Let's Braze Together!

Brazing basics, materials, solders, fluxes
Brazing what and how – a concise overview for you!

Contents

1. Basics and terms
2. The right application
3. What do I braze with what?
4. Who we are

Twice as helpful.
This booklet has two purposes. First, it offers brazing newcomers insight into the world of brazing and its terms. Second, it is a small, compact reference guide for brazing experts, letting them quickly see which brazing solders and fluxes are best to use with which metallic materials.

Brazing experts around the world see red – and they’ve been turning to that colour for more than 50 years. A fact that pleases us since red is the colour of our product brand Fontargen Brazing. At the end of this booklet, we give you a brief introduction to us and our company voestalpine Böhler Welding.

We wish you much success with this brazing booklet.

Mr. Braze
Why brazing?

Using brazing to join metallic materials has certain advantages:

» The joint strength can match or exceed the strength of the base material
» Brazing is production-efficient and cost-effective
» The working temperature is lower than when welding, minimizing component deformation
» Different base materials can be joined
» Thin and thick-walled components can be joined
» Small and wide gaps can be filled
Brazing is a process in which two or more items (usually metal) are joined together by melting and putting a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal. Brazing differs from welding in that the solidus temperature of the base material is not reached. Brazing, or hard soldering, is when the working temperature of the solder is above 450 °C. Soldering, or soft soldering, is when the temperature is below 450 °C.

Solders join the base materials and consist of alloys that melt easily (e.g. silver, copper, zinc, tin / L-Ag55Sn) or pure metal (e.g. copper). Melting range: from when melting starts (solidus temperature $T_s$) until the solder is completely liquid (liquidus temperature $T_l$). Working temperature $T_w$: lowest surface temperature needed for the solder to wet the base material joining surfaces.

Brazing fluxes in accordance to DIN EN 1045 (DIN 8511) are nonmetallic materials, e.g. silicates, carbonates, borates, chlorides, and fluorides. Their task is to:
- prevent additional formation of oxide on the component surface during heating;
- reduce the oxide before the solder melts;
- eliminate oxide during soldering and preventing it from reforming;
- minimize the surface tension of the melted solder to improve the flow over the base material (known as wetting).

Fluxes for brazing heavy metals:
These are known as type FH. They mainly consist of boron compounds and fluorides. The groups of numbers from 10 to 40 regulate the working temperature range and the corrosiveness. Examples:

- Type FH10
  Working range 550°C to 800 °C; application: silver-based brazing solders. The residues are corrosive and must be removed.

- Type FH21
  Working range 750 °C to 1100 °C; application: brass and German silver brazing alloy solders. The residues are not corrosive and can remain on the component.

Fluxes for brazing light metals:
The type FL class encompasses two types of fluxes that work above 550 °C and are used to braze aluminum.

- Type FL10
  Contains hygroscopic chloride. The residues are corrosive and must be removed.

- Type FL20
  Does not contain hygroscopic chloride. The residues are not corrosive and can remain on the component.
Chapter 2

The right application

When brazing metallic materials, many factors are important: the right solder, the right flux, the right application – and perfectly matching all influencing factors. Because as we brazing experts know, only one thing counts: the result. My tips and insight into the brazing steps on the next pages will help you achieve the perfect result.
The right solder

The solder alloy must be chosen based on its suitability for the brazing task. The parameters are: the shape of the workpiece that is to be brazed, the base material, the application in which the workpiece will be used (e.g., the solder’s resistance to corrosion, the maximum operating temperature), and naturally the required strength of the brazing joint as well as the media that will come into contact with the brazing joint.

The right flux

Choosing the right flux mainly depends on the choice of solder alloy, which in turn depends on the base materials that are to be joined. The melting range of the flux must be within the working temperature range of the solder.

Copper-phosphorus brazing solders

Application: gap soldering on copper, brass, bronze, red brass. Effect: The phosphorus embedded in the solder acts deoxidizing and has a flux effect. Therefore, these solders can be used on copper-to-copper joints without flux. With restrictions, flux-free soldering is also possible on a few alloys such as copper-zinc. This solder should not be used without flux on copper alloys such as brass, etc. A flux from the FH10 group can be used, for example F 300 H Ultra NT.

Attention!

Never use copper-phosphorus brazing solders to braze iron or nickel-based alloys.

This will cause the formation of iron or nickel phosphide, which will make the brazing seam brittle. This solder alloy is also not suitable for brazing joints that will be used in sulfuric atmospheres.

Be particular!
How to achieve a clean result

Cleaning the component before soldering
The workpieces/components that are to be joined should have a clean, oil-, grease-, and oxide-free service. Degreasing solvents are the best way to remove lubricants and oils. Use a cleaning fleece or sandpaper to remove the oxide from surfaces.

Applying the flux
Today, flux is primarily in the form of a paste though flux powder still has its applications. The graph shows the behavior of the flux in the brazing process over time and temperature.

As the temperature increases, the water in the flux paste evaporates. The flux “swells” and then dries as a white residue on the component. Just before the brazing temperature is reached, the flux liquefies again. It becomes clear and transparent. At the beginning of its working temperature, the flux becomes active and oxides are reduced. This is the range in which the working temperature of the brazing solder has to be reached. After one or two minutes, the flux is saturated with oxides and is no longer effective. Increasing the temperature above the working temperature range also makes the flux ineffective.

If the solder has not flowed by this point in time, it could be due to the following reasons:
- Incorrect application of heat, especially in parts with widely varying material thicknesses;
- Using a heat source with a too low power density (e.g. propane instead of acetylene gas).
Chapter 2.3

Flame brazing
With fuel gas or air-gas torch

Induction brazing
Using electromagnetic fields to produce heat

Furnace brazing
Different processes; here continuous furnace

Many brazing processes take place in a vacuum furnace.

According to heat source:

Heating parts and applying the solder

There are different heat sources for soldering with brazing solders. When brazing, it is important that the base materials be uniformly/evenly and quickly heated to the required brazing temperature.

Note that when joining parts have different sizes, densities, and/or poorer thermal conductivity, they will have to be heated up comparatively longer and at a higher temperature. When the brazing temperature has been reached, the solder should be positioned at the solder gap so that it will be pulled into the gap through capillary action, and, if there is a sufficient amount of solder, can form a concave fillet. When using a viscous solder alloy such as nickel silver and brass solders, the solder should be applied along the entire brazing joint in order to form a continuous brazed seam.

Note that similar to fluxes, the melted solder always flows at the hottest point of the brazing joint. Heat should be applied during the entire brazing process and ideally slightly longer to achieve a continual diffusion zone.

Removing flux residues

Corrosive fluxes (e.g. classes FH 10, FH 20, and FH 40) must be removed. The following procedures have proven effective in practice:

- Mechanical (sanding, milling, blasting)
- Brushing in hot water
- Pickling in a bath temperature of around 40 °C
- Quenching the parts while they are still hot (in this case, make sure that the base material and solder are not damaged due to structural changes, brittleness, tension, etc.)

Non-corrosive fluxes (e.g. classes FH 21, FL 20) can remain on the part.
This table tells brazing experts everything at a glance. Base materials, solders, fluxes - here you can see what works best with what. The following pages provide detailed information on solders and fluxes.

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Overview of Fontargon brazing product groups:
- Copper wire (CuSi3-wire)
- Aluminium solder
- Brass solder
- Silver solder
- Copper-Phosphor (-Silver) solder

Only use with flux!
"F 300 H Ultra NT"

Chapter 3
Overview of Fontargon brazing product groups:
- Copper wire (CuSi3-wire)
- Aluminium solder
- Brass solder
- Silver solder
- Copper-Phosphor (-Silver) solder

Only use with flux!
"F 300 H Ultra NT"
Fontargen A 210
Brass hard solder

<table>
<thead>
<tr>
<th>Classifications</th>
<th>DIN EN ISO 17672</th>
<th>DIN EN 1044</th>
<th>DIN 8513</th>
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<td>B-Cu60Zn(Si)-875/895</td>
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Composition, typical analysis (% w/w):

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<td>0.30</td>
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Technical specifications:

- Working temperature: 900 °C
- Elongation: 35%
- Melting range: 875 - 895 °C
- Electrical conductivity: 15 Sm/mm²
- Specific weight: 8.4 g/cm³
- Tensile strength: 350 N/mm²

Characteristics/application:

- Brazing alloy with good flowing properties, fairly insensitive to overheating. For gap brazing, joint brazing, and coating of steel, malleable cast iron, as well as copper and copper alloys with a solidus of > 900 °C.

Heat sources:

- Acetylene torch, conduction and resistance heating

Flux:

- F 100 series
- Rapidflux series

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Fontargen A 314
Cadmium-free silver alloy

<table>
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<tr>
<th>Classifications</th>
<th>DIN EN ISO 17672</th>
<th>DIN EN 1044</th>
<th>DIN 8513</th>
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<td>AG 103</td>
<td>L-Ag55Sn</td>
<td>B-Ag55ZnCuSn(Si)-630/660</td>
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<td>21.00</td>
<td>22.00</td>
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Technische Angaben:

- Working temperature: 650 °C
- Elongation: 25%
- Melting range: 630 - 660 °C
- Electrical conductivity: 7.5 Sm/mm²
- Specific weight: 9.4 g/cm³
- Tensile strength: 330 - 430 N/mm²

Characteristics/application:

- Low melting point, cadmium-free silver brazing alloy that is insensitive to overheating. For gap brazing of alloyed and unalloyed steel, nickel and nickel alloys, malleable cast iron, copper and copper alloys, and carbides. Achieves the best color matching when brazing stainless steel. Suitable for parts that will be used in seawater in accordance with marine code VG 81245, section 3. The absence of cadmium makes it especially suitable for brazing joints destined to come in contact with food. For brazing joints with a working temperature of ~200 °C on austenitic steels, ~70 °C on ferritic steels, and up to ~200 °C.

The temperature stability of brazing connections also depends on the design (gap geometry) and the base materials that are to be brazed, and may need to be established in a process qualification test.

Heat sources:

- Acetylene torch, air-gas torch, induction and resistance heating

Flux:

- F 300 series

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All provided information is based on careful investigation and comprehensive research. Nevertheless, we do not assume any warranty and liability for the correctness of the information or changes.
Fontargen A 319
Cadmium-free silver alloy

Classifications
DIN EN ISO 17672  DIN EN 1044  DIN 8513  DIN EN ISO 3677
Ag 134Si  AG 106  L-Ag34Sn  B-Cu36AgZnSn(Si)-630/730

Material no.
2.5157

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Technical specifications
- Working temperature: 710 °C
- Tensile strength: 340 - 480 N/mm²
- Melting range: 630 - 730 °C
- Elongation: 12%
- Specific weight: 9 g/cm³
- Electrical conductivity: 14 Sm/mm²

Characteristics/application
Cadmium-free brazing alloy for gap brazing of alloyed and unalloyed steel, nickel and nickel alloys, malleable cast iron, copper and copper alloys. Suitable for copper pipe installation in accordance with DVGW work certificate GW 2. For brazing joints with a working temperature of –200 °C on austenitic steels, –70 °C on ferritic steels, and up to +200 °C. The temperature stability of solder connections also depends on the design (gap geometry) and the base materials that are to be brazed, and may need to be established in a process qualification test.

Fluxes
- Acetylene torch, air-gas torch, induction and resistance heating

F 300 series

All provided information is based on careful investigation and comprehensive research. Nevertheless, we do not assume any warranty and liability for the correctness of the information or changes.

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Fontargen A 320
Cadmium-free silver alloy

Classifications
DIN EN ISO 17672  DIN EN 1044  DIN 8513  DIN EN ISO 3677
Ag 145Si  AG 104  L-Ag45Sn  B-Ag45CuZnSn(Si)-640/680

Material no.
BAg-36  2.5158

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Technical specifications
- Working temperature: 670 °C
- Tensile strength: 350 - 430 N/mm²
- Melting range: 640 - 680 °C
- Elongation: 12%
- Specific weight: 9.2 g/cm³
- Electrical conductivity: 13 Sm/mm²

Characteristics/application
Cadmium-free brazing alloy for gap brazing of alloyed and unalloyed steel, nickel and nickel alloys, malleable cast iron, copper and copper alloys. Suitable for copper pipe installation in accordance with DVGW work certificate GW 2 and for parts that will be used in seawater in accordance with marine code VG 81245, section 3. For brazing joints with a working temperature of –200 °C on austenitic steels, –70 °C on ferritic steels, and up to +200 °C. The temperature stability of solder connections also depends on the design (gap geometry) and the base materials that are to be brazed, and may need to be established in a process qualification test.

Fluxes
- Acetylene torch, air-gas torch, induction and resistance heating

F 300 series

All provided information is based on careful investigation and comprehensive research. Nevertheless, we do not assume any warranty and liability for the correctness of the information or changes.
Fontargen A 347
Silver brazing alloy, cadmium-free

Classifications
DIN EN ISO 17672  DIN EN 1044  DIN 8513  DIN EN ISO 3677
Ag 156  AG 102  L-Ag56Sn  B-Ag56CuZnSn-620/655
AWS A 5.8  Material no.
BAg-7

Composition, typical analysis (% w/w):
<table>
<thead>
<tr>
<th>Component</th>
<th>Ag</th>
<th>Cu</th>
<th>Zn</th>
<th>Sn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>96.00</td>
<td>22.00</td>
<td>17.00</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Technical specifications
- Working temperature: 650 °C
- Tensile strength: 350 - 430 N/mm²
- Melting range: 620 - 655 °C
- Specific weight: 9.5 g/cm³
- Electrical conductivity: 7.5 Sm/mm²

Characteristics/application
- Silver-bearing, cadmium-free low melting brazing alloy, insensitive to overheating for gap and joint brazing of alloyed and unalloyed steel, nickel, nickel alloys and malleable iron as well as the corresponding metals amongst each other. Brazing stainless steel provides the best possible colour match. The absence of cadmium makes it especially suitable for joints destined to come in contact with food. For applications with service temperatures until 200°C suitable.

Heat sources
- Flame, induction and resistance heating

Flux
- F 300 – Series

All provided information is based on careful investigation and comprehensive research. Nevertheless, we do not assume any warranty and liability for the correctness of the information or changes.

Fontargen A 350
Silver brazing alloy, cadmium-free

Classifications
DIN EN ISO 17672  DIN EN 1044  DIN 8513  DIN EN ISO 3677
Ag 450  B-Ag50ZnCuNi-660/705
AWS A5.8  AMS  Material no.
BAg-24  4788 B

Composition, typical analysis (% w/w):
<table>
<thead>
<tr>
<th>Component</th>
<th>Ag</th>
<th>Cu</th>
<th>Zn</th>
<th>Ni</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50.00</td>
<td>20.00</td>
<td>28.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Technical specifications
- Working temperature: 690 °C
- Melting range: 660 - 705 °C
- Specific weight: 9.2 g/cm³

Characteristics/application
- Nickel bearing silver brazing alloy with very good wetting properties on steel and hard metals, therefore ensuring very tough joints. Gap brazing of hard metals in combination with steel, tungsten, tantalum and molybdenum materials.

Heat sources
- Flame, induction and resistance heating

Brazing fluxes
- F 300 – Series

All provided information is based on careful investigation and comprehensive research. Nevertheless, we do not assume any warranty and liability for the correctness of the information or changes.
## Fontargen A 390
Silver brazing alloy, cadmium-free

### Classifications

<table>
<thead>
<tr>
<th>DIN EN ISO 17672</th>
<th>DIN EN 1044</th>
<th>DIN 8513</th>
<th>DIN EN ISO 3677</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag 245</td>
<td>B.Ag45CuZn-665/745</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AWS A 5.8</td>
<td>Material no.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BAg-5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Composition, typical analysis (% w/w):

<table>
<thead>
<tr>
<th>Ag</th>
<th>Cu</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.00</td>
<td>30.00</td>
<td>25.00</td>
</tr>
</tbody>
</table>

### Technical specifications

- Working temperature: 740 °C
- Melting range: 665 - 745 °C
- Specific weight: 8.9 g/cm³

### Characteristics/application

Cadmium free brazing alloy with good fluidity and capillary flow characteristics. For gap brazing of steel, cast iron, copper and copper alloys, nickel and nickel alloys, food industry, breweries, apparatus engineering, precision mechanics, musical instruments, precision tooling, refrigeration, aircraft construction, shipbuilding. Suitable for soldering when used in sea water.

### Heat sources

- Flame, induction and resistance heating

### Flux

- F 300 - Series

---

## Fontargen A 2003 FreeFlow
Copper-phosphorus alloy

### Classifications

<table>
<thead>
<tr>
<th>DIN EN ISO 17672</th>
<th>DIN EN 1044</th>
<th>DIN 8513</th>
<th>DIN EN ISO 3677</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuP 180</td>
<td>CP 202</td>
<td>L-Cu P 7</td>
<td>B-CuP-7</td>
</tr>
<tr>
<td>AWS A5.8</td>
<td>Material no.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCuP-2</td>
<td>2.1463</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Composition, typical analysis (% w/w):

<table>
<thead>
<tr>
<th>Cu</th>
<th>P</th>
<th>Remainder</th>
</tr>
</thead>
<tbody>
<tr>
<td>71.75</td>
<td>7.25</td>
<td>21.00</td>
</tr>
</tbody>
</table>

### Technical specifications

- Working temperature: 730 °C
- Melting range: 710 - 793 °C
- Specific weight: 8.1 g/cm³

### Characteristics/application

A 2003 FreeFlow is a very homogeneous and capillary active brazing alloy. Its high flow characteristics allows the operator to produce fast reproducible joint assemblies for gap brazing on copper, brass, tin bronze and gunmetal. It suits to brazing joints operated at temperatures between -60 °C and +150 °C (determined by notched flexural impact tests acc. To DIN EN 10045). Do not use in sulphurous environment and on Fe- and Ni-containing base alloys.

### Heat sources

- Flame, induction and resistance heating, TIG-torch.

### Brazing fluxes

- Only copper alloys require the use of flux
- F 300 - Series

---
Fontargen A 2004
Copper-phosphorus alloy

Classifications
- DIN EN ISO 17672
- DIN EN 1044
- DIN 8513
- DIN EN ISO 3677

Material no.
2.1462

Composition, typical analysis (% w/w):
- Cu: 93.80
- P: 6.20

Technical specifications
- Working temperature: 760 °C
- Tensile strength: 250 N/mm²

Characteristics/application
Filler metal with good flowing properties and capillary action. For gap brazing on copper, brass, tin bronze, and red brass. For joint brazing at working temperatures between -60 °C and +150 °C, determined using the Charpy impact test in accordance with DIN EN 10045.

Do not use in sulfuric atmospheres or on Fe and Ni alloys.

Heat sources
- Acetylene torch, conduction and resistance heating, WIG torch

Flux
No flux needed when used on copper F 300 series

Fontargen A 3002 FreeFlow
Silver containing copper-phosphorus alloy

Classifications
- DIN EN ISO 17672
- DIN EN 1044
- DIN 8513
- DIN EN ISO 3677

Material no.
BCuP-6

Composition, typical analysis (% w/w):
- Cu: 91.00
- P: 7.00
- Ag: 2.00

Technische Angaben
- Working temperature: 740 °C
- Tensile strength: 250 N/mm²

Characteristics/application
A 3002 FreeFlow is a very homogeneous Copper-phosphorus alloy with low silver content. Its high flow characteristics allows the operator to produce fast reproducible joint assemblies for gap brazing on copper and copper alloys. Joint brazing at working temperatures between -60 °C and +150 °C, determined by notched flexural impact tests according to DIN EN 10045. Do not use in sulphurous environments and on Fe- and Ni-alloys.

Heat sources
- Flame, induction and resistance heating, TIG torch

Brazing fluxes
- Only copper alloys require the use of flux F 300 series

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**Fontargen A 3005 FreeFlow**  
Copper-phosphorus alloy containing silver

<table>
<thead>
<tr>
<th>Classifications</th>
<th>DIN EN ISO 17672</th>
<th>DIN EN 1044</th>
<th>DIN 8513</th>
<th>DIN EN ISO 3677</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuP 282</td>
<td></td>
<td></td>
<td></td>
<td>B-Cu88Ag-643/771</td>
</tr>
<tr>
<td>AWS A 5.8</td>
<td>Material no.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CuP 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Composition, typical analysis (% w/w):**

<table>
<thead>
<tr>
<th>Cu</th>
<th>P</th>
<th>Ag</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.50 - 6.90</td>
<td>5.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Technical specifications**

- **Working temperature**: 710 °C
- **Melting range**: 643 - 771 °C
- **Specific weight**: ca. 8.2 g/cm³
- **Elongation**: 10%
- **Electrical conductivity**: 7 Sm/mm²

**Characteristics/application**

- Very uniform copper-phosphorus alloy containing silver. Excellent flowing properties for a fast and reproducible brazing process. High ductility. For gap brazing on copper, brass, tin-bronze, and red brass.
- For joint brazing at working temperatures between -60 °C and +150 °C, determined using the Charpy impact test in accordance with DIN 10045. Do not use in sulfuric atmospheres or on Fe and Ni alloys.

**Heat sources**

- Acetylene torch, conduction and resistance heating, WIG torch

**Brazing fluxes**

- No flux needed when used on copper F 300 series

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**Fontargen A 3015**  
Copper-phosphorus alloy with high silver content

<table>
<thead>
<tr>
<th>Classifications</th>
<th>DIN EN ISO 17672</th>
<th>DIN EN 1044</th>
<th>DIN 8513</th>
<th>DIN EN ISO 3677</th>
</tr>
</thead>
<tbody>
<tr>
<td>CuP 284</td>
<td>CP 102</td>
<td></td>
<td>L-Ag15P</td>
<td>B-Cu80AgP-645/800</td>
</tr>
<tr>
<td>AWS A5.8</td>
<td>Material no.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCuP 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Composition, typical analysis (% w/w):**

<table>
<thead>
<tr>
<th>Cu</th>
<th>P</th>
<th>Ag</th>
<th>Rest</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.00</td>
<td>5.00</td>
<td>15.00</td>
<td></td>
</tr>
</tbody>
</table>

**Technical specifications**

- **Working temperature**: 700 °C
- **Melting range**: 645 - 800 °C
- **Specific weight**: 8.4 g/cm³
- **Elongation**: 10%
- **Electrical conductivity**: 7.5 Sm/mm²

**Characteristics/application**

- Thin fluid copper-phosphorus alloy with high silver content and high ductility, even at low temperatures. Suitable for gap brazing of copper and copper alloys. Recommended for joints with strong thermal load and vibrations. Joint-brazing at working temperatures between -70 °C and +150 °C. Do not use in sulphurous environment and on Fe- and Ni-alloys.

**Heat sources**

- Flame, induction and resistance heating, TIG-torch.

**Brazing fluxes**

- Only copper alloys require the use of flux F 300 - Series

---

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Fontargen A 407 L
Aluminum hard solder

Classifications

<table>
<thead>
<tr>
<th>DIN EN ISO 17672</th>
<th>DIN EN 1044</th>
<th>DIN 8513</th>
<th>DIN EN ISO 3677</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al 112</td>
<td>Al 104</td>
<td>L-ASi12</td>
<td>B-AlSi5-575/585</td>
</tr>
<tr>
<td>AWS A 5.8</td>
<td>Material no.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BASI-4</td>
<td>3.2285</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Composition, typical analysis (% w/w):

<table>
<thead>
<tr>
<th>Al</th>
<th>Si</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.00</td>
<td>12.00</td>
</tr>
</tbody>
</table>

Technical specifications

<table>
<thead>
<tr>
<th>Working temperature</th>
<th>Specific weight</th>
<th>2.7 g/cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>590 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melting range</td>
<td>Tensile strength</td>
<td>100 N/mm²</td>
</tr>
<tr>
<td>575 - 585 °C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Characteristics/application

Good capillary action. For structure and color matching on aluminum and rolled/cast aluminum alloys. The Mg content must be ≤ 3%. The solidus temperature should be > 630 °C. Not suitable for joints that are to be anodized. This brazing alloy is also suitable for joining aluminum with Cr-Ni steel.

Heat sources

Inert gas furnace, vacuum furnace, induction and resistance heating, acetylene torch

Brazing fluxes

F 400 series

All provided information is based on careful investigation and comprehensive research. Nevertheless, we do not assume any warranty and liability for the correctness of the information or changes.

Fontargen A 202 M
Copper-silicon wire electrode for MIG brazing

Classifications

<table>
<thead>
<tr>
<th>DIN EN ISO 24373</th>
<th>DIN 1733</th>
<th>AWS A 5.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu 6560 (CuSi3Mn1)</td>
<td>SG-CuSi3</td>
<td>ERCuSi-A</td>
</tr>
<tr>
<td>Material no.</td>
<td>2.1461</td>
<td></td>
</tr>
</tbody>
</table>

Typical analysis of the weld metal (% w/w)

<table>
<thead>
<tr>
<th>Cu</th>
<th>Fe</th>
<th>Mn</th>
<th>Si</th>
<th>Sn</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>69.00</td>
<td>1.20</td>
<td>2.90</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Mechanical properties of pure welding deposit in accordance with DIN EN 1597-1 (minimum values at room temperature)

<table>
<thead>
<tr>
<th>Melting range</th>
<th>Impact energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>965 - 1032 °C</td>
<td>60 J</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tensile strength</th>
<th>Thermal conductivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 N/mm²</td>
<td>35 W/m • K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yield strength</th>
<th>Electrical conductivity (20°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 N/mm²</td>
<td>3 - 4 Sm/mm²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elongation (8-50d)</th>
<th>Thermal expansion coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>18.1 x 10⁻⁶/K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hardness (Brinell)</th>
<th>Specific weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 HB</td>
<td>8.5 kg/dm³</td>
</tr>
</tbody>
</table>

Characteristics/application

MIG brazing of zinc or aluminum-plated and uncoated steel plates. Applications: car body, air conditioning, ventilation, and container construction. The corrosion resistance of zinc-plated surfaces remains unaffected in the joining area. Very little deformation when brazing thin steel sheets.

Heat sources

Protective gas (DIN EN 439)

<table>
<thead>
<tr>
<th>MIG/MAG/HM/laser brazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>I 1 (Argon)</td>
</tr>
<tr>
<td>M 12 (Argon + 2.5% CO₂)</td>
</tr>
<tr>
<td>M 13 (Argon + 1 - 3% O₂)</td>
</tr>
</tbody>
</table>

Current mode

<table>
<thead>
<tr>
<th>Delivery form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (mm): 0.8/1.0/1.2/1.6</td>
</tr>
</tbody>
</table>

Spool type

<table>
<thead>
<tr>
<th>Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>TÜV</td>
</tr>
</tbody>
</table>

Welding position, in accordance with DIN EN 287

<table>
<thead>
<tr>
<th>PA</th>
<th>PB</th>
<th>PC</th>
<th>PD</th>
<th>PE</th>
<th>PF</th>
<th>PG</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### Fluxes

#### Brass and German-silver fluxes (in accordance with DIN EN 1045 (DIN 8511))

<table>
<thead>
<tr>
<th>Flux Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 100 (FH 21 / F-SH2)</td>
<td>White paste, non-corrosive, for brazing of steel, cast iron, malleable cast-iron, nickel and nickel alloys.</td>
</tr>
<tr>
<td>F 120 (FH 21 / F-SH2)</td>
<td>White powder, non-corrosive, for brazing of steel, cast iron, malleable cast-iron, nickel and nickel alloys. Mixed with distilled water, the powder becomes an easy-to-spread flux paste.</td>
</tr>
<tr>
<td><strong>Rapidflux (FH 21 / F-SH2)</strong></td>
<td>Clear liquid, non-corrosive, for brazing of steel, cast iron, malleable cast iron, nickel and nickel alloys. The liquid is used in conjunction with the appropriate Rapidflux equipment and is fed through the burner directly to the brazing joint.</td>
</tr>
<tr>
<td><strong>Rapidflux NT (FH 21 / F-SH2)</strong></td>
<td>Clear, non-toxic liquid, non-corrosive, for brazing of steel, cast iron, malleable cast iron, nickel and nickel alloys. The liquid is used in conjunction with the appropriate Rapidflux equipment and is fed through the burner directly to the brazing joint.</td>
</tr>
</tbody>
</table>

#### Silver fluxes (in accordance with DIN EN 1045 (DIN 8511))

<table>
<thead>
<tr>
<th>Flux Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 300 (FH 10 / F-SH1)</td>
<td>White powder, non-corrosive, for brazing of copper and copper alloys, nickel and nickel alloys, alloyed and unalloyed steel. Mixed with distilled water, the powder becomes an easy-to-spread flux paste.</td>
</tr>
<tr>
<td>F 300 H Ultra (FH 10 / F-SH1)</td>
<td>White, easy-to-spread paste, corrosive, for brazing of copper and copper alloys, nickel and nickel alloys, alloyed and unalloyed steel. Well suited for mechanical brazing, e.g. flame brazing.</td>
</tr>
<tr>
<td>F 300 H Ultra NT (FH 10 / F-SH1)</td>
<td>White, easy-to-dose, non-toxic paste, corrosive, for brazing of copper and copper alloys, nickel and nickel alloys, alloyed and unalloyed steel. Well suited for mechanical brazing, e.g. flame brazing.</td>
</tr>
<tr>
<td>F 300 HF Ultra (FH 12 / F-SH1)</td>
<td>Dark, easy-to-spread paste, corrosive, for brazing of copper and copper alloys, nickel and nickel alloys, alloyed and unalloyed steel and carbides. Particularly well suited for higher temperatures up to max. 850 °C.</td>
</tr>
<tr>
<td>F 300 DN (FH 10 / F-SH1)</td>
<td>White, easy-to-dose paste, corrosive, for brazing of copper and copper alloys, nickel and nickel alloys, alloyed and unalloyed steel. Well suited for mechanical brazing, e.g. flame brazing.</td>
</tr>
<tr>
<td>F 3400, F3400S (not standardized)</td>
<td>Clear sprayable liquid, slightly corrosive, for brazing of copper and copper alloys. Supports the fluidity of the solder in conjunction with Rapidflux and copper-phosphor-silver alloys.</td>
</tr>
</tbody>
</table>

#### Aluminum fluxes (in accordance with DIN EN 1045 (DIN 8511))

<table>
<thead>
<tr>
<th>Flux Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 400 NH (FL 20 / F-LH2)</td>
<td>White powder, non-corrosive, for brazing of aluminum and aluminum alloys with a Mg content of max. 0.5%. The powder is non-hygroscopic and mixed with distilled water it becomes an easy-to-spread flux paste. The brazing joints must be protected from moisture after brazing.</td>
</tr>
<tr>
<td>F 400 M (FL 10 / F-LH1)</td>
<td>White powder, corrosive, for brazing of aluminum and aluminum alloys with a Mg content of max. 3.0%. The paste is highly hygroscopic. Flux residues must be removed immediately after brazing is completed.</td>
</tr>
<tr>
<td>F 400 MD (FL 10 / F-LH1)</td>
<td>White, easy-to-dose paste, corrosive, for brazing of aluminum and aluminum alloys with a Mg content of max. 3.0%. The paste is highly hygroscopic and should be kept in a tightly closed container. Flux residues must be removed immediately after brazing is completed.</td>
</tr>
</tbody>
</table>

---

**Handbook with all Fontargen Brazing consumables.** Download at [www.voestalpine.com/welding/services/downloads](http://www.voestalpine.com/welding/services/downloads)
In-depth know-how for all types of brazing.

Through in-depth knowledge of processing methods and application methods, Fontargen Brazing provides the best brazing solutions based on proven products with German technology. Our application engineers have unique know-how based on decades of experience gained in countless application cases.

Fontargen Brazing is an internationally sought-after partner in the following focus industries:

- Automotive body construction – with specific solutions for qualified requirements with respect to tensile strength, surface coating, and sheet thicknesses
- Automotive engine construction – with copper- and nickel-based solder pastes that are adapted to the respective brazing task and process parameters
- HVAC&R – with high-quality brazing consumables
- Toolmaking – with solders and brazing technology for the brazing of carbide and diamond tools.

Portfolio

- Blank and coated silver rods and wires
- Fluxes
- Copper-phosphorus rods and wires
- Copper and aluminum wires
- Copper, tin, silver, and nickel soldering paste
- Brazing preform parts
- Brazing foils

Contact:

Philipp Koronakis
Vice President Business Unit Brazing
Tel.: +49 6351 401 190
E-Mail: philipp.koronakis@voestalpine.com

“We share our more than 50 years of experience with our customers and build on it with 300 new projects each year.”
There for you around the world

Fontargen Brazing as a voestalpine Böhler Welding product brand

voestalpine Böhler Welding

With over 100 years of experience, voestalpine Böhler Welding is the top global address for the daily challenges in the areas of joint welding, repair, hardfacing and cladding as well as brazing. Customer proximity is guaranteed by more than 43 subsidiaries in 25 countries, with the support of 2,300 employees, and through more than 2,000 distribution partners worldwide. With individual consultation by our application technicians and welding engineers, we make sure that our customers master the most demanding welding challenges. voestalpine Böhler Welding offers three specialized and dedicated brands to cater our customers’ and partners’ requirements.

Member of the voestalpine Group

The voestalpine Group is a steel-based technology and capital goods group headquartered in Linz, Austria, that operates worldwide. The spectrum ranges from steel production to top quality final products. 48,500 employees, 500 group companies and sites on all continents ensure the company’s success. As a member of the voestalpine Group, voestalpine Böhler Welding is part of a global network of metallurgy experts.

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Chapter 4

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Lasting Connections – As a pioneer in innovative welding consumables, Böhler Welding offers a unique product portfolio for joint welding worldwide. More than 2000 products are adapted continuously to the current industry specifications and customer requirements, certified by well-respected institutes and thus approved for the most demanding welding applications. As a reliable partner for customers, “lasting connections” are the brand’s philosophy in terms of both welding and people.

Tailor-Made Protectivity™ – UTP Maintenance ensures an optimum combination of protection and productivity with innovative and tailor-made solutions. Everything revolves around the customer and their individual requirements. That is expressed in the central performance promise: Tailor-Made Protectivity™.

In-Depth Know-How – As a leading brand of soldering and brazing consumables, Fontargen Brazing offers proven solutions based on 50 years of industrial experience, tried and tested processes and methods. This In-Depth Know-How has made Fontargen Brazing an internationally preferred partner for every soldering and brazing task.