TECHNICAL DATA

TYPE CMD

OIL-IMMERSED ON-LOAD TAP CHANGER

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SHANGHAI HUAMING POWER EQUIPMENT CO., LTD.

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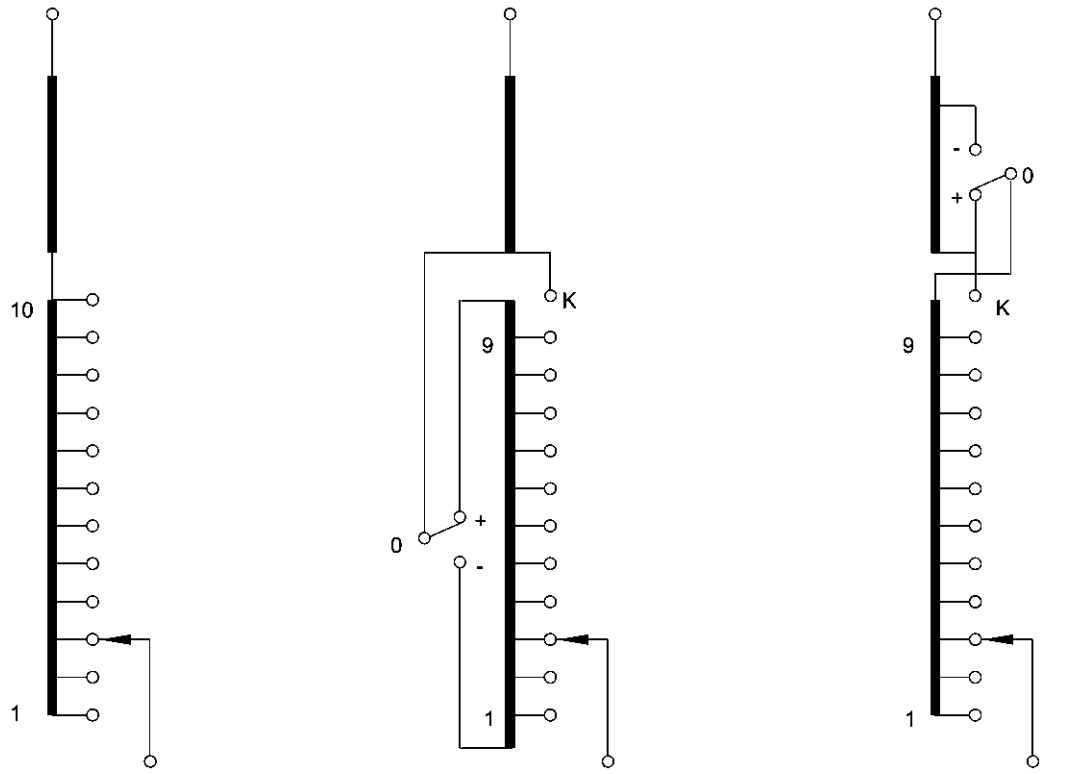
1. General

Type CMD on-load tap changer (herein referred as tap changer) is of combined structure, applicable to oil-immersed voltage regulating transformers. The tap changer is composed by diverter switch and tap selector, which is an in-tank structure mounted inside the transformer. Diverter switch is in a separate oil compartment. Tap selector is in the same oil as the windings in transformer tank . Tap changer is to be mounted on transformer tank top by means of bell type mounting through a top flange. Tap changer is operated by a motor drive unit. Tap changer and motor drive unit are connected by an upper gearbox, driving shaft and a bevel gear box. Tap changer provides both local and remote operation modes.

Three-phase Y-connection tap changer is applicable to neutral point, three units of single phase tap changers can be used for any selectable wingding connections for a three phase transformer. Its basic connection diagram is shown in Fig. 1 below.



a) Linear regulation b) Reversing regulation c) Coarse/fine regulation

Fig.1 Basic Connection Diagram of Tap Winding

2. Technical specifications

Type CMD on-load tap changer complies with IEC 60214-1:2003 standard. Tap changer technical specifications are listed in Table 1 below.

Table 1 Type CMD Series of On-Load Tap Changer Technical Specification

Item	Type		CMDIII			CMDI				
1	Max. rated through current (A)		400	600	1000	400	600	1000	1600	2400
2	Rated frequency (Hz)		50 or 60							
3	Connection		3-phase Y-connection for neutral point only			Single-phase for any selectable winding connection				
4	Max. rated step voltage (V)		3300		4000	3300		4000		
5	Rated step capacity		1500	1600	3000	1500	1600	3000	4400	5600
6	Short-circuit current test (kA)	Thermal (3s)	6	8	12	6	8	12	24	24
		Dynamic (peak)	15	20	30	15	20	30	60	60
7	Max. operating positions		14 without change-over selector; 27 with change-over selector							
8	Insulation to earth	The highest voltage for equipment (kV)	72.5		126		170		252	
		Rated separate source AC withstand voltage (kV/50Hz,1min)	140		230		325		460	
		Rated lightning impulse withstand voltage (kV,1.2/50μs)	350		550		750		1050	
9	Tap selector		Categorized into B, C, D, DE four sizes							
10	Mechanical life		Not less than 1,500,000 operations							
11	Electrical life		Not less than 200,000 operations							
12	Oil compartment of diverter switch	Service pressure	0.03 MPa							
		Leakage test	No leakage under 0.08 MPa for 24 hours							
		Over pressure protection	Rupture disc bursts at 300±20% KPa							
		Protective relay	Set oil flow speed at 1.0m/s ±10% (≤600A) or 1.2m/s ±10% (≥1000A)							
13	Motor drive unit		SHM-III or CMA7							
14	On line oil filter		ZXJY-1/ ZXJY-2/ ZXJY-3 according to requirement (Necessary when max. rated through current is 1000A and above or OLTC used for industrial applications)							

3. Type explanation

3.1. Type designation

Due to the different combinations of no. of phases, maximum rated through current, the highest voltage for equipment, tap selector size and connections, type CMD comes with various models. Hence, the type designation shall provide all the above technical parameter and below is its detailed explanation.

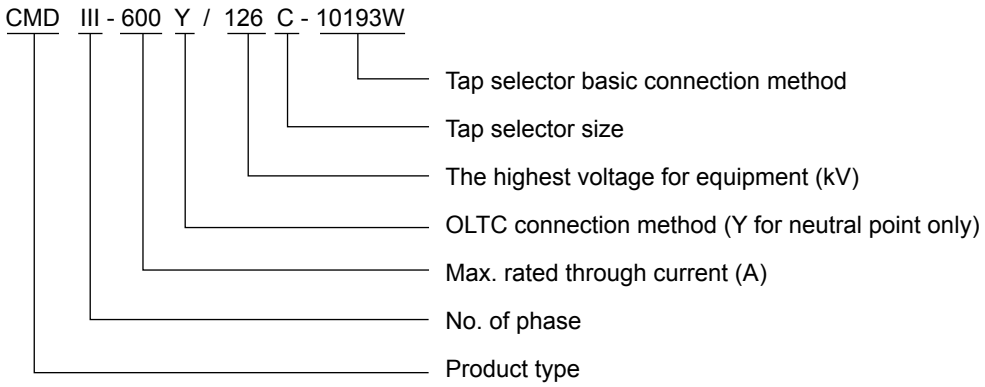


Fig. 2 Tap Changer Type Designation

3.2. Tap selector basic connection method

Because of voltage regulation range difference and winding connection variations, tap selector has a number of different specifications. Tap selector specification is decided by no. of inherent contacts, no. of operating positions, no. of mid positions and type of change-over selector. Please refer to Fig. 3. for indications of different tap selector parameters.

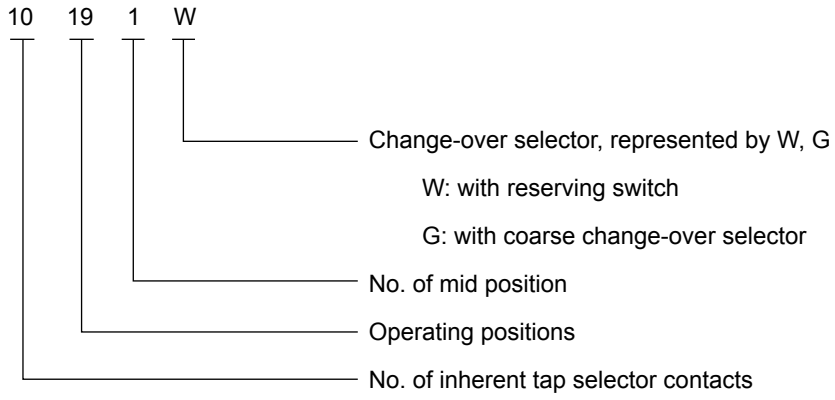


Fig. 3. Tap Selector Basic Connection Method Explanation

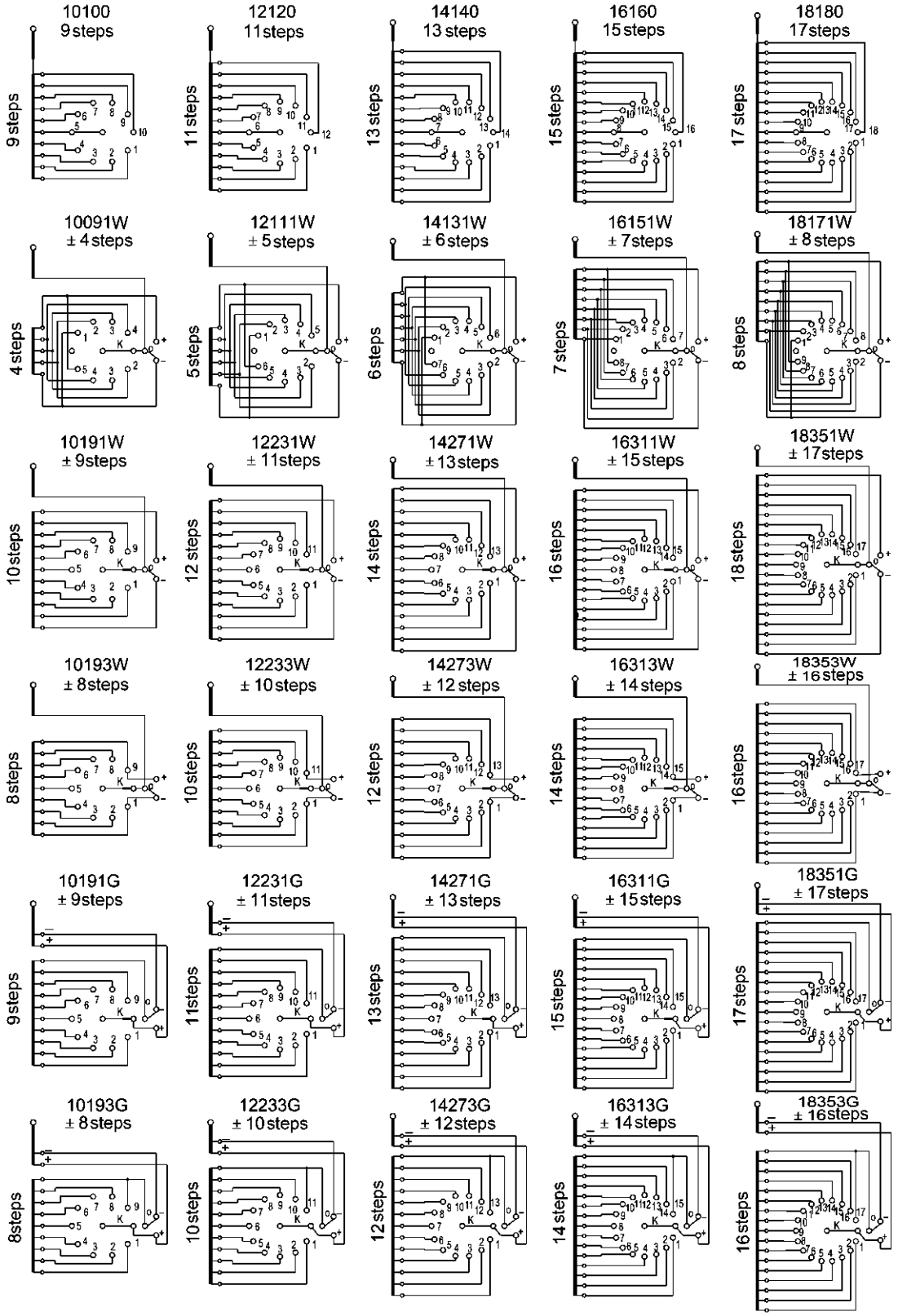


Fig. 4 Tap Selector Basic Connection diagram

3.3. Tap selector basic connection diagram

Different transformer tapping corresponds to different tap selector basic connection diagrams. Fig. 4 shows common basic connection diagrams. Special requirement can also be specially designed.

4. Terms and definitions

4.1. Through-current

Rated through current I_U:

The current flows through an on-load tap changer toward the external circuit, which can transferring from one tap to the other at the relevant rated step voltage and which can be carried continuously while meeting the requirement.

Maximum rated through-current I_{um}:

The highest rated through-current for which the tap changer is designed for and which forms the basis for all current related tests.

4.2. Step voltage

Rated step voltage U_i:

For each value of rated through current, the highest permissible voltage between terminals which are intended to be connected to successive taps of the transformer.

Maximum rated step voltage U_{im}:

The highest value of the rated step voltage for which the tap changer is designed. The maximum rated step voltage for type CMD OLTC is 4kV.

4.3. Step capacity

Step capacity is the product of step voltage and load current, that is $P_s=U_I$. Rated step capacity is the maximum permissible step capacity for the tap changer under continuous working condition, that is $P_{stN}=I_u \times U_i$. For a certain range of load, its rated step capacity can be represented by the range curve shown in Fig. 5. This range is defined by the maximum rated through-current on the horizontal axis and maximum permissible step voltage on the vertical axis. Loads within the defined curve are the rated values of the tap changer.

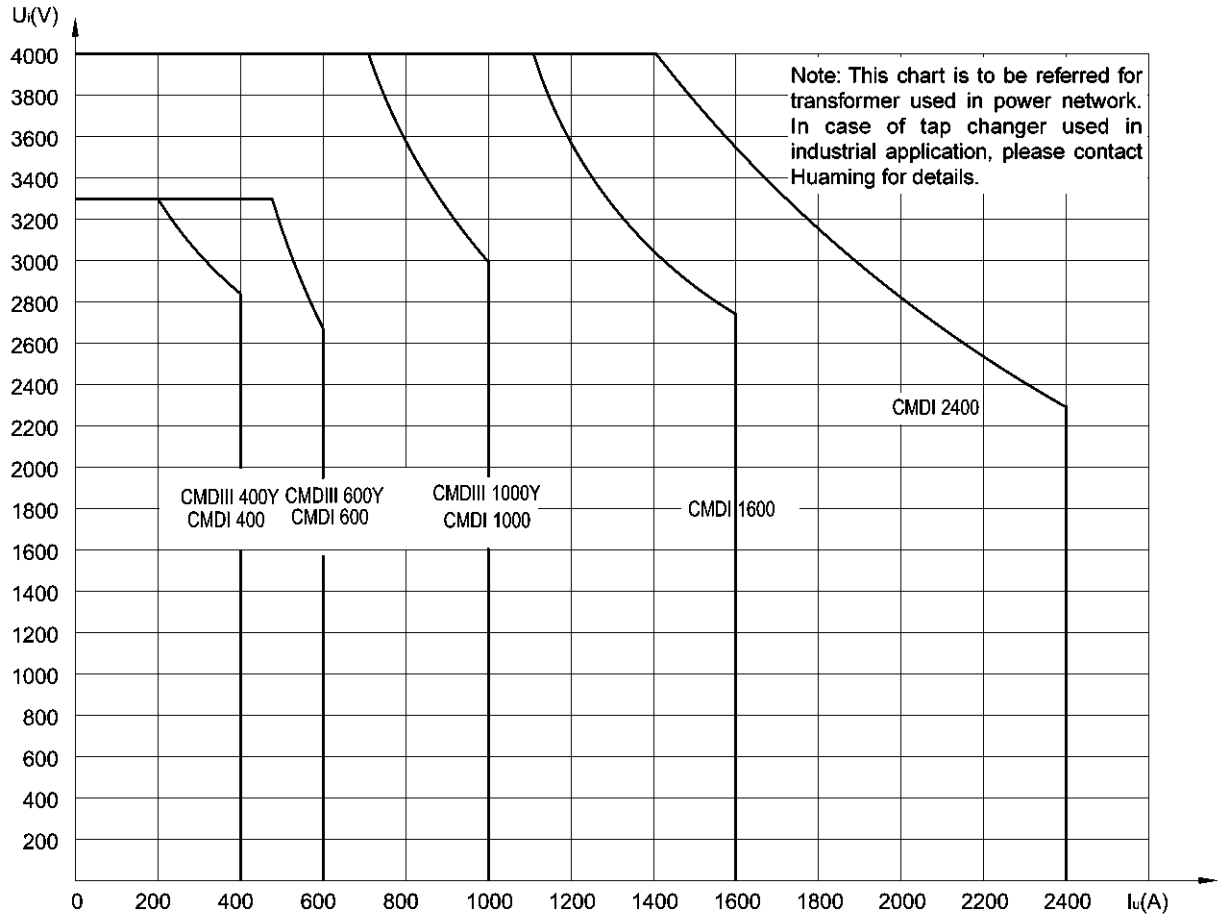


Fig. 5 Rated Step Capacity of Type CMD OLTC

4.4. Breaking capacity

According to stipulations of IEC60214-1, tap changer shall be able to break two times of maximum rated through-current and its relevant step voltage for 40 operations. Breaking capacity of type CMD OLTC is $P_{st.max}=2P_{StN} \approx 2I_{um} \times U_{StN}$

Where,

P_{StN}: rated step capacity

I_{um}: the maximum rated through-current

U_{StN}: relevant rated step voltage

4.5. Electrical life of arcing contact

The electrical life of type CMD OLTC relates to the current it breaks. Hence the electrical life can be estimated by its relative load. However, as the actual wear of the arcing contact is also subject to various factors during field operation, such as the contact material, transition resistors matching, etc, only the approximate value of electrical life can be given (as the shadow area in Fig. 6)

n: Number of operation

I_u: rated through-current

I_{um}: the maximum rated through-current

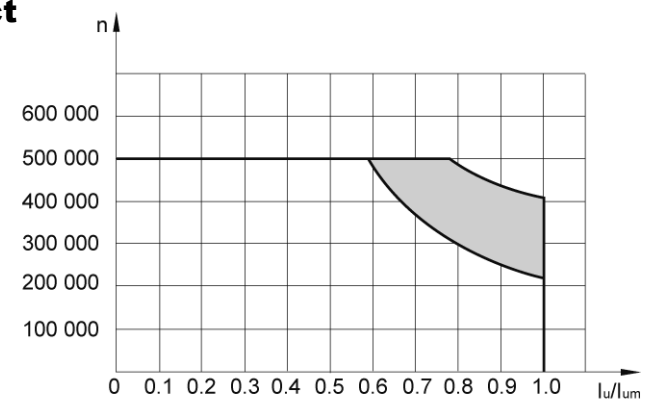


Fig.6 Estimated Mean Contact Life under Average Load Conditions

4.6. Short-circuit current test

According to IEC 60214-1: 2003, all contacts continuously carrying the current shall be able to withstand 2s (±10%) short circuit test current without melting, deformation or mechanical damage. Meanwhile the starting peak current value shall be 2.5 (±5%) times of the root means square value of rated short circuit test current. Refer the short circuit test current values to Table 1. Type CMD Series On-Load Tap Changer Technical Specification.

4.7. Service condition of tap changer

4.7.1. Service temperature range of tap changer in oil is -25℃ ~ +100℃

4.7.2. Service ambient air temperature range of tap changer is -25℃ ~ +40℃

4.7.3. Perpendicular deflection between ground and tap changer after being mounted on transformer shall be less than 2%.

4.7.4. There shall be no serious dust, explosive gas or corrosive gas on service site

Remark: Please contact us if special application required.

4.8. Internal insulation level of tap changer

The internal insulation level of type CMD tap changer is categorized into B, C, D, DE four sizes. Refer the internal insulation level to table 2. Basic connection diagram and insulation distance mark is shown in Fig. 7. Internal insulation must be checked when selecting the proper tap changer whether it's qualified for the voltage withstand requirement.

Table 3 Tap Changer Internal Insulation Level

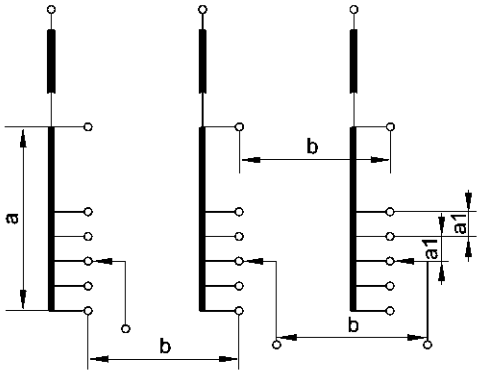
(unit: kV)

Designation code		Tap selector size B		Tap selector size C		Tap selector size D		Tap selector size DE	
		1.2/50μs	50Hz 1min	1.2/50μs	50Hz 1min	1.2/50μs	50Hz 1min	1.2/50μs	50Hz 1min
a		265	50	365	82	490	105	550	120
b		265	50	350	82	490	146	550	160
a0	I≤600A	90	20	90	20	90	20	90	20
	I≥1000A	130	20	130	20	130	20	130	20
a1		150	30	150	30	150	30	150	30
c1		500	145	550	180	590	225	660	230
c2		500	145	550	195	590	225	660	250

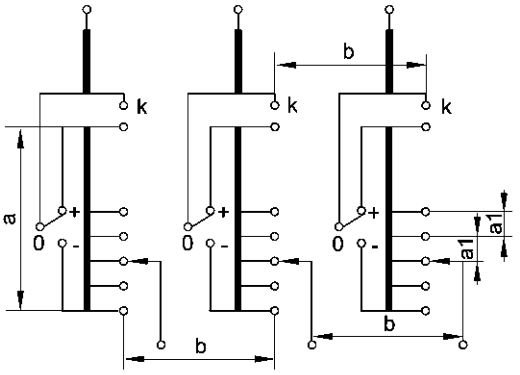
Note:

When a0 represents insulation of spark gap, its insulation is 1.2/50μs, 90kV, 100% responsive;

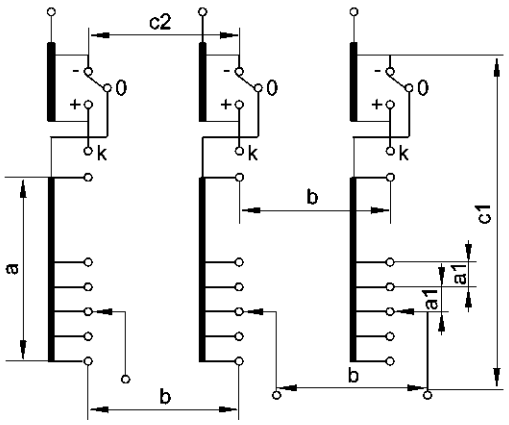
When a0 represents insulation of zinc oxide varistor, its insulation is 1.2/50μs, 90~130kV, 130kV is 100% responsive.



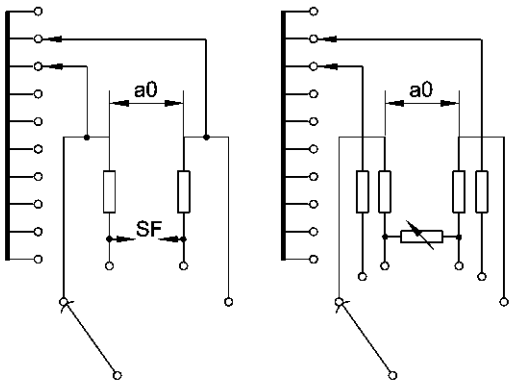
Linear Regulation



Reversing Regulation



Coarse/Fine Regulation



Spark Protection Gap (I≤600A)
Zinc Oxide Varistor (I≥1000A)

a: between start and end of a fine tap winding; also between start and end of coarse tap winding;
b: between any tapping of different fine tap windings, or between ends of different coarse windings;
a0: between selected and preselected of the diverter switch tapping;
a1: between any selected and preselected taps of the tap selector
c1: between the start of coarse tap winding and the current take-off terminal for the same phase;
c2: between start contacts (-)of coarse winding for different phases.

Fig. 7 Basic Connection Diagram and Insulation Distance Mark

4.9. Tap changer insulation level to earth

Tap changer insulation level is the insulation between tap changer live part and grounding part. It is determined by dielectric tests according to IEC-60214-1-2003. The requirement correlates to the transformer tap winding location, regulation range & regulation method, winding connection & arrangement and rated voltage of transformer winding. It's decided by the insulation to earth of transformer tap winding.

Table 3 Tap Changer Insulation Level to Earth (unit: kV)

The highest voltage for equipment U_m (kV)	Rated separate source AC withstand voltage(kV/50Hz,1min)	Rated lightning impulse withstand voltage (1.2/50μs)
72.5	140	350
126	230	550
170	325	750
252	460	1050

4.10. Tap changer mounting method

CMD tap changer is mounted to transformer tank top by a head flange. Hence, a mounting flange shall be provided by transformer producer, the dimension of which shall refer to the drawing of Appendix 34. Type CMD tap changer is only applicable to bell type mounting. The supporting flange of the tap changer is only for temporary support during the transformer conductor connection. After putting the bell tank, tap changer shall be fixed to the mounting flange of the transformer.

The connection pipes on head flange of Type CMD tap changer have two arrangement models. That is standard and left-right. (Refer details to Appendix 31). For tap changer with current of 1000A or above, only left-right model can be used. For tap changer with current of or less than 600A, either model is applicable and up to the customer's preference.

5. Special designs

5.1. Potential connection of the tap winding

For transformers with high voltage rating and big regulation range, during the operation of the change-over selector, the tap winding is disconnected momentarily from the main winding and in a so-called (suspension) status. At that moment, the tap winding takes a new potential which is determined together by the coupling capacitance to ground Ce and coupling capacitance to the adjacent winding Cw. (refer details to Fig.9). Usually this potential is different from the previous potential of the tap winding before the operation. The difference between the two is called bias voltage. This bias voltage turns out to be the recovery voltage on the gap of the change-over selector. When the recovery voltage exceeds a certain critical value, the change-over selector would discharge electricity and produce considerable amount of gas. This could be a serious problem. Therefore, potential connection of the tap winding must be considered when this bias voltage exceeds a certain value, in order to avoid the discharge during the operation of the change-over selector.

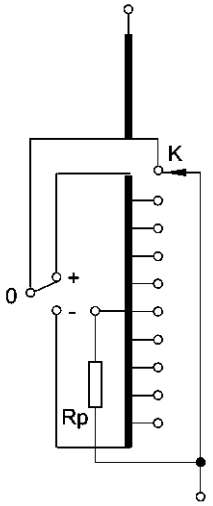


Fig. 8 Permanent Connection of the Tie-in Resistor Rp

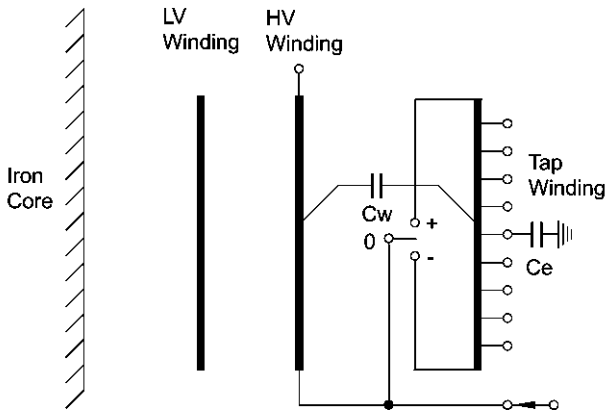


Fig.9 Winding Arrangement of Reversing Regulation of Double Winding Transformer

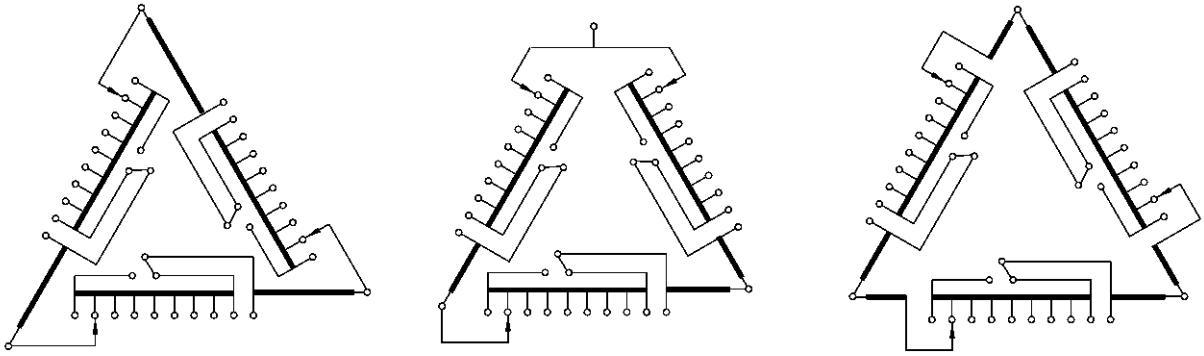
The permissible recovery voltage to type CMD tap changer is 35kV. In case the bias voltage of the change-over selector exceeds this value, a tie-in resistor with fixed value shall be permanently connected into the tap winding (refer to Fig. 8). The mounting location and dimension of tie-in resistor for CMD can be found in Appendix 37-1 and 37-2.

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

a) All transformer performance data: rated capacity, rated voltage, regulation range, connection of winding and insulation level, etc.;
b) Relative arrangement of winding: relative location between tap winding and adjacent winding or winding part;
c) Operating A.C.voltage across windings or layers of windings adjacent to the tap windings
d) Capacitance between tap winding and part of adjacent winding(Cw)
e) Capacitance of the tap winding to ground or grounded adjacent windings (if exist) (Ce)
f) Voltage stress across half the tap winding at lightning impulse voltage test
g) A.C. voltage across half the tap winding under operation and test conditions.(is normally derived from order specification sheet for tap changer)

5.2. Two phase and single phase of CMD

Type CMD tap changer can be designed as one motor drive unit (or three motor drive unit) driving three single phase tap changers or one two-phase plus one single phase tap changer, for regulation of delta connection or other regulation locations other than neutral point.



Three Single Phase Regulation at Line End of Delta Connection

One Single Phase + One Twophase Regulation at Line End

Three Single Phase Regulation at Middle of Delta Connection

Fig. 10 Basic Connections for Delta-Connected Transformer Winding

6. Motor drive unit

CMD OLTC may be operated by SHM-III or CMA7 motor drive unit according to the requirement, please refer to table 4 for technical data.

Table 4 Technical Data of Motor Drive Unit

Motor drive unit		SHM-III		CMA7	
Motor	Rated power (W)	750	1100	750	1100
	Rated voltage (V)	380,3AC/N		380/3AC	
	Rated current (A)	2.1	2.8	2.0	2.8
	Rate frequency(Hz)	50 or 60		50 or 60	
	Rotate speed (r.p.m.)	1400		1400	
Rated torque on drive shaft (Nm)		45	66	18	26
Revolution of the drive shaft per switching operation		33		33	
Revolution of the hand crank per switching operation		33		33	
Running time per switching operation (S)		5.6		About 5	
Max. operation positions		35		107	
Voltage for control circuit and heater circuit (V)		220/AC		220/AC	
Heater power (W)		50		50	
A.C. voltage test to ground (kV/50Hz, 1min)		2		2	
Approx. weight (kg)		73		90	
Protective degree		IP66		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. 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℃ to 40℃ 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.
HMC-3C technical data is as below:
Working voltage: 220V AC
Power frequency: 50Hz
Maximum operation positions: 107
Environment temperature: -10℃ to 40℃ Indoor

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. Accessories

8.1. Bevel gearbox

Bevel gearbox is used for the inter-connection of tap changer horizontal shaft and motor drive vertical shaft, in order to transfer the motor drive driving torque to the tap changer. Its overall dimension is shown in Appendix.

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 be cut off 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 Appendix.

8.3. Pressure relief device

Pressure relief valve and rupture disc are safety protection devices of oil-immersed on-load tap changer. In case tap changer has an internal failure, which decomposes the oil in the compartment and produces large amount gas, the internal pressure inside the oil compartment will increase dramatically. If this pressure couldn't be released, tap changer will be deformed or even explode. Therefore, pressure relief devices can avoid the upgrade of the failure.

Pressure relief valve is a self-sealing relief valve. It opens the cover in case of over pressure and re-closes after the pressure is released, which can be used repeatedly and minimize the liquid loss during the operation.

The rupture disc is a weak point on the top cover of tap changer. Once the pressure in the oil compartment exceeds the set value, the disc will explode to release the over pressure of the compartment, as a result the oil compartment will be prevented from damage.

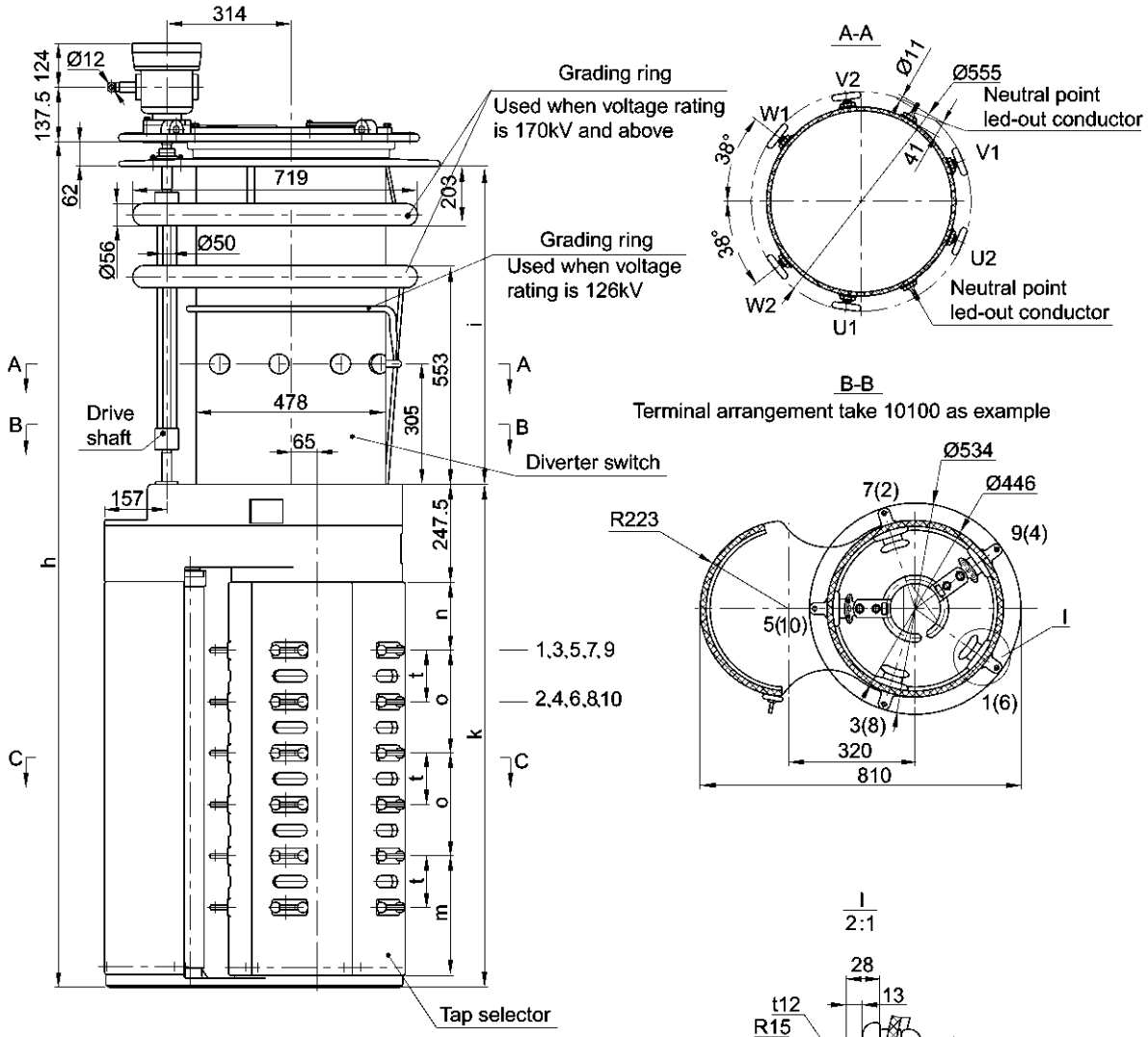
Pressure relief valve is a low-energy failure protection device. The rupture disc is a high-energy protection device. Tap changer failure usually tends to be high-energy failure. Hence, pressure relief valve is not recommended for tap changer, or use it as an assistant protection besides the rupture disc. Therefore, pressure relief valve is an optional accessory of tap changer for customer to select when ordering the tap changer.

8.4. On-line oil filter plant

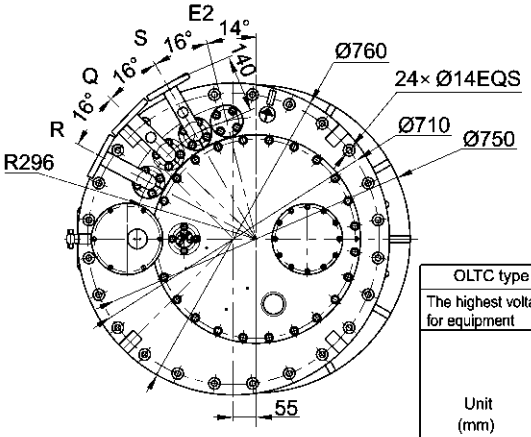
On-line oil filter is used to filter the transformer oil inside tap changer in circulation. This device can effectively filter carbon and metallic particles from the oil inside tap changer, and reduce its moisture. As a result, tap changer operation reliability is increased and maintenance interval is extended. For tap changer under frequent operations, such as furnace transformer, rectification transformer etc, the on-line oil filter plant is recommended. Meanwhile, for high rating voltage regulating transformer, on-line oil filter is also recommended. For CMD tap changer with the max. rated current I_{um} ≥1000A, on-line oil filter must be used.

9. Appendixes

Appendix 1. CMDIII-400/600A overall dimensions without change-over selector



Tap changer head (Ichnography)

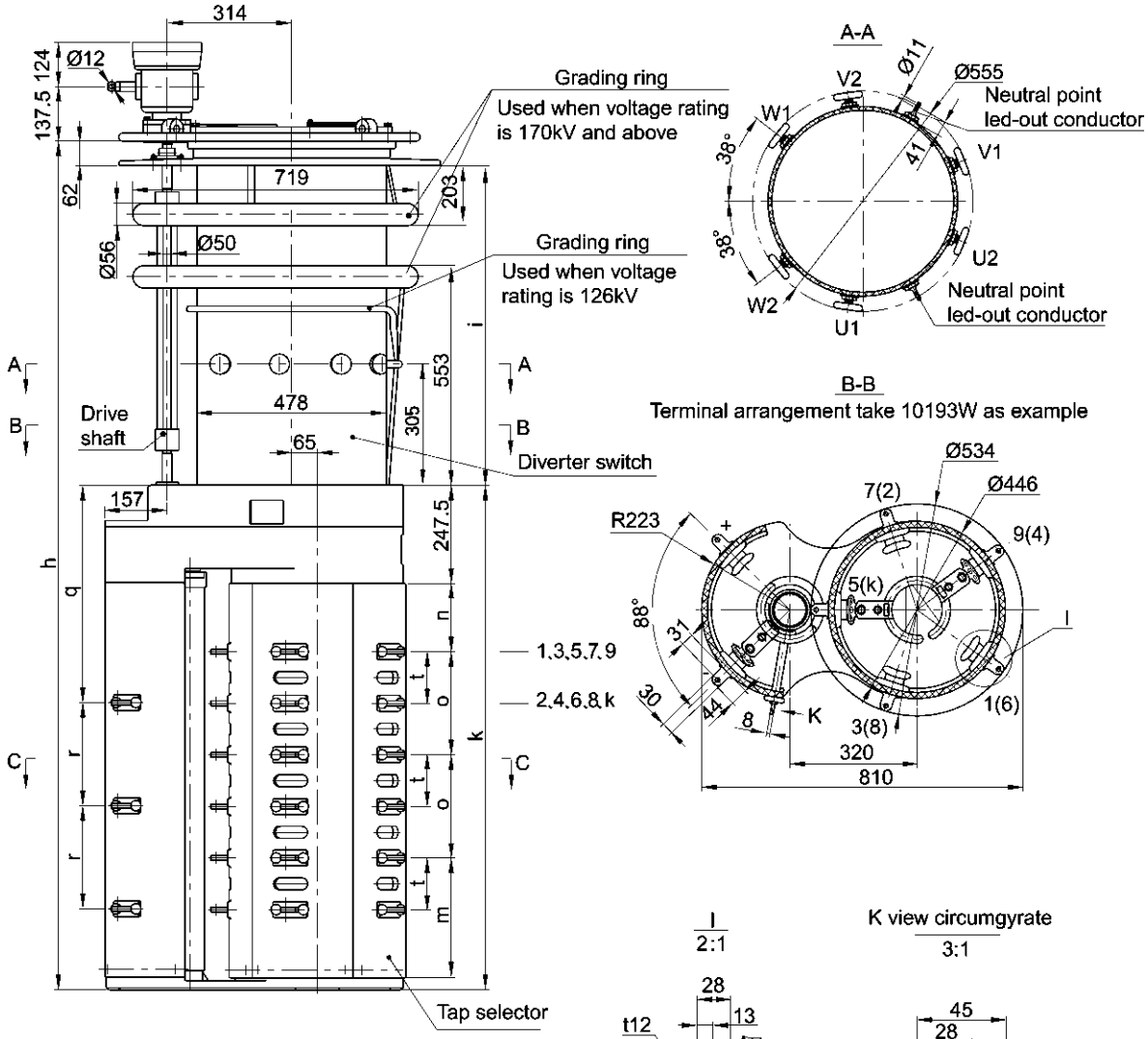


E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

OLTC type		CMDIII400/600-72.5 ~252/B				CMDIII400/600-72.5~252/C				CMDIII400/600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Unit (mm)	h	1966	2096	2226	2326	2140	2270	2400	2500	2596	2726	2856	2956
	i	805	935	1065	1165	805	935	1065	1165	805	935	1065	1165
	k	1099				1273				1729			
	n	147				172				237			
	o	210				260				390			
	t	105				130				195			
	m	252				302				432			
Oil filling dm^3		130	150	170	190	130	150	170	190	130	150	170	190
Displacement dm^3		195	220	240	255	205	230	255	265	215	240	260	275
Weight kg		290				295				300			

Unit: mm

Appendix 2. CMDIII-400/600A overall dimensions with reversing switch

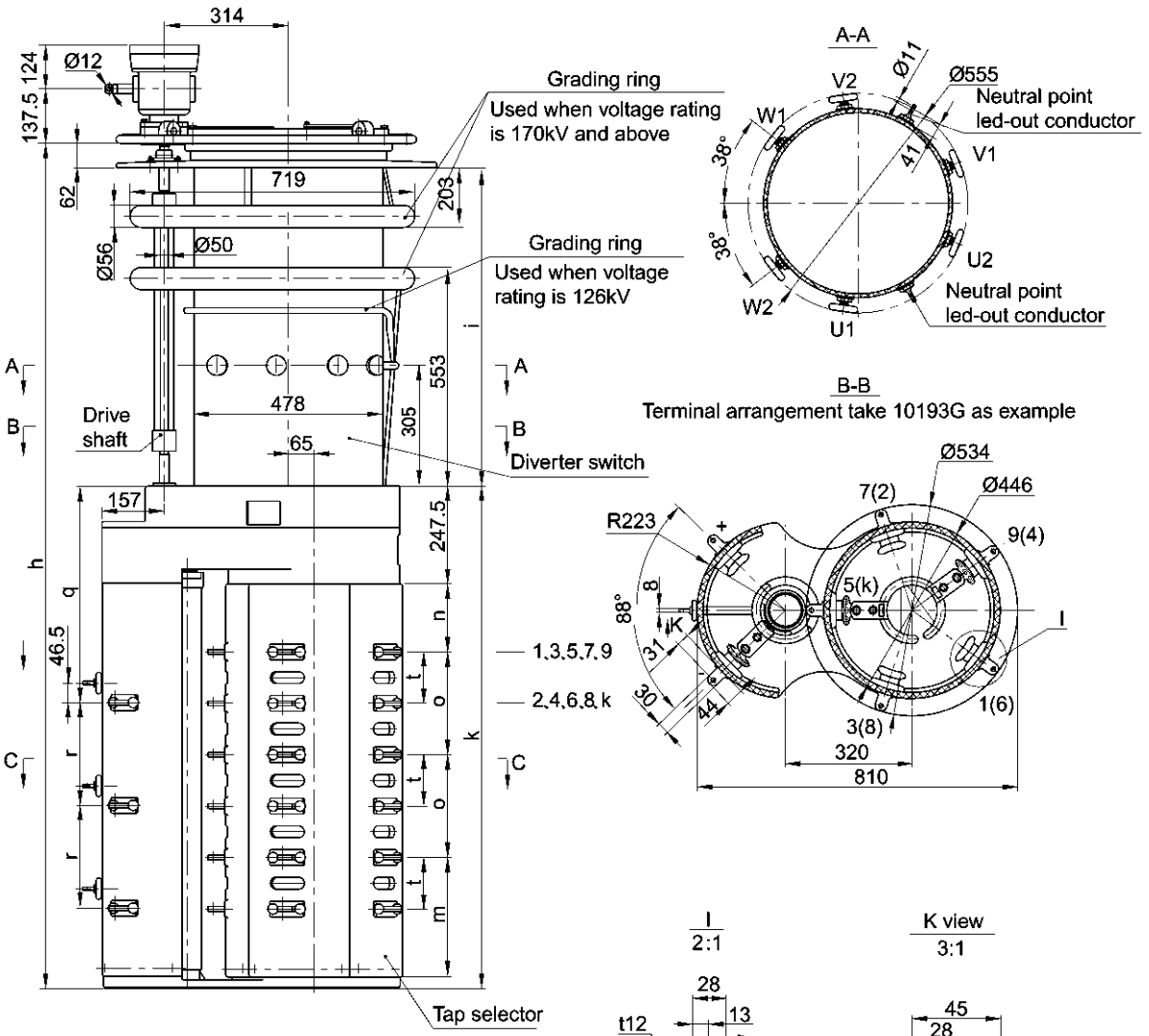


E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

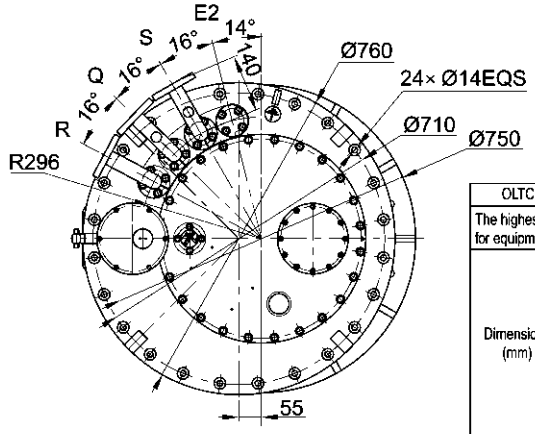
OLTC type		CMDIII400/600-72.5 ~252/B				CMDIII400/600-72.5~252/C				CMDIII400/600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	1966	2096	2226	2326	2140	2270	2400	2500	2596	2726	2856	2956
	i	805	935	1065	1165	805	935	1065	1165	805	935	1065	1165
	k	1099				1273				1729			
	n	147				172				237			
	o	210				260				390			
	t	105				130				195			
	m	252				302				432			
	r	210				260				390			
	q	499.5				549.5				679.5			
Oil filling dm^3		130	150	170	190	130	150	170	190	130	150	170	190
Displacement dm^3		200	225	245	160	200	235	255	270	215	240	260	275
Weight kg		300				305				310			

Unit: mm

Appendix 3. CMDIII-400/600A overall dimensions with coarse change-over selector



Tap changer head (Ichnography)

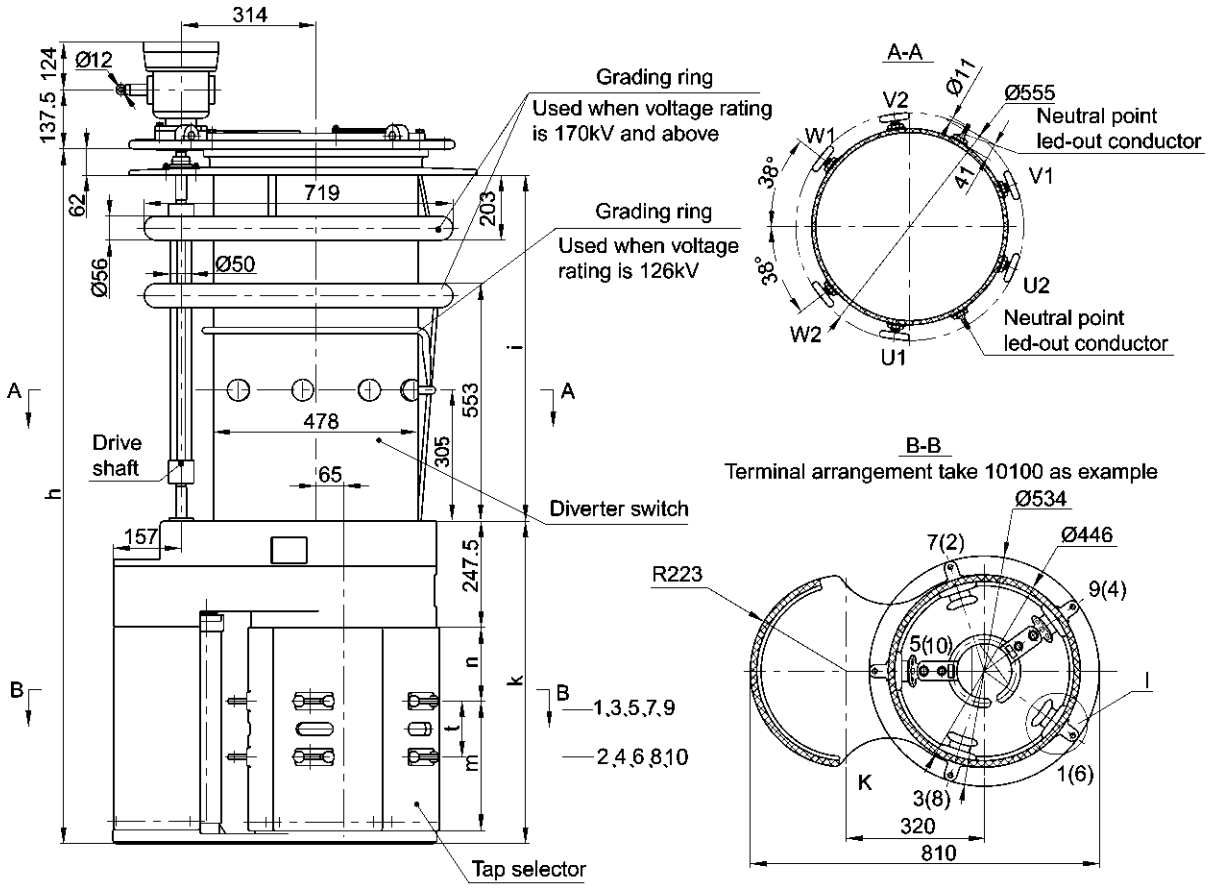


E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

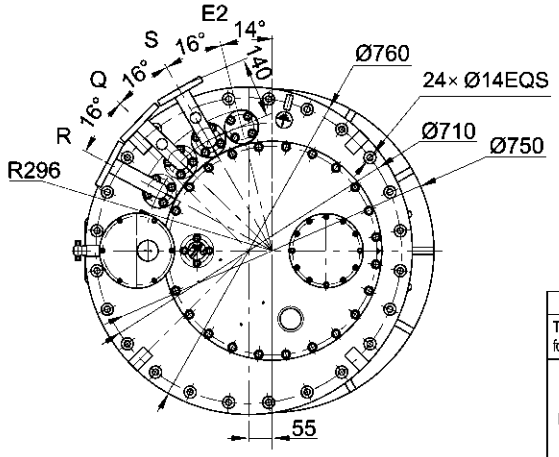
OLTC type		CMDIII400/600-72.5 ~252/B				CMDIII400/600-72.5~252/C				CMDIII400/600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	1966	2096	2226	2326	2140	2270	2400	2500	2596	2726	2856	2956
	i	805	935	1065	1165	805	935	1065	1165	805	935	1065	1165
	k	1099				1273				1729			
	n	147				172				237			
	o	210				260				390			
	t	105				130				195			
	m	252				302				432			
	r	210				260				390			
	q	499.5				549.5				679.5			
Oil filling dm^3		130	150	170	190	130	150	170	190	130	150	170	190
Displacement dm^3		200	225	245	160	200	235	255	270	215	240	260	275
Weight kg		300				305				310			

Unit: mm

Appendix 4. CMDI-400/600A overall dimensions without change-over selector

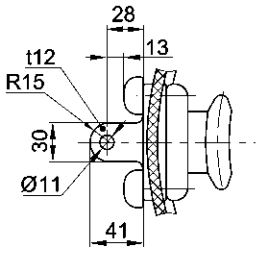


Tap changer head (Ichnography)



E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

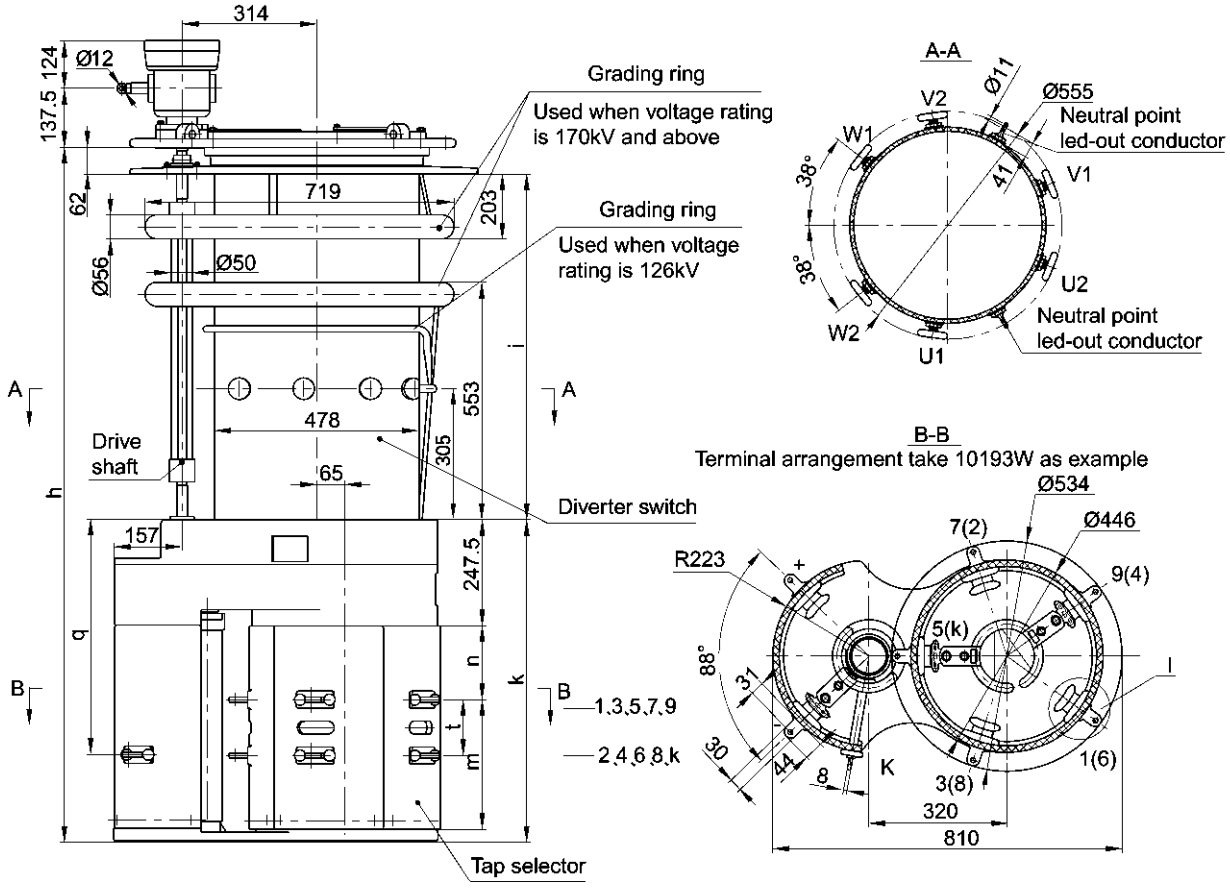
I
2:1



OLTC type		CMDIII400/600-72.5~252/C				CMDIII400/600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2140	2270	2400	2500	2596	2726	2856	2956
	i	805	935	1065	1165	805	935	1065	1165
	k	753				949			
	n	172				237			
	t	130				195			
	m	302				432			
Oil filling dm³		130	150	170	190	130	150	170	190
Displacement dm³		168	203	213	223	178	213	223	233
Weight kg		280				285			

Unit: mm

Appendix 5. CMDI-400/600A overall dimensions with reversing switch

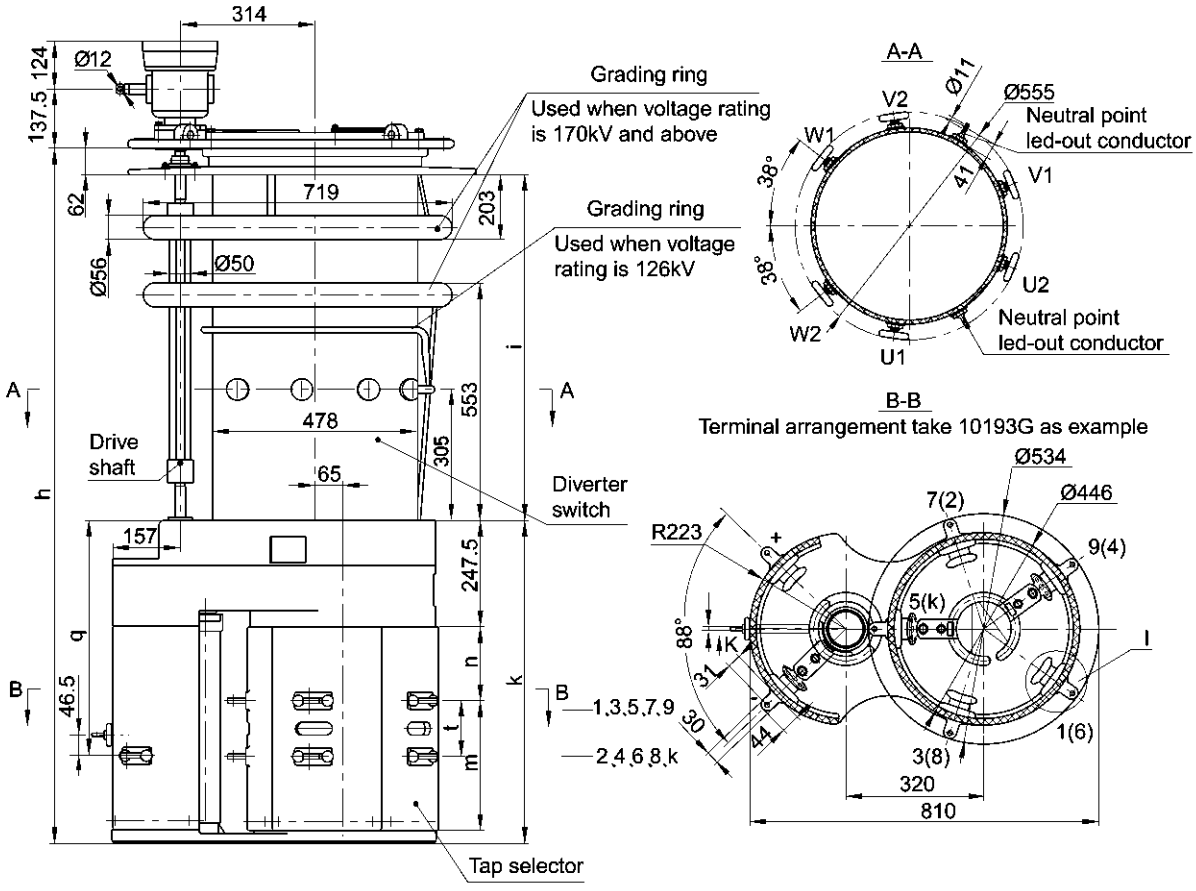


E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

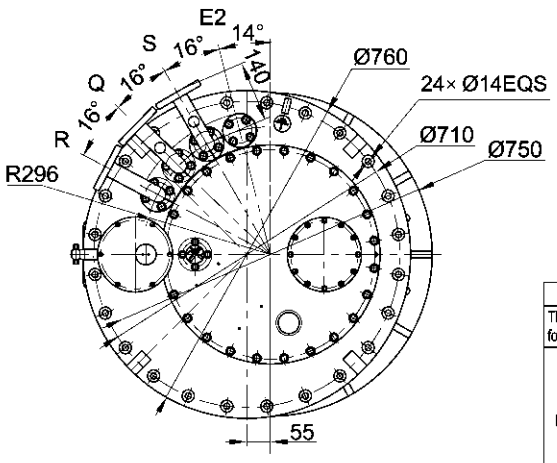
OLTC type		CMDIII400/600-72.5~252/C				CMDIII400/600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2140	2270	2400	2500	2596	2726	2856	2956
	i	805	935	1065	1165	805	935	1065	1165
	k	753				949			
	n	172				237			
	t	130				195			
	m	302				432			
	q	549.5				679.5			
Oil filling dm^3		130	150	170	190	130	150	170	190
Displacement dm^3		170	205	215	225	180	215	225	235
Weight kg		285				290			

Unit: mm

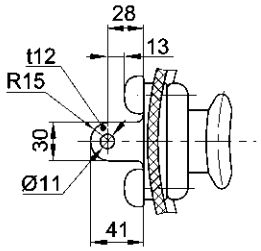
Appendix 6. CMDI-400/600A overall dimensions with coarse change-over selector



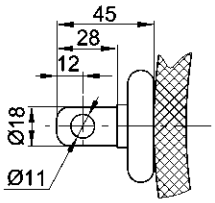
Tap changer head (Ichnography)



I
2:1



K view
3:1

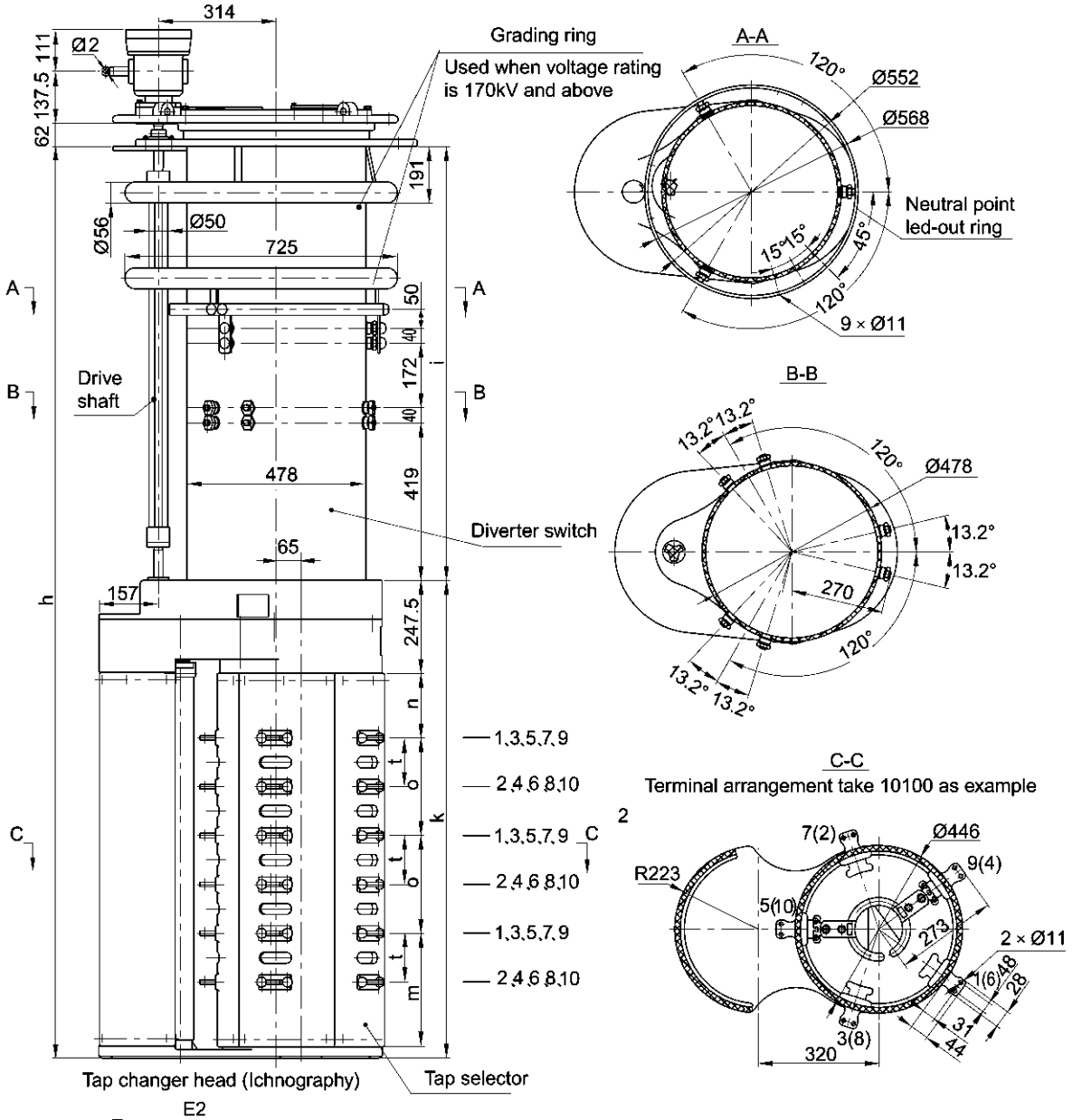


E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

OLTC type		CMDIII400/600-72.5~252/C				CMDIII400/600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2140	2270	2400	2500	2596	2726	2856	2956
	i	805	935	1065	1165	805	935	1065	1165
	k	753				949			
	n	172				237			
	t	130				195			
	m	302				432			
	q	549.5				679.5			
Oil filling dm^3		130	150	170	190	130	150	170	190
Displacement dm^3		170	205	215	225	180	215	225	235
Weight kg		285				290			

Unit: mm

Appendix 7. CMDIII-1000A overall dimensions without change-over selector

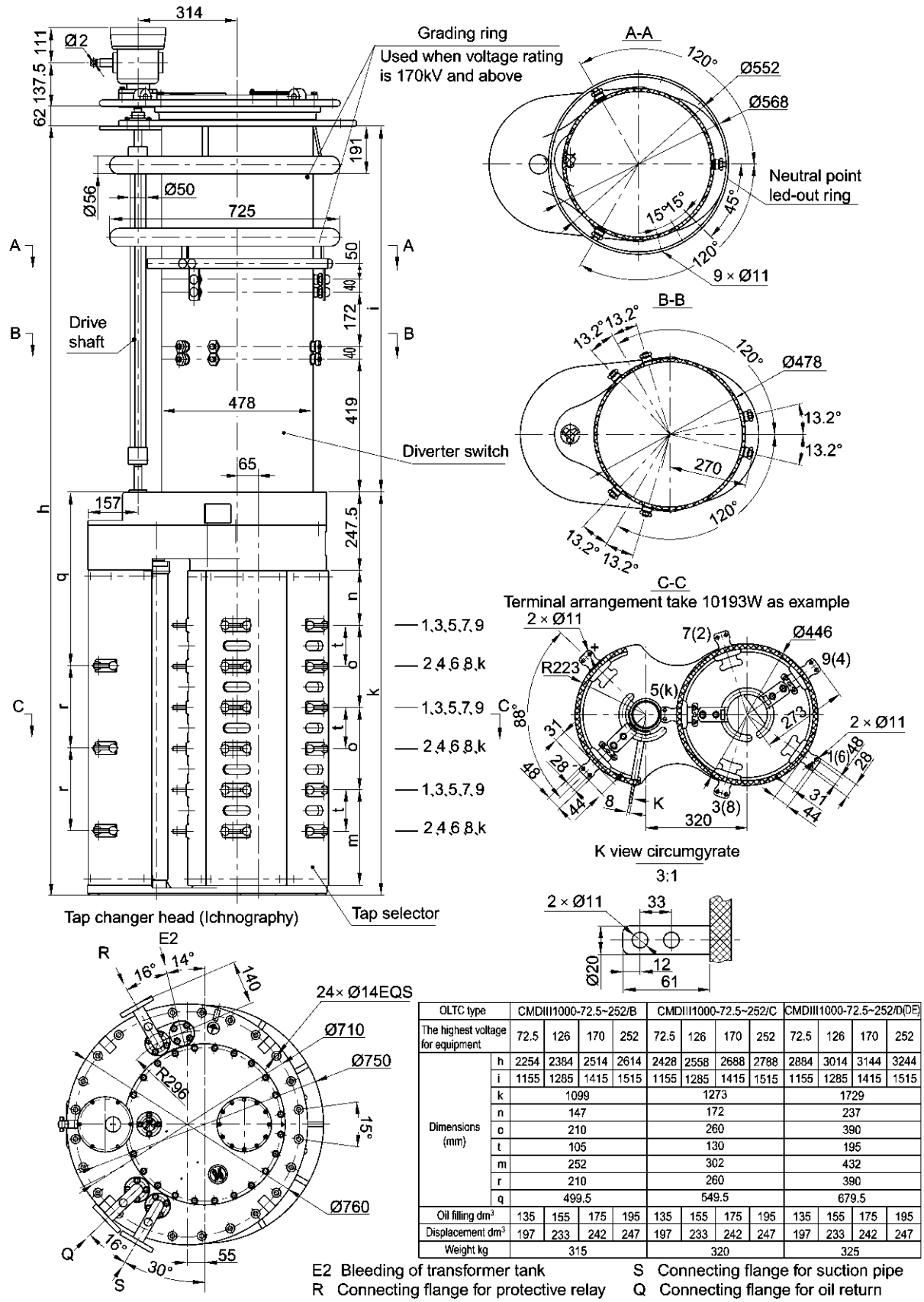


OLTC type		CMDIII1000-72.5~252/B				CMDIII1000-72.5~252/C				CMDIII1000-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2254	2384	2514	2614	2428	2558	2688	2788	2884	3014	3144	3244
	i	1155	1285	1415	1515	1155	1285	1415	1515	1155	1285	1415	1515
	k	1099				1273				1729			
	n	147				172				237			
	o	210				260				390			
	t	105				130				195			
	m	252				302				432			
Oil filling dm^3		135	155	175	195	135	155	175	195	135	155	175	195
Displacement dm^3		192	228	237	242	202	238	242	252	212	248	257	262
Weight kg		305				310				315			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

Appendix 8. CMDIII-1000A overall dimensions with reversing switch

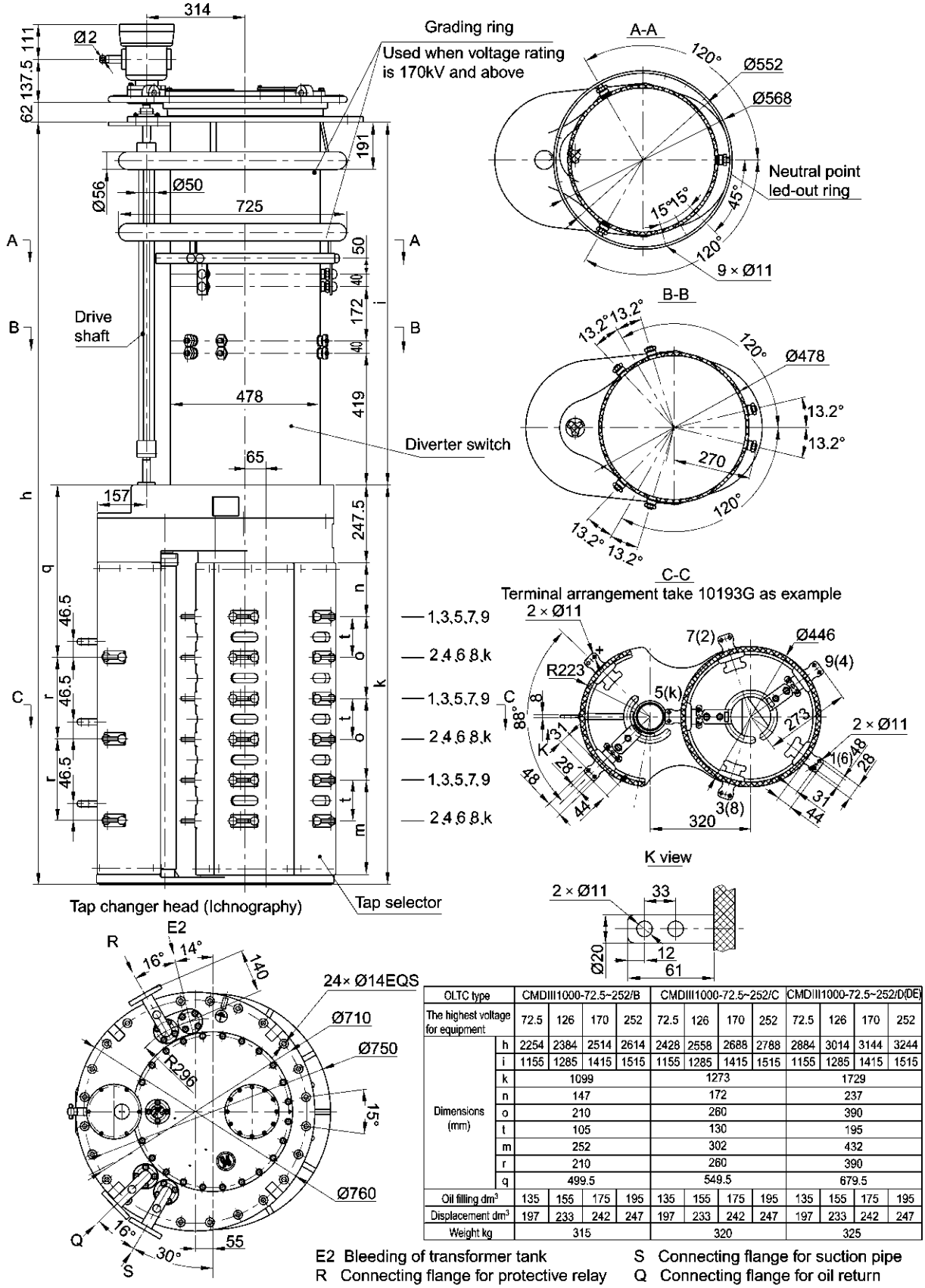


OLTC type		CMDIII1000-72.5~252/B				CMDIII1000-72.5~252/C				CMDIII1000-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2254	2384	2514	2614	2428	2558	2688	2788	2884	3014	3144	3244
	i	1155	1285	1415	1515	1155	1285	1415	1515	1155	1285	1415	1515
	k	1099				1273				1729			
	n	147				172				237			
	o	210				260				390			
	t	105				130				195			
	m	252				302				432			
	r	210				260				390			
	q	499.5				549.5				679.5			
Oil filling dm^3		135	155	175	195	135	155	175	195	135	155	175	195
Displacement dm^3		197	233	242	247	197	233	242	247	197	233	242	247
Weight kg		315				320				325			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

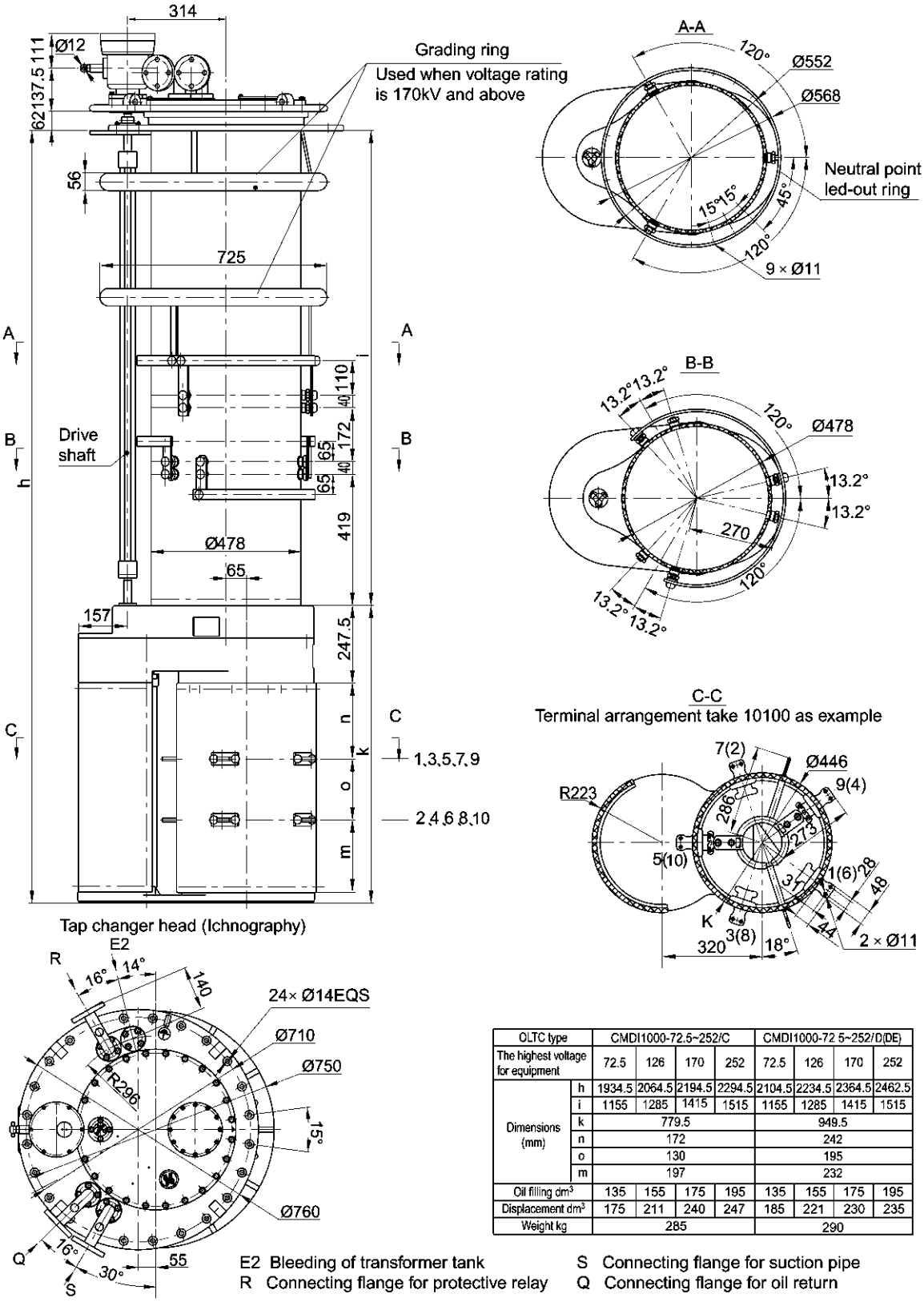
Appendix 9. CMDIII-1000A overall dimensions with coarse change-over selector



OLTC type		CMDIII1000-72.5~252/B				CMDIII1000-72.5~252/C				CMDIII1000-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2254	2384	2514	2614	2428	2558	2688	2788	2884	3014	3144	3244
	i	1155	1285	1415	1515	1155	1285	1415	1515	1155	1285	1415	1515
	k	1099				1273				1729			
	n	147				172				237			
	o	210				260				390			
	t	105				130				195			
	m	252				302				432			
	r	210				260				390			
	q	499.5				549.5				679.5			
Oil filling dm³		135	155	175	195	135	155	175	195	135	155	175	195
Displacement dm³		197	233	242	247	197	233	242	247	197	233	242	247
Weight kg		315				320				325			

Unit: mm

Appendix 10. CMDI-1000A overall dimensions without change-over selector

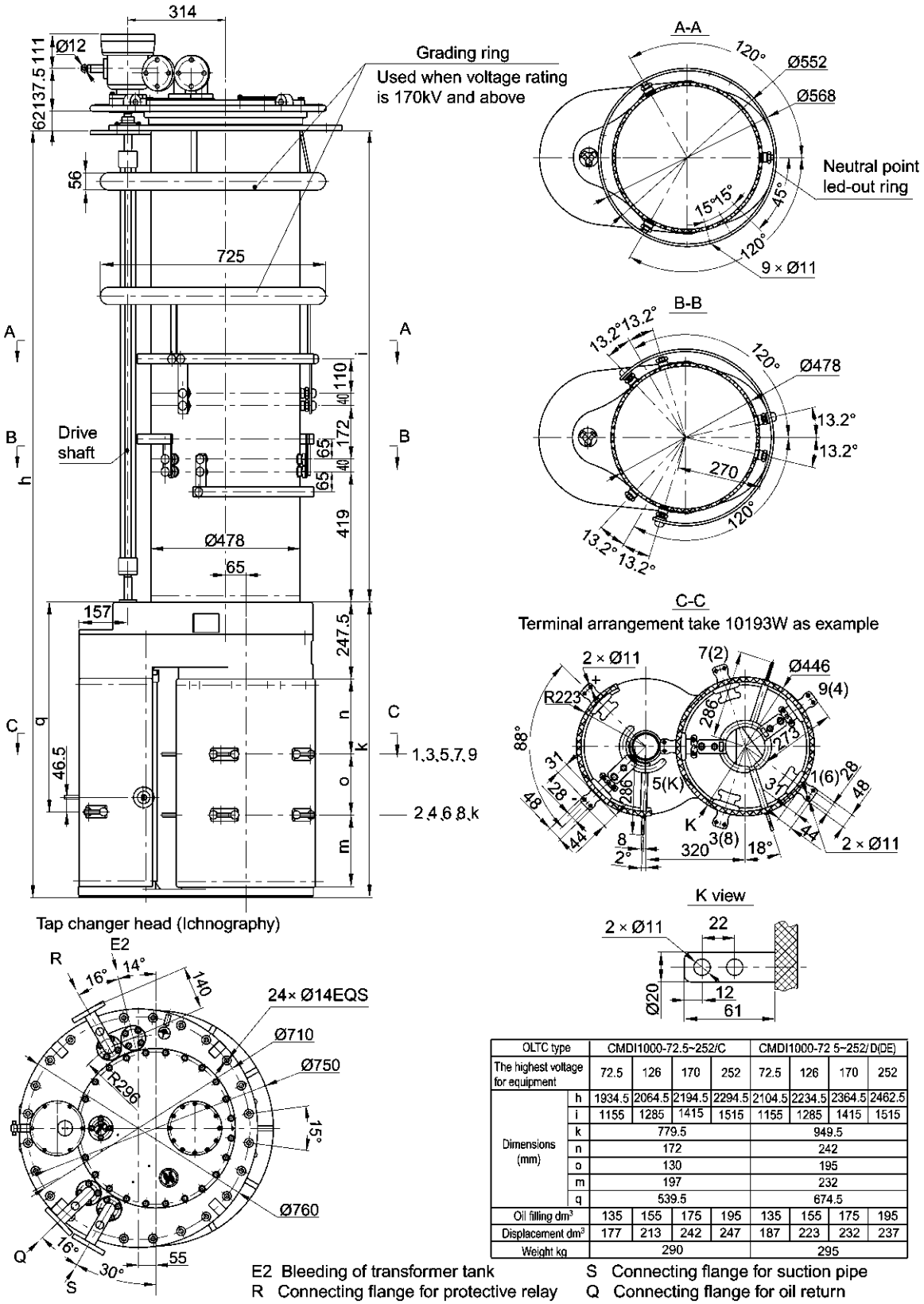


OLTC type		CMDI1000-72.5~252/C				CMDI1000-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	1934.5	2064.5	2194.5	2294.5	2104.5	2234.5	2364.5	2462.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	779.5				949.5			
	n	172				242			
	o	130				195			
	m	197				232			
Oil filling dm^3		135	155	175	195	135	155	175	195
Displacement dm^3		175	211	240	247	185	221	230	235
Weight kg		285				290			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

Appendix 11. CMDI-1000A overall dimensions with reversing switch

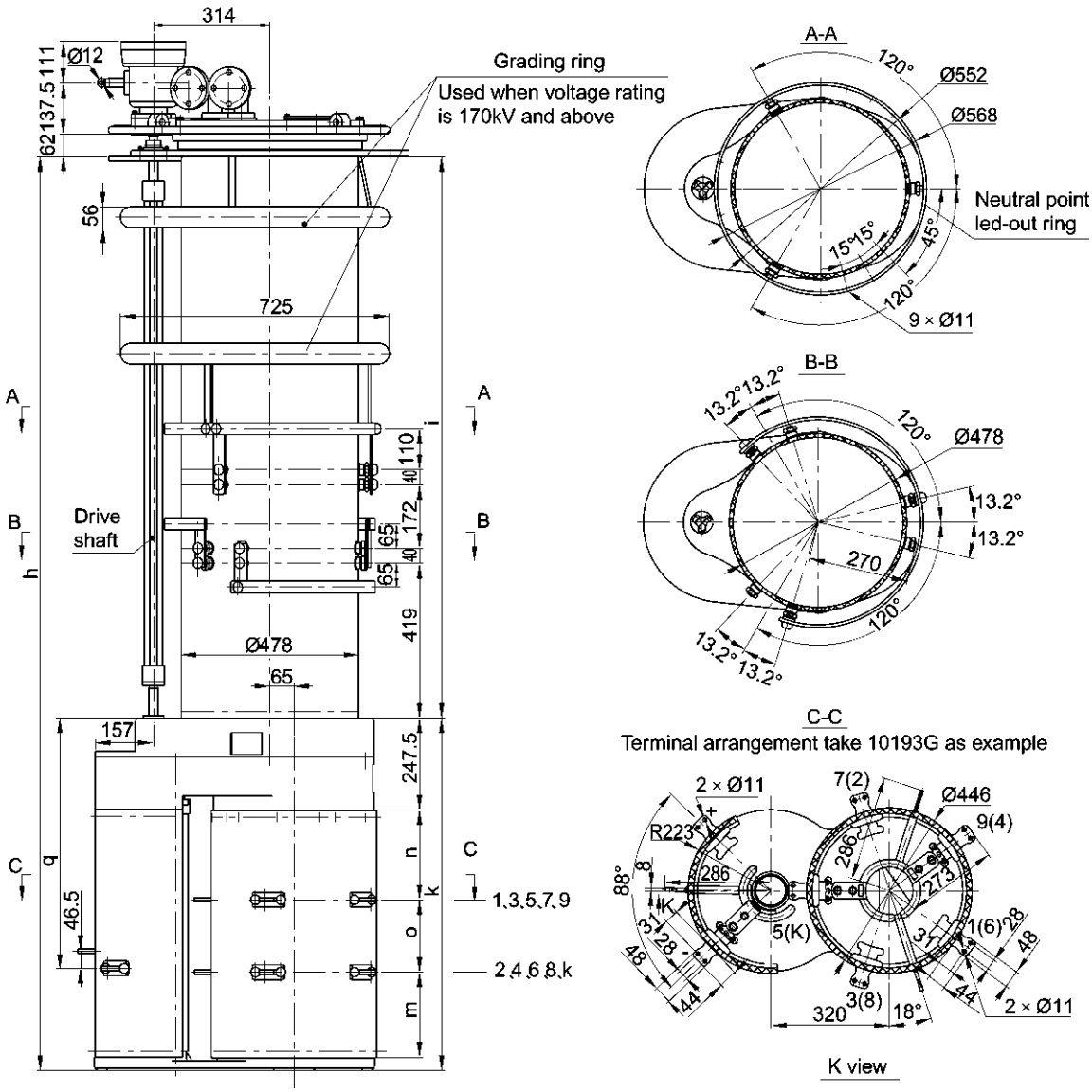


OLTC type		CMDI1000-72.5~252/C				CMDI1000-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	1934.5	2064.5	2194.5	2294.5	2104.5	2234.5	2364.5	2462.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	779.5				949.5			
	n	172				242			
	o	130				195			
	m	197				232			
	q	539.5				674.5			
Oil filling dm^3		135	155	175	195	135	155	175	195
Displacement dm^3		177	213	242	247	187	223	232	237
Weight kg		290				295			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

Appendix 12. CMDI-1000A overall dimensions with coarse change-over selector

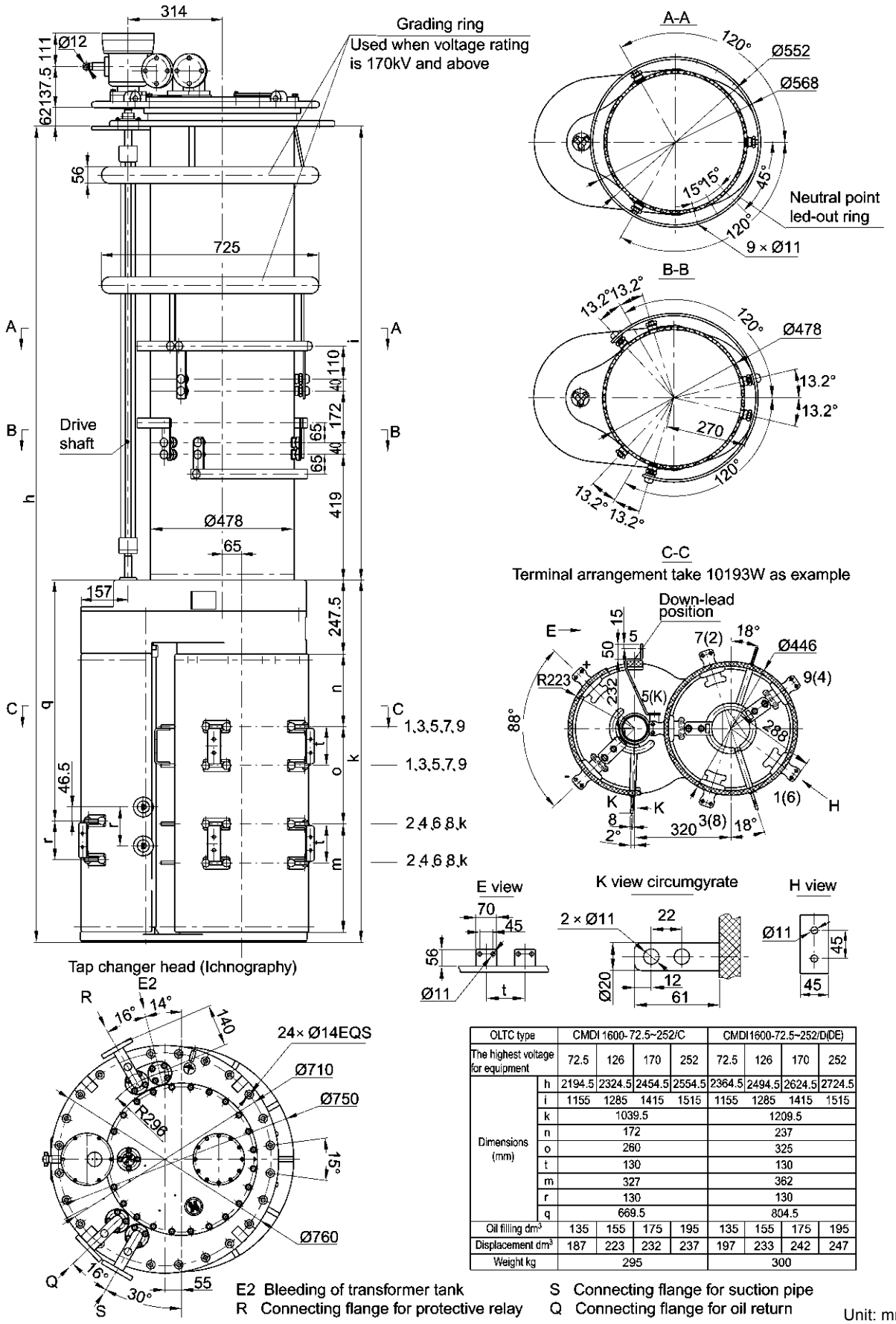


OLTC type		CMDI1000-72.5~252/C				CMDI1000-72 5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	1934.5	2064.5	2194.5	2294.5	2104.5	2234.5	2364.5	2462.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	779.5				949.5			
	n	172				242			
	o	130				195			
	m	197				232			
	q	539.5				674.5			
Oil filling dm³		135	155	175	195	135	155	175	195
Displacement dm³		177	213	242	247	187	223	232	237
Weight kg		290				295			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

Appendix 13. CMDI-1600A overall dimensions without change-over selector

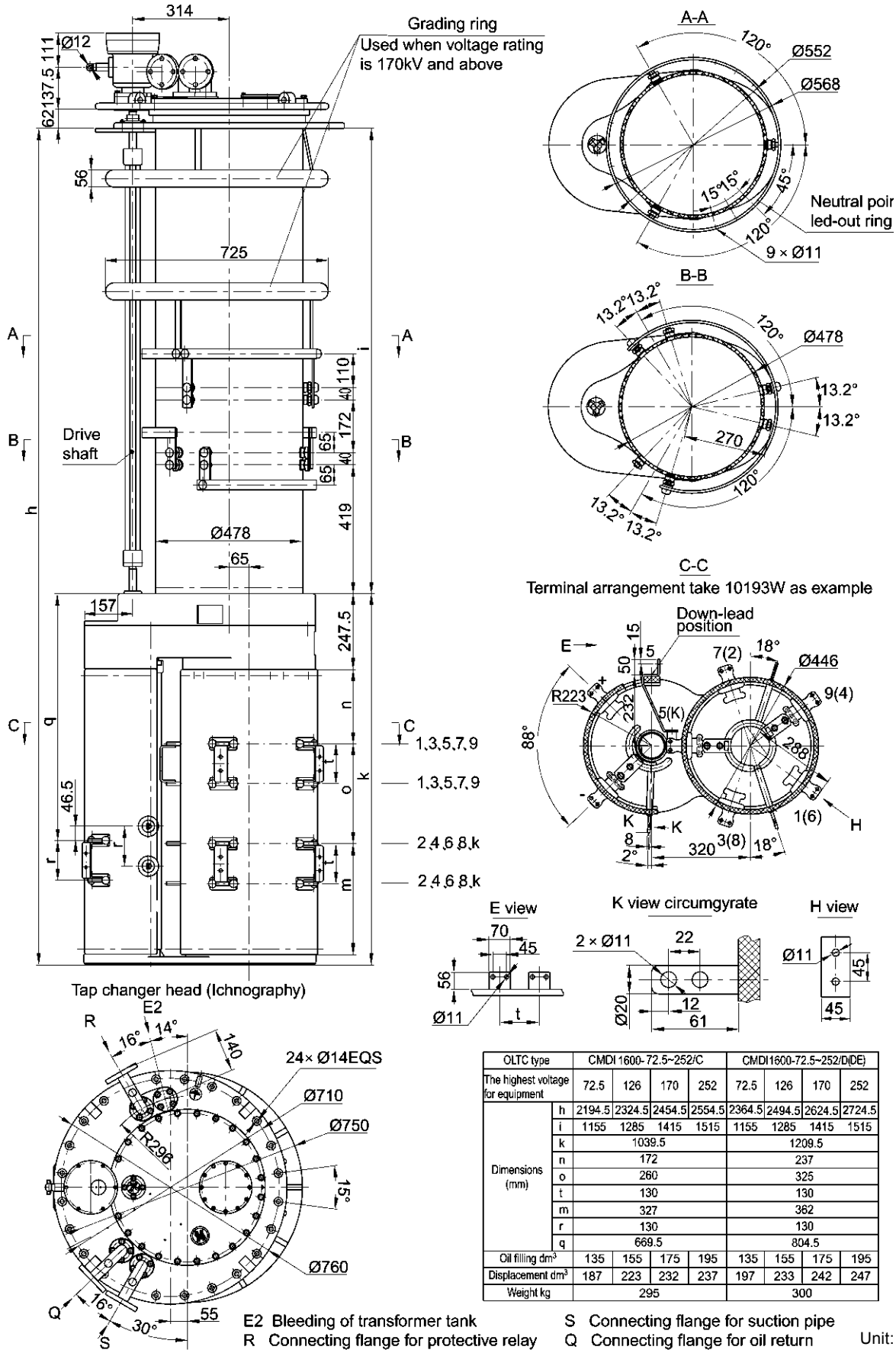


OLTC type		CMDI 1600-72.5~252/C				CMDI1600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2194.5	2324.5	2454.5	2554.5	2364.5	2494.5	2624.5	2724.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	1039.5				1209.5			
	n	172				237			
	o	260				325			
	t	130				130			
	m	327				362			
	r	130				130			
	q	669.5				804.5			
Oil filling dm³		135	155	175	195	135	155	175	195
Displacement dm³		187	223	232	237	197	233	242	247
Weight kg		295				300			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

Appendix 14. CMDI-1600A overall dimensions with reversing switch

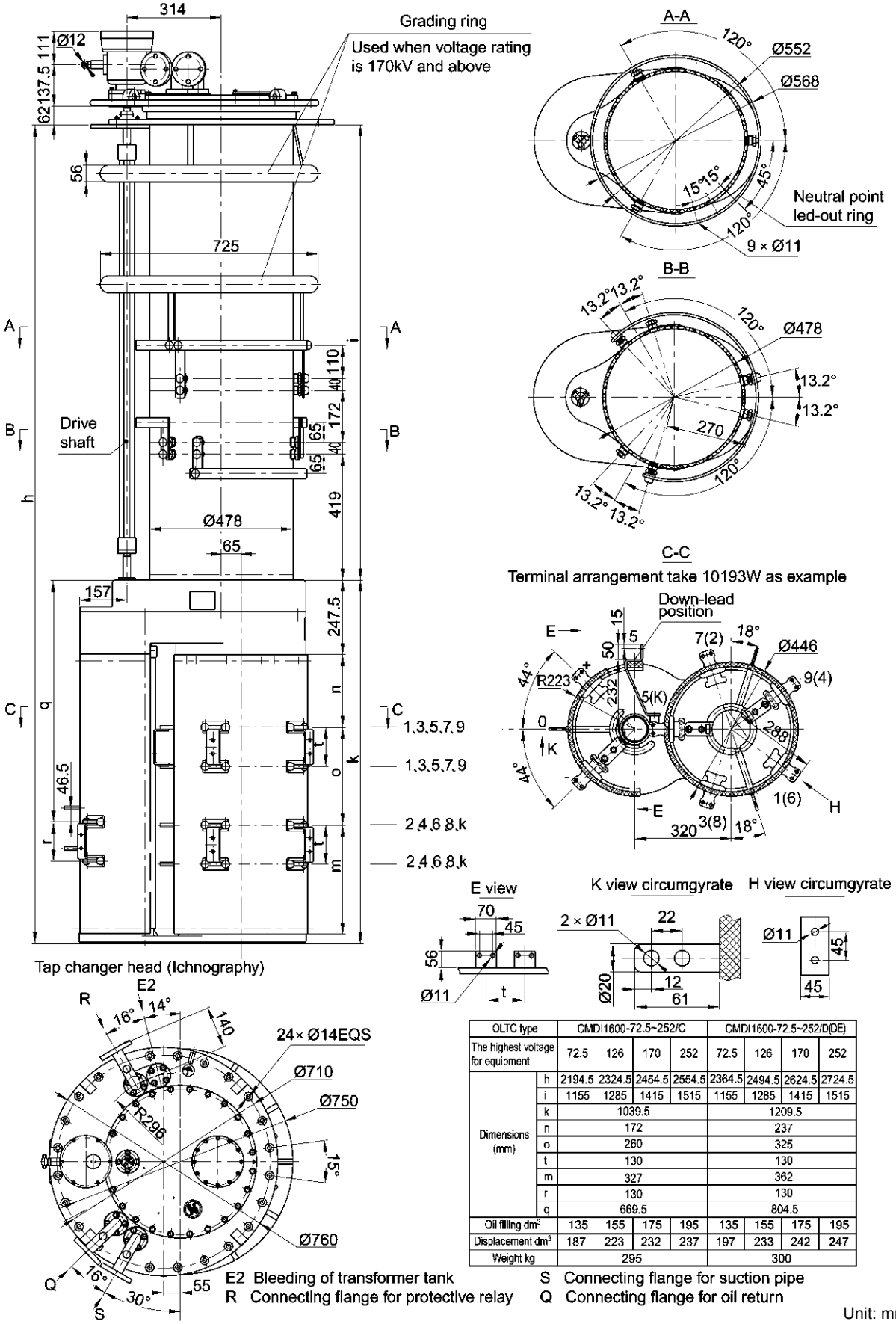


OLTC type		CMDI 1600-72.5~252/C				CMDI1600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2194.5	2324.5	2454.5	2554.5	2364.5	2494.5	2624.5	2724.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	1039.5				1209.5			
	n	172				237			
	o	260				325			
	t	130				130			
	m	327				362			
	r	130				130			
	q	669.5				804.5			
Oil filling dm^3		135	155	175	195	135	155	175	195
Displacement dm^3		187	223	232	237	197	233	242	247
Weight kg		295				300			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

Appendix 15. CMDI-1600A overall dimensions with coarse change-over selector

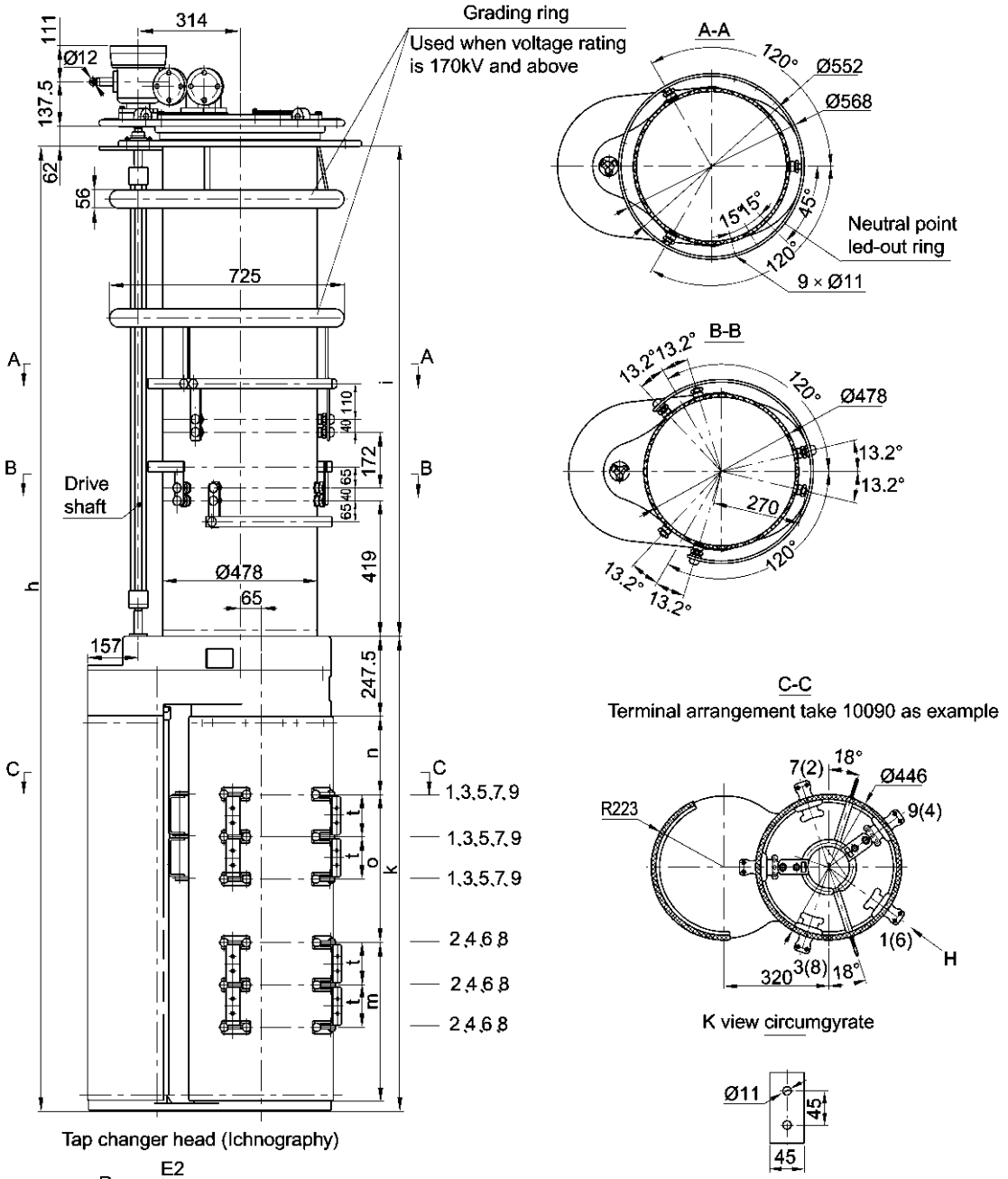


OLTC type		CMDI1600-72.5~252/C				CMDI1600-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2194.5	2324.5	2454.5	2554.5	2364.5	2494.5	2624.5	2724.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	1039.5				1209.5			
	n	172				237			
	o	260				325			
	t	130				130			
	m	327				362			
	r	130				130			
	q	669.5				804.5			
Oil filling dm³		135	155	175	195	135	155	175	195
Displacement dm³		187	223	232	237	197	233	242	247
Weight kg		295				300			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

Appendix 16. CMDI-2400A overall dimensions without change-over selector

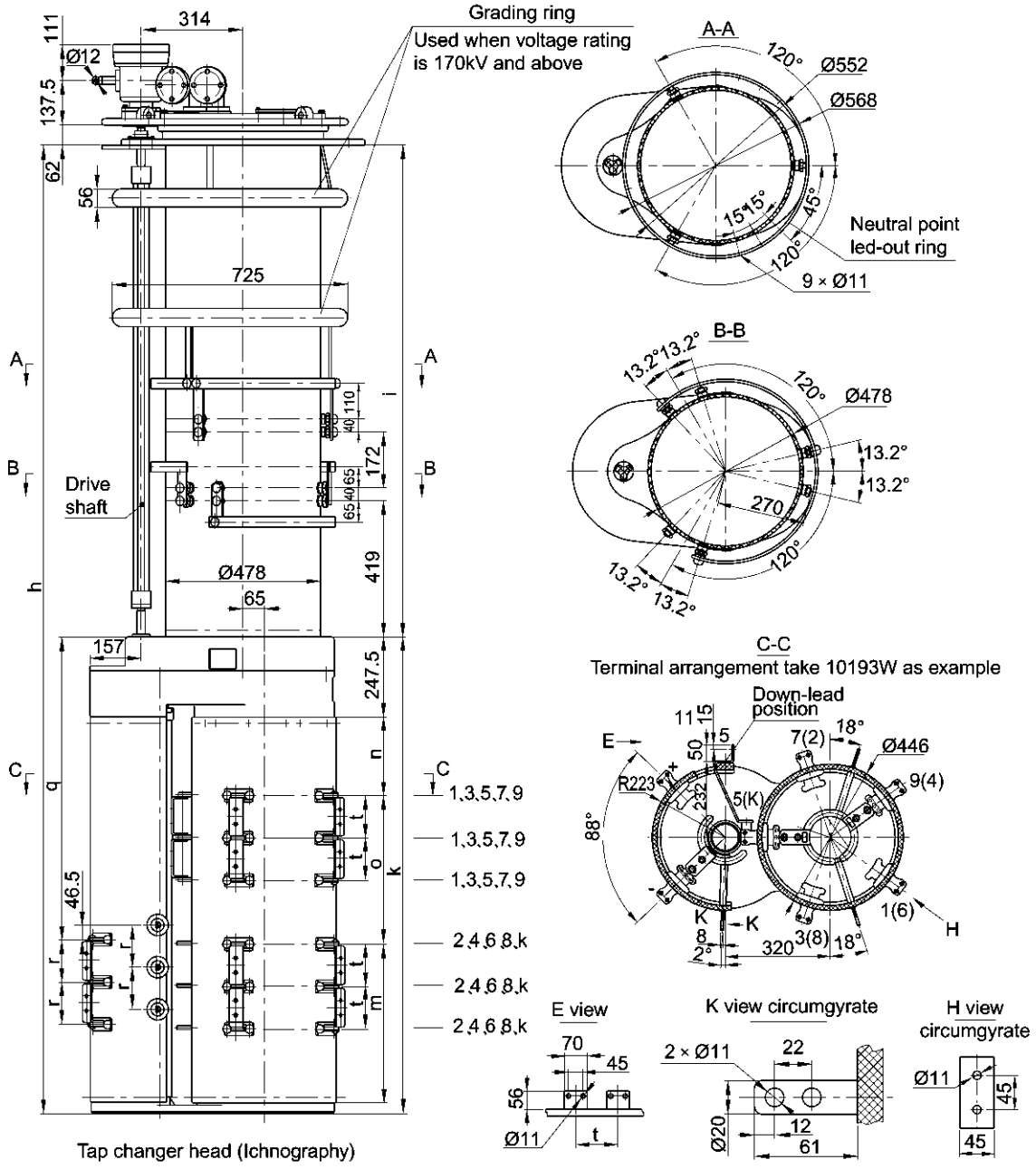


OLTC type		CMDI 2400-72.5~252/C				CMDI2400-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2454.5	2584.5	2714.5	2814.5	2624.5	2754.5	2884.5	2984.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	1299.5				1469.5			
	n	172				242			
	o	390				455			
	t	130				130			
	m	457				492			
Oil filling dm^3		135	155	175	195	135	155	175	195
Displacement dm^3		205	238	247	252	212	248	257	262
Weight kg		290				295			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Unit: mm

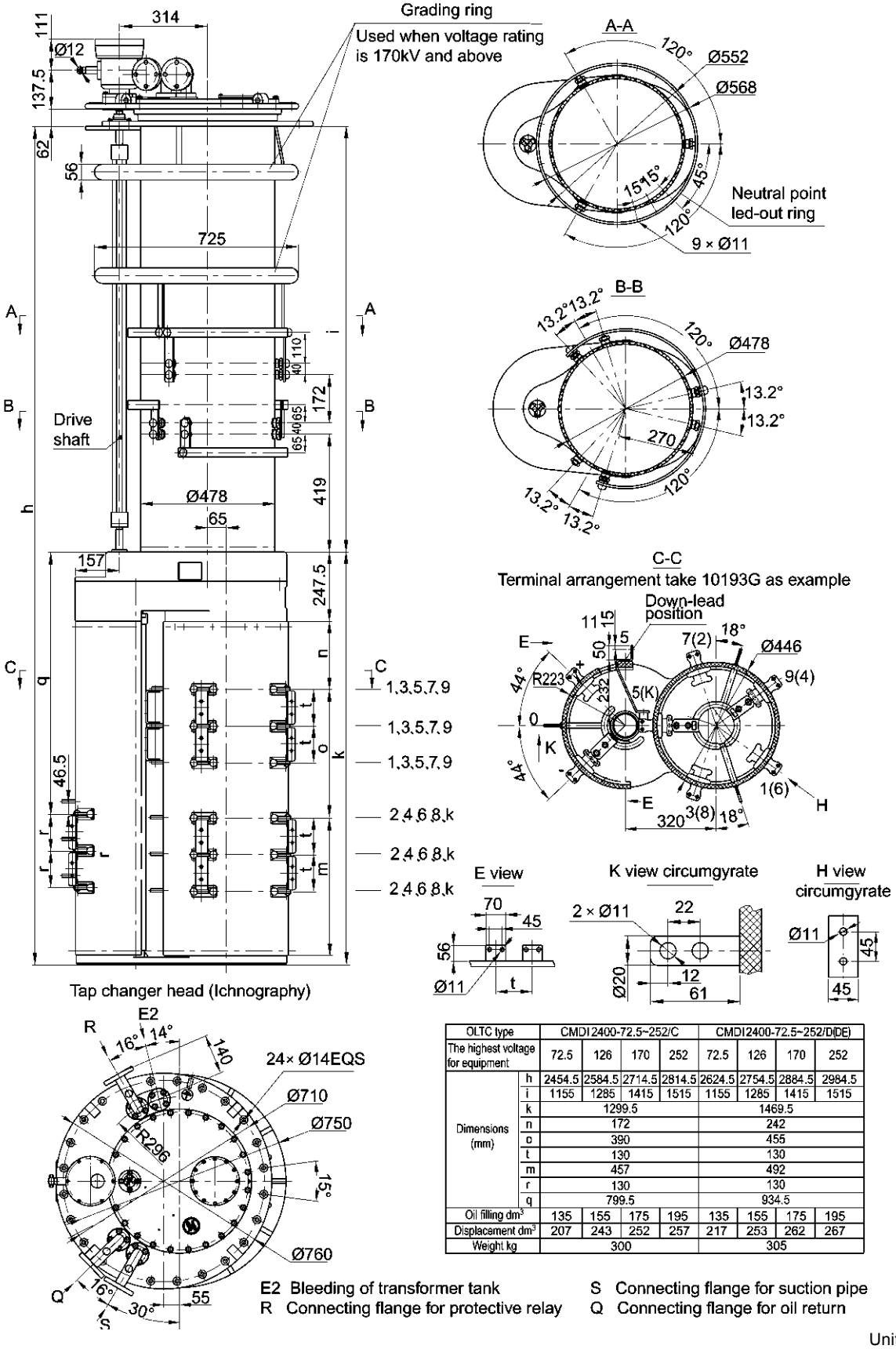
Appendix 17. CMDI-2400A overall dimensions with reversing switch



OLTC type		CMDI2400-72.5~252/C				CMDI2400-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2454.5	2584.5	2714.5	2814.5	2624.5	2754.5	2884.5	2984.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	1299.5				1469.5			
	n	172				242			
	o	390				455			
	t	130				130			
	m	457				492			
	r	130				130			
	q	799.5				934.5			
Oil filling dm³		135	155	175	195	135	155	175	195
Displacement dm³		207	243	252	257	217	253	262	267
Weight kg		300				305			

Unit: mm

Appendix 18. CMDI-2400A overall dimensions with coarse change-over selector



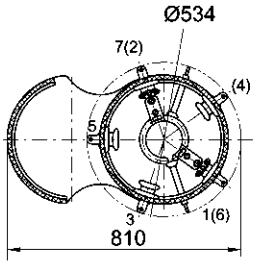
OLTC type		CMDI2400-72.5~252/C				CMDI2400-72.5~252/D(DE)			
The highest voltage for equipment		72.5	126	170	252	72.5	126	170	252
Dimensions (mm)	h	2454.5	2584.5	2714.5	2814.5	2624.5	2754.5	2884.5	2984.5
	i	1155	1285	1415	1515	1155	1285	1415	1515
	k	1299.5				1469.5			
	n	172				242			
	o	390				455			
	t	130				130			
	m	457				492			
	r	130				130			
	q	799.5				934.5			
Oil filling dm^3		135	155	175	195	135	155	175	195
Displacement dm^3		207	243	252	257	217	253	262	267
Weight kg		300				305			

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

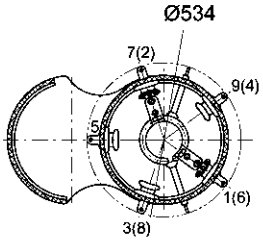
Unit: mm

Appendix 19. CMD tap selector contacts arrangement

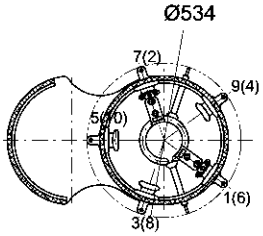
Without change-over selector



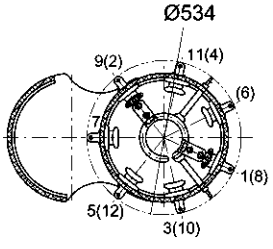
10070



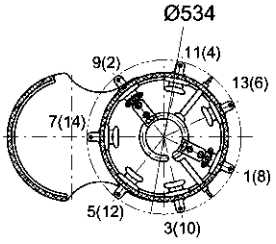
10090



10100

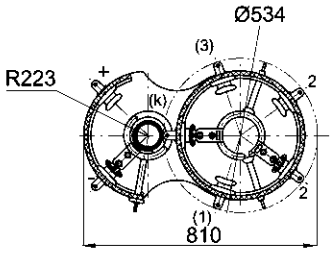


14120

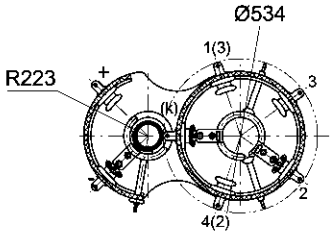


14140

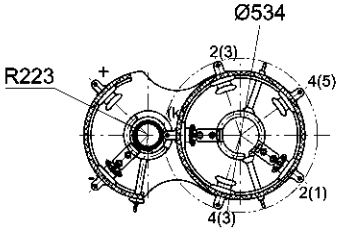
With reversing switch



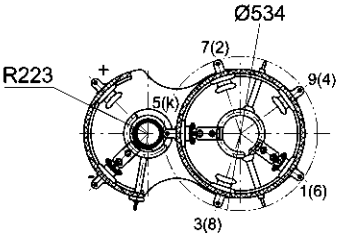
10051W



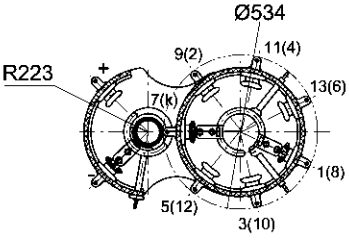
10071W



10091W

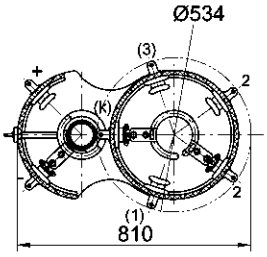


10191W

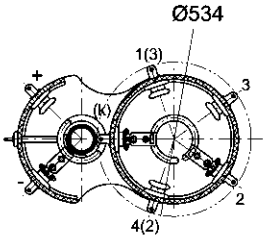


14271W

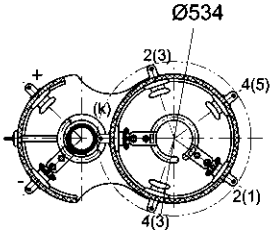
With coarse change-over selector



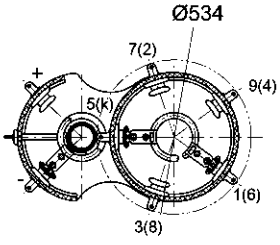
10051G



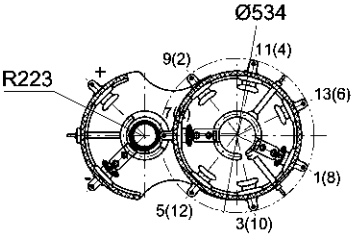
10071G



10091G



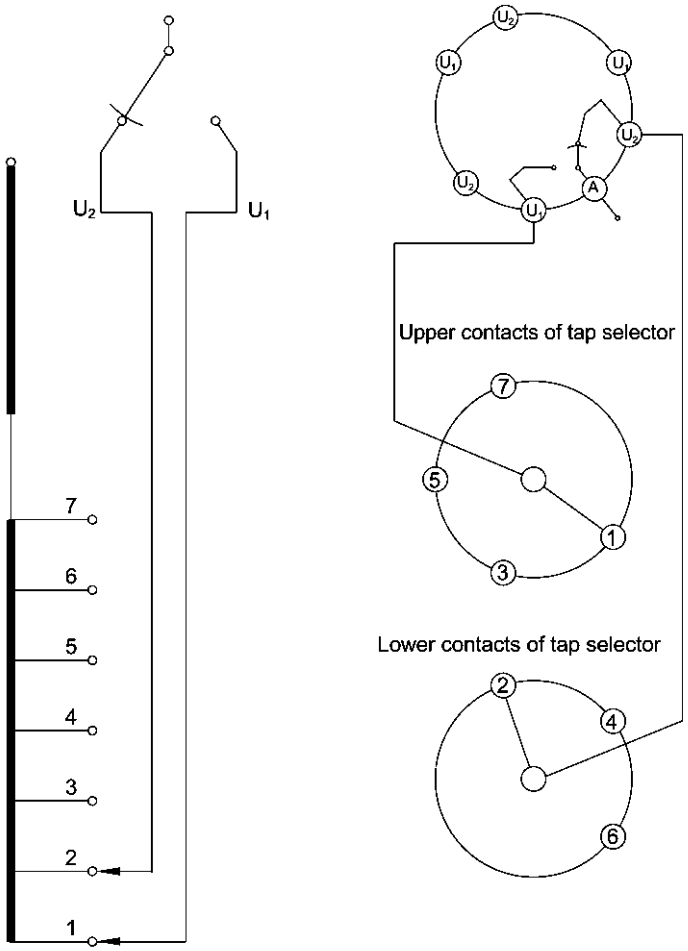
10191G



14271G

Unit: mm

Appendix 20. CMD (10070) operating position table and connection diagram

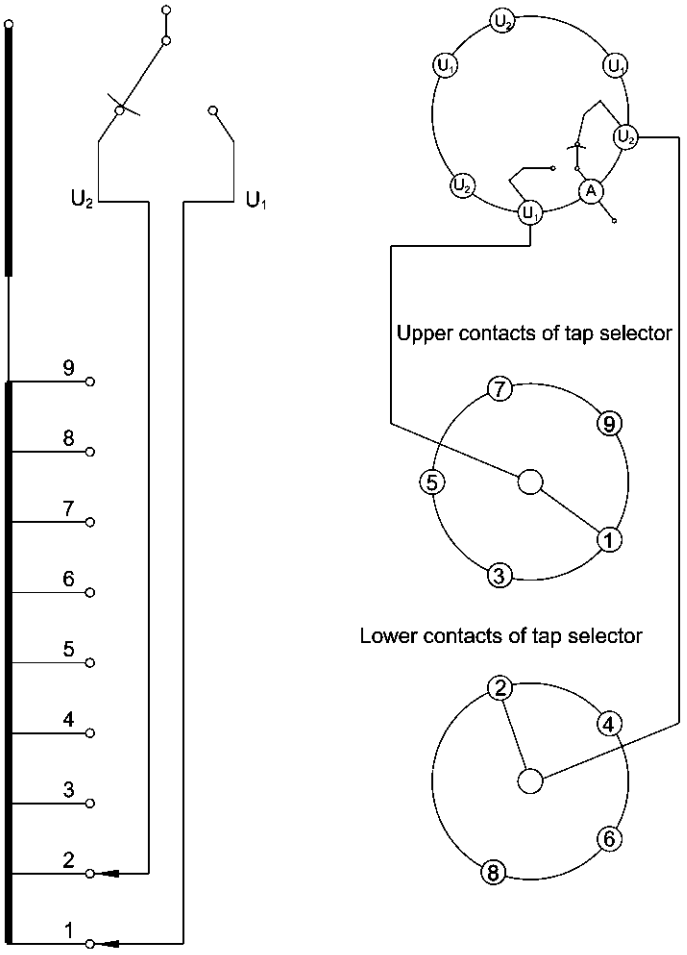


Operation position number	7
Different voltage number	7
Set position ●	4

Tap selector contact position	1	2	3	4	5	6	7
Display position	1	2	3	4	5	6	7

● Drawing is shown at the set position

Appendix 21. CMD (10090) operating position table and connection diagram

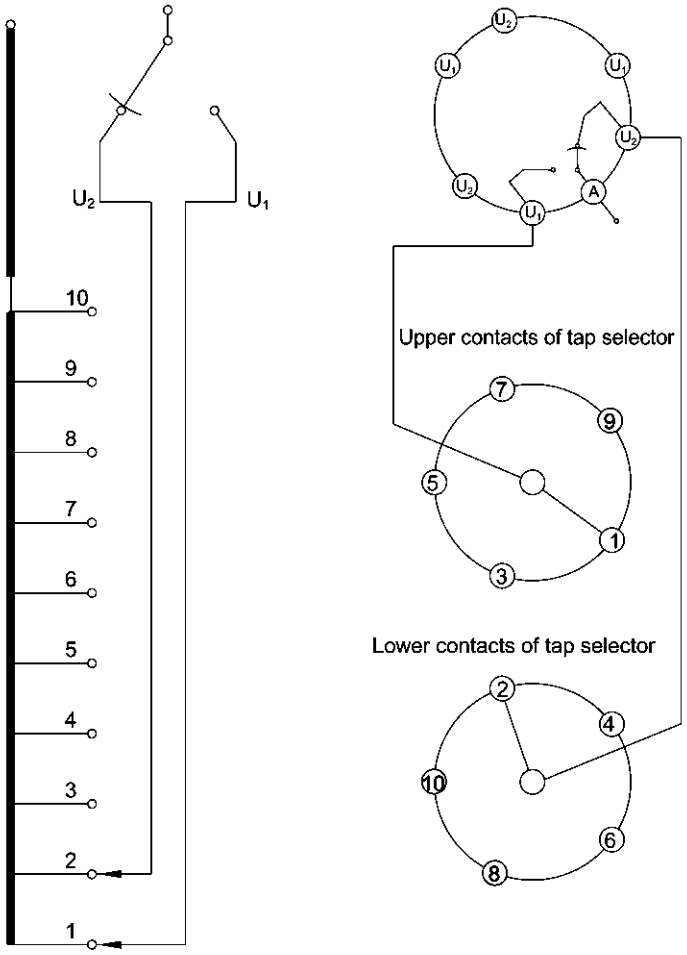


Operation position number	9
Different voltage number	9
Set position●	5

Tap selector contact position	1	2	3	4	5	6	7	8	9
Display position	1	2	3	4	5	6	7	8	9

● Drawing is shown at the set position

Appendix 22. CMD (10100) operating position table and connection diagram

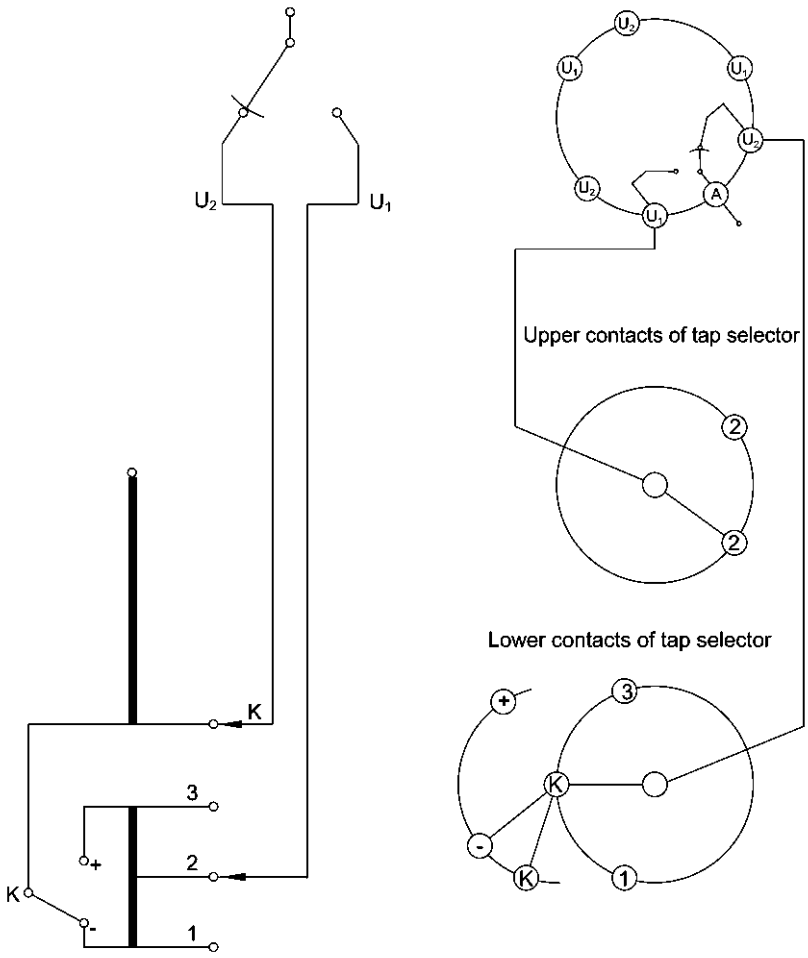


Operation position number	10
Different voltage number	10
Set position●	6

Tap selector contact position	1	2	3	4	5	6	7	8	9	10
Display position	1	2	3	4	5	6	7	8	9	10

● Drawing is shown at the set position

Appendix 23. CMD (10051W) operating position table and connection diagram



Please connect terminal 1 and "-", 3 and "+", 2 and 2 in the same phase.

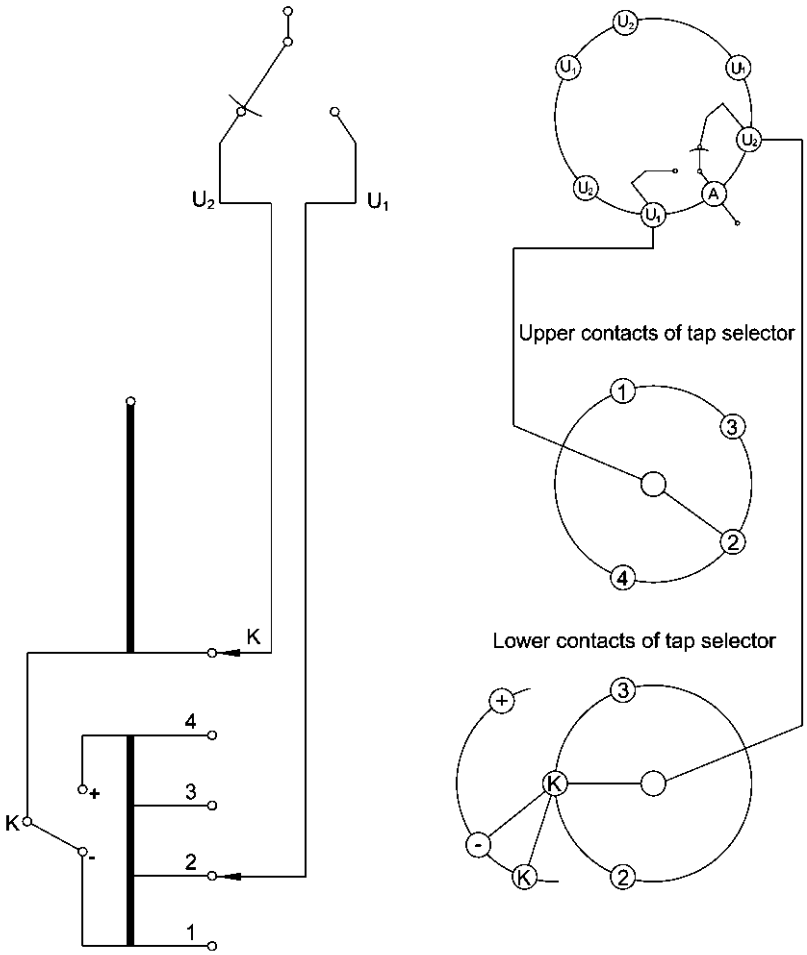
Operation position number	5
Different voltage number	5
Set position●	3

Change-over selector	←K+			←K-	
Tap selector contact position	1	2	K	2	3
Display position	1	2	3	4	5

●←

● Drawing is shown at the set position

Appendix 24. CMD (10071W) operating position table and connection diagram



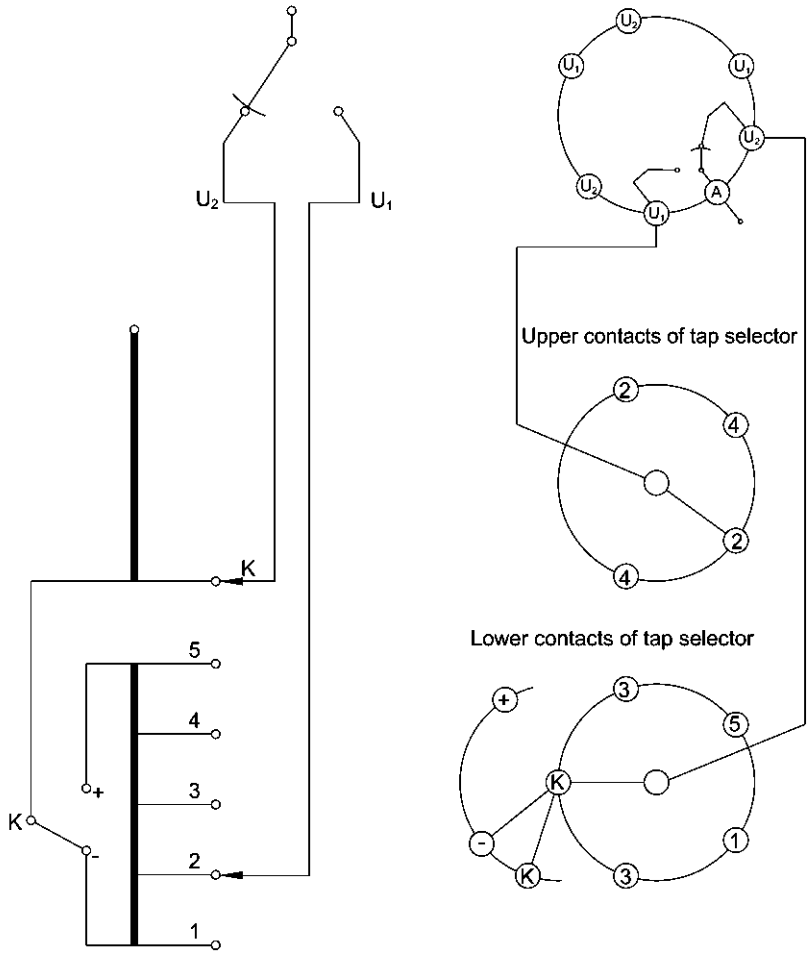
Please connect terminal 1 and "-", 4 and "+", 2 and 2, 3 and 3 in the same phase.

Operation position number	7
Different voltage number	7
Set position ●	4

Change-over selector	←K+				K-→		
Tap selector contact position	1	2	3	K	2	3	4
Display position	1	2	3	4	5	6	7

● Drawing is shown at the set position

Appendix 25. CMD (10091W) operating position table and connection diagram



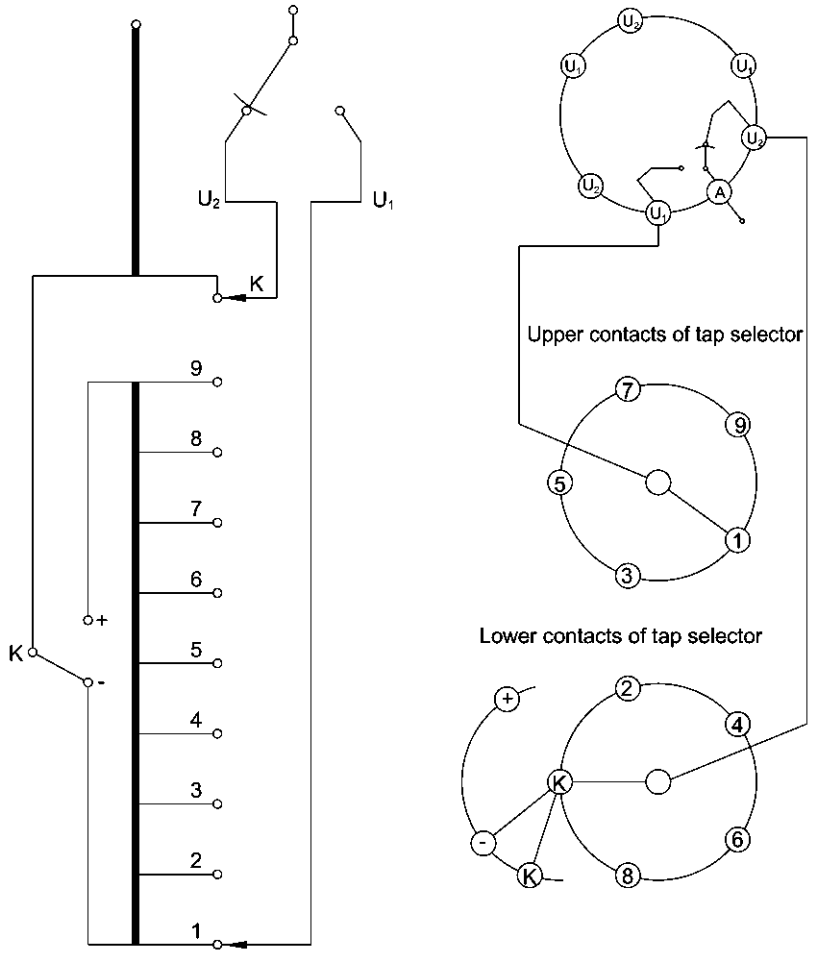
Please connect terminal 1 and "-", 5 and "+", 2 and 2, 3 and 3, 4 and 4 in the same phase.

Operation position number	9
Different voltage number	9
Set position●	5

Change-over selector	← K+ →				← K- →				
Tap selector contact position	1	2	3	4	K	2	3	4	5
Display position	1	2	3	4	5	6	7	8	9

● Drawing is shown at the set position

Appendix 26. CMD (10193W) operating position table and connection diagram

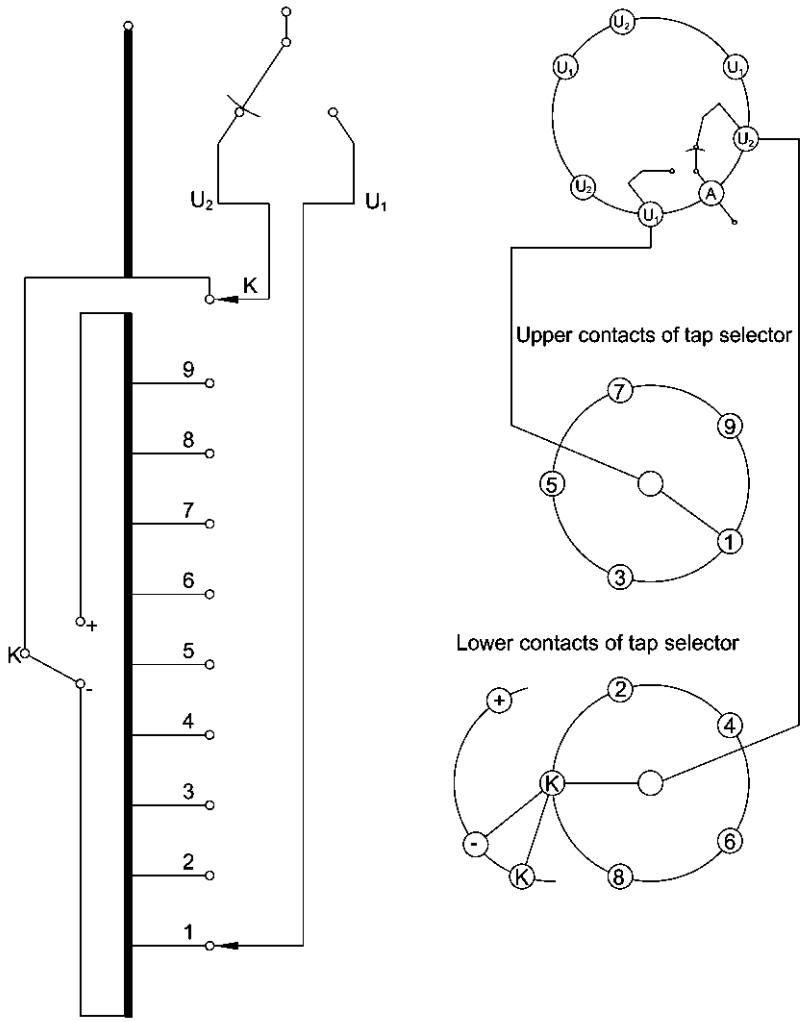


Operation position number	19
Different voltage number	17
Set position●	9b

Change-over selector	K+										K-								
Tap selector contact position	1	2	3	4	5	6	7	8	9	K	1	2	3	4	5	6	7	8	9
Display position	1	2	3	4	5	6	7	8	9a	9b	9c	10	11	12	13	14	15	16	17

● Drawing is shown at the set position

Appendix 27. CMD (10191W) operating position table and connection diagram

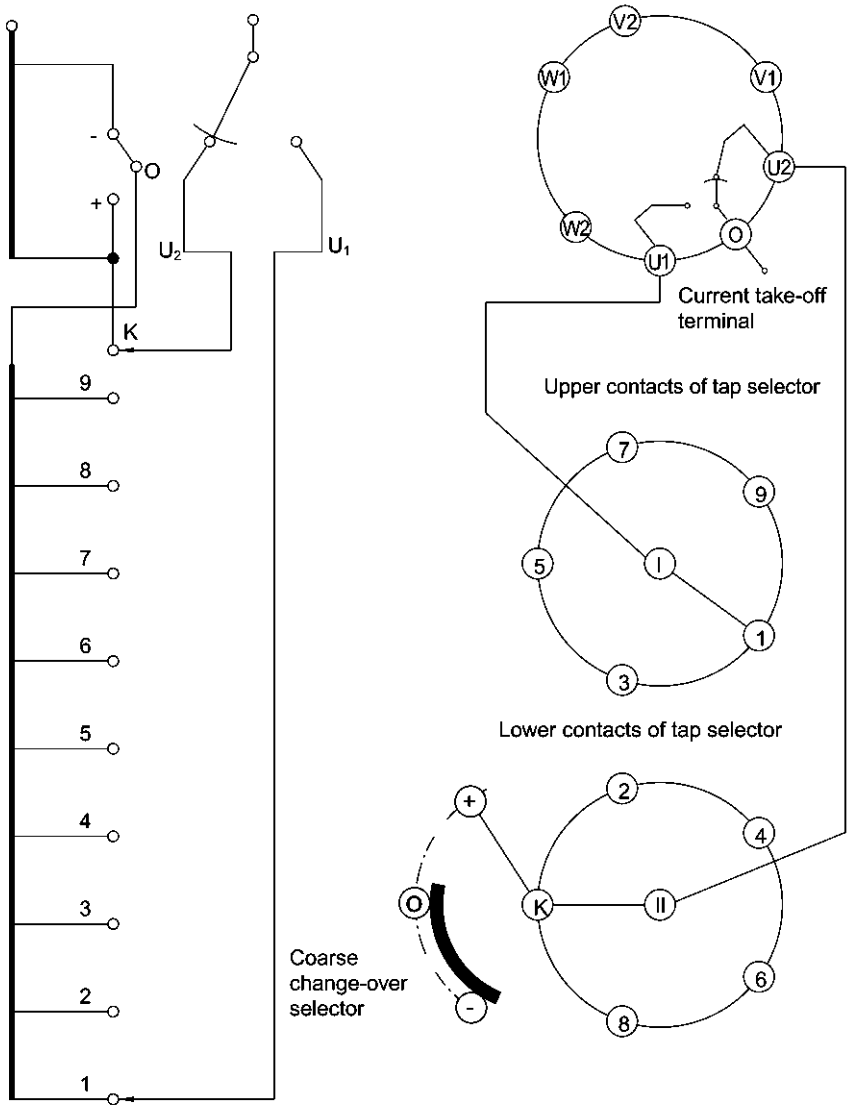


Operation position number	19
Different voltage number	19
Set position●	10

Change-over selector	K+										K-								
Tap selector contact position	1	2	3	4	5	6	7	8	9	K	1	2	3	4	5	6	7	8	9
Display position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

● Drawing is shown at the set position

Appendix 28. CMD (10191G) operating position table and connection diagram

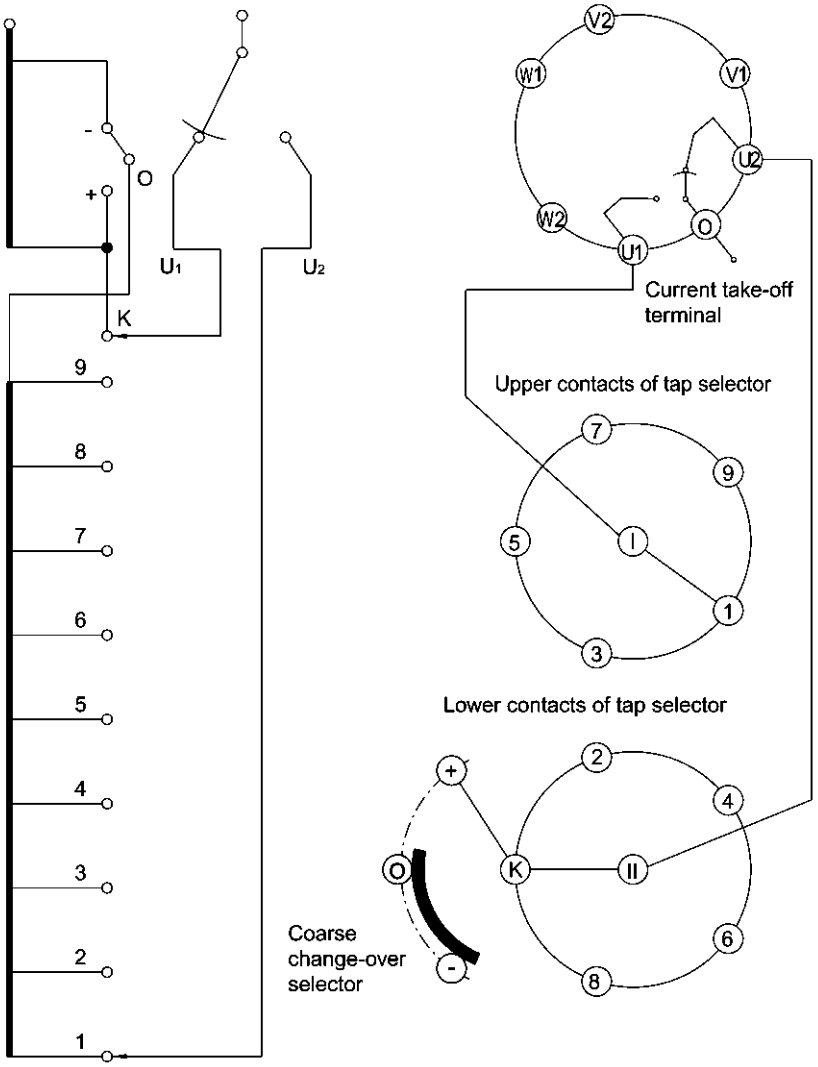


Operation position number	19
Different voltage number	19
Set position ●	10

Change-over selector	← O+ →									← O- →									
Tap selector contact position	1	2	3	4	5	6	7	8	9	K	1	2	3	4	5	6	7	8	9
Display position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
										● ←									

● Drawing is shown at the set position

Appendix 29. CMD (10193G) operating position table and connection diagram

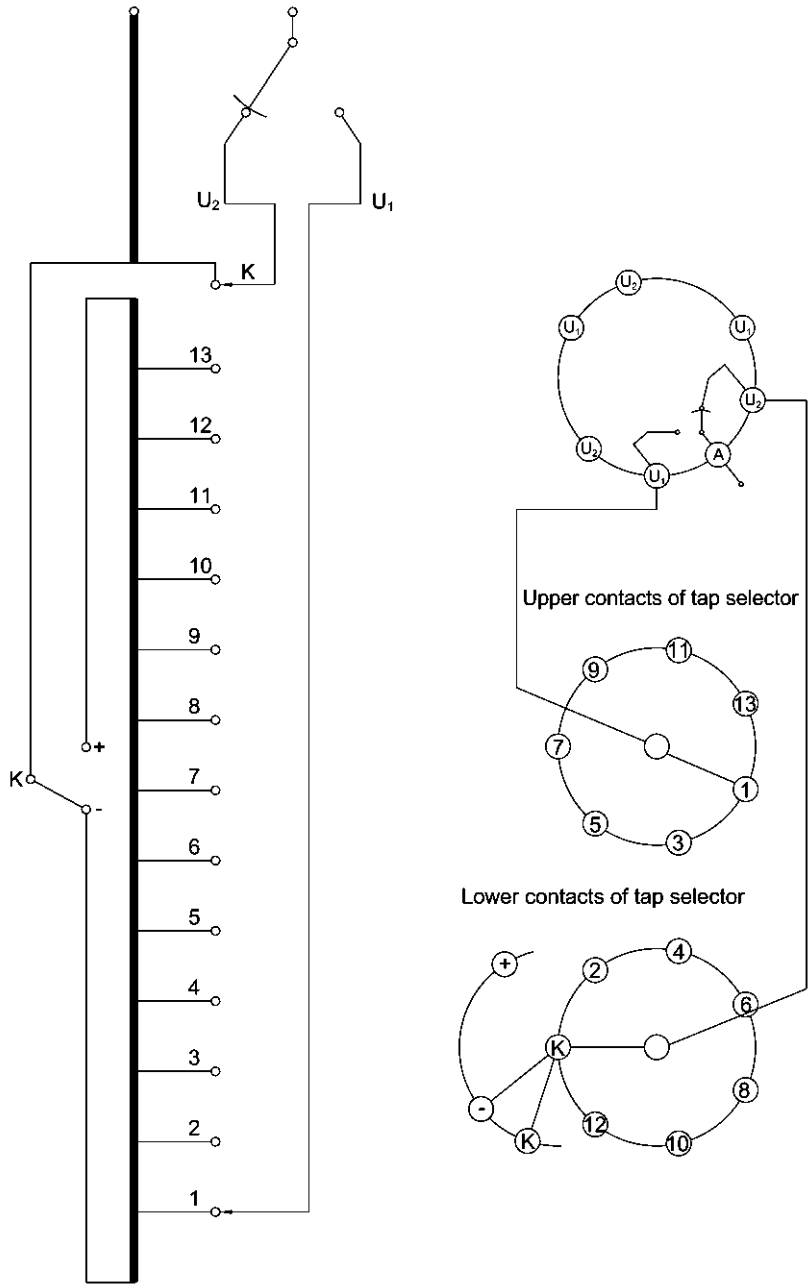


Operation position number	19
Different voltage number	17
Set position●	9b

Change-over selector	← O+ →										← O- →								
Tap selector contact position	1	2	3	4	5	6	7	8	9	K	1	2	3	4	5	6	7	8	9
Display position	1	2	3	4	5	6	7	8	9a	9b	9c	10	11	12	13	14	15	16	17

●← Drawing is shown at the set position

Appendix 30. CMD (14271W) operating position table and connection diagram

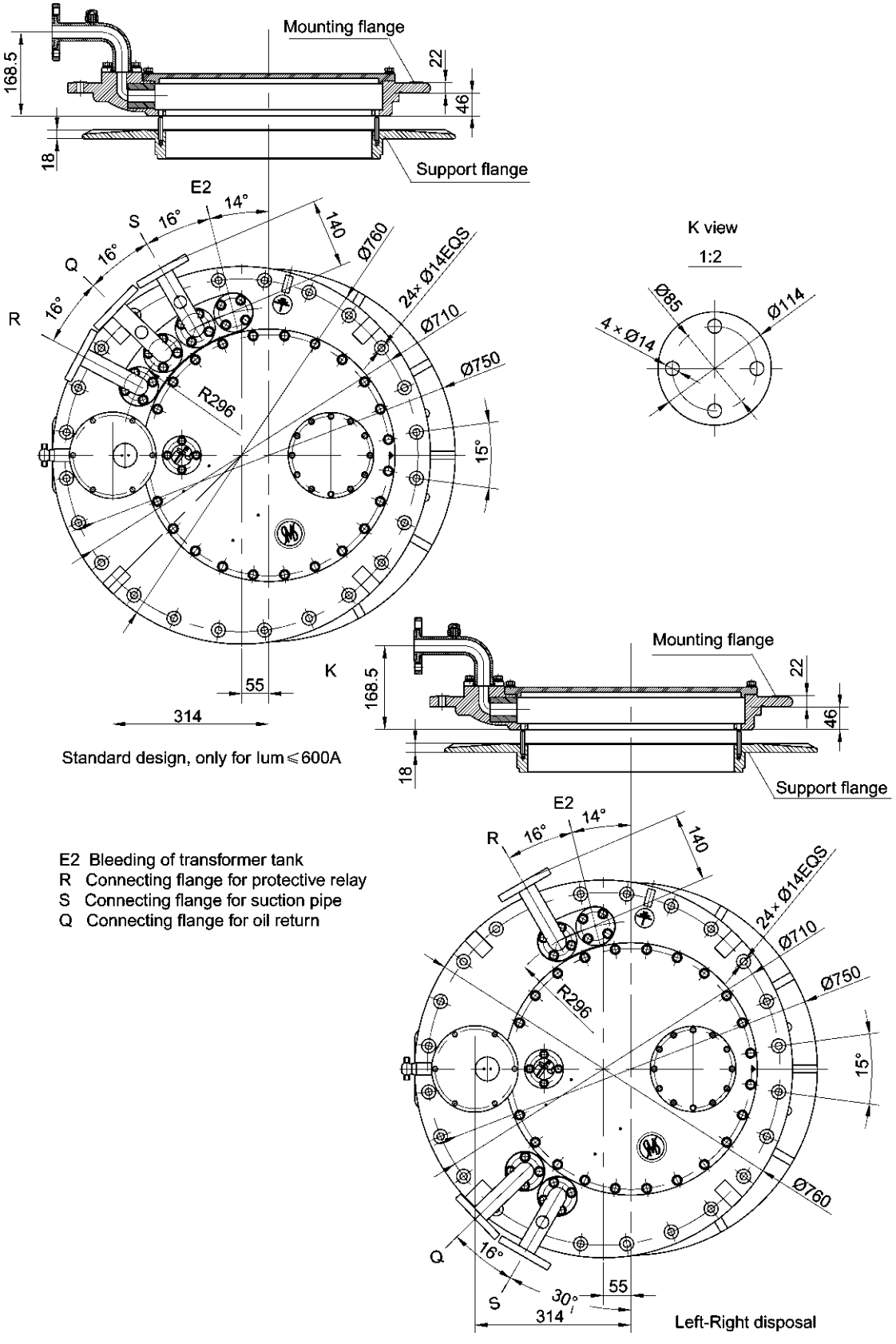


Operation position number	27
Different voltage number	27
Set position●	14

Change-over selector	K+													K-												
Tap selector contact position	1	2	3	4	5	6	7	8	9	10	11	12	13	K	1	2	3	4	5	6	7	8	9	10	11	12	13
Display position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27

● Drawing is shown at the set position

Appendix 31. CMD bell-type head flange, overall dimensions



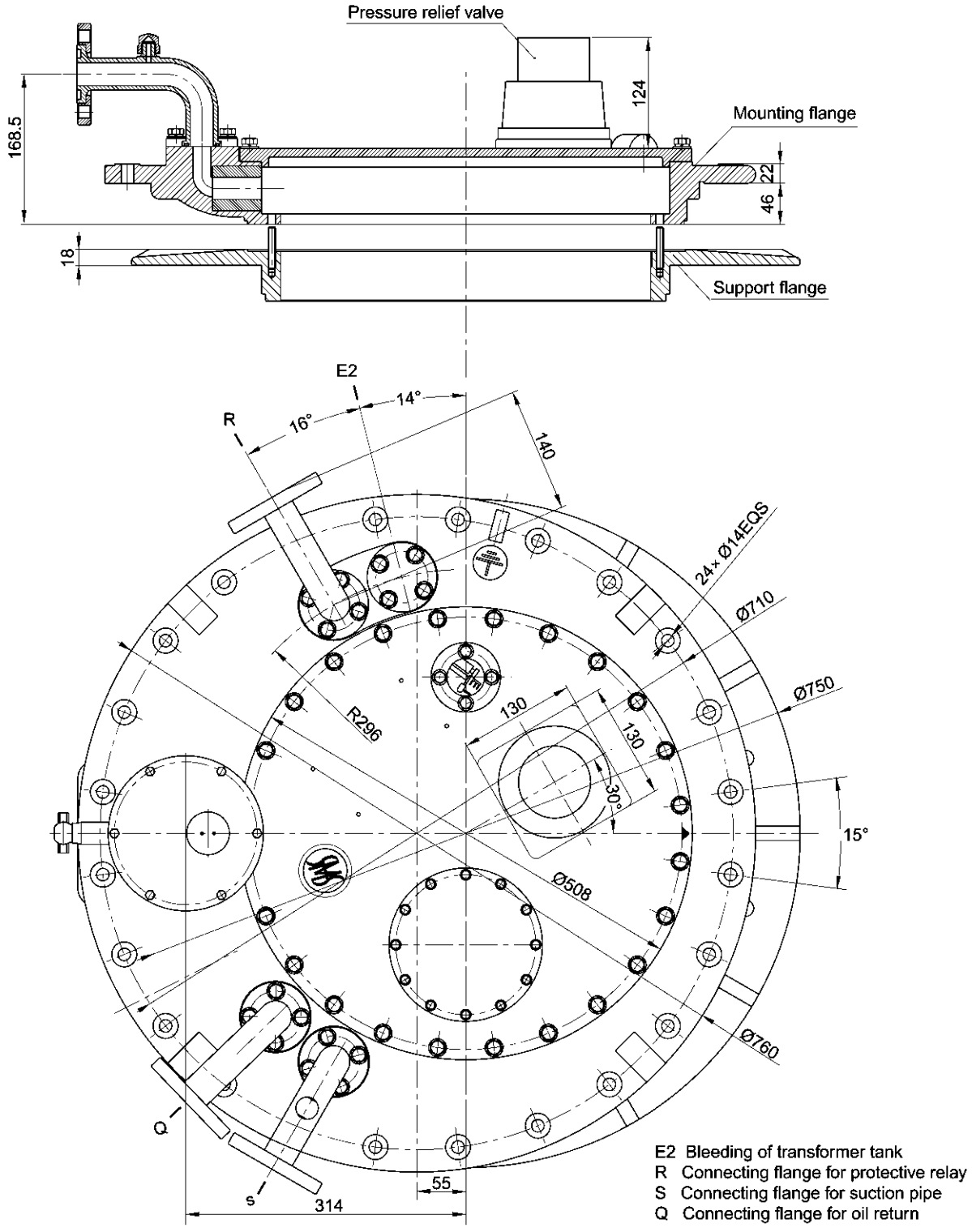
Standard design, only for Ium ⩽ 600A

E2 Bleeding of transformer tank
R Connecting flange for protective relay
S Connecting flange for suction pipe
Q Connecting flange for oil return

Left-Right disposal

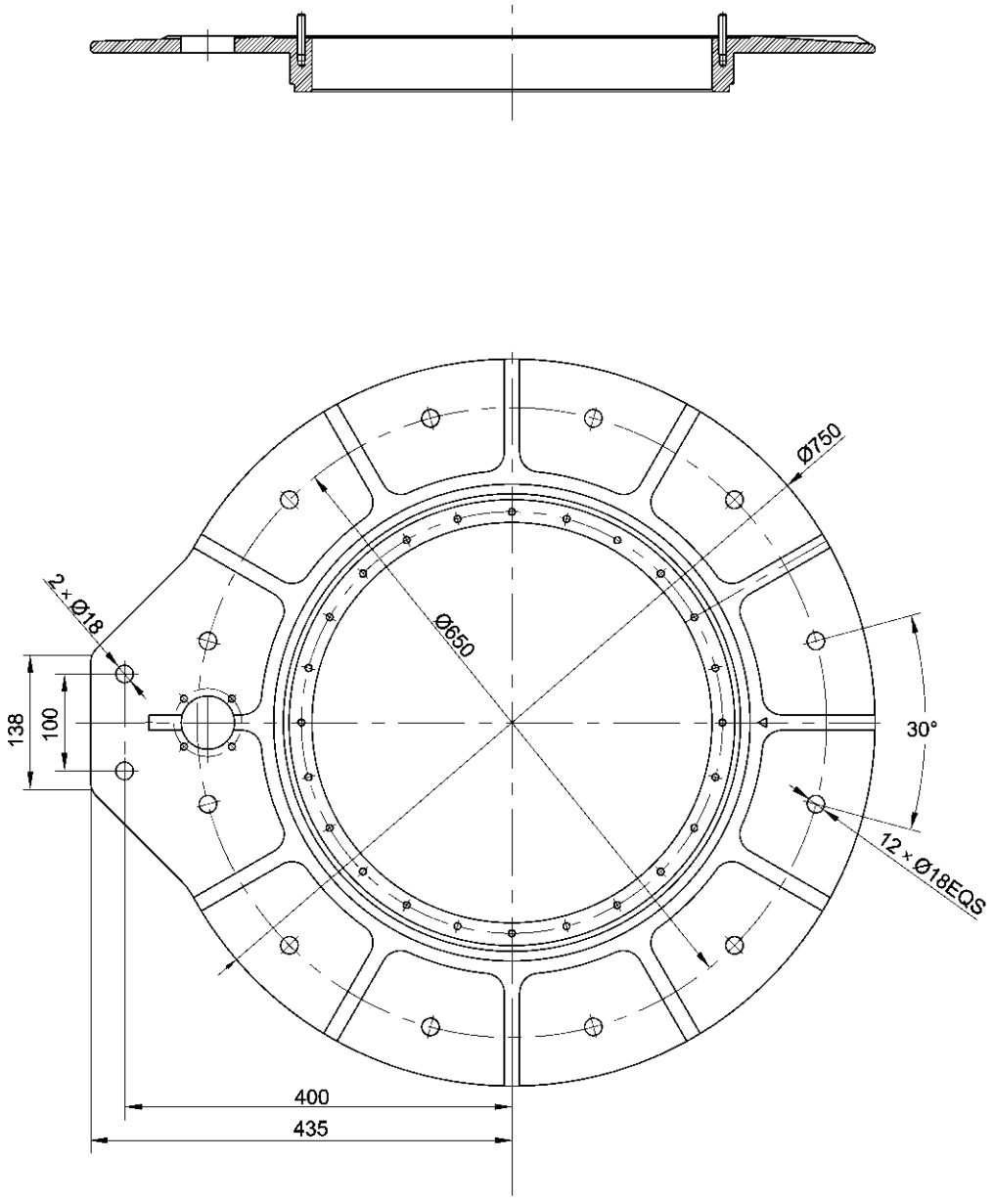
Unit: mm

Appendix 32. CMD bell-type head flange with pressure relief valve overall dimensions



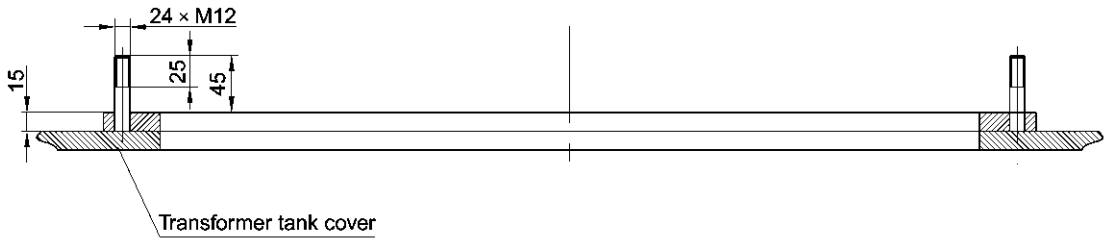
Unit: mm

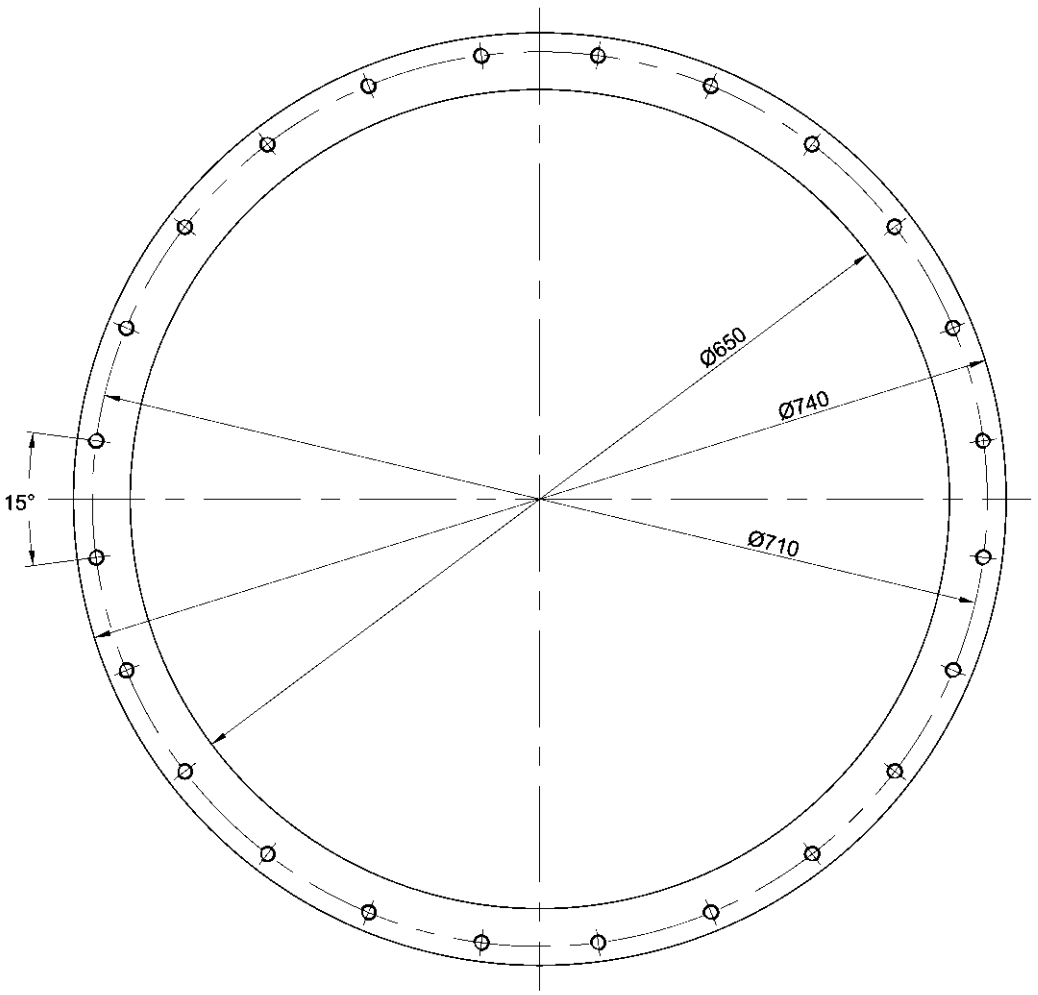
Appendix 33. CMD supporting flange overall dimensions



Unit: mm

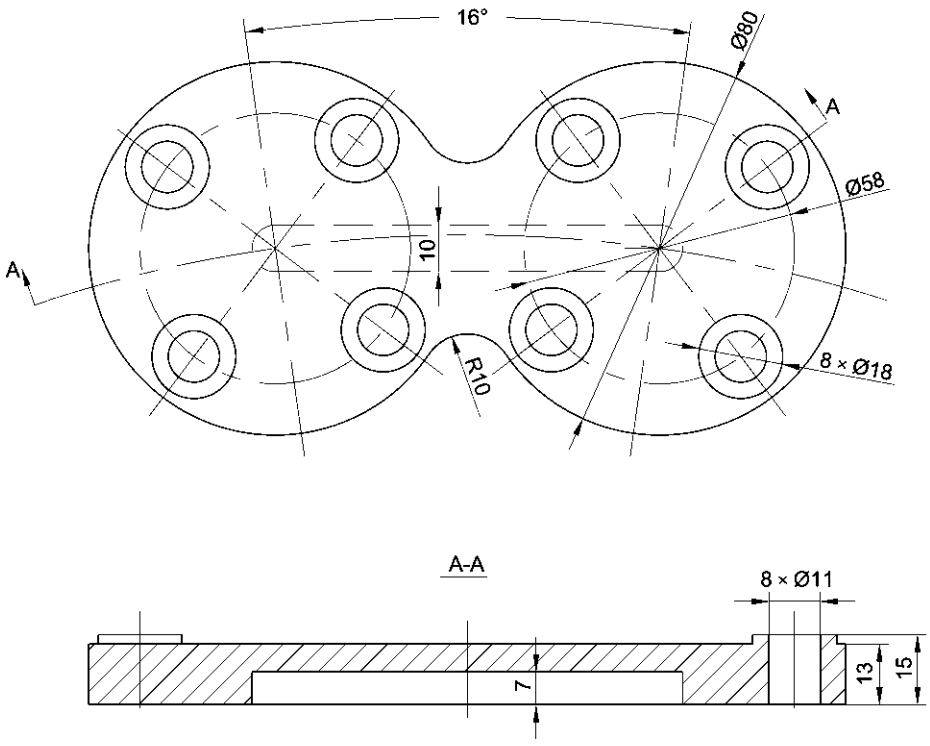
Appendix 34. Transformer mounting flange for CMD overall dimensions



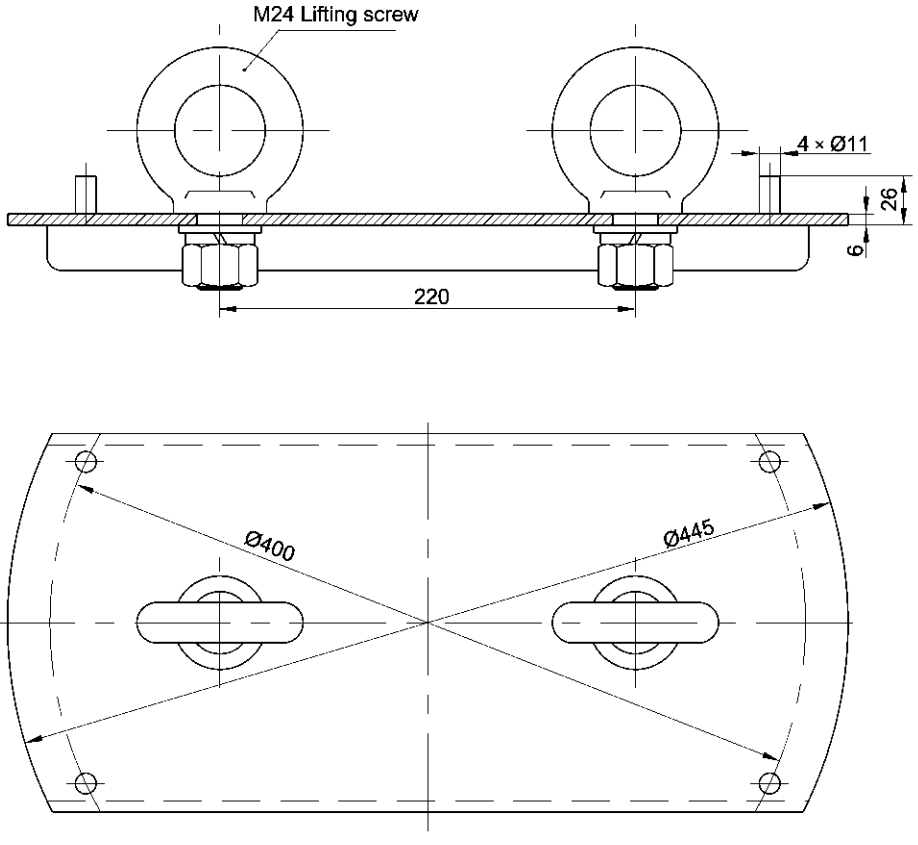


Unit: mm

Appendix 35. By-pass pipe, overall dimensions

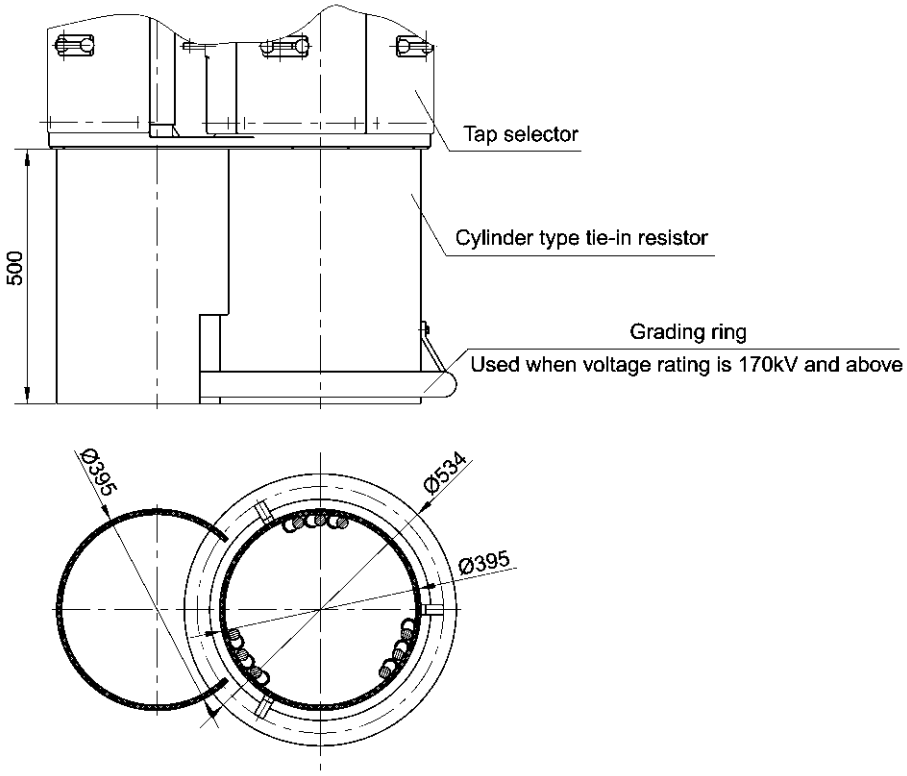


Appendix 36. Bell type structure lifting plate dimensions

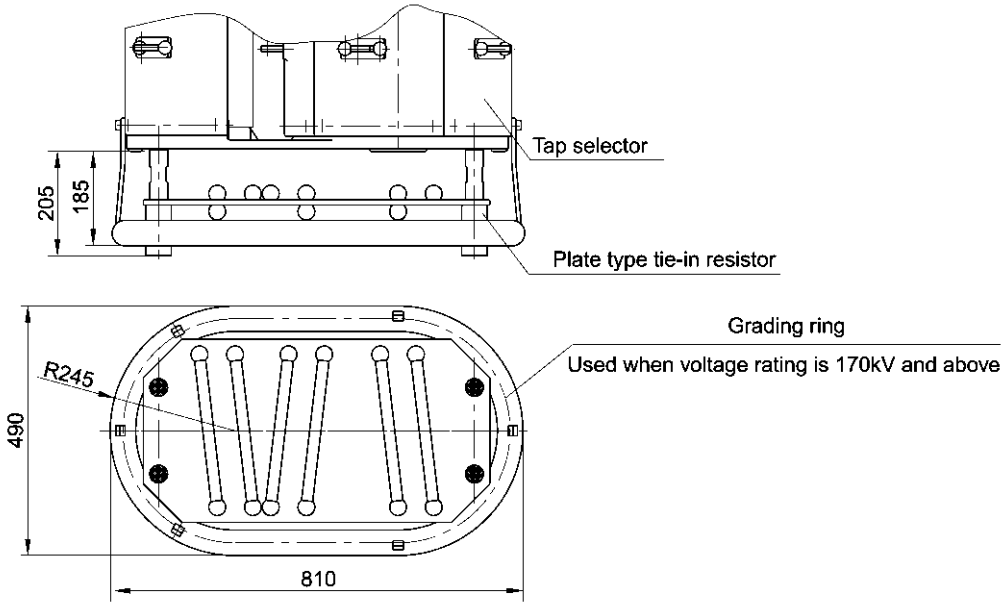


Unit: mm

Appendix 37-1. CMD OLTC mounted with tie-in-resistor on cylinder overall dimensions

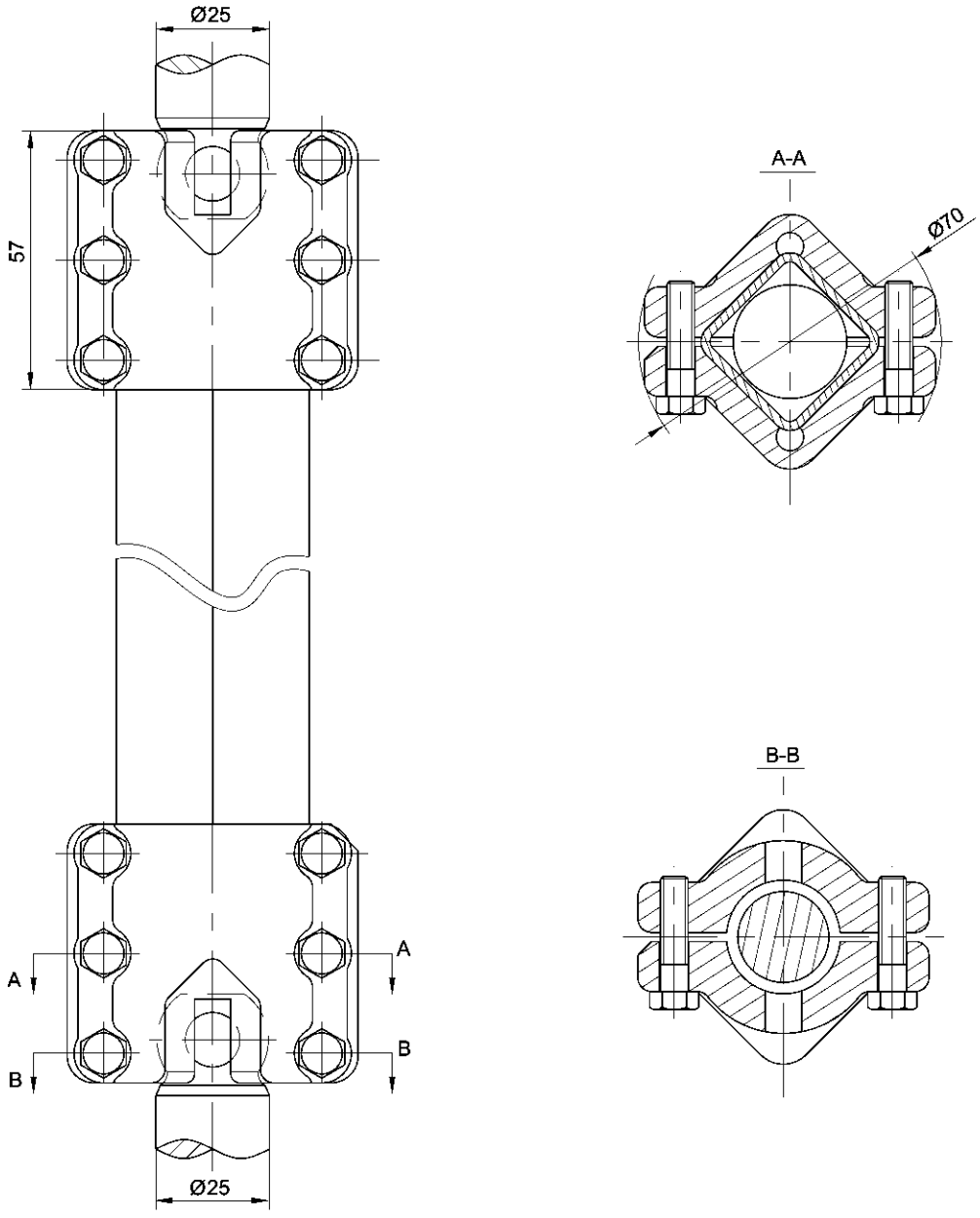


Appendix 37-2. CMD OLTC mounted with tie-in-resistor on plate overall dimensions



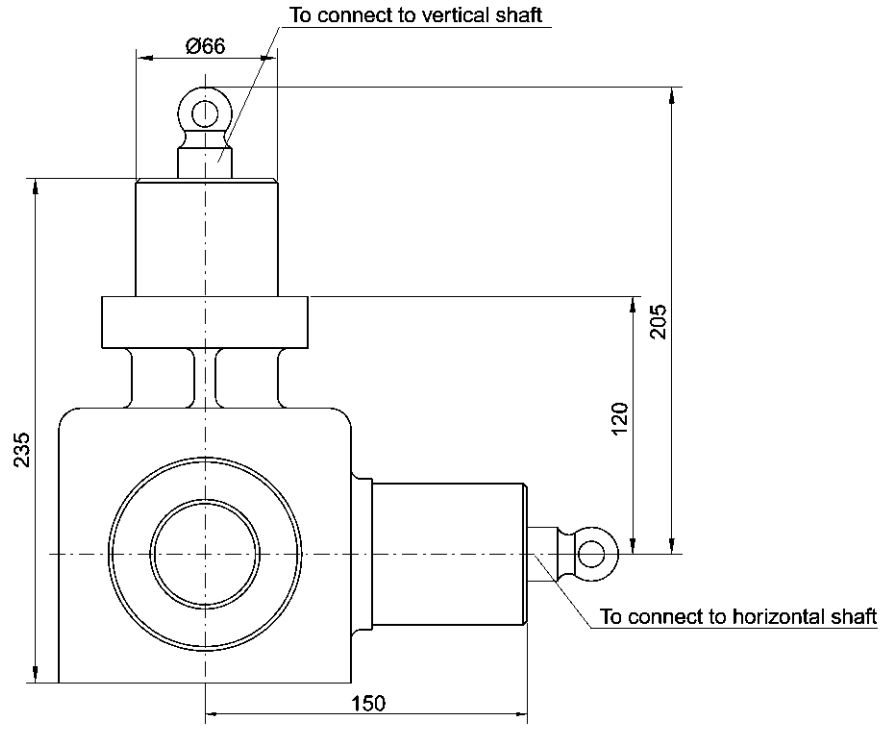
Unit: mm

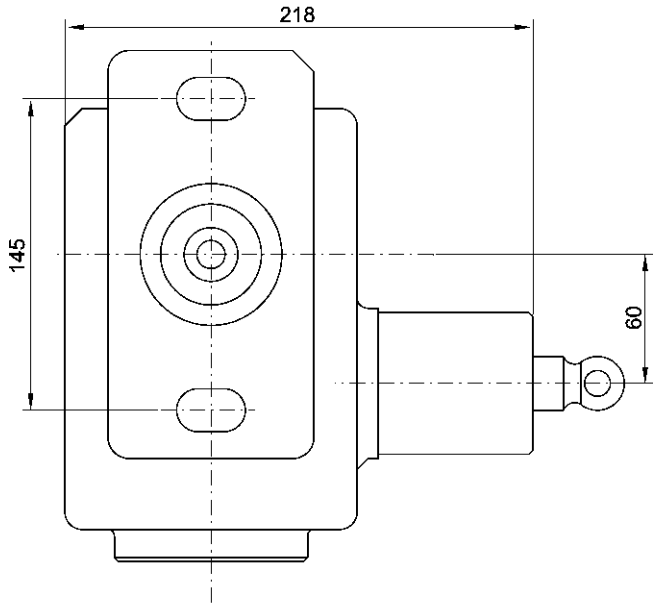
Appendix 38. Schematic drawing for connection of horizontal shaft and vertical shaft



Unit: mm

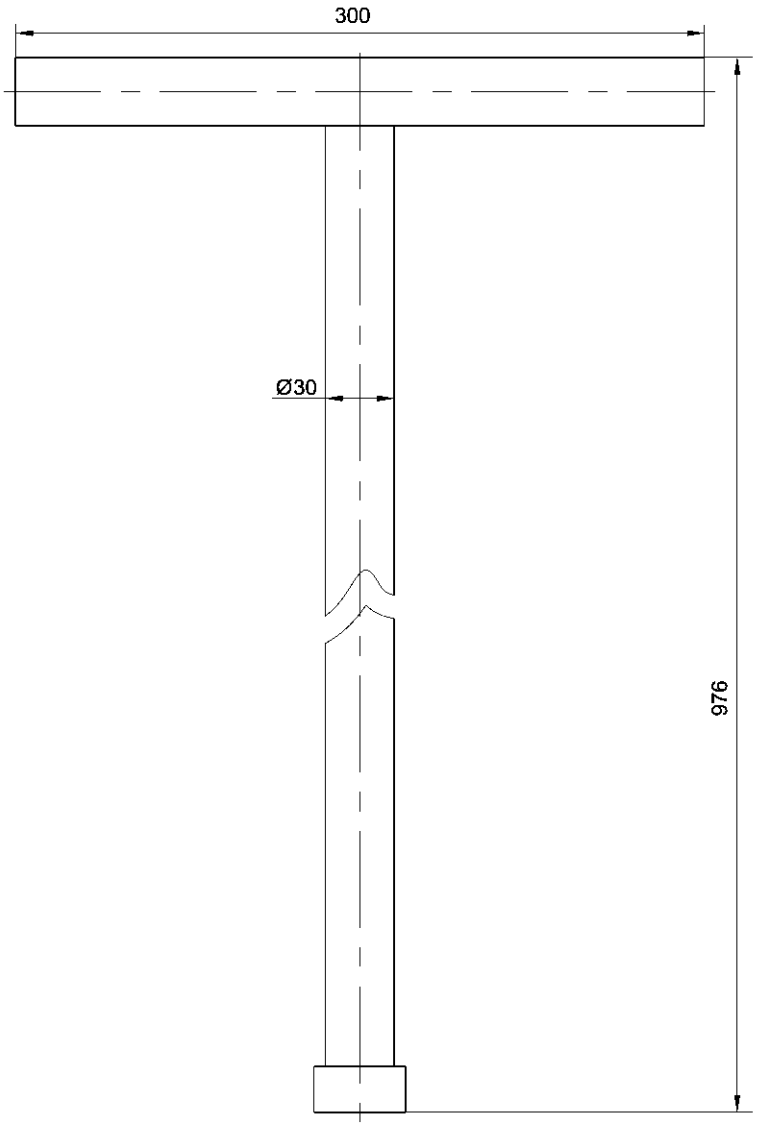
Appendix 39. Bevel gearbox dimension, applicable for MDU SHM-III & CMA7





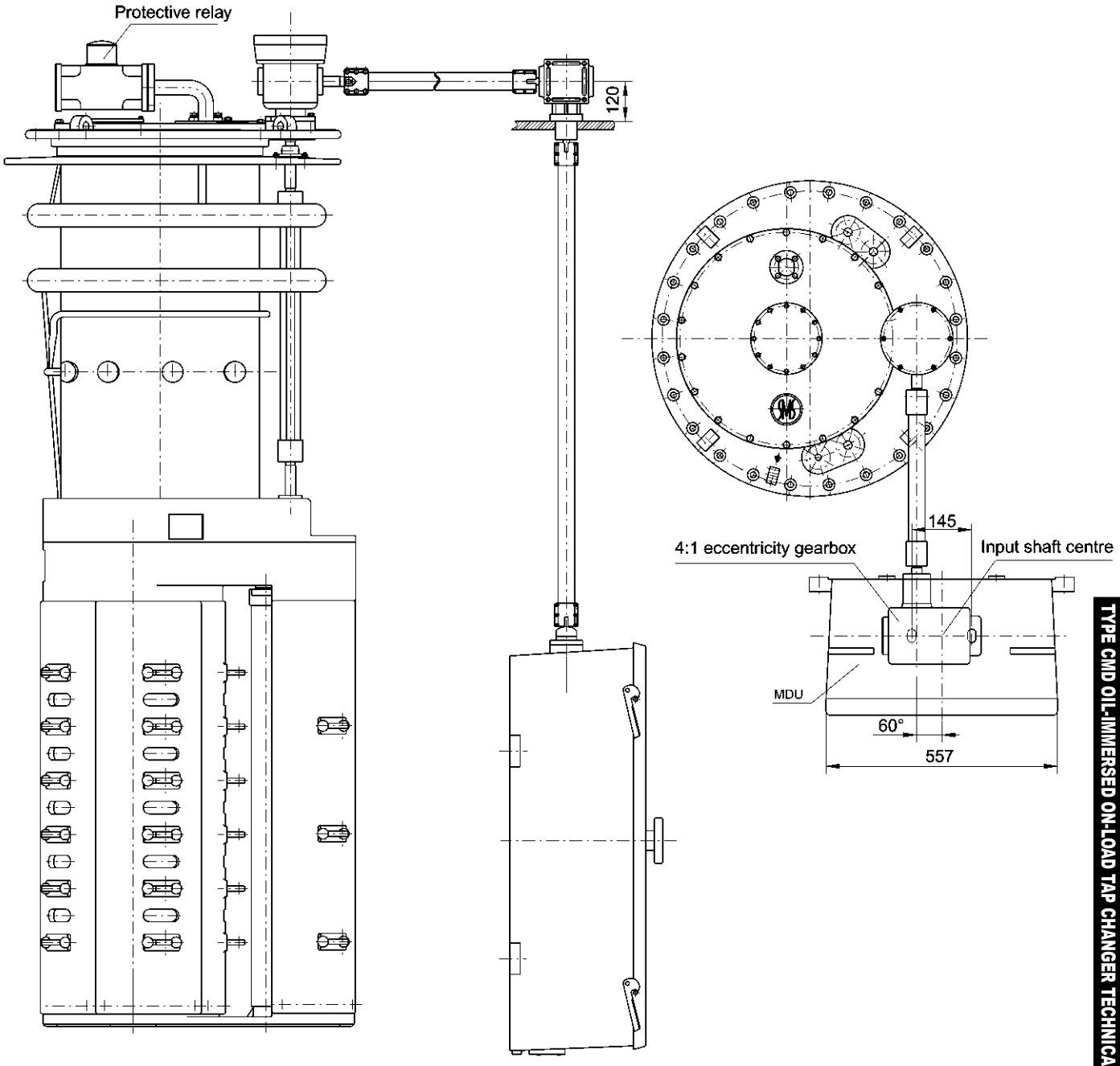
Unit: mm

Appendix 40. Operation key for oil discharge inside tap change oil compartment



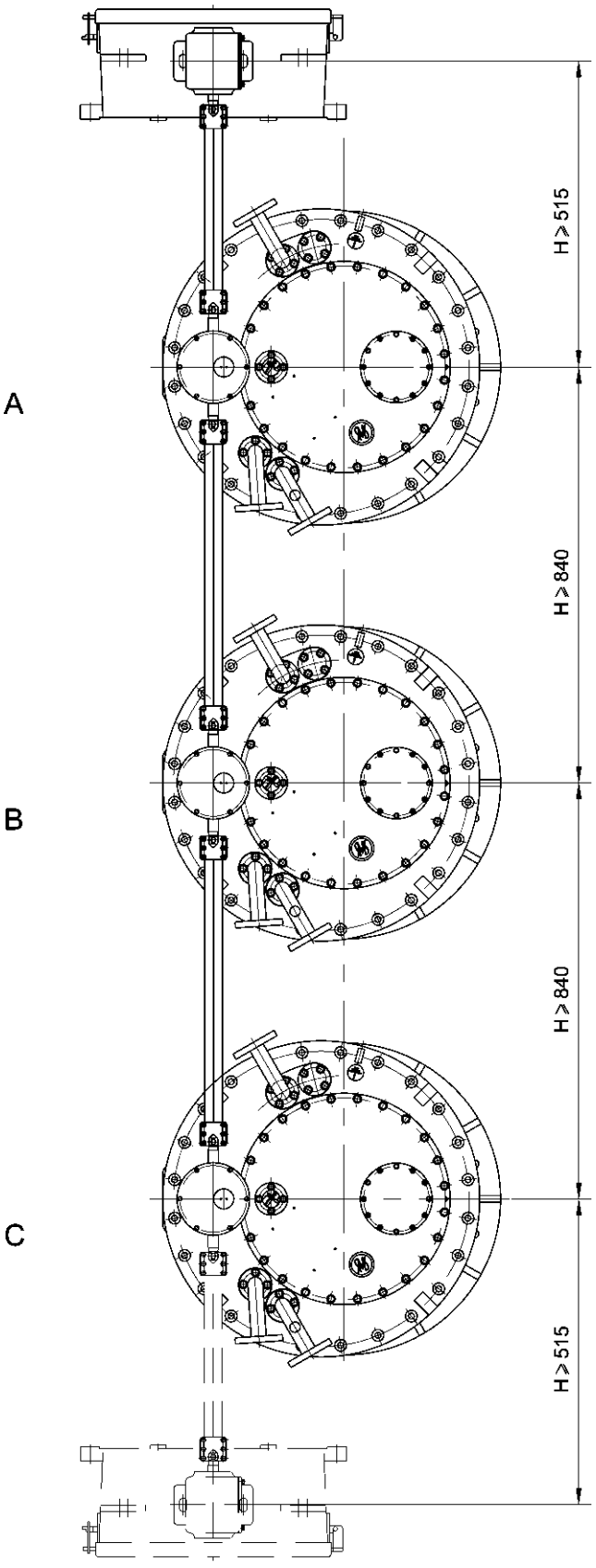
Unit: mm

Appendix 41. Schematic drawing for connecting of CMD OLTC and MDU



Unit: mm

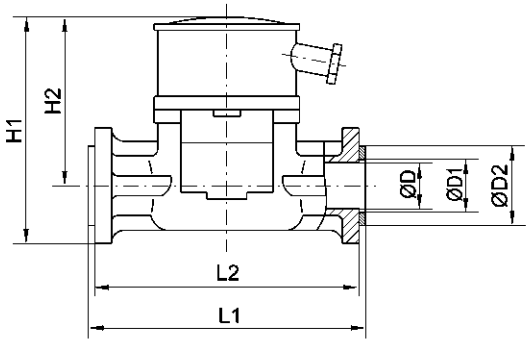
Appendix 42. Schematic drawing for 3 units of single phase CMD connection arrangement

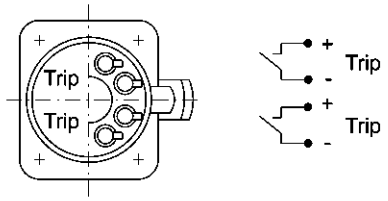


Unit: mm

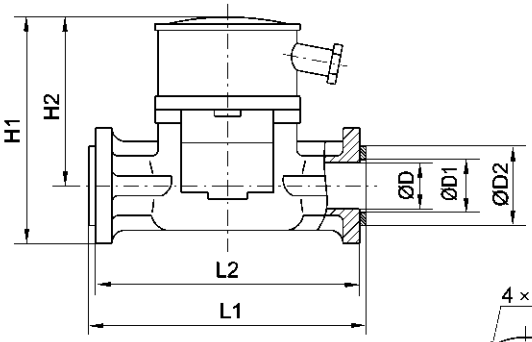
Appendix 43. Protective relay overall dimension

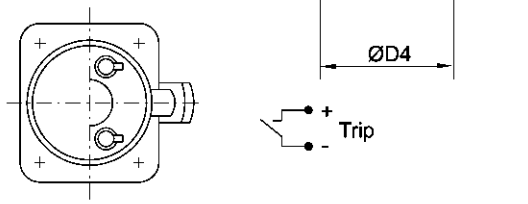
Type QJ6-25 protective relay





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

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