CZ Vacuum Type On-load Tap Changer Operation Instructions

HM 0.460.1101-01.02/2014

Shanghai Huaming Power Equipment Co.,Ltd.

Preface

1. These operation instructions comprise all necessary information relative to application and installation of CZ type vacuum on-load tap changer (OLTC). It is imperative to read seriously these instructions before using the OLTC.

2. All personnel involved in maintenance and repair of the OLTC must be professionally trained and suitably qualified.

3. With continuous technical improvement of the equipment, Shanghai Huaming Power Equipment Co., Ltd (Shanghai HM) always retains the right to revise the technical data and operation instructions.

4. In case of special designs and application beyond the scope of these instructions, it is indispensable to communicate with Shanghai HM in order to confirm particular technical solution as customization.

Contents

1 General

1.1 Safety instructions

1.1.1 It is obligatory that all personnel performing installation, commissioning and maintenance of this on-load tap changer are properly qualified as professional and obey strictly these operation instructions.

1.1.2 Wrong operation and misuse tend to occasion danger to human life, damage to the equipment or other property, or negative affection on the efficiency of the on-load tap changer.

1.1.3 To accentuate vital security information, the safety instructions are illustrated in 3 different forms as following:

WARNING

It symbols certain peril to human life and health. Neglecting this information can lead to fatal injury.

CAUTION

t signifies particular risk to the equipment and other property. Serious injury is still possible to occur.

NOTE

It indicates important information about a specific subject.

1.2 Specified use

CAUTION

Application of the on-load tap changer should be confined exclusively to the transformer clarified in specific order sheet. Only trained and qualified personnel are authorized to perform installation, commissioning and connection of the equipment. It is imperative that the user operates the on-load tap changer in accordance with specific application.

2 Summary

WARNING

Operation and maintenance of the CZ OLTC must be only performed by authorized personnel to prevent any improper use and free access to movable components.
The ambient service temperature of CZ OLTC ranges from -25℃～+40℃. It is obligatory for the user to take proper measures to prevent condensation on the equipment (transformer tank wall).

The CZ type vacuum on-load tap changer (abbreviated as OLTC), suitable for dry type transformer installed indoor, serves for voltage ratio adjustment under load of dry type transformer by realizing tap changes without interruption. The CZ on-load tap changer, designed in single-phase structure, can be applied on any transformer winding connections (star, delta, etc.). For dry type three-phase transformer, three sets of single-phase CZ OLTC can be mechanically coupled and operated by one unit of motor drive unit (abbreviated as MDU). CZ OLTC consists of diverter switch which executes high-speed resistor transition and tap selector. At first, the tap terminal is selected via tap selector and the subsequent switch under load is carried out through diverter switch. Vacuum interrupters serve as arc contacts of diverter switch while the load of main circuit is carried by specific main contact set.

For any standard CZ equipment delivery, one unit of MDU is comprised to achieve mechanical operation of OLTC (please refer to operation instructions of MDU for its running principles). It can function for local and remote control modes and is able to be installed outdoor due to its protective housing. In case of CZ OLTC equipped with huge cabinet, the MDU can be mounted on side surface of the cabinet.

CAUTION

If there is some special improvement of structure, the information can be found in specific order sheet beyond these instructions.

2.1 Main characteristics

2.1.1 Vacuum interrupter is designed to satisfy OLTC operation condition, thus to ensure that OLTC has reliable quality and long operation life.

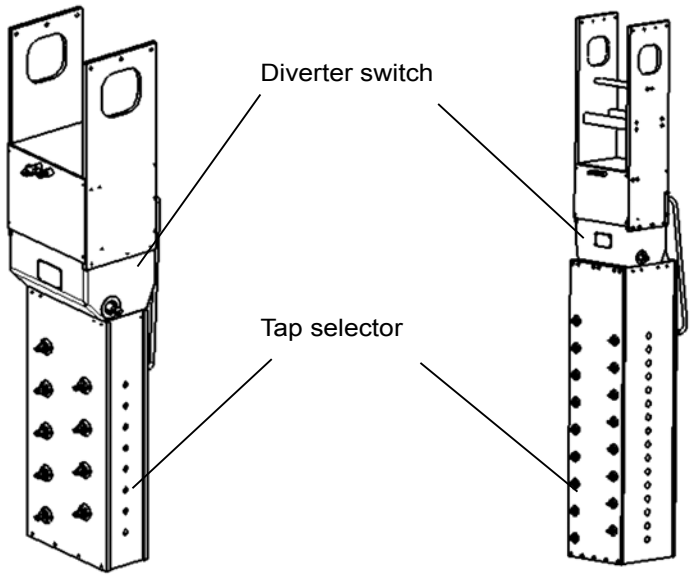
2.1.2 The vacuum interrupter are fixed completely in the insulation frame, it will not be interfered by

the moving of contact.

2.1.3 Vacuum interrupter works as arcing contact, there are special mechanical contacts carry the current for long in main circuit, thus tap changer has good arc extinguishing capability and can be reliable operated for long time.

2.1.4 Adopting double-resistor transition structure in diverter switch, therefore it can be used for the transformer with bigger capacity.

2.1.5 Energy accumulating system is with compressed spring and adopting typical triggering principle, to make tap changer operation in reliable and stable.



CZ of Um 40.5kV with 9 positions **CZ of Um 72.5 with 17 positions**

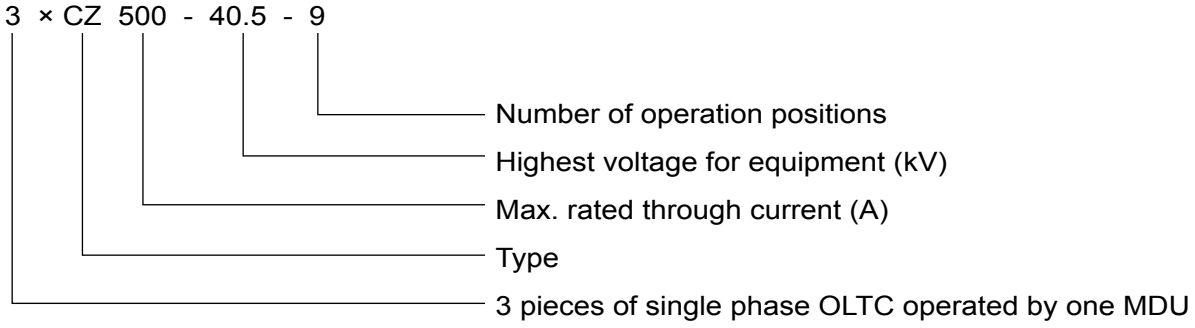
Figure 1

2.2 Main technical data

No.	On Load Tap Changer			CZ500	3 × CZ500
1	Number of Phase And Application			1	3
2	Max. Rated Through-Current (A)			500	
3	Short-circuit current test (kA)		Thermal (3s)	5	
			Dynamic (Peak)	12.5	
4	Max. Rated Step Voltage (V)			900	
5	Rated Step Capacity (kVA)			250	
6	Max. Operating Positions			17	
7	Rated Frequency (Hz)			50 or 60	
8	Insulation To Ground (kV)		Highest voltage of equipment (Um)	40.5	72.5
			Rated separate source AC withstand voltage(kV/50Hz,1min)	85	140
			Rated lightning impulse withstand voltage (kV,1.2/50μs)	200	350
9	Internal Insulation	Between Tap In Service And Pre-Selected(kV)	Rated separate source AC withstand voltage(kV/50Hz,1min)	5	5
			Rated lightning impulse withstand voltage (kV,1.2/50μs)	20	20
		Across Fine Tap Winding (kV)	Rated separate source AC withstand voltage(kV/50Hz,1min)	20	27
			Rated lightning impulse withstand voltage (kV,1.2/50μs)	80	150
10	Ambient Temperature of Operation (℃)			-25~+65	
11	Ambient Media of Operation			Air	
12	Adopted Motor Drive Unit			SHM or CMA7	
13	Electric Life			Not Less Than 300,000 Operations	
14	Mechanical Life			Not Less Than 800,000 Operations	

2.3 Designation of CZ vacuum type on-load tap changer

CZ vacuum type OLTC varies in different phase number, maximum through current, highest voltage for equipment and position number. In consequence, to distinguish type nuances, the designation of specific CZ indicates clearly the values of above-listed variations as shown in below Fig.2:



3 Structure and Conception (Refer to Appendix 1 for detail)

The CZ on-load tap changer is consisted of tap selector and diverter switch. Stationary contacts of the tap selector and output conductor row are installed respectively on two insulation plates in parallel each other, and the moving contacts of the tap selector is driven by screw bar to select tap terminal. Double stationary contacts in parallel connection are adopted for the tap selector, so it is strong in current-loading capacity.

The take-off terminals of tap selector are connected to diverter switch via conducting leads and are classified as odd side and even side. If the diverter switch runs at odd side, the moving contacts of the tap selector at even side can be selected, and the diverter switch is driven by energy accumulator and switched into even side after the selection completed. Thus, during next tap change, the moving contacts of tap selector at odd side are to be selected.

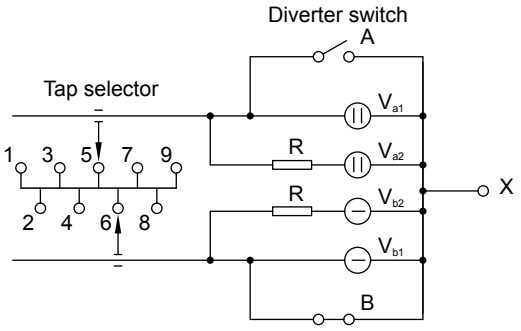
The energy transmission of the tap changer is realized when the linked horizontal drive shafts run the transmission mechanism of tap changer. This mechanism plays the role to activate moving contacts of the tap selector to realize tap selection and at the same time put the energy accumulating mechanism into operation. Once the tap selection finished, the energy accumulating mechanism triggers to make the diverter switch execute tap change under load following specified program “close” and “open”.

The diverter switch consists of four vacuum interrupters, one pair of main mechanical contacts, two sets of transition resistors and energy accumulating mechanism. The vacuum interrupters, fixed inside diverter switch, are characterized as large switching capacity and long service life. The main contacts are made of pure copper due to excellent load transmission capability of this material. Transition resistors are made of Ni-Cr alloy which can resist extreme heat. The energy accumulating mechanism adopts the principle of triggering after pass dead-point, which is reliable in terms of mechanical strength and necessary speed.

4 Operation principles of the tap changer

4.1 Connection diagram of tap changer

From the diagram, it can be seen that the tap changer is consisted of tap selector and diverter switch. The tap changer is operating at position 6 in the drawing above.

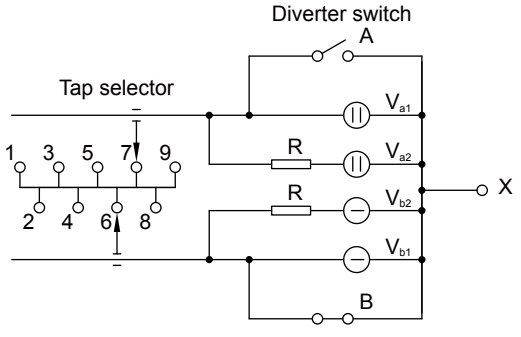


4.2 Operation principles of the tap changer

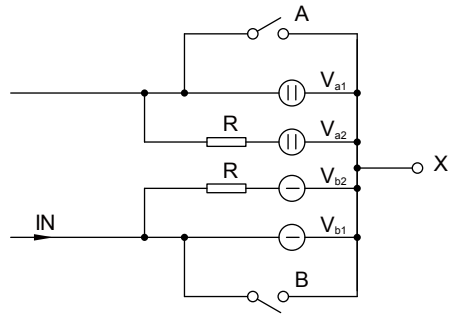
The description below is for the tap changing process from operation position 6 to position 7.

4.2.1 Load current flows from tap terminal 6 via main contact B to terminal X for outputting. The moving contact of the tap selector on odd side under no load condition moves from position 5 to position 7, shown in drawing below:

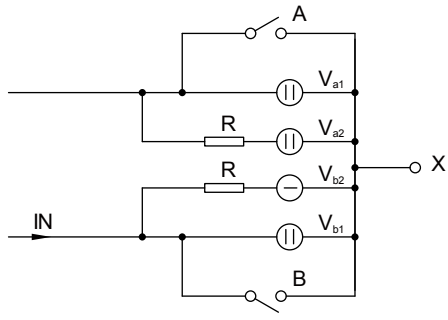
4.2.2 After finishing tap selection, the diverter switch releases via energy accumulator, by which the main contact of the diverter switch and vacuum interrupter is converted according the program below



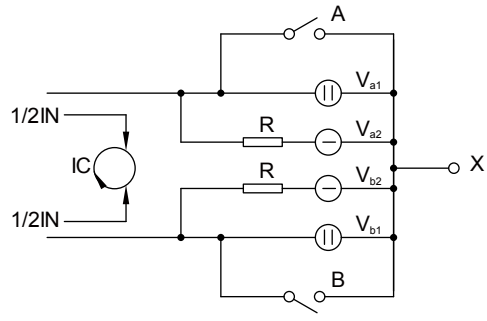
1st step: The main contact B opens and load current IN outputs via vacuum interrupter Vb1.



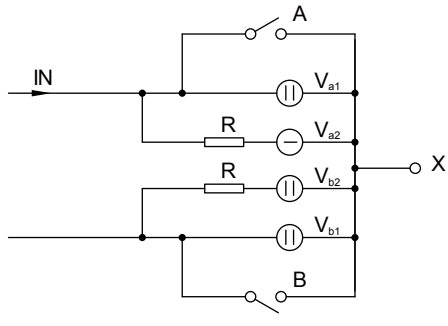
2nd step: Vacuum interrupter Vb1 opens, and load current IN outputs via transition resistance R and vacuum interrupter Vb2.



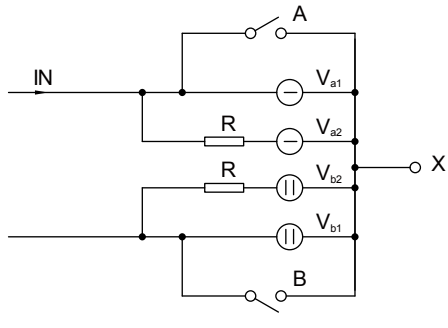
3rd step: Vacuum interrupter Va2 closes, the diverter switch is in middle-bridging status, load current outputs via double-resistance and vacuum interrupters Vb2 ,Va2. Step voltage produces loop current Ic in bridge circuit.



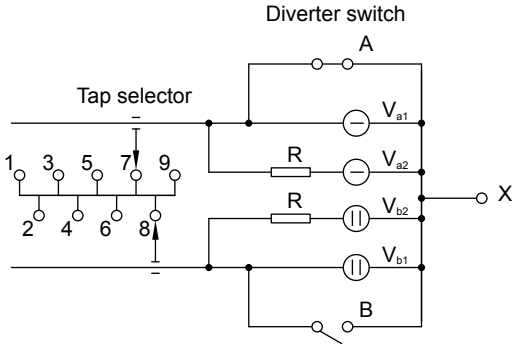
4th step: Vacuum interrupter Vb2 opens, load current is out put passing through single resistance R and vacuum interrupter Va2.



5th step: Vacuum interrupter Va1 closes, load current outputs via Va1.



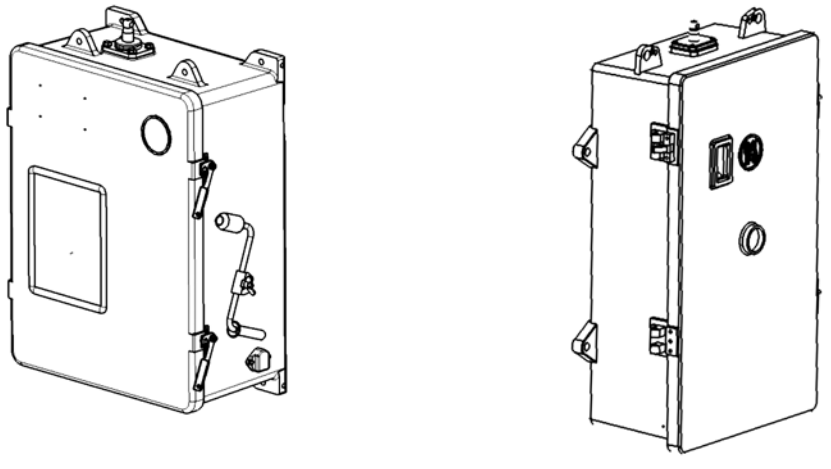
6th step: Main contact A closes, tap changing is completed and the tap changer on position 7.
Whereas, for load current passing through from main contact A to contact B, its switching sequence is similar to above.



5 Accessories of Tap Changer

5.1 Motor drive unit type CMA7

The tap changer CZ can be operated and driven by both CMA-7 and new type SHM. Customers can choose MDU according to their requirement or Huaming will decide the MDU type for customers. Please refer to the operation instructions of MDU for details.



SHM **CMA7**

Fig-2 Motor Drive Unit

5.2 Horizontal and Vertical drive shafts

The horizontal drive shaft (Fig.3) is for realizing the mechanical link between tap changer and bevel gear box, which is made of insulation materials. Length of drive shaft is determined according to insulation requirement between two single phases of tap changers, and between tap changer and MDU.

The vertical drive shaft (Fig.4) is for realizing the mechanical link between motor drive unit and bevel gear box, which is made of steel pipe in square section. The user can cut the shaft as per their needed length on site.

5.3 Bevel gear box (Fig-5)

The bevel gear box is mounted to link the horizontal and vertical drive shafts. It transmits the drive torque of MDU to OLTC body. Refer to Appendix 12 for overall dimensions.

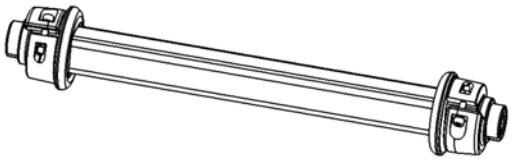


Fig-3 Horizontal drive shaft

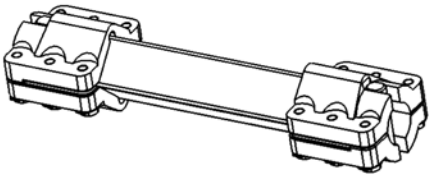


Fig-4 Vertical drive shaft

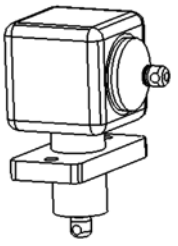


Fig-5 Bevel gear box

6 Shipment

6.1 Delivered items

6.1.1 Normal On-load tap changer (for the users who prefer to make the frame by themselves):

• On-load tap changer bodies (Fig-1)
• Motor Drive Unit (MDU), controller and cables
• Drive shafts, coupling parts, bevel gear box, special parts required by customers

CAUTION

In case of normal CZ OLTC, the tap changer bodies are packaged with drive shafts, coupling parts and bevel gear box.

6.1.2 On-load tap changer(delivered with supporting frame):

• On-load tap changer bodies (Fig-1)
• Motor Drive Unit (MDU), controller and cables
• Drive shafts, coupling parts, bevel gear box, special parts required by customers
• Supporting frame with standard fastening parts

6.1.3 On-load tap changer (with sealing cabinet):

• On-load tap changer will be mounted on the cabinet during transportation.

The delivered items should be strictly verified according to the packing list made before delivery. Cabinet, as special item, should be clarified in order sheet.

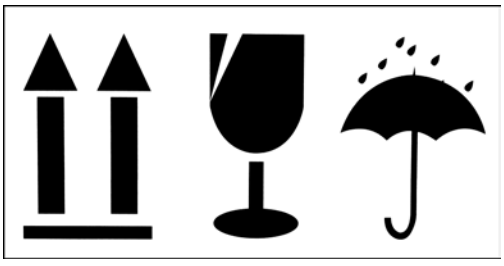
6.2 Transportation and delivery verification

6.2.1 Transportation

6.2.1.1 The package cases of delivered product are suitable for all kinds of transportation; Proper piling of cases is permitted but the supporting pressure limit of package cover is 500kg/m2.

6.2.1.2 During the transportation, it is necessary to arrange the cases according to its indicated position of gravity center. The lifting instructions signals should be respected when lifting goods.

6.2.1.3 Caution symbols on the package including (Fig.6)



Up **Fragile** **No wetness**

Fig-6

6.2.2 Delivery verification

During reception of goods, it is necessary to proceed as following:

The consignee of goods should verify thoroughly the delivery before sign on the shipment verification sheet. The subjects include:

• Check the quantity of delivery content on the basis of shipment documents;

• Check the completeness of package

In case of some detected damage on package, take the photo of relevant non-conformity. If delivery content does not correspond to the packing list, do not sign on the verification sheet and contact the transportation company immediately on the revealed problem. Meantime, feedback it to Shanghai Huaming (Tel.:86 21 5270 8966);

It is also necessary to perform the check and complain detected erosion due to affection of rain, snow and other kinds of witness.

All the delivery should be stored in dry environment before installation.

• The on-load tap changer should be stored in a sealed package isolated from outside influence. It can be only opened when installation.

CAUTION

Only professional personnel are permitted to perform the lift of the package.
The lifting capability of lifter equipment must be more than 1000kg.

The packing cases should be firmly fixed during transportation and lifting process. Put them down carefully to prevent any damage caused by shaking, swaying, fall, tip-over and knock.

WARNING

The load of equipment can cause lethal injuries when falling and tipping over !

If any fall or serious knock occur, there tend to be some severe damages. In this case, a general inspection should be performed and at necessary occasion it requires an inspection executed by professional technicians from Shanghai Huaming.

NOTE

Fall, off-balance and tip-over during transportation damage severely the equipment.

6.2.3 Verification

Open the packing cases and check possible damage due to transportation

• Deliver the cases to the site of installation;

• Check the completeness of delivery especially the accessories following packing list.

CAUTION

Avoid breaching the package when opening the cases.

If the content of delivery does not correspond the packing list, please contact directly the manufacturer.

6.3 Storage

If the goods have been store for over 1 year, it is necessary to check them strictly before installation. The goods that possess sealing package can be stored outdoor if the following requirements satisfied:

• Ambient temperature of the place of storage should not be superior to 40˚C and inferior to -25˚C;

• The equipment cannot be stored in an environment where flammable, explosive and errosive gas exist;

• The equipment must be properly protected against wetness, air pollution and risks of insects or rats, etc;

• Regular check of stored equipment should be performed.

NOTE

If storage lasts very much time, it is necessary to change desiccant regularly and reseal the package.

7 Installation of on-load tap changer (OLTC)

There are 3 kinds of installation for the CZ on-load tap changer as required by customer during order technical clarification (as illustrated below:)

CAUTION

The on-load tap changer is obliged to install on the clarified transformer in the order sheet.
Commissioning and installation of the on-load tap changer must be performed only by professional and qualified personnel.

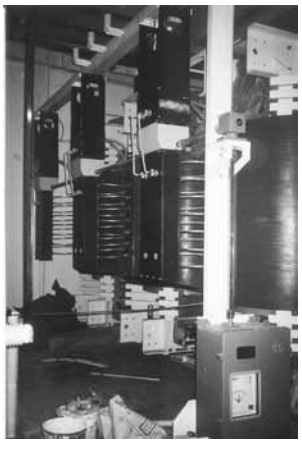


Fig. 7a Installation of the OLTC without frame nor cabinet

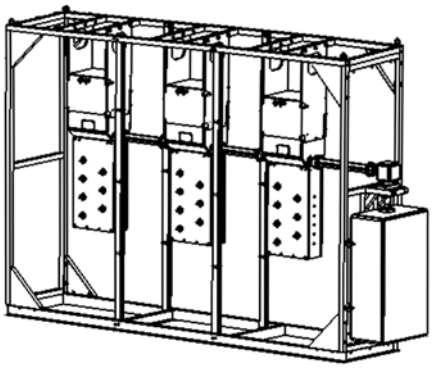


Fig.7b Installation of the OLTC with supporting frame

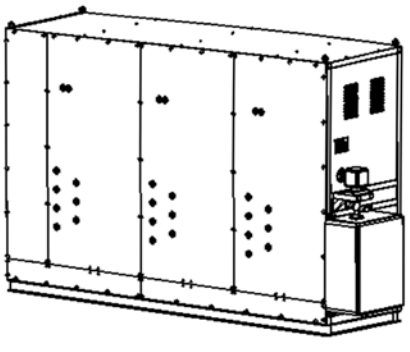


Fig.7c Installation of the OLTC with cabinet

7.1 Installation of the on-load tap changer

7.1.1Notice before installation:

Before coupling the 3 single-phase tap changers with the drive shafts and the motor drive unit, make sure that the indicated positions of tap changer and motor drive unit are in accordance.

CAUTION

The position of 3 single phases must correspond to that of motor drive unit.

Check the red mark inside the tap selector through the side board. The position indicated by the mark is exactly the position of tap changer. (Fig.8)

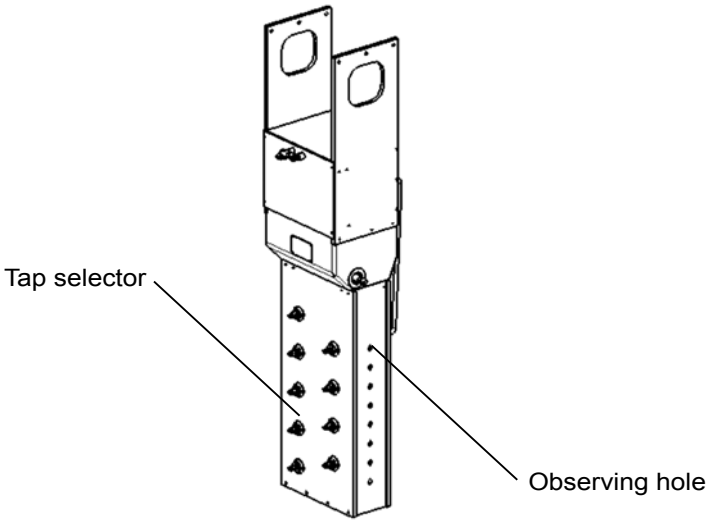


Fig-8 The observe hole location of tap selector

The operation positions of tap changer are categorized as odd and even. The odd positions are represented in white and the even ones represented in yellow. The way to verify the position is checking the color shown through the observing hole on the façade board of diverter switch. If the color is white, the tap changer is at an odd position. If the color is yellow, the tap changer is at an even position (Fig.9).

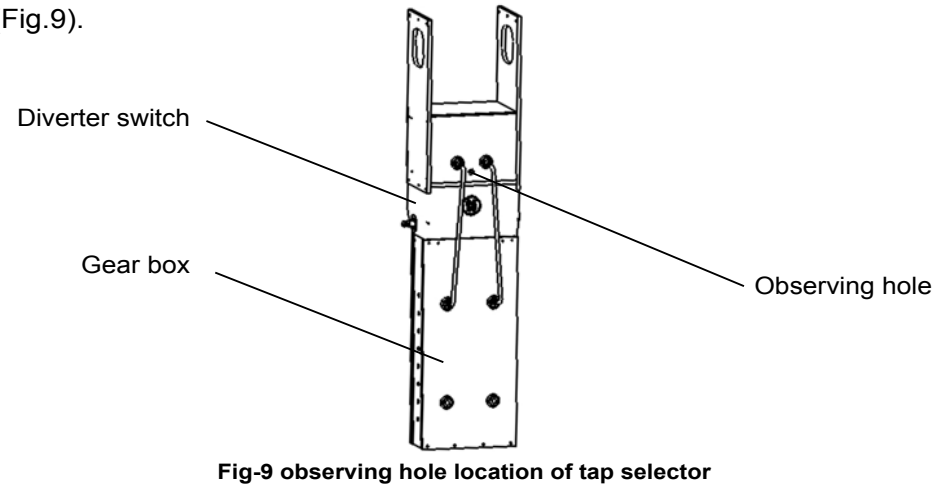


Fig-9 observing hole location of tap selector

7.1.2 Installation of on-load changer body on transformer (Fig-7a)

Due to the structure of CZ tap changer, it must be mounted in vertical manner (Fig.-10). Lift the on-load tap changer to the bracket of the transformer and fix it through the connection of 6 Φ13 holes on the upper insulating board of tap changer (as illustrated below) and 6 M12 bolt. Make sure all the bolts are fastened tightly and securely.

If the transformer winding is Delta connection, the insulation distance between phases of tap changers must be superior to 950mm (See b size in Appendix 8).

It is necessary to keep enough safety distance between the bottom bearing and the grounding parts or bottom surface of transformer.

In addition, a minimum clearance of 100mm must be preserved between the tap selector contacts and transformer winding.

7.2Installation of bevel gear box (Fig.-11)

The bevel gear box is mounted on a supporter by fastening 2 M14 bolts. Please refer to appendix for the dimensions of bevel gear box:

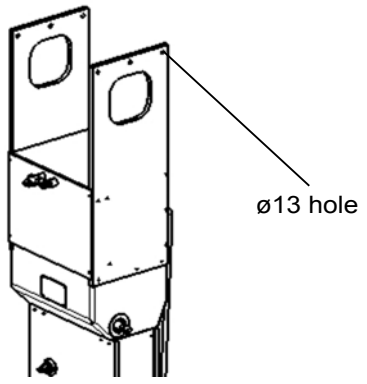


Fig-10 Installation of OLTC body

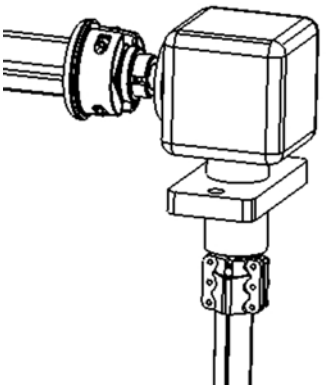


Fig.-11 Bevel gear box assembly

CAUTION

The input and output shaft of bevel gearbox should be aligned with the vertical drive shaft of motor drive unit and the horizontal drive shaft of tap changer along the same straight line.

7. 3 Motor drive unit assembly (Fig.-12)

The motor drive unit is fixed onto the designated location of transformer tank by fastening 4 pieces of M14 bolt to 4 Φ20 holes on the bottom of MDU.

Detailed installation instructions can be found in our Operation Instructions of MDU CMA7 (The overall dimensions of MDU can be found in Appendix 9 & 10 lifting hook & installation holes on ground)

CAUTION

The serial number of motor drive unit must match the serial number of the on-load tap changer (See nameplate). During coupling process, the MDU must be at the same position as the tap changer.

7.4 Installation of horizontal drive shaft (Fig.-13)

7.4.1 The horizontal drive shaft is the mechanical connection between the bevel gear box and the gear box of an on-load tap changer. It is also the mechanical connection between the gear boxes of different single-phase tap changers.

7.4.2 The drive shaft is designed as square-ended insulating shaft and the 2 ends of it are mounted with coupling pins and shaft joints.

CAUTION

During the installation of drive shaft, the tap changer and motor drive unit should be at set position.

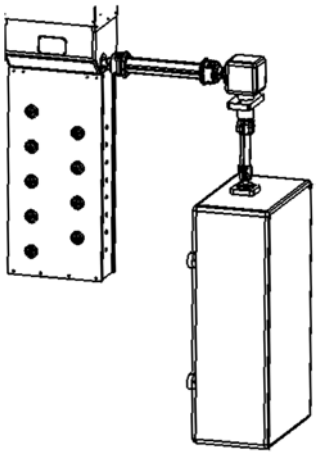


Fig.-12 Installation of MDU

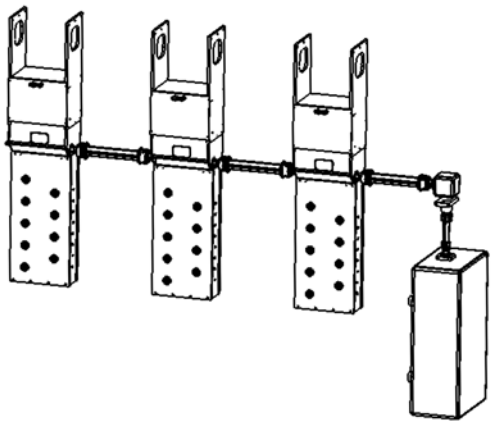


Fig.-13 Horizontal drive shaft assembly

7.4.3 Measure the distance between 2 single-phase tap changers and cut the length of shaft on basis of this value. Varnish the cut section surface with paint. Refer to appendix 11 for a diagram of installation.

Remark: Must keep enough distance between phases.

CAUTION

When connecting the shaft to each phase unit with coupling joint, it is necessary to keep an axial clearance of 3mm on shaft in axial direction. At the same time, it requires that all the centers of connection ends should be in a line (the calibration difference should be less than 8mm.

7.5 Installation of vertical drive shaft (Fig.-14)

7.5.1The vertical drive shaft is mechanical connection between the bevel gearbox and motor drive unit.

7.5.2The drive shaft is designed as a stainless steel square tube and the 2 ends of square pipe are installed with coupling pins and shaft joints.

7.5.3 If the size of square pipe exceeds the rated length, measure the distance value between the motor drive unit and the head of bevel gear box, then cut the square tube according to this value and re-install it.

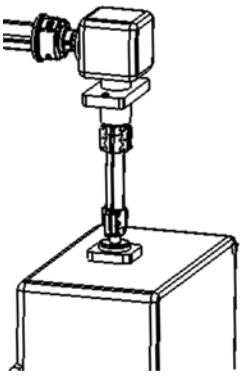


Fig.-14 Vertical drive shaft assembly

CAUTION

The position of tap changer and motor drive unit must be in accordance with each other. The tap changer and motor drive unit are both located at set position since ex-work. Please do not operate without permission.

7. 6 Adjustment of the tap changer

After connecting the tap changer, motor drive unit & the bevel gear box, adjustment shall be performed before actual operation.

7.6.1 First, adjust the link between phase A (which is close to the motor drive unit) of the tap changer and the motor drive unit. Adjust to reach a balance of turns both clockwise and counter clockwise.

7.6.2 Three phase synchronism adjustment of the tap changer
Use Phase A as a reference, adjust Phase B and Phase C of the tap changer to reach consistency. The synchronism is determined by the total turns of the hand crank of the motor drive unit before the energy accumulator is released. The degree of asynchronies shall be kept within 3/4 turns.

7.7 Installation of on-load tap changer with supporting frame

7.7.1 This design of CZ on-load tap changer is delivered with body totally assembled while the frame is to be assembled on site.

7.7.2 The supporting frame consists of footing base, right and left holders, upper holder, vertical and horizontal insulating poles and relative accessories including standard fasteners etc. When mounting the on-load tap changer with the frame, it is obliged to firstly fix the footing base of frame on ground base (the dimensions of grounding mounting holes are confirmed in order clarification). Then fix respectively the right and left holders to footing base before fastening upper holder to them. Finally fix the 4 footing with supporting plates and vertical insulating poles.

7.7.3 The installation of on-load tap changer in this case is identical to the above chapter.

7.7.4 Grounding connection should be securely performed on the supporting frame.

7.8 Installation of on-load tap changer with cabinet

7.8.1 This design of CZ on-load tap changer is delivered in integral manner with all parts assembled and coupled. All internal connection and inspection processes have been carried out before delivery. As result, neither connection nor commissioning need to be performed on site.

7.8.2 The place of installation should be absolutely plain and neat. The footings of cabinet are fixed on the ground base (the dimensions of grounding mounting holes are confirmed in order clarification). The connection of bolts must be secured.

7.8.3 Grounding connection should be securely done on the cabinet.

NOTE

In case of outdoor installation of cabinet, the relevant detailed instructions will be submitted particularly to the customer.

7.9 Grounding connection

Connect the grounding bolt to the supporting bracket of the transformer.

CAUTION

The grounding conducting lead must not affect the insulation distance to earth.

8 Connection of on-load tap changer and tap winding

It is imperative to connect the tap winding of transformer with the take-off terminals of on-load tap changer strictly according to connection diagram provided in the delivery.

CAUTION

Connect carefully all leads and make sure all connections are firm and secure. Take care that the connection could not press on the contacts of on-load tap changer, which proves distortion-proof.
The connection leads to tap selector terminals are not included in delivery.

9 Commissioning of on-load tap changer at transformer factory

Test tap switching operations

Some test tap switching operations must be performed before applying voltage to the transformer in order to check the mechanical functions of on-load tap changer (OLTC) and motor drive unit (MDU). These test tap switching operations are carried out in manual way for one cycle of operation throughout OLTC's tap range. When proceeding the operations, it is imperative to verify if the indicated position of OLTC and MDU is identical. At the same time, it is obligatory to measure the transmission ratio and DC resistor value of transformer before applying the equipment in service.

CAUTION

Non-accordance of the indicated position of OLTC and MDU proves the presence of a coupling failure. Operation with coupling problem can give rise to damage to the OLTC and transformer. In consequence, it is forbidden to run the equipment in this condition.

10 Maintenance

General inspection could be carried out by trained personnel; however, all maintenance should be performed by Huaming-trained personnel.

NOTE

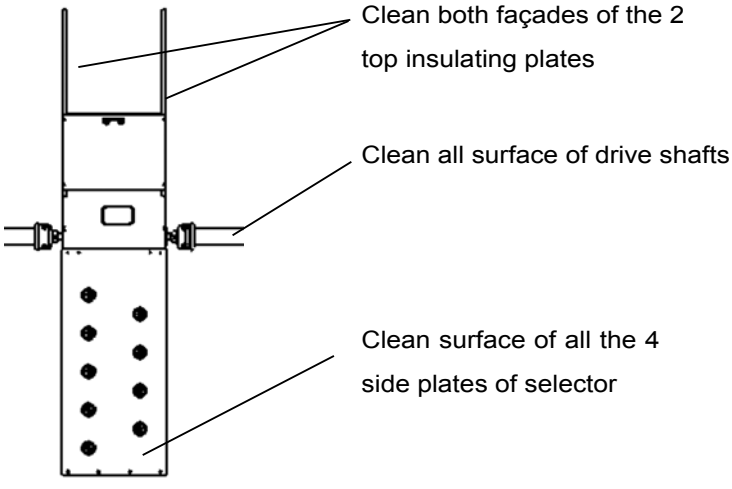
Damage will occur on tap changer and transformer if regular maintenance is not respected or is performed by unqualified personnel.

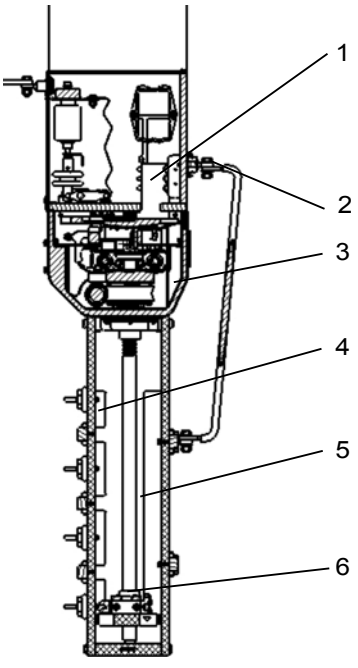
It requires one maintenance for every 100,000 operations or after one year on service. (After 800,000 operations, all tap changer be replaced) The subjects of it include:

10.1 Examine all external fasteners and see whether they are loose;

10.2 Remove dust from surface with a dry rag. (refer to the below illustration);

10.3 Lubricate the contacts of tap selector and diverter switch with industrial petroleum jelly; Add lubricant on the rotation mechanism and check the lubricant in transmission box.

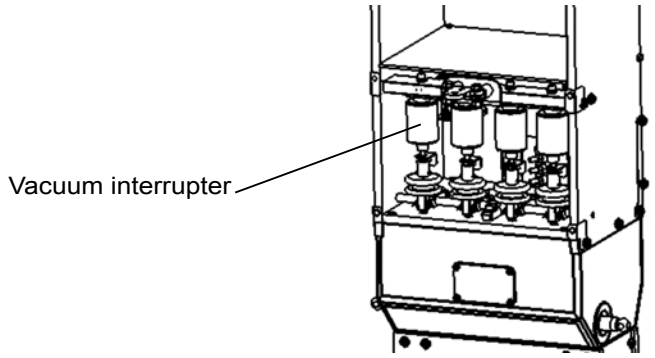




No.	Parts to be lubricated	Lubricant
1	Movable contacts of diverter switch	Industrial Petroleum jelly
2	Fix contacts of diverter switch	Industrial Petroleum jelly
3	Gear box	
4	Fix contacts of tap selector	Industrial Petroleum jelly
5	Screw rod	Industrial Petroleum jelly
6	Movable contacts of tap selector	Industrial Petroleum jelly

10.4 Check whether there exists abrasion, clamping and lack of pressure on some contacts.

10.5 Check whether the separation distance between contacts of vacuum interrupter is still over 2mm. If necessary, it requires inspecting vacuum degree by means of rated separate source AC withstand voltage test. The normal is that insulating level between fix and movable contacts of vacuum interrupter (at "open" position) can resist 4kV (50Hz 10min) as test voltage.



11 Documents

11.1 Qualification certificate;

11.2 Routine test report;

11.3 Vacuum on-load tap changer type CZ operating instructions;

11.4 Motor drive unit operating instructions and remote indicator or AVR manual.

12 Notes for ordering and application

12.1 The following data shall be offered by client when send an order:

12.1.1 Capacity of the transformer;

12.1.2 Voltage class of the transformer;

12.1.3 Max. tapping current;

12.1.4 Step voltage in the phase;

12.1.5 Drawing of transformer winding and connection model;

12.1.6 Voltage adjustment accuracy;

12.1.7 Operation positions;

12.1.8 Vector Group

12.2 Application notes

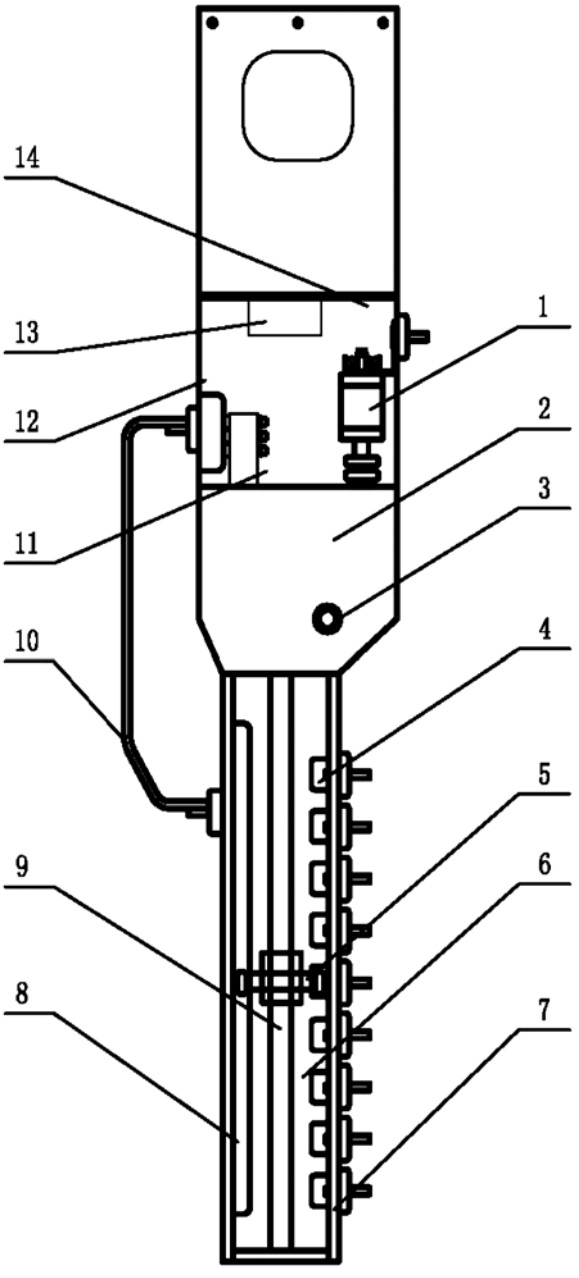
12.2.1 The product shall be stored at a dry place with ventilation, no heavy vibration and no corrosive gases;

12.2.2 User shall record the tap changer operation during application for future analysis and treatment if trouble happens;

12.2.3 Guaranteed term is 18 Months after delivery and 12 months after commissioning which ever comes first.

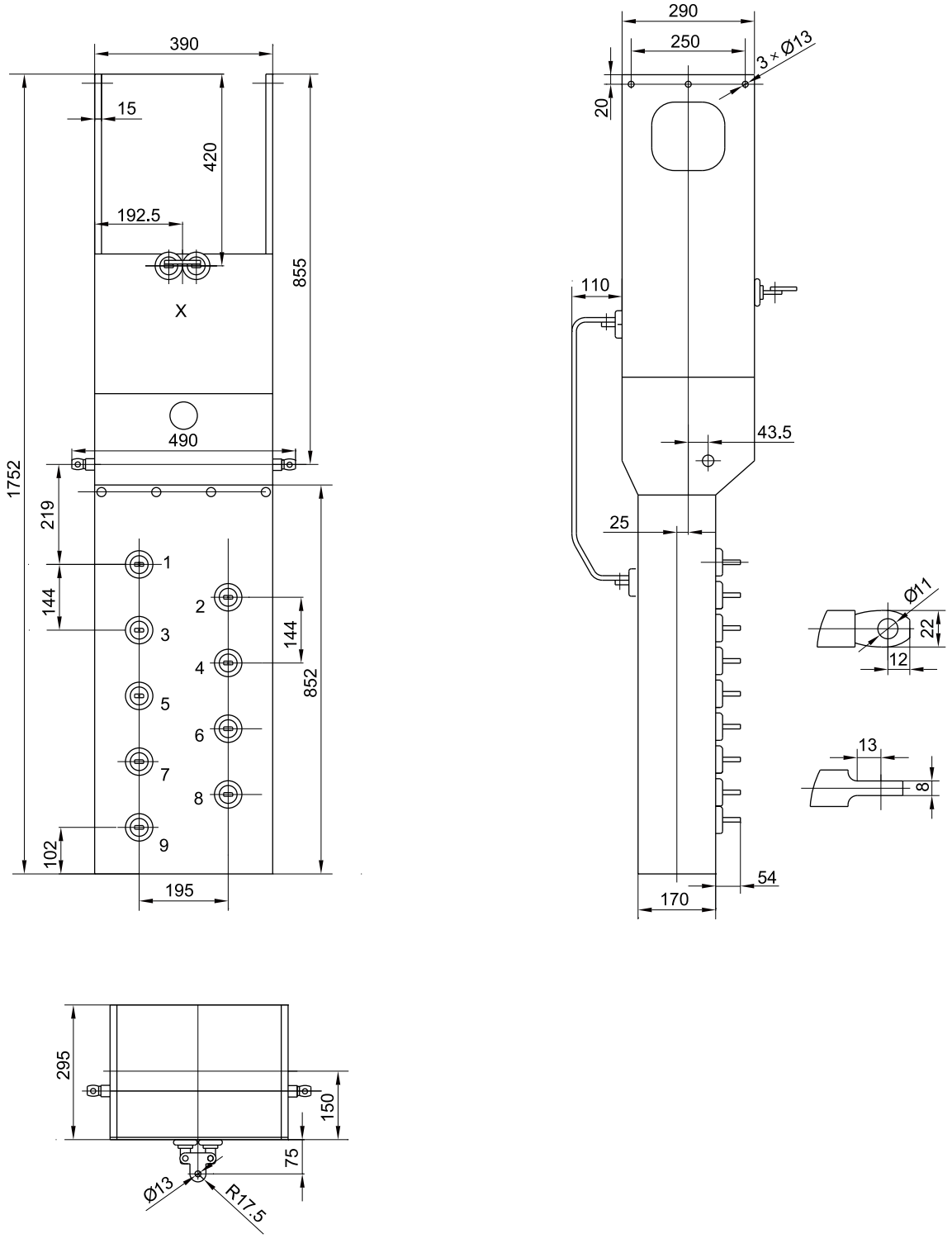
13 Appendix

Appendix 1 Structure of on-load tap changer



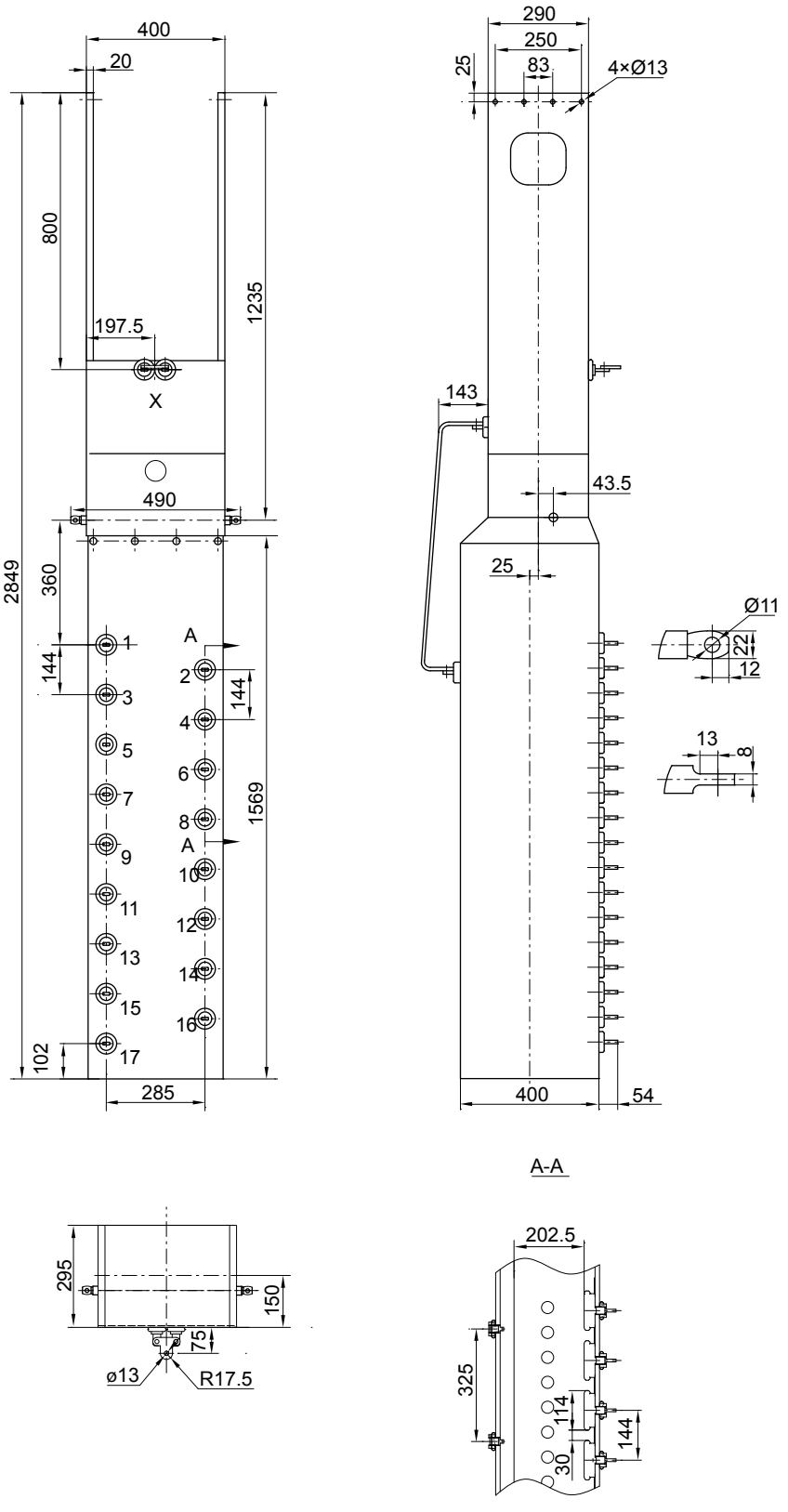
1-vacuum interrupter
2-transmission mechanism
3-drive shaft
4-fix contact of selector
5-movable contact of selector
6-tap selector
7-insulating board
8-Current take-off row
9-Screw rod
10-Conducting lead
11-Main movable contact
12-Main fix contact
13-transition resistor
14-diverter switch

Appendix 2 Overall dimensions of CZI500/ 40.5-9



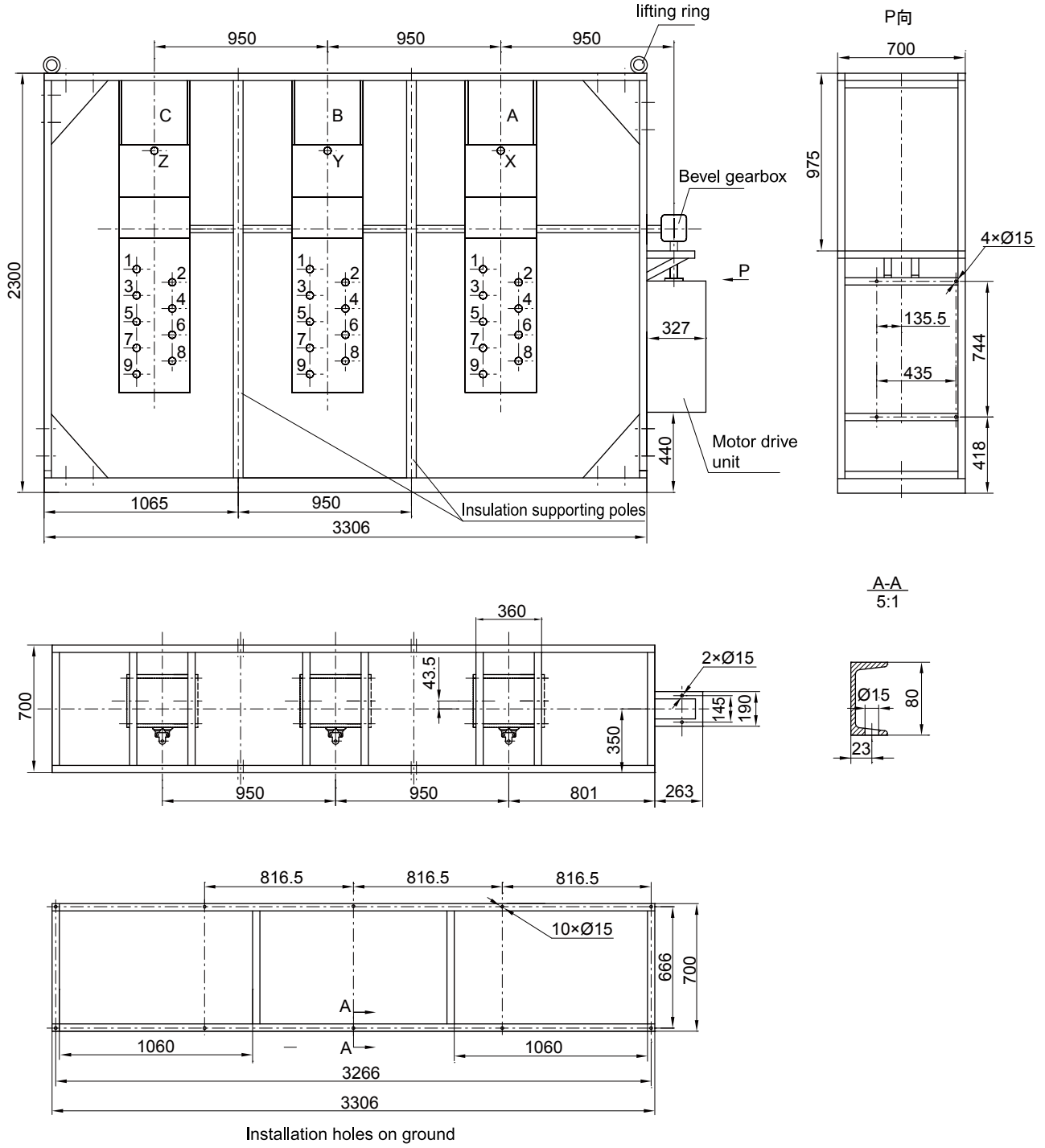
Unit: mm

Appendix 3 Overall dimensions of CZI500/ 72.5-17



Unit: mm

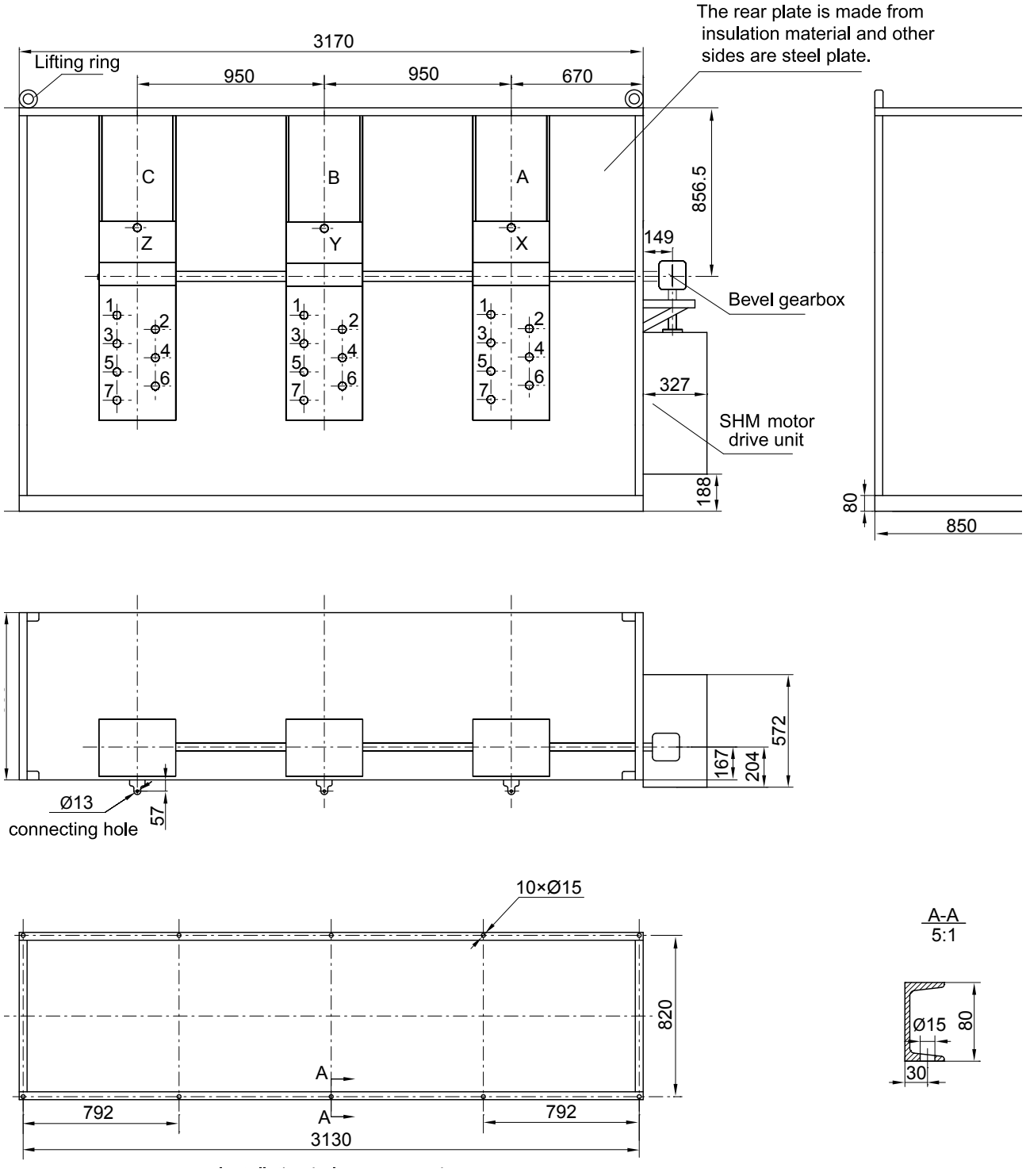
Appendix 4 3XCZI 500/ 40.5-9 with supporting frame



Installation holes on ground

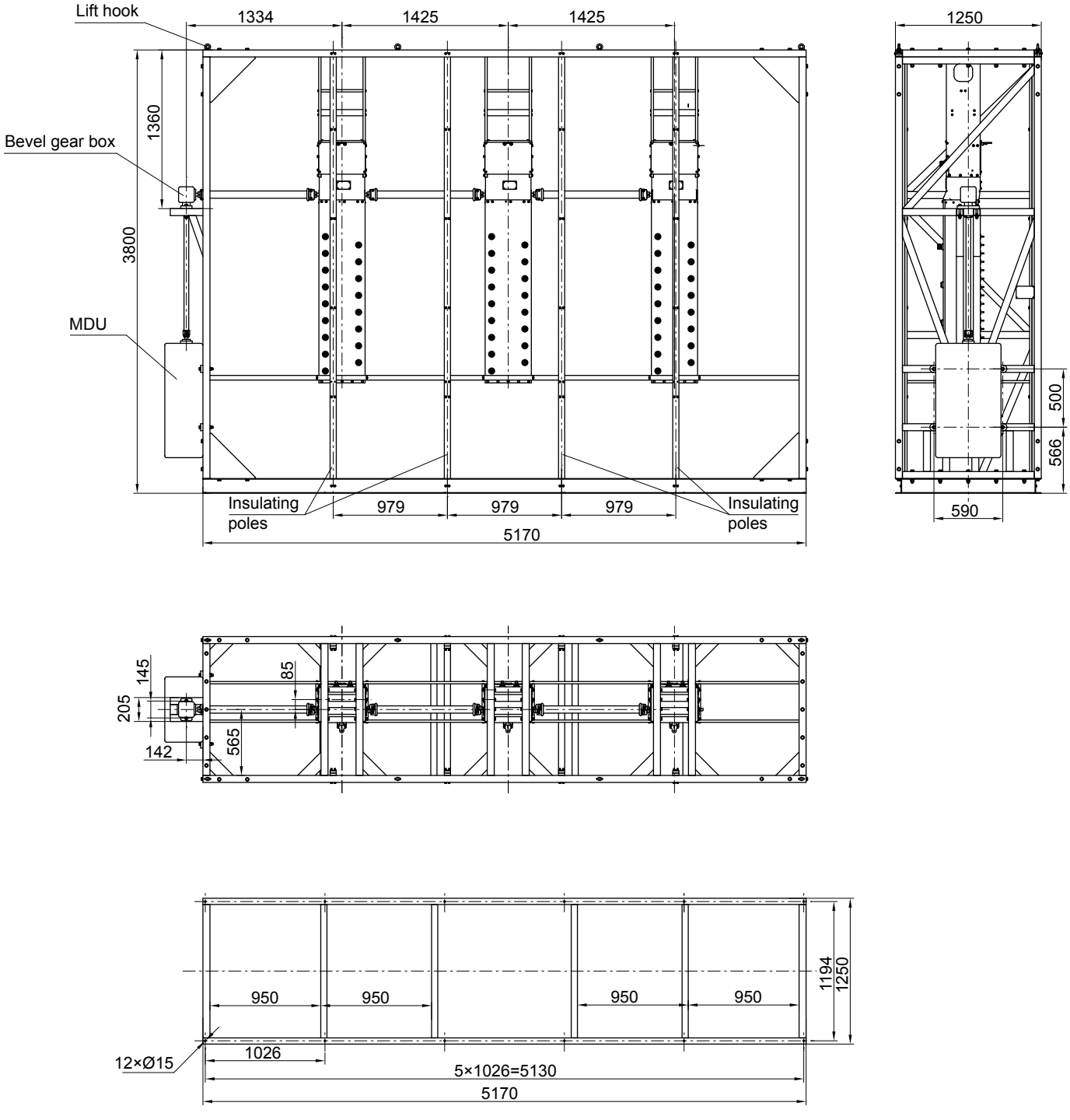
Unit: mm

Appendix 5 3XCZI500/ 40.5-9 installed in cabinet



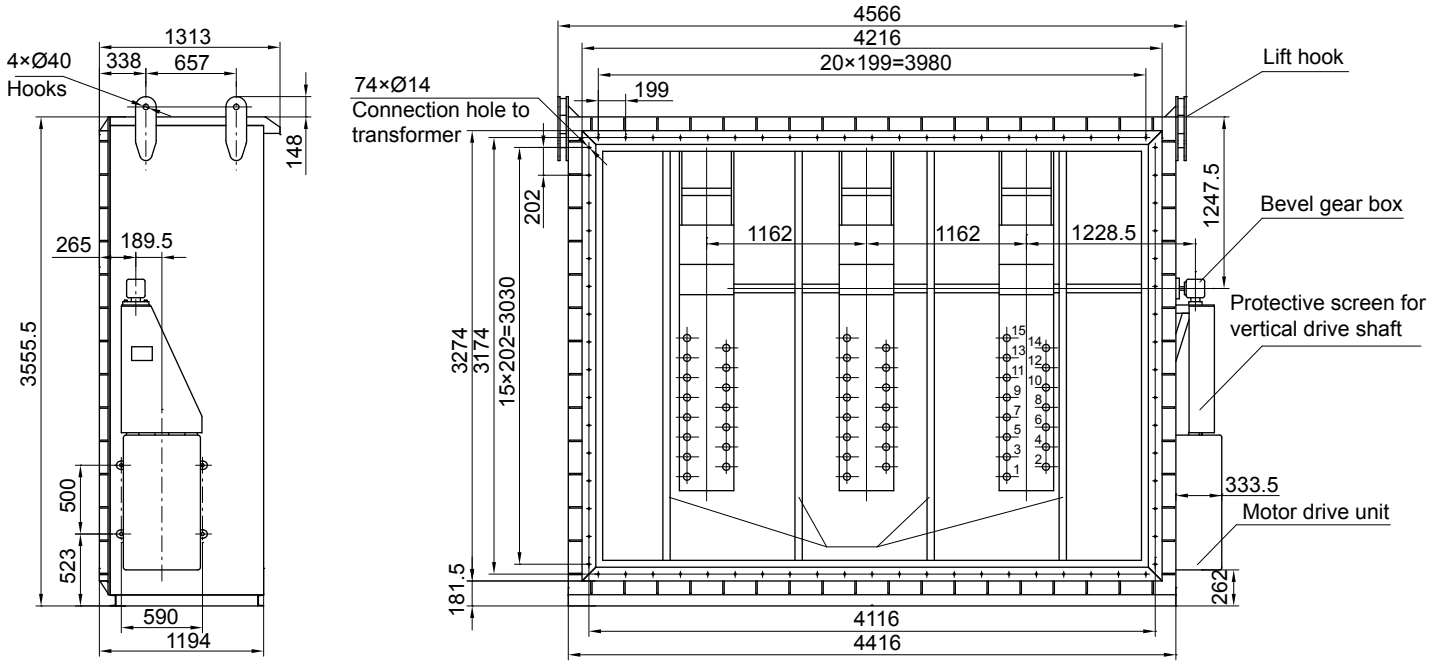
Unit: mm

Appendix 6 3XCZ I 500/ 72.5-17 with supporting frame

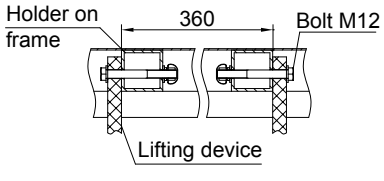


Unit: mm

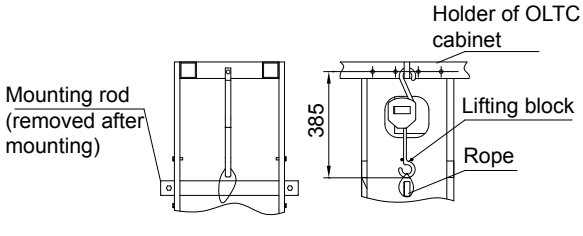
Appendix 7 3XCZI 500/72.5-15 installed in cabinet



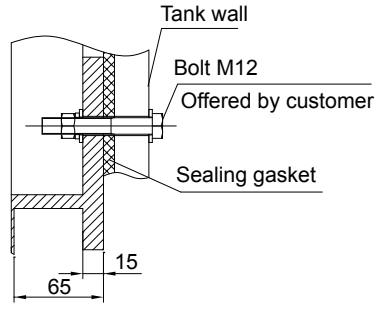
Mounting OLTC on the holder



Lifting of OLTC

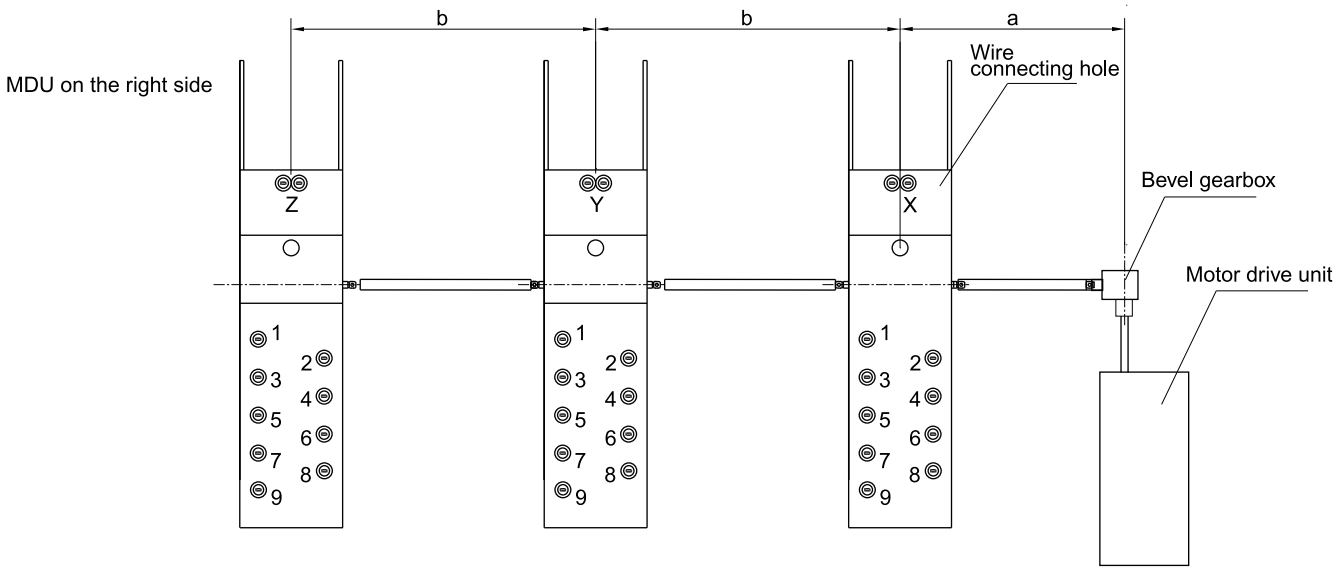


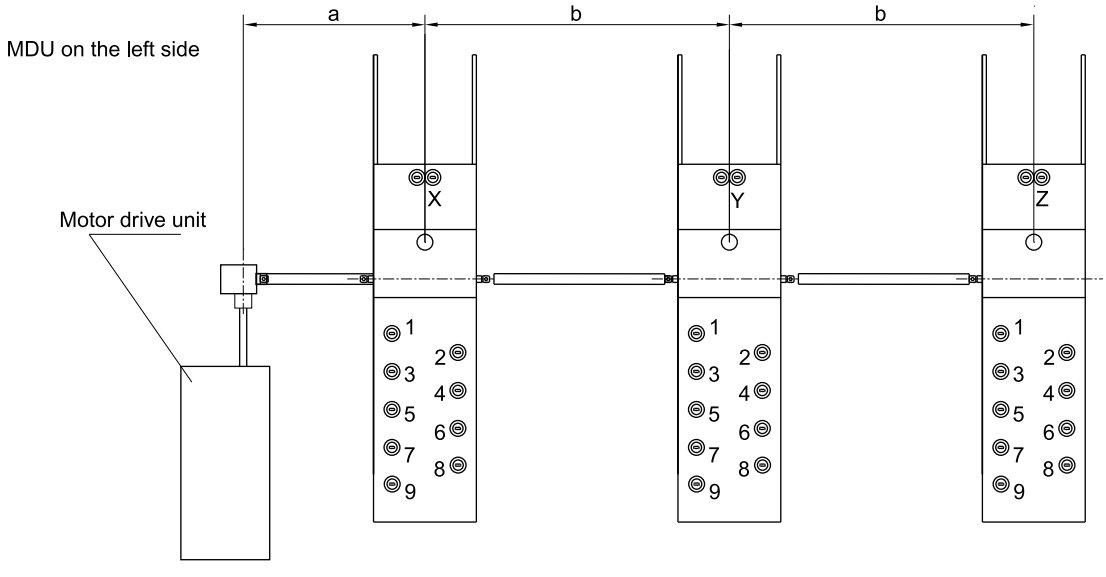
Connect the cabinet of OLTC to tank wall of transformer



Unit: mm

Appendix 8 Disposal drawing of 3 units of single phase CZ OLTC

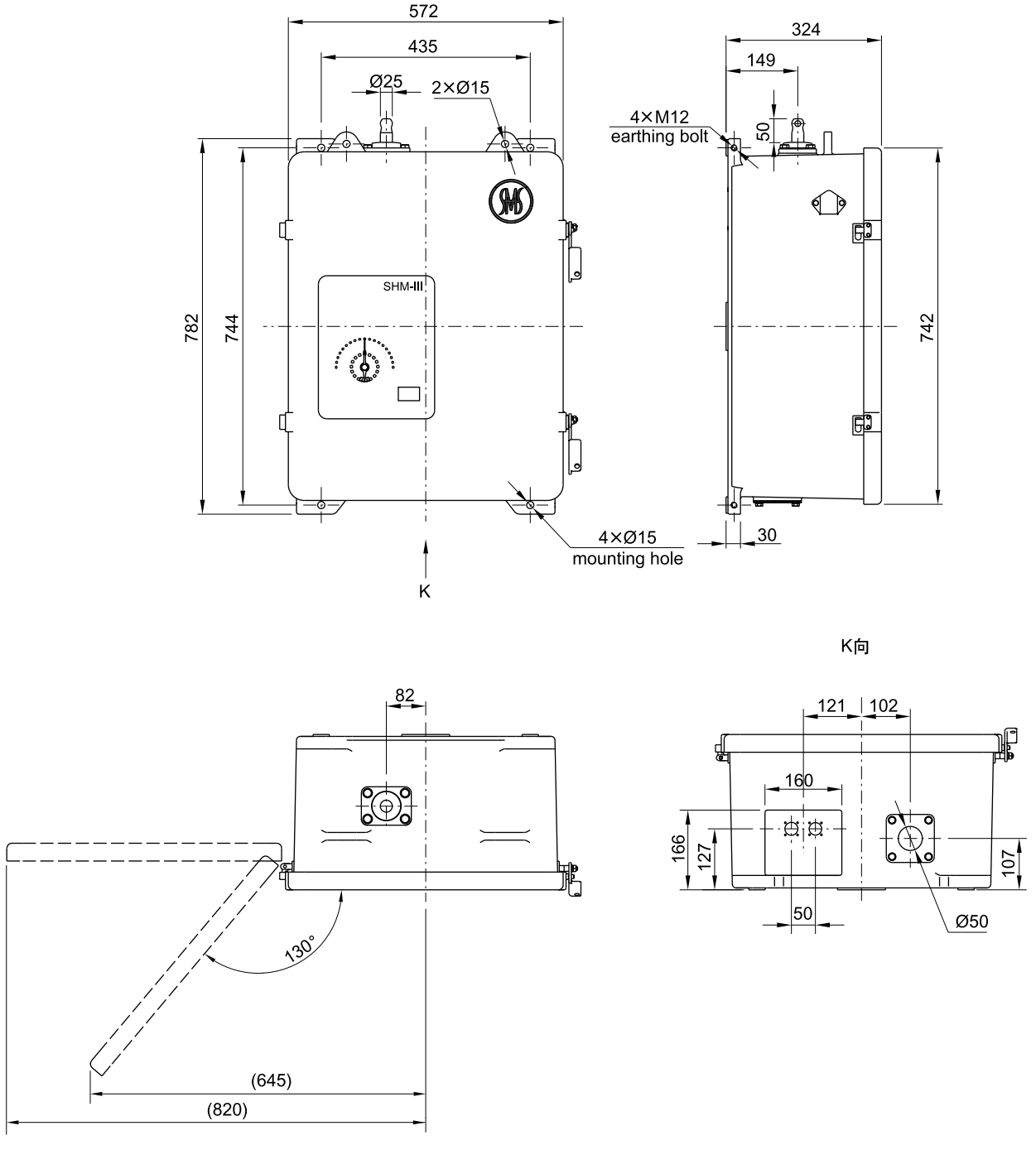




Note:
Suggested dimensions
b⩾600, when OLTC is connected at neutral point of star connection;
b⩾950, when OLTC is used for any other selectable winding connection
a⩾800

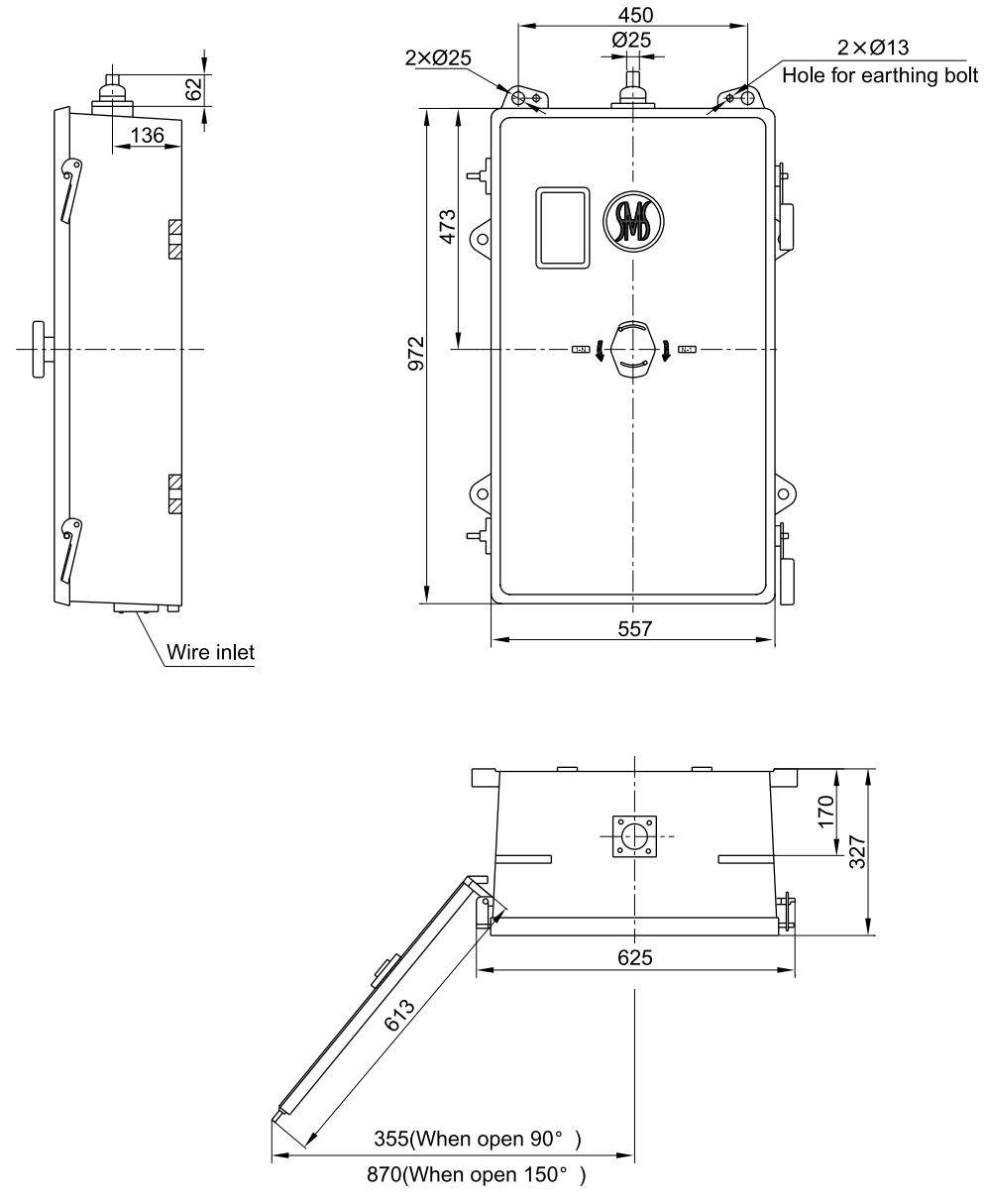
Unit: mm

Appendix 9 Overall dimensions of SHM motor drive unit



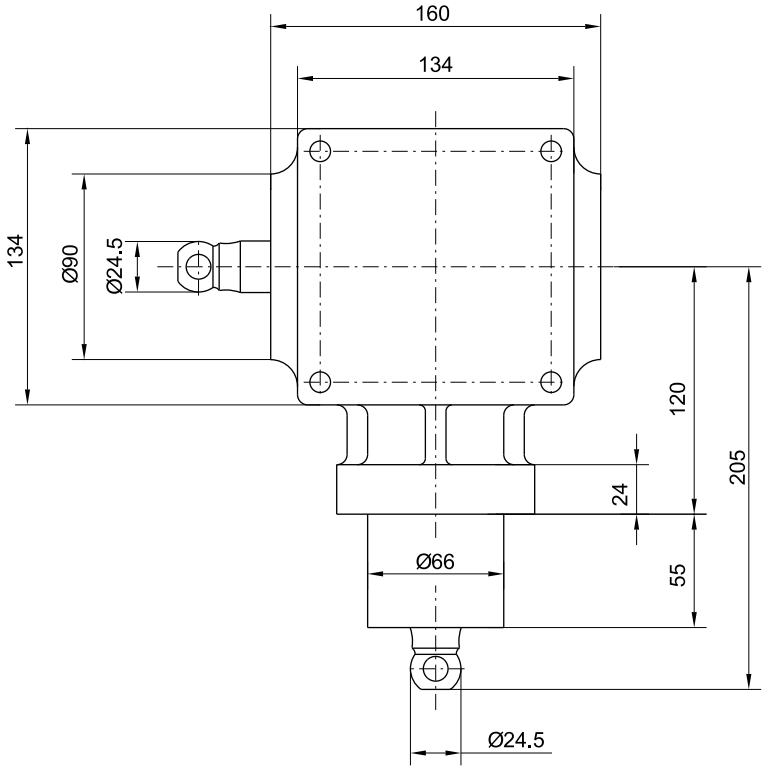
Unit: mm

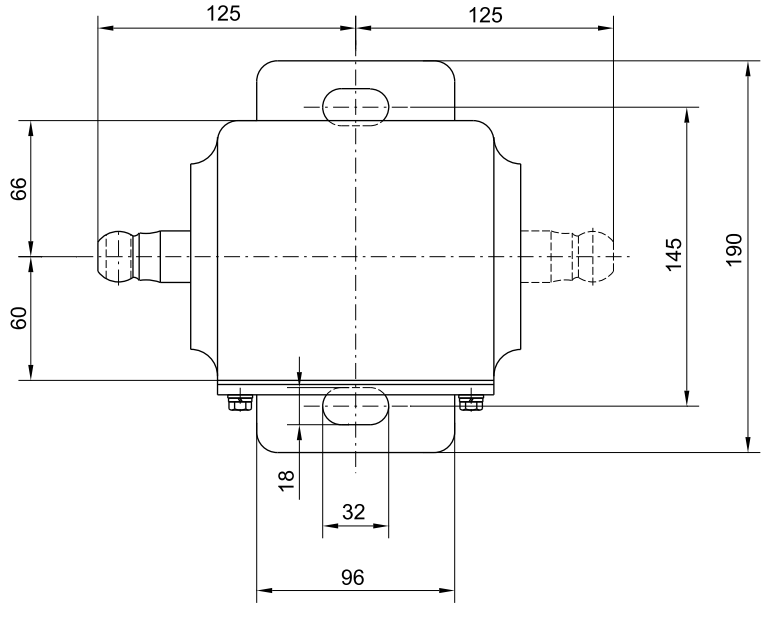
Appendix 10 Overall dimensions of CMA7 motor drive unit



Unit: mm

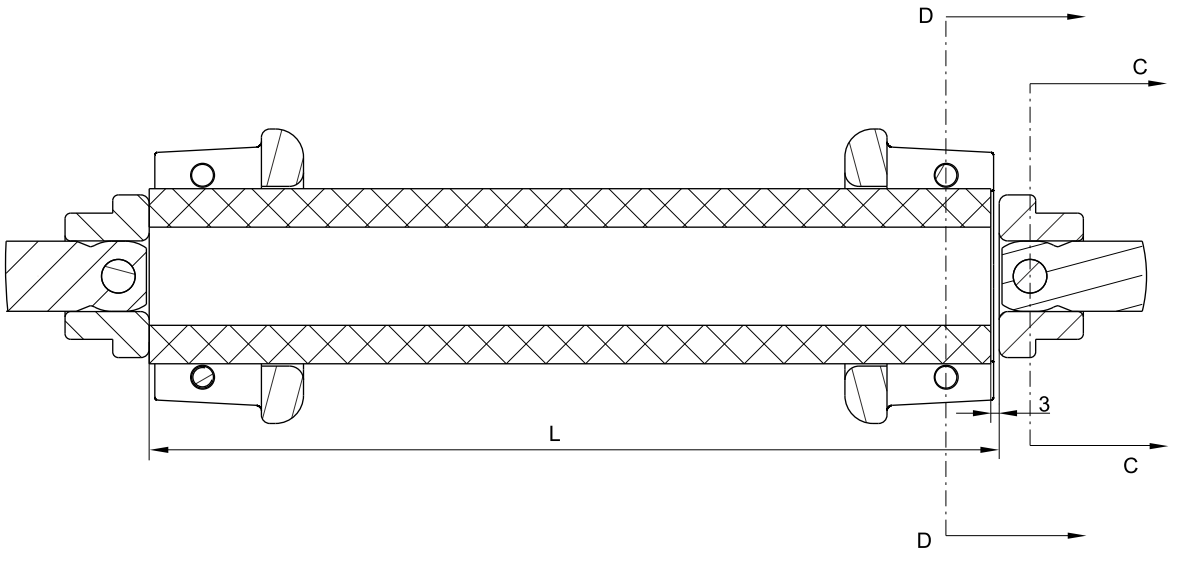
Appendix 11 Overall dimensions of bevel gear box

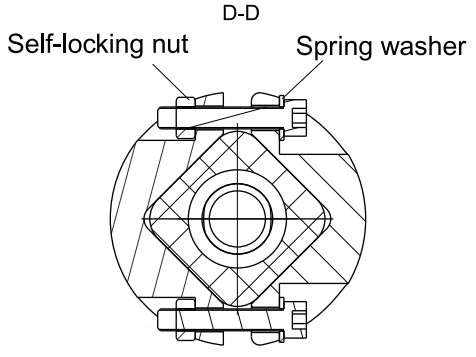


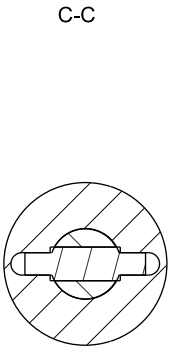


Unit: mm

Appendix 12 Installation of horizontal drive shaft







L=Distance between two ends of axis L-3=Cutting length of the shaft

Unit: mm

Shanghai Huaming Power Equipment Co., Ltd.

Address: No 977 Tong Pu Road, Shanghai 200333, P.R.China
Tel: +86 21 5270 3965 (direct)
+86 21 5270 8966 Ext. 8688 / 8123 / 8698 / 8158 / 8110 / 8658
Fax: +86 21 5270 2715
Web: www.huaming.com E-mail: export@huaming.com

01.12/2012.500