INDEX

1.Brief introduction

The ST5100 series UPS adopt advanced DSP control technique, they have a simple operation interface and strong communication function, the module design is easy to maintenance, and it have good EMC design, which makes it become a excellent and high performance UPS. Its technique specification is shown in the table below:

Tab 2-1 Technique specification

Specification \ model		ST5100-80K	ST5100 – 100K	ST5100 – 120K	ST5100 – 160K
In	Rectifier structure	Three line phase control rectifier			
	Voltage range (Vac)	380±25%			
	Rectifier input frequency range (Hz)	40~65			
	Synchronization frequency range (Hz)	50±5%			
	Line	3φ4W+GND			
	Battery voltage (VDC)	12V×29=348V			
	Charge current（A）	30	40	40	60
Out	Capacity（KVA）	80	100	120	160
	Phase	3φ4W			
	Voltage (Vac)	L－N：220 L-L:380			
	Frequency (Hz)	Mains input normal: automaticly synchronize the mains； Mains failure: 50± 0.2%			
	Three line 100 % load imbalance voltage stabilization	≤2%， allow 100% imbalance			
	Wave distortion	linear load THD＜3%			
	Transfer time （ms）	0			
	System efficiency	≥90%			
	Overload capacity	125% rated load: 15 minute ； 150% rated load: 1 minute；			

Other	Maintain bypass	Provide no transfer time maintain bypass switch			
	Start-up function	Support DC start-up function			
	LCD display	Three phase input voltage, input frequency, three phase output voltage, load, battery voltage, battery charge and discharge current and so on			
	LED display	UPS working status and failure indication			
	Alarm function	Input abnormal, battery low, over load, failure			
	Communication function	provide stem point communication and RS232/RS485, achieve UPS aptitude supervise 。			
	Battery testing function	(detail see in LCD display working battery testing control page introduction)			
	Protection	output short-circuit, over load, over temperature, battery low , output over voltage / low voltage			
	EMC	Meets standard GB/T 7260.3-2003			
	Noise （dB）	＜65			
	Cooling mode	Ventilator			
	Working temperature （℃）	0～40			
	Relative humidity	0 ~ 95%, No condensation			
	Dimension (wide × length × height)(mm)	1200×800×1600			
	Weight (Kg)	840	950	1180	1300

◆ The index fluctuation forgives a not another line to notify

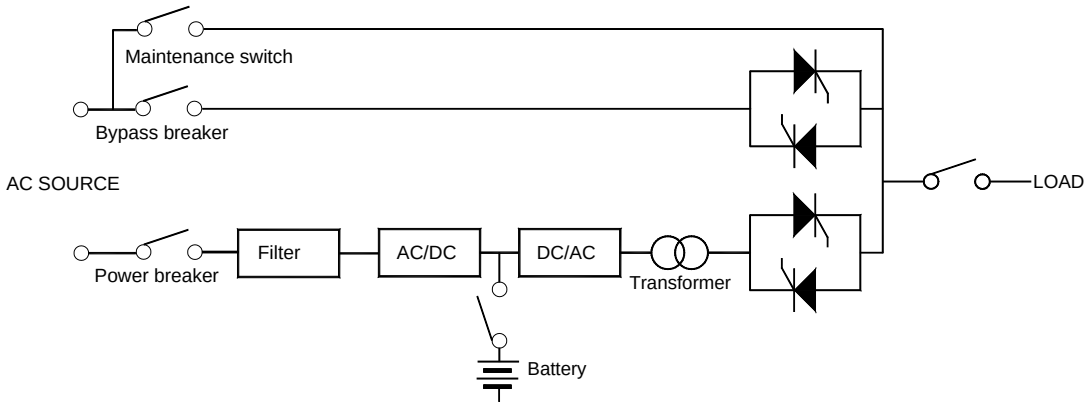
Tab 2-2 Technique specifications

index \ model		ST5100 P-80K	ST5100 P-100K	ST5100 P-120K	ST5100 P-160K
In	Rectifier configuration	Three line phase control rectifier			
	Voltage range (Vac)	380±25%			
	Rectifier input frequency range (Hz)	40~65			
	Synchronization frequency range (Hz)	50±5%			
	Line	3φ4W+GND			
	Battery voltage (VDC)	12V×29=348V			
	Refresh electric current（A）	30	40	40	60
Out	Capacity（KVA）	80	100	120	160
	Line	3φ4W			
	Voltage (Vac)	L－N：220 L-L: 380			
	Frequency (Hz)	Mains input normal: automaticly synchronize the mains； Mains failure: 50±0.2%			
	Three line 100% load imbalance voltage stabilization	≤2%， allow 100% imbalance			
	Parallel mode	A parellel mode with equal current output and without principal and subordinate			
	Output current unequalization when units are paralleled	≤5%			
	Wave distortion	linear load THD＜3%			
	Transient bypass transfer time（ms）	0			
	System efficiency	≥90%			
	Over loading capacity	125% rated load: 15 minute ； 150% rated load: 1 minute；			
Other	Maintain bypass	Provide no transfer time maintain bypass switch			
	Start-up function	Support DC start-up function			
	LCD display	Three phase input voltage, input frequency, three phase output voltage, load, battery voltage, battery charge and discharge current and so on			

	LED display	UPS working status and failure indication			
	Alarm function	Input abnormal, battery low, over load, failure			
	Communication function	provide stem point communication and RS232/RS485， achieve UPS aptitude supervise 。			
	Battery testing function	(Detail see in the LCD display working battery testing control page introduction)			
	Protection	Output short-circuit, over load, over temperature, battery low voltage, output over voltage /low voltage			
	EMC	Meets standard GB/T 7260.3-2003			
	Noise （dB）	＜65			
	Cooling mode	Ventilator			
	Working temperature （℃）	0～40			
	Relative humidity	0 ~ 95%, No condensation			
	Dimension (wide × length × height)(mm)	1200×800×1600			
	Weight (Kg)	920	1060	1190	1550

2. Working principle

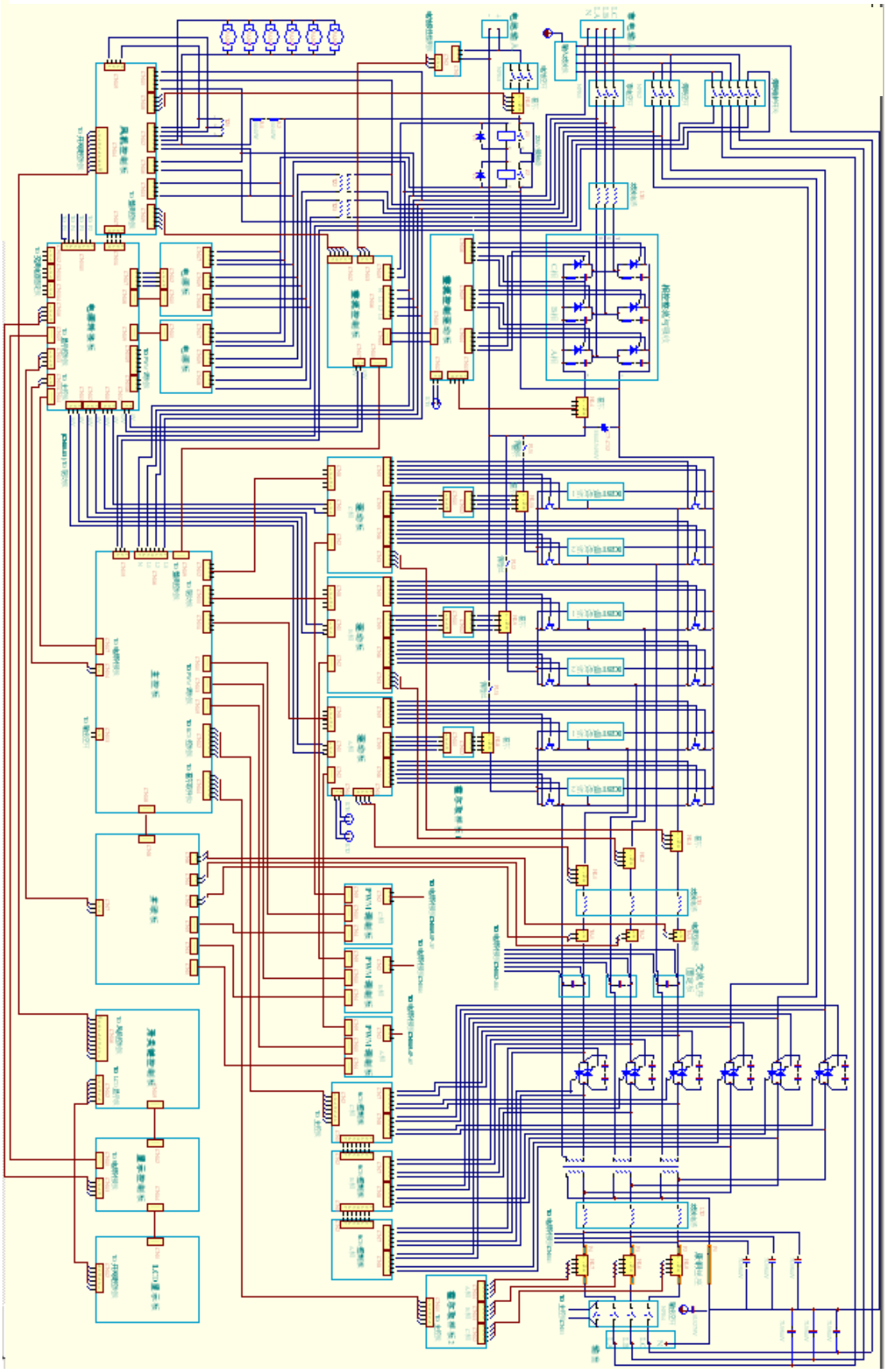
2.1 Working principle diagram



2.2 Working mode

When the utility is normal, the rectifier convert the AC input to DC power, it supply the inverter and charge the battery at the same time. Through the process of AC power changed to DC power, the inverter can supply more reliable and pure power to load, as the rectifier can dispel the problems of the portent, noise, unstable frequency and so on. When the utility is abnormal the battery connected to DC BUS will supply power to inverter, to protect load from AC power interrupting. when the inverter is failure (such as over-temperature, short circuit, output voltage abnormity, overload and so on), the inverter should shut off automatically. If the utility is normal at this moment, the switch will switch to bypass power to supply power to load. when you are maintaining, and the power must not be interrupted, you can shut off the inverter, and turn on the maintenance switch, then turn off the rectifier and bypass breaker. At this mode, AC power goes through maintenance switch to supply power to load. And at this time, there will be no any electricity in the UPS inside, and the maintenance person can work without any danger.

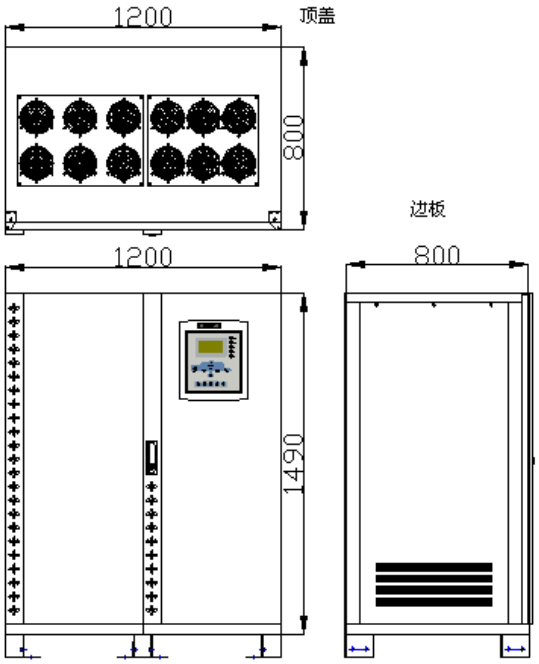
2.3 The UPS electrical connection diagram



3. UPS structure

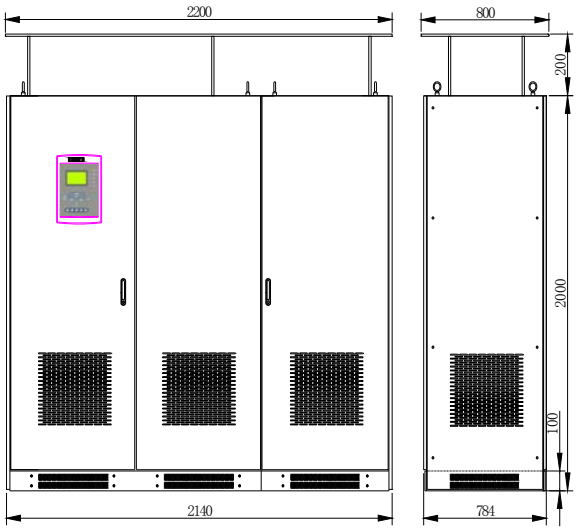
3.1 Shape

3.1.1 ST5100 80~ 160KVA shape and dimension



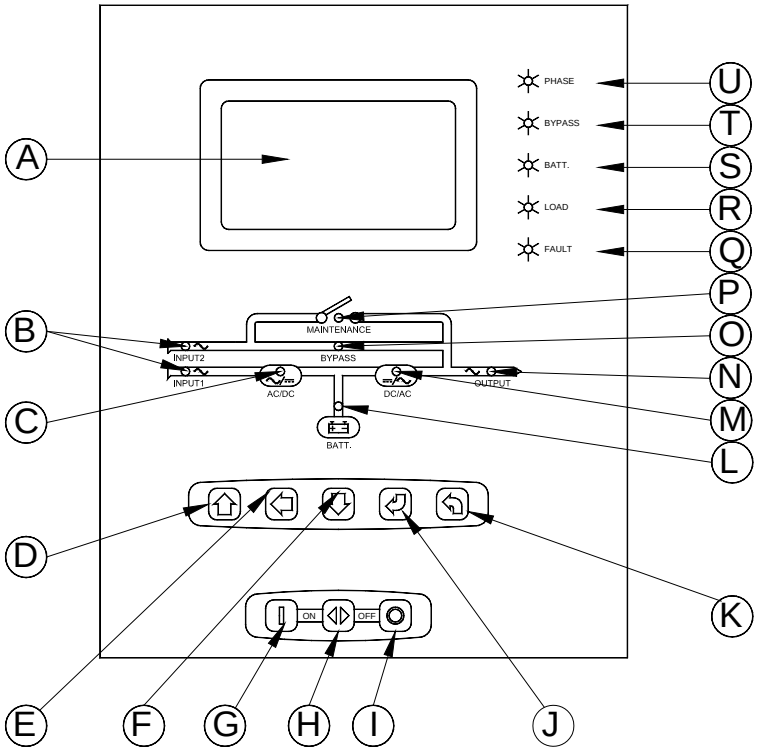
picture 3-1 ST5100 80～ 160K shape

3.1.2 ST5100 200~ 400KVA shape and dimension



picture 3-3 ST5100 300～ 400KVA shape and dimension

3.2 Panel introduction



Picture 3-4 Display panel

A: LCD display: display UPS operation parameter and status.(such as voltage, current, amount of load etc.)

B: Mains indicate light (green), it bright while mains input is normal.

C: Rectifier indicate light (green), it bright when the rectifier working normal.

D: Page up key, This key is “display upward / parameter setting +” function repeat.

E: Back page key left: Push this key to check the item LCD display or turn on background light

F: Turn over page key downward: Push this key mean “display downward / Parameter setting -”.

G: Switch on key: Match with a usage with H while switch on.

H: Confirm key: Push this key to confirm the function.

I: Shut down key: Match with a usage with H while shut down.

J: Confirm key: Usage while checking to seek the contents of LCD display.

K: Return to key: Usage while checking to seek the contents of LCD display.

L: The battery indicate light (green): When battery power supply, it bright.

M: The inverter indicate light (green): When the inverter working normally, the light is bright.

N: Output indicate light (green): The light is bright while there is output voltage.

O: Bypass indicate light (green): Bypass power supply the light is bright.

P: Maintenance bypass indicate light (green): When power is supplied by maintainance bypass the light bright.

Q: Failure indicate light (red): Rectifier, inverter, and bypass failure the light be bright.

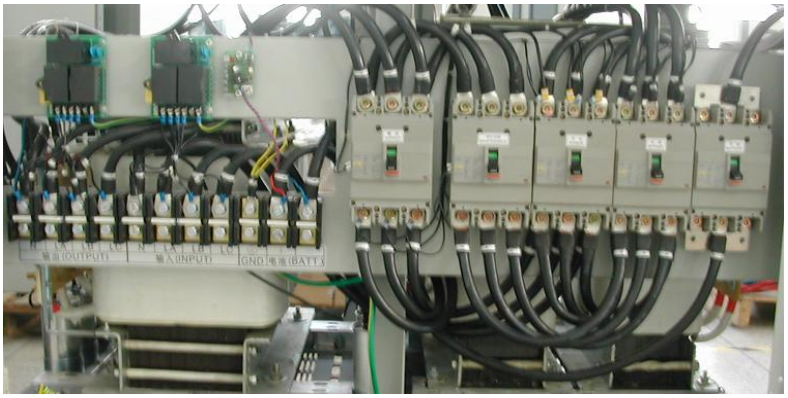
R: Overload indicate light (red): The light bright when UPS is overload.

S: Battery low indicate light (red): The light bright when battery low.

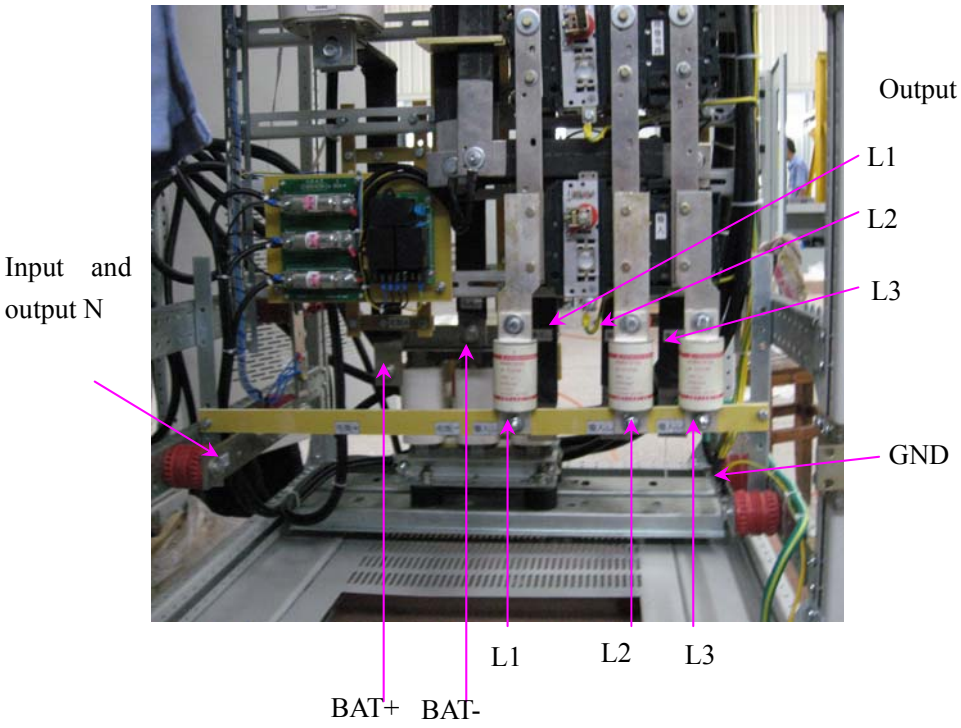
T: Bypass indicates light (red): Bypass output the light bright.

U: Phase indicates light (red): When the rectifier input, bypass input phase sequence wrong or phase lose, the light bright.

3.3 Terminal and breakers



80～160KVA



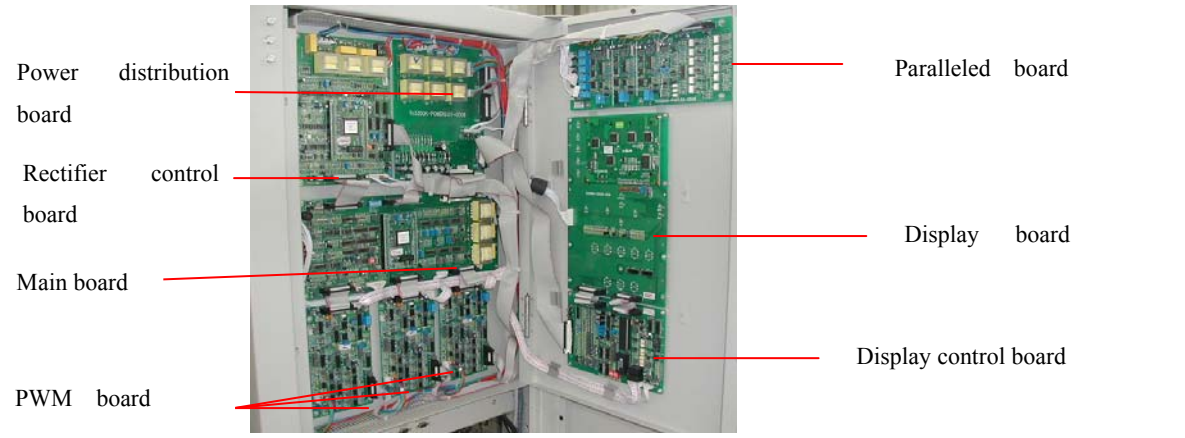
200~400KVA

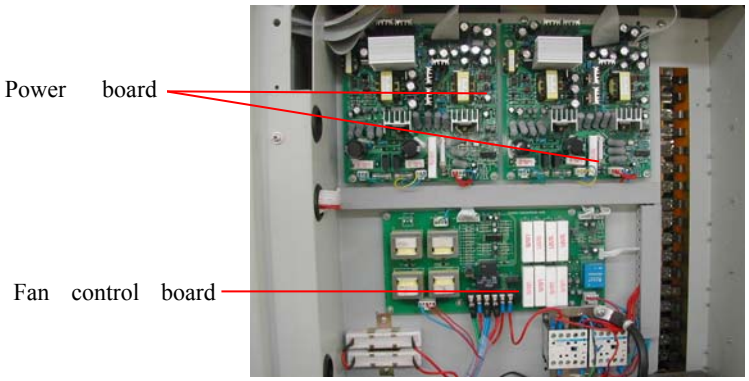
Picture 3-5 Terminal and breakers

3.4 Inside structure

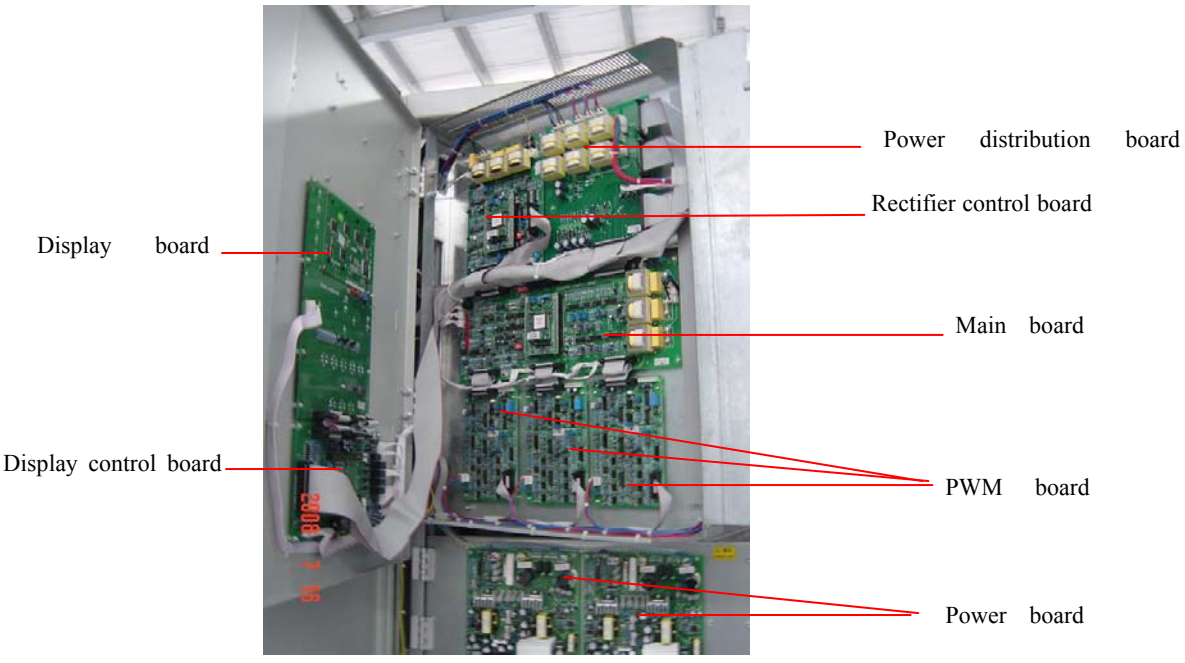
3.4.1 UPS inside structure

① Main PCB





80~160KVA



200~400KVA

Picture 3-6 machine main electrocircuit board

② Radiator module ：

Inverter

Rectifier

Bypass and output

Picture 3-7 ST5100 80~ 160K inverter module

Picture 3-8 ST5100 80~ 160K rectifier module, bypass and output SCR module

IGBT and its filter board

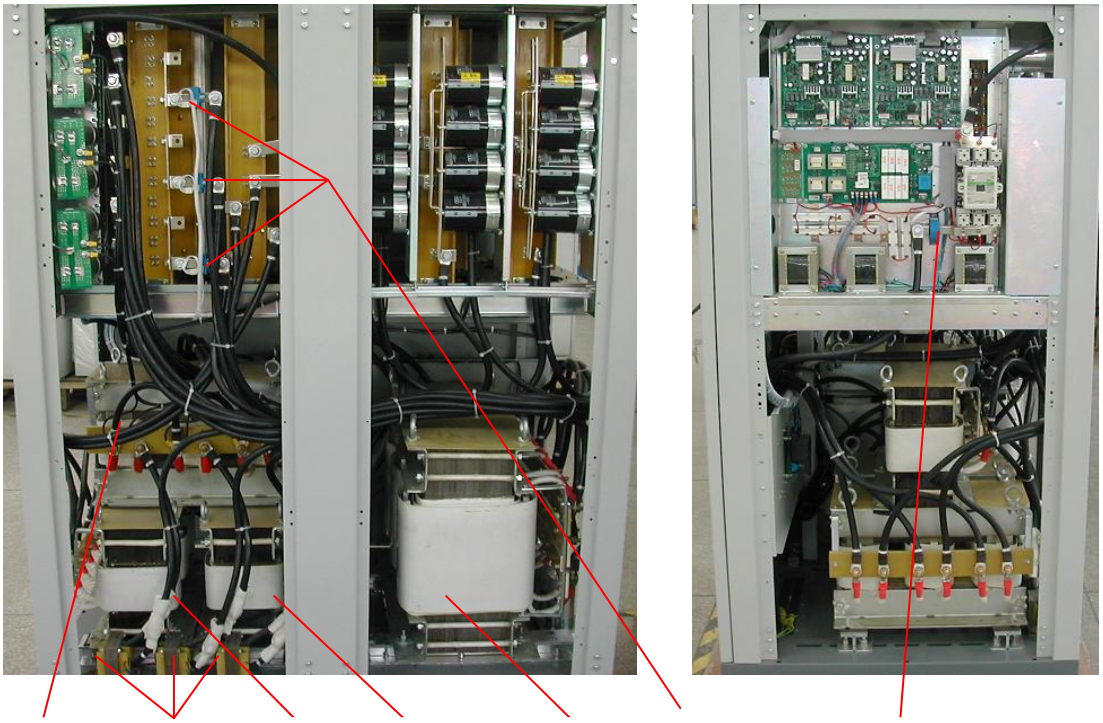
Bypass and inverter output SCR

Rectifier SCR

Picture 3-9 200~400KVA inverter module, rectifier module, bypass and output SCR module

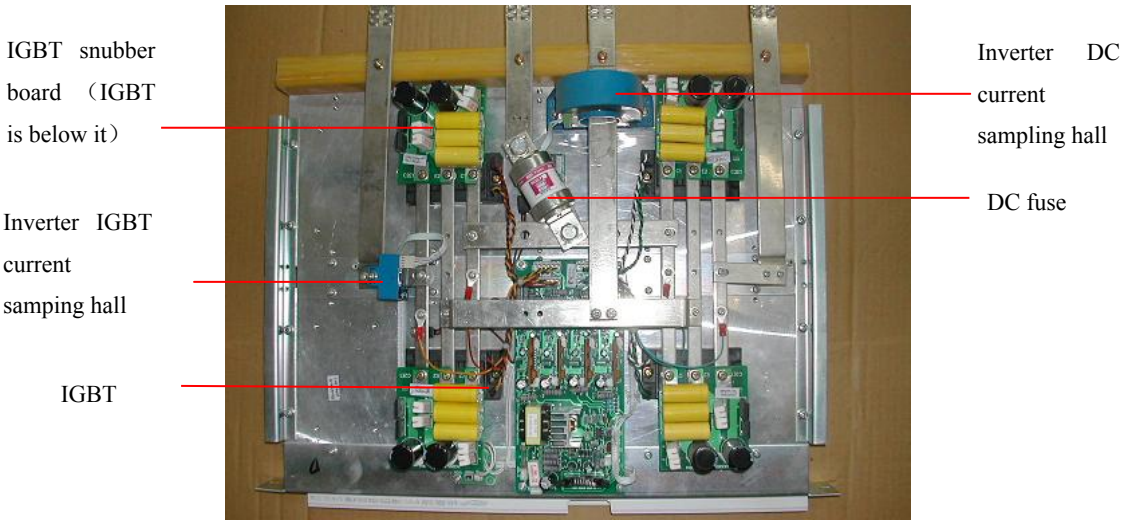
As above diagram, when we need to be replaced a component on the damage radiator module, we can remove the two screws fix on top and bottom of the radiator, and pull out the connect line of the radiator module, turn off the line box, pull out lines insided then pull out the radiator module.

③ Main circuit inductor, transformer, Hall:



picture 3-10 ST5100 80~ 160K back sight、right sight picture

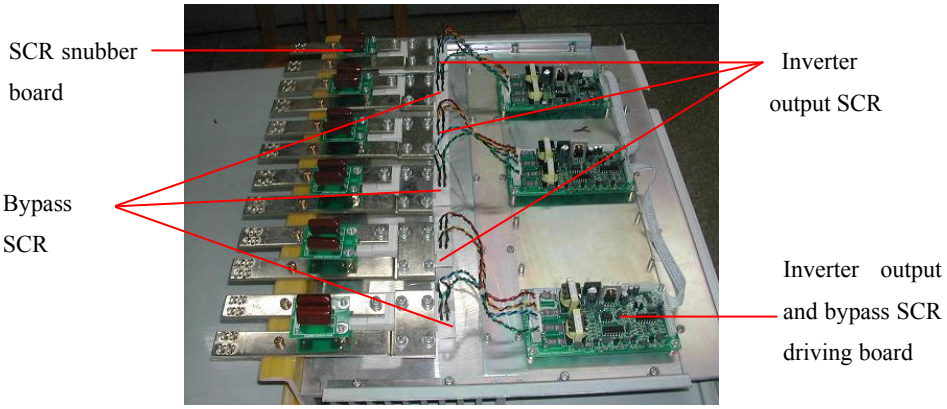
3.4.2 inverter radiator module



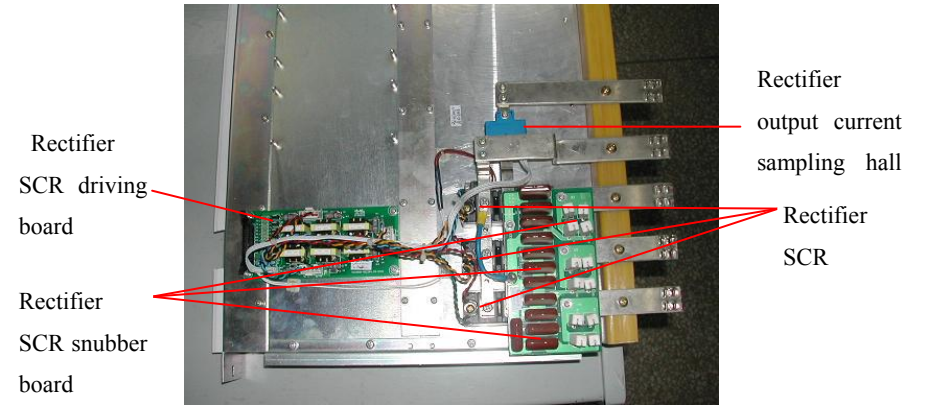
ST5100 80~ 160K（three modules）

Picture 3-11 inverter radiator module

3.4.3 rectifier and SCR radiator module



ST5100 80~160K bypass SCR radiator



ST5100 80~160K rectifier SCR radiator

picture 3-12 rectifier 、 bypass SCR radiator module

4. Function description

4.1 Function of system main parts

4.1.1 Rectifier control board function

① AC input phase sequence wrong or phase lose test: When AC input phase sequence wrong or phase lose, rectifier will stop working.

② Input voltage test: When the AC input voltage is out of permited value, rectifier will not work.

③ Bypass input phase sequence wrong or phase lose test: When bypass input phase sequence wrong or phase lose, rectifier control board DSP think that bypass is failure at this time, and send out a bypass failure signal to the inverter and request inverter not allow bypass output.

④ Bypass input voltage test: When the bypass input voltage is out os the permited range, rectifier control board DSP think that bypass is failure at this time, and send out a bypass failure signal to the inverter and request inverter not allow bypass output.

⑤ Output over voltage /over current protection:When the voltage/ current of the rectifier output exceeds permited range, rectifier will be shut down.

⑥ Charge current too big protection:When the charge current exceeds an enactment value, the rectifier automaticly stops working;

⑦ Boost charge/float Charge voltage tiny adjust: Through adjust rectifier control board RP6 and RP8 potential we can adjust the float charge voltage and boost charge voltage. Float Charge voltage adjust range is 390~400 VDC, and boost charge voltage range is 400~410 VDC;

⑧ The charge current setting: The rectifier control board SW1 DIP can be used to set charge current.

⑨ The rectifier over-temperature protection: The rectifier will stop working when the temperature is too high.

⑩ Rectifier six pulse control signal produce.

4.1.2 Main board function introduce:

① DSP voltage stability control.

② Output frequency 50Hz/60Hz, synchronous frequency range setting, output voltage, phase synchronous tiny adjust function.

③ Inverter protect function: over temperature, over load, output over voltage/low voltage, battery low, switch control, bus over current etc.

④ PS failure appearances indicate.

4.1.3 PWM board function introduce:

① Three phase inverter signal produce;

② Automatic equilibrium control;

③ Current feedback and current limit protection.

4.1.4 Display board function:

① Some parameter value display;

② Battery test, charge control;

③ System alarm signal display.

4.1.5 Rectifier driver board: Rectifier driver signal isolate and enlarge.

4.1.6 Inverter driver board: Inverter driver signal isolate and enlarge.

4.1.7 Bypass, inverter output SCR driving board: Bypass, inverter output SCR driver isolate and enlarge.

4.1.8 Power board: Supply +12VDC、-12VDC、30VDC、5VDC、24VDC power to the system.

4.1.9 Power backup and transfer board: Power transfer.

4.1.10 Fans control board:

① Fans speed control (full speed, half speed, stop);

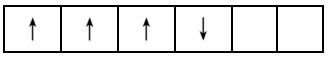
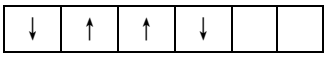
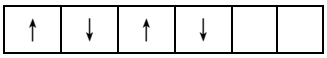
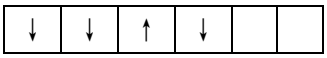
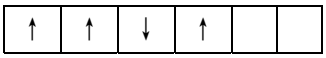
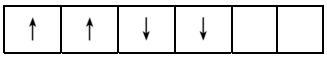
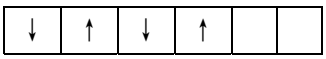
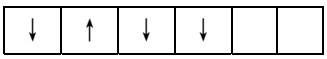
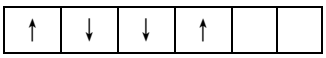
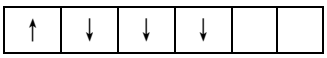
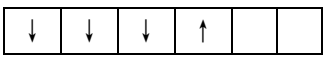
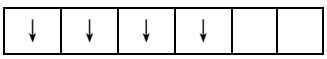
② DC buffer;
③ DC voltage isolate and sample.
④ DC current isolate sample.

4.1.11 Parallel board: Parallel control function.

4.2 DIP switch setting of each board

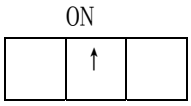
4.2.1 display control board board DIPswitch setup

① ID code setting: We can set the UPS ID code through display control board DIP switch setting, it can be set according to the table below **(For the UPS produced after 2007/01/01 the DIP switch is cancel and it can be set from panel LCD directly)**:

ID	Setting picture	ID	Setting picture
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	

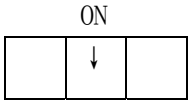
② Panel 50/60Hz system identify setting: It is shown in the picture below, when the DIP switch SW1 second pin as is turned to “ON” then it is set to 50Hz identify system, if it is turned to “OFF”, then it is set to

60Hz identify system **(For the UPS produced after 2007/01/01 the SW1 is cancel and the frequency identify system can be set from the panel LCD).**



SW1

50Hz system



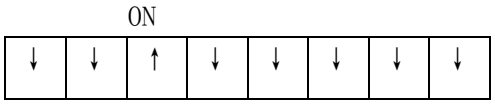
SW1

60Hz system

4.2.2 main board DIP switch setting

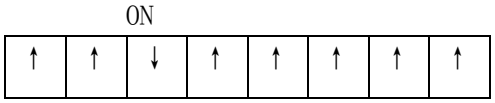
Main board has two DIP switch SW1, SW2, it can be used for parallel/single unit system setting and output 50/60Hz setting.

Parallel/single unit setting: As shown in the figure below.



SW2

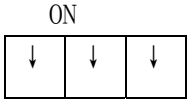
Parallel unit setting



SW2

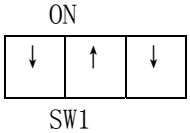
Single unit setting

① 50/60Hz output system setup ：It can beset according to the picture below. **（For the UPS produced after 2007/01/01 it just need to be set from the panel LCD）**



SW1

50Hz output system setup



SW1

60Hz output system setup

4.2.3 rectifier control board DIP switch setting

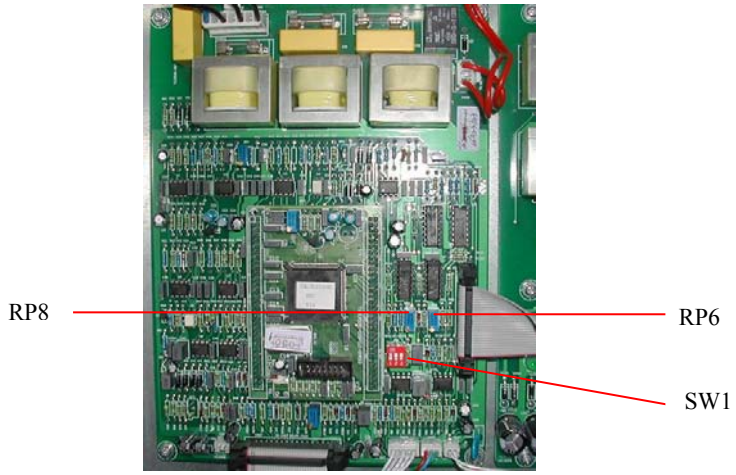
The UPS charge current canbe set through rectifier control board SW1, it is shown in the table below:

DIP switch SW1 setting	SW1-1	SW1-2	SW1-3	Charge current
				ST5100(P)-80~ 160K
Status	OFF	OFF	OFF	40A
	ON	OFF	OFF	30A
	ON	ON	OFF	20A

(For the 80~160KVA UPS produced after 2007/01/01 and 200~400KVA the charge current can be set from panel LCD, for 80~160KVA the charge current setting range is 5~40A, for 200~400KVA charge current setting range is 5~80A)

4.3 Potential function introduction

4.3.1 rectifier control board



picture 4-1 rectifier control board electrical organ position

RP6: Adjust float charge voltage, it should be adjusted to 394±4VDC;

RP8: Adjust boost charge voltage, it should be adjust to 405±5VDC.

4.3.2 main board

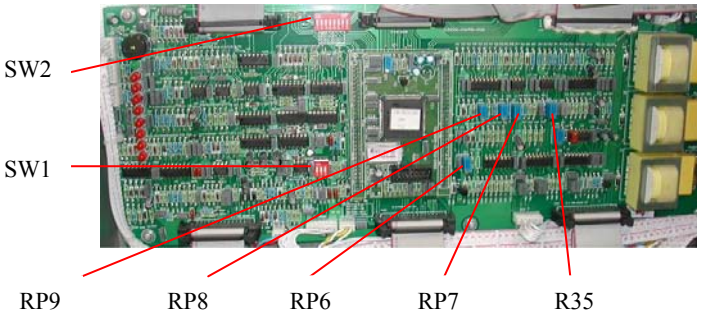


Figure 4-2 Rectifier board potential and DIP switch

RP6: Adjust output B phase voltage;

RP7: Adjust synchronous accuracy;

RP8： Adjust output A phase voltage;

RP9： Adjust output C phase voltage;

R35： Adjust synchronous accuracy.

4.3.3 PWM board

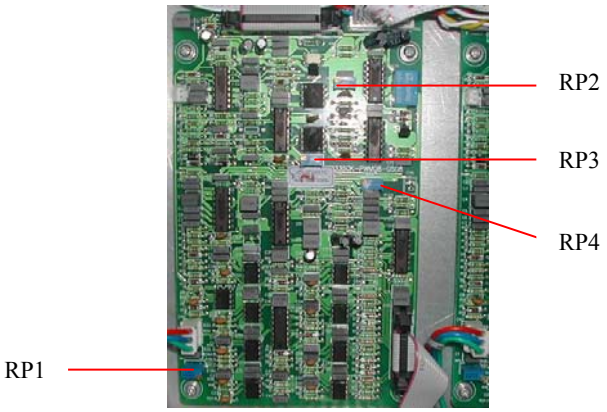


Figure 4-3 PWM board potential

RP1: Adjust triangle wave voltage; RP2、RP3: Adjust sine wave voltage; RP4: Handle equilibrium adjust。

4.3.4 display control board

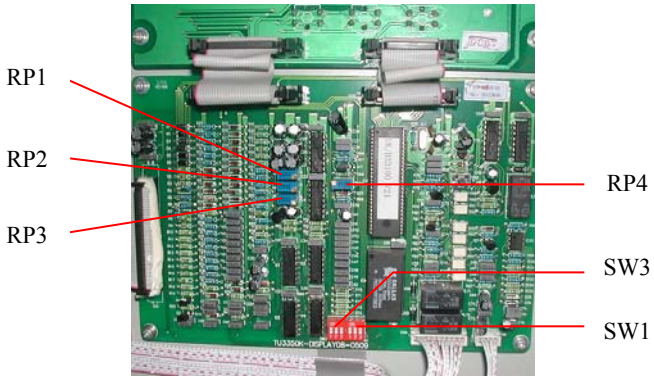


Figure 4-4 Display control board potential

R23：Battery voltage display value adjust；R24： A phase output current display value adjust; R25: B phase output current display value adjust; R26: C phase output current display value adjust; R40: A phase output voltage display value adjust; R42: B phase output voltage display value adjust; R41: C phase output voltage display value adjust; RP1: CPU 5V power adjusts.

4.3.5 power board

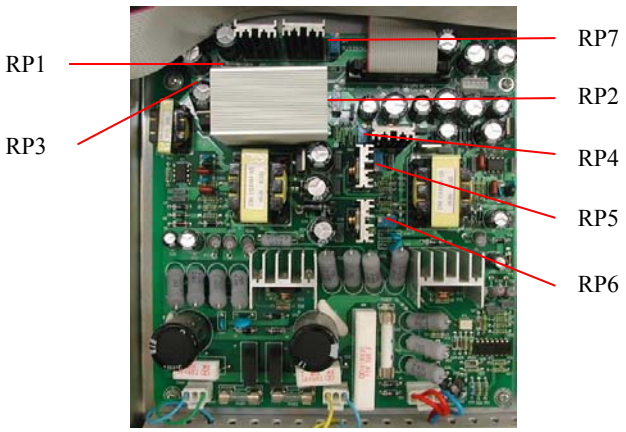


Figure 4-5 Power board potential

RP1: Adjust parallel board power -12V; **RP2**: Adjust SCR driver power 12V ; **RP3**: Adjust main control board power 12V; **RP4**: Adjust main control board power -12V; **RP5**: Adjust DSP power 5V; **RP6**: Adjust LCD power 5V; **RP7**: Adjust parallel board power 12V。

4.4 Main board indicate light introduce：

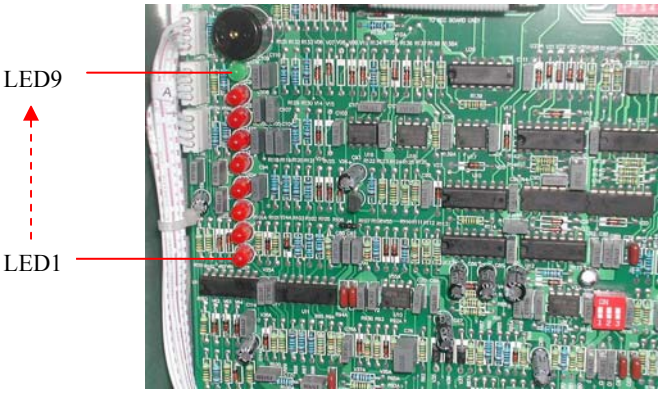


Figure 4-6 Main control board indicate light

LED1（red）： When system appears inverter output over voltage protection, IGBT over current protection or over current protection between two parallel units, it will light. Pressing the panel “OFF” key can clear the protection.

LED2（red）: Inverter output low voltage fault light.

LED3（red）: Inverter over temperature indicate light.

LED4（red）: Inverter output over voltage indicate light.

LED5（red）: It will light when the inverter does not work.

LED6（red）: When the system appear 200% rated overload, output phase unbalance,

output over voltage or low voltage software protection the light will light. The protection can be cleared when the power, bypass, battery breaker are turned off and then turned on again.

LED7（red）：Battery low indicate light, it lights when battery low or the moment rectifier start.

LED8（red）：Parallel line fault indicate light.

LED9（green）： It will light when the system become synchronous.

5. Some familiar symptoms and diagnosis program

5.1 symptom 1

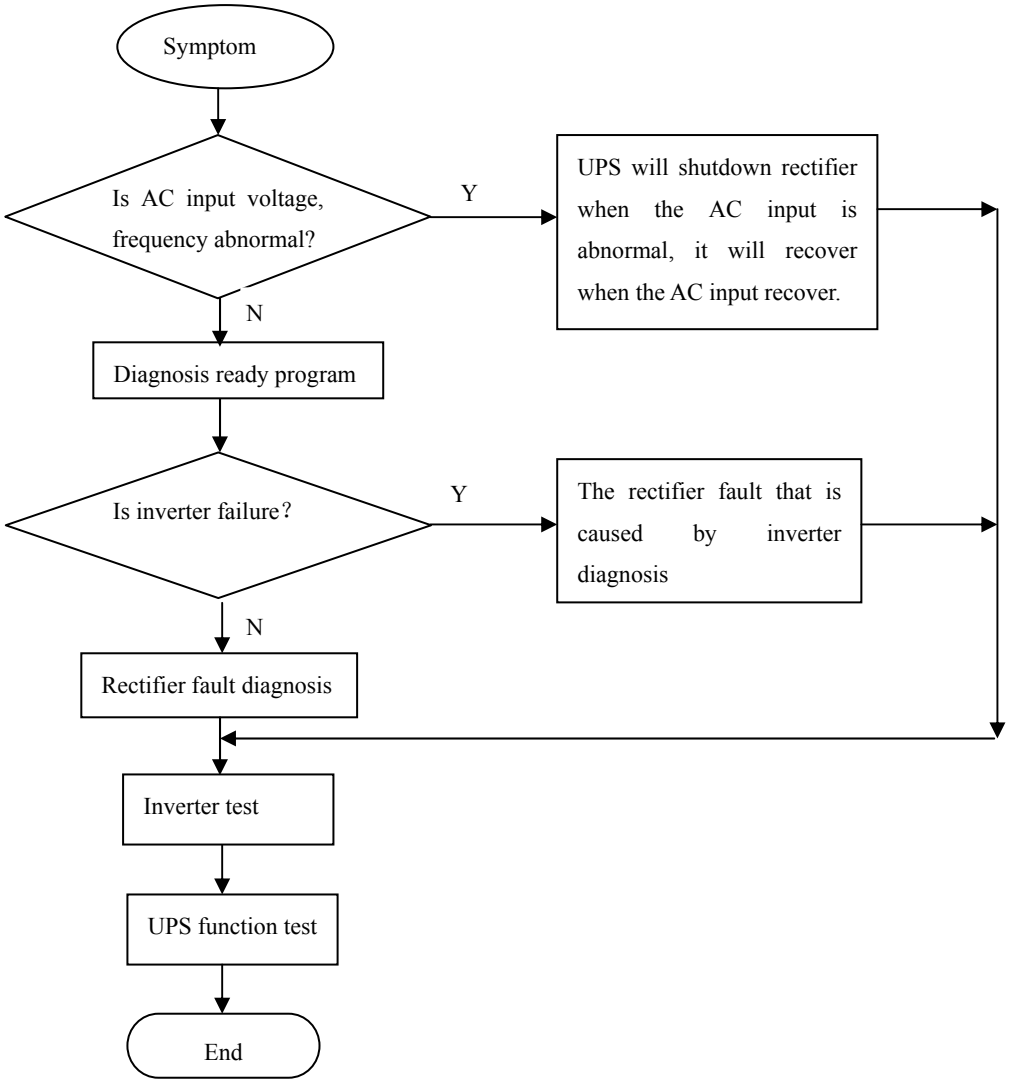
After turn on the power breaker or bypass breaker, the panel PHASE light is on and the buzzer beep continually.

This is caused by the input AC power phase lose or phase wrong, turn off the power breaker or bypass breaker, test the voltage between terminal AC input three phase LA, LB, LC to N, if one or two phase voltage is abnormal, it should be input phase lose, check the AC input line, else it should be input phase wrong, exchange any two lines of the three phase line and turn on the power breaker or bypass breaker.

5.2 Symptom 2

The panel rectifier light is off, LCD display that rectifier is abnormal and the buzzer beep Intermittently.

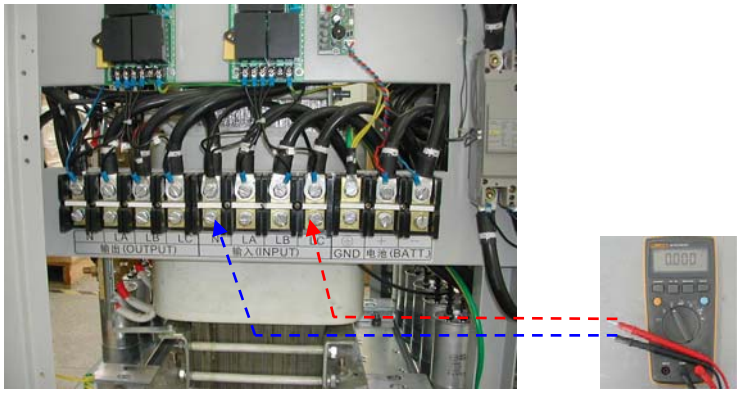
5.2.1 Diagnosis program:



5.2.2 Program description

① Utility voltage and frequency abnormal distinguish:

When the input utility voltage or frequency is abnormal, turn on the power breaker the panel rectifier light will be on, fault light will be off and the buzzer will beep intermittently. Test the voltage between the input three phase live line to neutral line, the value should be 165~275Vac, and the frequency should be 40~65Hz, as shown in figure 5-1, else it should be utility voltage or frequency abnormal.



Picture 5-1 utility input measure

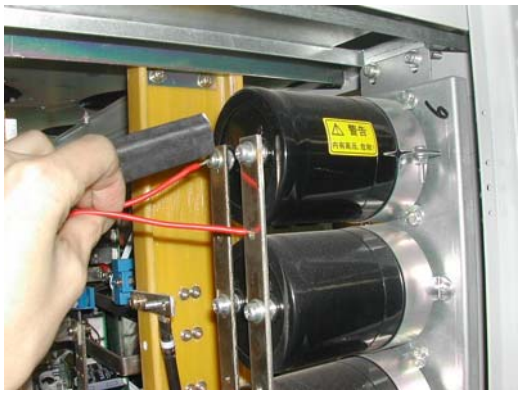
② **Diagnosis ready program：**

A. Press the panel “OFF” key to turn off the UPS.

B. Turn on the maintenance bypass switch or turn it to “BYPASS”, as shown in figure 5-2.

C. Turn off the power, bypass, battery and output breaker.

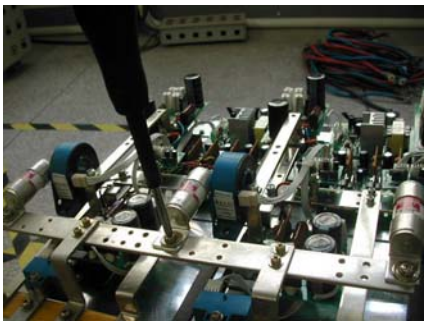
D. Discharge the rectifier capacitor with a resistance of 3KΩ/10W until the voltage of capacitor reduce to 0 VDC, as shown in picture 5-3.



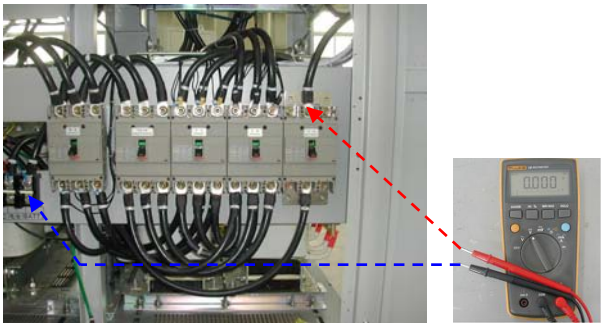
Picture 5-3 rectifiers filters turn on electricity of an electrolysis electric capacity

⚠ **Note：High voltage exists in the UPS, the programs should be carried out before the parts are replaced.**

③ Inverter fault diagnosis： The inverter fault diagnosis: Remove the inverter DC fuse, as shown in picture 5-4. Turn on the power breaker, if the rectifier start normally and the panel rectifier light is on, test the voltage between the battery breaker upper part to “BAT-” of the terminal with a multimeter(confirm that the battery breaker is Turn off) , as shown in picture 5-5. If the voltage is 394±4VDC，then the rectifier is normal, the fault should be caused by the inverter.

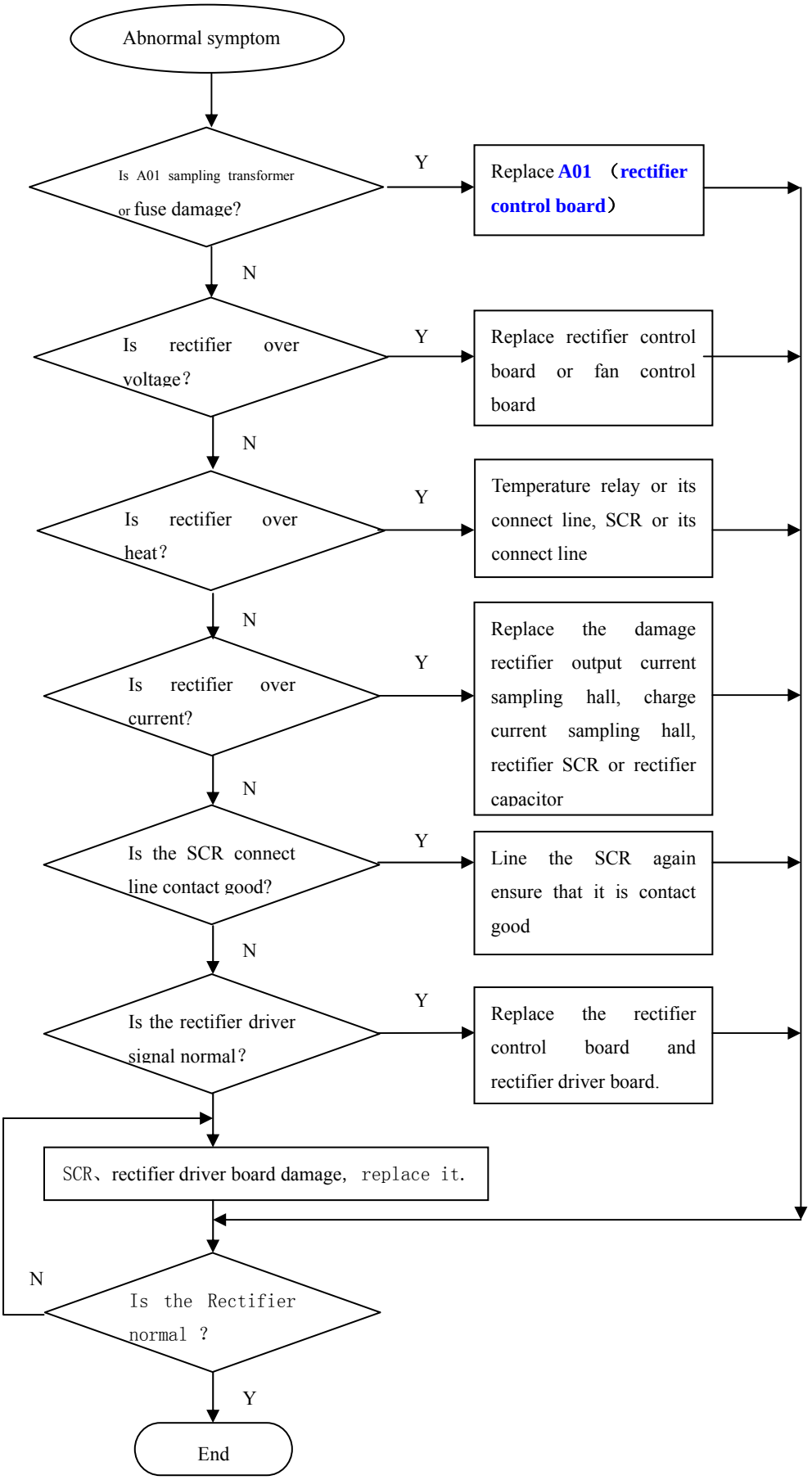


Picture 5-4 Remove DC fuse

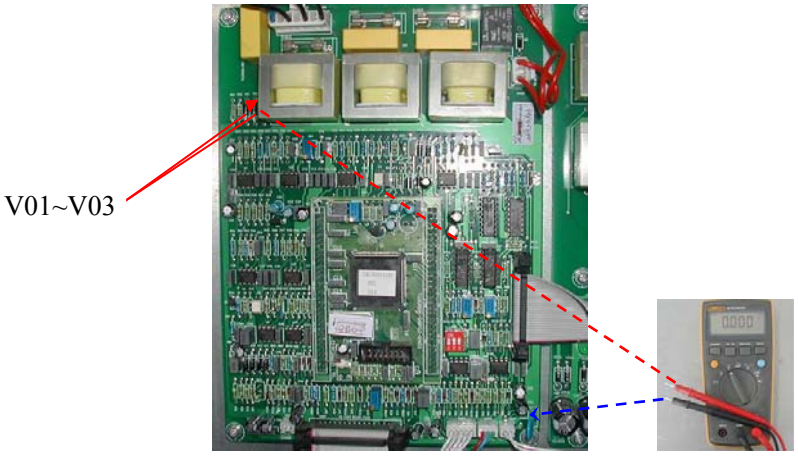


Picture 5-5 Test the rectifier voltage

④ Rectifier fault diagnosis program and describe:



A. Rectifier control board utility sampling transformer and fuse test: Turn on the power breaker, test the voltage between both sides of the fuse and “N”of CN6 on the board with a multimeter, the value should be about 220 Vac, else the fuse should be damage. Test the voltage between cathode of V01, V02, V03 on the board and GND(left pin of C64A), the value should be about 30Vac, as shown in picture 5-6. If the value is wrong, the transformer should be damage, replace the rectifier control board.

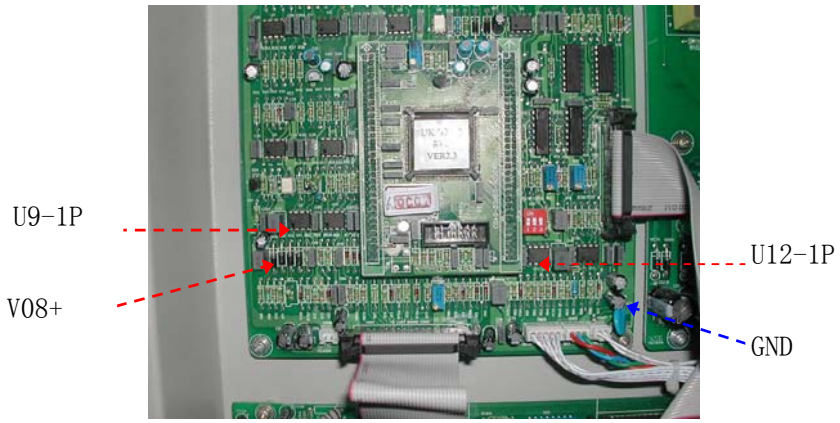


picture 5-6 utility samping voltage test

B. Diagnosis of rectifier over voltage: Turn off the power or bypass breaker, turn on the power breaker, test the rectifier output voltage with a multimeter, as shown in figure 5-5. If the voltage raise to 415VDC, and panel RETIFIER light off, FAULT light on, buzzer beep intermittently, and the rectifier output voltage descend, it means that the rectifier output is over voltage, it may caused by the damage of rectifier output voltage sampling hall of fans control board or damage of rectifier control board. Replace the rectifier control board or fans control board.

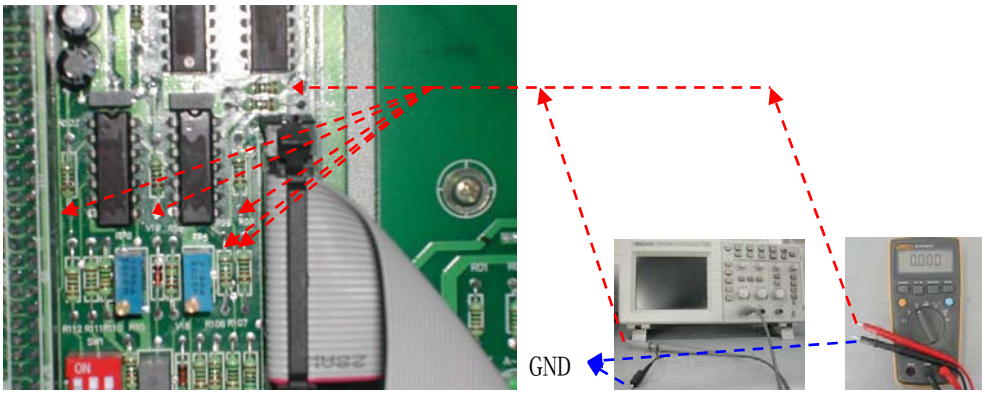
C. Diagnosis of rectifier over heat: When the UPS over heat protection enable, test the voltage between R75 with a multimeter, if the value is 0VDC then it should be rectifier over heat (it will be 5VDC normally). The problem may caused by temperature relay connect line contacting badly, temperature relay being bad, fans being bad or rectifier SCR being bad etc.

D. Diagnosis of rectifier over heat: When the rectifier over current protection enable, test the voltage between U9A-1P、U12-1P or V8+ and GND (C64A left pin), if the value is about 5 VDC, it should be rectifier over current or over charge protection, as shown in figure 5-8. It may caused by rectifier output current sampling hall, charge current sampling hall, rectifier capacitor or rectifier SCR being bad.

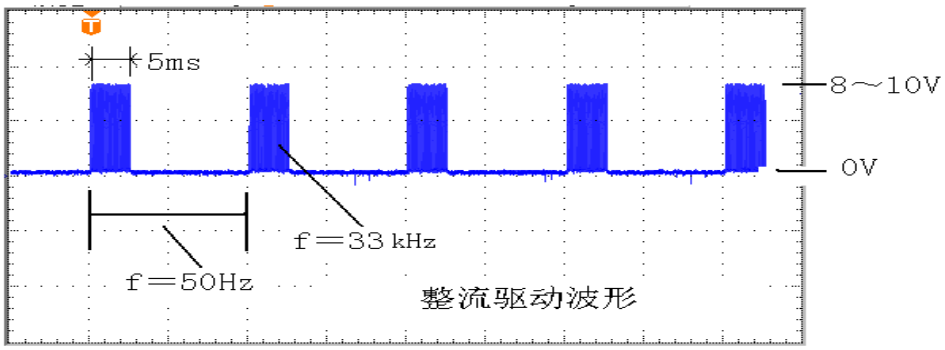


Picture 5-8 rectifier over current or charge over current protective test

E. Rectifier driver signal test: Turn off the power breaker, pull out CN12 of power backup and transfer board, as shown in figure 5-9. Turn on the power breaker again, test left pin of R98, R99, right pin of R100,R101,R102, upper pin of R103 to GND (left pin of C64A, as shown in figure 5-8) on the rectifier control board with a oscillograph, the signal waveform tested should be 50Hz pulse group, as shown in figure 5-10. It can be tested with a multimeter, the value should be 1.0±0.2VDC、1.4±0.2Vac.

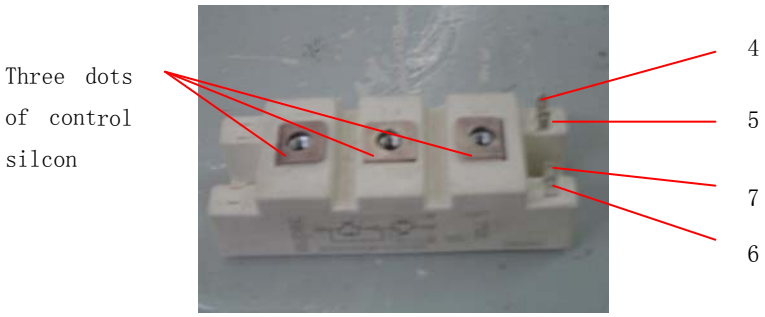


Picture 5-9 rectifier driving signal test



picture 5-10 rectifier driving sign test wave

F. SCR test: test the SCR any two pin between each of the pin 1,2,3 with a multimeter, the resistance tested should not be short circuit; test pin 4 to 5,pin 6 to 7 ,the resistance should be 10~100Ω,as shown in figure 3-17.



picture 5-11SCR test

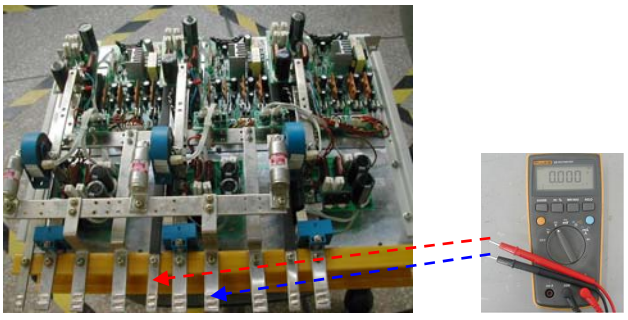
G. Rectifier test: Turn off the power breaker, put on the CN12 of power backup and transfer board, turn on the power breaker again, test the rectifier output voltage with a multimeter, the value tested will rise slowly, and stabilize at 394±4VDC at last.

⑤The rectifier symptom that caused by inverter diagnosis program:

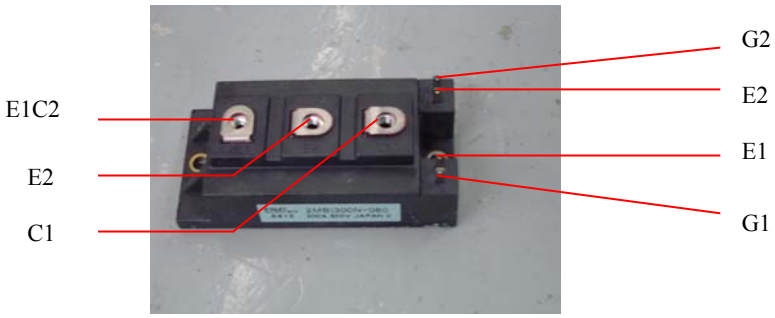
A. Turn the maintenance switch to "BYPASS", Turn off the power, bypass and battery breaker, discharge the rectifier capacitors with a 3KΩ/10W resistance until its voltage reduce to 0VDC.

B. Remove the inverter DC fuse, test the resistance between C1 and E2 of IGBT, as shown in figure 5-12, the value should be more than 10KΩ, else it should be IGBT or its filter board damage.

IGBT test: Test the E1C2 to C1, E2 to E1C2 of IGBT with a multimeter in diode mode(the first one tested with red pen), the value should be 0.3~0.6， test it contrary, the value should be ∞. Test G1 to E1, G2 to E2 of the IGBT with a multimeter in capacitor mode, the value tested should be 30～40nF, as shown in figure 5-13.



picture 5—12 inverter radiator board test resistance

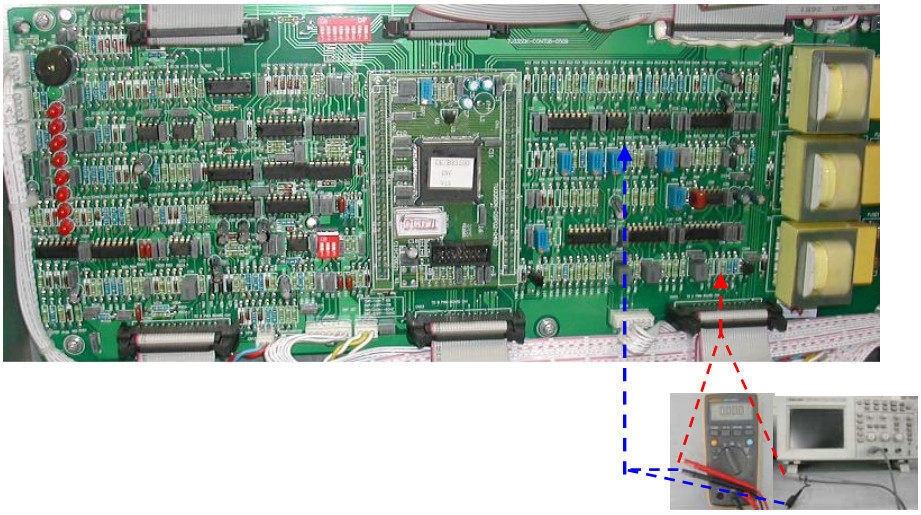


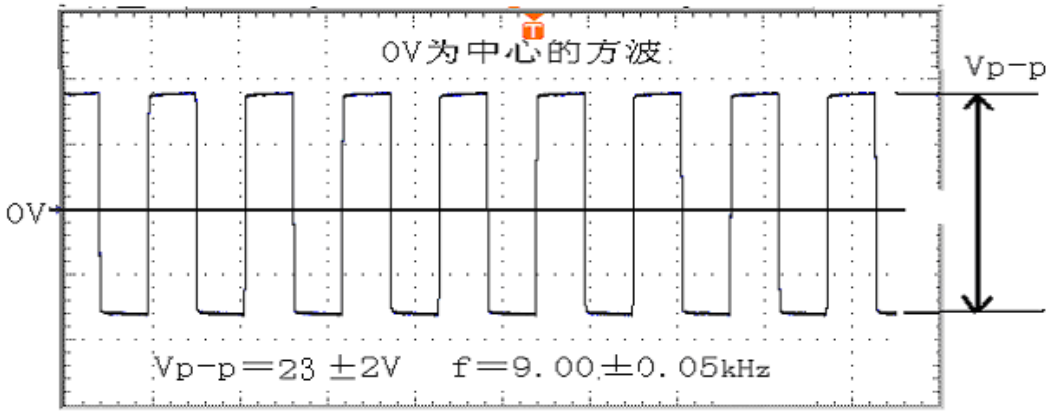
Picture 5-13 IGBT measure

IGBT filter board test: Remove the board, test the resistance between C1 and E2 on the board, the value should be more than 10 KΩ, else it should be damage. Replace it.

⑥Inverter test: Remove the inverter fuse, pull out CN11, CN12 of power backup and transfer board, pull out CN9, CN15 of main board.

A. Turn on the power breaker, test J1 of main board with a oscillograph, the waveform will be 9KHz square wave, the wave Vp-p should be 23±2V, frequency should be 9.00±0.05KHz. The oscillograph ground line can be connected to R37 down pin, as shown in figure 5-12. The signal can be tested with a multimeter, the value should be 11.10±0.2Vac，0.2±0.1VDC.

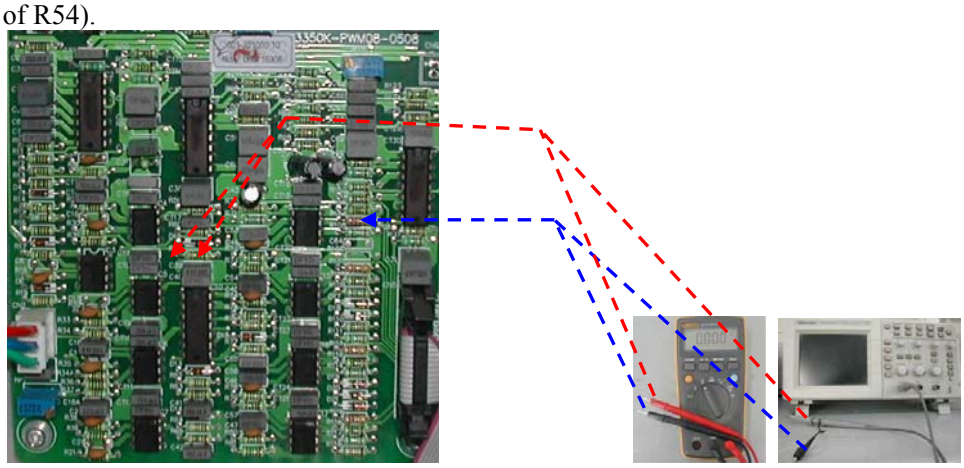


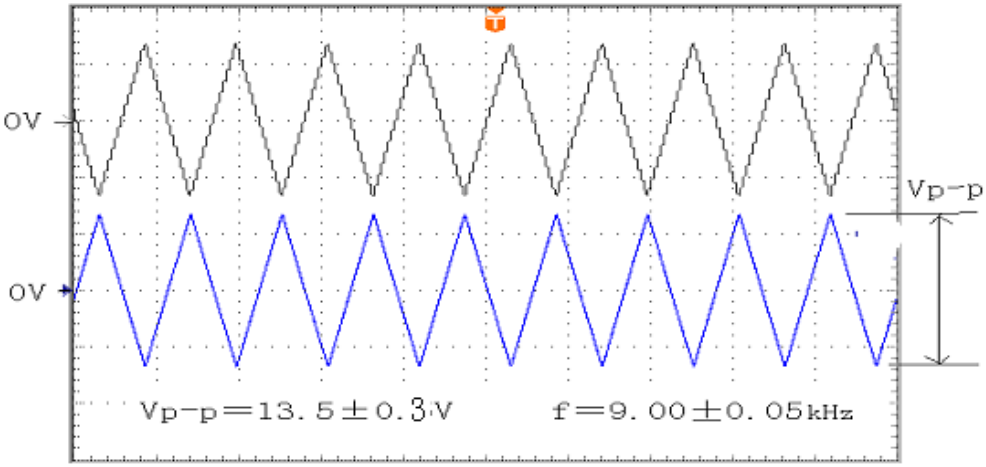


The square wave signal of diagram 5-14 main board 9 KHzseses measure and its wave

B. Test the PWM board (3 board) IC3-1P, 7P signal with a oscillograph, the wave should be two anti-phase 9KHz triangle wave, as shown in figure 5-13. It can be tested with a multimeter, the value tested should be 2.1±0.2Vac，0.1±0.1VDC (GND connect to right pin of R54).

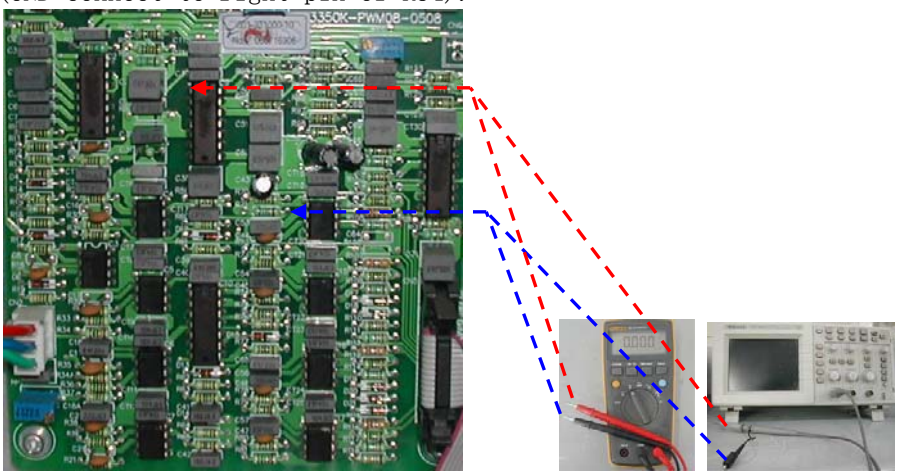
B.





Picture 5-13 Triangle wave signal test and waveform

C. Press “ON” key to turn on the UPS, test the three phase PWM board IC9-1P, the waveform should be sine wave and there is a slow start period, the phase differ between any two of the three sine wave of PWM board should be 120°. It can be tested with a multimeter, the value should be 1.0±0.2Vac，0.1±0.1VDC (GND connect to right pin of R54).



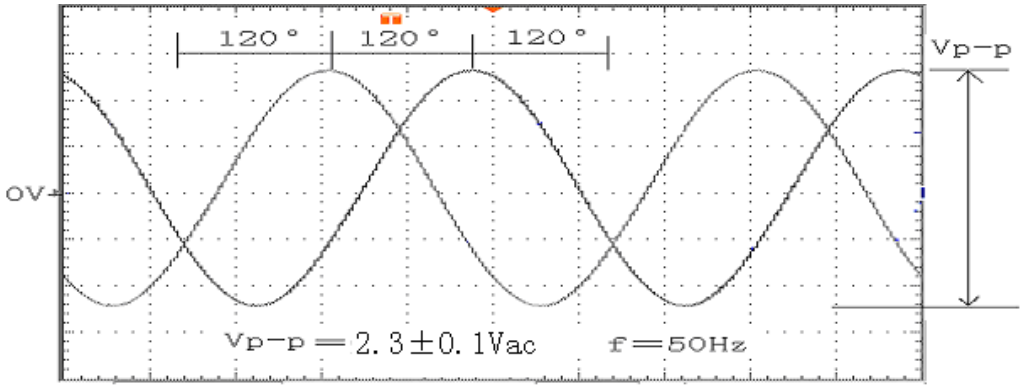


Figure 5-14 PWM board sine signal test and waveform

D. Test left pin of R113, R115, R104, R107 of the three PWM board, the waveform is SPWM wave, its Vp-p is 12±1V, as shown in figure 5-15. It can be tested with a multimeter, the value is 6.2±0.2Vac，6.2±0.2VDC.

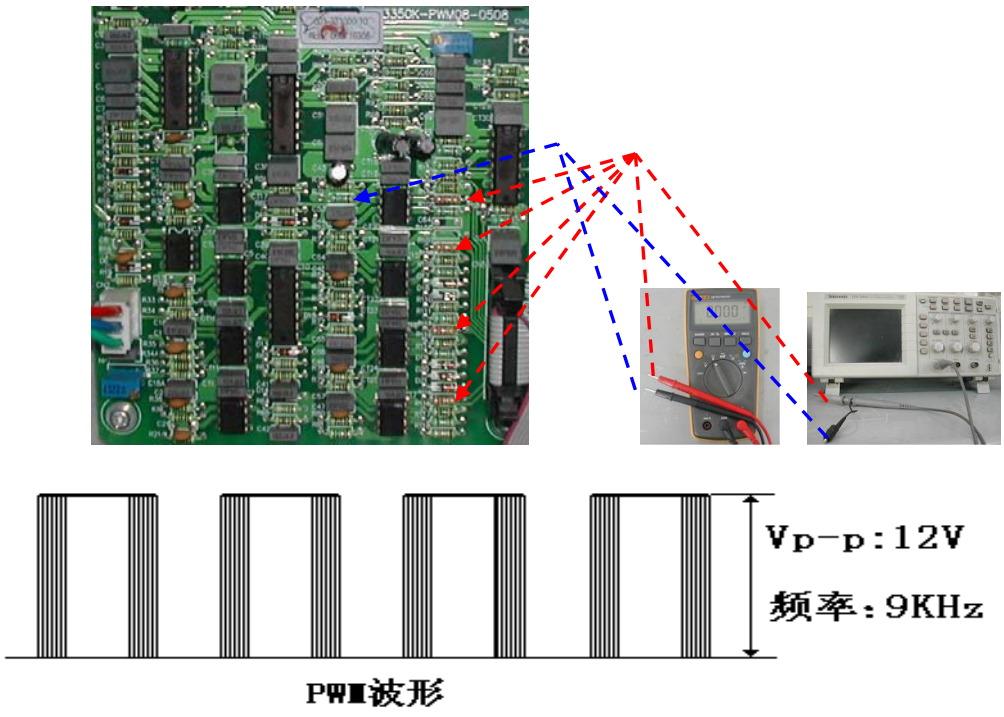


Figure 5-15 PWM board SPWM signal test and waveform

E. Test inverter driver board four SPWM driver signal between each G and E with a oscillograph, as shown in figure 5-16, It can be tested with a multimeter, the value is 10.8±0.2Vac，5.2±0.2VDC.

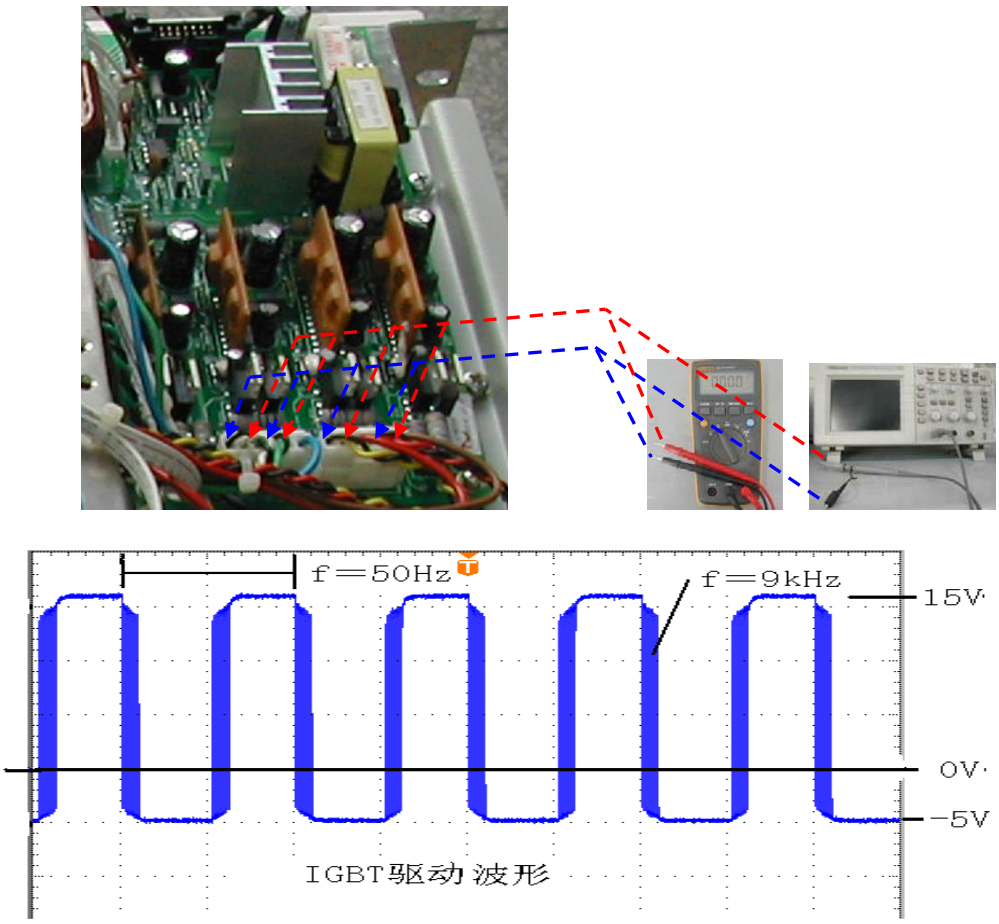
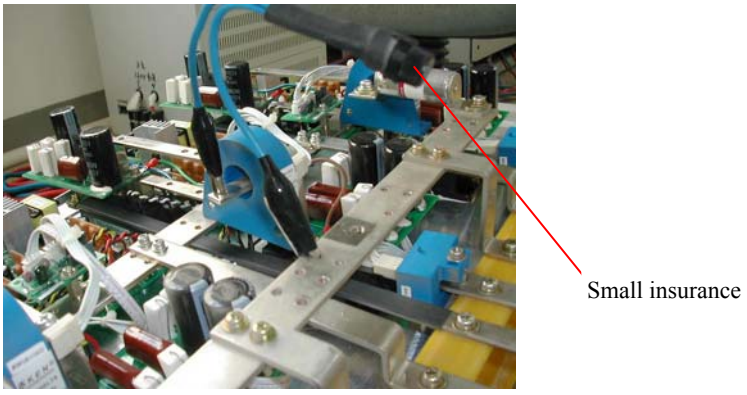


Figure 5-16 Inverter driver board SPWM driver signal

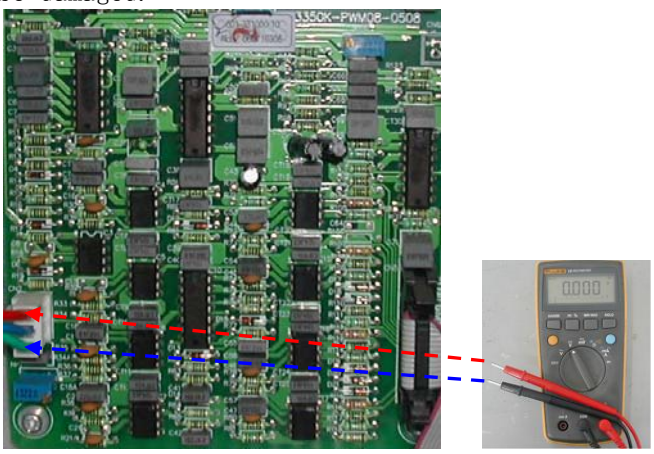
F. Turn off the UPS, turn off the power breaker, test the signal of V21+, V32+ of the main board, the ground line connect to R37 down pin. Turn on the power breaker, the voltage V21+ tested will be about 5VDC, the voltage V32+ tested will be 0VDC, turn on the UPS 30 seconds later its protection will enable, buzzer beep continually. Turn off the UPS.

G. Put on the CN12 of power backup and transfer board, put on CN09 of the main board, install three 5A fuse between the place the three inverter fuse uninstalled before.



Picture 5-17 ascend the small insurance tube try inverter

H. Turn on the power breaker, test the voltage between CN1-1P and 3P, it should have a rise period, and stabilize at about 30Vac, as shown in figure 5-18. Test the voltage between any two upper pins of the bypass breaker with a multimeter, the value should be 30~40Vac, else the bypass SCR or its control board should be damaged.



Picture 5-18 Measure the inverter feedback voltage

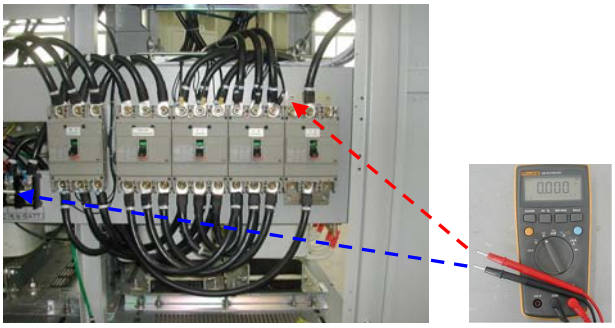
I. Turn off the UPS, Turn off the power breaker, discharge the rectifier capacitor until its voltage reduce to 0VDC, install the inverter fuse again, turn on the bypass breaker, turn the maintenance switch to "UPS" mode, put on the CN15 of main board.

⑦UPS function test:

A. Turn on the power breaker, the panel BAT.LOW indicate light and RECTIFIER indicate light on, turn on the bypass and output breaker, the panel BYPASS indicate light on and buzzer beep continually, 20s later the rectifier start normally, the BAT.LOW indicate light off, buzzer stop beeping, turn on the battery breaker. Turn on the UPS, the inverter start to work, the panel rectifier indicate light on, 30s later the inverter output SCR is turned on, and the bypass SCR is turned off, the panel BYPASS indicate light off, the inverter supply to output.

B. Switch function test: Turn off and turn on the UPS AC input power breaker of the power cabinet, test the UPS output voltage on the terminal, it should be uninterruptible, as shown in figure 5-21.

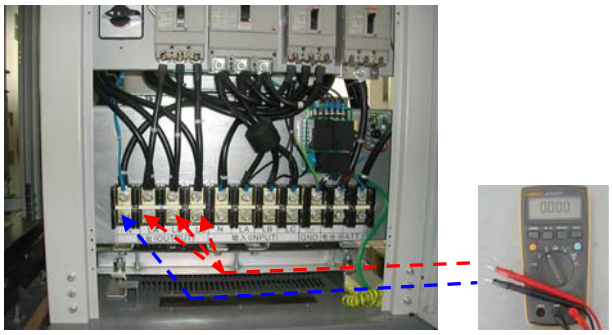
C. Charge function test: Turn off the battery breaker, test voltage between the UPS batterybreaker upper connector and BAT- of the terminal, the value should be 395±3VDC, as shown in figure 5-20.



Picture 5-20 measure of charge voltage

D. Operation with load function test: Turn on and turn off load, test the

voltage between any line of the three live lines and the neutral of the terminal with a multimeter, the value should be 220Vac±2%, as shown in 5-19.

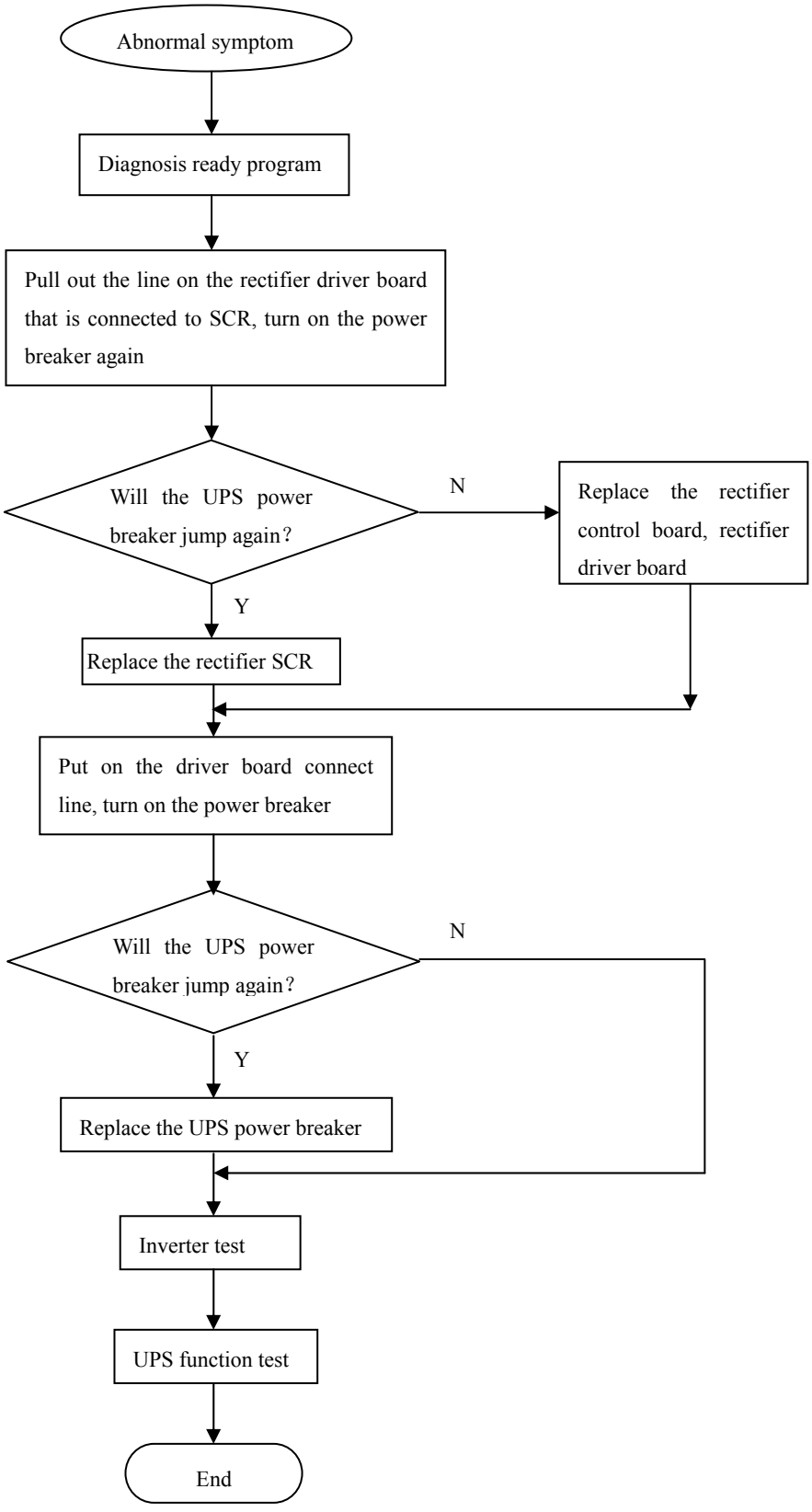


The diagram 5-21 output voltage measure

E. Bypass function test: Press “OFF” key to turn off the UPS, the RECTIFIER indicate light on, 30 seconds later it will switch from bypass to inverter output, and the BYPASS light off; during the switch, test the UPS output with a multimeter, it should be uninterruptible.

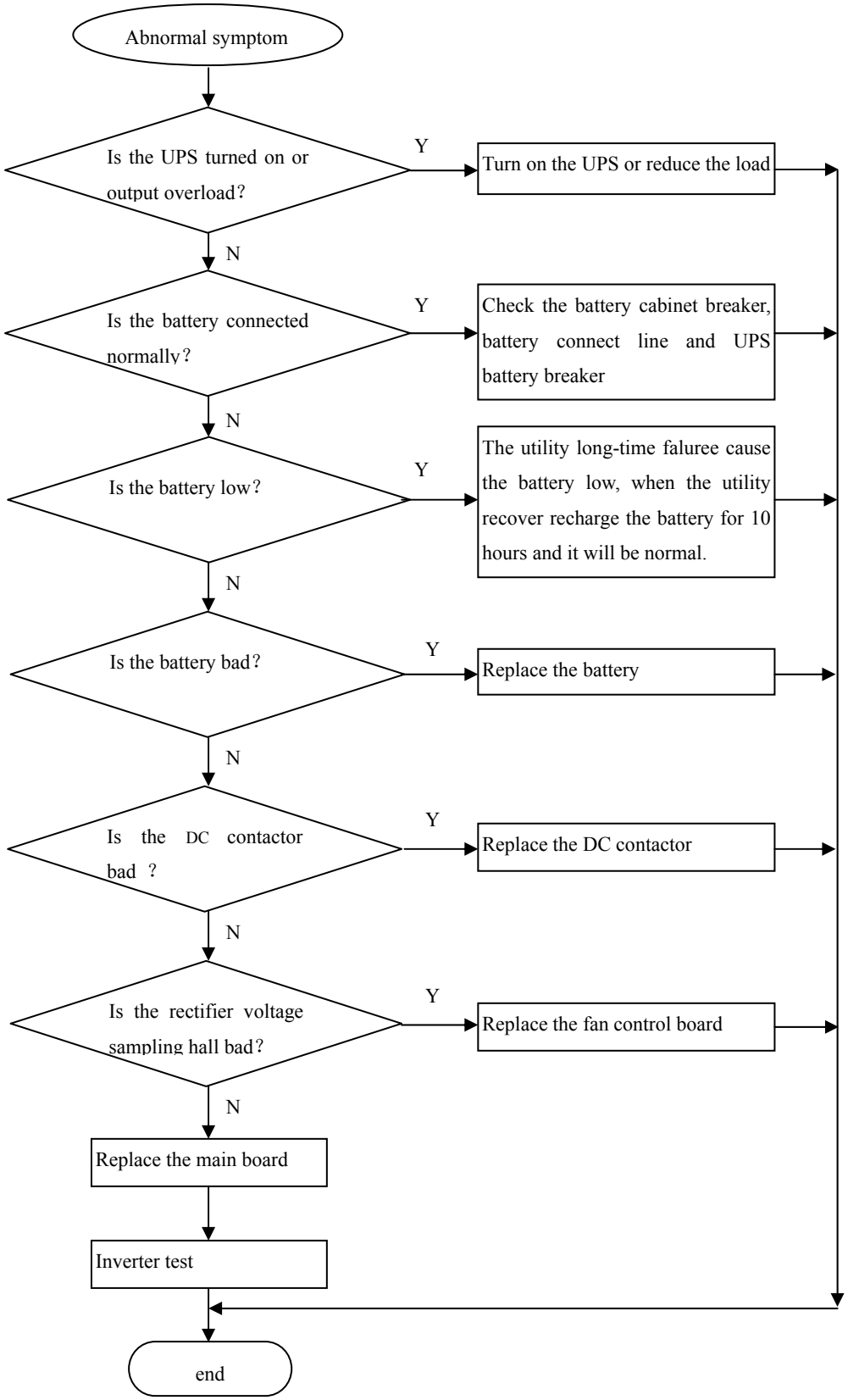
F. Display function test: During the test program concerned previously, the UPS panel LED/LCD should display correctly.

5.3 Symptom 3: The UPS power breaker trip when it operation normally



5.4 Symptom 4: When the utility is failure the UPS shutdown output and the panel BAT.LOW indicate light is on.

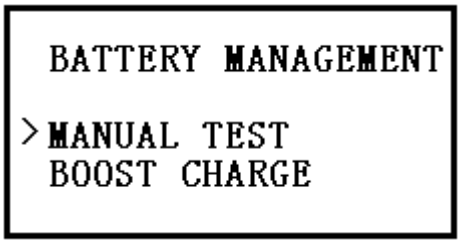
5.4.1 Diagnosis program

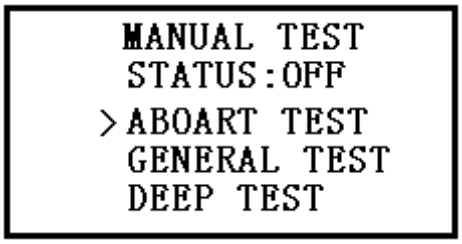


5.4.2 Program describe:

It is very possible that the symptom caused by battery bad, especially for the UPS that has been used for more than three years.

① **Battery test**: The UPS has battery test function, in the panel LCD there is a battery test function menu, there are three items in it, as shown in figure below. Choose the GENERAL TEST or DEEP TEST, the UPS will discharge the battery and test it, if the battery is bad, the panel LCD will display alarm message.

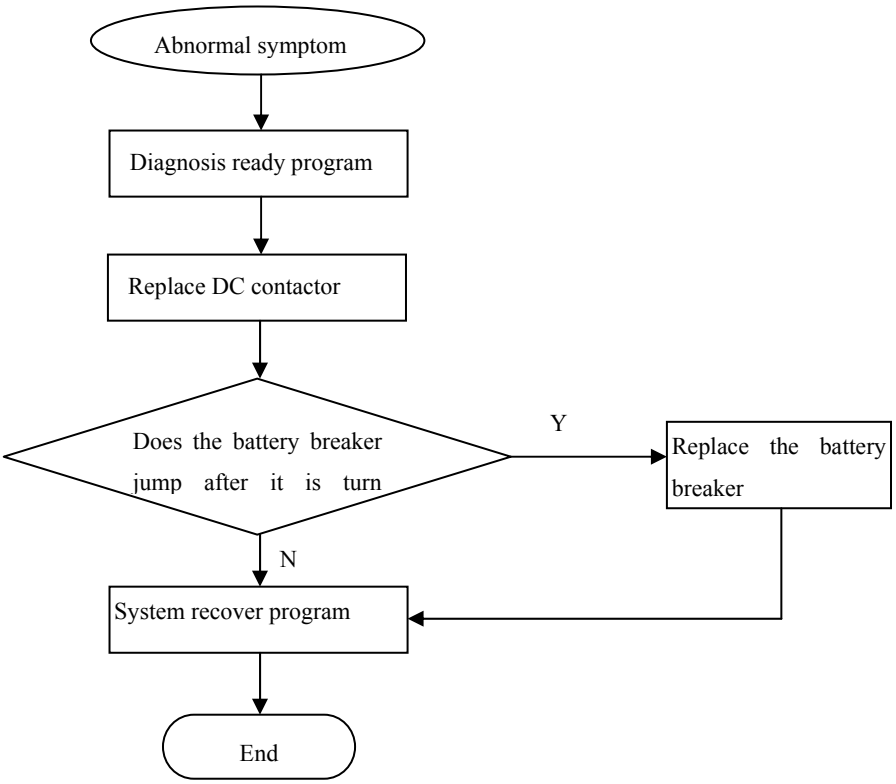




② **Test the DC contactor**：Test the voltage between the two control pins of the DC contactor with a multimeter, the value should be 197±2VDC, and the voltage between two contact pin should be 0, else the DC contactor should be damage.

③ Test the rectifier voltage sampling hall：Check the rectifier voltage that panel LCD display, if the value is much smaller than it is tested in fact, the rectifier voltage sampling hall should be bad.

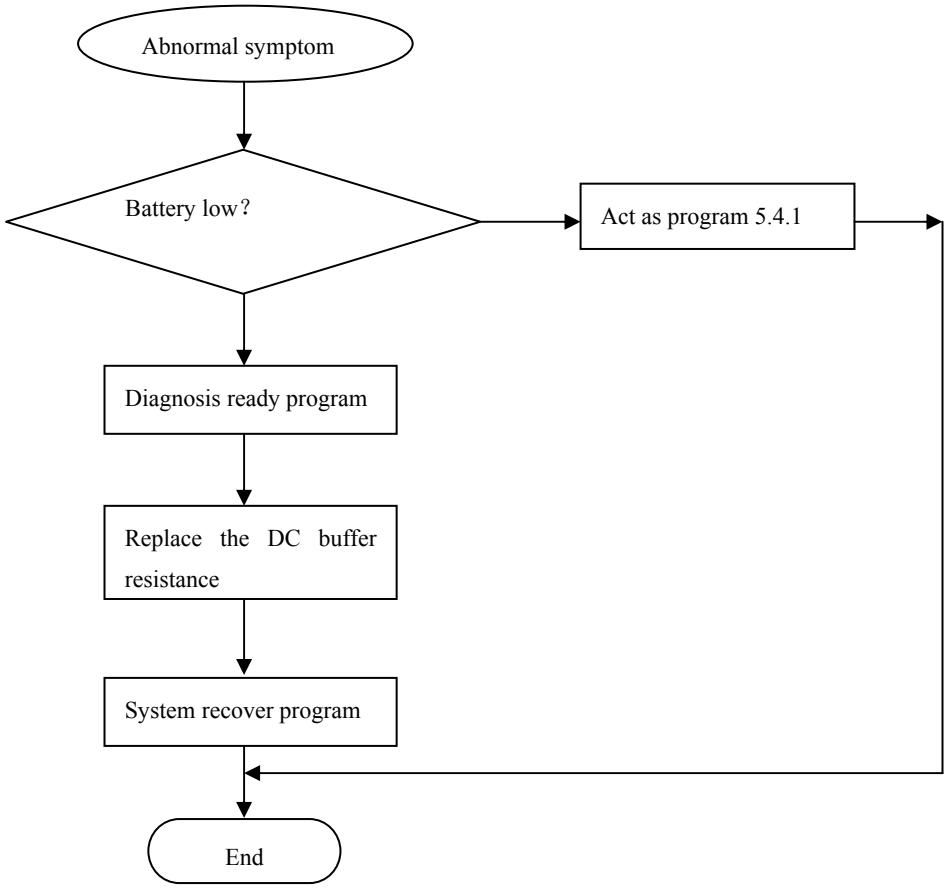
5.5 Symptom 5: In utility mode UPS is normal, but the battery breaker will trip when it is turned on in battery mode.



Program describe： System recover program：① Turn on the power, bypass, output breaker. ② Turn the maintenance switch to “UPS” mode. ③ Turn on the battery breaker after the panel BAT.LOW indicate light is off. ④ Press panel “on” key to turn on the UPS.

5.6 Symptom 6: In utility mode UPS is normal, but the UPS battery low protection enable when battery breaker is turned on in battery mode, and the panel BAT.LOW light on and the buzzer beep continually.

5.6.1 Diagnosis program：



5.6.2 Program describe:

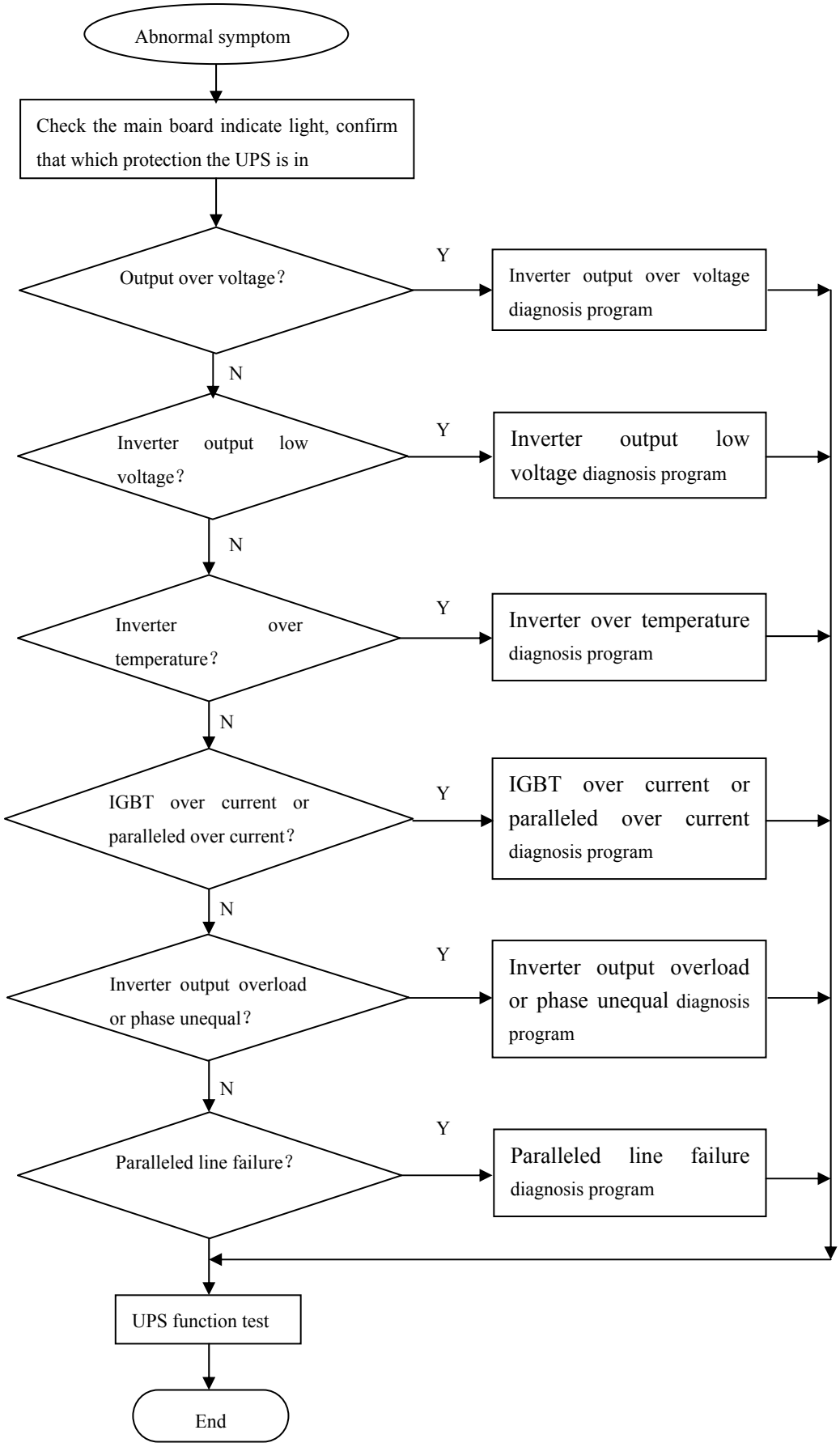
Test the DC resistance: test the resistance of the DC resistance that is locked upon the fan

control boar with a multimeter, as shown in figure 5-22。

Picture 5-22 Replace the DC buffer resistance

5.7 Symptom 7： The UPS switch to bypass, panel FAULT indicate light on and buzzer beeps continually

5.7.1 Diagnosis program



5.7.2 Program introduction

① Confirm that which protection the UPS is in according to main board LED display: Panel indicate light has been described before in the manual。

② **Inverter output over voltage diagnosis program:**

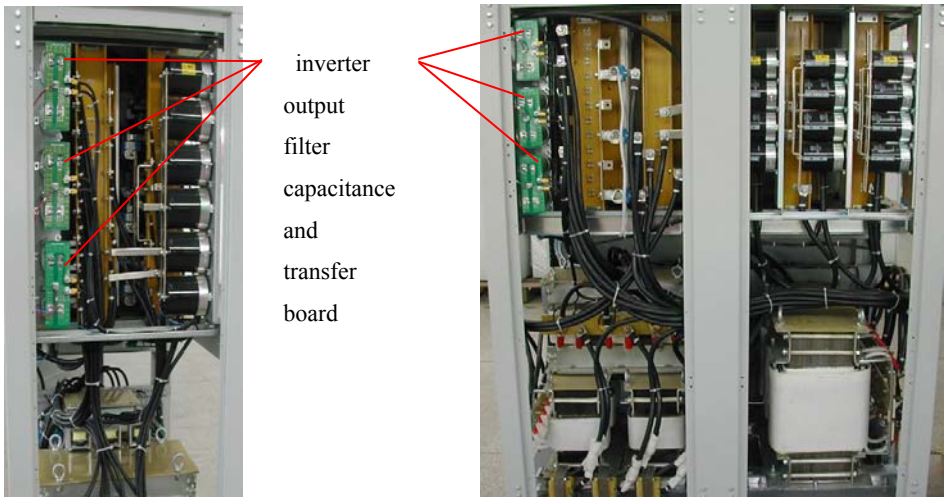
A. Press panel "off" key to turn off the UPS, test the voltage between CN2-1P and 3P on the PWM board, as shown in figure 5-18, press panel "on" key to turn on the UPS, the voltage tested should rise and stabilize at about 30Vac at last during the start process.

B. If the voltage is too small or is zero then the inverter output voltage-sampling transformer on the power backup and transfer board should be bad, if the value that voltage and frequency tested is variable, then the inverter output capacitor should be bad.

C. Diagnosis ready program (act as 5.1.2 mentioned in the manual).

D. Replace the bad power backup and transfer board or inverter output capacitor, as shown in figure 5-23.

E. Inverter test, system recover program (act as 5.1.2 and 5.4 mentioned in the manual)



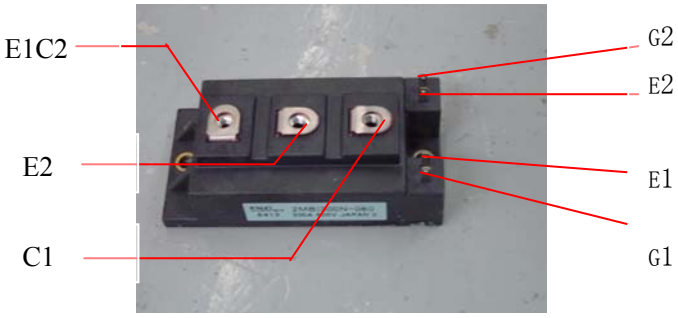
Picture 5-23 inverter the output filter replace of an electric capacity

③ Inverter output low voltage diagnosis program:

A. Turn off the UPS, test the voltage between two side of inverter DC fuse, if the value is not zero, the fuse should be bad.

B. Diagnosis ready program (act as 5.1.2 mentioned in the manual).

C. Test IGBT: Test the E1C2 to C1, E2 to E1C2 of IGBT with a multimeter in diode mode (the first one tested with red pen), the value should be 0.3~0.6, test it contrary, the value should be ∞. Test G1 to E1, G2 to E2 of the IGBT with a multimeter in capacitor mode, the value tested should be 30～40nF.



Picture 5-24 IGBT examine

D. Inverter test(act as 5.1.2 mentioned in the manual), if a board signal is abnormal, turn of the UPS, discharge the DC capacitor and replace the board.

E. System recover program.

④ IGBT over current, paralleled over current diagnosis:

A. Exit the paralleled system: act as paralleled system exit program described in the manual.

B. Turn on the failure UPS again, check the main board indicate light that if the IGBT over current or paralleled over current light is on, the light is on means that it is IGBT over current, else it should be paralleled over current, turn off the UPS, Turn off all the breakers of the UPS, discharge DC capacitor and replace the paralleled board and paralleled average current sampling transformer.

C. If it is IGBT over current, carry out diagnosis ready program (act as 5.1.2 mentioned in the manual).

D. Replace the IGBT current sampling hall, test IGBT, and replace the bad one.

E. Inverter test (act as 5.1.2 mentioned in the manual), if a board signal is abnormal, turn of the UPS, discharge the DC capacitor and replace the board.

Picture 5- 25 output current measure

⑤ Inverter overload or output phase unequal diagnosis:

A. Expel the problem of the load first if there is short circuit or overload

in it.

B. Test the current three phase output, as shown in figure 5-25. Calculate the actual load by Pn=Un*In (n=1,3), and compare to the load displayed in panel LCD, if the difference is too much (over 50%), the UPS output current sampling hall should be bad.

C. For output phase unequal fault, the UPS will operation normally without load, the difference amount three phase output voltages should enlarge with small load, and the UPS protection will enable with large load. Test the voltage between three DC fuse with a multimeter to confirm that if the fuse is bad.

D. Proceed diagnosis ready program.

E. Test IGBT.

F. Inverter test (act as 5.1.2 mentioned in the manual), if a board signal is abnormal, turn of the UPS, discharge the DC capacitor and replace the board.

G. System recover program.

⑥ Paralleled line failure diagnosis program:

A. In single system the problem may be caused by main board DIP switch setting mistake, it can be reset according to 4.2.2 mentioned in the manual.

B. It should be paralleled line poor contact or bad, turn off the UPS and connect it again or replace it.

5.8 Symptom 8: Turn on the bypass, power breaker, turn on the UPS and protection enable as soon as the inverter start.

Diagnosis program:

① Turn off the load, Turn off the bypass breaker, and turn off the UPS.

② Turn on the UPS again, if the symptom still exist, it should be inverter failure. Act as 5.6 mentioned in the manual.

③ If the UPS start normally, test the voltage between CN2-1P and 3P on the PWM board, the value has a low start progress, then it should be inverter output SCR , SCR driver board failure.

④ Proceed UPS diagnosis ready program.

⑤ Replace the inverter output SCR, SCR driver board.

⑥ Proceed system recover program.

⑦ UPS function test.

5.9 Symptom 9: The protection enable as soon as the UPS switch to inverter output after it is turned on about 30 seconds.

Diagnosis program:

① Turn off the load of the UPS, Turn off the bypass breaker, turn off the UPS.

② If the problem still exist, it should be inverter failure, act as 5.6 mentioned in the manual.

③ If it start normally, test the voltage between any two pins of the bypass breaker upper

pins, the value should be 20~30Vac, else the bypass SCR, SCR driver board or main board should be bad.

④ Proceed UPS diagnosis ready program.

⑤ Replace bypass SCR, SCR driver board or main board.

⑥ Proceed system recover program.

⑦ Proceed UPS function test.

6. Series Connection Hot Standby System diagnosis program

6.1 The standby UPS of series connection hot standby system diagnosis program

① Press “off” key of the panel to turn off the UPS, Turn off the standby UPS utility and bypass breaker;

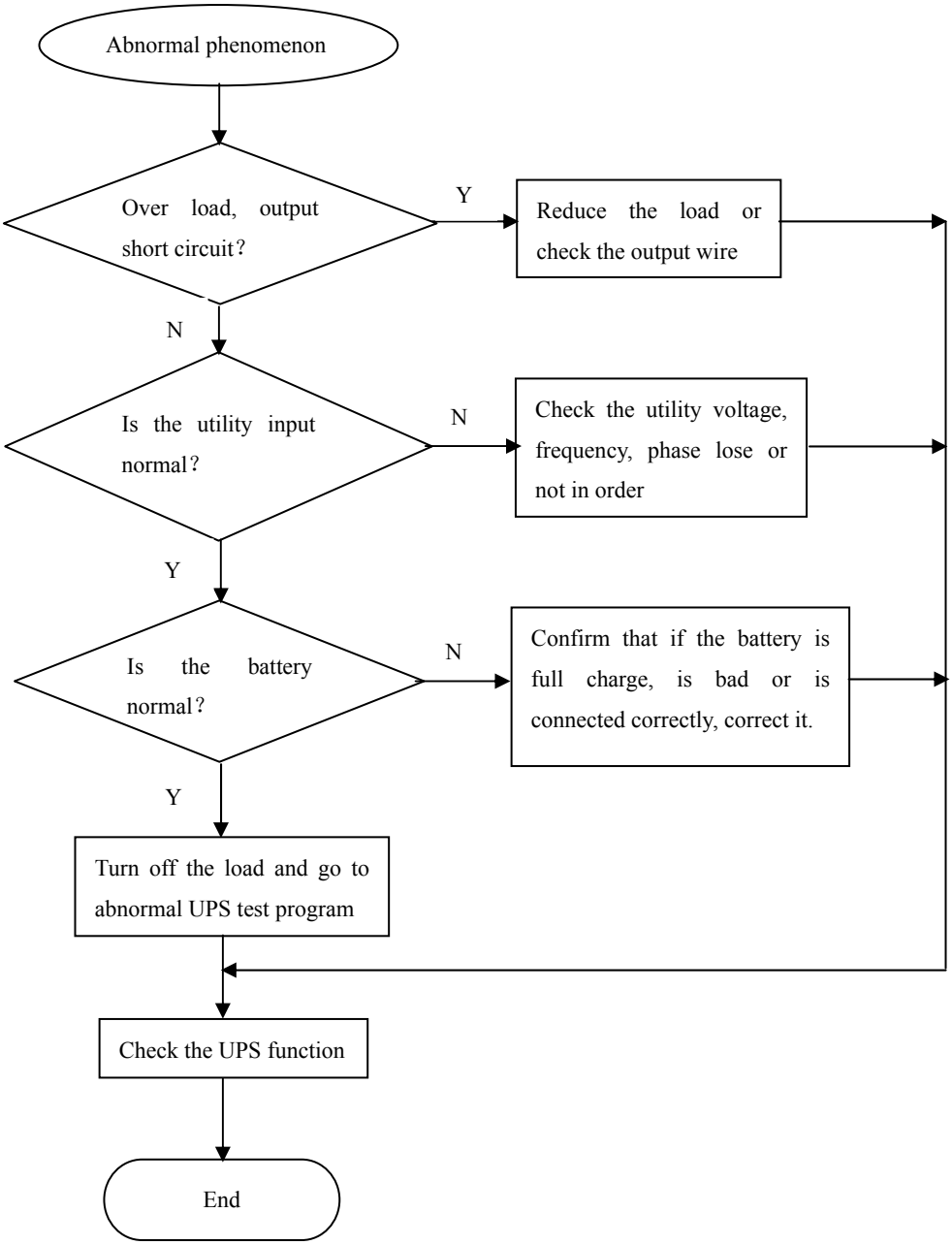
②Turn off the main UPS bypass breaker;

③Operation as single unit trouble-shooting program;

④ When the standby UPS is normal, turn on the utility and bypass breaker, press “on” key to turn on the UPS, turn on the battery breaker when the rectifier start normally, and turn on the bypass breaker of the main UPS.

6.2 The main UPS of series connection hot standby system diagnosis program

6.2.1 Diagnosis program:



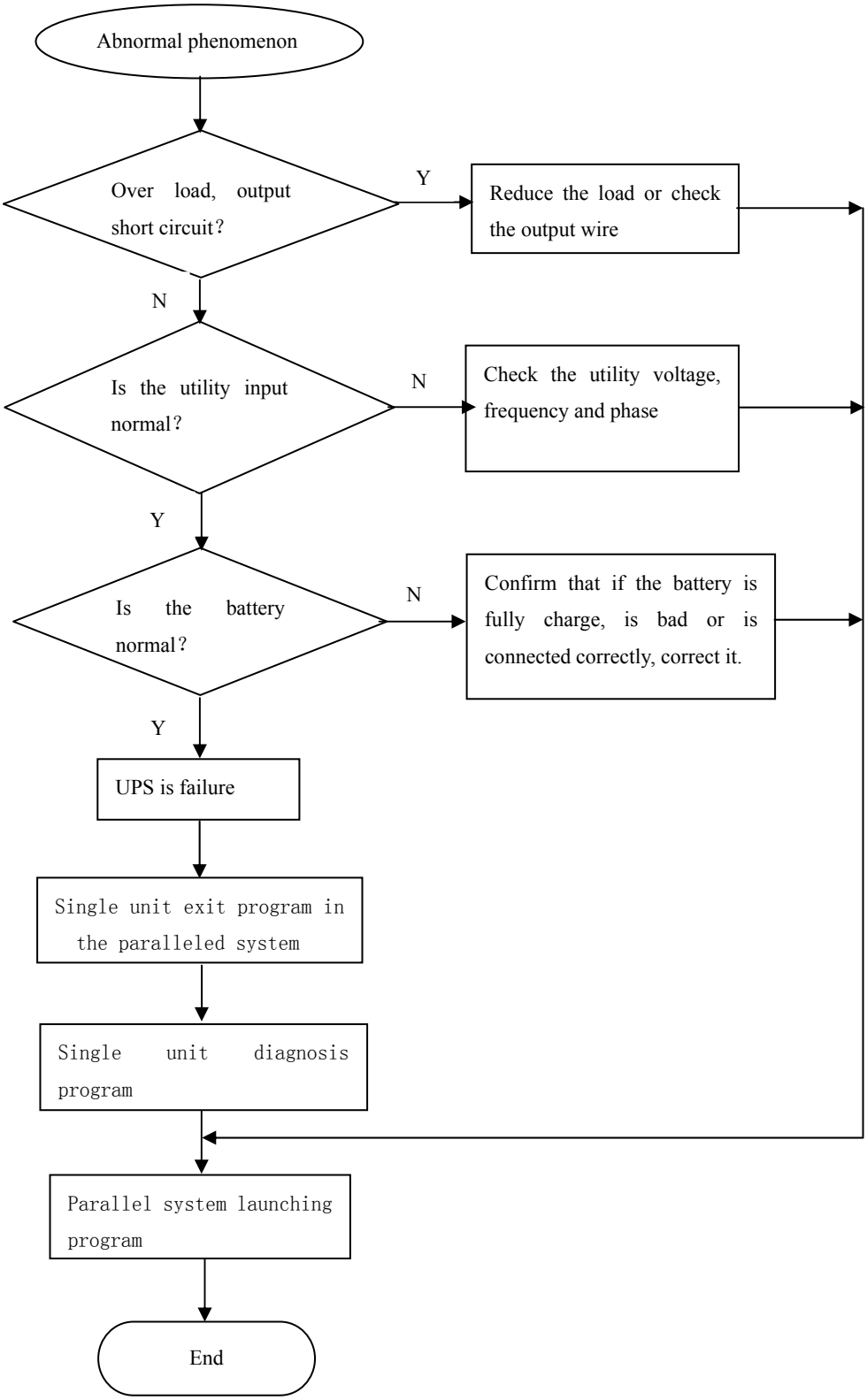
6.2.2 Program describe:

The program has been described before in the manual.

7. Paralleled system diagnosis program

7.1 Two units paralleled system diagnosis program:

7.1.1 Diagnosis program:



7.1.2 Program describe:

①Single unit exit program in the paralleled system:

A. Turn off the load of the UPS, press “off” key on the panel to turn off the two paralleled UPS;

B. Turn off the power, bypass and battery breaker of the two UPS, and turn off paralleled output breaker of the failure UPS.

C. Remove the paralleled wire, set the SW2 switch of the main board of two UPS to make them in single mode, as shown in 4.2.2 in the manual.

D. Turn on the power, bypass breaker of the normal UPS, turn on the battery breaker when the rectifier start normal, press “on” key on the panel to turn on the UPS.

②Paralleled system launching program:

A. Turn off the load of the UPS, Turn off the paralleled output breaker of the normal UPS;

B. Press “on” key on the panel to turn on two UPS;

C. Turn off the power, bypass and battery breaker of the two UPS;

D. Connect the two UPS with the paralleled wire, set the SW2 switch of the main board of two UPS to make them in two unit paralleled system mode;

E. Turn on the power, bypass breaker of the two UPS, turn on the battery breaker when the rectifier start normally, press “on” key on the panel to turn on the UPS.

F. After the UPS start normally, test the voltage between two UPS output with same phase, the value should be less than 10Vac, as shown in figure 7-1. Turn on the two output breaker without load, test the three live lines output current, and the value should be less than 3A, as shown in figure 7-2. Turn off the utility cabinet power breaker, test the voltage two UPS output should be 50Hz and the voltage should be 220Vac, test the output current should less than 3A. Turn on the cabinet power breaker, add the UPS load, and test the two UPS output current, the difference should less than 5% of nominal output current.

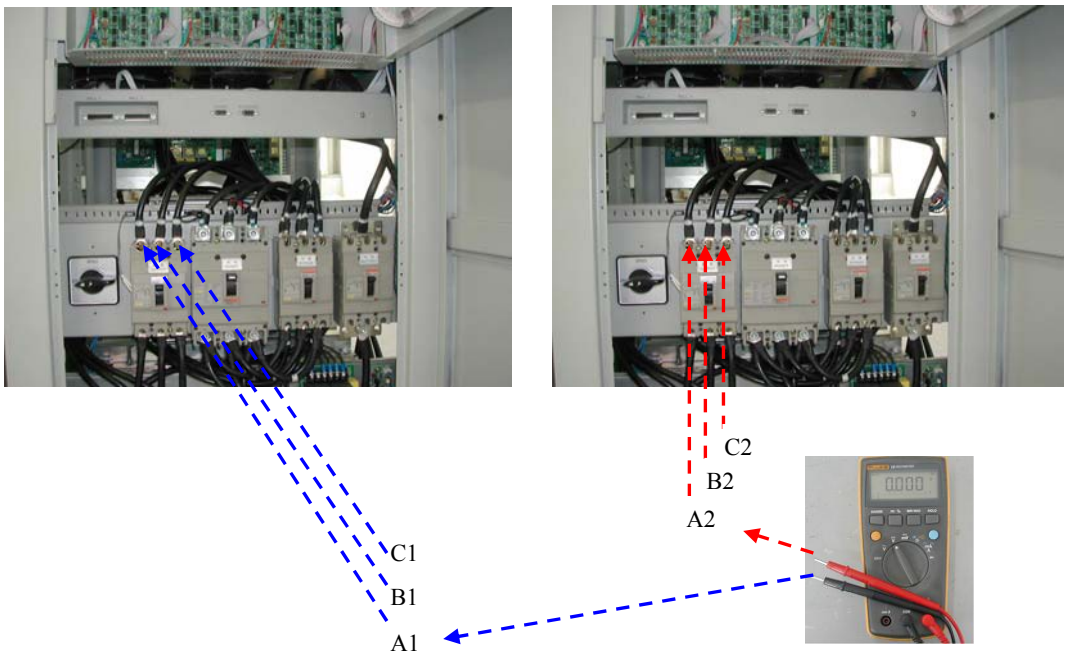


Diagram 7 paralleled output of the —s 1 units press bad of measure

Diagram 7 the —s 2 output the current measure

The ③ units paralleled system connects line diagram:

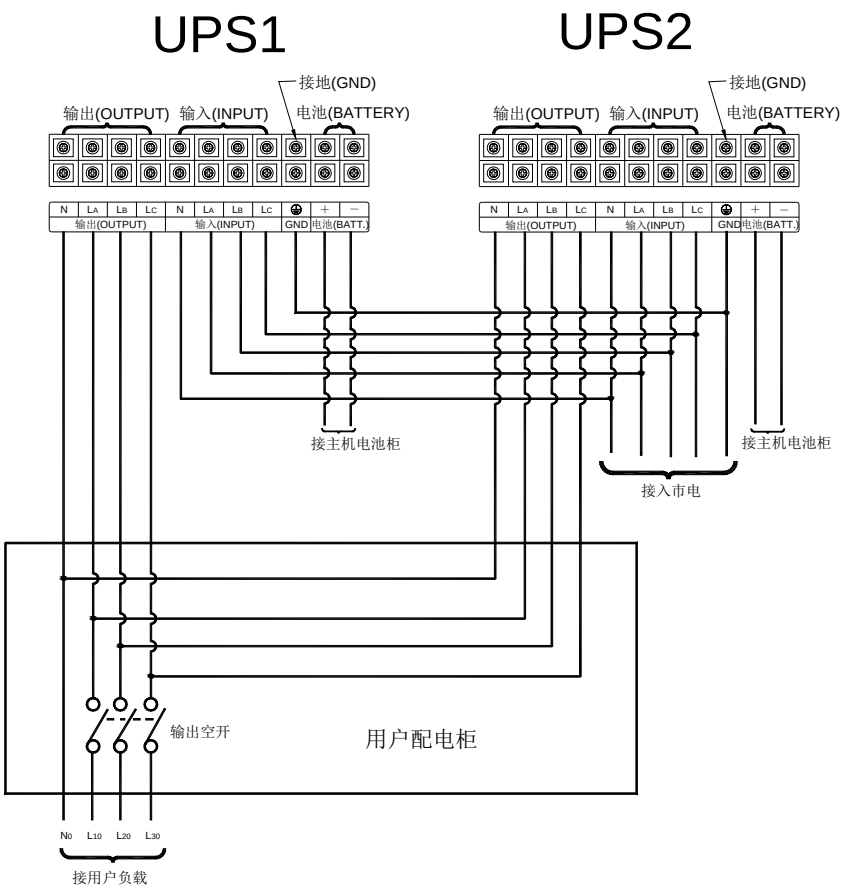


Diagram 7 paralleled system of the —s 3 units connect line diagram

7.2 Three or more units paralleled system diagnosis program:

Three or more units paralleled system diagnosis program is similar to two units paralleled system, the difference is single unit exit program and paralleled system recover program.

① Single unit exit program:

A. Turn off all UPS from panel;

B. Turn off the failure UPS bypass, power, battery and output breaker;

C. Pull out the failure UPS paralleled line, set the UPS to single unit, act as 4.2.2 in the manual.

D. Turn on the other UPS from the panel (if the load is bigger than one unit output nominal load, the load should be turned off or reduced).

② Paralleled system recover program:

A. Turn off the load, turn off all the UPS from the panel and turn off their output breaker;

B. Turn off the bypass, power, and battery breaker of all the UPS.

C. Connect the paralleled line and set the UPS that used to be failure to paralleled mode.

D. Turn on power, bypass breaker of all the UPS, and turn on the battery breaker after the rectifier start normally, turn on all UPS from the panel.

E. After the UPS start normally, test the voltage between two UPS output with same phase, the value should be less than 10Vac, as shown in figure 7-1, Turn off the output breaker, test the voltage between two output breaker upper three pins A1 and A2, B1 and B2, C1 and C2. Turn on the two output breaker without load, test the three live lines output current, and the value should be less than 3A, as shown in figure 7-2. Turn off the utility cabinet power breaker, test the voltage two UPS output should be 50Hz and the voltage should be 220Vac, test the output current should less than 3A. Turn on the cabinet power breaker, add the UPS load, and test the two UPS output current, the difference should less than 5% of nominal output current.