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## Design of a Frequency Converter

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### Abstract

In this paper, on the basis of 3 d graphics, proe design 37 kw inverter structure, this paper expounds the function of every parts and components in the frequency converter and how to use proe 3 d graphics, and show the three-dimensional structure of every parts and components in the frequency converter. Through innovative design of inverter structure, improved the performance of the inverter parts, such as panel structure, ventilation and heat dissipation of radiator, power plate heat resistance, and so on.

Now a variety of drawing software has been widely used in machinery industry field, if found that some of the steps there is an error, using proe can timely correction and improvement. Using proe design, not only in design and convenient many, also shortened the production cycle. This article through to the absorption of domestic and foreign advanced design idea and reference, structure and function of frequency converter in detail. The text mainly introduces the main functions of the various parts of the frequency converter, and how to use proe to draw.

### Keywords

Pro/E , frequency converter, assembly.

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## 1. Basic Introduction and Composition

The frequency converter (referred to as VFD) refers to the use of frequency conversion technology and microelectronic technology, which controls the power control equipment of the AC motor by changing the frequency of the working power supply in the motor. The frequency converter is mainly composed of rectification (AC to DC), filtering, inverter (DC to AC), braking unit, drive unit, and detection unit micro processing unit. Through the breaking of the internal IGBT, the inverter realizes the adjustment of the voltage and frequency of the output power supply, and it supplies the required power and voltage to the motor according to actual needs, thereby achieving the functions of energy saving and speed regulation. Moreover, if you encounter overcurrent, overvoltage, overload protection, etc., the inverter will also play a protection function. With the continuous development of society and the continuous advancement of technology, frequency converters have also been widely used in various fields.

The frequency converter is divided into four parts: high-capacity capacitor, rectifier unit, contactor and inverter.

Rectifier unit: converts fixed frequency AC power to DC power

High capacity capacitor: store converted power

Inverter: An electronic switch consisting of a high-power switching transistor array that converts direct current into square waves of different frequencies, widths and amplitudes.

Contactor: superimposes the amplitude and pulse width of the square wave, makes it into alternating current, and drives the motor according to a certain program.

## 2. Working Principle

The main function of the main circuit is to provide the power conversion part of the power supply to the asynchronous motor.

The main circuit of the inverter can be roughly divided into two types: voltage type and current type. The voltage type is a frequency converter that converts the source voltage of the direct current into an alternating current, and the capacitor is a filter of the direct current loop. The current-type inverter converts the DC of the current source into AC, and the inductor is its DC loop filtering. It consists of three parts, including a rectifying unit, a contactor, and an inverter.

## 3. Historical Development and Its Current Situation

Because the traditional DC speed control technology has a large volume failure rate. In order to meet the extensive needs of AC motor stepless speed regulation, the generation of the inverter is promoted.

In the 1960s, with the continuous development, thyristors and their upgraded products were widely used in power electronic devices. But in terms of performance, it does not meet people's needs.

In the 1970s, a huge breakthrough was achieved in the pulse width modulation variable voltage frequency conversion (PWM-VVVF) speed regulation.

After entering the 21st century, China's inverters have begun to rise gradually, and the technology has begun to gradually improve. As the scale continues to expand, it has also opened up its own market. Shanghai and Shenzhen are developed areas in China.

The frequency converter is also relatively developed. As a frontier position in China, there have been many inverter companies, such as Ou Rui inverter, Ying Wei Teng inverter, Huichuan inverter, Anbangxin inverter and so on. Many excellent inverter companies like this are constantly developing innovations and seeking new breakthroughs.

### 3.1 Development Status

Because the domestic inverters lack uniform and specific specifications, even if there are many manufacturers, they can not meet the expected requirements, and most of the inverters use V/F control and voltage vector control, with low precision and poor stability. There are some gaps in meaning with some countries abroad.

### 3.2 Development Trend

1. Towards miniaturization and light weight development.
2. Although inverters are widely used in industry, with the development of society, the opportunities for civilian use are getting bigger and bigger, and there is great potential for development in this area.
3. Achieve comprehensive digitalization and automation, more intelligent and humanized.
4. The current society is a society that promotes conservation-oriented development, so the inverter should also develop in a direction of conservation.

## 4. Inverter Function

Soft start energy saving

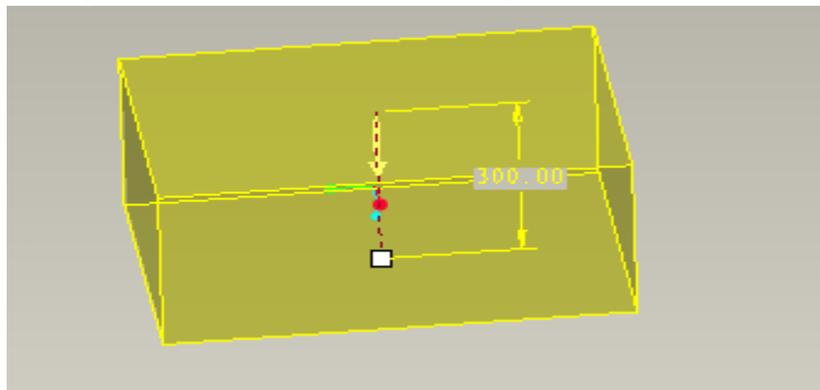
Frequent forced start of the motor will seriously damage the power grid, and there will be high requirements on the capacity of the power grid. When the motor is started, there will be a large current and vibration, which will greatly damage the baffle and the valve. After installing the inverter device, the function of the inverter will act on the starting current, so that it starts from zero, and the maximum current will not exceed the rated current, thus greatly reducing the impact on the power grid and the requirements on the power supply capacity. The service life of the equipment and valves.

Power factor compensation

The useless power will increase the line loss and the heat generated by the equipment. The main reason is that the efficiency of the equipment will be reduced, and the decrease in efficiency will result in a decrease in the useful power of the power grid, which will cause a large amount of useless power to be consumed in the line, causing serious Waste. If the inverter speed control device is used, the useful power of the power grid will be increased because of the filter capacitor inside the inverter, so that the loss of useless power is reduced, and the active power is greatly increased.

### 5. 37KW Inverter Structure Design

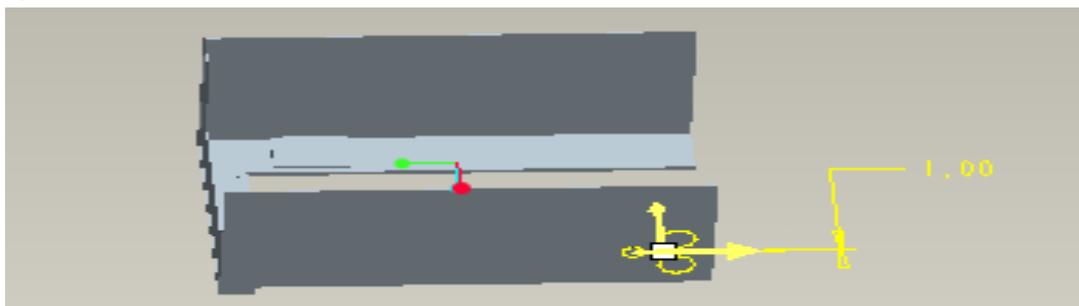
Step 1: Start Pro/E. Double-click the icon on the desktop to enter the PRO/E software, or click Start → Programs → Pro Engineer and go to Pro/E. Start selecting "New" → "Parts", → "Entity", enter the name "mianban", → "Use default template", and click the OK button. In the "New File Options" dialog box that pops up, select the "mmns\_part\_solid" option, and then click the "OK" button to enter the ProE drawing interface. Then select the Stretch button command, and select the sketch plane "FRONT" datum plane in the pop-up sketch dialog box, then click on the grass to draw a rectangle to stretch out a cuboid shape. The panel weld is the external main part of the inverter. Bracket structure, including front and rear panels and vents. As shown in Figure



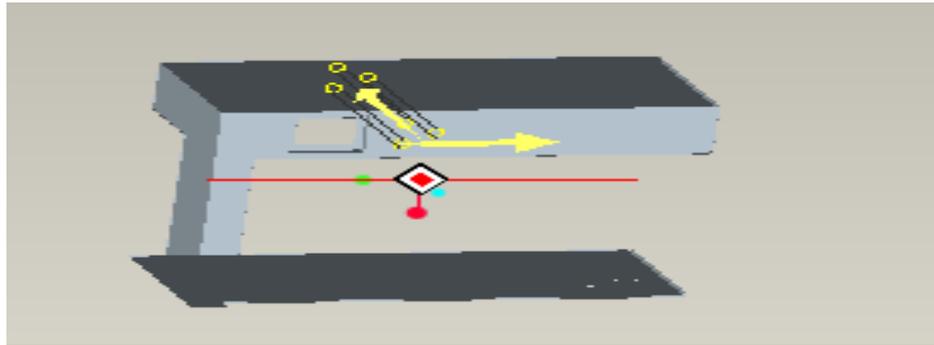
Cut it off and make the shell features, as shown in the figure



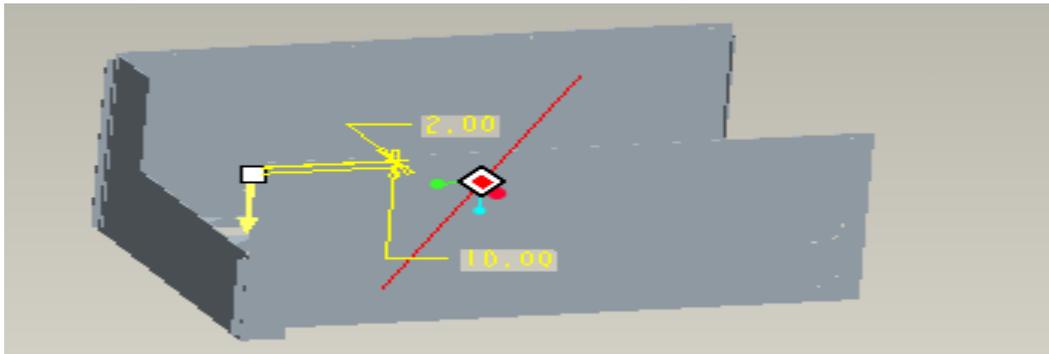
Cut it off, as shown



Stretching the right end of the outer casing inward, as shown

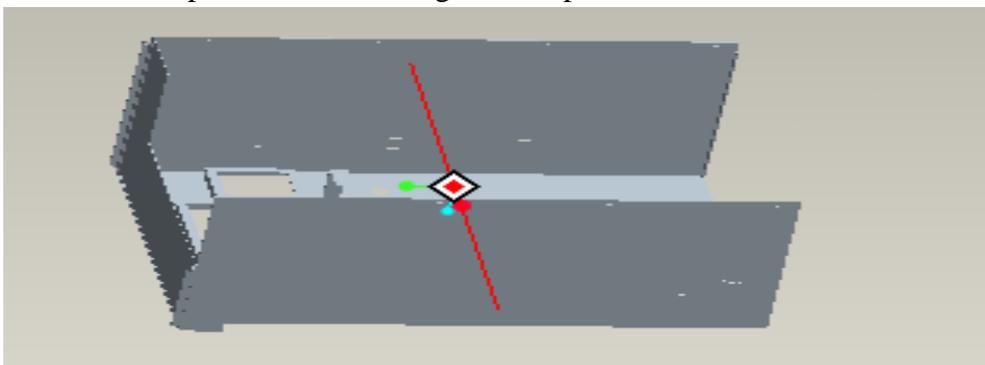


Cut it and make a protrusion at the left end, as shown in the figure

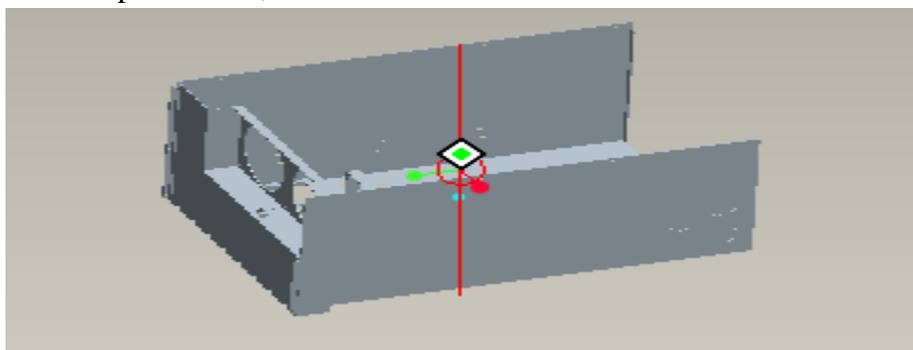


Then cut it off and make a protrusion, and merge the fan port into the left end notch, as shown in the figure

Then cut it off and make a protrusion, and merge the fan port into the left end notch, as shown in Figure

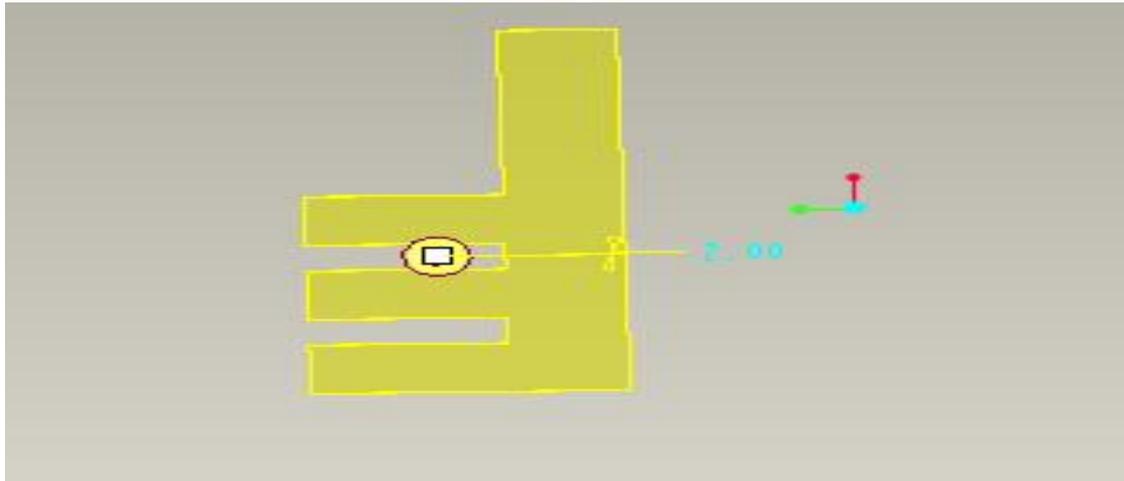


Finally, make cuts and protrusions, as shown

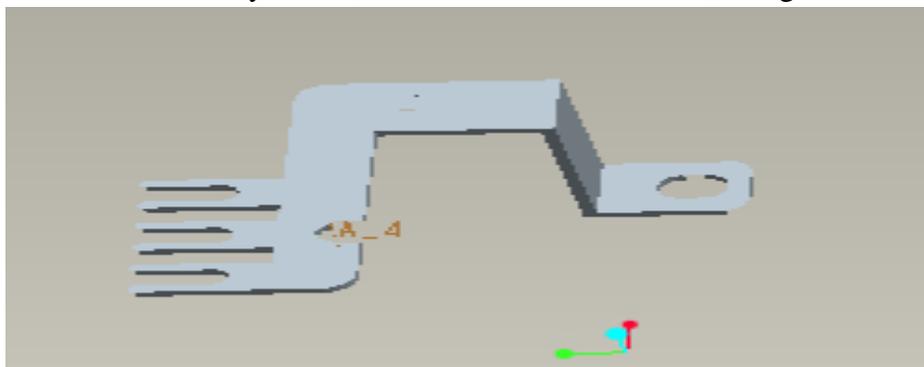


## 6. Design of Rectifying Copper Row Positive A

The function of the rectifying copper row positive A is to connect the frequency adjusting resistor and the rectifying module. Open proe, select the stretch command, select the "FRONT" datum, click on the sketch, draw a rectangle with a length of 63.25mm and a width of 32mm, stretch 2mm, click OK to cut and round, get the following picture As shown

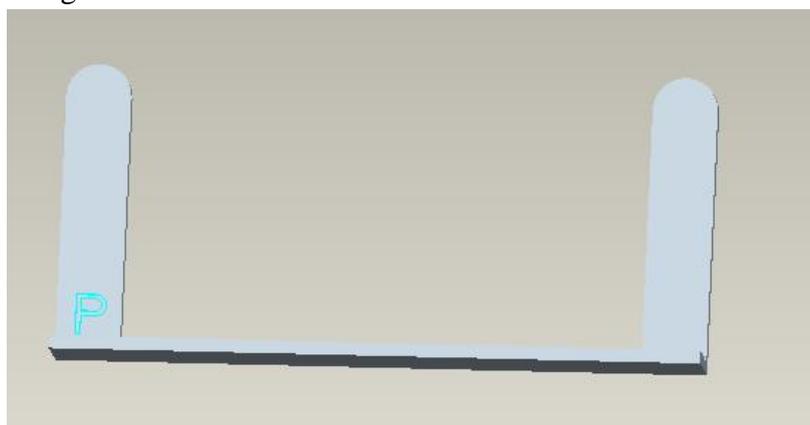


Stretch the previously stretched image to the left by 25mm and 15mm wide, then stretch it down by 39mm, then stretch it to the left by 21mm, click OK to cut and round, and get the following image

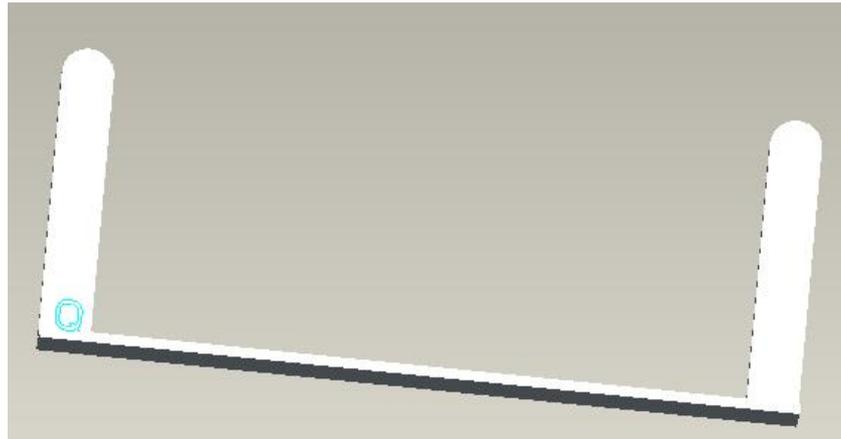


### 6.1 Design of Copper Row U

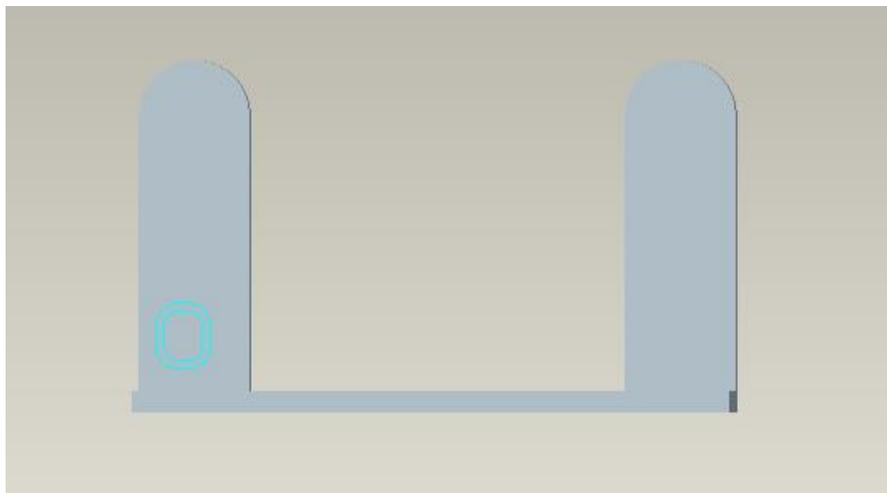
The function of the copper busbar U is to connect the two contactors. First draw a rectangle with a length of 100mm and a width of 10mm, then obtain a rectangular parallelepiped by stretching, then select a main plane to sketch, draw a rectangle with a length of 44mm and a width of 10mm, stretch to obtain a rectangular parallelepiped, and then round it. Corner, then click to confirm to get the copper row U1 as shown in Figure



Similarly, a rectangular parallelepiped copper row U2 with a bottom length of 146 mm and a width of 10 mm can be drawn, as shown in the figure.

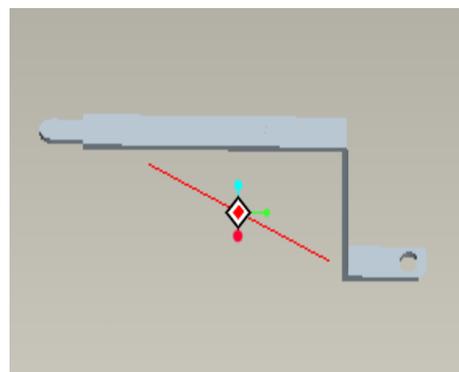
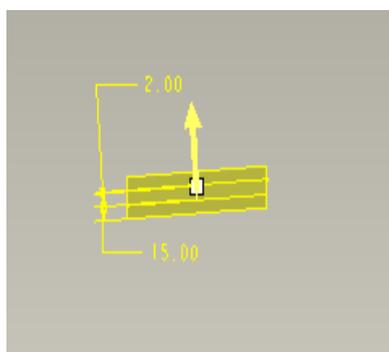


Similarly, a rectangular copper busbar U3 with a bottom surface length of 54 mm and a width of 10 mm can be drawn.



### 6.2 Design of Copper Row Z

The main function of the copper strip Z is to connect the inverter module to the contactor and pass the Hall current transformer. After entering proe, select the stretch command, select the “FRONT” datum plane and sketch, sketch a cuboid with a length of 34.75mm, a width of 15mm and a height of 2mm, and stretch it as shown in the figure.

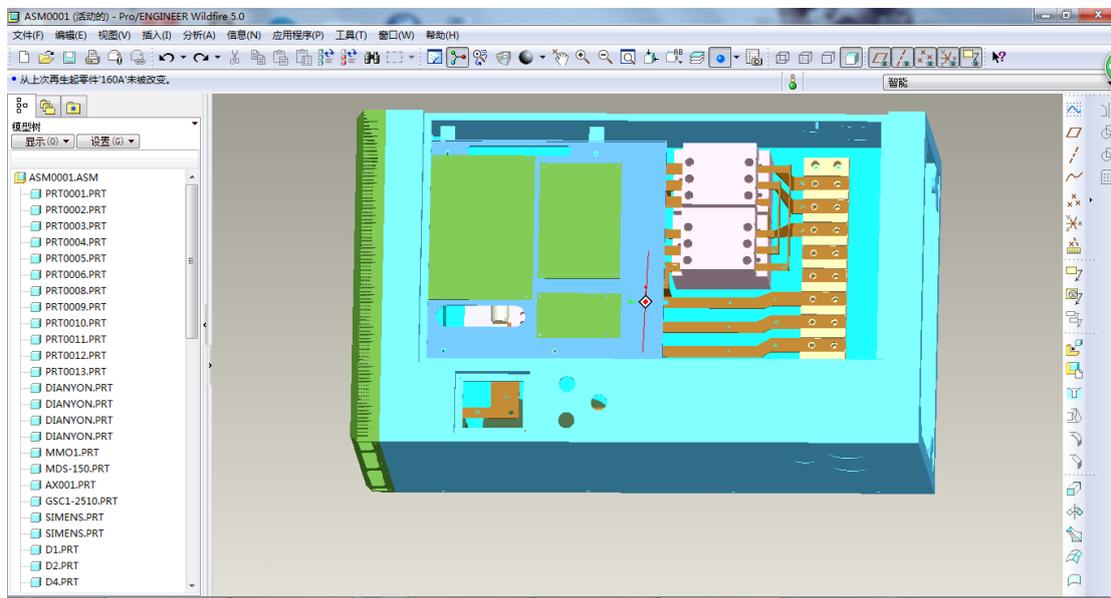
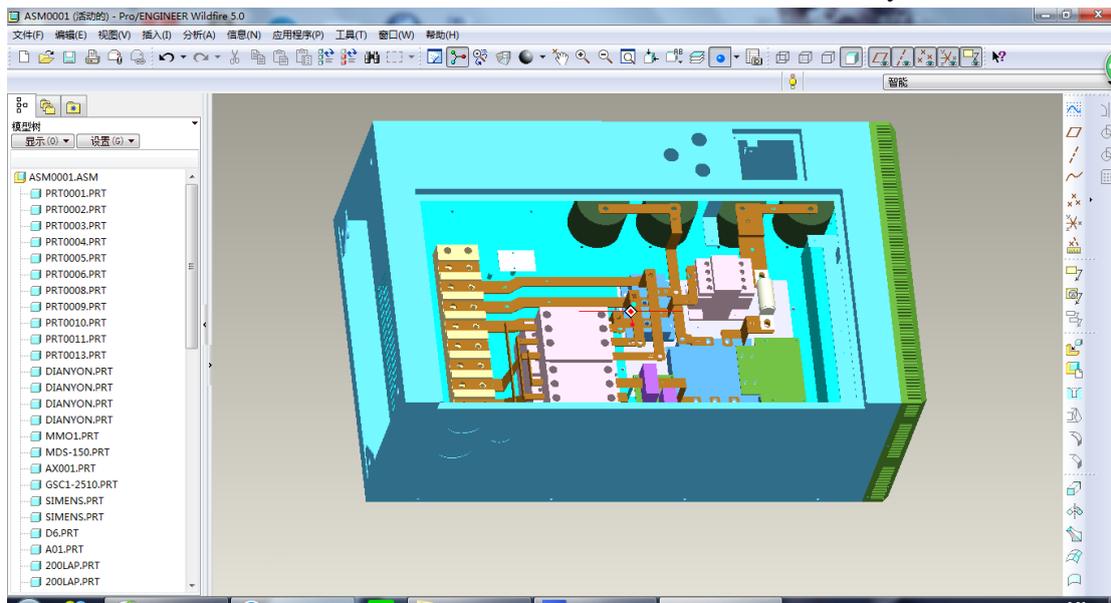


### 6.3 Assembly of 37KW Inverter

Frequency converter assembly is a very important part of the entire inverter design. Using ProE for assembly can find many problems that are difficult to find in practice. When you find a problem in the assembly, just go back and modify the part, ProE will automatically update the modified assembly relationship. To assemble, you must enter ProE's "Components" module to start a new assembly. When assembling the module, the panel welding should be added as the main body first, because the

panel is the general structure of the inverter, and the other components can be assembled through the panel.

By adding and assembling each part, a complete inverter structure diagram can be obtained. With the development of technology, the manufacturing process of inverters is more and more advanced, and it is not difficult to manufacture high-quality inverter structures. If the assembled parts are found to have problems in one aspect, the pit can be reassembled and recalibrated in reality, but it is not required to use proe. Just select the part in the tree view on the right side and right click. Click on "Edit Definition" to resize and reassemble, which is easier and easier to find than it is in reality.



## 7. Conclusion

The frequency converter (referred to as VFD) refers to the use of frequency conversion technology and microelectronic technology, which controls the power control equipment of the AC motor by changing the frequency of the working power supply in the motor. The frequency converter is mainly composed of rectification (AC to DC), filtering, inverter (DC to AC), braking unit, drive unit, and detection unit micro processing unit. Through the breaking of the internal IGBT, the inverter realizes the adjustment of the voltage and frequency of the output power supply, and it supplies the required power and voltage to the motor according to actual needs, thereby achieving the functions of energy saving and

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## References

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