

SILVER BRAZING FILLER METALS

MATTI-SIL"

SILVER BRAZING FILLER METALS

2

3

4

5

CONTENTS

Key

Products at a glance Standard Filler Metals Filler Metals for Special Applications Less Common/Reference Filler Metals Flux Selection for the Matti-sil™ Products Recommended Uses and Technical Considerations

PRODUCTS AT A GLANCE

Compositions

Matti-sil™ products have the following compositions:	Alloy System	Ag Cu Zn					
	Additional Elements	Sn Si					

Standard products are supplied to conform to ISO 17672, which supersedes the AWS and EN specifications. AWS A5.8 classified filler metals are listed on page 3 and EN 1044 filler metals on pages 4 and 5. Special products and those conforming to proprietary Johnson Matthey specifications are also listed on pages 4 and 5.

Note: Products of this type are commonly referred to as silver brazing alloys or silver solders.

Uses for the Products

Matti-sil[™] products are most commonly used to form joints on a combination of the following materials:

- ▶ Copper and copper alloys including brass, bronze, nickel silver and aluminum-bronze
- ▶ Steel (mild / tool and stainless) Note: Special considerations apply if stainless steel joints are exposed to water in service
- ▶ Tungsten carbide and poly-crystalline diamond (PCD) tools and wear parts including PDC cutters

Conditions for Use

The Matti-sil" products are primarily intended for use by brazing in air using a hand torch, fixed burner system, high frequency induction or resistance heating.

They should be used with a compatible brazing flux. This can be introduced to the joint by applying a separate flux powder or paste, by using a flux coated brazing rod or as a brazing paste with a built-in flux binder system.





PRODUCTS

STANDARD FILLER METALS

These products represent the most widely used silver brazing filler metals.

	Specification		Description	Properties	Product
	Specification		Description	Properties	Forms
Matti-sil [™] 56Sn	Ag Cu Zn	Sn Si	Matti-sil [™] 56Sn conforms to AWS A5.8 BAg-7 / ISO 17672	1 Flow	8 8
	56 22 17	5 -	Ag156 and can be used on most common engineering metals in standard or critical applications for brazing. It is an easy	0.002-0.005"	
	Melting Range °F	1145-1205	to use, general purpose silver brazing filler metal. It has the	-58°F / 392°F	
	AWS A5.8	BAg-7	lowest brazing temperature of its type, a short melting range	<u>^</u> 410-165	10
	ISO 17672:2010	Ag 156	and is free flowing when molten, producing neat joints with	≋ Yes	G Free
			small fillets.		
Matti-sil™ 45Sn	Ag Cu Zn	Sn Si	Matti-sil™ 45Sn is a general purpose filler metal with 45%	2 Flow	8
	45 27 25.5	2.5 -	silver bridging the gap in properties and cost between high	0.002-0.005"	
	Melting Range °F	1195-1251	silver 55/56% filler metals and the medium silver 38/40% filler metals. It has the lowest silver content to braze PCD	-58°F / 392°F	6
	AWS A5.8	BAg-36*	segments below 1382°F without degrading the diamond	<u>^</u> 420-185	10
	ISO 17672:2010	Ag 145	layer. It has good flow properties, but a slightly higher brazing	≋ Yes	@ Free
			temperature than the high silver content filler metals.		
Matti-sil™ 45AWS	Ag Cu Zn	Sn Si	Matti-sil™ 45AWS has a medium brazing temperature, melting	2 Flow	
	45 30 25		range, flow and silver content. Although it is not preferred to the	0.003-0.008"	
	Melting Range °F	1225-1370	more common Matti-sil™ 40Sn or 38Sn it has found use in marine	-58°F / 392°F	6
	AWS A5.8	BAg-5	applications because it is resistant to dezincification. It is also used as a medium temperature filler metal for copper alloy tubes	<u>^</u> 420-185	
	ISO 17672:2010	-	where joint gaps are variable and a fillet is desirable.	≋ Yes	@ Free
Matti-sil [™] 40Sn	Ag Cu Zn	Sn Si	Matti-sil™ 40Sn offers a good combination of properties.	2 Flow	8 8
	40 30 28	2 -	It has a medium brazing temperature, melting range, flow	0.003-0.008"	国长
	Melting Range °F	1200-1310 BAg-28	characteristics and silver content. Matti-sil™ 40Sn is widely	-58°F / 392°F	る Ø
	AWS A5.8		used as a general purpose silver brazing filler metal as well as for joining copper and its alloys to steel in HVAC&R	<u>^</u> 450-155	5
	ISO 17672:2010	Ag 140	applications.	≋ No	G Free
Matti-sil™ 38Sn	Ag Cu Zn	Sn Si	Matti-sil™ 38Sn has similar properties to Matti-sil™ 40Sn.	2 Flow	8 4
	38 32 28	2 -	It has a medium brazing temperature, melting range, flow	0.003-0.008"	宣
	Melting Range °F		characteristics and silver content. Matti-sil ^{**} 38Sn is favored in different global regions to Matti-sil ^{**} 40Sn where it is also used	-58°F / 392°F	⊘ 🖋
	AWS A5.8	BAg-34	in general purpose and HVAC&R applications.	<u>^</u> 430-175	[D]
	ISO 17672:2010	Ag 138		<u></u> ≋ No	@ Free
Matti-sil [™] 30	Ag Cu Zn	Sn Si	Matti-sil™ 30 has a long melting range and poor flow	3 Flow	8
	30 38 32		characteristics, which make it an ideal choice for applications	0.003-0.008"	
	Melting Range °F	1250-1410	where fillet build ups are required or close tolerance joint gaps are not present. It is used for brazing steel, copper and copper	-58°F / 392°F	(1) A
	AWS A5.8	BAg-20	alloy tubes and fittings in HVAC&R and automotive applications.	<u>^</u> 460-135	10
	ISO 17672:2010	Ag 230		≋ No	G Free
Matti-sil [™] 25Sn	Ag Cu Zn	Sn Si	Matti-sil™ 25Sn has a long melting range and poor flow	3 Flow	8 6
	25 40 33	2 -	characteristics, which make it an ideal choice for applications	0.003-0.008"	
	Melting Range °F	1270-1435	where fillet build ups are required or close tolerance joint gaps are not present. Like Matti-sil** 30Sn it may be used for	-58°F / 392°F	6
	AWS A5.8	BAg-37	brazing steel, copper and copper alloy tubes and fittings in	<u>^</u> 460-135	<u></u>
	ISO 17672:2010	Ag 125	HVAC&R and automotive applications.	≥ No	G Free

^{*}Not exact match

PRODUCTS

FILLER METALS FOR SPECIAL APPLICATIONS

These cadmium-free filler metals have been designed for use in specialised applications.

	Specification	Description	Properties	Product Forms
Matti-sil [™] 60	Ag Cu Zn Sn Si 60 26 14 - - Melting Range °F 1283-1346 EN1044: 1999 AG202 ISO 17672:2010 -	Matti-sil" 60 is a filler metal specified for use on cupro-nickel and nickel alloys (in particular 70:30 cupro-nickel). It has a brazing temperature above the stress relieving temperature of many of these types of metals thus preventing liquid metal stress cracking as a result of intergranular penetration. It is resistant to dezincification.	● Flow ■ 0.002-0.008 ■ -58°F / 392°F △ 420-155 Yes	E CO Free
Matti-sil™ 56Si	Ag Cu Zn Sn Si 56 22 16.75 5 0.25 Melting Range °F 1145-1205 EN1044: 1999 - ISO 17672:2010 -	Matti-sil* 56Si is a Johnson Matthey proprietary filler metal which has a small addition of silicon, is very free flowing and produces smooth neat joints with small fillets. It is not recommended on carbon steel components that are subject to high impact or fatigue stress in service.	1 Flow 2 0.002-0.005 3 -58°F / 392°F △ 410-165	E COFFEE
Matti-sil™ 55Sn	Ag Cu Zn Sn Si 55 21 22 2 - Melting Range °F 1166-1220 EN1044: 1999 AG103 ISO 17672:2010 Ag 155	Matti-sil" 55Sn is an easy to use, general purpose silver brazing filler metal. It has a low brazing temperature, short melting range and is free flowing when molten, producing neat joints with small fillets. Matti-sil"55Sn is a cadmium-free replacement for the high silver (38-50%) cadmium containing filler metals. It can be used on most common engineering metals.	1 Flow 1 0.002-0.005" 1 -58°F / 392°F △ 390-145 ≈ Yes / ♣	© Pree
Matti-sil™ 44	Ag Cu Zn Sn Si 44 30 26 - - Melting Range °F 1247-1355 EN1044: 1999 AG203 ISO 17672:2010 Ag 244	Matti-sil" 44 has a medium brazing temperature, melting range, flow and silver content. Although it is not preferred to the more common Matti-sil" 40Sn or 38Sn it has found use in marine applications because it is resistant to dezincification. It is also used as a medium temperature filler metal for copper alloy tubes where joint gaps are variable and a fillet is desirable.	2 Flow ■ 0.003-0.008"	E CO Free
Matti-sil™ 30Sn	Ag Cu Zn Sn Si 30 36 32 2 - Melting Range °F 1229-1391 EN1044: 1999 AG107 ISO 17672:2010 Ag 130	Matti-sil" 30Sn has a long melting range and poor flow characteristics, which make it an ideal choice for applications where fillet build ups are required or close tolerance joint gaps are not present. It is used for brazing steel, copper and copper alloy tubes and fittings in HVAC&R and automotive applications. It is a popular choice as a flux coated rod for site work.	3 Flow ■ 0.003-0.008"	
Matti-sil™ 24	Ag Cu Zn Sn Si 24 43 33 Melting Range °F 1364-1472 EN1044: 1999 - ISO 17672:2010 -	Matti-sil™ 24 has been incorporated into aviation / aerospace industry standards and is consequently used in the manufacture of components for applications in this field. It is also used as the first alloy in a two-step silver brazing operation, where the second joint is made with Matti-sil™ 55Sn.	② Flow	S & € E E E E E E E E E E E E E E E E E E
Matti-sil [™] 20Si	Ag Cu Zn Sn Si 20 44 35.85 - 0.15 Melting Range °F 1428-1500 EN1044: 1999 AG206 ISO 17672:2010 -	Matti-sil" 20Si is a high melting point silver brazing filler metal that has a comparatively narrow melting range providing reasonable flow properties when molten. It can be used when color matching to brass is required.	3 Flow ■ 0.003-0.008" ↓ -58°F / 392°F △ 330-145 ≅ No	© © GoFree



PRODUCTS

LESS COMMON / REFERENCE FILLER METALS

These cadmium-free Matti-sil" filler metals have been included for reference purposes. Their use is limited to niche or specialised applications.

	Specification				Description			Properties			Product Forms	
Matti-sil [™] 45	Ag	Cu	Zn	Sn	Melting Range °F	EN1044: 1999	ISO 17672: 2010	1	-4	Į.	≋	
	45	25	30	-	1256-1292	-	-	Flow	0.002-0.005"	-58 / 392°F	Yes	7 P 0
Matti-sil™ 34Sn	Ag	Cu	Zn	Sn	Melting Range °F	EN1044: 1999	ISO 17672: 2010	3			\approx	
	34	36	27.5	2.5	1166-1346	AG106	Ag 134	Flow	0.003-0.008"	-58 / 392°F	No	
Matti-sil™ 33	Ag	Cu	Zn	Sn	Melting Range °F	EN1044: 1999	ISO 17672: 2010	1	L		\approx	
	33	33.5	33.5	-	1292-1364	-	-	Flow	0.003-0.008"	-58 / 392°F	No	7 P 🗐 🔘
Matti-sil [™] 25	Ag	Cu	Zn	Sn	Melting Range °F	EN1044: 1999	ISO 17672: 2010	2	-1-		\approx	
	25	40	35	-	1292-1445	AG205	Ag 225	Flow	0.003-0.008"	-58 / 392°F	No	7 P 🗐 🔘
Matti-sil™ 18Si	Ag	Cu	Zn	Si	Melting Range °F	EN1044: 1999	ISO 17672: 2010	2	nile.	Į.	\approx	
	18	45.75	36	0.25	1443-1500	-	-	Flow	0.003-0.008"	-58 / 392°F	No	7 P 🗊 💿
Matti-sil™ 16	Ag	Cu	Zn	Sn	Melting Range °F	EN1044: 1999	ISO 17672: 2010	2	alle e		\approx	
	16	50	34	-	1454-1526	-	-	Flow	0.003-0.008"	-58 / 392°F	No	

FLUX SELECTION FOR THE MATTI-SIL" PRODUCTS



For brazing in air it is necessary to use a silver brazing flux in conjunction with the Matti-sil[™] filler metals. Silver brazing flux can be applied as a powder, paste, a flux-coated rod or via a brazing paste that contains a flux.

When selecting a flux to match the specific requirements of the application the following points need to be considered:

- ► The working range of the flux should be approximately 120°F higher than the liquidus temperature of the filler metal
- Special Johnson Matthey fluxes have been formulated to improve wetting of the filler metal on certain parent materials (e.g. tungsten carbide, stainless steel)
- ► Specific heating methods can give better results if the flux is matched with the heating process
- ▶ Other factors such as the heating time and mass of the components can influence flux selection

Johnson Matthey offers a wide range of fluxes, which can lead to improved joint quality. For more information on fluxes see our flux brochure.

PRODUCTS

RECOMMENDED USES AND TECHNICAL CONSIDERATIONS

Steel (including Stainless Steel)

Matti-sil" filler metals are ideal for use on steel including carbon and low alloy grades. They can also be used to braze stainless steel, however, care should be taken over the issue of interfacial corrosion in joints exposed to wet service conditions.

Specific Issues for Steel and Stainless Steel

Matti-sil* filler metals containing silicon can be used to braze steel assemblies but can form a brittle intermetallic layer, which might fail under high impact or fatigue stress in service.

Stainless steel tends to overheat causing flux exhaustion, heavy oxidation and lack of wetting.

Silver brazed joints made on stainless steel components can be susceptible to a form of corrosion when the joint is exposed to a wet or aqueous service environment.

Recommendations

- High silver silicon containing filler metals are not recommended where steel components

 are subject to high impact or fatigue stress in service a Matti-sil* filler metal that does not contain silicon should be specified.
- A lower melting point, free flowing product such as Matti-sil® 56Sn or Matti-sil® 55Sn and a flux such as Mattiflux® Stainless Steel Grade or Tenacity® No.5 are recommended.

 Interfacial corrosion occurs in silver brazed stainless steel joints exposed to aqueous
- environments. Special filler metals such as Argo-braze 56 or Argo-braze 632

Copper and Copper Alloys

Silver brazing is a widely used way of joining a range of copper alloys. Brasses are very successfully brazed with Matti-sil* filler metals. Aluminum bronze, aluminum containing brasses and nickel-silver can be brazed with certain precautions.

Specific Issues for Free Machining Brass

When brazing leaded brasses filler metal wetting becomes impaired resulting in poor penetration, which in turn results in the formation of joints containing a high percentage of voids. The degree of voiding may also result in joint leak tightness issues. Joints also show reduced mechanical properties - particularly poor ductility. Leaded brasses are also susceptible to thermal cracking.

High zinc brasses will melt or deform if heated too close to their melting point.

Decorative brassware requires color matching of the filler metal or neat brazed joints.

Recommendations

The problem occurs mostly in brasses with more than 2% lead content. If possible a lower lead content brass should be used. The lower melting filler metals, such as Matti-sil" 56Sn or Matti-sil" 55Sn are recommended. Additional flux should be used and joint gaps should be opened up to allow for reduced filler metal flow. Joints should be tested to prove that they are of a satisfactory quality.

- The use of a filler metal with a liquidus of below 1472°F or more than 16% silver content is recommended to avoid damaging the brass during brazing.
- Neater more presentable joints are achieved with Matti-sil[™] 56Sn or Matti-sil[™] 55Sn than with lower silver, more brass-colored products such as Matti-sil[™] 24, 20Si, 18Si and 16.

Specific Issues for Aluminum Bronze

Brazing of aluminum containing copper alloys directly to carbon steel will result in a brittle joint that will fail.

Standard silver brazing fluxes are not effective on alloys with more than 2% aluminum.

Recommendations

- Creating a physical barrier by nickel plating the aluminum containing copper alloy component

 → or by using an Argo-braze™ tri-foil will prevent the migration of aluminum through the molten

 brazing filler metal to the steel where it would cause a brittle joint.
- A special flux Mattiflux Aluminum Bronze Grade Flux is recommended for brazing these materials.

Nickel Alloys and Cupro-Nickel

These metals can be brazed with Matti-sil™ filler metals provided precautions to avoid stress cracking are taken.

Specific Issues for Nickel Alloys and Cupro-Nickel

Nickel alloys and cupro-nickel are susceptible to liquid metal stress cracking as a result of silver brazing with lower temperature filler metals.

Recommendations

This cracking is due to intergranular penetration of the filler metal in the parent metal grain boundaries. Stress relieving the components can eliminate the problem, however, if this is not possible Matti-sil™ 60 is recommended to help overcome this issue.

Tungsten Carbide and Poly-crystalline Diamond (PCD) Segments

The high silver content Matti-sil™ products are used to braze tungsten carbide or PCD segments to steel.

Specific Issues for Tungsten Carbide and PCD

Filler metal wetting and the build up of stress in the tungsten carbide due to the brazing process are important considerations.

PCD will begin to degrade at temperatures above 1382°F.

Recommendations

- Lower melting Matti-sil" products, such as Matti-sil" 56Sn or Matti-sil" 55Sn, are suitable for use on small pieces of tungsten carbide (less than 0.4" in any dimension). Less easy-to-wet grades and/or larger pieces often require a special Argo-braze product.
- For this reason the lower melting, free flowing Matti-sil" filler metals are selected. Matti-sil™ 56Sn, Matti-sil™ 55Sn or Matti-sil™ 45Sn are recommended.

Technical Considerations

Matti-sil™ Filler Metals Containing Tin

May be prone to cracking if quenched from high temperatures (in excess of 572°F).

Recommendations

This applies particularly to the low silver, high melting tin containing filler metals. They should not be quenched when brazing components with widely differing coefficients of thermal expansion.

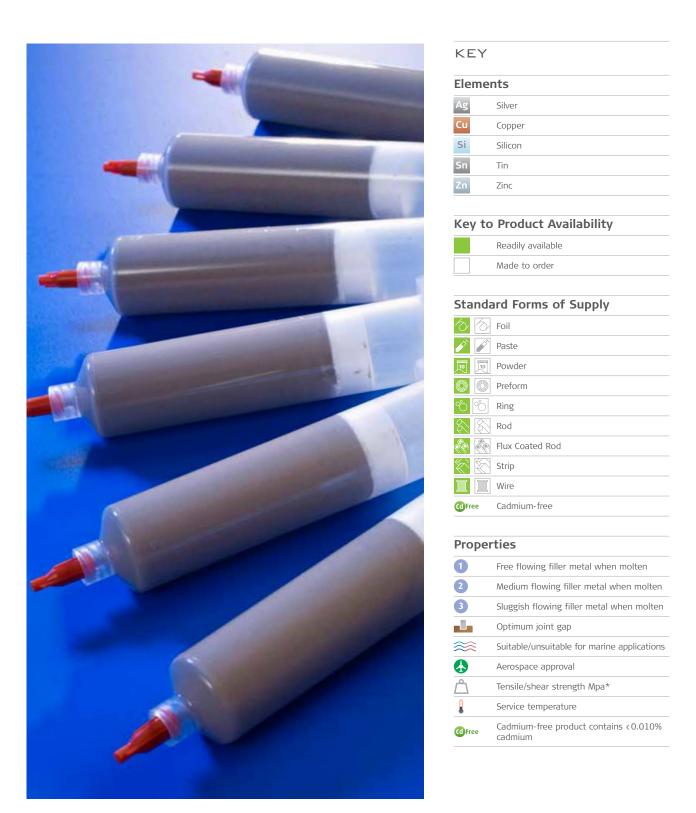
When not to use Matti-sil™ Filler Metals.

Matti-sil™ products are not suitable for brazing aluminum, cast iron, titanium or magnesium alloys.

Alu-flo[™] products are recommended for aluminum. Argo-braze[™] 49H can be used for cast iron alloys.



MATTI-SIL"



^{*} Please note that the tensile/shear strength data provided refers to the alloy strength in the cast condition. It does not directly relate to the strength of a brazed joint. Joint strength is more directly a function of factors such as the joint design and brazing process.



Europe and Worldwide Distribution

Johnson Matthey Metal Joining York Way, Royston, Hertfordshire, SG8 5HJ, UK.

Tel. +44 (0)1763 253200, Fax. +44 (0)1763 253168

Email: mj@matthey.com www.jm-metaljoining.com

Switzerland, Germany and Austria

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

Telefon +41 (0) 44 307 19 30, Fax +41 (0) 44 307 19 20

Email: info@johnson-matthey.ch www.johnson-matthey.ch

















Johnson Matthey Plc cannot anticipate all conditions under which this information and our products or the products of other manufacturers in combination with our products will be used. This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is given in good information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is given in good faith, being based on the latest information available to Johnson Matthey Pic and is, to the best of Johnson Matthey Pic's knowledge and belief, accurate and reliable at the time of preparation. However, no representation, warranty or guarantee is made as to the accuracy or completeness of the information and Johnson Matthey Pic assumes no responsibility therefore and disclaims any liability for any loss, damage or injury howsoever arising (including in respect of any claim brought by any third party) incurred using this information. The product is supplied on the condition that the user accepts responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. Freedom from patent or any other proprietary rights of any third party must not be assumed. The text and images on this document are Copyright and property of Johnson Matthey. This datasheet may only be reproduced as information, for use with or for resale of Johnson Matthey products. The JM logo®, Johnson Matthey name® and product names referred to in this document are trademarks of Johnson Matthey Pic, Royston, United Kingdom.