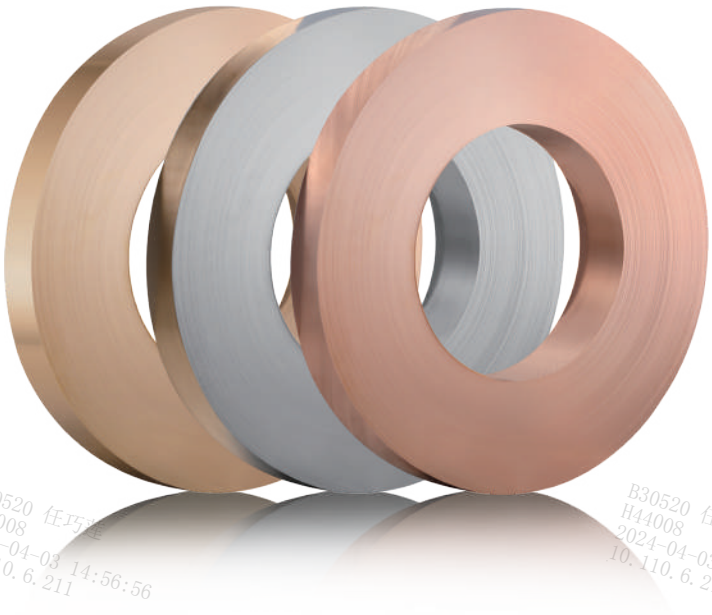
boway



# CU & CU-ALLOYS FOR CONNECTOR TERMINALS

Boway has the application-specific solutions you may need to make a state-of-the-art connector terminal

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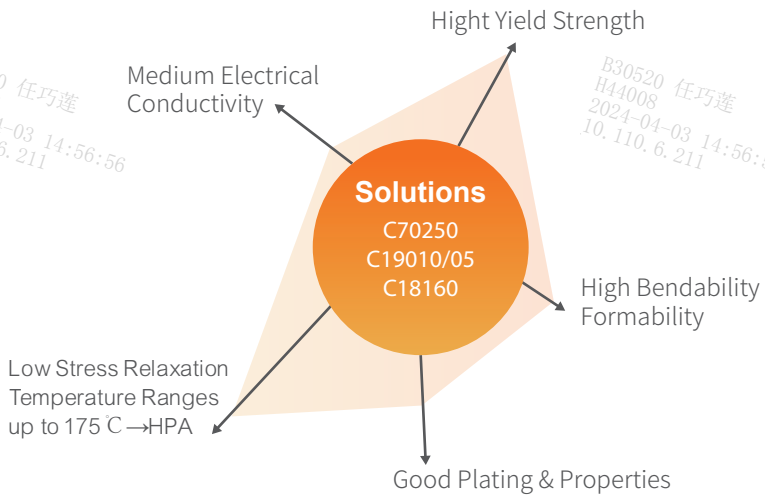
constantly create value for customers

## Requirements Connector Terminals & Springs

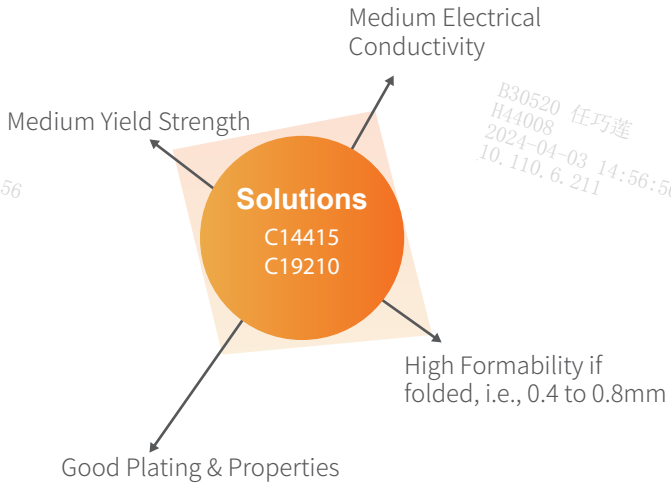
- Connector terminals are the heart of the electrical or electronic connector. There are many different designs typically with a male and female contact part made from a copper-based material or alloy.
- These terminals are commonly distinguished for signal or if they carry higher electrical current up to high power connectors.
- Majority of these connectors are preferably made using strips in copper and copper alloys. Due to the very different connector requirement profiles many different material solutions are required as well. Boway has the application-specific solutions you may need to make a state-of-the-art connector terminal.

## Example of Specific Connector Terminal Material Requirements

Signal Connector Female




Signal Connector Male /Pin




## Functional Requirements Connector Terminals & Springs

Key material properties used for the design of connector terminals are, e.g.

- Long term properties to assure a good contact force → Thermal stress relaxation properties
- Strength level – here commonly tensile test data is used
- Hardness – this as a surface property is commonly only an indicator and not specified together with the tensile test values – see EN standards
- Electrical and thermal properties
- Youngs modulus as parameter to describe the stiffness of an elastic loaded spring
- Formability/bending ( e.g. 90° or 180°)
- Plateability ( Sn or precious metals)
- Grain size requirements-e.g. for precise contact zones in press fit connectors

## Material Requirements for a Terminal

| Terminal requirements | Material parameters |
|---|---|
| Low power dissipation | High electrical conductivity |
| Good heat dissipation | High thermal conductivity |
| High contact force | High elastic limit/ Yield strength/High spring bending limit |
| Small displacement/contact opening | High Youngs Modulus |
| High energy storing capacity (i.e., press fit) | Low Youngs Modulus |
| Tight bending angles | Good bendability, low r/t |
| Persistent high contact force in use | Low stress relaxation |
| Persistent electrical performance in use | Good plating properties |

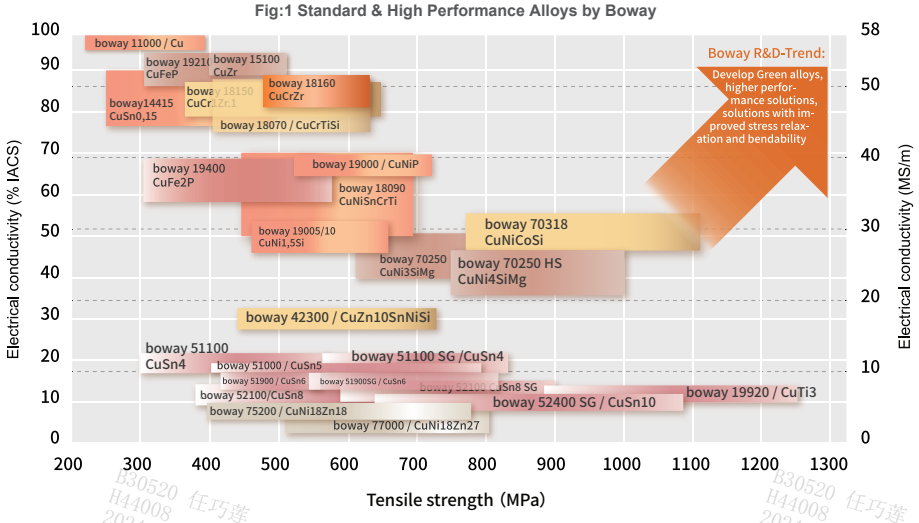
## Alloy Selection and Fabrication Properties

- Fabrication properties of copper and copper alloys may vary according to different customer or application requirements.
- E.g. Stamping of strips may require certain minimum ductility to allow tight bending radii or sufficient formability for coining processes.
- For different plating requirements we may recommend you different plating choices. See fabrication properties as well mentioned in our respective datasheets.
- Aside international standards we produce strips in Cu and copper alloys to individual properties. Our Technical Marketing Team can assist you in selecting the right alloy and plating! Please contact us!
- For detailed information we offer technical training sessions for customer design centers.

## Boway Alloy Map

In Figure 1 we describe the performance of different alloy regarding strength and electrical conductivity. Please note that the graph may change depending on different bending requirements or stress relaxation requirements. Please see the respective datasheets or contact our Technical Marketing Team.

Fig:1 Standard & High Performance Alloys by Boway



## The Alloy Groups

- **Copper Sorts:** Pure coppers are mostly characterized by the highest achievable electrical conductivities in combination with lower to medium strength. Pure copper plays today an important role in the transition towards electrification of mobility and energy. Further copper is the primary choice in which highest thermal conductivity is required. We need to differentiate between oxygen containing and oxygen free sorts. Oxygen free sorts may provide more safety against hydrogen embrittlement and allows better forming performance.

- **High Copper Alloys:** High copper alloys allow already higher strength vs. pure copper without loosing too much electrical or thermal conductivity. The alloy boway 14415 is the standard alloy for connector male /pins.

- **Bronze:** Boway provides the full range of Tin-Bronze alloys with standard or extreme fine grain " Super Grain " . With this extreme formability, higher strength can be realized using same chemistry.

- **Special Brass:** Boway manufactures high-end special brass as low-cost alternatives to high tin containing alloys at comparable material properties.

- **High Performance Alloys (HPA):** Boway specialized on manufacturing HPA due to most advanced production facilities and special processing know-how. HPA are the answer to many difficult design situations in which e.g., at high ambient temperature as well high contact forces are maintained. In addition, HPA allow extreme strength levels which might else only be known from e.g., ferrous materials at improved conductivity and formability.

## Special Product Adders

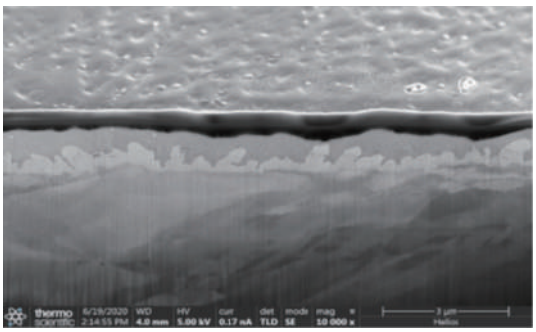
Hot Dip Tin coated strips (HDT)

Hot-Air leveled tin (HALT) coating reflects a well adhering Sn layer using pure Sn and tight thickness tolerances.

This technique is highly used in automotive connectors assuring a reliable and economical coating method.

Due to its application thru a liquid tin bath it creates by nature the famous intermetallic compound (IMC) assuring best adhesion to the base metal and limiting potential element diffusion during life-time.

As such whisker are commonly not any issue to HDT strips. Further details please refer to the boway HDT brochure.



## Strip Product Portfolio

| Alloy System | Boway Designation | Former Designation | UNS | EN | JIS | GB（China） |
|---|---|---|---|---|---|---|
| Cu | boway11000 | C11000 | C11000 | Cu-ETP | C1100 | T2 |
| | boway10300 | C10300 | C10300 | Cu-HCP | — | TUP0.003 |
| CuCr/Zr | boway15100 | C15100 | C15100 | CuZr0.1 | C1510 | TZr0.1 |
| | boway18160 | C18160 | C18160 | CuCr0.5Zr | — | — |
| | boway18150 | C18150 | C18150 | CuCr1Zr | — | TCr1-0.15 |
| CuCrSiTi | boway18070 | C18070 | C18070 | CuCrSiTi | — | TCr0.3-0.2-0.05 |
| CuNiSnCrTi | boway18090 | C18090 | — | — | — | — |
| CuNiP | boway19000 | PW49700 | C19000 | CuNi1P | — | — |
| CuTi | boway19920 | C91000 | C19920 | — | — | — |
| CuFe | boway19210 | C19210 | C19210 | CuFe0.1P | C1921 | TFe0.1 |
| | boway19400 | C19400 | C19400 | CuFe2P | C1940 | TFe2.5 |
| CuNiSi | boway19005 | C19005 | C19005 | — | — | — |
| | boway19010 | C19010 | C19010 | CuNiSi | — | — |
| | boway70260 | C70260 | C70260 | CuNi2Si | C7026 | BSi2-0.45 |
| | boway70250 | C7025 | C70250 | CuNi3SiMg | C7025 | BSi3.2-0.7 |
| | boway70250HS | C7025 | C70250 | — | C7025 | — |
| CuNiCoSi | boway70318 | PW47100 | C70318 | CuNi3CoSi | — | — |
| Special Brass | boway42300 | PW33520 | C42300 | CuZn10Sn1NiSi | — | — |
| | boway42500 | C42500 | C42500 | CuSn3Zn9 | — | HSn88-2 |
| CuSn / Bronze<br>*Super Fine Grain Version Available | boway14415 | C14415 | C14415 | CuSn0.15 | — | TSn0.12 |
| | boway51000 | C51000 | C51000 | CuSn5 | C5102 | QSn5-0.2 |
| | boway51100* | C51100 | C51100 | CuSn4 | C5111 | QSn4-0.3 |
| | boway51900* | C5191 | C51900 | CuSn6 | C5191 | QSn6-0.2 |
| | boway52100* | C5210 | C52100 | CuSn8 | C5210 | QSn8-0.3 |
| | boway52400* | C5240 | C52400 | CuSn10 | C5241 | QSn10-0.2 |
| CuNiZn | boway77000 | C7701 | C77000 | CuNi18Zn27 | C7701 | BZn18-26 |
| | boway75200 | C7521 | C75200 | CuNi18Zn18 | C7521 | BZn18-18 |
| | boway76400 | C76400 | C76400 | CuNi18Zn20 | — | BZn18-20 |

## Strip Tolerances

- Boway uses high-precision equipment which allows achieving tightest tolerances and most competitive geometric properties. Boway can achieve tolerances far tighter compared to international standards.
- Special processes can be taken during strip production in order to minimize shape deviations such as coilset, camber, twist or cross bow. This is the basis to produce high-end terminal products.

### Thickness Tolerances of Connector Strips

| Thickness（mm） | Standard | Ultra Tolerance |
|---|---|---|
| 0.05-0.10 | ±0.005 | ±0.003 |
| >0.10-0.20 | ±0.006 | ±0.004 |
| >0.20-0.30 | ±0.008 | ±0.005 |
| >0.30-0.50 | ±0.012 | ±0.006 |
| >0.50-0.80 | ±0.015 | ±0.008 |
| >0.80-1.30 | ±0.020 | ±0.010 |
| >1.30-1.80 | ±0.030 | ±0.020 |
| >1.80-2.30 | ±0.040 | ±0.030 |
| >2.30-3.00 | ±0.060 | ±0.040 |
| >3.00-4.00 | ± 0,070 | ± 0,050 |

### Width Tolerances of Connector Strips

| Temper | Thickness | Width | | | |
|---|---|---|---|---|---|
| | | ≤50mm | >50-100mm | >100-200mm | >200-400mm |
| Non-soft | 0.07—0.5 | ±0.05 | ±0.10 | ±0.20 | ±0.30 |
| | >0.5—1.0 | ±0.10 | ±0.15 | ±0.20 | ±0.30 |
| | >1.0-2.0 | ±0.15 | ±0.2 | ±0.25 | ±0.40 |
| | >2.0-2.5 | ±0.25 | ±0.30 | ±0.35 | ±0.50 |
| | >2.5-3.0 | ±0.50 | ±0.50 | ±0.50 | ±0.50 |
| | >3.0-4.0 | ±0.60 | ±0.70 | ±0.80 | ±1 |
| Soft | 0.07—0.5 | ±0.05 | ±0.10 | ±0.20 | ±0.30 |
| | >0.5—1.0 | ±0.20 | ±0.20 | ±0.25 | ±0.30 |
| | >1.0-2.0 | ±0.20 | ±0.25 | ±0.30 | ±0.40 |
| | >2.0-2.5 | ±0.30 | ±0.35 | ±0.40 | ±0.50 |
| | >2.5-3.0 | ±0.50 | ±0.50 | ±0.50 | ±0.50 |
| | >3.0-4.0 | ±0.60 | ±0.70 | ±0.80 | ±1 |

Possible Strip Widths: 8-600mm-depending on alloy

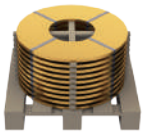
## Connector Strip Surfaces

**boway** CNQ – Surface: Standard Connector Surface
- Valid for Cu alloys / Thickness below 1 mm
  - Ra max 0.25 µm
  - Limit of scratches feelable by finger nail

**boway** CNX – Surface: Connector Surface Extra
- Valid for Cu alloys / Thickness below 1 mm
  - Ra max 0.15 µm
  - Rz max 1 µm
  - Dry surface

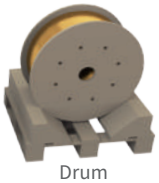
## Delivery Format

- Boway strips in coil form



Coil

- Boway strips in drum form depending geographical region



Drum

- Boway strips in boway multiple coil form depending geographical region

Boway multiple coil

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