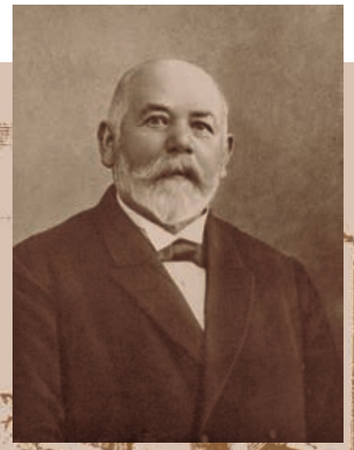
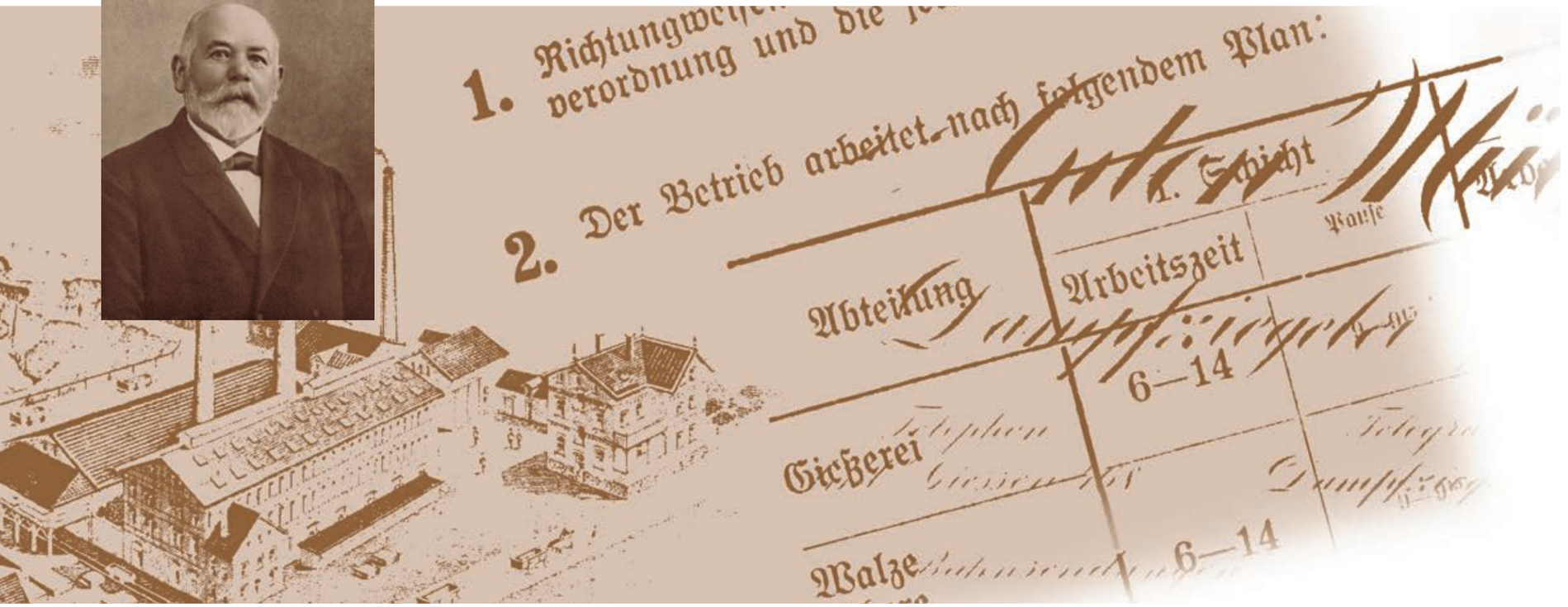

# Wire solutions for the electronics industry

## Square and round wire

bedra
intelligent wires

# Quality is a question of precision






Founded more than 120 years ago, the Berkenhoff GmbH produces innovative high-tech precision wires for electronic components, special applications, spark erosion, welding and brazing technology. **bedra** is the only manufacturer of precision wire to offer the complete production process from one source: casting, rolling, drawing, annealing and electroplating. More than 30 million kilometres of precision wire in more than 100 alloys are produced annually in two German factories and sold under the umbrella brand **bedra** through representatives and sales companies in more than 50 countries.

The precision and reliability that distinguish Berkenhoff fine wires have made the **bedra** brand a quality and market leader. The high-tech products made of copper, brass, bronze and nickel-silver in the form of coated wires, composite wires and plain wires, are tailored to meet the customer requirements in an optimal way.

As a result of our active participation in joint industry and university research projects, Berkenhoff repeatedly develops product innovations that define the market.

**Welcome to Berkenhoff!**

**CONTENTS**



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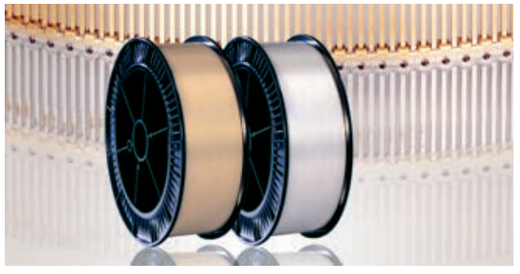
## bedraedm


Innovative wire electrodes for all spark erosion applications. From the global market leader, of course.

## bedrawelding

High-tech wires in several alloys for brazing and welding technology.

## bedraelectronics



Customised wire solutions for the electronics industry. Competence in materials, shapes and surface coatings.

- Use of the purest metals
- Controlled melting process

# Alloy diversity

**bedra** is a specialist supplier to the processing industry for high quality wire solutions in the electronics and electrical engineering sectors and covers all process steps from melting to surface refinement.

More than 100 alloys, such as tin-bronze, brass and nickel-silver, as well as other special alloys, are produced in its own foundry from the element copper.

With this alloy diversity, it is possible to cover an extensive range of requirements with respect to electrical and mechanical properties. We are able to manufacture small lot sizes upon customer request.

Any deviation from the standard is recognised and corrected by a gapless quality management system. This forms the basis for providing consistent product quality and stable processing.

We offer an extensive, high quality product portfolio in order to meet the expectations of automotive, aerospace, telecommunications, information technology, industrial technology and entertainment industries.

1. **Own foundry technology**
2. **Highly conductive and thermosetting alloys**
3. **Product development**

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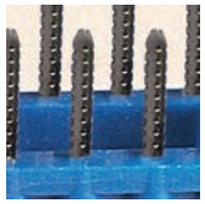

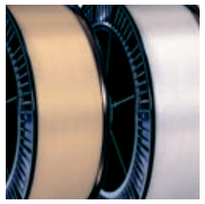

- Exact layer winding
- Precise knurling

# Wire geometries

**bedra** electronics wires are used worldwide in passive, electro-mechanical and interconnect components. The miniaturisation of the components makes increasingly high demands of materials and processing technologies. Knowledge of materials and processing is the technological edge of bedra that makes possible new solutions in the final product for our customers.

**bedra** is a specialist in the manufacture of square, rectangular, octagonal profile, flat and round wire in both plain and knurled versions.

The observance of the most precise tolerances in terms of dimensions, diagonals and edge radius, as well as exact knurling, precision and process stability, support the increased demands for the state of the art processing of the wire.

The fulfilment of optimal straightness requirements and customer-specific product parameters, coupled with exact layer winding, complete the high quality standards of **bedra**.

1. **Variety of wire geometries**
2. **Compliance with the narrowest tolerances**
3. **Plain and knurled versions**

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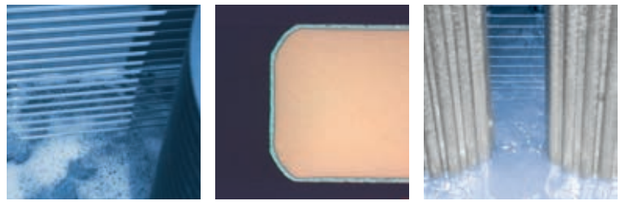

- Modern, high performance electrolytes
- Consistent coatings
- Highly pure tin anodes

# Surface refinement

Various galvanic equipment is available for the production of a consistent surface quality for a variety of wire geometries and coating variants. The high quality level of the coatings is ensured through internal inspections in our own laboratory.

The spectrum extends from simple pure tin coatings through variants with nickel or copper barrier layers to multilayer technology. The use of highly pure tin electrolytes ensures the fulfilment of requirements for high brazing temperatures.

The reflow technology used increases the whisker safety of electroplated wires and supports modern processing in the high-tech industry.

The strict fulfilment of all environmental guidelines and testing for ROHS compliance by certified, external testing institutions completes the production process.

**1. Electroplating**

**2. Multilayer technology**

**3. Reflow technology**

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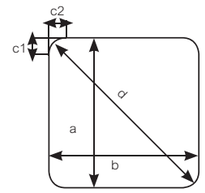
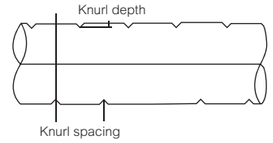
| Materials | | Standardisation | | | Physical properties of the materials | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | bedra type | EN designation | EN abbreviation | CDA UNS No. | Density kg/dm³ | Thermal conductivity W/m • K | Coefficient of thermal expansion $10^{-6}$/K | Electrical conductivity | |
| | | | | | | | | MS/m | IACS % |
| Tin-bronze alloys | Bz0.6 | | | | 8.9 | 185 | 17.8 | ~25 | ~42 |
| | Bl4 | CuSn4 | CW 450 K | | 8.9 | 90 | 18.2 | 12 | ~20 |
| | Bl5 | CuSn5 | CW 451 K | C51000 | 8.8 | 75 | 18.5 | 9.5-10.5 | ~16-18 |
| | B65 | CuSn6 | CW 452 K | C51900 | 8.8 | 75 | 18.5 | 8.0-8.5 | ~14 |
| | Bl80 | CuSn8 | CW 453 K | C52100 | 8.8 | 67 | 18.5 | 7.0-7.5 | ~12-13 |
| Brass alloys | Ms98 | | | | 8.9 | ~300 | 17.5 | ~45 | ~77 |
| | Ms95 | CuZn5 | | C21000 | 8.9 | 249 | 18.0 | 33.0 | ~56 |
| | Ms90 | CuZn10 | CW 501 L | C22000 | 8.8 | 184 | 18.2 | ~24.0 | ~41 |
| | Ms85 | CuZn15 | CW 502 L | C23000 | 8.8 | 159 | 18.5 | 20.0-22.0 | ~34-38 |
| | Ms80 | CuZn20 | CW 503 L | C24000 | 8.7 | 142 | 18.8 | 17.0-19.0 | ~29-32 |
| | Ms70 | CuZn30 | CW 505 L | C26000 | 8.5 | 126 | 19.8 | 15.5-16.5 | ~26-28 |
| | Ms64 | CuZn36 | CW 507 L | C27000 | 8.4 | 121 | 22.2 | 14.5-15.5 | ~25-26 |
| Nickel silver alloys | Ns1755 | CuNi18Zn27 | CW 410 J | C77000 | 8.7 | 29 | 16.7 | 3.2 | ~5 |
| | Ns18 | CuNi18Zn20 | CW 409 J | C76400 | 8.7 | 33 | 17.7 | 3.3-3.7 | ~6 |
| Copper materials | E-Cu58 | Cu-ETP | CW 004 A | C11000 | 8.9 | 394 | 17.3 | 58.6 | ~100 |
| | Cu-OF | Cu-OF | CW 008 A | C10200 | 8.9 | 393 | 17.0 | ~58 | ~>99 |
| | CuAg0.1 | CuAg0,10 (OF) | CW 019 A | C10700 | 8.9 | 380 | 17.0 | 54-56 | ~92-96 |
| Highly conductive alloys | CuAg1 | | | | 8.9 | 247 | 17.0 | 40-45 | ~68-77 |
| | CuAg0.5Zn1 | | | | 8.9 | 295 | 17.8 | 45-47 | ~77-80 |
| | CuMg0.4 | | | | 8.9 | 240 | 17.6 | >36 | ~>61 |
| | CuMg0.1 | | | | 8.8 | ~320 | 17.5 | ~47 | ~81 |
| Special alloys | CuNi3Si | CuNi3Si1 | CW 112 C | | 8.8 | 59-120 | 16.0 | hardened 16-19 | ~27-32 |
| | CA725 | CuNi9Sn2 | CW 351 H | C72500 | 8.9 | 48 | 15.8 | 6.5 | ~11 |
| | NIBRODAL116 | | | | 8.8 | 33 | 17.0 | hardened 6.2-6.4 | ~11 |

## Surface finishes

| Diffusion barrier layer | Sn100 Matt | Sn100 Bright | Sn100 Reflow | Sn100 Multiple layer | Ag | Au | Ni |
|---|---|---|---|---|---|---|---|
| None | • | • | • | • | • | | • |
| Ni | • | • | • | • | | • | |
| Cu | • | • | • | • | | | |




Standard parameters:
dimensions, diagonals, edge radius, knurling




| Square wires | Dimensional ranges | Minimum tolerance | Edge radius | Knurling |
|---|---|---|---|---|
| | 0.300 to 1.500 mm | +/- 0.005 mm | Min. of 0.03 mm, increasing dependent upon the cross-section | Standard<br>Knurl spacing: 0.3 and 0.5 mm<br>More upon request<br>Max. knurl depth of 0.06 mm at spacing of 0.3 mm<br>Max. knurl depth of 0.08 mm at spacing of 0.5 mm |
| Coating | All dimensions | | | |
| Reflow | All dimensions | | | |

| Flat wires | Dimensional ranges | Minimum tolerance | Edge radius | Knurling |
|---|---|---|---|---|
| | Height 0.050 – 0.800 mm<br>Special dimensions up to 2.45 mm<br>Width 0.300 – 4.000 mm | Height +/- 0.002 mm<br>Width +/- 0.010 mm | Min. 0.03 mm<br>Increasing dependent upon cross-section | Standard<br>Knurl spacing: 0.3 and 0.5 mm<br>More upon request<br>Max. knurl depth of 0.06 mm at spacing of 0.3 mm<br>Max. knurl depth of 0.08 mm at spacing of 0.5 mm |
| Coatings | Min. height of 0.300 mm<br>Width 0.400 mm<br>Max. height of 2.450 mm<br>Width 4.000 mm | | | |
| Reflow | Min. height of 0.300 mm<br>Width 0.400 mm<br>Max. height of 0.800 mm<br>Width 3.000 mm | | | |

| Round wires | Dimensional ranges | Minimum tolerance | | Knurling |
|---|---|---|---|---|
| | 0.400 –3.000 mm | +/- 0.005 mm | | Standard<br>Knurl spacing 0.3/0.5/0.6 and 0.8 mm<br>More upon request<br>Max. knurl depth of 0.06 mm at spacing of 0.3 mm<br>Max. knurl depth of 0.08 mm at spacing of 0.5 mm<br>Knurl depth at spacing of 0.6 and 0.8 mm<br>Max. 0.10 mm |
| Coating | All dimensions | | | |
| Reflow | Max. 2.000 mm | | | |

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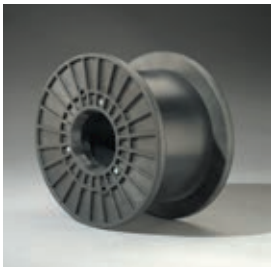

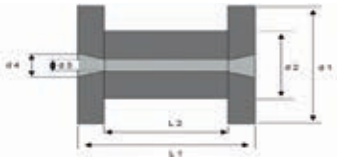

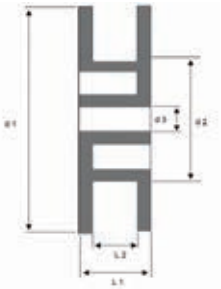

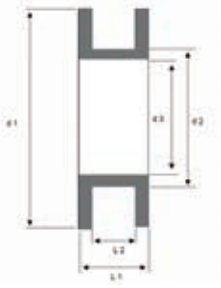

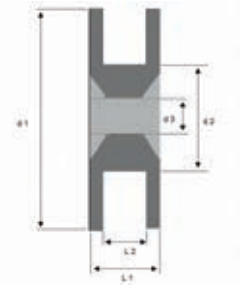

**Fig. 1** **Fig. 2** **Fig. 3** **Fig. 4**

**Coil types**

| Type | Max. filling weight [kg] | Figure | d1 | d2 | d3 | d4 | L1 | L2 |
|---|---|---|---|---|---|---|---|---|
| **K 100** | 2 | 1 | 100 | 63 | 16 | 24 | 100 | 80 |
| **K 125** | 3,5 | 1 | 125 | 80 | 16 | 24 | 125 | 100 |
| **K 160** | 8 | 1 | 160 | 100 | 22 | 34 | 160 | 128 |
| **K 200** | 16 | 1 | 200 | 125 | 22 | 34 | 200 | 160 |
| **K 250** | 22 | 1 | 250 | 160 | 22 | 34 | 200 | 160 |
| **K 355** | 50 | 1 | 355 | 224 | 36 | 60 | 200 | 160 |
| **SD 300 K** | 16 | 2 | 300 | 212 | 51,5 | - | 103 | 91 |
| **SH 370 K** | 15 | 3 | 370 | 311 | 305 | - | 80 | 70 |
| **SH 390 K** | 20 | 3 | 390 | 310 | 305 | - | 89 | 79 |
| **DWF 500/127-350** | 150 | 4 | 500 | 315 | 127 | 136 | 350 | 280 |
| **VM 630/127x150PS** | 80 | 4 | 630 | 500 | 127 | - | 150 | 100 |
| **VM 710/127-190** | 120 | 4 | 710 | 500 | 127 | - | 190 | 120 |
| **VM 400/127-186** | 45 | 4 | 400 | 320 | 127 | - | 185 | 150 |
| **VM 400/90-186** | 45 | 4 | 400 | 320 | 90 | - | 185 | 150 |
| **VM 400/90-100** | 20 | 4 | 400 | 320 | 90 | - | 100 | 65 |



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