



TECHNICAL DATA

TYPE WSL

OFF-CIRCUIT TAP CHANGER

HM0.154.602



SHANGHAI HUAMING POWER EQUIPMENT CO., LTD.

General

1. General	2
2. Technical specifications	2
3. Type designation	3
4. Terms and definitions	5
5. Special design	10
6. Operation method	10
7. Position indicator	11
8. accessories	11
9. Appendixes	11
Appendix 1 WSLIV-600/800/1000A overall dimensions, linear regulation	12
Appendix 2 WSLV-600/800/1000A overall dimensions, single-bridging regulation	13
Appendix 3 WSLVI-600/800/1000A overall dimensions, Y-D change-over regulation	14
Appendix 4 WSLVII-600/800/1000A overall dimensions, double-bridging regulation	15
Appendix 5 WSLVIII-600/800/1000A overall dimensions, series-parallel regulation	16
Appendix 6 WSLII-600/800/1000A overall dimensions, reversing regulation	17
Appendix 7 WSLII-1200/1600A overall dimensions, reversing regulation	18
Appendix 8 WSLIV-1200/1600A overall dimensions, linear regulation	19
Appendix 9 WSLIV-2000/2400/3000A overall dimensions, linear regulation	20
Appendix 10 WSLII-1000/1200A overall dimensions, reversing regulation, type A, special design	21
Appendix 11 Overall dimensions of transformer mounting flange for standard tank	22
Appendix 12 Overall dimensions of transformer mounting flange for bell-type	23
Appendix 13 Head flange for standard tank, type A, manual or motor driving at man position	24
Appendix 14 Head flange for standard tank, type B, manual or motor driving at man position	25
Appendix 15 Head flange for standard tank, type A, hand wheel operating on top	26
Appendix 16 Head flange for standard tank, type B, hand wheel operating on top	27
Appendix 17 Head flange for bell-type, type A, manual or motor driving at man position	28
Appendix 18 Head flange for bell-type, type B, manual or motor driving at man position	29
Appendix 19 Head flange for bell-type, type A, hand wheel operating on top	30
Appendix 20 Head flange for bell-type, type B, hand wheel operating on top	31
Appendix 21 bell-type supporting flange, type A	32
Appendix 22 bell-type supporting flange, type B	33
Appendix 23 Overall dimensions of the connection terminal	34
Appendix 24 Schematic mounting diagram of the motor driving off-circuit tap changer	35
Appendix 25 Schematic mounting diagram of the manual driving off-circuit tap changer	36
Appendix 26 Overall dimensions of bevel gearbox	37
Appendix 27 Overall dimensions of manual drive mechanism	38

1. General

Type WSL Off-Circuit Tap Changer (herein referred as tap changer) is of in-tank structure and without separate oil compartment. It is mounted to transformer tank by a tap changer head flange.

By the operation method, tap changer can be divided into motor driving at man position, and manual drive mechanism operating at man position as well as hand wheel manual operation on the top.

By the dimensions of contact circle diameter, tap changer can be divided into type A and type B. Tap changer head flange can be either bell type mounting or standard tank mounting type.

By tap changer internal structure, it can be divided into linear, single-bridging, double-bridging, Y-D change-over, series-parallel change-over and reversing. Refer to table 2 for the basic connection methods code and Fig. 2 for connection schematic diagrams.

2. Technical Specifications

Type WSL off-circuit tap changer complies with IEC 60214-1:2003 Tap changer technical data is listed in Table 1 below.

Table 1 Type WSL Series of Off-Circuit Tap Changer Technical Data

Item	Type		WSL, WDL							
1	No. of Phases		3-phase (WSL), single-phase (WDL)							
2	Max. rated through current(A)		600	800	1000	1200	1600	2000	2400	3000
3	Short-circuit current test (kA)	Thermal (3s)	9	12	15	15	20	24	26	30
		Dynamic (Peak)	22.5	30	37.5	37.5	50	60	65	75
4	Rated frequency (Hz)		50 or 60							
5	Insulation to ground (kV)	The highest voltage for equipment	12		72.5			126		
		Rated separate source AC withstand voltage(kV/50Hz,1min)	36		140			230		
		Rated lightning impulse withstand voltage (kV,1.2/50μs)	75		325			550		
6	Internal insulation		Refer to table 3							
7	Contact circle diameter		Type A: Ø350 Type B: Ø500 or Ø550							
8	Max. operating positions		Max. 5 for type A and max. 11 for type B, see appendix							
9	Mechanical life		Not less than 10,000 operations for manual driving Not less than 100,000 operations for motor driving							
10	Weight (kg)		Type A Max.: 100				Type B Max.: 195			

Remark: The tap changer can be designed and produced according to special requirements, please contact us accordingly Single-phase W □ L OCTC drawings are not including in this Technical Data, please contact us if you require single-phase W □ L OCTC.

3. Type designation

3.1. Type explanation

Due to the different combinations of number of phases, maximum rated through current, the highest voltage for equipment and connections, type WSL off-circuit tap changer comes with various models. Hence, the type designation shall provide all the above technical parameters and below is its detailed explanation in Fig. 1.

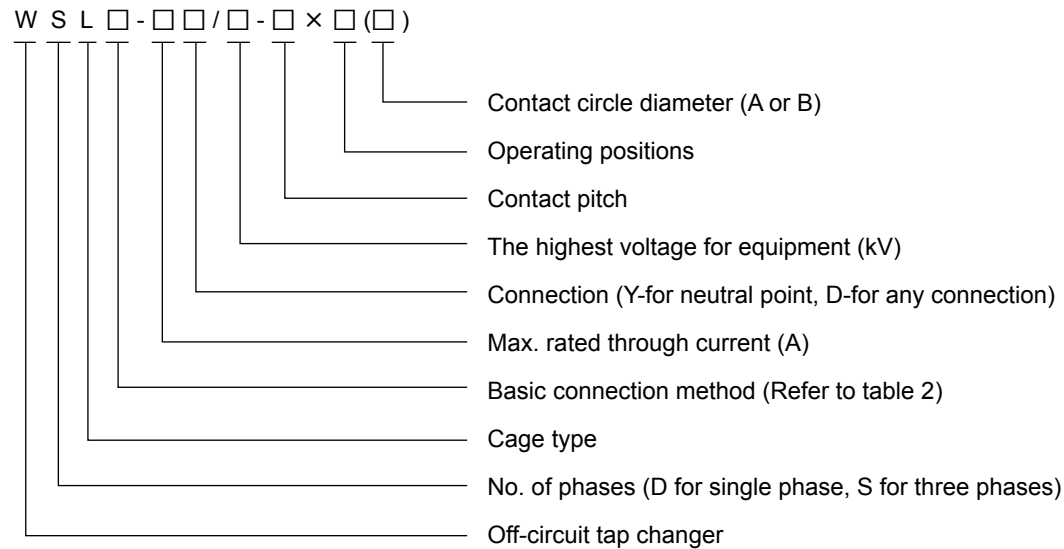


Fig. 1 Tap Changer Model Explanation

Table 2 Tap Changer Basic Connection Method and Mark

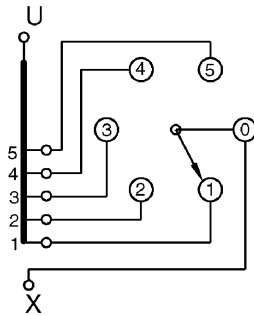
Code	IV	V	VI	VII	V III	II
Connection	Linear	Single-bridging	Y-D change-over	Double-bridging	Series-paralle Change-over	Reversing

3.2. Tap changer basic connection diagram

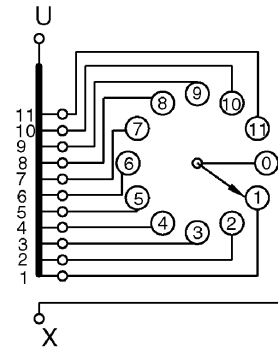
Different transformer winding tapping corresponds to different tap changer basic connection diagram. Fig.2 shows commonly used connections. It can also be specially designed as per customer requirement.

Linear

Type A

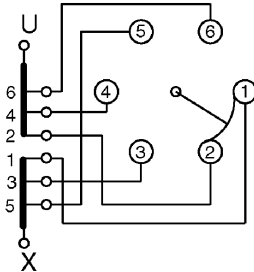
 6×5

Type B

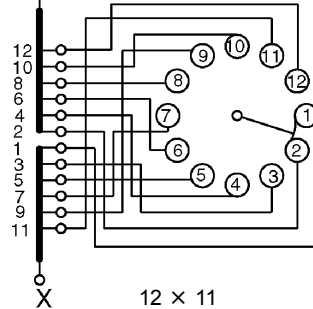
 12×11

Single-bridging

Type A

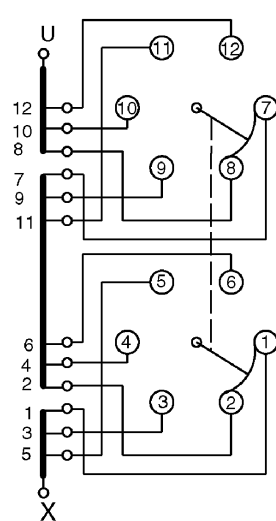
 6×5

Type B

 12×11

Double-bridging

Type A

 6×5

Type B

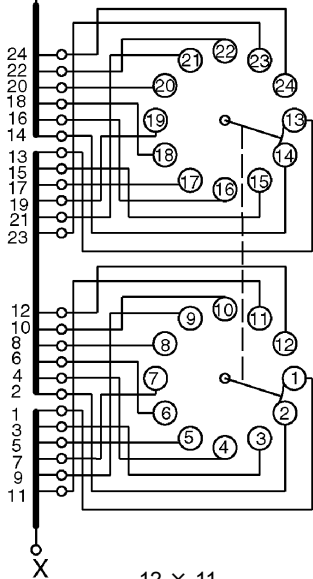
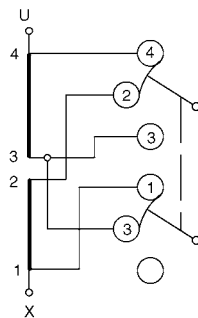
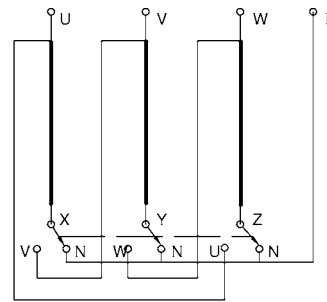
 12×11

Fig. 2 Tap Changer Basic Connection Diagram

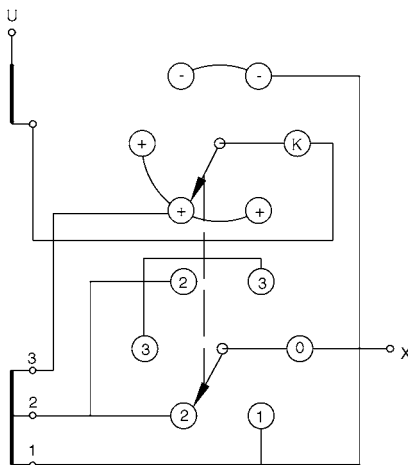
Series-parallel change-over



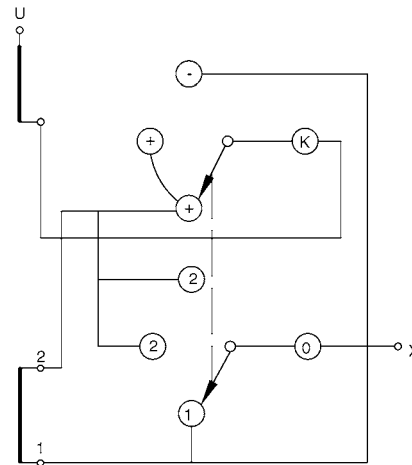
Y-D change-over



Reversing



6 × 5



4 × 3

Fig. 2 Tap Changer Basic Connection Diagram (Continued)

4. Terms and definitions

4.1. Rated through-current

Rated through current I_u : The current flowing through the tap changer toward the external circuit, which can be carried continuously while meeting the requirement.

The 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. 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 Type WSL Series of Off-Circuit Tap Changer Technical Data.

4.3. Service condition of tap changers

4.3.1. Service temperature range of the tap changer in oil is $-25^\circ\text{C} \sim +100^\circ\text{C}$.

4.3.2. Service ambient air temperature range of tap changer is $-25^\circ\text{C} \sim +40^\circ\text{C}$. Relative humidity is less than 85%.

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

4.3.4. There shall be no serious dust, explosive gas or corrosive gas on service site Remark: Please contact us if special application required.

4.4. Internal insulation of tap changer

The internal insulation of WSL off-circuit tap changer is mainly depending on the rated withstand voltage of actual required gradient. Voltage gradient of tap changer internal insulation usually occurs during the transformer lightning impulse test and inductive withstand voltage test. It changes with the tap positions. Refer to table 3 for the internal insulations and fig. 3 for basic connection diagram and insulation distance mark. It must be checked when selecting the tap changer to ensure the conformity with insulation requirement.

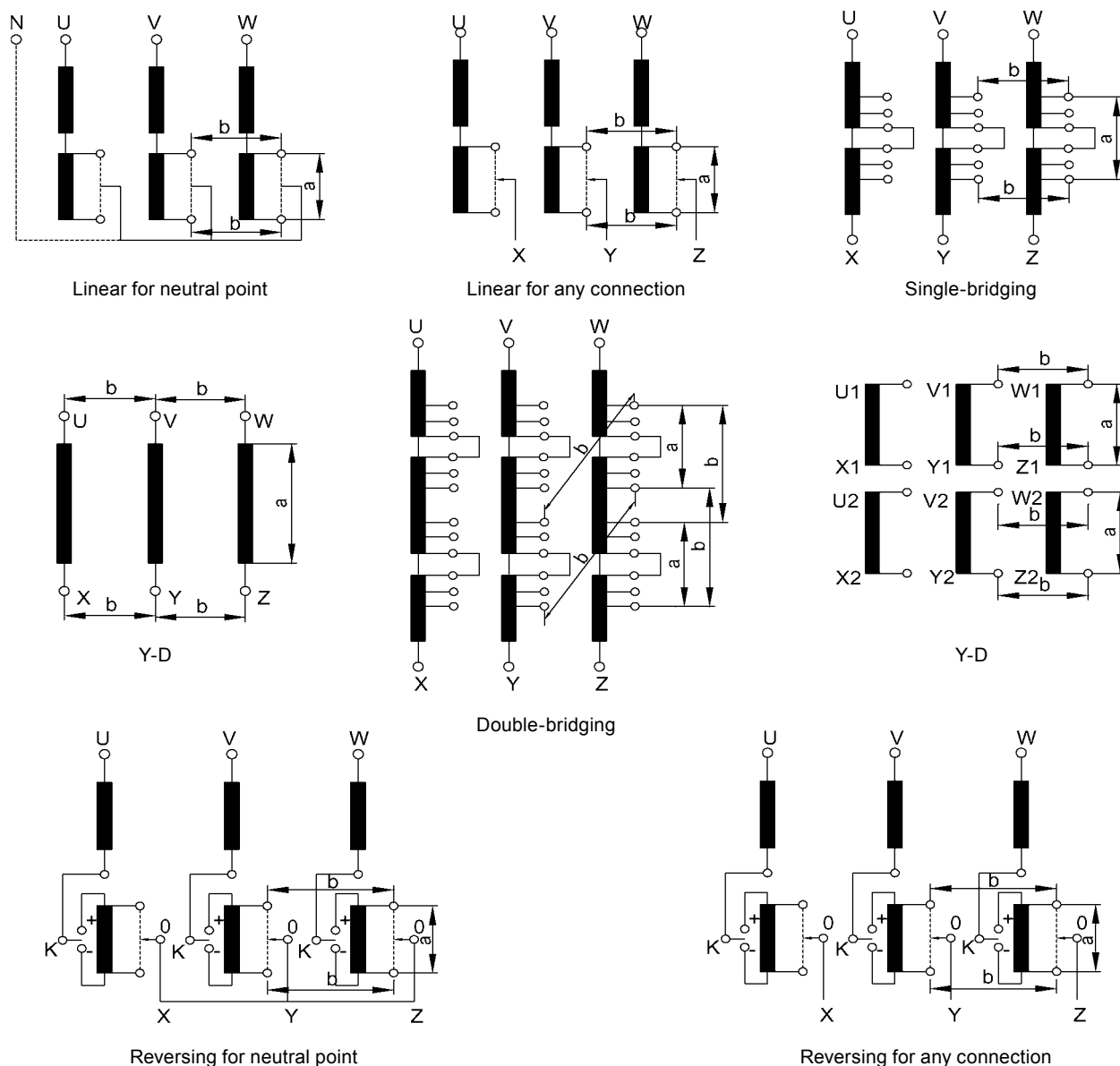


Fig. 3 Basic Connection Diagram and Insulation Distance Mark

Table 3 Tap Changer Internal Insulation Level

(Unit:kV)

Basic connection method Contact circle diameter		Linear for neutral point (IVY)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s
12	a	2-3	65	158	2-5	90	216
		4-5	65	158	6-11	65	158
	b	-	53	160	-	53	160
72.5	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	65	158
	b	-	72	226	-	72	226
126	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	65	158
	b	-	92	272	-	92	272
Basic connection method Contact circle diameter		Linear for any connection (IVD)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s
12	a	2-3	65	158	2-5	90	216
		4-5	65	158	6-11	65	158
	b	-	53	160	-	53	160
72.5	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	45	200
	b	-	200	450	-	200	450
126	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	65	158
	b	-	260	575	-	260	575
Basic connection method Contact circle diameter		Single-bridging (V)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s
12	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	65	158
	b	-	53	160	-	53	160
72.5	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	65	158
	b	-	185	405	-	185	405
126	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	65	158
	b	-	260	575	-	260	575

Table 3 Tap Changer Internal Insulation Level (Continued 1)

(Unit:kV)

Basic connection method Contact circle diameter		Double-bridging (VII)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s
12	a	2-5	65	158	2-5	90	216
		-	-	-	6-11	65	158
	b	-	53	130	-	53	130
72.5	a	2-5	65	158	2-5	65	158
		-	-	-	6-11	45	200
	b	-	185	130	-	185	405
126	a	2-5	70	216	2-5	85	258
		-	-	-	6-11	45	200
	b	-	225	495	-	225	495
Basic connection method Contact circle diameter		Series-parallel (VIII)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	kV, 50Hz,1min	kV, 1.2/50 μ s		kV, 50Hz,1min	kV, 1.2/50 μ s	
12	a	65	158		90	216	
	b	53	130		53	130	
72.5	a	-	-		90	216	
	b	-	-		185	405	
126	a	-			90	216	
	b	-			260	575	
Basic connection method Contact circle diameter		Y-D (VI)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	kV, 50Hz,1min	kV, 1.2/50 μ s		kV, 50Hz,1min	kV, 1.2/50 μ s	
12	a	75	170		90	216	
	b	53	130		53	130	
72.5	a	-	-		-		
	b	-	-		-		
126	a	-	-		-		
	b	-	-		-		

Table 3 Tap Changer Internal Insulation Level (Continued 2)

(Unit:kV)

Basic connection method Contact circle diameter		Reversing for neutral point (IIY)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s
12	a	2-3	65	158	2-3	90	216
		4-5	65	158	4-5	65	158
	b	-	53	160	-	53	160
72.5	a	2-5	65	158	2-5	90	216
	b	-	-	-	-	-	-
126	a	2-5	65	158	2-5	90	216
		-	-	-	-	-	-
	b	-	92	272	-	92	272
Basic connection method Contact circle diameter		Reversing for any connection (IID)					
		Ø350mm			Ø500mm		
The highest voltage for equipment	Insulation distance	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s	Tap Positions	kV, 50Hz,1min	kV, 1.2/50 μ s
12	a	2-3	65	158	2-5	90	216
		4-5	65	158	-	-	-
	b	-	53	130	-	53	130
72.5	a	2-5	65	158	2-5	90	216
	b	-	-	-	-	-	-
126	a	2-5	65	158	2-5	90	216
		-	-	-	-	-	-
	b	-	260	575	-	260	575

4.5. Tap changer insulation to earth

The insulation to earth is the insulation between tap changer live parts and grounding parts, it is determined by dielectric tests according to IEC-60214-1-2003 (refer to table 4).

Table 4 Tap changer 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)
12	35	75
72.5	140	325
126	230	550
170	325	750
252	460	1050

4.6. Tap changer mounting method

Type WSL off-circuit tap changer is a cage type without oil compartment, it can be mounted to transformer tank top by a head flange. Hence, transformer shall provide a mounting flange, there are two mounting methods of standard tank and bell-type according to the transformer structure, please refer to Appendix for dimensions.

5. Special design

This technical data is including relevant parameters of common tap changers; special design will be considered according to the requirements by client, such as big current rating or special connections. Please contact us for special requirement with details technical data.

For single phase off-circuit tap changer, please contact us for relevant overall dimensions.

6. Operation method

6.1 Hand wheel operation

Drive the main shaft of the tap changer directly through hand wheel on the top of the tap changer, thus to realize the tap changing.

6.2 Manual drive mechanism at man position

The manual drive mechanism is mounted on one side of the transformer tank, by which operate the tap changer through the drive shaft and bevel gearbox. Refer to appendix for overall dimensions and mounting schematic diagram.

6.3 Motor drive unit at man position

Using of CMA9 or CMA7 motor drive unit to realize the motor driving for the tap changer. Refer to Huaming tap changer type selecting manual for overall dimensions and table 5 for technical data of motor drive unit. Motor drive unit is mounted on the side of transformer, driving the tap changer through driving shaft and bevel gearbox. It is suitable for the tap changer required frequently tap changing or remote operation, see drawing in appendix.

Table 5 Motor Drive Unit Technical Data

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

7. Position indicator

7.1 HMC-3W off-circuit tap changer position indicator

HMC-3W OCTC position indicator is designed for CMA7 and CMA9 motor drive unit, it can be used to indicate the OCTC position in remote room.

HMC-3W technical data is as below, please refer to HMC-3W manual for details.

Working voltage: 220V AC

Power frequency: 50Hz

Maximum operation positions: 39

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

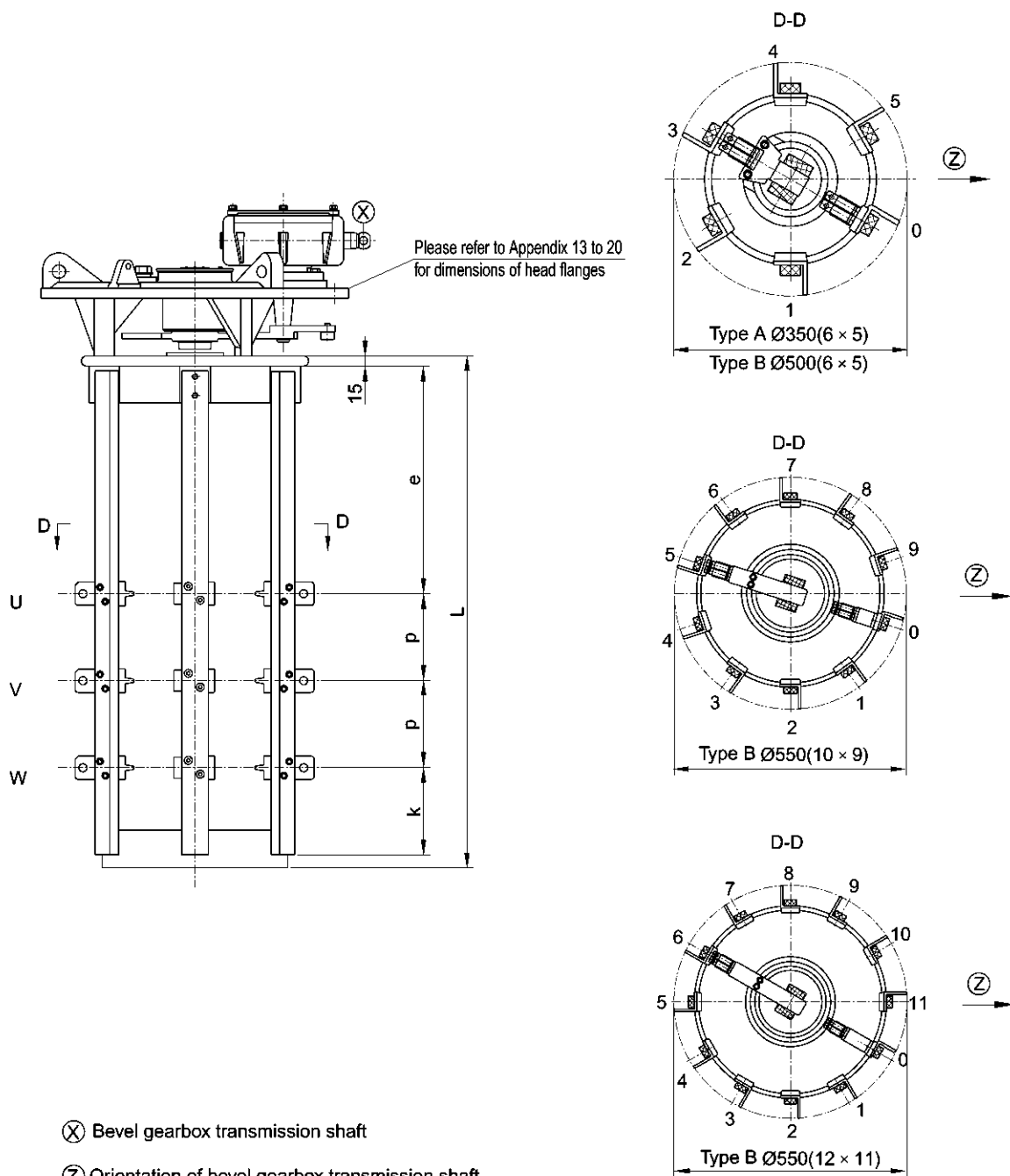
Note: for special power supply please inform when ordering.

8. Accessories

Bevel gearbox is applicable for connection of horizontal shaft of the tap changer and vertical shaft of the motor drive unit, by which transferring the driving torque from motor drive unit to the tap changer, its overall dimensions is shown in appendix 26.

9. Appendixes

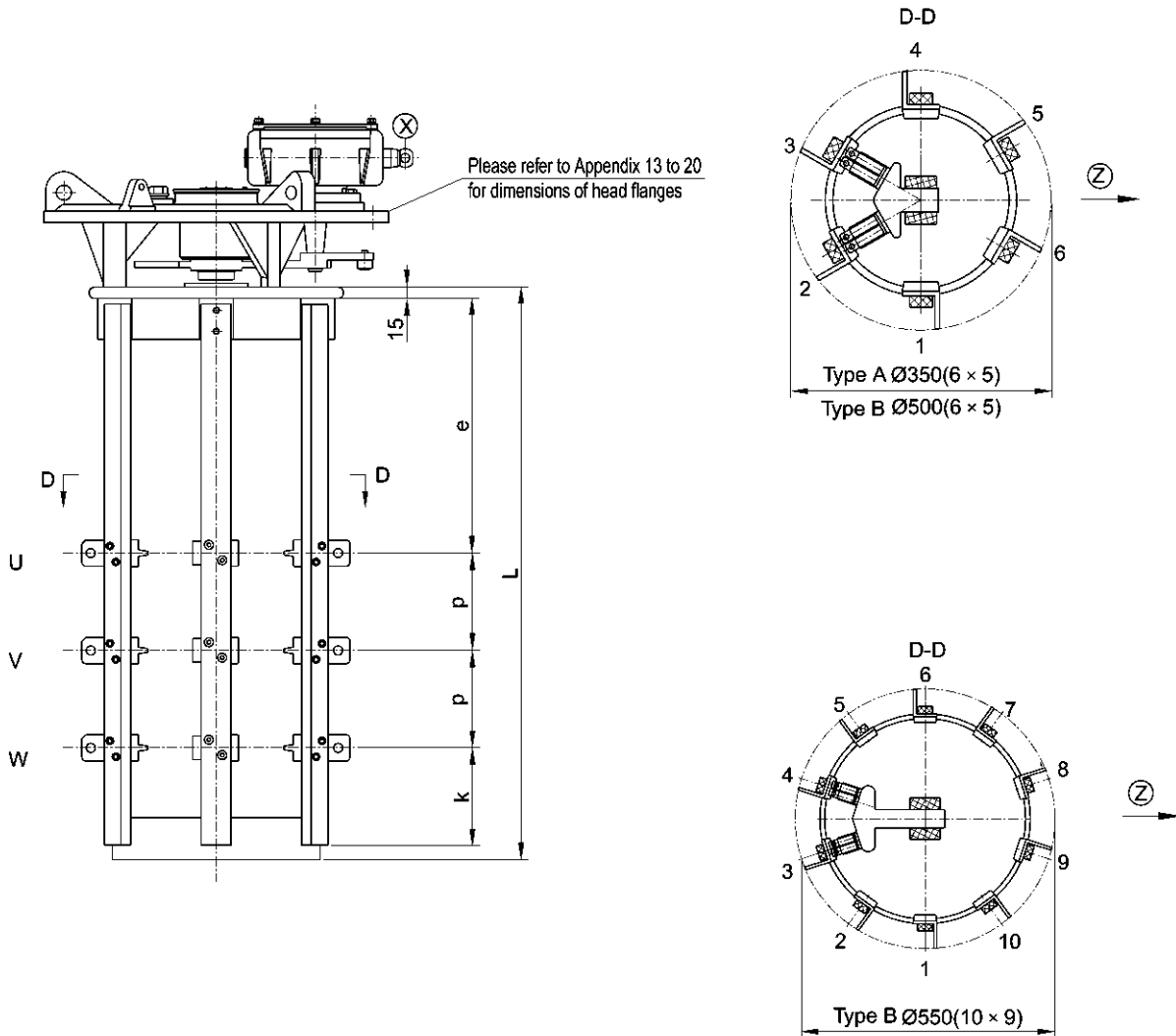
Appendix 1. WSLIV-600/800/1000A overall dimensions linear regulation



Connection	Y				D			
The highest voltage for equipment	e	p	k	L	e	p	k	L
12kV	200	130	130	624	200	130	130	624
72.5kV	340	130	140	774	340	280	140	1074
126kV	470	170	150	994	470	410	150	1474

Unit: mm

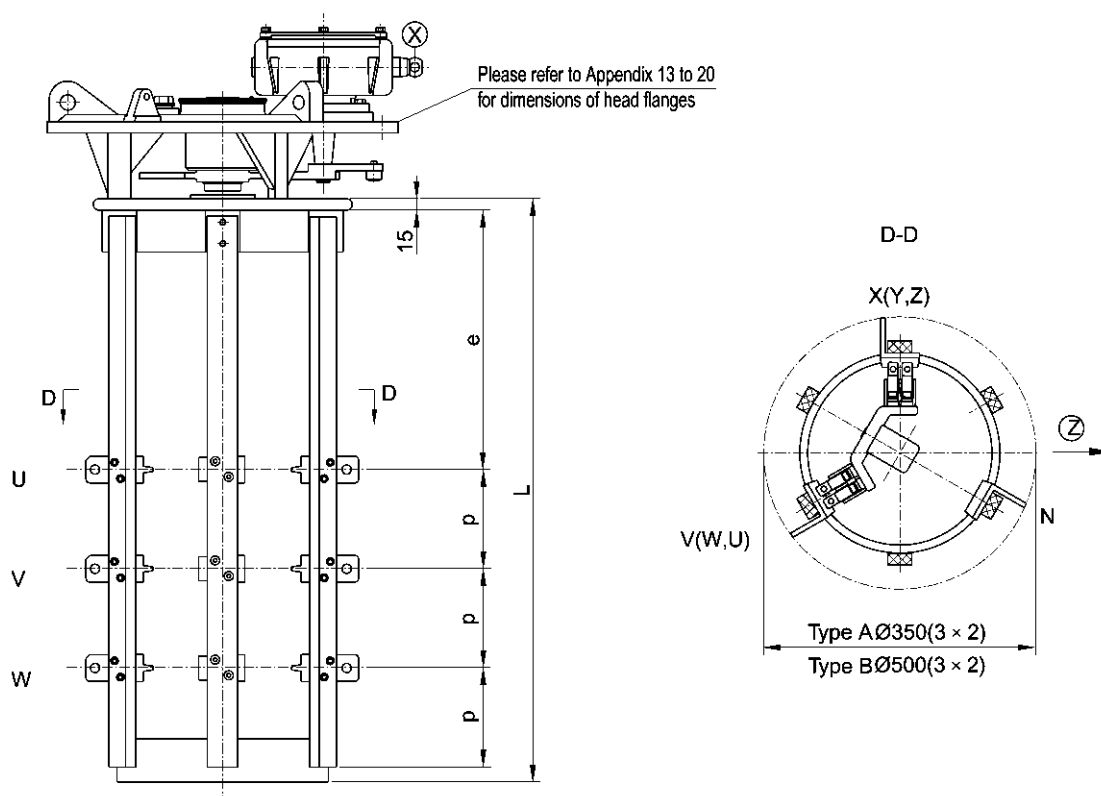
Appendix 2. WSLV-600/800/1000A overall dimensions single-bridging regulation



Connection	D			
The highest voltage for equipment	e	p	k	L
12kV	200	130	130	624
72.5kV	340	280	140	1074
126kV	470	410	150	1474

Appendix 3. WSLVI-600/800/1000A overall dimensions

Y-D change-over regulation



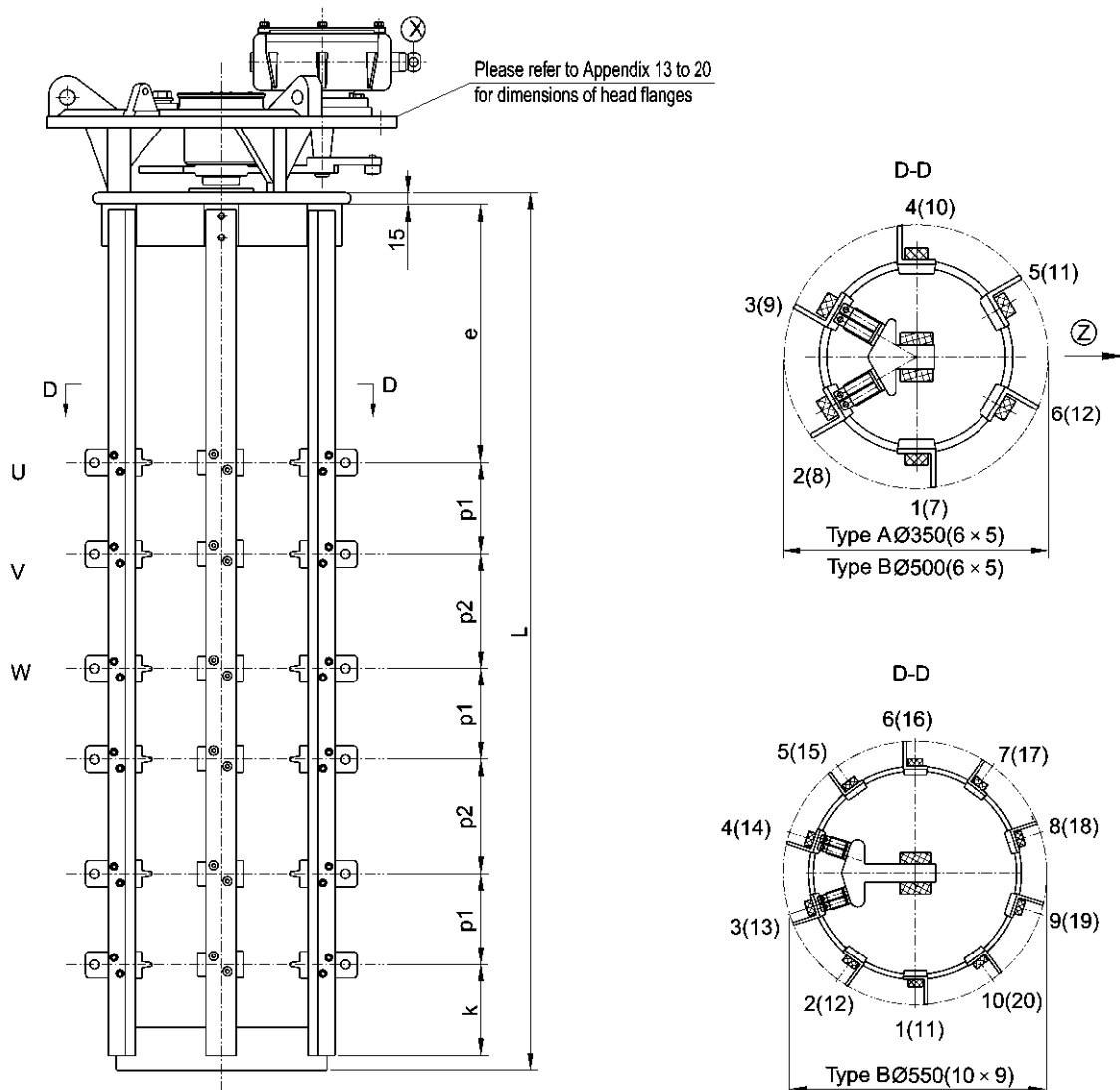
⊗ Bevel gearbox transmission shaft

⊙ Orientation of bevel gearbox transmission shaft

Note: 1) Generally type A is applicable to the current of 800A and below
2) Please refer to Appendix 23 for contact dimensions

The highest voltage for equipment	e	p	L
12kV	200	130	624
72.5kV	340	280	1214

Appendix 4. WSLVII-600/800/1000A overall dimensions double-bridging regulation



⊗ Bevel gearbox transmission shaft

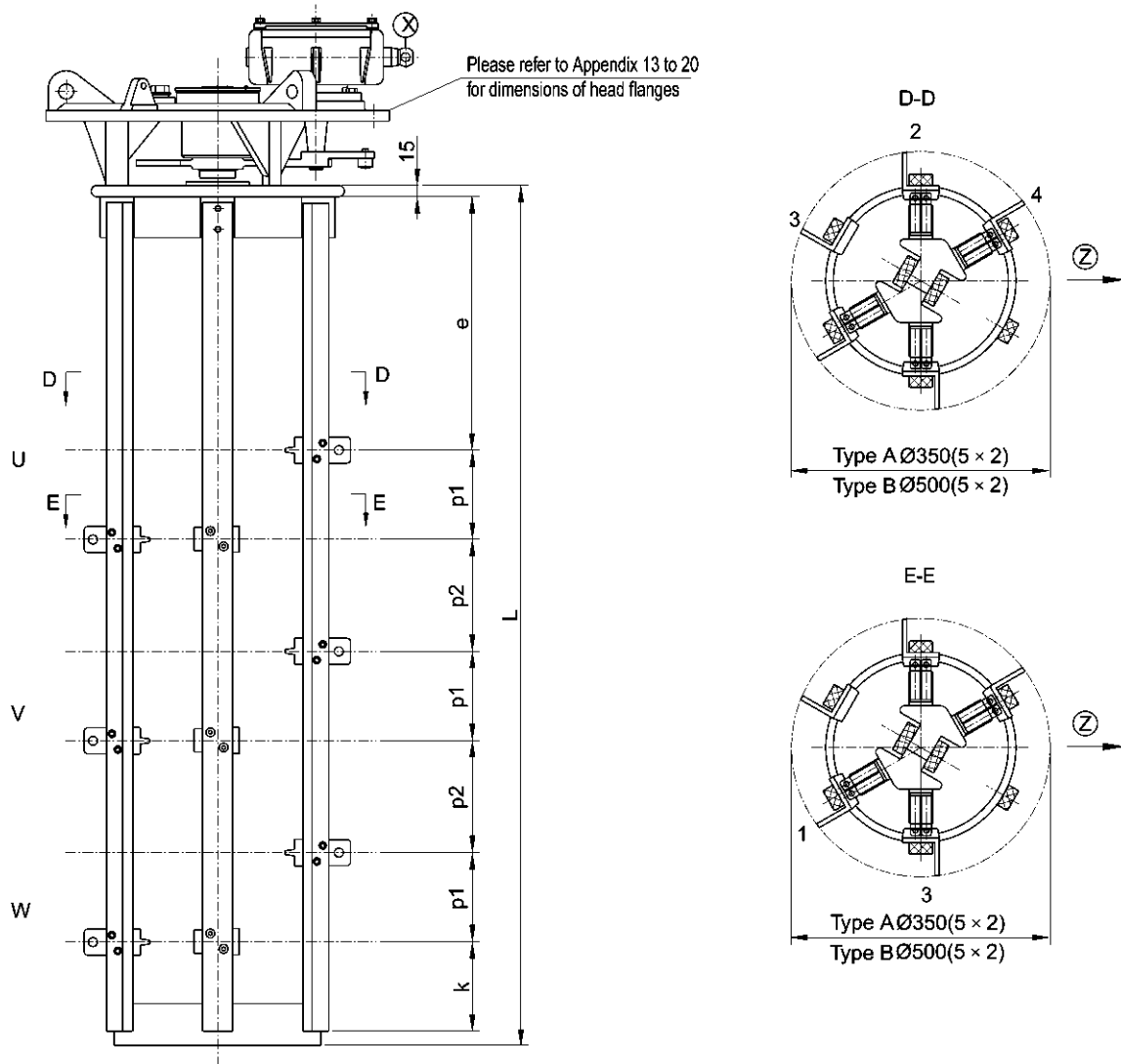
② Orientation of bevel gearbox transmission shaft

Note: 1) Generally type A is applicable to the current of 800A and below

2) Please refer to Appendix 23 for contact dimensions

The highest voltage for equipment	e	p1	p2	k	L
12kV	200	120	150	120	1014
72.5kV	340	160	280	140	1554
126kV	470	170	410	150	1984

Appendix 5. WSLVIII-600/800/1000A overall dimensions series-parallel regulation



(X) Bevel gearbox transmission shaft

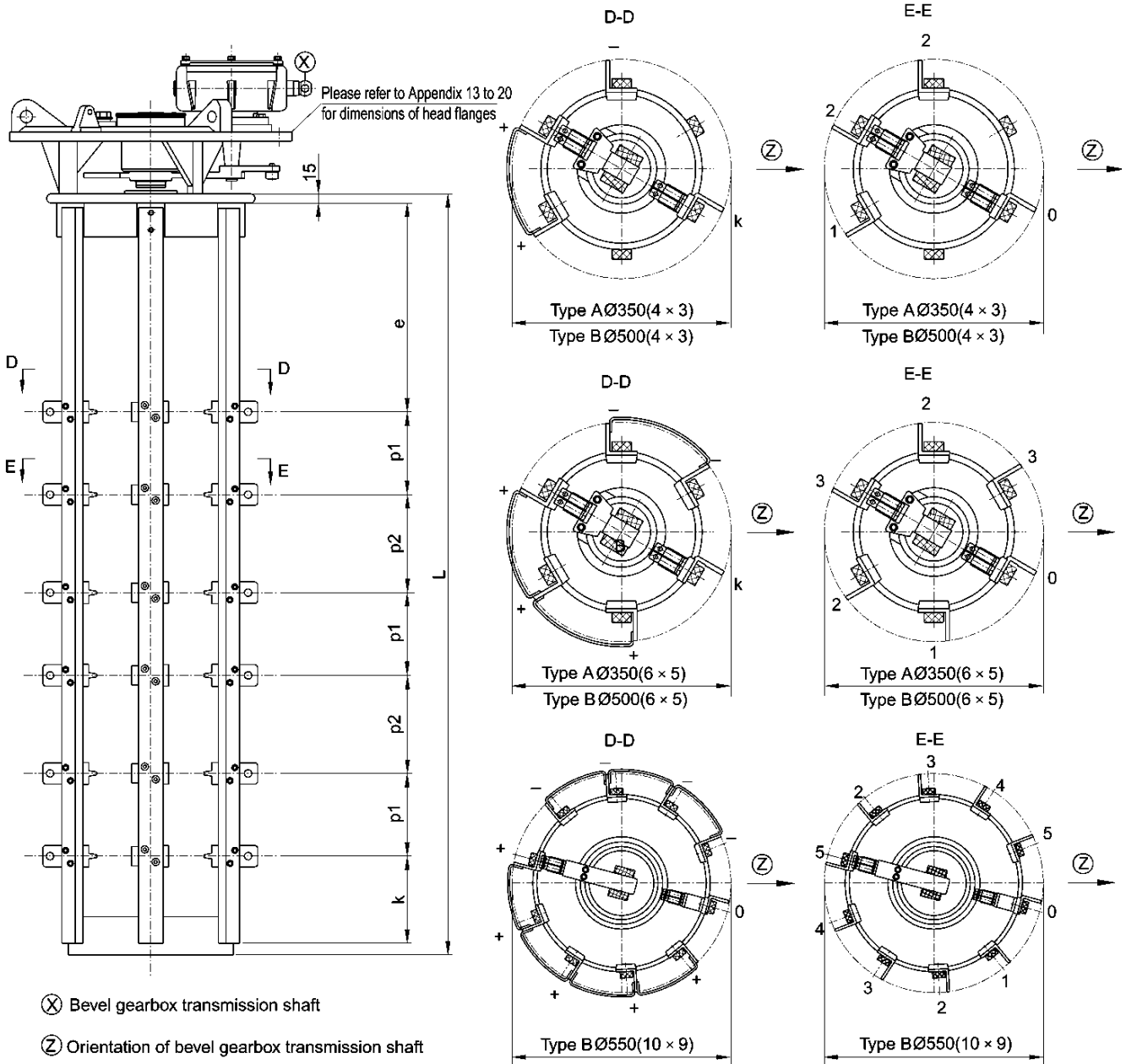
(Z) Orientation of bevel gearbox transmission shaft

Note: 1) Generally type A is applicable to the current of 800A and below

2) Please refer to Appendix 23 for contact dimensions

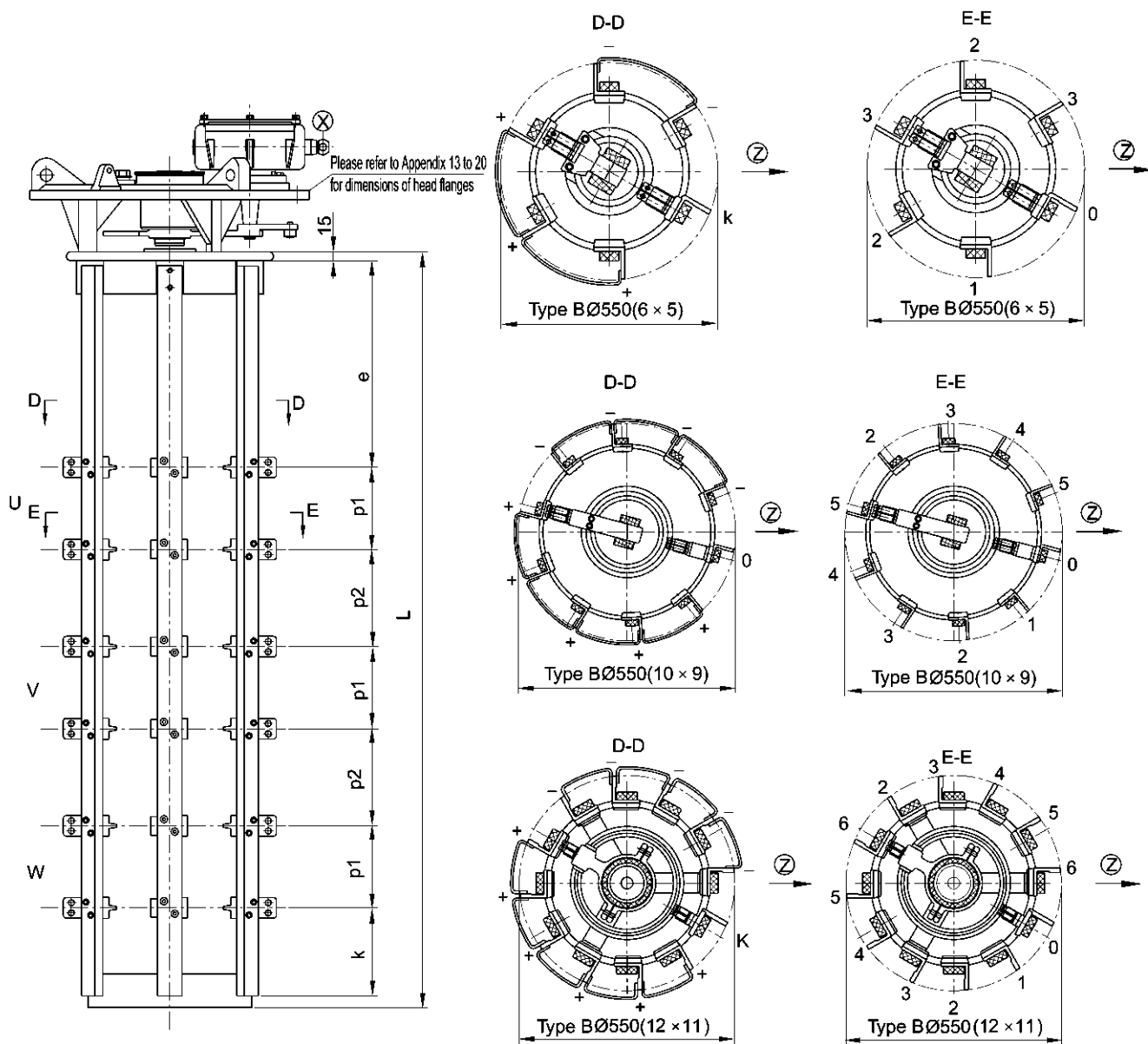
The highest voltage for equipment	e	p1	p2	k	L
12kV	200	120	150	120	1014
72.5kV	340	160	280	140	1554
126kV	470	170	410	150	1984

Appendix 6. WSLII-600/800/1000A overall dimensions reversing regulation

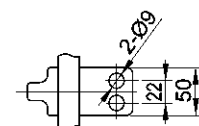


Connection	Y					D				
The highest voltage for equipment	e	p1	p2	k	L	e	p1	p2	k	L
12kV	170	120	120	120	904	200	120	150	120	1014
72.5kV	340	135	160	145	1244	340	160	280	140	1554
126kV	470	170	170	150	1504	470	170	410	150	1984

Appendix 7. WSLII-1200/1600A overall dimensions reversing regulation



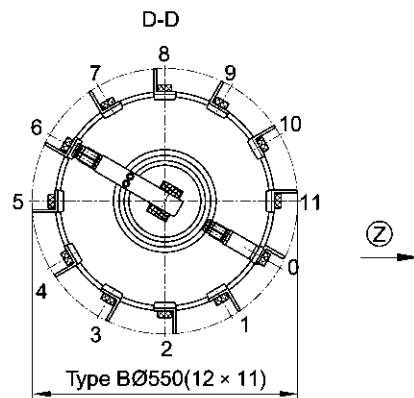
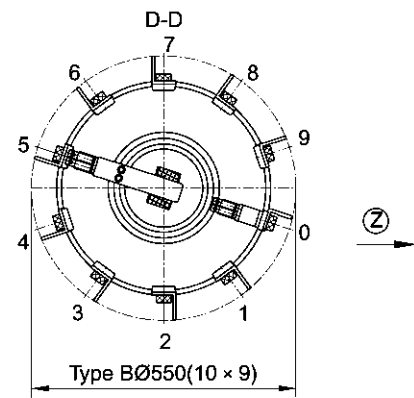
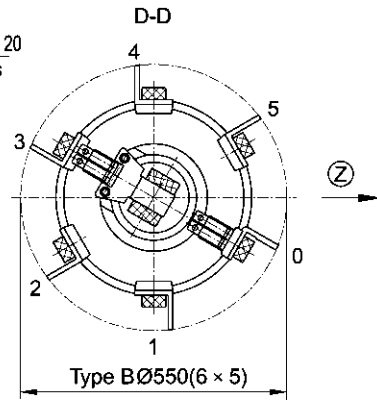
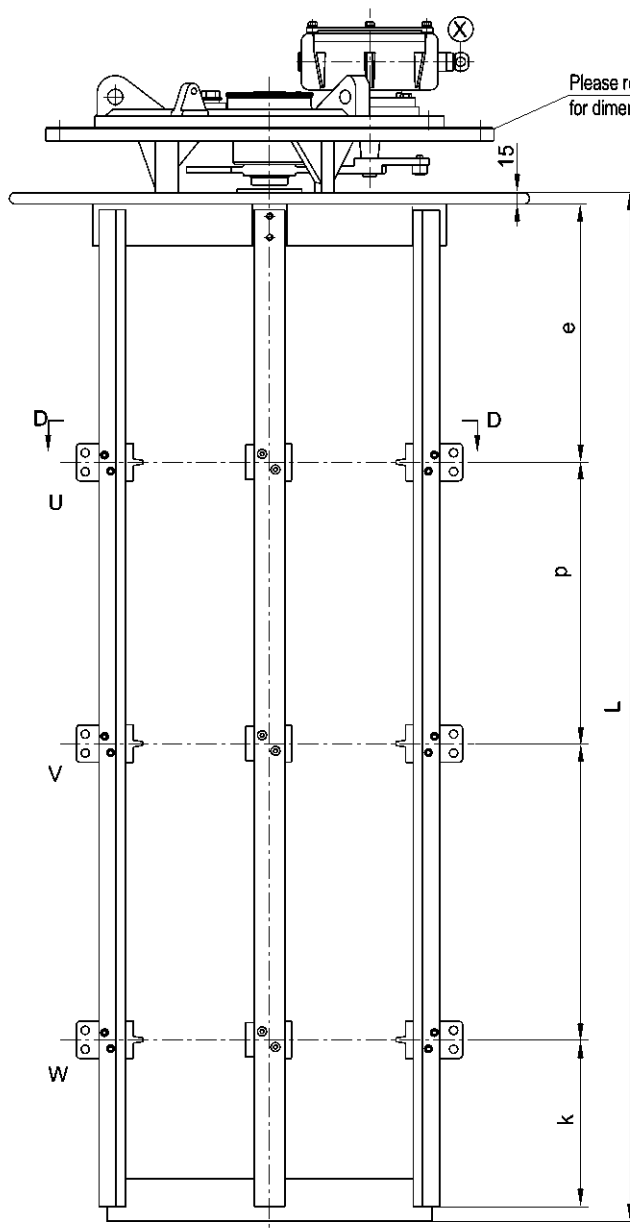
Connection	Y				
The highest voltage for equipment	e	p1	p2	k	L
12kV	220	135	135	100	1031
72.5kV	390	135	160	145	1294



Type B contact (2-holes)

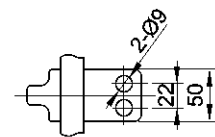
Unit: mm

Appendix 8. WSLIV-1200/1600A overall dimensions linear regulation



⊗ Bevel gearbox transmission shaft

⊙ Orientation of bevel gearbox transmission shaft

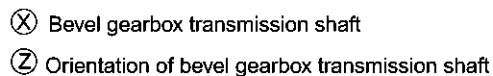


Type B contact (2-holes)

Connection	Y				D			
The highest voltage for equipment	e	p	k	L	e	p	k	L
12kV	250	130	130	674	250	180	130	774
72.5kV	390	130	140	824	390	330	140	1224
126kV	520	170	150	1044	520	460	150	1624

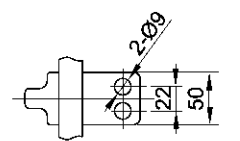
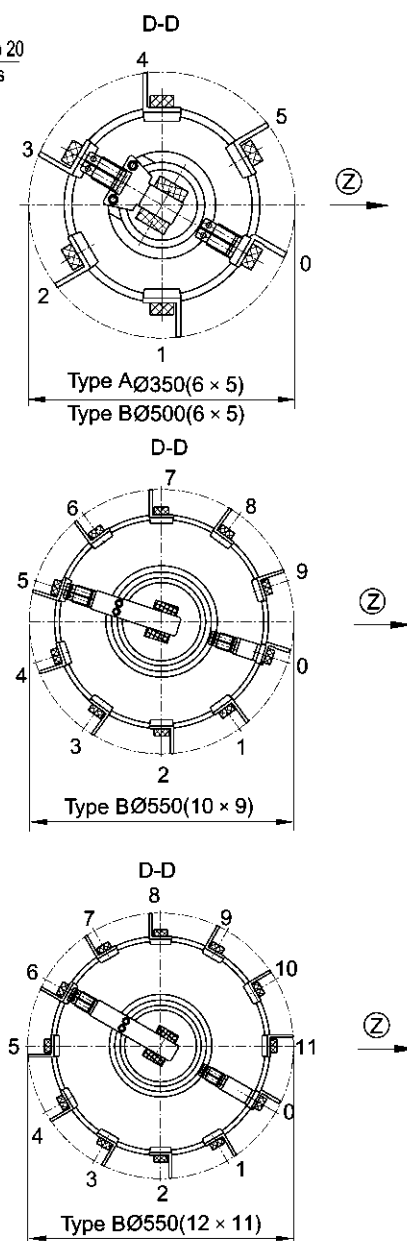
Unit: mm

TYPE WSL OFF-CIRCUIT TAP CHANGER TECHNICAL DATA



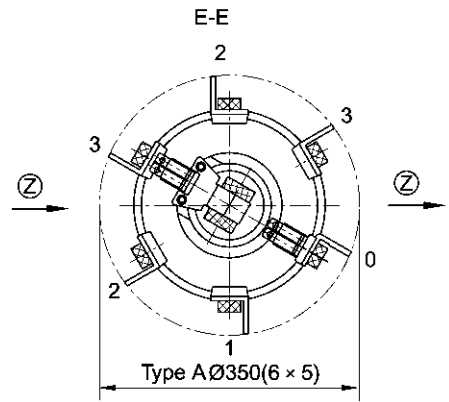
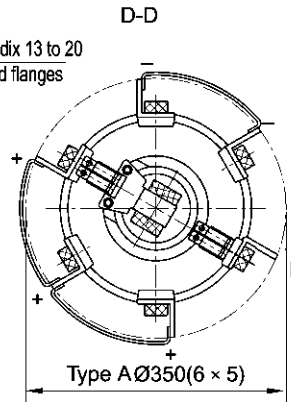
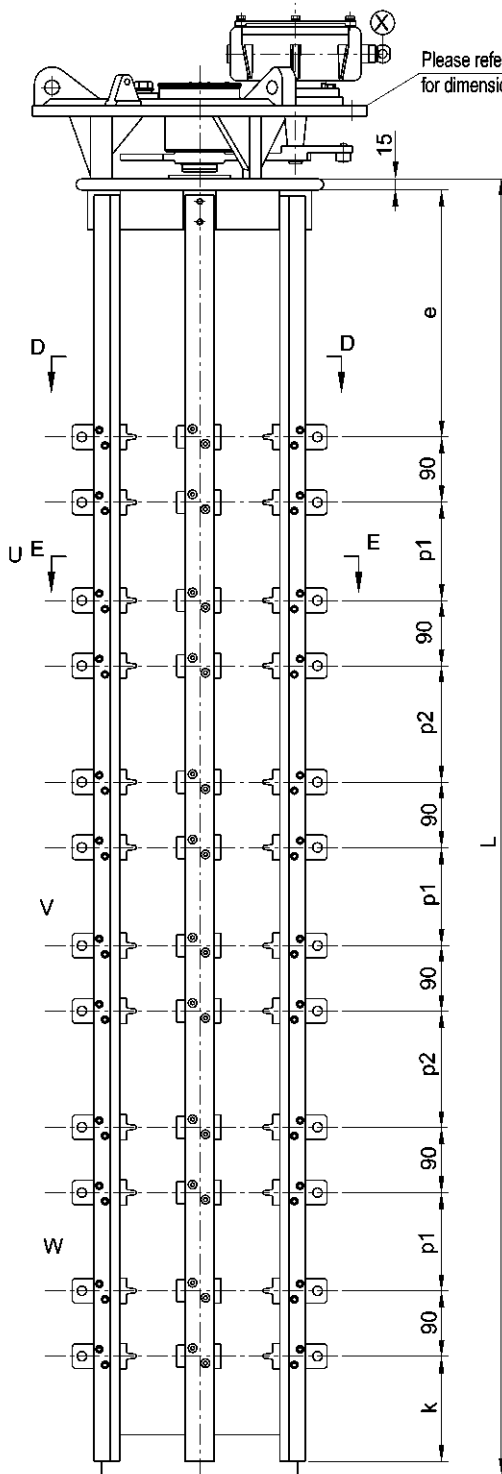
Connection	Y			
The highest voltage for equipment	e	p	k	L
12kV	250	130	130	1034
72.5kV	390	130	140	1184
126kV	520	170	150	1404

Remark: The contact dimension for 3000A OCTC will be submitted when order



Type B contact (2-holes)

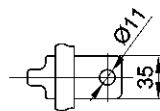
Appendix 10. WSLII-1000/1200A overall dimensions reversing regulation, type A, special design



⊗ Bevel gearbox transmission shaft

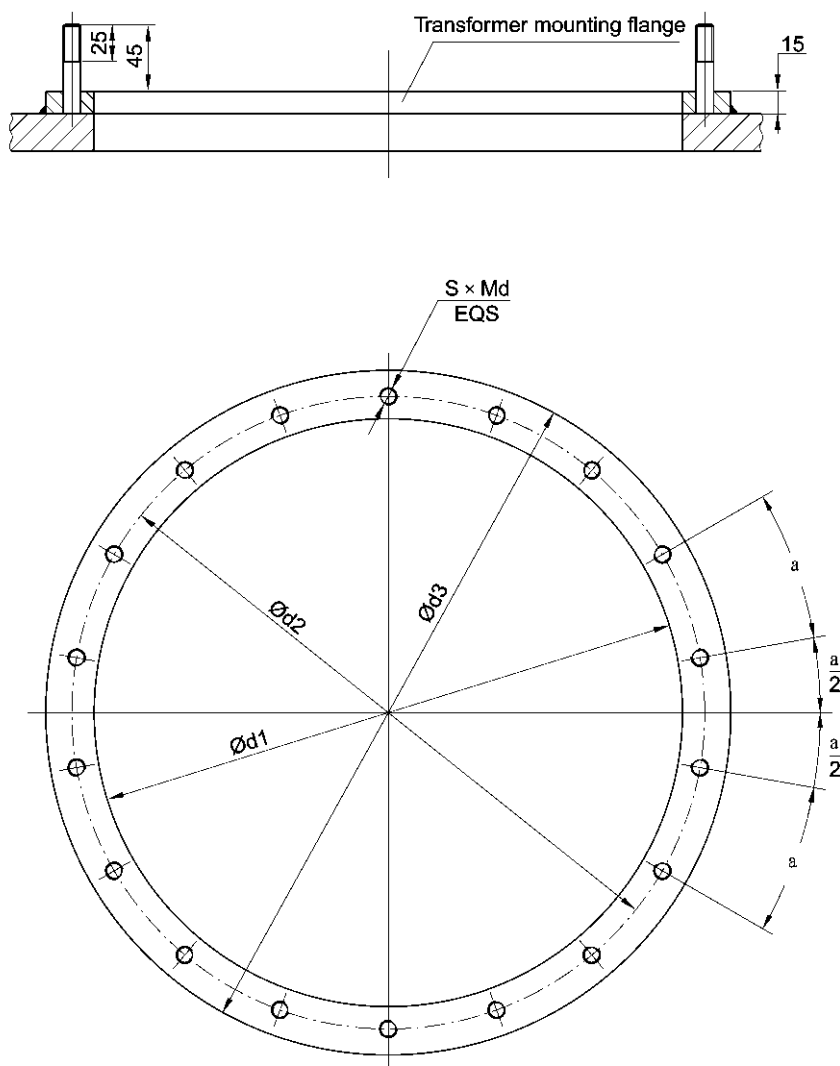
⊙ Orientation of bevel gearbox transmission shaft

Type A contact (single-hole)



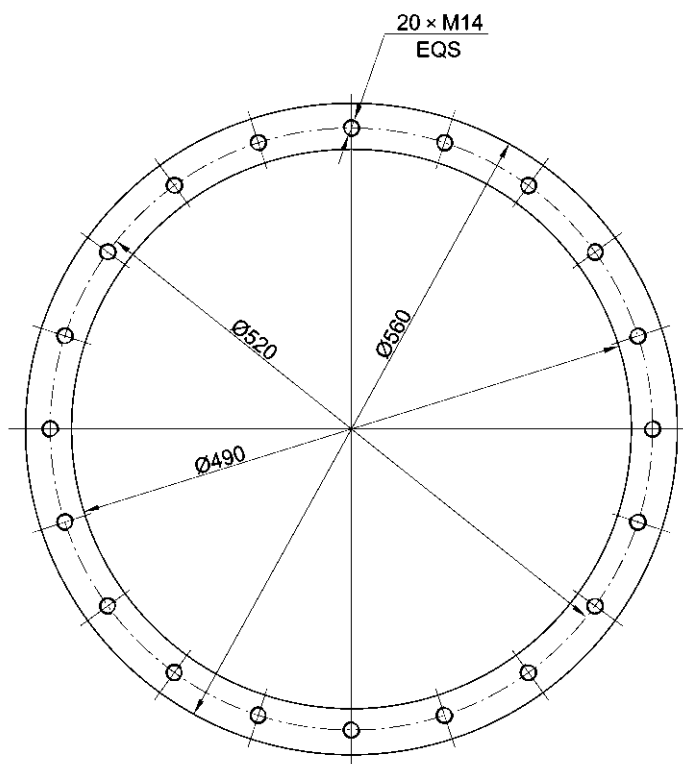
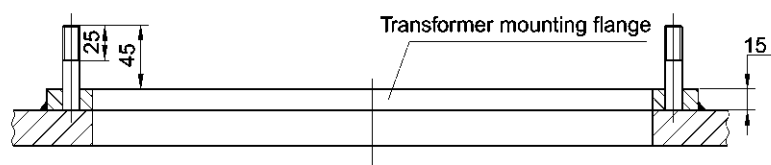
Connection	Y				
The highest voltage for equipment	e	p1	p2	k	L
12kV	170	135	135	100	1500
72.5kV	340	135	160	145	1784

Appendix 11. Overall dimensions of transformer mounting flange for standard tank

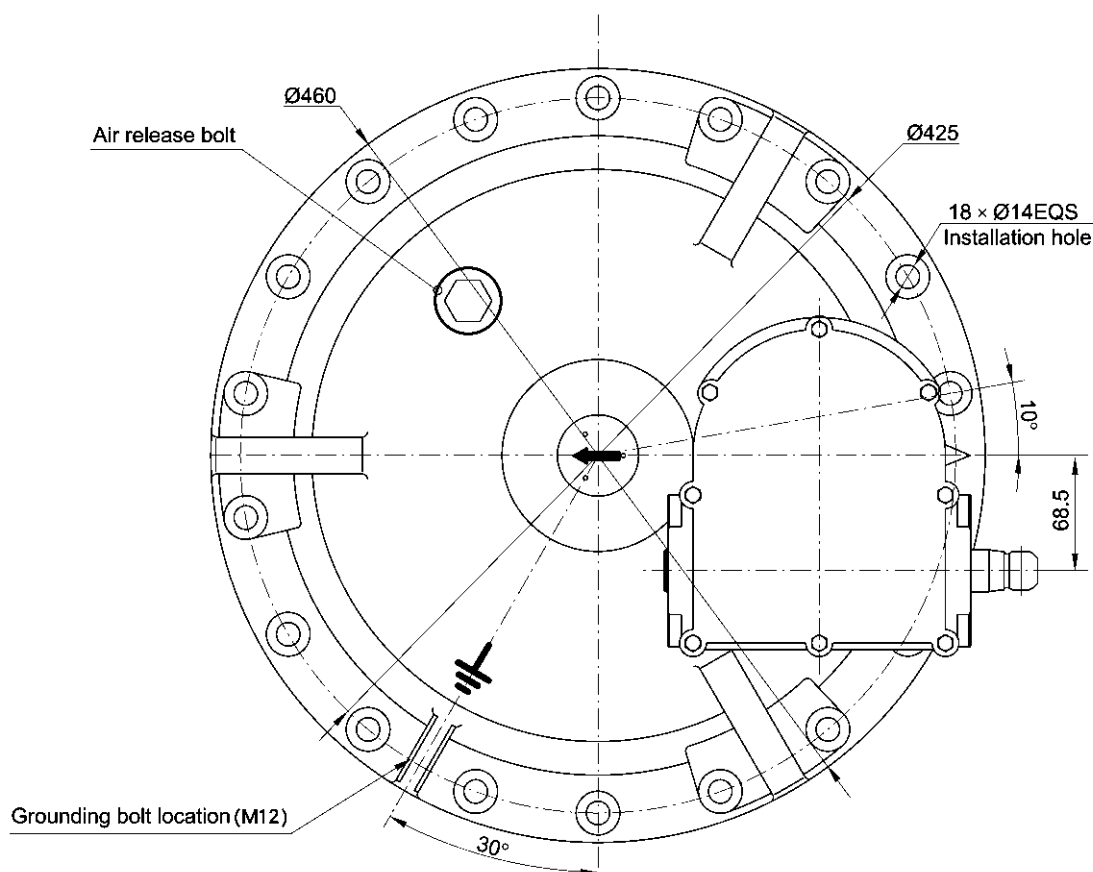
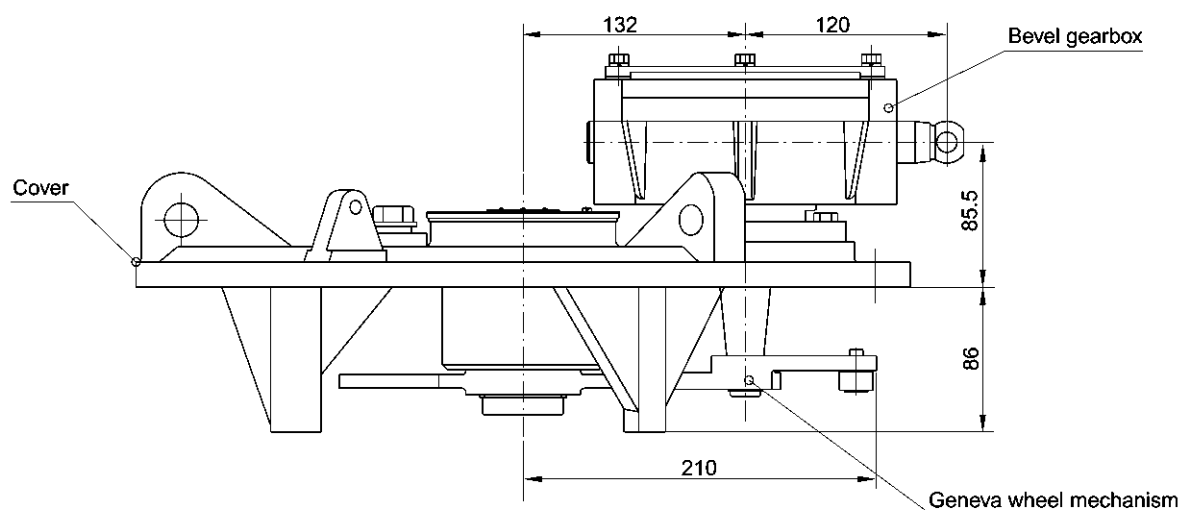


	Diameter d1	Diameter d2	Diameter d3	Bolt distributing S-Md	Distributing angle a
Type A	Ø395	Ø425	Ø460	18-M12	20°
Type B (Ø500)	Ø520	Ø550	Ø590	20-M12	18°
Type B (Ø550)	Ø570	Ø600	Ø640	20-M12	18°

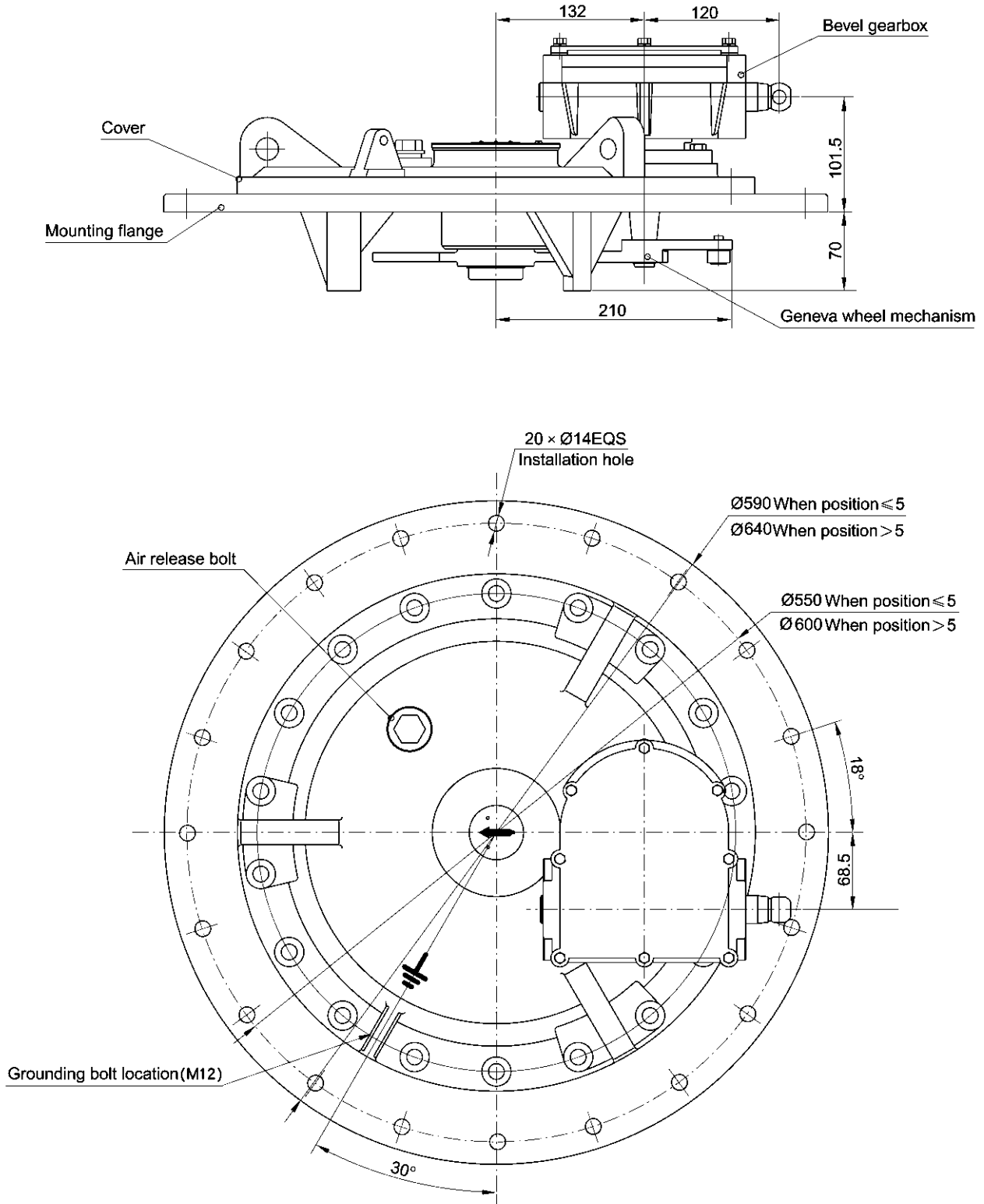
Appendix 12. Overall dimensions of transformer mounting flange for bell-type



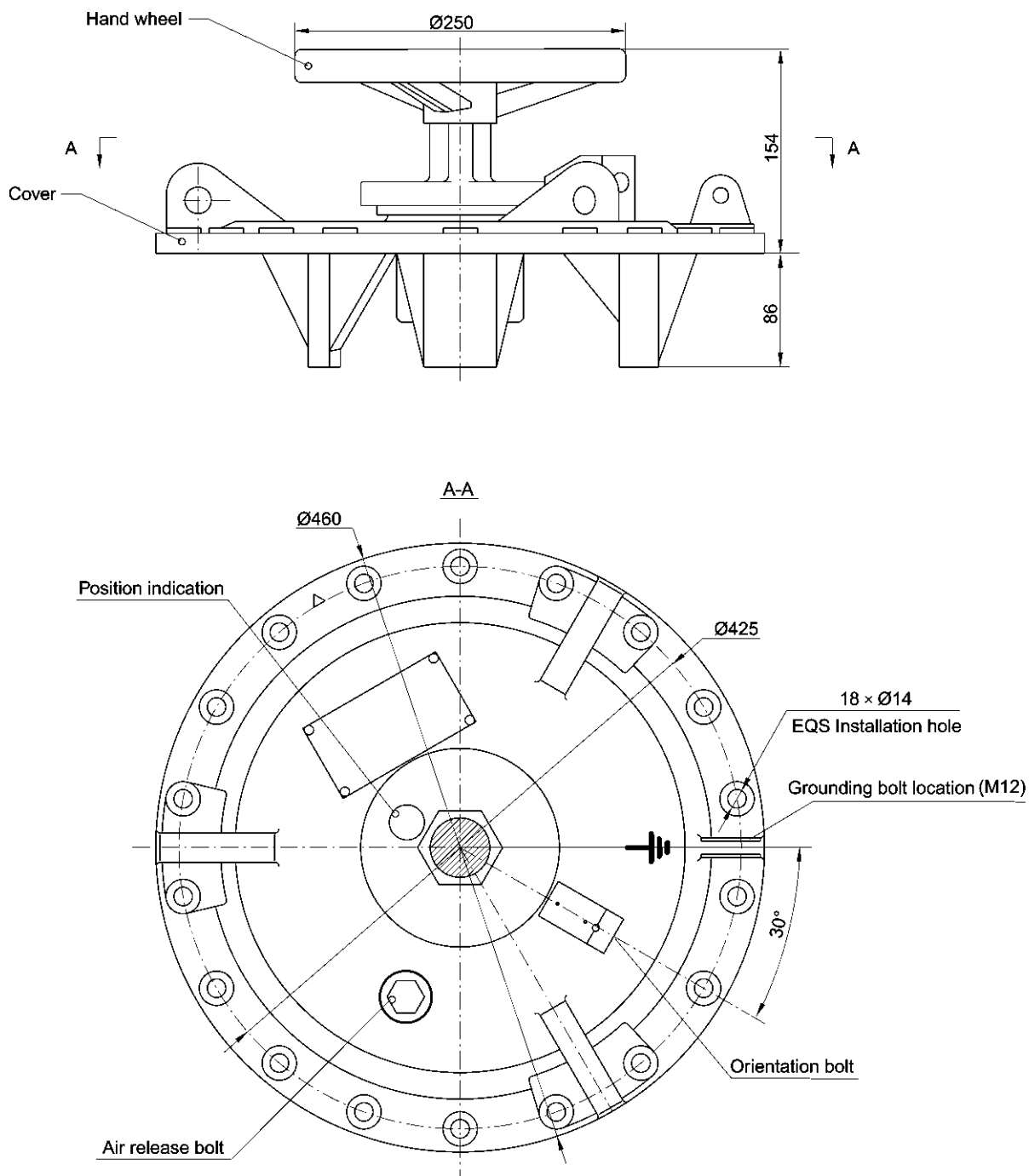
Appendix 13. Head flange for standard tank, type A manual or motor driving at man position



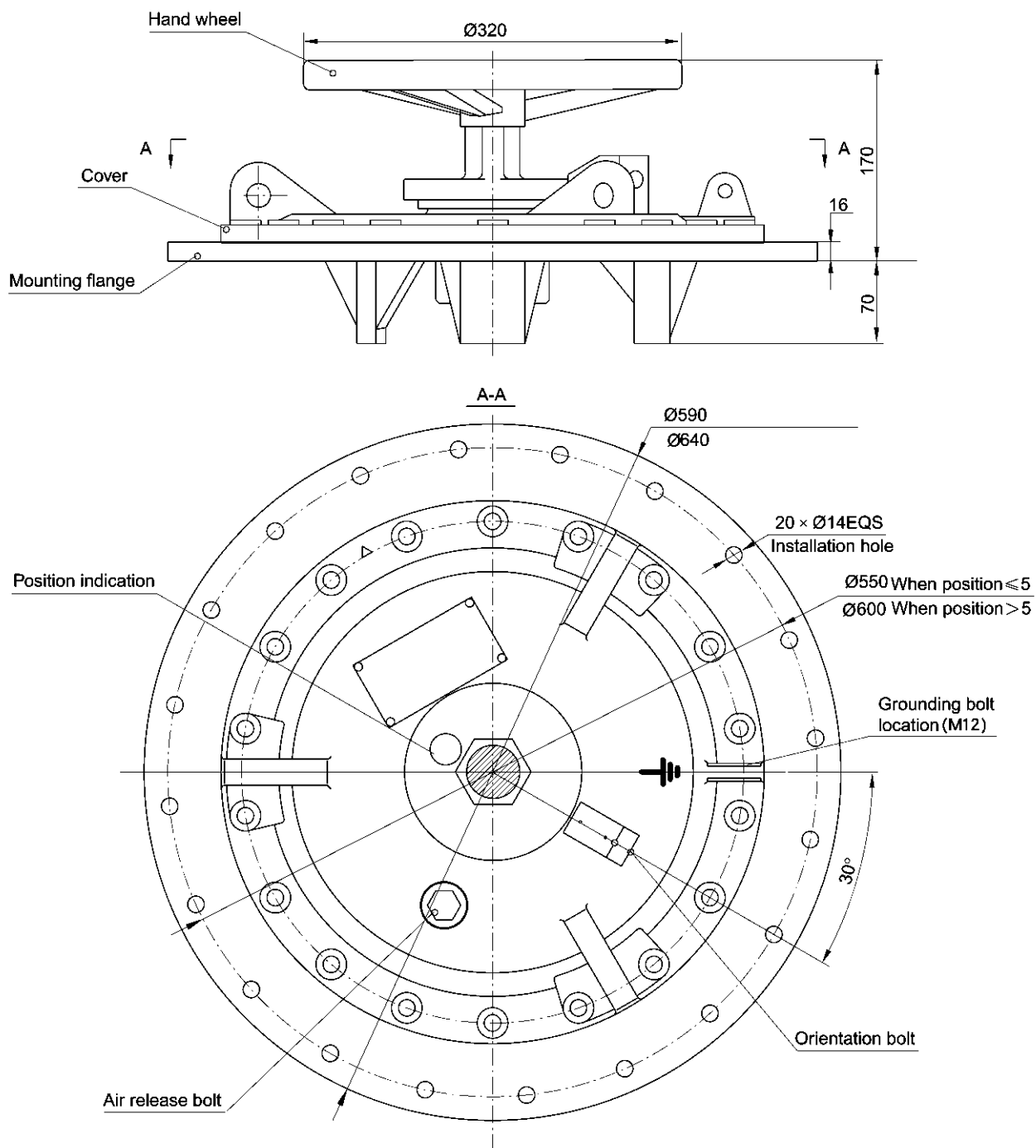
Appendix 14. Head flange for standard tank, type B manual or motor driving at man position



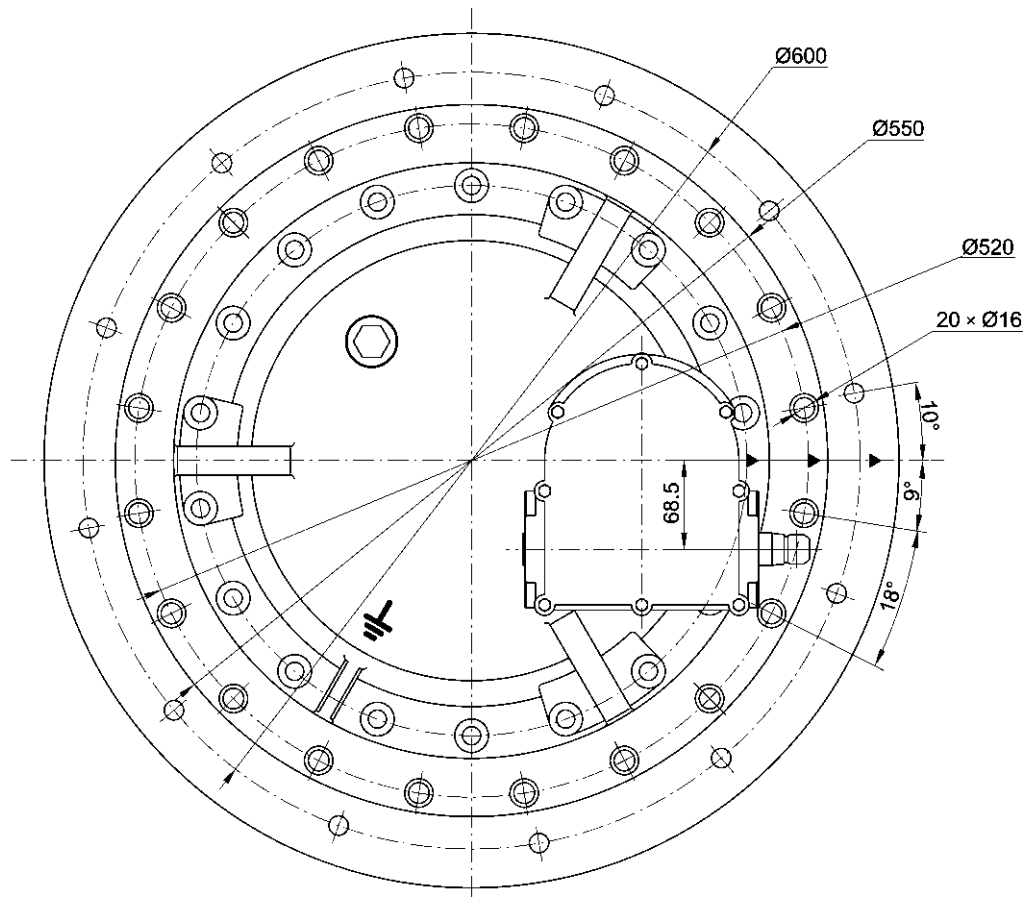
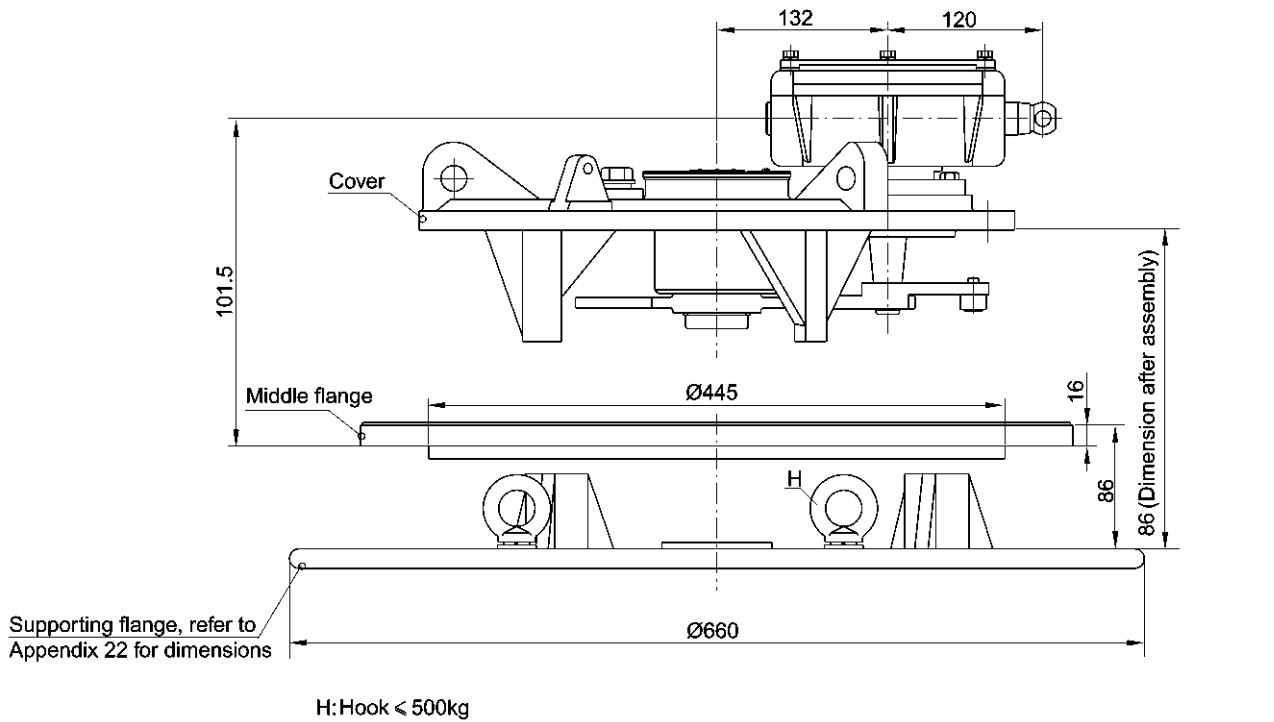
Appendix 15. Head flange for standard tank, type A hand wheel operating on top



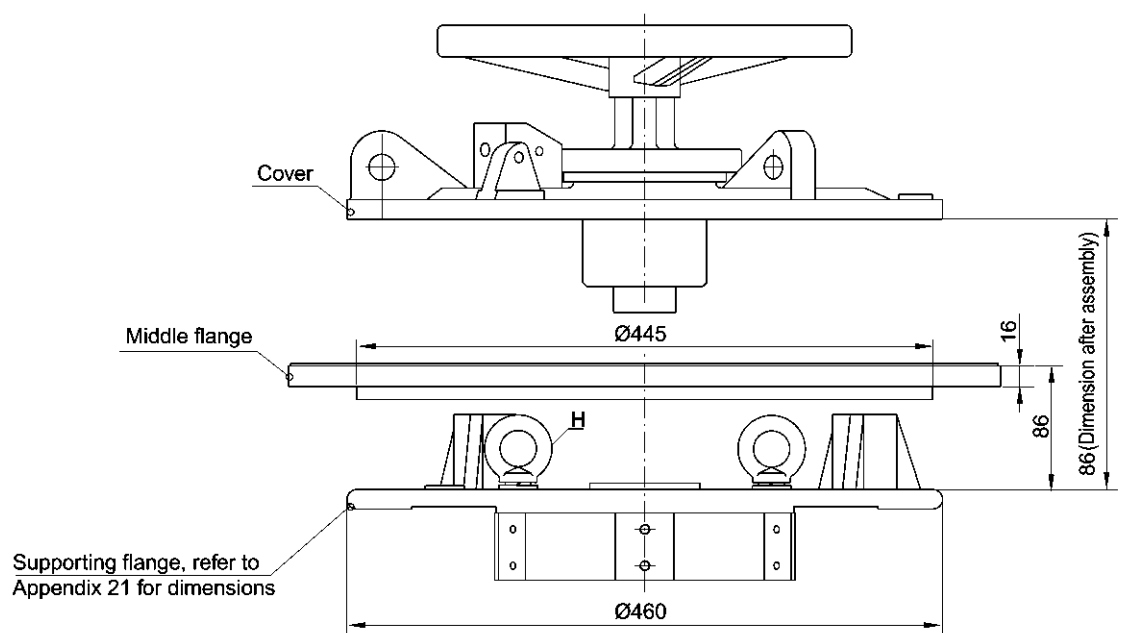
Appendix 16. Head flange for standard tank, type B hand wheel operating on top



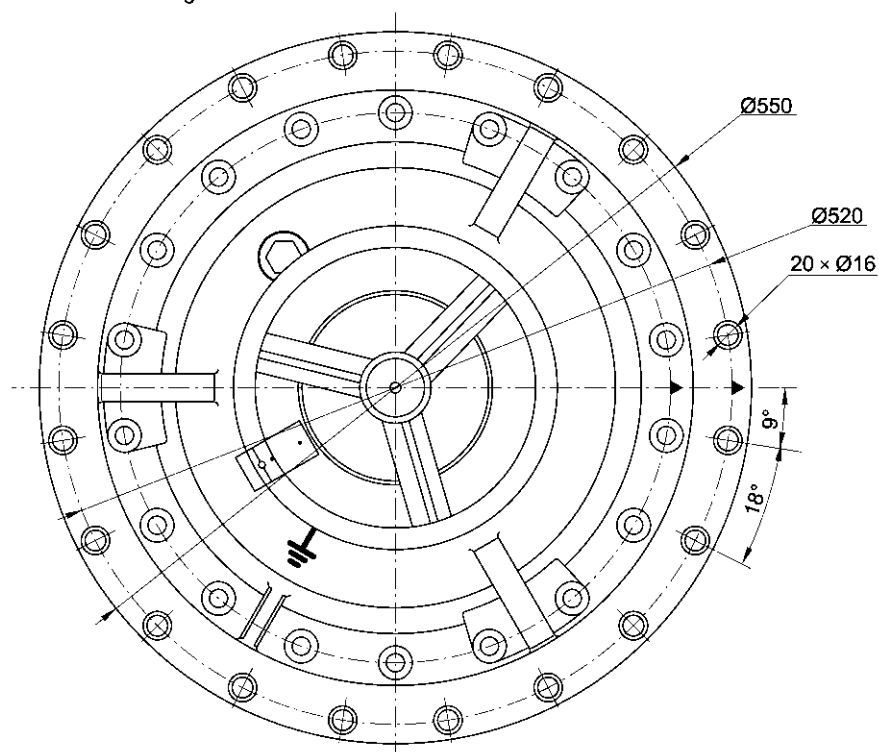
Appendix 18. Head flange for bell-type, type B manual or motor driving at man position



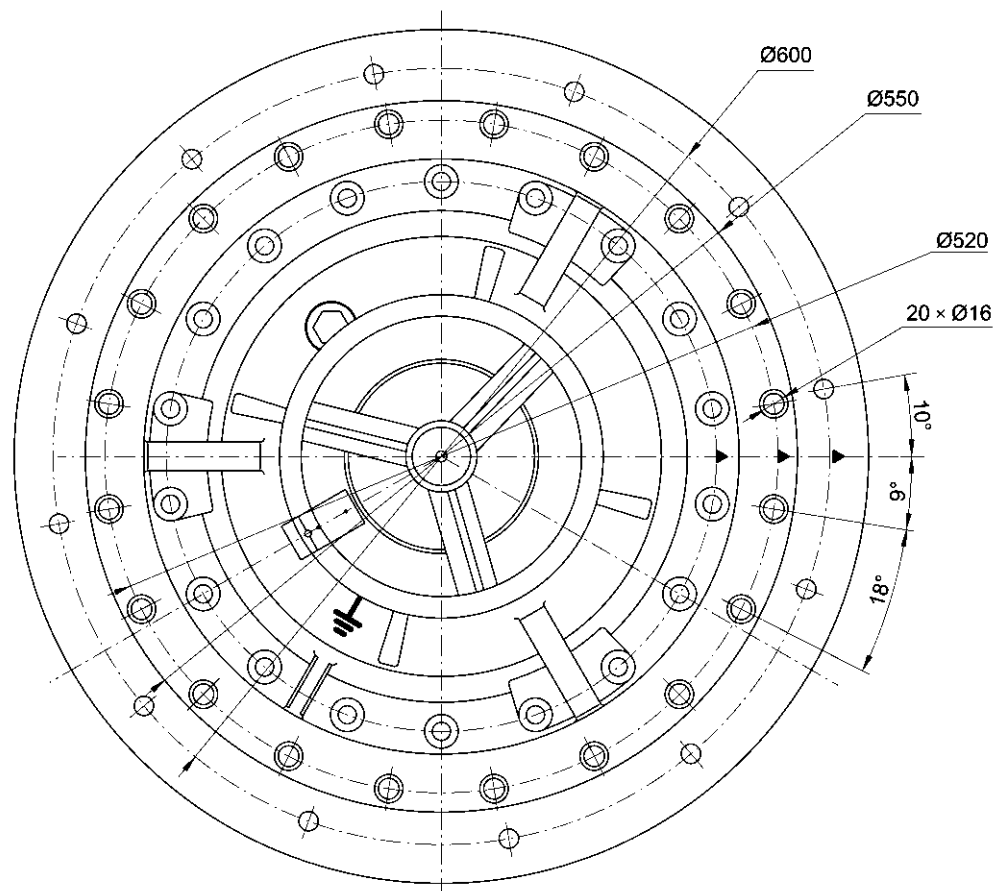
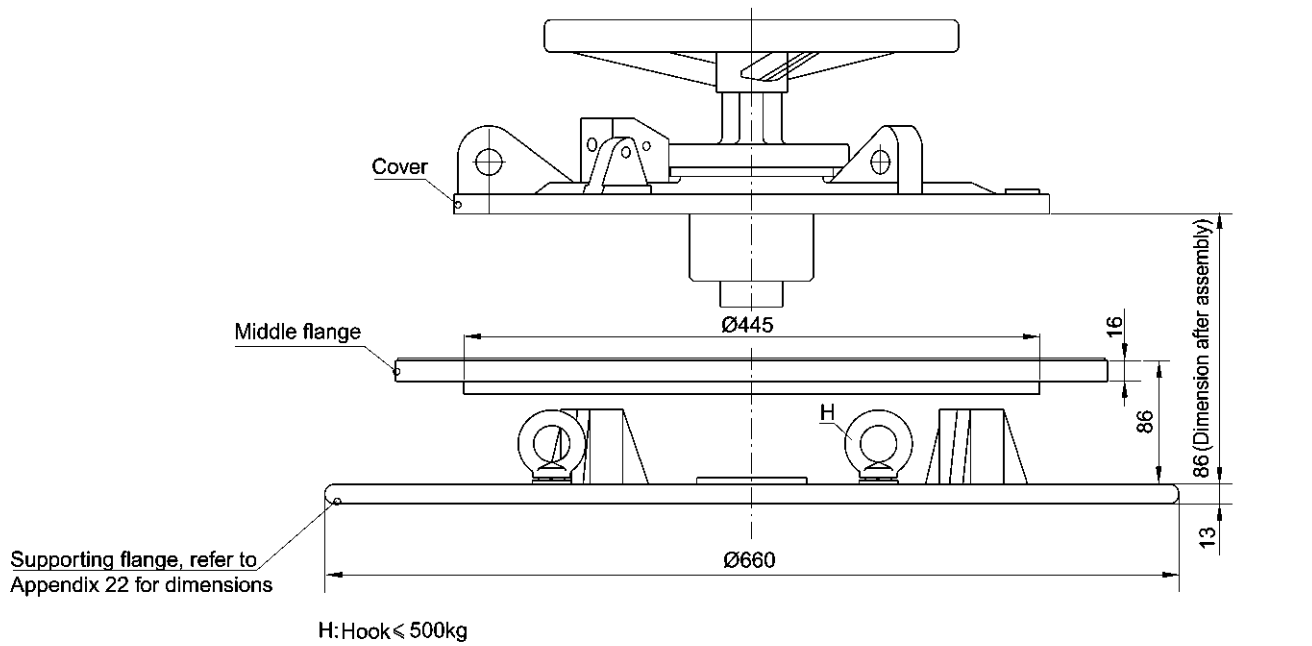
Appendix 19. Head flange for bell-type, type A hand wheel operating on top



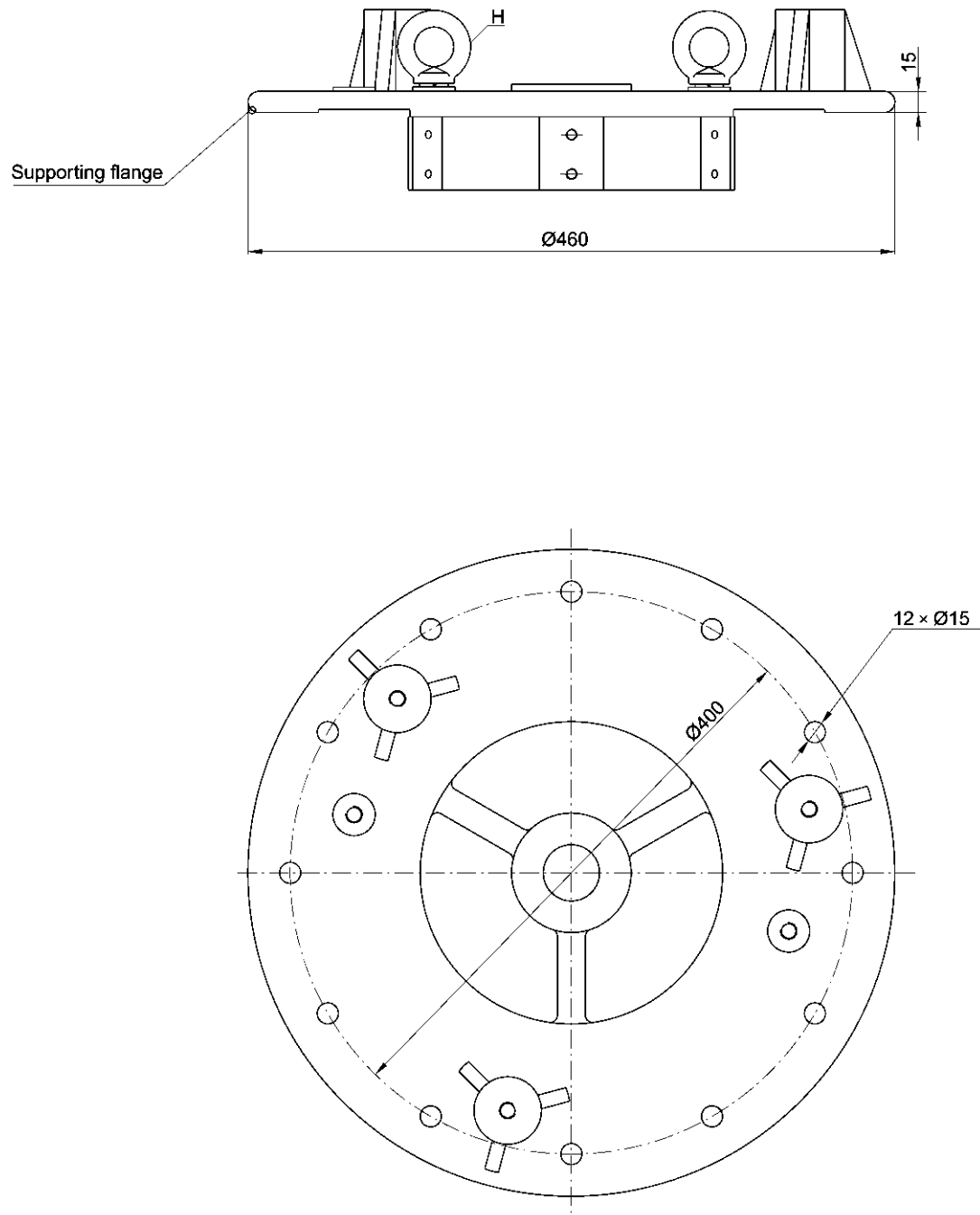
H: Hook $\leq 500\text{kg}$



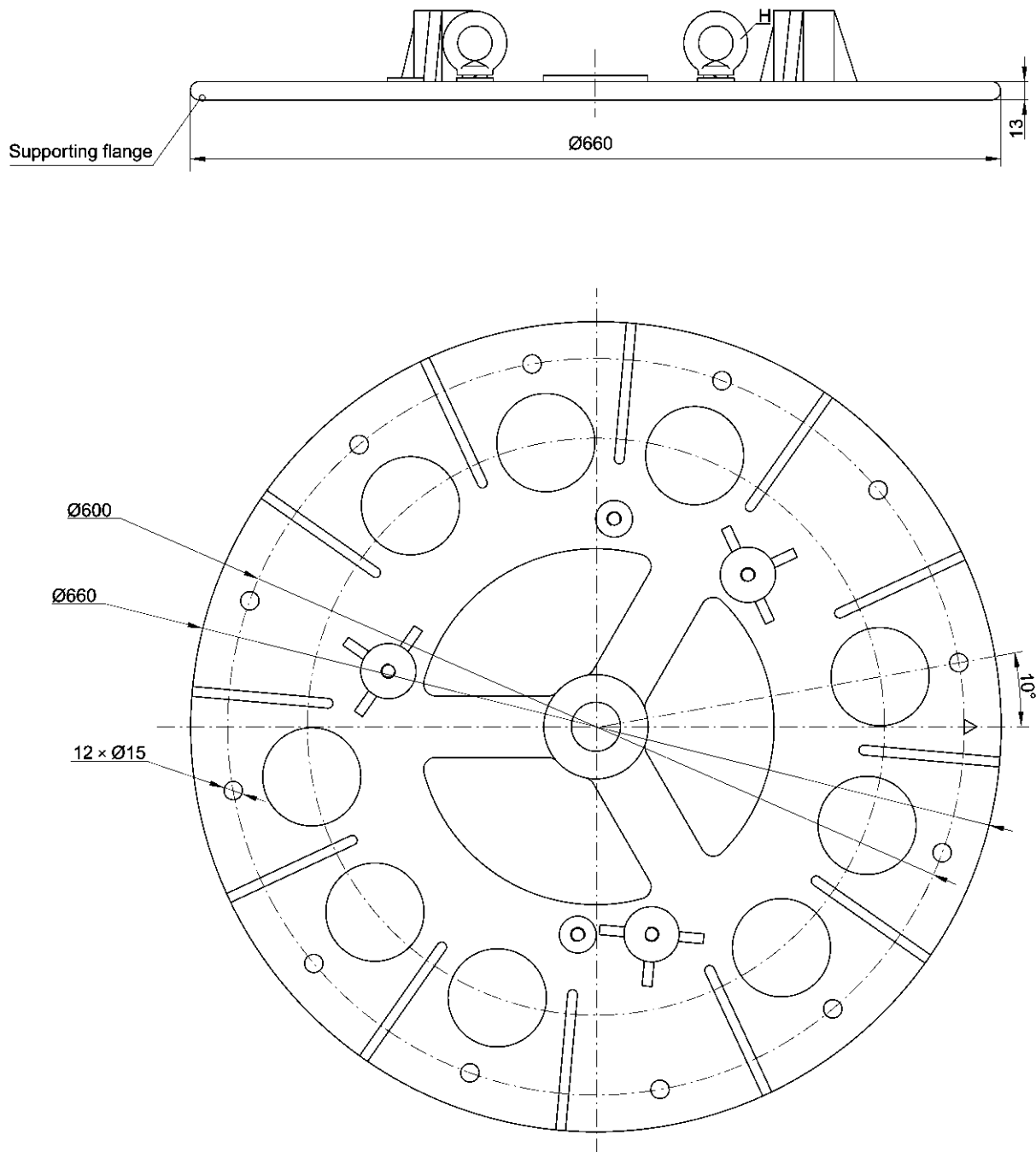
Appendix 20. Head flange for bell-type, type B hand wheel operating on top



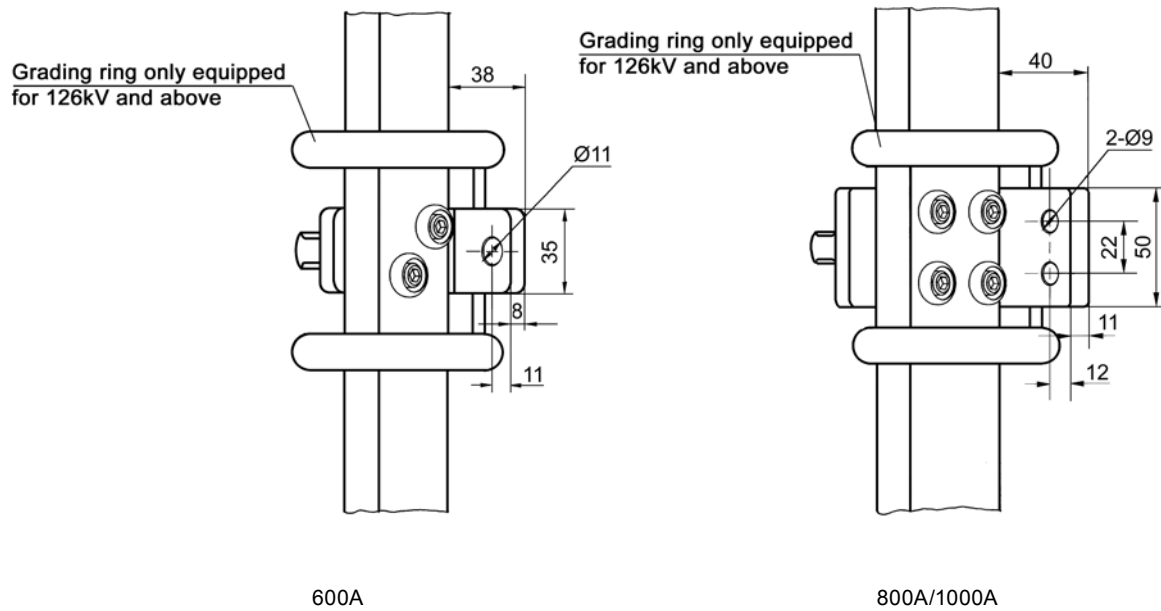
Appendix 21. bell-type supporting flange, type A



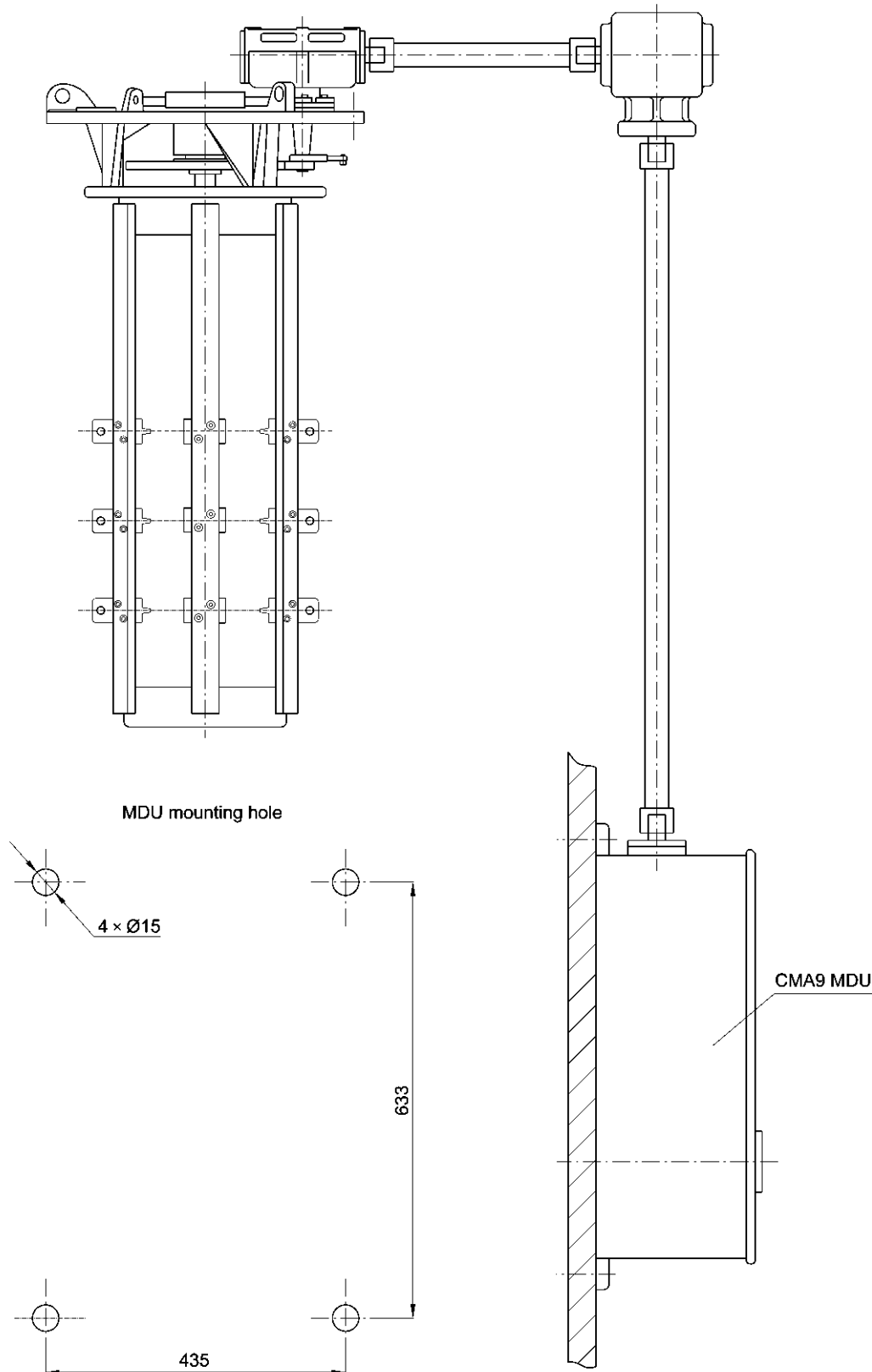
Appendix 22. bell-type supporting flange, type B



Appendix 23. Overall dimensions of the connection terminal

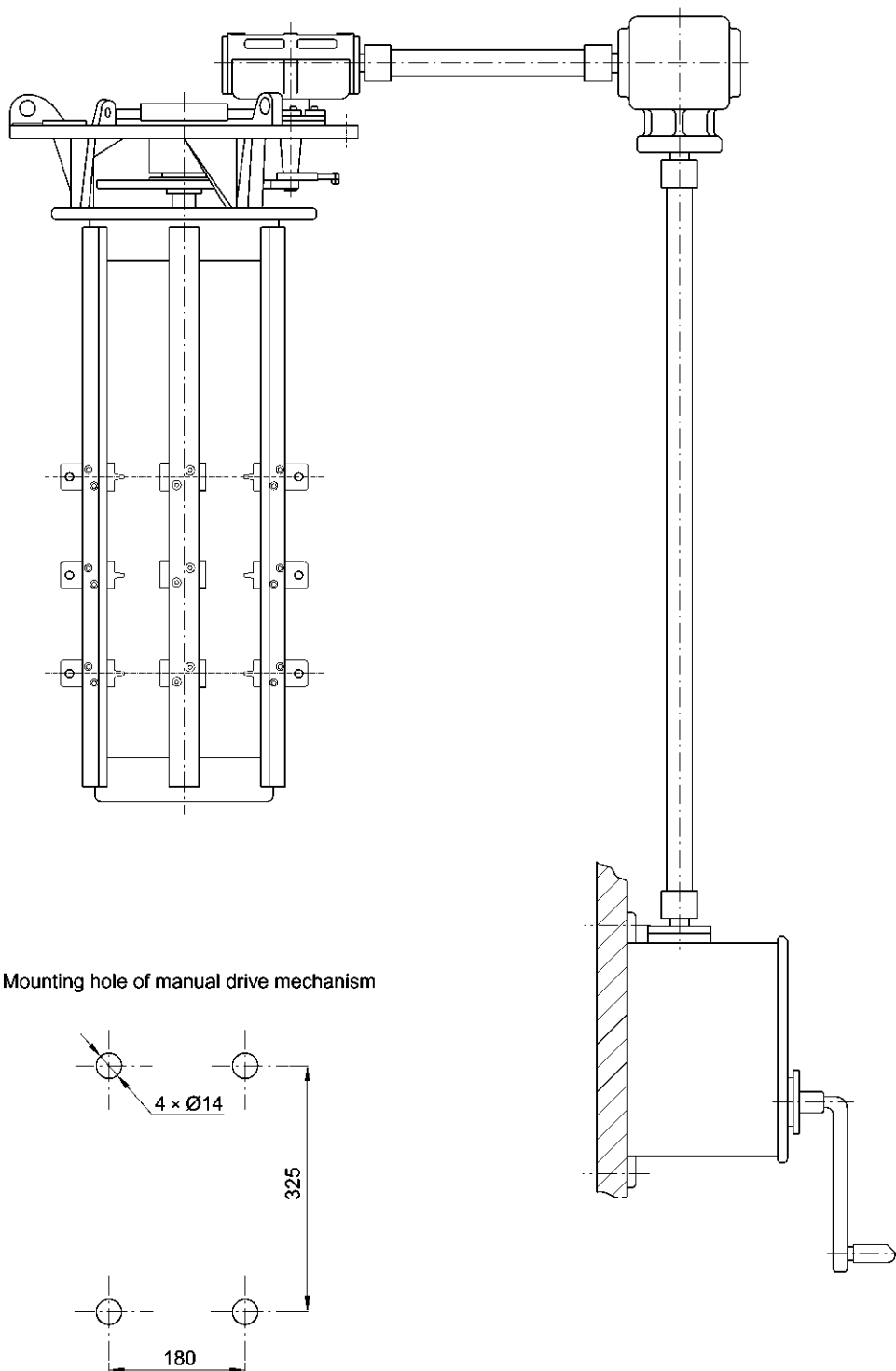


Appendix 24. Schematic mounting diagram of the motor driving off-circuit tap changer

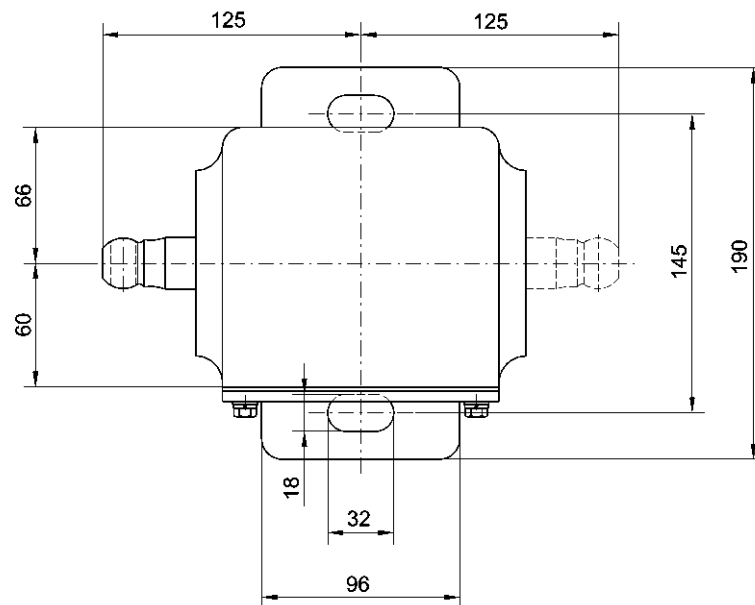
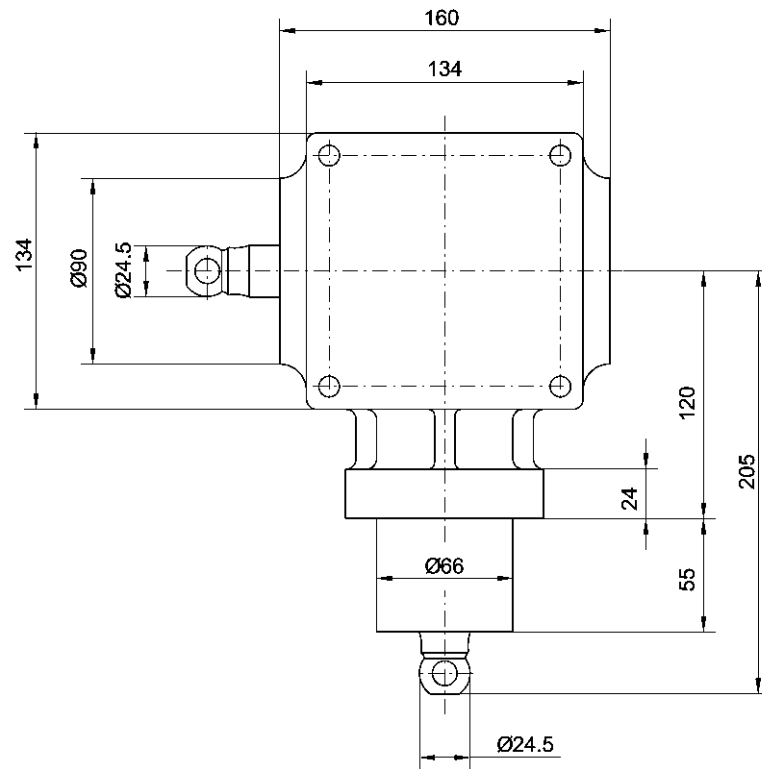


Unit: mm

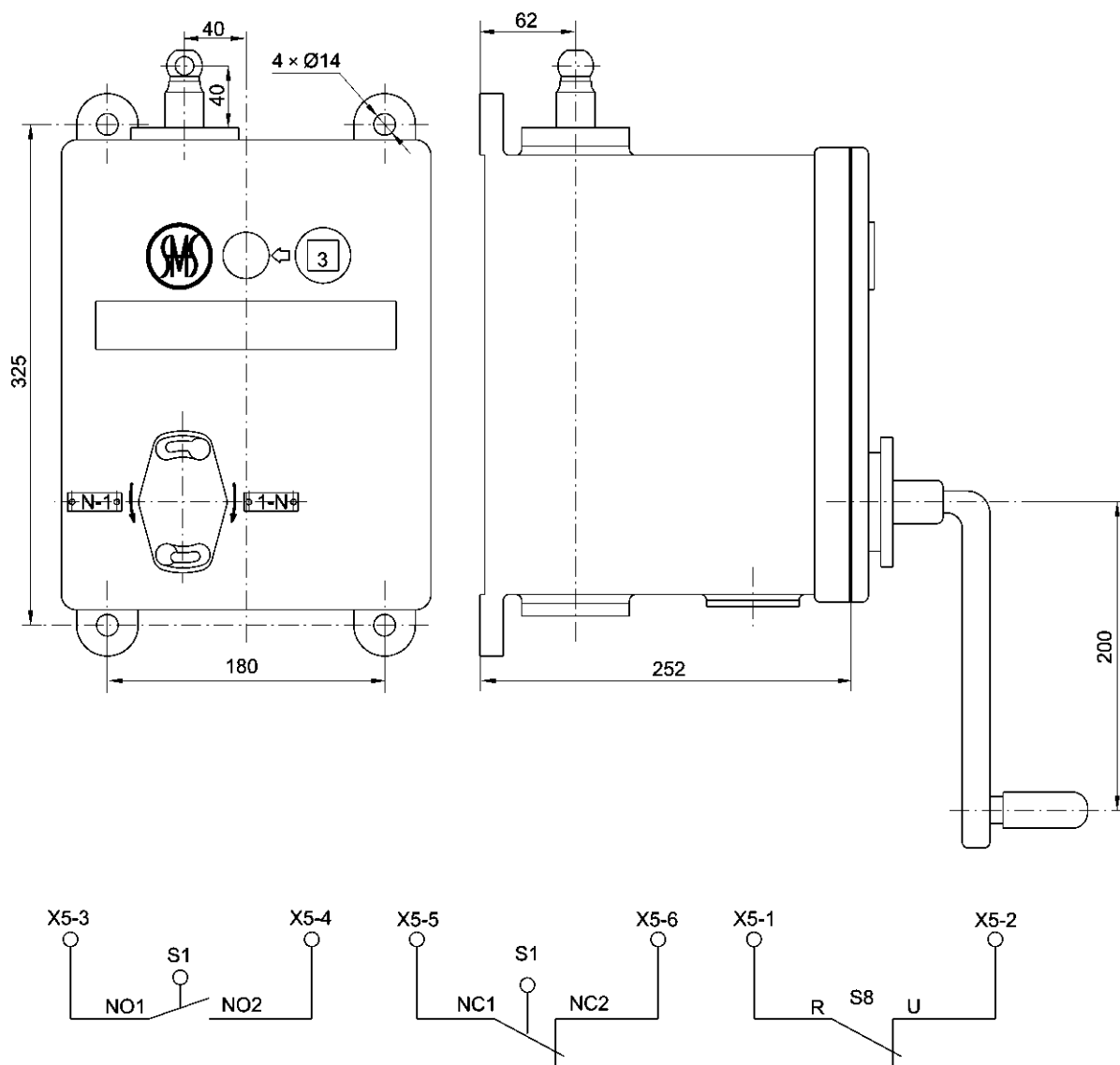
Appendix 25. Schematic mounting diagram of the manual driving off-circuit tap changer



Appendix 26. Overall dimensions of bevel gearbox



Appendix 27. Overall dimensions of manual drive mechanism



S1-NO1, S1-NO2 are the operation in progress signals. S1-NC1, S1-NC2 are the operation complete signals. S8-R, S8-U are drawn from the manual drive mechanism to terminal X5-1, X5-2. If hand crank is inserted for manual operation, then the X5-1, X5-2 are disconnected so that the contacts will open. If hand crank is removed, then the X5-1, X5-2 are connected. The signals are used for interlock between the tap changer and the transformer circuit breaker.



SHANGHAI HUAMING POWER EQUIPMENT CO., LTD.

Address: 977 Tong Pu Road, Shanghai, P.R.China 200333

Tel: +86 21 5270 3965(direct)

+86 21 5270 8966 Ext.

8688/8123/8698/8158/8110/8658

Fax: +86 21 5270 2715

Web: www.huaming.com

E-mail: export@huaming.com