mkm
we live copper

# Overview of Materials

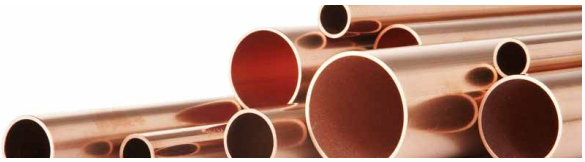
# Contents

# Bars and profiles

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Copper | Cu-ETP | CW004A | DIN EN 13601 | Copper containing oxygen, with high electrical conductivity (> 58.0 MS/m), not hydrogen-resistant, no weldability or solderability requirements. Used to build switchgear, busbars |
| | Cu-OF | CW008A | DIN EN 13601 | Oxygen-free copper with high purity and high electrical conductivity (> 58.0 MS/m), high demands on hydrogen-resistance, easy to weld and solder. Used in vacuum engineering, electronics |
| | Cu-OFE | CW009A | DIN EN 13601 | Oxygen-free copper with very high purity, very high electrical conductivity (> 58.58 MS/m) and very good hydrogen-resistance. Used in vacuum engineering, semiconductor manufacturing, electronic valves, microelectronics |
| | Cu-HCP | CW021A | DIN EN 13601 | Deoxidised copper with low residual phosphorus content and limited electrical conductivity (> 57 MS/m), good weldability, solderability and hydrogen-resistance. Used in apparatus engineering, electrical engineering, generator building |
| | Cu-PHC | CW020A | DIN EN 13601 | Deoxidised copper with low residual phosphorus content and high electrical conductivity (> 58.0 MS/m), good formability, good weldability, solderability and hydrogen-resistance. Used in electronics, cladding materials, collector segments |
| Low-alloyed copper | CuAg0,10<br>CuAg0,04 | CW013A<br>CW011A | DIN EN 13601 | Copper low-alloyed with silver, with high electrical conductivity (> 58.0 MS/m) and improved tempering resistance as well as better creep behaviour than highly conductive copper. Application: commutator segments, commutator rings, contacts, welding electrodes, busbars, cooling fins |
| | CuAg0,10P<br>CuAg0,04P | CW016A<br>CW014A | DIN EN 13601 | Deoxidised copper with limited electrical conductivity (> 57 MS/m) combined with good weldability, hard solderability and hydrogen-resistance. Application: main alloy for building generators |
| | CuSP | CW114C | DIN EN 12164 | Deoxidised copper which is very easy to machine and process, good for cold-upsetting and easy to weld and hard-solder. Application: machining, e.g. parts manufactured on automatic lathes |
| | CuCr1Zr | CW106C | DIN EN 12163/12167 | Very strong copper alloy with good conductivity, used for contact components and for resistance welding (automotive industry) |
| CuNi alloy | CuNi10Fe1Mn | CW352H | DIN EN 12165 | Alloy with good resistance against seawater, corrosion and erosion and good weldability. Application: desalination plants, shipbuilding, apparatus engineering |

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

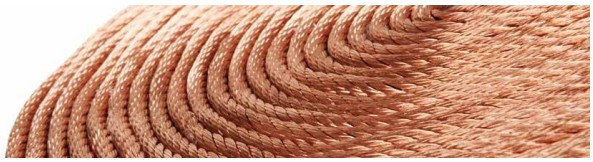
# Tubes



| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Copper | Cu-DHP | CW024A | | Deoxidised copper with limited residual phosphorus content, hydrogen-resistance, very good weldability and hard solder-ability without any electrical conductivity requirements |
| | | | DIN EN 1057 | Application: sanitary installations and heating systems |
| | | | DIN EN 12449 | Application: industrial use (fixtures, vaporisers) |
| | | | DIN EN 12451 | Application: heat exchangers |
| | | | DIN EN 12735-1/ 12735-2 | Application: refrigeration and air conditioning |
| | | | DIN EN 13348 | Application: medical gases and vacuums |
| | | | DIN EN 13349 | Application: precoated tubes with massive mantles |
| | Cu-ETP | CW004A | | Copper containing oxygen, with high electrical conductivity (> 58.0 MS/m), not hydrogen-resistant, no weldability or solderability requirements |
| | | | DIN EN 12449 | Application: industrial use, fixtures and components with electrical conductivity requirements, tube clips, cable lugs |
| | | | DIN EN 13600 | Application: in electrical engineering |
| | Cu-OF | CW008A | | Oxygen-free copper with high purity and high electrical conductivity (> 58.0 MS/m), high demands on hydrogen-resistance, easy to weld and solder |
| | | | DIN EN 13600 | Application: vacuum engineering, electronics |
| | | | DIN EN 12449 | Application: industrial use (e.g. fixtures and components with electrical conductivity requirements as well as solderability and weldability) |
| | Cu-OFE | CW009A | DIN EN 13600 | Oxygen-free copper with very high purity, very high electrical conductivity (> 58.58 MS/m) and very good hydrogen-resistance. Application: vacuum engineering, semiconductor manufacturing, electronic valves |
| | Cu-HCP | CW021A | | Deoxidised copper with low residual phosphorus content and limited electrical conductivity (> 57 MS/m), good weldability, solderability and hydrogen-resistance |
| | | | DIN EN 12449 | Application: industrial use (e.g. electrical engineering applications, solderable and weldable) |
| | | | DIN EN 13600 | Application: electrical engineering |
| Copper alloy | CuNi10Fe1Mn | CW352H | DIN EN 12449<br>DIN EN 12451 | Alloy with good resistance against seawater, corrosion and erosion and good weldability.<br>Application: apparatus engineering, shipbuilding, brake lines, heat exchangers |

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

# Wire



## Wire rod

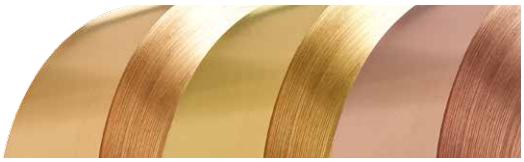
| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Copper | Cu-ETP1 | CW003A | DIN EN 1977 | Copper containing oxygen, with very high electrical conductivity (> 58.58 MS/m), not hydrogen-resistant, no weldability or solderability requirements. Application: qualities defined by drawability and surface requirements for the manufacture of wire and enamelled wire, specialised cable applications |
| | Cu-ETP | CW004A | DIN EN 1977 | Copper containing oxygen, with high electrical conductivity (> 58.0 MS/m), not hydrogen-resistant, no weldability or solderability requirements. Application: qualities defined by drawability and surface requirements for the manufacture of wire and subsequent cables |
| Low-alloyed copper | CuAg0,1 | CW013A | DIN EN 1977 | Copper low-alloyed with silver, with high electrical conductivity (> 58.0 MS/m) and improved tempering resistance as well as better creep behaviour than highly conductive copper. Application: contact engineering, contact wire and special applications, commutators |

## Wire

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Copper | Cu-ETP1 | CW003A | DIN EN 13602 | Copper containing oxygen, with very high electrical conductivity, not hydrogen-resistant, no weldability or solderability requirements. Application: manufacturing single wires, multiple wires, stranded wire, wire rope (bare and tinned) for various ranges of cables used in electrical engineering, specialised cable manufacturing |
| | Cu-ETP | CW004A | DIN EN 13602 | Copper containing oxygen, with high electrical conductivity, not hydrogen-resistant, no weldability or solderability requirements. Application: manufacturing single wires, multiple wires, stranded wire and wire rope (bare and tinned) for use in electrical engineering |
| | Cu-OF | CW008A | DIN EN 13602 | Oxygen-free copper with high purity and high electrical conductivity, high demands on hydrogen-resistance, easy to weld and solder. Application: manufacturing single wires, multiple wires, stranded wire and wire rope (bare and tinned) as cable applications in electrical engineering |
| | Cu-OFE | CW009A | DIN EN 13604 | Oxygen-free copper with very high purity, very high electrical conductivity and very good hydrogen-resistance. Application: superconductors, high-performance transmission cables |
| Copper alloy | CUSn6** | CW452K | DIN EN 12166 | Low-wear wrought alloy with higher strength and yield strength than copper, easy to solder and highly corrosion-resistant. Application: for all types of spring, particularly in the electrical industry: heating conductors for passenger vehicles |

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement. **) On request.

# Strips



## Copper

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Copper | Cu-ETP | CW004A | DIN EN 13599<br>DIN EN 1652 | Copper containing oxygen, with high electrical conductivity (> 58.0 MS/m), not hydrogen-resistant, no weldability or solderability requirements. Application: cable strip for heavy current, underwater and specialised cables, electrical engineering, electronics |
| | Cu-PHC | CW020A | DIN EN 13599 | Deoxidised copper with low residual phosphorus content and high electrical conductivity (> 58.0 MS/m), good formability, good weldability, solderability and hydrogen-resistance. Application: cable strip for heavy current, underwater and specialised cables, electrical engineering, electronics |
| | Cu-HCP | CW021A | DIN EN 13599 | Deoxidised copper with low residual phosphorus content and limited electrical conductivity (> 57 MS/m), good weldability, solderability and hydrogen-resistance. Application: cable strip for heavy current, underwater and specialised cables, electrical engineering, electronics |
| | CU-DHP | CW024A | DIN EN 1652<br>DIN EN 1172 | Deoxidised copper with limited residual phosphorus content, very good weldability and hard solderability, hydrogen-resistance and without any electrical conductivity requirements. Application: roofing, solar technology, Wärmetaucher |
| | CU-OF | CW008A | DIN EN 13599<br>DIN EN 1652 | Oxygen-free copper with high purity and high electrical conductivity (> 58.0 MS/m), high demands on hydrogen-resistance, easy to weld and solder. Application: cable strips |
| | CU-OFE | CW009A | DIN EN 13599 | Oxygen-free copper with very high purity, very high electrical conductivity (> 58.58 MS/m) and very good hydrogen-resistance. Application: electrical engineering, electronics, vacuum engineering |

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

## Low-alloyed copper alloys

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Low-alloyed copper | CuAg0,1 | CW013A | DIN EN 13599 | Copper low-alloyed with silver, with high electrical conductivity (> 58.0 MS/m) and improved tempering resistance as well as better creep behaviour than highly conductive copper. Application: accumulator production and electronic components |
| | CuAg0,1P | CW016A | DIN EN 13599 | Deoxidised copper with limited electrical conductivity (> 57 MS/m) combined with good weldability, hard solderability and hydrogen-resistance. Application: accumulator production and electronic components |
| | CuZn0,5 | CW119C | DIN EN 1652 | Low-alloyed copper with high conductivity, high softening temperature, very easy to cold-form, bend and punch, good corrosion-resistance, suitable for soldering and welding, hydrogen-resistant. Application: apparatus engineering, components for electrical engineering |

## Copper-zinc alloys

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Brass | CuZn5 | CW500L | DIN EN 1652 | Alloy with very good cold formability, well suited to pressing, embossing, enchasing. Application: installation equipment for electrical engineering, construction industry, facades, jewellery industry |
| | CuZn10 | CW501L | DIN EN 1652 | |
| | CuZn15 | CW502L | DIN EN 1652 | |
| | CuZn20 | CW503L | DIN EN 1652 | |
| | CuZn28** | | | Alloy with very good cold formability by means of deep-drawing, pressing, riveting, crimping. Application: every type of deep-drawn part, ammunition |
| | CuZn30 | CW505L | DIN EN 1652 | |
| | CuZn33 | CW506L | DIN EN 1652 | Alloy with very good cold formability, especially suitable for crimping and cold-upsetting. Application: radiator strips |
| | CuZn36 | CW507L | DIN EN 1652 | Main alloys for the application of brass materials, highly suitable for cold forming by means of deep-drawing, pressing, upsetting, rolling, thread rolling, embossing, bending, easy to solder and weld, suitable for electrolytic polishing. Application: polished parts, furniture industry, punched and bent parts |
| | CuZn37 | CW508L | DIN EN 1652 | |
| | CuZn40 | CW509L | DIN EN 1652 | Alloy with good hot and cold formation properties, suitable for bending, riveting, upsetting and crimping and, in its soft state, for embossing as well as deep-drawing, better machinability than CuZn5 to CuZn37. Application: punched and bent parts, apparatus engineering |

Note: Additional alloying with zinc improves corrosion resistance.
Increasing the zinc content increases strength and hardness.

**) Not included in DIN EN 1652.

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

## Copper-tin alloys



| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Tin bronze | CuSn5 | CW451K | DIN EN 1652 | Alloy with good cold formability and corrosion-resistance, insensitive to stress corrosion cracking. Application: electrical industry, automotive construction |
| | CuSn6 | CW452K | DIN EN 1652 | Alloy with good cold formability and very good corrosion-resistance, easy to solder. Application: electrical industry |
| | CuSn8 | CW453K | DIN EN 1652 | Alloy with good cold formability, higher abrasion resistance, corrosion-resistance, strength and hardness than CuSn6, good sliding properties. Application: springs, sliding elements |

Note: increasing the tin content increases strength and hardness while reducing formability.

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

# Sheets/plates/discs

## Copper

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Copper | Cu-ETP1 | CW004A | DIN EN 13599<br>DIN EN 1652 | Copper containing oxygen, with high electrical conductivity (> 58.0 MS/m), not hydrogen-resistant, no weldability or solderability requirements.<br>Application: components for electrical engineering, cable lugs, connectors, busbars, EDM parts |
| | Cu-HCP | CW021A | DIN EN 13599 | Deoxidised copper with low residual phosphorus content and limited electrical conductivity (> 57 MS/m), good weldability, solderability and hydrogen-resistance. Application: components for electrical engineering, busbars, mould engineering, EDM parts, foundry engineering, cooling plates |
| | Cu-PHC | CW020A | DIN EN 1652<br>DIN EN 1653 | Deoxidised copper with low residual phosphorus content and high electrical conductivity (> 58.0 MS/m), good formability, good weldability, solderability and hydrogen-resistance.<br>Application: components for electrical engineering |
| | Cu-DHP | CW024A | DIN EN 1652<br>DIN EN 1653 | Deoxidised copper with limited residual phosphorus content, very good weldability and hard solderability, hydrogen-resistance and without any electrical conductivity requirements.<br>Application: container-building, facades, brewery and distillery equipment, foundry engineering, furnace-building, cooling plates |
| | Cu-OF | CW008A | DIN EN 13599<br>DIN EN 1652 | Oxygen-free copper with high purity and high electrical conductivity (> 58.0 MS/m), high demands on hydrogen-resistance, easy to weld and solder.<br>Application: components for electrical engineering, busbars, vacuum applications, sputtering targets, welding equipment, nuclear engineering (cooling elements in CASTOR containers) |
| | Cu-OFE | CW009A | | High purity, Cu 99.99% for vacuum switching systems, targets |
| | Cu-DLP | CW023A | DIN EN 1652<br>DIN EN 1653 | Deoxidised copper with reduced residual phosphorus content (P 0.005 to 0.013%) without any electrical conductivity requirements, hydrogen-resistant, easy to weld and solder.<br>Application: foundry engineering |

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

## Low copper wrought alloys

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Low-alloyed copper | CuAg0,10 | CW013A | DIN EN 13599 | Copper low-alloyed with silver, with high electrical conductivity (> 58.0 MS/m) and improved tempering resistance as well as better creep behaviour than highly conductive copper. Application: engraved plates, foundry engineering, mould manufacturing |
| | CuAg0,10P | CW016A | DIN EN 13599 | Deoxidised copper with limited electrical conductivity (> 57 MS/m) combined with good weldability, hard solderability and hydrogen-resistance. Application: foundry engineering, mould manufacturing |
| | CuCr1Zr | CW106C | DIN EN 17670 | Curable material with electrical conductivity, medium tensile strength and high temperature-resistance. Application: electrical engineering and machine-building for current-carrying contact components, single and multiple use mould engineering |
| | CuNi2Si | CW111C | by arrangement | Mould engineering, machine parts, die casting equipment |
| | CuSi3Mn | | | Apparatus engineering, heat exchangers, chemical industry, construction industry, crafts |

## Cupronickel wrought alloys

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| CuNi alloys | CuNi5Fe1Mn | | GOST | Alloy with good resistance against seawater, erosion and corrosion, and good weldability. Application: offshore, maritime applications |
| | CuNi10Fe1Mn | CW352H | DIN EN 1652 | Alloy with good resistance against seawater, erosion and corrosion and good weldability. Application: apparatus engineering, tube sheet plates, seawater processing, welded tubes, maritime applications, cladding |
| | CuNi30Mn1Fe | CW354H | DIN EN 1652 | Alloy with outstanding resilience against seawater, erosion and corrosion (because it contains more nickel) and good weldability. Application: apparatus engineering, tube sheet plates, seawater processing, maritime applications, cladding |

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

## Copper-aluminium alloys (aluminium bronze)

Sheets/plates/discs

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Aluminium bronze | | | | Key properties:<br>Alloys with high strengths compared with copper materials (including at higher temperatures) combined with outstanding corrosion-resistance against neutrals and acids, watery media and seawater, good resilience against scaling as well as erosion and cavitation.<br>Note: aluminium content improves corrosion-resistance |
| | CuAl8Fe3 | CW303G | DIN EN 1652 | Application: chemical apparatus engineering, tube sheet plates, maritime applications, potash industry |
| | CuAl8Fe3Sn | | | Application: chemical apparatus engineering, tube sheet plates, maritime applications, potash industry |
| | CuAl9Mn2 | | | Application: highly stressed bearing components, sliding strips |
| | CuAl10Ni5Fe4 | CW307G | DIN EN 1653 | Application: maximum-strength parts, highly stressed bearing components, wearing parts, ship propellers, chemical apparatus engineering, tube sheet plates, maritime applications, potash industry |

## Copper-tin alloys (bronze)

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Tin bronze | CuSn5 | CW451K | DIN EN 1652 | Alloy with good cold formability and corrosion-resistance, insensitive to stress corrosion cracking.<br>Application: electrical industry, automotive engineering, facades, monuments, works of art |
| | CuSn6 | CW452K | DIN EN 1652 | Alloy with good cold formability and very good corrosion-resistance, easy to solder.<br>Application: all types of spring, especially electrical industry, flexible metal tubes, facades, monuments, works of art |
| | CuSn8 | CW453K | DIN EN 1652 | Alloy with good cold formability, higher abrasion resistance, corrosion-resistance, strength and hardness than CuSn6, good sliding properties.<br>Application: sliding elements, especially for thin-walled sliding bearing bushings and sliding strips, springs |

Note: increasing the tin content increases strength and hardness while reducing formability.

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

## Copper-zinc alloys, lead-free (brass)

Sheets/plates/discs

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Brass (lead-free) | CuZn5 | CW500L | DIN EN 1652 | Alloy with very good cold formability, well suited to pressing, embossing, enchasing. Application: installation components for electrical engineering, construction industry, facades, jewellery industry |
| | CuZn10 | CW501L | DIN EN 1652 | |
| | CuZn15 | CW502L | DIN EN 1652 | |
| | CuZn20 | CW503L | DIN EN 1652 | |
| | CuZn28** | | | Alloy with very good cold formability by means of deep-drawing, pressing, riveting, crimping. Application: cooling plates, musical instruments, every type of deep-drawn part, flat springs, ammunition |
| | CuZn30 | CW505L | DIN EN 1652 | |
| | CuZn33 | CW506L | DIN EN 1652 | Alloy with very good cold formability, especially suitable for crimping and cold-upsetting. Application: cooling plates |
| | CuZn36 | CW507L | DIN EN 1652 | Main alloys for the application of brass materials, highly suitable for cold forming by means of deep-drawing, pressing, upsetting, rolling, thread rolling, embossing, bending, easy to solder and weld, suitable for electrolytic polishing. Application: etching quality e.g. clock and watch faces, furniture industry |
| | CuZn37 | CW508L | DIN EN 1652 | |
| | CuZn40 | CW509L | DIN EN 1652 | Alloy with good hot and cold formation properties, suitable for bending, riveting, upsetting and crimping and, in its soft state, for embossing as well as deep-drawing, better machinability than CuZn5 to CuZn37. Application: capacitor bases, facades, apparatus engineering, furniture fittings |

Note: Additional alloying with zinc improves corrosion resistance.
Increasing the zinc content increases strength and hardness.

**) Nicht in DIN EN 1652 enthalten.

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.

## Copper-zinc alloys, leaded (brass)



| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Brass (leaded) | CuZn39Pb0,5 | CW610N | DIN EN 1652 | Alloy with good cold and hot formability combined with adequate machinability. Application: bending, riveting, upsetting, crimping, tube sheet plates |
| | CuZn39Pb2 | CW612N | DIN EN 1652 | Alloy with good cold and hot formability combined with very good machinability, limited cold formability by means of bending, riveting, crimping, good for punching. Application: turning, drilling and milling quality, tool making, fixtures, engraved plates |

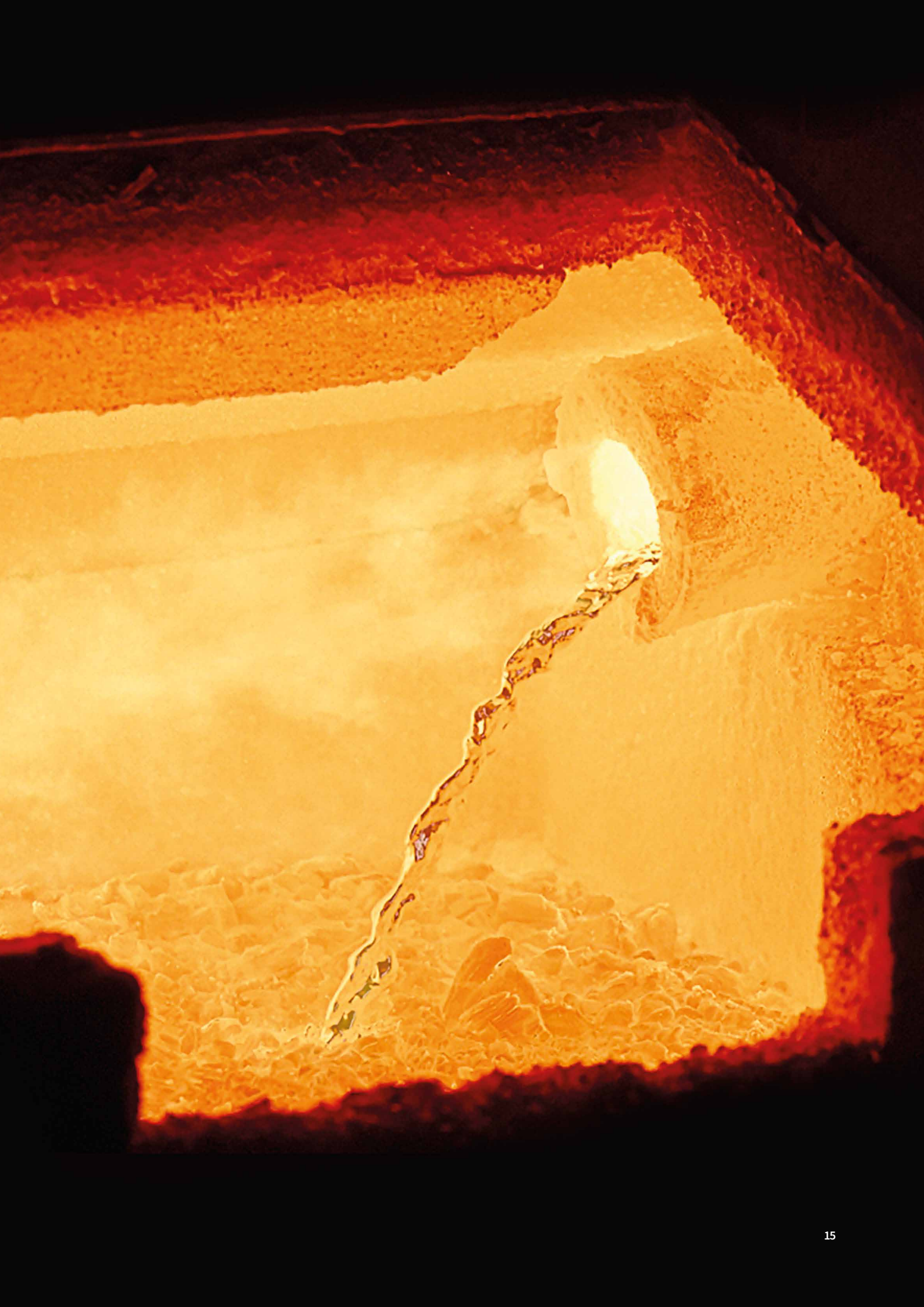
Note: Increasing the lead content improves machinability and reduces cold-formability.

## Special brass

| Material | European material descriptor | | Manufacturing standard*) | Typical properties/application |
|---|---|---|---|---|
| Special brass | CuZn20Al2As | CW702R | DIN EN 1652 | Alloy with arsenic to improve dezincification resistance. Application: capacitors, seawater applications, welded tubes |
| | CuZn28Sn1As | | ASTM B171/ASME | Alloy with improved dezincification resistance and conditional seawater resistance. Application: capacitors, heat exchangers, apparatus engineering |
| | CuZn38AlFeNiPbSn | CW715R | DIN EN 1653 | Alloy with higher strength combined with good machinability. Application: apparatus engineering, capacitors, heat exchangers |
| | CuZn38Sn1As | CW717R | DIN EN 1653 | Alloy with good corrosion-resistance. Application: capacitors, heat exchangers, apparatus engineering, cladding |

Note: copper-zinc alloys with additional alloy elements to improve dezincification resistance (As) and seawater resistance (Al).
Additional alloys on request.

*) Other standards (national and international) as well as customer specifications can be complied with by arrangement.



# Product areas

## STRIP

MKM supplies preliminary strip, industrial strip, transformer strip, cable and HF cable strip and roofing strip. We manufacture all of our strip products using our Conti-M® technology which we developed inhouse, using continous casting technology to achieve a uninterrupted 24/7 process.

## SHEETS, PLATES AND DISCS

MKM offers sheets, plates and discs in a wide range of dimensions. Our rolling mill is supplied by our own foundries. Our strengths lie in a rich range of more than fifty alloys. We can also produce plates and discs to customer specific drawings on request.

## WIRE

MKM supplies the entire spectrum of wire rod, from thick, medium and fine wire to stranded wire and wire rope. Our fully integrated Contirod® technology allows us to offer copper wire products and alloy wire products (plain and tinned) with a wide range of finishes.

## TUBES

MKM supplies tubes of different lengths, diameters and thicknesses. Our HETCU® (installation tubing) and HETCOOL® (refrigeration, air conditioning and medical technology) product families are extremely well established in the market. Consistent quality management from our own continuous casting plant, right through to the tube drawing process guarantees seamless tubing with outstanding quality.

## BARS

MKM is one of Europe's leading producers of copper bars and profiles. Our production range encompasses a wide range of sizes in various grades of copper. We also produce customised profiles based on technical drawings.

## CUSTOM SOLUTIONS

MKM develops solutions tailored entirely to its customers' requirements. With the technical means and many years of experience, we regularly find unconventional solutions.

We can manufacture any of our products in compliance with the relevant DIN standards, internationally established standards and custom requirements.
All of our packaging is appropriate to the products it contains.

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