INSTRUCTION MANUAL

For

SINGLE PHASE & THREE PHASE
AC Voltage Stabilizers

Please read this manual carefully before using the product.

Contents

Operating Instruction

1. Summary

The SVC/TND, SVC/TNS, SBW and DBW Series AC compensating electric-power Voltage Stabilizers are designed to stabilize the voltage of output current, using the latest technology introduced from Europe and Japan. When the inputvoltage from the power grid fluctuates, the voltage stabilizer will automatically adjust by itselfto the preset output voltage.

These voltage stabilizers incorporate large capacitance, high efficiency, no-waveform distortion and automatic voltage adjustment so that they can function properly. The stabilizer can withstand instantaneous overload and operate for a long time. It has optimal manual-operation and automatic-operation functions. It is designed to protect equipment from over and trader voltage, and phase failures.

These series vary from small, light weight, to large, complicated casings, with ease of installation and running reliability, They can be used for large-scale electromechanical equipment, metal-processing equipment, production line, construction engineering equipment, elevators, medical treatment appliances, computer chambers, computer-control equipment, embroidery and textile equipment, and other industrial equipment, air conditioners, broadcast and television, bowling equipment, hotels and home appliances, and lighting in various fields, etc., etc., that require stable voltages.

2. Strueture

It comprises of phase compensating transformer, phase regulating transformer, insulating transformer, gearing, electrical brush contact system, case-body and control panel. The surface of the cylindrical solenoid for the three-phase regulating transformer is burnished with wipe-off insulation. Smooth conductor surface enables efficient with the electrical brush. The gearing is made up of servo motor, worm-wheel gear, gear, chain wheel and chain. Reliable structure of the brush contact system ensures appropriate brush pressure. The case is of enclosed type, small with good heat dissipation. The control panel is easily readable with accurate indications.

3. Operational Prineiple

Three Phase AC Compensating Electric-power Voltage Stabilizers are made up of three-phase compensating transformer, three-phase regulating transformer, TUV voltage detecting unit, servo motor control and gearing, contact operating circuit and protection circuit. The electric functional block diagram is shown in Fig l.

The primary winding of the regulating transformer TUV is connected in the shape of a Y. It is connected with the output terminal of the voltage stabilizer; the secondary winding is connected with the primary winding of the compensating transformerTB. The operation principle of the compensating

transformer can be found in Fig 2. The impedance drop of the compensating transformer is calculated as follows :

Uao= Uai+ Uac

In the formula.

Uai.... A-phase input voltage of the voltage stabilizer

Uao ....A-phase output voltage of the voltage stabilizer

Uac ....A-phase compensating voltage of the voltage stabilizer

The principle is: When the A-phase voltage increases by △Uai, △Uac of the compensating voltage Uac will change accordingly; and when Uac is equal to Uai, A-phase output voltage Uao is kept constant. B and C phases follow the same principle.

The procedure of voltage-stabilizing is as follows: Once the output voltage is set, the voltage detecting unit will signal the control unit which operates the servo motor,SM, through a reducing mechanism and drive the electrical brush set on the regulating transformer to slide or scroll with the chain. In this way, the secondary voltage of the regulating transformer call be adjusted to change the polarity and magnitude of the compensating voltage and control the output voltage to thepermitted range of voltage set.

Fig 1 Electric functional block diagram of automatic compensating electric-power voltage stabilizer

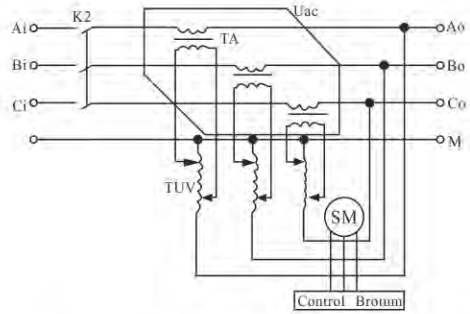
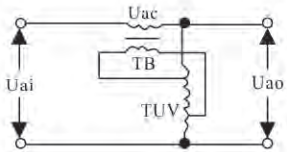


Fig 2 Schematic diagram of single-phase compensating circuit



4. **Basic components and circuit**

1. Compensating transformer

When the polarity and magnitude voltage increase on the primary coil, the secondary coil, which is connected with the load loop in series, will produce compensating voltage with the changes required.

2. Regulating transformer

The regulating transformer is a three-phase autotransformer that will adjust the secondary voltage automatically. It has three paks of electrical brushes that can slide symmetrically and automatically. By using the chain to drive the electrical brush to slide on along the exposed part (slideway) of the autotransformer's cylindrical solenoid, the servo motor can adjust the secondary voltage correspondingly so that the compensating voltage will be kept constant.

3. Control circuit of servo motor

The servo motor has two control options: manual-operation and automatic operation,which can be selected by using a changeover switch. At manual-operation, press the voltage step-up button if you want to increase the output voltage, and press t he voltage step-down button if you want to decrease the output voltage, so as to set the output voltage required. At the manual option, the voltage stabilizer does not function automatically. When the automatic option is selected, the voltage step-up/down can be detected automatically by the detecting unit, and will be set at the required voltage.

4. Switchgear and operation of three-phase main

(1) Three AC contactors are connected to the main circuit (one for shifting of mains supply, one for voltage stabilizing startup, and one for protection) of the voltage stabilizer 30 KVA - 100 KVA.

(2) An automatic switch and a knife switch are installed in the main circuit of voltage stabilizers above 150K. To operate the voltage-stabilizing function, one should only position the knife switch handle to voltage stabilizing, and press the button for voltage stabilizing. If you want to connect to the power grid directly, you should position the knife switch to the mains supply.

5. Detecting and adjusting unit of three-phase voltage stabilizer

The sampling control transformer detects the sampling voltage and control voltage from the output terminal of the voltage stabilizer. The upper limit reference voltage is derived from transforming, commutating, wave-filtering, stabilizing, and dividing of the common voltage. The signal voltage, which changes to the output voltage, can be derived after transforming, commutating and wave-filtering ofthe sampling voltage. When the signal voltage is between the upper-limit and the lower-limit voltage, all the contacts of the control relays are in "OFF" position. When the signalvoltage exceeds the upper-limit or the upper-limit reference voltage, the control relay and contact relay will activate. Servo motor runs to adjust compensating voltage and stabilize the output voltage. In other words, when the output voltage exceeds the permitted range of set

voltage, the voltage detecting unit will send the command to adjust the output voltage until the voltage arrives at the set voltage within the tolerance allowed. The voltage stabilizer can be adjusted between ±1% and 5% with the potentiometer PR3. The central position of the rated voltage is adjusted by the regulator potentiometer.

6. Three-phase protection circuit

(1) The automatic switch QA protects the main circuit from overload and short circuit. The OLSl and QLS2 limit switches form the current protection circuit. When the electrical brush slides and touches the upper-limit or lower-limit solenoid, the voltage regulating relay will be disconnected from the power supply, stopping the servo motor, thus protecting the circuit from overrunning.

(2) The normally closed contact of the control relay is closed while-the over and under voltage protection circuit is in normal running state. When the signal voltage exceeds the set-value or falls below the set-value, the normally closed contact of the protection relay will be activated, the circuit will be cut off and the automatic compensating system will not work. The overvoltage set-value is about 420V and the under-voltage set-value 320, and the acousto-optic alarm is factory set before delivery.

(3) Protection circuit for phase sequence and loss ofphase

When one of the phase sequence of the three-phase power supply is mismatched or lose phase. the indicator light of the phase sequence protector will be off, and the whole machine will be in automatic protection state.

7. The stabilizer has two control boards, named A and B. If there is any malfunction found on control board A during operation, one can manually activate the changeover switch of the startdby position to control board B, which will work instead of board A.

8. Voltage detecting and adjusting unit of single-phase voltage stabilizer

The operation principle of the detecting and adjusting unit of the single-phase voltage stabilizer is the same as the three-phase voltage stabilizer.

The automatic switch QA protects the main circuit from overvoltage and short circuit. The automatic voltage compensating system is set with over-current protection. When the electfical brush slides to each side and hit the limit switch, the normally closed contact willbe cut off, and the servo motor will stop.

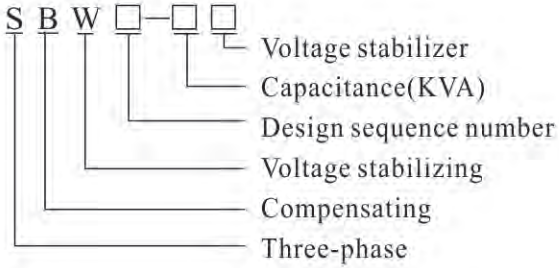
When the overvoltage protection circuit is in normal running state, the normally closed contact of the control relay is closed. When the signal-voltage exceeds the set-value of overvoltage protection,the normally closed contact of the control relay will be cut off and the control circuit along with the automatic compensating system will stop working.

The circuits of the three-phase and single-phase voltage stabilizers are shown in Fig 3, 4, 5, 6 and 7.

5. Model, Specifications and Main Technical Indications

1. Model

The model of the SBW series voltage stabilizer is shown below



6. Service conditions

These voltage stabilizers should be used indoors. The normal service conditions are as follow:

1. Ambient ternperature: -5 ℃ ~+45 ℃ ;
2. Height above sea level: not exceeding 1000m;
3. Relative temperature:≤ 90%
4. There should be no gas, vapour, chemical, dust, dirt or other volatile ingredient of any explosive nature that will influence the operation of the voltage stabilizer at the installation site.
5. There should be no severe vibration or uneven level/surface at the installation site.
6. The user should seek consultation if the product is used in special conditions.

7. Notice for ordering

1. To place an order, you should clearly state the model ofthe product, the capacitance, rated output voltage, range of input voltage variation, precision of voltage stabilizing and power supply input position.
2. For special requirements, please contact our Technical Department for advice.

8.Technical Specifications

Model	Rates Capacitance (KVA)	Output Current (A)	Input Voltage (V)	Output Voltage (V)	Phase number	Withstand Voltage (V)	Insulance (MΩ)	Efficiency	Waveform distortion	Opweration Frequency (Hz)	Voltage Stabilizing Precision
SBW-10	10	16	304~456	380±3% can be set	Three-phase	2000V no disruption for lmin	≥3	≥98%	≤0. 1%	50~60	≤ ±5% can be set (three pahse output balance)
SBW-20	20	31									
SBW-30	30	46									
SBW-50	50	76									
SBW-100	100	152									
SBW-180	180	274									
SBW-225	225	342									
SBW-320	320	487									
SBW-400	400	608									
SBW-500	500	761									
SBW-600	600	913									
SBW-800	800	1217									
SBW-1000	1000	1521									
SBW-1200	1200	1825									
SBW-1600	1600	2434									
DBW-3	3	14	176~264	220±3% can be set	Single-phase	1500V no disruption for lmin					
DBW-5	5	23									
DBW-10	10	46									
DBW-20	20	91									
DBW-30	30	137									
DBW-50	50	228									
DBW-100	100	455									
DBW-180	180	818									
DBW-225	225	1013									
DBW-300	300	1364									
SVC/TND-0.5	0.5	2.3	150~260	220±3% can be set	Single-phase	1500V no disruption for lmin					
SVC/TND-1	1	4.5									
SVC/TND-1.5	1.5	6.8									
SVC/TND-2	2	9									
SVC/TND-3	3	13.6									
SVC/TND-5	5	22.7									
SVC/TND-7.5	7.5	34									
SVC/TND-10	10	45									
SVC/TND-15	15	67									
SVC/TND-20	20	90									
SVC/TND-30	30	136									
SVC/TNS-6	6	9	280 ~ 430	380±3% can be set	Three-phase	2000V no disruption for lmin					
SVC/TNS-9	9	13.6									
SVC/TNS-15	15	22.7									
SVC/TNS-20	20	31									
SVC/TNS-30	30	45									
SVC/TNS-40	40	61									
SVC/TNS-60	60	90									
SVC/TNS-100	100	152									

Troubleshooting and Maintenance

1. Unpacking examination

(1) Check the carton to see if it has been damaged during transportation.
(2) Check for technical documents, certificate of conformity, warrant and accessories that should come with the equipment .
(3) Check whether the compensating transformer, the regulating transformer and other components are in good condition.
(4) Check whether the fasteners are loose, moved out of position, and whether the terminals are well-connected.
(5) Check whether the voltage regulating system and gearingis in good working condition. If the carbon brush is misplaced or broken, correct the placement or replace it before using.

Notice: Do not store the machine in a damp place for a long time; otherwise the machine's performance and quality will be affected.

2. Notice for location

(1) The installation site of the voltage stabilizer should be dry and well ventilated,without severe vibration, and should be protected against dust, sand or rainfall.
(2) During removal,it should be handled with care. Do not over-incline the stabilizer as that would create stress on the chassis. The machine should be placed on an even keel.
(3) There should be enough space around the machine to ensure ventilation and convenience for maintenance.

3. Insulation requirements

Cover and strap the input and output terminals and lead to the testing point. Test the insulant to ground ofthe testing point with a 1000V megohm meter; the measured value should be more than lMfl.,and ifthe value is less than lMfl, check the causes, or remove the humidity in the case with an electric heater until it reaches the standard value.

4. Instailation and connection

(1) Connection of the voltage stabilizer under 225KVA; the three-phase wires A, B, and C of the input power supply should be pulled in from the lower rear part ofthe case, through the current transformer (the number of turns is according to the request ofthe nameplate), and connected to the terminals of the pile head of the air switch in the case.
(2) Connection of the voltage stabilizer above 320KVA; the three-phase wires A, B, and C ofthe input power supply should be connected to the copper bus corresponding to the upper pile head ofthe air switch or the air breaker(the bus is marked with the letters A, B, and C)..

(3) Connecting cables of multi-case products; the connecting wires of the double-case and four-case can be the soft copper wires with section no less than Imm^2, and the wires should be connected to the line contact of the inter-case terminals.
(4) Connection of outgoing line, each connection terminal marked with "output voltage" on the voltage stabilizer should be connected with load. The specification of the connecting wire is decided by the user according to the load. Generally, it should be the same as the incoming cables.
(5) Chassis protective earthing; the gauge of the earth wire must be according to the specifications ofthe local power supply authority. The earth wire should be connected to the pile head marked with "earth wire" in this case. The resistance of the earth wire should be les than 0.4 Ω.
(6) The gauge of the incoming cable can be selected by the user according to the magnitude of the machine's capability. The following table is for reference only.

Capacitance (KVA)	20	30	50	100	180	225	320	400	500	600	800	1000
Wire(mm^2)	6	10	16	50	90	150	240	Copper bus wiring is suggested.				

5. Earthing examination

It is important for the person troubleshooting to check the connecting wires carefully, so as to ensure the reliable operation of the voltage stabilizer. The details are as follows:

(1) Check the main loop connecting wire to see whether it is properly connected, and whether the connecting wires of the universalbreaker switch or QN knife switch is lpose; screw it tight if it comes loose.
(2) Check the contact wires of all kinds of electrical devices behind the panel such as the voltmeter, ammeter, lamp indicator button, changeover switch, and see whether they are properly connected. You should tighten them if they come loose.
(3) Check the circuit board to see whether the connecting wires of each point are properly connected. You should tighten them if they are loose.
Check the servo motor on the voltage regulator and see whether the connecting wire of the limit switch is in order. You should tighten it if it is loose.
(4) Check the control circuit board and C45 power switch, which controls the power supply of the electric motor in the control box, and see whether they are closed.

6. Electric operation and troubleshooting

(1) Set the "Manual/Automatic" optional switch to the "Manual" position.

(2) Set the knife switch to the "Voltage Stabilizing" position; the voltage stabilizer is in zero load state. Switch on the power supply, close the switch QA, and at this time, the indicator light of the three-phase electrical source on the panel will be lit up. The reading is shown on the input voltmeter and the input power-on test is completed.

(3) Press the "Voltage Stabilizing" button, and after 5-15 seconds later, the delay relay will be closed, which makes the output contactor electfified and closed. The green light for "Voltage Stabilizing" is on. Then according to the reading shown on the output voltmeter Vo, press the "Voltage Step-up" or "Voltage Step-down"button, and the pointer of the output voltmeter will rise or fall accordingly; thus completing the manual voltage regulation test.

Note:

If the voltage stabilizer cannot start up and the indicator lamps of the phase sequence protector are not lit up after pressing the " Voltage Stabilizing" button, it means that the phase sequence is wrongly connected. To rectify it, you should first off the power supply and then interchange any two lead wires.

After pressing the "Voltage Stabilizing" button, the voltage stabilizer will have output voltage, but the instantaneous warning and automatic trip protection will function to show that the connection is correct. If the input voltage is on the high side, the output voltage will also be on the high side, and will exceed the protection-value for overvoltage. At this point, you should adjust the "Manual/Automatic" optional switch to "Automatic". Press the "Voltage Stabilizing" button and monitor the reading on the voltmeter until the voltage is stabilized t0 380V, and then follow the next step. Under the "Voltage Step-up" and "Voltage Step-down" stages, you can troubleshoot the stabilizer and make it stabilize at the required voltage automatically. If any thing abnormal occurs, please contact our company as soon as possible.

(4) Set the "Manual/Automatic" switch to "Manual" and press the " Voltage Step-up" button until the voltage value reaches 400V or so. Shift the switch to " Automatic" and the output voltage will fall accordingly to 380V or so. This is the voltage step-up test. Set the "Manual/Automatic" switch to "Manual", and press the "Voltage Step-down" button to make the voltage arrive at 360V or so. Shift the switch to "Automatic" and the output will rise accordingly t0 380V or so. This is the voltage step-down test. Automatic voltage stabilizing test is completed when the above mentioned two tests are successfully carried out.

Set the "Manual/Automatic" switch to "Automatic" when the troubleshooting is done and the voltage stabilizer will be operational.

(5) Set the knife switch to ';Mains Supply", close the QA switch and you can get the "mains supply" output.

Note for troubleshooting voltage stabilizers above 400KVA:

The testing of this kind of stabilizers is similar to the troubleshooting method of the voltage stabilizer 400KVA. As the capacitance is relativelylarge, the automatic power-up and time delay input equipment are generally not built-in unless requrred by the user.

Note for troubleshooting split-phase voltage regulating stabilizer:

The testing of this kind of stabilizer is similar to the troubleshooting method of the above mentioned stabilizer. The difierence is that the split phases regulate the voltage separately, and the regulating system of each phase is separate and uncorrelated with other phases. Each phase is set with manuaUautomatic switch; the troubleshooting should be carried out phase by phase.

7. Load operation

When troubleshooting, the load should be added step by step; one should take strict precautions against overload.

It is strongly recommended that the load of the voltage stabilizer should not exceed 80 % of the rated value; the stabilizing efficiency and the reliability is the highest at this point. If the load is constantly on the high side, you should increase the cooling system when operating it.

If breakdown occurs at the time the machine is running with a large load, it is best to increase the load step by step when the power supply is resumed. One should take precautions against simultaneous start-up of several high-power electro motors, otherwise the high electric current will damage the voltage stabilizer.

Common Maifuncton and Troubleshooting

No.	Malfunction	Cause	Solution
1	Can not start	1.Phase error sequence of input power wiring or abnormal electric network;	1. Change any two power suply wires,or check if the power line is in order(check for correct phase order if the phase order protector light is on.and then stsrt the device.)
		2.Air switch in the device is not closed or broken;	2.Switch on ir replace air switch;
2	Can not regulate the voltage	1.Sampling,transformer is broken;	1,2,3,amd4:Repair or relace
		2.Comtrol circrit board is broken;	
		3.The motor is brlken;	
		4.The mechanical system failed	
		5.Load feeds back higher harmonic wave	
3	Voltage regulation actuates in one direction only	1.Normally closed contact of travel limit switch is open or broken;	Replace
		2.Mamual/automatic changeover switch comtact is broken;	
		3.Step-up/down relay on the comtrol panel is broken;	
4	No output voltage	1.Normally closed comtact of stop button is open;	Replace
		2.The contact of voltage stabilizing button is broken;	
		3.Contact(KM) in main loop is broken;	
5	Ofthen trip	1.Overvoltage value of comtrol circuit board is not adjusted well;	Have it adjusted or repaired by professional personnel.
		2.The resistance of control circuit board varies..	

8. Function, collocation and troubleshooting method of the control panel;

For loss of phase and phase sequence relay - When the incoming cables are wrongly connected, the indicator light will not come on, and the stabilizer will not work.

For overvoltage and undervoltage protection relay — When the voltage stabilizer is faulty or the incoming voltage is too high or too low, which causes the output voltage to exceed 420V or less than 320V, KC3 will activate (protection light comes on) to stop the voltage stabilizer from functioning and the alarm will sound. Use PR3 relay to adjust the value of the overvoltage protection point. Use PRl to adjust the value of the undervoltage protection point.

For KC lstep-up relay — When the output voltage of the stabilizer is set under the stabilizing range, KC1 activates the servo motor to drive the electrical brush and increase the output voltage to380, and releases KC1, thus completing the automatic regulating process.

For KC2 step-down relay—When the output voltage of the stabilizer exceeds the stabilizing range that has been set, KC2 activates the servo motor to drive the electrical brush and lower the output voltage to 380V, and releases KC1, thus completing the automatic regulating process.

For RPP central voltage regulating relay—Set the voltage stabilizerin zero load running state by first adjusting RP to minimum (adjust anti-clockwise), and then turning RPP1; turn anti-clockwise to lower the output voltage and turn clockwise to raise the output voltage.

For PR regulating relay of voltage-stabilizing precision — Turn the potentiometer anti-clockwise, and the voltage stabilizing precision inclines to the direction of 1%; turn the potentiometer clockwise, and the voltage stabilizing precision inclines to the direction of 5%.

9. Daily maintenance

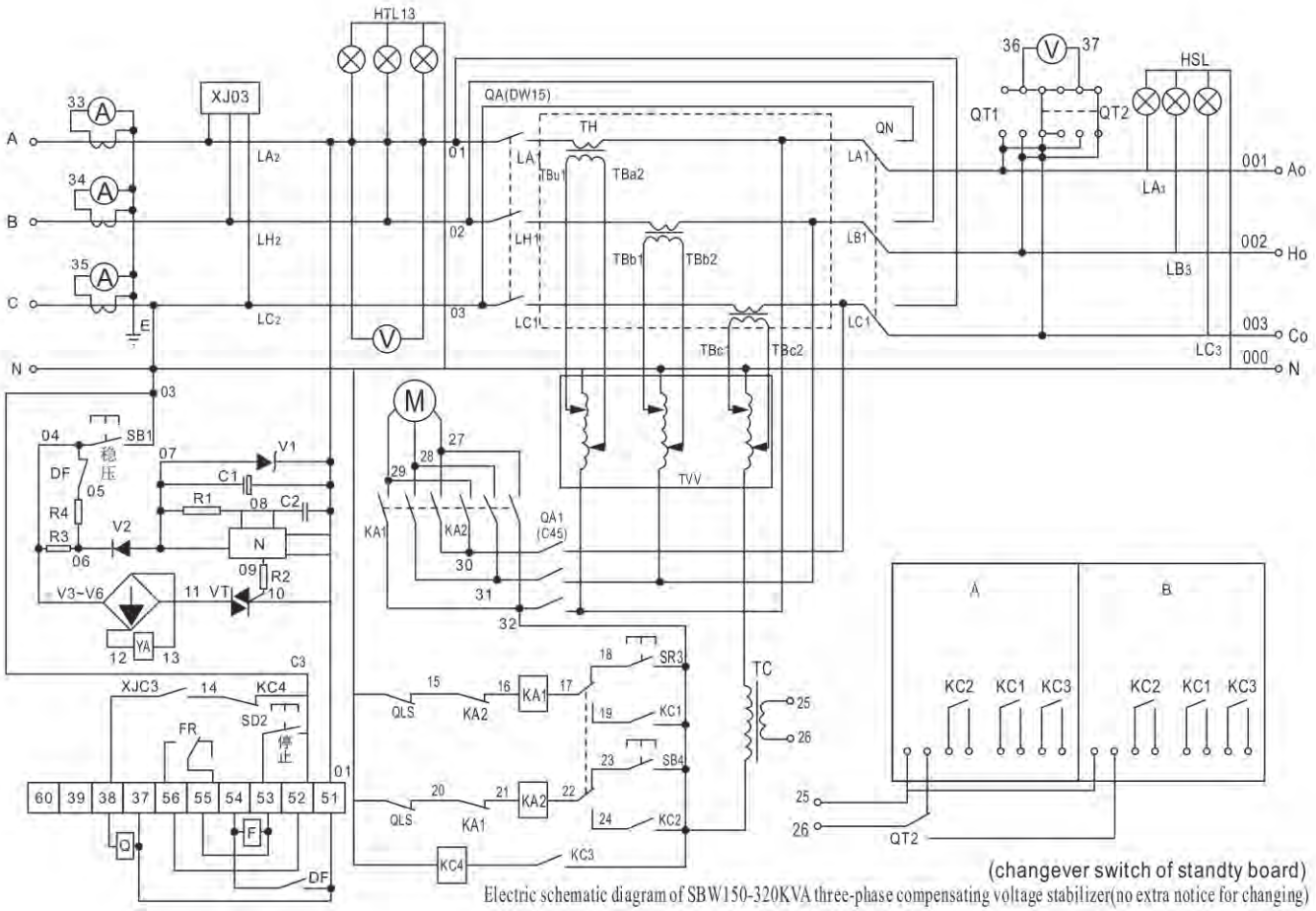
During operation, check the working state of the voltage stabilizer regularly; also check for temperature rise in the compensating transformer and regulating transformer to see if:

(1) They are normal .
(2) The load surpasses the rated value .
(3) The input voltage surpasses the stipulated limit .
(4) The regulating system and gearing (includes gearing chains and reduction case) are working normally .
(5) Any of the 6 carbon brush came loose.
(6) The carbon brushes are on the same level and the same line.

If any of the problems mentioned above are encountered, rectify them immediately. For further information, please notify the management personnel at once to avoid damaging the equipment.

It is suggested that maintenance should be carded out every three months, which includes the following:

(1) Remove dust and dirt on the components of the voltage stabilizer.
(2) Check the components and replace them if they are damaged.
(3) Check the decelerator of the regulating system and the chain gearing to see ifthey are working normally. You should keep the chains lubricated, and correct the tension of the chains; replace broken or greatly-abraded brush strips. Clean the coil of the columnar regulator with carbon tetrachloride and cotton.
(4) Make records ofmaintenance carefully.



Electric schematic diagram of SBW150-320KVA three-phase compensating voltage stabilizer(no extra notice for changing)

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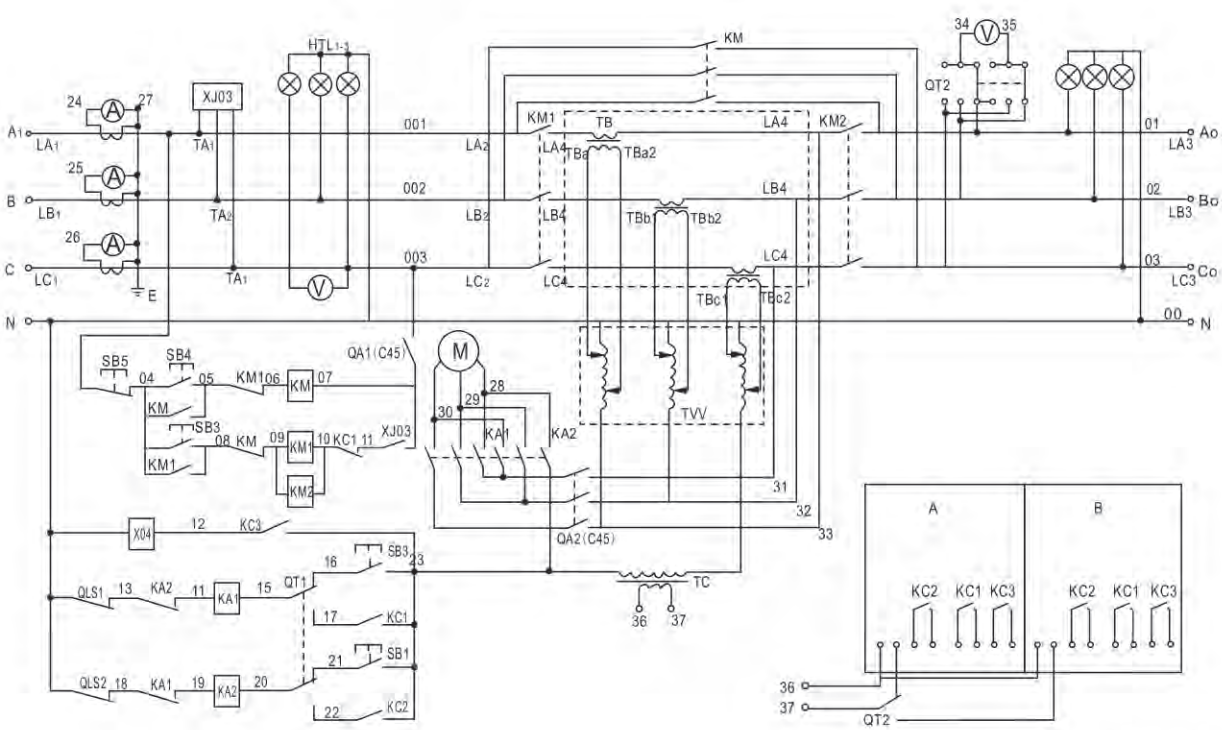

Electric,schematic diagram of SBW20~100KVA three-phase compensating voltage stabiliaer(no extra notice for changing)

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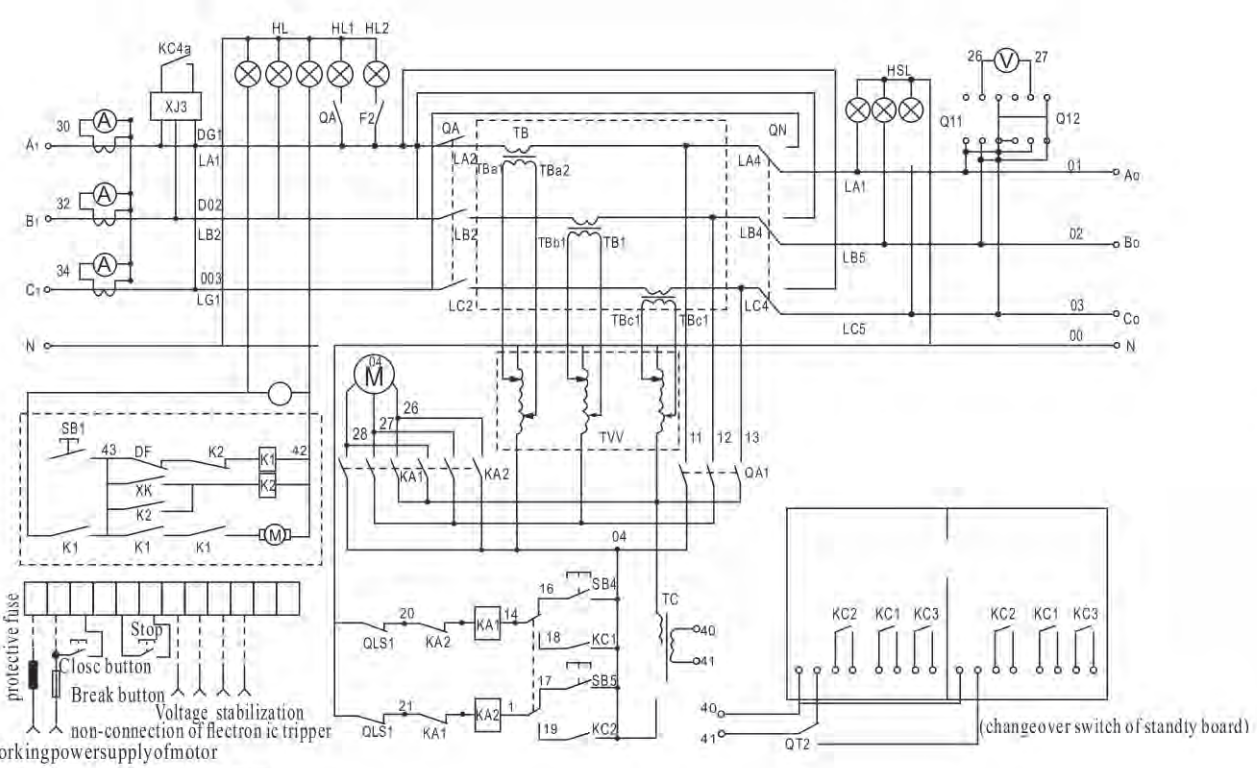

Connection sketch map of DW15-1000-4000

universal breaker non energy-storage operation for users

Electric schematic diagram of SBW400~600KVA three-phase compensating voltage stabilizer (no extra notice for changing)