Research on Plugging Technology of J30JH Electric Connector without Tail Cover

Zhibin Liu¹,²*, Yuhui Wang³, Yongquan Xia³, ¹,², Yu Wang¹,², Ruizhao Du¹,²
¹Beijing Institute of Spacecraft Environment Engineering, Beijing 100094, China
²Beijing Engineering Research Center of the Intelligent Assembly Technology and Equipment for Aerospace Product, Beijing 100094, china
³Communications Satellite Division, Beijing 100094, China
*Corresponding author’s e-mail: raindown@126.com

Abstract. By analysing the plug-in condition of a J30JH low frequency connector, we can find that technological tests were carried out on both the prototype and the normal sample satellites, the plug-in tooling was studied, the plug-in method was optimized, the operation process was solidified, the connection reliability of low frequency connectors in spacecraft assembly and test was improved, the product quality was ensured, and the plug-in of low frequency connectors was implemented smoothly. Lay a solid foundation.

1. Introduction
There are four types of J30JH connectors without tail cover used in the development of a certain model, which are 9, 15, 21 and 100 needles respectively. As shown in Table 1, they include all the instruments involving the J30JH connector without tail cover. Each socket of the instrument corresponds to a plug at the end of the low frequency cable network. Specific low frequency connectors for each device are as follows:

Table 1. A Model J30JH Electric Connector without Tail Cover

| Serial number | Socket type | Number of sockets |
|---------------|-------------|-------------------|
| 1.            | J30JH15ZK   | 229               |
| 2.            | J30JH21ZK   | 125               |
| 3.            | J30JH9ZK    | 27                |

We can take Instrument 1 as an example. We can find that the electrical connector: X2 of each instrument in 40 instruments, a total of 40, model J30JHJ15ZK (15 pins), corresponding to low-frequency cable network electrical connector model J30JHJ15TJ (15 pins).

2. Reasons for improvement
Two key issues are addressed, as follows:

2.1. The holding part of tailless hood is smaller
Fig. 1 shows the J30JHJ21TJ (21 pins) electrical connector. Because there is no tail cover and the holding area is small, there may be a risk of damage to the cable at the root of the plug during cable
plugging. It can be seen from the figure that there are two ways to hold the plug, one is the top and the other is the side. It is necessary to design the plugging tooling to assist the plugging work.

![J30JH connector plug](image1.png)

Figure 1. J30JH connector plug

### 2. Small operating space around electrical connectors

We can take Instrument 2 as an example. There are 8 types of low frequency connectors J30JHJ15TJ (15 pins) on the instrument. There are 8 rows of high frequency connectors in each row. The operating space is on the side of the instrument, as shown in Figure 2.

![Three-dimensional model](image2.png)

Figure 2. Three-dimensional model

### 3. Improvement thinking

In the stage of preliminary electrical satellite survey, all J30JH plugs on the satellite are plugged and pulled out. Through different methods and communication with operators, a lot of experience has been accumulated, and deficiencies in the actual process have been found, which provides ideas for the follow-up tooling design.

#### 3.1. Process test

**Low Frequency Cable Network and Instrument Connection:** Fig. 3 and Fig. 4 show two ways of plugging low frequency cable network plugs and instrument sockets:

1) Mode 1 is to clamp the upper and lower ends of the plug with a finger.
2) Mode 2 is to clamp the left and right sides of the plug with fingers.

**Low Frequency Cable Network Plug and Test Cable Plug:** In the process of electrical measurement, there are two ways to connect the test cable and the satellite low frequency cable network, as well as the instrument, as shown in Fig. 5 and Fig. 6.

Experiments show that:
1) Because mode 1 has a large clamping area and is easy to apply force, mode 1 is better than mode 2, and the idea of mode 1 is adopted in tooling design.

2) Compared with the removal process, the insertion process is relatively easy to implement, and no auxiliary tooling is needed. Therefore, tooling design mainly starts from the angle of removal.
3.2. Plug and draw tools design

(1) Design scheme

The three-dimensional sketch of the plug-in tooling is shown in Fig. 7. The working principle is as follows:

1) The whole structure adopts the lever principle, the end is responsible for clamping the end face of the plug from the side, and the two springs at the tail are responsible for connecting the whole, ensuring that the upper and lower parts will not be disconnected to achieve the same function as "tweezers";

2) When the finger exerts force on the tail of the tooling, the end opens, which is convenient for clamping into the end face of the plug. When the tail is loosened, the tooling automatically tightens under the action of spring force, clamps the plug, and can be pulled out.

3) The tail is provided with a process hole, and the tie rope is put on the hand to avoid tool dropping.

(2) Process test

The actual use schematic diagram is shown in Fig. 8 and Fig. 9. The tooling enters the operating space from the back of the plug. The finger exerts force on the tail of the tooling, so that the tooling end is opened, placed in place, the tail is loosened, the end is closed under the tension of the spring, and then the plug is clamped. After confirming the connection position, we use force to the tail of the plug and pull out the plug.
(3) Test results

The experimental results show that the insertion tooling has the following remarkable advantages compared with bare hand insertion.

1) The application position increased significantly and the connection was reliable, which greatly improved the safety and reliability of the insertion.

2) Operating parts are not limited by plug layout and space, and plugs can be pulled out at any position.

3.3. Plug-and-Drop operating procedure

The plug-and-play procedure is described below.

1) We put the rope tied to the hole in our hand;

2) The finger exerts force on the spring at the tail of the tooling to make the end of the tooling open, go deep into the operating part, place it in place and loosen the tail;

3) The plug is clamped at the end of the tooling. After confirming the connection position, the two hands hold the back position of the tooling end to apply force to the end of the plug and pull out the plug.

4) One hand supports the plug, the other hand exerts force on the tail spring of the tooling, so that the tooling end is opened and the tooling is removed from the plug.
4. Concluding remarks
Through the application of the model, the effect is good, and the plugging and pulling problem of the tailless J30JH electrical connector is effectively solved to ensure the smooth progress of the assembly test process, which can be extended to all spacecraft assembly process using J30JH low frequency connector.

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