Welcome to Use Guizhou Changzheng OLTC

Please read this instruction carefully before you operate the purchased on load tap changer. Be sure to pay attention to the following matters:

1. Check and accept the products according to the packing list when receiving products. Keep the evidence if there are any damages during transportation in order to claim compensation from the responsible party and protect your rights.
2. The tap changer only can be used with the transformer which specified in the order. You need to consult with our company in advance if you want to change the purpose of this product.
3. The installation, put into operation, maintenance and repair of the product should be complied with the operating instruction and relevant provisions of security.

The figures, charts, and other data in this manual may differ from the products delivered. These drawings are for reference only and we reserve the right to make changes. If there is any change, no further notice.

Give the word of “Warning” when ignoring a requirement will cause the life damage of operator. This is a warning of danger to life and health, disregarding this warning can lead to the serious or fatal injury.

Give the word of “Careful” when ignoring a requirement will lead to the damage to the equipment. This information indicates particular danger to this device or other equipment of the user, but the serious or fatal injury can’t be excluded.

In order to emphasize at any time, the word of “Caution” will be used, remind it should be careful when operating according to the requirements of “Warning” and “Caution”.

These are additional explanations for a certain subject.

Content

Note

All data in this manual may be different in details from the tap-changer that we delivered. We reserve the right to change without notice.

January, 2019

1. General introduction

ZS on-load tap-changer applies to oil immersed transformer of rated voltage 10kV, 35kV, the max. rated through current is three-phase 125A, 200A, 400A, rated frequency is 50Hz, which change the tap connection position under the state of load in order to regulate the transformer ratio and improve the electric energy quality.

The technical performance of ZS on-load tap-changer meets to the requirements of GB10230.1 <Tap-changer Section 1: Performance Requirements and Test Method> and IEC60214-1 < Tap-changer Section 1: Performance Requirements and Test Method>

WARNING

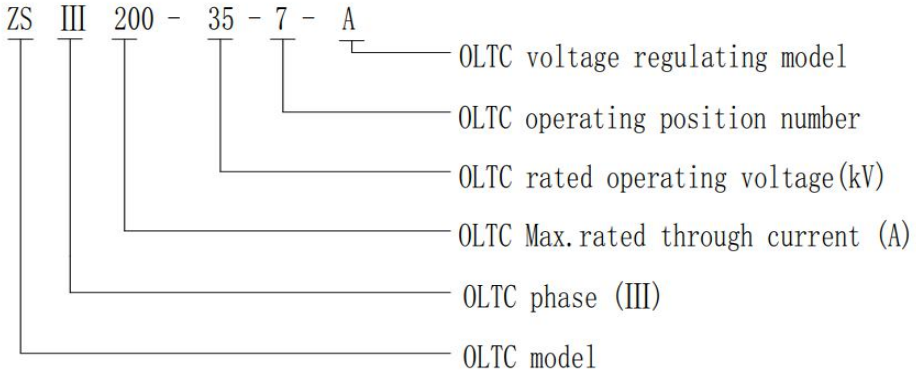
Only use the on load tap changer with the transformer specified in the order.

The installation, electrical connection and commissioning of the on load tap changer must be carried out by qualified and skilled personnel according to these operating instructions.

Any unauthorized modification and alteration of the tap changer is forbidden without first consulting Changzheng.

In the process of installation, electrical connection and commissioning of on load tap changer, if didn't operate according to this instruction, it may causes the faults of tap changer and transformer and even leads to personal injury and equipment damage.

1.1. Instruction of product model



For example: ZSIII200-35-7-A

ZS three-phase on-load tap-changer, max. rated through current: 200A, rated voltage: 35kV, service position numbers: 7, neutral point liner regulating: A.

Note:

OLTC voltage regulating model:

A (Neutral point liner regulating, without neutral point output)

DA(Delta connection linear regulating)

A1(Neutral point liner regulating, with neutral point output)

B (middle bridging connection)

X1,X2(for arc suppression coil)

1.2. Environment condition of using

1.2.1. The environment temperature of tap-changer: it is -25℃～40℃ in air and -25℃～105℃ in transformer oil.
1.2.2. There is no serious dust as well as other explosive and corrosive gases in the mounting place.
1.2.3. The inclination between mounting plane and vertical plane is no more than 2%.

1.3. Basic parameters

1.3.1. The main parameters of tap-changer see table 1, basic connection diagram see figure 1.
1.3.2. The contact resistance of every single contact point of contacts is no grater than 500 μΩ.
1.3.3. The oil temperature rising of every long-term current carrying contact and conductive parts will not exceed 20K while the on-load tap-changer is under the 1.2 times max.rated through current.

2. Product structure and working principle

2.1. OLTC structure

The ZS type on-load tap-changer is a cylinder-type selector switch. The breaking principle combines the operating characteristics of switching and selection. The OLTC body is installed in a separate oil chamber isolated from the transformer.
The OLTC is mainly divided into four major components:
(1) Fast transmission mechanism (including electric motor, worm gear and cycloidal gear reduction mechanism, arm plate, crank arm and tension spring, etc.)
(2) Switch components (including rotating arm, groove wheel, main shaft, dynamic and static contact system and transition resistance, etc.)
(3) Oil tank shell (including top cover, oil pillow, oil chamber and cylinder bottom, etc.)
(4) Signal and safety device (including position indicator, gas relay, pressure release valve, mechanical limit screw) (electrical limit, sequence control in YK-3A automatic controller)

2.2 The working principle of the OLTC

After the motor power is turned on, the arm plate is driven by the worm gear and the cycloid pin wheel after deceleration. The arm plate pushes the cantilever during the rotation process, so that the tension spring gradually stretches the energy storage. When the line is in the "dead point" position, the tension spring is suddenly released, so that the cantilever passes through the toggle wheel quickly, and the contact assembly is driven by the main shaft, which is the same as the current-limiting connection between the main contact and the transition contact The transition resistance is switched in turn, so the switch is switched from one tap to the next.

This series on-load tap-changer is embedded combined structure (tap-changer body and motor drive mechanism consist of the overall insertion structure). It consists of oil compartment, tap-changer body, fast speed mechanism, drive mechanism, security protection and tap position

indicator. It can mate with YK-3A, YK-4A controller to perform the tap position operating and transferring so as to achieve automatic control.

After YK-3A, YK-4A controller sent out the operation instruction, the motor of the tap-changer drive mechanism begin to operate. After two-level worm gear and worm wheel speed reducing, it drives the cambered plate to prod the toggle arm, the energy storage spring release suddenly, the fast speed mechanism drive the tap-changer moving contact to complete the tap change from one tap position to another tap position.

3. Receiving notes

After the release testing, on-load tap-changer is set in the service position. Then use the protected against moisture package, deliver as a whole.

During the process of transportation, the products must be lifted and put lightly, damp proof and rainproof and never can be inverted.

The products should be checked and accepted according to packing list when receiving the goods;

If you found the transport damage, you should take pictures of the packing box and the package goods which are damaged, keep them as evidence in order to claim the compensation from the responsible party, and protect your rights.

Put the on-load tap-changer in the warehouse with air flow, the relative humidity is not greater 85%, the temperature is not higher than ＋ 40℃ and lower than -25℃, there shall be no corrosive gases in the storage environment and should not be affected by the rain and snow.

On-load tap-changer should be stored in the airtight package, it only can be opened till the mounting.

4. Installation

The outline and mounting size see the appendix.

The tap-changer should be mounted at the adjustment position and it should be mounted vertically on the transformer tank cover, the mounting inclination shouldn’t exceed 2%.

4.1 Installation of ZS on-load tap-changer on the box type transformer

4.1.1 Clean the seal surface of the tap-changer mounting flange on the transformer tank cover, put a seal gasket which provided with the tap-changer on this seal surface.

4.1.2 Lift the tap-changer vertically, put it on the tap-changer mounting flange of the transformer tank cover slowly, do not impact the connection terminal of tap-changer.

4.1.3 Check if the tap-changer is correct installed on the transformer tank cover, fasten the tap-changer on the transformer tank cover by screw bolts after align with the position. Note: The next operation can be performed only after the tap-changer was fastened on the transformer tank cover.

4.1.4 Tap lead wire connecting the transformer tap coil and tap-changer.
4.1.5 For the tap-changer equipped with tap-changer oil conservator, it is necessary to install the respirator of the tap-changer oil conservator.

4.2 Installation of ZS on-load tap-changer on the bell type transformer tank cover.

4.2.1 Remove the tap-changer head cover (keep well the seal ring), then remove the control loop lead wire in the tap-changer tank and the fasteners between the body and tank, lift the tap-changer body.
4.2.2 Remove the 18 connecting screw bolts and 1 positioning screw bolt of tap-changer supporting flange and tank, remove the tank.
4.2.3 Lift the supporting flange and oil compartment to the temporary supporting structure which inside of the transformer by using of lift ring bolt and lift plate (accessory).
4.2.4 After the transformer tank cover installed on the transformer body, install the tank flange on transformer tank cover and align with the supporting flange, pay attention to align with the positioning pin and fasten the bolts.
4.2.5 Adjust the supporting flange, raise or decrease the mounting position of supporting flange in order to ensure the assemble clearance between the supporting flange and tank flange is in the scope of 5-20mm.
4.2.6 After pre-install the tap-changer on the transformer correctly, connect the tap lead wire between the tap coil and tap-changer.
4.2.7 Lift the transformer tank cover to install it on the transformer body, clean the joint face, put well the seal ring. Then lift the oil compartment by using of lift plate, fasten the fasteners between the tap-changer oil compartment and tank.
4.2.9 Reinstall the tap-changer and tap-changer oil conservator respirator according to the above in reverse procedure.

NOTE

In order to avoid the impacting between the fixed contact of the tap-changer body and the fixed contact on the insulation wall of the oil compartment insulation cylinder, it is necessary to lift the tap-changer body up for approx. 60mm during the process of lifting the tap-changer body, after rotated it for about 10° , lift the tap-changer body slowly.

4.3 Drying of the tap-changer

4.3.1 Vacuum drying
The tap-changer top cover must be opened before drying in the oasthouse and transformer oil tank.
The tap-changer in air of atmospheric pressure with a temperature rise of 10℃/hour to final temperature of 110℃, drying it in hot air for 15h, and drying in the vacuum (vacuum residual pressure 10-3 bar) for 80 hours with temperature at 110℃.
4.3.2 Circulating drying with hot air
The tap-changer top cover must be opened before drying.
The tap-changer in air of atmospheric pressure with a temperature rise of 10℃/hour to final temperature of 110℃, circulating drying with hot air for 72h.

NOTE

It is not allowed to operate the tap-changer without oil after drying.

4.4 Oil filling

For ZS(35kV) series tap-changer, when fill the oil into transformer should unscrew the bleed bolts of tap-changer to bleed till the oil leaks from the bleeding hole, then tighten the bolts.
Tap-changer should be filled into qualified transformer oil.

4.5 The connection between the tap-changer and YK-3A, YK-4A controller

Tap-changer can be directly connected to the YK-3A, YK-4A controller by the cables with aerospace plug. For the operations of YK-3A and YK-4A controller, please see the operating instructions of YK-3A and YK-4A controllers.

4.6 Check before the tap-changer is put into service

4.6.1 Check if the QJ4-25 gas relay and protective circuit of transformer is normal.
4.6.2 Tap-changer operated for 3 circles, check if the action of tap-changer is flexible, the tap position is correct and mechanical limit is reliable.
4.6.3 Measure the DC resistance of the transformer coil (with tap-changer) at each tap position and compare with the delivery data to see if it is normal.
4.6.4 Check if the seal leaks oil.

5. Warranty

5.1 After the was tap-changer put into service, record the operating times of tap-changer correctly and save the data. It is necessary to drain the oil in the tap-changer oil compartment from oil suction pipe to perform the oil sample anaylse test regularly (3-6 months). When the electric resistance strength of oil is lower than 25 kV or the water content of oil is higher than 40ppm, the transformer oil must be replaced.
5.2 After the tap-changer is put into operation for the first year, check it once per half year. After that the time can be prolonged according to the maintenance results and operating times. After running 5000 to 10000 times, or when the transformer is overhauled or normally maintained, the tap-changer should be maintained too.
5.3 When overhaul, the tap-changer and the transformer must be powered off and reliably grounded. Under the circumstance of the air relative humidity smaller than 65％, the tap-changer can not be exposed in the air for more than 10h, otherwise, it must be dried.

5.4 Overhaul steps

5.4.1 Drain the oil from the oil suction pipe until the oil level of tap-changer falls down to the lower flange position of oil compartment
5.4.2 Dismantle the top cover of tap-changer and the leading wire of controlling circuit in the tap-changer, dismantle the oil suction pipe inside the tap-changer.

5.4.3 Remove the fasteners between the body and the oil compartment, and take out the tap-changer body, for the ZS(35kV) series tap-changers, lift it up for about 60mm, then rotate about 10° to let the contacts on the body is staggered with the corresponding contacts, then slowly rising it up; for ZS (10kV) tap-changer, keep the tap-changer at the no-load position, it must removed the two mechanical limit screw first, and then align the "0" position on the indicating board with the "0" position on the grooved wheel, remove the bolts of bottom board and lift out the tap-changer insert.

The installation procedure should be performed in the reverse order of above procedures.

5.4.4 Clean every part of the tap-changer body and inside wall of the oil compartment with clean transformer oil.

Take out the tension spring fixed pin, check if the tap-changer can rotate flexibly, the tension spring is damaged, the arc surface of the toggle arm and grooved wheel is over-worn. The clearance between the upper & lower surface of grooved wheel and slot device should be equidistance at both sides.

Check the burning condition of contacts: if the burning damage dose not exceed 1mm, it can be grinded with the fine emery cloth to decrease the frictional resistance between the moving and fixed contacts (because the speed of burning damage is very different for the each contact, it can adopt the method of interchange contacts to prolong the service life); if the burning loss of the contact exceeds 1mm, it must be replaced.

NOTE

It must to adjust the horizontal position of contacts to make the parallelism between moving and fixed contact of every phase is not greater than ±0.2mm.

Measure the values of transition resistance and contact resistance.

Check if the fasteners are loosening.

Check if the controller and cables are reliably connected with tap-changer.

Power on the power source, tap-changer operates for 10 circles. Pay attention to if the tap-changer has the phenomenon of slow acting.

At last check according to the inspection items before put into service by description as above.

6. Warranty

Within 12 months since installation or within 18 months since shipped from manufacturer, under the condition of the customer obey the correct storage and operation rules, if the product fails to work because of quality problems, manufacturer will replace or repair it for free.

7. Appendix

Appendix 1. On-load tap-changer technical parameter table

1. ZS (10kV) technical parameter

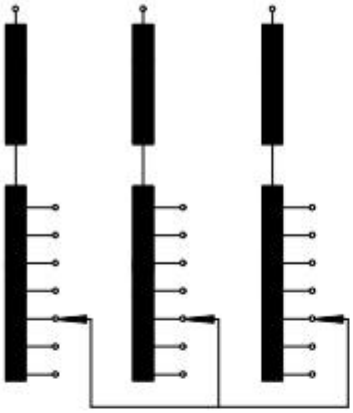
Item	Specifical			ZSIII100-A		ZSIII200-A	ZSIII100-X2	ZSIII100-X1	
1	Max. rated through current(A)			100		200	100	100	
2	Rated frequency (Hz)			50 or 60					
3	Phase			3		3	1	1	
4	Connection model			Y D		Y	Any	Any	
5	Short circuit current(kA)	Thermal(3s)		2		4	2	2	
		Dynamic(peak)		5		10	5	5	
6	Max. Rated step voltage(V)			300		300	300	1000	600
7	Max. number operating position			9		9	9	9	11、14
8	Insulation level (kV)	Rated voltage		10					
		Max. service voltage		12					
		Lightning impulse withstand voltage(1.2/50μs)		75		75	75	75	75
		Power frequency withstand voltage (50Hz, 1min)	To Ground	35		35	35	34	35
			Interphase	18	35	18	-	-	
			Between Max. & Min. Tap position	18		18	18	35	25
			Between adjacent contacts	18		18	18	30	18
9	Mechanical service life			>500000 times					
10	Electric service life			>50000 times					
11	Seal test	Working pressure		0.03MPa					
		Testing pressure		No leakage under 0.08MPa for 24 hours					
12	Weight(Without oil)(kg)			50		80	35	60	
13	With auto controller			YK-2A					

Note:
ZSIII100 is single resistance transition mode, only suitable for transformers with constant power direction, not for connecting transformers, the tap position of the "1" tap changer must be connected to the tap with the largest number of turns

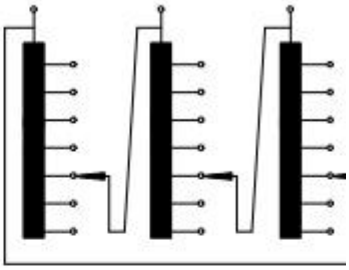
2. ZS (35kV) technical parameter

Item	Specifical			ZSIII200-A	ZSIII200-B	ZSIII200-DA	ZS I 100-X1	ZS I 200-X1
1	Max. rated through current (A)			200	200	200	100	200
2	Rated frequency (Hz)			50 or 60				
3	Phase			3	3	3	1	1
4	Connection model			Y (N point)	Y/D (bridge)	D/Y	Any	Any
5	Short circuit current (kA)		Thermal (3s)	4	4	4	2	4
			Dynamic (peak)	10	10	10	5	10
6	Max. Rated step voltage (V)			600				500
7	Max. number operating position			10	9	10	11、14	14
8	Insulation level (kV)	Rated voltage		35				
		Max. service voltage		40.5				
		To ground	Power frequency withstand voltage (50Hz, 1min)	85				
			Lightning impulse withstand voltage (1.2/50μs)	200				
		Interphase	Power frequency withstand voltage (50Hz, 1min)	85			-	25
			Lightning impulse withstand voltage (1.2/50μs)	200			-	-
		Between Max. & Min. tap position	Power frequency withstand voltage (50Hz, 1min)	45			25	18
			Lightning impulse withstand voltage (1.2/50μs)	105			-	-
		Interstep	Power frequency withstand voltage (50Hz, 1min)	10			18	18
			Lightning impulse withstand voltage (1.2/50μs)	30			-	-
9	Mechanical service life			>500000 times				
10	Electric service life			>50000 times				
11	Seal test		Working pressure	0.03MPa				
			Sealing performance	No leakage under 0.08MPa for 24 hours				
			Overpressure protection	Blasting cover 300kPa±20% overpressure blasting				
			Protection relay	Setting the flow rate 1.0m/s±10%				
12	Weight (Without oil) (kg)			150			60	
13	With auto controller			YK-3A				

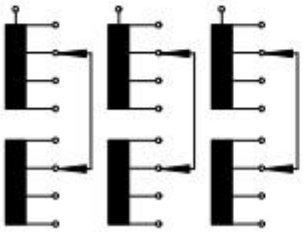
Appendix 2. ZS basic wiring diagram



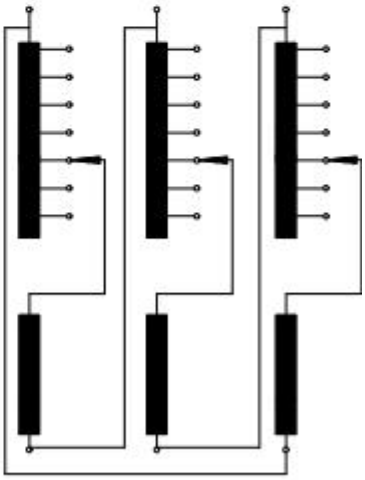
Y connection neutral point voltage regulation



D connection linear regulating

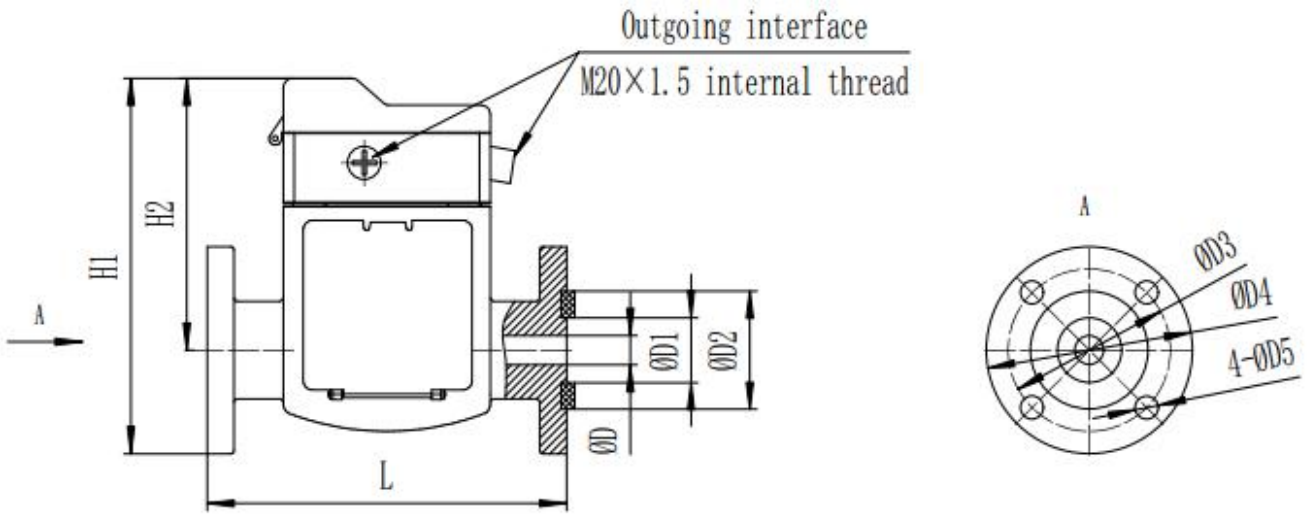


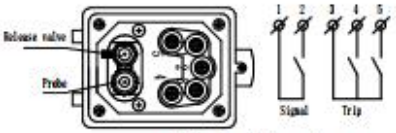
Middle bridge voltage regulating



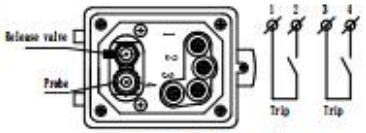
Terminal voltage regulating

Appendix 3. The outline & installation dimensions of the gas relay

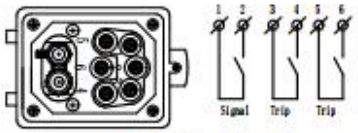




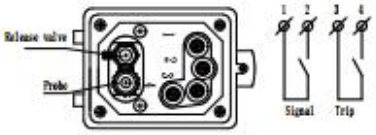
QJ5-25 wiring diagram



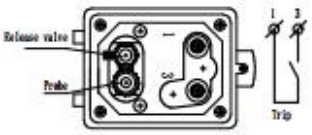
QJ6-25 wiring diagram



QJ7-25 wiring diagram



QJ4-25 wiring diagram

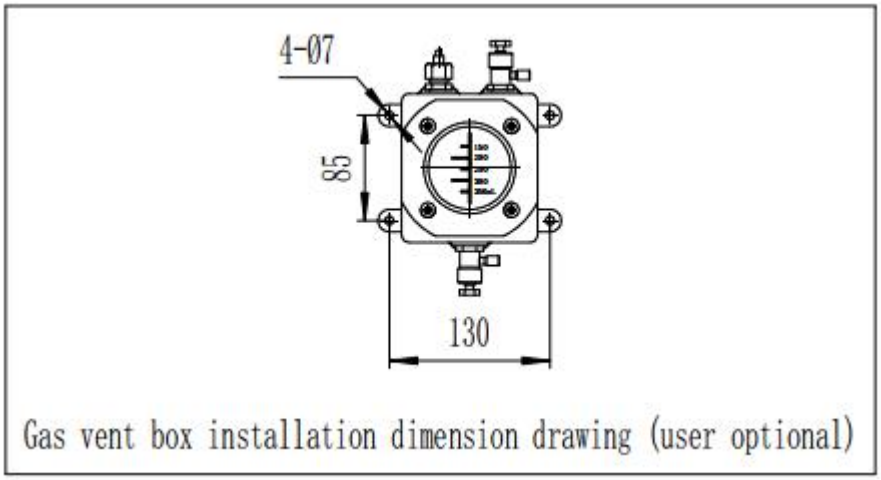


QJ4G-25 wiring diagram

Model	D	D1	D2	D3	D4	D5	H1	H2	L	Note
QJ4-25	25	35	65	85	115	14	215	158	200	Single signal, single trip
QJ4G-25	25	35	65	85	115	14	190	133	200	Single trip
QJ5-25	25	35	65	85	115	14	215	158	200	Single signal, double trip with COM
QJ6-25	25	35	65	85	115	14	190	133	200	Double trip
QJ7-25	25	35	65	85	115	14	215	158	200	Single signal, double trip W/O COM

Note: 1. The probe is a test button;
2. The number of the wiring terminal varies with different manufacturers, and the actual product shall prevail.

Gas relay outline and installation dimensions



Gas vent box installation dimension drawing (user optional)

Appendix 4. ZS OLTC outline and installation dimensions

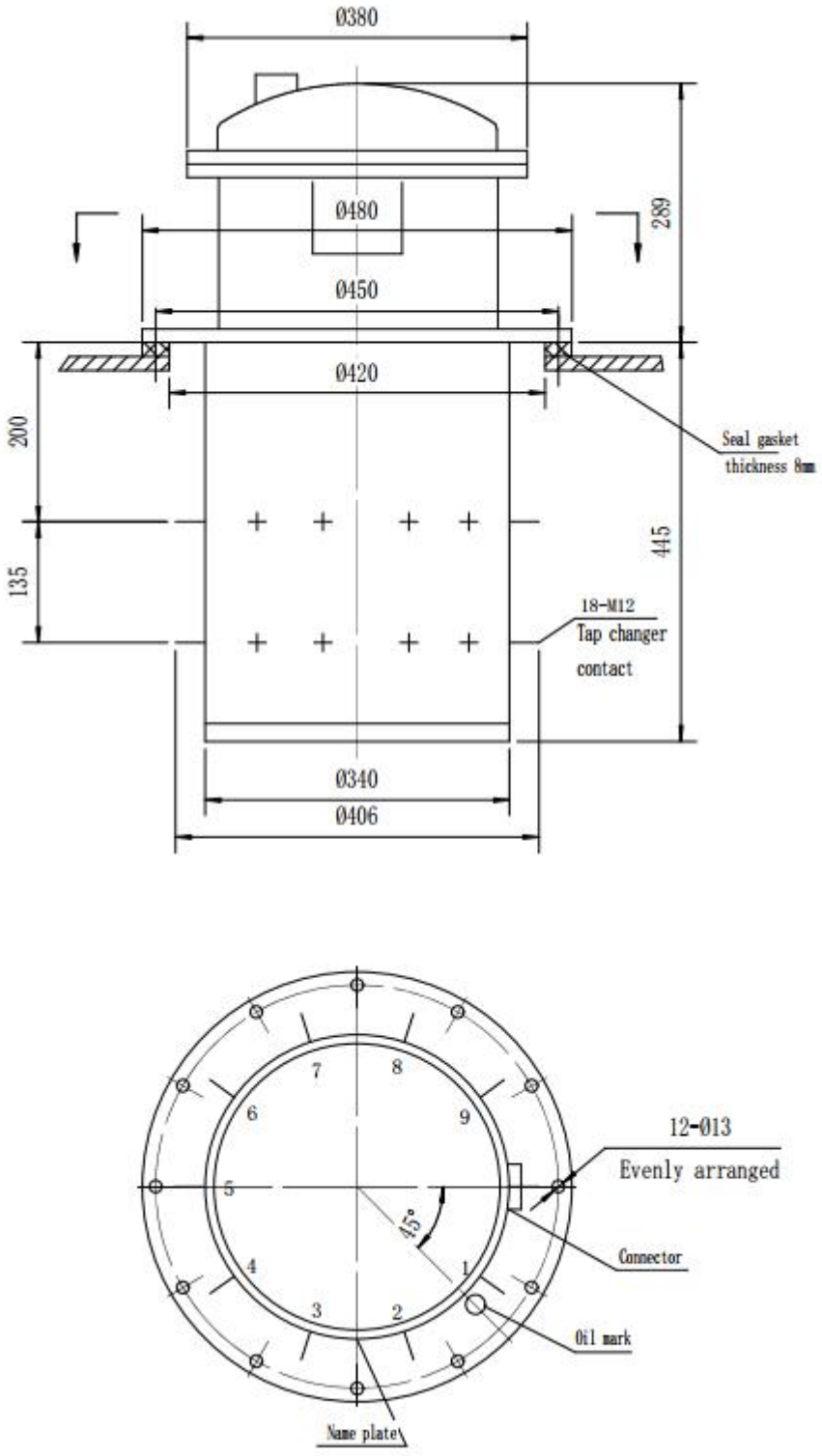


Figure 1. ZS Ⅰ100-10-9-X1 outline dimensions diagram

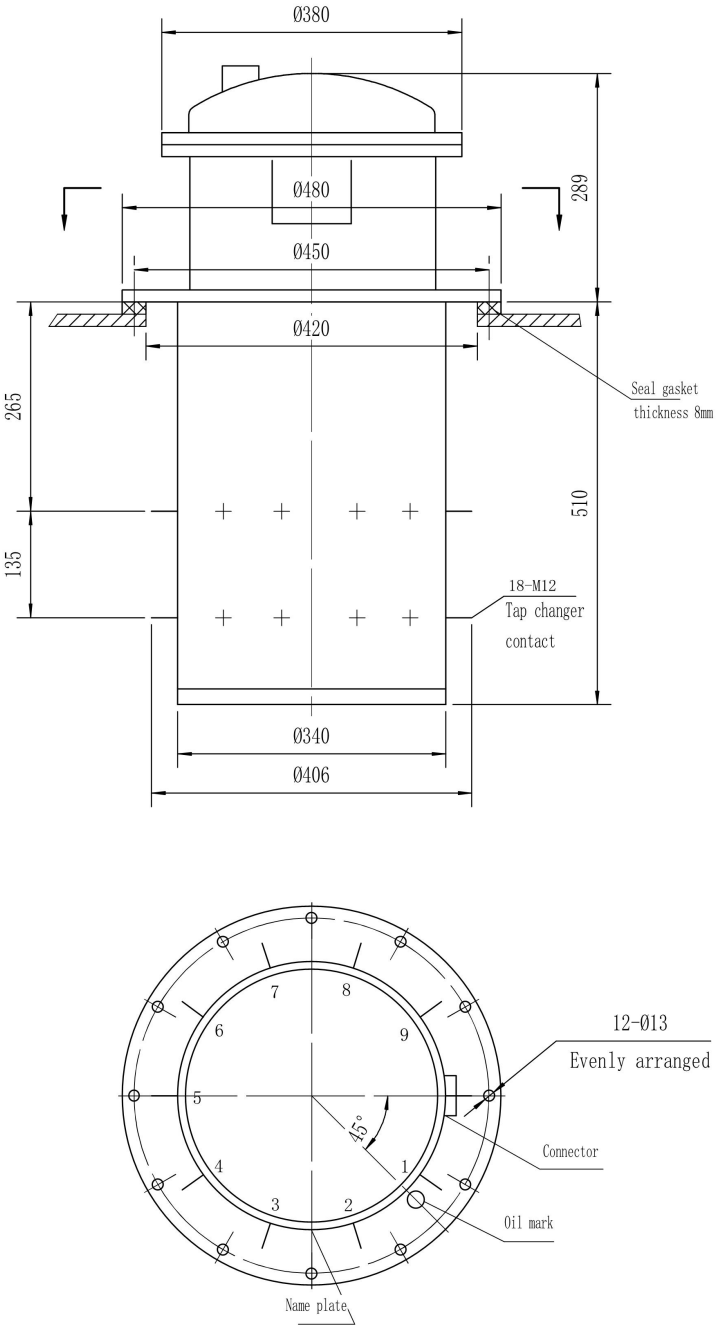


Figure 2. ZS Ⅰ100-35-9-X1 outline dimensions diagram

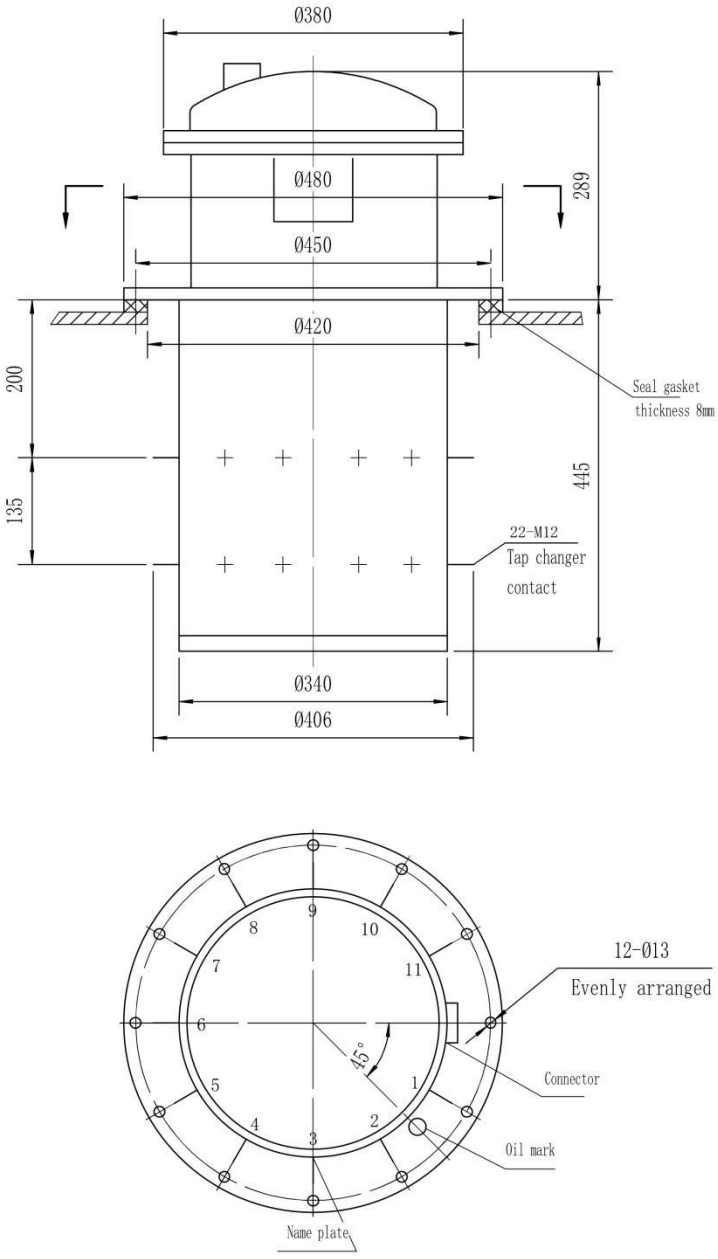


Figure 3. ZS Ⅰ100-10-11-X1 outline dimensions diagram

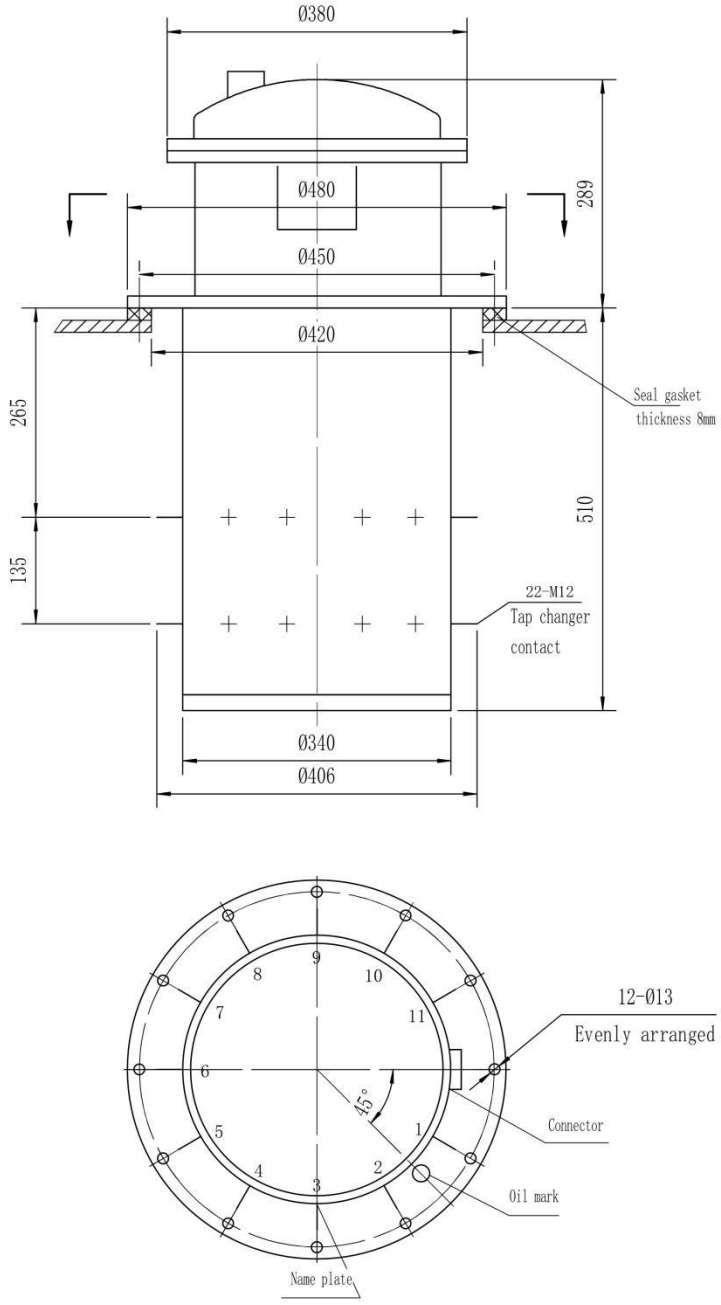


Figure 4. ZSⅠ100-35-11-X1 outline dimensions diagram

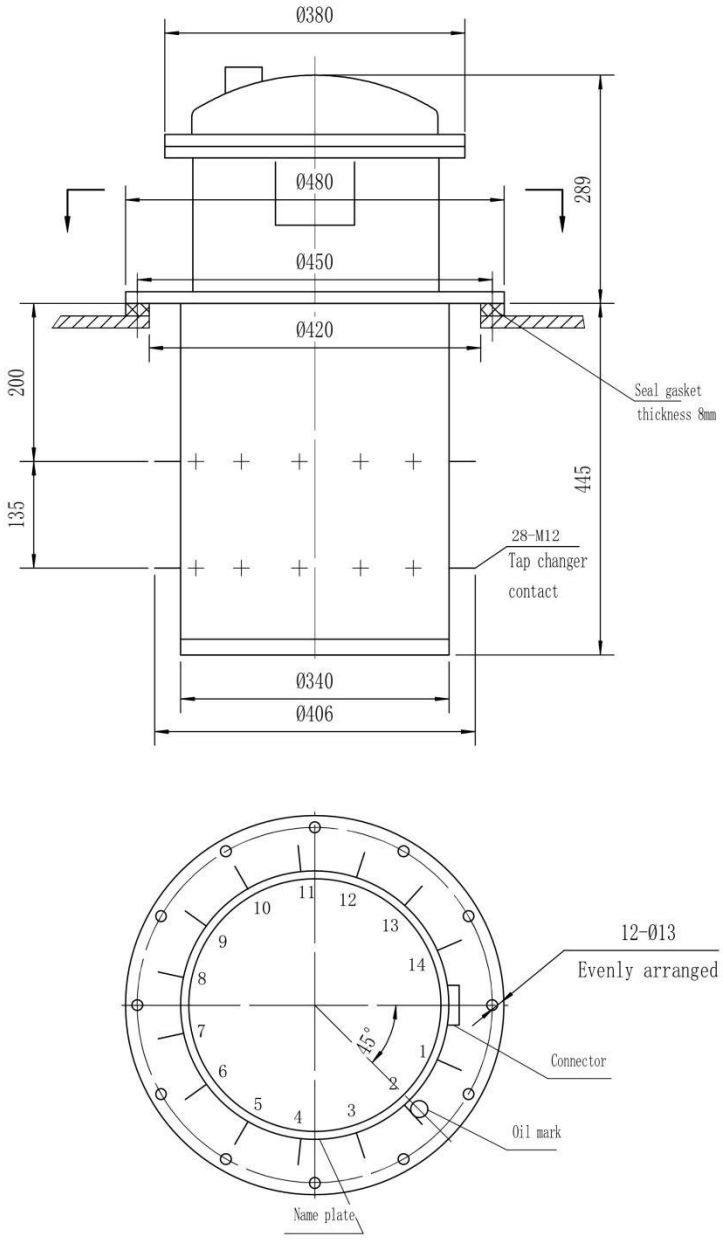


Figure 5. ZS Ⅰ100-10-14-X1 outline dimensions diagram

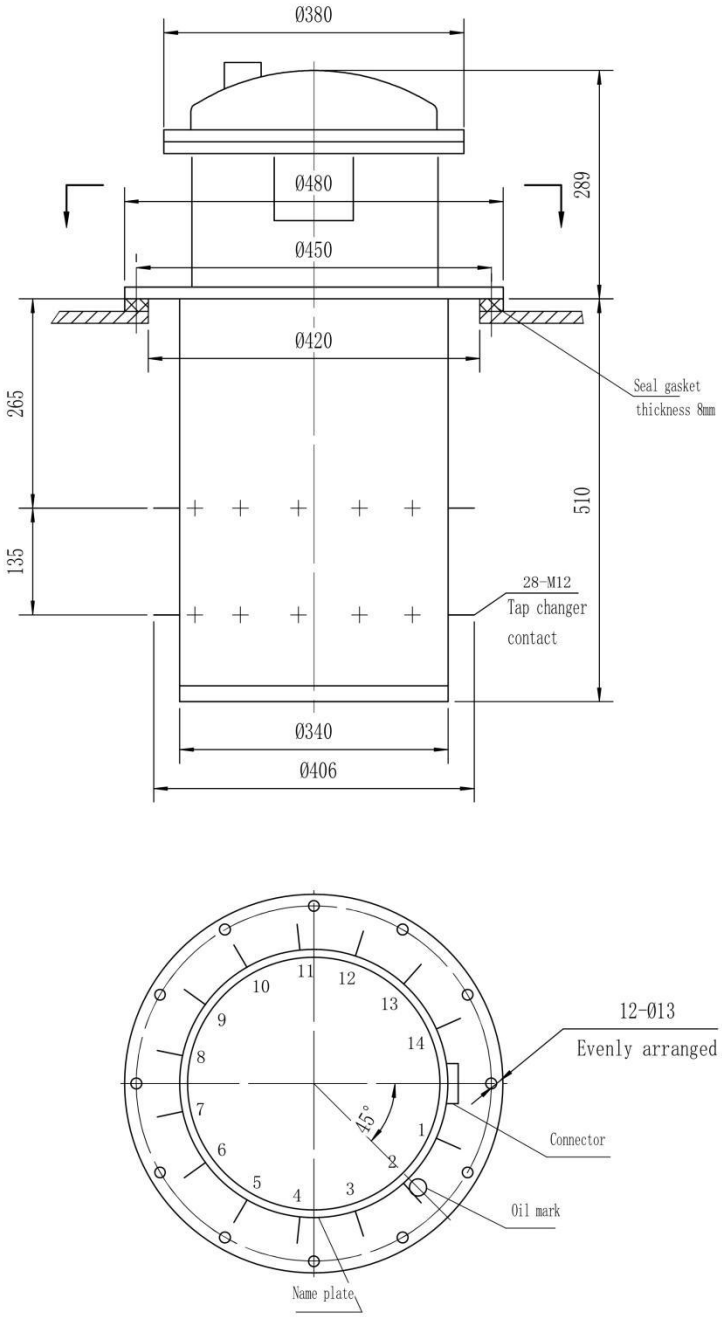


Figure 6. ZS Ⅰ100-35-14-X1 outline dimensions diagram

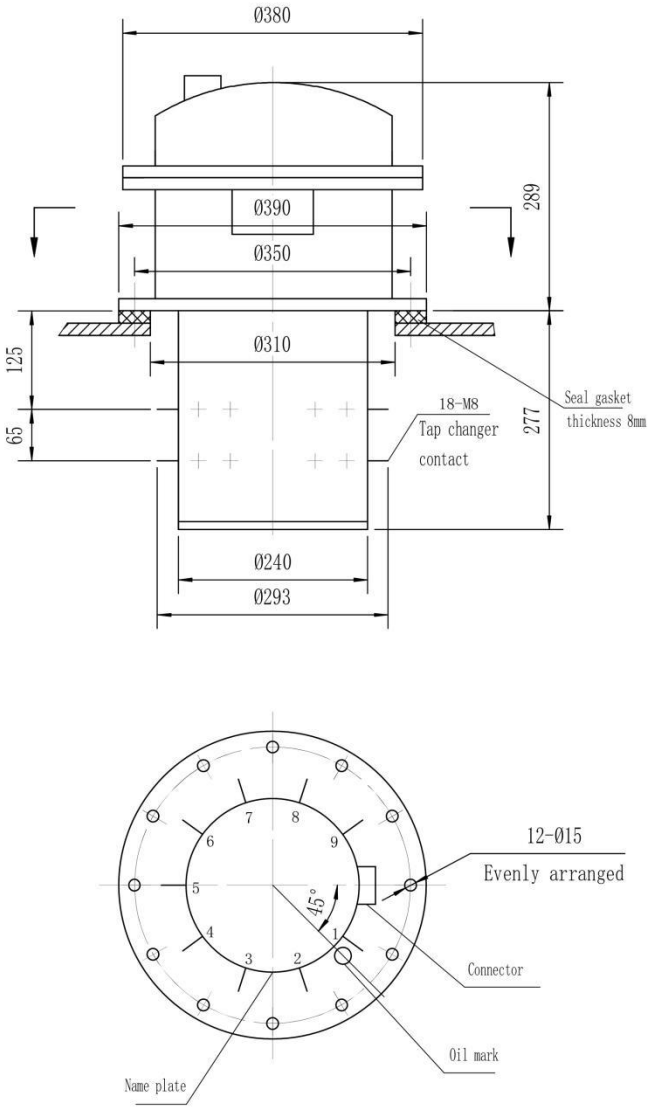


Figure 7. ZSⅠ100-10-9-X2 outline dimensions diagram

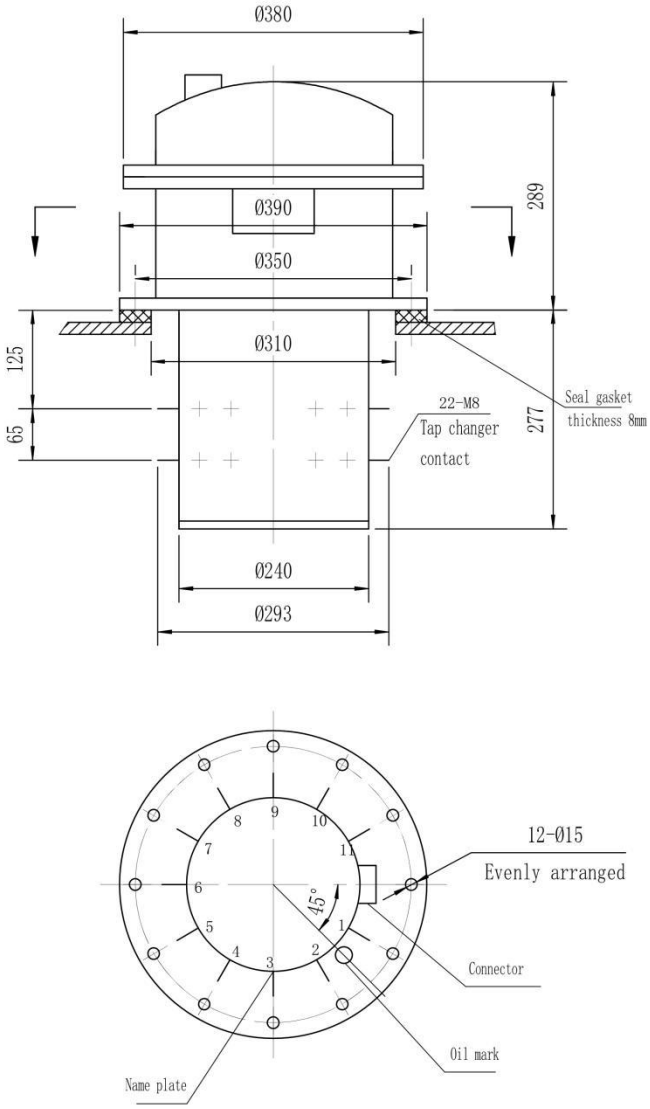


Figure 8. ZSⅠ100-10-11-X2 outline dimensions diagram

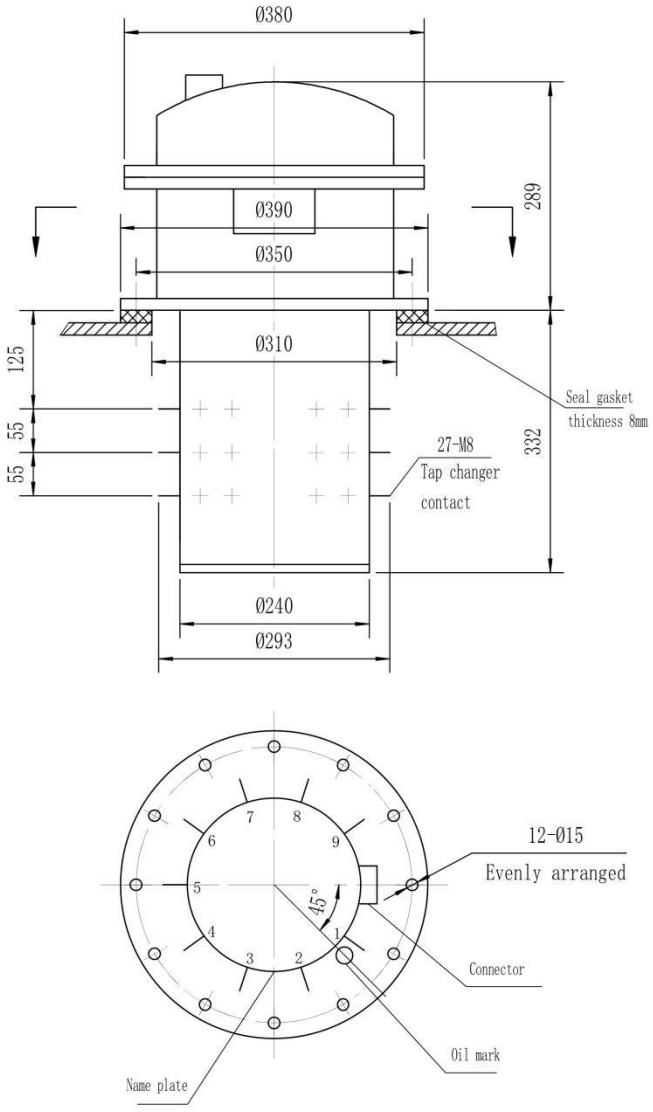


Figure 9. ZSⅢ100-10-9-A outline dimensions diagram

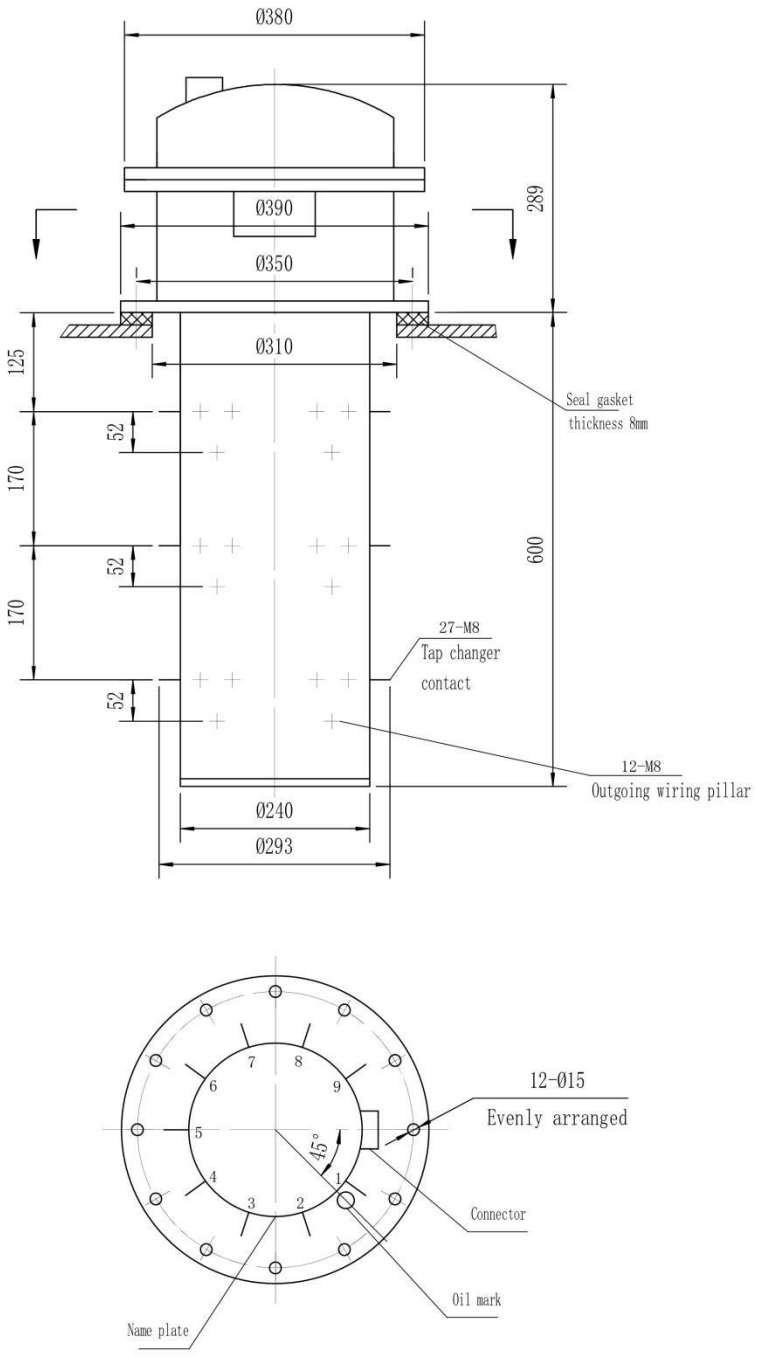


Figure 10. ZSⅢ100-10-9-DA outline dimensions diagram

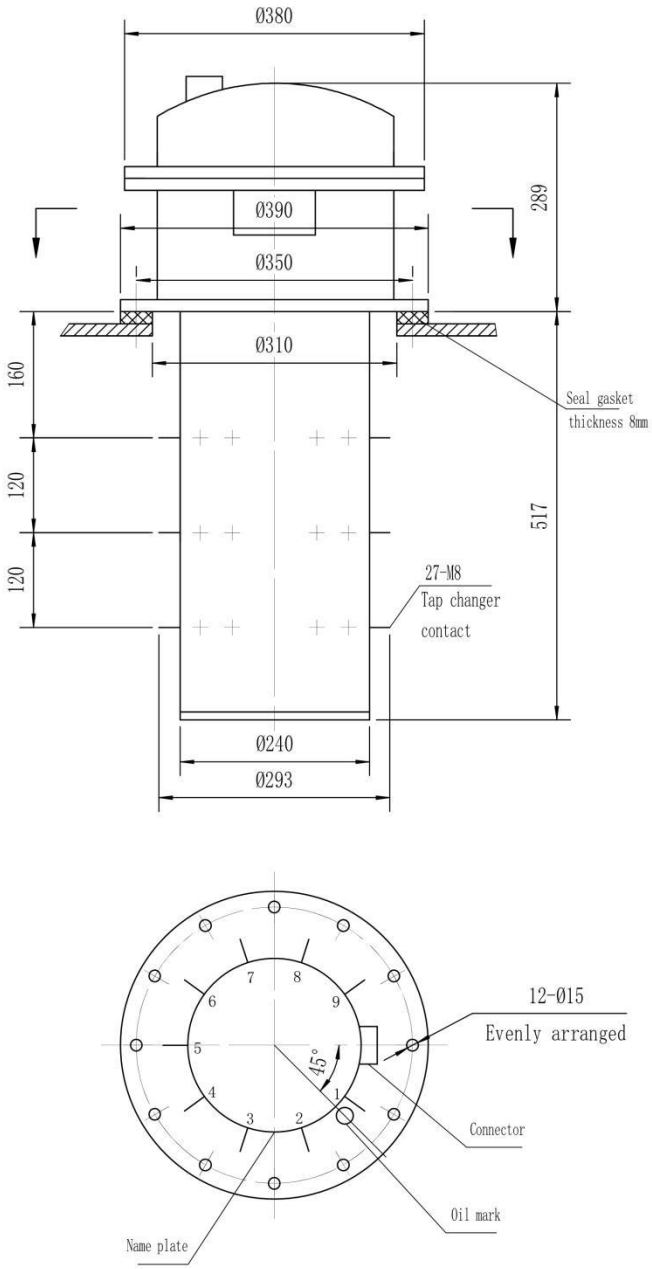


Figure 11. ZSⅢ200-10-9-A outline dimensions diagram

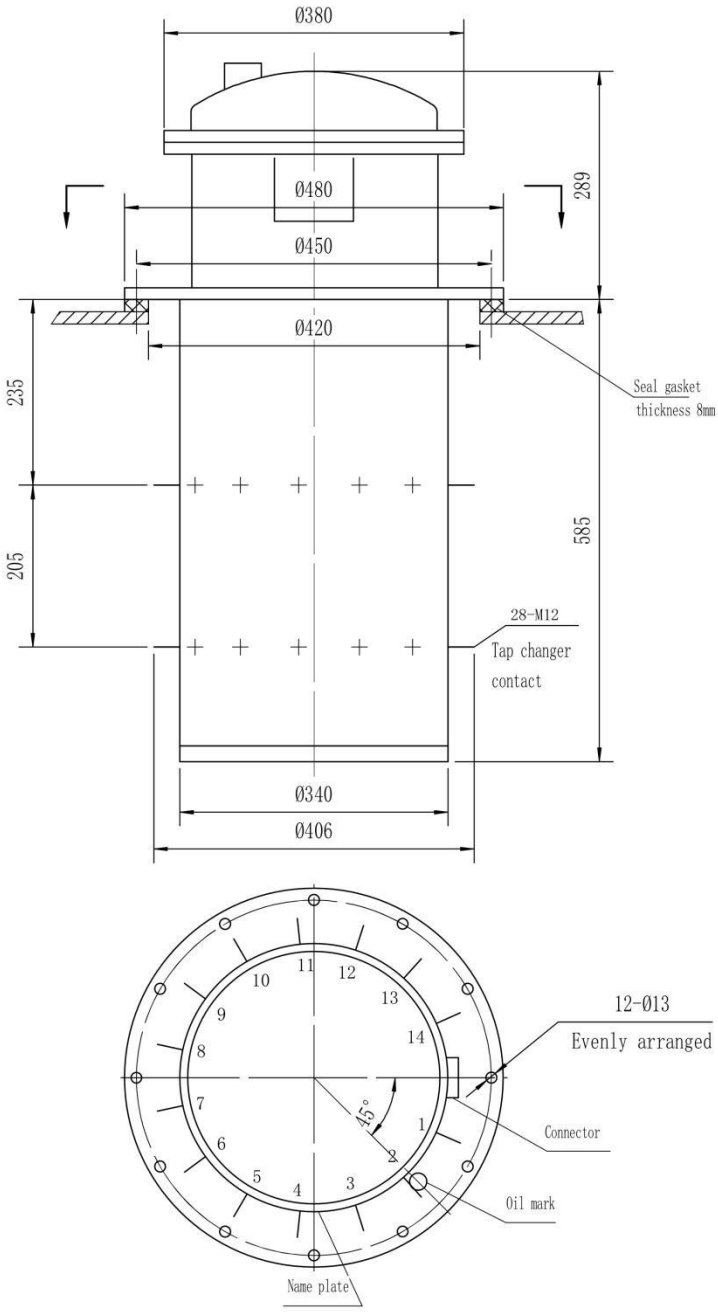
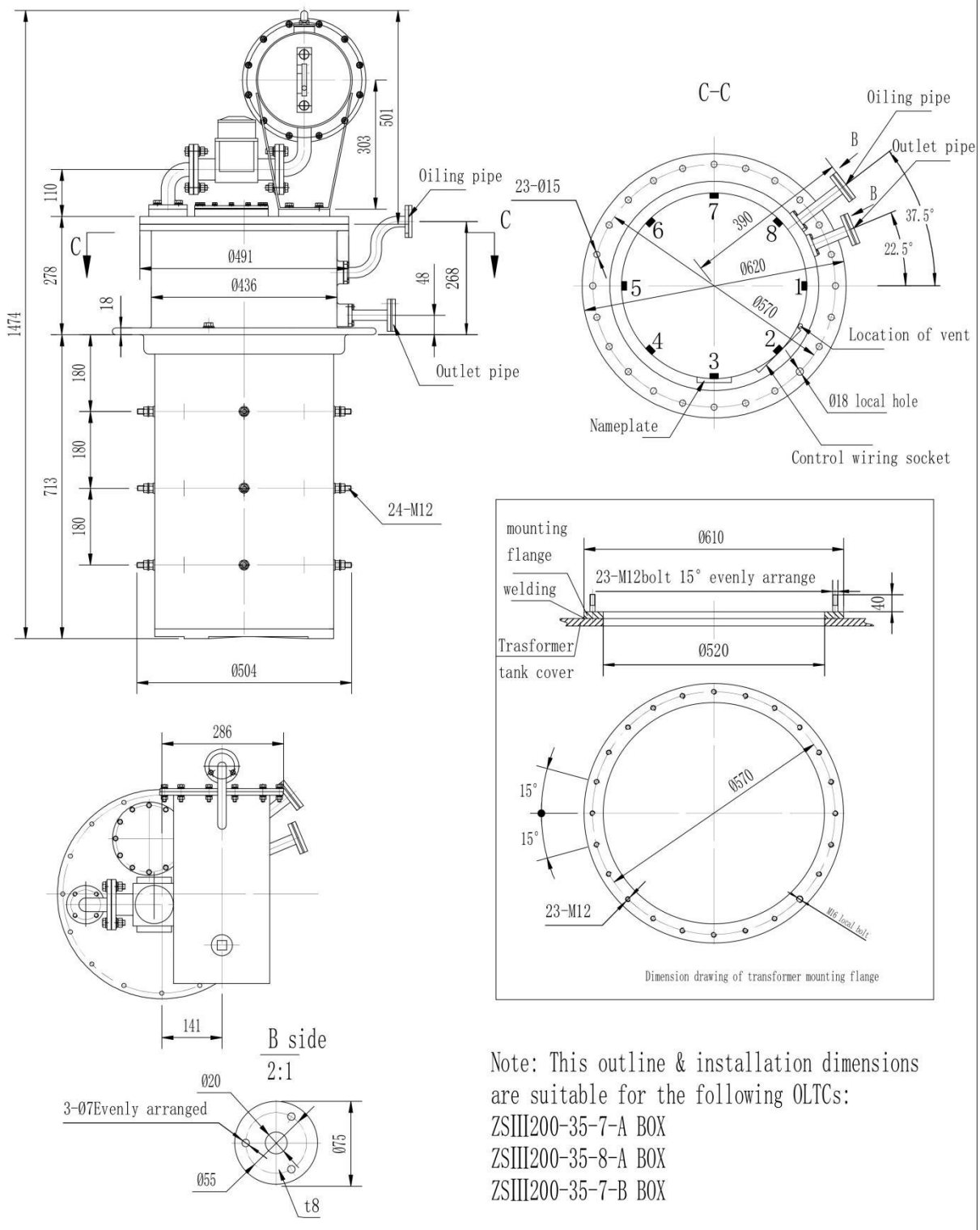
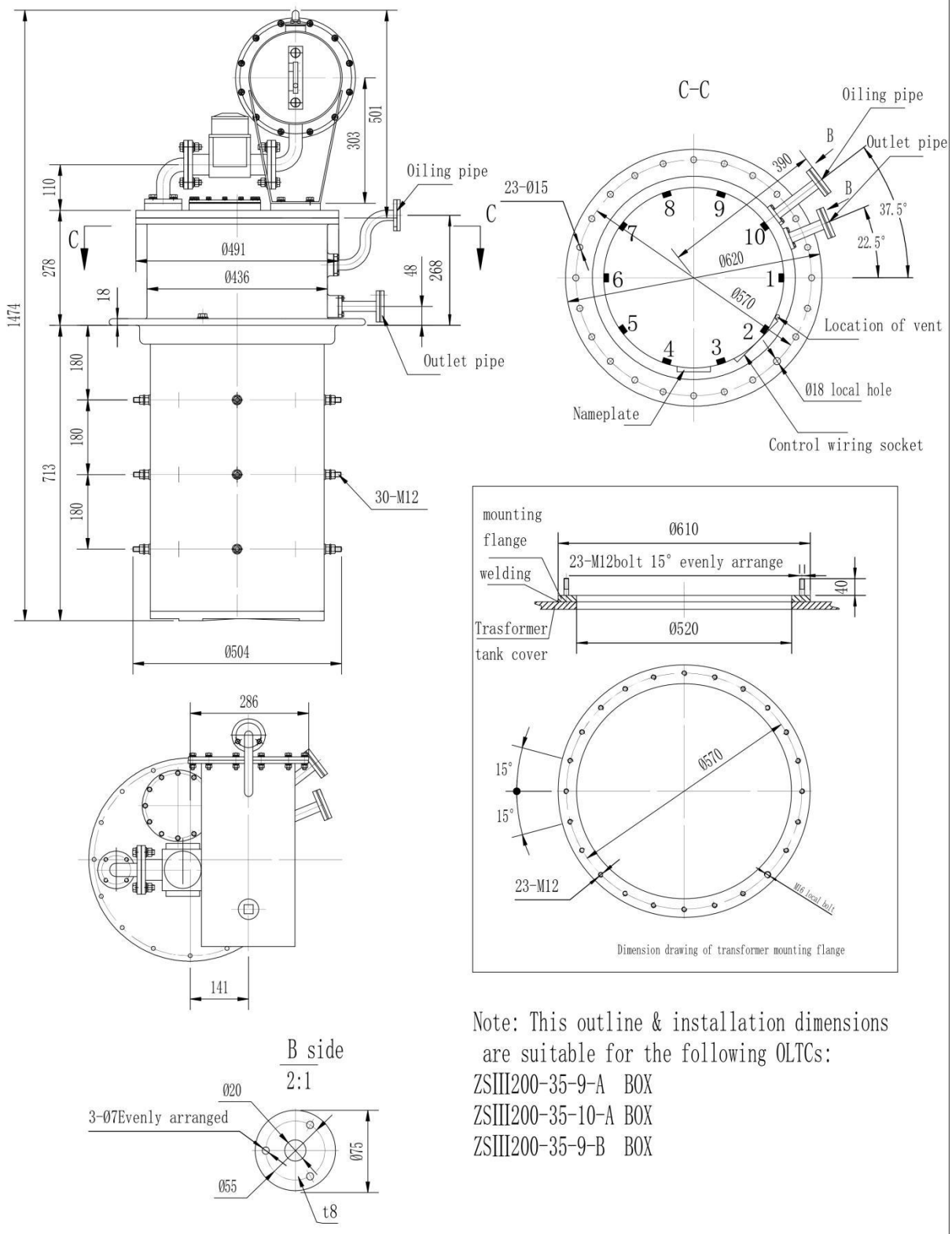


Figure 12. ZS Ⅰ200-10-14-X1 outline dimensions diagram



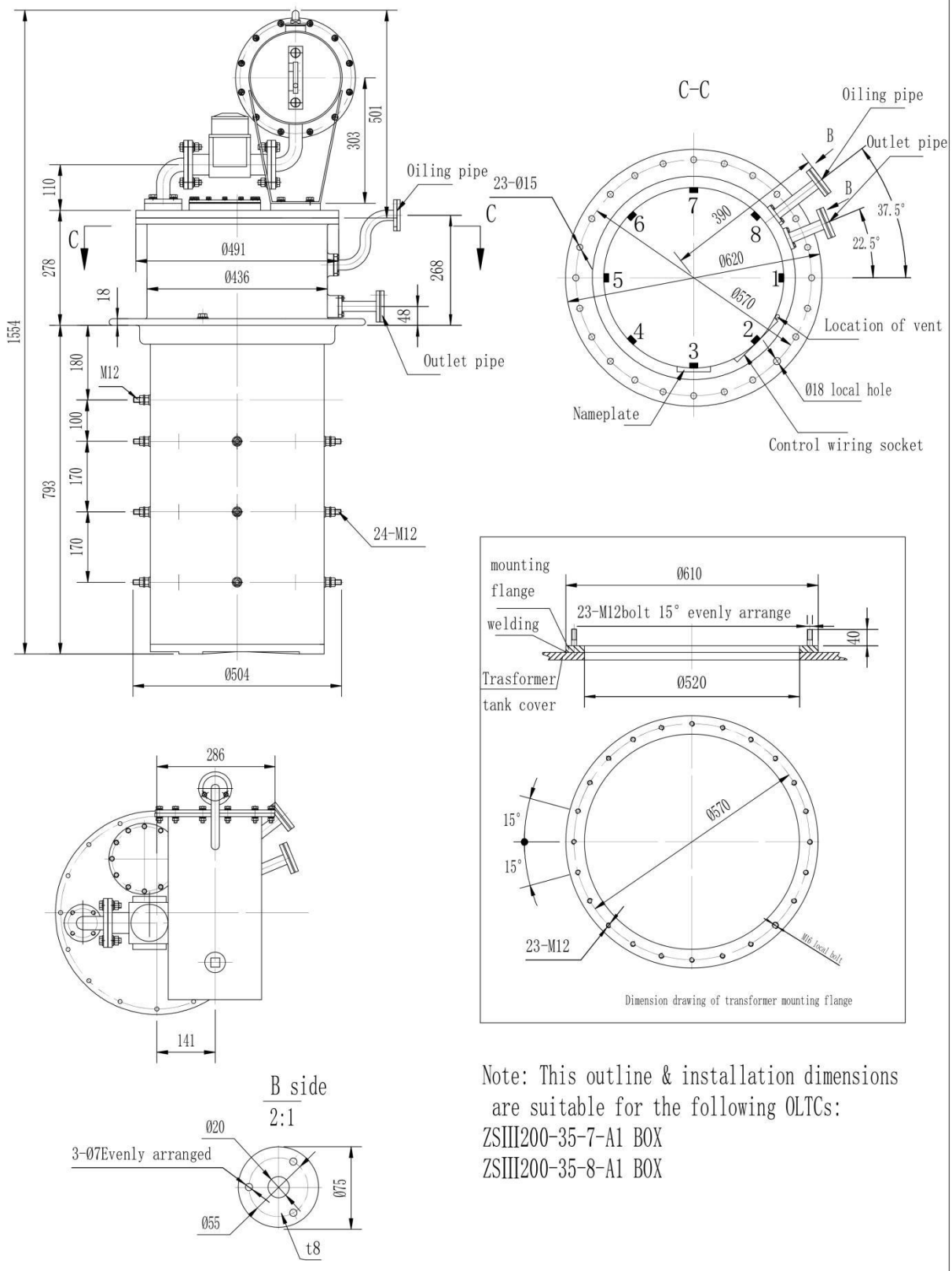
Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII200-35-7-A BOX
ZSIII200-35-8-A BOX
ZSIII200-35-7-B BOX

Figure 13. ZSIII200-35-7-A(B) Box type
Outline and installation dimensions diagram



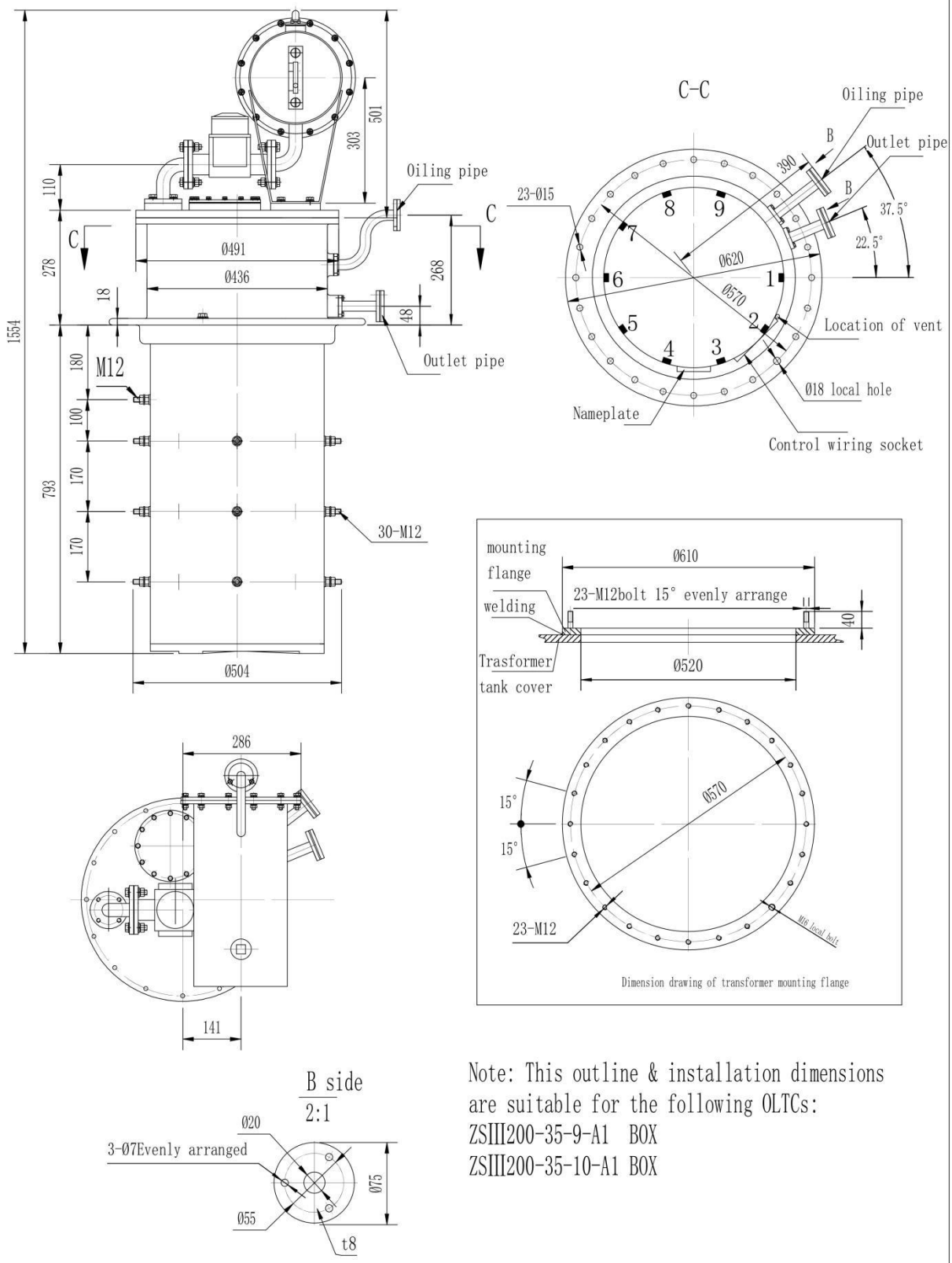
Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII200-35-9-A BOX
ZSIII200-35-10-A BOX
ZSIII200-35-9-B BOX

Figure 14. ZSIII200-35-9-A(B)Box type
Outline and installation dimensions diagram



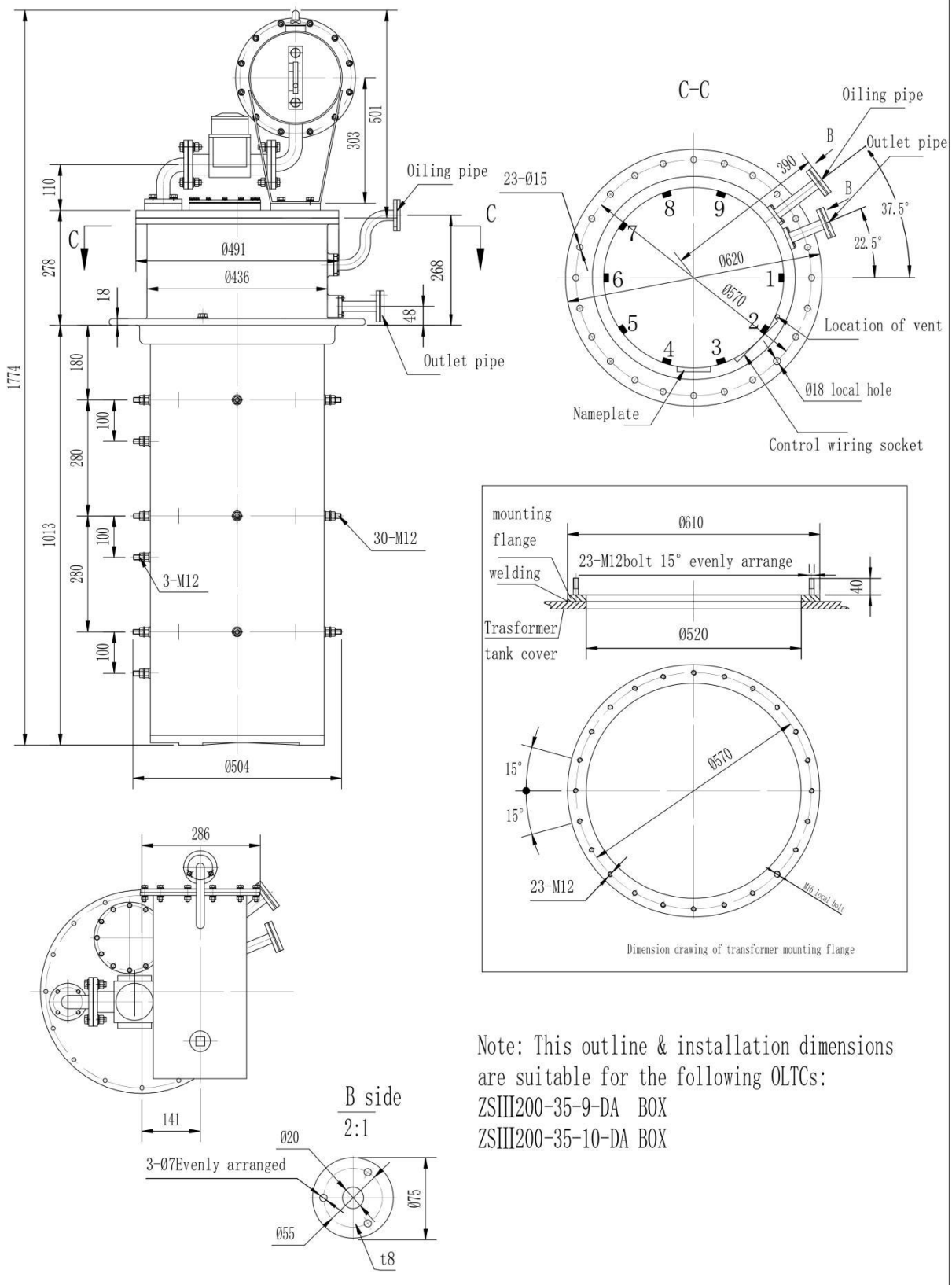
Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII200-35-7-A1 BOX
ZSIII200-35-8-A1 BOX

Figure 15. ZSIII200-35-7-A1 Box type
Outline and installation dimensions diagram



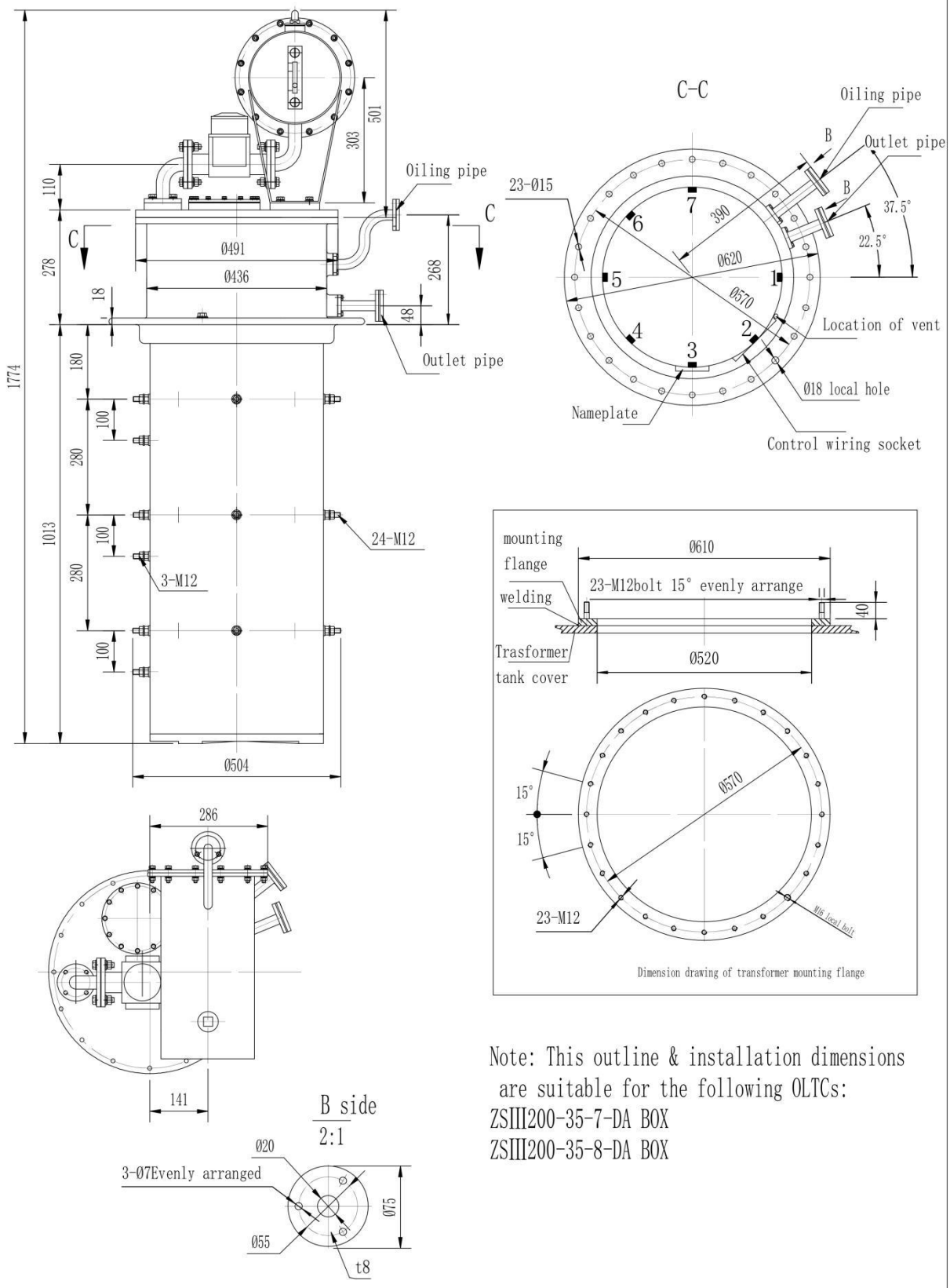
Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII200-35-9-A1 BOX
ZSIII200-35-10-A1 BOX

Figure 16. ZSIII200-35-9-A1 Box type
Outline and installation dimensions diagram



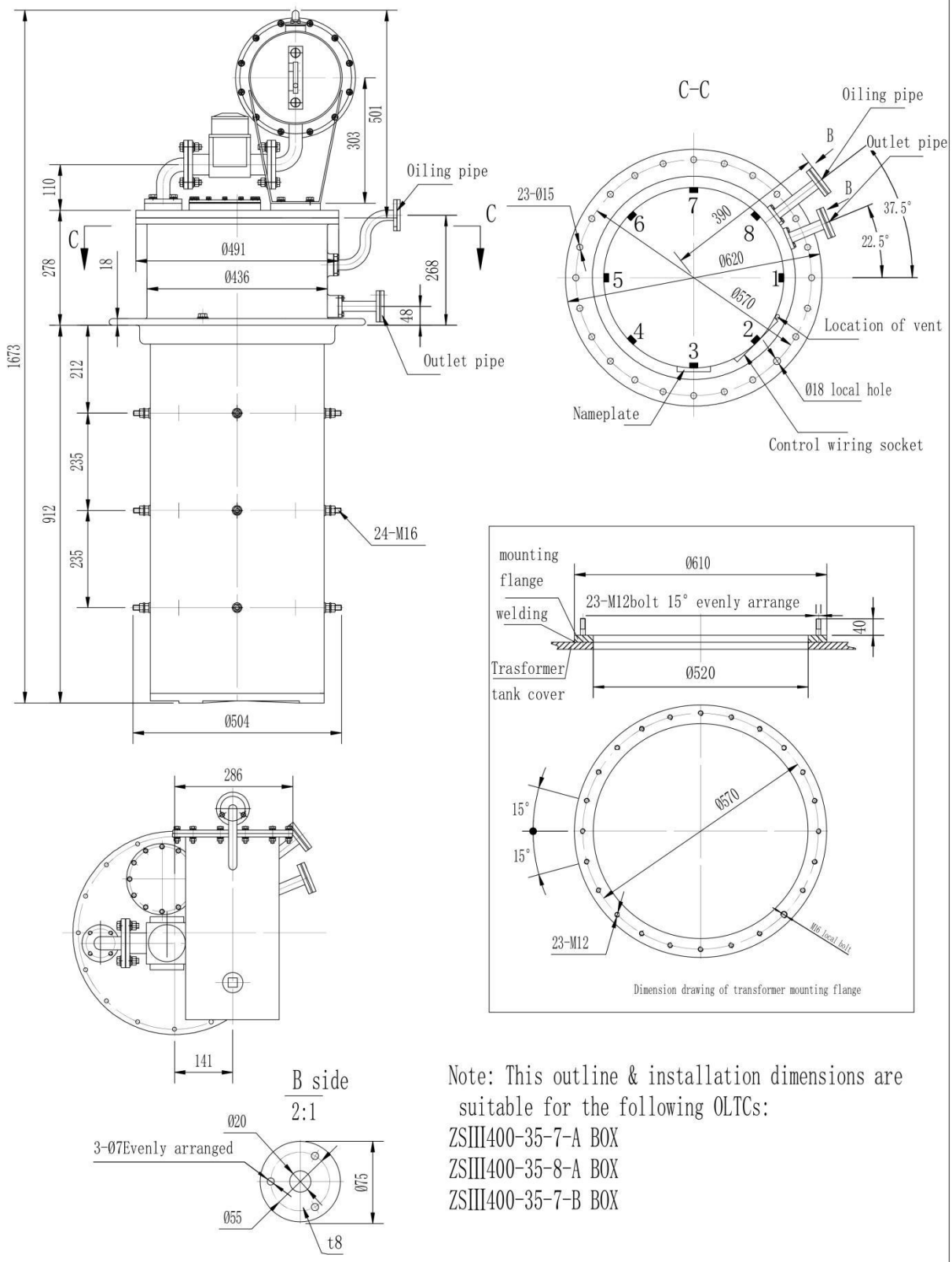
Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII200-35-9-DA BOX
ZSIII200-35-10-DA BOX

Figure 17. ZSIII200-35-9-DA Box type
Outline and installation dimensions diagram



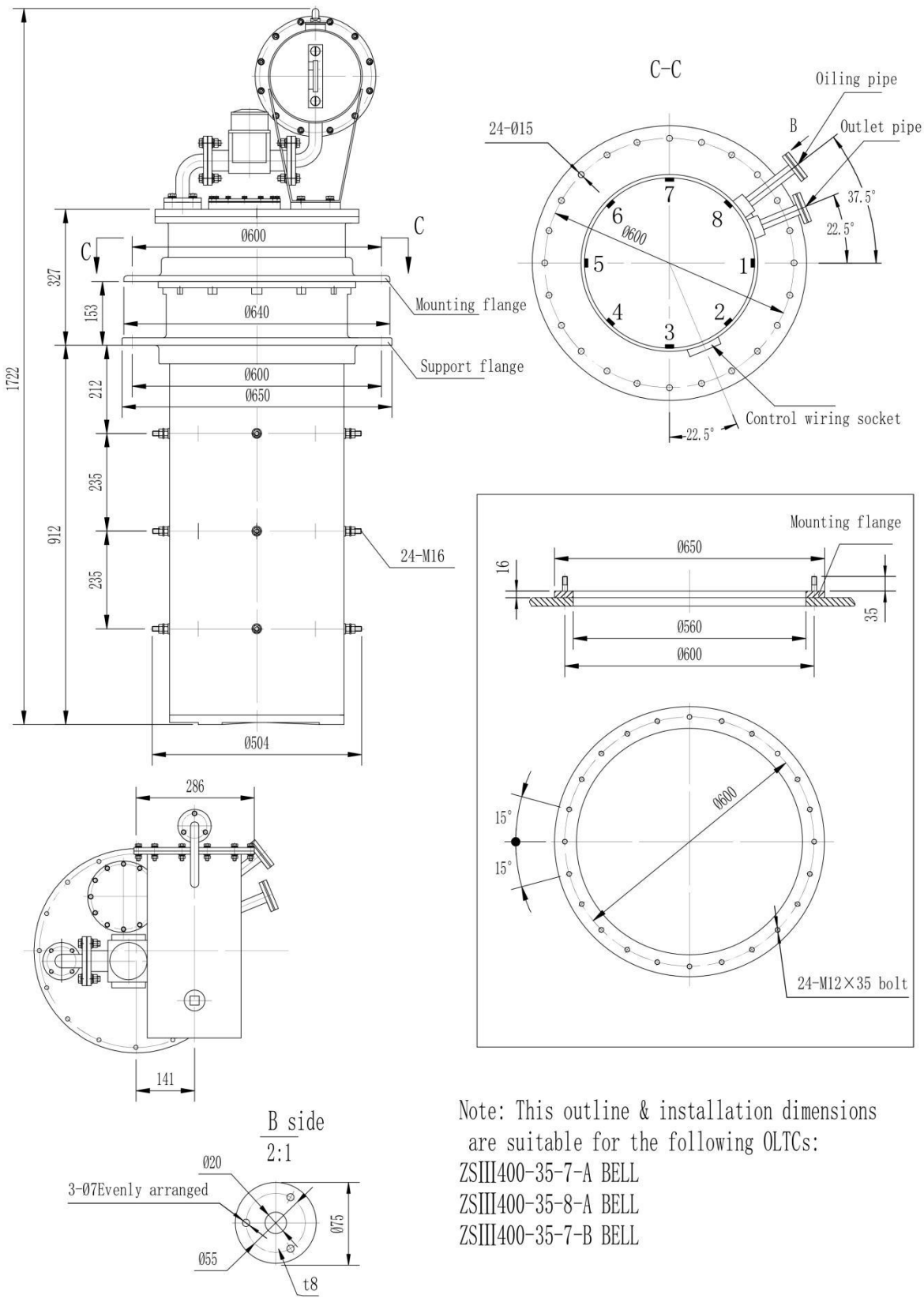
Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII200-35-7-DA BOX
ZSIII200-35-8-DA BOX

Figure 18. ZSIII200-35-7-DA Box type
Outline and installation dimensions diagram



Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII400-35-7-A BOX
ZSIII400-35-8-A BOX
ZSIII400-35-7-B BOX

Figure 19. ZSIII400-35-7-A(B) Box type
Outline and installation dimensions diagram



Note: This outline & installation dimensions are suitable for the following OLTCs:
ZSIII400-35-7-A BELL
ZSIII400-35-8-A BELL
ZSIII400-35-7-B BELL

Figure 20. ZSIII400-35-7-A(B) Bell type
Outline and installation dimensions diagram

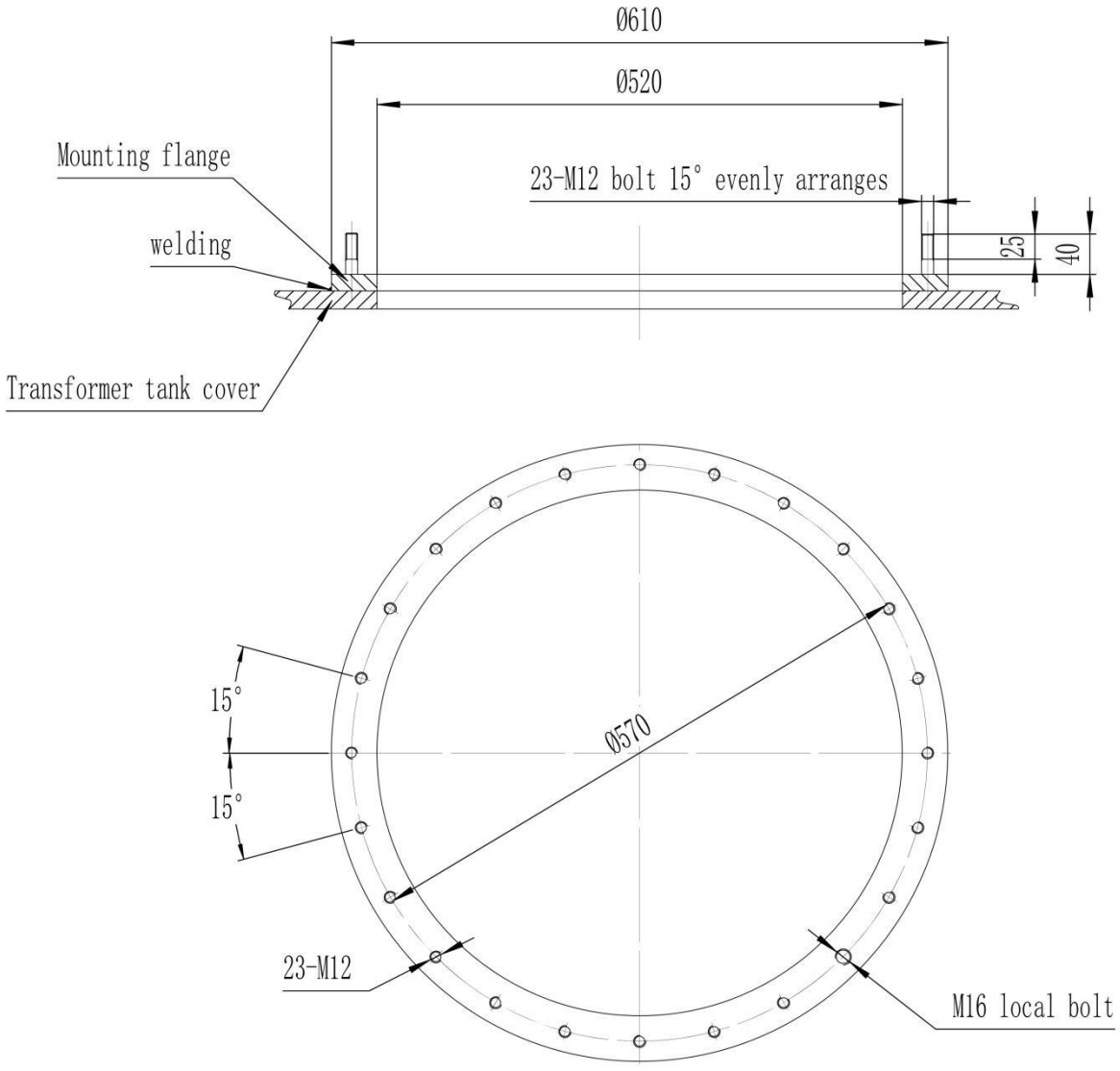


Figure 21. Box type installation flange dimensions diagram

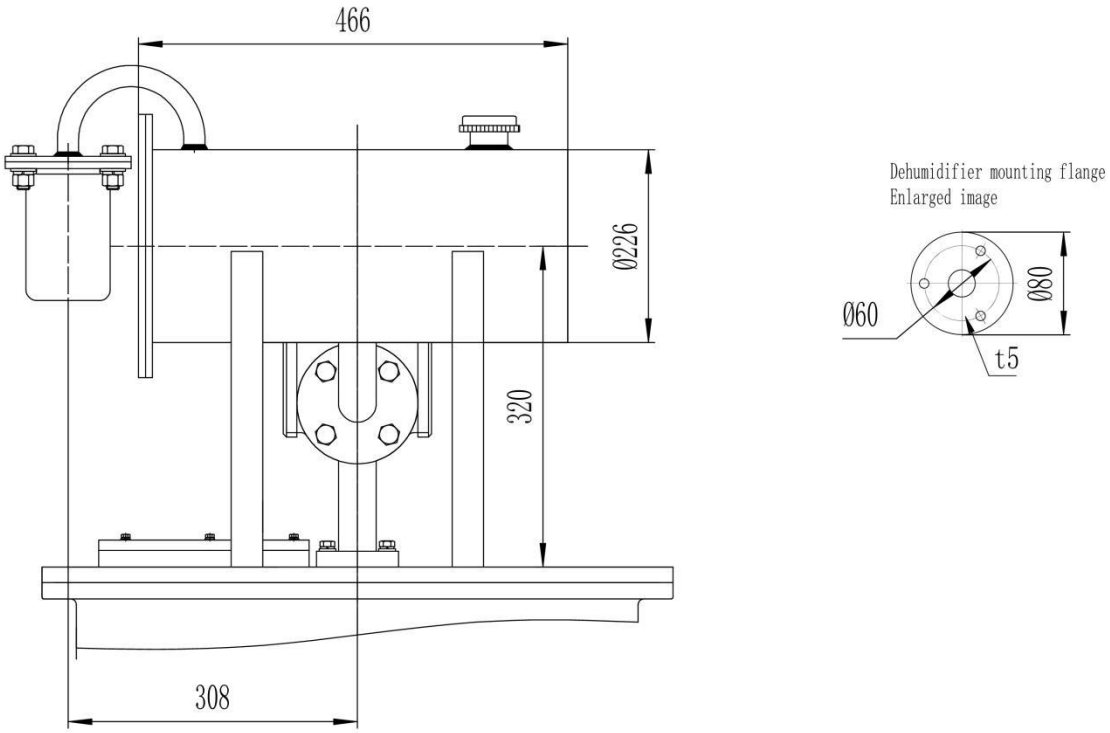
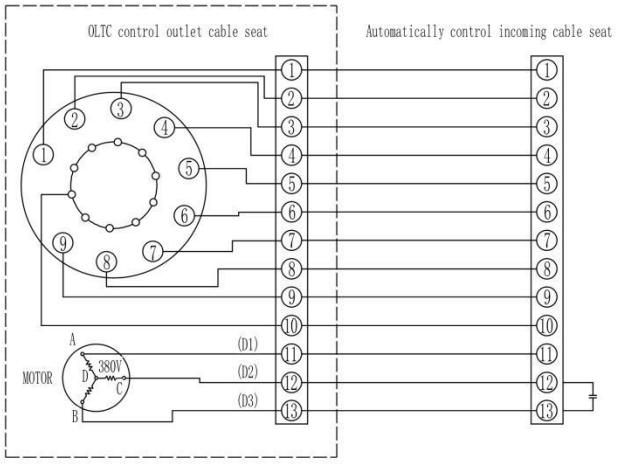


Figure 22. Oil tank outline dimensions diagram



Note:
1. This wiring diagram is applicable to the OLTC with remote controller;
2. In the figure, 1, 2, 3, 4, 5, 6, 7, 8, and 9 indicate the step display, 10 indicates the COM terminal of the step, and 11, 12, 13 indicate the motor wires D1, D2, D3;
3. The OLTC is generally divided into 11, 12 for the upward direction, and 12, 13 for the downward direction.

Figure 23. OLTC & Contraller electric wiring diagram