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 is part of the Precious Metal Products Division of Johnson Matthey plc,  
 a global supplier of brazing filler metals, solders and fluxes.  
 A broad range of quality products, supported by excellent customer service  
 and technical expertise make us  
**BRAZING SPECIALISTS**

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**METAL JOINING WALL CHART**

**PRODUCTS**

Silver Brazing  
Filler Metals



Precious Metal Brazing  
Filler Metals



Base Metal Brazing  
Filler Metals



Silver-Copper-Phosphorus  
Brazing Filler Metals



Leading Brand Silver  
Brazing Fluxes



Brazing and Soldering  
Pastes



Fluxes for Special  
Applications



Soft Solders  
and Fluxes



Precious Metal  
Products



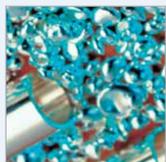
Environmental  
Technologies



Fine Chemicals



Precious Metal  
Capability



Broad Product  
Range



100 Years of  
Accumulated Knowledge



Technical Expertise and  
Customer Service



Product Quality and  
Management Systems



**METAL JOINING**

**JOHNSON MATTHEY**

# JOHNSON MATTHEY METAL JOINING PRODUCT REFERENCE CHART

## SILVER AND COPPER PHOSPHORUS BRAZING FILLER METALS

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

	Ag	Cu	Zn	Sn	Si	Melting Range °C	EN1044:1999	ISO 17672:2010
Silver-flo™ 60	60	26	14			695-730	AG202	
Silver-flo™ 56	56	22	17	5		618-652	AG102	Ag 156
Silver-flo™ 55	55	21	22	2		630-660	AG103	Ag 155
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™ 20	20	44	35.85		0.15	776-815	AG206	

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\*. \*Special considerations apply refer to Johnson Matthey for more info.  
Silver-flo™ 55 and 56 are general purpose cadmium-free filler metals. They combine 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 such as Easy-flo™ and Easy-flo™ No. 2. 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.

### Silver-flo™ Range - Special Applications

	Ag	Cu	Zn	Sn	Ni	Melting Range °C	EN1044:1999	ISO 17672:2010
Silver-flo™ 56S	56	22	16.75	5	0.25	618-652		
Silver-flo™ 4535	45	25	26.8	3	0.2	640-680		
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™ 18	18	47.5	36		0.25	784-816		

Silver-flo™ 56S and 4535 are proprietary filler metals containing silicon, which in conjunction with tin improves alloy flow and surface appearance. Silver-flo™ 4535 like 452 and 45 contains 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 by model engineers.

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

	Ag	Cu	Zn	Sn	Ni	Melting Range °C	EN1044:1999	ISO 17672:2010
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™ 16	16	50	34			790-830		

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

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

	Ag	Cu	P	Melting Range °C	EN1044:1999	ISO 17672:2010
Sil-fos™ Plus	18	75	7	644	CP101	CuP 286
Sil-fos™ 15	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 heating, refrigeration, air-conditioning and heat exchanger components.  
Silbralloy™ can be used instead of Copper-flo™ when low cost foil metal with higher ductility is required.

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

	Cu	P	Sn	Other	Melting Range °C	EN1044:1999	ISO 17672:2010
Copper-flo™	92.2	7.8			714-810	CP201	CuP 182
Copper-flo™ 2	92	6		2 Sb	690-825	CP301	CuP 389
Copper-flo™ 3	93.8	6.2			714-890	CP203	CuP 179
Stan-fos™	86.2	6.8	7		640-680	CP302	CuP 386

The 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-phosphorus 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™ and Copper-flo™ No.3 are widely used in refrigeration pipe work and 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.

### Silver-flo™ and Argo-braze™ Products as Alternatives for Discontinued Cadmium Bearing Filler Metals

Cadmium-Containing Product	Ag	Cu	Zn	Cd	Ni	Melting Range °C	EN1044:1999	ISO 17672:2010
Easy-flo™	50	15	16	19		620-630	AG301	Ag 155
Easy-flo™No.2	42	17	16	25		608-617	AG303	Ag 155
DIN Argo-flo™	40	19	21	20		595-630	AG304	Ag 155
Argo-flo™	38	20	22	20		608-655		Ag 140
Mattibrazetm35	35	26	21	18		610-700	AG305	Ag 140
Argo-Swift™	30	28	21	21		607-685	AG306	Ag 140
Argo-bond™	23	35	27	15		616-735		Ag 130
Easy-flo™No.3	50	15.5	15.5	16	3	634-656	AG351	Ag 450

Concerns over user safety and the long-term impact of cadmium within the environment mean that the Easy-flo™ range of products has been discontinued.  
The conversion chart to the right shows the cadmium-free alternative that is most often selected as an alternative.  
\*Please note that it is advisable to consult Johnson Matthey before changing to a cadmium-free product.

### 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 17672:2010
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™ 49LM	49	27.5	20.5	0.5	2.5		670-710				
Tri-foil											
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™ 49LM is the universal brazing tri-foil used for larger carbide tips and circular saw blades.  
Argo-braze™ 40 has a long melting range and gap filling characteristics. It is used on both steel and carbide parts.

### 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 17672:2010
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	

Argo-braze™ 632 and Argo-braze™ 56 are designed to prevent interfacial (crevice) corrosion, which may result in rapid failure of joints made in stainless steel when exposed to water. Both filler metals have long melting ranges and are not free flowing or easy to use.

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

	Ag	Cu	In	Sn	Ni	Melting Range °C	AMS	AWS A5.8	EN1044:1999	ISO 17672:2010
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

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 was formerly called Silver-Copper Eutectic™ by Johnson Matthey. It is ideal for flux-less brazing of copper, nickel and metalised ceramics. Argo-braze™ 72 is supplied in two grades; 'Vacuum' Grade 1, as indicated by the letter 'V', which is suitable for components that will operate in a vacuum; and Grade 3 for applications where ultra high purity of the alloy is not required.  
Argo-braze™ 63V and Argo-braze™ 61V are indium bearing filler metals suitable for similar applications to Argo-braze™ 72V and can be used in conjunction with it in step brazing operations.  
Argo-braze™ 60V was formerly known as RT5N™ and can meet a variety of niche requirements.  
V1 indicates that the filler metal is supplied to a tightly controlled volatile impurity specification, Grade 1 of the relevant standard, making the filler metal suitable for vacuum service e.g. in thermionic vacuum tube type devices.

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

	Ag	Cu	Zn	Ni	Mn	Melting Range °C	AMS	AWS A5.8	EN1044:1999	ISO 17672:2010
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.  
V1 indicates that the filler metal is supplied to a tightly controlled volatile impurity specification, Grade 1 of the relevant standard, making the filler metal suitable for vacuum service e.g. in thermionic vacuum tube type devices.

### Active-braze™ Silver Brazing Filler Metals

	Ag	Cu	Ti	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

These products are representative of the Active-braze™ brazing filler metals – other compositions are available. They are suitable for brazing of diamond, ceramics and titanium alloys.

## BRAZING FLUXES

### General Purpose Silver Brazing Fluxes

	Working Range °C	EN1045
Easy-flo™ Flux Powder	550-800	FH10
Easy-flo™ Flux Paste	575-825	FH10
Mattiflux™ 100 Flux Paste	550-800	FH10

The leading brand general-purpose flux, good for hot-tinning.  
Good overhead resistance but provides less cover when molten.  
Smooth general-purpose flux with good overhead resistance.

### Medium and High Temperature Brazing Fluxes

	Working Range °C	EN1045	Notes
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. 5A Flux Powder	600-900	FH12	Contains boron for improved wetting on tungsten carbide.
Tenacity™ No. 20 Flux Powder	750-1000	FH21	For brass brazing / bronze welding with the Argente™ 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™.

### Silver Brazing Fluxes for Special Applications

	Working Range °C	EN1045	Notes
Easy-flo™ Aluminium Bronze Grade Flux Paste	550-775	FH11	For brazing on parent metals (aluminium bronze) containing 2-10% aluminium.
Easy-flo™ Medium Temperature Grade Flux Powder	600-800	FH10	A general-purpose flux powder with good overhead resistance.
Easy-flo™ Stainless Steel Grade Flux Paste	550-775	FH10	Contains more fluoride, good for stainless steel with short heating cycles.
Easy-flo™ Stainless Steel Grade Flux Powder	550-775	FH10	Contains more fluoride, good for stainless steel with short heating cycles.
Easy-flo™ Dipping Grade Flux Paste	550-750	FH10	Active at low temperatures, good for 'dipping' and induction brazing applications.
Liquid Flux No. 25	600-850	FH10	A liquid flux for where limited fluxing is needed.
Tenacity™ No. 6 Flux Powder	550-800	FH12	Contains boron for improved wetting on tungsten carbide.
Tenacity™ No. 6 Flux Paste	550-800	FH12	Contains boron for improved wetting on tungsten carbide.
Tenacity™ No. 2 Modified Flux Powder	550-900	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.
Silver-flo™ Flux Powder	550-775	FH10	A basic grade economic flux.
Silver-flo™ Flux Paste	550-775	FH10	A paste equivalent to Easy-flo™ Flux Powder.

### Fluxes for Aluminium Brazing Applications

	Working Range °C	Flux Residues
Alu-flo™ No. 1 Flux Paste	450-650	Corrosive
Alu-flo™ No. 2 Flux Paste	575-650	Non-Corrosive

Alu-flo™ No.1 Flux Paste is a chloride based flux suitable for use with Alu-flo™ HT and MT. Residues are corrosive and should be removed with warm water washing after brazing.  
Alu-flo™ No.2 Flux and Paste is a fluoride based flux suitable for use with Alu-flo™ HT and MT. Residues are insoluble and inert and cannot be removed after brazing.

### Fluxes for Jewellery Applications

	Working Range °C
Palla-flo™	700-1100
Oro-flo™	550-800

Palla-flo™ is a petroleum jelly based flux suitable for brazing cobalt containing palladium alloy jewellery.  
Oro-flo™ is a distinctive yellow liquid based flux suitable for brazing gold jewellery.

## 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 17672:2010
Orobraze™ 845	60	20		20		835-845			
Orobraze™ 890	80	20				890			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	</		