Development of a New Wire Junction Block

1. INTRODUCTION

As in-vehicle electric appliances improve in function, the number of circuits accommodated in a junction block (hereafter denoted as J/B), which can be defined as an effective device for simplifying wire harnesses, tends to increase. Simultaneously, customers require attaching greater importance to weight reduction from the standpoint of environment preservation. The requirements of our customer for the development at this time were: 1) the same dimensional standard as before the minor model change, 2) a 25 % increase in the number of circuits accommodated, and 3) weight reduction. To address these requirements, we have employed a wire J/B and reduced the pin pitch of the connector using a 1.0-size connector. See Figure 1.

2. BASIC STRUCTURE OF J/B

2.1 Modification toward Wire J/B

The former J/B before the minor car model change comprised seven stacks of busbar layers. In such a stacked busbar layer configuration, the number of stacks increases in proportion to the number of circuits resulting in a J/B of large size. We therefore employed a new J/B configuration in which electric wire was used for small current circuits such as signal circuits while the busbars continued to be used for large current circuits such as power circuits. In the new configuration for small current circuits, the conventional conductor 2 mm wide and 0.64 mm thick can be replaced by a ϕ0.8 mm electric conductor, thereby realizing such improvements as: 1) circuit density upgrading due to reduction in needed cross sectional area, and 2) weight reduction due to reduction in the volume of conductors used. See Figure 2. It was decided to continuously use two busbar layers out of seven layers of the conventional J/B, while assigning the thickness of other five layers to the space of wiring so as to accommodate the increased circuits.

Two types of J/Bs were developed at this time. They have symmetrical profiles with each other, and are to be installed at the driver and passenger seats, respectively. Regardless of right-hand or left-hand steering cars, the J/B for the driver seat accommodates circuit boards while the J/B for the passenger seat has a space corresponding to the circuit boards. A flexible joint connector comprising coiled electric wires was installed in the space, realizing further an effective use of space. See Figure 3.

2.2 High-Speed Wiring

Conventional wire J/Bs that Furukawa Electric was producing in volume had been manufactured through a process such that electric wires were installed in the grooves provided on the wiring board. See Figure 4 (the insert on the upper right). This structure made it difficult, since the wires could not reach the bottom of the grooves,

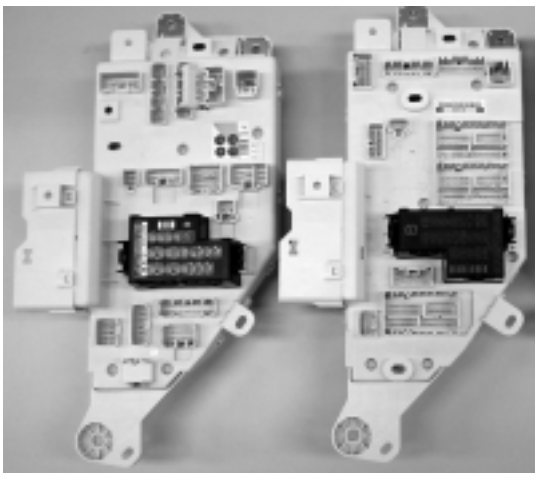


Figure 1 Appearance of J/Bs before (left) and after (right) minor model change.

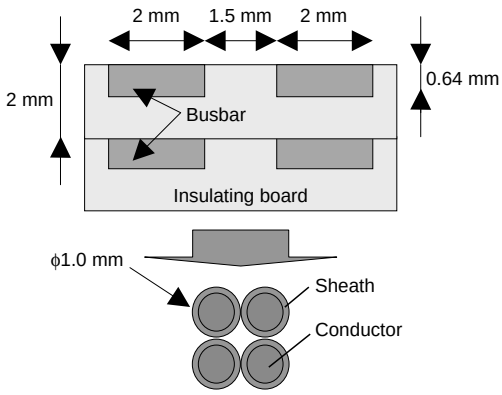
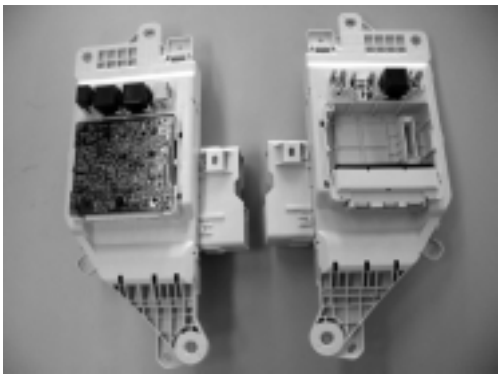


Figure 2 Comparison of circuit configurations between conventional and wire J/Bs.



For driver seat with circuit boards

For passenger seat with joint connector

Figure 3 Back view of J/Bs.

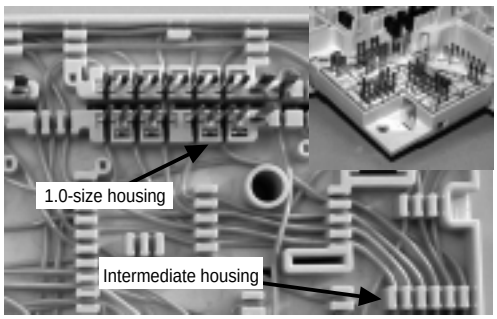


Figure 4 Wiring board with 1.0-size housing. Conventional wire J/B is shown in the insert.

to increase the wiring speed thus posing a problem of immense manhours needed for production. The design concept of “wiring in the grooves” was reexamined, therefore, to adopt a structure of “fastening properly only the spots that need fastening”. More specifically, the insulation-displacement connections and the bent portions of electrical wires were fastened, leaving other portions free, as shown in Figure 4.

3. DETAILS OF J/B STRUCTURE

3.1 Issues Involved with 1.0-Size Connector

It was necessary to use a small sized connector to cope with the input and output terminals that increased in number due to the increased circuits. We applied the 1.0-size connector to the developed product, which is smaller than the 2.3-size connector. Whereas Furukawa has developed a wire J/B using the 2.3-size connector before, a wire J/B using the 1.0-size connector is the first product for the company. Mechanical interference of insulation-displacement connections was eliminated by a staggered arrangement, and a triple insulated winding wire was employed in the 1.0-size connector reducing the conventional wire size of ϕ1.6 mm to ϕ1.0 mm, thereby succeeding in using the connector.

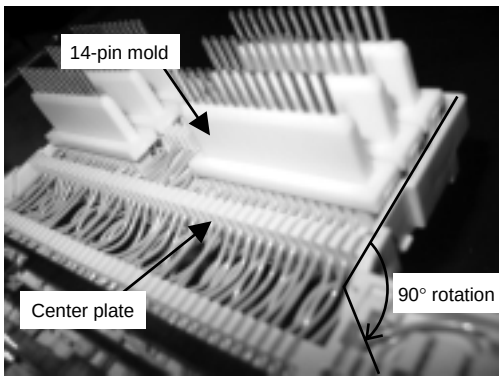


Figure 5 Center plate divided into two.

3.2 Alignment Connector

Because no changes in its profiles were required, the alignment connector with 84 pins on its lateral face that had been used before the minor model change was employed at this time with some modifications made on the partial structures.

3.2.1 Center Plate

The center plate was adapted to the connector with lateral pin direction by dividing it into two to have a folding angle of 90Åã. The electric wires are led directly into the divided center plate, and are provided with surplus lengths at the folding part of the plate taking folding into consideration. See Figure 5.

3.2.2 14-pin Mold

The alignment connector comprises six blocks of 14-pin molds to have 84 pins in total. Each block in the form of mold is bulk jointed to the center plate by insulation-displacement connection, so that the preciseness of the insulation structures and alignment is maintained.

4. ACHIEVEMENTS

The wire J/B developed at this time has achieved significant improvements over the one before the minor model change. The number of circuits has increased by 25 % from 231 circuits to 292 circuits, and the mass has reduced by 20 % from 2250 grams to 1780 grams. Moreover, the wiring speed has been improved by a factor of three, enabling suppression of manufacturing cost increase. See Figure 6.

5. CONCLUSION

Whereas the wire J/B presented here has improved the circuit density by accommodating increased number of circuits into the same casing volume, downsizing of the casing is insufficiently achieved. Hereafter, we plan to investigate downsizing of the main body of the J/B further as well as its circuit density improvement.

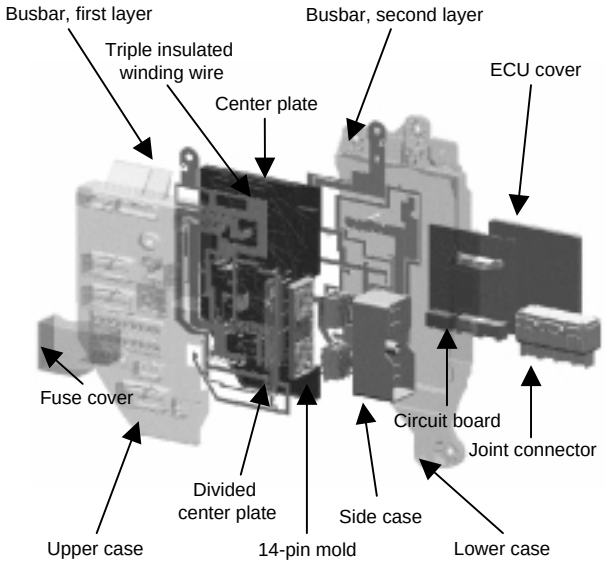


Figure 6 Exploded view of developed wire J/B assembly.

For more information, please contact:
Electric Components Engineering Dept., Automotive Products Div.
TEL: +81-5958-5-1956
FAX: +81-5958-5-2431