

SBW(F)-DBW series Voltage Stabilizer for Industry Use

User Manual

1. Summary

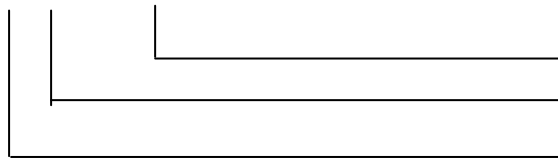
DBW/SBW(F) compensation Automatic Voltage Stabilizer is designed referring to international congener products. When input voltage fluctuated, it can output the voltage automatically and stably. Our product has many advantages as follows: high power capacity, high efficiency, wide input voltage range, high output voltage precision, smooth voltage regulation, broad load application, long continuous work life, no wave distortion, strong protection performance, little dimension, light weight, work reliability, easy operation, simple maintenance and so on.

This product is widely used in industrial and mining enterprise, communications, broadcast television, traffic, national defense, construction, medical treatment, large-scale mechanical and electrical equipment of scientific research and culture departments, production assembly line, construction project equipment, broadcast television equipment, medical equipment, precision machine tool, electronic computer, precision instrument, elevator and so on.

2. Model & Technical Specification

a) The model of SBW series voltage stabilizer is shown as below:

X BW — — XXX



F: Independent phase regulation

Rated Capacity(KVA)

Compensation voltage stabilizer

D: Mono-phase、S: Three-phase

b) Main Technical Specification

Input voltage	220V/380V +/-20% or 30%; custom design available	Efficiency	≥ 98%
Output voltage	220V/380V ±(2~5)%, can be set	Insulation resistance	>2MΩ
Output voltage wave	Sine wave	Withstand voltage	2000V/1min
Waveform Distortion	No additional waveform distortion	Over-load capacity	1min. at 2 times of the rated current.
Response speed	≤1.5S (when outside voltage has 10% of change)		

c) Main Protection Function

Over-voltage & under-voltage Protection	When output voltage exceeds $\pm 10\%$ rated voltage, Stabilizer cut off output source automatically.
Phase sequence protection	When the sequence of three phase are incorrect, Stabilizer cut off output automatically
Phase lack protection	If phase lacked, Stabilizer cut off output automatically
Mechanical breakdown protection	If servomotor or drive system happened to malfunction, Stabilizer cut off output automatically
Short-circuit protection	If output short circuit, air switch cut off input automatically
Bypass Function	When the breakdown happens to the stabilizer, the bypass will work manually(default) or automatically(can be customized by requirement)

d) Models and Specification

Phase No.	Model (KVA)	Rated capability (KVA)	Output max current (A)	Size (mm) D×W×H	Cabinet QTY	Weight (kg)
Single-phase	DBW-10	10	45	500×650×1320	One	180
	DBW-15	15	68	500×650×1320		258
	DBW-20	20	91	500×650×1320		290
	DBW-25	25	114	500×650×1320		310
	DBW-30	30	136	500×650×1320		320
	DBW-40	40	182	500×700×1500		338
	DBW-50	50	227	620×800×1500		354
	DBW-60	60	273	620×800×1500		390
	DBW-80	80	364	680×920×1620		410
	DBW-100	100	455	680×920×1620		470
	DBW-120	120	545	680×920×1620		498
	DBW-150	150	682	680×920×1750		531
	DBW-180	180	818	680×920×1750		540
	DBW-200	200	909	680×920×1750		550

Three-phase	SBW-20	20	30	720×600×1250	One	230
	SBW-30	30	45	720×600×1250		240
	SBW(F)-50	50	76	720×600×1250		287
	SBW(F)-60	60	91	720×600×1250		301
	SBW(F)-80	80	121	820×620×1440		379
	SBW(F)-100	100	152	820×620×1440		414
	SBW(F)-120	120	182	820×620×1440		435
	SBW(F)-150	150	227	770×900×1620		577
	SBW(F)-180	180	273	770×900×1620		600
	SBW(F)-200	200	303	770×900×1620		610
	SBW(F)-225	225	341	800×1000×1650		705
	SBW(F)-250	250	379	800×1000×1650		728
	SBW(F)-300	300	455	900×1100×1850		890
	SBW(F)-320	320	485	900×1100×1850		815
	SBW(F)-350	350	530	900×1100×1850		940
	SBW(F)-400	400	606	900×1100×1850		1020
	SBW(F)-450	450	681	900×1100×1850		1063
	SBW(F)-500	500	758	1050×900×1860		Two
	SBW(F)-600	600	909	1050×900×1860	1390	
	SBW(F)-800	800	1212	1000×800×1860	three	2180
	SBW(F)-1000	1000	1515	1000×800×1860		2370
	SBW(F)-1200	1200	1818	900×900×1860	Four	2670
	SBW(F)-1400	1400	2121	1000×1100×1860		3200
	SBW(F)-1600	1600	2424	1000×1100×1860		3800
	SBW(F)-1800	1800	2727	1000×1200×1860		4800
	SBW(F)-2000	2000	3030	1000×1200×1860		4990
	SBW(F)-2500	2500	3798	1250×1200×2000		6600
	SBW(F)-3000	3000	4545	1250×1200×2000		7200

3. Working Condition

The SBW(F) and DBW series voltage stabilizers should be used indoor, if require outdoor use, please ask us if it is available. The normal service conditions are as follow:

- 1) Ambient temperature: -5℃~+45℃;
- 2) Height above sea level: not exceeding 1000 meters;
- 3) Relative temperature: ≤90%;
- 4) There should be no gas, vapor, chemical sediments, dust, dirt, or other volatile and erosive medium that will influence the insulation intensity of the voltage stabilizer at the installation site;
- 5) There should be no serer vibration or bump at the installation site;
- 6) The user should consult with us if the product is used in special using condition which does not meet the above mentioned conditions.

4. Structure

It is made up of three phase/single phase compensating transformer, three phase/single phase regulating transformer, isolation transformer, gear, electrical brush contact system, case-body and control system. The surface of the cylindrical solenoid of the three phase/single phase regulating transformer is burnished and wiped off insulation. Smooth conductor surface enables it to contact with the electrical brush well; the gearing is made up of servo motor, worm-wheel, worm, chain wheel and chain. Reasonable and reliable structure of the brush contact system assures the brush pressure. The case-body is of enclosed type, small bulk and good radiating capability. The instrumentation is located observably with accurate indications.

5. Basic components and circuit

1) Compensating transformer

When the polarity and magnitude voltage increased on the primary coil changes, the secondary coil that is connected with the load loop in series will produce compensating voltage with changeable amplitude value and polarity.

2) **Regulating transformer** is a three-phase autotransformer that can adjust secondary voltage automatically. It has three pairs 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(slide way)of the autotransformer's cylindrical solenoid, the servo motor can adjust the secondary voltage reposefully and carry the point of changing compensating voltage and keeping the stabilization of output voltage.

3) Control circuit of servo motor

The servo motor has two control modes: manual-operation and automatic-operation, which can be selected by using changeover switch. When at the position of manual-operation, press the button of voltage step-up is you want to increase the output voltage and press the button of voltage step-down if you want to decrease the output voltage so as to make the output voltage meet the power supply requirement. At this time, the voltage stabilizer does not have the function of voltage stabilizing. When the automatic operation is selected, the voltage step-up/down can be detected automatically by the detecting unit to carry the point of automatic voltage stabilizing.

4) Switchgear and operation circuit of three phase main circuit

- (1) The AC contactor are set in the main circuit (one for shifting of mains supply, one for voltage stabilizing startup, and one for protection)of voltage stabilizer 30KVA-100KAV.
- (2) An automatic switch and a knife switch are set in the main circuit of voltage stabilizer above 150K.To turn the voltage stabilizing function, one should only put the knife switch handle to the position of voltage stabilizing, and press the button of voltage stabilizing. If you want to connect the power grid directly, you should only put the knife switch to the position of mains supply.

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

Sampling control transformer takes out the sampling voltage and control voltage from the output terminal of the voltage stabilizer. The upper-limit reference voltage can be gotten after transforming, commutating, wave-filtering, stabilizing, and dividing of control voltage. The signal voltage, which changes subject to output voltage, can be gotten after transforming, commutating and wave-filtering of sampling voltage. If output it to the comparator for comparison, when the signal-voltage is between the upper-limit and lower-limit voltage, all the contacts of the control relays are on“OFF”position, when the signal voltage exceeds the upper-limit and the upper-limit reference voltage(precision),the control relay and contact relay will actuate. Servo motor runs to adjust compensating voltage and stabilize the output voltage. In a word, when the changing of output voltage exceeds the permitted-range of set-precision, the voltage detecting unit will of send the command of adjusting the output until the voltage resumes to the permitted-range of the set precision. The voltage stabilizing precision can be adjusted between $\pm 1\%$ 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 out. The QLS1 and QLS2 limit switches from the overrun protection circuit. When the electrical brush slides and touches the upper-limit or lower-limit switch, coil of the voltage regulating relay will be disconnected with the power supply to release the relay and stop the servo motor and protect 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 over voltage protection set-value or fall under the under pressure protection set value, the normally closed contact of the protection relay will be cut off and accordingly the control circuit will be cut off, the automatic compensating system will quit working. The over voltage set value is about 420V and the under voltage set value 320V and acoustic optic alarm is set well before delivery.
 - 3) Protection circuit for phase sequence and loss of phase
When the leading 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 whole machine will be in automatic protection state.
- 7) This machine has two control boards named A and B. if there is any malfunction found on control board A during using, you can prod the changeover switch of the standby board 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 detection 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 over voltage and short out. The automatic voltage compensating system is set with overrun protection. When the electrical brush slides to each side and hit the limit switch, the normally closed contact will be cut off, and servo motor will stop.

When the over voltage 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 over voltage protection, the normally closed contact of the control relay will be cut off and accordingly the control circuit will be cut off, and the automatic compensating system will quit working.

6. Service condition

The SBW(F) and DBW series voltage stabilizers should be used indoor. The normal service condition are as follow:

- 7) Ambient temperature: $-5^{\circ}\text{C}\sim+45^{\circ}\text{C}$;
- 8) Height above sea level: not exceeding 1000 meters;
- 9) Relative temperature: $\leq 90\%$;
- 10) There should be no gas, vapor, chemical seciment, dust, dirt, or other volatile and erosive medium that will influence the insulation intensity of the voltage stabilizer at the installation site;
- 11) There should be no serer vibration or bump at the installation site;
- 12) The user should consult with us if the product is used in special using condition which does not meet the above mentioned conditions.

7. Notice for ordering

- 1) To place an order, you should make clear the model of the 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 with our technical department for further advices.

Manual for debugging and maintenance

1. Unpacking examination

- (1) Whether the pack is damaged during transportation.
- (2) Whether the technical document, and fittings are all complete.
- (3) Whether the compensating transformer, the regulating transformer and other components are in good condition.
- (4) Whether the fasteners are loosened, shifted, and whether the terminals are well connected.
- (5) Whether voltage regulating system and gearing are safe and reliable. If the carbon brush is misplaced or broken, correct it or replace it in time.

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

2. Notice for location

- (1) The installation site of the voltage stabilizer should be dry and ventilated without severe vibration, dust or sand, and rainfall penetration.
- (2) During removal, it should be handled with care, over-incline is banned. The stress on chassis should be even. The machine should be placed on even keel.
- (3) There should be enough space around the machine to insure the ventilation and the convenience for maintenance.

3. Insulation Requirements

Strap the input and output terminals and lead out the testing point. Test the insulation to ground of the testing point with a 1000V megohm meter, the measured value should be more than 1M Ω , if the value is less than 1 M Ω , check the causes, or dry the humidity in the case with an electric heater until it reaches the standard value.

4. Insulation and connection

(1) Leading connection for the voltage stabilizer under 225KVA; The three-phase wires A, B and C of the input power supply should be led in from the lower and rear part of the case, through the current transformer, (the number of turns is according to the request of the nameplate) and connected with the upper pile head of the air switch in the case.

(2) Leading connection for the voltage stabilizer above 320KVA: The three-phase wires A, B and C of the input power supply should be connected with the copper bus corresponding to the upper pile head of the air switch or the air breaker (the bus is marked with the letters A, B and C).

(3) Connecting wire for multi-case products: the connecting wire for the double-case and four-case can be the soft copper wire with section no less than 1mm² and the wire should be connected with the line contact bank of the inter-case terminal and ranged up-to-down correspondingly.

(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 connection wire is decided by the user according to the load. Generally, it should be the same as the leading wire.

(5) Chassis protective earthing: the gauge of the earth wire is carried out according to the relative stipulations of local power supply authority. The earth wire should be connected with the pile head, which marked with "earth wire" in the case. The resistance of earth wire should be less than 0.4Ω .

(6) The gauge of the power leading wire can be chosen by the user according to the magnitude of machine's capability. The following table is only for reference.

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

The first and most important step for the debugging personnel is to check the connecting wires carefully, which is pivotal to assure the reliable running of the voltage stabilizer. The detailed working contents are as follows:

- (1) Check the main loop connection wire and see whether it is firm and reliable, whether the connecting wires of the universal breaker switch of QN knife switch comes loose. Screw it down if it comes loose.
- (2) Check the contact wires of all kinds of electrical devices behind the panel such as voltmeter, ammeter, lamp indicator button, change-over switch and see whether they are firm and reliable. You should screw them down if they come loose.
- (3) Check the circuit board and see whether connecting wire of each point comes loose. You should screw it down if it comes loose.

Check the servo motor on the voltage regulator and see whether the connection wire of limit switch is reliable. You should screw it down if it comes loose.

- (4) Check the control circuit board and circuit breaker which control the power supply of electric motor in the control board and see whether they are closed.

6. Operation of electrifying and debugging

- (1) Put the "Manual/Automatic" optional switch to the position of "Manual".
- (2) Put the knife switch to the position of "Voltage Stabilizing" the voltage stabilizer is in zero load state, switch on the power supply, close the switch QA, at this time, the indicator light of the three-phase electrical source on the panel is on. The reading is shown on the input voltmeter, and the input power-on test is finished.
- (3) Press the button of "Voltage Stabilizing", about 5-15 seconds later, the delay relay is closed, which makes the output contactor electrified and close. The green light for Voltage Stabilizing is on. Then, according to the reading shown on the output voltmeter, press button of Voltage Step-up or Voltage Step-down, the pointer of output voltmeter will rise or fall accordingly and the manual voltage regulation test is finished.

Notices:

If the voltage stabilizer cannot be started up and the indicator light of the phase sequence protector does not shine after pressing the button of "Voltage Stabilizing", the means the phase sequence is wrongly connected. To clear the trouble, you should first cut off the power supply and then only exchange any two leading wires of the three.

After pressing the button of "Voltage Stabilizing", the voltage stabilizing will have output

voltage, but instantaneous warning and automatic trip protection will function, which is to show the connection is right. As the input voltage is on the high side, and the output voltage is also in high side and will exceed the protection-value for over voltage. At this time, you should put the “Manual/Automatic” optional switch to the position of “Automatic”, push the button of “Voltage Stabilizing”, watch the reading on the voltmeter until the voltage is stabilized to 380V, and then operate as step 4. Under the two states of “Voltage Step-up” and “Voltage Step-down” debug the stabilizer and make clear if it can stabilize the voltage to 380V automatically. If anything abnormal occurs, please contact with our company at once.

(4) Put the button of “Manual/Automatic” switch to position of “Manual”, push the button of “Voltage Step-up” and make the voltage value reach to 400V or so. Shift the switch to the position of “Automatic”, the output voltage will accordingly fall to 380V or so. This is voltage step-up test. Put the button of “Manual/Automatic” switch to the position of “Manual”, push the button of “Voltage Step-down” and make the voltage value reach to 360V or so. Shift the switch to the position of “Automatic”, the output voltage will according rise to 380V or so. This is voltage step-down test. Automatic voltage stabilizing test is finished upon the success of above two tests.

Put the “Manual/Automatic” switch to the position of “Automatic” when the debugging is over and the voltage stabilizer will be in running state.

(5) Put the knife switch to the position of “mains supply”, close the QA switch and you can get the “mains supply” output.

Notice for debugging voltage stabilizers above 400KVA;

The capacitance products of this kind have the similar debugging method with the voltage stabilizer under 400KVA, But as the capacitance is relatively large, generally the equipment of automatic power up and time delay input are not designed (which can be added according to the user’s request)

Notice for debugging of split-phase voltage regulating stabilizer:

The capacitance products of this kind have the similar debugging method to the above-mentioned stabilizer. The difference is that the split phases regulate the voltage severally; the regulating system of each phase is separate and uncorrelated with other phase. Each phase is set with manual/automatic switch; the debugging should be carried phase by phase.

7. Load operation

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

It is strongly recommended that the load of voltage stabilizer should not surpass 80% of rated value, the stabilizing efficiency and the reliability is the highest at this time. If the load is assuredly on the high side, you should strengthen the cooling measures when use it.

If breakdown occurs at the time the machine is running with large load, it is required that the load should be increased step by step when the power supply is resumed. One should take strict precautions against simultaneous start up of several high-power electro motors, or the overwhelming electric current will damage the voltage stabilizer.

Common Malfunction and Troubleshooting

No.	Malfunction	Cause	Solution
1	Can not start	1.Error phase sequence of input power wiring or abnormal electric network;	1. Change any two power supply wires, or check if the power line is in order(it is in correct phase order if the phase order protector light is on. And then start the device
		2.Air switch in the device is not closed or broken;	2. Switch on or replace air switch;
2	Can not regulate the voltage	1.Sampling transformer is broken;	1,2,3 and 4: repair or replace
		2.Control circuit board is broken;	
		3.The motor is broken	
		4.The mechanical system failure	
		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.Manual/Automatic changeover switch contact is broken;	
		3.Step-up/down relay on the control panel is broken;	
4	No output voltage	1.normally closed contact of stop button is open;	Replace
		2.The contact of voltage stabilizing button is broken;	
		3.Contact KM in main loop is broken	
5	Often trip	1.Over voltage value of control 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 adjusting method of the components on control panel:

For loss of phase and phase sequence reply: When meet with leading misphase or loss of

phase, the indicator light does not shine and the machine cannot start.

For over voltage and under voltage protection reply: When the voltage stabilizer goes wrong or the leading voltage is too high or too low and makes the output voltage exceed 420V or less than 320V, KC3 actuates (protection light is on) to stop the voltage stabilizer, and the siren will sound. Use PR3 relay to adjust the value of over voltage protection point. Use PR1 to adjust the value of under voltage protection point.

For KC1 step-up relay: When the output voltage of the stabilizer is under the set stabilizing range. KC1 actuates to make the servo motor drive the electrical brush and increase the output voltage to 380V, and KC1 release. The process of automatic regulating is over.

For KC2 step-down reply: When the output voltage of the stabilizer exceeds the set stabilizing range, KC2 actuates to make the servo motor drive the electrical brush and lower the output voltage to 380V, and KC1 release. The process of automatic regulating is over.

For RP1 central voltage regulating relay: Put the voltage stabilizer in zero load running state, first adjust RP2 to minimum (adjust anti-clockwise), then revolve RPP1; Revolve anti-clockwise, to lower the output voltage and revolve clockwise to raise the output voltage.

For PR2 regulating relay of voltage-stabilizing precision: Revolve the potentiometer anti-clockwise, the voltage stabilizing precision inclines to direction of 1%; revolve the potentiometer clockwise, the voltage stabilizing precision inclines to the direction of 5%.

9 . Daily maintenance

During operation, scout regularly the working state of the voltage stabilizer, check the temperature rise of the compensating transformer and regulating transformer and see if they are normal, if the load surpasses the rated value, if the input voltage surpasses the stipulated limit, if the regulating system and gearing (includes gearing changes and reduction case) are working normally, if carbon brush racks come loose, If the carbon brushes are on the same planar and the same line. None of the problems mentioned above is permitted. So you should solve it in time if any of the problems is found. For further information, please notice the management personnel for solution to avoid damaging the equipment.

It is suggested that maintenance should be made every three months, which includes:

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