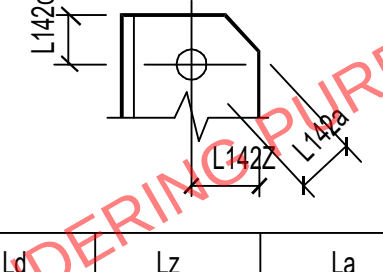
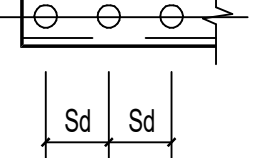
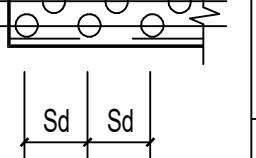
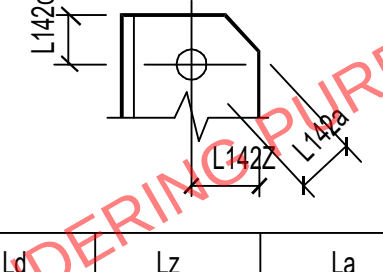
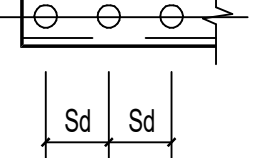
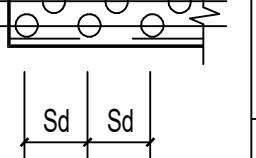
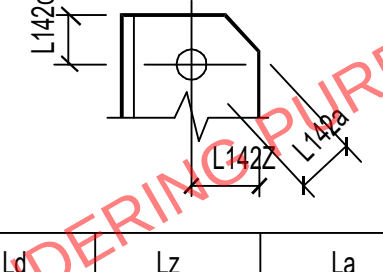
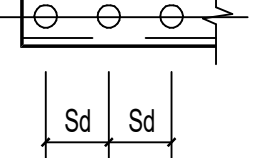
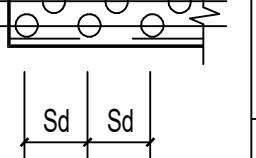
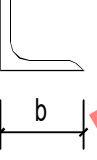
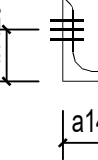
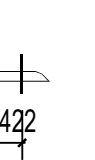
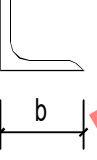
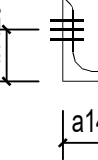
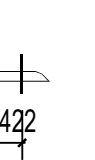
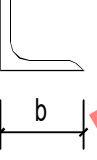
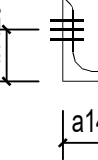
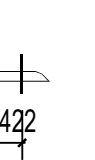


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A	Design Description											A																																																																																																																																													
B	1. General notes: (1)The structure's design working life is 50 years. (2)Unless otherwise specially notes, all dimensions are in millimeters. The elevation is marked in meters. (3)All steel components are processed with hot dip galvanizing corrosion, with zinc coating thickness is not less than 90. (4)Galvanized amount of all steel components per square meter shall be not less than 610 grams, and that of bolt per square meter shall be not less than 395 grams. (5)Hot dip galvanize must be according to ISO1461 code. (6)To use on-site cold spray zinc where galvanized layer damaged, the average thickness 100um.					(6)The height of fillet weld is not less than the minimum thickness of the connecting member but not more than its 1.2 times minimum thickness. (7)For thicker weldments, groove welding is used to ensure connection strength. (8)The bolts of the bracket members are bolted with a single flat washer and a single spring washer. (9)The gap between the joints of two angle steel is 10mm. (10)When the internal encased angel steel is connected, the means of shoveling the back of the internal encased angel steel is adopted, while the means of shoveling the external encased angel steel arc is used for the external. (11)Base line of angle steel and bolt shall be used in accordance with Table 1, except those indicated in the figure. (12)The bolt spacing and edge distance of angle steel and gusset plate shall be used in accordance with Table 2, except those indicated in the figure. (13)All kinds of bolt and washer specifications shall be used in accordance with Table 3.					Table 2 <table><tr><th rowspan="3">BOLT diameter</th><th rowspan="3">Diameter of bolt holes</th><th colspan="2">Bolt Pitch</th><th colspan="3">Bolt margin and end-to-end distance</th></tr><tr><th>Single-row</th><th>Double-row</th><th colspan="3"></th></tr><tr><th></th><th></th><th>L1</th><th>L2</th><th>La</th></tr><tr><td>16</td><td>17.5</td><td>50</td><td>80</td><td>35</td><td>≥ 21</td><td>≥ 23</td></tr><tr><td>20</td><td>21.5</td><td>60</td><td>100</td><td>40</td><td>≥ 26</td><td>≥ 28</td></tr><tr><td>24</td><td>25.5</td><td>80</td><td>120</td><td>50</td><td>≥ 31</td><td>≥ 33</td></tr></table> Note: The numerical unit in the table is mm.	BOLT diameter	Diameter of bolt holes	Bolt Pitch		Bolt margin and end-to-end distance			Single-row	Double-row						L1	L2	La	16	17.5	50	80	35	≥ 21	≥ 23	20	21.5	60	100	40	≥ 26	≥ 28	24	25.5	80	120	50	≥ 31	≥ 33	B																																																																																																							
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C	2. Materials: (1)Steel: 1)Steels used in the steel structure are CQ and S355 JR grade steel. 2)As for level CQ steel, its yield strength is not less than 235MPa; tensile strength is 370 - 500MPa; percentage elongation after fracture is not less than 26%; the impact absorbing energy of impact test (V-notch) at +20 C (longitudinal) is not less than 27J. 3)As for level S355 JR steel, its yield strength is not less than 345MPa; tensile strength is 470-630MPa; percentage elongation after fracture is not less than 20%; the impact absorbing energy of impact test (V-notch) at +20 C (longitudinal) is not less than 34J.					4. Transport and stacking: (1)After the components are transported to the site, the column beam members shall be stacked separately to prevent confusion during assembly. (2)The galvanized layer due to transport and lifting damage shall be cleaned first, and then applied zinc-rich paint. (3)During transport, the same components shall be bundled and stacked together. The sleepers are placed at the end of the component and the layers to prevent deformation and damage caused by the collision of the galvanized layer.					C																																																																																																																																														
D	(2)Bolts, nuts and washers: 1)Bolts shall be level 8.8 hot dip galvanizing pieces with nuts, flat washers and spring washers; 2)Nuts and washers shall be level 8.8 hot dip galvanizing pieces.					Table 3 <table><tr><th>Component name</th><th>Level</th><th>Specification</th><th>Symbol</th><th>No thread length (mm)</th><th>Clamping thickness (mm)</th></tr><tr><td rowspan="10">Bolt</td><td rowspan="10">6.8</td><td>M16X35</td><td></td><td>7</td><td>8 ~ 9</td></tr><tr><td>M16X45</td><td></td><td>9</td><td>10~19</td></tr><tr><td>M16X55</td><td></td><td>19</td><td>20~29</td></tr><tr><td>M16X65</td><td></td><td>29</td><td>30~39</td></tr><tr><td>M20X40</td><td></td><td>8</td><td>9~10</td></tr><tr><td>M20X50</td><td></td><td>10</td><td>11~20</td></tr><tr><td>M20X60</td><td></td><td>20</td><td>21~30</td></tr><tr><td>M20X70</td><td></td><td>30</td><td>31~40</td></tr><tr><td>M20X80</td><td></td><td>40</td><td>41~50</td></tr><tr><td>M20X90</td><td></td><td>50</td><td>51~60</td></tr><tr><td rowspan="6">Bolt</td><td rowspan="6">6.8</td><td>M20X100</td><td></td><td>60</td><td>61~70</td></tr><tr><td>M24X50</td><td></td><td>9</td><td>10~14</td></tr><tr><td>M24X60</td><td></td><td>14</td><td>15~24</td></tr><tr><td>M24X70</td><td></td><td>24</td><td>25~34</td></tr><tr><td>M24X80</td><td></td><td>34</td><td>35~44</td></tr><tr><td>M24X90</td><td></td><td>44</td><td>45~54</td></tr><tr><td rowspan="4">Flash Washer</td><td rowspan="4">CQ</td><td>-2</td><td rowspan="4"></td><td rowspan="4">Thickness X number</td><td>d=13.5 D=24</td><td></td></tr><tr><td>-3(A)</td><td>d=17.5 D=30</td><td></td></tr><tr><td>-3(B)</td><td>d=22 D=37</td><td></td></tr><tr><td>-4</td><td>d=26 D=44</td><td></td></tr><tr><td rowspan="4">Spring washer</td><td rowspan="4">CQ</td><td>-1</td><td rowspan="4"></td><td rowspan="4">Thickness X number</td><td>d=13.5 D=24</td><td></td></tr><tr><td>-4</td><td>d=17.5 D=30</td><td></td></tr><tr><td>-5</td><td>d=22 D=37</td><td></td></tr><tr><td>-6</td><td>d=26 D=44</td><td></td></tr></table>					Component name	Level	Specification	Symbol	No thread length (mm)	Clamping thickness (mm)	Bolt	6.8	M16X35		7	8 ~ 9	M16X45		9	10~19	M16X55		19	20~29	M16X65		29	30~39	M20X40		8	9~10	M20X50		10	11~20	M20X60		20	21~30	M20X70		30	31~40	M20X80		40	41~50	M20X90		50	51~60	Bolt	6.8	M20X100		60	61~70	M24X50		9	10~14	M24X60		14	15~24	M24X70		24	25~34	M24X80		34	35~44	M24X90		44	45~54	Flash Washer	CQ	-2		Thickness X number	d=13.5 D=24		-3(A)	d=17.5 D=30		-3(B)	d=22 D=37		-4	d=26 D=44		Spring washer	CQ	-1		Thickness X number	d=13.5 D=24		-4	d=17.5 D=30		-5	d=22 D=37		-6	d=26 D=44		D																																				
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E	(3)Rods: 1)The electrode type shall match the material of the connection base material; 2)As for CQ steel, E43xx electrode is adopted; 3)As for S355 JR steel, E50xx electrode is adopted;					Table 1 <table><tr><th rowspan="3">No.</th><th rowspan="3">Width of Angle Steel Bomb</th><th rowspan="3">Benchmark gauge line distance</th><th colspan="3">Bolt alignment distance</th><th rowspan="3">Arrayed pitch a1424</th><th rowspan="3">Maximum allowable opening diameter φ</th></tr><tr><th>Single-row</th><th colspan="2">Double-row</th></tr><tr><th>a1420</th><th>a1421</th><th>a1422</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>1</td><td>40</td><td>20</td><td>20</td><td></td><td></td><td></td><td></td></tr><tr><td>2</td><td>45</td><td>25</td><td>25</td><td></td><td></td><td></td><td>11</td></tr><tr><td>3</td><td>50</td><td>30</td><td>30</td><td></td><td></td><td></td><td>13</td></tr><tr><td>4</td><td>56</td><td>30</td><td>30</td><td></td><td></td><td></td><td>15</td></tr><tr><td>5</td><td>60</td><td>35</td><td>35</td><td></td><td></td><td></td><td>17</td></tr><tr><td>6</td><td>70</td><td>40</td><td>40</td><td></td><td></td><td></td><td>19</td></tr><tr><td>7</td><td>80</td><td>45</td><td>45</td><td></td><td></td><td></td><td>21.5</td></tr><tr><td>8</td><td>90</td><td>50</td><td>50</td><td></td><td></td><td></td><td>23.5</td></tr><tr><td>9</td><td>100</td><td>55</td><td>55</td><td></td><td></td><td></td><td>23.5</td></tr><tr><td>10</td><td>110</td><td>60</td><td>60</td><td></td><td></td><td></td><td>15.5</td></tr><tr><td>11</td><td>120</td><td>70</td><td>70</td><td>50</td><td>85</td><td>35</td><td>15.5</td></tr><tr><td>12</td><td>140</td><td></td><td></td><td>60</td><td>105</td><td>45</td><td></td></tr><tr><td>13</td><td>160</td><td></td><td></td><td>60</td><td>125</td><td>65</td><td></td></tr><tr><td>14</td><td>180</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>15</td><td>200</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table> Note: The numerical unit in the table is mm.					No.	Width of Angle Steel Bomb	Benchmark gauge line distance	Bolt alignment distance			Arrayed pitch a1424	Maximum allowable opening diameter φ	Single-row	Double-row		a1420	a1421	a1422									1	40	20	20					2	45	25	25				11	3	50	30	30				13	4	56	30	30				15	5	60	35	35				17	6	70	40	40				19	7	80	45	45				21.5	8	90	50	50				23.5	9	100	55	55				23.5	10	110	60	60				15.5	11	120	70	70	50	85	35	15.5	12	140			60	105	45		13	160			60	125	65		14	180							15	200							E
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F	3. Manufacturing: (1)All components and gussets shall be blanked after lofting, and member size in the steel list is only for the preparation. (2)Trial assembly of steel structure must be done during processing, if no problem and then batch processing can be carried out. (3)Steel structure processing must meet the requirements of relevant drawings and acceptance criterion, and then it can be transported to the site. (4)To avoid bending of the galvanized member when removed from the zinc pot, the appropriate lifting point shall be selected.					(5)Component welding shall be carried out in accordance with the corresponding welding procedures and regulatory requirements.					F																																																																																																																																														
G	Table 4 <table><tr><th>Rev.</th><th>Name</th><th>Date</th><th>Notes</th></tr><tr><td>0</td><td>Zeng P.</td><td>2021.08.10</td><td>As Built Drawing</td></tr></table> APPROVED BY  ZESCO LIMITED ENGINEER  aurecon CONTRACTOR  CEEC HEPOL  中国能源建设集团湖南省电力设计院有限公司 CHINA ENERGY ENGINEERING GROUP HUNAN ELECTRIC POWER DESIGN INSTITUTE CO.,LTD. Lusaka Transmission and Distribution Rehabilitation Project Approved by He Z.G. Checked by Wu S.H. 132/33/11kV WATERWORKS SUBSTATION Reviewed by Wang C.P. Designed by Luo Y.Z. WATER TOWER STRUCTURE Scale Date 2021.09.10 DESIGN DESCRIPTION ALL RIGHTS RESERVED, NO REUSE WITHOUT AUTHORIZATION. Dwg No. 43-IBA00901Z-TQ315-01											Rev.	Name	Date	Notes	0	Zeng P.	2021.08.10	As Built Drawing	G																																																																																																																																					
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4. Transport and stacking:

(1)After the components are transported to the site, the column beam members shall be stacked separately to prevent confusion during assembly.

(2)The galvanized layer due to transport and lifting damage shall be cleaned first, and then applied zinc-rich paint.

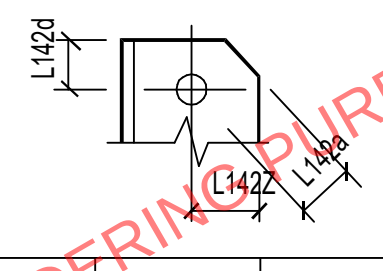
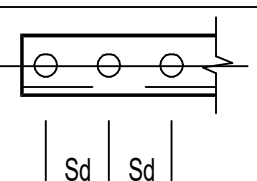
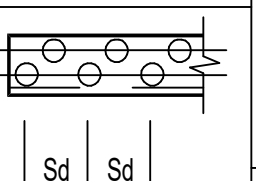
(3)During transport, the same components shall be bundled and stacked together. The sleepers are placed at the end of the component and the layers to prevent deformation and damage caused by the collision of the galvanized layer.

Table 1

No.	Width of Angle Steel Bomb	Benchmark gauge line distance	Bolt alignment distance			Arrayed pitch a1424	Maximum allowable opening diameter ϕ		
			Single-row	Double-row					
			a1420	a1421	a1422				
1	40	20	20						
2	45	25	25				11		
3	50	30	30				13		
4	56	30	30				15		
5	60	35	35				17		
6	70	40	40				19		
7	80	45	45				21.5		
8	90	50	50				23.5		
9	100	55	55				23.5		
10	110	60	60				15.5		
11	120	70	70	50	85	35	15.5		
12	140			60	105	45			
13	160			60	125	65			
14	180								
15	200								

Note: The numerical unit in the table is mm.

Table 2

BOLT diameter	Diameter of bolt holes	Bolt Pitch		Bolt margin and end-to-end distance		
		Single-row	Double-row			
				L _a	L _z	L _a
16	17.5	50	80	35	∠ 21	∠ 23
20	21.5	60	100	40	∠ 26	∠ 28
24	25.5	80	120	50	∠ 31	∠ 33

Note: The numerical unit in the table is mm.

Table 3

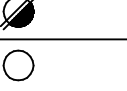
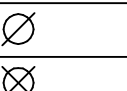
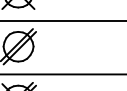
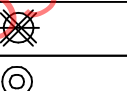
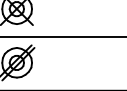
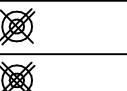
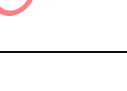
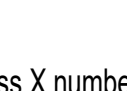
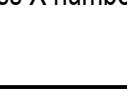
Component name	Level	Specification	Symbol	No thread length (mm)	Clamping thickness (mm)
Bolt	6.8	M16X35		7	8 ~ 9
		M16X45		9	10~19
		M16X55		19	20~29
		M16X65		29	30~39
		M20X40		8	9~10
		M20X50		10	11~20
		M20X60		20	21~30
		M20X70		30	31~40
		M20X80		40	41~50
		M20X90		50	51~60
Bolt	6.8	M20X100		60	61~70
		M24X50		9	10~14
		M24X60		14	15~24
		M24X70		24	25~34
		M24X80		34	35~44
		M24X90		44	45~54
Flash Washer	CQ	-2		Thickness X number	d=13.5 D=24
		-3(A)			d=17.5 D=30
		-3(B)			d=22 D=37
		-4			d=26 D=44
Spring washer	CQ	-1		Thickness X number	d=13.5 D=24
		-5			d=17.5 D=30
		-6			d=22 D=44

Table 4

Rev.	Name	Date	Notes
0	Zeng P.	2021.08.10	As Built Drawing

APPROVED BY

 **ZESCO LIMITED**

ENGINEER

 **aurecon**

CONTRACTOR

 **CEEC HEPOL**

CEEC 中国能源建设集团湖南省电力设计院有限公司

CHINA ENERGY ENGINEERING GROUP HUNAN ELECTRIC POWER DESIGN INSTITUTE CO.,LTD.

Lusaka Transmission and Distribution Rehabilitation Project

Approved by

He Z.G.

Checked by

Wu S.H.

132/33/11kV WATERWORKS SUBSTATION

Reviewed by

Wang C.P.

Designed by

Luo Y.Z.

WATER TOWER STRUCTURE

Scale

Date

2021.09.10

DESIGN DESCRIPTION

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1

2

3

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5

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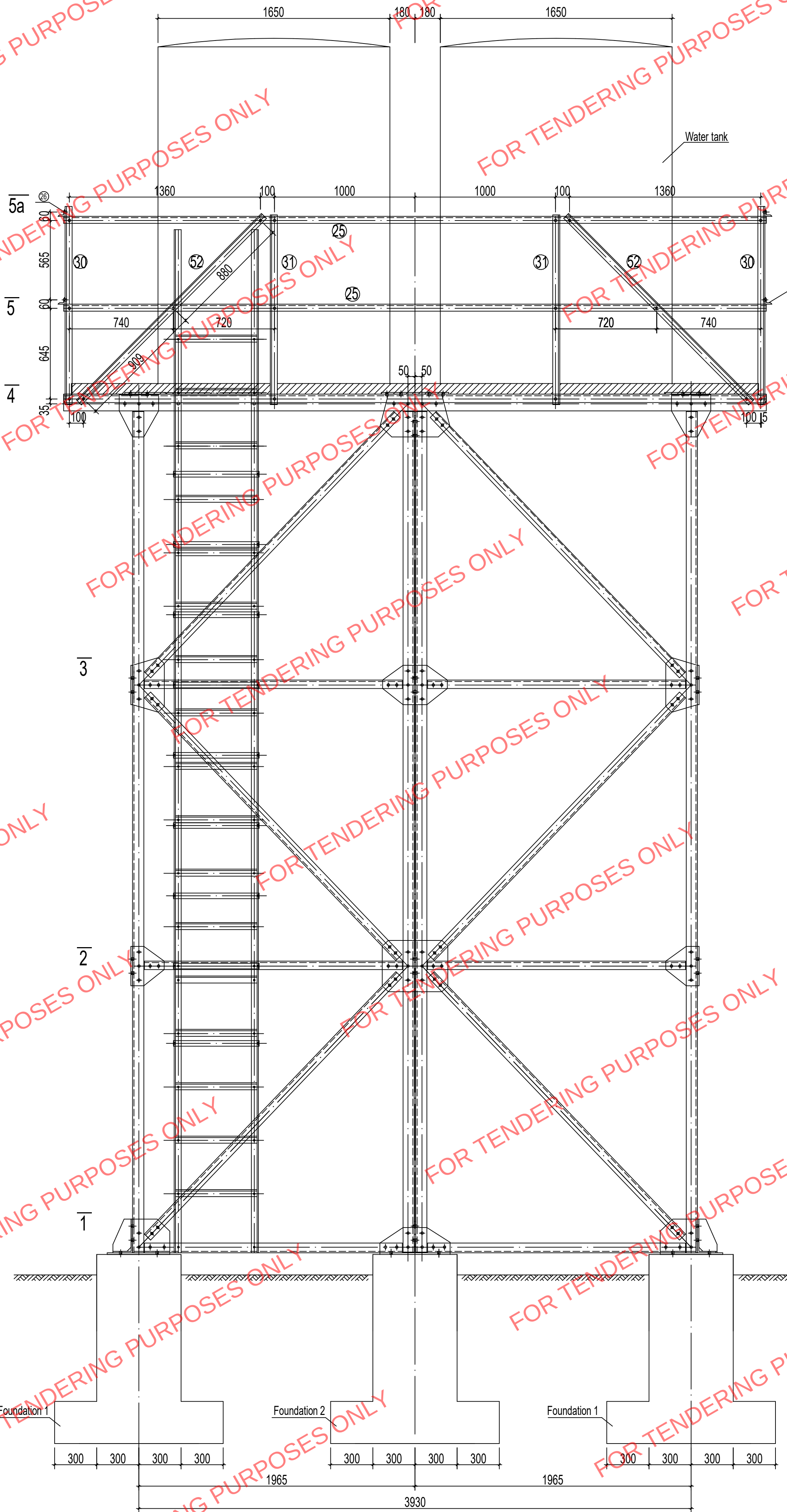
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9

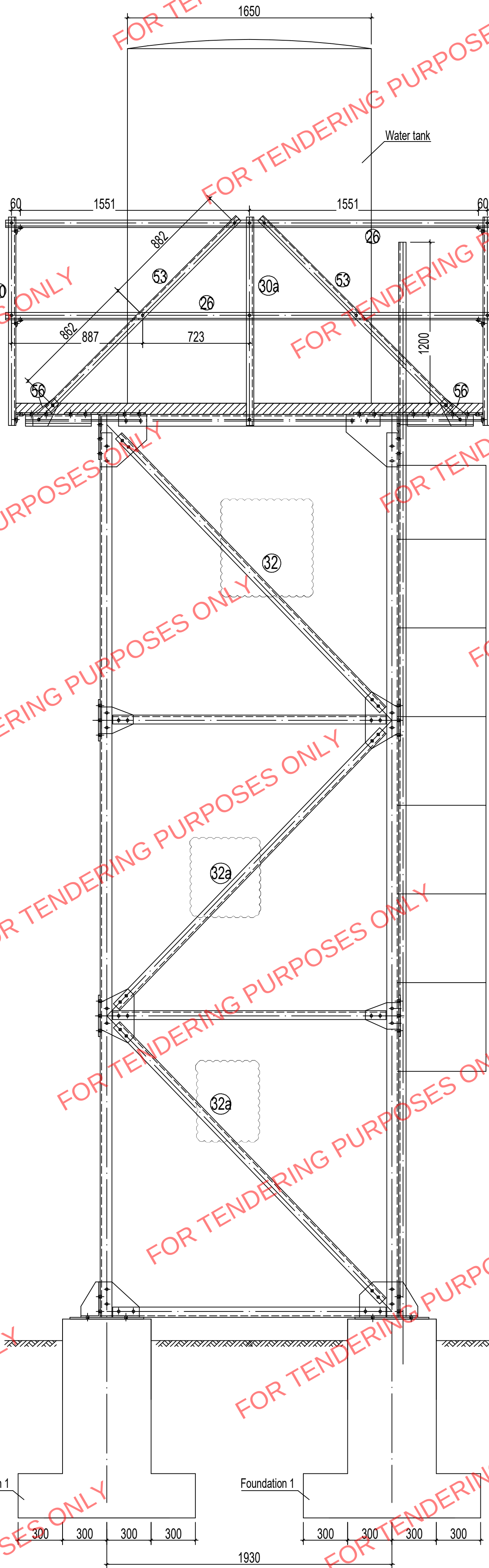
10

11

12



Elevation view



Side elevation

Note:

1. Dimensions in the drawings are in "mm", and elevations are in "m".
2. See Drawing 03 and 04 for the section drawings
3. Adopt 2 finished water tanks, with the diameter of 1.65m and capacity of 5000L/tank.
4. Wood plates of 3000X150X100 (length x width x height) shall be used to pave the roof platform of the water tower. Wood surface brush anti-corrosion paint, and anti-ants treatment.
5. The water level in the water tank is not less than 0.5m.
6. Water tank should be tied up when install.

0	Zeng P.	2021.08.10	As Built Drawing
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ZESCO
LIMITED

ENGINEER

aurecon

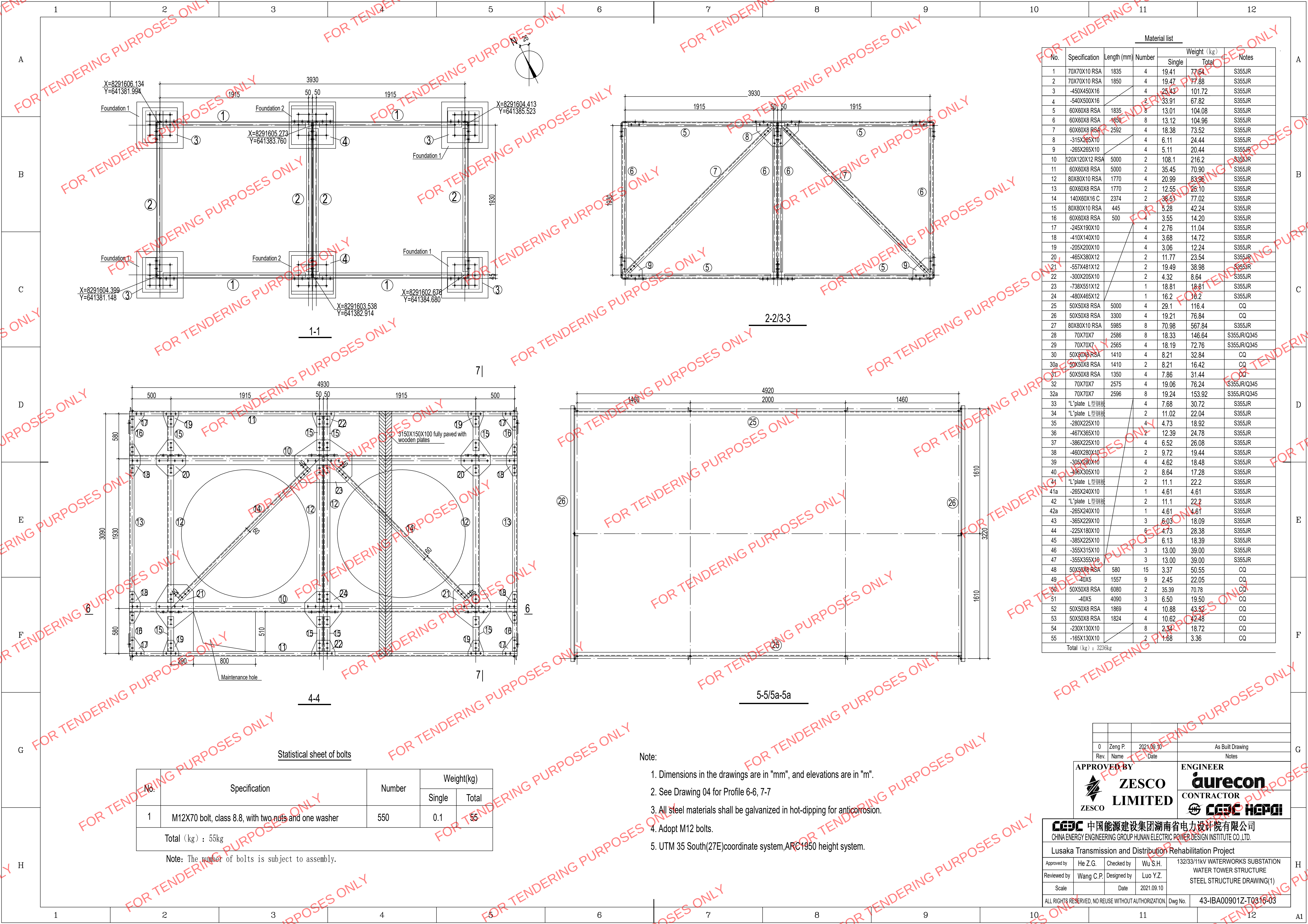
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CHINA ENERGY ENGINEERING GROUP HUNAN ELECTRIC POWER DESIGN INSTITUTE CO.,LTD.

Lusaka Transmission and Distribution Rehabilitation Project
132/33/11kV WATERWORKS SUBSTATION
WATER TOWER STRUCTURE
ELEVATION

Approved by	He Z.G.	Checked by	Wu S.H.	132/33/11kV WATERWORKS SUBSTATION
Reviewed by	Wang C.P.	Designed by	Luo Y.Z.	WATER TOWER STRUCTURE
Scale		Date	2021.09.10	ELEVATION
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Material list						
No.	Specification	Length (mm)	Number	Weight (kg)		Notes
				Single	Total	
1	70X70X10 RSA	1835	4	19.41	77.64	S355JR
2	70X70X10 RSA	1850	4	19.47	77.88	S355JR
3	-450X450X16		4	25.43	101.72	S355JR
4	-540X500X16		2	33.91	67.82	S355JR
5	60X60X8 RSA	1835	8	13.01	104.08	S355JR
6	60X60X8 RSA	1850	8	13.12	104.96	S355JR
7	60X60X8 RSA	2592	4	18.38	73.52	S355JR
8	-315X265X10		4	6.11	24.44	S355JR
9	-265X265X10		4	5.11	20.44	S355JR
10	120X120X12 RSA	5000	2	108.1	216.2	S355JR
11	60X60X8 RSA	5000	2	35.45	70.90	S355JR
12	80X80X10 RSA	1770	4	20.99	83.96	S355JR
13	60X60X8 RSA	1770	2	12.55	25.10	S355JR
14	140X60X16 C	2374	2	38.51	77.02	S355JR
15	80X80X10 RSA	445	8	5.28	42.24	S355JR
16	60X60X8 RSA	500	4	3.55	14.20	S355JR
17	-245X190X10		4	2.76	11.04	S355JR
18	-410X140X10		4	3.68	14.72	S355JR
19	-205X200X10		4	3.06	12.24	S355JR
20	-465X380X12		2	11.77	23.54	S355JR
21	-557X481X12		2	19.49	38.98	S355JR
22	-300X205X10		2	4.32	8.64	S355JR
23	-738X551X12		1	18.81	18.81	S355JR
24	-480X465X12		1	16.2	16.2	S355JR
25	50X50X8 RSA	5000	4	29.1	116.4	CQ
26	50X50X8 RSA	3300	4	19.21	76.84	CQ
27	80X80X10 RSA	5985	8	70.98	567.84	S355JR
28	70X70X7	2586	8	18.33	146.64	S355JR/Q345
29	70X70X7	2565	4	18.19	72.76	S355JR/Q345
30	50X50X8 RSA	1410	4	8.21	32.84	CQ
30a	50X50X8 RSA	1410	2	8.21	16.42	CQ
31	50X50X8 RSA	1350	4	7.86	31.44	CQ
32	70X70X7	2575	4	19.06	76.24	S355JR/Q345
32a	70X70X7	2596	8	19.24	153.92	S355JR/Q345
33	"L" plate L型钢板		4	7.68	30.72	S355JR
34	"L" plate L型钢板		2	11.02	22.04	S355JR
35	-280X225X10		4	4.73	18.92	S355JR
36	-467X365X10		2	12.39	24.78	S355JR
37	-386X225X10		4	6.52	26.08	S355JR
38	-460X280X10		2	9.72	19.44	S355JR
39	-305X280X10		4	4.62	18.48	S355JR
40	-396X305X10		2	8.64	17.28	S355JR
41	"L" plate L型钢板		2	11.1	22.2	S355JR
41a	-265X240X10		1	4.61	4.61	S355JR
42	"L" plate L型钢板		2	11.1	22.2	S355JR
42a	-265X240X10		1	4.61	4.61	S355JR
43	-365X229X10		3	6.03	18.09	S355JR
44	-225X180X10		6	4.73	28.38	S355JR
45	-385X225X10		3	6.13	18.39	S355JR
46	-355X315X10		3	13.00	39.00	S355JR
47	-355X355X10		3	13.00	39.00	S355JR
48	50X50X8 RSA	580	15	3.37	50.55	CQ
49	-40X5	1557	9	2.45	22.05	CQ
50	50X50X8 RSA	6080	2	35.39	70.78	CQ
51	-40X5	4090	3	6.50	19.50	CQ
52	50X50X8 RSA	1869	4	10.88	43.52	CQ
53	50X50X8 RSA	1824	4	10.62	42.48	CQ
54	-230X130X10		8	2.34	18.72	CQ
55	-165X130X10		2	1.68	3.36	CQ
Total (kg) :				3236kg		

No.	Specification	Number	Weight(kg)	
			Single	Total
1	M12X70 bolt, class 8.8, with two nuts and one washer	550	0.1	55
Total (kg) : 55kg				

Note: The number of bolts is subject to assembly.

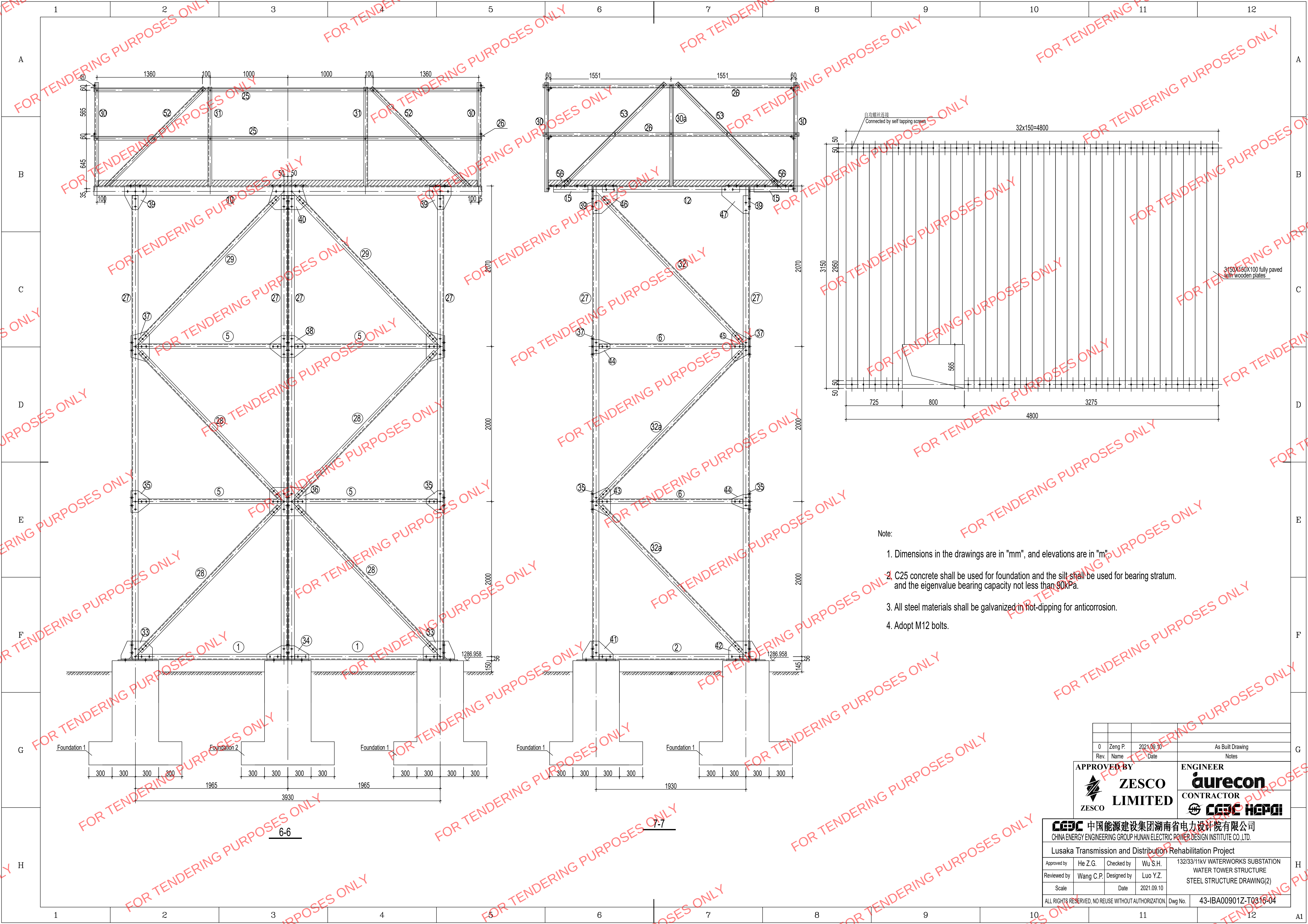
Note:

- Dimensions in the drawings are in "mm", and elevations are in "m".
- See Drawing 04 for Profile 6-6, 7-7
- All steel materials shall be galvanized in hot-dipping for anticorrosion.
- Adopt M12 bolts.
- UTM 35 South(27E)coordinate system,ARC1950 height system.

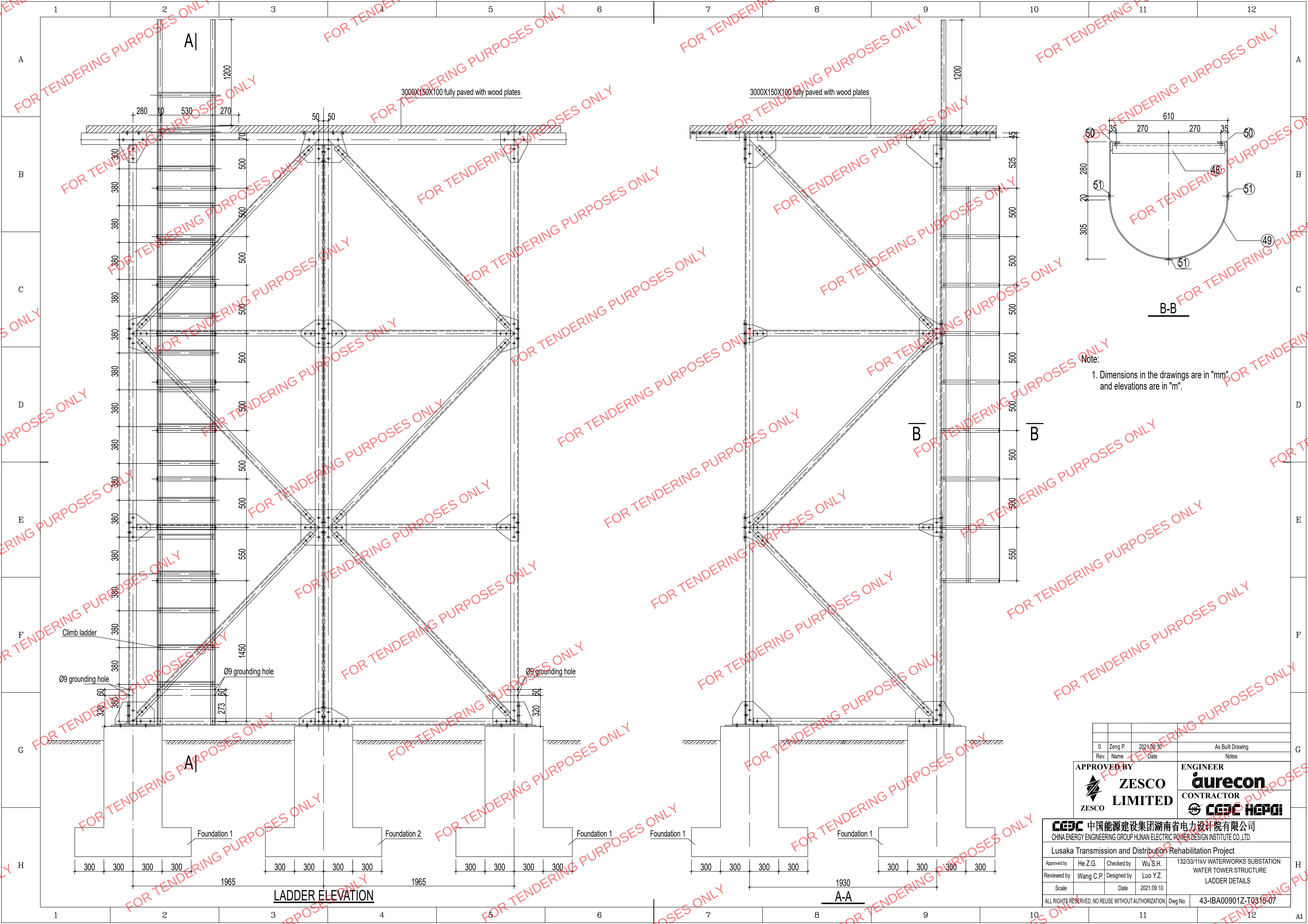
0	Zeng P.	2021.08.10	As Built Drawing
Rev.	Name	Date	Notes

APPROVED BY		ENGINEER	
 ZESCO LIMITED		 CONTRACTOR	
 中国能源建设集团湖南省电力设计院有限公司		 中国能源建设集团湖南省电力设计院有限公司	

Lusaka Transmission and Distribution Rehabilitation Project			
Approved by	He Z.G.	Checked by	Wu S.H.
Reviewed by	Wang C.P.	Designed by	Luo Y.Z.
Scale		Date	2021.09.10
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ZESCO LIMITED			CONTRACTOR	
				
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ENERGY ENGINEERING GROUP HUNAN ELECTRIC POWER DESIGN INSTITUTE CO.,LTD.				
a Transmission and Distribution Rehabilitation Project				
He Z.G.	Checked by	Wu S.H.	132/33/11kV WATERWORKS SUBSTATION	
Wang C.P.	Designed by	Luo Y.Z.	WATER TOWER STRUCTURE	
	Date	2021.09.10	STEEL STRUCTURE DRAWING(2)	
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Note:
1. Dimensions in the drawings are in "mm"
and elevations are in "m".

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Rev.	Name	Date	Notes
APPROVED BY			ENGINEER  CONTRACTOR  CEEC HEPOL
 ZESCO LIMITED			
中国能源建设集团湖南省电力设计院有限公司 CHINA ENERGY ENGINEERING GROUP HUNAN ELECTRIC POWER DESIGN INSTITUTE CO.,LTD.			
Transmission and Distribution Rehabilitation Project			
He Z.G.	Checked by	Wu S.H.	132/33/11kV WATERWORKS SUBSTATION
Wang C.P.	Designed by	Luo Y.Z.	WATER TOWER STRUCTURE
	Date	2021.09.10	LADDER DETAILS
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