ZM On Load Tap Changer Technical Data

I. ZM Technical Data

Item	Specification		III300	III500	III600	I301	I501	I601	I800	I1200	I1500
1	Max.rated through current(A)		300	500	600	300	500	600	800	1200	1500
2	Rated frequency(Hz)		50 or 60								
3	Phase & connect model		Three phase for meutral point of Y connection			Single phase for selectable winding connection					
4	Max. rated step voltage(V)		3300								
5	Rated step current(kVA)		1000	1400	1500	1000	1400	1500	2640	3100	3500
6	Short circuit current (kA)	Termal(3s)	6	8	8	6	8	8	16	24	24
		Dynamic(peak)	15	20	20	15	20	20	40	60	60
7	Number of operating position		Linear regulation: 7、10、12、14、16、18、22、34 Reversing and coase and fine regulation: ±3～±17								

8	Insulation level of tap changer (kV)					
		Rated Voltage	35	66	110	150	220
		Max.working voltage	40.5	72.5	126	170	252
		Power frequency withstand voltage(50Hz,1min)	85	140	230	325	460
		Rated lightning impulse withstand voltage(1.2/50μs)	200	350	550	750	1050

9	Tap selector	4 grades of A, B, C and D according to the insulation level
10	Mechanical service life	Not less than 800,000
11	Electrical service life	Not less than 200,000
12	Oil compartment for diverter switch — Service pressure	3×10^4Pa
	Oil compartment for diverter switch — Leakage test	No leakage under 6×10^4Pa 24 hours
	Oil compartment for diverter switch — Over pressure protection	Blasting cap blast at $(4\sim5)\times10^5$Pa
	Oil compartment for diverter switch — Protective relay	QJ4-25 oil flow speed set at 1.0m/s±10%
13	Oil drainage volume (L)	About 190～270
14	Oil filling volume (L)	About 125～190
15	Weight (kg)	About 240～350
16	Motor-driven unit	MAE/MA7B

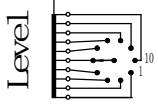
Note:1.Step capacity = step voltage x load cuttent; Rated step capacity is the continuous permissible max.step capacity.

2.For single-phase tap changer formed by parallel of three-phase tap changer contacts; it is necaessary to take coil shounting of transformer into consideration. For ZMI800, there are two shunts. For ZMI1200 and I1500, there are three shunts.

3.The tap-changer of single phase liner regulating with 34 operating positions only have: I500A, I 800A, I1500A.

II. ZM basic wiring

10100
Level 9



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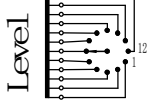

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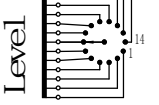

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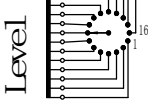

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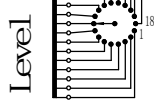

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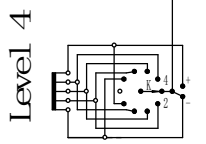

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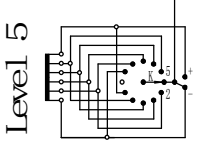

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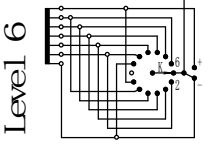

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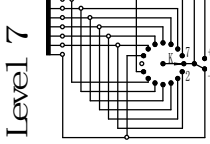

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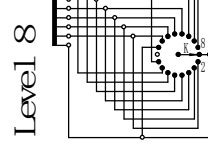

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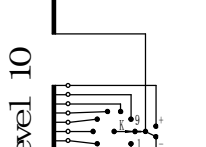

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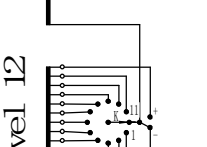

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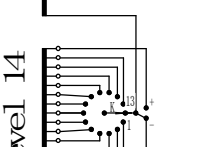

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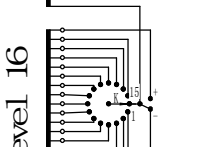

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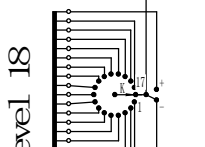

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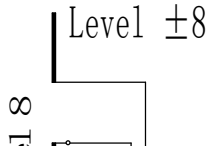

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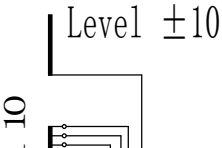

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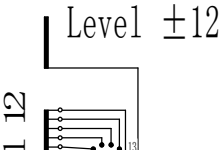

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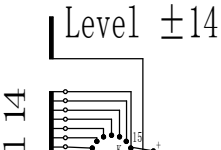

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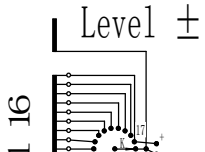

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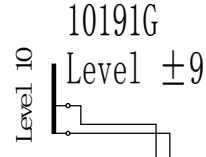
Level ±9



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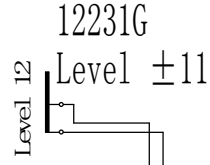
Level ±11



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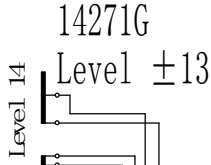
Level ±13



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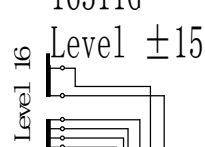
Level ±15



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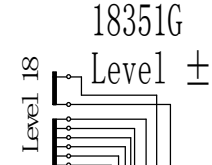
Level ±17



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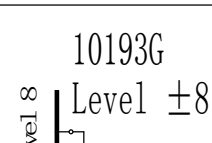
Level ±8



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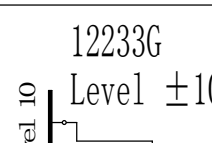

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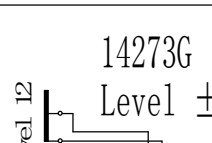
Level ±12



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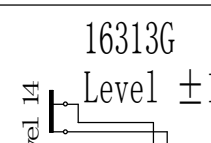

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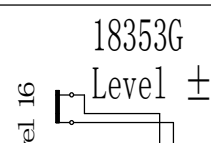
Level ±16

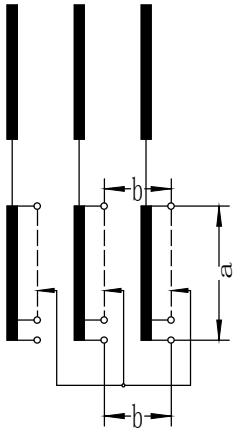


III. Internal insulation level of ZM

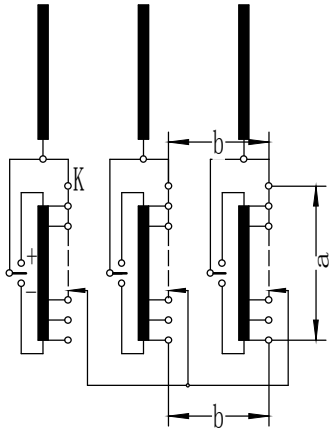
Symbol of insulation distance	Tap selector type A		Tap selector type B		Tap selector type C		Tap selector type D	
	kV 1.2/50 μs	kV 50Hz1min	kV 1.2/50 μs	kV 50Hz1min	kV 1.2/50 μs	kV 50Hz1min	kV 1.2/50 μs	kV 50Hz1min
a	135	50	265	50	350	82	490	105
b	135	50	265	50	350	82	490	146
c_1	200	95	485	143	545	178	590	208
c_2	200	95	495	150	550	182	590	225
d	135	50	265	50	350	82	490	105

Voltage gradiant of every part of regulating coil

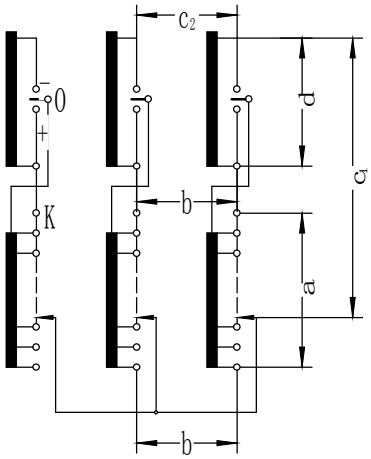
III300、III500、III600



Linear regulating

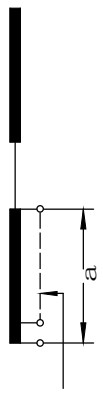


Reversal regulating

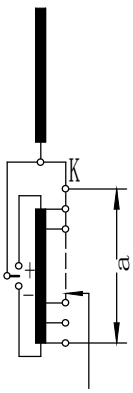


Coarse and fine regulating

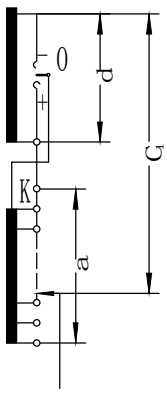
Ⅰ301、Ⅰ501、Ⅰ601、Ⅰ800、Ⅰ1200、Ⅰ1500



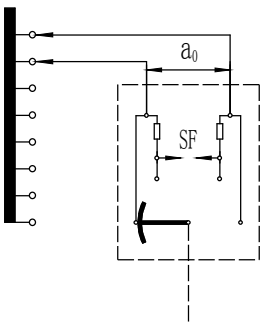
Linear regulating



Reversal regulating

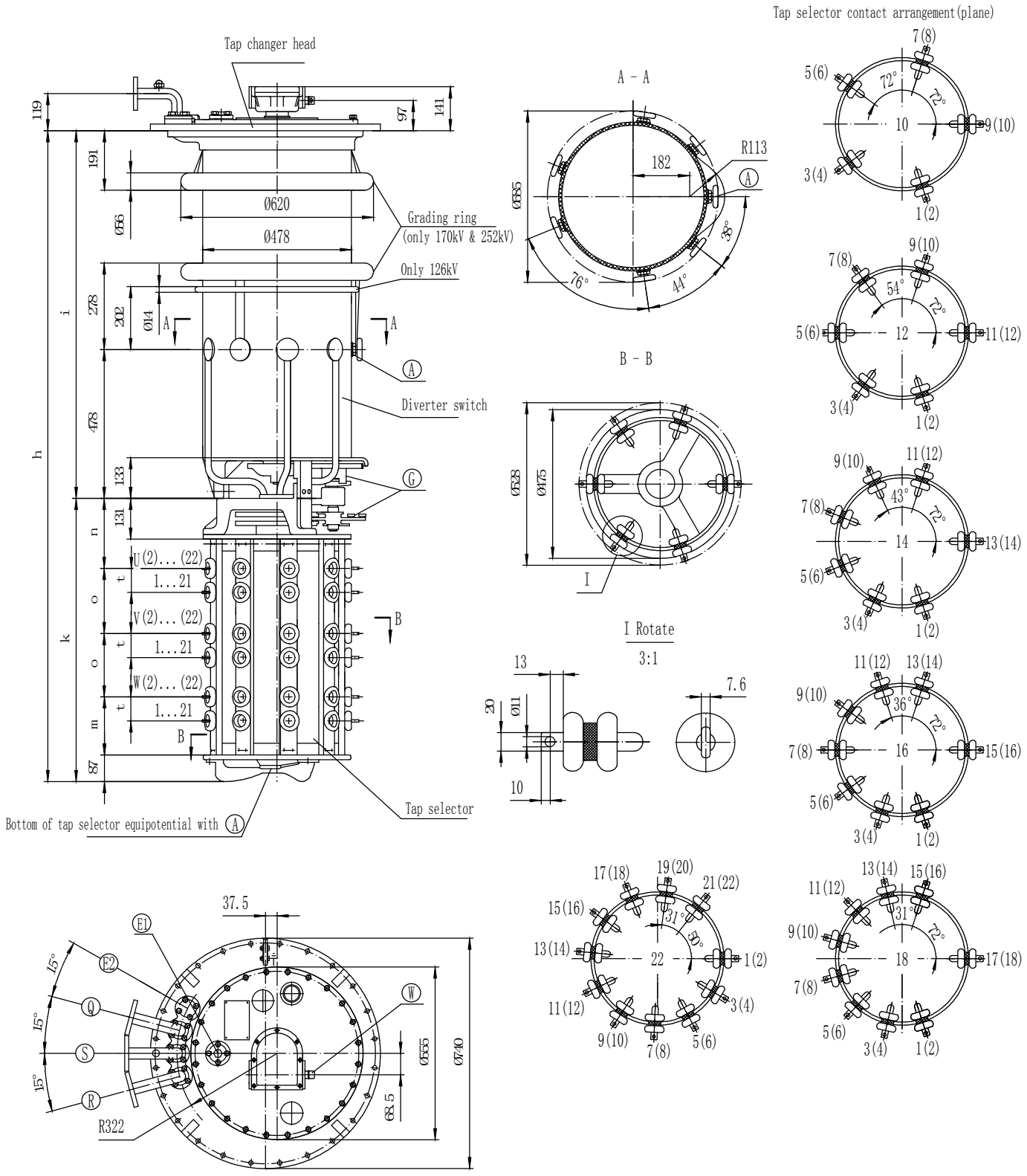


Coarse and fine regulating



Interstep insulation level a_0 of SF with spark gap is:
50Hz 1min 20kV & 1.2/50 μs 90kV.

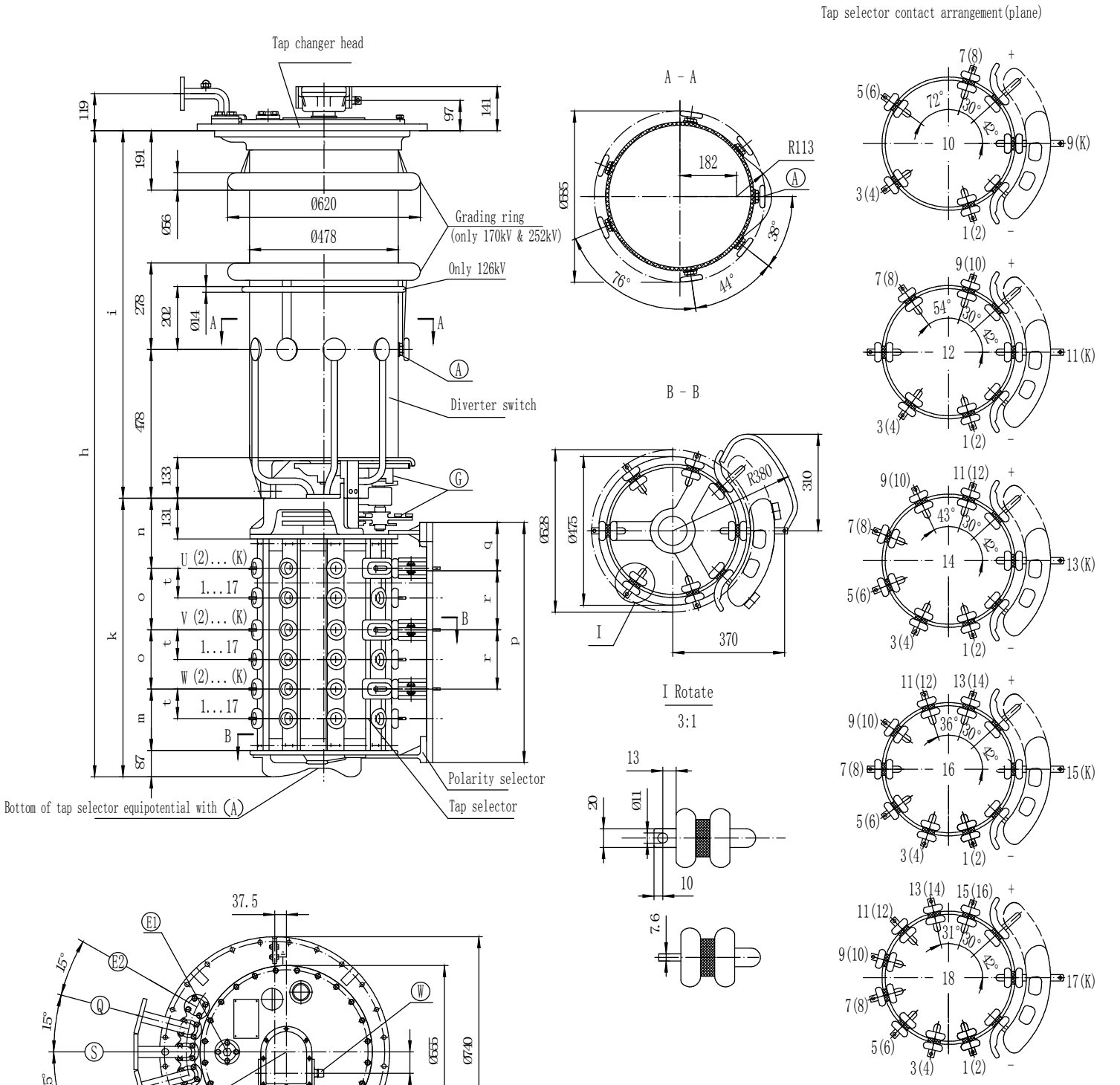
IV. External dimension diagram of ZM



Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Selector No.		A		B				C				D			
Max working voltage(kV)		40.5	72.5	72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1795	1795	1893	2023	2153	2253	2068	2198	2328	2428	2253	2383	2513	2613
	i	996	996	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	799		897				1072				1257			
	n	229		233				258				323			
	o	154		190				240				280			
	t	77		95				120				95			
	m	175		197				247				287			
Valume of oil dm³		130		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		194		194	219	239	259	195	220	240	260	198	223	243	263
Weight kg		255		260				265				275			

Figure 1 ZMIII300/III500/III600 Linear regulating



Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
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Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
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Ⓡ-Protective relay connecting flange
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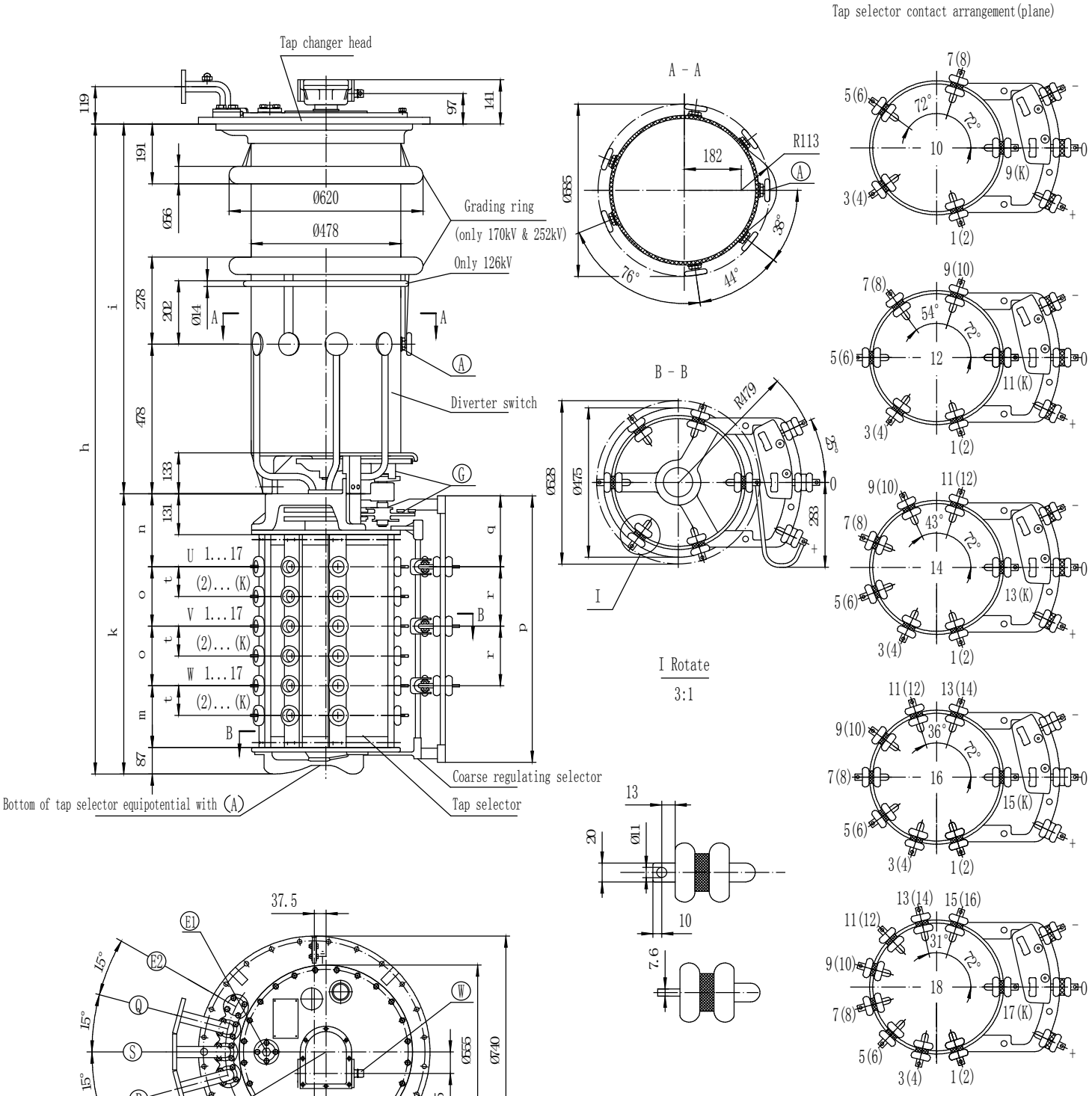
Ⓦ-Transmission shaft

Selector No.		A		B				C				D			
Max.working voltage(kV)		40.5	72.5	72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1795	1795	1893	2023	2153	2253	2068	2198	2328	2428	2523	2653	2783	2883
	i	996	996	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	799		897				1072				1527			
	n	229		233				258				323			
	o	154		190				240				370			
	t	77		95				120				185			
	m	175		197				247				377			
	r	154		190				240				370			
	q	233		255				305				435			
	p	685		783				958				1413			
Valume of oil dm³		130		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		199		199	224	244	264	199	224	244	264	207	232	252	272
Weight kg		270		275				285				310			

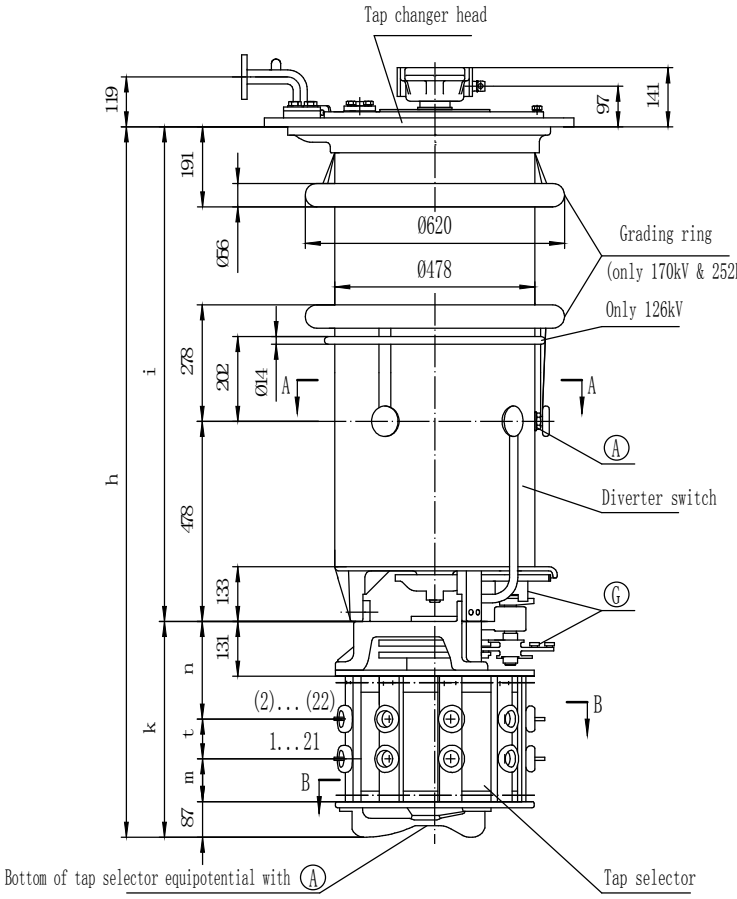
Figure 2 ZMIII300/III500/III600 Reverse regulating

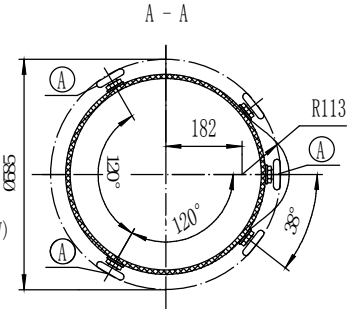


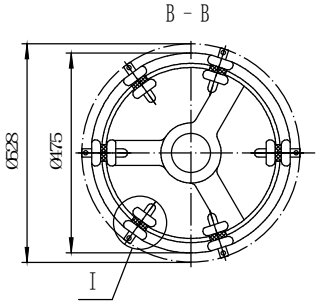
Selector No.		A		B				C				D			
Max. working voltage(kV)		40.5	72.5	72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1795	1795	1893	2023	2153	2253	2068	2198	2328	2428	2523	2653	2783	2883
	i	996	996	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	799		897				1072				1527			
	n	229		233				258				323			
	o	154		190				240				370			
	t	77		95				120				185			
	m	175		197				247				377			
	r	154		190				240				370			
	q	272.5		276.5				301.5				366.5			
	p	794		892				1067				1522			
Valume of oil dm³		130		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		199		199	224	244	264	199	224	244	264	207	232	252	272
Weight kg		270		275				280				305			

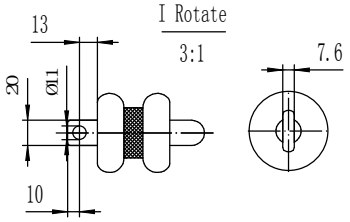
(A)-Tap changer current terminal (neutral point)
(E1)-Oil spill hole of tap changer head
(E2)-Oil spill of transformer oil tank
(G)-Transmission of tap selector
(Bottom of tap selector equipotential with (A))
(Q)-Oil return flange connacting flange
(R)-Protective relay connecting flange
(S)-Oil suction flange connecting flange
(W)-Transmission shaft

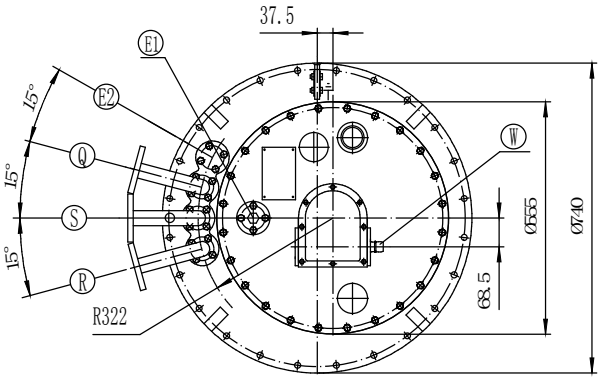
Frigure 3 ZMIII300/III500/III600 Coarse and fine regulating

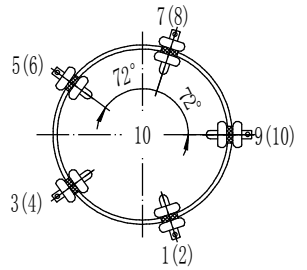


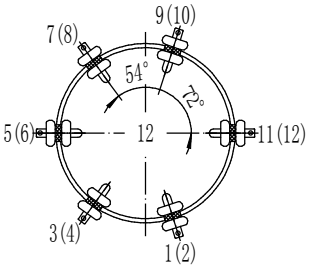


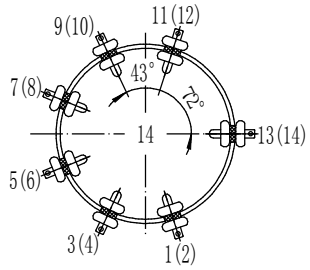


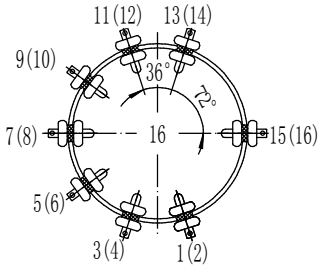


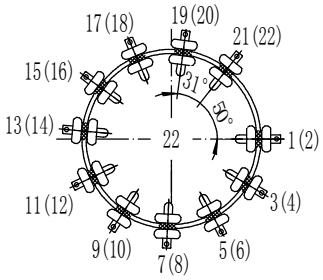


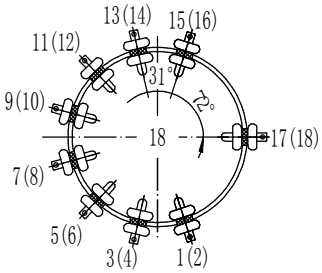




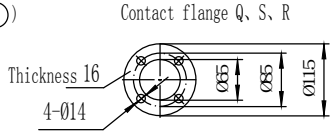






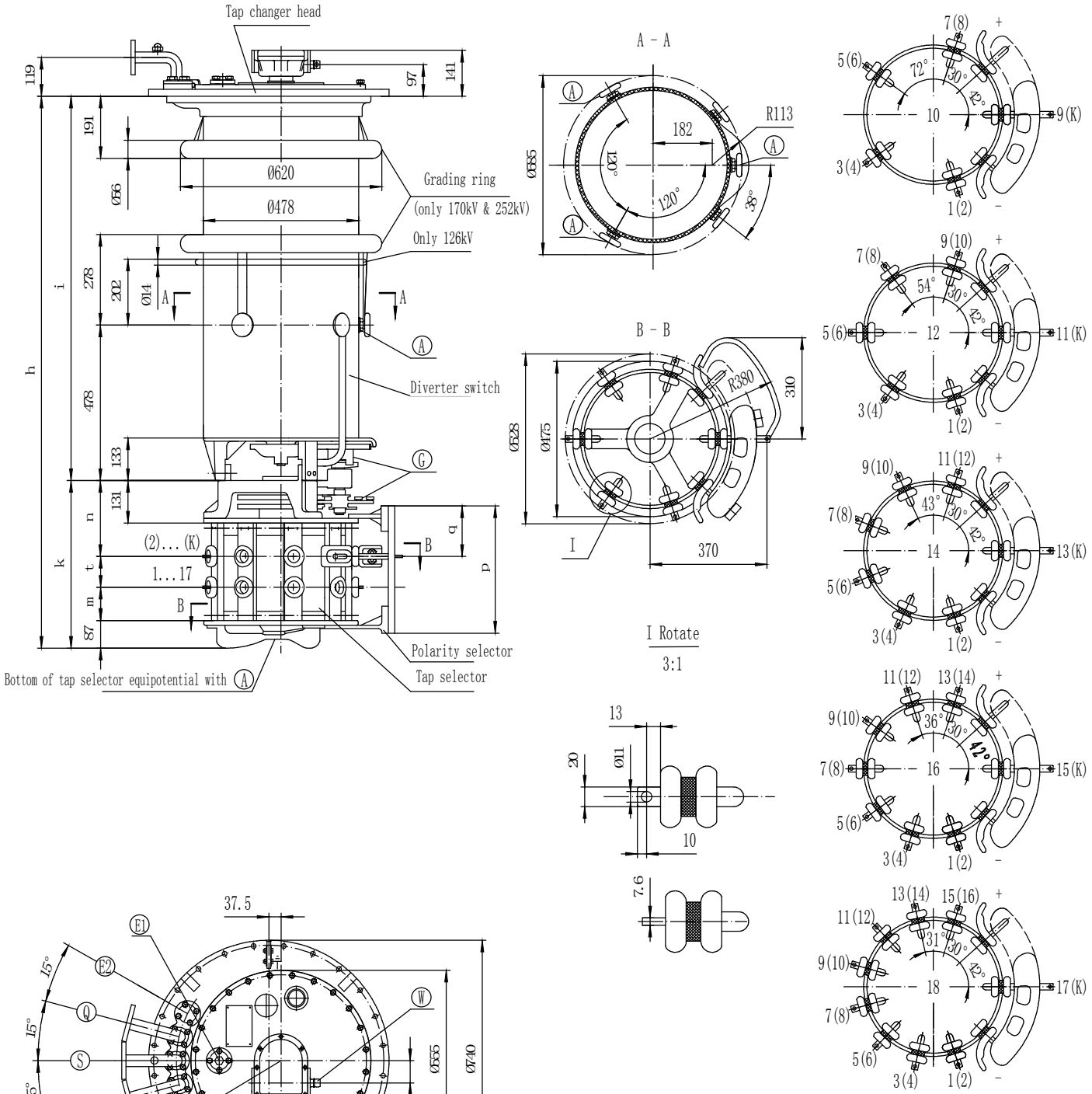


Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft



Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1513	1643	1773	1873	1588	1718	1848	1948	1783	1913	2043	2143
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	517				592				787			
	n	233				258				323			
	t	95				120				185			
	m	102				127				192			
Valume of oil dm^3		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm^3		189	214	234	254	189	214	234	254	190	215	234	255
Weight kg		240				240				245			

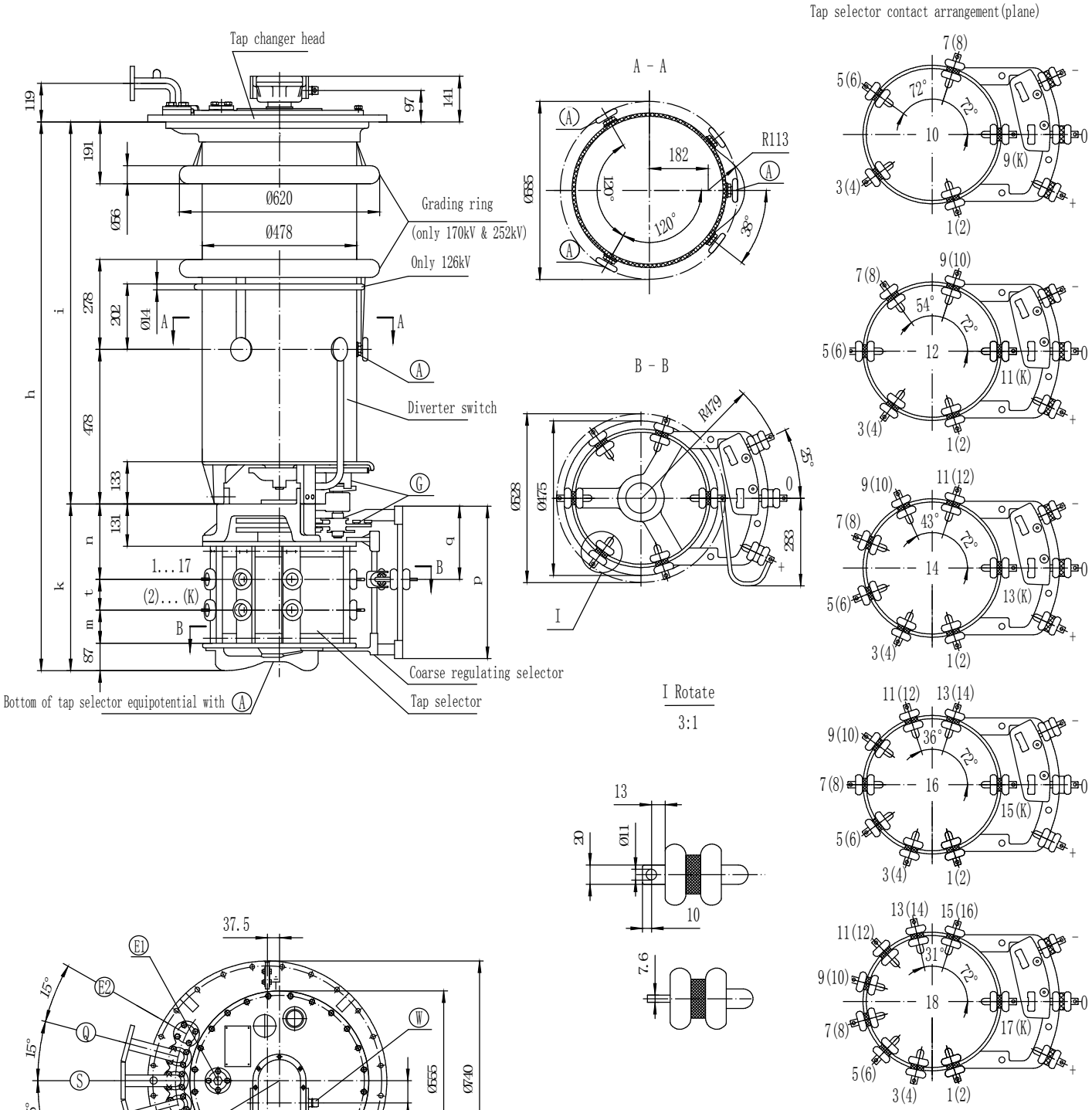
Figure 4 ZMI301/I501/I601 Linear reulating



Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Selector No.		B				C				D			
Max. working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1513	1643	1773	1873	1588	1718	1848	1948	1783	1913	2043	2143
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	517				592				787			
	n	233				258				323			
	t	95				120				185			
	m	102				127				192			
	q	160				185				250			
	p	403				478				673			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		191	216	236	256	192	217	237	257	193	218	238	258
Weight kg		250				255				260			

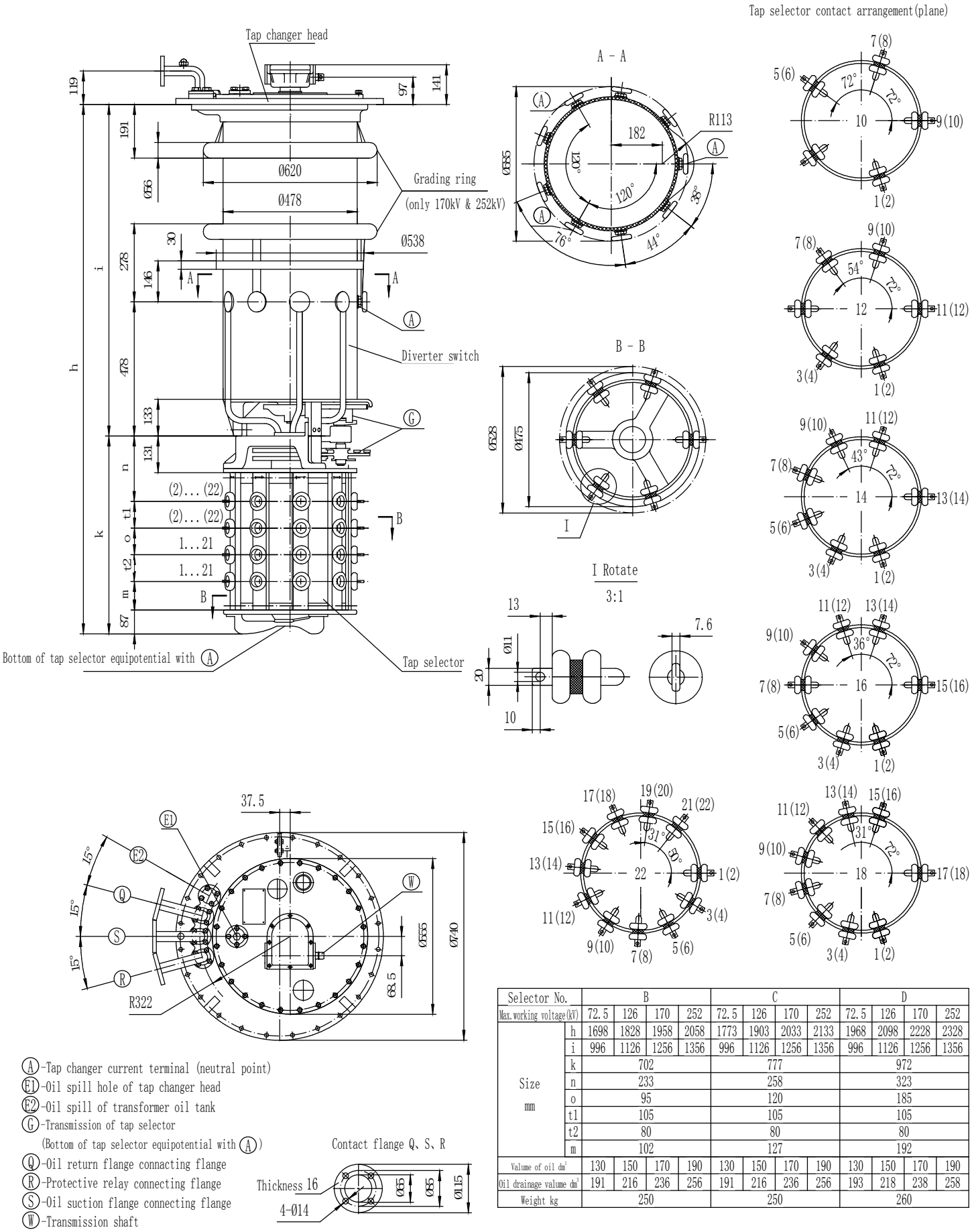
Figure5 ZMI301/I501/I601 Reverse regulating



Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1513	1643	1773	1873	1588	1718	1848	1948	1783	1913	2043	2143
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	517				592				787			
	n	233				258				323			
	t	95				120				185			
	m	102				127				192			
	q	276.5				301.5				366.5			
	p	512				587				782			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		193	218	238	258	193	218	238	258	195	220	240	260
Weight kg		260				260				265			

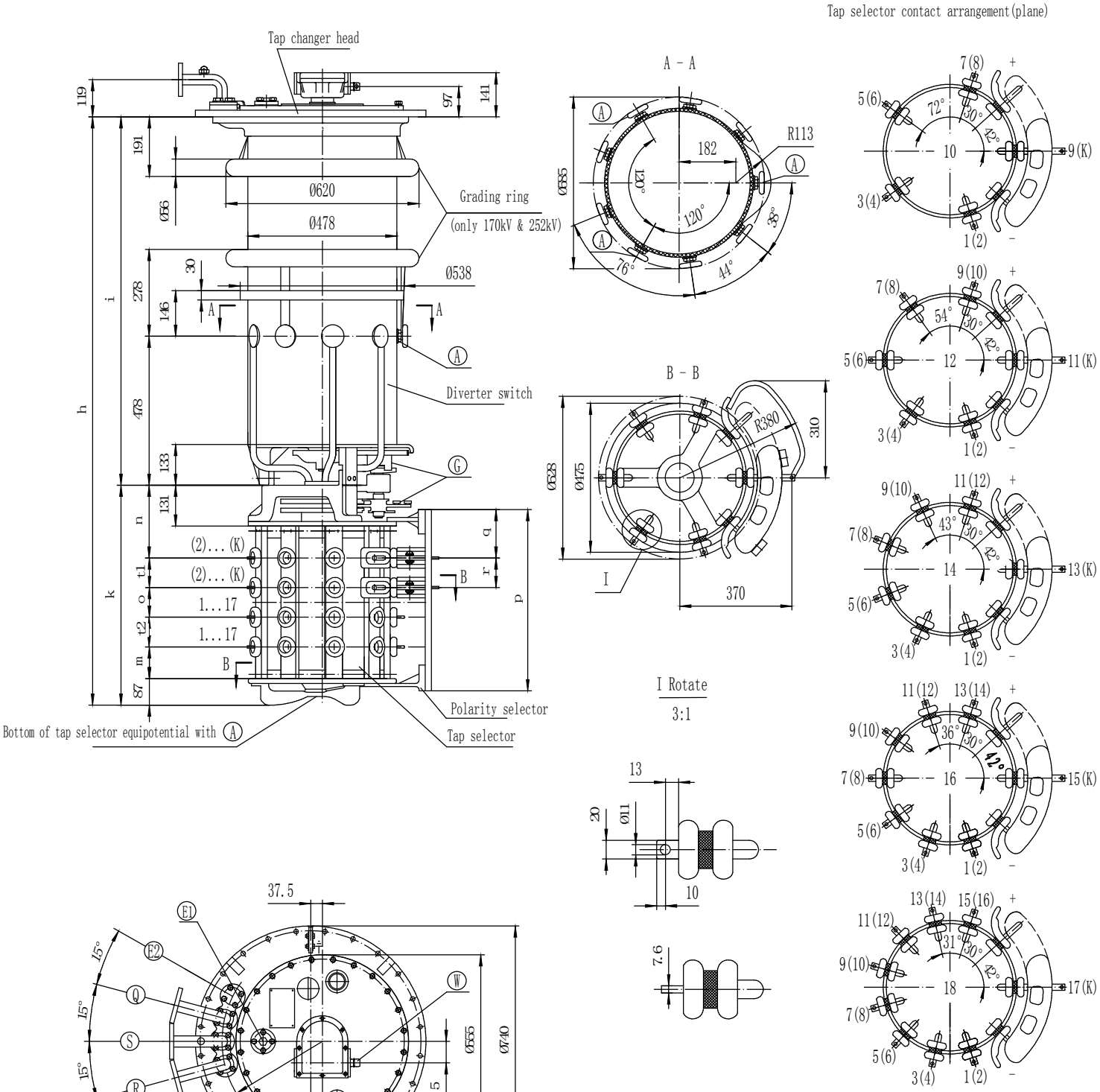
Figure 6 ZMI301/I501/I601 Coarse and fine regulating

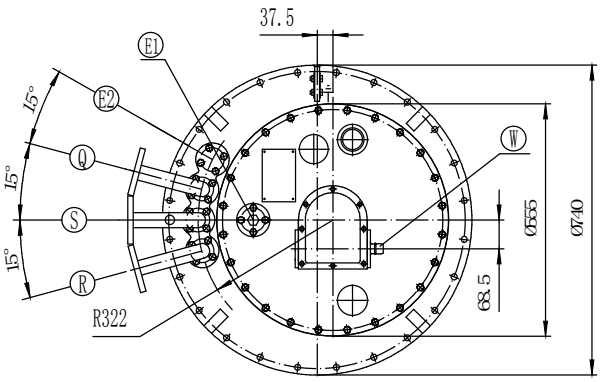


Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

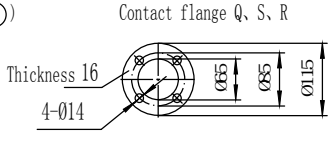
Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1698	1828	1958	2058	1773	1903	2033	2133	1968	2098	2228	2328
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	702				777				972			
	n	233				258				323			
	o	95				120				185			
	t1	105				105				105			
	t2	80				80				80			
	m	102				127				192			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		191	216	236	256	191	216	236	256	193	218	238	258
Weight kg		250				250				260			

Figure 7 ZMI800 Linear regulating



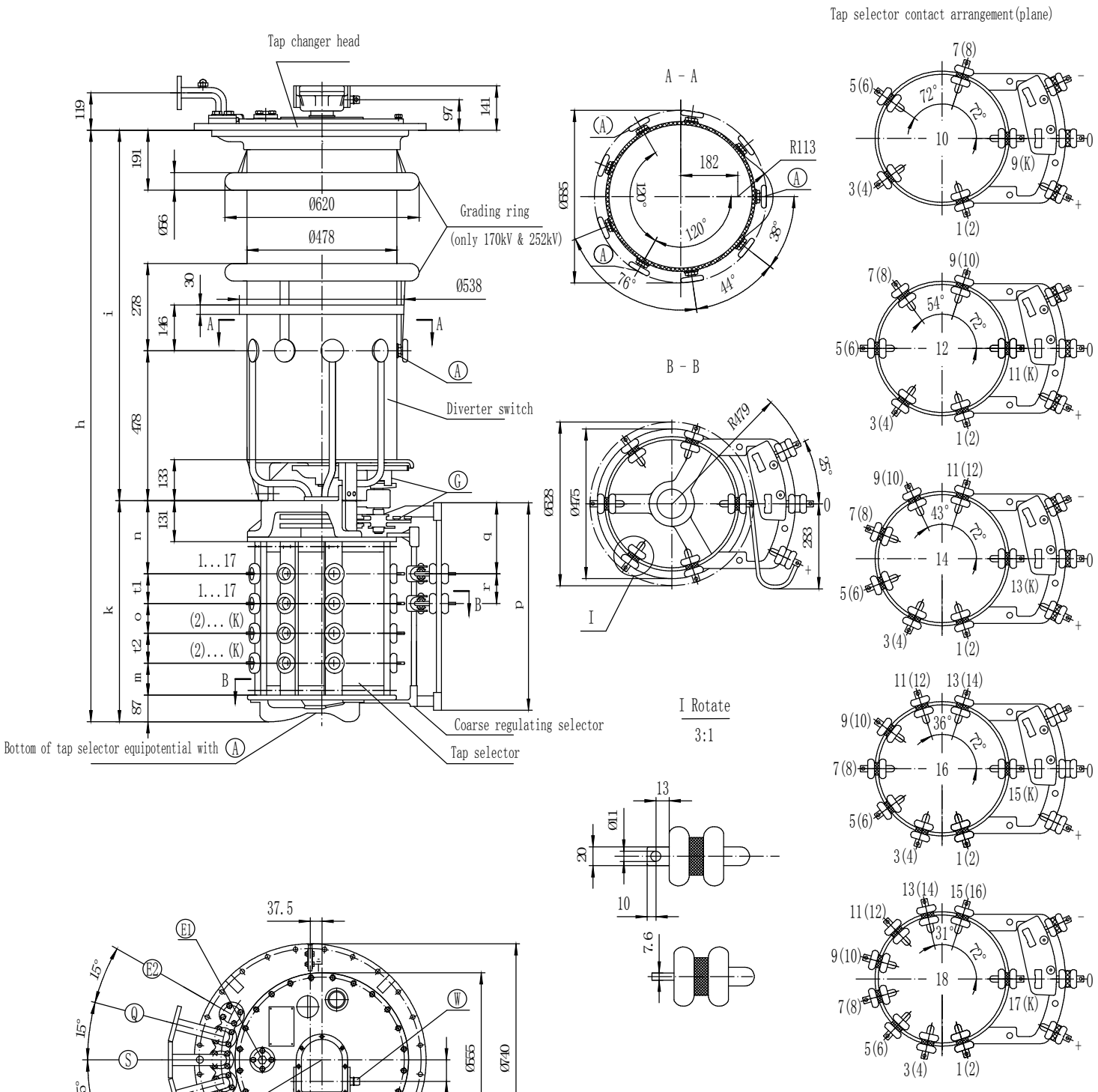


Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft



Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1698	1828	1958	2058	1773	1903	2033	2133	1968	2098	2228	2328
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	702				777				972			
	n	233				258				323			
	o	95				120				185			
	t1	105				105				105			
	t2	80				80				80			
	m	102				127				192			
	r	105				105				105			
	q	160				185				250			
	p	588				663				858			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		195	220	240	260	195	220	240	260	199	224	244	264
Weight kg		265				270				275			

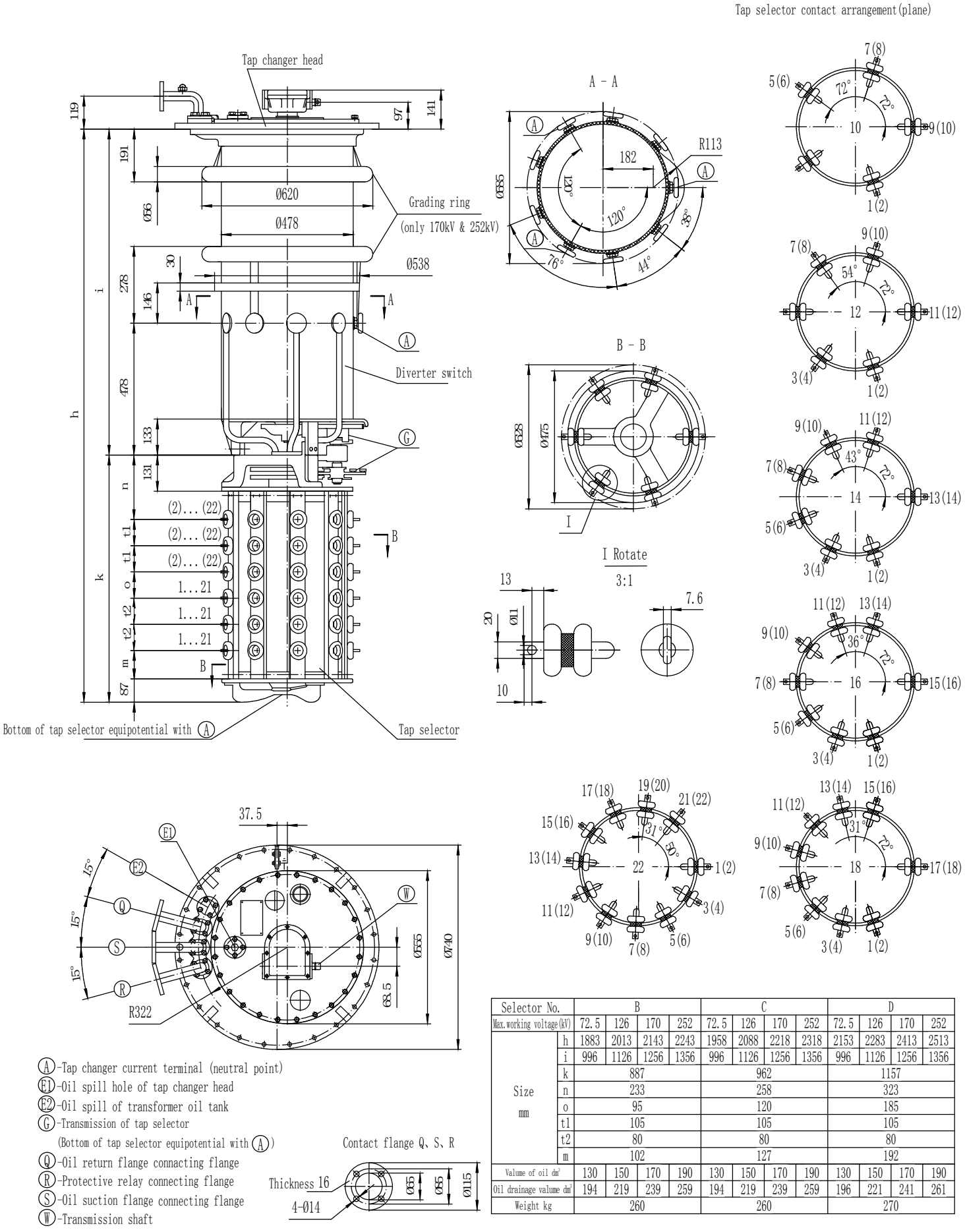
Figure 8 ZMI800 Reverse reuglating



Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1698	1828	1958	2058	1773	1903	2033	2133	1968	2098	2228	2328
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	702				777				972			
	n	233				258				323			
	o	95				120				185			
	t1	105				105				105			
	t2	80				80				80			
	m	102				127				192			
	r	105				105				105			
	q	276.5				301.5				366.5			
	p	697				772				967			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		195	220	240	260	196	221	241	261	199	224	244	264
Weight kg		265				270				275			

Figure 9 ZMI800 Coarse and fine regulating

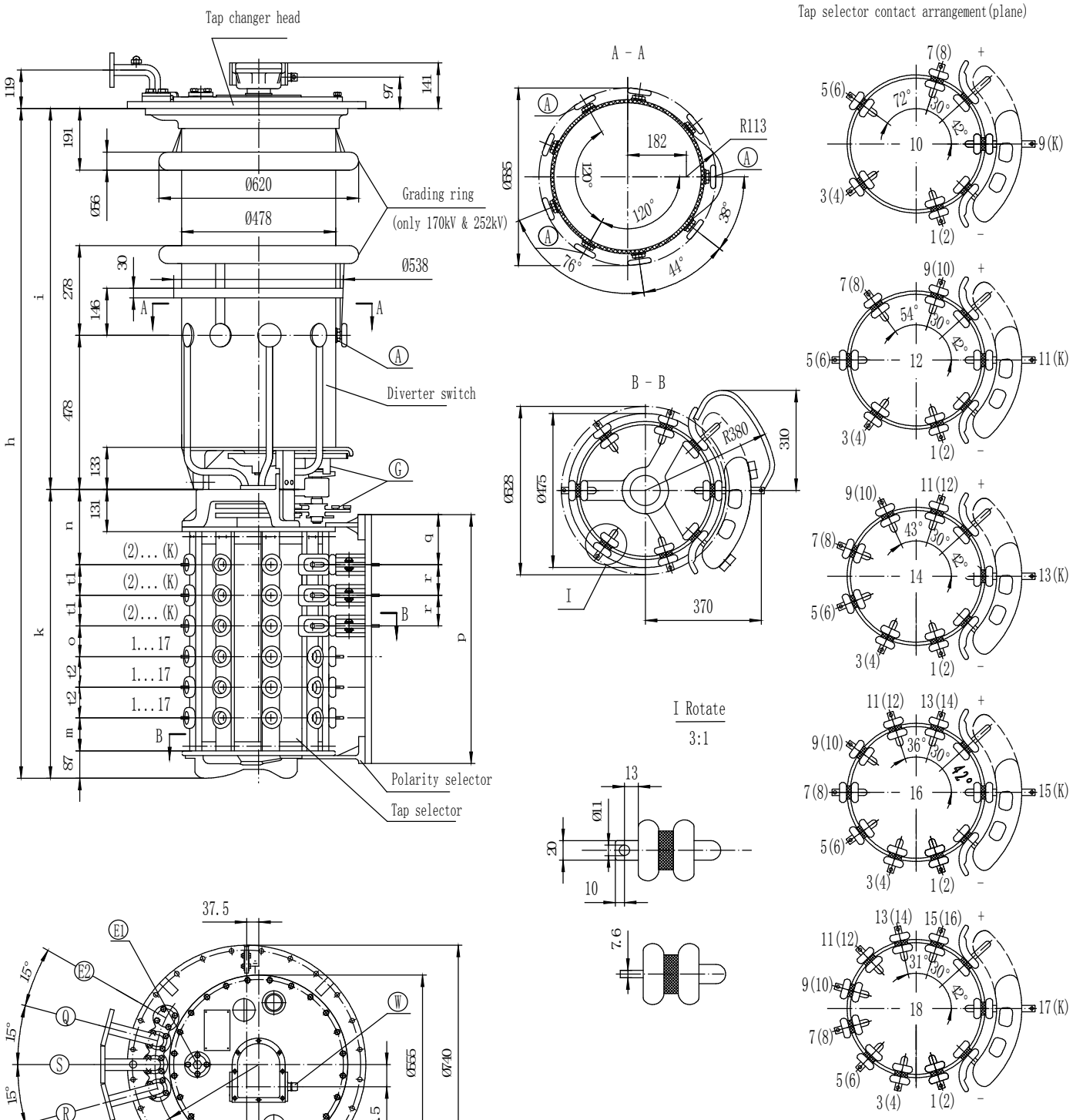


Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connecting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Contact flange Q、S、R

Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1883	2013	2143	2243	1958	2088	2218	2318	2153	2283	2413	2513
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	887				962				1157			
	n	233				258				323			
	o	95				120				185			
	t1	105				105				105			
	t2	80				80				80			
	m	102				127				192			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		194	219	239	259	194	219	239	259	196	221	241	261
Weight kg		260				260				270			

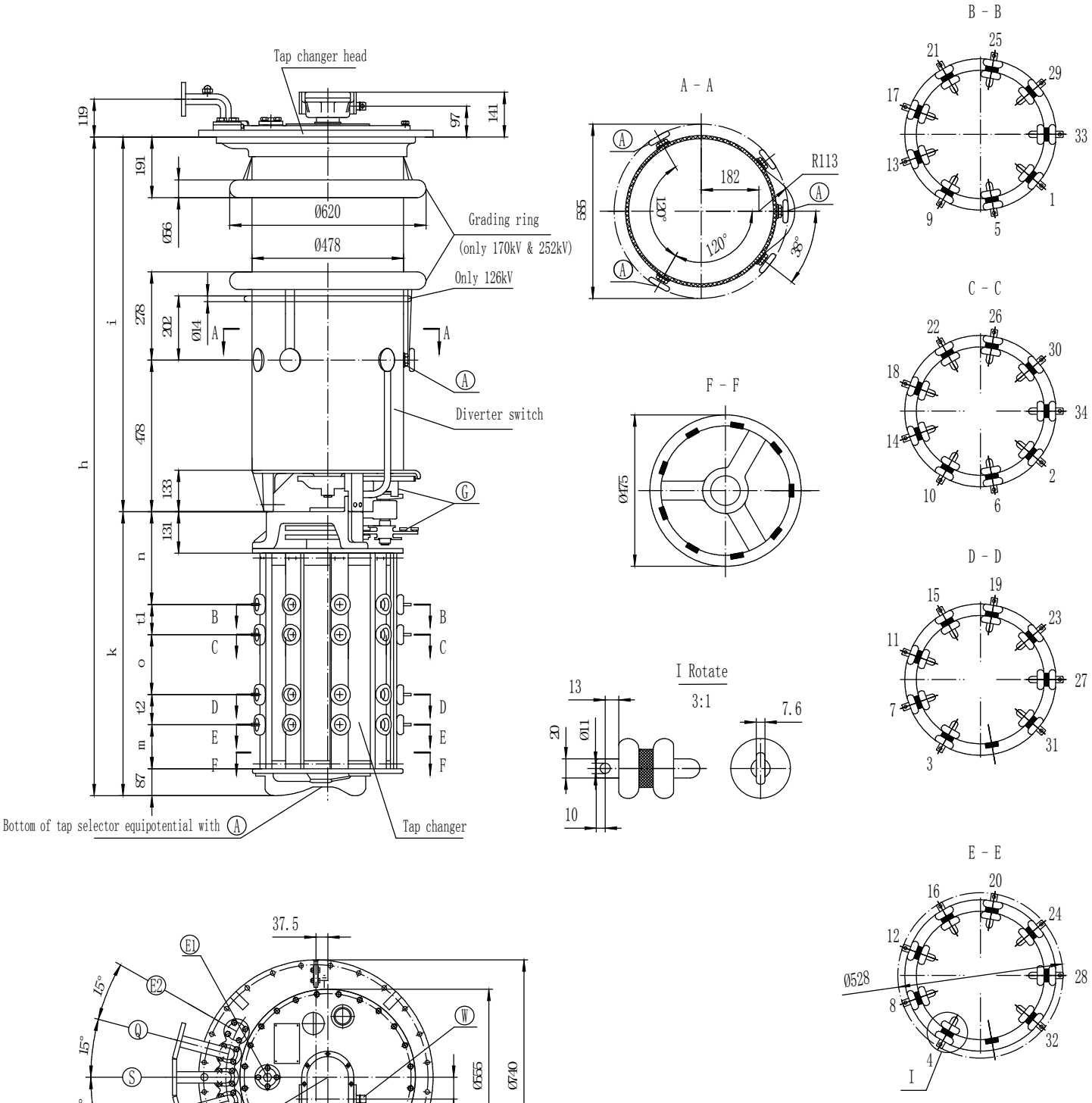
Figure 10 ZMI1200/I1500 Linear regulating



Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1883	2013	2143	2243	1958	2088	2218	2318	2153	2283	2413	2513
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	887				962				1157			
	n	233				258				323			
	o	95				120				185			
	t1	105				105				105			
	t2	80				80				80			
	m	102				127				192			
	r	105				105				105			
	q	160				185				250			
	p	773				848				1043			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		200	225	245	265	200	225	245	265	204	229	249	269
Weight kg		285				285				295			

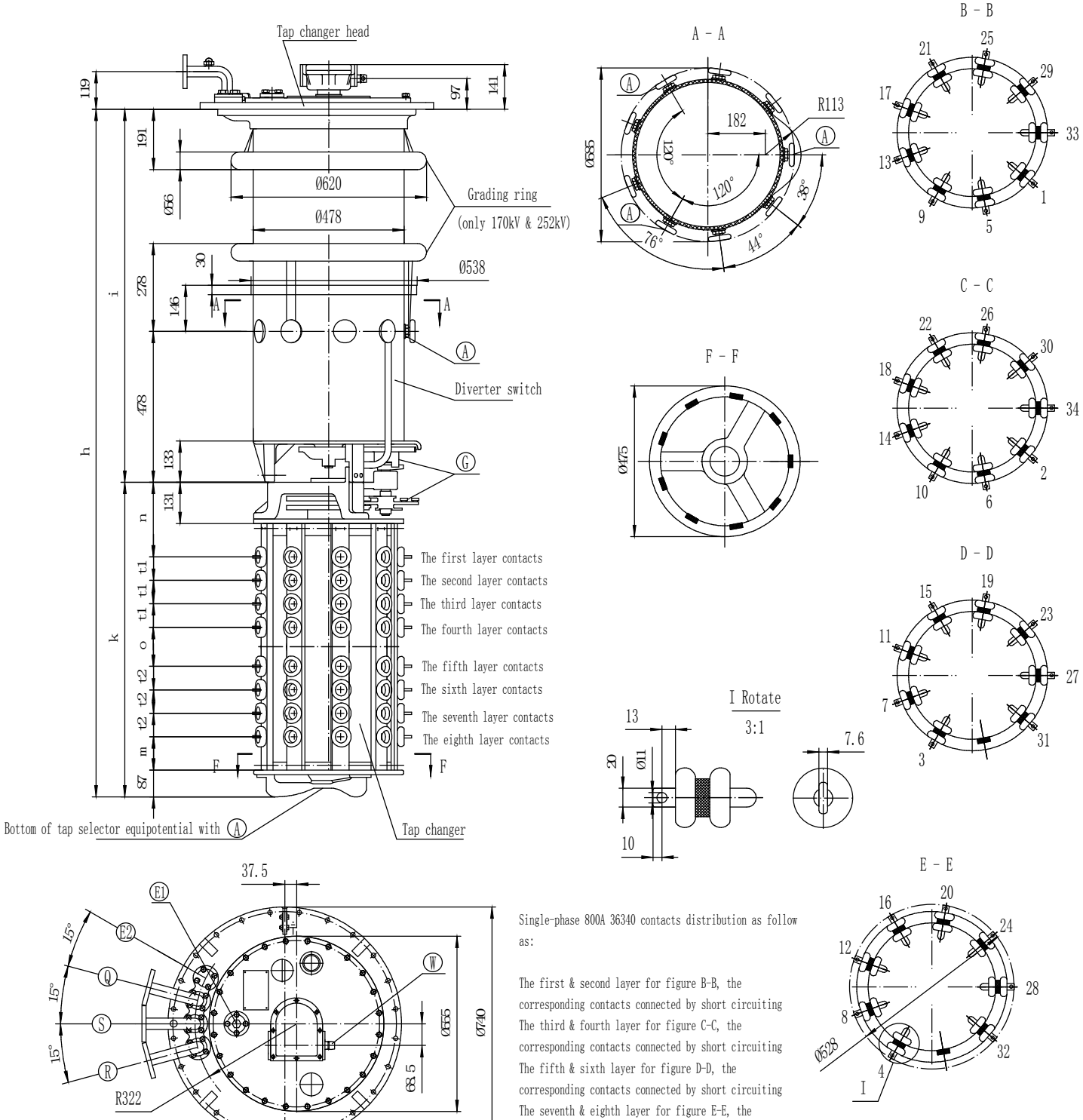
Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Figure 11 ZMI1200/I1500 Reverse regulating



Selector No.		C			
Max. working voltage(kV)		72.5	126	170	252
Size mm	h	1935	2065	2195	2295
	i	996	1126	1256	1356
	k	939			
	n	323			
	o	185			
	t1	77			
	t2	77			
	m	192			
Valume of oil dm³		130	150	170	190
Oil drainage valume dm³		245	249	255	259
Weight kg		260			

Figure 13 ZMI500A 36340 Multistage linear reuglating



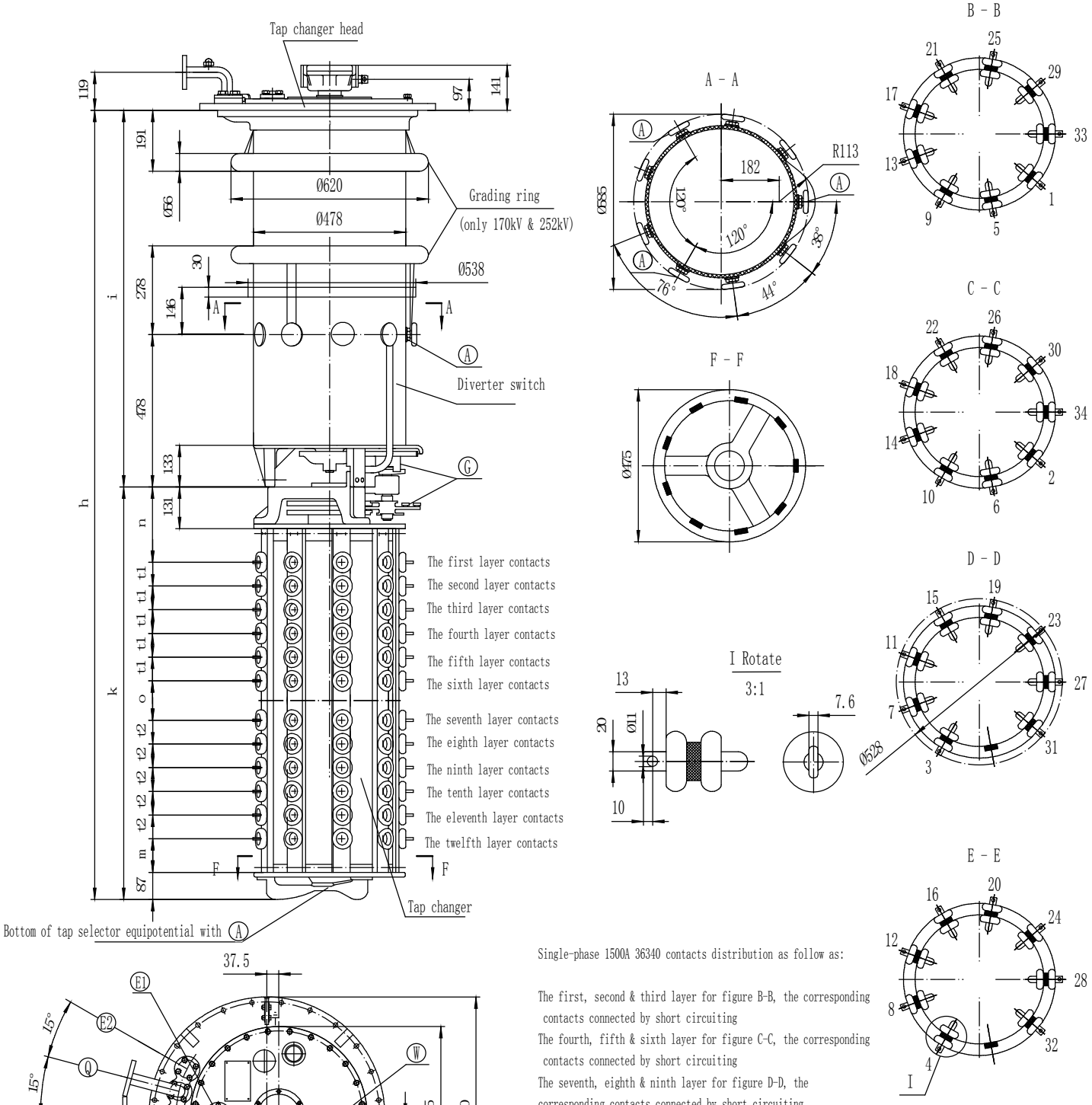
Single-phase 800A 36340 contacts distribution as follow as:

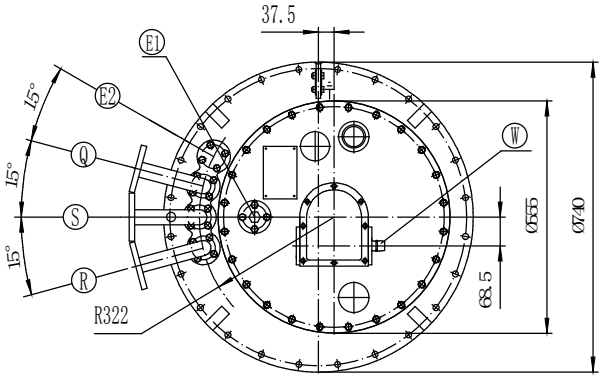
The first & second layer for figure B-B, the corresponding contacts connected by short circuiting
The third & fourth layer for figure C-C, the corresponding contacts connected by short circuiting
The fifth & sixth layer for figure D-D, the corresponding contacts connected by short circuiting
The seventh & eighth layer for figure E-E, the corresponding contacts connected by short circuiting

Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Selector No.		C			
Max.working voltage(kV)		72.5	126	170	252
Size mm	h	2243	2373	2503	2603
	i	996	1126	1256	1356
	k	1247			
	n	323			
	o	185			
	t1	77			
	t2	77			
	m	192			
Valume of oil dm³		130	150	170	190
Oil drainage valume dm³		260	263	264	265
Weight kg		260			

Figure 14 ZMI800A 36340 Multistage linesar regulating





Single-phase 1500A 36340 contacts distribution as follow as:

The first, second & third layer for figure B-B, the corresponding contacts connected by short circuiting

The fourth, fifth & sixth layer for figure C-C, the corresponding contacts connected by short circuiting

The seventh, eighth & ninth layer for figure D-D, the corresponding contacts connected by short circuiting

The tenth, eleven & twelfth layer for figure E-E, the corresponding contacts connected by short circuiting

Selector No.		C			
Max.working voltage(kV)		72.5	126	170	252
Size mm	h	2446	2576	2706	2806
	i	996	1126	1256	1356
	k	1450			
	n	293			
	o	140			
	t1	77			
	t2	77			
	m	162			
Valume of oil dm³		130	150	170	190
Oil drainage valume dm³		260	263	264	265
Weight kg		305			

Ⓐ-Tap changer current terminal (neutral point)
Ⓔ1-Oil spill hole of tap changer head
Ⓔ2-Oil spill of transformer oil tank
Ⓖ-Transmission of tap selector
(Bottom of tap selector equipotential with Ⓐ)
Ⓠ-Oil return flange connacting flange
Ⓡ-Protective relay connecting flange
Ⓢ-Oil suction flange connecting flange
Ⓦ-Transmission shaft

Contact flange Q、S、R

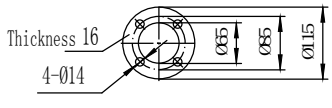
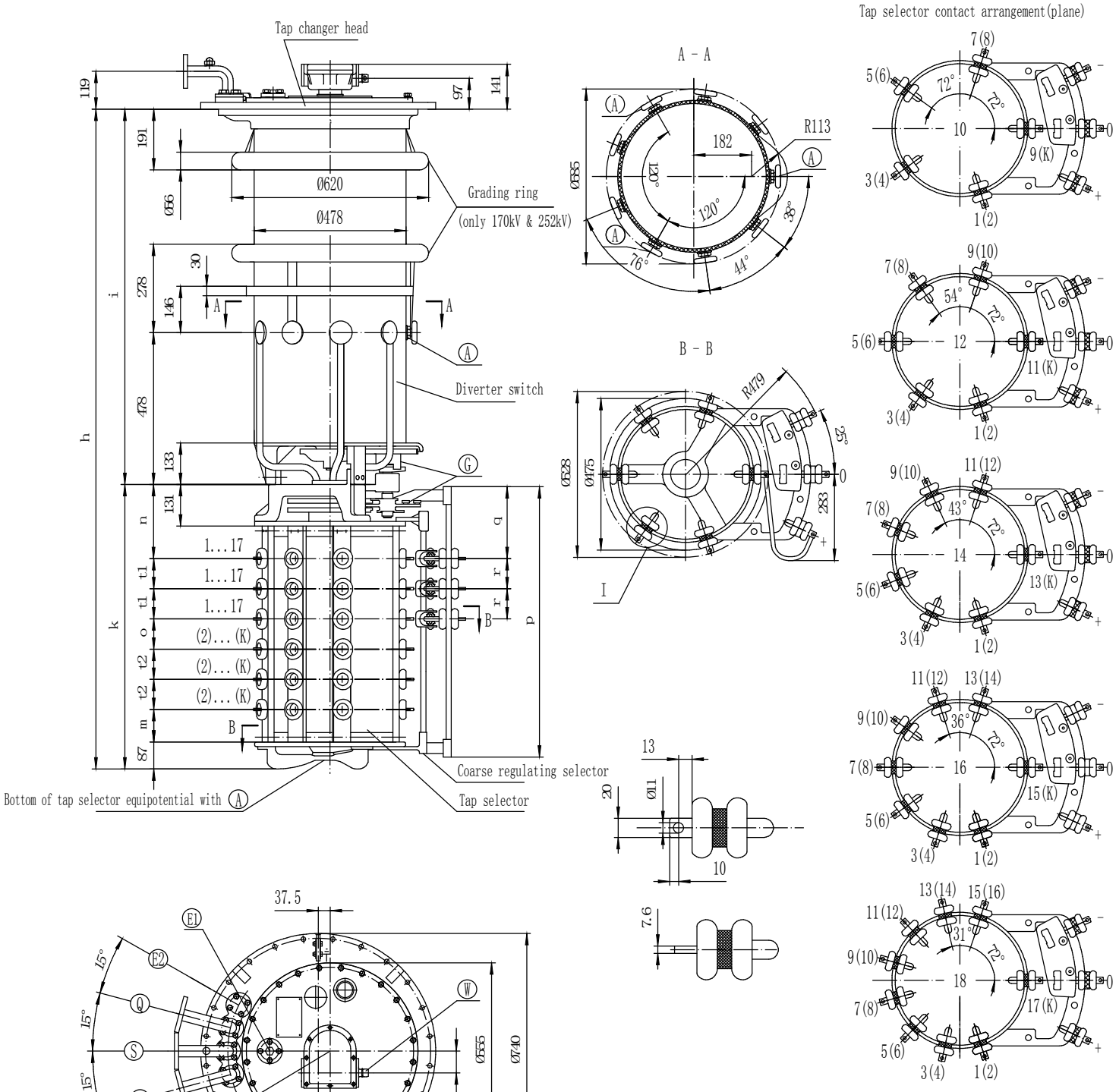


Figure 15 ZMI1500A 36340 Multistage linesar regulating



Selector No.		B				C				D			
Max.working voltage(kV)		72.5	126	170	252	72.5	126	170	252	72.5	126	170	252
Size mm	h	1883	2013	2143	2243	1958	2088	2218	2318	2153	2283	2413	2513
	i	996	1126	1256	1356	996	1126	1256	1356	996	1126	1256	1356
	k	887				962				1157			
	n	233				258				323			
	o	95				120				185			
	t1	105				105				105			
	t2	80				80				80			
	m	102				127				192			
	r	105				105				105			
	q	276.5				301.5				366.5			
	p	882				957				1152			
Valume of oil dm³		130	150	170	190	130	150	170	190	130	150	170	190
Oil drainage valume dm³		200	225	245	265	200	225	245	265	204	229	249	269
Weight kg		285				285				295			

Figure 12 ZMI1200/I1500 Coarse and fine regulating

V. ZM installation dimensions

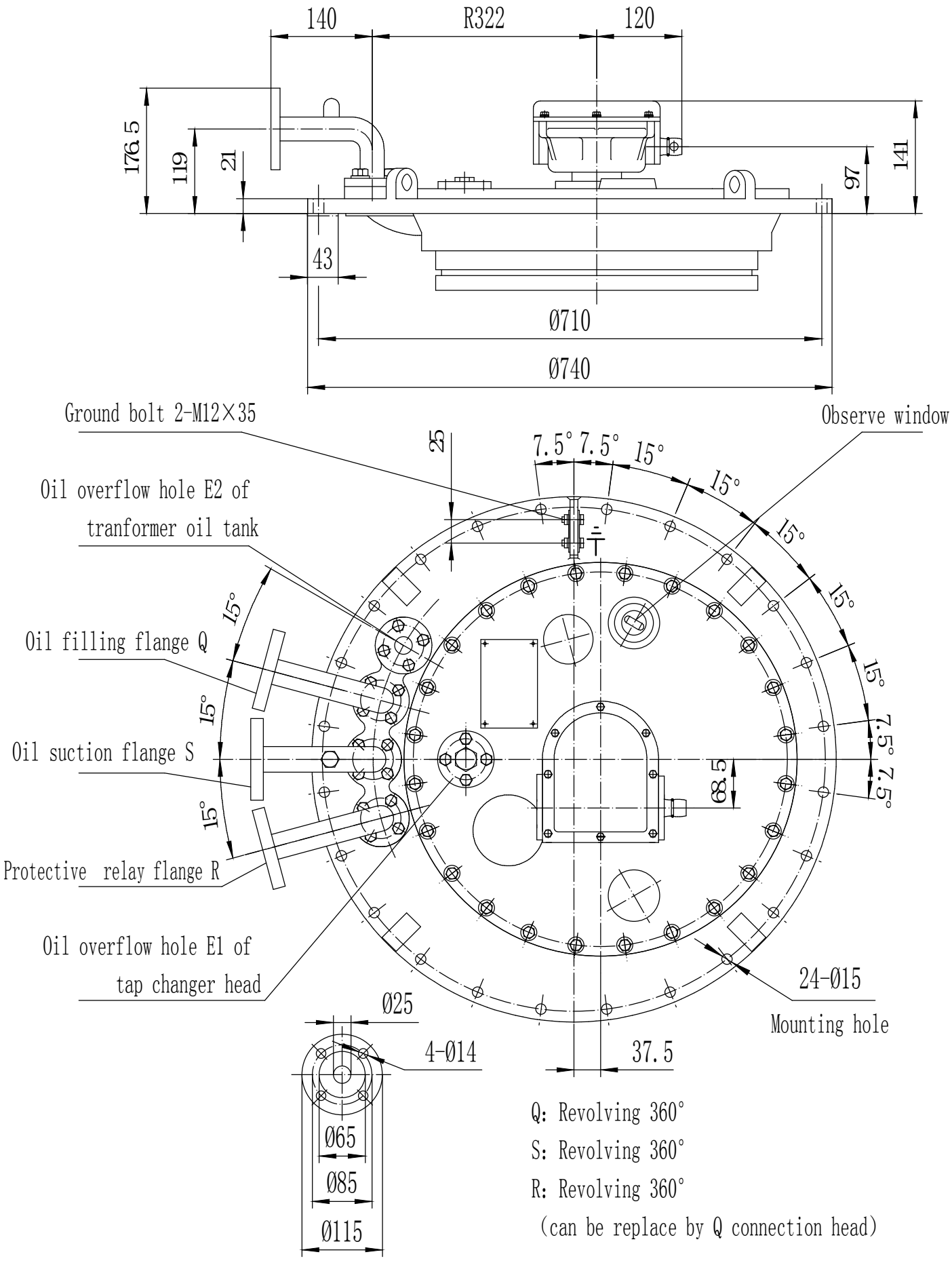


Figure 16 ZM head installation dimension

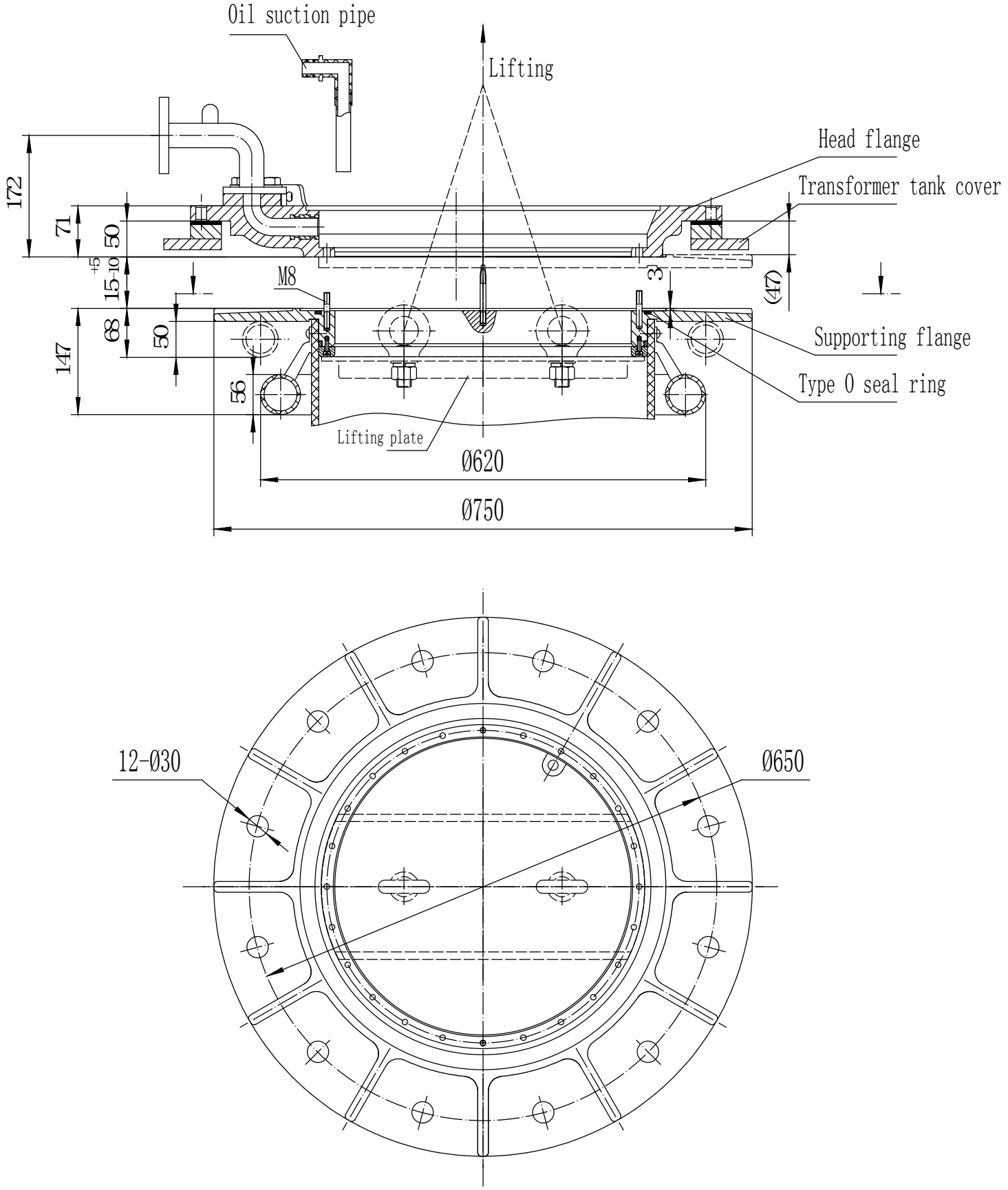


Figure 17　ZM Bell type mounting dimension diagram

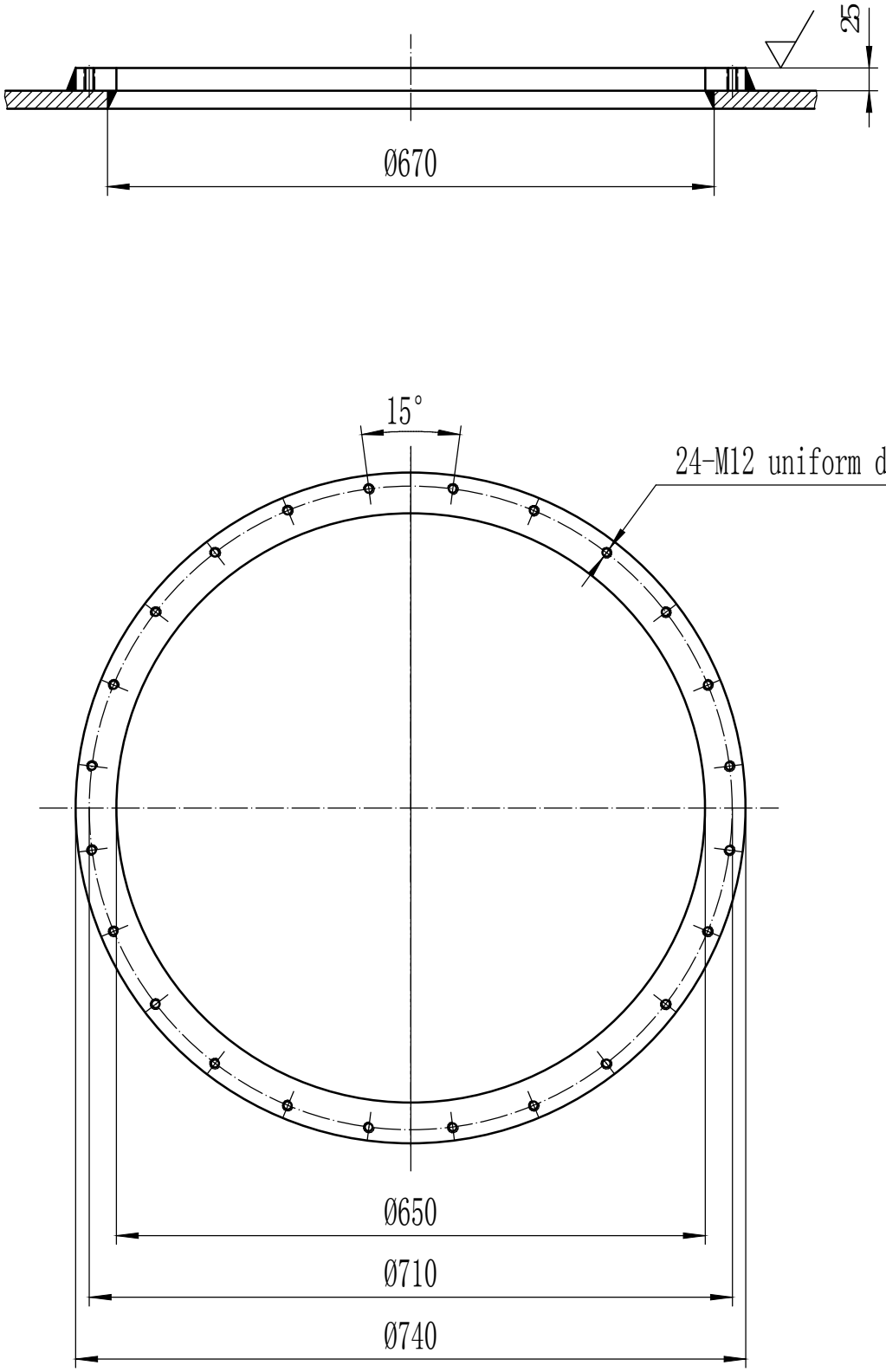


Figure 18 ZM mounting flange dimension of transformer tank cover

VII. Layout selection diagram of ZM head cover

1. head cover arrangment selection diagram without pressure relese valve

In order to meet requirement of customers. Plase choose the manufacture method of head cover in the order. If customer does't make any choose. then asscording to figure A. If there any special angle situation, please claim when give order.

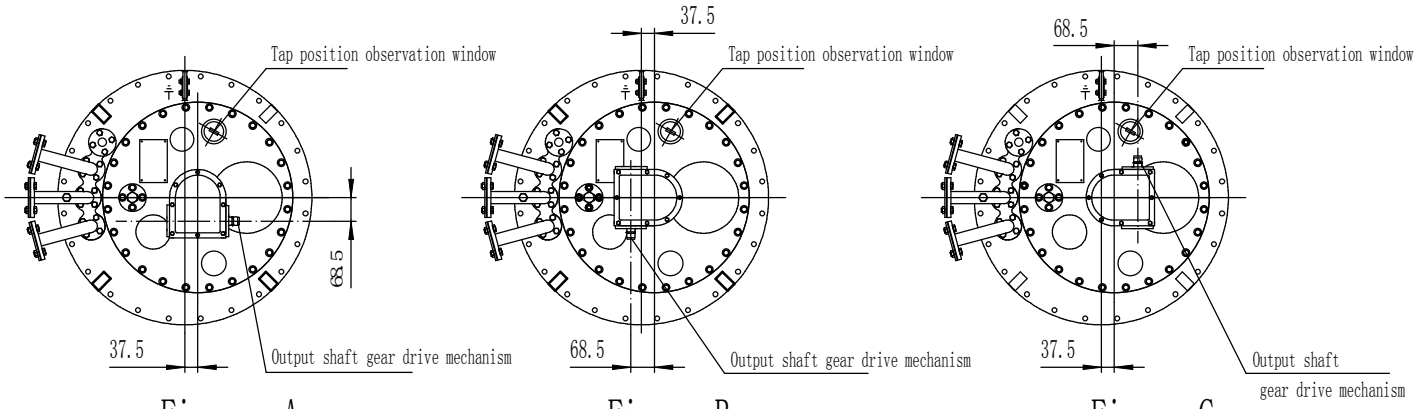


Figure A Figure B Figure C

2. Head cover layout selection diagram with pressure release valve

In order to meet to the requirement from customer. please choose the manufacture method of head cover in the order. If costomer doesn't make any choose, then according figure D to assemble. If there are any special angle situation, please claim it in the oreder.

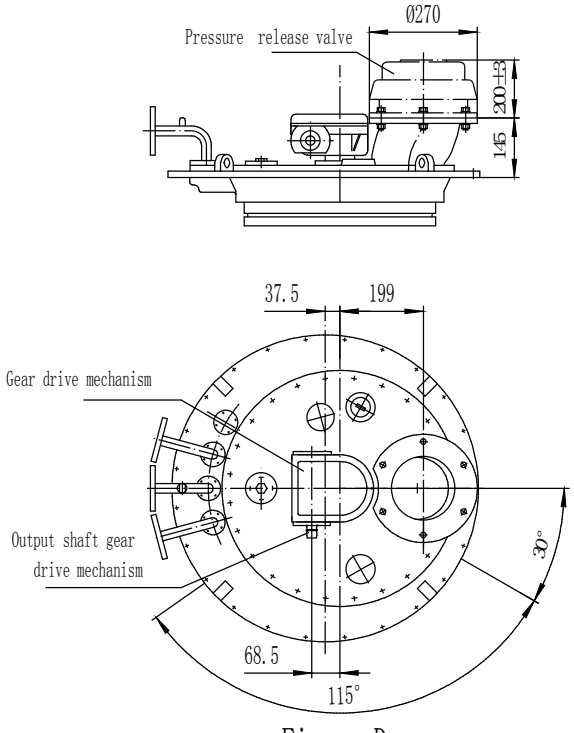


Figure D

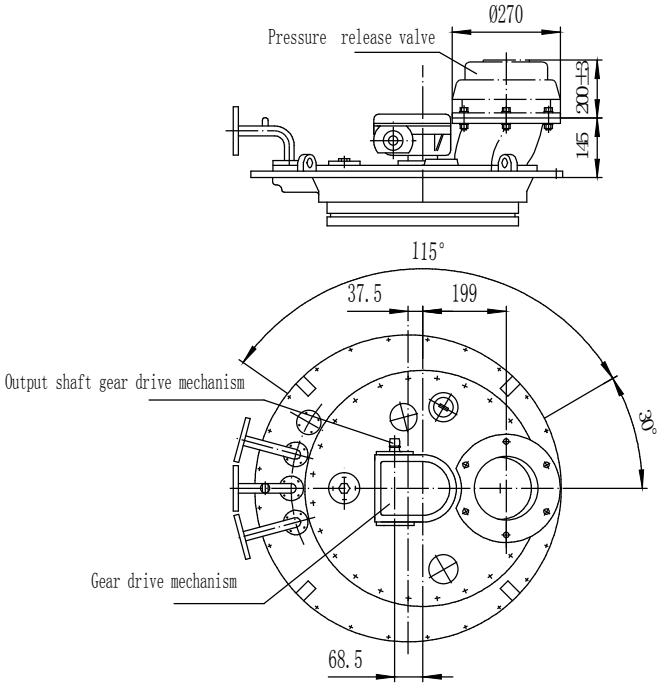
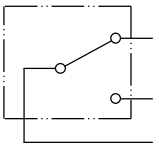
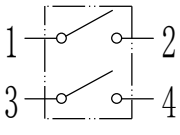
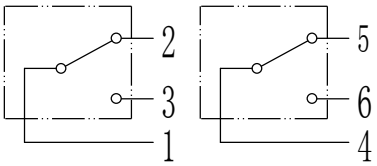


Figure E

Pressure release electrical signal output connection diagram		
		
Standard	Type I	Type II

VIII. ZM Three mechanical linkage layout drawing

Note: Normal circumstances, three machanical linkage production to Figure F, if want to production to figure G, that need to user requests

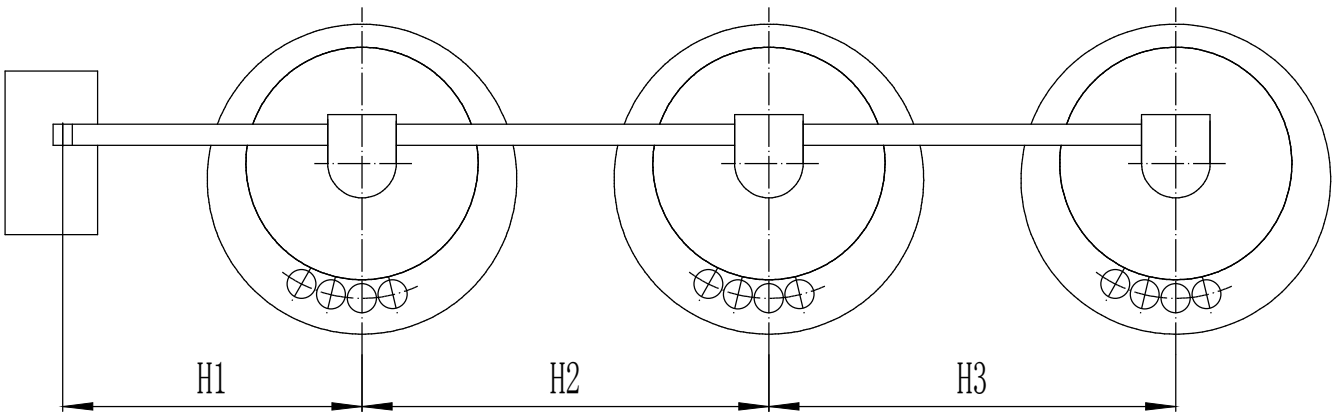


Figure F

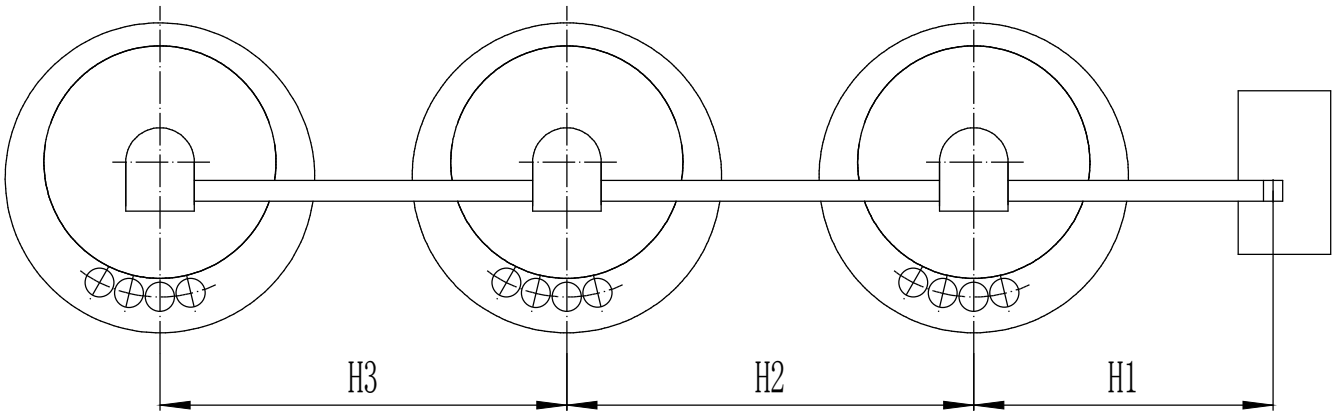
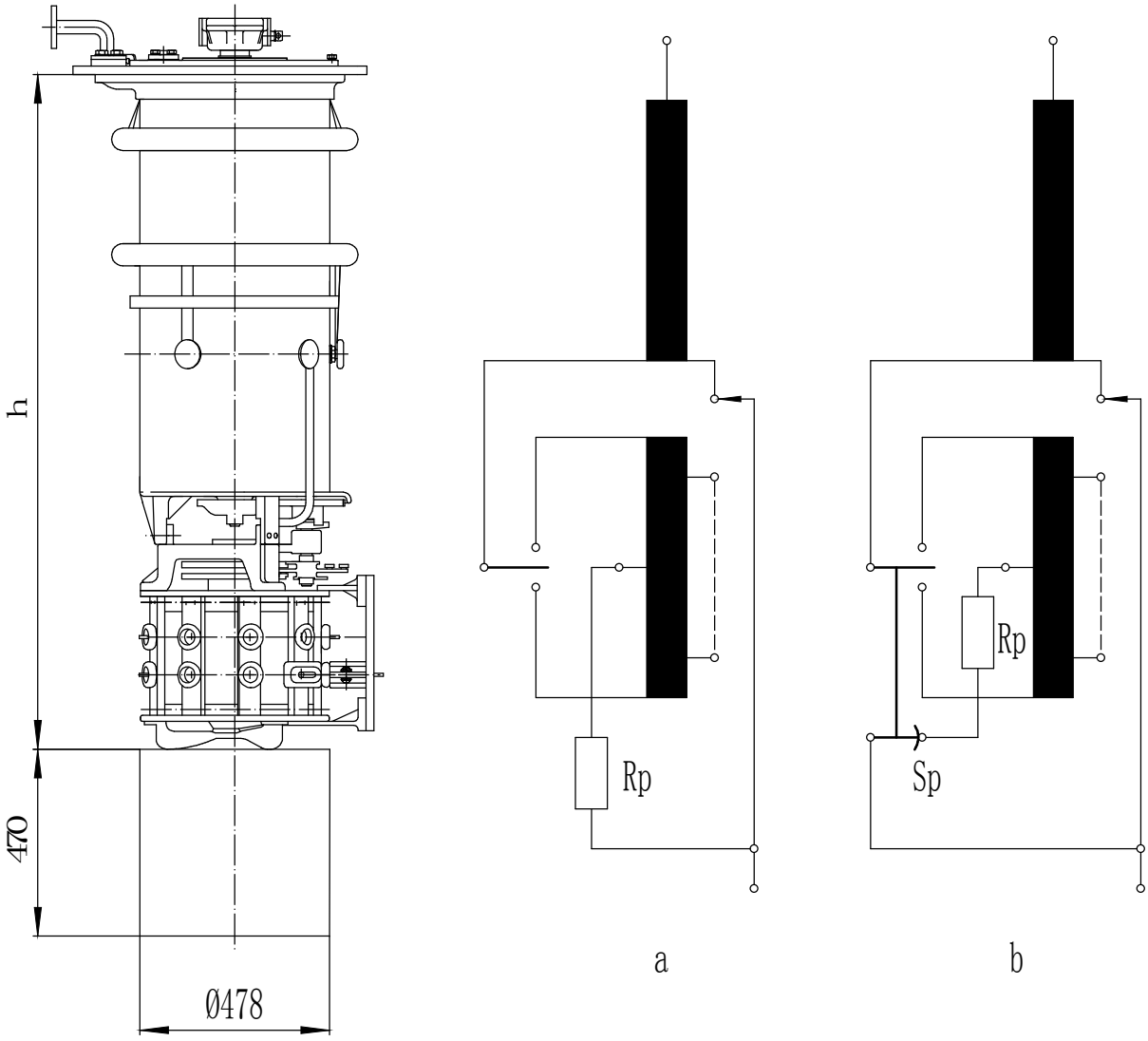


Figure G

layout model		Figure F	FigureG
Min size (mm)	H1≥	515	515
	H2≥	840	840
	H3≥	840	840
Max size (mm)	H1≤	2254	2254
	H2≤	2249	2249
	H3≤	2249	2249

IX. Potential resisitance and potential of ZM

During the tao changer over selector operation, the decomposition winding in a "susoended " state. Because there coupling capacitance C_w in main winding and tap winding, there is a coupling capacitance C_e in tap winding in the enclosure's sake, the change-over selelctor spark discharge. Order to reduce spark discharge gas, using solid junction potential resistance or by a potential opening to link potential resistance.



a- Solid junction potential resistance R_p

b- Borrow potential switch S_p

solid junction potential resistance R_p