APW3 Power Supply Repair Guide

I. Notes

1. To prevent the possible danger of electric shock, non-professionals should not disassemble the casing;

2. The qualification of maintenance personnel must meet the specified requirements;

3. Maintenance personnel are required to use a unique case opener when opening and repairing the power adapter to avoid damage to the internal components of the product;

4. After the product is opened, it is required to discharge the high - voltage capacitor;

5. The instruments and equipment used for maintenance must meet the specified requirements;

6. The instruments and equipment to be repaired must be effectively grounded, and the maintenance environment requires anti-static requirements;

7. The materials used for maintenance must meet the specified requirements; to ensure the accuracy and traceability of the materials used for maintenance, the materials used for maintenance must be the production materials of the corresponding model, and the material replacement requirements are confirmed to be correct.

II. Maintenance tools and instruments

1. Tools: 300W soldering iron, desoldering gun, anti-static brush, anti - stati wrist strap, needle nose pliers or diagonal pliers, tweezers, screwdriver, 150W protection light;

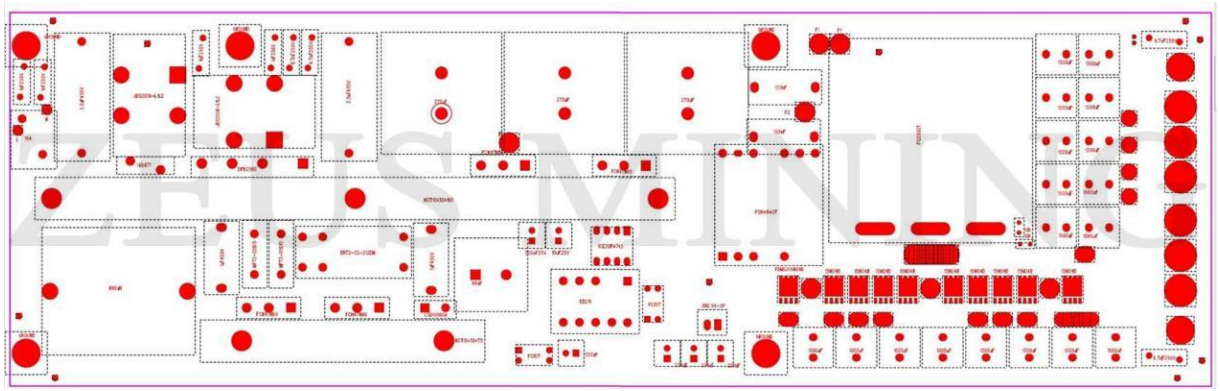
2. Material: tin wire (lead-free environmental protection), washing water, silica gel;

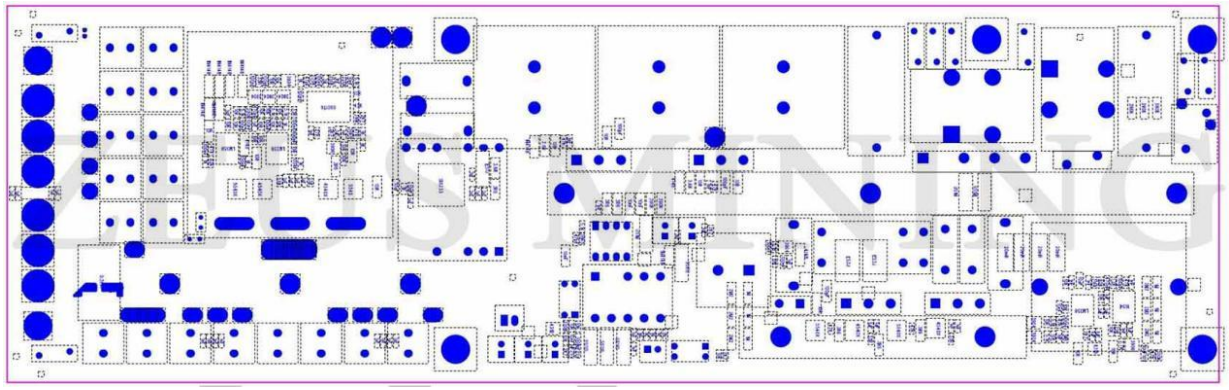
3. Instruments: power tester, voltage regulator (auto coupler 2000W), electronic load tester (1800W), Fluke 15b+ multimeter, oscilloscope.

III. Basic technical parameters

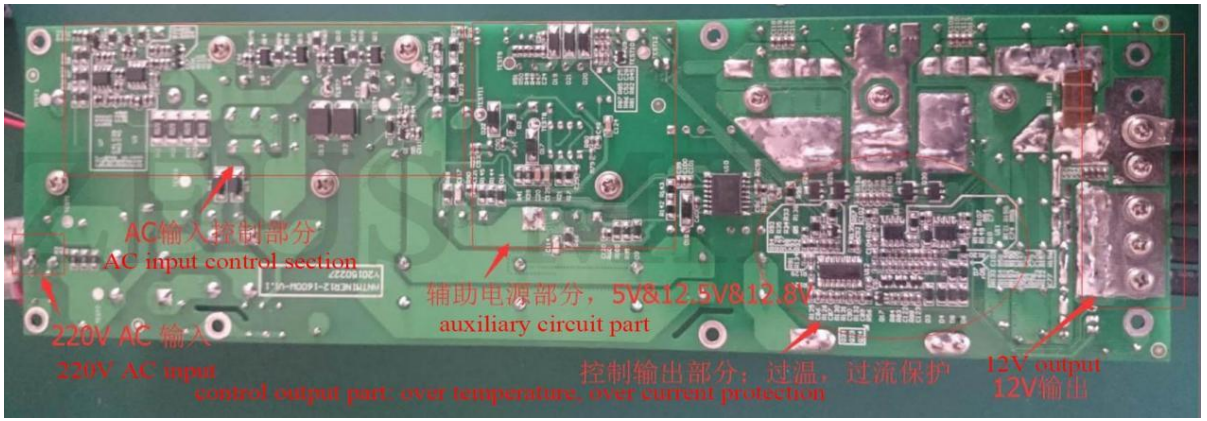
APW3 power input 176~264V AC, output voltage: DC12V, rated current 133A, rated power: 1600W, voltage accuracy <2%. 12 parallel outputs.

IV. Top layer picture & Bottom layer picture

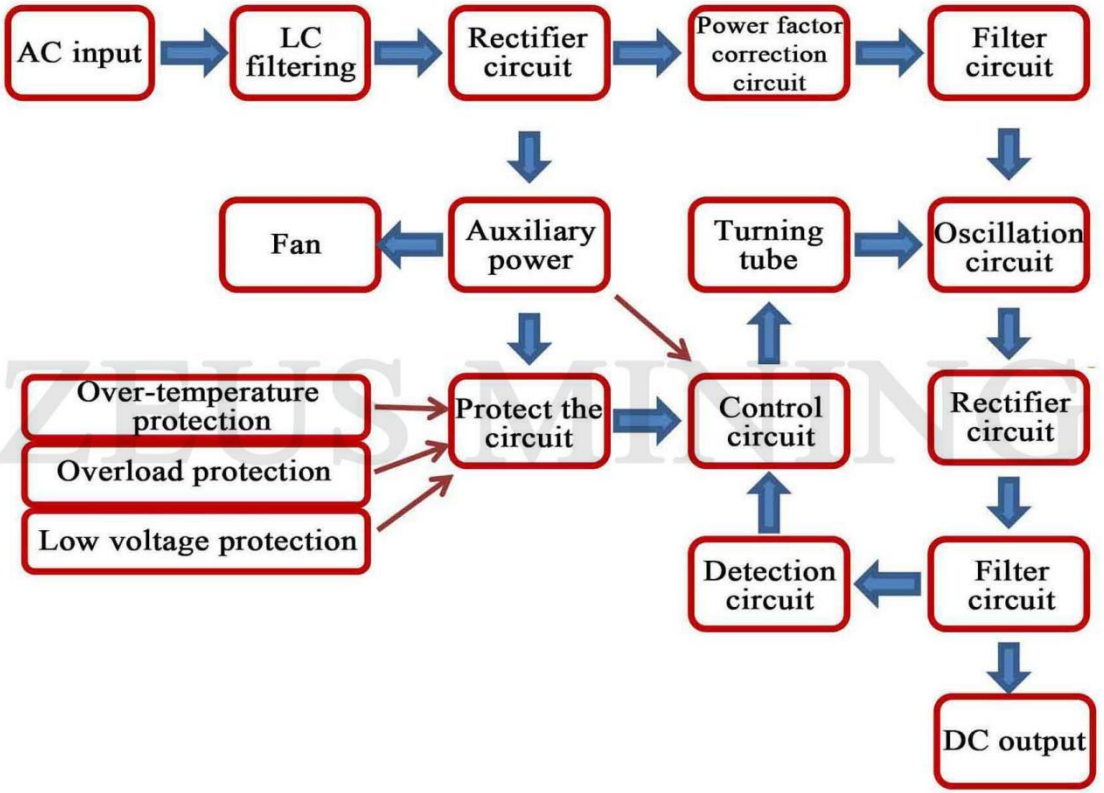




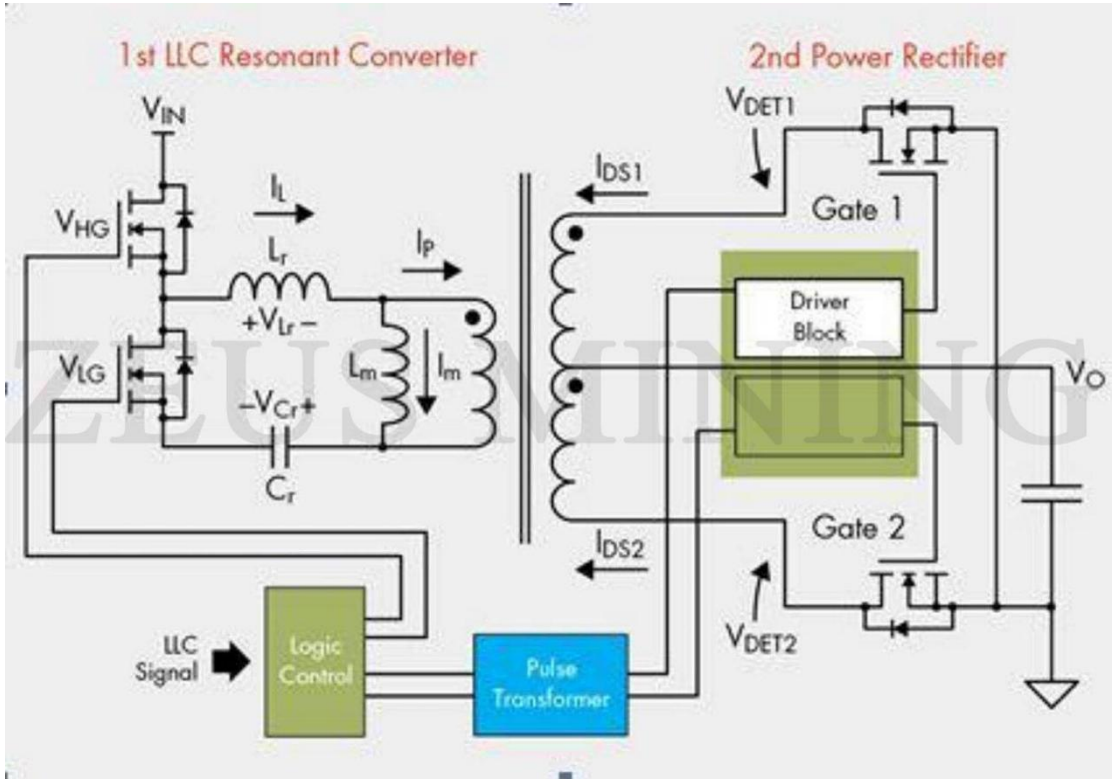
V. Function description of the main components of the Bottom layer



VI. Basic principle block diagram of power supply



VII. Oscillation circuit schematic



VIII. Power core components

The circuit board contains the following parts:

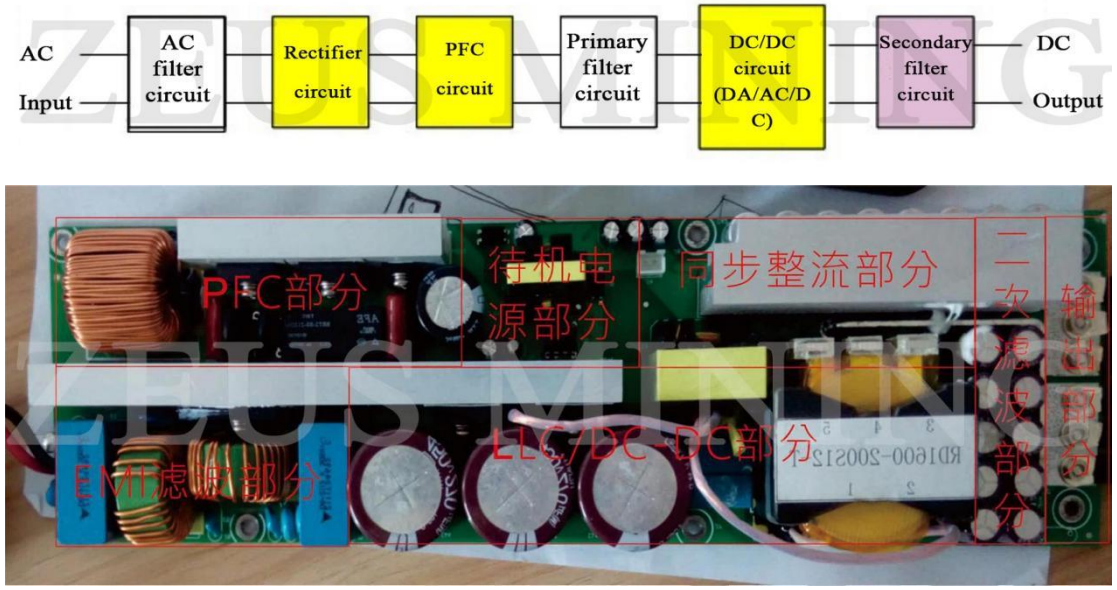
1. EMI filter part

2. PFC part

3. Standby power part

4. Llc DC-DC part

5. Synchronous rectification part



EMI filter

A standard EMI filter is usually a low-pass filter circuit composed of a series reactor and a parallel capacitor. Its function is to allow the frequency signal of the device to enter the device when it is normally working and to hinder the high-frequency interference signal. We used two common mode inductors, two large X capacitors, and six Y capacitors. In addition, there is a varistor to prevent external high voltage spikes from damaging the power supply.

This part of the circuit does not affect the performance parameters of the power supply under normal circumstances, mainly for certification, and is helpful for electromagnetic testing.

PFC circuit

Significance: Keep the current waveform and voltage shape of the power input consistent and simulate a resistive load.

For users, PFC circuits can improve the utilization rate of distribution lines.

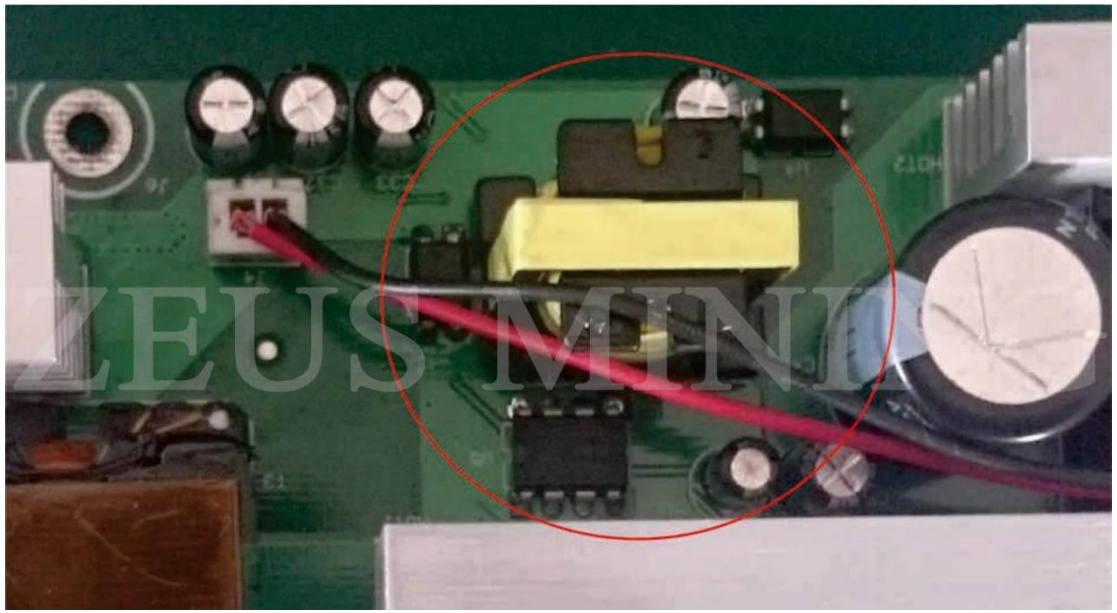
Under normal circumstances, the power supply with a PFC circuit has a high power factor, more significant than 0.95, and harmonic components do not need to be considered.

Of course, except for the faulty circuit design of this part.

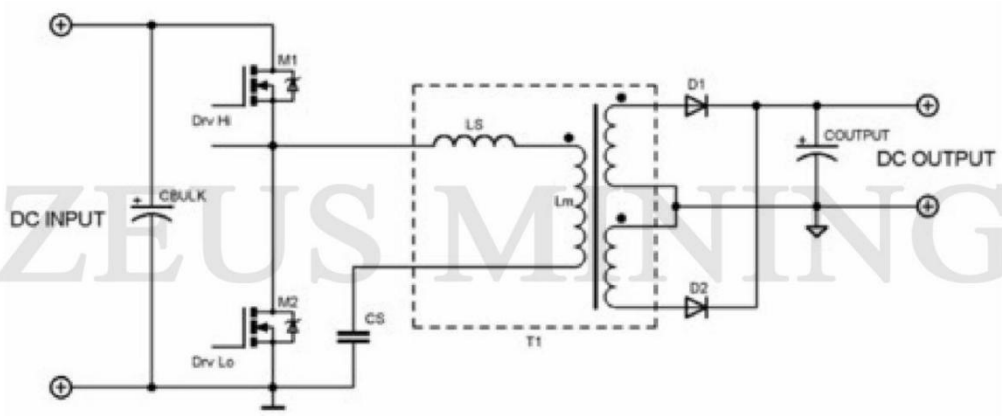
Standby power section

The APW3 circuit board contains two power supplies: the main output 12V (1600W); there is a small standby power supply inside; the primary purpose of this power supply is to provide power for the internal chips, fans, relay, etc.

When the power supply is powered on, it is found that there is no response, and the fan does not respond. Therefore, it is necessary to consider whether there is a problem with the standby power supply.

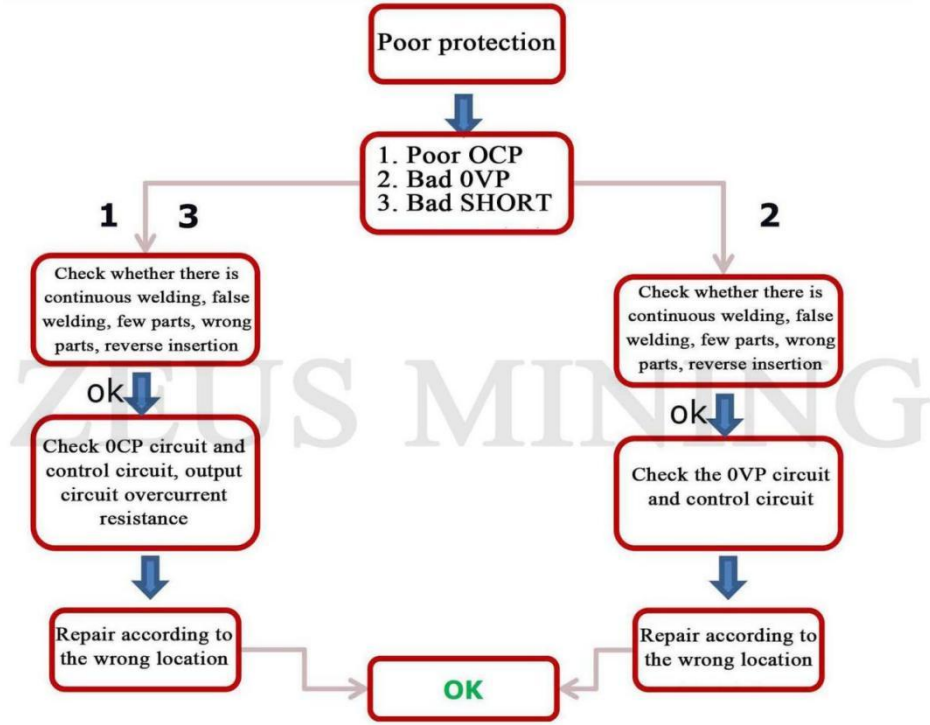


LLC DC - DC



IX. APW3 PSU FAQ Repair

1. Maintenance process for poor protection function



Protective function

The poor protection function of the product is mainly manifested in the large short-circuit current, the burn-in caused by the short circuit, the large or small overcurrent point, the unstable input voltage, the output overvoltage, and the high or low-temperature point, and so on.

The related components are R34-R47, D13, D14, C30-C40, of which U3, U7 are input protection; U10, Q25 are current protection; U12, Q30 are temperature protection;

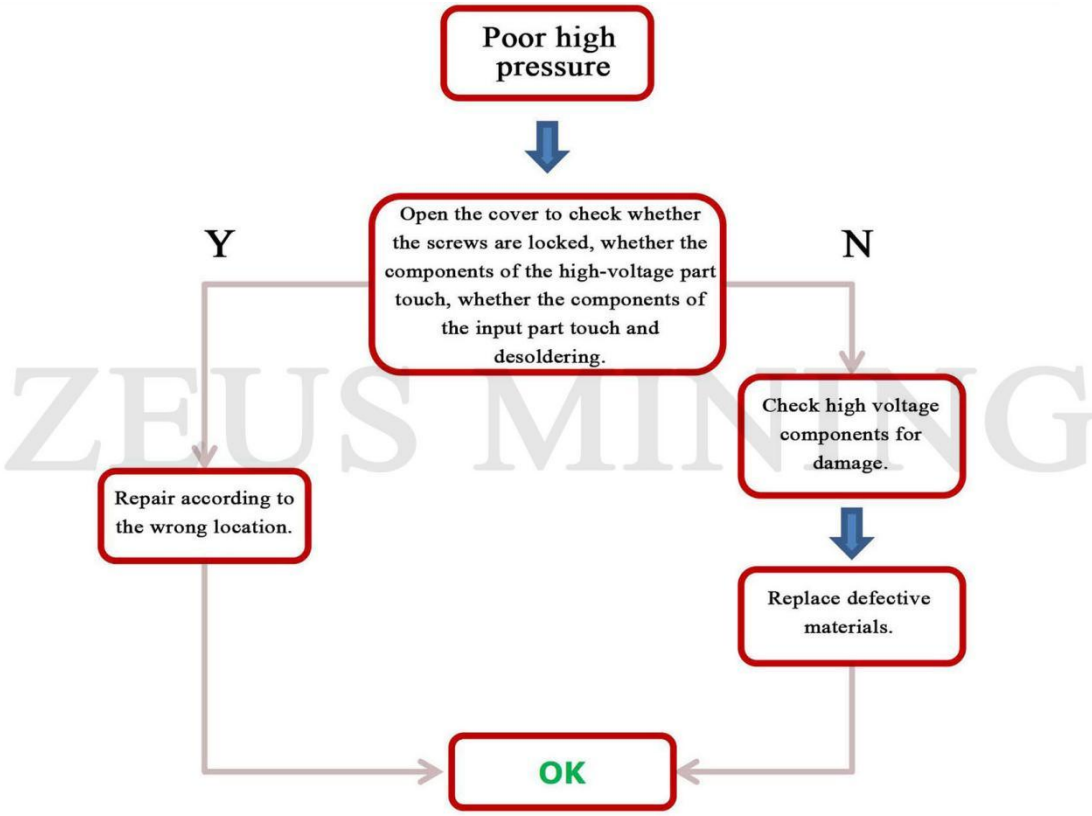
The vulnerable components are D13, D14, U3, U7, U10, U12, etc.

For example, the U11 pin in the attached picture has a short circuit of tin bead, resulting in no secondary output.

In addition:

There are still many problems caused by defective products caused by external conditions, resulting in damage to the input end protection function device, such as input safety fuse F1, varistor MOV1, etc.

2. High-voltage defective repair process



Poor high pressure

The high voltage defect of the product is mainly manifested in that the leakage current is too large during the withstand voltage test, which is mainly caused by:

a. The internal insulation strength of the power transformer is not enough;

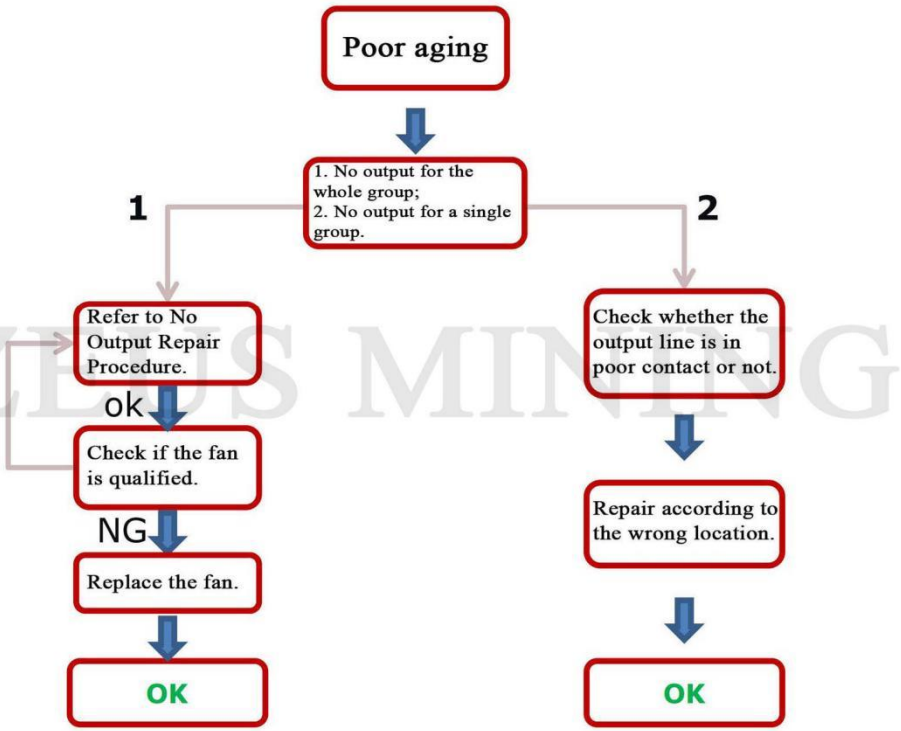
b. The creepage distance between the high voltage area and the low voltage area of the transformer is not enough;

c. The space distance or creepage distance between the high-voltage parts of the power supply and the low-voltage parts is not enough;

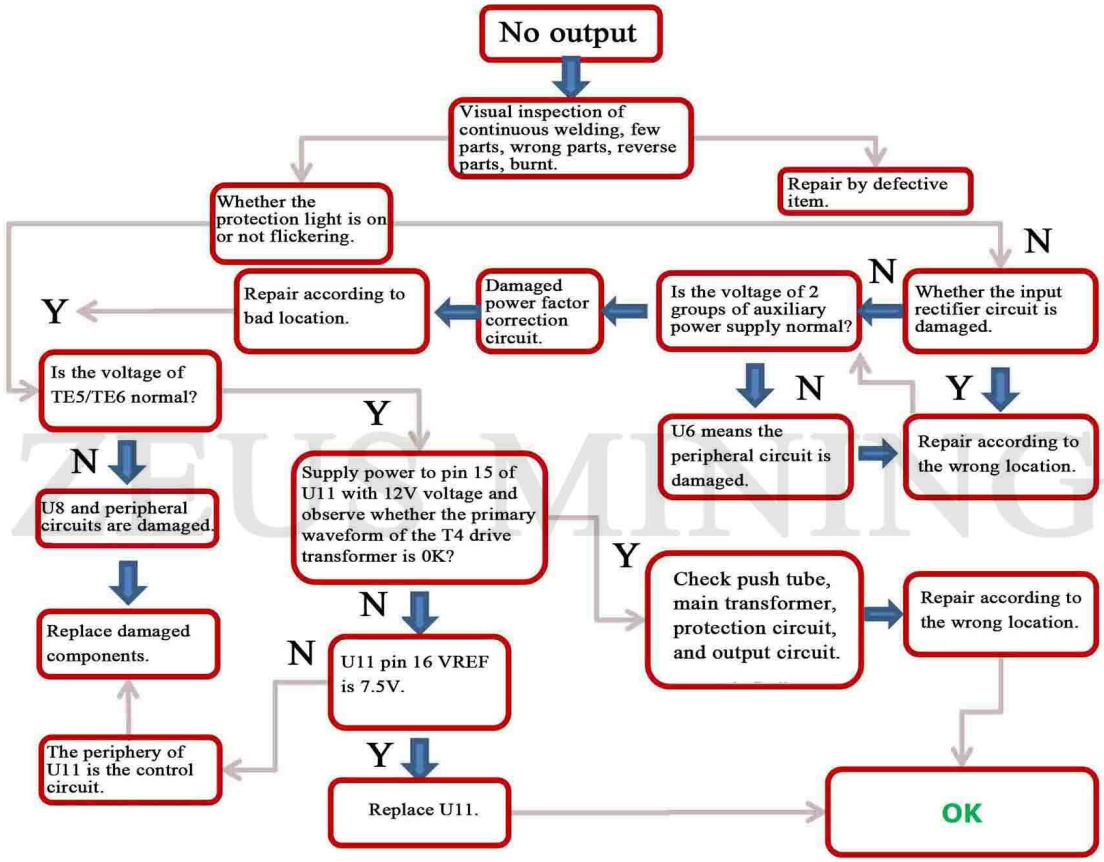
d. The distance or insulation strength of the metal heat sink connected to the low-voltage part of the power supply product and the components in the high-voltage area is not enough;

e. The insulation strength of the metal heat sink connected to the high-voltage part of the power supply product and the components in the low-voltage area is not enough;

3. Aging and defective maintenance process



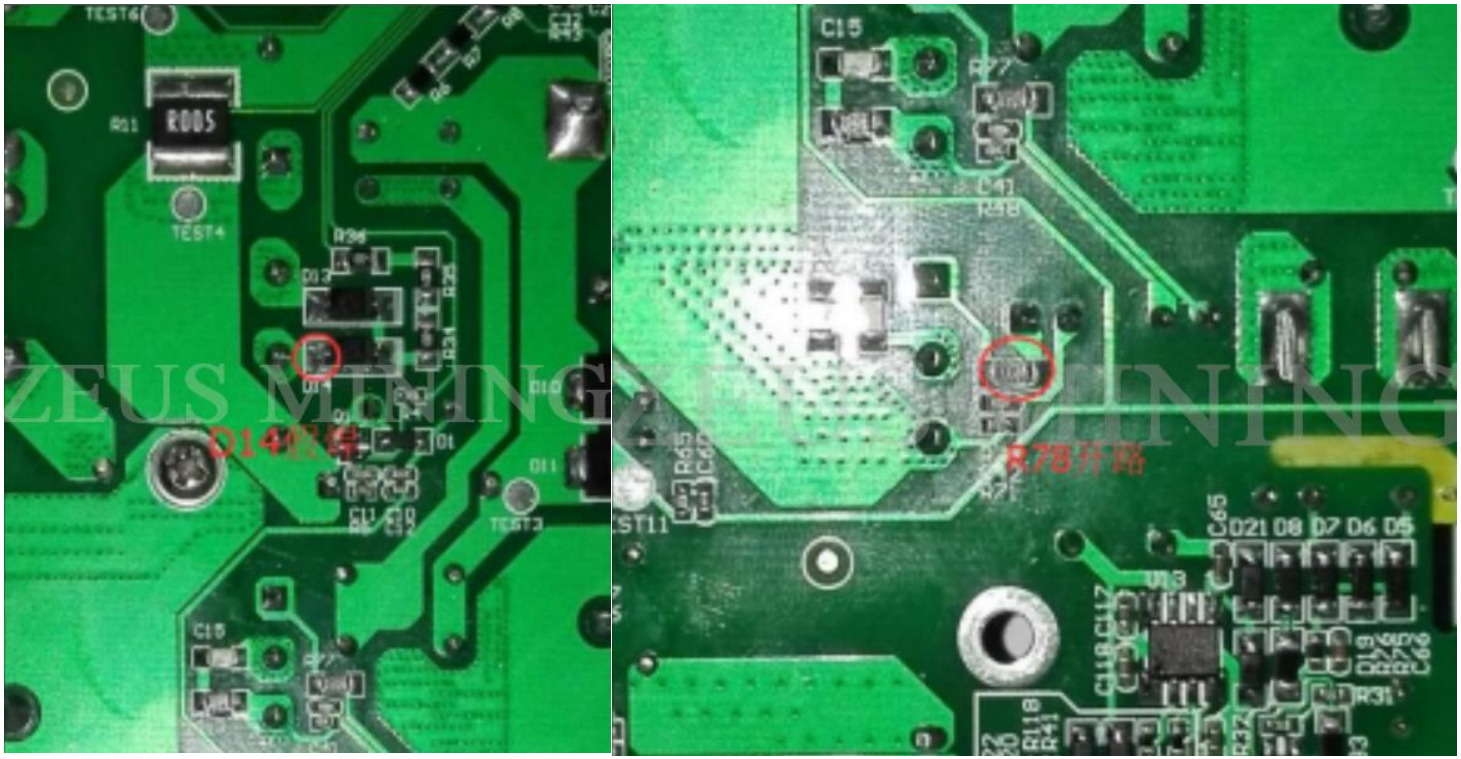
4. No output maintenance process



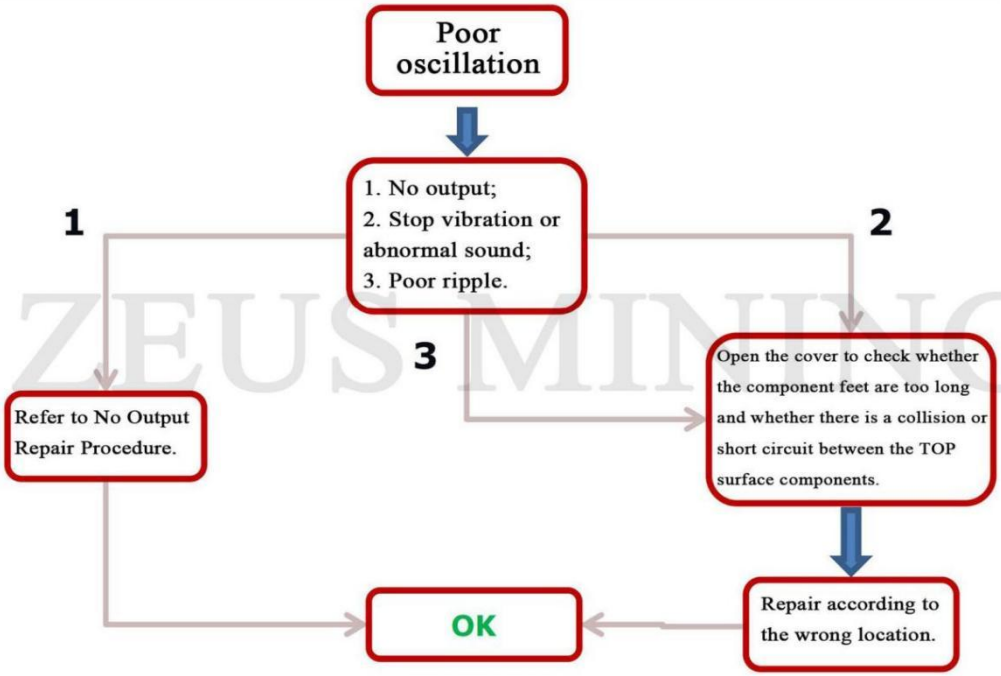
No output

No output is the most common bad phenomenon of the power supply. Many factors cause the power supply to have no output, including process and material problems. Such phenomena need to be analyzed according to the specific situation, such as device opening, short circuit, product burn-in, a parts failure, fuse damage, etc.

The figure below shows that the diode D14 has no output due to false welding, and the open circuit of R78 results in no output.



5. Maintenance process for poor vibration



Test steps:

1. Visually inspect the board. After ensuring that the board is free from soldering, continuous welding, electrolytic capacitor polarity, plug-in components are installed in place, and MOS tube insulating gaskets are all normal, connect the input line L / N of the board to the positive and negative output lines.

2. Turn on the AC input air switch; after all the multimeters are read correctly, set the electronic load current to 1A, and record the electronic load voltage at this time. The voltage value of 12.18 - 12.25V is qualified.

3. Set the electronic load current to 133A, record and test the voltage, power, and power factor of the AC side power meter. The power factor is more significant than 0.99, and the ripple is less than 120MV.

4. Rotate the knob of the electronic load to increase the current by 2A / div; the current protection point is 134-153A, the direct protection is qualified, and the protection value is recorded.

5. Turn off the AC switch and electronic load and remove the AC input cable and DC output cable.

Note:

The large electrolytic capacitor is charged before the fan stops, and you need to wait for the fan to stop completely before you can touch the board.

Judgment standard (this test needs to use an electronic load, power tester, voltage regulator)

Test items	Test Conditions	Judgment standard	Judgment standard	Qualified	Product code
Input starting voltage	Output no load	205V startup is qualified			
The output voltage	Load 1A	12.15 - 12.25V			
efficiency	Full load (230V)	>92.0%			
power factor	Output full load, input 220V	>0.99			
Overcurrent protection	Input 220V	134-153A			
ripple	Fully loaded 133A	<120MV			
TEST5/TEST6	Output no load	370-385V			

TEST11/TEST6	Output no load	11.5V-13.8V			
TEST10/TEST9	Output no load	11.5V-13.8V			

X. Common fault maintenance

NO.	Fault symptom	Cause	Solution
1	The fan does not run, and there is no 12V output.	The power supply on the AC side is abnormal.	1. Check if the AC input line of the power supply is nomal and the plugs at both ends are not loose. 2. Check if the grid is powered and the voltage is normal.
2	The fan usually runs; there is no 12V output.	1. Low grid voltage; 2. Power protection.	1. Use a Fluke 15b+ multimeter to confirm that the current voltage is above 205V to turn the power on. 2. Detect whether the power supply has an output short circuit or overload. This situation will cause the power supply to enter the lock protection state. Therefore, it needs to be re-powered after the fault is removed to recover.
3	After the power supply stops output for a few seconds, it	The power supply has entered the over-temperature protection.	1. Check if the fan is running normally; 2. Check if the cooling air duct of the power supply is blocked;

	resumes normal operation. Then, after a few minutes 0 continuous operation, it stops outputting again.		3. Check if the power supply has accumulated excessive dust inside for a long time; 4. Check if the power used by the power supply or the ambient temperature exceeds the power supply limit curve value.
4	Output is normal; the fan does not work.	The fan is faulty.	1. Check if the fan is blocked by debris; 2. The fan is faulty!
5	The normally working power supply suddenly has no output and will not start again.	The PSU is in overcurrent protection.	Using the electronic load tester to check whether the current of the load exceeds the upper limit of the overcurrent protection of the power supply. The power supply sets the overcurrent protection to the locked state to prevent the power supply from continuing to output when the load is abnormal, causing a dangerous situation such as a fire.