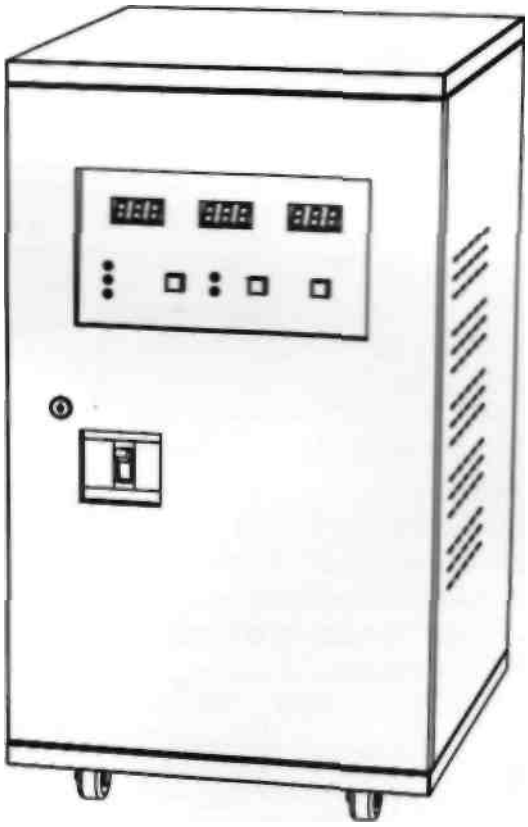
ES-SVC SERIES

THREE PHASE SERVO MOTOR TYPE AUTOMATIC VOLTAGE REGULATOR

USERS MANUAL



(Version 1.0)

Please read this manual carefully before installing or using this machine!

Content

1. SAFETY INSTRUCTIONS

The following instructions are related to human safety, please read them carefully!

1.1 Human Safety

There is high voltage inside the running voltage regulator, in order to avoid electric shock, do not open the voltage regulator or take off the input wires and output wires.

The connection wires must be laid reasonable. It may cause electric accident due to the wires are trampled.

The voltage regulator must be connected to the ground. Grounding resistance must be less than 0.1 MΩ. Without ground connection or improper ground connection can be dangerous for human safety, and also can cause high risk of electronic circuit board faults.

Never connect the ground wire to the conduit of central heating system, gas supply system, water supply system, or any other public utilities.

1.2 Installation and Operation

Keep the package for future moving or repairing.

Keep far away from wall and flammable material.

Do not block the cooling holes of the voltage regulator.

Make sure all the wires are well and tightly connected, not loose or disconnected.

The ground wire and neutral wire can't be reversely connected, otherwise it may damage the voltage regulator or cause electric shock.

The live wire and neutral wire can't be reversely connected.

For three phase voltage regulator, the maximum power capacity of each phase is 1/3 of the full rated capacity.

Do not use the voltage regulator in damp environment.

Do not drop any foreign material (like clips, nails, etc.) into the voltage regulator.

In emergencies (damage to the cabinet or to the connections, splashing of liquid, drop of any foreign material into the voltage regulator), please switch it off, disconnect the wiring connection from the mains power and from the loads, then contact the authorized dealer.

In the event of sudden temperature changes such as from cold to the normal working temperature, mist can form inside the voltage regulator. The voltage regulator must be dry before being switched on. Due to this reason, wait for at least 2 hours before switching it on.

The voltage regulator can only be repaired by the authorized technical person. Any attempt to open and to repair it by the user on his own could prove to be dangerous.

Placing magnetic storage media on top of the regulator may result in data corruption.

1.3 When Input Comes From Generator

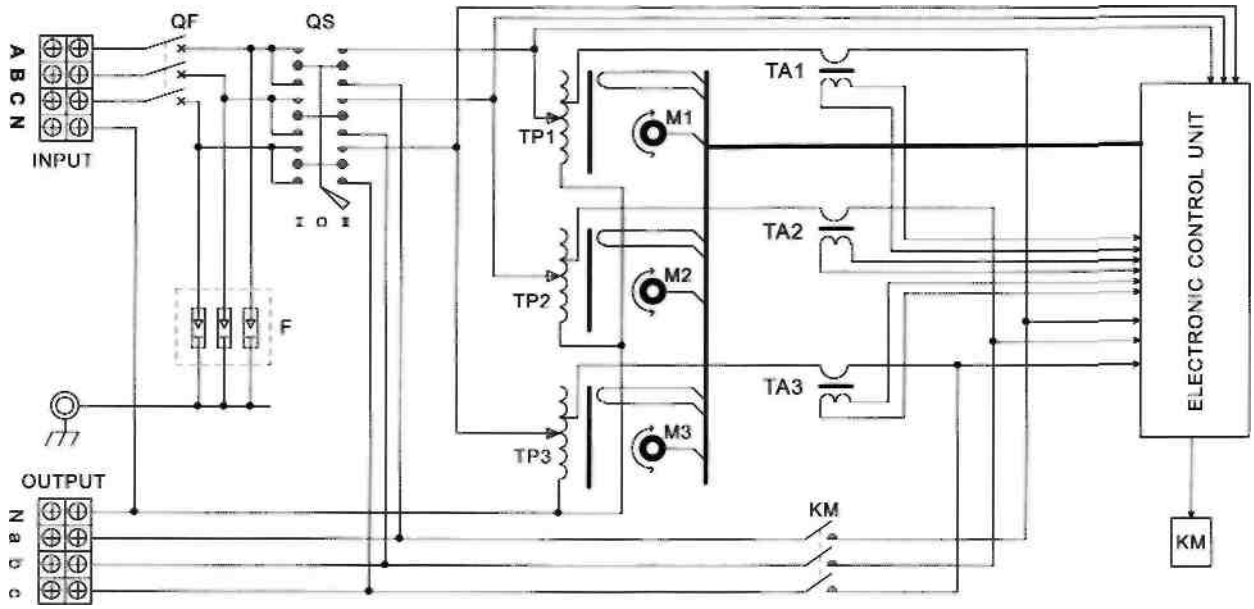
The capacity of the generator must be biggerthan the rated capacity of the voltage regulator, otherwise the generator and voltage regulator can't work properly.

The output frequency of the generator must be within 45-65Hz. And the generator should has sine wave output, otherwise the regulator can't work properly.

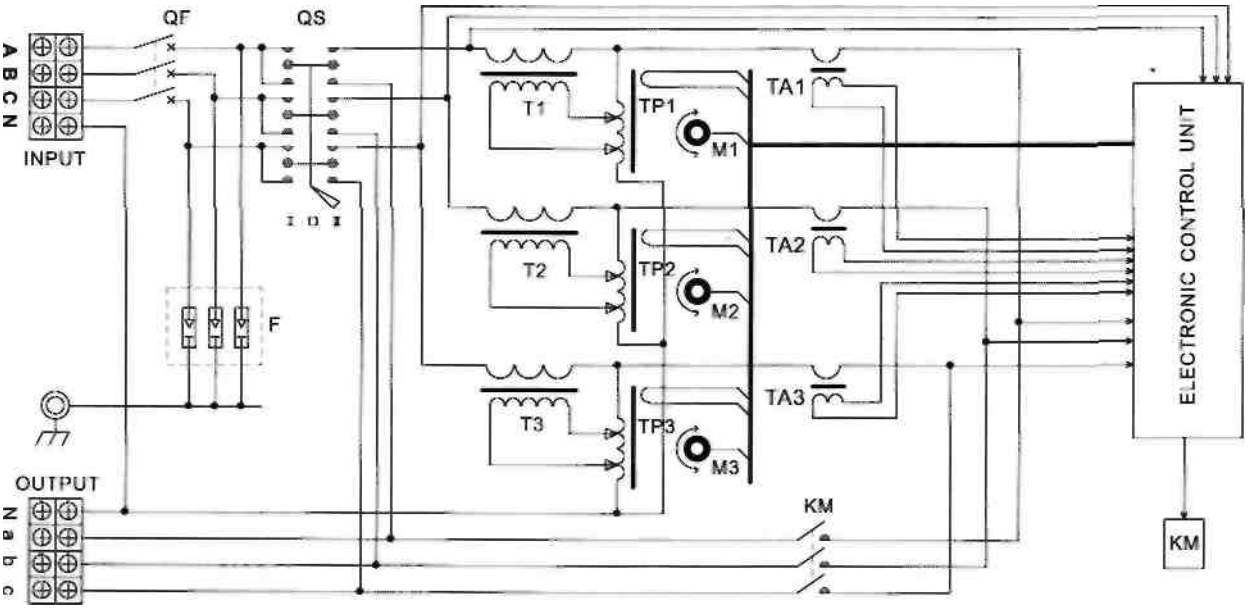
2. SPECIFICATION

2.1 Schematic of Voltage Regulator

(SVC-10K, SVC-15K, SVC-20K, SVC-30K)



(SVC-45K, SVC-60K, SVC-80K, SVC-100K)



QF: AIR BREAKER
QS:MANUAL BYPASS SWITCH
F: SURGE PROTECTION DEVICE
KM: CONTACTOR
T1J2.T3: SERIES TRANSFORMER
TP1, TP2, TP3: VARIABLEAUTOTRANSFORMER
M1, M2, M3: SERVO MOTOR
TA1JA2.TA3: CURRENT TRANSFORMER

2.2 Features

High Efficiency

Using high purity oxygen-free copper wire for the windings, and high magnetic density silicon-steel plate for the cores, the transformer has very low idle power consumption, and the temperature rise is slow.

100% Unbalanced Loading Capability Between Three Phases

Using the independent regulating for each phase, so that it can handle the 0-100% unbalanced loads between three phases.

Digital Display

Digital display to show the input voltage, output voltage, output current, and other status of the voltage regulator.

Advanced Protection

The integrated automatic protection circuit offers a full range of protection to protect the machine and the loads. When output voltage is exceeding the upper or lower limit, or open phase happens, the output will be cut off automatically and the buzzer will give warning .

Strong Overload Ability

100% load for long time, 120% for 3 minutes, 150% for 30 seconds, 200% for 10 seconds, 300% for 5 seconds

Configurable Nominal Output Voltage (Optional)

It allows the user to select the nominal output voltage between 380V.400V and 415V.

Isolated Manual Bypass Switch

Surge Protection Device (Optional)

Additional surge protection device can be added, to depress the surge and spike from the mains power.

2.3 Main Specification

INPUT

Rated Input Voltage	380V (400V/415V Optional)
Input Voltage Range	276-450V or customized
Input Frequency	45-65HZ
Power Factor	0.98

OUTPUT

Rated Output Voltage	380V (400V/415V Optional)
Output Precision	±3% (±1% Optional)
Response Time	<1 s, against 10% variation of input voltage
Efficiency	>96%
Loading Ability	120% for 180s, 150% for 30s, 200% for 10s, 300% for 5s

DIGITAL DISPLAY

Input Voltage	Line Voltage: AB, BC, CA	Phase Voltage: A, B, C
Output Voltage	Line Voltage: AB, BC, CA	Phase Voltage: A, B, C
Output Current	Phase Current: A, B, C	

PROTECTION AND ALARM

Output Under Voltage	Output cutoff by contactor + "L" in display + Buzzer beeping
Output Over Voltage	Output cutoff by contactor + "H" in display + Buzzer beeping
Overload	Output cutoff by contactor + "F" in display + Buzzer beeping
Over Temperature	Output cutoff by contactor + "C" in display + Buzzer beeping
Phase Failure	Output cutoff by contactor + Buzzer beeping
Wrong Phase Sequence	Can't switch on regulator + "P" in display + Buzzer beeping
Short Circuit	Input cutoff by air breaker
Bypass	Isolated Manual Bypass Switch
Output Delay Time	6s/180s Selectable
Surge/Spike	Optional, Replaceable SPD

SAFETY

Insulation Voltage	2,000V/60s
Insulation Resistance	>5MQ
Creepage Distance	>8mm
Grounding Resistance	<0.1MQ
Insulation Class of Coil	Class F(155°C)
Cooling Mode	Cooling Fan
IP Level	IP20
Audible Noise	<65dB at 1m distance with full load

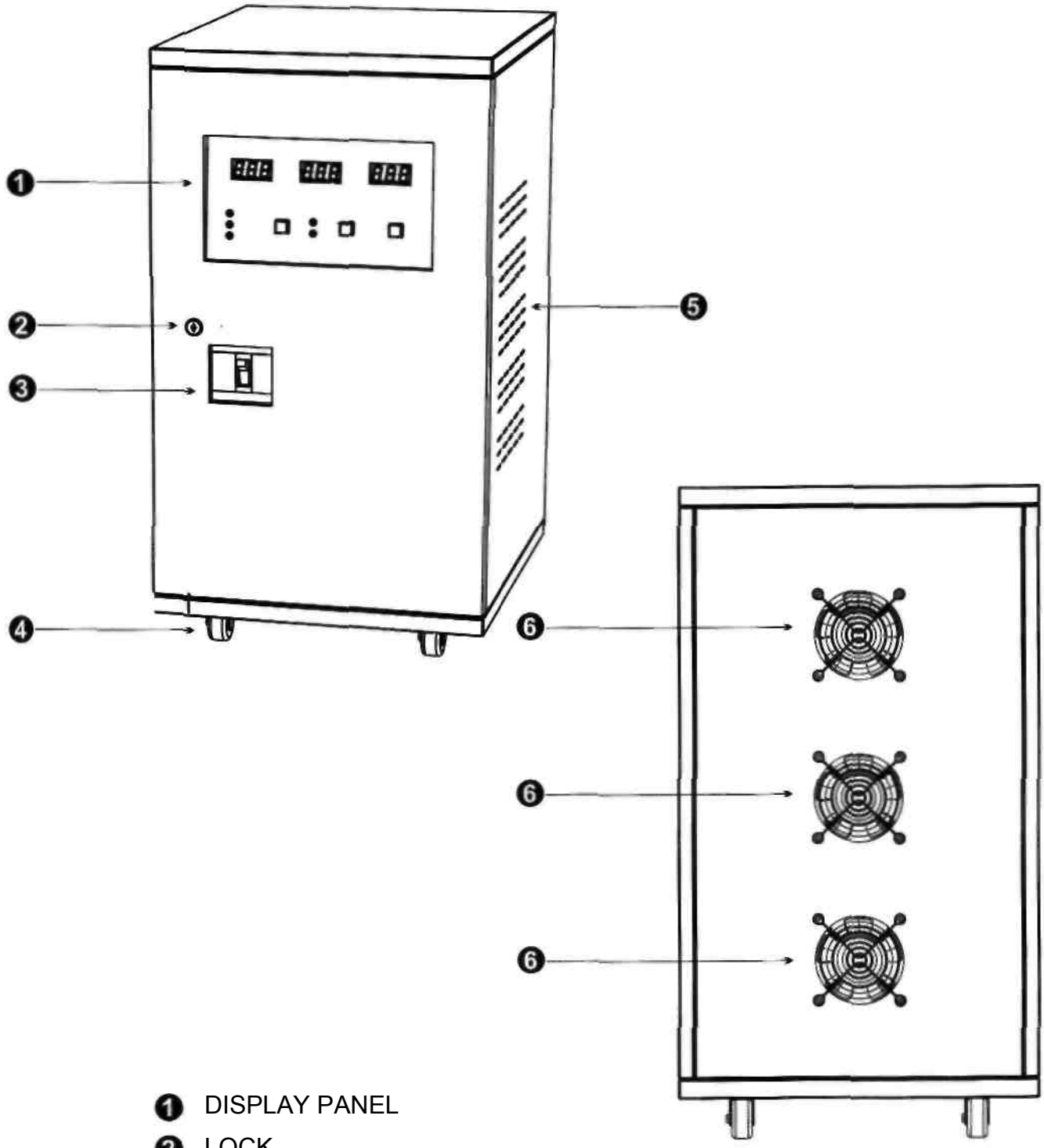
OPERATING CONDITIONS

Operating Temperature	-5°C - +45°C
Operating Humidity	10%-90%, non-condesing
Operating Altitude	<1,000m

Model No.	**Rated Capacity** (VA/W)	**Rated Current** (A)	**Machine Size** (WxDxH mm)	**Weight** (kgs)
SVC-10K	10k/8k, 10k/6k	15A	520x460x830	70
SVC-15K	15k/12k, 15k/9k	23A	520x460x830	78
SVC-20K	20k/16k, 20k/12k	30A	520x460x830	100
SVC-30K	30k/24k, 30k/18k	45*A	520x460x830	108
SVC-45K	45k/36k	68A	520x600x1080	174
SVC-60K	60k/48k	91A	520x600x1080	191
SVC-80K	80k/64k	121A	570x600x1080	210
SVC-100K	100k/80k	152A	570x600x1080	235

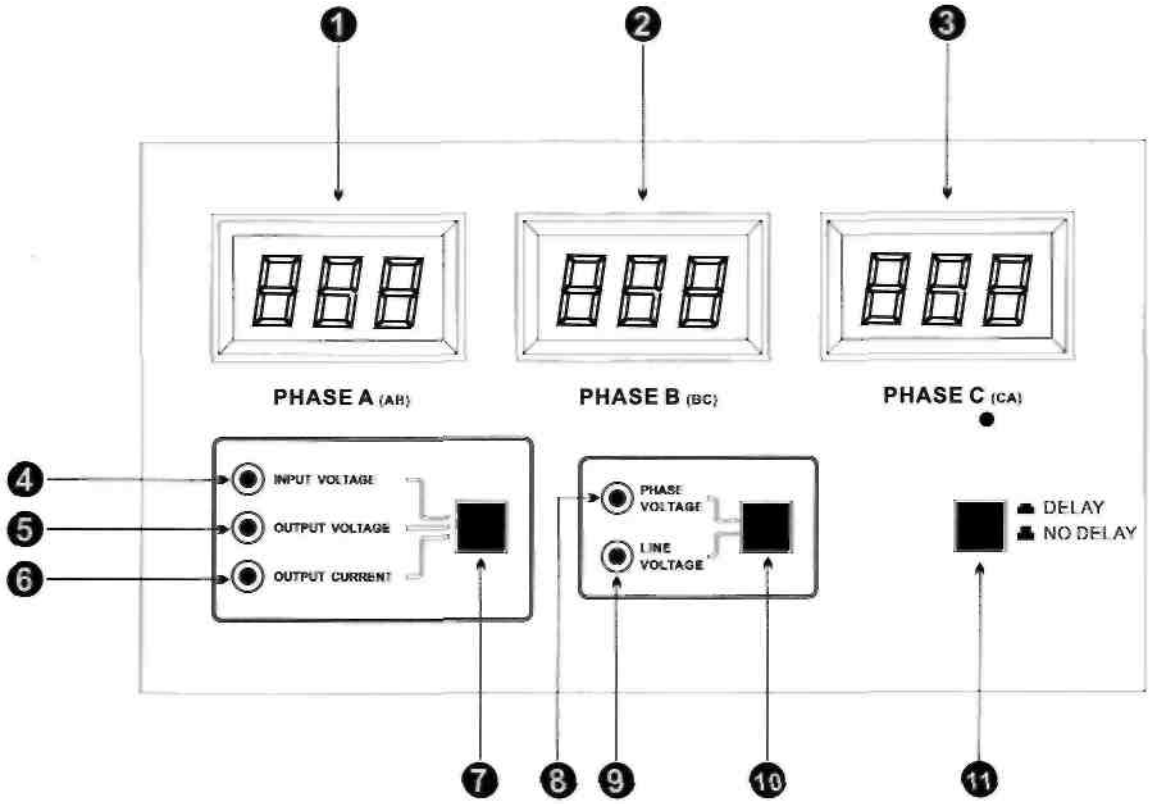
3. FAMILIAR WITH THE VOLTAGE REGULATOR

3.1 External View



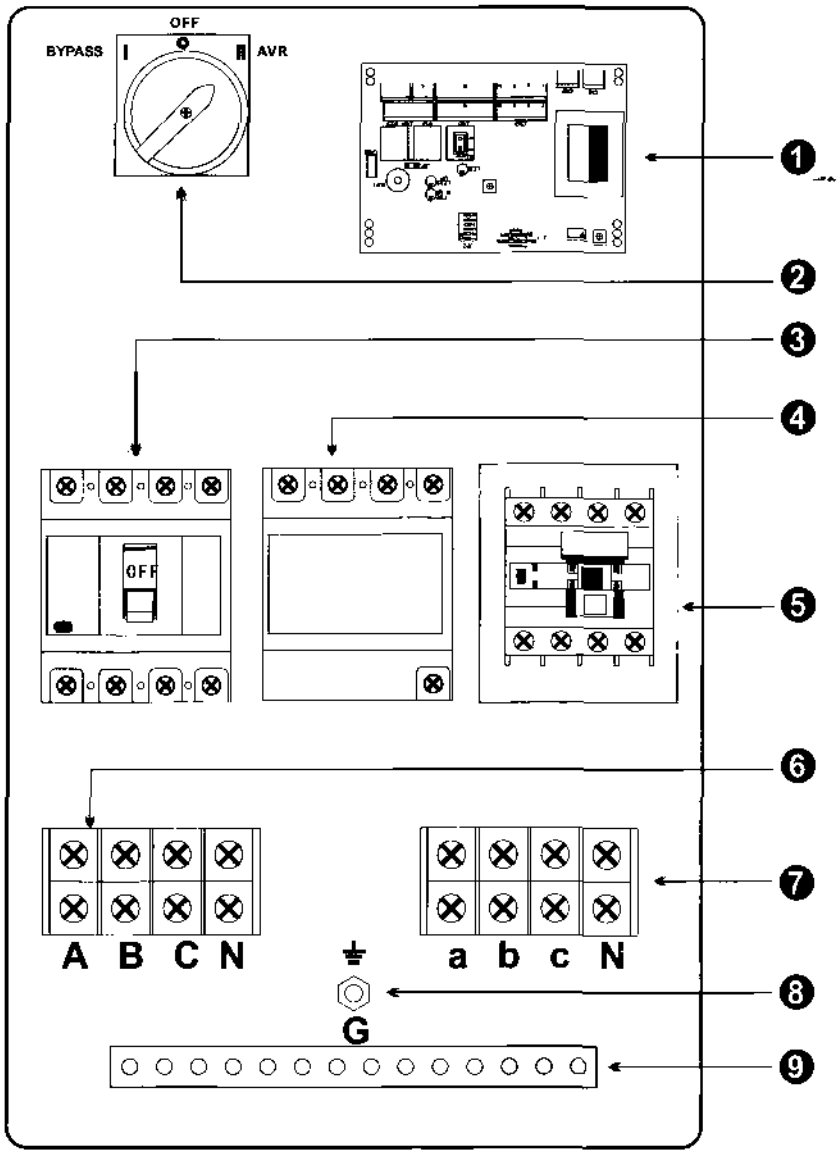
1. DISPLAY PANEL
2. LOCK
3. AIR BREAKER
4. CASTER
5. COOLING HOLE
6. COOLING FAN

3.2 Display Panel



1. DISPLAY OF PHASE A (AB)
2. DISPLAY OF PHASE B (BC)
3. DISPLAY OF PHASE C (CA)
4. "INPUT VOLTAGE" INDICATOR
5. "OUTPUT VOLTAGE" INDICATOR
6. "OUTPUT CURRENT" INDICATOR
7. SWITCH BUTTON OF "INPUT AND OUTPUT VOLTAGE"
8. "PHASE VOLTAGE" INDICATOR
9. "LINE VOLTAGE" INDICATOR
10. SWITCH BUTTON OF "PHASE AND LINE VOLTAGE"
11. DELAYBUTTON(DELAY=180S,NODELAY=6S)

3.3 Internal View



1. MAIN BOARD
2. MANUAL BYPASS SWITCH
3. INPUT AIR BREAKER (MAINS SWITCH)
4. REPLACEABLE SPD (OPTIONAL)
5. CONTACTOR
6. INPUTTERMINAL BLOCK
7. OUTPUT TERMINAL BLOCK
8. EARTH CABLE TERMINAL
9. CABLE HOLDER

4. PRODUCT EXAMINATION

The voltage regulator is 100% tested before shipment. Check if it has been damaged after unpacking it, according to the follow steps:

4.1 Packing Contents

Delivered pack includes:

Voltage Regulator	1 set
User's Manual	1 piece
Warranty Card	1 piece
Key	1 pair

4.2 Visual Observation

Check the name plate of the voltage regulator to verify the model no., rated voltage, and rated capacity is in accordance with your purchase order.

Make sure the exterior case of the voltage regulator is not damaged. If you notice any damage, please contact the transportation company and the authorized dealer. Do not try to open it or use it!

4.3 Name Plate

MODEL		-> Model No
CAPACITY		-> Power Capacity (kVA/kW)
INPUT		-> Input (phase, connection, voltage, frequency)
OUTPUT		-> Output (phase, connection, voltage, frequency)
DATE		-> Date of Manufacture
S/N		-> Serial No

5. PLACEMENT

For safety, better performance and longer life span, the voltage regulator should be handled and placed according to the following instructions.

5.1 Moving

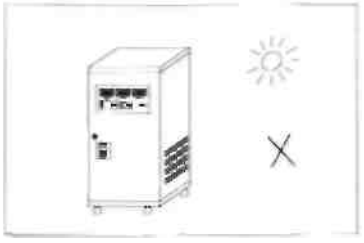
Cut off input, remove all the wires connected to the voltage regulator.

Do not move the voltage regulator upside down.

Rough handling is prohibited

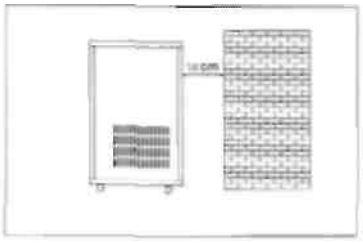
5.2 Environment of Placement

• Do not place voltage regulator on an uneven, tilted or vibrative place



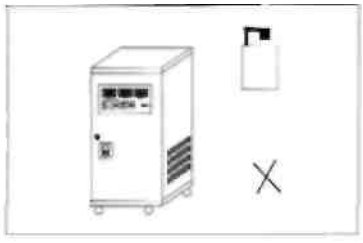
• Keep away from direct sunlight, rain or excessive humidity

• Keep away from fire, heat sources



• Place voltage regulator in a well ventilated place, keep away at least 10cm from the wall.

• Operation temperature -5°C - +45°C, humidity 0-90%, non-condensing



• Keep away from corrosive gas or fluid

6. WIRING CONNECTION

6.1 Wiring Precautions

Please obey the laws, regulations of electrical safety in your country/area when choosing the wires and doing the wiring connection.

Make sure the wires are correctly selected. The over current ability of the wires should not be less than the rated current, please refer to **Paragraph 2.3** in page4.

It's recommended to choose the copper wire, instead of aluminum wire.

Other conditions (cooling condition, wire laying method, distance between the voltage regulator and distribution box, etc) must be considered when choosing wires.

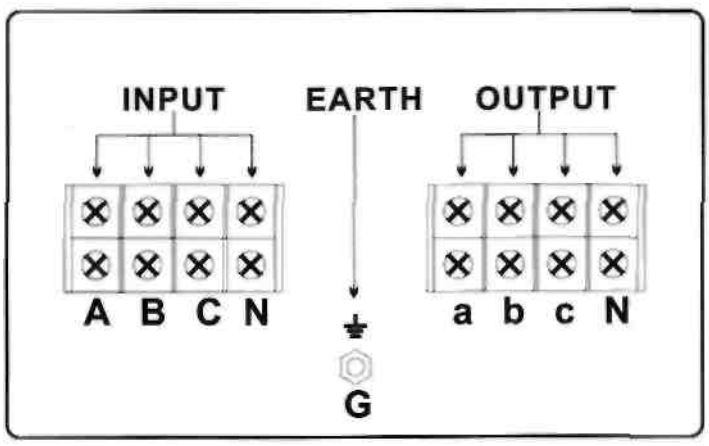
Wiring connection must be tight, to prevent weak contact and electrical shock.

Make sure the polarity and phase sequence are correct.

Make sure to cut off the input mains power when making the wiring connection.

6.2 Wiring Connection

Please check the wiring label below the input and output terminal block, if there is any discrepancy, please consult to the authorized dealer.



7. OPERATION

7.1 Switch On **The** Voltage **Regulator**

Make sure all the loads connected to the voltage regulator are switched off.
Make sure the **MANUAL BYPASS SWITCH** is on the **"AVR"** (or **"II")** position.
Put the **INPUT AIR BREAKER** to **"ON"** position, the voltage regulator starts to work.
Switch on the loads one by one.

7.2 Switch Off **The** Voltage **Regulator**

Switch off all the loads.
Put the **INPUT AIR BREAKER** to **"OFF"** position.

7.3 From Regulating Mode to Bypass Mode

Switch off all the loads.
Put the **INPUT AIR BREAKER** to **"OFF"** position.
Put the **MANUAL BYPASS SWITCH** to **"BYPASS"** (or **"I)** position.
Put the **INPUT AIR BREAKER** to **"ON"** position
Switch on the loads one by one.

7.4 From Bypass Mode to Regulating Mode

Switch off all the loads.
Put the **INPUT AIR BREAKER** to **"OFF"** position.
Put the **MANUAL BYPASS SWITCH** to **"AVR"** (or **"II)** position.
Put the **INPUT AIR BREAKER** to **"ON"** position.
Switch on the loads one by one.

7.5 Operation Of Display Panel

Each digital display shows the **Input Voltage, Output Voltage, Output Current** for each phase(A, B,C), and the **Line Voltage** (AB, BC, CA) for Input and Output. It also shows the status of the voltage regulator by means of symbol:

"L": Output Under Voltage
"H": Output Over Voltage
"C": Transformer Windings Over Temperature
"F": Overload
"P": Input Wrong Phase Sequence

Press **SWITCH BUTTON OF PHASE AND LINE VOLTAGE** to switch the display between **Phase Voltage** and **Line Voltage.**
Press **SWITCH BUTTON OF INPUT AND OUTPUT** to switch the display between **Input Voltage, Output Voltage, and Output Current.**
Press down the **DELAY BUTTON** to select the delay time of 180 seconds, press it up to select the delay time of 6 seconds.

8. ALARM AND PROTECTION

8.1. Overload Protection

When load is <120%, the voltage regulator won't give alarm and protection.
Once the load is over 120%, the buzzer will beep once per 2 seconds, in the same time, the countdown time for output cutoff will be shown in the display. Once the countdown is finished, the output will be cut off by contactor, in the same time, symbol "F" will be shown in the display, and the buzzer will beep once per second.

Load Rate	Countdown Time
>120%	180s
>150%	30s
>200%	10s
>300%	5s

If overload is eliminated within 15 minutes, the output will be automatically restored. Otherwise, the user must restart the voltage regulator.

8.2. Under Voltage Protection

Once the output voltage is below the lower limit, symbol "L" will be shown in the display and keep flashing, in the same time, the buzzer will beep once per 2 seconds. After 20 seconds, the output will be cut off by contactor, and the buzzer will beep once per second .
When the input voltage increases to normal range, the output will be automatically restored.

8.3. Over Voltage Protection

Once the output voltage is over the upper limit, symbol "H" will be shown in the display and keep flashing, in the same time, the buzzer will beep once per 2 seconds. After 20 seconds, the output will be cut off by contactor, and the buzzer will beep once per second .
When the input voltage decreases to normal range, the output will be automatically restored.

8.4. Over Temperature Protection

Once the temperature of transformer windings is over the limit, the output will be cut off immediately by contactor, symbol "C" will be shown in the display and keep flashing, **in** the same time, the buzzer will beep once per second
When the temperature decreases to normal range, the output will be automatically restored.

8.5. Input Wrong Phase Sequence Protection

The voltage regulator can't be switched on if the phase sequence is wrong, symbol "P" will be shown in the display and keep flashing, in the same time, the buzzer will beep once per second.

8.6. Short Circuit Protection

The **INPUT AIR BREAKER** will trip off to cut off the input if short circuit happens.

8.7. Surge Protection (Optional)

The additional SPD (Surge Protection Device) will protect the voltage regulator and connected loads from being damaged by surge, spike or thunder strike.
Check periodically if the SPD is void.

9. MAINTENANCE

The voltage regulator is basically maintenance free! But regular check and maintenance can extend its life span.

9.1. Preventive Method.

Do not put any liquid on top of the voltage regulator.
Try to install the voltage regulator in a clean place, avoid much dust, sandy area.

9.2. Regular Inspection.

Shut down the voltage regulator completely.
Use cotton cloth and detergent to clean the machine body and ventilation holes.
Check all terminals, replace the damaged ones with same specification.
Check if it's still valid or void, if a Surge Protection Device (SPD) is included.

9.3. Extraordinary Inspection.

when malfunction happens, refer to ***ANNEXI: TROUBLE SHOOTING*** in page 13.
Refer to the authorized dealer or manufacturer if needed.
In thunder or rainy season, extraordinary inspection should be executed.
The cooling fans should be replaced every three years.

10. OTHERS

This user's manual is only for the **IVR** series voltage regulator.

Though the voltage regulator is designed and manufactured according to strict safety standards, if it's applied to any application which may cause any dangerous damage to human safety or human life, include but not limited to the following cases, please refer to the authorized dealer or manufacturer.

Traffic system
Medical equipment
Nuclear system or power system
Aviation and aerospace
Other special applications

ANNEX I: TROUBLESHOOTING

Faulty	Reason/How to Check	What to do
Input air breaker trips off.	Heavily overloaded.	Reduce the load to its rated capacity.
	The load is short circuit.	Remove the load.
	Air breaker is faulty.	Contact authorized dealer or manufacturer.
Contactor trips off.	Overload protection.	Reduce the load to its rated capacity.
	Under voltage protection.	Wait till the utility voltage returns to normal.
	Over voltage protection.	Wait till the utility voltage returns to normal.
	Over temperature protection.	Wait till the temperature returns to normal.
	Contactor is faulty.	Contact authorized dealer or manufacturer.
Output voltage is out of range while contactor not trips off.	Wiring connection is loose.	Fasten the wiring connection.
	Input frequency is out of range (45-65Hz).	Stop to use the voltage regulator until the input frequency backs to normal.
	Control board is faulty.	Contact authorized dealer or manufacturer.
	Contactor is faulty.	Contact authorized dealer or manufacturer.
Voltage regulator can not be switched on.	Input phase sequence is wrong.	Make the correct connection.
	Manual bypass switch is at "OFF" position	Put it at the "AVR" or "II" position.
Cooling fan is not running.	Temperature of winding does not reach to 55°C.	It's normal, not faulty.
	Connection of cooling fan is loose.	Fasten the connection of cooling fan.
	Fan is faulty	Contact authorized dealer or manufacturer.
Sparkle comes from variable auto-transformer.	Surface of transformer is not smooth.	Use abrasive tape to smoothen the surface.
	Carbon brush set is faulty.	Contact authorized dealer or manufacturer.
Smoke comes from inside cabinet.	Inside parts/components are damaged.	Contact authorized dealer or manufacturer.
Bad smell comes from inside cabinet.	Inside parts/components are damaged.	Contact authorized dealer or manufacturer.

For any faulty out of above table, please contact the authorized dealer or manufacturer immediately!