

| Designation  | DIN    | EN     | UNS (ASTM) | AISI | LMSA                          |
|--------------|--------|--------|------------|------|-------------------------------|
| <b>CuBe2</b> | 2.1247 | CW101C | C17200     | -    | <b>A100</b> G200<br>G210 G220 |

## Chemical composition (weight %)

| Cu      | Be          | Co + Ni   | Co + Ni + Fe | Pb         |
|---------|-------------|-----------|--------------|------------|
| Balance | 1.80 - 2.00 | 0.2% min. | 0.6% max.    | 0.02% max. |

Copper plus additions equal 99.5% minimum.

In order to achieve maximum homogeneity and consistent quality, the actual tolerances on both alloy components and impurities are significantly tighter and more precisely defined than the standard composition indicated.

## Main technical properties and features

Beryllium copper Brush 25 achieves the highest strength and hardness available among all copper alloys after age hardening, and is consequently very widely used. It exhibits excellent bendability and general formability prior to ageing, especially in the tempers A (TB00), ¼ H (TD01) and ½ H (TD02). After forming and in the fully age hardened condition, the alloy Brush 25 provides a unique combination of very high strength and high conductivity, high fatigue strength limit and an excellent thermal strength relaxation behaviour.

## Typical manufacturing range

|                        |                               | Thickness (mm) | Width (mm)   | Length (mm) |
|------------------------|-------------------------------|----------------|--------------|-------------|
| <b>Rolled products</b> | Strip in coils <sup>1)</sup>  | 0.005 - 2.000  | 1.5 - 200.0  | -           |
|                        | Strip as sheets <sup>1)</sup> | 0.015 - 2.000  | 10.0 - 200.0 | 100 - 3000  |
| <b>Drawn bar</b>       | Bars and wire <sup>2)</sup>   | upon request   |              |             |

1) Not all our production possibilities are presented here. Other dimensions or other product forms available upon request. Certain combinations of thicknesses and widths are not possible.

2) Alloy 25 is generally not used for applications requiring good machinability. For screw machined parts, we recommend the alloy Brush M25, CuBe2Pb. For improved machinability

## Mechanical properties of strips

| Temper          |      |      |                  | Heat Treatment | R <sub>p0.2</sub> (N/mm <sup>2</sup> ) | R <sub>m</sub> (N/mm <sup>2</sup> ) | A <sub>50mm</sub> (%) | Hardness HV | R/t (90°) G/B <sup>2)</sup> |
|-----------------|------|------|------------------|----------------|--|-------------------------------------|-----------------------|-------------|-----------------------------|
| A               | R410 | H090 | dead soft        | -/-            | 190-380                                | 410-540                             | 35-60                 | 90-150      | 0.0/0.0                     |
| A <sup>1)</sup> | R430 | H100 | soft + skin pass | -/-            | 210-380                                | 430-560                             | 35-60                 | 100-150     | 0.0/0.0                     |
| ¼ H             | R510 | H130 | ¼ hard           | -/-            | 420-560                                | 510-610                             | 15-35                 | 120-180     | 0.0/0.0                     |
| ½ H             | R580 | H180 | ½ hard           | -/-            | 530-660                                | 580-690                             | 8-25                  | 180-215     | 0.5/1.0                     |
| H               | R680 | H215 | hard             | -/-            | 650-800                                | 680-830                             | 2-8                   | 215-250     | 1.0/2.9                     |
| H+              | R800 | H240 | aprights         | -/-            | ≥ 750                                  | ≥ 800                               | -/-                   | ≥ 240       | -/-                         |

After age hardening (by the customer)

|      |       |      |                   |            |           |           |      |         |     |
|------|-------|------|-------------------|------------|-----------|-----------|------|---------|-----|
| AT   | R1130 | H350 | soft + hardened   | 3h / 315°C | 960-1210  | 1130-1350 | 10-3 | 350-410 | -/- |
| ¼ HT | R1190 | H360 | ¼ hard + hardened | 2h / 315°C | 1050-1300 | 1190-1420 | 6-3  | 360-430 | -/- |
| ½ HT | R1270 | H370 | ½ hard + hardened | 2h / 315°C | 1100-1350 | 1270-1490 | 5-1  | 370-440 | -/- |
| HT   | R1310 | H380 | hard + hardened   | 2h / 315°C | 1150-1420 | 1310-1520 | 3-1  | 380-450 | -/- |

1) The temper "soft + skin pass" is not given in the EN standard. The skin pass improves the surface quality of the soft temper.

2) Minimum bend radius at 90°. R = radius, t = thickness of the strip, G = "Good way" and B = "Bad way".

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## Mechanical properties of rods and wires

| Rods            | Temper |      |           | Heat Treatment | Rp <sub>0.2</sub> (N/mm <sup>2</sup> ) | Rm (N/mm <sup>2</sup> ) | A <sub>50mm</sub> (%) | Hv (N/mm <sup>2</sup> ) |
|-----------------|--------|------|-----------|----------------|--|-------------------------|-----------------------|-------------------------|
| A <sup>1)</sup> | R420   | H090 | Dead soft | -              | 140-210                                | 420-600                 | ≥ 35                  | 90-180                  |
| H <sup>1)</sup> | R600   | H200 | hard      | -              | 500-750                                | 600-800                 | ≥ 10                  | 200-250                 |

After hardening (at the customer)

|                  |       |      |                 |            |           |           |     |         |
|------------------|-------|------|-----------------|------------|-----------|-----------|-----|---------|
| AT <sup>1)</sup> | R1150 | H360 | soft + hardened | 3h / 325°C | 1000-1250 | 1150-1350 | ≥ 3 | 360-390 |
| HT <sup>1)</sup> | R1300 | H390 | hard + hardened | 2h / 325°C | 1150-1400 | 1300-1500 | ≥ 2 | 390-430 |

1) These tempers do not correspond exactly to those of the EN standard  
Values are valid for diameters < 25 mm

| Wire             | Temper |      |        | Heat Treatment | Rp <sub>0.2</sub> (N/mm <sup>2</sup> ) | Rm (N/mm <sup>2</sup> ) | A <sub>50mm</sub> (%) | Hv (N/mm <sup>2</sup> ) |
|------------------|--------|------|--------|----------------|--|-------------------------|-----------------------|-------------------------|
| A <sup>1)</sup>  | R400   | H090 | soft   | -              | 130-210                                | 400-540                 | ≥ 30                  | 90-170                  |
| ¼H <sup>1)</sup> | R620   | H200 | ¼ hard | -              | 510-730                                | 620-800                 | ≥ 3                   | 200-250                 |
| ½H <sup>1)</sup> | R750   | H230 | ½ hard | -              | 620-870                                | 750-940                 | ≥ 2                   | 230-300                 |
| ¾H <sup>1)</sup> | R890   | H270 | ¾ hard | -              | 790-1040                               | 890-1070                | ≥ 2                   | 270-340                 |
| H <sup>1)</sup>  | R960   | H300 | hard   | -              | 890-1110                               | 960-1140                | ≥ 1                   | 300-360                 |

After hardening (by the customer)

|                   |       |      |                   |            |           |           |     |         |
|-------------------|-------|------|-------------------|------------|-----------|-----------|-----|---------|
| AT <sup>1)</sup>  | R1100 | H340 | soft + hardened   | 3h / 325°C | 990-1250  | 1100-1380 | ≥ 3 | 340-430 |
| ¼HT <sup>1)</sup> | R1200 | H370 | ¼ hard + hardened | 2h / 325°C | 1130-1380 | 1200-1450 | ≥ 2 | 370-460 |
| ½HT <sup>1)</sup> | R1270 | H390 | ½ hard + hardened | 2h / 325°C | 1170-1450 | 1270-1490 | ≥ 2 | 390-470 |
| ¾HT <sup>1)</sup> | R1310 | H410 | ¾ hard + hardened | 2h / 325°C | 1200-1520 | 1310-1590 | ≥ 2 | 410-500 |
| HT <sup>1)</sup>  | R1340 | H420 | hard + hardened   | 2h / 325°C | 1240-1520 | 1340-1590 | ≥ 1 | 420-500 |

1) These tempers do not correspond exactly to those of the EN standard

## Physical properties

|  |                       |   |
|--|-----------------------|---|
| Modulus of elasticity                    | KN/mm <sup>2</sup>    | 125 - 131 (before and after hardening, respectively)    |
| Poisson ratio                            |                       | 0.285   |
| Density                                  | kg/dm <sup>3</sup>    | 8.25 - 8.36 (before and after hardening, respectively)  |
| Melting point / Melting range            | °C                    | 875 - 985   |
| Linear dilatation coefficient (20-300°C) | 10 <sup>-6</sup> / °C | 17  |
| Thermal conductivity at 20°C             | W/m °K                | 110   |
| Electrical resistivity                   | μΩcm                  | 11-9, 8-6 (before and after hardening, respectively)    |
| Electrical conductivity                  | MS/m                  | 9-11, 13-16 (before and after hardening, respectively)  |
| Electrical conductivity                  | % IACS                | 15-19, 22-28 (before and after hardening, respectively) |
| Magnetic properties                      |                       | Non magnetic (Slightly diamagnetic)                     |
| Permeability                             |                       | μ = 1.0006  |

## Typical uses

Spring contacts, diaphragms, bellows, electric and electronic contacts and connectors, switches, relays, bearings, resistance welding electrodes, various parts for the watch industry such as wheels, watch hands, balances, levers etc.

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|                    |              |               |              |                      |           |                                |
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|--------------------|--------------|---------------|--------------|----------------------|-----------|--------------------------------|

## Tolerances (strip and foil)

| Thickness   | Thickness (mm) |         | EN Standard        |                    | Lamineries MATTHEY SA |                   |                |
|---|----------------|---------|--------------------|--------------------|-----------------------|-------------------|----------------|
|   | ≥              | <       | 10140<br>Precision | 10258<br>Precision | LMSA<br>Standard      | LMSA<br>Precision | LMSA<br>Extrem |
| <p>The table shown is an outline of our typical thickness tolerances available. They are tighter than industry standards.</p> <p>Our "Precision" and "Extreme" tolerances are available upon request.</p> | 0.025          | 0.025   | -                  | -                  | -                     | -                 | ± 0.001        |
|   | 0.025          | 0.050   | -                  | -                  | ± 0.003               | ± 0.002           | ± 0.0015       |
|   | 0.050          | 0.065   | -                  | ± 0.003            | ± 0.003               | ± 0.0025          | ± 0.002        |
|   | 0.065          | 0.100   | -                  | ± 0.004            | ± 0.004               | ± 0.0035          | ± 0.003        |
|   | 0.100          | 0.125   | ± 0.005            | ± 0.006            | ± 0.005               | ± 0.004           | ± 0.003        |
|   | 0.125          | 0.150   | ± 0.005            | ± 0.006            | ± 0.005               | ± 0.005           | ± 0.004        |
|   | 0.150          | 0.250   | ± 0.010            | ± 0.008            | ± 0.008               | ± 0.006           | ± 0.004        |
|   | 0.250          | 0.300   | ± 0.010            | ± 0.009            | ± 0.009               | ± 0.007           | ± 0.005        |
|   | 0.300          | 0.400   | ± 0.010            | ± 0.010            | ± 0.010               | ± 0.007           | ± 0.005        |
|   | 0.400          | 0.500   | ± 0.015            | ± 0.012            | ± 0.012               | ± 0.008           | ± 0.006        |
|   | 0.500          | 0.600   | ± 0.015            | ± 0.014            | ± 0.014               | ± 0.010           | ± 0.007        |
|   | 0.600          | 0.800   | ± 0.015            | ± 0.015            | ± 0.015               | ± 0.010           | ± 0.007        |
|   | 0.800          | 1.000   | ± 0.015            | ± 0.018            | ± 0.018               | ± 0.012           | ± 0.009        |
|   | 1.000          | 1.200   | ± 0.020            | ± 0.020            | ± 0.020               | ± 0.015           | ± 0.012        |
|   | 1.200          | 1.250   | ± 0.020            | ± 0.020            | ± 0.020               | ± 0.015           | ± 0.012        |
| 1.25  | 1.500          | ± 0.020 | ± 0.020            | ± 0.020            | ± 0.015               | ± 0.014           |                |

### Width

Our width tolerance is + 0.2 -0.0 mm (or ± 0.1 mm upon request). They are available for slit widths < 125 mm and thicknesses < 1.00 mm. Special tolerances upon request.

### Camber

|   | Width (mm) |     | Camber max. (mm/m) |          |               |          |
|---|------------|-----|--------------------|----------|---------------|----------|
|   | >          | ≤   | LMSA standard      |          | LMSA extrêmes |          |
|   |            |     | ≤ 0.5 mm           | > 0.5 mm | ≤ 0.5 mm      | > 0.5 mm |
| Our tolerance "standard" respects the EN Standard 1654 (Length of measurement 1000 mm).<br>Other tolerances upon request. | 3          | 6   | 12                 | -        | 6             | -        |
|   | 6          | 10  | 8                  | 10       | 4             | 5        |
|   | 10         | 20  | 4                  | 6        | 2             | 3        |
| Other tolerances upon request.  | 20         | 250 | 2                  | 3        | 1             | 1.5      |

### Surface

Special surface qualities upon request

### Flatness

Special requirement on the longitudinal or transversal flatness upon request

## Dimensional tolerances (rod and wire)

| Diameter  | Standard tolerances   |               |  | Special tolerances |
|---|---|---------------|--|--------------------|
|   | ≤ 3.0mm   | h8            | + 0 / - 14 μm  |                    |
| > 3.0 and ≤ 6.0mm   | h8  | + 0 / - 18 μm | Upon request, rod and wire can be delivered with tighter tolerances (h5, h6, h7) by means of additional drawing and/or grinding processes. |                    |
| > 10.0 and ≤ 10.5mm   | h8  | + 0 / - 22 μm |  |                    |
| > 10.5 and ≤ 18.0mm   | h9  | + 0 / - 43 μm |  |                    |
| > 18.0 and ≤ 30.0mm   | h9  | + 0 / - 52 μm |  |                    |
| Mill-hardened, non-ground bars are available with tolerances h9 for diameters ≤ 10.5 mm and h10 for the larger diameters. |   |               |  |                    |
| <b>Out-of-roundness</b>   | Maximum equals half of the tolerance value of the diameter.<br>Upon request rod and wire can be ordered with tighter out-of-roundness tolerances. |               |  |                    |
| <b>Length</b>   | The standard length of rods is 3 m +/- 30mm. Rod can be ordered pointed and chamfered   |               |  |                    |

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