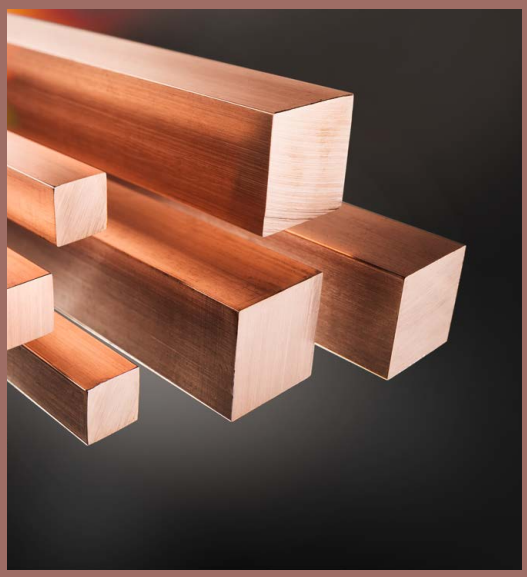
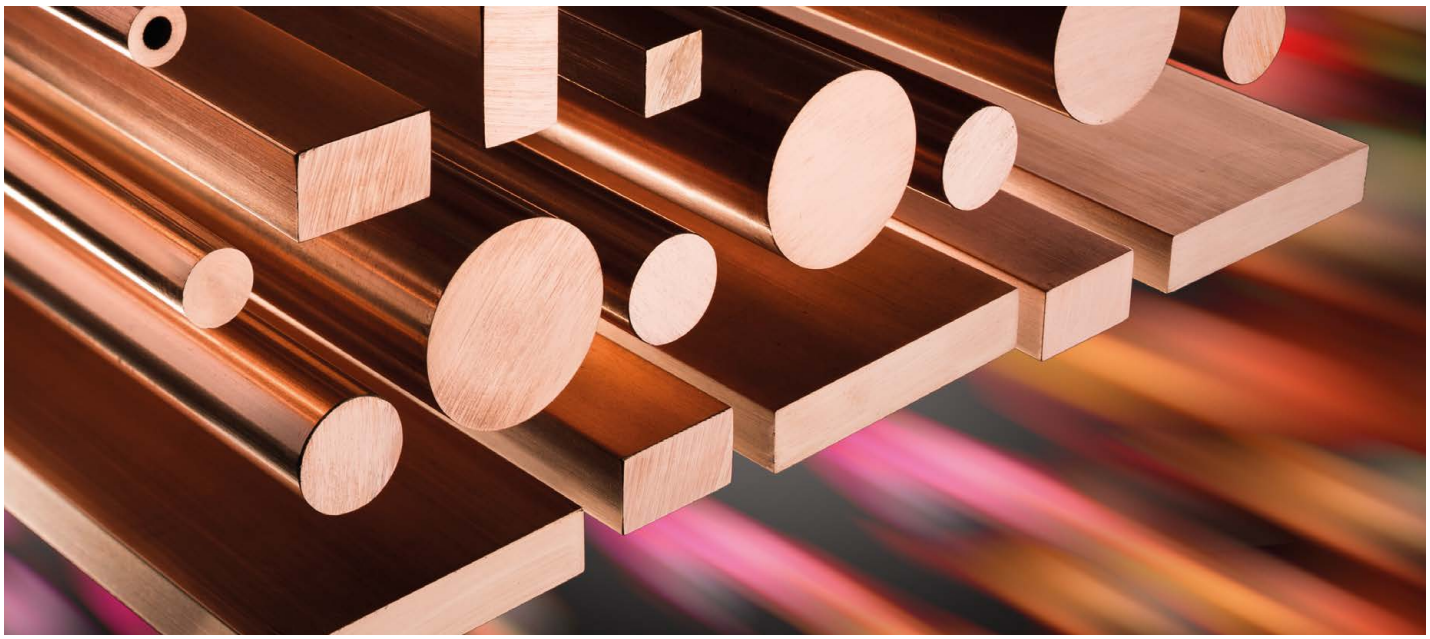
OSNA-Cu58®
Special machining alloys

KME

KME Germany GmbH & Co. KG
OSNA-Cu58® [EN]



KME Germany GmbH & Co. KG
Extruded and Drawn Products



The KME group is one of the world's largest manufacturer of copper and copper alloy products. The group's corporate goal is to develop and manufacture products that meet customer demands, supporting them in finding solutions for their specific applications, and providing services as a long-term partner.

The business unit extruded and drawn products within KME's special products division is specialised in the manufacture of materials for free machining. For nearly fifty years now it has been producing the most varied alloys designed to meet different requirements.

The KME alloys OSNA-Cu 58® have been specially developed to meet the demands of machining copper alloys. These alloys are based on oxygen-free copper with the addition of either tellurium or sulphur.

The OSNA-Cu 58® range of alloys offer excellent cutting properties and high electrical and thermal conductivity.

OSNA-Cu58®
Copper for free machining

OSNA-Cu 58® has been specially developed for cutting purposes. It is a low-alloyed copper material based on technically oxygen-free copper added with tellurium or sulphur.

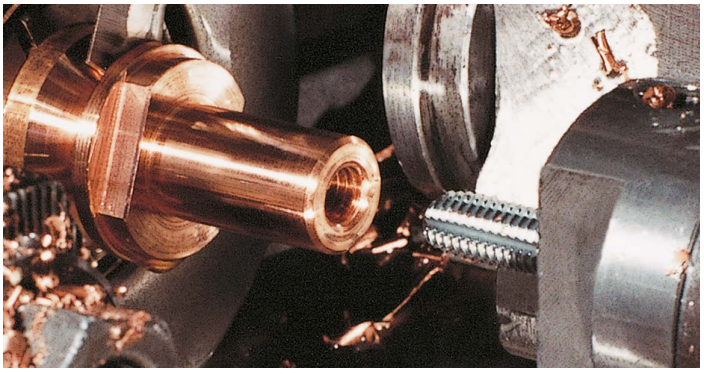
These additions considerably improve the cutting properties of copper without loss of its other typical properties, especially conductivity.

Because of its natural properties, copper is indispensable in many fields of industry and engineering. Pure copper, as commercially available, is of particular importance wherever material of high electrical and thermal conductivity is required. However, when it comes to machine cutting, this material shows difficulties. The extreme toughness of copper, which makes it eminently suitable for non-cutting processes proves to be a disadvantage. The reason is that the formation of long chips slows down the operation when drilling and turning, and results in rapid deterioration of cutting tools. When using CNC-control, and on conventional autolathes, the processing of pure copper is normally not efficient in terms of time, manpower and tooling.

OSNA-Cu 58® is a perfect combination that offers excellent cutting properties and high electrical and thermal conductivity. It produces chips which are short and fly off quickly – an important prerequisite for smooth and efficient subsequent processing, including work on CNC-controlled automatic lathes that require high-quality semifinished material.

Quality Management
To ensure this, KME quality management has been set up, implementing and certifying the row of DIN EN ISO 9001 by Lloyd's Register Quality Assurance.

KME has earned a reputation worldwide as a consistent supplier of high quality materials for many decades. It is our declared corporate policy to fulfil our customers' expectations of excellent products and service from KME.



OSNA-Cu58®
Applications

Drilling
For drilling, drills made of carbide or high-speed steel, as used for machining brass, have proved to be suitable. Small holes should be drilled with twist drills made from carbide with inner cooling, ensuring that the spiral flute is well polished to facilitate chip clearance.

For absolute precision and high surface quality (e. g. gas torch tips), reamers are recommended for the final cut. For larger holes the use of double cutting drills and tube bits is advisable. If a twist drill is employed for larger holes, a tapered chisel edge is normally used.

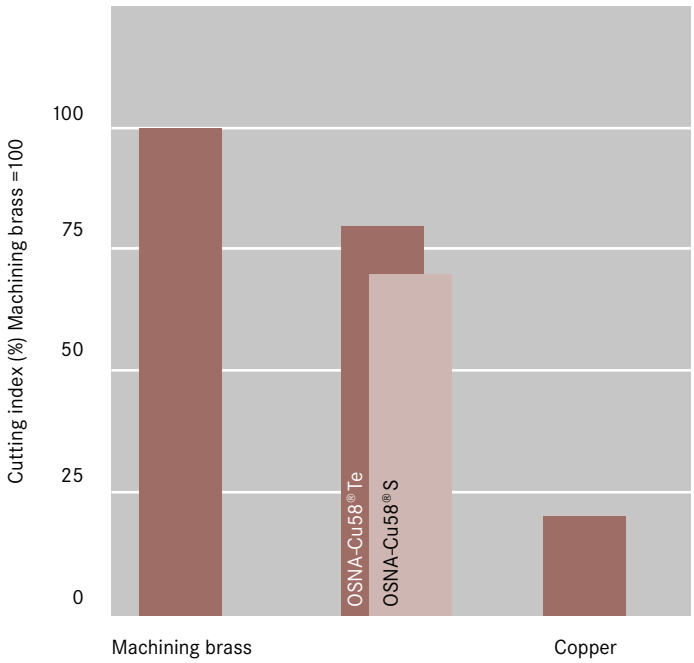
OSNA-Cu 58® can be drilled dry. However, a thorough coating with light cutting oil, as applied for turning, is indicated in order to minimise cutting tool wear. Feed should be constant and ensure that chips are removed from the hole.

To calculate optimal drilling conditions for OSNA-Cu 58® with twist drills, use the following reference values:

Angle of twist	24 – 40°
Clearance angle	12 – 15°
Point angle	118°
Tool rake	3 – 8°
Cutting speed	50 – 100 m/min.
Feed	0.03 – 0.5 mm/rotation

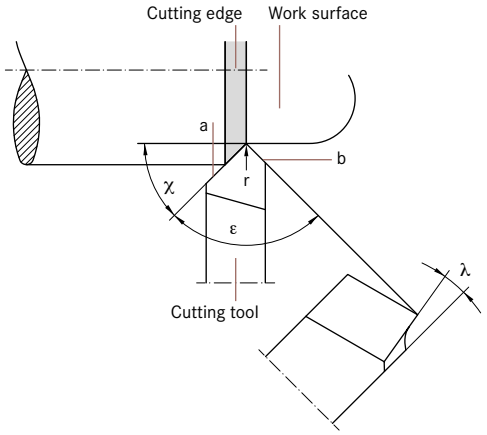
Cutting feed speeds depend in each case on drill diameter, thickness of workpiece and drill hole depth.

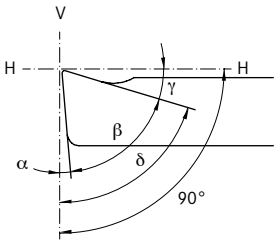
Cutting index of machining brass, OSNA-Cu58® and copper



Cutting
The OSNA-Cu 58® alloys belong to cutting class 1 with a cutting index of 70/80 (basis: machining brass = 100). The cutting properties of OSNA-Cu 58® S are marginally lower than OSNA-Cu 58® Te.

For gun drilling (e. g. nozzle holes) and other very complicated cutting work OSNA-Cu 58® Te is usually recommended.





α Clearance angle
β Wedge angle
γ Tool rake
δ Cutting angle
ε Point angle
χ Setting angle
λ Edge inclination – negative
a Major cutting edge
b Minor cutting edge
r Edge rounding off

H – H horizontal plane
V – V vertical plane

Thread cutting

The thread should be manufactured by rolling (hobbing) to avoid disrupting the material's grain structure. Furthermore, thread rolling improves the fatigue strength.

Thread cutting should be carried out at a medium cutting speed, with thorough cooling and lubrication with light cutting oil. High pressure cooling is recommended for removing swarf which would otherwise adhere to the cutting tool and damage the thread profile. For all copper, including KME OSNA-Cu 58® quality, coarser threading is recommended.

Note

When using the alloy OSNA-Cu 58® as a raw material for screws, notch sensitivity must be taken into account.

Turning

For turning OSNA-Cu 58®, the same carbide tools in CNC-controlled automatic lathes can be used as for machining brass. The use of carbide tools instead of self-hardening steel increases tool life and allows a considerably higher cutting speed. However, if the surface of the part has to be of high quality, self-hardening steel is prefered.

Turning data of OSNA-Cu 58®

Description	Hard Metal
Cutting speed Coarse turning (m/min) Finishing cut (m/min)	 100 - 240 150 - 300
Forward feed Coarse turning (mm/rot.) Finishing cut (mm/rot.)	 0,3 - 0,7 0,1 - 0,4
Tool rake γ	3° - 7°
Edge inclination λ Coarse turning Finishing cut	 1° bis 2° - 2° bis - 4°
Clearance angle α	4° - 8°

Various types of gas nozzles, nozzle holders and contact pins, shown in actual size

OSNA-Cu58®
The advantages

OSNA-Cu 58® is available in two different versions: **OSNA-Cu 58® Te (CuTeP)** and **OSNA-Cu 58® S (CuSP)**. Both versions are of excellent quality and meet today's requirements for machining copper. Besides outstanding cutting properties and very good conductivity, these requirements include:

- Constant high quality guaranteed through our comprehensive quality assurance system.
- Absolute precision for automatic processing.
- Bright surface.
- Tolerances, which, on request, can be tighter than the EN/ASTM stipulates.

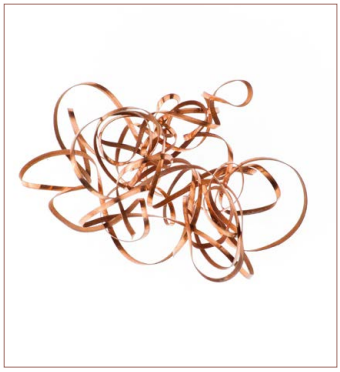
KME not only offers a range of standard sizes available immediately from stock but also a wide range of non-standard sizes that exceed EN/ASTM requirements.

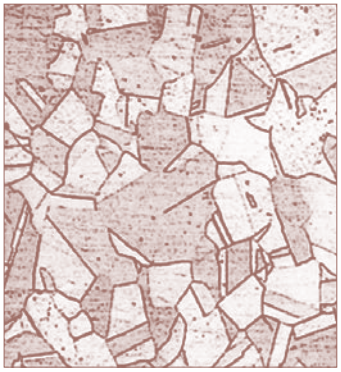
We are able to supply material to all national and international standards and offer our customers the benefits of our qualified technical expertise.

OSNA-Cu 58® has achieved an excellent record in many areas of industry. It is ideal for the economical manufacture of:

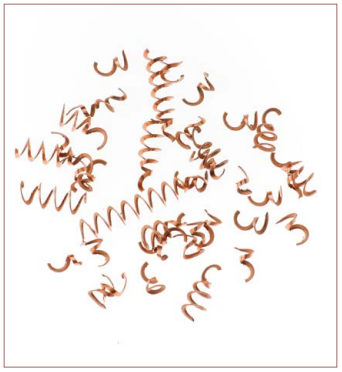
- Bases for diodes and thyristors.
- Torch tips in gas welding.
- Screws, nuts, contact and fixtures in electrical engineering.
- Miniature plug-and-socket connectors and other small parts in electronics.
- Screwed pipe connections, cut fittings and similar parts when used instead of machining brass in cases where higher corrosion resistance is required.

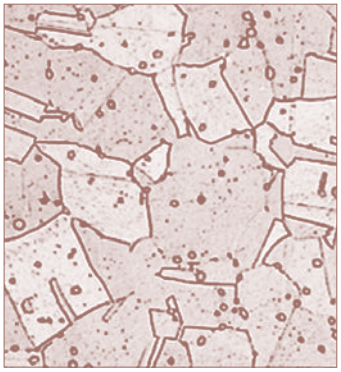
Copper grain structure





OSNA-Cu58® grain structure





OSNA-Cu58®
Physical data and technical information

Machining
If the chip removal rate of machining brass (CuZn 39Pb3) on autolathes is taken to be 100 for the purpose of comparison, then the cutting properties of OSNA-Cu58® Te are 80 and with OSNA-Cu58® S 70, while unalloyed copper only reaches an evaluation figure of 20. The bar chart shows the excellent machining properties of OSNA-Cu58® compared with copper and relative to machining brass.

Scrap disposal
When working with OSNA-Cu58® Te (copper tellurium), great care must be taken to strictly segregate copper tellurium scrap. Tellurium copper scrap should not be mixed with normal unalloyed copper scrap as it makes it unusable in the recycling furnace.

Plating
For certain applications, finished products made of machining copper have to be galvanically coated with silver, nickel, gold, etc. Various types of copper behave differently in the electrolyte:

OSNA-Cu 58® Te
In some electrolytes, such as silvering baths, the deposit turns black. This discoloration can be avoided by galvanic pre-coppering of the part, whereby the copper coating must be free from pores. This can be achieved by using suitable electrolytes (e. g. bright copper bath) at approx. plating thickness of approx. 15 µm.

OSNA-Cu 58® S
This copper material is also liable to blackening of untreated parts in silver baths. This can also be avoided by galvanic pre-coppering, as with OSNA-Cu58® Te.

Cold and warm forming
As OSNA-Cu58® alloys have been especially developed for machining applications, its cold-forming properties are inevitably slightly reduced. However, the cold-forming properties of OSNA-Cu58® still compare favourably with other copper alloys.

In soft-annealed condition, 40% forming is still possible. For a greater degree of forming, intermediate annealing is recommended.

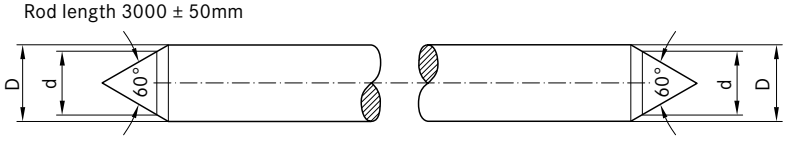
Even in half-hard condition, OSNA-Cu58® can be cold formed. This condition is therefore preferred for parts which require not only machining but also a certain degree of cold hammer forging.

OSNA-Cu58® Te and OSNA-Cu58® S are excellent for hot-forming. All common hot-forming processes are possible within a temperature range of 750 - 875° C.

Soldering and welding
OSNA-Cu58® materials are suitable for soft and hard soldering. It has better mechanical properties at high temperatures than standard Cu-ETP/C110 copper. This is advantageous for soft-soldering. If done properly, cold-formed OSNA-Cu58® can be soft-soldered without significant loss of hardness. To soft-solder, use lead and tin solder. Silver-solder is recommended for hard soldering. Welding of OSNA-Cu58® is not recommended. The welding seam easily becomes porous or vulnerable to cracks. Therefore welding should be avoided wherever possible.

The High Performance Rod HPR
HPR OSNA-Cu58® special rods are excellent for magazine feeding into autolathes because of their tight diameter and length tolerances. The ends are finished to allow easy feeding. Round rods with a tolerance of ISO h 9, and a closer straightness tolerance can be produced to order.

Finishing of rod ends



Chamfered end
Ratio of diameter:
d:D = 0.85-0.95

Pointed end
Ratio of diameter:
d:D = 0.6-0.8

OSNA-Cu58®
Material comparison

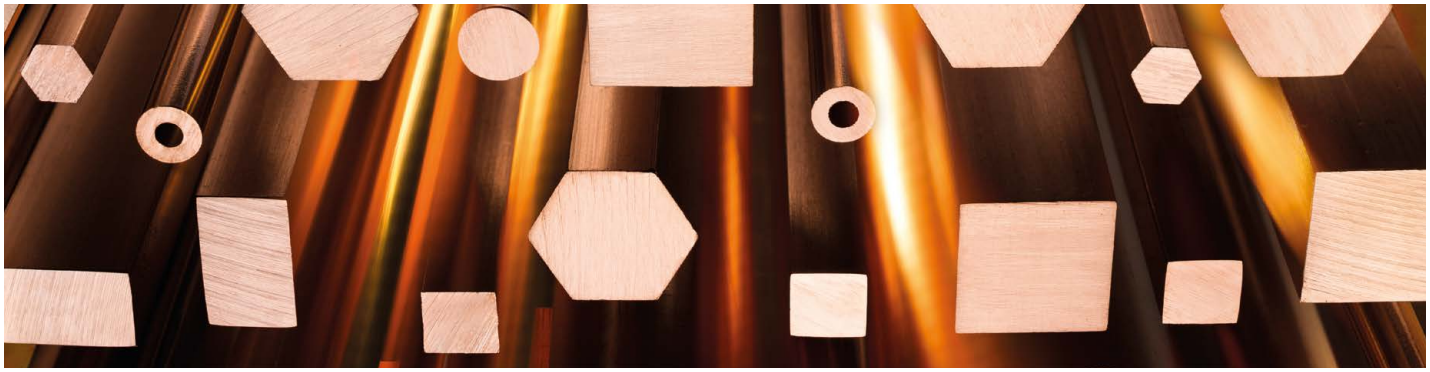
Material comparison		OSNA-Cu58® Te (CuTeP)	OSNA-Cu58® S (CuSP)	Cu-HCP
Cutting properties (mean) machining brass = 100		80	70	20
EN 12164 – EN 12166 – EN 12168		CuTeP – CW118C	CuSP – CW114C	CW021A
ASTM: (B 301)		C 14500	C 14700	C 10300
Recrystallisation temperature °C Soft annealing temperature °C		~ 520 600 - 650	~ 430 500 - 600	~ 350 (Cu-ETP ~ 200) 450 - 600
Cold forming properties Hot forming properties		good good	good good	very good very good
Soft-soldering Hard-brazing		very good good	very good good	very good very good
Gas welding TIG welding MIG welding		poor medium poor	poor medium poor	very good very good very good
Resistance spot welding and seam welding Resistance butt welding		bad moderate	bad moderate	bad very good
Corrosion resistance		good	good	good
Density at 20° C	g/cm³	8.9	8.9	8.9
Melting point (liquidus)	°C	ca. 1075	ca. 1075	1083
Mean linear coefficient of expansion 30 - 300° C	10^{-6}/K	18.0	18.0	17.6
Electrical conductivity at 20° C Soft temper	MS/m	≥ 50 (86 % IACS)	≥ 50 (86 % IACS)	≥ 57 (98% IACS)
reference values Heat conductivity at 20° C Specific heat at 20° C Young's modulus Modulus of torsion	 W/(m·K) J/(kg·K) MPa MPa	 356 380 100,000 35,000	 356 380 100,000 35,000	 390 380 100,000 35,000
Magnetic behaviour		non-magnetic	non-magnetic	non-magnetic

Product range

Product range and properties (according to EN 12164 – EN 12166 – EN 12168)
OSNA-Cu 58® Te (CuTeP) and OSNA-Cu 58® S (CuSP)

Type of product	Material condition	Dimension diameter, across-flats mm	Tensile strength R_m (min.) MPa	0.2 % proof strength $R_{p\,0.2}$ (min.) MPa	Elongation A_5 (min.) %	Brinell hardness approx. HBW 2.5/62.5
Rods and wires *(up to max. 100 mm hex.)*	extruded M	7.1-150[1] ≤ 140[2]	no prescribed mechanical properties			
	R250 R300 R360	≤ 130[2] ≤ 50[2] ≤ 20	250 300 360	180 240 300	7 5 -	90 100 110
round, square, hexagonal *(square + hexagonal rods up to max. 100 mm)*	hammer-quality[3]	≤ 12 > 12 – ≤ 30 > 30 – ≤ 140	250 - 300 240 - 290 240	200 180 180	10 15 20	65 - 85 65 - 85 ≥ 60
Tubes, also round core with profiled exterior	M	∅ 9 - 100 wall thickness 2 - 12 depending on ∅	no prescribed mechanical properties			
	H080		-	-	-	80 - 130
Profiles [3]	on request	on request				

1) Wires up to 25 mm, rods above 150 mm on request 2) Above 25 mm only in form of rods 3) Not in EN range



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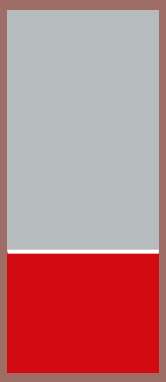
Special Products



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