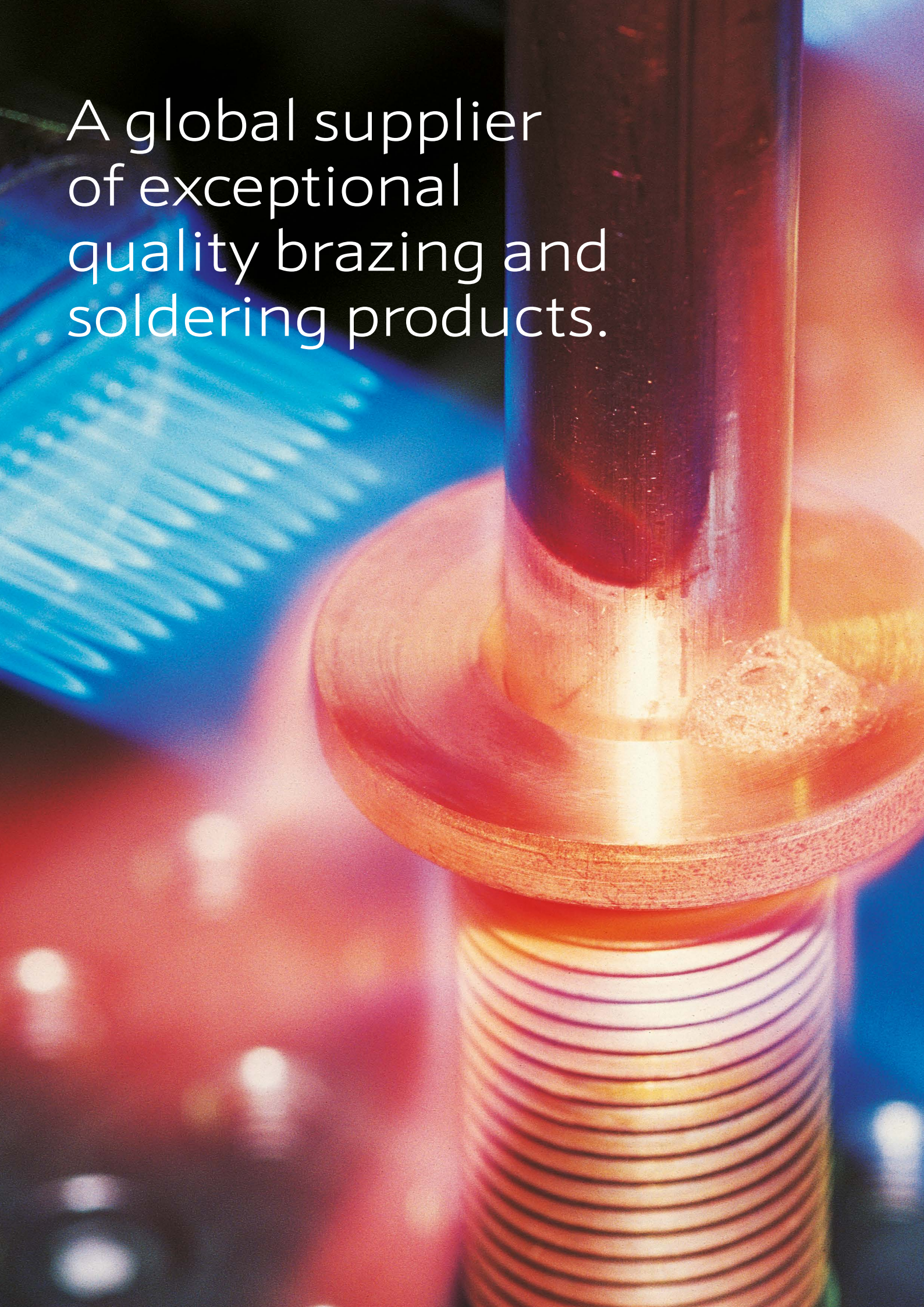
JM

# Brazing and soldering products

Johnson Matthey
Inspiring science, enhancing life


A global supplier
of exceptional
quality brazing and
soldering products.

# Brazing and soldering products

Johnson Matthey can trace its origins back to 1817 as a gold assayer based in London. Today we are a global leader in sustainable technologies, applying our cutting edge science and creating solutions with our customers that make a real difference to the world around us.

We are proud of our products and technologies, how our customers use them and the positive impact they have on our planet. At the same time, we are passionate about how science can enable global solutions for clean air, improved health and make the most efficient use of our planet's natural resources.

Johnson Matthey has a rich history of supplying metal joining products. We have an enviable reputation for excellent quality, customer service and technical support. Our expert team will help find the right solution for all your metal joining needs.

## Precious Metal Capability

As an expert in precious metals, Johnson Matthey possesses both metal trading capability and materials knowledge giving it a unique standing in the global brazing market.

## Broad Product Range

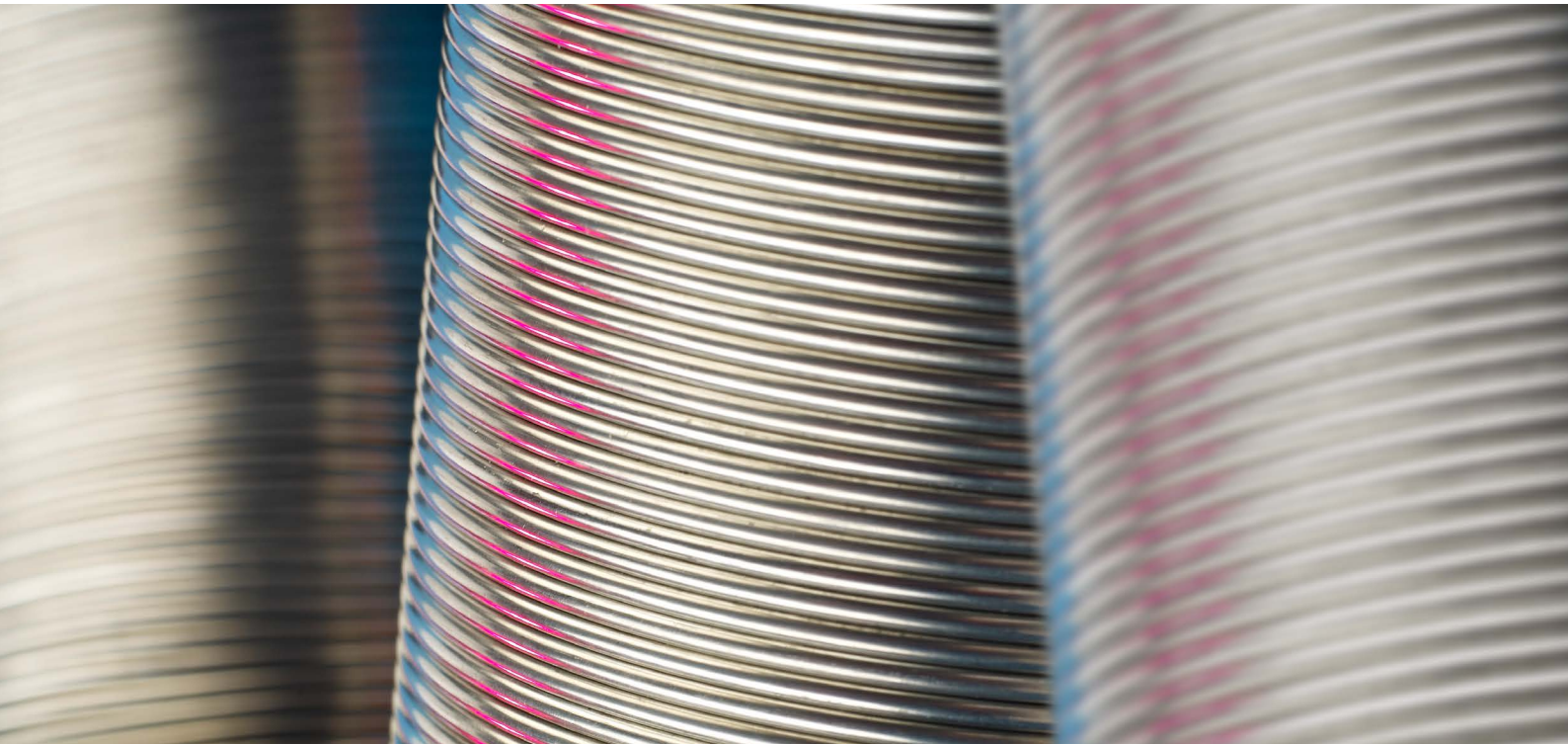
Today Johnson Matthey offers one of the broadest ranges of products of any company in its field meeting the needs of its customers and of emerging technologies.

## Technical Expertise

With accumulated knowledge of industrial brazing stretching back for over 100 years and with the experience of our people worldwide, Johnson Matthey provides comprehensive technical support.

## Customer Service

Providing good customer service is at the heart of what we do. Our customer service teams are friendly and experienced. We aim to meet customers' requirements.



## Quality Systems

Manufacturers of products and components worldwide trust in the quality of Johnson Matthey. The business is approved to ISO 9001 and holds many customer approvals.

## Global Supply Capability

We are a global supplier of brazing filler metals, solders and fluxes. We supply over 50 countries worldwide from our bases in the UK, Switzerland, Australia and China.

## Technical Support

Our technical people are available to meet customers face to face and aim to understand customers' requirements from a technical, quality and commercial perspective.

## Development Advice

The ideal time to offer technical advice is at the beginning of a project. We are able to give practical solutions from design to production stages of a new product or process development.

## Optimise the Brazing Process

Where brazing forms an important step in the production of a component Johnson Matthey can help to optimise this process in terms of cost, quality and time.

## Product Development

Our product development programme is supported by the JM Technology Centre and links with universities to develop new products and understanding for both emerging technologies and challenging new applications.

## Troubleshooting

We offer answers to a wide range of problems including brazing technique, joint design or quality, the need for improved productivity, process reliability and metallurgical issues.

## Technical Seminars and Training

Our technical expertise has enabled us to run the successful international seminars 'Brazing Fundamentals' and 'Brazing of Tungsten Carbide and PCD'. We also offer bespoke training for customers.

# Brazing and soldering products

## Silver brazing filler metals

- Silver-Flo™
- Argo-braze™

## Silver/copper-phosphorus brazing filler metals

- Sil-fos™
- Copper-flo™

## Brazing fluxes

- Easy-flo™
- Tenacity™
- Alu-flo™

## Gold and palladium based brazing filler metals

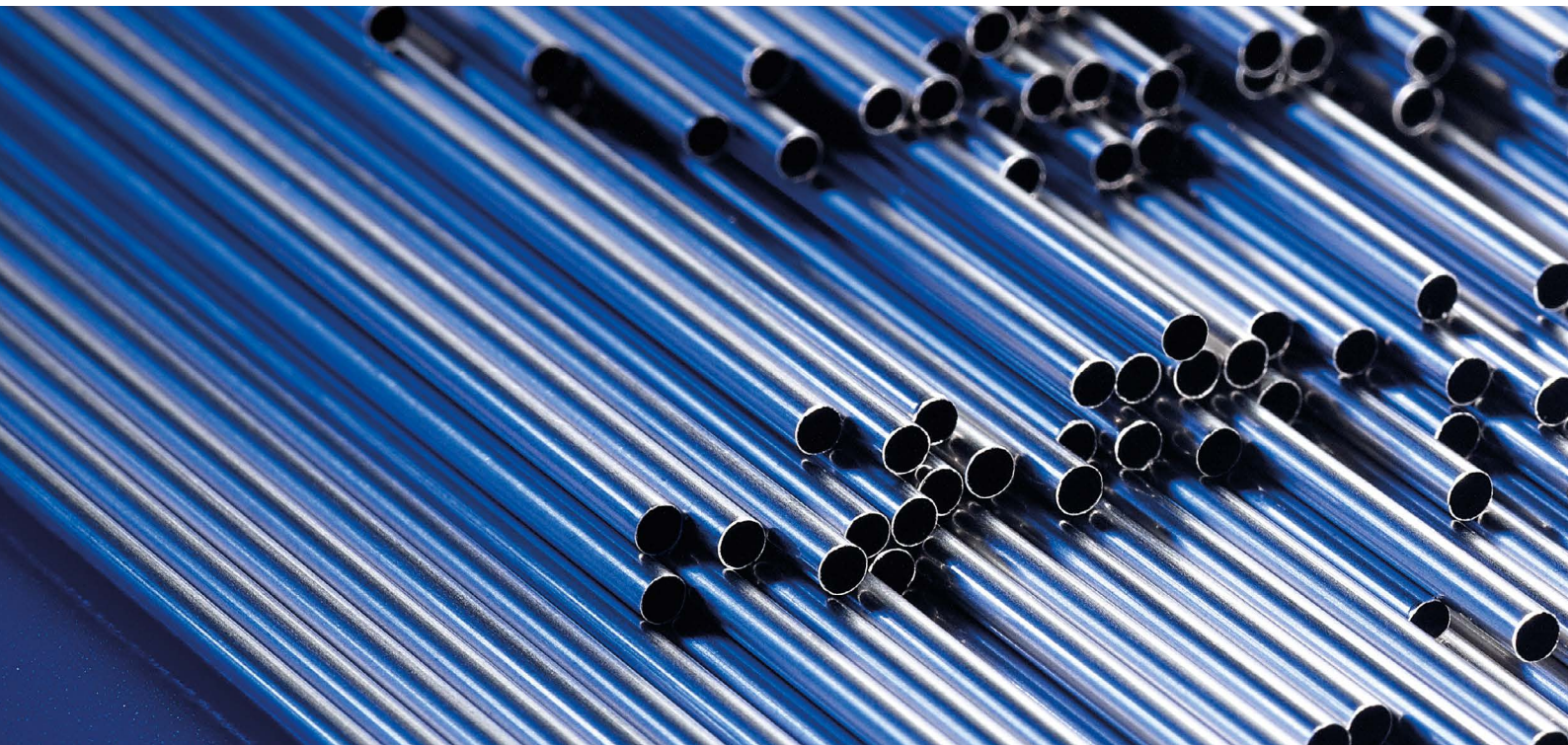
- Orobraze™
- Pallabraze™

## Base metal brazing filler metals

- JM Bronze™
- Argentel™
- Nickelbraze™
- Alu-flo™

## Filler metals and fluxes for soft soldering

- Soft Solder



# Silver Brazing Filler Metals

## Silver-flo™ Range of Cadmium-Free Silver Brazing Filler Metals

| | Ag | Cu | Zn | Sn | Si | Melting Range °C | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|
| **Silver-flo™ 55** | 55 | 21 | 22 | 2 | | 630-660 | AG103 | Ag 155 |
| **Silver-flo™ 56** | 56 | 22 | 17 | 5 | | 618-652 | AG102 | Ag 156 |
| **Silver-flo™ 452** | 45 | 27 | 25.5 | 2.5 | | 640-680 | AG104 | Ag 145 |
| **Silver-flo™ 40** | 40 | 30 | 28 | 2 | | 650-710 | AG105 | Ag 140 |
| **Silver-flo™ 38** | 38 | 32 | 28 | 2 | | 660-720 | | Ag 138 |
| **Silver-flo™ 302** | 30 | 36 | 32 | 2 | | 665-755 | AG107 | Ag 130 |
| **Silver-flo™ 252** | 25 | 40 | 33 | 2 | | 680-760 | AG108 | Ag 125 |

**Silver-flo™** products can be used to join the common engineering metals such as copper, copper alloys (brass, bronze, nickel silver, aluminium bronze, copper nickel), nickel alloys*, steel, stainless steel* and tungsten carbide*.
**Silver-flo™ 55 and 56** are general-purpose cadmium-free filler metals combining low brazing temperatures with short melting ranges. Both are free flowing, produce neat joints and are easy to use. They are used as replacements for cadmium-containing filler metals. In Europe **Silver-flo™ 55** is most common, **Silver-flo™ 56** in the US.
**Silver-flo™ 40** is a popular general-purpose product with medium melt and flow characteristics.
**Silver-flo™ 302** is a higher- and longer-melting filler metal and a useful gap-filling alloy.
*Special considerations apply, refer to Johnson Matthey for more information.

## Silver-flo™ Range - Special Applications

| | Ag | Cu | Zn | Sn | Si | Melting Range °C | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|
| **Silver-flo™ 60** | 60 | 26 | 14 | | | 695-730 | AG202 | |
| **Silver-flo™ 56S** | 56 | 22 | 16.75 | 5 | 0.25 | 618-652 | | Ag 156Si |
| **Silver-flo™ 453S** | 45 | 25 | 26.8 | 3 | 0.2 | 640-680 | | Ag 145Si* |
| **Silver-flo™ 44** | 44 | 30 | 26 | | | 675-735 | AG203 | Ag 244 |
| **Silver-flo™ 43** | 43 | 37 | 20 | | | 690-775 | | |
| **Silver-flo™ 24** | 24 | 43 | 33 | | | 740-800 | | |
| **Silver-flo™ 20** | 20 | 44 | 35.85 | | 0.15 | 776-815 | AG206 | Ag 220 |

**Silver-flo™ 56S** and **453S** are proprietary filler metals containing silicon, which in conjunction with tin improves alloy flow and surface appearance.
**Silver-flo™ 453S, 452** and **45** contain 45% silver and can provide economic alternatives to **Silver-flo™ 56** and **Silver-flo™ 55.**
**Silver-flo™ 44 and 43** are used in marine pipe-work applications being resistant to dezincification.
**Silver-flo™ 24** is used in aerospace components and for step brazing.
* Nearest specification for product.

## Silver-flo™ Range - Less Common/Reference Filler Metals

| | Ag | Cu | Zn | Sn | Si | Melting Range °C | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|
| **Silver-flo™ 45** | 45 | 25 | 30 | | | 680-700 | | |
| **Silver-flo™ 34** | 34 | 36 | 27.5 | 2.5 | | 630-730 | AG106 | Ag 134 |
| **Silver-flo™ 33** | 33 | 33.5 | 33.5 | | | 700-740 | | |
| **Silver-flo™ 30** | 30 | 38 | 32 | | | 695-770 | AG204 | Ag 230 |
| **Silver-flo™ 25** | 25 | 40 | 35 | | | 700-790 | AG205 | Ag 225 |
| **Silver-flo™ 18** | 18 | 45.75 | 36 | | 0.25 | 784-816 | | |
| **Silver-flo™ 16** | 16 | 50 | 34 | | | 790-830 | | |

These **Silver-flo™** filler metals have niche uses or are included for reference purposes.

## Silver-flo™ Range - Silver Solders for Silverware Applications

| | Ag | Cu | Zn | Melting Range °C |
|---|---|---|---|---|
| **Silver-flo™ 67 Extra Easy** | 67 | 13.7 | 19.3 | 667-709 |
| **Silver-flo™ 67 Easy** | 67 | 23 | 10 | 705-723 |
| **Silver-flo™ 67 Hard** | 67 | 29 | 4 | 745-778 |
| **Silver-flo™ 74 Medium** | 74 | 19.2 | 6.8 | 720-765 |
| **Silver-flo™ 81 Enamelling** | 81 | 14 | 5 | 730-800 |

Johnson Matthey's range of guaranteed hallmarking quality jewellery 'solders' demonstrate excellent flow characteristics and produces neat 'soldered' joints and seams. Varying grades are available, easy, medium and hard which can be used for complex 'step-soldering' operations.

# Silver/Copper Phosphorus Brazing Filler Metals

## Sil-fos™ Range - Silver Copper Phosphorus Brazing Filler Metals

| | Ag | Cu | P | Melting Range °C | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|
| **Sil-fos™ Plus** | 18 | 75 | 7 | 644 | CP101 | CuP 286 |
| **Sil-fos™** | 15 | 80 | 5 | 644-800 | CP102 | CuP 284 |
| **Sil-fos™ 5** | 5 | 89 | 6 | 644-815 | CP104 | CuP 281 |
| **Sil-fos™ 6** | 6 | 86.75 | 7.25 | 644-718 | | CuP 283 |
| **Silbralloy™** | 2 | 91.7 | 6.3 | 644-825 | CP105 | CuP 279 |

These filler metals are recommended for the flux-less brazing of copper. On brass, bronze and other copper alloys a separate flux **(Easy-flo™/Tenacity™ No. 4A)** is needed. They should not be used on nickel or iron containing metals, including all grades of steel, because a brittle joint will result.
**Sil-fos™** is the most ductile of this range of filler metals and is the only one that is available as a foil. It is widely used in electrical components.
**Sil-fos™ 6** has the best flow of the group but has less alloy ductility.
**Sil-fos™ 5** provides the best combination of ductility and flow of the group making it the filler metal of choice for joining tubes in HVACR components.
**Silbralloy™** can be used instead of **Copper-flo™** when a low cost filler metal with improved ductility is required.

# Johnson Matthey Metal Joini

## Argo-braze™ Range for Brazing of Cemented Carbides (WC) and PCD Diamond Segments

| | Ag | Cu | Zn | Ni | Mn | In | Melting Range °C | AMS | AWS A5.8 | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Argo-braze™ 64** | 64 | 26 | | 2 | 2 | 6 | 730-780 | | | | |
| **Argo-braze™ 502** | 50 | 20 | 28 | 2 | | | 660-705 | 4788 | BAg-24 | | Ag 450 |
| **Argo-braze™ 49H** | 49 | 16 | 23 | 4.5 | 7.5 | | 680-705 | | BAg-22 | AG502 | Ag 449 |
| **Argo-braze™ 40** | 40 | 30 | 28 | 2 | | | 670-780 | | BAg-4 | | Ag 440 |

These products are most commonly used for brazing cemented tungsten carbide and tungsten carbide faced PCD tips. The manganese and/or nickel in them improve wetting of the filler metal.
**Argo-braze™ 64** can be used to braze materials that are subsequently treated with a PVD coating such as titanium nitride. It contains no elements (such as Cd or Zn) that would be volatile under coating conditions.
**Argo-braze™ 49H and Argo-braze™ 502** are widely used for small/medium carbides and as a substitute for **Easy-flo™ No.3**. **Argo-braze™ 502** is also available as a tri-foil.
**Argo-braze™ 40** has a long melting range and gap-filling characteristics. It is used on both steel and carbide parts.

## Argo-braze™ Range of Tri-foils for Brazing Cemented Carbides (WC) and PCD Diamond Segments

| | Ag | Cu | Zn | Ni | Mn | In | Melting Range °C | AMS | AWS A5.8 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Argo-braze™ 502 Tri-foil** | 50 | 20 | 28 | 2 | | | 660-705 | 4788 | BAg-24 | Ag 450 |
| **Argo-braze™ 49LM Tri-foil** | 49 | 27.5 | 20.5 | 0.5 | 2.5 | | 670-710 | | | |

Tri-foils are composite materials with the brazing filler metal shown above on either side of a central copper core. They are designed to artificially thicken a joint, relieving stress and reducing the incidence of cracking. Tri-foils are commonly used for brazing of large tungsten carbide segments (>20mm) and in cases where residual stress from cooling is a factor.

## Argo-braze™ Range for Brazing of Stainless Steel Joints Exposed to Water or Moisture in Service

| | Ag | Cu | Ni | In | Sn | Melting Range °C | AMS | AWS A5.8 | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Argo-braze™ 632** | 63 | 28.5 | 2.5 | | 6 | 691-802 | 4774 | BAg-21 | | Ag 463 |
| **Argo-braze™ 56** | 56 | 27.25 | 2.25 | 14.5 | | 600-711 | | | AG403 | Ag 456a |

**Argo-braze™ 632 and Argo-braze™ 56** are designed to prevent interfacial (crevice) corrosion in stainless steel silver-brazed joints that are exposed to water in, for example, damp or wet service environments. Both filler metals have long melting ranges and are not free-flowing or easy to use.

## Argo-braze™ Range for Vacuum Tubes, Vacuum Brazing and Electronic Components

| | Ag | Cu | In | Sn | Ni | Melting Range °C | AMS | AWS A5.8 | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Argo-braze™ 72NiV** | 71.5 | 28 | | | 0.5 | 780-795 | | BAg-8b | | |
| **Argo-braze™ 72V** | 72 | 28 | | | | 778 | | BAg-8 | AG401 | Ag 272 V1 |
| **Argo-braze™ 63V** | 63 | 27 | 10 | | | 685-730 | | | | |
| **Argo-braze™ 61V** | 61.5 | 24 | 14.5 | | | 630-705 | | BAg-29 | | |
| **Argo-braze™ 60V** | 60 | 30 | | 10 | | 602-718 | 4773 | BAg-18 | AG402 | Ag 160 |

This range of products can be supplied to a vacuum-grade specification, with lower impurity limits, which can be required for brazing in vacuum or service in vacuum (e.g. Thermionic Valves).
A 'V' added as a suffix after the product name shows that a vacuum-grade product, according to ISO17672: 2016 Vacuum Grade 1, will be supplied.
This range of products can also be supplied in a non-vacuum grade where ultra-high purity of the alloy is not required.

**Argo-braze™ 72NiV** is a modified version of **Argo-braze™ 72V** that contains nickel for improved wetting on ferrous and nickel based parent materials.
**Argo-braze™ 72V** (formerly Silver-Copper Eutectic™) is ideal for flux-less brazing of copper, nickel and metalised ceramics.
**Argo-braze™ 63V and 61V** are low temperature, indium-bearing filler metals often used in step brazing operations.
**Argo-braze™ 60V** (formerly RTSN™) can meet a variety of niche requirements. It is also used in air brazing operations (flame/induction) in its non-vacuum specification.

## Argo-braze™ Range for Aerospace and Miscellaneous Applications

| | Ag | Cu | Zn | Ni | Mn | Melting Range °C | AMS | AWS A5.8 | ISO17672:2016 |
|---|---|---|---|---|---|---|---|---|---|
| **Argo-braze™ 85** | 85 | | | | 15 | 960-970 | 4766 | BAg-23 | Ag 485 |
| **Argo-braze™ 562** | 56 | 42 | | 2 | | 771-893 | 4765 | BAg-13a | Ag 456 |
| **Argo-braze™ 54** | 54 | 40 | 5 | 1 | | 718-857 | 4772 | BAg-13 | Ag 454 |
| **Argo-braze™ 25DHE** | 25 | 52.5 | 22.5 | | | 675-855 | | | |

**Argo-braze™ 85** is a copper-free brazing filler metal used for brazing assemblies which will see ammonia in service or temperatures up to 400˚C.
**Argo-braze™ 562, 54 and 25DHE** are brazing filler metals that are used in various aerospace components. **Argo-braze™ 562** can be supplied to Vacuum Grade 1 specification.

## Copper-flo™ Range - Copper Phosphorus Brazing Filler Metals

| | Cu | P | Sn | Sb | Melting Range °C | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|
| **Copper-flo™** | 92.2 | 7.8 | | | 714-810 | CP201 | CuP 182 |
| **Copper-flo™ No. 2** | 92 | 6 | | 2 | 690-825 | CP301 | CuP 389 |
| **Copper-flo™ No. 3** | 93.8 | 6.2 | | | 714-890 | CP203 | CuP 179 |
| **Copper-flo™ No. 5** | 92.75 | 7.25 | | | 710-793 | | CuP 181 |
| **Stan-fos™** | 86.2 | 6.8 | 7 | | 640-680 | CP302 | CuP 386 |

**Copper-flo™** filler metals are recommended for the flux-less brazing of copper most commonly for joining tubes and pipes in heating, refrigeration, air-conditioning and heat exchanger components. They have lower ductility than the silver-copper-phos products.
**Copper-flo™** filler metals should not be used on nickel or iron-containing metals, including all grades of steel, because a brittle joint will result.

**Copper-flo™, Copper-flo™ No.3, Copper-flo™ No.5** are widely used in HVACR joints.
**Copper-flo™ and Copper-flo™ No.2** are used for copper cylinders.
**Stan-fos™** is a very free-flowing filler metal that produces a good surface finish on joints. However it has low ductility and requires the use of a flux.

# ing Product Reference Chart

## Brazing Fluxes

### Easy-flo™ Silver Brazing Fluxes - General Purpose

| | Working Range °C | EN1045 | |
|---|---|---|---|
| **Easy-flo™ Flux Powder** | 550-800 | FH10 | The leading brand general-purpose flux, good for hot-rodding. |
| **Easy-flo™ 100 Flux Paste** | 550-800 | FH10 | Smooth general-purpose flux with good overheat resistance. |

These products are popular general-purpose silver brazing fluxes. They can be used on the common engineering metals including copper, copper alloys (brass, bronze, nickel silver, copper nickel), nickel alloys, steel, stainless steel and tungsten carbide. Specialised fluxes are often required for aluminium bronze, stainless steel and tungsten carbide.

### Easy-flo™ Silver Brazing Flux Pastes - Special Purpose

| | Working Range °C | EN1045 | |
|---|---|---|---|
| **Easy-flo™ Low Temperature Grade Flux Paste** | 550-800 | FH10 | Smooth paste good for copper alloys and induction heating. |
| **Easy-flo™ Medium Temperature Grade Flux Paste** | 600-800 | FH10 | A general-purpose flux paste with good overheat resistance. |
| **Easy-flo™ High Temperature Grade Flux Paste** | 575-825 | FH10 | Good overheat resistance but provides less cover when molten. |

### Easy-flo™ Silver Brazing Fluxes – Special Purpose for Specific Markets

| | Working Range °C | EN1045 | |
|---|---|---|---|
| **Easy-flo™ K Grade Flux Powder** | 550-800 | FH10 | A general-purpose flux powder for Swiss, German and Austrian markets. |
| **Easy-flo™ A Grade Flux Paste** | 550-800 | FH10 | A general-purpose flux paste for Swiss, German and Austrian markets. |

### Easy-Flo™ Silver Brazing Fluxes For Special Applications

| | Working Range °C | EN1045 | |
|---|---|---|---|
| **Easy-flo™ Stainless Steel Grade Flux Paste** | 550-775 | FH10 | Additional fluoride, good for stainless steel with short heating cycles. |
| **Easy-flo™ Stainless Steel Grade Flux Powder** | 550-775 | FH10 | Additional fluoride, good for stainless steel with short heating cycles. |
| **Easy-flo™ Aluminium Bronze Grade Flux Paste** | 550-775 | FH11 | For brazing on parent metals (aluminium bronze) containing 2-10% Al. |

### Tenacity™ Brazing Fluxes - Boron Modified

| | Working Range °C | EN1045 | |
|---|---|---|---|
| **Tenacity™ No. 6 Flux Powder** | 550-800 | FH12 | This powder contains boron for improved wetting on tungsten carbide. |
| **Tenacity™ No. 6 Flux Paste** | 550-800 | FH12 | This paste contains boron for improved wetting on tungsten carbide. |
| **Tenacity™ No. 5A Flux Powder** | 600-900 | FH12 | A higher temperature boron-modified flux powder. |
| **Tenacity™ No. 3A Flux Paste** | 600-875 | FH12 | This boron-modified flux conforms to AMS 3411. |

The addition of elemental boron to brazing fluxes improves filler metal wetting on refractory metals and difficult to wet materials such as tungsten carbide. It should be noted that boron-modified fluxes are not suitable for use on low or nickel-free stainless steels if interfacial corrosion is likely to be a hazard in service because they can promote the corrosive mechanism.

### Tenacity™ Brazing Fluxes - Medium and High Temperature

| | Working Range °C | EN1045 | |
|---|---|---|---|
| **Tenacity™ No. 4A Flux Powder** | 600-850 | FH10 | For brazing larger copper parts and prolonged heating cycles. |
| **Tenacity™ No. 5 Flux Powder** | 600-900 | FH10 | For stainless steel, heavy parts and prolonged heating cycles. |
| **Tenacity™ No. 20 Flux Powder** | 750-1000 | FH21 | For brass brazing/bronze welding with the **Argentel™** range. |
| **Tenacity™ No. 125 Flux Powder** | 750-1200 | FH21 | For brazing with **JM Bronze™** filler metals such as **F Bronze™**. |
| **Tenacity™ No. 125 Flux Paste** | 750-1200 | FH21 | For brazing with **JM Bronze™** filler metals such as **F Bronze™**. |

These products are designed for components requiring extended heating cycles, low silver or copper-based brazing filler metals.

### Specialised Tenacity™ Fluxes

| | Working Range °C | EN1045 | |
|---|---|---|---|
| **Tenacity™ No. 2 Modified Flux Powder** | 550-800 | FH10 | Specially modified for use as coating on brazing rods. |
| **Tenacity™ No. 14 Flux Powder** | 550-750 | FH10 | A very fluid flux that prevents red staining on brass. |

### Alu-Flo™ Fluxes For Brazing Aluminium

| | Working Range °C | Flux Residues | |
|---|---|---|---|
| **Alu-flo™ No. 1 Flux Paste** | 450-650 | Corrosive | A chloride based flux suitable for use with **Alu-flo™ HT** and **MT**. |
| **Alu-flo™ No. 2 Flux Powder** | 575-650 | Non-Corrosive | A fluoride based flux suitable for use with **Alu-flo™ HT** and **MT**. |

These products are designed for low temperature aluminum brazing in air.

## Braze Stop-Off Compounds

### Stop-flo™ Stop-off or Parting Compounds

| | Working Range °C | |
|---|---|---|
| **Stop-flo™ No. 1 Braze Stop-off** | Up to 1600 | Standard stop-off compound for use on the general engineering metals |
| **Stop-flo™ No. 2 Braze Stop-off** | Up to 1600 | Specially formulated stop-off compound for use on titanium alloys |

These products are formulated to prevent the flow and wetting of molten brazing filler metal across the surface of a component during the brazing process. They are suitable for vacuum furnace, controlled atmosphere or air brazing processes.
**Stop-flo™ No.1** and **Stop-flo™ No.2** are available in paint, paste or tape form.
Residues of **Stop-flo™ No.1** or **No.2** before and after brazing are best removed using a water wash.

# Precious Metal Brazing Filler Metals

## Orobraze™ Range of Gold-Based Brazing Filler Metals

| | Au | Cu | Ni | Ag | Pd | Melting Range °C | AMS/AWS A5.8 | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|
| **Orobraze™ 890** | 80 | 20 | | | | 890 | BAu-2 | | Au 800 |
| **Orobraze™ 940** | 62.5 | 37.5 | | | | 930-940 | | AU102 | Au 625 V1 |
| **Orobraze™ 950** | 82 | | 18 | | | 950 | 4787/BAu-4 | AU105 | Au 827 V1 |
| **Orobraze™ 970** | 50 | 50 | | | | 955-970 | | | Au 503 |
| **Orobraze™ 990** | 75 | | 25 | | | 950-990 | | AU106 | Au 752 V1 |
| **Orobraze™ 998** | 37.5 | 62.5 | | | | 980-998 | BAu-1 | AU103 | Au 375 V1 |
| **Orobraze™ 1005** | 35 | 65 | | | | 970-1005 | | | Au 354 |
| **Orobraze™ 1018** | 30 | 70 | | | | 996-1018 | | AU104 | Au 295 V1 |
| **Orobraze™ 1030** | 35 | 62 | 3 | | | 1000-1030 | BAu-3 | | Au 351 |
| **Orobraze™ 1040** | 70 | | | 30 | | 1030-1040 | | | |
| **Orobraze™ 1045** | 70 | | 22 | | 8 | 1005-1045 | 4786/BAu-6 | | Au 700 |

## Pallabraze™ Range of Palladium-Bearing Brazing Filler Metals

| | Pd | Ag | Cu | Ni | Mn | Melting Range °C | AMS/AWS A5.8 | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|
| **Pallabraze™ 810** | 5 | 68.5 | 26.5 | | | 807-810 | BAg-30 | PD106 | Pd 287 V1 |
| **Pallabraze™ 840** | 10 | 67.5 | 22.5 | | | 834-840 | | PD104 | Pd 388 V1 |
| **Pallabraze™ 850** | 10 | 58 | 32 | | | 824-850 | BAg-31 | PD105 | Pd 387 V1 |
| **Pallabraze™ 880** | 15 | 65 | 20 | | | 856-880 | | PD103 | Pd 481 V1 |
| **Pallabraze™ 900** | 20 | 52 | 28 | | | 876-900 | | PD102 | Pd 484 V1 |
| **Pallabraze™ 950** | 25 | 54 | 21 | | | 901-950 | BAg-32 | PD101 | Pd 587 V1 |
| **Pallabraze™ 1010** | 5 | 95 | | | | 970-1010 | | PD204 | Pd 288 V1 |
| **Pallabraze™ 1090** | 18 | | 82 | | | 1080-1090 | | PD203 | Pd 483 V1 |
| **Pallabraze™ 1120** | 20 | 75 | | | 5 | 1000-1120 | | | Pd 485 |
| **Pallabraze™ 1225** | 30 | 70 | | | | 1150-1225 | | | |
| **Pallabraze™ 1237** | 60 | | | 40 | | 1237 | | PD201 | Pd 647 V1 |

**Orobraze™ and Pallabraze™ Brazing Filler Metals**
Johnson Matthey Metal Joining supply a wide range of precious metal brazing filler metals. The specialised filler metals of the **Orobraze™** and **Pallabraze™** product ranges have been extended in recent years. This section of the product reference chart lists both the traditional Johnson Matthey products and the more recent additions shown below.
**Gold-copper Orobraze™** filler metals show good wetting on Fe, Ni, Co, Ta, Nb and W.

**Gold-nickel Orobraze™** filler metals (**Orobraze™ 950** and **990**) show good high temperature strength (up to 600˚C), resistance to oxidation, and resistance to crevice corrosion on stainless steel.
**Pallabraze™** products can be used to braze a variety of materials from stainless steel to metalised ceramics. They exhibit good resistance to oxidation and elevated temperature strength.

## Miscellaneous Precious Metal Brazing Filler Metals

| Melting up to 1000˚C | Au | Pd | Ag | Ni | Cu | Si | In | Cr | Other | Melting Range °C |
|---|---|---|---|---|---|---|---|---|---|---|
| **Pallabraze™ 851** | | 46.7 | | 47.2 | | 6.1 | | | | 810-851 |
| **Pallabraze™ 880Ga** | | 9 | 82 | | | | | | 9 Ga | 845-880 |
| **Orobraze™ 895** | 75 | | 5 | | 20 | | | | | 885-895 |
| **Orobraze™ 900** | 60 | | | | 37 | | 3 | | | 860-900 |
| **Pallabraze™ 960** | | 36 | | 50 | | 0.5 | | 10.5 | 3 B | 820-960 |
| **Pallabraze™ 977** | | 30 | | 57.1 | | | | 10.5 | 2.4 B | 941-977 |
| **Orobraze™ 1000Cr** | 72 | | | 22 | | | | 6 | | 975-1000 |
| **Orobraze™ 1000** | 40 | | | | 60 | | | | | 980-1000 |

| Melting between 1000-1050˚C | Au | Pd | Ni | Cu | In | Other | Melting Range °C |
|---|---|---|---|---|---|---|---|
| **Orobraze™ 1004** | 35 | 10 | 14 | 31.5 | | 9.5 Mn | 971-1004 |
| **Orobraze™ 1010** | 73.8 | | 26.2 | | | | 980-1010 |
| **Orobraze™ 1013** | 25 | 15 | 10 | 37 | | 13 Mn | 970-1013 |
| **Orobraze™ 1025** | 20 | | | 78 | 2 | | 975-1025 |
| **Orobraze™ 1037** | 70 | 8 | 22 | | | | 1005-1037 |
| **Orobraze™ 1050** | 70 | | 30 | | | | 960-1050 |

| Melting above 1050˚C | Au | Pd | Ag | Ni | Cu | Co | Mn | Melting Range °C | AMS/AWS A5.8 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Orobraze™ 1052** | 25 | 15 | | 18 | 31 | | 11 | 1017-1052 | | |
| **Pallabraze™ 1070** | | 10 | 90 | | | | | 1025-1070 | | |
| **Orobraze™ 1121** | 50 | 25 | | 25 | | | | 1102-1121 | 4784 | Au 507 |
| **Pallabraze™ 1169** | 30 | 34 | | 36 | | | | 1135-1169 | 4785 | Au 300 |
| **Pallabraze™ 1197** | | 22.5 | 48.5 | 10 | 19 | | | 910-1179 | | |
| **Pallabraze™ 1219** | | 65 | | | | 35 | | 1219 | BPd-1 | |
| **Orobraze™ 1270** | 92 | 8 | | | | | | 1200-1270 | BAu-8 | |

The miscellaneous **Orobraze™** and **Pallabraze™** product ranges shown are used for a variety of applications. Consult **www.jm-metaljoining.com** for more information on an individual product.

Johnson Matthey
Inspiring science, enhancing life

# Base Metal Brazing Filler Metals

## JM Bronze™ and Copper Based Brazing Filler Metals

| | Cu | Zn | Ni | Mn | Sn | Co | Others | Melting Range °C | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Copper** | 99.9 | | | | | | | 1081 | CU101 | Cu 110 |
| **P Bronze™** | 91.75 | | | | 8 | | 0.25 P | 882-1027 | | |
| **B Bronze™** | 97 | | 3 | | | | 0.03 B | 1081-1101 | CU105 | Cu 186 |
| **C Bronze™** | 86.85 | | 2.15 | 11 | | | | 965-995 | | |
| **D Bronze™** | 86 | | | 10 | | 4 | | 980-1030 | | |
| **F Bronze™** | 58 | 38 | | 2 | | 2 | | 890-930 | | |
| **H Bronze™** | 52.5 | | 9.5 | 38 | | | | 880-920 | | |
| **J Bronze™** | 67.5 | | 9 | 23.5 | | | | 925-955 | | |

**JM Bronze™** filler metals are a range of special products designed for high temperature brazing of steel and carbide components. The JM Bronze products which contain nickel and or manganese can show improved wetting on tungsten carbide.
**Copper** can be used as a filler metal. It can be supplied in a variety of forms and is used in reducing atmosphere or vacuum brazing processes.
**P Bronze™** is used for furnace brazing of mild steel and offers good gap-filling properties.
**B Bronze™** was developed for furnace brazing of stainless steel under reducing atmospheres. The joints produced in both ferritic and austenitic steels exhibit resistance to interfacial corrosion. It will penetrate joint gaps ranging from an interference fit up to 0.5 mm and has consequently been used to braze mild steels where the gaps are too large for copper (i.e. over 0.025 mm).
**C Bronze™** has good gap-bridging properties (0.025 to 0.75 mm) and offers excellent resistance to interfacial corrosion when used on ferritic or austenitic stainless steels. Due to the manganese content the alloy requires a furnace atmosphere with a dew point better than -40°C and if used for vacuum brazing a partial pressure of argon is required.
**D Bronze™ and F Bronze™** are used to braze rock drills. They show good wetting, strength and an ability to allow heat treatment of the drill shank during brazing. Induction brazing is used in air with **Tenacity™ No. 125** flux.
**H Bronze™ and J Bronze™** are manganese-containing filler metals used in road planing tools, and drills.

## Argentel™ Copper Based Brazing Filler Metals

| | Cu | Zn | Ni | Sn | Si | Mn | Melting Range °C | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|
| **Argentel™ No. 1** | 60 | Bal | | | 0.3 | | 875-895 | CU301 | Cu 470a |
| **Argentel™ 302** | 60 | Bal | | 0.35 | 0.3 | | 875-895 | CU302 | |
| **Argentel™ 303** | 60 | Bal | | 0.2 | 0.3 | 0.15 | 870-900 | CU303 | Cu 670 |
| **Argentel™** | 48 | Bal | 10 | | 0.2 | | 890-920 | CU305 | Cu 773 |

**Argentel™ No. 1** and products of a similar composition (e.g. JM CZ6) are designed for brazing steel or copper components and also for brazing steel to tungsten carbide in tooling applications.
**Argentel™ 302** and products of similar composition contain controlled additions of tin and silicon. This improves the flow and surface appearance and gives reasonable filler metal penetration.
**Argentel™ 303** and products of similar composition contain controlled additions of tin, silicon and manganese. This gives good fillet formation with reasonable flow and penetration.
**Argentel™** is a braze/bronze welding alloy that contains nickel, which makes the alloy stronger and harder but less fluid when molten than a standard Cu-Zn filler metal such as **Argentel™ No.1** or **Argentel™ 303**.

## Alu-flo™ Range of Aluminium Brazing Filler Metals

| | Al | Si | Cu | Zn | Melting Range °C | AMS/AWS A5.8 | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|
| **Alu-flo™ HT** | 88 | 12 | | | 575-585 | BAlSi-4 | AL104 | Al 112 |
| **Alu-flo™ MT** | 86 | 10 | 4 | | 520-585 | BAlSi-3 | AL201 | Al 210 |
| **Alu-flo™ LT** | 2 | | | 98 | 377-385 | | | |

**Alu-flo™** filler metals are primarily used for joining aluminium alloys – the 1000 series (e.g. 1100), 3000 series (e.g. 3003, 3004), 5005 and some 6000 alloys (eg.6061, 6031, 6951). They are used in the manufacture of automotive components, cookware and aluminium heat exchangers.
**Alu-flo™ HT** has a short melting range and exhibits good alloy flow.
**Alu-flo™ MT** is less free-flowing and should be considered when the joint gaps are larger.
**Alu-flo™ No.1 or Alu-flo™ No.2** Flux Powder or Paste should be used with these filler metals.
**Alu-flo™ LT** is a high temperature solder for aluminium.

## Nickelbraze™ HTN Nickel Based Brazing Filler Metals

| | Ni | Cr | Fe | B | Si | P | C | Melting Range °C | AMS/AWS A5.8 | EN1044:1999 | ISO 17672:2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Nickelbraze™ HTN1** | Bal | 14 | 4.5 | 3.1 | 4.5 | | 0.7 | 980-1060 | 4775/BNi-1 | NI101 | Ni 600 |
| **Nickelbraze™ HTN1A** | Bal | 14 | 4.5 | 3.1 | 4.5 | | | 980-1070 | 4776/BNi-1a | NI1A1 | Ni 610 |
| **Nickelbraze™ HTN2** | Bal | 7 | 3.0 | 3.1 | 4.5 | | | 970-1000 | 4777/BNi-2 | NI102 | Ni 620 |
| **Nickelbraze™ HTN3** | Bal | | 0.5 | 3.1 | 4.5 | | | 980-1040 | 4778/BNi-3 | NI103 | Ni 630 |
| **Nickelbraze™ HTN4** | Bal | | 1.5 | 1.8 | 3.5 | | | 980-1070 | 4779/BNi-4 | NI104 | Ni 631 |
| **Nickelbraze™ HTN5** | Bal | 19 | | | 10.1 | | | 1080-1135 | 4782/BNi-5 | NI105 | Ni 650 |
| **Nickelbraze™ HTN6** | Bal | | | | | 11 | | 875 | BNi-6 | NI106 | Ni 700 |
| **Nickelbraze™ HTN7** | Bal | 14 | | | | 10.1 | | 890 | BNi-7 | NI107 | Ni 710 |

**Nickelbraze™ HTN** brazing filler metals are used to join stainless steel, nickel and cobalt base alloys. They provide exceptional resistance to chemical corrosion and oxidation coupled with high strength at elevated temperatures. These alloys are widely used particularly within the aerospace, automotive and nuclear industries using vacuum or controlled atmosphere brazing methods. These products are available as pastes, powders or tapes. Several can be supplied in rapidly solidified foil form.

## Ti-flo™ Range of Brazing Filler Metals for Titanium

| | Ti | Ni | Cu | Ag | Al | Other | Melting Range °C |
|---|---|---|---|---|---|---|---|
| **Ti-flo™ 830** | | | | 95 | 5 | | 780-830 |
| **Ti-flo™ 950** | 70 | 15 | 15 | | | 0.3% max | 902-950 |

**Ti-flo™ 950** This filler metal will wet titanium, titanium-based alloys and super alloys. It exhibits good wetting characteristics on ceramic surfaces eliminating the need for metalisation and plating processes. Because of its high titanium content it is very strong and has good corrosion resistance. Typical applications include brazing of vacuum tubes, wave-guides and titanium-based rocket and engine components in the aerospace industry. **Ti-flo™ 950** should be brazed in a high vacuum environment. Other filler metals suitable for brazing titanium alloys include **Pallabraze™ 880Ga**, **Active-braze™ No.1**, **Active-Braze™ No.2**, silver and standard silver.

Colour indicates Brand Label

# Active Brazing Filler Metal Products

## Active-braze™ Silver Brazing Filler Metals

| | Ag | Cu | Ti | In | Al | Melting Range °C |
|---|---|---|---|---|---|---|
| **Active-braze™ No. 1** | 92.75 | 5 | 1.25 | | 1 | 860-912 |
| **Active-braze™ No. 2** | 68.8 | 26.7 | 4.5 | | | 830-850 |
| **Active-braze™ No. 10** | 70 | 28 | 2 | | | 780-800 |
| **Active-braze™ No. 15** | 60 | 24 | 2 | 14 | | 620-720 |

A number of other compositions of **Active-braze™** products are available in addition to those shown above. **Active-braze™ No.1** and **2** are available as pastes and are suitable for the brazing of diamond, ceramics and titanium alloys. **Active-braze™ No.10** brazing paste is used for the brazing of PCBN tips to tungsten carbide. **Active-braze™ No.10** can also be used for the brazing of natural and CVD single crystal diamonds, graphite, carbon-carbon composites and silicon carbide. **Active-braze™ No.15**, which has a lower brazing temperature than **Active-braze™ No.10** is used for applications involving the brazing of PCD (Polycrystalline Diamond).

# Soft Solders

## Silver-Tin-Lead and Silver-Lead Soft Solder Alloys

| | Ag | Sn | Pb | Melting Range °C | EN29453 | ISO 9453:2014 |
|---|---|---|---|---|---|---|
| **JM6236** | 2 | 62 | 36 | 178-190 | Alloy No. 30 | Alloy No. 171 |
| **Comsol™** | 1.5 | 5 | 93.5 | 296 | Alloy No. 34 | Alloy No. 191 |
| **A25™** | 2.5 | | 97.5 | 304 | Alloy No. 32 | Alloy No. 181 |
| **A5™** | 5 | | 95 | 304-370 | Alloy No. 33 | Alloy No. 182 |

**Comsol™** has excellent creep resistance when compared to tin-lead solders at room and elevated temperature. It has improved wetting and flow on copper alloys compared with **A25™** / **A5™** and can be used for step soldering.
**A25™ and A5™** offer increased strength and creep resistance at elevated temperatures over tin-lead solders. Silver in these solders improves flow and wetting onto copper and copper based alloys.

## Tin-Lead Soft Solder Alloys

| | Sn | Pb | Sb | Melting Range °C | EN29453 | ISO 9453:2014 |
|---|---|---|---|---|---|---|
| **JM595** | 5 | 95 | | 300-315 | | Alloy No. 123 |
| **JM1090** | 10 | 90 | | 268-302 | Alloy No. 8 | Alloy No. 122 |
| **JM1585** | 15 | 85 | | 225-290 | | Alloy No. 121 |
| **JM2080** | 20 | 80 | | 183-275 | | Alloy No. 117 |
| **JM3070** | 30 | 70 | | 185-255 | Alloy No. 7 | Alloy No. 116 |
| **JM3565** | 35 | 65 | | 183-245 | Alloy No. 6 | Alloy No. 115 |
| **JM4060** | 40 | 60 | | 183-235 | Alloy No. 5 | Alloy No. 114 |
| **JM4552** | 45 | 52.5 | 2.5 | 185-215 | | |
| **JM4555** | 45 | 55 | | 183-224 | Alloy No. 4 | Alloy No. 113 |
| **JM5050** | 50 | 50 | | 183-215 | Alloy No. 3 | Alloy No. 112 |
| **JM5840** | 40 | 58 | 2 | 185-231 | Alloy No. 14 | Alloy No. 134 |
| **JM5941** | 59 | 41 | | 183-190 | | |
| **JM6040** | 60 | 40 | | 183-190 | Alloy No. 2 | Alloy No. 103 |
| **JM6337** | 63 | 37 | | 183 | Alloy No. 1 | Alloy No. 102 |

This chart shows the range of tin-lead solders currently available and still widely used. Customers are advised to check with current legislation to ensure that the use of lead-containing solder is acceptable for each application.

## Lead-Free Soft Solder Alloys

| | Sn | Ag | Cu | Sb | Melting Range °C | EN29453 | ISO 9453:2014 |
|---|---|---|---|---|---|---|---|
| **Plumbsol™** | 97.5 | 2.5 | | | 221-225 | | |
| **P35™** | 96.5 | 3.5 | | | 221 | | Alloy No. 703 |
| **P35Sb™** | 96.15 | 3.5 | | 0.35 | 221 | | |
| **P40™** | 96 | 4 | | | 221-228 | Alloy No. 28 | Alloy No. 701 |
| **P5™** | 95 | 5 | | | 221-235 | | Alloy No. 704 |
| **97C** | 97 | | 3 | | 230-250 | Alloy No. 24 | Alloy No. 402 |
| **99C** | 99.3 | | 0.7 | | 230-240 | Alloy No. 23 | Alloy No. 401 |
| **LM10A™** | 87 | 10 | 3 | | 214-275 | | |
| **95A** | 95 | | | 5 | 230-240 | Alloy No. 18 | Alloy No. 201 |

The products in this range are all lead-free and should be considered before the use of a lead-containing product. They offer greater strength than conventional tin-lead alloys.
**Plumbsol™, P35™, P35Sb™, P40™ and P5™** are silver-tin solders which have excellent soldering characteristics and provide improved strength particularly in service at moderately elevated temperatures. They are a good colour-match with stainless steel and the joints do not suffer from interfacial corrosion.
**P35Sb™** is available as a specially formulated industrial grade solder paste only.
**97C and 99C** tin-copper solders are now used in all copper plumbing installations as well as industrial applications where the lead content of solder is banned or undesirable.
**LM10A™** produces joints exhibiting relatively high tensile strength and conductivity for a soft solder alloy. It is used in electrical control gear and in steam control equipment where its conductivity, strength and creep properties at higher temperatures are considered important.

## LM™ Indium-Bearing Soft Solder Alloys

| | In | Sn | Pb | Ag | Melting Range °C | ISO 9453:2014 |
|---|---|---|---|---|---|---|
| **LM118E™** | 52 | 48 | | | 118 | Alloy No. 601 |
| **LM149E™** | 80 | | 15 | 5 | 149 | |
| **LM157E™** | 100 | | | | 157 | |
| **LM195™** | 58 | | 39 | 3 | 165-195 | |
| **LM210™** | 50 | | 50 | | 184-210 | |

These specialised indium-containing solders are used in electronic applications.

**Please note:** Johnson Matthey recommends the use of lead-free products wherever possible. Unless a sound technical reason exists for doing otherwise we do not recommend the use of lead and cadmium-containing materials. The use of lead in products is increasingly recognised as being undesirable both in terms of the long-term environmental impact and recyclability of products. The End of Life Vehicles (ELV) Directive (2000/53/EC), the RoHS Regulations in Directive 2002/95/EC and WEEE Directive on waste electrical and electronic equipment (2002/96/EC) prevent the use of certain hazardous substances including lead-containing materials. The use of lead in potable water systems has also been prohibited in Europe and in many countries worldwide.

# Soft Solder Fluxes

## Soft Solder Fluxes

| | | Recommended For Use On | Flux Residues | Working Range °C |
|---|---|---|---|---|
| **Soft Solder Flux No. 1S** | Liquid Flux | Carbon steel/stainless steel | Corrosive | 180-350˚C |
| **Soft Solder Flux No. 2S** | Liquid Flux | Copper/brass | Intermediate | 180-350˚C |
| **Soft Solder Flux No. 3S** | Paste Flux | Copper/brass/carbon steel/stainless steel | Corrosive | 180-350˚C |
| **Soft Solder Flux No. 4S** | Dispensable Flux | Copper/brass | Intermediate | 180-350˚C |

The Johnson Matthey range of soft solder fluxes includes corrosive and intermediate liquid fluxes as well as corrosive and intermediate paste fluxes.

**UK Distribution**

Johnson Matthey
Gate 14, York Way
Royston
Hertfordshire
SG8 5HJ
United Kingdom

Tel +44 (0)1763 253200
Fax +44 (0)1763 253168
mj@matthey.com
www.jm-metaljoining.com

**Worldwide Distribution (except UK)**

Johnson Matthey & Brandenberger AG
Glattalstrasse 18
Postfach 485
CH-8052
Zürich
Switzerland

Tel +41 (0) 44 307 19 30
Fax +41 (0) 44 307 19 20
info@matthey.com
www.johnson-matthey.ch

**www.matthey.com**