



## **TECHNICAL DATA**

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### **TYPE CV & SV**

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### **OIL-IMMERSED ON-LOAD TAP CHANGER**

HM0.154.001



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

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## 1. General

CV & SV on-load tap changer (hereinafter referred to as CV or CV OLTC) is a selector switch type of OLTC, CV is applied for oil-immersed regulating transformer. The design of CV contact system is of rolling type dual resistor transition structure. CV is mounted on the top of the transformer tank via head flange, which is divided into two mounting models namely bell-type and standard tank.

CV OLTC is operated by motor drive unit through connection with head gear mechanism, driving shaft and bevel gear unit, it could be realized to operate OLTC locally or remotely.

Three-phase CV in Y-connection is only used at neutral point of star connection transformer, 3-phase D-connection CV is for any 3-phase transformer winding connections, and single-phase type CV can be applied for any selectable transformer winding connections. The basic connections of voltage regulating winding is shown as following Fig. 1.

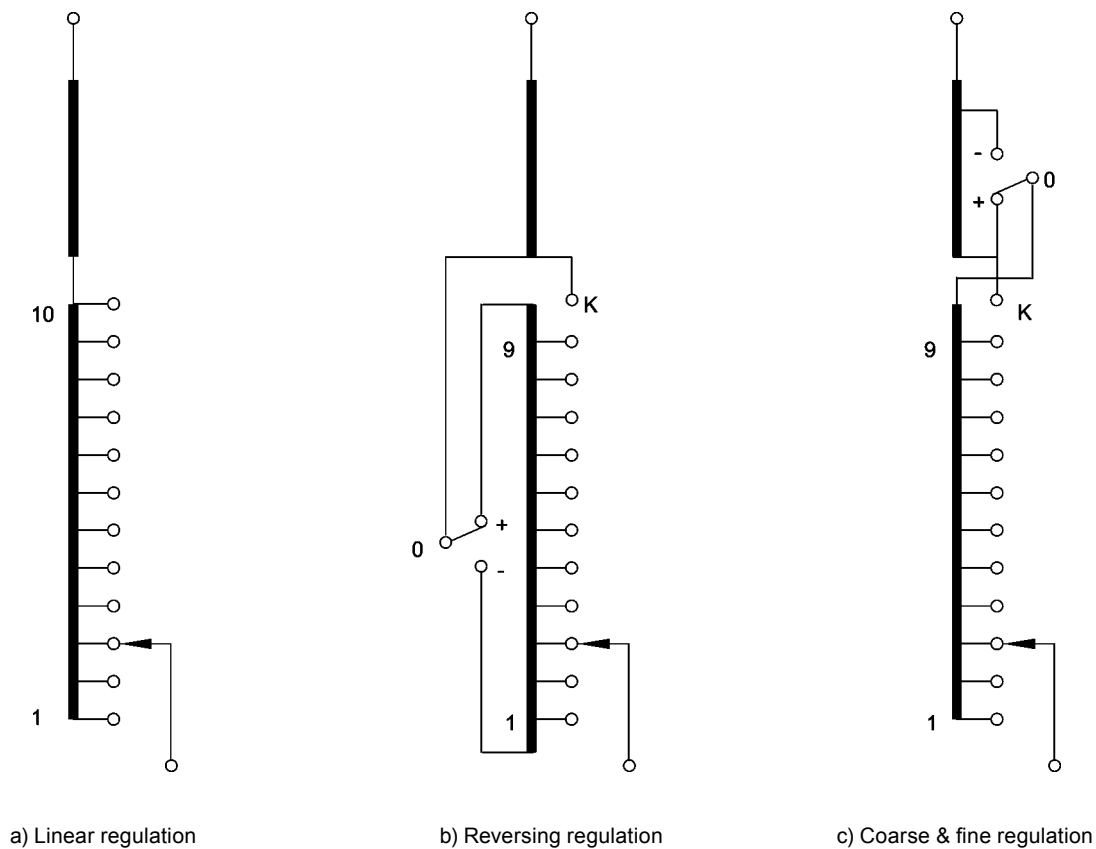


Fig.1 The Basic Connections of Voltage Regulating Winding

## 2. Technical specifications

CV OLTC is designed and produced according to IEC-60214-1(2003), the main specifications are shown by Table 1.

Table 1 CV &amp; SV Series OLTC Main Technical Specifications

Model	OLTC models		CVIII350Y		CVIII350D		CV I 350		SVIII500Y		SVIII500D		CV700	
1	Max.rated through-current (A)		350						500				700	
2	Rated frequency (Hz)		50 or 60											
3	Number of poles		3		3		1		3		3		1	
4	Connection application		Y-in the neutral, D and single pole- in any part of the winding											
5	Short-circuit current test (kA)	Thermic (3 secs.)	5						7				10	
		Dynamic (peak value)	12.5						17.5				25	
6	Max.Step voltage (V)	10 contacts	1500						1500				1500	
		12 contacts	1400						1400				1400	
		14 contacts	1000						-				1000	
7	Rated Step capacity (kVA)	10 contacts	525						400~525*				660	
		12 contacts	420						325~420*				520	
		14contacts	350						-				450	
8	Max.operating positions	Without change-over selector	14						12				14	
		With change-over selector	27						23				27	
9	Insulation to ground (kV)	Highest voltage for equipment Um	40.5						72.5					
		Rated separate source AC withstand voltage(kV/50Hz,1min	85						140					
		Rated lightning impulse withstand voltage (kV,1.2/50μs)	225						350					
10	Rated withstand voltages of the internal insulation		See section 4.6											
12	Mechancial life		not less than 800,000 operations											
13	Electrical life		not less than 200,000 operations											
14	Oil compartment	Operating pressure	0.03MPa											
		Test pressure	0.08MPa, without any leakage for 24 hours											
		Over pressue protection	bursting cap bursts at 300kPa±20% overpressure											
		Protection relay	Setting oil flow speed 1.0m/s±10%											
15	Equipped with motor drive unit model		SHM-III or CMA9, CMA7											
16	OLTC models		CVIII350Y		CVIII350D		CV I 350		SVIII500Y		SVIII500D		CV I 700	
17	Weight ( approx.kg )		140		150		120		190		200		130	
18	Oil displacement volume (approx. dm³)	Without change-over selector	135		185		85		205		240		120	
		With change-over selector	165		220		115		235		275		150	
19	Volume of oil filling Vs and oil conservator DV (approx.dm³)		Vs	DV	Vs	DV	Vs	DV	Vs	DV	Vs	DV	Vs	DV
		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

\* The max through current should be decreased to 350A and 300A, when the switching capacity are 525kVA and 420kVA

### 3. Model explanation

#### 3.1 Designation of the model

CV OLTC series specifications depend on number of phase, value of max. rated through current and highest voltage of equipment, as well as connection mode etc., the designation of CV OLTC shows above different parameters, please refer to below code example for details:

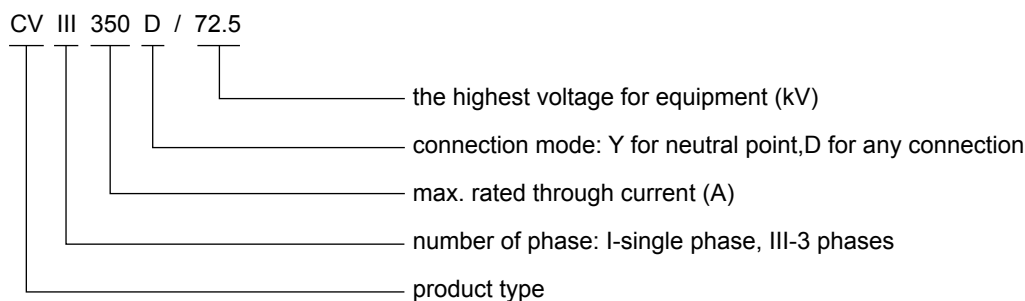


Fig.2 CV OLTC Type Explanation

#### 3.2 Basic connections of selector switch

According to transformer regulating range and winding connection modes, there are different selector switch, and its specification is relevant to number of contact pitch, operating positions, number of middle-position and mode of change-over selector. Please refer to following expression:

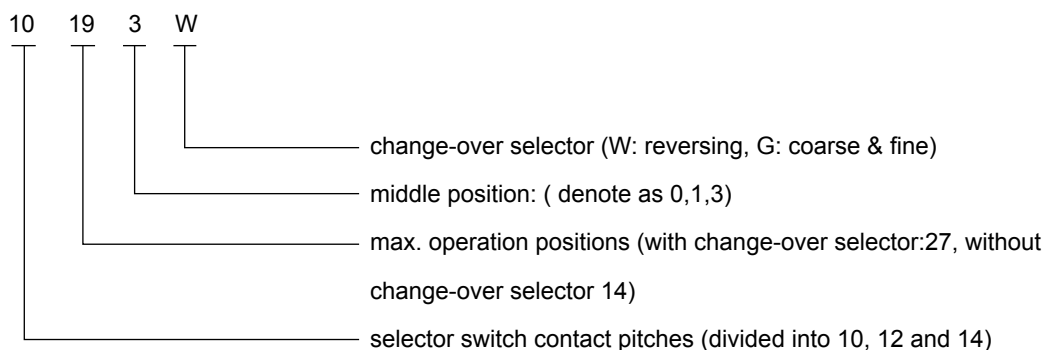


Fig.3 Explanation of Basic Connection of Selector Switch

#### 3.3 CV OLTC basic connection diagram

CV OLTC basic connection diagram is relevant to tap mode of transformer regulating winding, Fig. 4 shows basic connection diagram of CV, special design is possible according to the requirement.

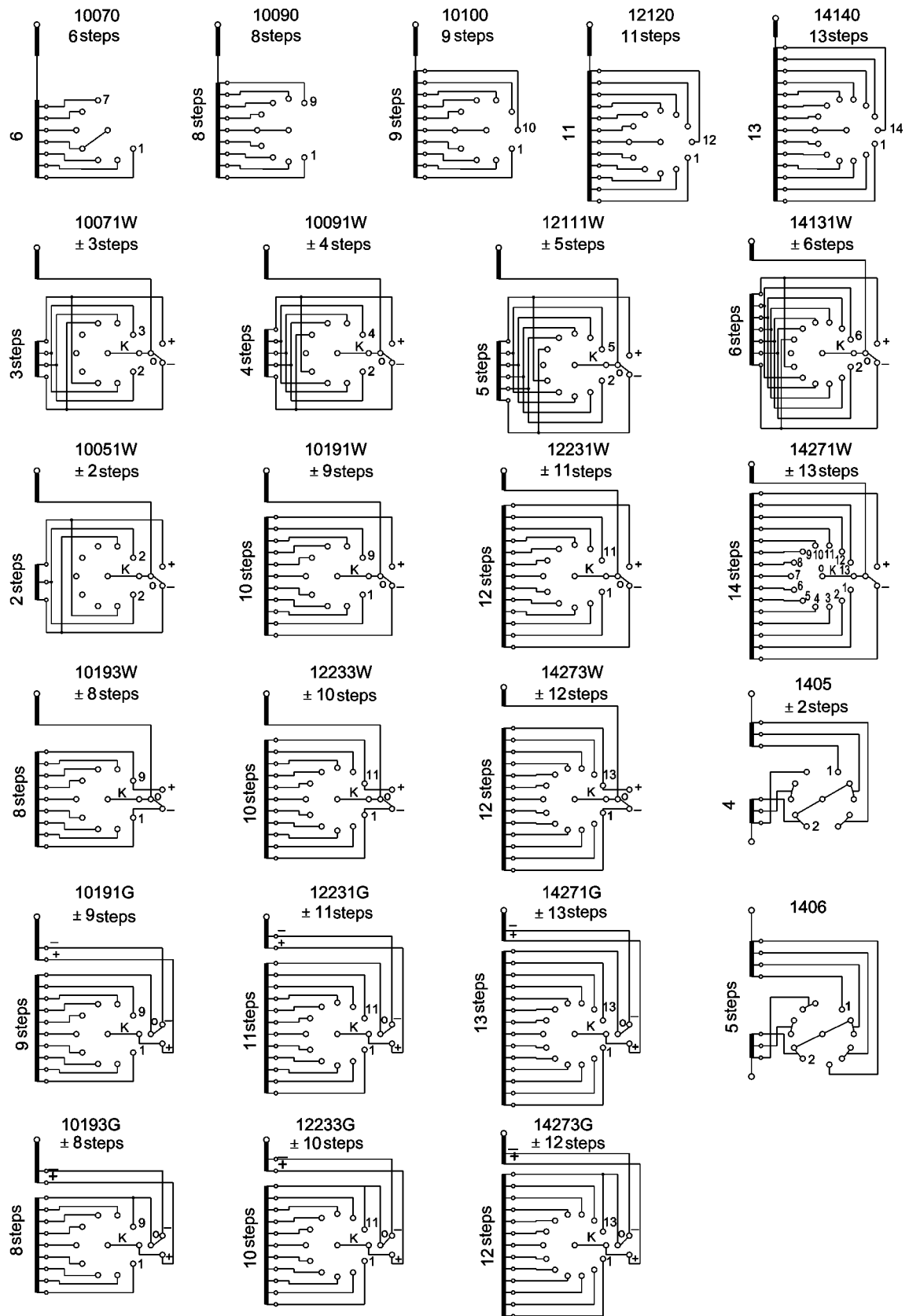


Fig.4 OLTC Basic Connection Diagram

## 4. Terms and definitions

### 4.1 Rated through current ( $I_u$ ), Rated step voltage ( $U_i$ ) and step capacity ( $P_{stN}$ )

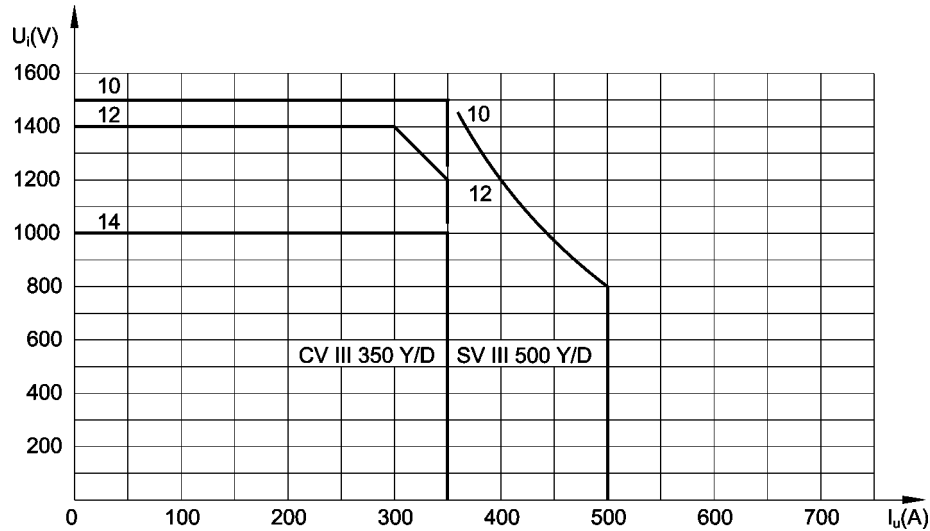


Fig.5 Curve of Rated Switching Capacity of 3-Phase OLTC

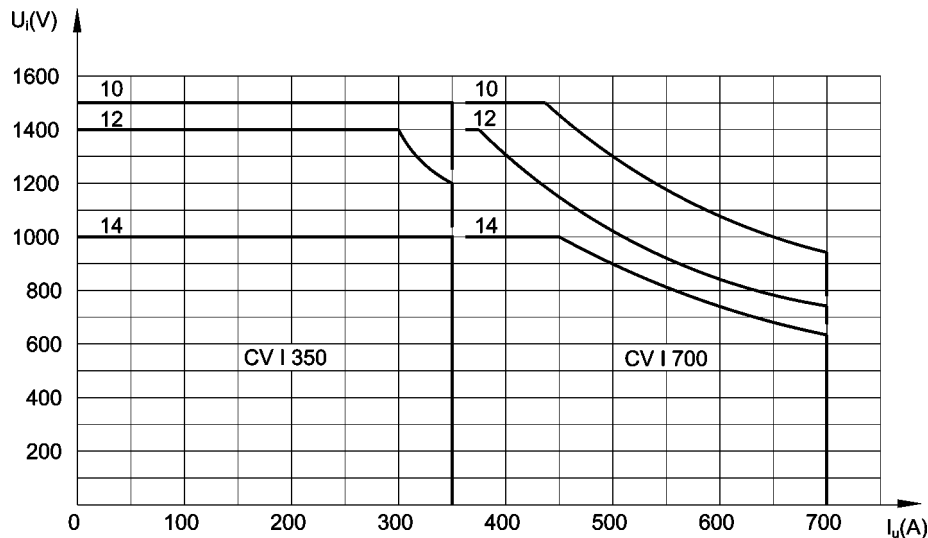


Fig.6 Curve of Rated Switching Capacity of Single -Phase OLTC

According to above curve, the Max. rated through current and relevant step voltage is determined, except limited by switching capacity, the step voltage is also effected by OLTC interior insulation level. Thus summation of OLTC step voltages ( $U_T$ ) has to meet below conditions:

10-contact pitch:  $U_T = \sum U_i \leq 13500V$     12-contact pitch:  $U_T = \sum U_i \leq 13200V$     14-contact pitch:  $U_T = \sum U_i \leq 13000V$

### 4.2. Breaking capacity

The breaking capacity  $P_{stmax}$  refers to the maximum switching capacity under the safe changeover load, according to IEC60214-1(2003) stipulation, breaking switches shall be performed at a current corresponding to twice the maximum rated through-current ( $I_{um}$ ) and at its relevant rated step voltage( $U_i$ ), that is breaking capacity  $P_{stmax}$  is twice of rated switching capacity  $P_{stN}$ .

### 4.3. Contact life

The main expected contact life of selector switch arcing contacts can be estimated based on the relevant load ( $I_u/I_{um}$ ) shown in below Fig. 7. The selector switch arcing contact life also depends on many influencing factors, particularly the condition of switching. Therefore, only average data are given in the figure(not applicable to constant current service condition).

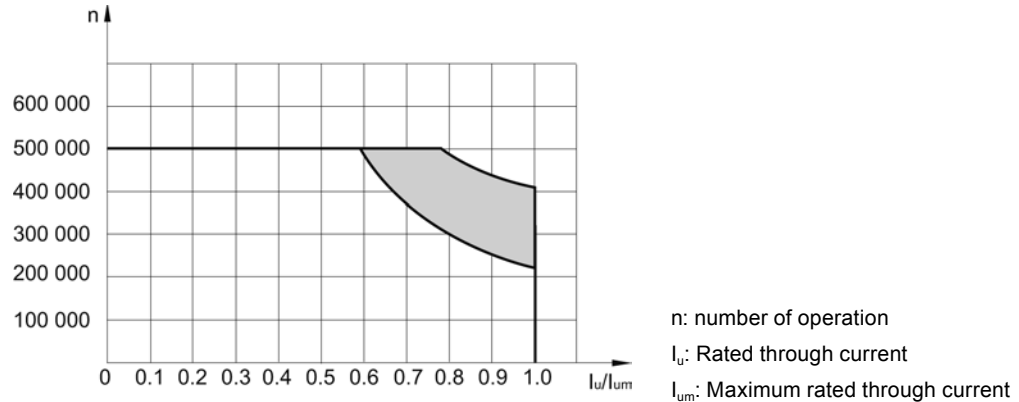


Fig.7 Estimated Mean Contact Life Under Average Load Conditions

### 4.4 Short-circuit current test

According to IEC 60214-1: 2003, all contacts continuously carrying the current shall be able to withstand 2s ( $\pm 10\%$ ) short circuit test current without melting, deformation or mechanical damage. Meanwhile the starting peak current value shall be  $2.5 (\pm 5\%)$  times of the root means square value of rated short circuit test current. Refer the short circuit test current values to Table 1. CV & SV Series OLTC Main Technical Specifications.

### 4.5 OLTC operation conditions

4.5.1 OLTC service temperature range in oil is from  $-25^{\circ}\text{C}$  to  $100^{\circ}\text{C}$ .

4.5.2 OLTC service ambient air temperature environment for OLTC is from  $-25^{\circ}\text{C}$  to  $40^{\circ}\text{C}$ .

4.5.3. Vertical inclination of OLTC should not be over 2% when it is mounted onto the transformer.

4.5.4. OLTC should be operated in the areas without heavy dust and any corrosive or explosive gas.

Caution: Please specify when ordering if OLTC will be operated in special environment not under the conditions above.

### 4.6 OLTC interior insulation level

OLTC interior insulation level is relevant to basic regulation mode (Fig.8), please check the OLTC interior insulation level value on table 2 when choosing of OLTC type, the OLTC interior insulation level should satisfy the requirement.

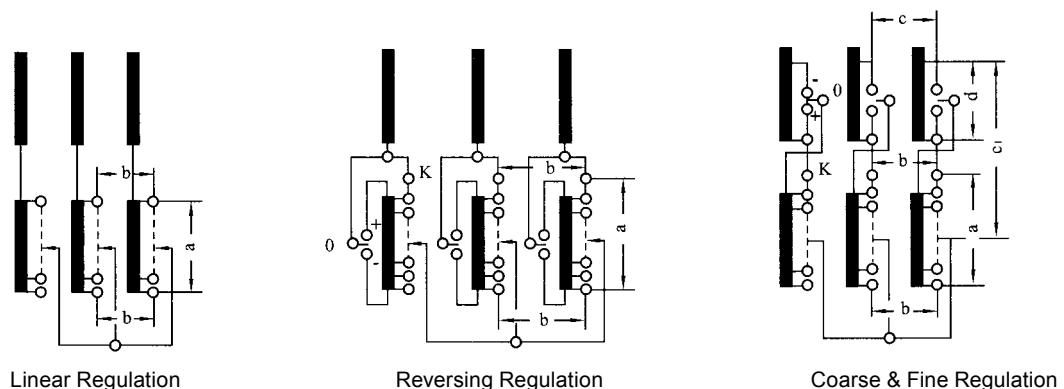


Fig.8 Basic Regulation Modes and Codes of Insulation Distance

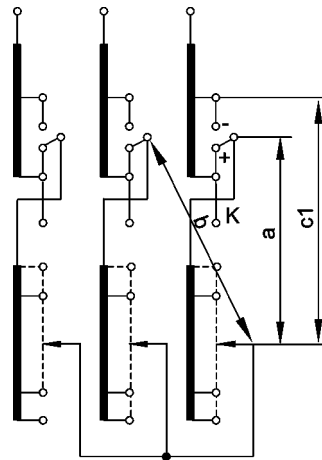


Table 2 OLTC Interior Insulation Level

Insulation distance		Withstand voltage	OLTC type		
			CVIII 350Y	CVIII 350D	CV I 350
			SVIII 500Y	SVIII 500D	CV I 700
a	10 contact pitches	kV, 1.2/50μs	200		
		kV, 50Hz 1min	50		
	12 contact pitches	kV, 1.2/50μs	180		
		kV, 50Hz 1min	50		
	14 contact pitches	kV, 1.2/50μs	170		
		kV, 50Hz 1min	50		
b	40.5kV	kV, 1.2/50μs	200	225	-
		kV, 50Hz 1min	70	85	-
	72.5kV	kV, 1.2/50μs	200	350	-
		kV, 50Hz 1min	70	140	-
c	40.5kV	kV, 1.2/50μs	350	350	-
		kV, 50Hz 1min	140	140	-
	72.5kV	kV, 1.2/50μs	350	350	-
		kV, 50Hz 1min	140	140	-
d		kV, 1.2/50μs	200		
		kV, 50Hz 1min	53		
f	40.5kV	kV, 1.2/50μs	225		
		kV, 50Hz 1min	85		
	72.5kV	kV, 1.2/50μs	350		
		kV, 50Hz 1min	140		

**Note:**
**a: between maximum tap and minimum tap of the same phase**
**b: between any two taps of the different phase**
**c: between the beginning of the coarse tap of different phase**
**d: between the beginning and the end of coarse tap of the same phase**
**f: to ground**

The voltage gradient between the terminals of change-over selector and the upper terminals of the selector for the coarse regulation. (refer to Fig.9)



**Fig.9 The Voltage Gradient For The Coarse Regulation**

**Note:** Because of the practical arrangement of the change-over selector, the voltage gradient between the terminal "0" of the change-over selector and the upper terminal of the selector corresponds to the insulation distance "a" (same phase) or the insulation distance "b" (phase to phase). The insulation distance between the fine regulation selector and the change-over selector is principally not to be considered.

#### 4.7 OLTC insulation to earth

OLTC insulation to earth, that is insulation between OLTC live parts and earth portion, its rated value determined by dielectric tests according to IEC-60214-1(2003), please refer to table 3 below.

The demand of insulation to earth for OLTC is relevant to OLTC connection location at transformer tap winding, regulation range and mode, tap winding connection model and structure disposal, as well as the rated voltage of transformer tap winding, anyhow, it is determined by insulation to ground of transformer voltage regulating winding.

**Table 3 OLTC Insulation Level To Earth**

(unit: kV)

The highest voltage for equipment (kV)	Rated separate source AC withstand voltage (kV/50Hz, 1min)	Rated lightning impulse withstand voltage (kV, 1.2/50μs)
40.5	85	225
72.5	140	350

#### 4.8 OLTC installation method

CV & SV OLTC is mounted onto transformer tank cover via head flange, thus, there is connection flange which should be prepared by transformer producer, please refer to 9.11 "Schematic diagram of transformer connection flange" for dimensions. OLTC is suitable for standard tank type or bell-type transformer, for bell-type mounting, the OLTC supporting flange is used as temporary support when connection the tap changer to transformer winding, after transformer bell-cover mounted well, the OLTC should be fixed onto transformer connection flange.

## 5. Special design

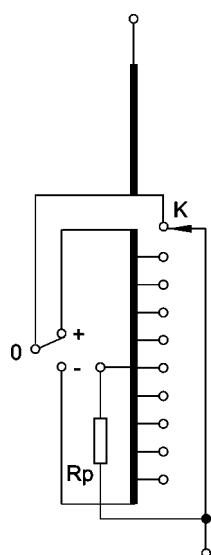
### Potential connection of the tap winding

For high voltage or wide regulation range on-load regulating transformer, during the operation of the change-over selector the tap winding is disconnected momentarily from the main winding, the regulating section will be broken away from the main coil and at status of "suspend", thus voltage regulating winding will gain the new potential that depends upon coupling capacities  $C_e$  (to ground) and  $C_w$  (between adjacent tap winding), refer to Fig.11. Generally this potential is different from the one of voltage regulating winding before change-over selector acting, the difference of them is designated as bias voltage. This bias voltage is produced at the breaking point of the separated contacts during the operation of change-over selector. If these differential voltages exceed a certain limit value, it may cause spark on change-over selector and bring a number of gas, it will be the serious problem. Therefore measures regarding potential connection of the winding must be taken.

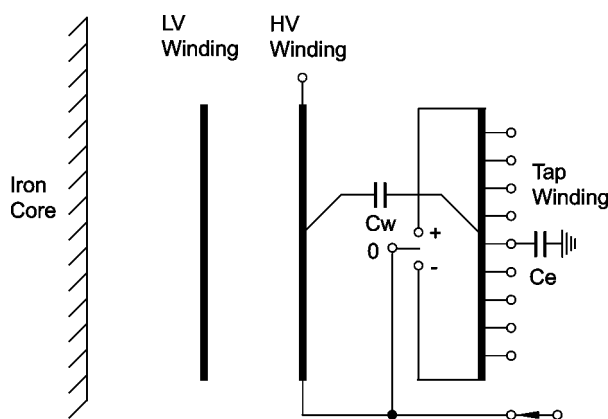
The limiting value of the bias voltage for type CV & SV is 15kV. If it is expected that the bias voltage will be higher than this value, the regulation section should be permanently connected to a fixed potential through tie-in resistors. Please refer to attachment 9.12-1 & 9.12-2.

For calculating the change-over selector stress and dimensioning the tie-in resistors, the following details of the transformer specifications required when ordering:

- Complete transformer parameter: rated capacity, rated voltage, voltage regulating range, winding connection model, insulation level and so on
- Arrangement of the windings, i.e. the relative position of the tap winding to the adjacent coil or winding parts
- Operating a.c.voltage across windings or layers of windings adjacent to the tap windings
- Capacitance of the tap winding to adjacent windings( $C_w$ )
- Capacitance of the tap winding to ground or grounded adjacent windings (if exist) ( $C_e$ )
- Voltage stress across half the tap winding at lightning impulse voltage test
- A.C.voltage across half the tap winding under operation and test conditions. ( is normally derived from order specification sheet for tap changer)



**Fig.10 Potential Connection With Permanently Connected Tie-In Resistor  $R_p$**



**Fig.11 The Reversing Regulation Winding Arrangement Of Two Windings Transformer**

## 6. Motor drive unit

CV & SV OLTC may operated by SHM-III or CMA9 motor drive unit, it could be also driven by CMA7 motor drive unit according to the requirement.

SHM-III motor drive unit is developed by Huaming with many advantages, the mechanism transmission system is installed into SHM-III cabinet, and control system is integrated inside HMK8 which is mounted in control room, thus to ensure the operation reliability. Please refer to table 4 for motor drive unit technical data.

**Table 4 Motor Drive Unit Technical Data**

Motor drive unit		SHM-III		CMA7		CMA9
Motor	Rated power (W)	750	1100	750	1100	370
	Rated voltage (V)	380,3AC/N		380/3AC		380/3AC
	Rated current (A)	2.1	2.8	2.0	2.8	1.1
	Rate frequency(Hz)	50 or 60		50 or 60		50 or 60
	Rotate speed (r.p.m.)	1400		1400		1400
Rated torque on drive shaft (Nm)		45	66	18	26	40
Revolution of the drive shaft per switching operation		33		33		2
Revolution of the hand crank per switching operation		33		33		30
Running time per switching operation (S)		5.6		About 5		About 4
Max. operation positions		35		107		27
Voltage for control circuit and heater circuit (V)		220/AC		220/AC		220/AC
Heater power (W)		50		50		30
A.C. voltage test to ground (kV/50Hz, 1min)		2		2		2
Approx. weight (kg)		73		90		70
Protective degree		IP66		IP56		IP56
Mechanical endurance (operations)		Not less than 2,000,000		Not less than 800,000		

**Note:** Please specify if special voltage required for motor, and control & heater circuit.

## 7. OLTC operation controllers

### 7.1 HMK8 controller

HMK8 controller is the device for remote control of SHM-III motor drive unit; it realizes OLTC switching operation through SHM-III. HMK8 can display the OLTC switching operation status and tap positions.

HMK8 has BCD code position signal output (contact capacity:AC250V/5A or DC30V/5A) and remote control signal input (non potential contact), it can also communicate with host computer via RS485 interface to realize remote supervising of OLTC position.

HMK8 main technical data is as below, refer to HMK8 manual for more details.

Working voltage: 380V, 3AC/N

Power frequency: 50Hz/60Hz

Maximum operation positions: 35

Environment temperature: -10°C to 40°C Indoor

## 7.2 HMC-3C position indicator

HMC-3C OLTC position indicator is a support fitting for CMA7 and CMA9 motor drive unit, it can be used to indicate the OLTC position, and has the function of "1→ N", "STOP", "N→ 1" control as well as remote control indicator lamp, its input is decimal code and output is BCD code. Please refer to HMC-3C manual for details.

## 7.3 Automatic voltage regulator ET-SZ6 and HMK-2A

Automatic voltage regulator ET-SZ6 and HMK-2A is adopted for OLTC automatic voltage regulation, ET-SZ6 can be used for parallel operation in model of master and slave, please refer to relevant manual for details.

# 8 OLTC accessories

## 8.1 Bevel gear unit

Bevel gear unit is used for connecting horizontal shaft and vertical shaft between OLTC body and motor drive unit, thus driving torque of motor drive unit can be transmitted to on-load tap changer, the overall dimensions of bevel gear unit is shown on attachment 9.13.

## 8.2 Protective relay

Protective relay is the one of protective devices for oil-immersed on-load tap changer, when OLTC interior failure produces gas and oil surge, the protective relay contact acts, and switches on to the tripping circuit of the transformer circuit breaker, the transformer will trip at once.

Protective relay is mounted onto the connection pipe between OLTC head and conservator, make sure that protective relay marked with arrowhead side shall be connected to conservator. Huaming provides two types of protective relay which are QJ4G-25 (with 1 pair of trip contact) and QJ6-25 (with 2 pairs of trip contact), please refer to attachment 9.14 for dimensions.

## 8.3 Pressure relief device

Pressure relief valve and pressure release cover is the security protective device for oil-immersed OLTC, when OLTC interior fails, oil in oil chamber is gasified and a number of gases produced, thus oil pressure of oil chamber is increased rapidly, OLTC oil compartment will be deformed even exploded if the pressure inside is not released in time, therefore, pressure relief device is necessary to install to avoid failures exaggeration.

Pressure relief valve is a auto-sealed valve, when over pressure, the cover is open and pressure will be released, and then it will close again. It can be reused, and the liquid loss could be controlled to minimum volume when it is acting.

Pressure release cover is the weak point on the OLTC head cover, once oil chamber pressure exceeds adjusted value, the pressure release cover will be broken, thus over-pressure is released, and OLTC oil compartment is protected.

Pressure relief valve is a device for low energy failure, and pressure release cover is the device for high energy failure, whereas most of failure of OLTC body is of high energy failure, so our standard offer is OLTC equipped with pressure release cover, and pressure relief valve is only provided when customer specifies. For type CV OLTC only one of them is available for selection since the space on the CV OLTC top is limited.

## 8.4 Online oil filter plant

Online oil filter plant is application for oil circulating filtering for on-load tap changer, this device can effectively purify dissociated carbon or metal particles, and reduce the water content of transformer oil inside OLTC chamber, when OLTC is on normal operation status. With online oil filtering, OLTC will have reliable operation, less maintenance, we recommend that OLTC should be equipped with online filter when it operates frequently especially when OLTC is applied for furnace transformer and rectification transformer, also for ultra high-voltage transformer, online oil filter is necessary.

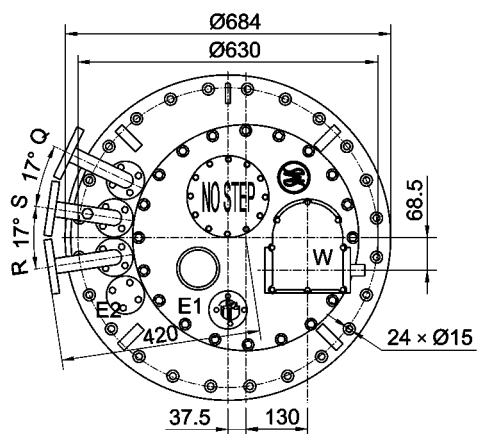
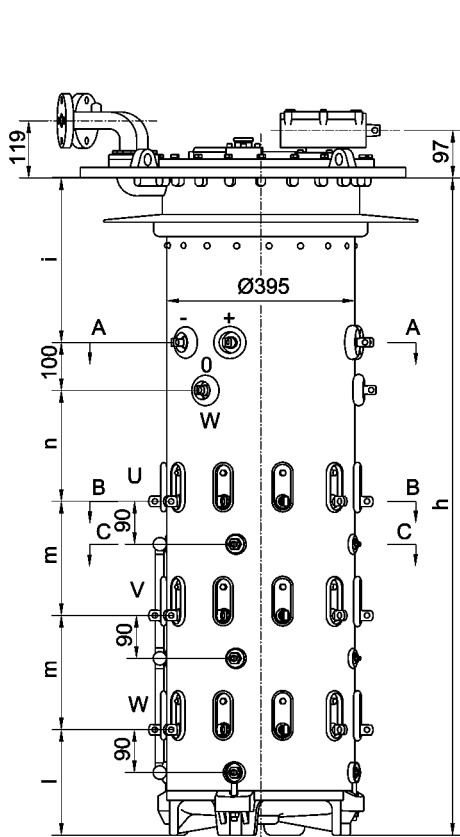
OLTC type	Operation condition	Filter application
Type CV & SV, universal	Annual tap changing operations >15,000	Recommend
CVIII-350D SVIII-500D	Operation in tropical and subtropical districts with variation of temperature	Recommend
CVIII-350D/72.5 SVIII-500D/72.5	The voltage regulating section is arranged at the starting end of the winding	Compulsory

**Table 6 Insulation And Water Content Request Of OLTC Oil**

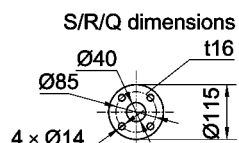
OLTC type	Water content	Insulation
CVIII 350Y SVIII 500Y	< 40PPm	> 30kV/2.5mm
CVIII 350D SVIII 500D	< 30PPm	> 40kV/2.5mm
CVI 350 CVI 700	< 30PPm	> 40kV/2.5mm

## 9. Appendix

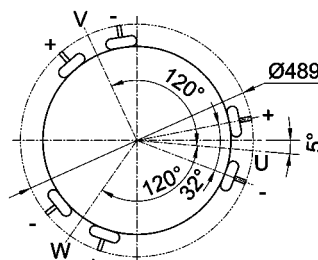
## 9.1. Overall dimensions of CV 350 OLTC with change-over selector



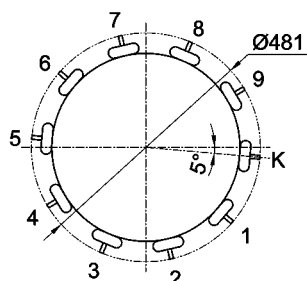
E1: bleeding of tap changer head  
E2: bleeding of transformer tank  
R: connecting flange for protective relay  
S: connecting flange for suction pipe  
Q: connecting flange for oil return  
W: head gear unit



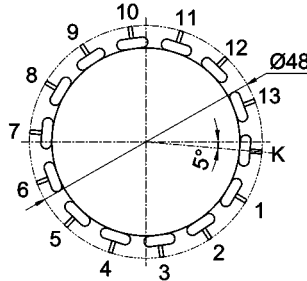
A-A  
Change-over selector terminals



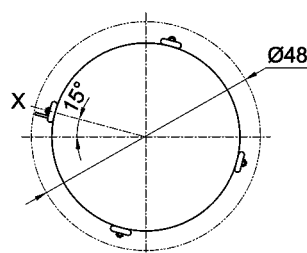
B-B  
Selector switch terminals (10XXX)



B-B  
Selector switch terminals (14XXX)

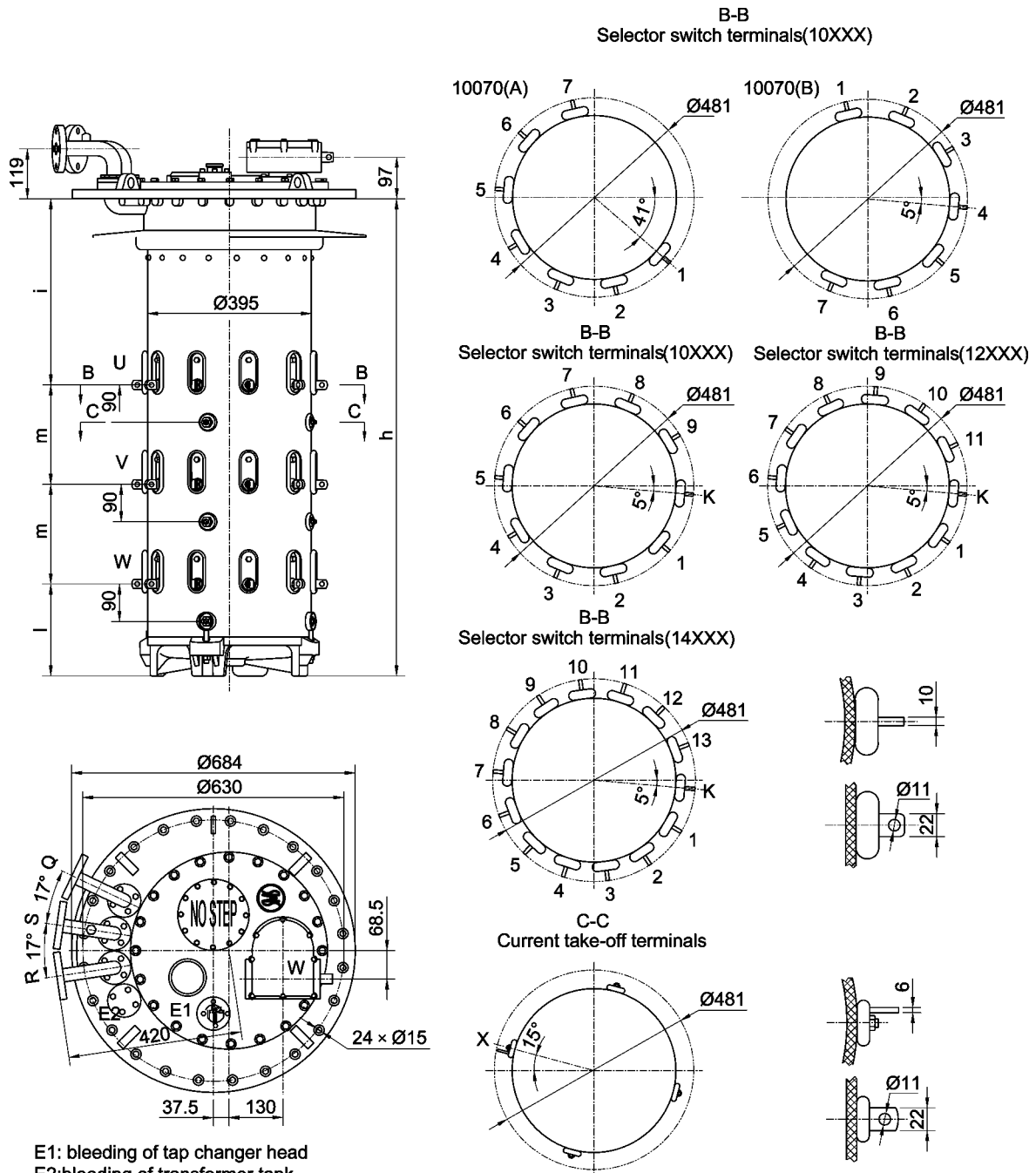


C-C  
Current take-off terminals

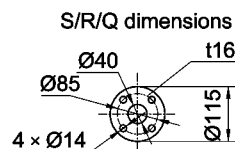


Type and voltage class	CV III 350Y		CV III 350D		CV I 350	
	40.5kV	72.5kV	40.5kV	72.5kV	40.5kV	72.5kV
Dimensions (mm)	h	1381	1381	1621	1735	865
	i	346	346	346	346	346
	m	240	240	360	400	
	l	221	221	221	221	221
	n	234	234	234	268	198

## 9.2. Overall dimensions of CV 350 OLTC without change-over selector



E1: bleeding of tap changer head  
E2:bleeding of transformer tank  
R: connecting flange for protective relay  
S: connecting flange for suction pipe  
Q: connecting flange for oil return  
W: head gear unit

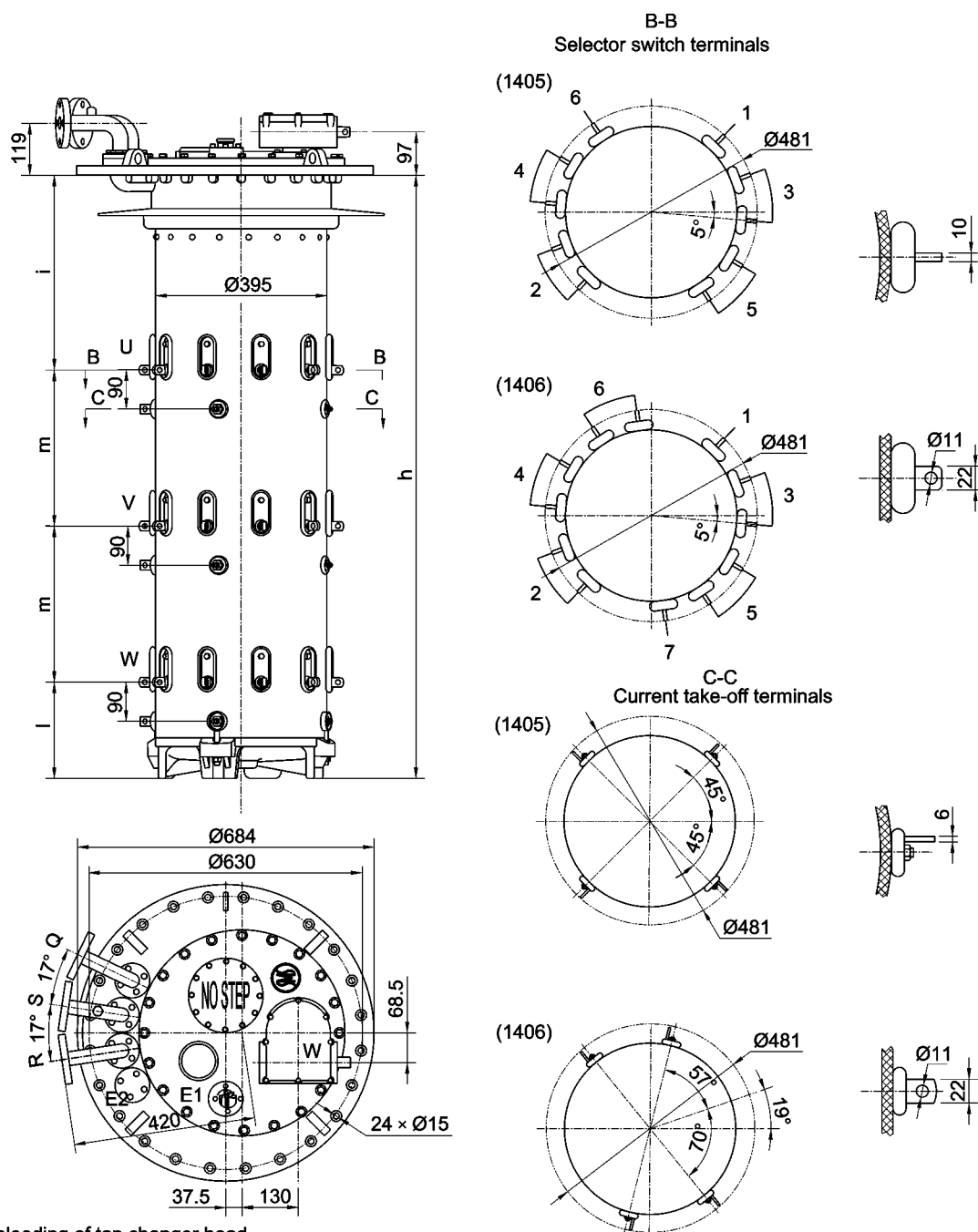


Type and voltage class		CVIII350Y		CVIII350D		CV I 350	
		40.5kV	72.5kV	40.5kV	72.5kV	40.5kV	72.5kV
Dimensions (mm)	h	1150	1190	1390	1510	670	710
	i	449	489	449	489	449	489
	m	240	240	360	400		
	l	221	221	221	221	221	221

Unit: mm



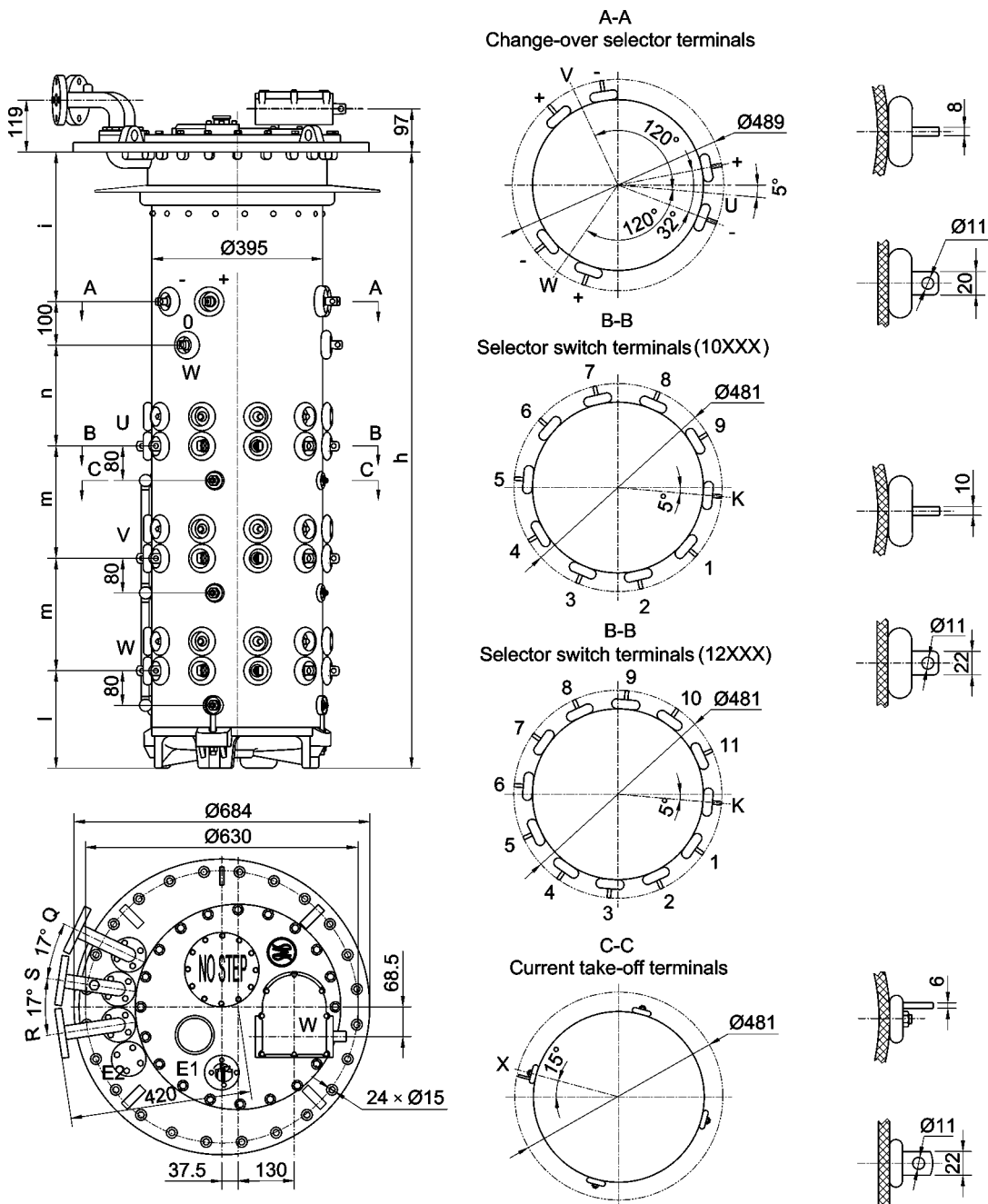
### 9.3. Overall dimensions of CVIII 350 OLTC bridging connection



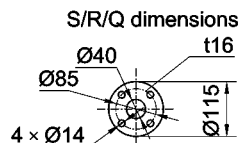
E1: bleeding of tap changer head  
 E2: bleeding of transformer tank  
 R: connecting flange for protective relay  
 S: connecting flange for suction pipe  
 Q: connecting flange for oil return  
 W: head gear unit

Type and voltage class		CVIII 350		
		40.5kV	72.5kV	126kV
Dimensions (mm)	h	1390	1510	1750
	i	449	489	589
	m	360	400	470
	l	221	221	221

#### 9.4. Overall dimensions of SVIII 500 OLTC with change-over selector

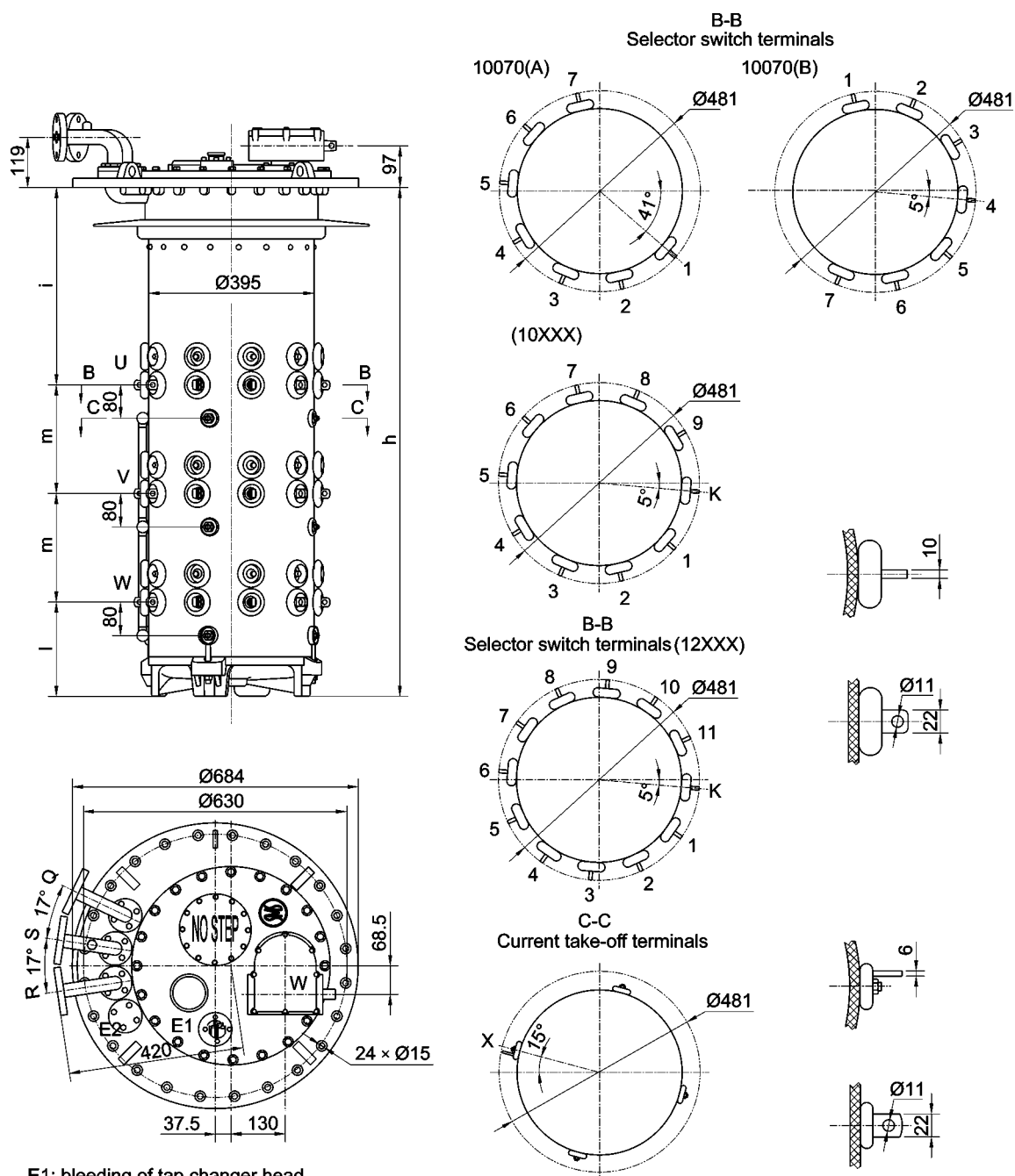


E1: bleeding of tap changer head  
E2:bleeding of transformer tank  
R: connecting flange for protective relay  
S: connecting flange for suction pipe  
Q: connecting flange for oil return  
W: head gear unit

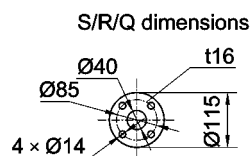


Type and voltage class		SVⅢ500Y		SVⅢ500D	
		40.5kV	72.5kV	40.5kV	72.5kV
Dimensions (mm)	h	1430	1430	1670	1784
	i	346	346	346	346
	m	262	262	382	422
	l	225.5	225.5	225.5	225.5
	n	234.5	234.5	234.5	268.5

## 9.5. Overall dimensions of SVIII 500 OLTC without change-over selector



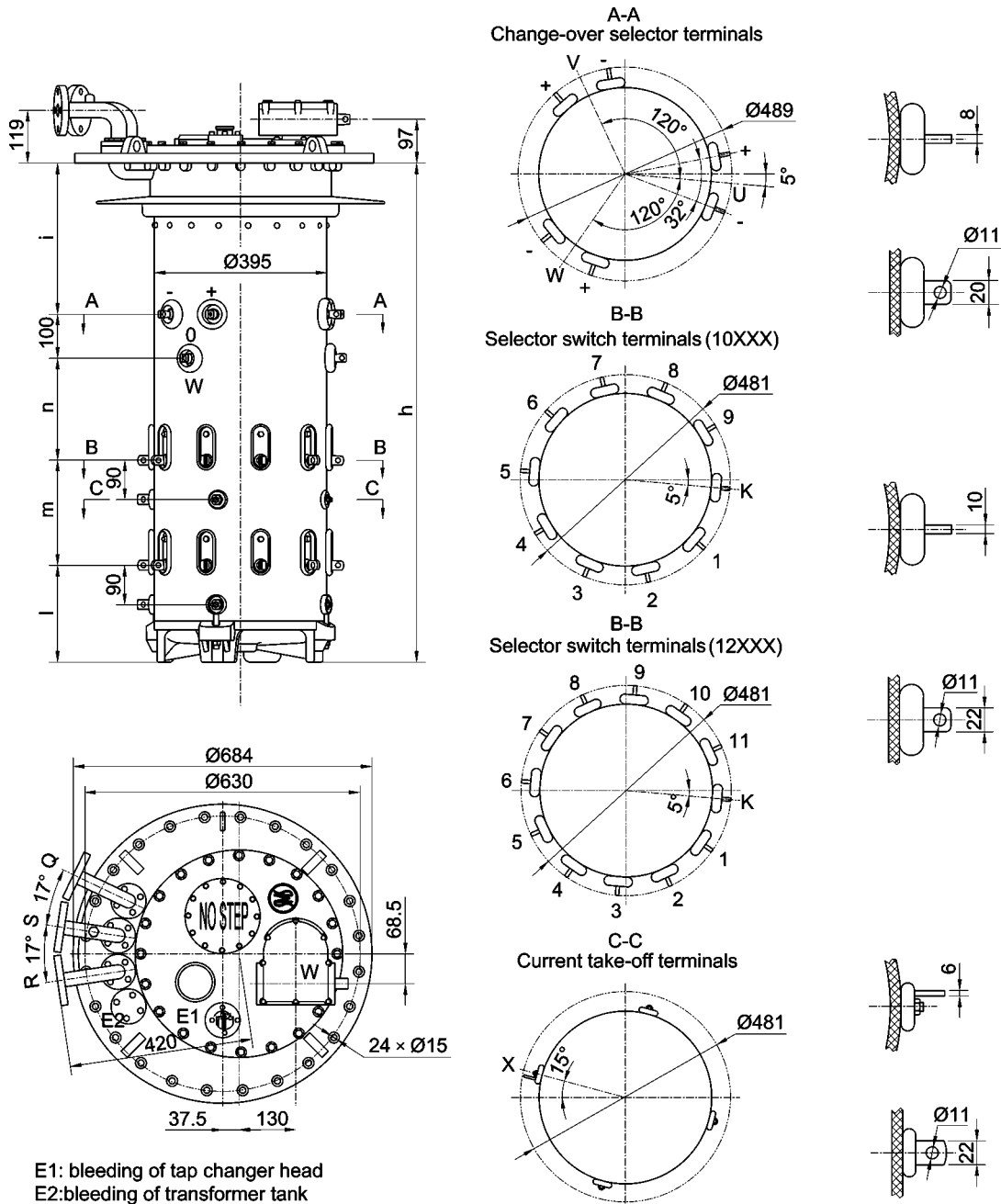
E1: bleeding of tap changer head  
 E2: bleeding of transformer tank  
 R: connecting flange for protective relay  
 S: connecting flange for suction pipe  
 Q: connecting flange for oil return  
 W: head gear unit



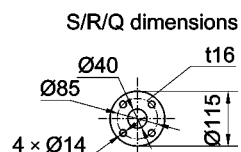
Type and voltage class		SVIII500Y		SVIII500D	
		40.5kV	72.5kV	40.5kV	72.5kV
Dimensions (mm)	h	1222	1262	1462	1582
	i	472.5	512.5	472.5	512.5
	m	262	262	382	422
	l	225.5	225.5	225.5	225.5

Unit: mm

## 9.6. Overall dimensions of CVI 700 OLTC with change-over selector



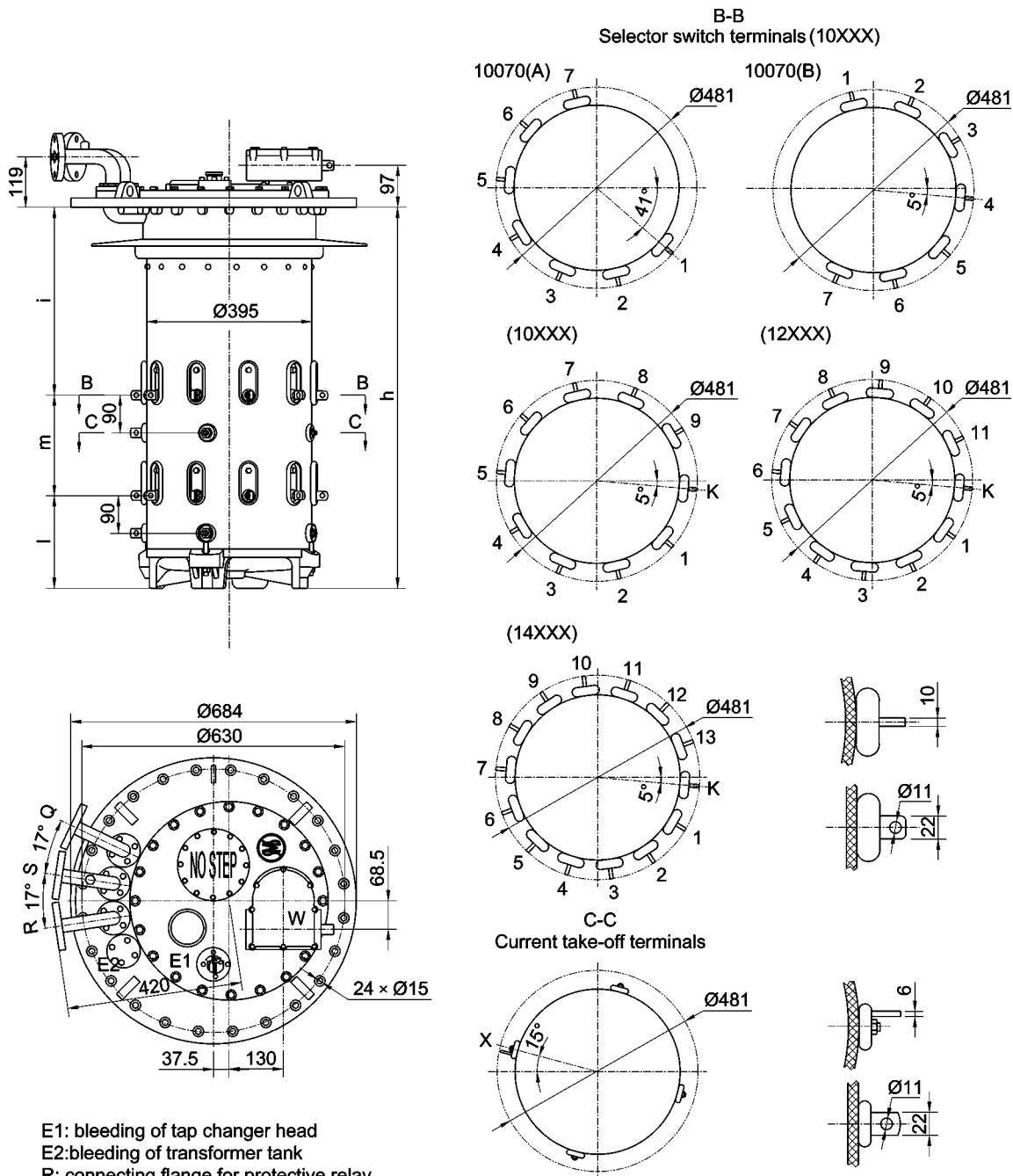
E1: bleeding of tap changer head  
 E2: bleeding of transformer tank  
 R: connecting flange for protective relay  
 S: connecting flange for suction pipe  
 Q: connecting flange for oil return  
 W: head gear unit



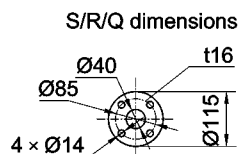
Type and voltage class		CV I 700	
		40.5kV	72.5kV
Dimensions (mm)	h	1141	
	i	346	
	m	240	
	l	221	
	n	234	

Unit: mm

## 9.7. Overall dimensions of CVI 700 OLTC without change-over selector



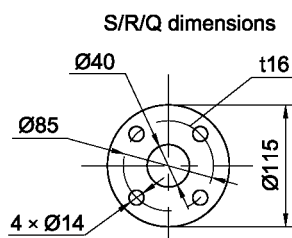
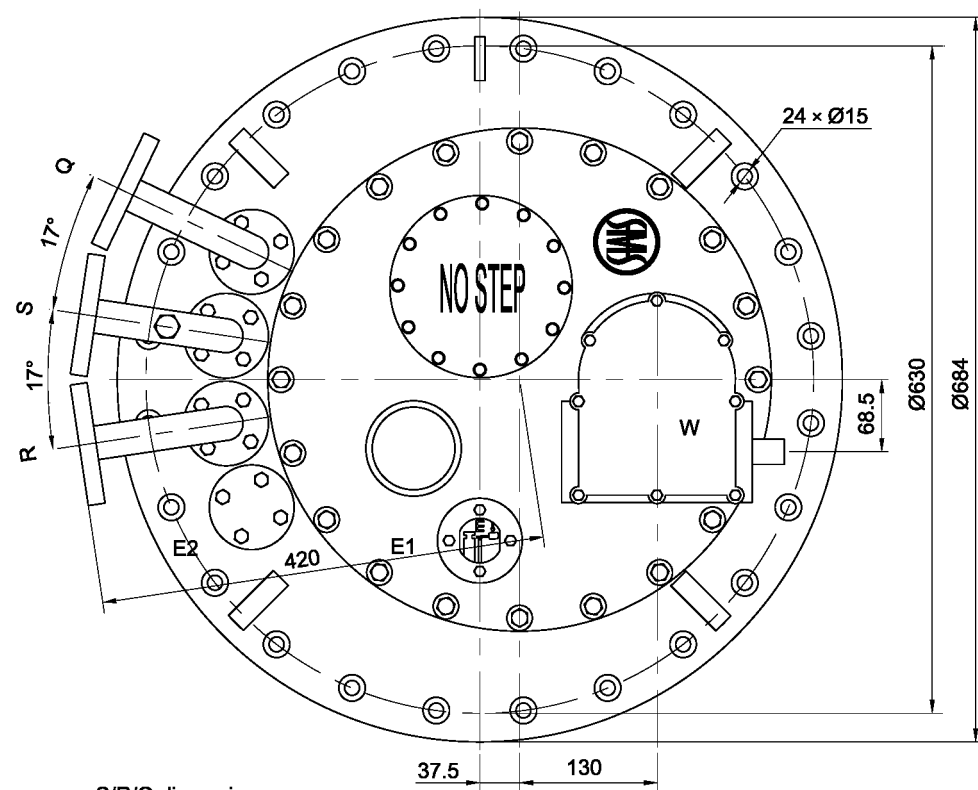
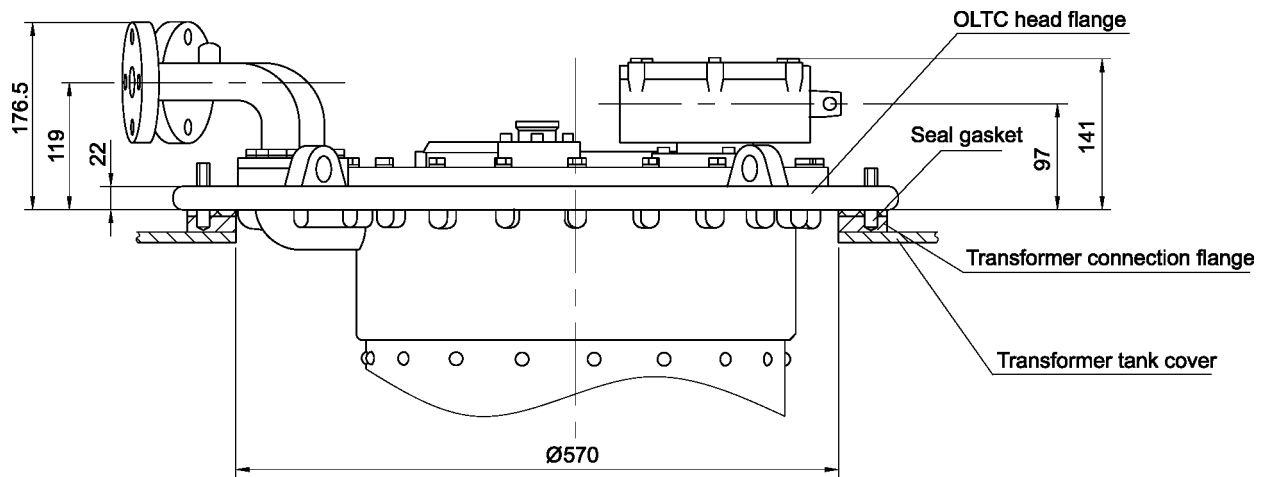
E1: bleeding of tap changer head  
E2: bleeding of transformer tank  
R: connecting flange for protective relay  
S: connecting flange for suction pipe  
Q: connecting flange for oil return  
W: head gear unit



Type and voltage class		CV I 700	
		40.5kV	72.5kV
Dimensions (mm)	h	910	950
	i	449	489
	m	240	240
	l	221	221

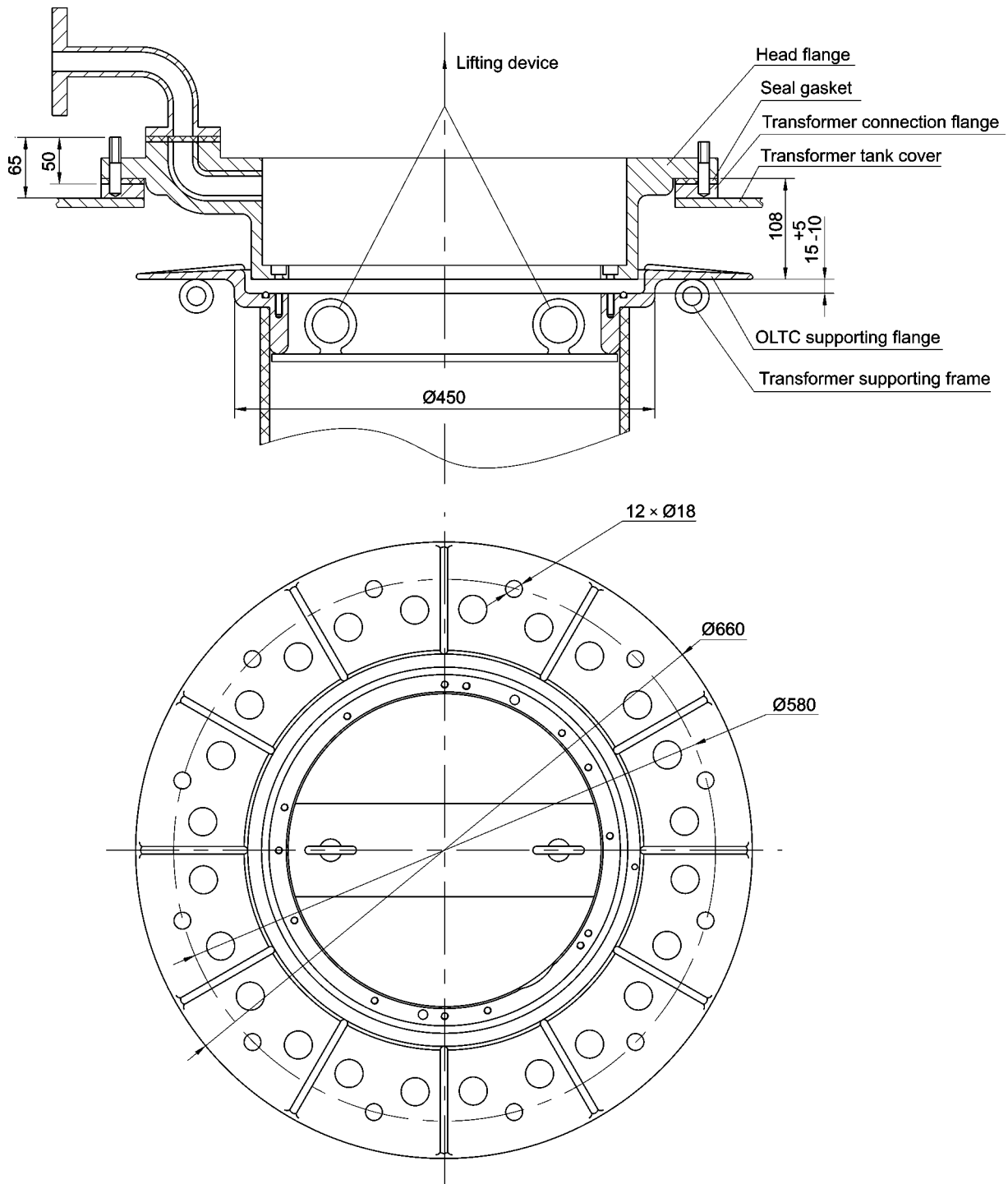
Unit: mm

### 9.8. Overall dimensions of OLTC head flange installation for standard tank

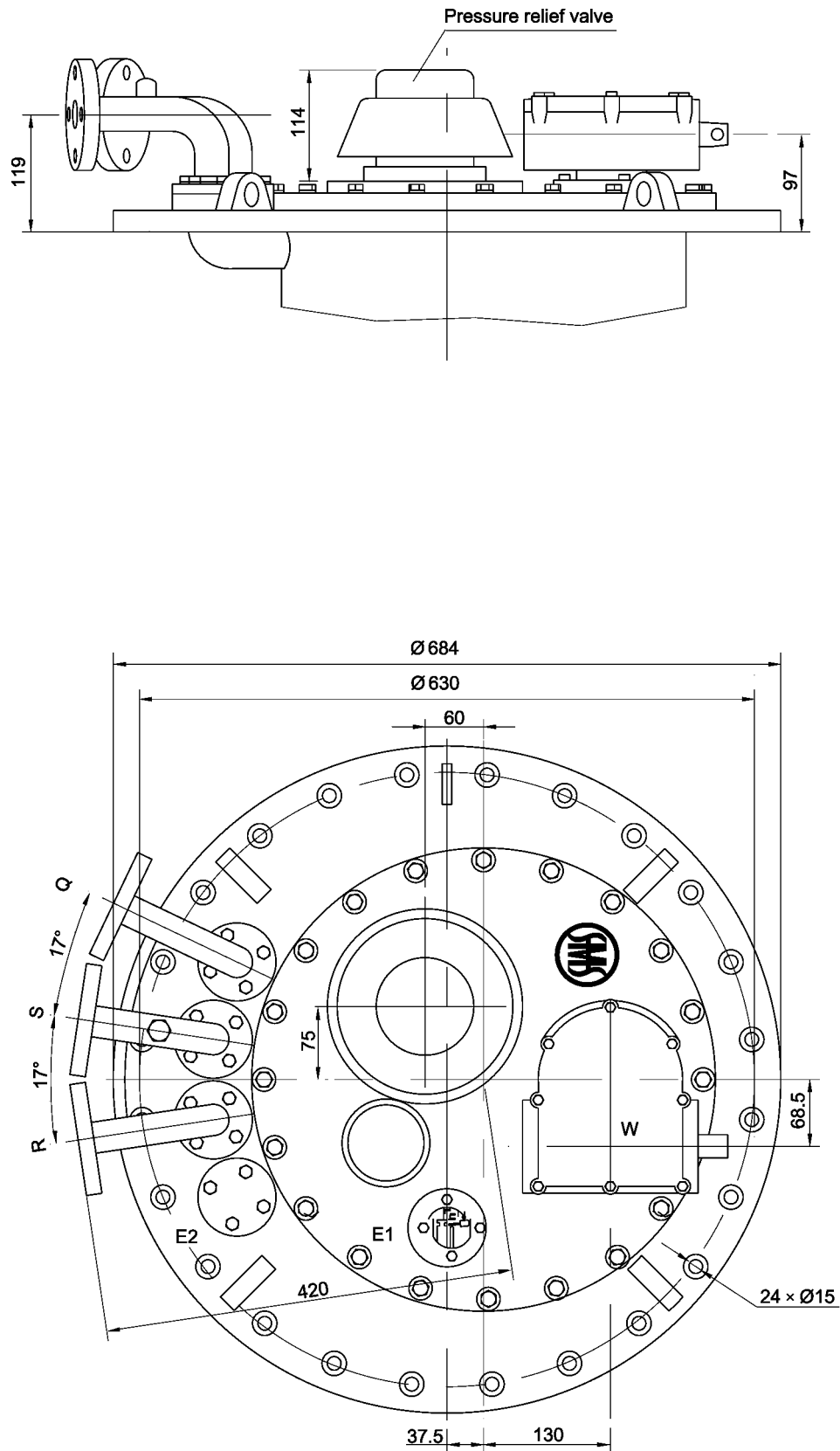


- E1: bleeding of tap changer head  
E2:bleeding of transformer tank  
R: connecting flange for protective relay  
S: connecting flange for suction pipe  
Q: connecting flange for oil return  
W: head gear unit

### 9.9. Overall dimensions of OLTC head flange installation for bell-type

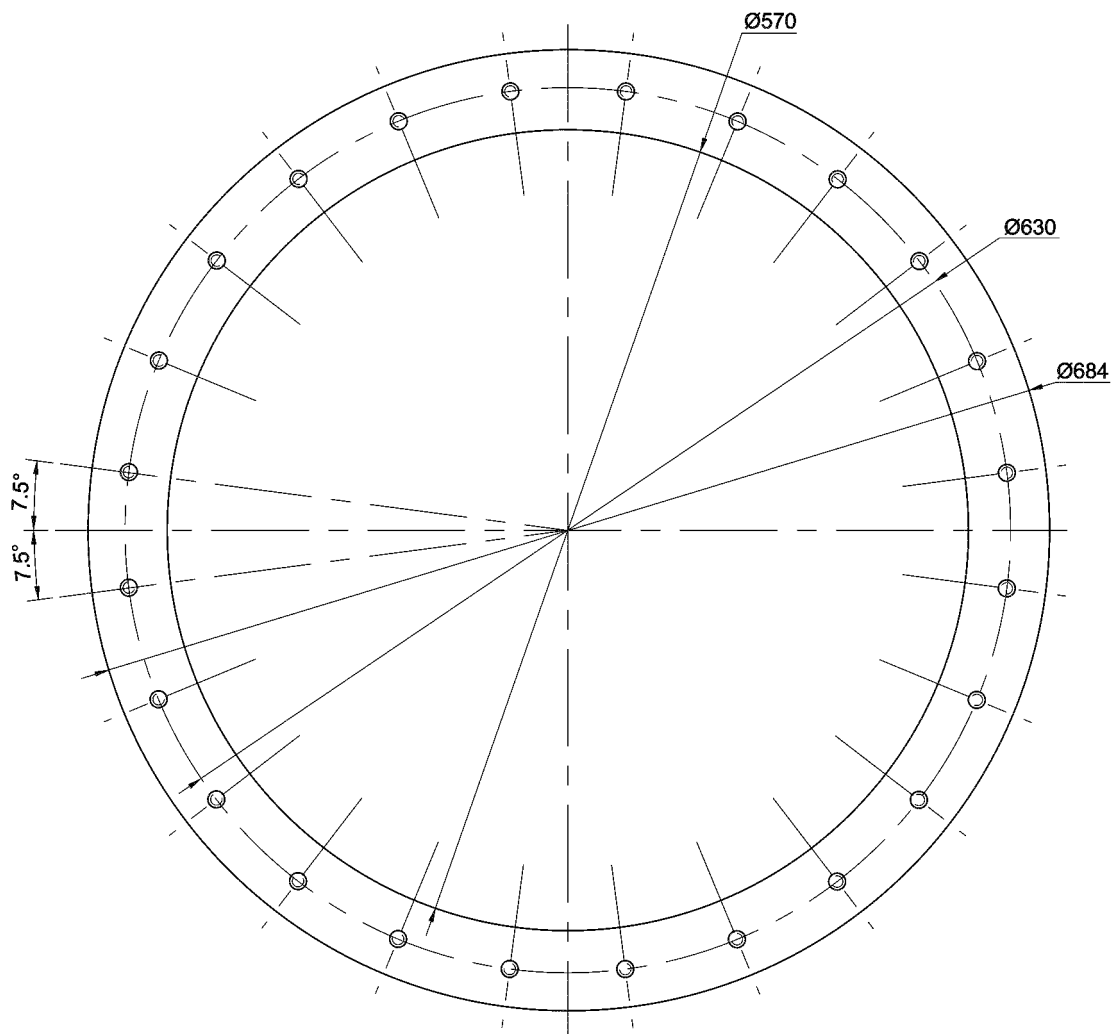
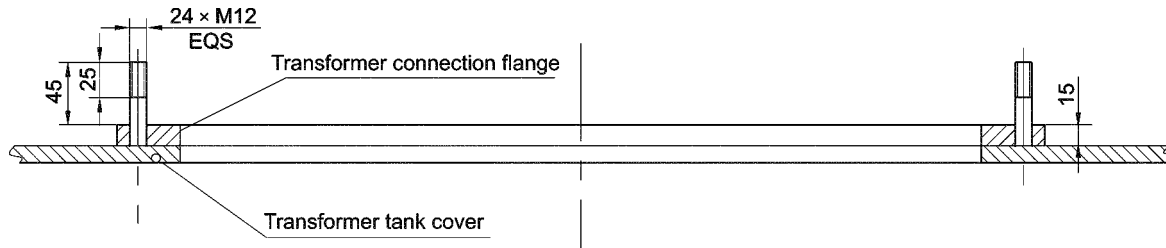


# 9.10. Schematic diagram of OLTC head installed with pressure relief valve

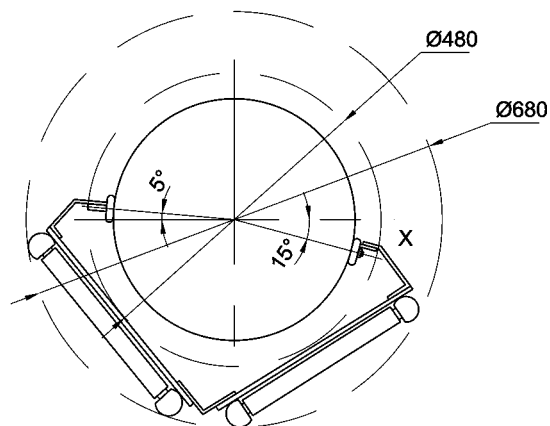
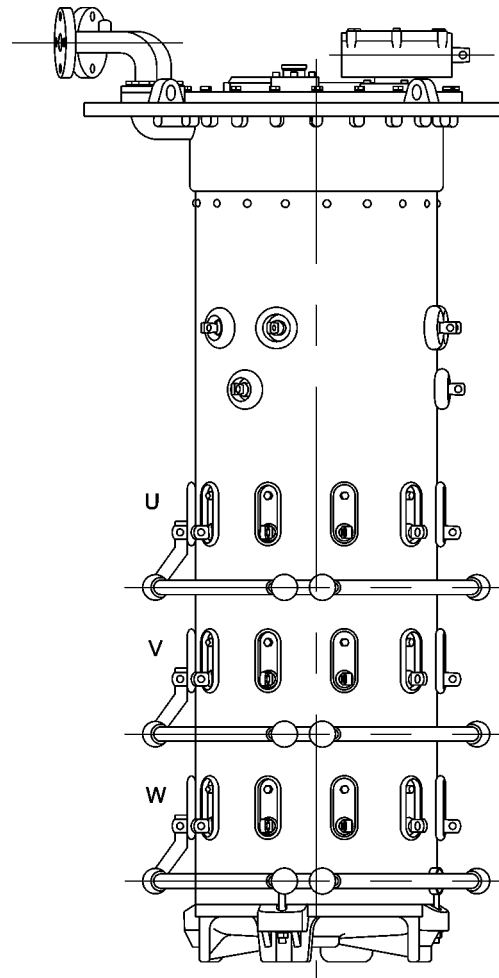


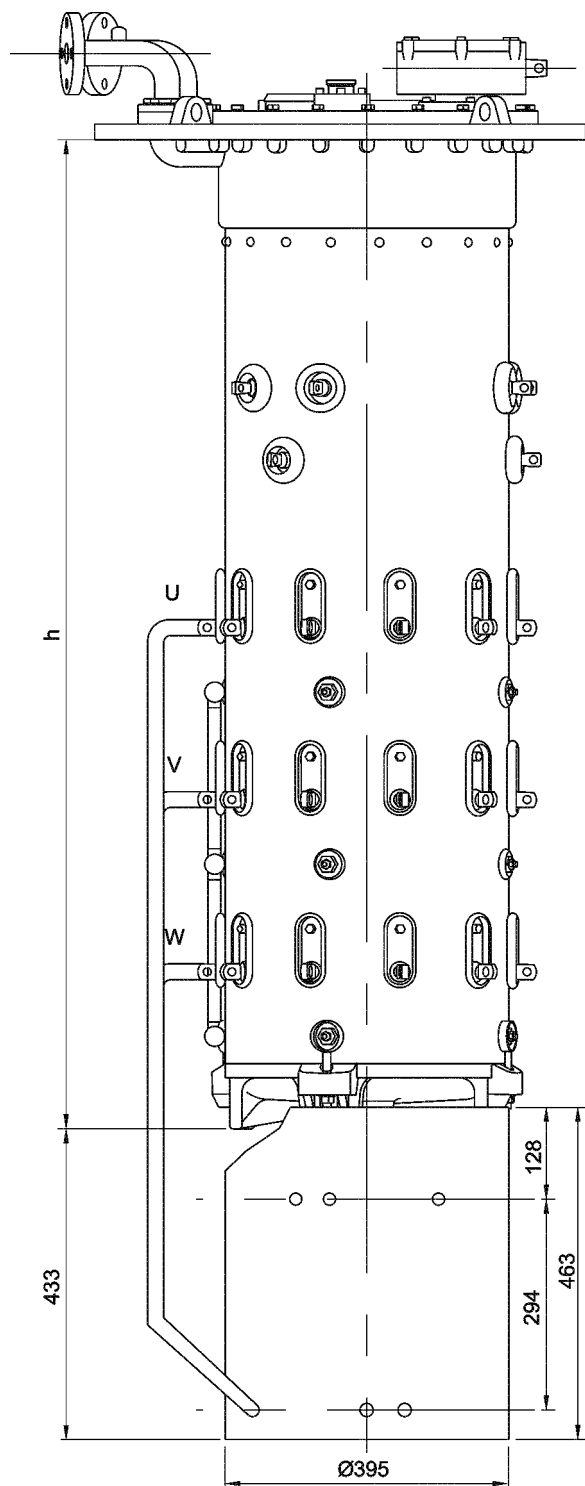


### 9.11. Schematic diagram of transformer connection flange

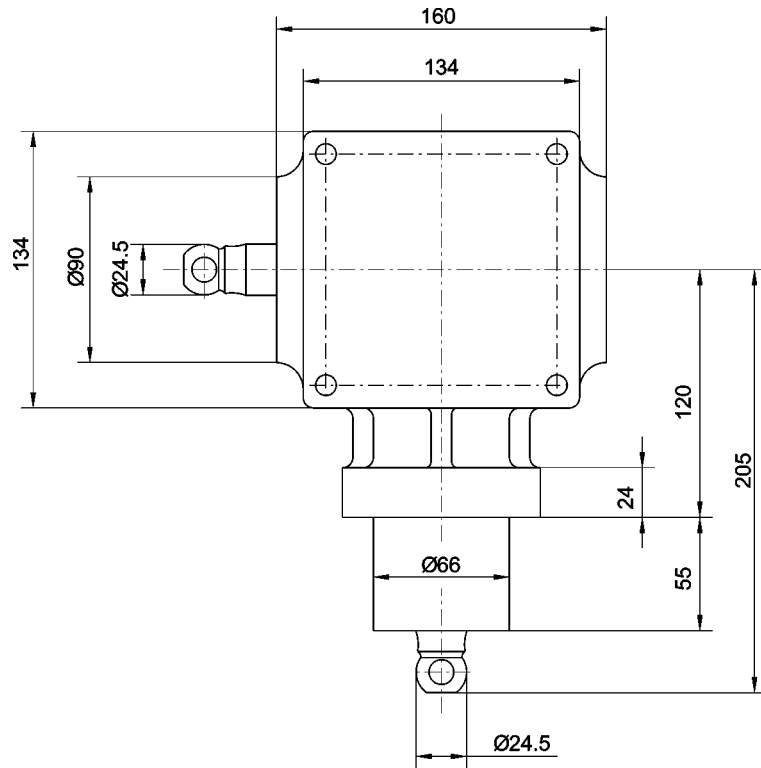


## 9.12 -1. Installation dimensions of tie-in resistor with 2-piece in circuit



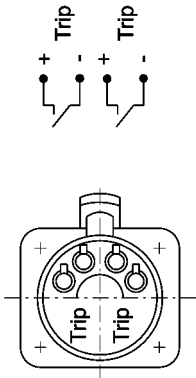
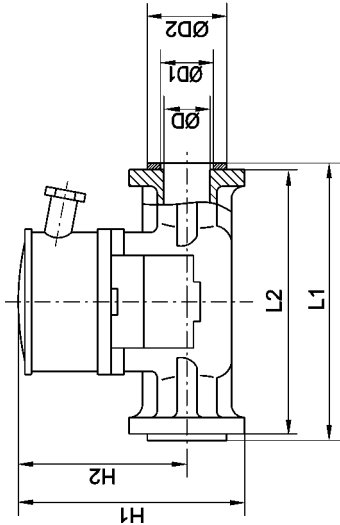
**9.12-2. Installation dimensions of tie-in resistor with 3-piece at bottom**

### 9.13. Overall dimensions of bevel gear unit

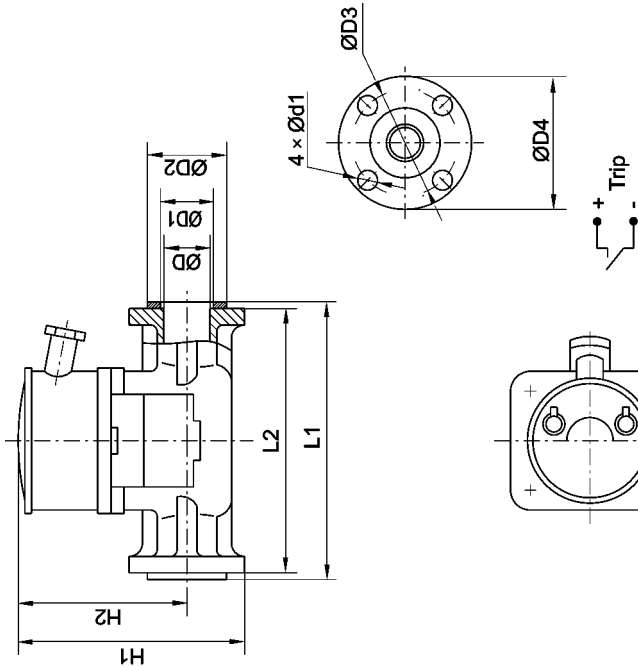


9.14. Dimensions of protective relay

Type QJ6-25 protective relay



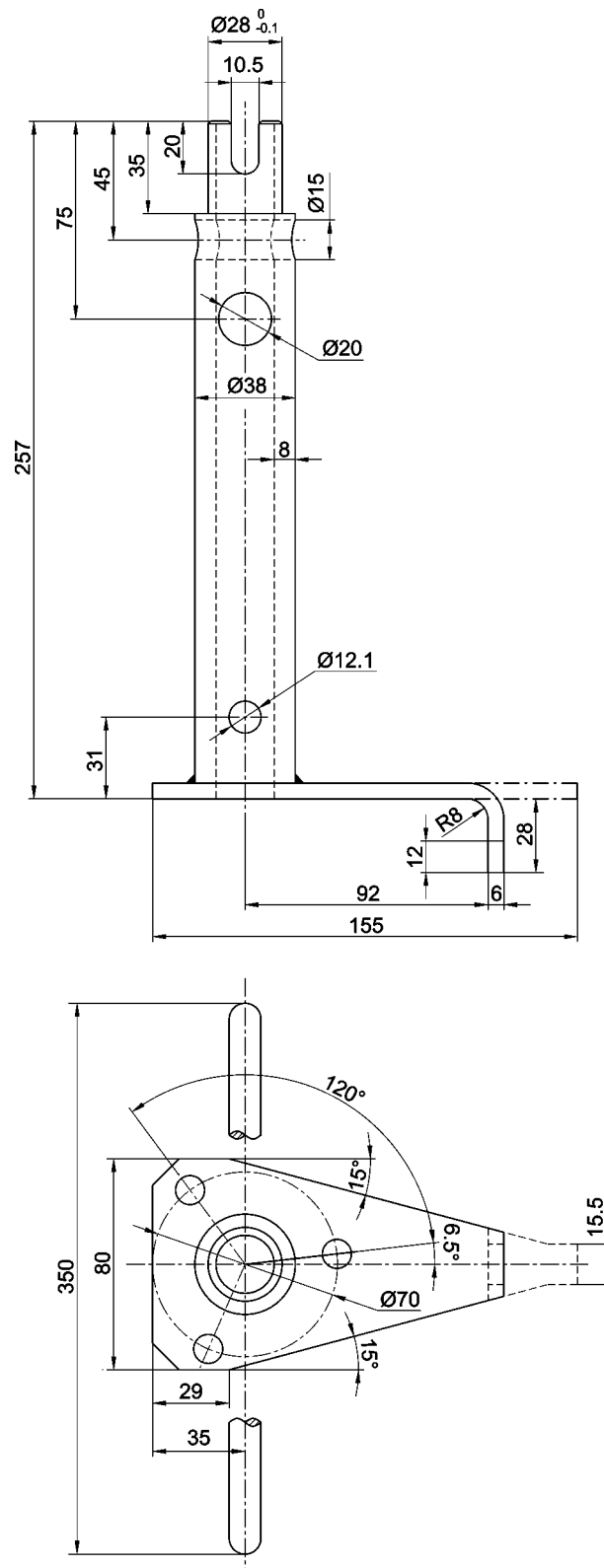
Type QJ4G-25 protective relay



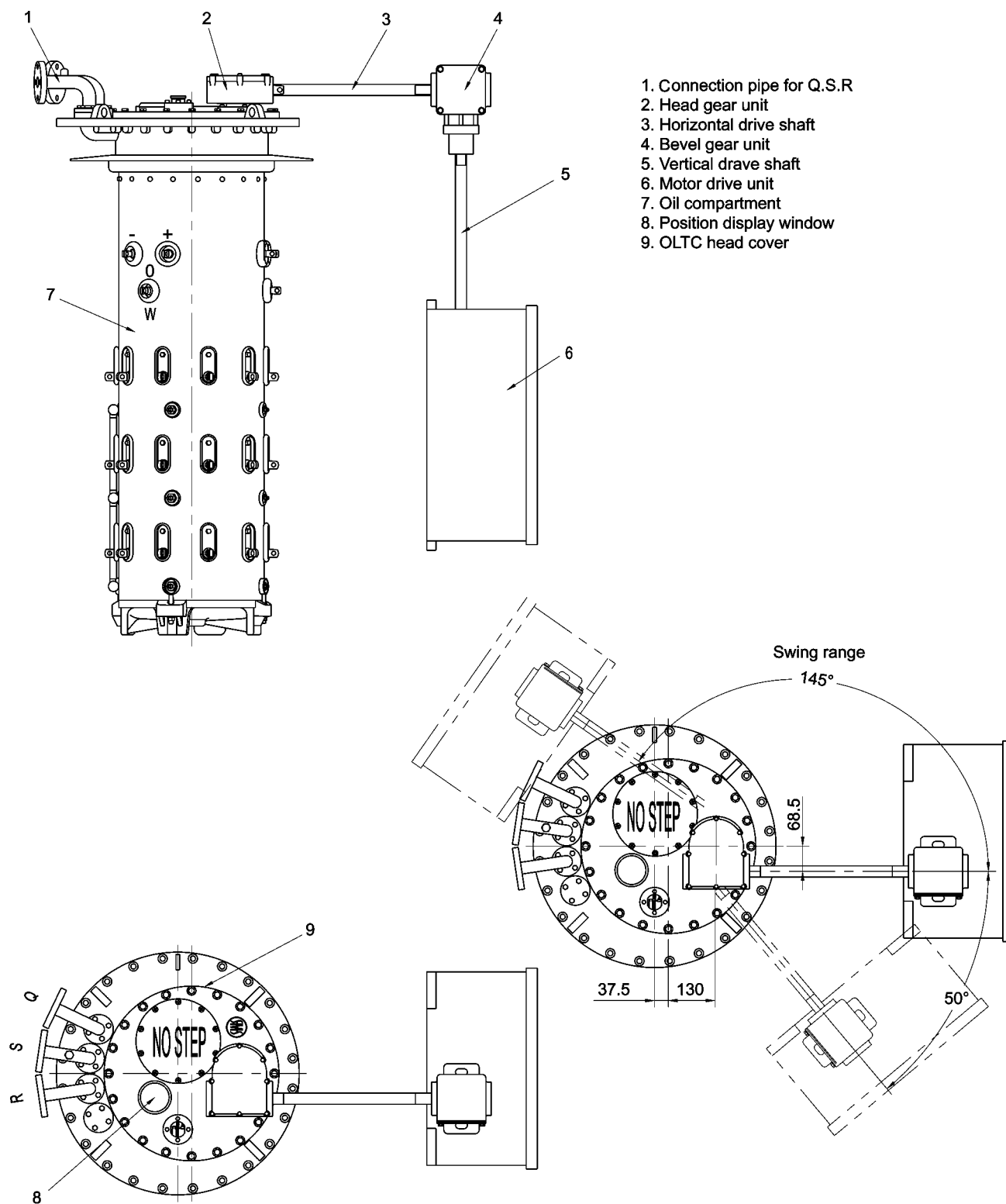
Model	D	D1	D2	D3	D4	d1	H1	H2	L1	L2	Remark
QJ4G-25	25	35	65	85	115	14	195	133	208	200	With one pair of trip signal
QJ6-25	25	35	65	85	115	14	215	153	208	200	With two pairs of trip signals

Unit: mm

### 9.15. Operating key for OLTC insert



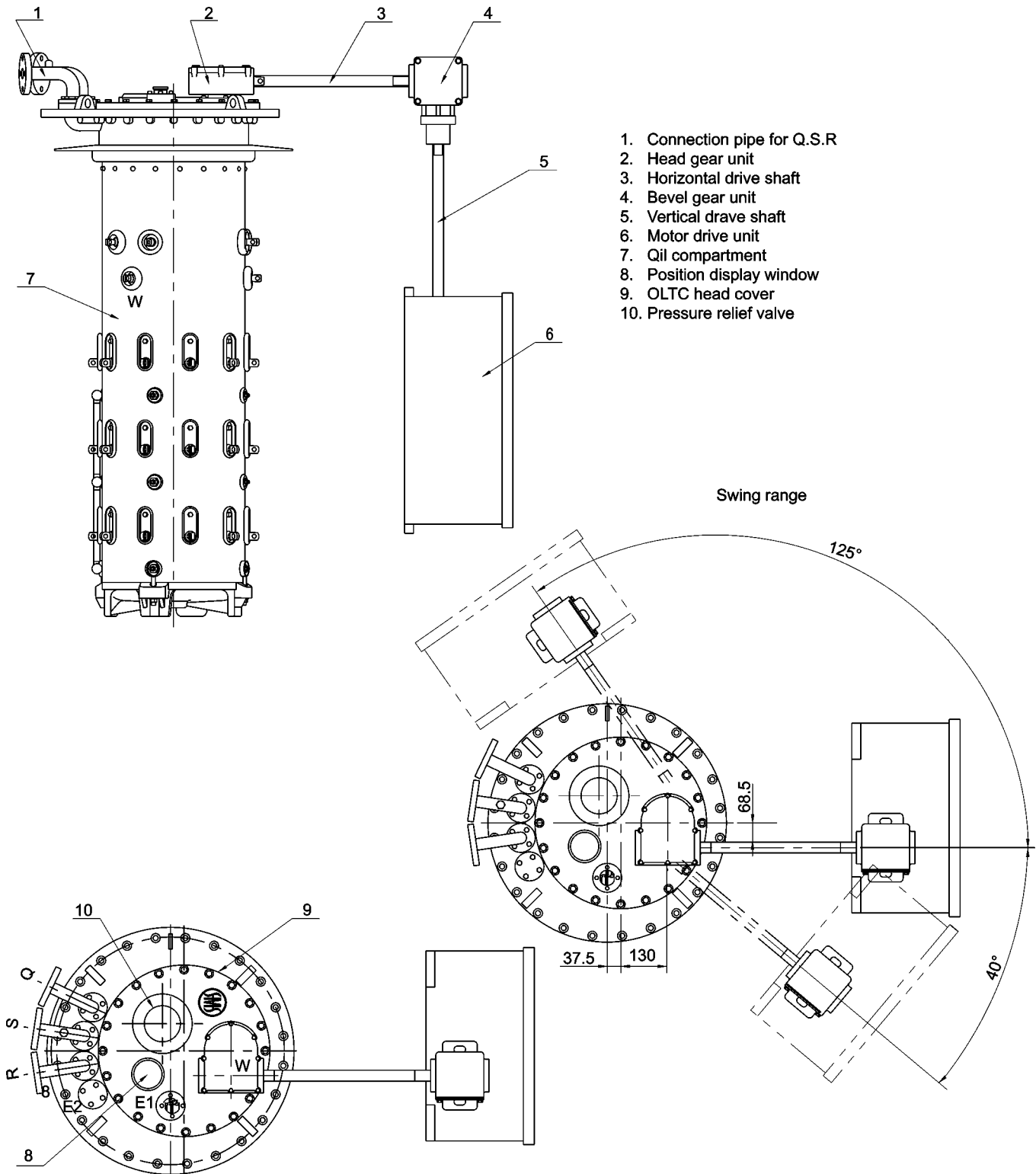
## 9.16. Schematic drawing of OLTC head gearing swing range



Notice: Above is for horizontal drive shaft output at right side, it is possible for output at left side.

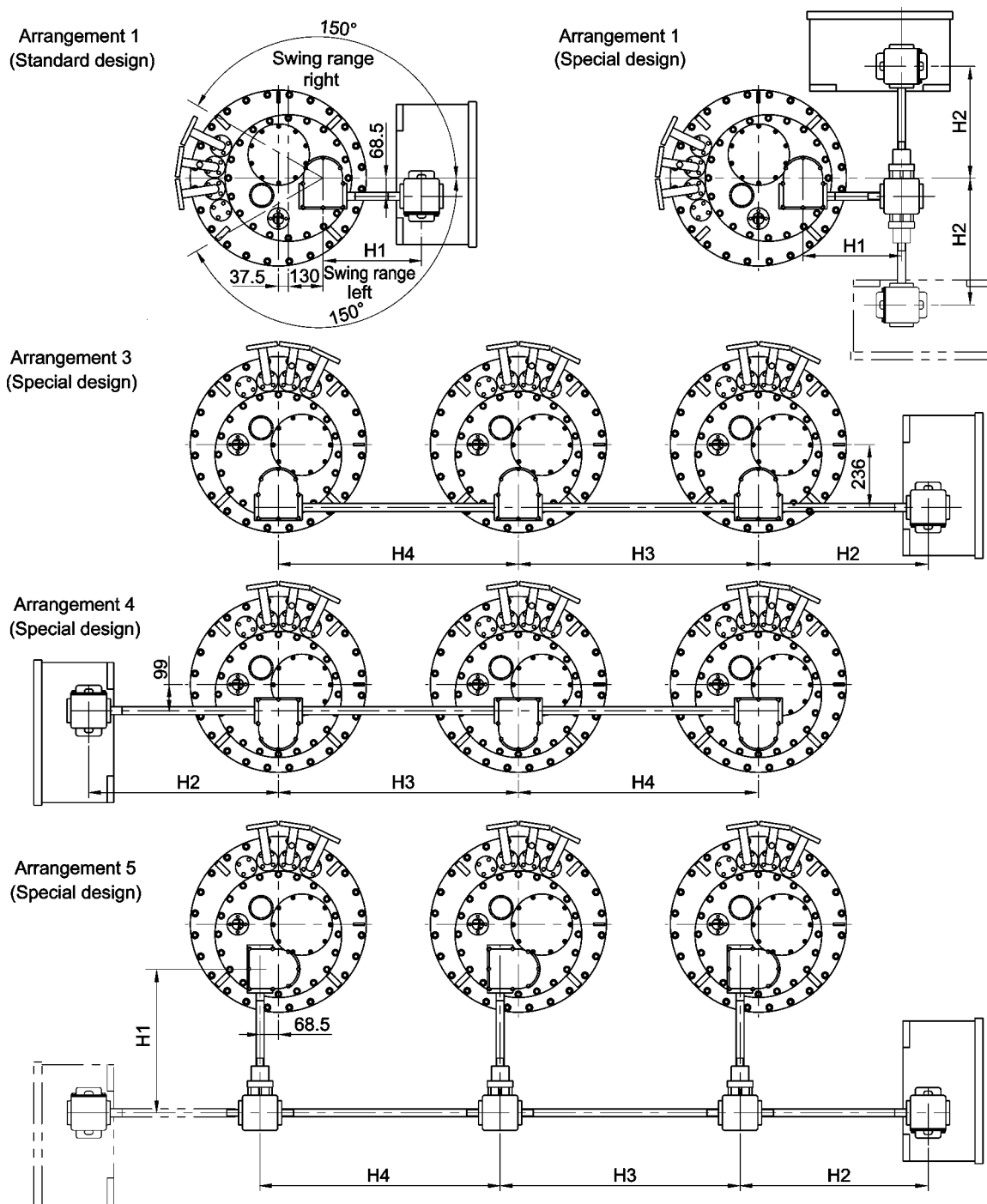
Unit: mm

### 9.17. Schematic drawing of OLTC head gearing swing range (with pressure relief valve)





## 9.18. Schematic drawing of 3 units of single phase OLTC arrangement



Arrangement	H1	H2	H3 and H4
1	> 400	-	The minimum dimensions of H3 and H4 determined by the insulation distance between the phases A.B.C. (For mechanical the minimum limit is 740mm)
2	> 400	> 400	
3,4	-	> 400	
5	> 520	> 400	

Note:

H1 and H2 may be realized as minimum dimensions, possibly increased by a certain position of the head gear unit.



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