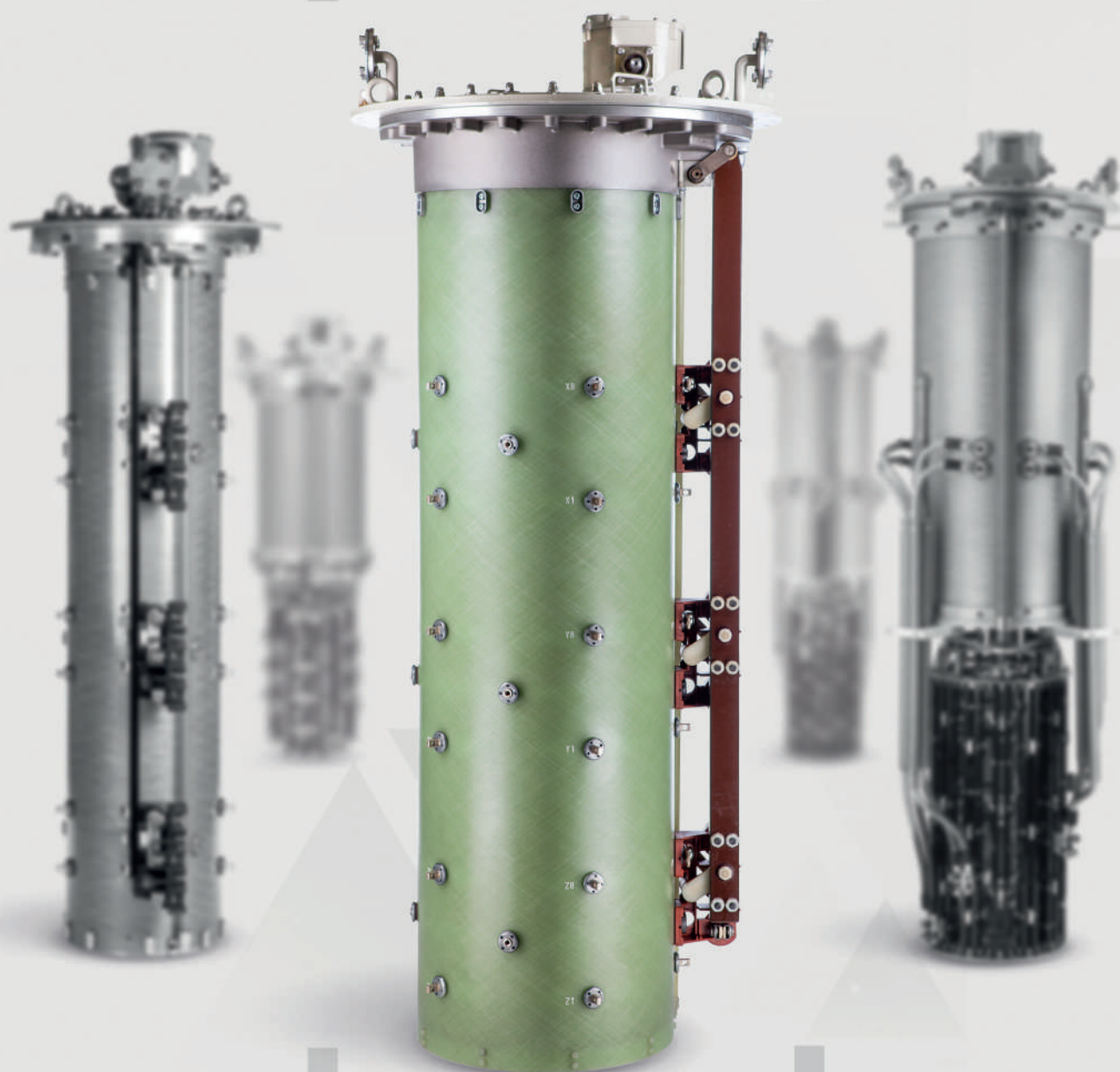


ON LOAD TAP CHANGERS

TYPE RSV 12



VOLTA P
E L P R O M

**ON LOAD TAP
CHANGERS
RSV12
TECHNICAL DATA**

Elprom Heavy Industries

2023

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Notes:

- 1) This technical data catalog is intended to be used by transformer designers as well as other technical personnel responsible for maintenance, diagnostics, and operation of OLTCs.
- 2) Elprom Heavy Industries reserves the right to make changes in the overall dimension drawings and connection diagrams without prior notice. Updated drawings are provided as part of the technical documentation received by the customer at the time of the product delivery; updated drawings can be provided also to potential customers on request.
- 3) Every OLTC is manufactured according to the specific data in the order specification sheet filled in by the client.
- 4) Elprom Heavy Industries is not responsible for the client choice in the selection of an OLTC expected to meet specific transformer requirements.

1. Basic characteristics

This series meet the requirements of the IEC 60214-1:2014 standard.

1.1. Basic technical data

Refer to Table 1.

Table 1: Basic technical data

OLTC type		RSV 12 – I / D / Y – 250 / 400 / 600 A								
Number of phases and application		Single phase – at any point of the winding ⁴⁾			Three phase – at any point of the winding			Three phase – neutral point ⁵⁾		
Maximum rated through current, (A)		250	400	600	250	400	600	250	400	600
Short circuit withstand current, (kA)	R.m.s. value (3 s duration)	4	6	6	4	6	6	4	6	6
	Peak value	10	15	15	10	15	15	10	15	15
Maximum rated step voltage per phase (V)		2000	2000	2000	2000	2000	2000	2000	2000	2000
Rated step capacity (kVA) ¹⁾		500	800	1200	500	800	1200	500	800	1200
Rated frequency (Hz)		50/60								
Insulation to earth	Highest voltage for equipment – insulation to earth and between phases for D connection, (kVr.m.s) ²⁾	41,5			72,5			145		
	Rated lightning impulse withstand voltage (kV, 1,2/50 µs)	200			350			650		
	Rated chopped wave lightning impulse (kV)	220			385			715		
	Rated switching impulse (kV)	-			-			540		
	Rated separate source AC withstand voltage, 1 min duration (kV, r.m.s.)	70			140			275		
Maximum number of operating positions		Without change-over selector – 12 With a change-over selector – 23								
OLTC inner insulation level		Refer to section 1.4								
Oil pressure in the OLTC oil compartment		Operating oil pressure up to 0,3 x 10 ⁵ Pa (testing pressure – 0,6 x 10 ⁵ Pa) Vacuum-proof for drying								
Siphon for draining the oil from the diverter switch oil compartment		Standard equipment								
Drying		In vacuum furnace – up to 110 °C In kerosene vapor – up to 125 °C								
Displaced by the OLTC volume in dm ³ (approx.) ³⁾		Three phases OLTC: 345 - 470 Single phase OLTC: 190								
Oil filling quantity of the OLTC oil compartment (Vs) in dm ³ (approx.) ³⁾		Three phases OLTC: 265 - 360 Single phase OLTC: 145								
Weight, (kg) ³⁾		Three phases OLTC: 585 - 745 Single phase OLTC: 340 - 352								
Oil temperature range	At rated load	between – 25 °C and + 105 °C								
	At overload according to IEC 60214-1	up to + 115 °C								

ON LOAD TAP CHANGERS
TYPE RSV 12

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- 1) For more details refer to section 1.2.
- 2) In accordance with IEC 60214-1:2014, highest effective value for phase-to-phase voltage in a three-phase system for which an on-load tap changer is designed with respect to its insulation.
- 3) For more details refer to the attached particular drawing.
- 4) Only 72,5 kV.
- 5) 41,5 kV and 72,5 kV only.

Notes: 1) Minimum volume of the conservator, considering the temperature oil expansion when the temperature changes from -30°C to $+100^{\circ}\text{C}$: $\Delta V = 0,1V_s + 5 \text{ dm}^3$.

2) In this catalogue Are used the following symbols:
Y – OLTC intended for winding connected in star;
D – OLTC intended for winding connected in triangle

1.2. Rated through-current (Ir), rated step voltages (Uir) and step capacity (Pst)

The rated trough-current and its relevant rated step voltage are defined by the curve, which area represent the step capacity - Fig. 1.

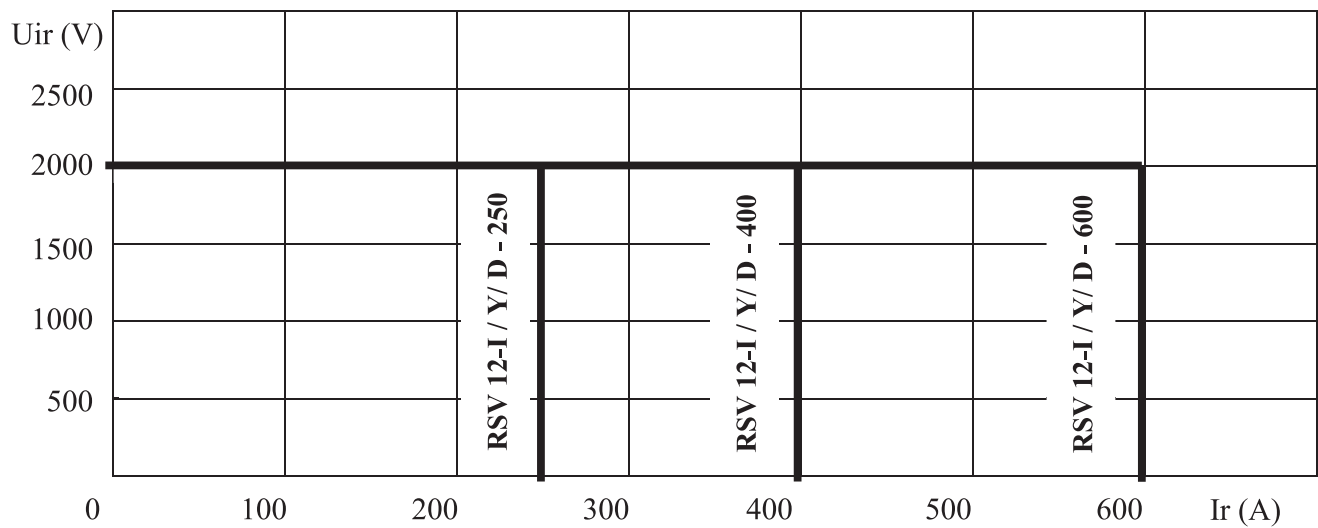


Fig. 1: Step capacities (rated through-current I_r ; relevant rated step voltages U_{ir})

In case of over excitation of the transformer, the maximum step voltage can be increased with 10% under the condition that the step capacity is limited to its rated value.

The specific commutation regimes are clarified in the technical data catalog for all Voltap OLTCs.

1.3. Electrical and mechanical endurance.

The electrical endurance of the diverter switch depends on many factors, connected with the operating conditions. The number of operations until inspection and replacement of vacuum interrupters, obtained experimentally at maximum rated through current, relevant step voltage and $\cos(\varphi) = 1$ is given in Table 2.

Table 2: Electrical and mechanical endurance of three phase OLTC

OLTC	Number of switching operations for OLTC RSV 12 – I / D / Y – 250 / 400 / 600 A
Number of switching operations till inspection	300 000
Number of switching operations till replacement of vacuum interrupters	800 000
Mechanical endurance-number of switching operations	1 200 000

Detailed information about the number of switching operations till inspection for the different tap-changers is given in the RSV 12 Installation and Operation Manual.

ON LOAD TAP CHANGERS TYPE RSV 12

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1.4. Insulation level

The withstand voltage values from the different insulation distances are given in Table 3. Fig. 2 shows the main connection diagrams and the typical insulation distances to them.

For a correct OLTC selection, these voltage values should correspond to the voltage values that occur during the lightning impulse test, the induced voltage test and the power frequency voltage test of the transformer. The least favorable position of the OLTC should be taken into account.

The insulation to earth and the tap selector insulation size are not mutually connected and can be selected in accordance with the specific requirements.

The designations of the insulation distances in next Table 3 are as follows:

a_0 = between any two adjacent contacts (acc. the fine winding succession) of the tap selector, selected or not;

b_1 = between the beginning and the end of fine tap winding;

b_2 = between identical contacts of different phases;

c_1 = between the beginning of the coarse winding and the end fine tap winding;

c_2 = between the beginnings of the coarse winding of different phases.

d = between the beginning and the end of the coarse winding.

They are shown in Fig. 2.

Table 3: Withstand voltages

Insulation distance		Test voltage, kV	OLTC TYPE								
			RSV 12 - Y- 250/400/600			RSV 12 - D- 250/400/600			RSV 12 - I - 250/400/600		
a ₀	41,5 kV	1,2/50 μs	110			110			-		
		LIC	120			120			-		
		AC test voltage	20			20			-		
	72,5 kV	1,2/50 μs	110			110			110		
		LIC	120			120			120		
		AC test voltage	20			20			20		
	145 kV	1,2/50 μs	-			120			-		
		LIC	-			130			-		
		AC test voltage	-			30			-		
Insulation to earth kV		41,5	72,5	145	41,5	72,5	145	41,5	72,5	145	
b ₁	10 contacts	1,2/50 μs	200	200	-	200	200	250	-	200	-
		LIC	220	220	-	220	220	260	-	220	-
		AC test voltage	50	50	-	50	50	75	-	50	-
	12 contacts	1,2/50 μs	170	170	-	170	170	210	-	170	-
		LIC	187	187	-	187	187	231	-	187	-
		AC test voltage	40	40	-	40	40	45	-	40	-

Table 3: Withstand voltages (continuation)

b₂*	41,5 kV	1,2/50 μ s	200	200	-
		LIC	220	220	-
		AC test voltage	80	80	-
	72,5 kV	1,2/50 μ s	350	350	-
		LIC	385	385	-
		AC test voltage	140	140	-
	145 kV	1,2/50 μ s	-	650	-
		LIC	-	715	-
		SI	-	540	-
		AC test voltage	-	275	-
c₁	41,5 kV	1,2/50 μ s	350	350	-
		LIC	385	385	-
		AC test voltage	140	140	-
	72,5 kV	1,2/50 μ s	350	350	350
		LIC	385	385	385
		AC test voltage	140	140	140
	145 kV	1,2/50 μ s	-	350	-
		LIC	-	385	-
		AC test voltage	-	140	-
c₂*	41,5 kV	1,2/50 μ s	200	200	-
		LIC	220	220	-
		AC test voltage	80	80	-
	72,5 kV	1,2/50 μ s	350	350	-
		LIC	385	385	-
		AC test voltage	140	140	-
	145 kV	1,2/50 μ s	-	650	-
		LIC	-	715	-
		SI	-	540	-
		AC test voltage	-	275	-
d	41,5 kV	1,2/50 μ s	280	280	-
		LIC	308	308	-
		AC test voltage	70	70	-
	72,5 kV	1,2/50 μ s	280	280	280
		LIC	308	308	308
		AC test voltage	70	70	70
	145 kV	1,2/50 μ s	-	280	-
		LIC	-	308	-
		AC test voltage	-	70	-

* - The shown values are valid for any position of the tap selector and change-over selector.

ON LOAD TAP CHANGERS TYPE RSV 12

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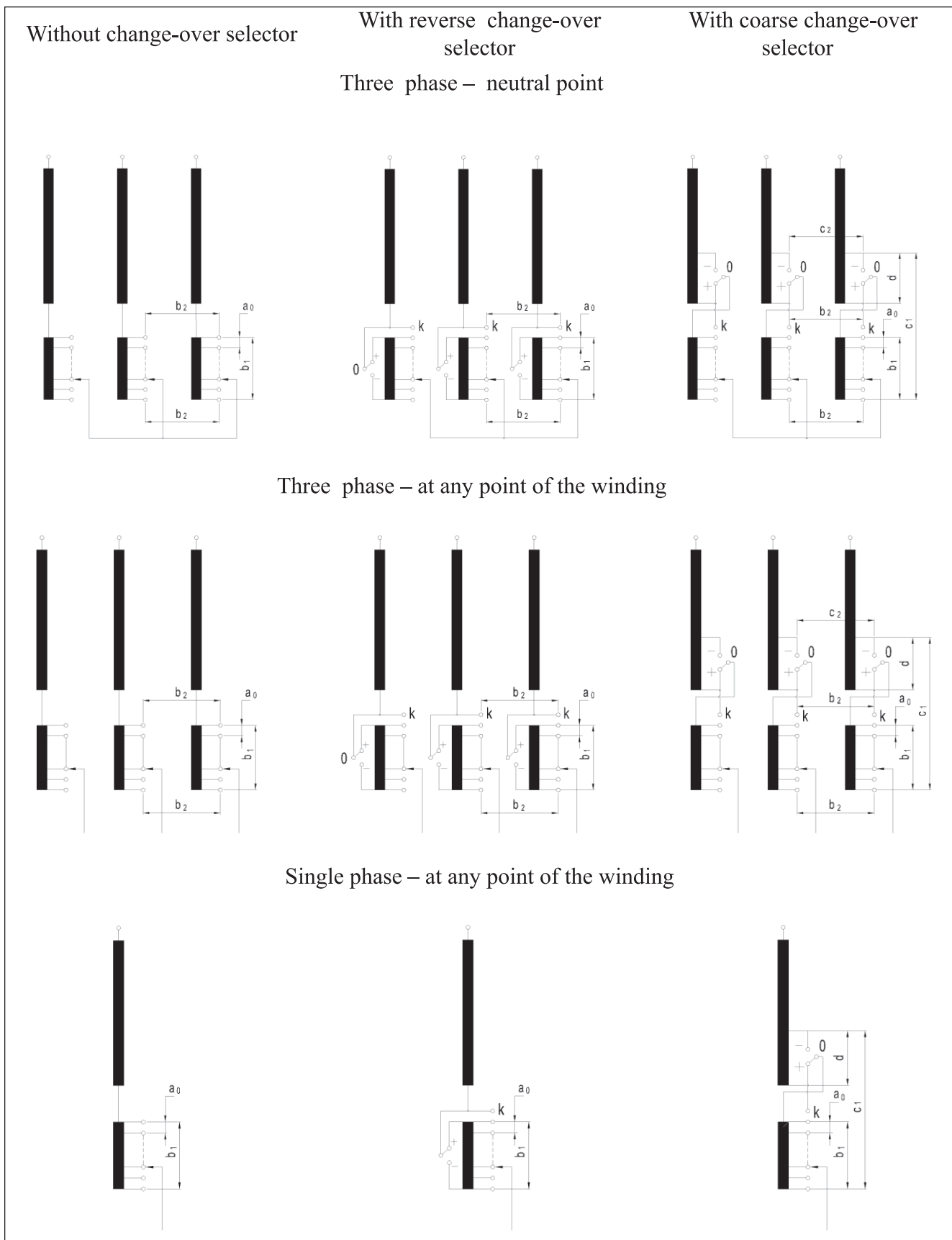


Fig. 2: Insulation distances of the tap winding

2. Review of the RSV 12 types

2.1. Main dimensions

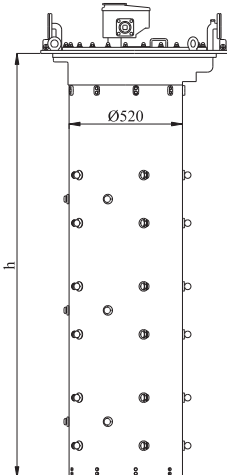
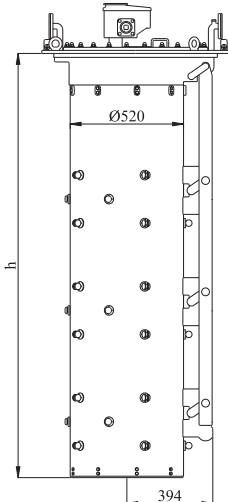
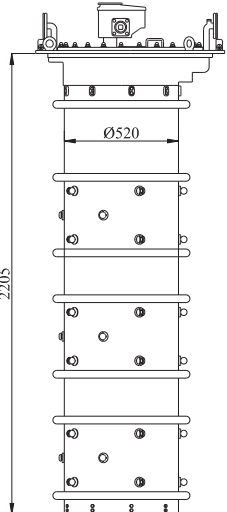
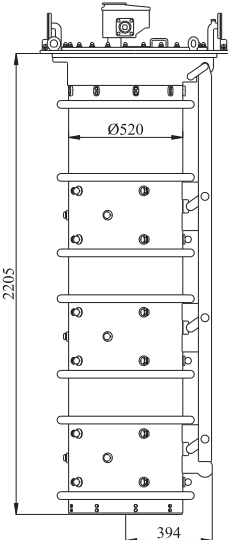
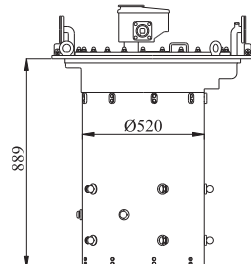
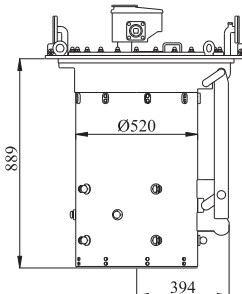
Without change-over selector	With change-over selector	RSV 12 type						
2.1.1. Three phases								
		RSV 12 – Y/ D – 250/400/600 <table><tr><th>Um in kV</th><th>h in mm</th></tr><tr><td>41,5</td><td>1657</td></tr><tr><td>72,5</td><td>1847</td></tr></table>	Um in kV	h in mm	41,5	1657	72,5	1847
Um in kV	h in mm							
41,5	1657							
72,5	1847							
		RSV 12 – D – 250/400/600 – 145 kV						
2.1.2. Single phases								
		RSV 12 – I – 250/400/600 – 72,5 kV						

Fig. 3: Main dimensions

2.2. Basic connection diagrams.

2.2.1. Designation and range of regulation

Basic diagrams with contacts designation, corresponding to the designations in the overall drawings are shown on figures 4 and 5.

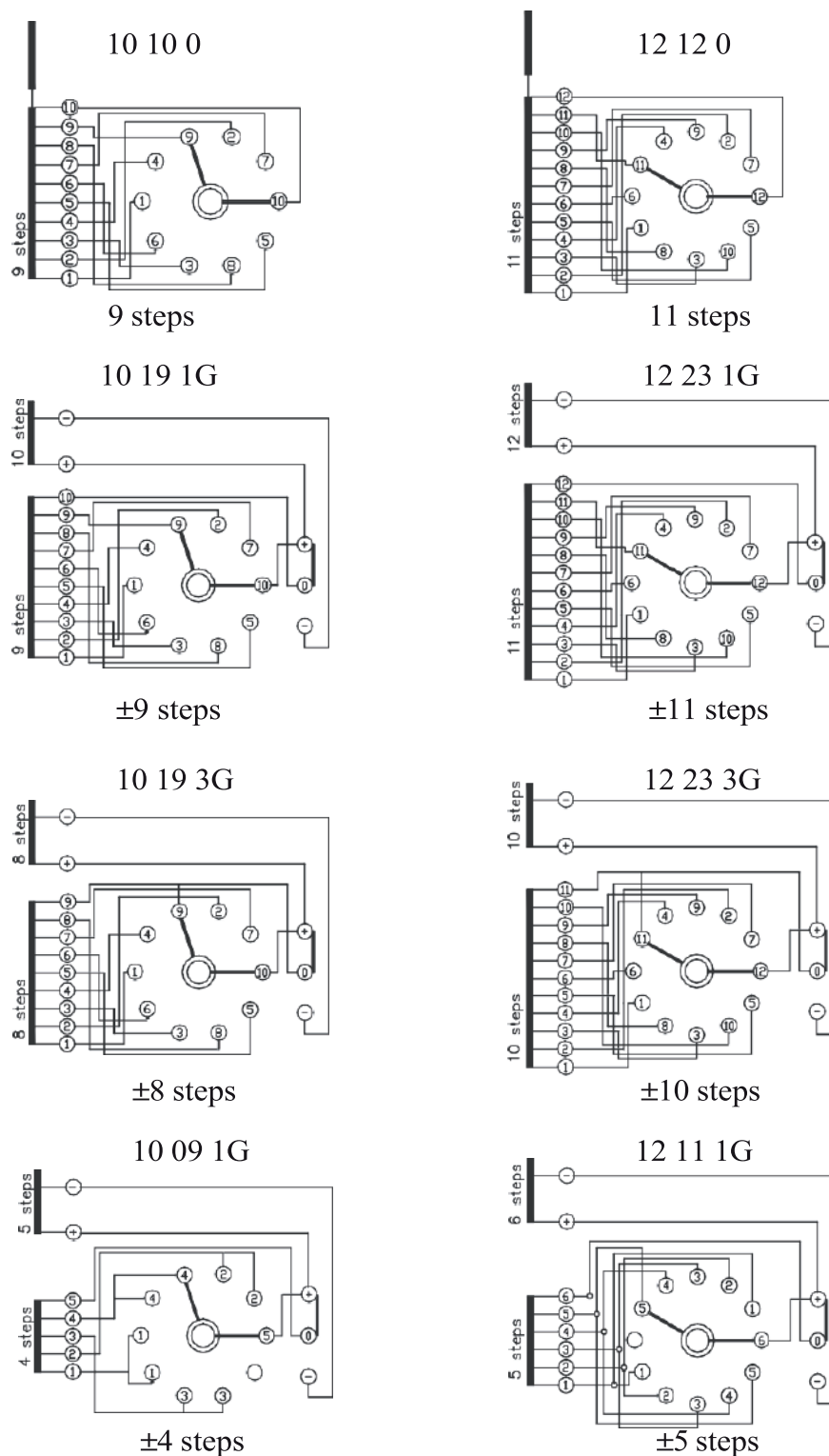


Fig. 4: Basic connection diagrams

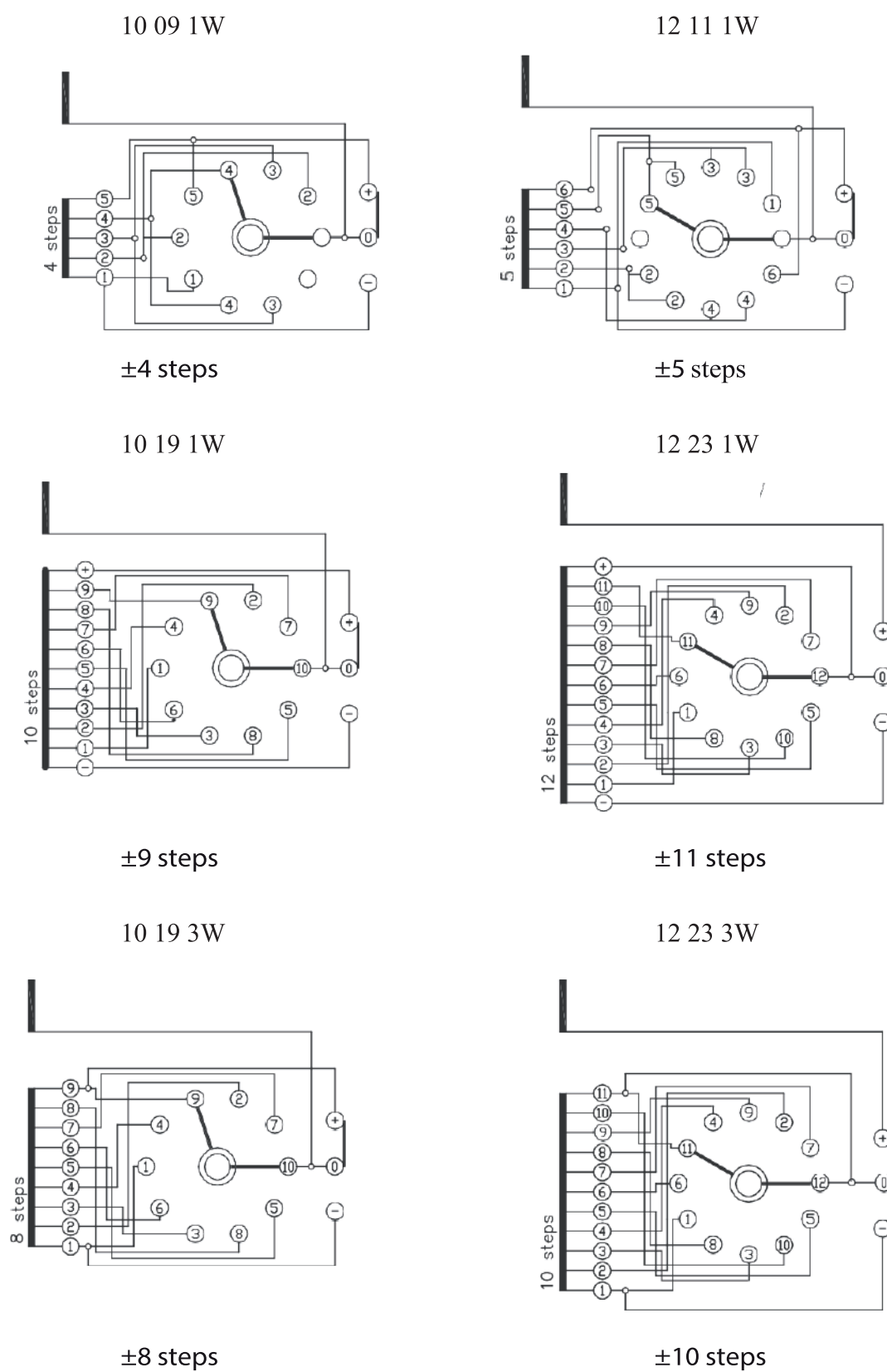


Fig. 5: Basic connection diagrams

ON LOAD TAP CHANGERS
TYPE RSV 12

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2.2.2. Examples of basic connection diagrams

Examples of basic connection diagrams and designation of the service positions and respective position of the selector and change-over selector contacts are shown on figures from 6 to 9.

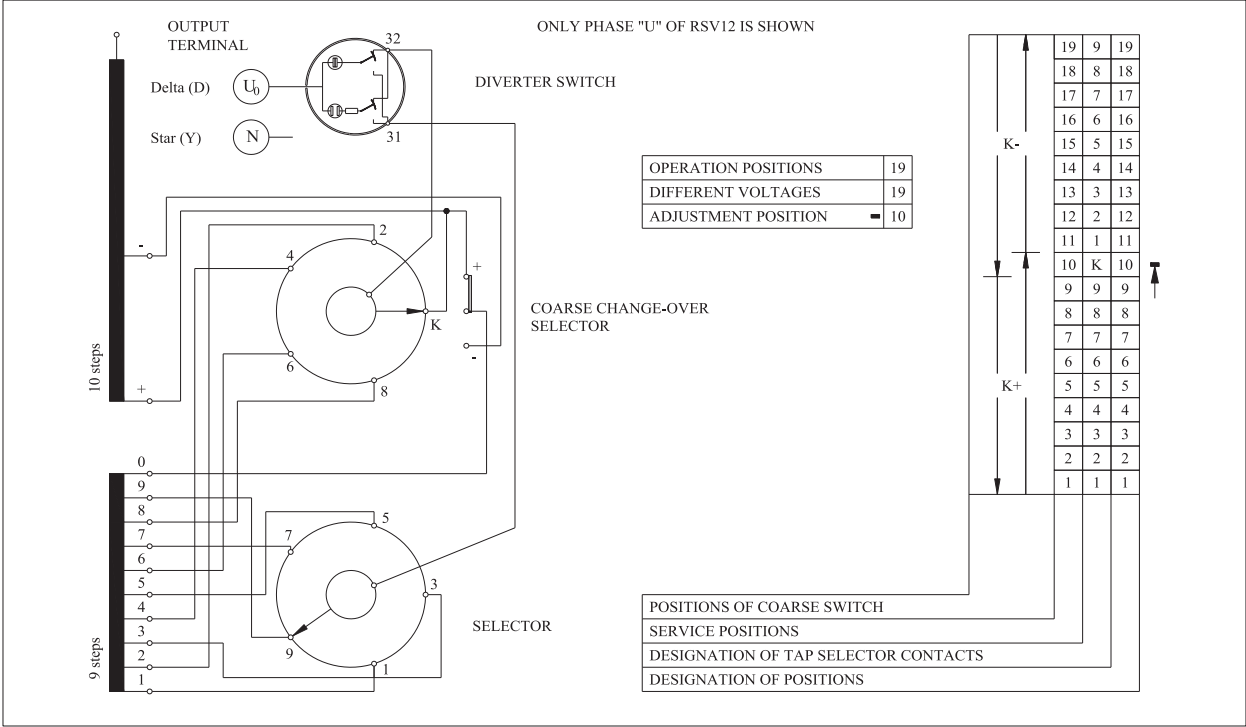


Fig. 6: Basic connection diagram 10.19.1G

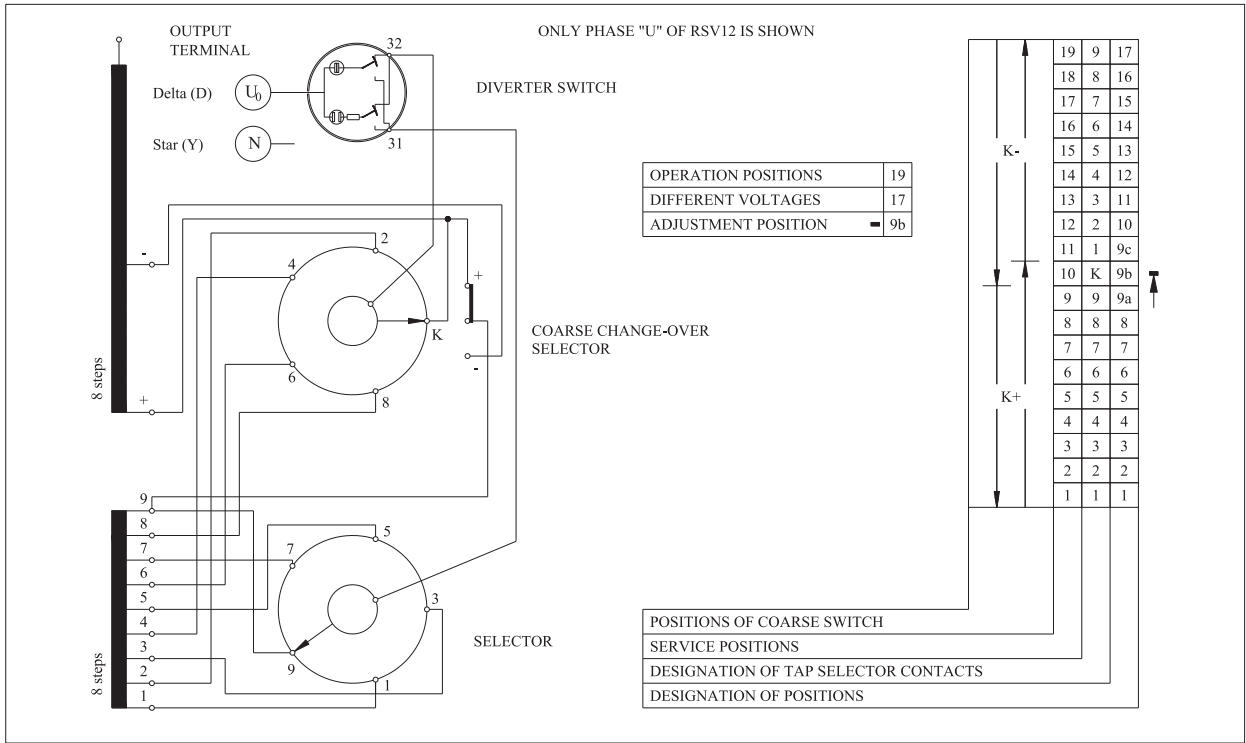


Fig. 7: Basic connection diagram 10.19.3G

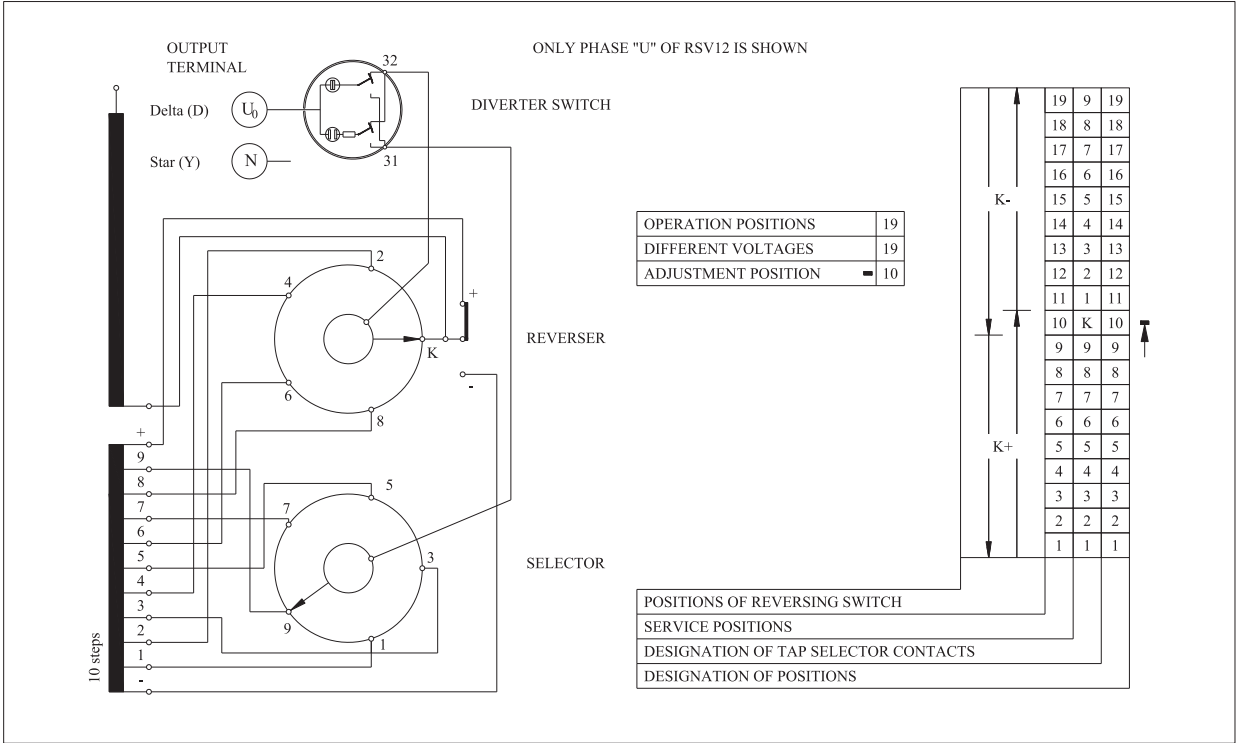


Fig. 8: Basic connection diagram 10.19.1W

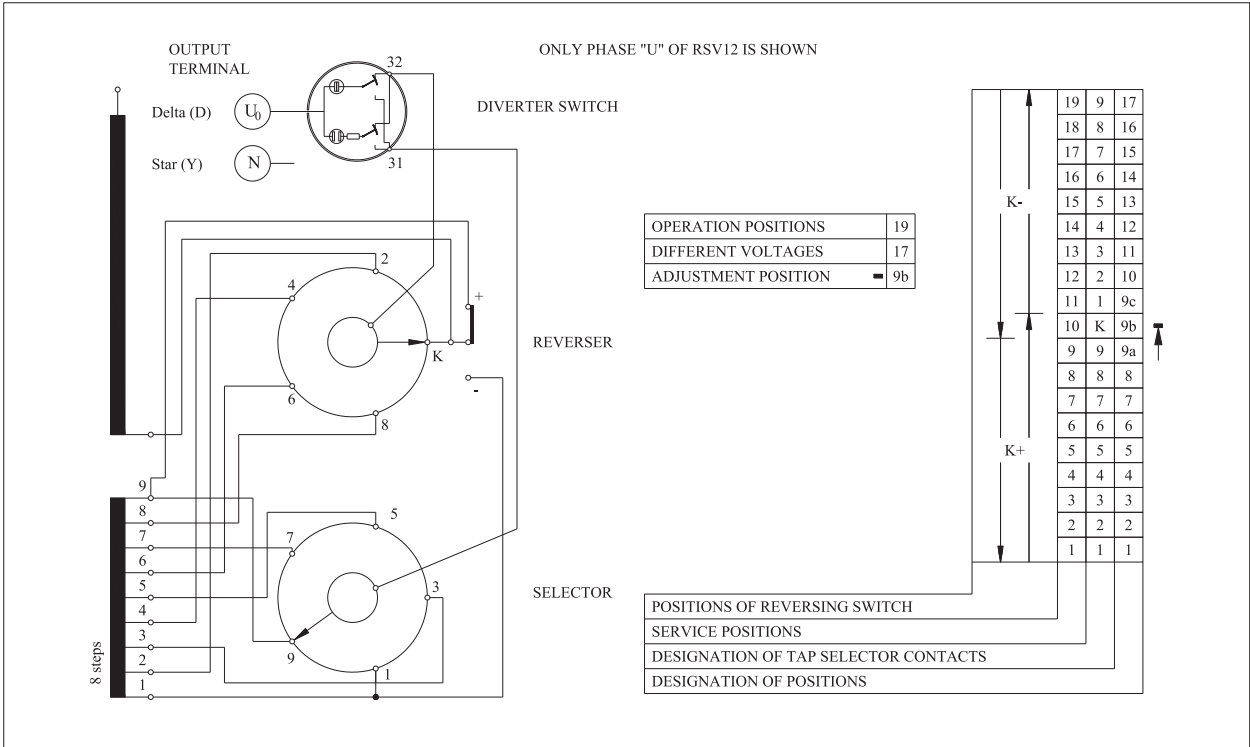


Fig. 9: Basic connection diagram 10.19.3W

3. Appendixes

3.1. Overall dimension drawings of OLTCs

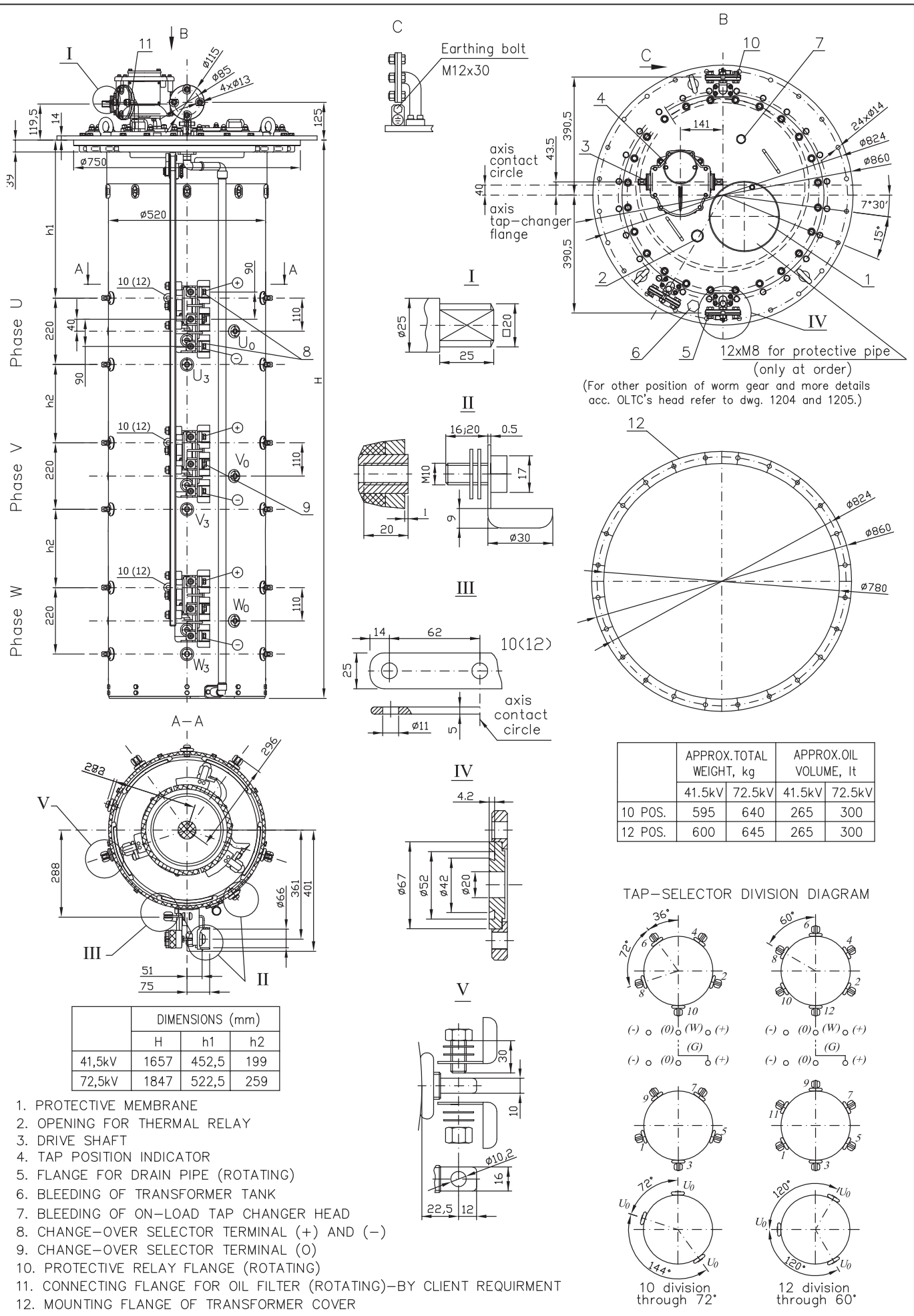
On-load tap-changer RSV 12 - D - 250/400/600A - 41,5/72,5kV - 10/12 G/W	– dwg. №1197
On-load tap-changer RSV 12 - I - 250/400/600A - 72,5kV - 10/12 G/W	– dwg. №1198
On-load tap-changer RSV 12 - D - 250/400/600A - 145kV - 10/12 G/W	– dwg. №1199
On-load tap-changer RSV 12 - Y - 250/400/600A - 41,5/72,5kV - 10/12 G/W	– dwg. №1202
On-load tap-changer RSV 12 - D - 250/400/600A - 41,5/72,5kV - 10/12 0	– dwg. №1207
On-load tap-changer RSV 12 - I - 250/400/600A - 72,5kV - 10/12 0	– dwg. №1208
On-load tap-changer RSV 12 - Y - 250/400/600A - 41,5/72,5kV - 10/12 0	– dwg. №1209
On-load tap-changer RSV 12 - D - 250/400/600A - 145kV - 10/12 0	– dwg. №1210
On-load tap-changer RSV 12 - Location of the neutral point connections	– dwg. №1213

3.2. Additional drawings of OLTCs

On-load tap-changer RSV 12: Tap-changer head with PRD type “Qualitrol”	– dwg. №1204
On-load tap-changer RSV 12: Tap-changer head Flange Arrangement	– dwg. №1205

3.3. RSV12 – driving shafts arrangement

On-load tap-changer RSV 12: Driving Shafts Arrangement	– dwg. №1206
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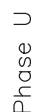


VOLTA P
ELPROM

ON-LOAD TAP-CHANGER
RSV 12 D 250/400/600A 41,5/72,5 kV
10/12 G/W

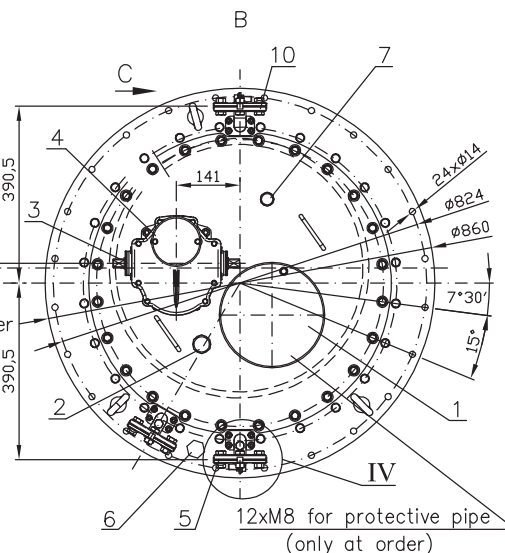
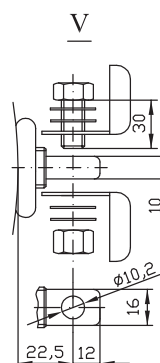
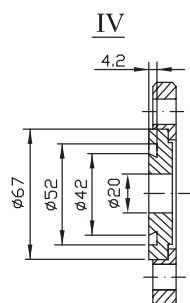
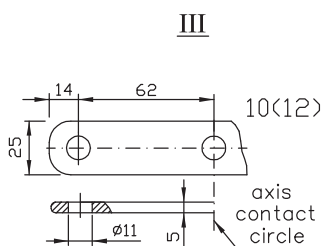
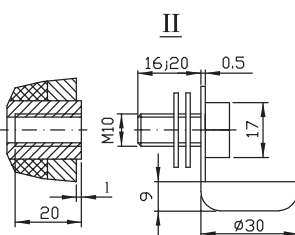
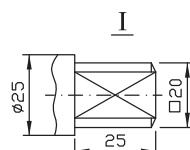
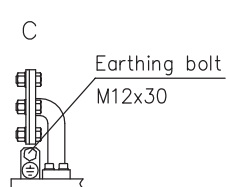
№ 1197

2023

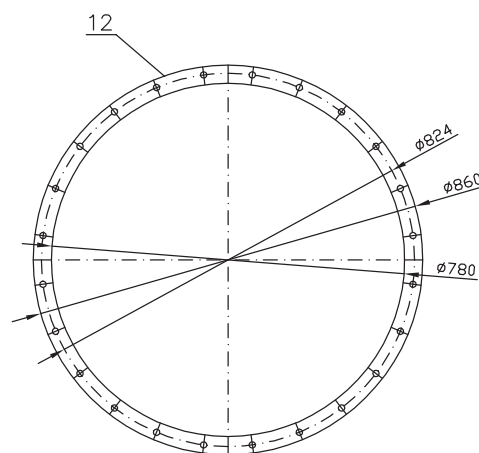


	APPROX.TOTAL WEIGHT, kg	APPROX.OIL VOLUME, lt
10 POS.	350	145
12 POS.	352	145

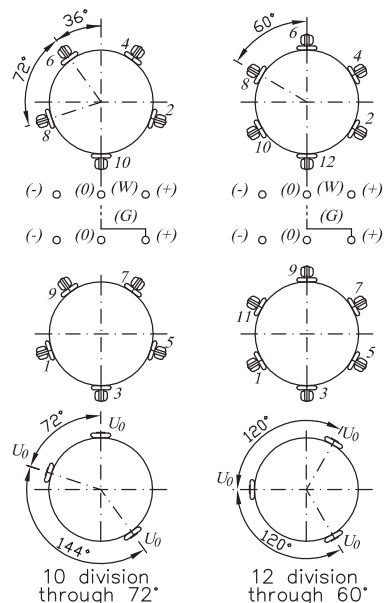
1. PROTECTIVE MEMBRANE
2. OPENING FOR THERMAL RELAY
3. DRIVE SHAFT
4. TAP POSITION INDICATOR
5. FLANGE FOR DRAIN PIPE (ROTATING)
6. BLEEDING OF TRANSFORMER TANK
7. BLEEDING OF ON-LOAD TAP CHANGER HEAD
8. CHANGE-OVER SELECTOR TERMINAL (+) AND (-)
9. CHANGE-OVER SELECTOR TERMINAL (O)
10. PROTECTIVE RELAY FLANGE (ROTATING)
11. CONNECTING FLANGE FOR OIL FILTER (ROTATING)—BY CLIENT REQUIREMENT
12. MOUNTING FLANGE OF TRANSFORMER COVER

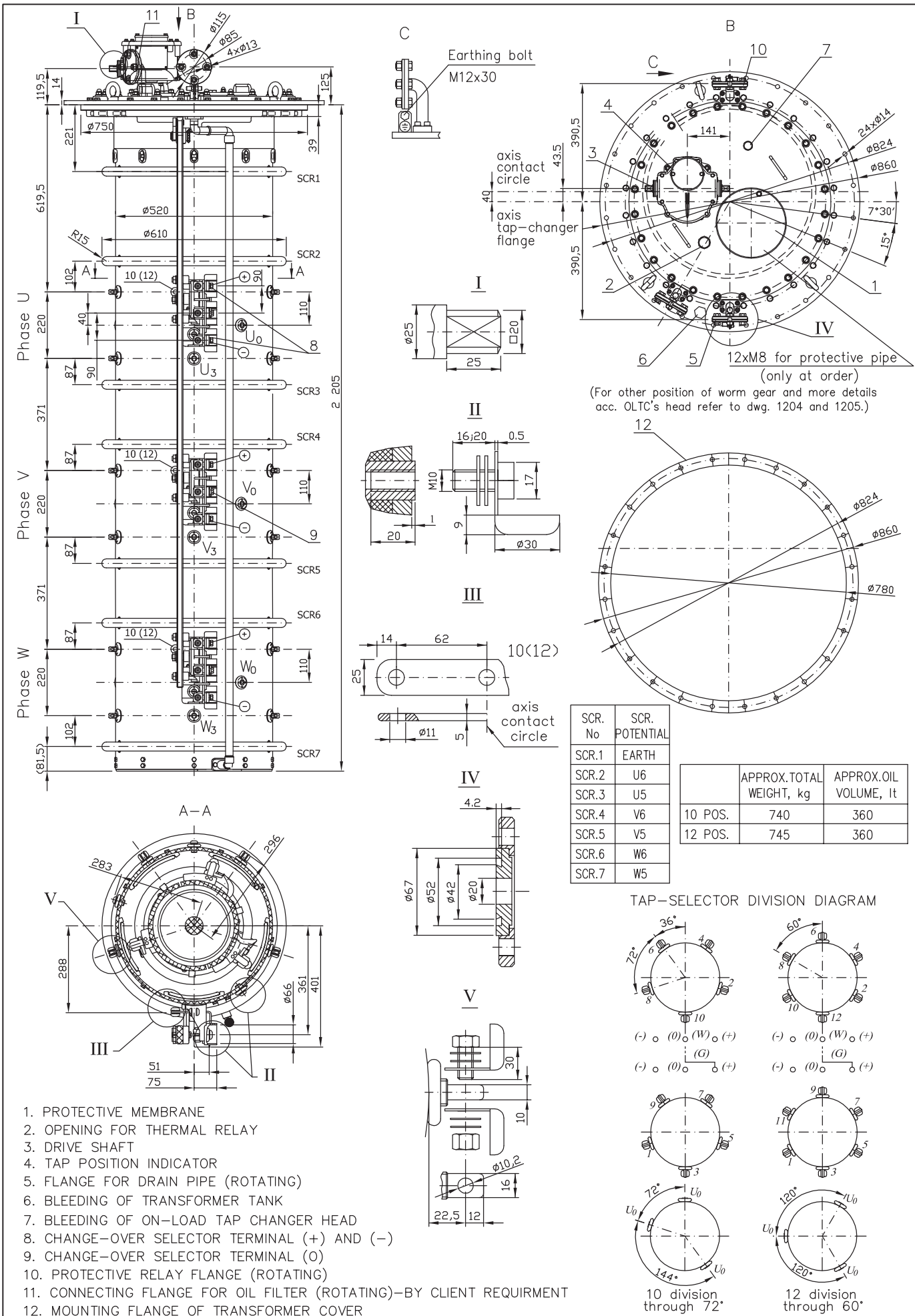


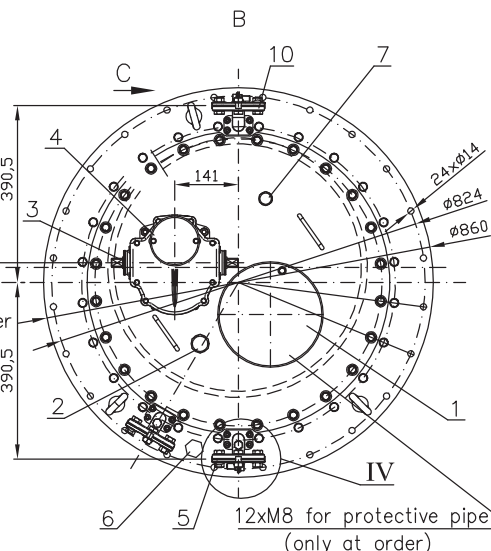
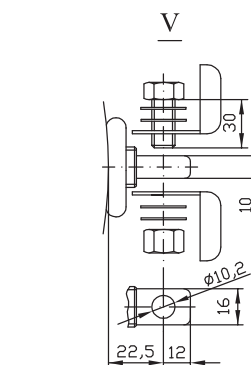
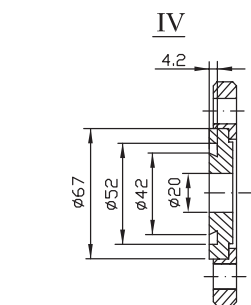
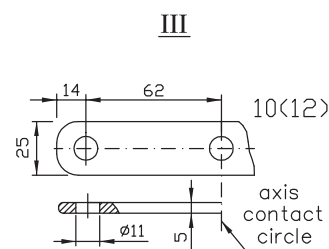
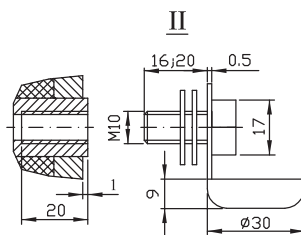
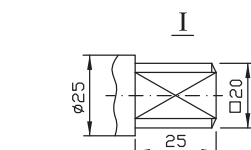
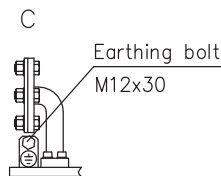
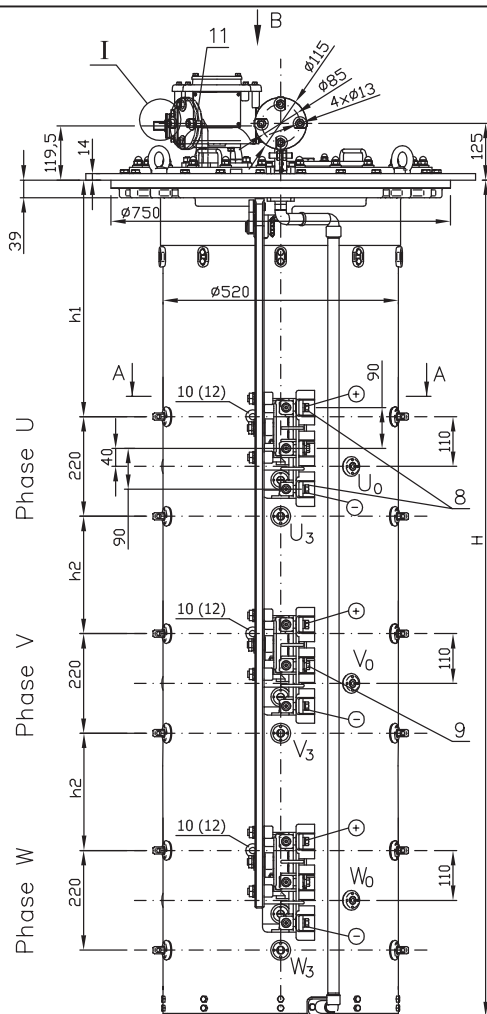
(For other position of worm gear and more details acc. OLTC's head refer to dwg. 1204 and 1205.)



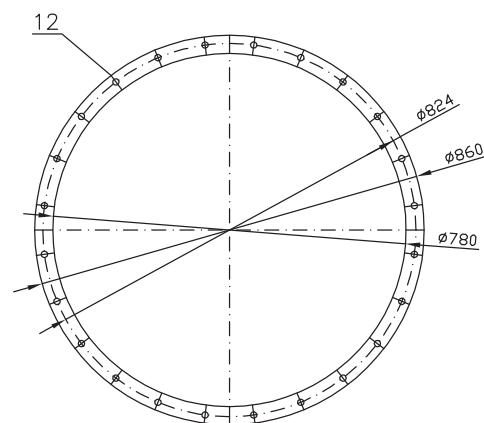
TAP-SELECTOR DIVISION DIAGRAM





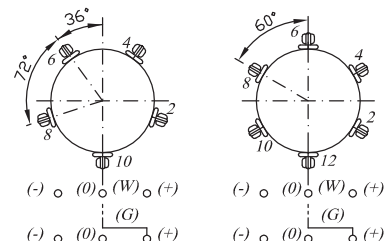


(For other position of worm gear and more details acc. OLTC's head refer to dwg. 1204 and 1205.)

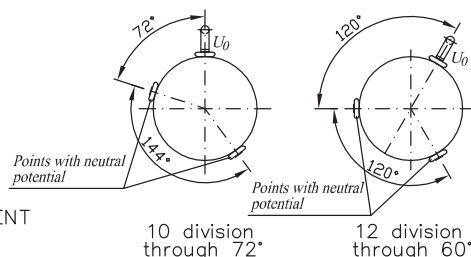


	APPROX. TOTAL WEIGHT, kg		APPROX. OIL VOLUME, lt	
	41.5kV	72.5kV	41.5kV	72.5kV
10 POS.	595	640	265	300
12 POS.	600	645	265	300

TAP-SELECTOR DIVISION DIAGRAM



POSITION OF THE NEUTRAL CONNECTIONS (For more details acc. their mounting see dwg. 1213)



	DIMENSIONS (mm)		
	H	h1	h2
41,5kV	1657	452,5	199
72,5kV	1847	522,5	259

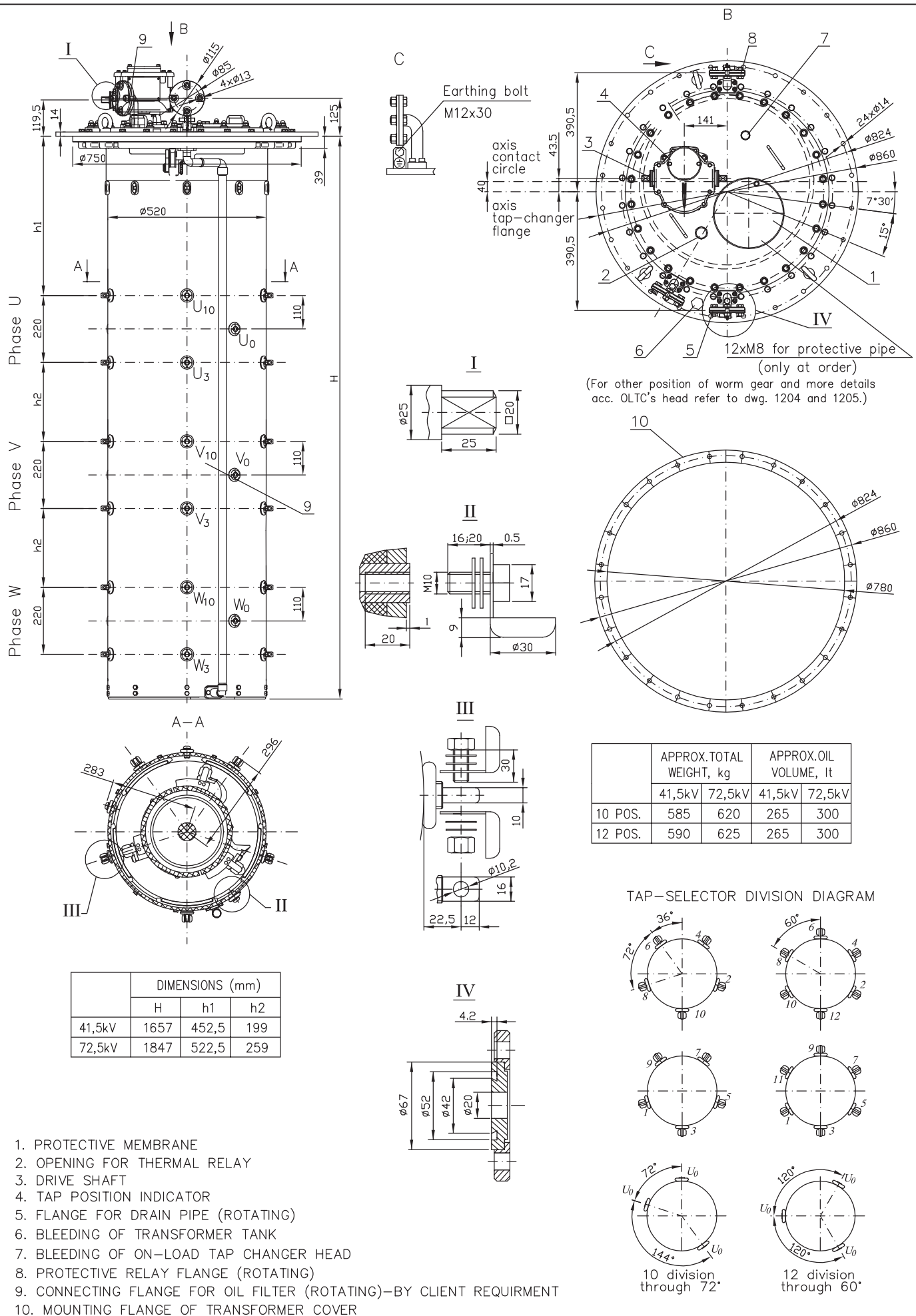
- PROTECTIVE MEMBRANE
- OPENING FOR THERMAL RELAY
- DRIVE SHAFT
- TAP POSITION INDICATOR
- FLANGE FOR DRAIN PIPE (ROTATING)
- BLEEDING OF TRANSFORMER TANK
- BLEEDING OF ON-LOAD TAP CHANGER HEAD
- CHANGE-OVER SELECTOR TERMINAL (+) AND (-)
- CHANGE-OVER SELECTOR TERMINAL (0)
- PROTECTIVE RELAY FLANGE (ROTATING)
- CONNECTING FLANGE FOR OIL FILTER (ROTATING)-BY CLIENT REQUIREMENT
- MOUNTING FLANGE OF TRANSFORMER COVER

VOLTA
ELPROM

ON-LOAD TAP-CHANGER
RSV 12 Y 250/400/600A 41,5/72,5kV
10/12 G/W

№1202

2023



VOLTA P
ELPROM

ON-LOAD TAP-CHANGER
RSV 12 D 250/400/600A 41,5/72,5kV
10/12 0

№ 1207

2023

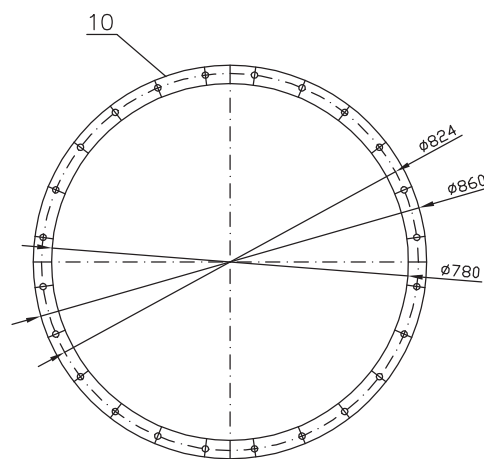
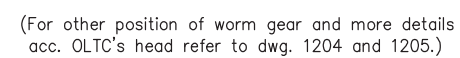
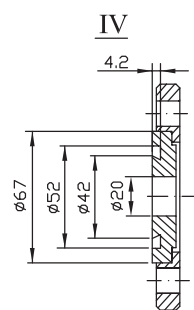
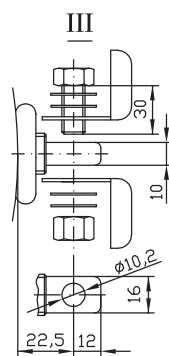
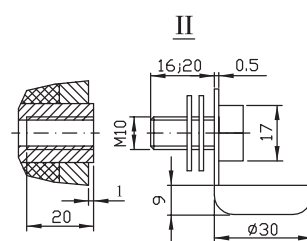
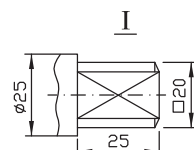
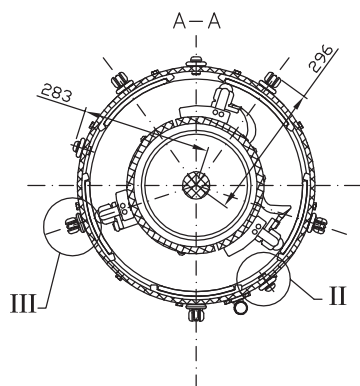
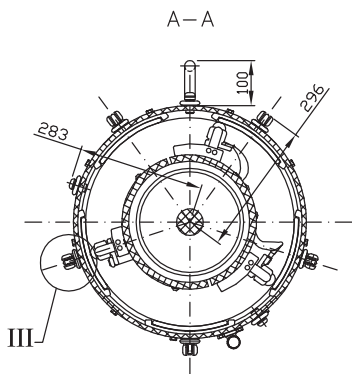
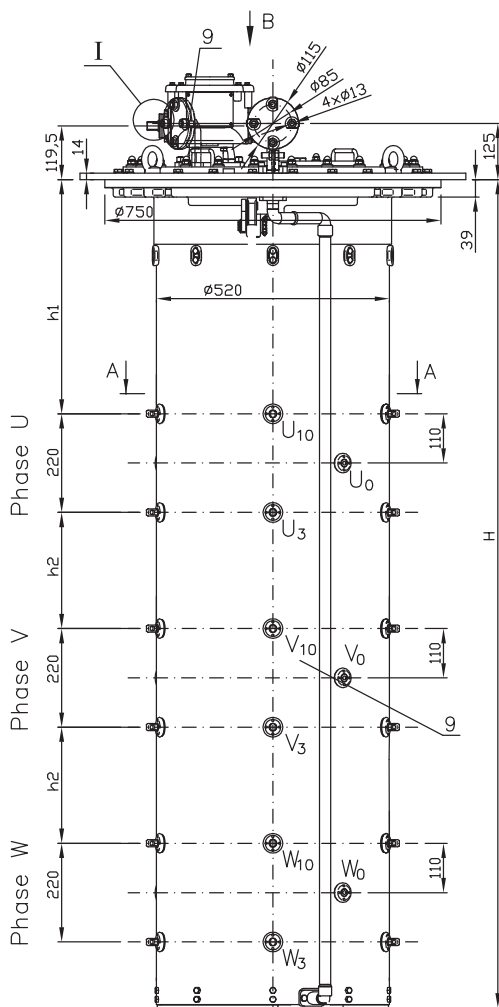


Figure 1 consists of four circular diagrams arranged in a 2x2 grid, illustrating the angular positions of the 10 and 12 divisions of a scale. Each diagram shows a circle with radial lines and marks labeled with numbers or U_0 .

- Top-left diagram:** A circle with 10 divisions. The angle between adjacent divisions is 72° . The angle between adjacent marks is 36° . The marks are labeled 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.
- Top-right diagram:** A circle with 12 divisions. The angle between adjacent divisions is 60° . The angle between adjacent marks is 30° . The marks are labeled 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12.
- Bottom-left diagram:** A circle with 10 divisions. The angle between adjacent divisions is 72° . The angle between adjacent marks is 144° . The marks are labeled U_0 .
- Bottom-right diagram:** A circle with 12 divisions. The angle between adjacent divisions is 120° . The angle between adjacent marks is 120° . The marks are labeled U_0 .

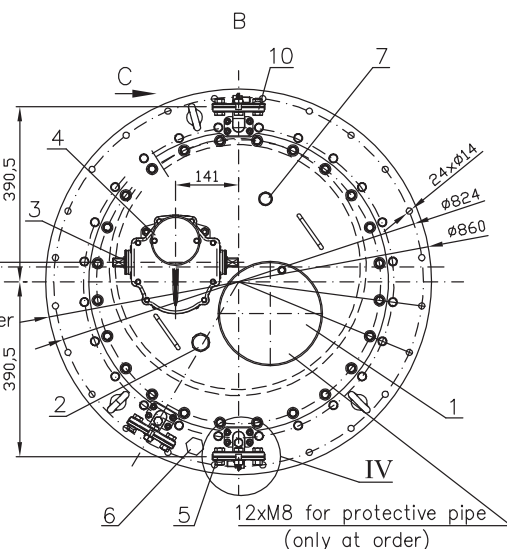
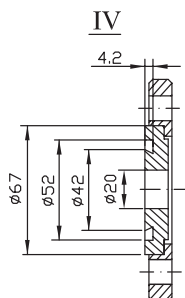
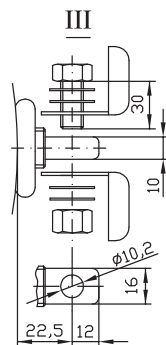
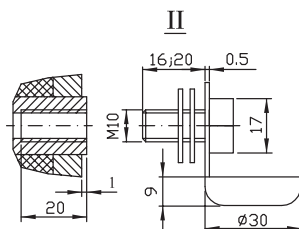
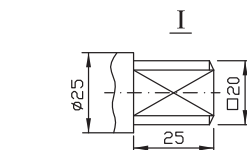
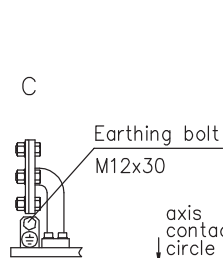
	APPROX.TOTAL WEIGHT, kg	APPROX.OIL VOLUME, lt
10 POS.	340	145
12 POS.	342	145

1. PROTECTIVE MEMBRANE
2. OPENING FOR THERMAL RELAY
3. DRIVE SHAFT
4. TAP POSITION INDICATOR
5. FLANGE FOR DRAIN PIPE (ROTATING)
6. BLEEDING OF TRANSFORMER TANK
7. BLEEDING OF ON-LOAD TAP CHANGER HEAD
8. PROTECTIVE RELAY FLANGE (ROTATING)
9. CONNECTING FLANGE FOR OIL FILTER (ROTATING)-BY CLIENT REQUIREMENT
10. MOUNTING FLANGE OF TRANSFORMER COVER

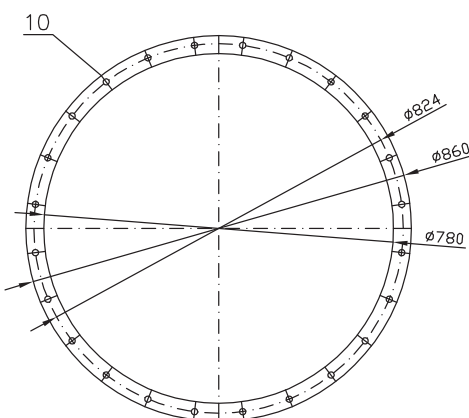


	DIMENSIONS (mm)		
	H	h1	h2
41,5kV	1657	452,5	199
72,5kV	1847	522,5	259

1. PROTECTIVE MEMBRANE
2. OPENING FOR THERMAL RELAY
3. DRIVE SHAFT
4. TAP POSITION INDICATOR
5. FLANGE FOR DRAIN PIPE (ROTATING)
6. BLEEDING OF TRANSFORMER TANK
7. BLEEDING OF ON-LOAD TAP CHANGER HEAD
8. PROTECTIVE RELAY FLANGE (ROTATING)
9. CONNECTING FLANGE FOR OIL FILTER (ROTATING)—BY CLIENT REQUIREMENT
10. MOUNTING FLANGE OF TRANSFORMER COVER

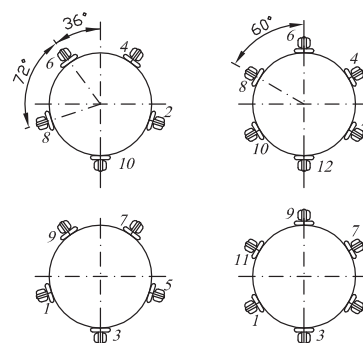


(For other position of worm gear and more details acc. OLTC's head refer to dwg. 1204 and 1205.)

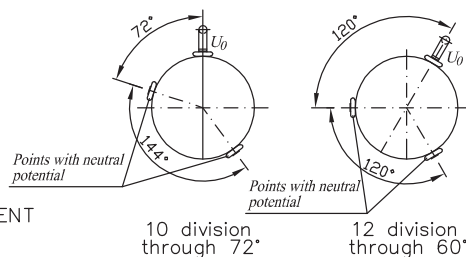


	APPROX.TOTAL WEIGHT, kg		APPROX.OIL VOLUME, lt	
	41,5kV	72,5kV	41,5kV	72,5kV
10 POS.	585	620	265	300
12 POS.	590	625	265	300

TAP-SELECTOR DIVISION DIAGRAM



POSITION OF THE NEUTRAL CONNECTIONS
(For more details acc. their mounting see dwg.1213)

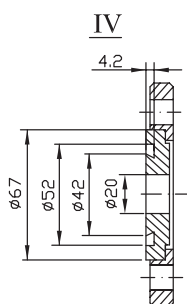
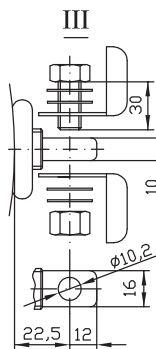
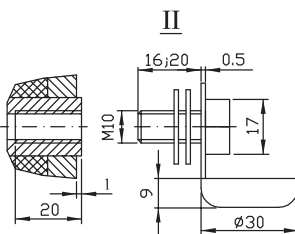
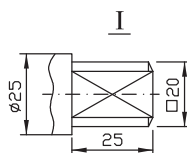
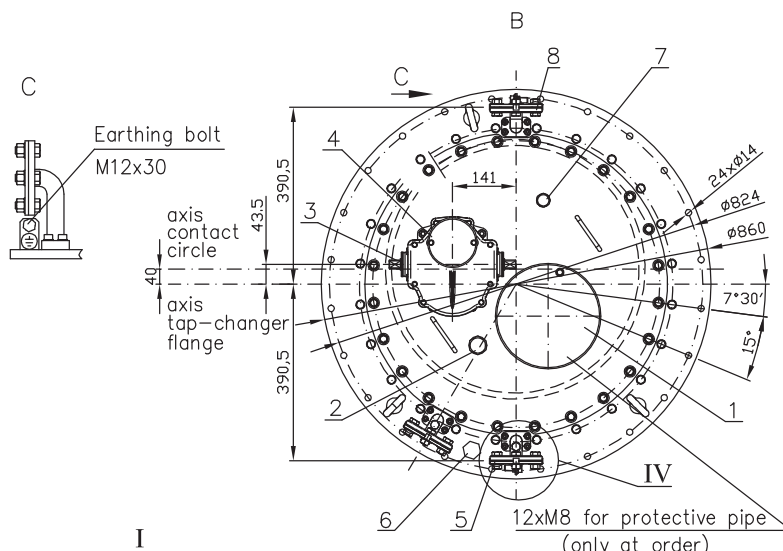
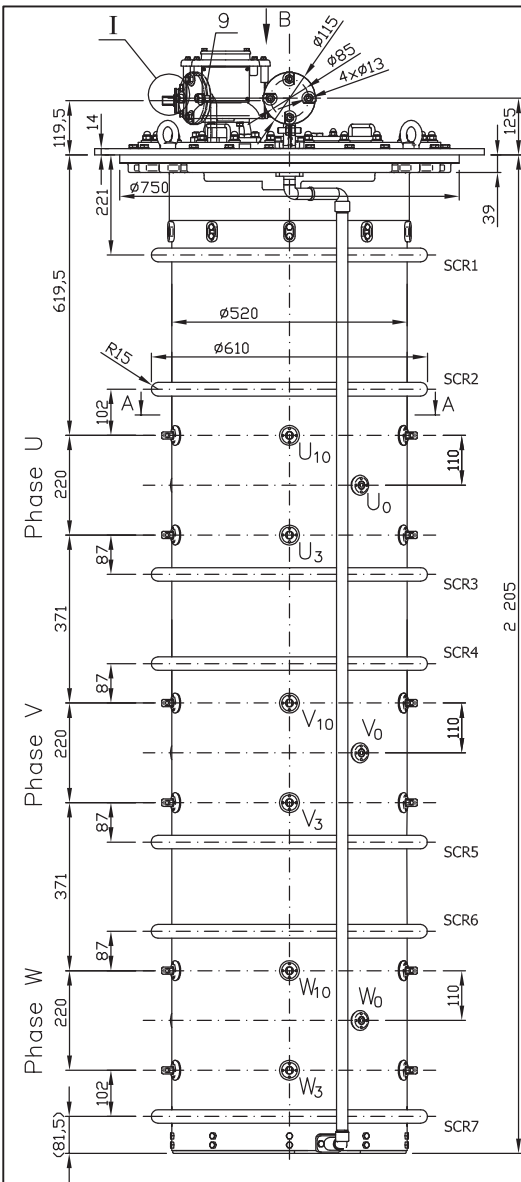


VOLTA P
ELPROM

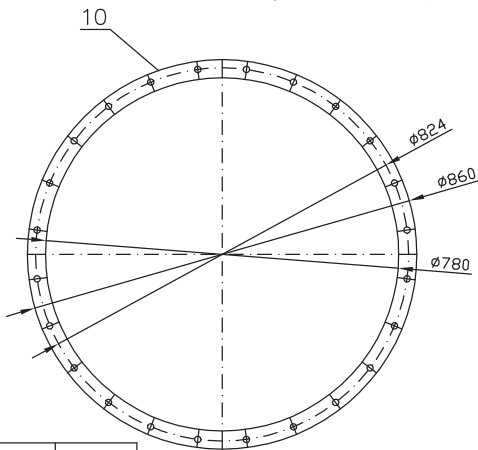
ON-LOAD TAP-CHANGER
RSV 12 Y 250/400/600A 41,5/72,5kV
10/12 0

№1209

2023



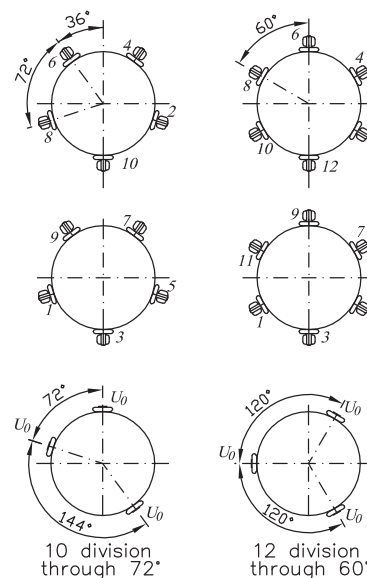
(For other position of worm gear and more details acc. OLTC's head refer to dwg. 1204 and 1205.)



SCR. No	SCR. POTENTIAL
SCR.1	EARTH
SCR.2	U6
SCR.3	U5
SCR.4	V6
SCR.5	V5
SCR.6	W6
SCR.7	W5

	APPROX.TOTAL WEIGHT, kg	APPROX.OIL VOLUME, lt
10 POS.	715	360
12 POS.	720	360

TAP-SELECTOR DIVISION DIAGRAM



1. PROTECTIVE MEMBRANE
2. OPENING FOR THERMAL RELAY
3. DRIVE SHAFT
4. TAP POSITION INDICATOR
5. FLANGE FOR DRAIN PIPE (ROTATING)
6. BLEEDING OF TRANSFORMER TANK
7. BLEEDING OF ON-LOAD TAP CHANGER HEAD
8. PROTECTIVE RELAY FLANGE (ROTATING)
9. CONNECTING FLANGE FOR OIL FILTER (ROTATING)–BY CLIENT REQUIREMENT
10. MOUNTING FLANGE OF TRANSFORMER COVER

VOLTA P
ELPROM

ON-LOAD TAP-CHANGER
RSV 12 D 250/400/600A 145kV
10/12 0

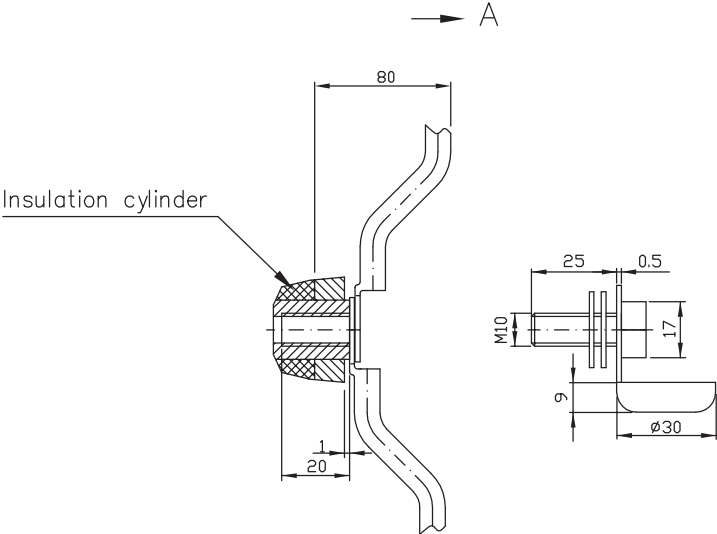
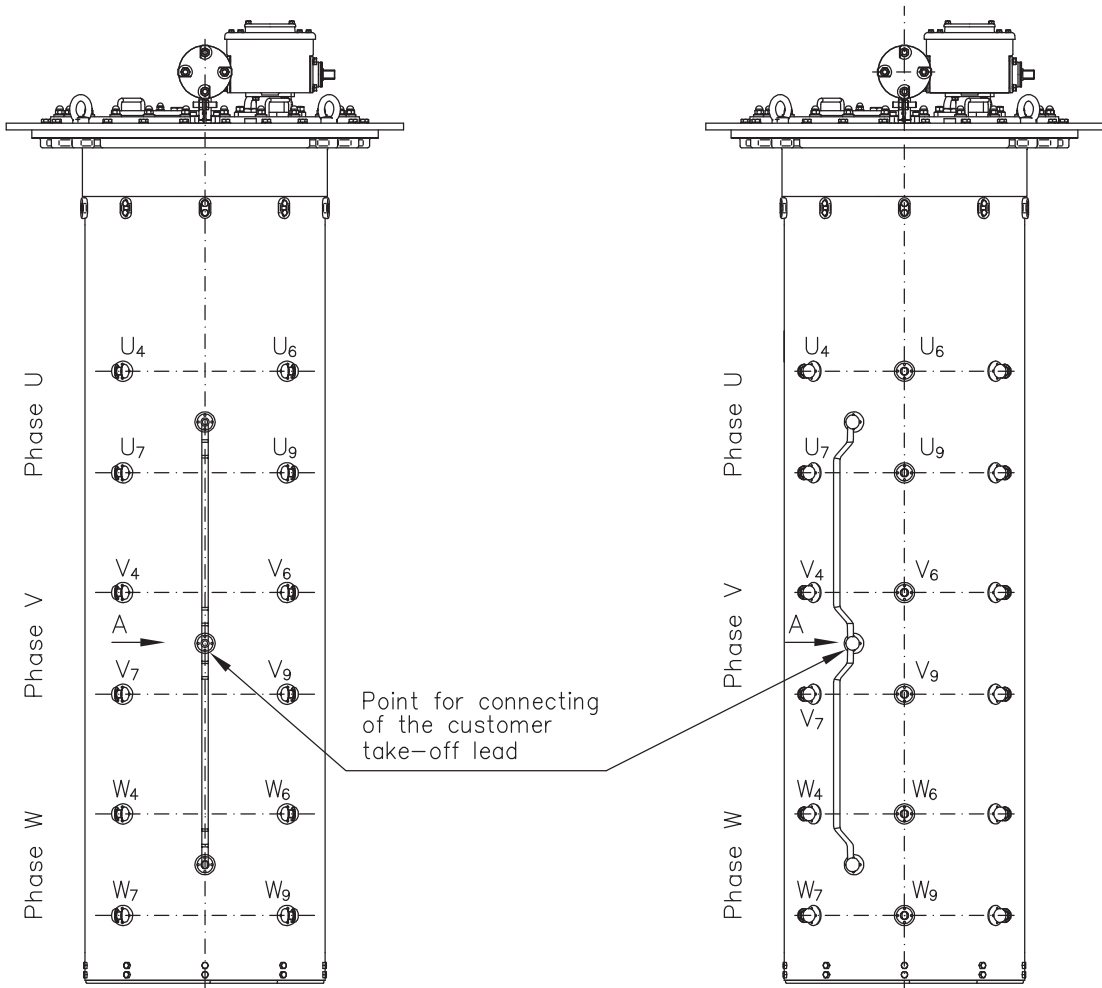
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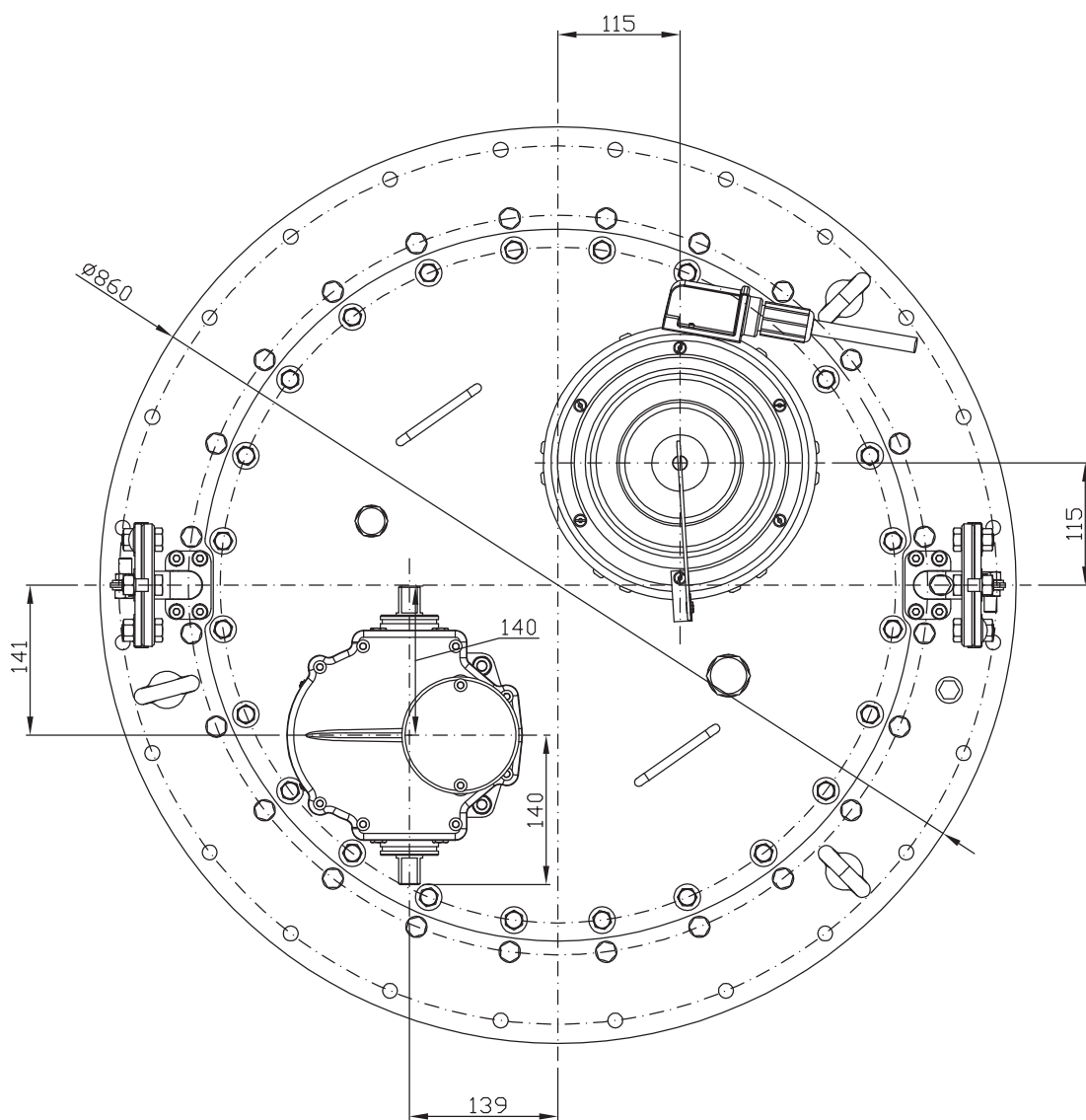
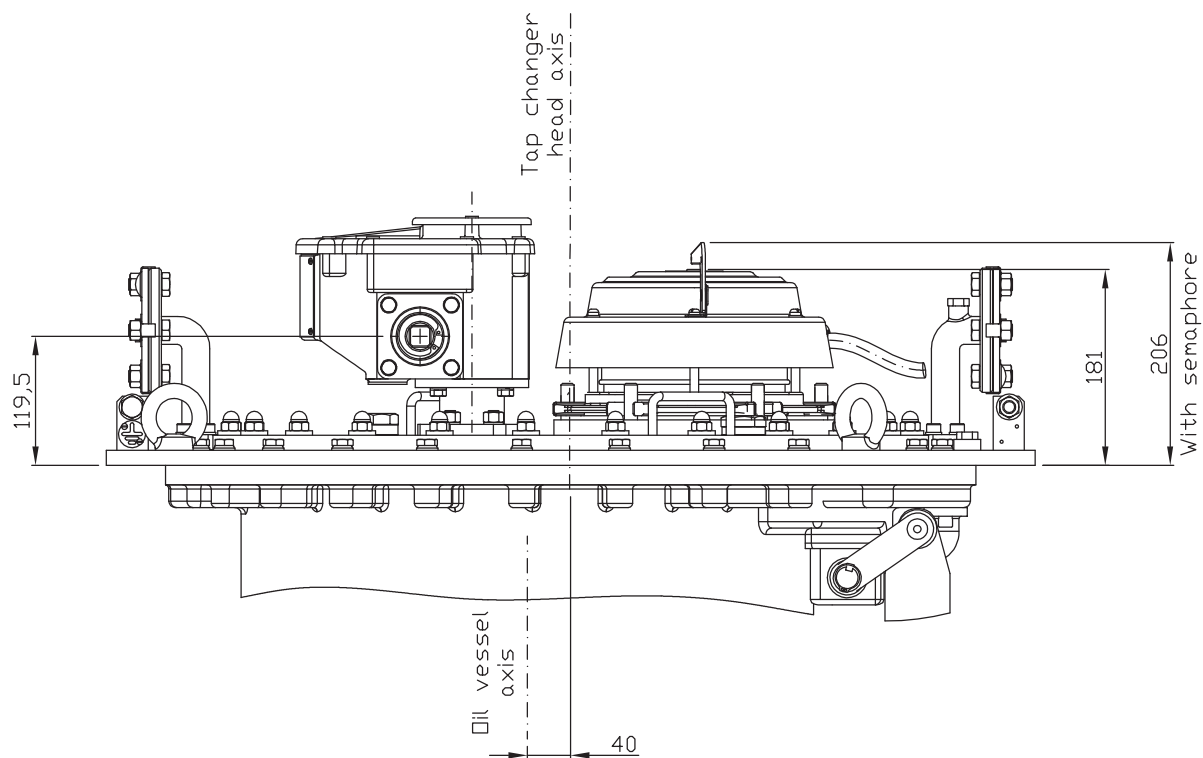
2023

View against change-over selector

10 division

12 division





VOLTA P
ELPROM

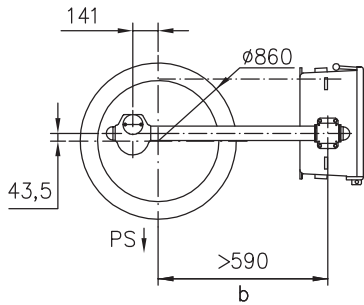
**ON-LOAD TAP-CHANGER RSV 12
TAP-CHANGER HEAD WITH PRD
TYPE 'QUALITROL'**

№ 1204

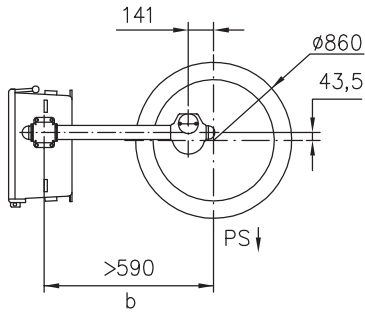
2023

HORIZONTAL SHAFTS ARRANGEMENT
STANDARD DESIGN

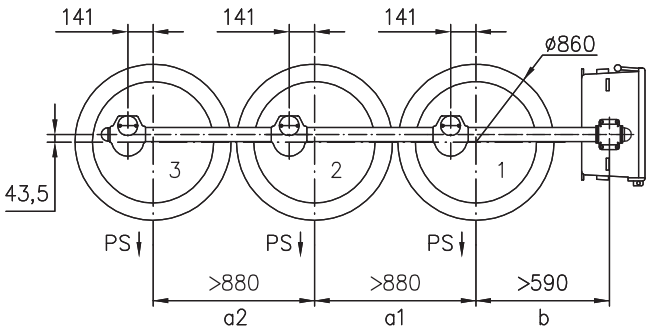
P1



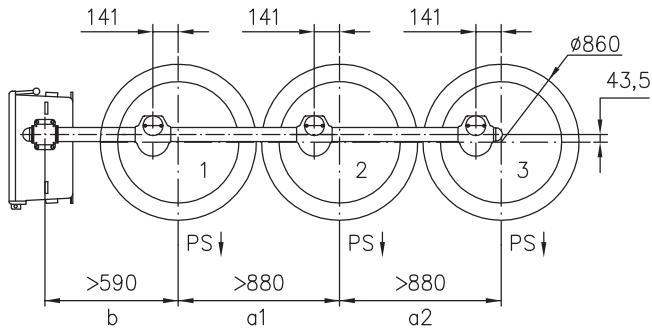
P2



P3

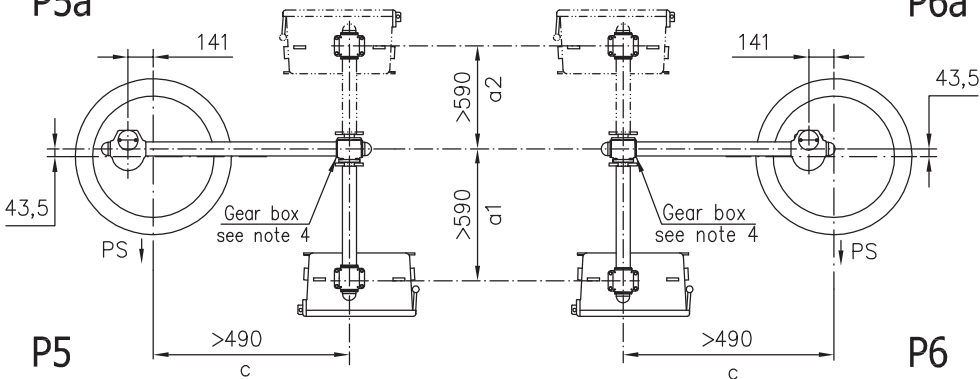


P4

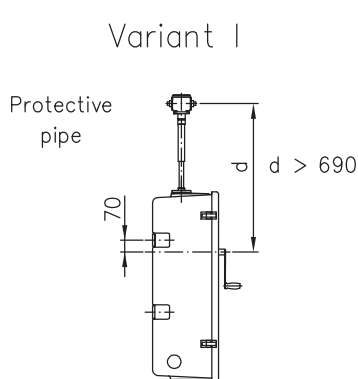


HORIZONTAL SHAFTS ARRANGEMENT
SPECIAL DESIGN

P5a



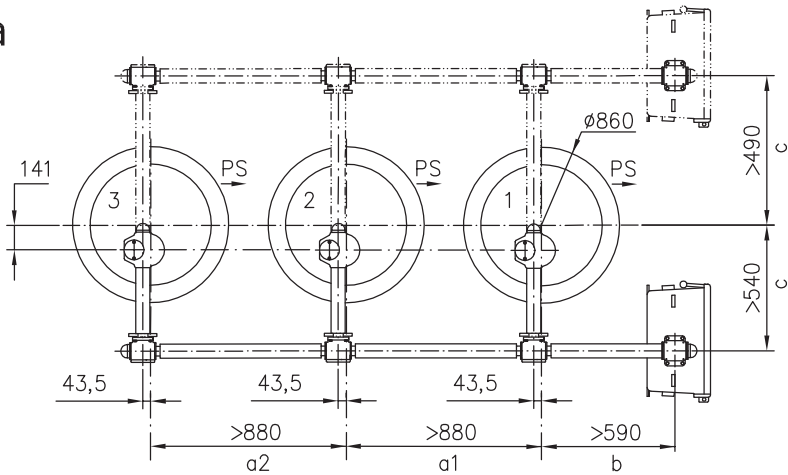
P6a



P5

P6

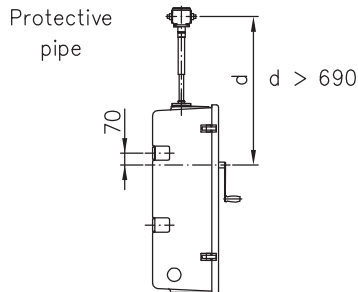
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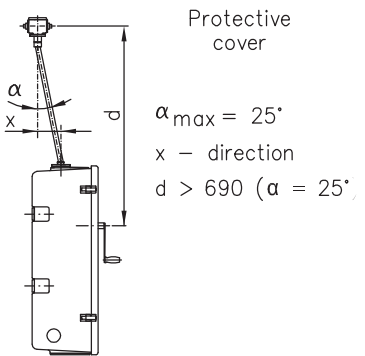
P7

VERTICAL SHAFTS
ARRANGEMENT

Variant I



Variant II



VOLTA P
EL PROM

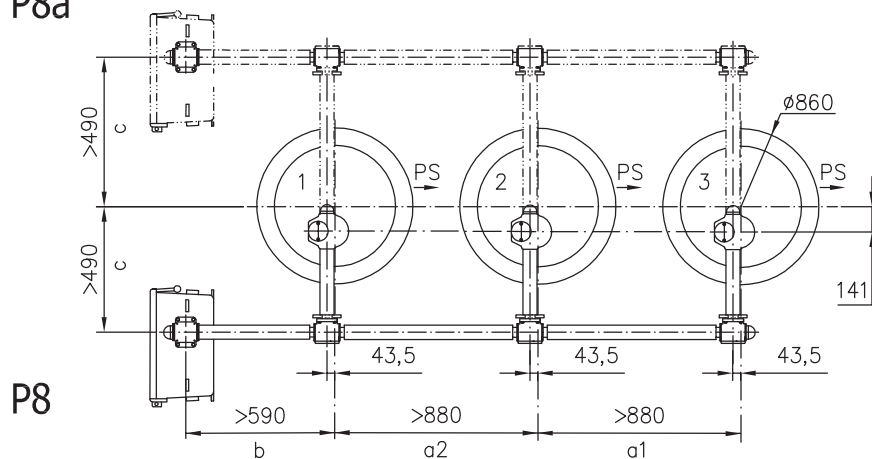
ON-LOAD TAP-CHANGER RSV 12
DRIVING SHAFTS ARRANGEMENT

№ 1206

2023

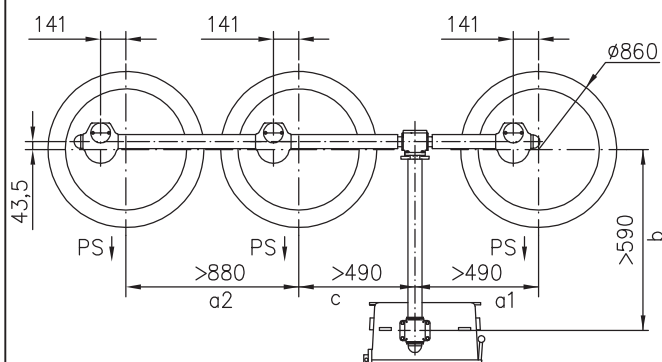
1/3

P8a

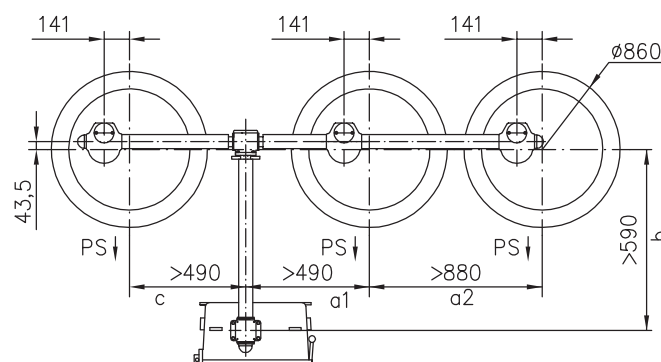


P8

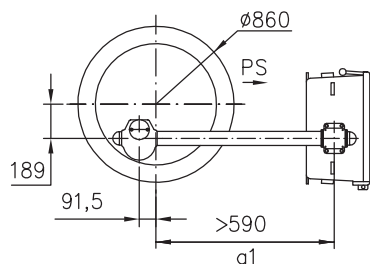
P9



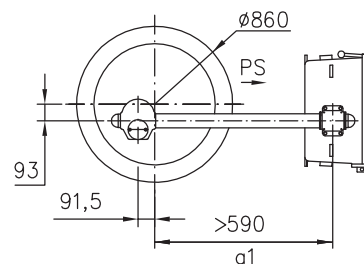
P10



P11



P12

[illegible]

EQUATIONS

Disposal Shaft length	P7	P7a	P8	P8a	P9	P10	P11	P12
La1	a1–290				a1–466		a1–233,5	
La2	a2–290				a2–360		—	—
Lb	b–246		b–333,5		b–320		—	—
Lc	c–540	c–257	c–540	c–257	c–184		—	—
Ld	$\frac{d-615}{\cos\alpha}$							

NOTES: 1. "L"— Driving shaft length.

2. PS – Disposal of change–over selector.

3. Distances are determined by mechanical reasons only.

Insulating distances are not considered.

4. In case of two units, number 3 or 1 are omitted.

5. Gear box is No202.4.

For more information see Manual EA581.4e.

ON LOAD TAP CHANGERS

TYPE RSV 12

VOLTA P
E L P R O M

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Web: www.voltage.com
