



Johnson Matthey
Metal Joining



MATTI-PHOS™
COPPER-FLO™

SILVER/COPPER-PHOSPHORUS
BRAZING FILLER METALS

MATTI-PHOS™ & COPPER-FLO™

BRAZING FILLER METALS

CONTENTS

Products at a glance	2
Silver/Copper-Phosphorus Brazing Filler Metals	3
Silver/Copper-Phosphorus Brazing Filler Metals	4
Recommended uses for Matti-phos™ & Copper-Flo™ Filler Metals	5
Filler Metal Selection	6
Key	7

PRODUCTS AT A GLANCE

Compositions

These products have the following compositions:

Matti-phos™	Ag	Cu	P	
Copper-flo™	Cu	P	Sn	Sb

Standard products are supplied to conform to ISO17672.

Special products conform to proprietary Johnson Matthey specifications.

Uses for the Products

The Matti-phos™ and Copper-flo™ products are most commonly used to form joints on the following materials:

- ▶ Copper tubes, pipes and fittings
- ▶ Copper alloys including brass, bronze, nickel silver and aluminium-bronze
- ▶ Electrical engineering applications

Conditions for Use

The Matti-phos™ and Copper-flo™ products are typically used for brazing in air using a hand torch, fixed burner system, high frequency induction or resistance heating.

These products are self-fluxing when used on copper. When used to braze copper alloys a compatible brazing flux should be used. This can be applied using a Johnson Matthey flux powder or paste, or a brazing paste with a flux binder system included.



MATTI-PHOS™ & COPPER-FLO™

PRODUCTS

SILVER/COPPER-PHOSPHORUS BRAZING FILLER METALS

These products are mainly used for brazing copper to copper. They are self-fluxing on copper and therefore do not require a separate flux for this application.

	Specification			Description	Properties	Product Forms
Matti-phos™ Plus	Ag	Cu	P	Matti-phos™ Plus is the most free flowing filler metal from the Matti-phos™ range. It is used in niche applications where its low melting temperature, flow properties and electrical conductivity are an advantage. Matti-phos™ Plus is not particularly ductile and should not be used in applications where vibration, stress or deformation of the joint in service are possible.	-58 / 300°F 1 Flow Low 1 0.001-0.003" 1190°F	
	18	75	7			
	Melting Range		1190°F			
	EN1044: 1999		CP101			
	ISO 17672:2010		CuP 286			
Matti-phos™	Ag	Cu	P	Matti-phos™ is a widely used product being the most ductile of the silver/copper-phosphorus brazing filler metals and the only one available as a foil. It is used extensively in electrical engineering applications where it is used to make electrically conductive joints. It is also used in heating and ventilation and refrigeration applications to join copper pipes.	-58 / 300°F 2 Flow High 0.002-0.008" 1300°F	
	15	80	5			
	Melting Range		1190-1475°F			
	AWS A5.8		BCuP-5			
	ISO 17672:2010		CuP 284			
Matti-phos™ 6	Ag	Cu	P	Matti-phos™ 6 is one of the most free flowing filler metals from the Matti-phos™ range making it popular in heat exchanger, air conditioning and refrigeration (HVAC&R) applications. It is also one of the least ductile and should not be used in applications involving exposure to strong vibrations, impact loads or where some deformation of the joint might be expected in service.	-58 / 300°F 1 Flow Low ¹ 0.001-0.003" 1275°F	
	6	86.75	7.25			
	Melting Range		1190-1325°F			
	AWS A5.8		BCuP-4			
	ISO 17672:2010		CuP 283			
Matti-phos™ 5	Ag	Cu	P	Matti-phos™ 5 provides the best combination of flow and ductility of all the silver/copper-phosphorus type brazing filler metals. As a result it is used in heat exchanger, air conditioning and refrigeration (HVAC&R) applications for flux-free brazing of copper pipes and tubes. It is also used for joining copper and copper alloys in electrical engineering applications.	-58 / 300°F 2 Flow Medium 0.002-0.008" 1325°F	
	5	89	6			
	Melting Range		1190-1495°F			
	AWS A5.8		BCuP-3			
	ISO 17672:2010		CuP 281			
Silbralloy™	Ag	Cu	P	Silbralloy™ sits between Matti-phos™ 5 and Copper-flo™. It is less ductile and free flowing than Matti-phos™ 5 but more ductile whilst being less free flowing than Copper-flo™. It is used in HVAC&R applications for flux-free brazing of copper pipes or seams. Silbralloy™ HP is a variation of this product that is available. It conforms to ISO 17672: CuP 280 / AWS A5.8 BCuP-6 having a higher phosphorus level (nominally 7%) making it freer flowing but less ductile.	-58 / 300°F 2 Flow Medium-Low 0.002-0.008" 1360°F	
	2	91.7	6.3			
	Melting Range		1190-1450°F			
	EN1044: 1999		CP105			
	ISO 17672:2010		CuP 279			



MATTI-PHOS™ & COPPER-FLO™

PRODUCTS

SILVER/COPPER-PHOSPHORUS BRAZING FILLER METALS

These products are mainly used for brazing copper to copper. They are self-fluxing on copper and therefore do not require a separate flux for this application.

	Specification			Description	Properties	Product Forms
Copper-flo™	Cu	P		Copper-flo™ is the most free flowing copper-phosphorus filler metal, however, due to its high phosphorus content it is one of the least ductile. It is best suited for making copper joints of the true capillary type and should not be used in applications involving exposure to strong vibrations, impact loads or where some deformation of the joint might be expected in service.	-58 / 300°F - Flow Medium-Low 0.001-0.003" 1325°F	
	92.2	7.8				
	Melting Range	1317-1490°F				
	EN1044: 1999	CP201				
	ISO 17672:2010	CuP 182				
Copper-flo™ No.2	Cu	P	Sb	Copper-flo™ No.2 is a specialised copper-antimony-phosphorus filler metal. It was specifically designed for flux-less brazing of copper cylinders for domestic and industrial heating systems where it is used for seam joints. The antimony in this filler metal improves its flow characteristics whilst allowing the phosphorus level to be kept low hence optimizing ductility.	-58 / 300°F - Flow Medium 0.002-0.008" 1360°F	
	92	6	2			
	Melting Range	1274-1517°F				
	EN1044: 1999	CP301				
	ISO 17672:2010	CuP 389				
Copper-flo™ No.3	Cu	P		Copper-flo™ No.3 is a low cost, relatively ductile filler metal (when compared to Copper-flo™), which is not too fluid when molten so can be held in the joint area when brazing. These characteristics make Copper-flo™ No.3 a popular choice for air-conditioning and refrigeration applications. Where greater ductility is required Matti-phos™ 5 should be used.	-58 / 300°F 3 Flow Medium-Low 0.002-0.008" 1400°F	
	93.8	6.2				
	Melting Range	1317-1674°F				
	EN1044: 1999	CP203				
	ISO 17672:2010	CuP 179				
Stan-fos™	Cu	P	Sn	Stan-fos™ is not self-fluxing on copper and must be used with a brazing flux such as Mattiflux™ Flux Powder. It is free flowing and produces a smooth fillet. Stan-fos™ is brittle/not ductile and should therefore not be used in applications involving exposure to strong vibrations or impact loads. It is used primarily on copper to copper alloy joints.	-58 / 300°F 1 Flow Low 0.001-0.003" 1290°C	
	86.2	6.8	7			
	Melting Range	1184-1256°F				
	EN1044: 1999	CP302				
	ISO 17672:2010	CuP 386				



MATTI-PHOS™ & COPPER-FLO™

TECHNICAL

RECOMMENDED USES FOR MATTI-PHOS™ & COPPER-FLO™ FILLER METALS

Copper to Copper

Matti-phos™ & Copper-flo™ brazing filler metals are most often used to braze copper to copper. The phosphorus within the filler metals gives them a self-fluxing capability. There is therefore no need for a separate brazing flux.

Specific Issues for Copper to Copper

Tough-pitch copper is subject to deterioration if heated to a high temperature in reducing conditions. It contains dissolved cuprous oxide, which may be chemically reduced in a reducing flame or atmosphere to leave small cavities in the metal.

Recommendations

This effect is known as hydrogen embrittlement. When brazing this material a neutral or slightly oxidizing flame is therefore recommended. Phosphorus de-oxidized or oxygen-free copper should be specified.

Copper Alloys

Matti-phos™ & Copper-flo™ products can be used to join copper alloys such as brass, bronze or gunmetal.

Specific Issues for Copper Alloys

A separate flux is required because the self-fluxing action only occurs on copper.

Recommendations

Mattiflux™ Flux Powder or Mattiflux™ Flux Paste. Mattiflux™ Low Temperature Grade Flux Paste also performs well on copper alloys. Tenacity™ No.4A Flux Powder may be used where long heating cycles are required.

NOT RECOMMENDED FOR

Brazing of Parent Materials Containing Iron or Nickel

Matti-phos™ & Copper-flo™ products should not be used to braze any iron or nickel containing materials including carbon and stainless steel.

Specific Issue: Metals Containing Iron or Nickel

The phosphorus within the filler metal will form brittle, intermetallic, phosphide compounds at the joint interface. This will cause complete failure of the joints.

Recommendations

Matti-sil™ or Argo-braze™ products may be suitable for these applications, consult Johnson Matthey for more information.

Sulfurous Atmospheres at Elevated Service Temperatures

Matti-phos™ & Copper-flo™ products are not suitable for use in sulfurous atmospheres at elevated service temperatures.

Specific Issue: Sulfurous Atmospheres at Elevated Service Temperatures

Phosphorus containing filler metals should not be used in cases where they will be exposed to sulfurized gases at elevated temperatures, for example in model engineering boilers.

Recommendations

Matti-sil™ or Argo-braze™ products may be suitable for these applications - consult Johnson Matthey for more information.



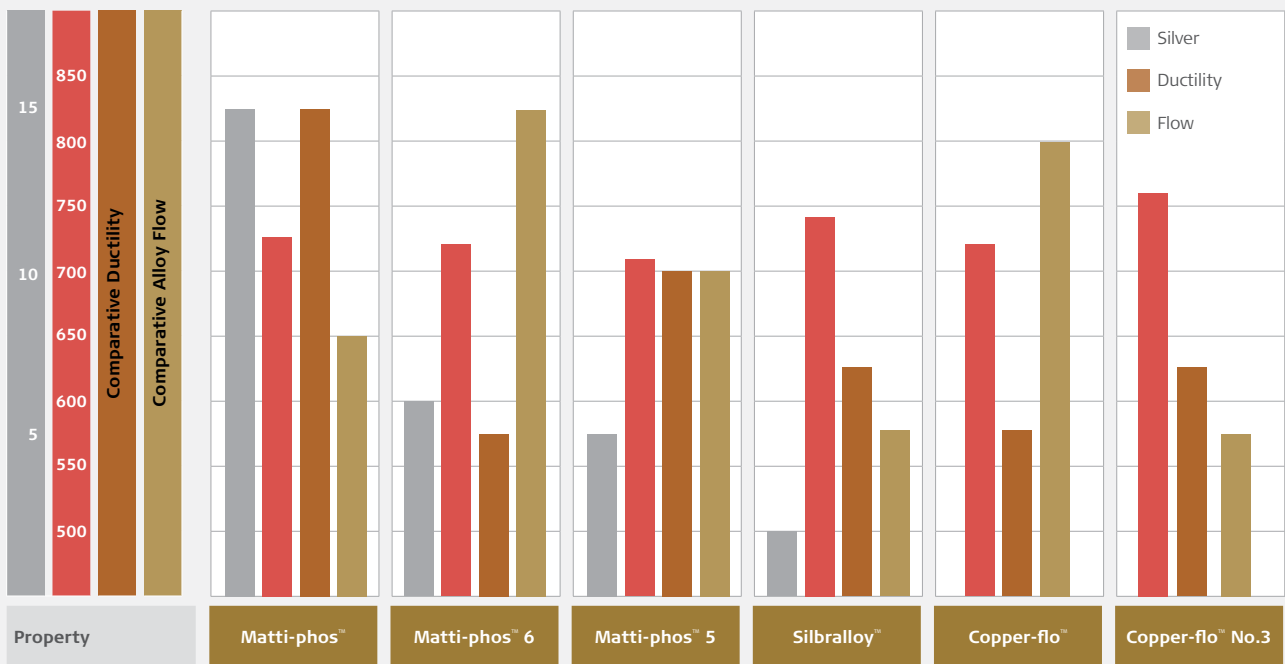
MATTI-PHOS™ & COPPER-FLO™

FILLER METAL SELECTION

When selecting a brazing filler metal from the Matti-phos™ & Copper-flo™ range it is necessary to understand about the flow and ductility of the different products. Silver and phosphorus are the key elements. Silver is used to improve the filler metal's ductility but increases its cost.

The higher the phosphorus content the more free flowing but less ductile the filler metal becomes. The relationship between these elements is shown below.

The Cost-Ductility-Flow Relationship



Property	Matti-phos™	Matti-phos™ 6	Matti-phos™ 5	Silbralloy™	Copper-flo™	Copper-flo™ No.3
Silver %	15	6	5	2	0	0
Working temperature °F	1300	1275	1325	1360	1325	1400
Comparative ductility	High	Low ¹	Medium	Medium - Low	Low ¹	Medium - Low
Comparative alloy flow	Medium	High/free flowing	Medium	Low ²	Medium	Low ²
Comparative cost	High	Medium	Medium	Medium - Low	Low	Low
Typical applications	Electrical	HVAC & R	HVAC & R Heat exchangers	HVAC & R	HVAC & R Heat exchanger return bends	RAC ³

¹ Not suitable for use on joints which will be subjected to strong vibrations, impact loads, manipulation or deformation after brazing or in service

² Low flow make these alloys a good choice for situations where the filler metal needs to be kept in the joint area and must bridge a wide gap.

³ Refrigeration and Air Conditioning.

MATTI-PHOS™ & COPPER-FLO™



Elements

Ag	Silver
Cu	Copper
Si	Silicon
Sn	Tin
Zn	Zinc

Properties

1	Free flowing filler metal when molten
2	Medium flowing filler metal when molten
3	Sluggish flowing filler metal when molten
	Optimum joint gap
	Tensile/shear strength Mpa
	Working temperature

Key to Product Availability

The product description charts in this book indicate which products are readily available from stock at the time of this brochure being printed. If a product is indicated in a lighter shade it can be supplied to order.

Standard Forms of Supply

	Foil
	Paste
	Powder
	Preform
	Ring
	Rod
SO	Special Order
	Strip
	Wire


Johnson Matthey
 Metal Joining

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 faith, being based on the latest information available to Johnson Matthey Plc and is, to the best of Johnson Matthey Plc'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 Plc 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 Plc, Royston, United Kingdom.