



CUSTOMIZED METAL STRIP PRODUCTS

manufactured with world-wide
leading strip technologies

» established in OEM series

» made of copper, aluminium,
steel and as material
compounds



IAA»
MOBILITY

Please visit us at the
IAA Summit in Munich
from 09th to 12th September
Hall B3 Stand E10



laser
welding



cold
rolling



heat
treatment



surface
finishing



edge
treatment



profile
technology



„Opposites attract.“ Innovative strip products with different material properties in a single strip.

voestalpine Precision Strip is a pioneer and trailblazer for laser welding technologies. For more than 40 years we have been the world's largest manufacturer of bi-metal strips, and a strategic key supplier to the world's leading metal saw manufacturers.

With our established longitudinal laser welding processes we connect different strip steels into a single inseparable unit with faultless, first-class weld seams that can then be further processed.

A significant benefit arises from connecting different strip materials: The combination of different material parameters in one strip makes savings possible in the following work steps, such as welding, soldering, fixing or riveting and furthermore leads to improved mechanical characteristics and savings in materials and weight.

CUSTOMER BENEFITS

- » Combining multiple materials into one welded strip
- » New opportunities for stamped components
- » Delivered as a coil with outer-diameter up to 1400 mm
- » Optimising subsequent processing steps, e.g. no welding, soldering or riveting operations required
- » Material savings giving savings in weight and costs

OPPOSITE PROPERTIES

| | |
|-----------------------------|--------------------------------------|
| soft | hard |
| standard material | highly alloyed material |
| economical | high value |
| magnetic | non magnetic |
| good electronic conductor | poor electronic conductor / isolator |
| good thermal conductor | poor thermal conductor / isolator |
| high spring tension | low spring tension |
| corrosion or acid resistant | not corrosion or acid resistant |

SPECIAL NON-FERROUS METAL STRIPS FOR ELECTRONIC APPLICATIONS



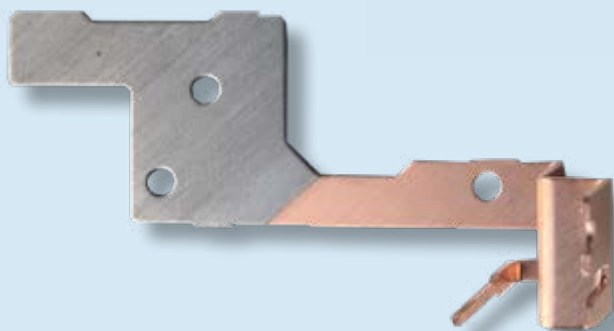
E-Mobility is on everyone's talk nowadays. In the coming years motor cars should turn away from using the combustion engine in favor of electrical engines. One thing is certain, electrification cannot be halted – on the one hand sensor technology in motor cars is multiplying, with stronger 48 Volt on-board power supply networks amongst other things. On the other hand strong currents must be carried in the framework of the completely new drive concept.

In both cases we believe that our special metal strips can be the intelligent and efficient solution for component construction in electronics.

APPLICATIONS

- » Lead frames
- » Plugs, plug sockets
- » Clamp connections
- » Press-fit zones
- » Stamped and stamped/bent components
- » Power electronic parts, e.g. semiconductors, transistors, IGBT

„Our laser-welded strips are used as a series product in the battery technology of well-known OEMs, both in cars and eBikes.“



STAMPED AND BENT PARTS

APPLICATION CONNECTORS WITH PARTICULAR PROPERTIES

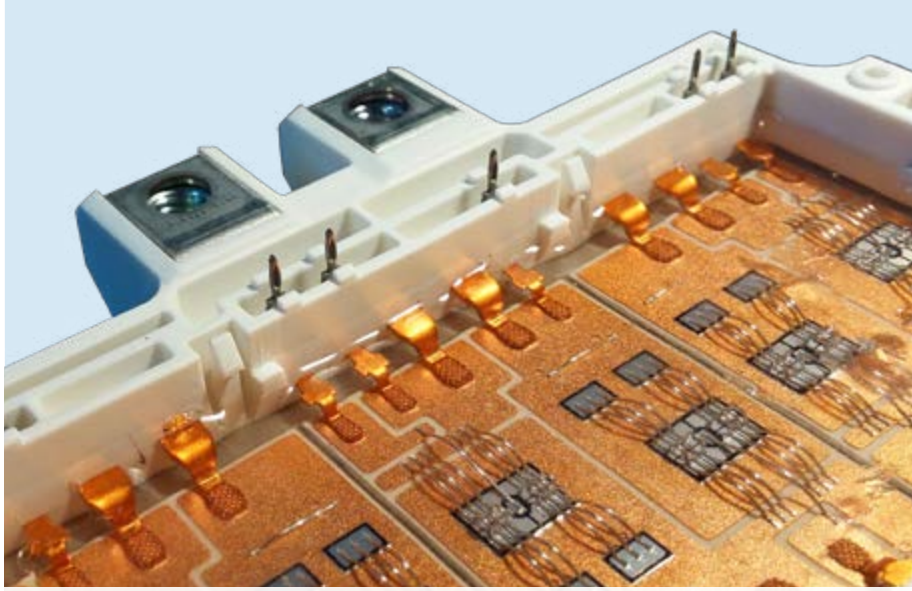
Utilizing the advantages of steel. By combining copper materials with copper alloys or steel we can provide structural components with the opportunity of integrating the advantages of steel. Certain steel grades have a considerably higher degree of hardness or elasticity compared to copper, and these can be used above all in the fields of electrical plug-in connections or spring contacts. Over and above, combining a corrosion-resistant or acid-resistant steel into a welded strip makes uses in more demanding environments possible, such as for example in the field of automotive fuels or exhaust areas.

Our special strips can be manufactured with an even thickness throughout or also with a welded step. Both flat as well as stepped strips are rolled again, so the weld seam is levelled off and flattened down. With relatively similar hardness of the components, a higher degree of forming is also possible. In this case, the weld seam disappears completely visually and is often only recognisable via the colour gradient.

APPLICATION FIELDS

- » Automotive
- » Power electronics
- » Power train
- » Electrical supply
- » Aerospace
- » Welding processes

| | |
|---------------------------|------------------------------|
| Strip thickness | 0.40 mm to 2.00 mm |
| Strip thickness with step | one component up to 4.00 mm |
| Strip width | up to 120.00 mm welded strip |
| Welding seam | cold rolled, levelled |
| Optional surface | brushed, slightly oiled |



POWER ELECTRONICS

APPLICATION PRESS-FIT-ZONES AND ULTRA SONIC WELDING

For the field of power electronics. Laser welded strips unite two opposing characteristics – for the one part with a high degree of hardness, for the other part with a very low degree of hardness. The copper alloy with a high degree of hardness and rigidity (e.g. CuNiSi or CuNi3SiMg) fulfils the requirements of press-fit zones and is combined with pure copper for ultrasonic welding processes with a reduced stress loading on the substrate (DCB) and higher processing security.

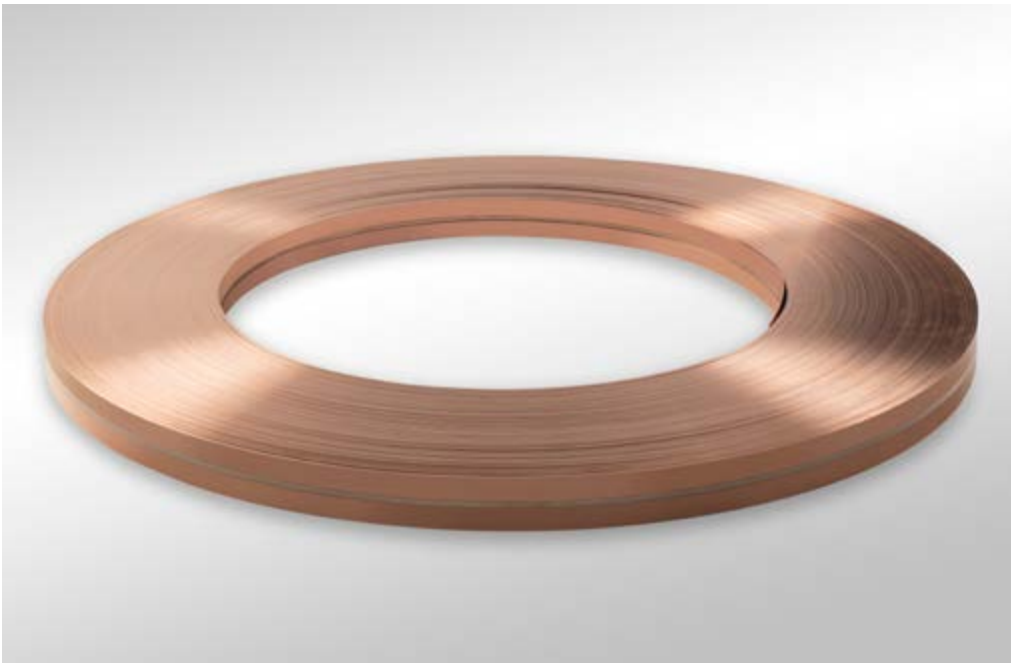
APPLICATION FIELDS

- » Power electronics
- » Semiconductors
- » Transistors



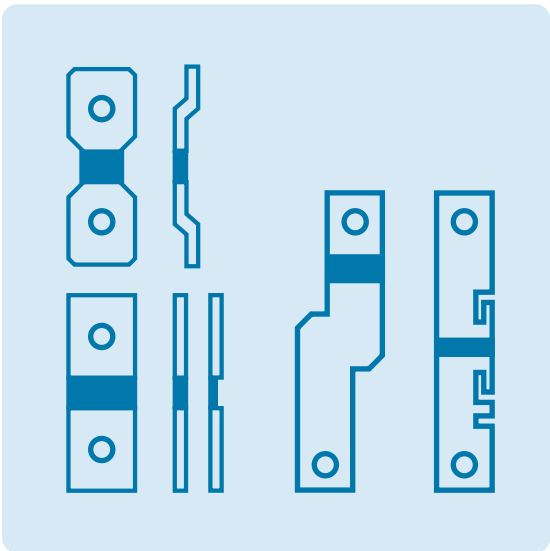
| | |
|---------------------------|-------------------------------------|
| Strip thickness | 0.40 / 0.60 / 0.63 / 0.80 / 1.20 mm |
| Strip thickness with step | one component up to 4.00 mm |
| Strip width | up to 120.00 mm welded strip |
| Welding seam | cold rolled, levelled |
| Optional surface | brushed, slightly oiled |

APPLICATION SHUNTS FOR POWER MEASURING IN HIGH-QUALITY SECTOR



voestalpine Precision Strip GmbH acts as an independent supplier of welded strips for the production of shunts. Due to the world market leadership in saw bimetal strip production, we have a number of laser welding lines and thus sufficient capacity in the production of NEM special strips for shunts.

In general, special strips can be produced flat, and so with all components in equal thicknesses or with a welded step. It makes no difference whether the component with the lower strength is in the middle or at the edge.



Illustrations of welded and stamped shunt components

APPLICATION FIELDS

- » Automotive
- » Power electronics
- » Power train
- » Electrical supply
- » Aerospace
- » Welding processes

MATERIAL

- » Copper Cu-HCP/PHC or Cu-OF
- » Copper - resistance alloys
(Copper-manganese-nickel-alloy (e.g. Resistan © Wieland, Manganin © Isabellenhütte, NICLAL43 © LeBronze)
- » other resistance alloys on request

| | |
|----------------------------|-------------------------|
| Thickness resistance alloy | 0.35 mm to 1.50 mm |
| Thickness copper | 0.40 mm to 2.50 mm |
| Width welded strip | up to 120.00 mm |
| Optional surface | brushed, slightly oiled |



MATERIAL- COMPONENTS FOR SPECIAL BI-/TRIMETAL STRIPS

A wide range of material components are available for our welded multi-material strips, which can be freely combined with each other.

The table shows an extract of materials, that have already been welded with positive results on our welding lines. Further materials are available on request.

STEEL

- » Carbon steels
- » Spring steels
- » Corrosion resistant steels

COPPER

- » Copper
- » Copper alloys
- » Copper resistance alloys

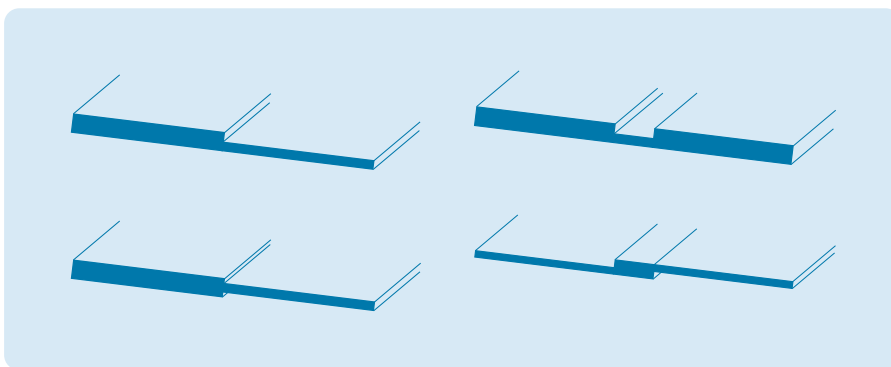
| | EN | UNS | BOEHLER-No. |
|--|------------------|-------------|-------------|
| Cu-OF | CW 008 A | C10200 | C008 |
| Cu-OFE | CW 009 A | C10100 | C009 |
| CU-OFE (DCB-Grade) | CW 009 A | C10100 | C009 |
| Cu-PHC | CW 020 A | C10300 | C020 |
| Cu-HCP | CW 021A | C10300 | C021 |
| | | | |
| CuFe2P | CW 107 C | C19400 | C107 |
| CuNiSi | CW 109 C | C19010 | C109 |
| | | | |
| CuSn0,15 | CW 117 C | C14415 | C117 |
| CuSn4 | CW 450 K | C51100 | C450 |
| CuSn6 | CW 452 K | C51900 | C452 |
| CuNi3SiMg | n.g. | C70250 | C250 |
| CuMn12Ni2 | n.g. | n.g. | C362 |
| CuCrSiTi | n.g. | n.g. | n.g. |
| | | | |
| | DIN Material No. | DIN No. | BOEHLER-No. |
| Steel - austenitic, corrosion resistant | 1.4301 | X5CrNi18-10 | A500 |
| Steel - austenitic, corrosion resistant | 1.4310 | X10CrNi18-8 | A520 |
| Steel - ferritic, corrosion resistant | 1.4509 | X2CrTiNb18 | N109 |
| Standard carbon steel | 1.0338 | DC04 | Q327 |



RANGE OF DIMENSION & TECHNICAL POSSIBILITIES

Laser welded coil Cu-HCP
with austenitic spring steel

| | |
|--|---|
| Thickness of welded strip | up to 2.00 mm |
| Thickness of welded strip with step | up to 4.00 mm thin strip up to maximum 2.00 mm |
| Width of welded strip | up to 120.00 mm |
| Coil inner-Ø | Standard = 400 mm or 500 mm |
| Coil outer-Ø | up to 1400 mm |
| Specific coil weight | up to 10 kg/mm |



Example of cross-sectional
representation of welded
seams, also in combination
with profiled strips.

CHARACTERISTIC OF WELD SEAM ALL PARAMETERS WELL IN HAND

We must pay attention to two factors during the welding process:

1. Applying optimum parameters for the highest quality weld seam for the combination of materials on hand
2. Securing the continuity of the process

Comprehensive measures have been developed and taken for both factors. These ensure that we are able to provide a meaningful guarantee for the quality of the weld seam.

The individual components are matched to each other in terms of length in order to produce rings of maximum size with the highest possible utilisation of material. In this process, strip welding joints are marked according to customer specifications.

Our quality laboratories examine each order in detail to make sure the manufactured product fully matches the customer specifications:

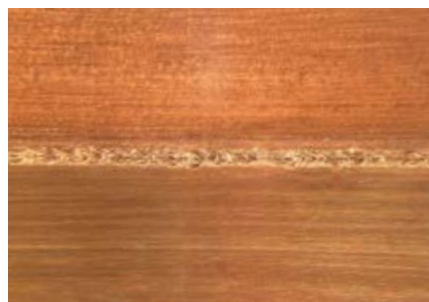
- » Metallurgical batch identification of raw materials using a spectrometer
- » Dimensional testing – by random sampling as well as online in the production process
- » Mechanical testing: bending tests with a 1.00 mm radius, 90° angle, hardness tests, tensile samples...
- » X-ray examination of weld seams for porosity
- » Hardening proof tests



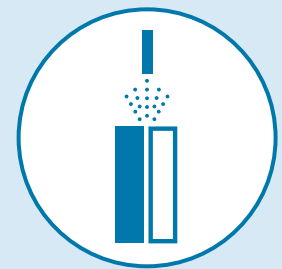
Polished sample of weld seam of copper-steel-combination



Longitudinal and cross-ways **bending tests** of the weld seam, radius 1.00 mm, 90° angle



Optical 100%-inspection of welding seam Cu-HCP and CuSn6 with support by eddy-current testing



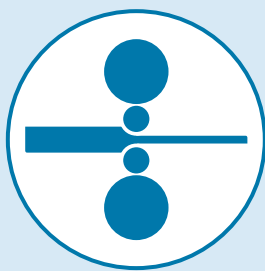
LASER WELDING

The company voestalpine Precision Strip is one of the pioneers of welding technology, and we are development partners for renowned European laser manufacturers.

As a leader in the global market for laser welded strips for the metal saw industry, we produce thousands of tonnes of laser welded strip each year and do so with equipment and technology we have developed in our own company, manufactured and optimised right down to the smallest details.

The wide range of machines and technologies leads to the required flexibility of setting all parameters for every customer order in the best way. And this is not only necessary for the welding process. Especially the know-how in the preparation and post-processing of the material ensures the production of a high-quality product.

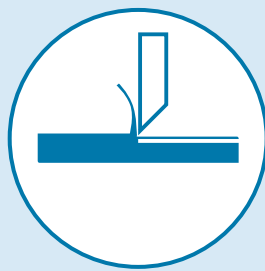
STRIP PRE- AND POSTPROCESSING MORE THAN ONLY „WELDING“



COLD ROLLING

The cold rolling process for steel has been one of the core competences in our company for as long as we can remember. This competence can now also be used for non-ferrous metals. We can precisely set the width of strips in our cutting plant. In plain English, we can prepare the source materials in advance for many target materials, and by doing so we have recourse to large coils and thus have significantly more independence from individual suppliers.

Over and above this, our rolling technology makes so-called „dressing“ of strips possible, i.e. the weld seam is levelled off and flattened following welding. With materials of a similar hardness, we are even able to re-shape them by up to 30% to 50%. The location of the weld seam can then only be detected by different strip colours.

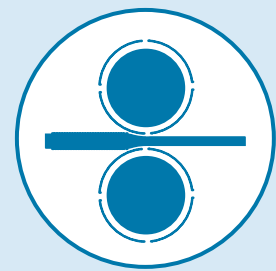


EDGE TREATMENT

A welding process will achieve the highest quality result if the strip edges of components were prepared with maximum precision. And only in this way precise strip positioning is possible, permitting a continuous and stable welding operation. Our specialist machine operators have developed this process over decades and are continuing to optimise it to this day.

We guarantee an optimum working life for the weld seam through our use of automated, high-precision strip-positioning, that ensures a continuity of absolutely centered material welding throughout the entire welding process.

We have also developed this technology in-house and from our current point of view had the head start for many decades.



SURFACE FINISHING

We have further options in a number of technologies for surface finishing:

- » brushing or polishing
- » grinding
- » surface re-structuring through cold-profile-rolling



ALUMINIUM- COPPER- SPECIAL STRIP

The copper-aluminium connection, for various applications in the electronics sector, produced in a combination of two proven processes: roll cladding and laser welding. This has two decisive advantages!

Battery technology is one of the rapidly growing industrial sectors. And if you work in this field, sooner or later you'll come across the necessary combination of aluminum and copper – whenever battery cells have to be connected to each other.

In contrast to steel-copper or copper-copper connections, conventional connection technologies cannot be used without restrictions. In the plating process, hardness limits are reached relatively quickly. In the welding process, intermetallic phases act as obstacles to the flow of electricity.

We have developed a process that eliminates both technical limits.



POSSIBLE APPLICATIONS

- » Battery connector or battery measurement tap in the field of electromobility
- » Thick wire bond surface for electronic components without AlSi coating
- » Aluminium cables or cable lugs in the field of electromobility

BENEFITS

- » Qualitative and permanent connection of copper and aluminium in one strip/coil
- » Connection especially with harder copper alloys such as CuSn6 or CuNiSi-defined hardness
- » Available in small quantities for samples from 50 kg



BATTERY CONNECTOR

FOR LOW CURRENTS AND COMPLEX APPLICATIONS

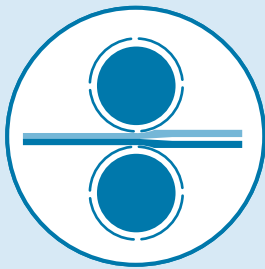
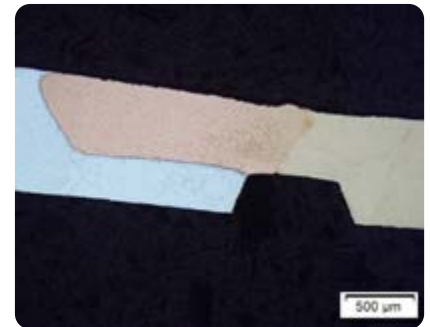
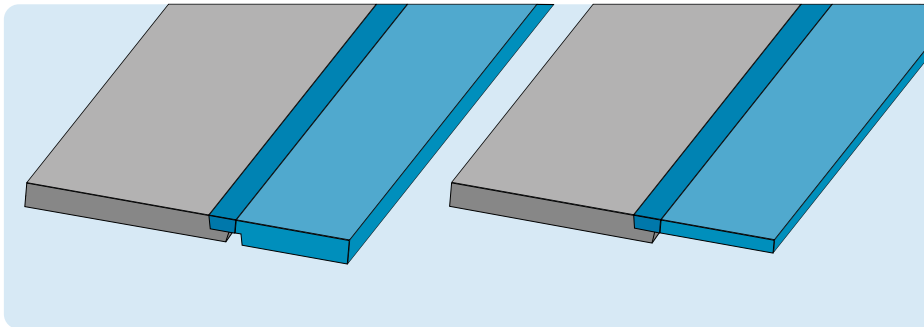
PRESS-FIT ZONES & WIRE BONDING

Material selection with harder copper alloys e.g. CuNiSi or CuSn6

While the cladding process is limited to the use of soft materials, hardness plays a subordinate role in the welding process. This means that the strength can be defined independently of the pre-clad strip and is no longer influenced until the finished strip is produced.

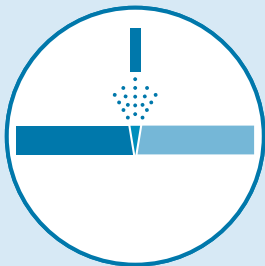
Detail of connection point:

Aluminium Al99.5 with the clad copper Cu-HCP and the welded-on alloy CuSn6. Due to the process, a groove is created on the underside between the aluminium and copper. This prevents the formation of an Al-Cu mixture during welding, which would result in intermetallic phases.



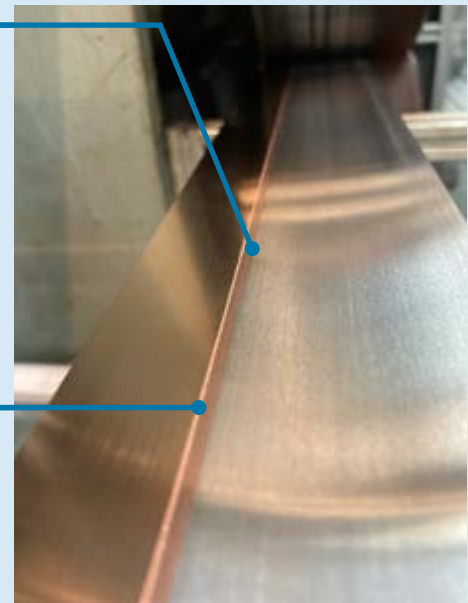
Step 1: Roll cladding

Several copper strips are longitudinally plated into an aluminium backing strip to a material composite that can no longer be separated. This strip is then cut in the middle of the clad strips.



Step 2: Laser welding

In the second step, another copper strip in any alloy can be welded to the clad copper material. A material composite of aluminium and copper (alloy) is created, without intermetallic phases or resistances that would occur with direct welding.



FOR HIGH-CURRENT APPLICATIONS BUSBARS

Excellent electrical and mechanical properties for thicker strips > 3 mm

Busbars for power transmission in electric vehicles or stationary energy storage systems are becoming increasingly important. Reliable joining solutions for aluminium-copper strips with higher material thicknesses are particularly in demand.

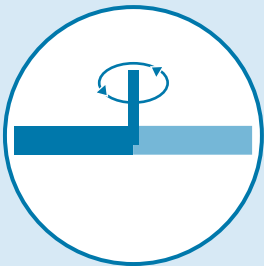
Friction stir welding: precise and robust

In friction stir welding, the materials are plasticised by frictional heat and form-fit welded together. The process is particularly suitable for

- » Non-ferrous metals with a low melting temperature
- » Mixed connections such as aluminium-copper



Now available in rods in standard dimensions. Also available in small and sample quantities!



Post-processing for the highest requirements

The weld seam is clearly visible after joining. Depending on customer requirements, there are two options for post-processing: milling or cold rolling the strip

Delivery form

Due to the thickness of the strip, delivery in coils is not possible. Delivery is therefore made in bars or as finished individual parts in pieces

PRODUCT DIMENSIONS & MATERIALS

| | Cladding / Laser-welding | Friction stir welding*) |
|----------------------------------|------------------------------|-------------------------|
| Thickness Aluminum | 0.60 mm bis 1.50 mm | 1.50 mm bis 5.00 mm |
| Thickness Copper / Copper Alloys | 0.35 mm bis 1.50 mm | 1.50 mm bis 5.00 mm |
| Width of the whole strip | bis zu 120.00mm | 80 mm bis 400 mm |
| Surface (optional) | slightly oiled | milled or cold rolled |
| 1. Component | Al99,5 + Cu OF edge cladding | Al99,5 |
| 2. Component | Cu PHC | Cu PHC |
| | CuNiSiCuSn6 | CuSn0,15 |
| | CuSn6 | |
| | CuCrSiTi | |
| | CuNi3SiMg | |

PROFILED STRIP STEELS IN STEEL, COPPER, AND ALUMINIUM

Profiles, outside the rectangular cross-section, with grooves, steps or elevations - with two fundamentally different production processes, either cold-rolled or by a machining process.

Due to our extensive possibilities in strip processing and the high vertical range of manufacture, we can respond flexibly to the application or the product requirement. This not only offers technical advantages, but can also have a very positive effect on output, material use and thus on the efficiency of the project.

The dialogue with the customer, even at the development stage, is decisive for the successful completion of a project. As a specialist in belt production, we can look back on decades of experience and, in conjunction with the technological possibilities, we find the right combination of these.

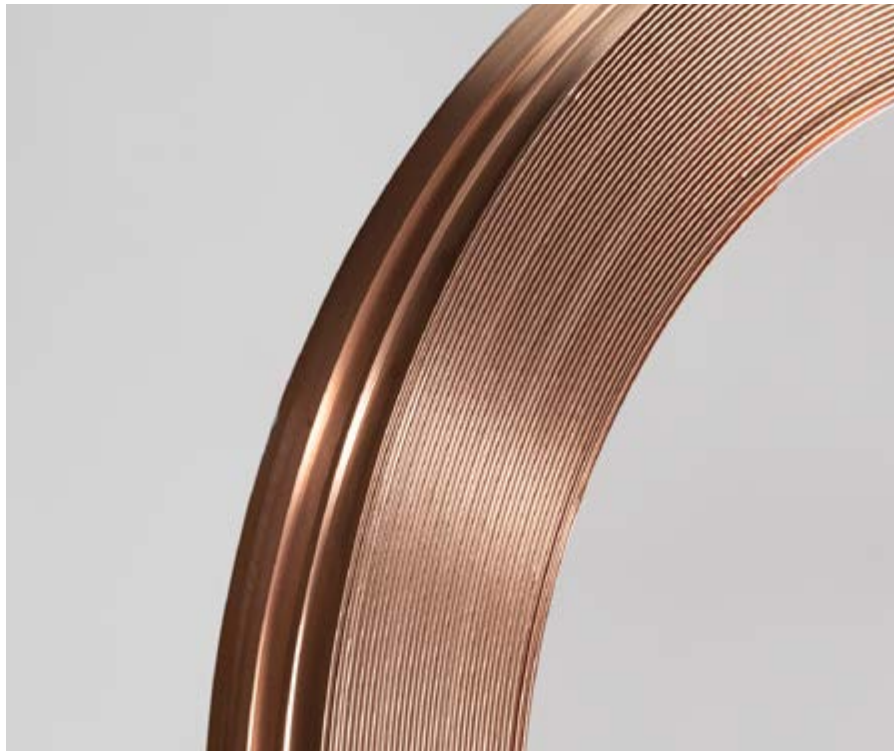


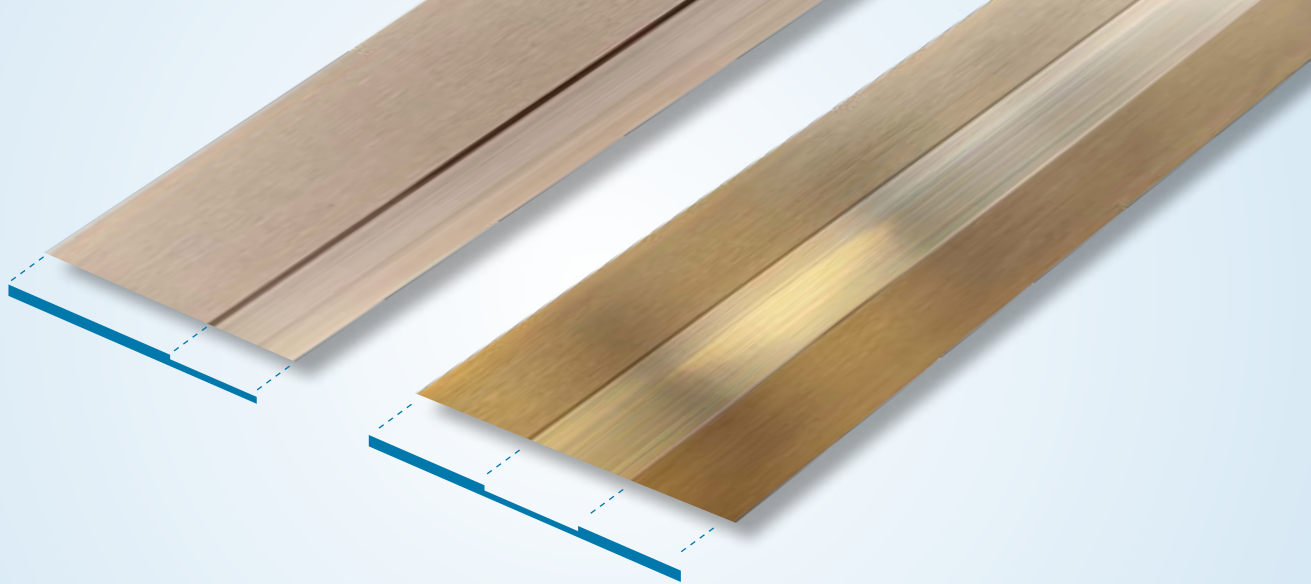
BENEFITS

- » Consistently high, homogenous quality throughout strip fabrication lines
- » Resistance to creaking and wearing at the edges
- » Delivered as a coil

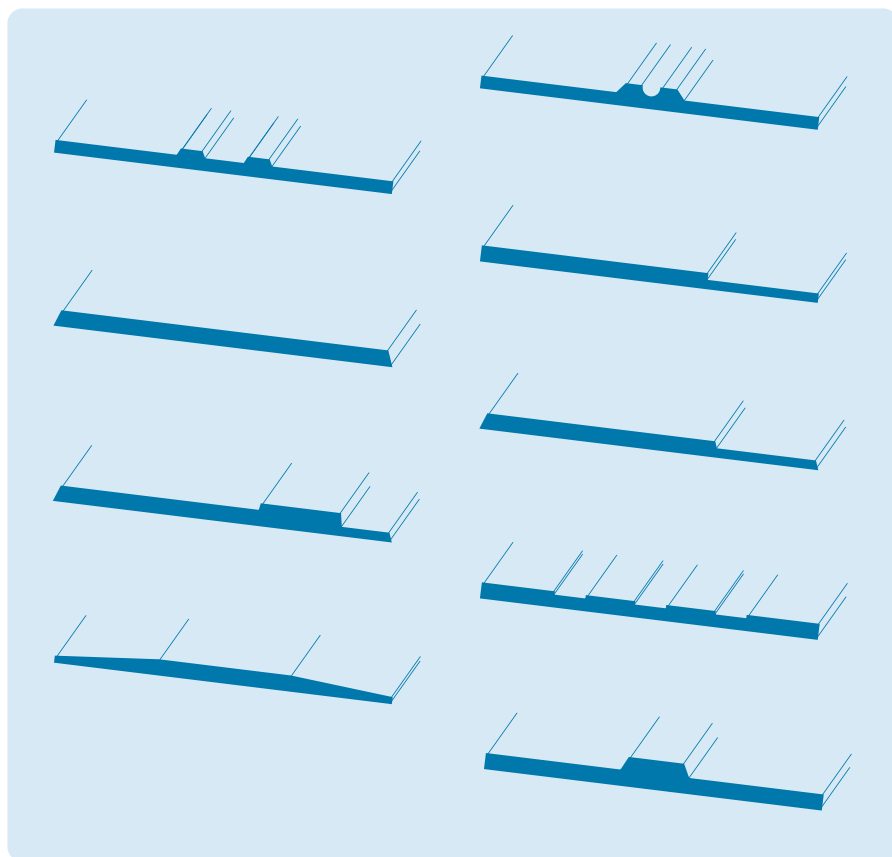
MATERIALS

- » Profiled shapes for the widest variety of **steel grades**, (tool steels, carbon steels, corrosion-resistant chromium steels, austenitic steels...)
- » **Non-ferrous metals**, predominantly copper, copper alloys, aluminium, aluminium alloys





| | |
|----------------------------|-----------------------------|
| Profile thickness | 0.30 mm to 6.00 mm |
| Profile width | 6.50 mm to 250.00 mm |
| Ratio of width - thickness | 8:1 (= flat strip) |
| Optional surface | brushed, slightly oiled |
| Coil inner-Ø | 400 mm = Standard or 500 mm |
| Coil outer-Ø | up to 1400 mm |
| Specific coil weight | up to 10 kg/mm |



Examples of profiled strip products, made both from steel and also from non-ferrous metals

The company voestalpine Precision Strip is a manufacturer of cold-rolled steel and non-ferrous-metal-strips meeting the highest quality standards available. With our production and distributions companies in Austria, Sweden and United States as well as our sales subsidiaries in the China and Spain we employ 1300 people and export our products for more than 400 Mio € to over 85 countries worldwide. Since 2007 our company is a 100% subsidiary of the voestalpine AG.

WE ARE LOOKING FOR THE EXTRAORDINARY

The company voestalpine Precision Strip is the specialist for cold-rolled strip steels and non-ferrous-metals for special applications. The vertical range of manufacturing goes way beyond classical manufacturing technologies, such as rolling, annealing, hardening and tempering.

A large number of additional manufacturing technologies are available, in particular for processing coils. We see the combination of these technologies and the manufacture of innovative product solutions arising from this as our core competence.

Over and above this, we are partners for new developments as well as being metallurgical consultants. Through intensive research in our laboratories and state-of-the-art quality management we are in a position to make recommendations on materials for a wide variety of customer application.





OUR SPECIALITY EXPERTISE AND OPTIMISATION

We not only guarantee the quality to our customers but place an emphasis on also being stable and reproducible from delivery to delivery. We built long-term relationships with our customers over many years, always with the same objective: Special niche products to precise dimensions, optimum mechanical properties delivering economic benefits.

Economic benefits are achieved through optimising the process chain:

Our well grounded, extensive metallurgical skill base and know-how of our customer applications often leads to a target-oriented recommendation

Combining many different production technologies will create a decisive advantage – especially with demanding customer requirements



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