CV2 Type Vacuum On-Load Tap Changer Operation Instructions

HM 0.460.4101-03-02/2017

Shanghai Huaming Power Equipment Co.,Ltd.

Contents

1 General

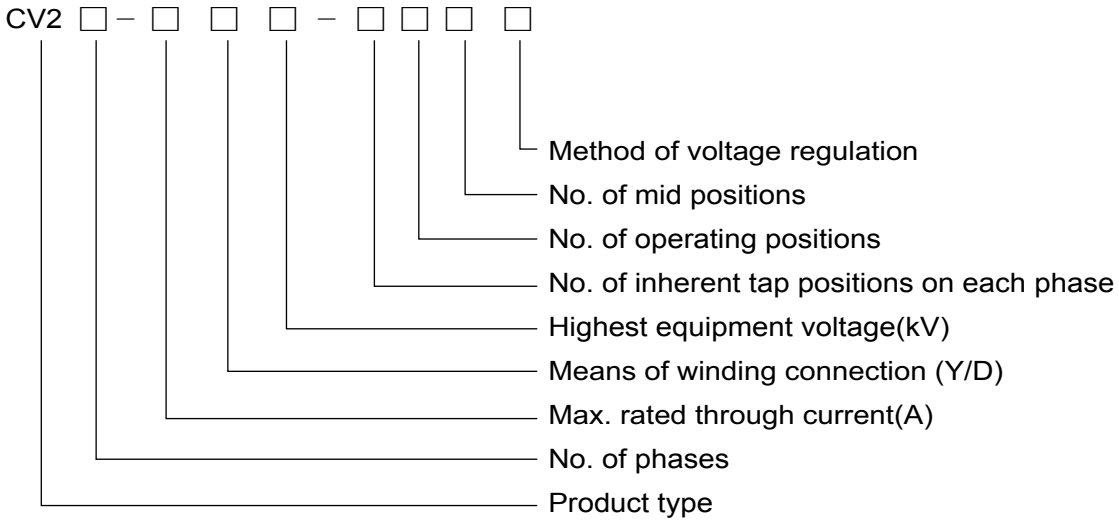
CV2 on load tap changer (herein referred as the tap changer) is of selector switch structure, which combines the functions of diverter and selector.
The tap changer is mounted to the transformer tank cover by its head.
When the tap changer is used without a change-over selector, the maximum operating positions available is 12, and it is up to 23 positions if with a change-over selector.

This operating instruction includes the necessary information for the installation and operation of following types of tap changer (with and without change-over selector).
Three phases tap changer for neutral point: CV2 III-250Y, CV2 III-350Y, CV2 III-500Y.
Three phases tap changer for any connection: CV2 III-250D, CV2 III-350D, CV2 III-500D.
Single phase tap changer: CV2 I-250, CV2 I-350, CV2 I-500.

CV2III-500Y/40.5-10193W

CV2III-500D/40.5-10070

1.1 Model denomination



Example: CV2III-500Y/72.5-10193W
It represents CV2 type, three-phase, 500A max. rated through current, 72.5kV highest equipment voltage, Y-connection, 19 operating position and three middle-position, with change-over selector.

1.1.1 Highest equipment voltage class: 40.5kV, 72.5kV, 126kV, 145kV.

1.1.2 Number of operating positions for tap changer:
Without change-over selector, the number of maximum operating position can be up to 10 and12 respectively; with change-over selector, it can be up to 19,23 respectively.

1.1.3 There are two types of change-over selectors, namely reversing regulation represented by W and coarse/fine regulation represented by G. Mid position no. can be 1or 3. Linear regulation without change-over selector is represented by 0.

1.1.4 It can be installed in the transformer by tank type or by bell type.

1.2 Scope of application

The tap changer is used for power transformer and rectifier transformer of rated voltage from 40.5 to 145kV, rated current not more than 500 A, frequency 50 or 60 Hz. The taps of the transformer can be changed by the tap changer on load to regulate the output voltage for the purpose of regulating line voltage.

1.3 Rated application conditions and requirement

1.3.1 The storage ambient temperature of OLTC is from -25℃ to 40℃ . The storage humidity of the

OLTC should be no more than 85 percent.

The service temperature of standard designed OLTC is -25℃ to 40℃

If the temperature exceeds the range of above (-25℃ to 40℃), please specify when ordering.

Service temperature range of tap changer in oil is -25℃ ~ + 105℃ (suitable for 115℃ during overload).

1.3.2 To meet the ordering requirements and comply with the operating environment, if the requested service temperature is out of the range of -25℃ to 40℃ , the suitable material and accessories of the OLTC will be specially selected and applied.

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.

2. Technical Data

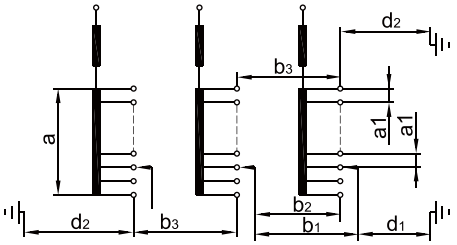
2.1 Rated parameters of tap changers (see table)

Max. rated through current(A)		250			350			500		
No. of phases		1	3	3	1	3	3	1	3	3
Connection method		-	Y	D	-	Y	D	-	Y	D
Max. rated step voltage	10 &12 contacts	2000			2000~1500*			1500~1000*		
Rated step capacity (kVA)	10 &12 contacts	500			525			525		
Short-circuit current test (kA)	Thermal (3s)	4.5			4.5			7.5		
	Dynamic (Peak)	11.25			11.25			18.75		
Max. operating positions		12 for linear			12 for linear			10 for linear		
		23 for reversing or coarse/fine			23 for reversing or coarse/fine			19 for reversing or coarse/fine		
Insulation to ground (kV)	Highest voltage for equipment Um	40.5			72.5		126		145	
	Rated separate source AC withstand voltage(kV/50Hz,1min)	85			140		230		275	
	Rated lightning impulse withstand voltage (kV,1.2/50μs)	225			325		550		650	
Internal Insulation Level		Refer to item 2.3								
Mechanical Life		1,500,000 operations								
Electrical Life		600,000 operations								
Oil compartment	Service pressure	0.03MPa								
	Leakage test	No leakage under 0.08 MPa for 24 hours								
	Over pressure protection	Rupture disc bursts at 300±20% KPa								
	Protective relay	QJ4-25, Set oil flow speed at 1.0m/s ±10%								
Equipped with motor drive unit		SHM-D or CMA7								
Tap changer model		CV2 III -250	CV2 I -250		CV2 III-350		CV2 I-350	CV2 III-500		CV2 I-500
Net weight (kg) without oil		120	90		140		100	160		140
Oil filling volume (dm^3)		170	130		185		140	200		180

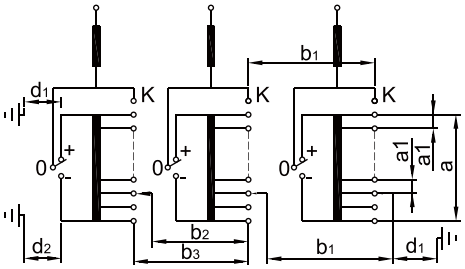
*** Please refer to Fig.5 on page 6**

2.2 The voltage gradient between the terminals of the tap selector

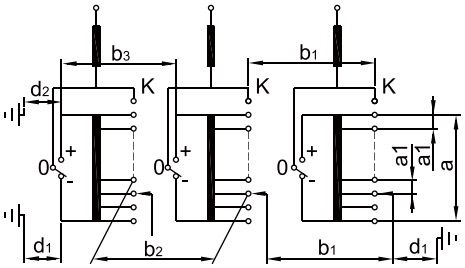
Without change over selector

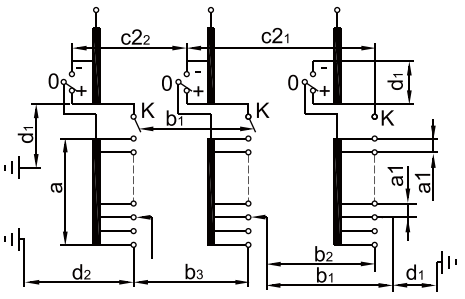


The reversing change over selector on the (+) position

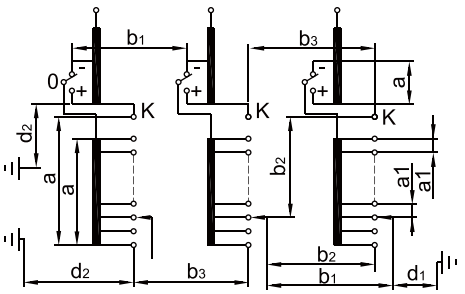


The reversing change over selector on the (-) position





The coarse/fine change over selector on the (-) position



a1= between any tap conacts of tap selector (connect or disconnect)
a= between the maximum tap and minimum tap of the tap winding. If there is coarse tap winding, it is between the maximum tap and minimum tap of the coarse tap winding.
Caution: when the coarse tap terminal is on the change over selector (-) position and withstanding the impulse voltage, the value between the maximum terminal of the coarse tap winding connected to the contact K of the tap selector and the tap selector contact of the tap winding's maximum terminal in the same phase must comply with the permissible withstand voltage of "a".

b= between the contacts of tap selector of different phases, and between the contacts of change over selector of different phases, this distance connects to the maximum terminal (or minimum terminal) of the tap winding or one contact of the tap selector.
The permissible voltage between the contacts of the tap changer in Delta connection varies with position of the change over selector and tap selector. So it must meet the each different withstanding voltage of b1, b2 and b3.
b1= between the selected contacts in different phases,
b2= between the pre-selected contact in one phase and unselected
contact in other phase,
b3= between the un-selected contacts in different phases.

d= Between tap selector contact and change over selector (+) contact to ground. Delta connection adopts two values:
d1= when the change over selector is on the (+) position, between the terminal to earth, and between the change over selector (+) contact to earth;
d2= when the change over selector is on the (-) position, between the un-selected contacts of the tap selector, and between (+) contact to earth.

Besides, when the coarse tap winding is on the (+) position of the change over selector, it should also include:
c2= between the (-) contacts of the changer over selector in different phases; and between a (-) contact of the change over selector and a (+) contact of the change over selector in another phase.
Delta connection adopts different permissible value as follows:
c21= between a (-) contact of the change over selector and a (+) contact of the change over selector in another phase.
c22= between the (-) contacts of the change over selector in different phases.

2.3 Rated withstanding voltage of changer insulation distance

		Imposed voltage and duration	CV2 III -D			CV2 III -Y	
a	10 contact pitch	kV 1.2/50 μs	200			200	
		kV 50Hz 1min	50			50	
	12 contact pitch	kV 1.2/50 μs	180			180	
		kV 50Hz 1min	50			50	
a1	10 contact pitch	kV 1.2/50 μs	200			200	
		kV 50Hz 1min	50			50	
	12 contact pitch	kV 1.2/50 μs	180			180	
		kV 50Hz 1min	50			50	
b			b1	b2	b3		
	Um=40.5kV	kV 1.2/50 μs	200	250	300		
		kV 50Hz 1min	70	80	90		
	Um=72.5kV	kV 1.2/50 μs	350	490	520		
		kV 50Hz 1min	140	165	180		
	Um=126kV	kV 1.2/50 μs	550	570	600		
		kV 50Hz 1min	230	240	250		
	Um=145kV	kV 1.2/50 μs	650	730	800		
		kV 50Hz 1min	275	285	300		
c2			$C2_1$	$C2_2$			
	Um=40.5kV	kV 1.2/50 μs	250	300		200	
		kV 50Hz 1min	80	90		50	
	Um=72.5kV	kV 1.2/50 μs	490	520		200	
		kV 50Hz 1min	165	180		60	
	Um=126kV	kV 1.2/50 μs	570	600		200	
		kV 50Hz 1min	240	250		85	
	Um=145kV	kV 1.2/50 μs	730	800		200	
		kV 50Hz 1min	285	300		85	
d			d_1	d_2		d_1	d_2
	Um=40.5kV	kV 1.2/50 μs	200	350		200	300
		kV 50Hz 1min	70	90		70	90
	Um=72.5kV	kV 1.2/50 μs	350	490		350	490
		kV 50Hz 1min	140	165		140	165
	Um=126kV	kV 1.2/50 μs	550	570		550	570
		kV 50Hz 1min	230	240		230	240
	Um=145kV	kV 1.2/50 μs	650	730		650	730
		kV 50Hz 1min	275	285		275	285
c1	Um=40.5kV	kV 1.2/50 μs	400			400	
		kV 50Hz 1min	100			100	
	Um=72.5kV	kV 1.2/50 μs	400			400	
		kV 50Hz 1min	100			100	
	Um=126kV	kV 1.2/50 μs	400			400	
		kV 50Hz 1min	100			100	
	Um=145kV	kV 1.2/50 μs	400			400	
		kV 50Hz 1min	100			100	

2.4 Technical parameter of OLTC

2.4.1 The contact resistance of different contacts is not greater than 300μΩ.

2.4.2 The time of each tap change is about 4.4 sec.

2.4.3 Vacuum interrupter of the OLTC at rated capacity could reach 600,000 operations.

2.4.4 Mechanical life of the OLTC could reach 1,500,000 operations.

2.4.5 The OLTC is maintenance free for 300,000 operations.

3. Structure of the tap changer

OLTC can be divided into three big components, namely the tap changer head cover, the selector switch, and the oil compartment.

Fig.1

3.1.1 The tap changer head cover is made of aluminium alloy by precision casting. On the cover, there is gear actuating mechanism, inspection window, oil and gas discharge valve, protective diaphram and oil-resistant sealing ring between the cover and the flange (fig.1.).

3.1.2 Selector switch

The selector switch is of overall structure. There are spring energy-accumulating mechanism on the top and diverter & selector in the middle.

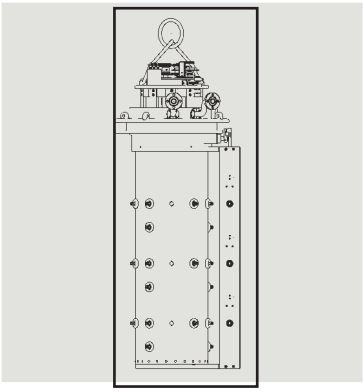


Fig.2

Attention: Don't remove the spring mechanism when lifting the selector switch (fig.2.).

3.1.2.1 Spring energy-accumulating mechanism

The spring mechanism is on the top of the selector switch, consisting of gears, Geneva wheel, wheel driver and spring as a sub assembly. Its function is to actuate the movement from the motor drive into the movement of the contacts on the main shaft (fig.3.).

Fig.3

3.1.2.2 Main shaft (fig.4.)
There are contacts assemblies and transition resistors on the main shaft.
3.1.2.3 Intermediary contact supporting cage
On the cage, there are fixed contacts and floating contacts, which are connected to the fixed contact on the oil compartment cylinder.
3.1.3 Oil compartment (fig.5.)
There is a die casting aluminium alloy flange on the top of the oil compartment head. The middle is the insulating cylinder with fixed contacts and there is metal part at the bottom of insulation cylinder. The oil-resistant rubber sealing rings are used for the connection of these three parts. Changer-over selector is installed outside the oil compartment when it is required.

Fig.4

Fig.5

4. Connecting the tap winding and tap changer current take-off leads

The transformer tap leads must be connected to the tap changer according to the specific tap changer connection diagram which is supplied with the product.

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 for insulating must be retained.

Check all terminals marks whether they are in accordance with the connection diagram. The terminals have through-holes for the connection of cable shoes to one side of the terminals.
Terminals of changer-over selector: 11mm inner diameter matched with M 10-bolts for connection (fig.6.).

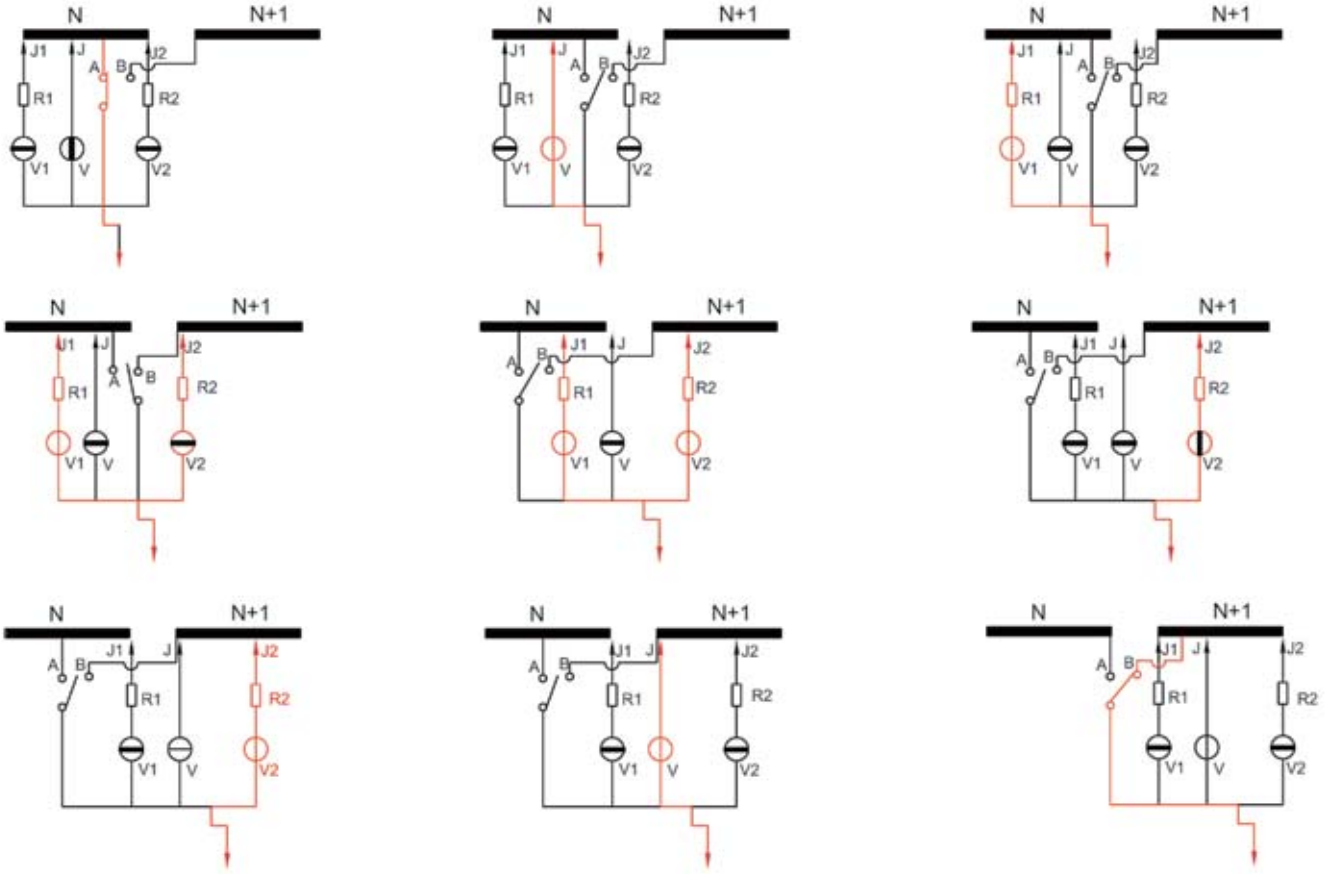
Neutral connection lead of the tap changer is outside the insulating cylinder. This lead serves as the neutral point of the tap changer and tap winding, and must not be disconnected (fig.7.).

Fig.6

Fig.7

5. Switching process of selector switch contacts

The switching process of selector switch contacts follows the diagram below (fig.8.).



J1, J, J2 tap select contactor, transition circuit

V1, V2 transition contact (vacuum interrupter)

V main contact (vacuum interrupter)

A, B tap selector contact, main circuit

R1, R2 transition resistor

Fig. 8

6. Basic circuit diagrams of tap changer

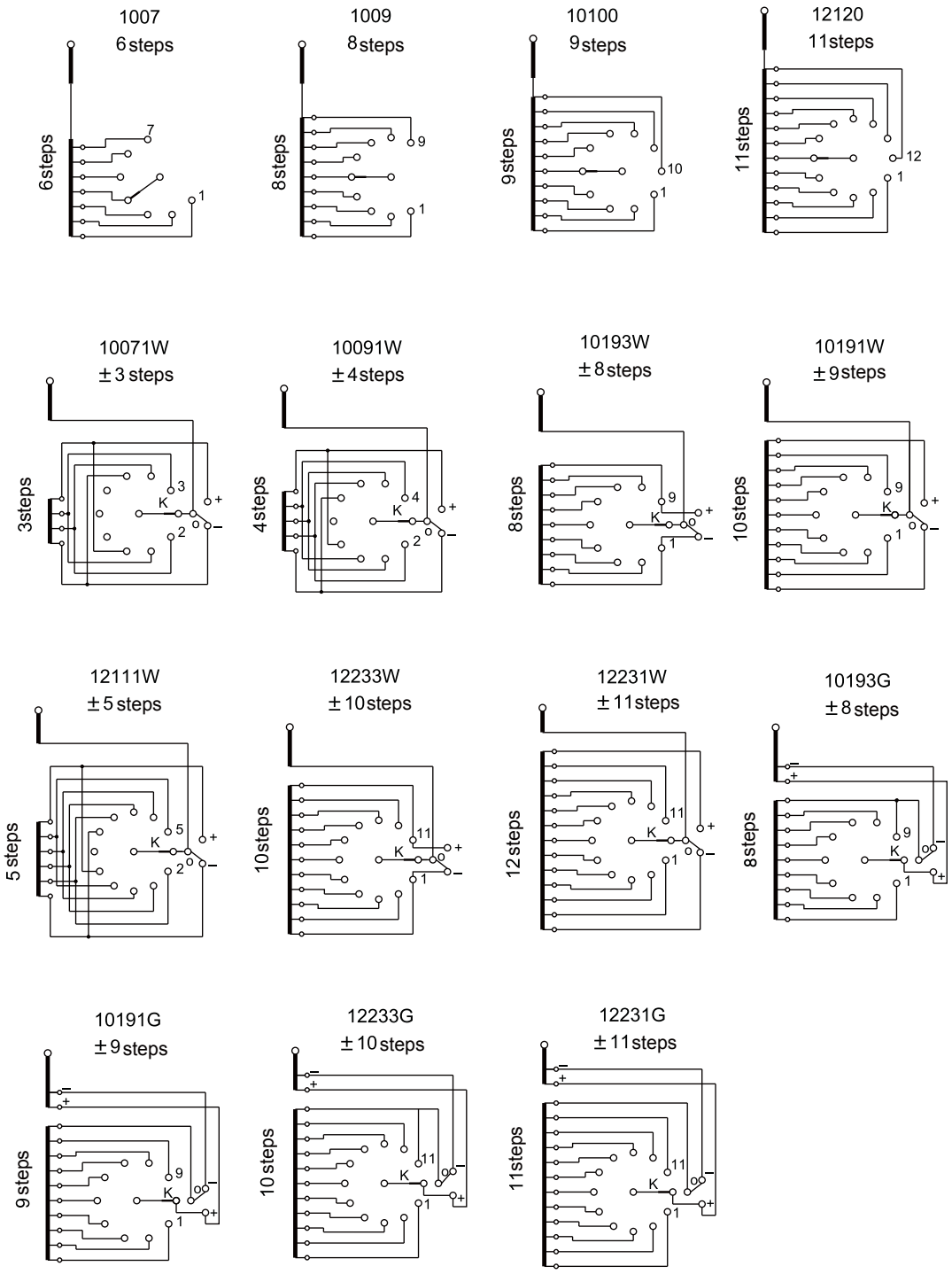


fig.9 Basic diagrams

7. Installation of the tap changer

7.1 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 (see appendix 2).

7.2 Installation of the tap changer head to the tank top type transformer cover (see appendix 3)

Attention: It is used for the installation of tap changer without reversing change over selector to the tank top type transformer cover only.

Procedures are as following:

1) Clean all sealing surfaces (tap changer head flange and 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 completed tap changer.

4) Fasten the tap changer head flange to the transformer mounting flange.

Installation of the tap changer with change over selector(Fig.10)

1) Remove the head cover of the tap changer.

2) Disassemble the mounting flange of the tap changer (Fig.11), pay attention on the location of trangle.

3) Lift the transformer tank cover onto the tap changer.

4) Assemble the tap changer mounting flange onto the transformer cover plate slowly.

5) Fasten the bolts between the tap changer flange and supporting flange,pay attention on the location of trangle.

6) Fasten the tap changer head cover.

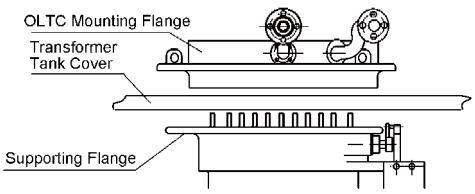


fig.10

7.3 Installation of the tap changer into the bell-type tank

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 4).

The tap changer is lifted into the supporting rack, fixed and connected there. For the mounting of the tap changer head to the bell-type cover, we recommend to use a mounting flange according to paragraph 7.1(see appendix 2).

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.

7.4 Installation procedures of the tap changer to the bell-type transformer

It is not necessary for CV2 to lift the main shaft when the tap changer is mounted to the bell-type transformer.

7.4.1 Detaching the tap changer head cover

Before installation, the tap changer head cover should be removed first. Unfasten 24 M10 X35 bolts and washers on the cover. Then remove the tap changer head cover.

7.4.2 Detaching the tap changer mounting flange

7.4.2.1 Before detaching the tap changer mounting flange, pay attention to the position mark of the tap changer and ensure that the tap changer is on position no.1.(fig.12,13).

7.4.2.2 Firstly unfasten the screw connection between the suction pipe and flange.

7.4.2.3 Unfasten the M8 screws which connects the tap changer flange and oil compartment supporting flange.

7.4.2.4 Lift the main body of the selector switch carefully, if necessary, put it aside and cover with plastic bag.

7.4.2.5 Unfasten 24 pcs of M8 hex screws between the head flange and supporting flange and keep the nuts and dished washers well.

7.4.2.6 Remove the mounting flange of the tap changer and avoid damaging the sealing ring.

7.4.2.7 After removing the supporting flange, please note the change-over selector and do not touch it.

7.4.3 Installation of the tap changer in bell type transformer tank

7.4.3.1 Before installation of the Bell type OLTC, clean the oil compartment and the sealing surface

7.4.3.2 Lift the oil compartment of the bell type tap changer above the tranformer, then lower it slowly.

7.4.3.3 Install the head flange of the OLTC. Firstly clean the sealing face and put the oil-proof sealing gasket on the mounting flange, then put the head flange of the OLTC on the mounting flange.

7.4.3.4 Leave a gap around 5mm to 15mm according to different height between head flange and supporting flange.

Fig.11

Fig.12

Fig.13

Fig.14

7.4.3.5 Use the lifting device to lift the supporting flange. (see appendix 7)
7.4.3.6 Fasten the 24 M8 screws and washers between the head flange and supporting flange.
7.4.3.7 Lift the selector switch into the oil compartment on tap position no.1, pay attention to the triangle alignment mark.
7.4.3.8 Fasten 18 M8 screws on the selector switch.
7.4.3.9 Re-connect the suction pipe and head flange of the OLTC.
7.4.4 Installation of the head cover
7.4.4.1 Evenly fasten 24 M10×38 screws and washers on the head cover of the OLTC.
7.4.4.2 Check if the OLTC is on tap position no.1 through the inspection window on the head cover of the OLTC.

Tap change is forbidden without oil in the OLTC.
Over-riding the limit position of the OLTC is forbidden. Check if the tap position is correct through the inspection window in the voltage transforming ratio rest from time to time.

8. Drying procedure and filling the oil

8.1 Drying treatment

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

8.1.1 Vacuum-drying process
8.1.2 Drying in the vacuum oven
When drying the transformer in the oven, the tap changer head cover must be removed.
Heating up
The tap changer is under normal atmospheric pressure with a temperature rise rate of 10℃ /hour until maximum final temperature of 110+5℃ .
Pre-drying
The tap changer stays in max 110+10℃ circulating air for a duration of 8 to 10 hours.
Vacuum-drying
Dry the tap changer at a temperature of max. 110+10℃ under a residual pressure of 10^{-3} bar for a duration of 20 hours.
8.1.3 Drying in the transformer oil tank
If the transformer should be dried in its tank, the inside of the tap changer must be vacuumed by a bypass pipe, as the tap changer head cover remains closed during the entire drying process. The tap changer head cover can stand vacuum pressure.
For easy handling, it is suggested to connect the bypass pipe between connector E and R of the tap changer head (see appendix 3 or fig.15, 16).
Refer to section 8.1.1 for the procedure, temperature, duration and pressure of the drying process.

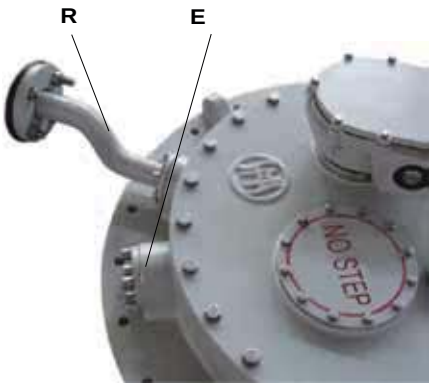


Fig.15

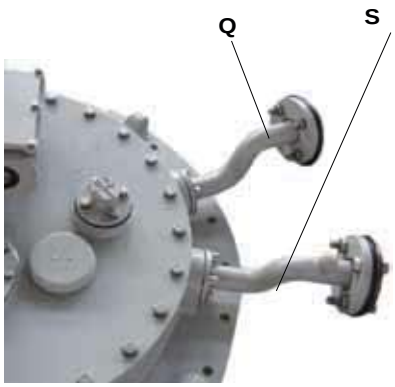


Fig.16

Fig.17

8.2 Vapor-phase drying process

Before starting the drying procedure, the oil bleeding screw in the oil compartment bottom must be loosened by a special wrench for exhausting the kerosene vapor. It must be screwed again after the drying procedure.

8.2.1 Vapor-phase drying in the vacuum autoclave

When drying in the autoclave remove the tap changer cover first. Keep the suction pipe unblock. Keep the kerosene vapor at a temperature of about 90 ℃ for 3 to 4 hours. The kerosene vapor rises with a rate of 10 ℃ / hour until a maximum temperature of 125 ℃ . The duration of the drying procedure is normally the same as that of the transformer.

8.2.2 Vapor-phase drying in the transformer tank

If the transformer is to be vapor-phase treated in its own tank the selector switch must be lifted out. Check if the oil bleeding screw is closed after vapor-phase drying.

Attention: after the drying process, the tap changer must not be operated without oil and the oil bleeding screw must be fastened.

8.3 Fill the oil

For filling new oil under vacuum, use the pipe connection S or Q. For draining vacuum to the changer, a bypass pipe between connection E and R is to be installed for vacuuming both the oil compartment and the transformer simultaneously.

9. Pipe connectors

The tap changer head is provided with 3 pipe connectors. These pipe connectors can not be swiveled because of angle fixation (figure 18 in appendix 3).

Fig.18

9.1 Protective relay (fig. 18)

Attention: the relay is to be mounted by connecting the pipe connectors in

horizontal position to the tap changer head as closer as possible.
The arrow on the relay should point towards the oil conservator when mounted.
The pipe should be inclined by at about 2% to 4% angle to the oil conservator.

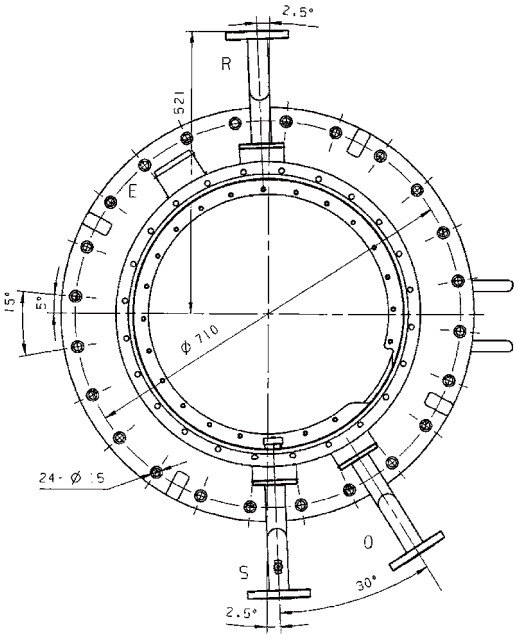


Fig.19

9.2 Pipe connector S for suction pipe
This connector is used for taking out oil sample.

9.3 Pipe connector Q
This connector is for filling the oil.

9.4 Connector of flange E
Generally the flange is sealed by a dummy cover. This flange hole leads directly to the transformer oil tank from the bottom of the tap changer head.

10. Mounting the motor drive unit, the bevel gear and the drive shaft

10.1 Mounting the motor drive unit (see appendix 9)
Please consult the operation inspection of SHM-III or CMA7 for detail 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 12).
Attention:
The horizontal part of the drive shaft must be in proper alignment with the output shaft of bevel gear box.
After loosening the fixing bolts, the gear box unit can be swiveled. Adjust the bevel gear unit according to section 10.4

10.3. After adjusting the upper gear unit the bolts has to be re-tightened.

10.4 Mounting the drive shaft

Mounting procedure of the drive shaft is as follows: Firstly, the vertical shaft is to be mounted between motor drive unit and bevel gear, then the horizontal shaft 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.

The square shaft is delivered 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. (rotation difference balance check)

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 total 10 full cycles of operations.

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

11.2 Oil replenishment

The tap changer has to be completely filled with transformer oil via the oil conservator. The height of oil level of tap changer oil conservator should nearly equal to transformer oil conservator or 100 to 200mm lower.

11.3 Deflation after oil replenishment

11.3.1 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.20).

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

11.3.3 Open the valve of protective relay until oil overflow,then close the valve.

Fig.20

11.4 Grounding

The grounding stud of tap changer head should be

connected to the transformer cover. The grounding stud of motor drive should be connected to the transformer oil tank.

12. Transporting the transformer to the operating site

In case it is necessary to dismount the motor drive from the transformer for transporting reasons, set the motor drive to the same position as the tap changer. Uncouple the motor drive and drive shaft. 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 E and R of the tap changer head.
The oil level will lower by approx. 5 liters after 2 to 4 weeks storing without oil conservator.
If it become necessary to transport or store the transformer without oil filling, drain the switch oil of the tap changer completely.
If it tends to be stored for a long time, the heater of motor drive should be powered on.

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 connected into the tripping circuit of the circuit breakers in a way that an energizing of the protective relay immediately trips the transformer.
Test the function of the circuit breakers by pushing button “off”. Only push “on” button when the transformer is going to work.
After switching on the transformer, on-load tap changer operations can be performed. Switching gas accumulating under the cover of the tap changer head will cause a small oil displacement.

14 Supervision in service

Pay special attention to:
Check if the tap changer head protective relay and the motor drive protective relay works properly.
Oil tightness of the tap changer head seal, the protective relay and the pipe connections. Tightness of the motor drive housing, visual inspection of the control devices in the motor drive unit.
It is absolutely necessary to inspect the transformer and the tap changer when the protective relay trips.
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 failure of tap changer or motor drive, or protective relay trip, and difficult to repair,

please contact the Service Department of Shanghai Huaming Power Equipment Co., Ltd.

We recommend a periodic inspection of the tap changer equipment to maintain its reliability in operation.

The insulation oil of the tap changer should be checked routinely according to relative procedures.

Model	S trength of insulation oil	Water content of oil
Y connection	30kV/2.5mm(min)	<40μL/L
D connection	40kV/2.5mm(min)	<30μL/L
Single phase	40kV/2.5mm(min)	<30μL/L

15. Inspections

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

The maintenance includes pipe inspection, motor drive check and some replacement of wearing parts.

We recommend the inspection work could be done by our Service Department in principle, who can carry it out in a professional and proper manner.

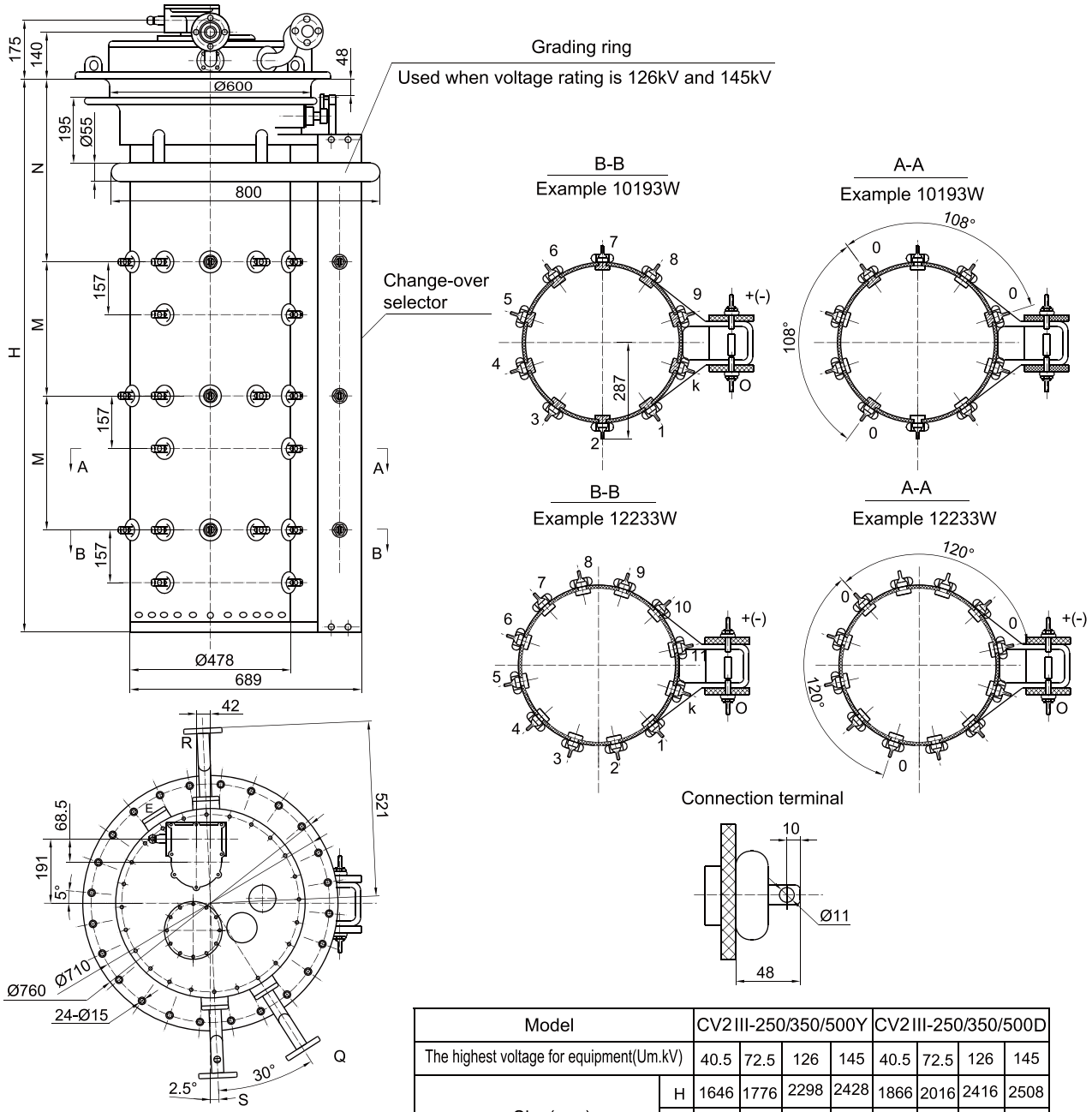
Maintenance period:

The OLTC insert must be lifted up for inspection when it operates 300,000 times.

The whole selector switch must be replaced after 600,000 times operating.

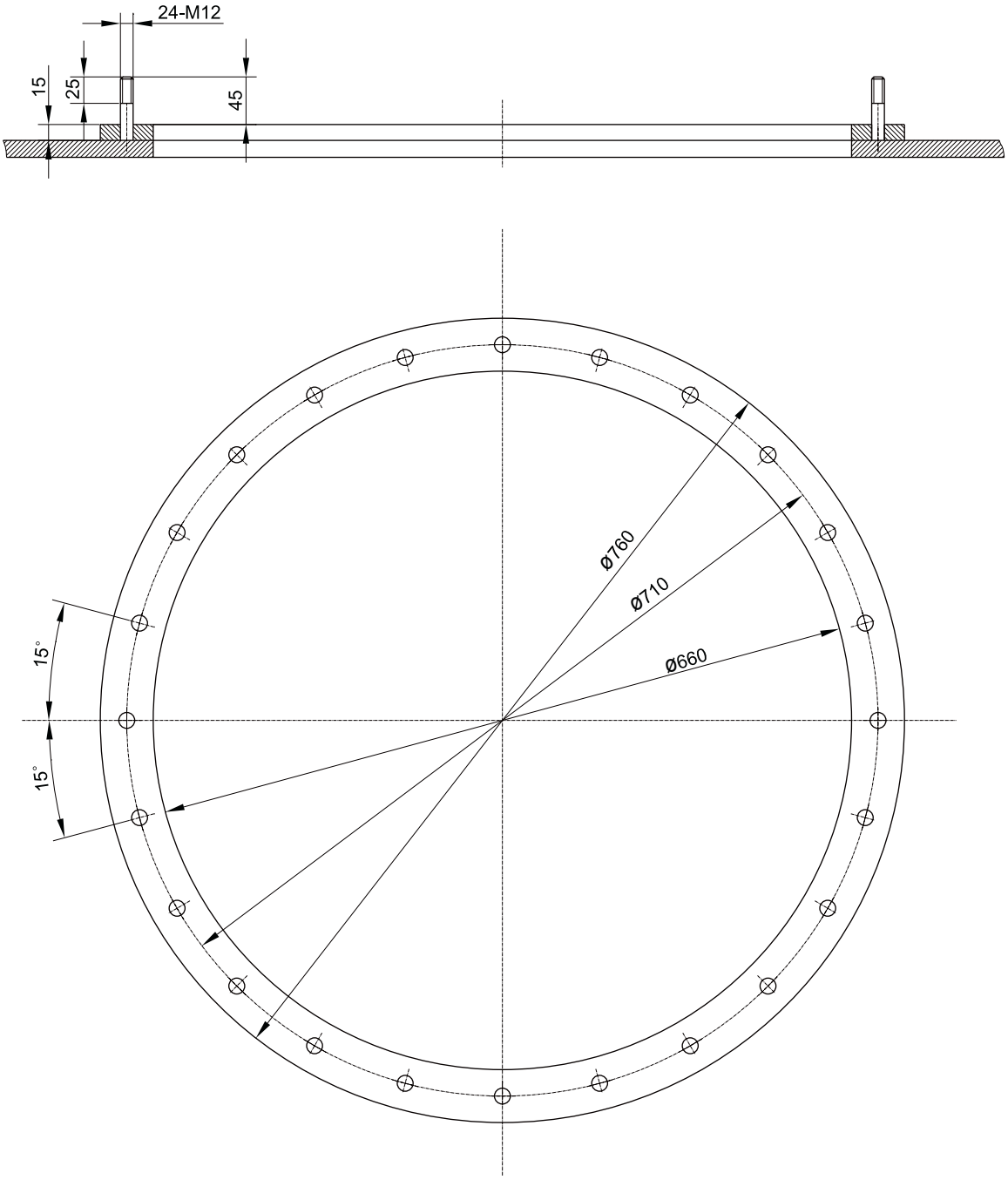
16. Appendix

Appendix 1 Overall dimensions of the tap changer



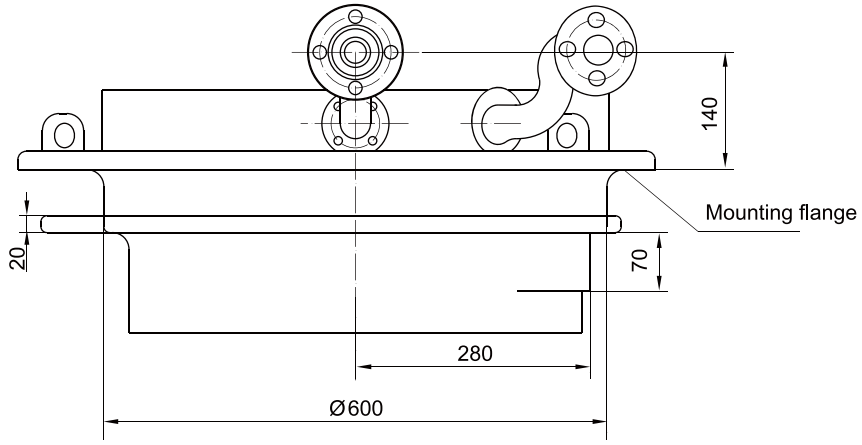
Model		CV2III-250/350/500Y				CV2III-250/350/500D			
The highest voltage for equipment(Um.kV)		40.5	72.5	126	145	40.5	72.5	126	145
Size(mm)	H	1646	1776	2298	2428	1866	2016	2416	2508
	N	544	594	724	774	544	594	724	774
	M	399	439	635	675	509	559	694	715

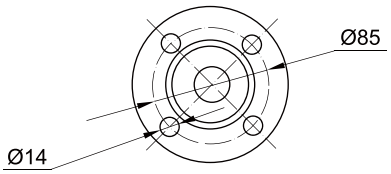
Appendix 2 Overall dimension of mounting flange to transformer

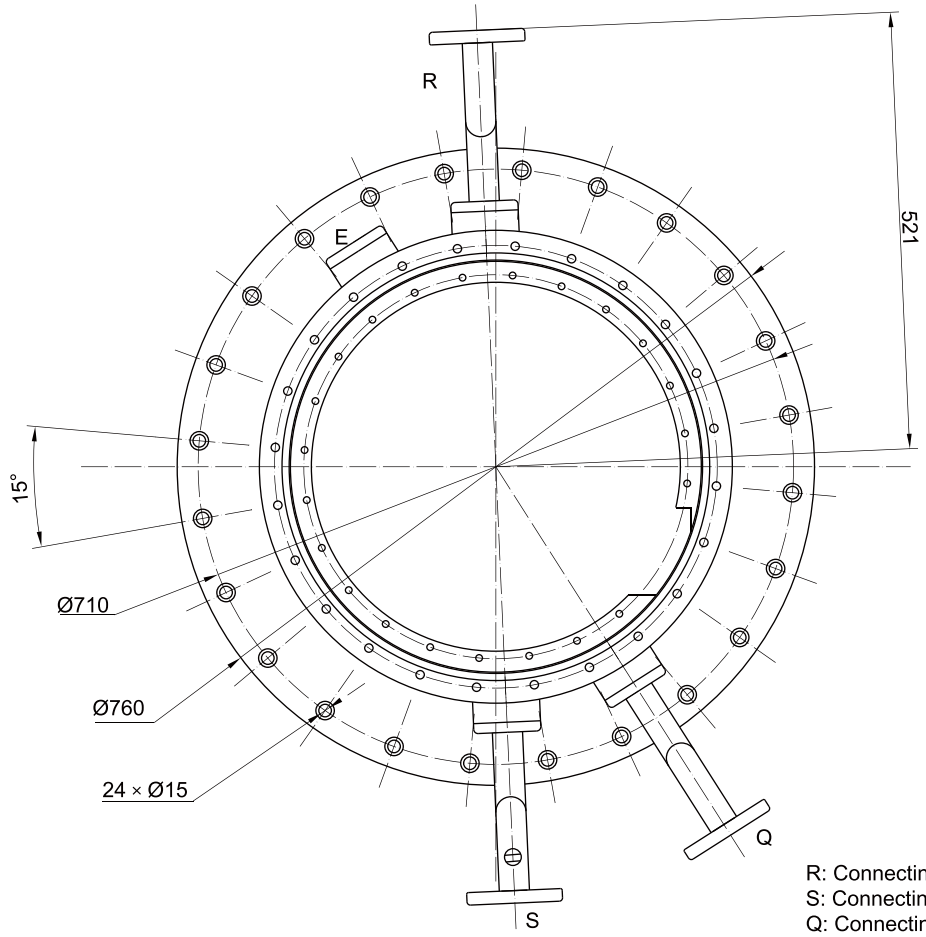


Unit:mm

Appendix 3 Overall dimensions of tank top flange

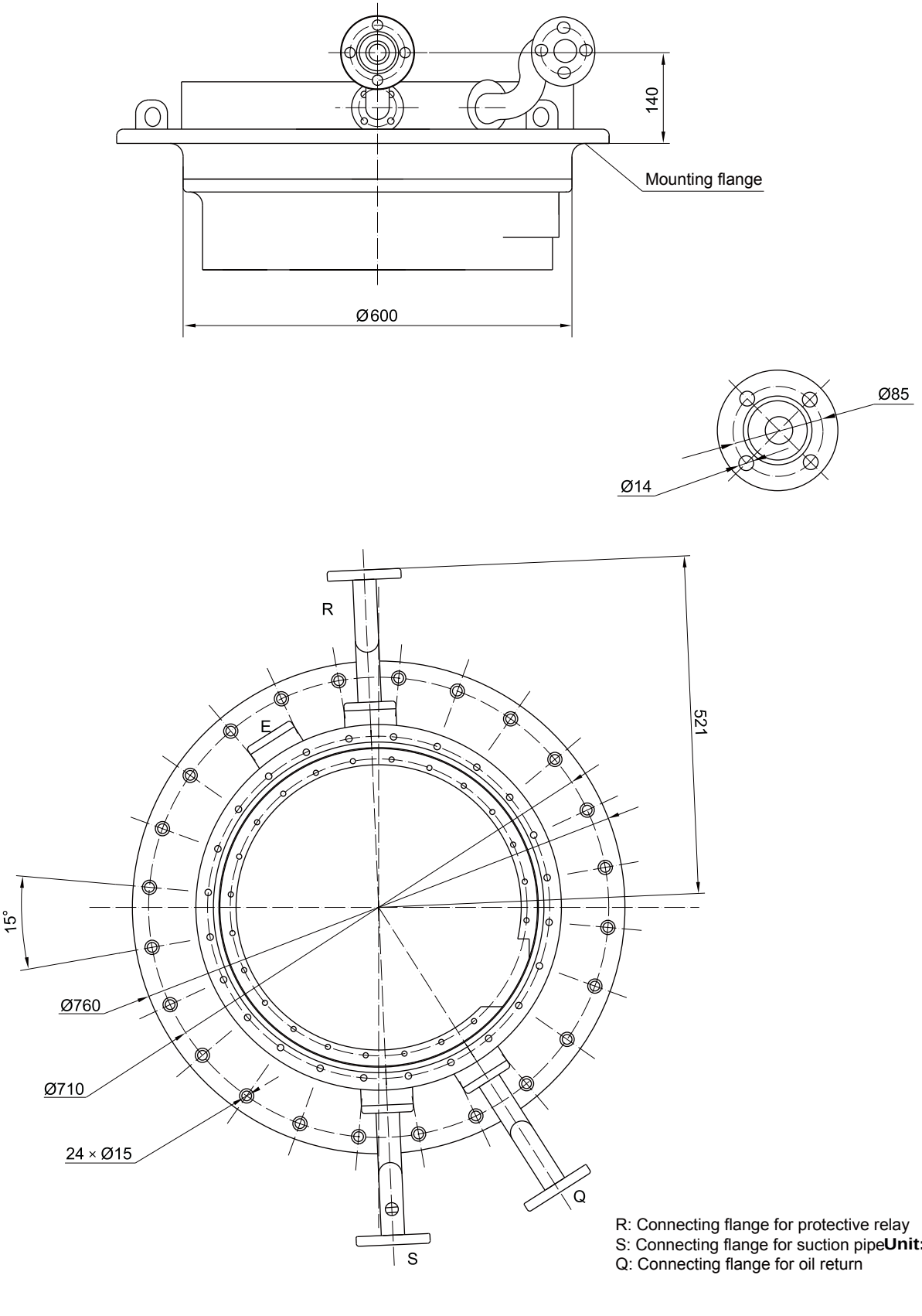






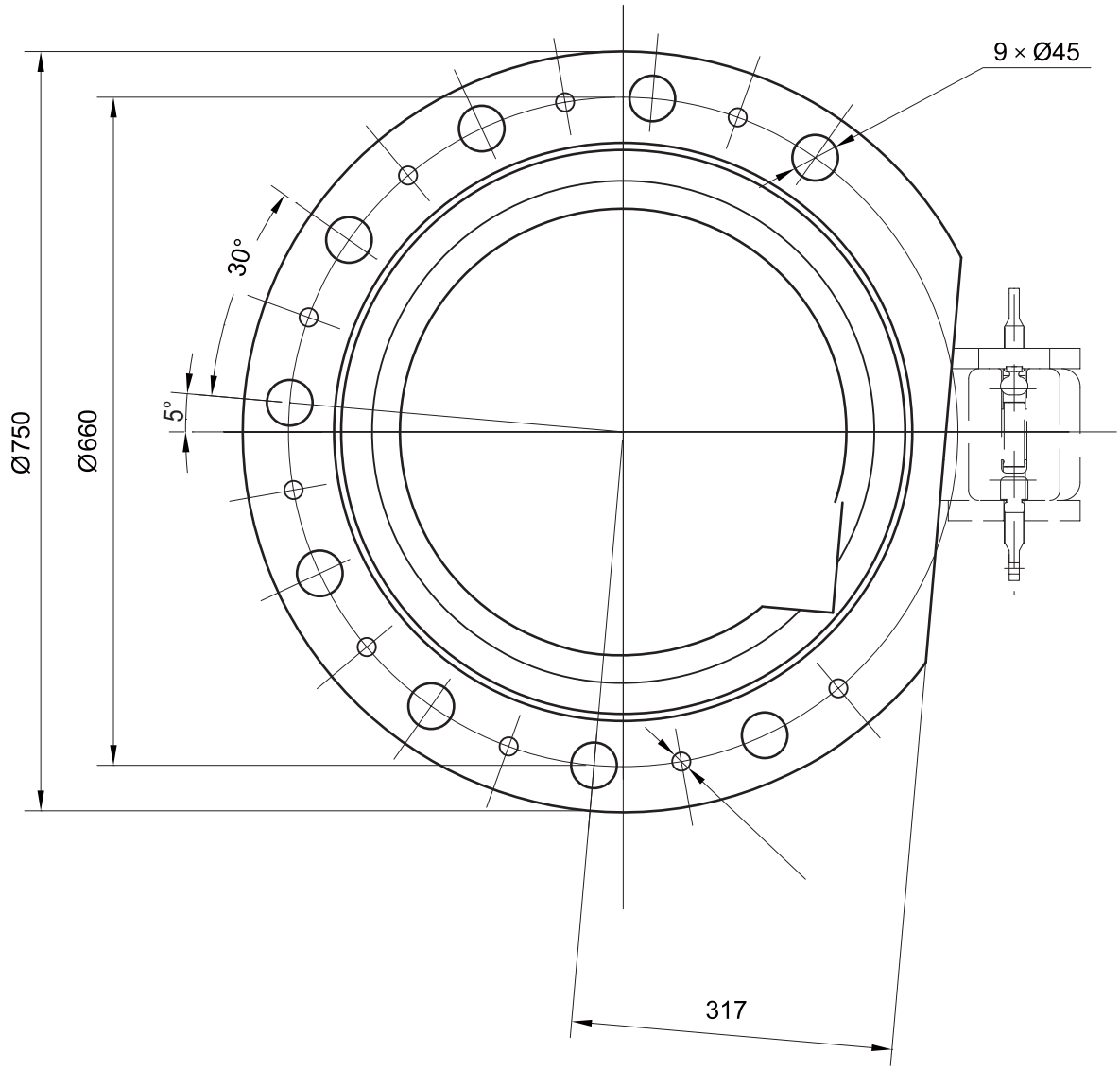
R: Connecting flange for protective relay
S: Connecting flange for suction pipe
Q: Connecting flange for oil return **Unit:mm**

Appendix 4 Overall dimensions of bell-type flange



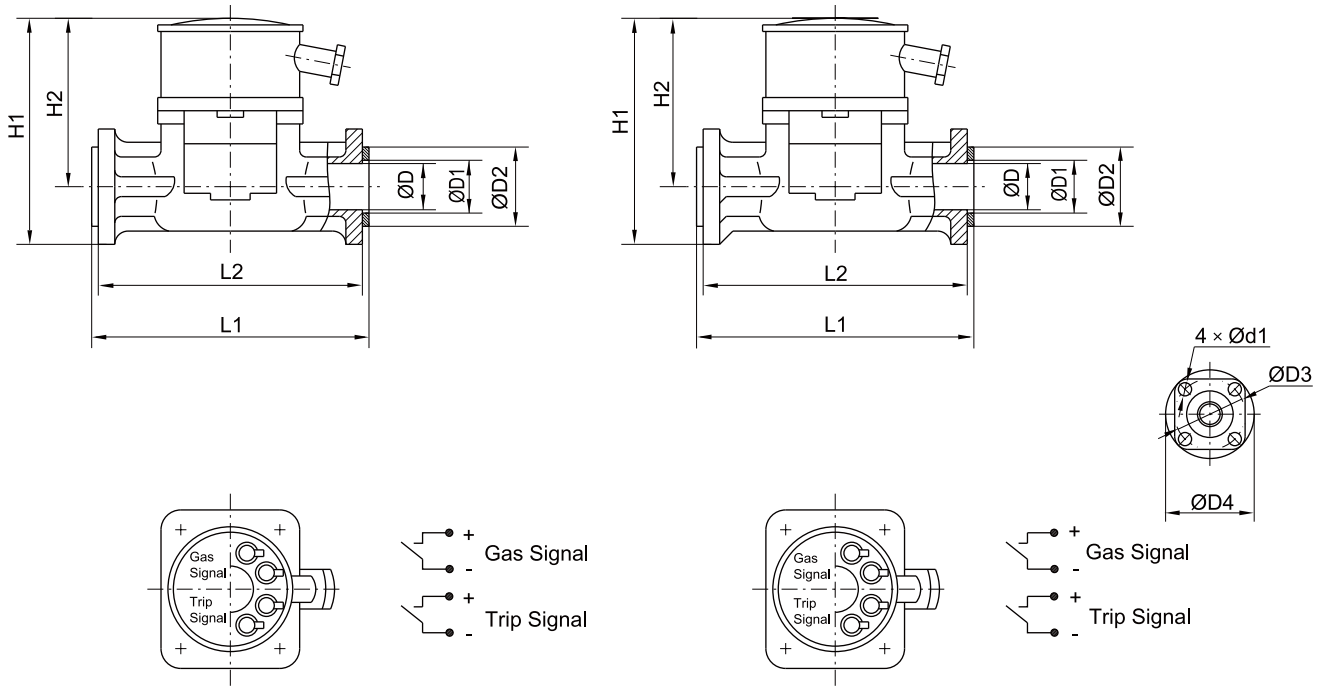
R: Connecting flange for protective relay
S: Connecting flange for suction pipe**Unit:mm**
Q: Connecting flange for oil return

Appendix 5 Overall dimensions of bell-type supporting flange



Unit:mm

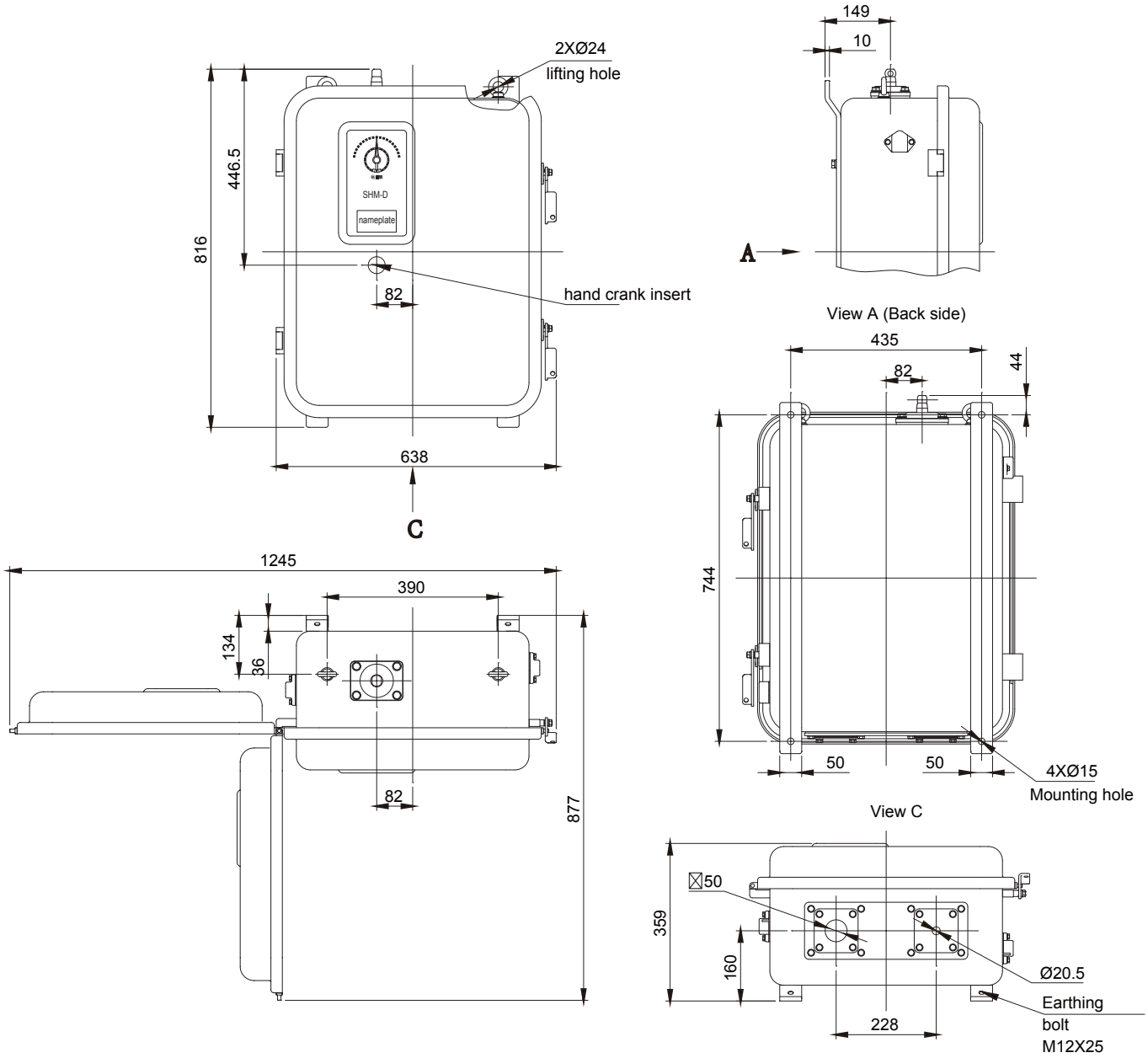
Appendix 6 Overall dimensions of protective relay



Model	D	D1	D2	D3	D4	d1	H1	H2	L1	L2	Note
QJ4-25A	25	35	65	85	115	14	215	153	208	200	1 pair of gas signal and 1 pair of trip signal, gas release device connected to man position
QJ4-25	25	35	65	85	115	14	215	153	208	200	1 pair of gas signal and 1 pair of trip signal

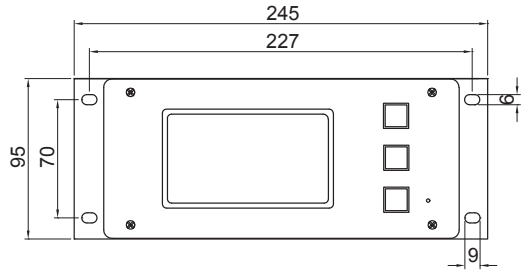
Unit:mm

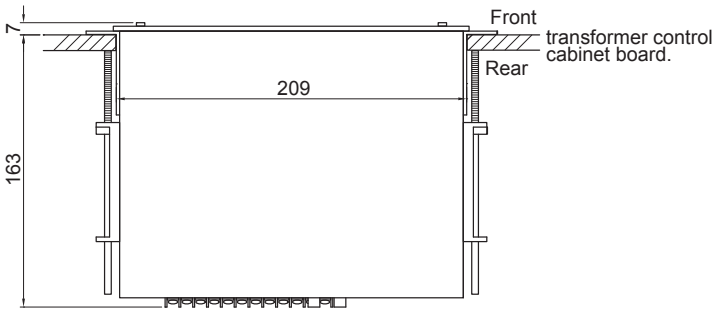
Appendix 7 Overall dimensions of SHM-D motor drive unit



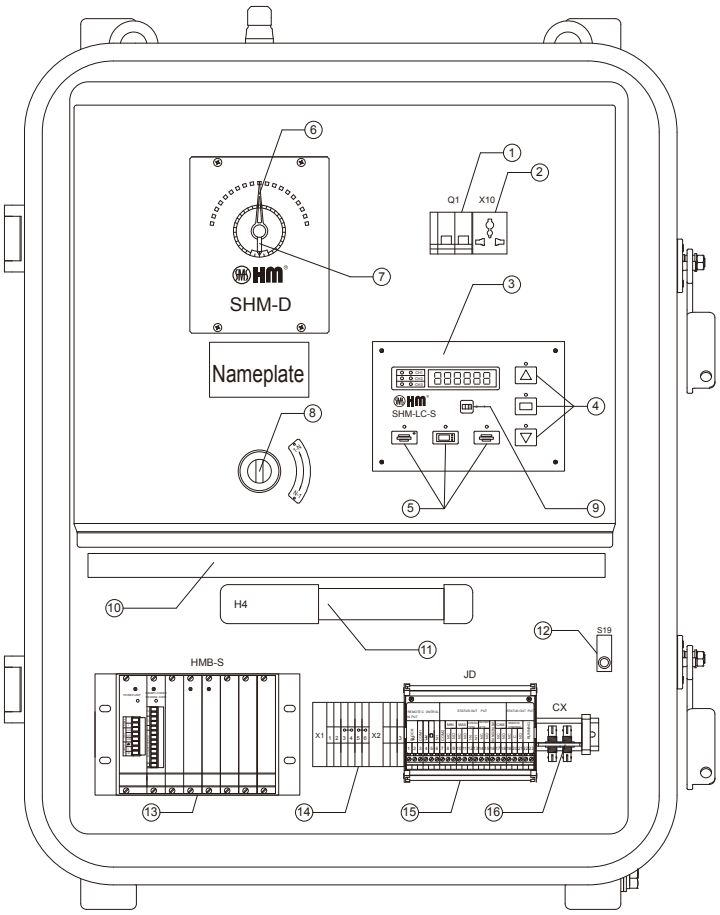
Unit:mm
Scale：1:10

Appendix 8 Overall dimensions of SHM-D type on-load tap changer controller





Appendix 9 SHM-D internal component arrangement



⑨ SHM-LC-S Operation counter instruction

1 2 3	Press operation button then the counter start working and the result will be displayed on the nixie tube. It will turn back to non-counter status after few seconds.

③ SHM-LC-S local controller status instruction

Position		Status	Meaning
Nixie tube (non-counter status)	Lowest three	Digit	Display tap changer current position
	Secondary	A	Motor drive unit is at Max. or Min. position
	Top	L	Block the motor drive unit. No further operation.
		d	Motor fault
		H	Hand crank inserted and motor operation forbidden
		E-01	Motor drive unit is not at the proper position
		E-02	Configuration fault or error
		E-03	Variable of before and after operation of position sensor abnormal
		E-04	No or invalid position sensor
Communication instruction lamp	CH1	Light flash	Send position signal
	CH2	Flash	Communicating with remote controller
	CH3	Flash	Communicating with debugging interface

⑤ SHM-LC-S 'local', 'remote control' , 'communication' instruction

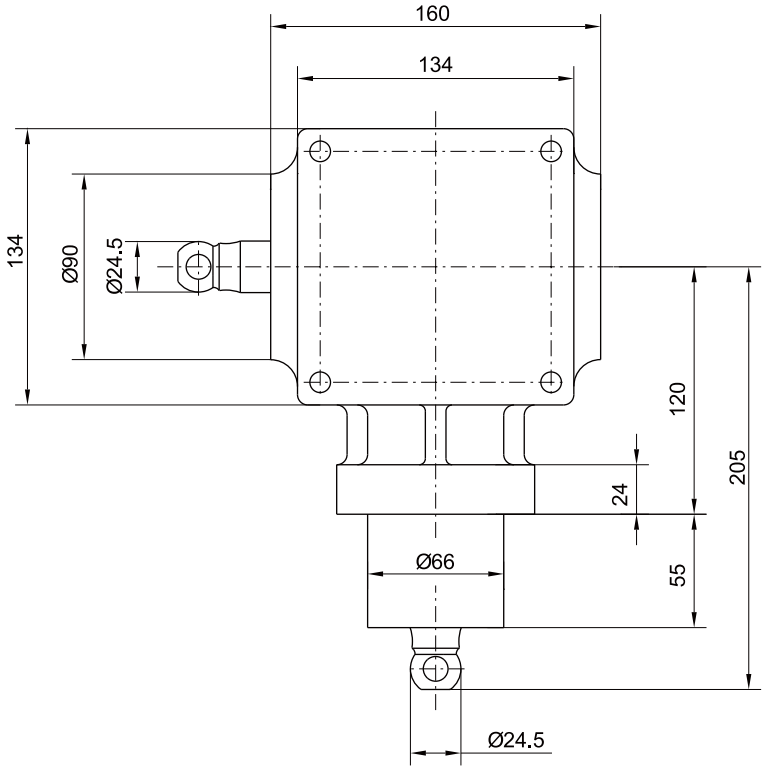
(communication)	Remote control input terminal of MDU is added as a special design. Controlled by external signal and please refer to the specific drawing.
(remote control)	Controlled via optical fiber
(local)	User can press 'raise', 'stop', and 'lower' button which locate on the local control module

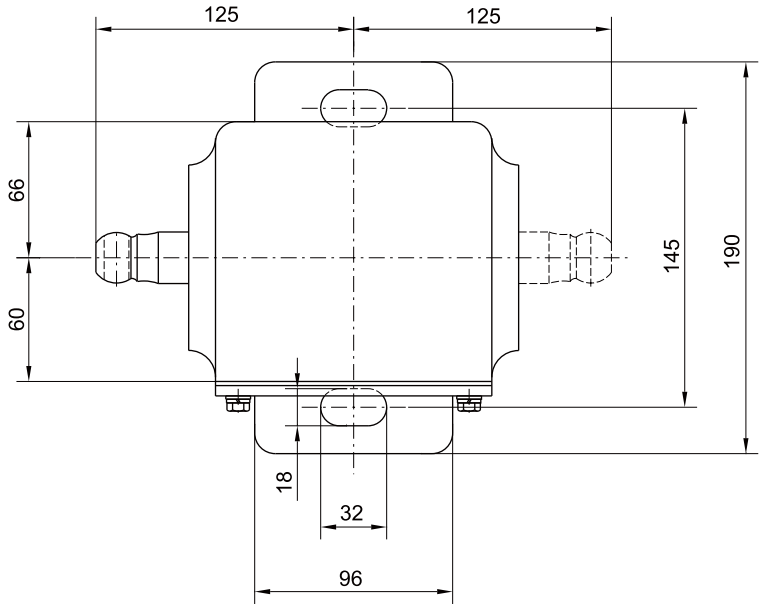
④ SHM-LC-S local mode button instruction

△	Raise position
□	Stop
▽	Lower position

1 MICRO CIRCUIT BREAKER
2 AUXILIARY POWER SUPPLY SOCKET
3 LOCAL CONTROL MODULE
4 'RAISE', 'STOP', 'LOWER' BUTTON
5 'REMOTE', 'COMMUNICATION', 'LOCAL' BUTTON
6 POSITION INDICATION
7 TAP CHANGE INDICATION
8 SPIN AXIS FOR HAND CRANK
9 COUNTER KEY
10 WIRE SLOT
11 LAMP
12 DOOR SWITCH
13 POSITION SIGNAL OUTPUT MODULE
14 TERMINAL BLOCK
15 SIGNAL INPUT/OUTPUT INTERMEDIATE RELAY PLATE
16 OPTICAL FIBER INTERFACE

Appendix 10 Overall dimensions of bevel gear





Unit:mm

Shanghai Huaming Power Equipment Co., Ltd.
Address: No 977 Tong Pu Road, Shanghai 200333, P.R.China
Tel: +86 21 5270 3965 (direct)
+86 21 5270 8966 Ext. 8688 / 8123 / 8698 / 8158 / 8110 / 8658
Fax: +86 21 5270 2715
Web: www.huaming.com E-mail: export@huaming.com

April 2017