



## **GENERAL AND APPLICATION**

ZW37-40.5 model Outdoor AC HV Vacuum Circuit Breaker is jointly designed by HEAG and the relevant units organized by Sate Power Company. The design concept is novel. It adopts advanced technology, is of high technical level and accords with standards of IEC-62271-100, GB1984-2003 and DL403-91.

The product mainly applies to three phase power system of AC 50Hz 40.5kV, and is used for opening and closing load current and fault current, special for frequent operation locations.

### NORMAL SERVICE CONDITIONS

- ◆ Altitude above sea level not exceeding 1000m ;
- ♦ Environmental ambient temperature: -35°C~+40°C;
- Monthly average relative humidity not exceeding 90%, Daily average relative humidity not exceeding 95%;
- Earthquake intensity not exceeding 8 degree;
- Air polluted degree: IV;
  Ice covering thickness: 20mm;
- ♦ Wind speed not exceeding 34m/s;
- Installation site: without flammable, explosive or corrosive material, and frequent violent vibration.

# MODEL AND MEANING



1



### PRODUCT FEATURE

- General structure: A supporting porcelain insulator with an epoxy bushing. The upper is an epoxy bushing with vacuum interrupter inside, the lower is a supporting porcelain insulator with an insulation drawbar and a linkage rod. Three poles of supporting porcelain insulators are together mounted on a mechanism box, and the movable terminal of interrupter is linked with the output shaft through the insulation drawbar.
- The enclosure of interrupter is outdoor epoxy resin and is whole sealed using introduced foreign advanced technology, which has reached the international advance level and is the first domestic creation. It has advantages of anti-condensation, ant-ageing, outdoor high temperature and freezing resistant, so as to avoid a series of problems caused by gas or oil charging and has basically reached the level of maintenance-free.
- The movable terminal of interrupter is vertically linked with the output shaft through the insulation drawbar and vertically moves, which is safe, reliable and convenient for commissioning and maintenance.
- The mechanism and linkage rod are mounted inside a waterproof box, where a heater can be installed to prevent the electric control components from moisture.
- The product can be allocated with various ratios of current transformers for measurement and protection. The user can choose the right CT according to the requirement.
- The product is of novel structure, simple and reliable, small volume and light weight, and is convenient for mounting.
- It can be allocated with a control terminal interface to be used for automated distribution network and unmanned substation.

table 2

# MAIN TECHNICAL PARAMETERS

5.1	5.1 Main technical parameters of circuit breaker			table		
No		Items	Unit	Data		
1	Rated voltage		kV	40.5		
2	Rated current		Α	630, 1250, 1600, 2000		
3	Rated sho	ort-circuit breaking current		20	25	31.5
4	Rated short-circuit making current (peak)		kΔ	50	63	80
5	Rated sho	ort-time withstand current		20	25	31.5
6	Rated pea	ak withstand current		50 63 80		80
7	Rated sho	ort circuit duration	S	4		
0	Rated insulation level	1min P.F. withstand voltage	k)/	95		
8		lightning impulse withstand voltage (peak)	ΓV	185		
9	Rated ope	rating sequence		O-0.3s-CO-180s-CO		s-CO
10	Breaking t	imes of rated short-circuit breaking current	timo	20		
11	Mechanical life		ume	10000		
12	Rated ope	rating voltage	V	220 (DC、AC)		)
13	Rated voltage of auxiliary circuit V 220 (DC、AC)			)		

#### 5.2 Main mechanical parameters of circuit breaker

No	Items	Unit	Data
1	Open distance of contact	mm	20±2
2	Contacting travel of contact		3±1
3	Average closing speed	m/s	0.8±0.3
4	Average opening speed	11/3	1.8±0.3
5	Closing time		40~100
6	Opening time	Me	20~60
7	Closing/Opening time	1015	≤65
8	Three phase opening asynchronism	] [	≤2

2



continued table 2

No	Items	Unit	Data
9	Three phase closing asynchronism	ms	≤2
10	Bounce time of contact closing		≤5
11	Circuit resistance of each phase	μΩ	≪60
12	Contact self-closing pressure	N	180±50
13	Center distance between phases	mm	700±5

### **PRODUCT STRUCTURE**

6.1 The structure and installation dimension of ZW37-40.5 model vacuum circuit breaker refers to Fig. 3.

6.2 The circuit breaker consists of vacuum interrupter enclosed by epoxy resin, supporting porcelain bushing, base, operating mechanism and transmission components. Thereinto, upper wiring block, fixed conductive rod and movable conductive rod of interrupter, soft links and lower wiring block compose a conductive circuit. The operating mechanism installed on the base operates the movable conductive rod of interrupter through the transmission components which consists of crutch arm, long-axis linkage rod and insulation drawbar.

6.3 The vacuum interrupter is casted and whole sealed with high-performance epoxy resin and the shape adopts big creepage distance umbrella skirts structure with advantages of anti-condensation, anti-aging, outdoor high temperature and freezing resistant. It directly connects with the supporting porcelain bushing without the liquid or gas insulation medium filled inside .

### WORKING PRINCIPLE

The operating mechanism of spring energy storage connects with the base with 8-M12 bolt, and the working principle is as follows (see Figure 1):

7.1 Electrical energy storage: The mechanism is a two-step gear speed-down system. The motor transmits input torque to the driving pawl of the big gear through the small gear of input shaft after two-step deceleration, and the driving pawl drives the feeding bushing connected with energy storage shaft to make the crutch arm lengthen the closing spring, so as to realize energy storage. After energy is stored, the rocker arm pushes the micro-switch to cut off the power, and the clutch wheel simultaneously puts the driving pawl up to be away from the driving block, thereby to ensure that the energy storage mechanical system will not be destroyed under the effect of inertia force.

7.2 Manual energy storage: Insert the manual energy storage handle into the hole of the energy storage rocker arm, then swing up and down by about 35°, drive the pawl wheel through the pawl of rocker arm and make the energy storage shaft rotate to realize closing energy storage.

7.3 Closing operation: When the mechanism is in opening & energy stored state (Figure 1A), the closing spring will keep this state under the effect of the detent and half shaft. When the closing tripping half shaft rotates clockwise by about 20° to the tripping position, the closing detent will rotate clockwise under the force effect of the closing spring, then the closing spring will quickly release the stored energy and the closing cam will rotate clockwise, so as to complete the closing operation.

7.4 Opening operation: The mechanism keeps the closing state under the effect of the half shaft and the withhold plate of 5-linkage mechanism. When the opening half shaft rotates anti-clockwise by about 20°, the withhold plate will rotate anticlockwise, then the balance state of the linkage mechanism is released and it will move to the opening position under the load force effect of circuit breaker.

7.5 In Figure 1C & 1D,

1) When the mechanism is in energy non-stored state, if NC contacts of travel switch are connected, the energy storage switch K will close and the power of motor will be on, then the closing spring will start storing energy. After the energy is stored, NC contacts of micro-switch will open and cut off the power of motor to make it stop rotating. The micro-switch has another pair of NO contacts using for energy storage signal indicator YD.

2) After the closing spring finishes storing energy, if the mechanism is open, it will carry out closing operation as long as the closing button HA closes and the closing coil HQ is electrified. Once the closing operation is completed, NC contact of auxiliary

3



switch will open and cut off the power of closing electromagnet.

3) After the mechanism is closed, if NO contact of auxiliary switch closes, the mechanism will carry out the opening operation as long as the opening button FA closes and the opening coil FQ is electrified. Once the opening operation is completed, NO contact of auxiliary switch will open and cut off the power of the opening electromagnet coil. The auxiliary switch has other groups of NO/NC contacts using for the closing/opening indications HD, LD.



Fig. 1-A Opening & energy stored state



Fig. 1-C Opening & energy non-stored state



Fig. 1-B Closing & energy stored state



Fig. 1-D Closing & energy non-stored state

# **PRODUCT INSTALLATION, OPERATION AND DEBUGGING**

8.1 Inspection:

1) After receiving the equipment, the user shall check if the appearance is good, if the porcelain bushing and epoxy resin are broken or have the cracks, and if the mechanism box is good.

2) Check if the technical data on the name -plate accord with the ordering requirements, if the attached files are complete, and if the spare parts and accessories accord with the packing list.

### 8.2 Debugging

The circuit breaker has been strictly tested before leaving factory, the mechanical parameters satisfy the data listed in table 2 (details as per Factory Test Report). The user can carry out debugging or detection as follows:





1) Adjust the two M14 nuts at the both ends of linkage rod to meet the requirement of open distance of contact, so that the moving travel of movable conductive rod inside the interrupter will be within  $20 \pm 2$ mm.

2) In the closing position, adjust M14 nut at the lower end of linkage rod, so that the distance between the nut and the junction will be within  $3\pm1mm$  (over travel of contact).

8.3 Installation: The circuit breaker shall be horizontally fixed and installed on the concrete bracket with enough strength and stiffness with  $M4 \times 16$  bolts. Before put it into operation, please check if the indicators of opening, closing and energy storage are correct, and swab the transmission parts with adequate lubricants, firstly try manual energy storage operation and manual opening /closing operation, then proceed with electrical opening/closing operation. If every indicator is normal and accords with the technical data, do P.F. withstand test for one time, then the product can be put into operation if no abnormalities.

### LIFTING AND TRANSPORTATION

During lifting, pay attention to the centre of gravity downward, horizontally lift and overturn & leaning shall be prohibited. During transportation, necessary shockproof measure shall be taken to avoid violent vibration and collision. Suggest to bind the product by the nylon rope to protect the porcelain bushing from damaging.

# MAINTENANCE AND STORAGE

The product is not oil-filled and inflating and without leakage as a result. It is of simple structure, convenience maintenance basically reaches the level of maintenance-free. To ensure the power system safely and reliable operate, termly check and lubricating shall be done. Mainly check the operating mechanism and the transmission components, and swab the movable positions with suitable lubricants.

### COMMON FAULTS AND SOLUTION

Common Faults Points Faults	Non-normal Energy Storage	Non-normal Closing	Non-normal Opening
1. Operating power is correct or not	$\checkmark$	$\checkmark$	$\checkmark$
2. Wiring is correct or not	$\checkmark$	$\checkmark$	$\checkmark$
3. Coil is damaged or not		$\checkmark$	V
4. Changeover switch completely changes over or not		$\checkmark$	$\checkmark$
5. Adjustment of micro-switch's acting arm is suitable or not	$\checkmark$		
6. Contacting between pawl and closing half shaft is suitable or not(0.8~1.4)mm	$\checkmark$	$\checkmark$	$\checkmark$
7. Contacting between double cam and opening half shaft is suitable or not( $0.8 \sim 1.4$ )mm		$\overline{\mathbf{V}}$	$\checkmark$
8. Torsion spring force of opening half shaft is suitable or not		V	$\checkmark$

# PRINCIPLE SCHEMATIC AND WIRING DIAGRAM



ZL- Whole-bridge rectifying silicon reactor WK-Micro-switch HK- Aux. Switch HQ- Closing coil TQ- Opening coil D- Energy storage motor K- Energy storage switch HA- Closing button TA- Opening button CZ- Aero plug JX- Terminal block

Principle Schematic Wiring Diagram



-JX-12 JX-13 -JX-15 -JX-16 JX-18 -JX-19 -JX-10 JX-14 JX-17 -JX-20 -JX-11 6-XL-JX-2 -JX-5 9-XL--JX-8 JX-3 JX-4 7-XL-1-XC -\_\_\_\_\_. . 511 (18) (b) <u>201</u> <u>(5</u> (0) 33 = 51 103 105 107 109 207 209 211 205 113  $\left| \begin{array}{c} \\ \end{array} \right| \\ \hline \end{array} \right|$ 20 2 6 (12) (13) (14) (15) 17 (19) (3) 21) (22) (23) (8) (24) 9 CZ (12) (1)5  $\overline{(}$ 9 (1) (13) (14) (15) 16 21 2 3 4 6 8 (18) (19) 20 22 (24) (25)



# **OUTLINE & INSTALLATION DIMENSION**



Fig. 3-A Product Structure of Low-current Circuit Breaker (<1250A)



Fig. 3-B Product Structure of Heavy-current Circuit Breaker (>1250A)



7

Fig. 4 Installation Hole Dimension







Remarks:

1. The dimensions of steel bracket and concrete base are only for reference. The detail dimensions shall be designed according to the geological conditions on spot and the requirements of user.

2. Barb bolt 4-M16 can be imbeded in advance or fixed by second grouting. If adopt the method of second grouting, the hole for second grouting shall be deserved when pour and cast the concrete base.



华仪电气股份有限公司 HUAYI ELECTRIC CO., LTD.

Office Add: No.138 Ningkang W. Road, Yueqing City, Zhejiang, P.R. China P.C.:325600 Factory Add: Weisi Road, Yueqing Economic Development zone Yueqing, Zhejiang, P.R. China Tel: 0577-62558769 Fax: 0577-27898866 / 62538979 http://www.heag.cn E-mail: sales@heag.com

