



*The Right Choice!*

# Operation Manual

## **HDBW/HSBW Single/Three-phase**

High-power Compensation AC Voltage Stabilizer

Please read this manual carefully before installing and using the products.

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## HDBW/HSBW High-power Compensation AC Voltage Stabilizer

### 1. General

#### 1.1 Principle & characteristics

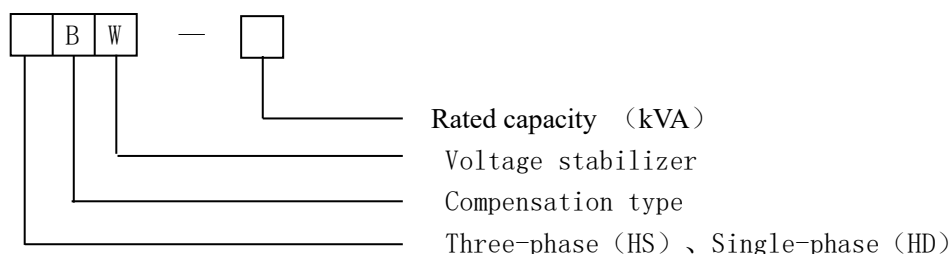
HSBW series full-automation three-phase high-power voltage stabilizer (hereinafter referred to as voltage stabilizer), is made up of post type variable voltage transformer, compensation transformer, sampling control circuit, protective control circuit, low-speed synchronous motor mechanism, etc., when the fluctuation is produced by unstable voltage or variation of user's load, the sampling circuit will process the voltage signal and transmit it to synchronous motor, in order to make the synchronous motor drive the carbon brush of post type variable voltage transformer move up and down and guarantee stable output voltage. This voltage stabilizer has lots of visual features like large capacity, low consumption, high efficiency, wide range of voltage stabilization, high precision, strong protective function, reliable run, convenience in use and maintenance and so on.

#### 1.2 Scope of application

This series of voltage stabilizers has been applied to electronic computer, precise machine tool, precise machine, testing equipment, elevator, importing equipment and process line in the following realms: industrial and mining enterprise, post & telecom, oil field, railway road, construction site, school, hospital, national defence, science research and so on. Meanwhile, it is suitable for LV distribution terminal user whose mains voltage is too low or too high, or the amplitude of fluctuation is too large as well as electrical equipment whose load varies greatly such as elevator and stirring mill, in a word, it is the best AC voltage stabilizing power supply for equipment and location requiring the stable voltage.

### 2. Model, performance index and specification

#### 2.1 Model



Scope of voltage stabilization refers to the permissible variation range of input voltage when the output voltage of voltage stabilizer is ensured within the accuracy permissible range. In general, the scope of voltage stabilization is  $\pm 20\%$ , that is, the variable range of input voltage is 304~456V.

#### 2.2 Performance index

- Wide scope of voltage stabilization: 304~456V;
- Little waveform distortion, no additive distortion;
- High accuracy of voltage stabilization:  $380V \pm 3\%$ ;
- Input voltage and output voltage have the same phase;
- Good adjustment performance: Realize stepless control;
- High efficiency: Over 98%
- Short response time: Less than 0.5S
- Applicable for any loads including resistive load, inductive load and capacitive load.
- Long service life: Run continuously for a long time;
- With under-voltage, over-voltage and failure protection functions;

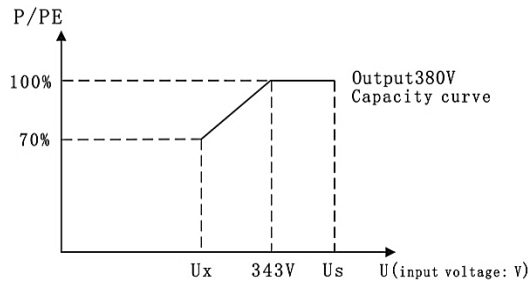
- k) Automatic cut-in (if the power network fails for several seconds, it can run automatically after delaying 5s when the power supply resumes).

### 2.3 Specification

Model		Rated capacity (kVA)	Rated power (Hz)	Scope of input voltage (V)	Output voltage (V)	Weigh (kg)
Three-phase	HSBW-10 kVA	10	50/60	304-456	380	247
	HSBW-15 kVA	15	50/60			250
	HSBW-20 kVA	20	50/60			255
	HSBW-30 kVA	30	50/60			260
	HSBW-50 kVA	50	50/60			295
	HSBW-100 kVA	100	50/60			400
	HSBW-150 kVA	150	50/60			660
	HSBW-180 kVA	180	50/60			710
	HSBW-200 kVA	200	50/60			770
	HSBW-225 kVA	225	50/60			815
	HSBW-250 kVA	250	50/60			830
	HSBW-300 kVA	300	50/60			1033
	HSBW-320 kVA	320	50/60			1074
	HSBW-350 kVA	350	50/60			1135
	HSBW-400 kVA	400	50/60			1195
	HSBW-500 kVA	500	50/60			1310
	HSBW-600 kVA	600	50/60			1410
	HSBW-800 kVA	800	50/60			2150
	HSBW-1000kVA	1000	50/60			3100
	HSBW-1600 kVA	1600	50/60			5000
HSBW-2000 kVA	2000	50/60	7000			
Single-phase	HDBW-10 kVA	10	50/60	176-264	220	220
	HDBW-20 kVA	20	50/60			270
	HDBW-30 kVA	30	50/60			335
	HDBW-50 kVA	50	50/60			355
	HDBW-100 kVA	100	50/60			455

Note: If any special requirements, please negotiate with the manufacturer.

### 2.4 Curve of output capacity



**Curve of output capacity**

**3 Service conditions**

Indoor normal service conditions for HS (HD) BW series voltage stabilizer as follows:

Environment temperature: -5°C~+40°C

Altitude: 1000m below;

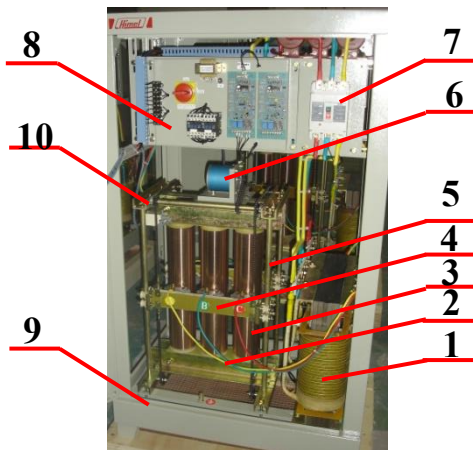
Relative humidity: 90%

Place for installing: No gas, steam, chemical deposition, dust, dirt or explosive and corrosive mediums seriously affecting the electric insulation, and

Without serious vibration or bump

**4 Structure & operating principle**

**4.1 Refer to figure 1 for structure of HSBW series voltage stabilizer**



Illustration

- 1. Compensation transformer(T2)
- 2. Transformer (T1)
- 3. Chain
- 4. Insulating holder of carbon brush
- 5. Cross shaft
- 6. Synchronous motor
- 7. Molded case circuit breaker
- 8. Control board
- 9. Frame
- 10. Travel switch

Diagram 1 Structure of HSBW voltage stabilizer

**4.2 Working principle**

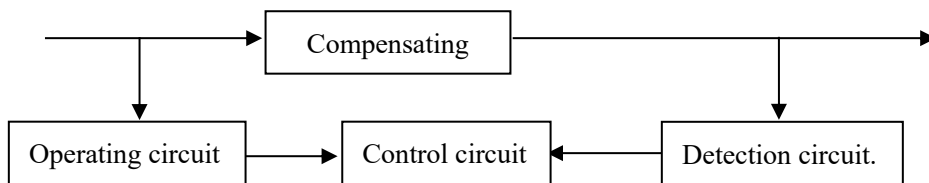


Diagram 2

The voltage stabilizer comprises compensating circuit, operating circuit, control circuit and detection circuit, as shown in diagram 2, hereinto, the compensating circuit, detection circuit and control circuit compose the automatic compensation system of output voltage.

The compensating circuit is consisted of compensation transformer T2 and regulating transformer T1 with the synchronous motor and gearing-down mechanism, its auto compensation principle of output circuit takes phase A as the example, the relevant information is described as follows, and it is clear from diagram 3, when the impedance drop of compensation transformer is ignored, the formula  $U_{Ao} = U_{Ai} \pm \Delta U$  will be got

Wherein:  $U_{Ai}$  represents the voltage stabilizer A-phase input voltage;

$\Delta U$  represents the voltage stabilizer A-phase compensation voltage;

$U_{Ao}$  represents the voltage stabilizer A-phase output voltage;

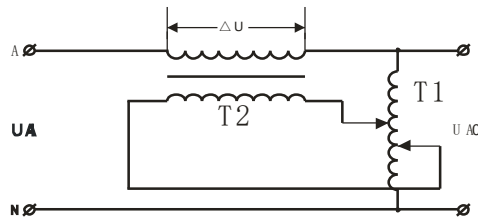
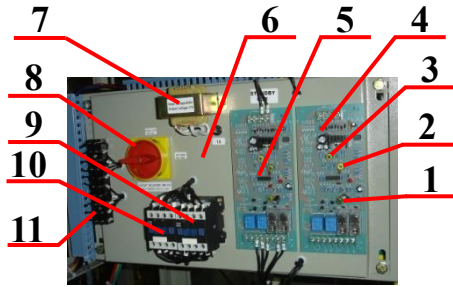


Diagram 3

When the input voltage  $U_{Ai}$  changes, or the output voltage  $U_{Ao}$  changes due to load disturbance, the detection circuit will collect sampling signals from the output terminal of voltage stabilizer, then send out control orders to command the synchronous machine to drive carbon brush to slide along the coil surface to-and-fro, thus to regulate the output voltage, and finally change the direction and magnitude of compensation voltage  $\Delta U$  of the correction transformer, and realize the aim of keeping the output voltage  $U_{Ao}$  stable automatically.



Description

- |                                  |                           |
|----------------------------------|---------------------------|
| 1. Potentiometer W3              | 7. Transformer T3         |
| 2. Potentiometer W2              | 8. Output selector switch |
| 3. Potentiometer W1              | 9. AC contactor KM1       |
| 4. Control circuit board         | 10. AC contactor KM2      |
| 5. Standby control circuit board | 11. Connecting terminal   |
| 6. Master control board          |                           |

Diagram 4 Structure drawing of control board

**5. Main parts**

**5.1 Correction transformer (T2)**

Correction transformer (T2) is a type of three-phase dry type transformer, can be used to change voltage.

**5.2 Regulating transformer (T1)**

Regulating transformer (T1) is a type of three-phase autotransformer that drives three pairs of symmetrical sliding brushes with synchronous motor. The output voltage of secondary voltage  $\Delta U$  (compensation voltage) can be regulated and kept stable through driving the carbon brush by synchronous motor with chain to slide along the bare part (slide way) of drum type winding of the autotransformer.

**5.3 Control circuit**

Voltage detection circuit is a control circuit that gives the control order to drive the synchronous motor to rotate forward, rotate inversely or stop rotation through sampling, rectifying, filtering, stabilizing voltage and comparing the voltage.

**6. Outline size**

Outline size of voltage stabilizer as follows:

Capacity (kVA)		Outline structure		Size (mm)
Three-phase	HSBW-10~50	Enclosed type	Single-cabinet	800×570×1320
	HSBW-100			850×645×1430
	HSBW-150			1050×750×1750
	HSBW-180~250			1050×750×1850
	HSBW-300			1200×950×2050
	HSBW-400			1200×1100×2155
	HSBW-500			1400×1100×2155
	HSBW-600			1400×1100×2255
	HSBW-800			1350×1100×2255
	HSBW-1000			1400×1200×2255
	HSBW-1600~2000		Four-cabinet	1450×1200×2255
Single-phase	HDBW-20~50k	Enclosed type	Single-cabinet	800×570×1320
	HDBW-75~100k			850×620×1700

## **7. Use & maintain**

### **7.1 Unpacking inspection**

Please make unpacking inspection to check if the product is in right condition, to check if it is in line with your requirements on power and voltage class, to see if the mechanical part and metal part are rusted or deformed, also to examine if the product is damaged due to transportation or inappropriate storage. If found the above phenomenon, the product is not suitable for putting into operation, please contact the supplier for solutions in time.

### **7.2 Inspection before electrifying**

- a) Each part of the voltage stabilizer should be in right condition, fasteners should be firm and reliable;
- b) Carbon brush element should be clean and dry, the contact part should be reliable, and the movable part should be flexible;
- c) Carbon brush and slide way of regulating transformer should be clean and smooth, no oxide film;
- d) Carbon brush should be poisoned on the slide way smoothly, no defect or damage;
- e) Input voltage is in line with the voltage stabilizing range of the voltage stabilizer.

### **7.3 Wiring**

7.3.1 Connect the power input lines to A, B and C binding posts of input terminal of voltage stabilizer, connect the loads to a, b and c binding posts of output terminal, please connect according to the color code yellow, green and red of the bus line, zero line (neutral line) should be connected to O (N) binding post of voltage stabilizer or to the lower copper bar, only when the zero line has been wired in that the product can be put into operation, at last, the enclosure must be earthed reliably.

7.3.2 For voltage stabilizer of double-cabinet or above, bus line among cabinets should be wired according to the color, others can be connected according to the number.

### **7.4 Power-on inspection and regulation**

7.4.1 No-load inspection (please turn off the electrical equipment first)

7.4.1.1 When the wiring is finished, please set the manual/auto change-over switch on the panel in the “Manual” position, set the self-starting switch (toggle switch in the machine) in the “Stop” position, close the mains switch, power indicator on the panel goes on, press the “Utility power” button, the output voltage displayed by voltmeter should be the same as input voltage and line voltage.

7.4.1.2 Press “Stop” button and then “Start” button to turn on the self-compensating system, indicator lamp goes on, if the “Step Down” or “Step Up” buttons are pressed for short time, the synchronous machine will drive the carbon brush to slide, and the output voltage will be decreased or increased correspondingly, if the “Step Up” button is pressed continuously, the over-voltage protection circuit will cut off the power supply automatically when the output voltage is beyond 425V.

7.4.1.3 Set the manual/auto change-over switch in the “Manual” position, press “Start” button and then “Step Up” or “Step Down” button to enable the power supply of synchronous machine to be cut off when the carbon brush slide or the two sides of slide way impact on the limit switch, please pay attention that this test should be finished in short time, otherwise, some faults would be caused due to over-high output voltage; (Note: This item has been well regulated before the product leave the factory, users need not regulate again)

7.4.1.4 Set the manual/auto change-over switch in the “Auto” position, output voltage can be

regulated into the voltage-stabilizing range automatically.

7.4.1.5 Set the self-starting switch in the “Utility Power” or “Voltage Stabilization” position; cut off the power supply, close again several seconds later, the system can be put into service automatically 5s later, and output utility power or stabilized voltage. When the self-starting switch is set in the “Stop” position, it cannot start automatically when the power is cut off, only when pressing the “Start” button that it can start again.

7.4.2 Regulation of output voltage, over-voltage value and under-voltage value

7.4.2.1 Voltage-stabilizing accuracy of the product is about 3% when the product leaves the factory, usually users need not regulate it again.

7.4.2.2 If necessary, regulate the output voltage through regulating the potentiometer W1 on the control board.

7.4.2.3 When the product leaves the factory, the over-voltage protection value has been set as follows: Phase voltage  $246V \pm 4V$ , line voltage  $425V \pm 7V$ , and the under-voltage protection value has been set as follows: Phase voltage  $184 \pm 4V$ , line voltage  $320V \pm 7V$ , usually users need not regulate them again. W2 is used to regulate the under-voltage protection value, and W3 is used to regulate the over-voltage protection value.

7.5 Notification for order

7.5.1 Please completely understand the service conditions and service methods before putting the machine into operation;

7.5.2 The load current can't exceed the specified output current;

7.5.3 When the input voltage is in the permissible range, provided that the output voltage is unstable, please examine and remove the fault, then, let the machine run again.

7.5.4 When the input voltage exceeds the permissible range, the output voltage will vary correspondingly; in case that it is far beyond the permissible range, this machine will protect by itself, without any voltage output, so it takes effect on protecting electrical equipment and the machine itself, if user has to go on using the power supply, just start the “utility power” button, the voltage stabilizer will output the utility power, but itself can't work.

7.5.5 Under normal service conditions, the voltage stabilizer can run continuously for a long time at rated load.

7.6 Symptom analysis and remedy

7.6.1 Output voltage far deviates the stable value:

- a) The manual/auto change-over switch is not in the “auto” position; please set it in the “auto” position.
- b) The input voltage is beyond the range of voltage stabilization;
- c) The carbon brush is poor in contact or hasn't slid on the slide way; please give the correct adjustment.
- d) The machine is in the state of utility power output, it hasn't passed voltage stabilization, so the indicator lamp of voltage stabilization can't go on.

7.6.2 The output voltage has tiny deviation from stable value; please adjust the voltage stabilization potentiometer W1 on the control board.

7.6.3 The vibration of output voltage: The instantaneous fluctuation of mains voltage is quite large, or the load varies frequently.

7.6.4 No voltage output:

- a) KM3 is destroyed



- b) The machine occurs fault, the protective circuit starts (LBD on the control panel goes on).
- c) The input voltage scope far exceeds the specified value, which shows on the control circuit board of over/under voltage protection. (luminescent tube goes on).

7.6.5 The following phenomena not involved in the fault range:

- a) After energized, the device can't start yet, the reason that is open-phase or no neutral wire;
- b) Under no load, the output is normal, but under full load, the output voltage drops, the reason is that the input line is too long or its sectional area is too small.

## 7.7 Maintain

7.7.1 Clear away the dust and dirt on each part of voltage stabilizer, especially, on the carbon brush, slide way, brush holder, guide rail and speed change mechanism, and the dust or dirt must be cleared away with the "carbon tetrachloride" and cotton cloth;

7.7.2 Change the brush that has been worn or damaged;

7.7.3 Repair or change the elements that has the failure;

7.7.4 After the machine runs for 2-3 months, the chain tightness degree shall be adjusted, and the rotation part of machine shall be fed with the engine oil.

## 8. After-sale service

Any high-power compensation AC voltage stabilizer manufactured by us, its guarantee period lasts 12 months from purchasing day, within the guarantee period, if the product has any quality problem, user may contact our maintenance service or distributor with the sales invoice or product warranty card, and will get the satisfying reply.

## 9. Notification for order

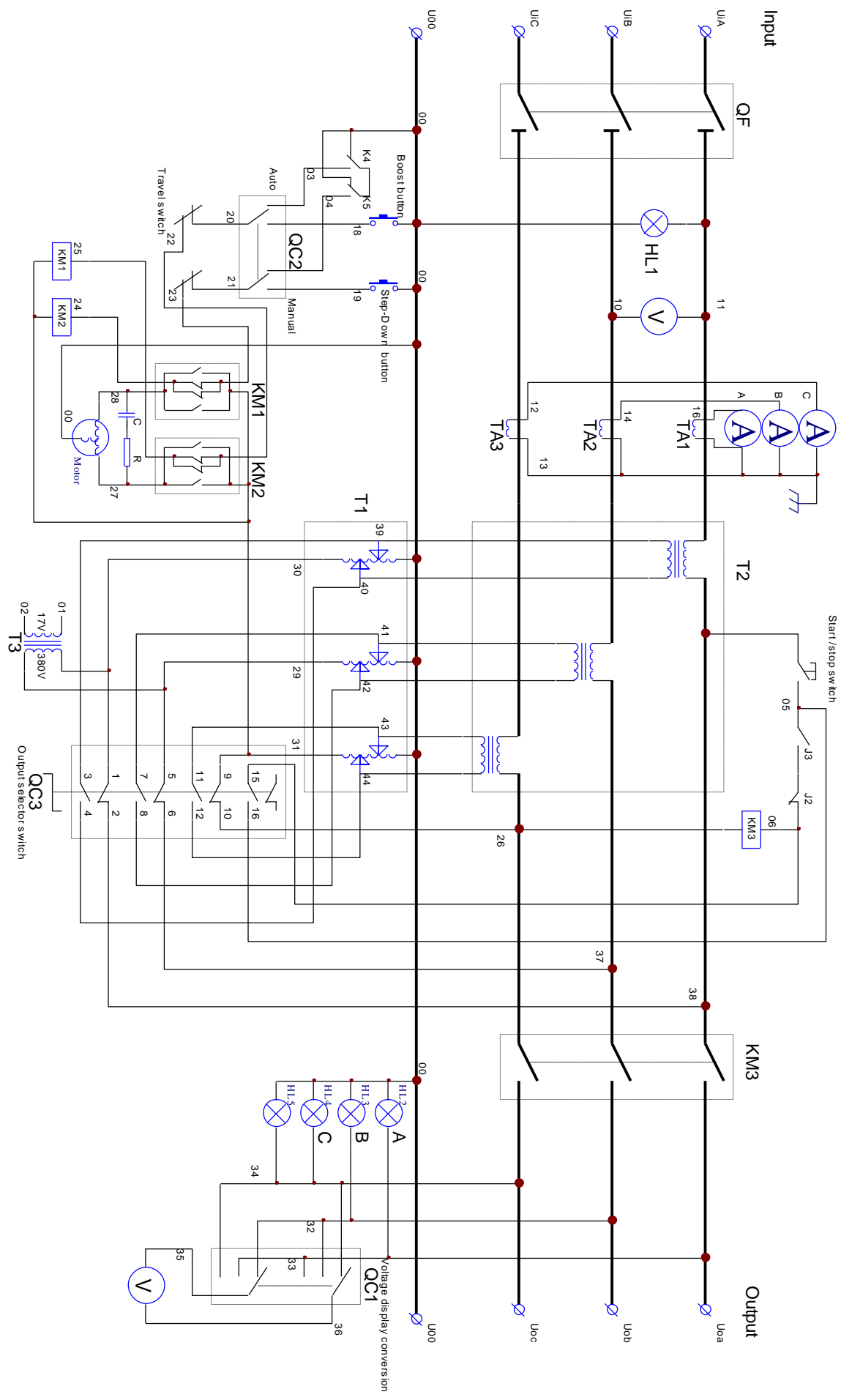
9.1 When ordering, please specify the model, capacity, accuracy of voltage stabilization, scope of input voltage and output voltage;

9.2 If any particular requirements, please contact us, we will design according to your requirements.

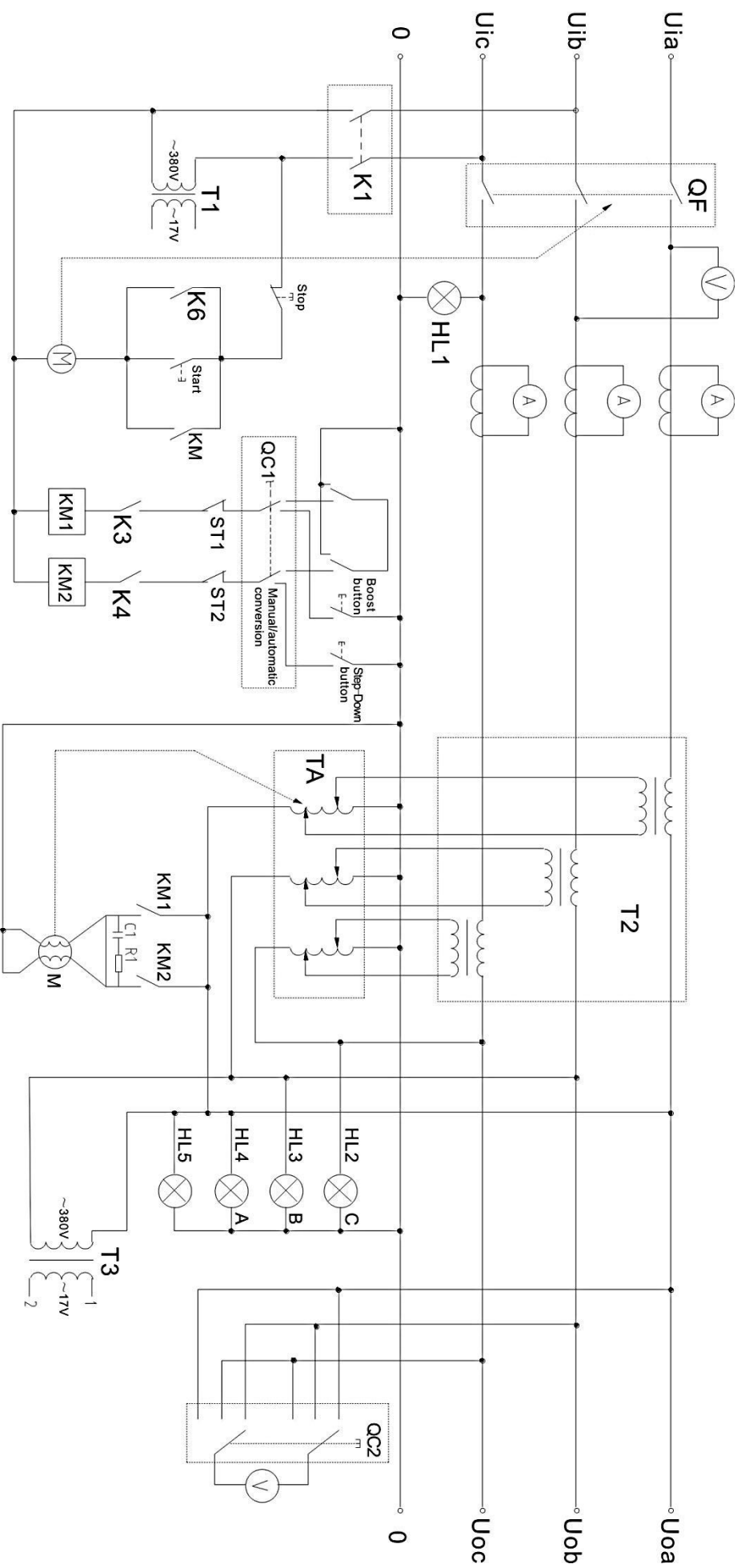
9.3 When delivered, the following accessories shall be contained:

- a) One copy of operation manual
- b) One set of carbon brush
- c) One standby control board (Have been assembled in the machine);

# HSBW-10~250kVA Electrical schematic



# HSBW-300~800kVA Electrical schematic



# PCB Schematic

