User Guide for Wire-to-Board Connector

1. Product Name and Specifications of Product

Hirose products are identified by two product names and specifications, each of which has the meaning shown below:

<table>
<thead>
<tr>
<th>Statement on Catalog</th>
<th>Description (Example)</th>
<th>Intended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product No.</td>
<td>DF11CZ-4DP-2V(21)</td>
<td>The HRS number is a product name that is provided to represent the feature of the product because the enumeration of figures makes it difficult to understand the product image.</td>
</tr>
<tr>
<td>HRS No.</td>
<td>CL541-0200-6</td>
<td>This is the control number used by a computer.</td>
</tr>
<tr>
<td>Specification Code</td>
<td>DF11CZ-4DP-2V(21)</td>
<td>The figure in parentheses shows the specification code. Regarding the basic profile of the product, the product with the Specification Code shows a product variation or a different packaging form.</td>
</tr>
</tbody>
</table>

2. Connector Sales Quantities

The connector is sold in units of pack, in units of piece, and in units of reel as shown below.

1. **Package Unit Sales**
   - Object
     - Connector w/o specification code
     - 1 pack = Contain 100 pieces. The order should be placed in units of pack.

2. **Pieces Unit**
   - Object
     - Connector in magazine/tray
     - The order should be placed in multiple numbers of pieces contained in the magazine/tray.

3. **Reel Unit**
   - Object
     - Reel terminal
     - Connector in embossed package
     - The order should be placed in units of reel.
     - Note 1: For the units of pieces packed for one reel, refer to the catalog.

3. Selection of Plating

For the selection criteria for tin plating and gold plating, the use conditions shown below shall be the general guidelines.

3-1. **General guideline for selection of plating**

<table>
<thead>
<tr>
<th>Plating Specification</th>
<th>Tin Plating</th>
<th>Gold Plating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion/removal times *1</td>
<td>30 times or below</td>
<td>50 times or below</td>
</tr>
<tr>
<td>Vibrations *2</td>
<td>N/A</td>
<td>Available</td>
</tr>
<tr>
<td>Environmental burdens *3</td>
<td>N/A</td>
<td>Available</td>
</tr>
<tr>
<td>Operating current</td>
<td>100μA or over</td>
<td>100μA or over</td>
</tr>
</tbody>
</table>

*1: The insertion/removal times vary according to series models. For details, refer to the catalogs of series models.

*2: Conditions under which the connector is subjected to continuous or intermittent vibrations/shocks.

*3: The environmental burdens include effects of hydrogen sulfide/salt water/sulfur dioxide; effects of the outdoor environment and continuous application of high-load cycle.

3-2. **Fitting of different kinds of metals**

Avoid the fitting of tin plating and gold plating. The simultaneous use of tin and gold results in a corrosion phenomenon called potential difference corrosion that occurs because the difference in individual electrical potential is large, which may cause deterioration in the performance of contacts.
4. Wire Connection Conditions

4-1. Crimping

4.1.1. Items required prior to start crimping

The work-related documents shown below are required before starting the harness connections. (The mark shows the document required.)

When the documents shown below are not available, ask our sales personnel to provide them.

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Description</th>
<th>Automatic Crimping Machine</th>
<th>Hand Crimping Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Basic Procedures for Crimping Work</td>
<td>General explanation of work related to wire connection</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(2) Operating Instructions for Terminal Crimping Machine</td>
<td>Explanation of main press machine unit</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(3) Table of Applicator Parts Installation</td>
<td>Explanation for Applicator Installation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(4) Crimp Conditions</td>
<td>Standard values of: Crimp height; Tensile strength</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(5) Crimp Quality Standards</td>
<td>Various standards for crimping conditions</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(6) Operating Instructions for Hand Crimping Tool</td>
<td>Inspection items of: Crimp height; Tensile strength; and others</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

4.1.2. Tools

When crimping work is applied to our series terminals (contacts), the tool designated by Hirose should be used. Crimping work by using tools other than as designated must not be done because it may result in contact failure, disconnection of cable, etc.

* Connectors crimped with tools other than those designated by Hirose shall not be quality guaranteed.

* The operating instructions manual is available for the crimping machine and the applicator. Be sure to carefully read the operating instructions manual before implementing the work.

4.1.3. Applicable electric wires

Check that the electric wire to be used is in the range of application.

If you intend to use an electric wire other than the recommended one, be sure to request the Crimping Conditions Slip for the wire specifications to be used. In case the crimp height setup has been executed for the electric wire you requested, the Crimping Conditions Slip will be issued without any change. If the height setup has not been done yet, the setting will be done after conducting the conformance testing anew.

- Items that should be presented when you request for the Crimping Conditions Slip:
  - (1) Terminal name; (2) Electric wire used (UL Style, AWG size, core wire configuration, outer diameter of sheath)
  - Electric wire that is required for conformance testing: 20 m

[Precautions]

- Electric wires that are applicable for crimping connectors shall, principally, be the tin-plated stranded soft-copper wire.
  - (Contact us for the non-plated wires.)
- Crimping of electric wires wherein single wires, polyester yarns, etc., exist and crimping of tin-coated wires should be avoided.
- The setting values of crimp height (Note 1) vary between tin-plated and gold-plated terminals even if the same electric wires are used.
- The setting values of crimp height (Note 1) vary depending on the difference in the core wire configuration even if the computed cross-sectional area is the same.

Note 1: The crimp height is an important item that determines crimping quality. We execute crimping tests for each electric wire to ensure the optimal value for the crimp height with high precision, thereby ensuring optimal setup values.
4-1-4. Precautions for crimping work

(1) Stripping of electric wire
The stripping length of electric wire varies depending on the connector used, types of wire, etc.; therefore, set the optimal length according to cutting conditions.
Notes:
- The core wires shall not be damaged, or part of the wires shall not be disconnected or dropped out.
- The length of core wires and the cut-end face of the sheath shall not be uneven or come apart.

(2) Crimp height
In case the crimp height is outside the preset value, serious accidents regarding quality may occur. Therefore, the work must be controlled.
Be sure to measure the crimp height at the start, midway, and end of the crimping work.
Use the micrometer for measuring the crimp height.

<Measurement Method>

Crimp height (coat)

Crimp height (core wire)

Micrometer (Anvil)

Micrometer (Spindle)
*Measurement should be done almost at the barrel center.
### 3) Exterior view of crimping

<table>
<thead>
<tr>
<th>(1) No/excessive bell mouse</th>
<th>(2) Deep driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>No/excessive bell mouse may result in a disconnection, insufficient tensile strength and an unstable electrical connection.</td>
<td>Deep driving may result in a disconnection of core wires.</td>
</tr>
</tbody>
</table>

- [Image: No bell mouth vs Excessive bell mouth](image)

<table>
<thead>
<tr>
<th>(3) Insufficient core wire insertion</th>
<th>(4) Shallow driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient core wire insertion may result in insufficient tensile strength and an unstable electrical connection.</td>
<td>Shallow driving may allow the load on core wires to be delivered directly to the crimping part of conductors, resulting in a disconnection.</td>
</tr>
</tbody>
</table>

- [Image: Invisible core wire vs Excessive core wire length](image)

<table>
<thead>
<tr>
<th>(5) Protrusion of core wire is excessive.</th>
<th>(6) Protruded core wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive protrusion may result in contact failure or insufficient insertion into the housing.</td>
<td>Protrusion of core wire may result in unstable electrical connection or insufficient tensile strength.</td>
</tr>
</tbody>
</table>

- [Image: Excessive core wire length vs Protrusion of core wire](image)

<table>
<thead>
<tr>
<th>(7) Deformation of the terminal (Bent-Up/Down)</th>
<th>(8) Deformation of the terminal (Twisting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive bent-up/down may disable insertion of the connector into housing.</td>
<td>Excessive twisting may disable insertion of the connector into housing.</td>
</tr>
</tbody>
</table>

- [Image: Deformation (Bent-Up/Down) vs Deformation (Twisting)](image)
<table>
<thead>
<tr>
<th>(9) Deformation of the terminal (Rolling)</th>
<th>(10) Deformation of insulation barrel (Kickback)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive rolling may disable insertion of the connector into housing.</td>
<td>Excessive kickback will allow the terminal to be exposed from the housing after the connector is inserted into the housing, which may result in problems related to resistance to pressure.</td>
</tr>
</tbody>
</table>

![Micrometer (Spindle) and Rolling](image1)

![Micrometer (Anvil) and Kickback](image2)

<table>
<thead>
<tr>
<th>(11) Uneven anvil trace at core wire crimping part</th>
<th>(12) Flaw or dent on crimping surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uneven anvil trace may result in unstable electrical contact.</td>
<td>Flaws or dents on the crimping surface may result in deformation of the terminal, peeling of plating, etc.</td>
</tr>
</tbody>
</table>

![Uneven anvil trace](image3)

![Even anvil trace](image4)

![Good Product](image5)

![Flaws/dents](image6)

<table>
<thead>
<tr>
<th>(13) Excessive primp burrs or uneven sizes of burrs at right/left sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive burrs or excessively uneven sizes of burrs on the right/left sides may result in cracks in the terminal, unstable electrical connections, insufficient strength, or deformation of the terminal caused by the burrs.</td>
</tr>
</tbody>
</table>

![Burr](image7)
4-2. Crimping Work

4.2.1. Items required before starting crimping work

Before starting harness connection, the work-related documents shown below are required (The mark shows the required documents.)

If the documents are not available, request them from Hirose.

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Description</th>
<th>Automatic Crimping Machine</th>
<th>Hand Crimping Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Basic Procedures for Crimping Work</td>
<td>Crimp height</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specified values of tensile strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other inspection items</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Operating Instructions for</td>
<td>Handling procedures of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal Crimping Machine</td>
<td>crimping machine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Table of Applicator Parts</td>
<td>Crimp height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>Specified values of tensile strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other inspection items</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.2. Tools

When crimping is applied to our series terminals (contacts), be sure to use the tools designated by Hirose. Do not conduct crimping work with tools other than the designated tool. Neglecting this caution may result in contact failure, disconnection, etc.

* Be careful that products to which crimping work is done with tools other than the tool designated by Hirose shall not be guaranteed.
* Operating instruction manual is available for each crimping machine. Be sure to carefully read the operating instruction manual before implementing the crimping work.

4.2.3. Conforming electric wires

For the electric wires used for crimping connectors, be sure to use the electric wires recommended by Hirose. If you intend to use electric wires other than the recommended ones, contact us before using the wires in advance. We will determine whether or not they are conforming wires.
4-2-4. Crimping work precautions
Visually check (together with a loupe or the like) the exterior appearance to ensure that crimping is done correctly. The inspection items differ by connectors. Refer to the operating instruction manuals for respective connectors.

(1) Processing of electric wire
- The cut-end face of sheath shall not be uneven and the core wire shall not protrude.

(2) Crimp height
In case the crimp height is out of the preset value, serious accidents regarding quality may occur. Therefore, the work must be controlled.
Be sure to measure the crimp height at the start, midway, and end of the crimping work.
Use the DF1B Height Gauge (*) for measuring crimp height.
(*) The product is not available directly at Hirose.
Distribution source: Yokoyama Kiko, Ink. (TEL: +81-3-3765-6621; FAX: +81-3-3765-6603)
2-1-19 Omorihoncho, Ota-ku, Tokyo 143-0011
The height gauge can also be used for the crimping connectors DF3, DF4 and DF11 in addition to DF1B.

<Measurement Method>
The measurement methods differ by connectors. For details, check the operating instruction manuals for respective products.
(3) Exterior view of crimping

<table>
<thead>
<tr>
<th>Item</th>
<th>Quality Conditions and Judgment</th>
</tr>
</thead>
</table>
| (1) Electric wire protrusion position | ■ Refer to the dimensions shown in the above-stated figure. The clearance from the end surface of the housing is 0.3 mm or below.  
■ Crimping wherein protrusion of electric wire is excessive or the cut-end face is directed upward is not acceptable. |
| (2) Exposure of core electric wire | ■ In case the electric wire sheath is broken and a core wire is exposed at the crimped part, judgment shall be made regarding if it is usable or not according to the standard shown below:  
○ Usable  
×Not Usable |
| (3) Burrs on electric wire sheath | ○ Usable  
×Not Usable |
| (4) Breakage of cable clamp | ×Not Usable  
Do not use the connector wherein the cable cramp is broken from the positional displacement of crimping punch.  
If such phenomenon occurs, it is assumed that a problem exists with the feeding of connector or the positional relationship between the punch and the connector. Check the tool setup. |
(4) Exterior view of crimped part

The distance from the U-slit part to the leading end of electric wire shall be within the range of dimensions shown in Figure 6.

The core wire shall not be exposed at the leading end of electric wire. In addition, the sheath shall not be half-slipped off or slipped off completely.

The swelling height of sheath at the slit shall be within the range of dimensions shown in Figure 8.

Fitting of the sheath into the terminal shall be symmetrical to the center. In addition, there shall be no deformation of the mated part caused by extreme displacement.
5. Mounting Precautions

5-1. Surface-mount connector (Type SMT)

5-1-1. Temperature profiles
The temperature conditions for the mounting work should be set according to the temperature profiles designated by Hirose.
(The profiles are shown in the leaflet of each product.)

5-1-2. Metal mask thickness
For the thickness and the aperture ratio of the metal mask, the conditions recommended by Hirose should be used.
(The conditions are shown in the leaflet of each product.)

5-1-3. Silk print
There is often a case that the connector rises because of the thickness of silk print that exists between the bottom surface of connector and the substrate, resulting in the case that solder will not be adhered easily. Pay attention so that the silk print will not enter the bottom surface area of connector.

5-1-4. Vacuum pick-up area
The vacuum pick-up area is described in the catalogs of respective products.

5-1-5. Discoloration, etc. occurring after solder reflow
- Discoloration of the housing
  After solder reflow, slight discoloration may occur on the insulated housing, which will not affect the quality at all. Severe discoloration may present that the temperature exceeded the peak temperature of solder reflow. If this is the case, check the temperature profile.
- Discoloration of the terminal and shell
  After solder reflow, slight discoloration may occur on terminals, which will not affect the quality at all. Severe discoloration may present that the temperature exceeded the peak temperature of solder reflow. If this is the case, check the temperature profile.
- Blister
  When mounting the connector, there may be a case that molds other than those on the mating surface swell, which causes no problems in terms of product performance.
5-2. Insertion-mounting connector (DIP Type)

5-2-1. Flow temperature
The temperature conditions for mounting work shall be subject to the soldering conditions recommended by Hirose. (The conditions are shown in the leaflet of each product.)

5-2-2. Dipping time
The dipping time for mounting work shall be subject to the soldering conditions recommended by Hirose. (The dipping times are shown in the leaflet of each product.)

5-2-3. Hand soldering
The hand soldering conditions for mounting work shall be subject to the soldering conditions recommended by Hirose. (The conditions are shown in the leaflet of each product.)

5-3. Repair
When the mounted connector is to be repaired by hand soldering, pay attention to the melting of the housing or deformation of the terminals.

5-4. Others
Execution of work under any condition other than those recommended by Hirose may result in generation of solder balls.

6. Cleaning Conditions

6-1. Cleaning with organic solvent

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Normal Temperature Cleaning</th>
<th>Heated Cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPA (Isopropyl alcohol)</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Normal Temperature Cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPA (Isopropyl alcohol)</td>
<td>✔ Within 5 min.</td>
</tr>
</tbody>
</table>

*Table-1* Organic solvent cleaning of each connector unit

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Normal Temperature Cleaning (*1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPA (Isopropyl alcohol)</td>
<td>✔</td>
</tr>
</tbody>
</table>

*Table-2* Organic solvent for connector to which cable is directly attached (*1)

*1: Connector whose electric wires are also exposed to cleaning liquid

*2: The ✔ mark shows cleaning is possible.

6-2. Water-based cleaning
When a water-based cleaning solvent (terpene, alkali saponifier, etc.) is to be used, choose the cleaning agent based on the table of influence against metals and resins issued by the manufacturers of cleaning agents. For example, such cleaning agent that affects tin plating cannot be used for tin-plated connectors. In addition, pay attention not to leave the connector with moisture unremoved.

6-3. Cleaning precaution
At the time of organic solvent-based and water-based cleaning, if flux or cleaning agent remains on the connector, it may cause deterioration in electrical performance. Be sure to carefully check that cleaning has been done robustly.
7. Ratings

[Rated Current Values]
Even if the rated current of the main connector unit is 3 A, when the allowable current of electric wires used is 1 A, the overall rating will be 1 A.

Avoid the use wherein electric current exceeding the rated current is branched into multiple circuits for feeding power as much as possible. Even if the current value per circuit is set within the rating for the purpose of calculation, the concern is that conduction is made at a current exceeding the rating because current per circuit is not distributed evenly because of fluctuations of the electrically conducting path or contact resistance. If you are intended to employ such use, the general guideline should be set to about one-third of the stated rating.

In addition, hot-swap (Note 1) must not be conducted.
(Note 1) The term hot-swap means to execute insertion and removal of wire with electric current applied.

[Range of Temperatures and Humidity]

<table>
<thead>
<tr>
<th></th>
<th>Operating temperature range</th>
<th>Storage temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>-35 to 85°C</td>
<td>-10 to 60°C</td>
</tr>
<tr>
<td>Operating humidity range</td>
<td>40 to 80%</td>
<td>40 to 70%</td>
</tr>
</tbody>
</table>

The term "storage" used herein shows the long-term storage state for unused product before mounting the substrate.
For the non-conductive state after mounting the substrate and the temporary storage condition at the time of transportation, etc., the operating temperature condition shall be applied.

* Since respective temperature ranges and humidity ranges differ by products, check the catalogs of respective products for details.

---

**CAUTION**


Be sure to carefully read the guide before using the connector to use it without any problem.
Basic Precaution Statement

■ Injury
1. Improper handling of jigs and tools could result in injuries and accidents. Be sure to implement the work correctly by referring to the operating instruction manual.
2. Pay careful attention to handling of connector to prevent injuries with metal parts or edges of connector. In particular, insertion and removal of connectors that are not mounted on the substrate may result in injuries because such connectors have a small hold and insertion and removal of connectors cannot be done successfully.
3. Be careful not to cut your hand, etc. with reel terminal, interlayer paper, etc.

■ Combination of use
1. Hirose shall not guarantee the mating of Hirose connectors with products of other manufacturers.
2. Avoid mating of connectors having different plating on contact mating areas.
3. Hirose shall not guarantee use of connectors with cables other than conforming cables. Contact us in advance if you require an examination of such use.
4. Failures caused by use of tools other than those designated by Hirose shall not be covered by the product warranty.

■ Applications
1. Hirose shall not guarantee applications to the fields of aviation, space, and nuclear.
2. Be sure to contact Hirose in advance when you intend to apply our connectors to automotive and marine fields. (We will examine the possibility in guarantee depending on conditions.)
3. Avoid use of connectors outdoors or under any environment equivalent thereto.

■ Electrical current rating
1. Avoid the use of connectors under the condition exceeding the rated values.

■ Short circuit
1. To prevent the occurrence of unexpected short circuits, give consideration so that panels or metal pieces will not contact the connectors.

■ External appearance
1. There may be a case that black spots, etc., are generated on the mold resin, which does not cause any problem in terms of quality.
Handling Precautions

**Precautions for insertion**

1. **How to hold the connector**
   Gently hold the cables at the root part and insert it in a manner to push the connector with your fingertip. At this time, be sure to hold the entire part of the cable to prevent concentration of the force onto any one of the cables.

2. **Insertion angle**
   Insert the connector horizontally. Insertion of the connector under the extremely inclined state may result in deformation of the terminal or breakage of the housing. Be sure to insert the connector horizontally.

---

**Precautions for removal**

1. **How to hold the connector**
   Hold the cables so that all cables can be removed evenly and then remove the cables.

2. **Insertion angle**
   Do not remove the cables obliquely in the state that they are inclined extremely. Neglecting this caution may result in deformation of the terminal or breakage of the housing. Be sure to insert the connector horizontally.
■ Connection of electric wires
1. Bundling of electric wires at a place near the socket may result in a disconnection of wire, unstable contact, etc. Be sure to allow the deflection as shown in the following figure, and pay attention not to apply loads including excessive twisting.

2. When using thick electric wires, short wires may deform the terminal from the twisting of electric wires. For executing the wiring work, be sure to ensure the arrangement not to twist the electric wires.

■ Transportation precautions
1. Transportation of connector
   Be careful that the connector will be deformed when a load is applied to the extent that the packaging form (cardboard) is deformed or when the package is dropped.

2. Transportation of harness
   Be careful that application of an excessive load to the socket under the condition that the harnesses are connected results in deformation of connectors and locks.