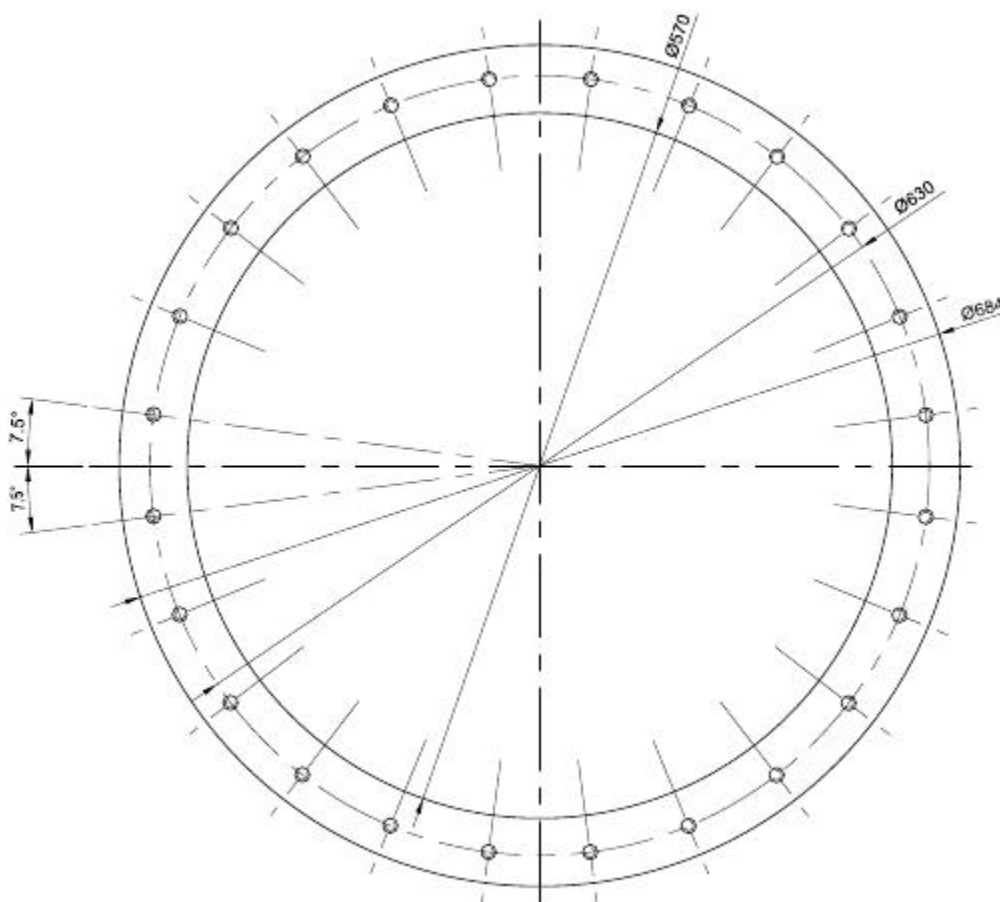
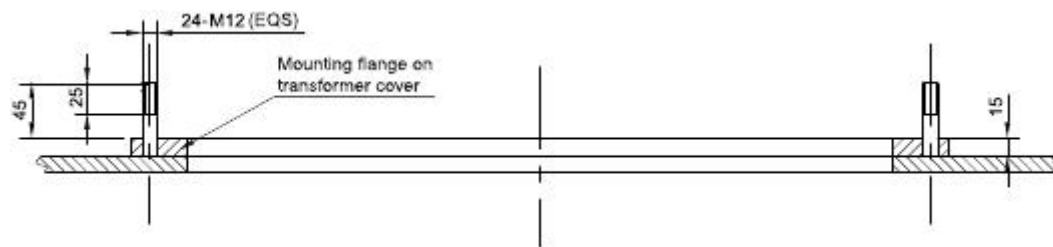
If well organized and prepared, such inspection can be completed by qualified and well trained personnel in one day.

We recommend the inspection work could be done by our Service Department in principle. Thus skilled inspection could be proceeded by retrofitting some new designed components and parts.

## 16. APPENDIX

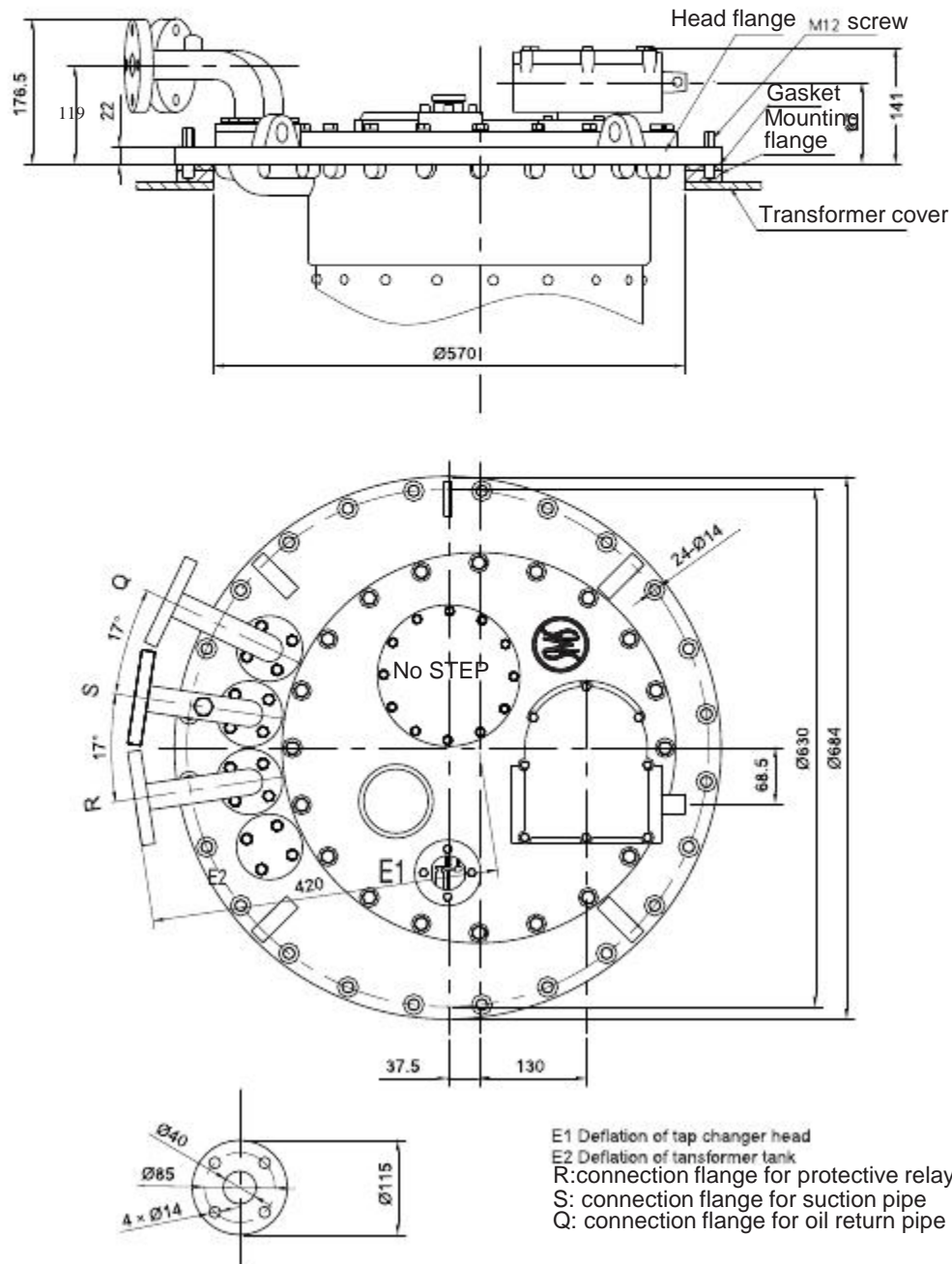
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## Appendix 1 Mounting Template of CV OLTC Head



Unit:mm

## Appendix 2 Overall Drawing of CV OLTC Head

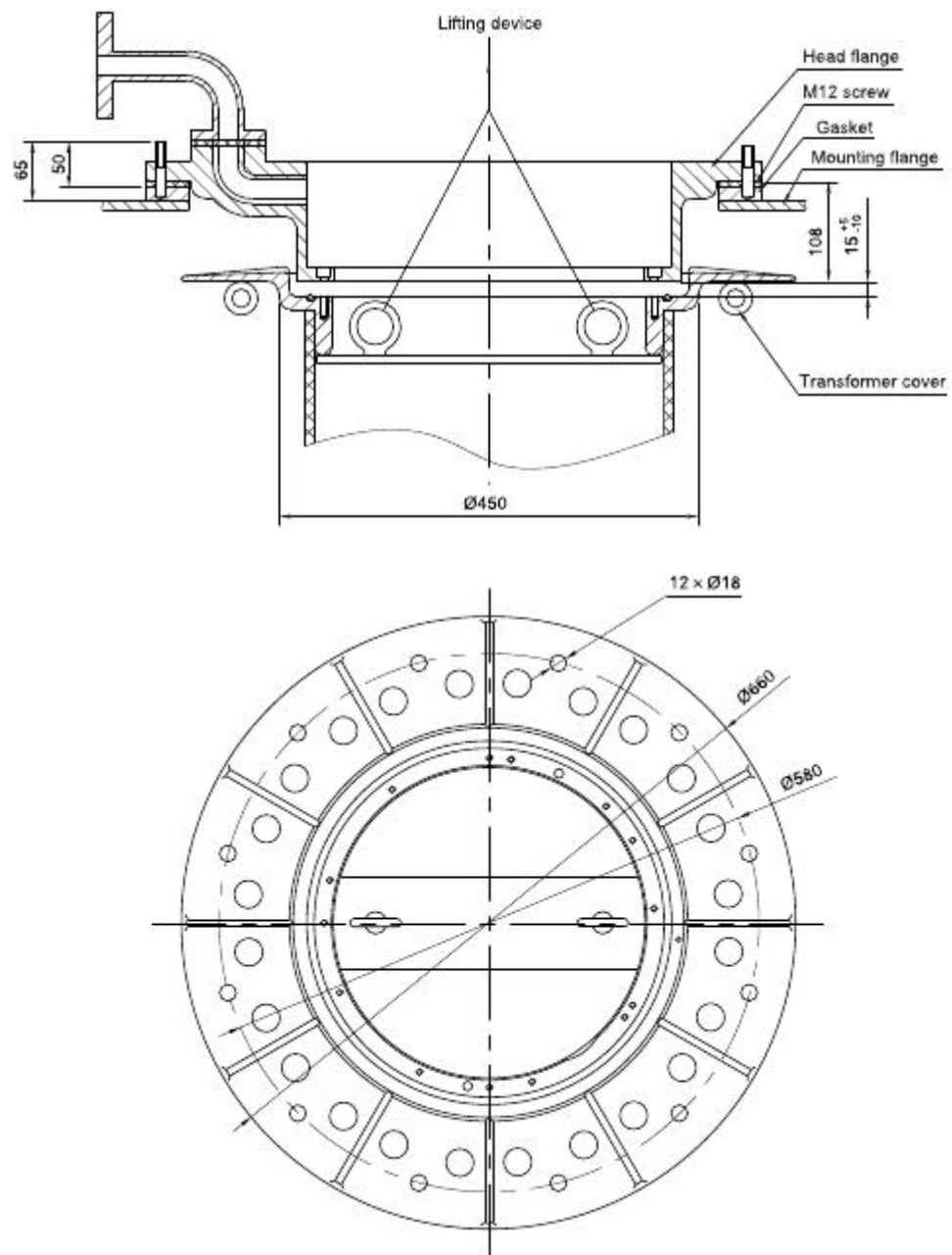


Connection flange R,S,Q

Unit:mm



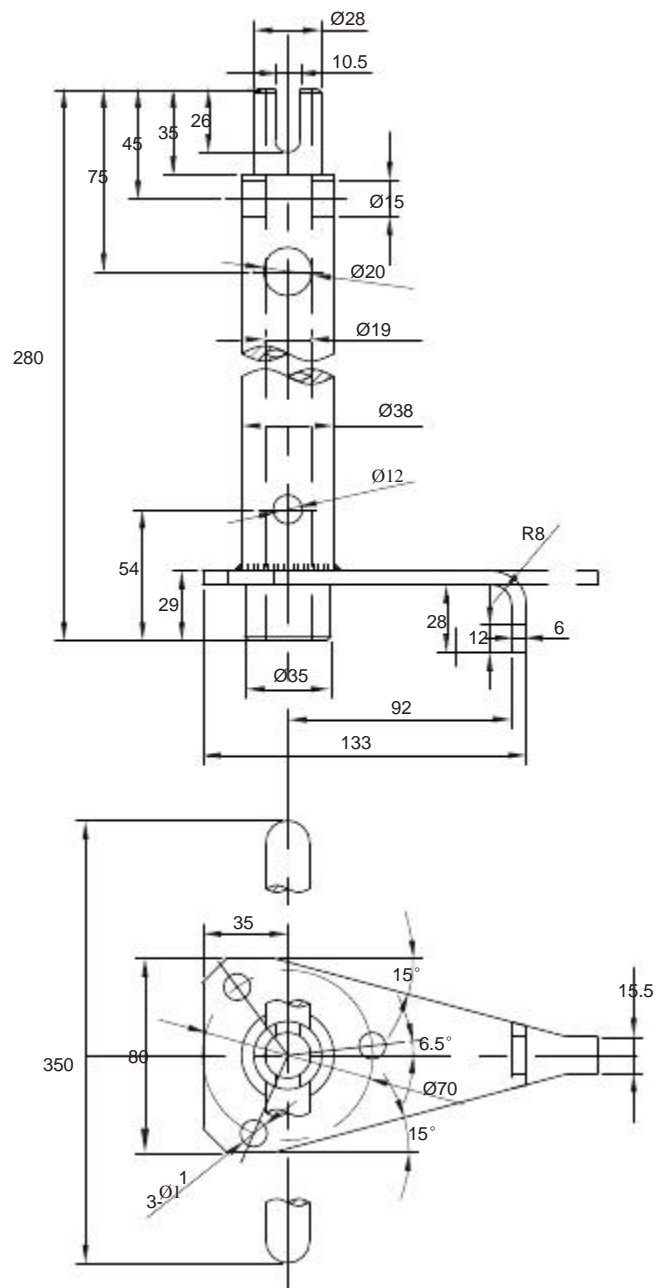
### Appendix 3 Overall Drawing of Bell-Type Flange



Unit:mm

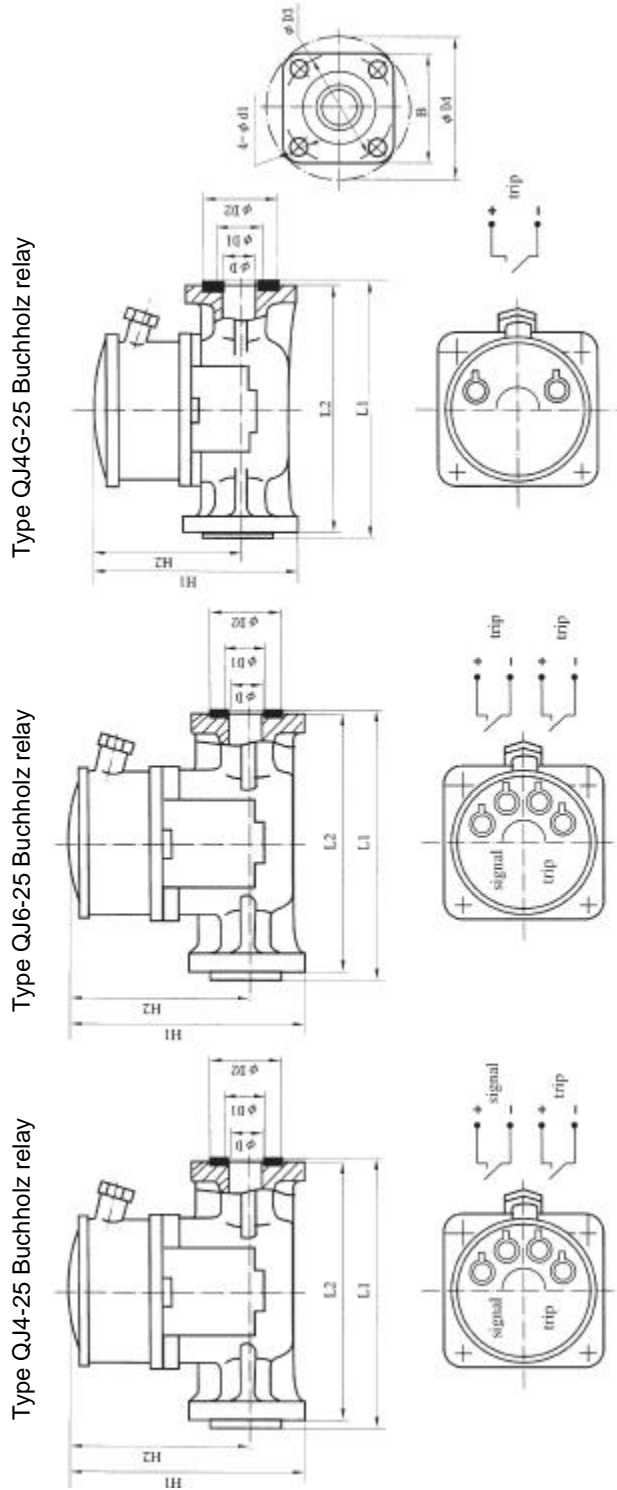


## Appendix 4 Overall Drawing of Lifting Device



Unit:mm

## Appendix5 Overall Drawing of Protective Relays

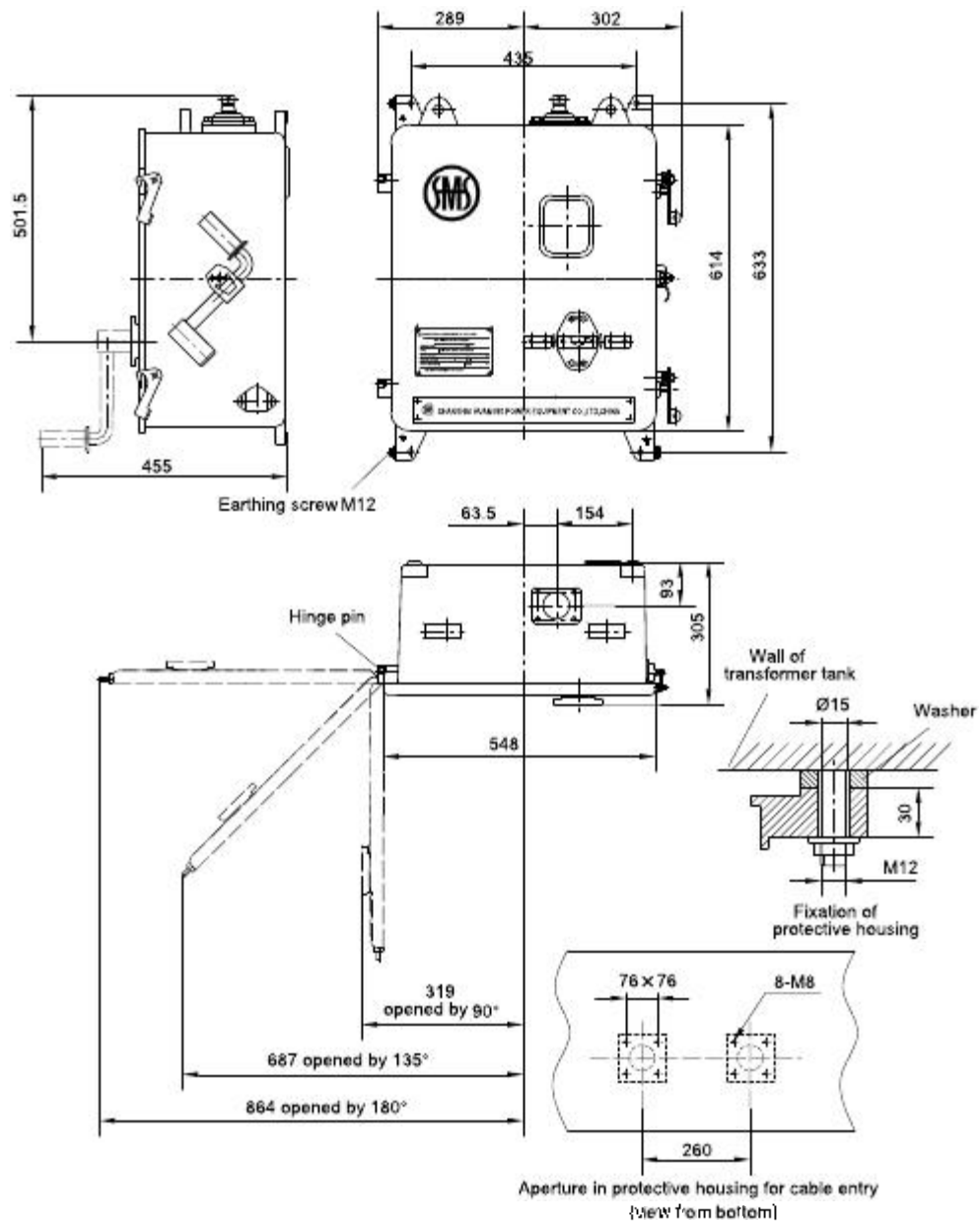


Model	Code number	D	D1	D2	D3	M <sub>d</sub>	d 1	H1	H2	L1	L2	B	h	Remarks
QJ4-25	5XJ.236,1(2)	25	31	56	85		14	186	141	206	200	90×90	≥250	4 terminal polar with light float for on-load tap changer
QJ4G-25	6ET.236,106,1(2)	25	31	56	85		14	154	109	206	200	90×90	≥190	2 terminal polar without light float for on-load tap changer
QJ6-25		25	31	56	85		14	186	141	206	200	90×90	≥250	4 terminal polar with light float for on-load tap changer

Note:1. Type QJ4-25 and QJ6-25 Buchholz relay are classified into square and round flange; φD4 115 is the dimension for round flange. Please specify "square" and "round" during making an order.

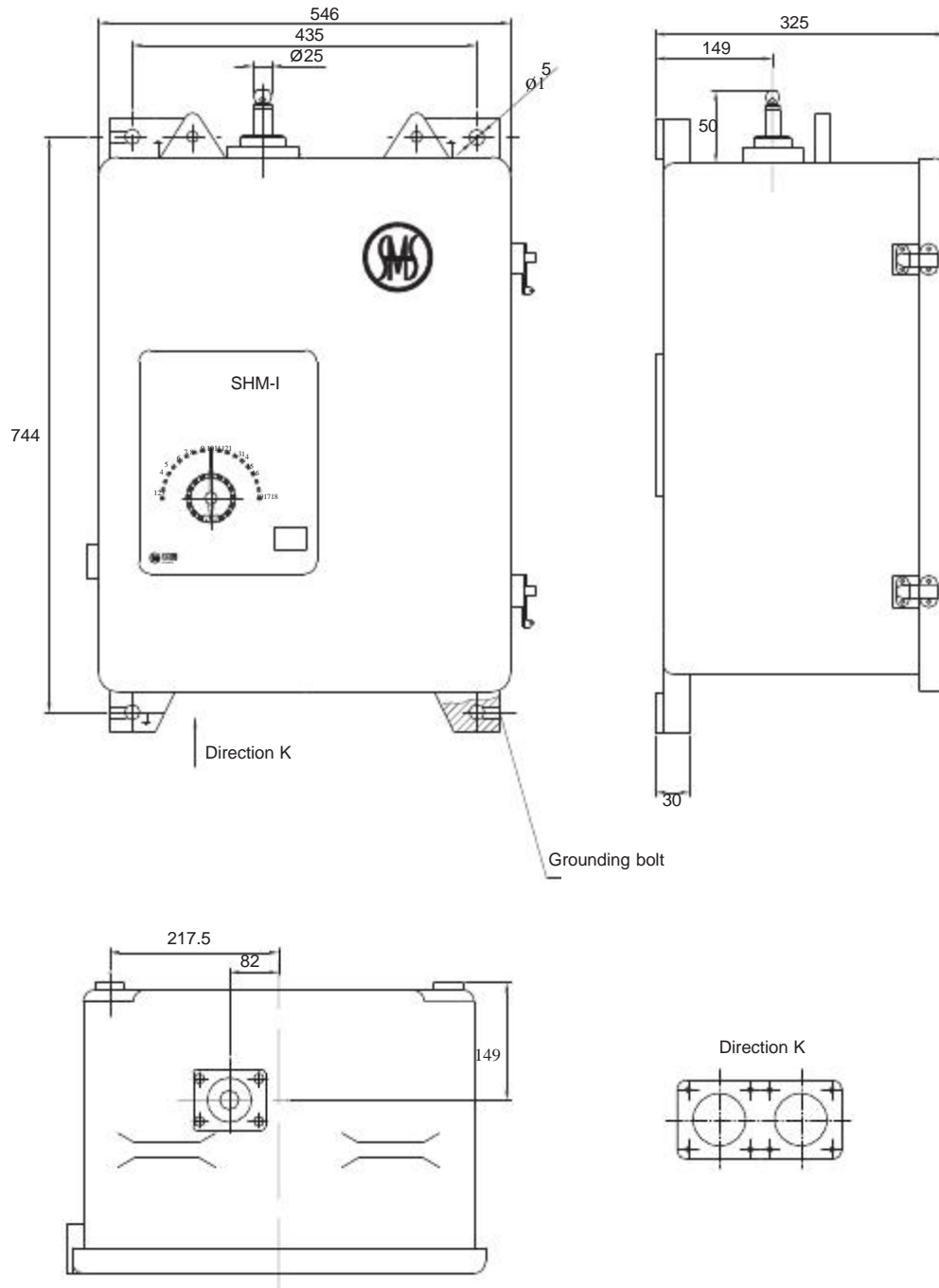
2. For the digit of the code number, when no parentheses are added, it applies to general region, when parentheses are added, it applies to hot humid region. For example 6ET 236, 0191 is suitable for general district and 6 ET,236,019, 2 is suitable for damp and hot region.

## Appendix 6 Overall Drawing of CMA9 Motor Drive Unit



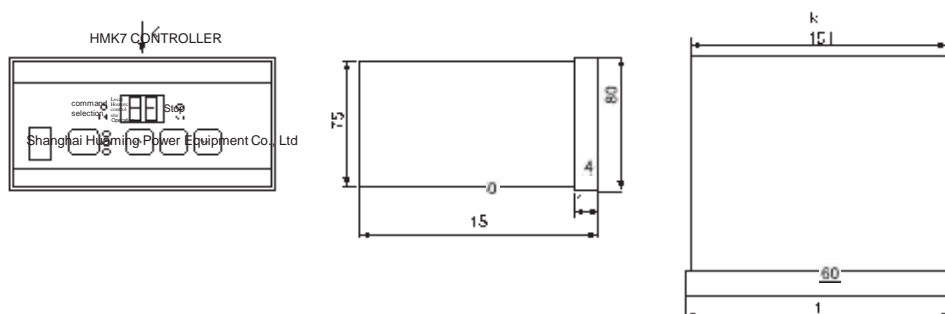
Unit:mm

## Appendix 7 Overall Drawing of SHM-1 Motor Drive Unit

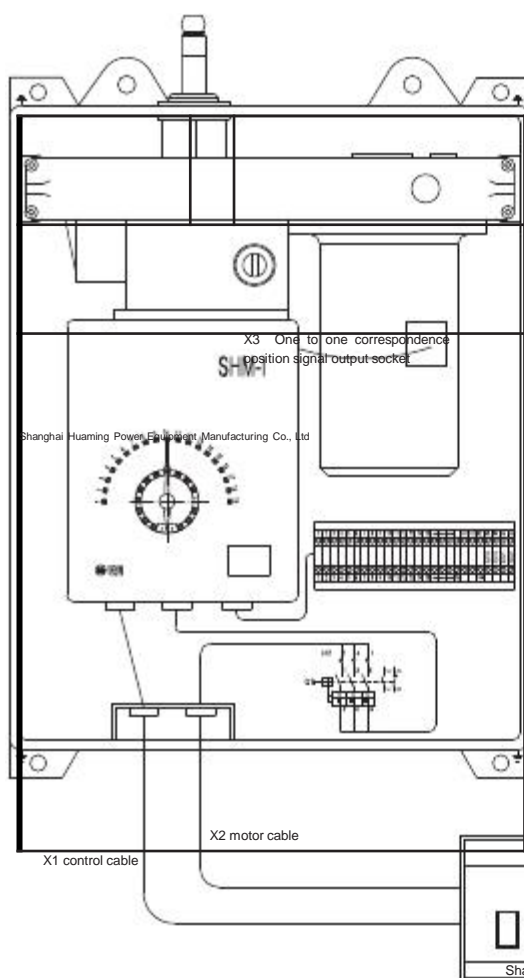


Unit:mm

## Appendix 8 Overall Drawing of HMK7 Controller



## Appendix 9 Connection Between HMK7 Controller and SHM-1 MDU

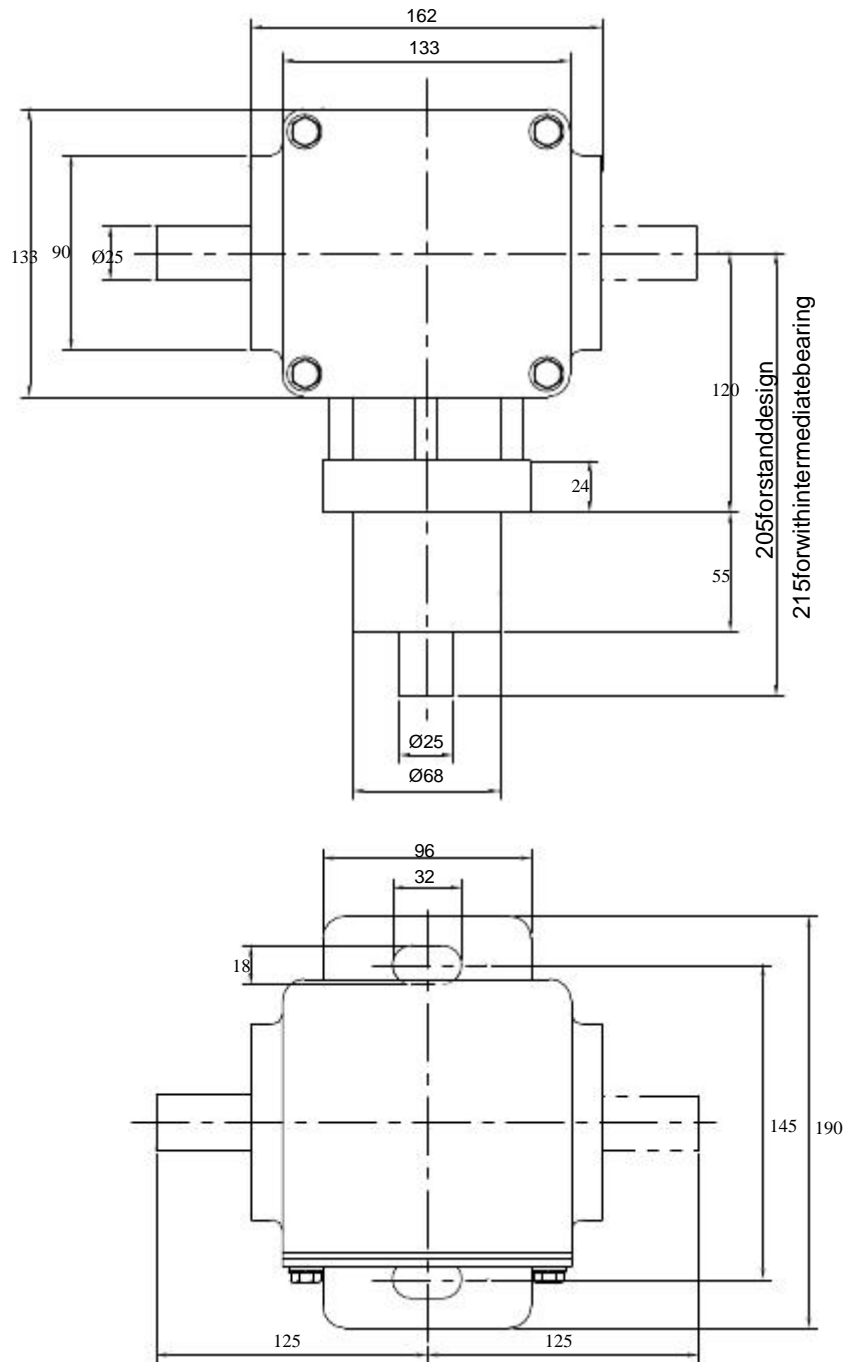


Explanations of X3 terminals

X3 socket No	Explanation
X3-1	Tap changer position signal digit "1"
X3-2	Tap changer position signal digit "2"
X3-3	Tap changer position signal digit "3"
X3-4	Tap changer position signal digit "4"
X3-5	Tap changer position signal digit "5"
X3-6	Tap changer position signal digit "6"
X3-7	Tap changer position signal digit "7"
...	
...	
...	
X3-34	Tap changer position signal digit "34"
X3-35	Tap changer position signal digit "35"
...	
X3-40,41	Operation signal output terminal to connect with CX3-1, 2 terminals
X3-42	Tap changer position signal common terminal
X3-43,44	Note Q1: Circuit breaker (with auxiliary contact)
X3-45,46	
	Q1-21, Q1-22 Contact capacity: DC220V/0.3A

Note: One to one corresponding signal  
Contact capacity: 0.5A/24V DC

## Appendix 10 Overall Drawing of Bevel Gearing



Unit:mm



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