Johnson Matthey

EASY-FLO™
TENACITY™
ALU-FLO™

BRAZING FLUXES

BRAZING FLUXES

contents

products at a glance

Compositions

Easy-flo™, Tenacity™ and Alu-flo™ brazing fluxes are specially formulated proprietary products. They each contain a number of inorganic metal salts.

In general the products conform to EN 1045.

Uses for the Products

Easy-flo™ fluxes are used in a variety of silver brazing operations. For example, special grades have been formulated for specific parent metals or heating methods.

Tenacity™ fluxes are intended for use in specialised silver brazing and high temperature copper brazing applications.

Alu-flo™ fluxes are designed to be used with an aluminium brazing filler metal.

Conditions for Use

These products should be used with a compatible brazing filler metal. Ideally they will be applied as a pre mixed paste which should be brushed onto the joint surfaces prior to assembly and subsequent heating.

These fluxes are used when brazing in air using a hand torch, fixed burner system or high frequency induction equipment.

EASY-FLO™

PRODUCTS

easy-flo™ silver brazing fluxes - general purpose

These products are popular general purpose silver brazing fluxes. When selecting a flux it is important to match its recommended working range with the liquidus temperature of the brazing filler metal.

Easy-flo™ Flux Powder

Recommended for

- A working range of of 550-800˚C
- Use on most common engineering metals (excluding aluminium)
- Excellent flux pick-up onto warmed brazing rod when using 'hot-rodding' technique Can
- be used on stainless steel at <700˚C

Description

Easy-flo™ Flux Powder is a globally renowned white silver brazing flux powder. It is a leading brand flux popular with both distributors and end users.
This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium to long
Flux Residue Removal	30 min 60˚C
Standard Packaging	250g 500g 5kg 25kg

Easy-flo™ 100 Flux Paste

Recommended for

- A working range of 550-800˚C
- Use on most common engineering metals (excluding aluminium)
- Especially for ferrous materials

Description

Easy-flo™ 100 Flux Paste is an excellent smooth white general purpose silver brazing flux. It is also sold as Mattiflux™ 100 Flux Paste in certain markets.
This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium to long
Flux Residue Removal	30 min 60˚C
Standard Packaging	1kg 7kg

easy-floTM silver brazing fluxes - special applications

These products are specially modified flux pastes designed for different applications.

Easy-flo™ Low Temperature Grade Flux Paste

Recommended for

- A working range of 550-750˚C
- Use on most common engineering metals (excluding aluminium)
- Use on copper and copper alloys Induction
- heating, rapid heating cycles Application by
- dipping of components

Description

Easy-flo™ Low Temperature Grade Paste is a thin smooth white paste. It is a general purpose silver brazing flux also marketed as Easy-flo™ Dipping Grade Flux Paste. This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	1kg 7kg

Easy-flo™ Medium Temperature Grade Flux Paste

Recommended for

- A working range of 600-800˚C
- Use on most common engineering metals (excluding aluminium)
- Use with lower silver content filler metals
- Performs well with extended heating and at the top of its working range

Description

This is a white general purpose silver brazing flux paste. It is intended for use with low silver content filler metals and on components where brazing times will be protracted.
This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium to long
Flux Residue Removal	30 min 60˚C
Standard Packaging	1kg 5kg

Easy-flo™ High Temperature Grade Flux Paste

Recommended for

- A working range of 575-825˚C
- Use on most common engineering metals (excluding aluminium)
- Has good 'temperature-time stability' and overheat resistance.
- Good vertical hold on components

Description

Easy-flo™ High Temperature Grade Flux Paste is a silver brazing flux, which performs well with extended heating and at the top of its working range.
This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Medium
Activity	Medium
Life	Medium to long
Flux Residue Removal	30 min 60˚C
Standard Packaging	250g 500g 1kg 7kg

EASY-FLO™

products

easy-flo™ silver brazing fluxes – special purpose for specific markets

Easy-flo™ K Grade Flux Powder

Recommended for

- A working range of of 550-800˚C
- Developed for Swiss, German and Austrian markets
- Use on most common engineering metals including copper, brass and steel (excluding aluminium)

Description

Easy-flo™ K Flux Powder is a special purpose white silver brazing flux powder. It is exclusively offered in Swiss, German and Austrian markets where its brazing characteristics are preferred.
This flux conforms to **EN1045 FH10.**

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	500g 5kg

Easy-flo™ A Grade Flux Paste

Recommended for

- A working range of 550-800˚C
- Developed for Swiss, German and Austrian markets where its brazing characteristics are preferred
- Use on most common engineering metals (excluding aluminium)

Description

Easy-flo™ H Flux Paste is an excellent smooth white general purpose silver brazing flux. It is also marketed as Mattiflux™ 120 Flux Paste in certain markets.
This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium to long
Flux Residue Removal	30 min 60˚C
Standard Packaging	1kg

easy-flo™ silver brazing fluxes for special applications

These products are designed for improved preformance on specific metals.

Easy-flo™Stainless Steel Grade Flux Powder

Recommended for

- A working range of 550-775˚C Especially
- for stainless steel components where a higher fluoride content boosts activity Suitable for most common engineering
- metals and on certain aerospace work

Description

A general purpose silver brazing flux powder, which offers improved fluxing on stainless steel when used with brazing filler metals with a liquidus temperature up to 725˚C. This flux conforms to **EN1045 FH10.**

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	500g 5kg

Easy-flo™Stainless Steel Grade Flux Paste

Recommended for

- A working range of 550-775˚C Especially
- for stainless steel components where a higher fluoride content boosts activity Suitable for most common engineering
- metals and on certain aerospace work

Description

A general purpose silver brazing flux paste, which offers improved fluxing on stainless steel when used with brazing filler metals with a liquidus temperature up to 725˚C. This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	1kg

Easy-flo™Aluminium Bronze Grade Flux Paste

Recommended for

- A working range of 550-775℃
- Silver brazing of aluminium bronze and copper alloys where the formation of aluminium oxide prevents standard fluxes from working successfully

Description

A specialised silver brazing flux for aluminium bronze and copper alloys with 2-10% aluminium where standard fluxes are unable to dissolve surface aluminium oxide.
This flux conforms to **EN1045 FH11.**

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	1kg

TENACITY™

products

tenacity™ brazing fluxes - boron modified

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™ No.6 Flux Powder

Recommended for

- A working range of 550-800˚C
- Improving wetting of the filler metal on cemented tungsten carbide Tungsten
- carbide backed PCD Grades of cast iron
-

Description

Tenacity™ No.6 Flux Powder is a brown boron modified flux for use on tungsten carbide and materials containing refractory metals. It has superior fluxing activity to many other products of its type.
This flux conforms to **EN1045 FH12**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	500g 4kg

Tenacity™ No.6 Flux Paste

Recommended for

- A working range of 550-800˚C
- Improving wetting of the filler metal on cemented tungsten carbide Tungsten
- carbide backed PCD Grades of cast iron
-

Description

Tenacity™ No.6 Flux Paste is a brown boron modified flux for use on tungsten carbide and materials containing refractory metals. It has superior fluxing activity to many other products of its type.
This flux conforms to **EN1045 FH12**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	500g

Tenacity™ No.5A Flux Powder

Recommended for

- A working range of 600-900˚C Improving wetting of the filler metal on cemented tungsten carbide
- Tungsten carbide backed PCD
- Refractory metals
- Has good 'temperature-time stability' and overheat resistance.

Description

Tenacity™ No.5A Flux Powder is designed for use on stainless steel, tungsten carbide and materials containing refractory metals in instances where there is a need for a higher temperature flux with improved wetting. This flux conforms to **EN1045 FH12**.

Flux Characteristics

Fluidity	Medium to low
Activity	High
Life	Long
Flux Residue Removal	NaOH
Standard Packaging	500g

Tenacity™ No.3A Flux Paste

Recommended for

- A working range of 600-875˚C
- Improving wetting of the filler metal on cemented tungsten carbide Tungsten
- carbide backed PCD Grades of cast iron
-

Description

Tenacity™ No.3A Flux Paste is a non-standard boron modified flux for use on stainless steel, tungsten carbide and materials containing refractory metals.
This flux conforms to **AMS 3411 / EN1045 FH12**

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	500g

TENACITY™

products

tenacity™ brazing fluxes - medium and high temperature

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

Tenacity™ No.4A Flux Powder

Recommended for

- A working range of 600-850˚C
- Silver brazing where a higher working range flux is needed such as with lower silver content filler metals
- Brazing large copper alloy components
- Phosphorus containing filler metals

Description

Tenacity™ No.4A Flux Powder is a medium temperature flux intended for use with lower silver content brazing filler metals or where a higher working range flux is needed.
This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium to long
Flux Residue Removal	NaOH
Standard Packaging	500g

Tenacity™ No.5 Flux Powder

Recommended for

- A working range of 600-900˚C
- Prolonged heating operations Large
- assemblies in steel or copper Stainless
- steel above 700˚C Controlling filler
- metal spread

Description

Tenacity™ No. 5 Flux Powder is a high temperature silver brazing flux with a long life and wide working range. It is restrictive when molten and forms insoluble glass-like residues.
This flux conforms to **EN1045 FH10**.

Flux Characteristics

Fluidity	Medium to low
Activity	High
Life	Medium to long
Flux Residue Removal	NaOH
Standard Packaging	250g 500g 5kg

Tenacity™ No.20 Flux Powder

Recommended for

- A working range of 750-1000˚C
- Bronze or braze welding operations
- Copper, mild and low alloy steels Use
- with copper-based filler metals

Description

Tenacity™ No.20 Flux Powder is a high temperature flux designed for bronze welding/braze welding/brazing with Argentel™ brass type filler metals. This flux conforms to **EN1045 FH21**.

Flux Characteristics

Fluidity	Medium to low
Activity	High
Life	Medium to long
Flux Residue Removal	
Standard Packaging	250g 500g

Tenacity™ No.125 Flux Powder

Recommended for

- A working range of 750-1200˚C
- Use on mild and low alloy steels and tungsten carbide
- Use with copper-based brazing filler metals JM Bronze™ filler metals such as F Bronze™
-

Description

Tenacity™ No. 125 Flux Powder is a high temperature flux powder suitable for use with Argentel™ and JM Bronze™ filler metals This flux conforms to **EN1045 FH21.**

Flux Characteristics

Fluidity	Medium to low
Activity	High
Life	Long
Flux Residue Removal	
Standard Packaging	400g 4kg

Tenacity™ No.125 Flux Paste

Recommended for

- A working range of 750-1200˚C
- Use on mild and low alloy steels and tungsten carbide
- Use with copper-based brazing filler metals
- JM Bronze™ filler metals such as F Bronze™

Description

Tenacity™ No. 125 Flux Paste is a high temperature flux paste suitable for use with Argentel™ and JM Bronze™ filler metals
This flux conforms to **EN1045 FH21.**

Flux Characteristics

Fluidity	Medium to low
Activity	High
Life	Long
Flux Residue Removal	
Standard Packaging	700g

TENACITY™

products

specialised tenacity™ fluxes

These products are designed for niche applications.

Tenacity™ No.2 Modified Flux Powder

Recommended for

- A working range of 550-800˚C
- Flux coating on brazing rods

Description

Tenacity™ No. 2 Modified Flux Powder is formulated for use as a flux for coating silver brazing rods. It is a specially milled white flux powder which is active early in its working range.
Conforms to: **EN1045 FH10**

Flux Characteristics

Fluidity	Medium to low
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	25kg

Tenacity™ No.14 Flux Powder

Recommended for

- A working range of 550-750˚C Brass
- where red staining is a problem Being
- active early in its working range Low
- temperature hand torch brazing operations

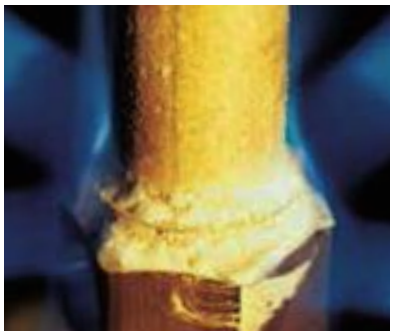
Description

Tenacity™ No. 14 Flux Powder is a specialised silver brazing flux used on brass where red staining due to oxidation of zinc is a problem.
Conforms to: **EN1045 FH10**

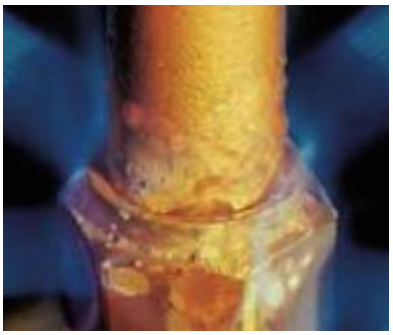
Flux Characteristics

Fluidity	Medium to low
Activity	High
Life	Medium to low
Flux Residue Removal	H_2SO_4
Standard Packaging	500g 5kg

Heating flux to brazing temperatures



The flux becomes white and solidifies as water is driven off



The flux becomes clear and watery as it approaches brazing temperature

Flux protects the component from oxidation as the brazing filler metal flows

ALU-FLO™

products

alu-flo™ fluxes for brazing aluminium

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

Alu-flo™ No.1 Flux Paste

Recommended for

- A working range of 520-610°C Excellent dispensibility
- Use with aluminium silicon/Alu-flo™ HT filler metals
- Brazing aluminium <620˚C.

Description

An active chloride based aluminium brazing flux with corrosive flux residues. Conforms to: **EN1045 FL10**

Flux Characteristics

Fluidity	Good
Activity	High
Life	Medium
Flux Residue Removal	30 min 60˚C
Standard Packaging	1kg

Alu-flo™ No.2 Flux Paste

Recommended for

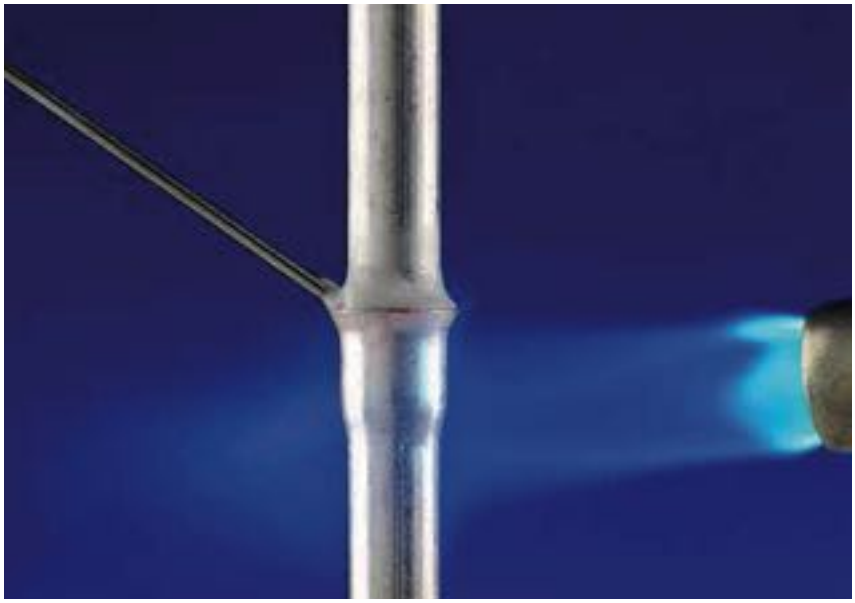
- A working range of 575-600°C Excellent dispensibility
- Use with aluminium silicon/Alu-flo™ HT filler metals
- Brazing aluminium <600˚C.

Description

An active fluoride based aluminium brazing flux with non-corrosive flux residues. Conforms to: **EN1045 FL20**

Flux Characteristics

Fluidity	Good
Activity	Low
Life	Low
Flux Residue Removal	Not possible
Standard Packaging	1kg



the purpose of a flux

The purpose of a brazing flux is to remove oxides present on the parent materials and the filler metal and those formed during brazing. Fluxes do not prevent oxidation from occurring but a carefully selected flux will remove oxide that is formed during brazing.

A molten brazing filler metal will only wet and flow over a parent material if both are substantially free of surface oxide. Simply removing surface oxide as part of the pre-cleaning process is not effective, since a new oxide layer is rapidly formed on heating. Thus, to achieve an oxide-free surface, it is necessary either to: -

1. Remove oxide as it is formed by the use of a suitable brazing flux.
2. Overcome oxidation during brazing by heating in a protective atmosphere or vacuum.
3. Use self-fluxing silver/copper/phosphorus filler metals - only applicable when brazing copper to copper.

Flux Performance and Characteristics

Pre-cleaning: Brazing fluxes are only designed to remove oxide films. Where other contaminants such as oil, paint and lacquer are present these should be removed by pre-cleaning before brazing, using either mechanical or chemical methods.

Flux Application Method

It is recommended that flux should be applied as a paste to both joint surfaces before assembly. Application of flux after assembly places great demands on the fluidity of the molten flux and its ability to penetrate capillary joints. Powders should be mixed into a smooth paste of double cream consistency with the addition of a drop or two of liquid detergent.

Working Range and Temperature Effects

If a flux is not heated up to its working range surface oxides will be present on the components and there will be insufficient heat in them to melt the filler metal. The filler metal will not melt and flow on the surface of the components. If a flux is heated beyond its working range it will rapidly become exhausted, the components and flux residues will blacken and the flux will stop working. The brazing filler metal will melt but not flow or wet out on the oxidised metal surfaces.

To be effective the flux must be both molten and active before the brazing filler metal melts, and it must remain active until the brazing filler metal flows through the joint and solidifies on cooling. The working ranges of Johnson Matthey's brazing fluxes are given in the table on page 10. It is good practice to select a flux which is active at least 50˚C below the solidus of the brazing filler metal and which is still active at a temperature at least 50˚C above the liquidus of the brazing filler metal. This will ensure that the flux is effective during the brazing operation.

Flux Volume

The volume of flux required will vary depending on the nature of the application. Usually it is sufficient to coat the joint faces and the surrounding component surfaces with a layer of paste using a brush. Using an excess of flux is in no way detrimental to the quality of the brazed joint, and can assist flux residue removal. Application of flux to surfaces away from the joint helps to prevent oxidation of the components. The use of too little flux can lead to flux exhaustion resulting in unsound brazed joints. It is, therefore, usually best practice to use too much rather than too little flux.

Flux Fluidity

Molten fluxes exhibit different levels of viscosity, which can change during the heating cycle. In most cases it is desirable to have a fluid flux with low viscosity which allows the filler metal to flow freely and displace the flux. Certain fluxes are less fluid resulting in less filler metal spread beyond the joint area. The more fluid a flux is when molten the easier it will be displaced by the filler metal

Flux Activity

Johnson Matthey Easy-flo™ and Tenacity™ fluxes are suitable for use on copper, brass, mild steel and most other common engineering materials. Certain metal oxides are less readily removed by chemical fluxes. In these cases a specialised or more active flux is necessary to break down the oxides formed and allow good filler metal flow and wetting. Special purpose fluxes exist for aluminium bronze, stainless steel, tungsten, molybdenum and tungsten carbide. Silver brazing fluxes are not effective on aluminium, magnesium, titanium or their alloys.

Flux Life

Flux has to remove the oxides on the component and must continue to remove fresh oxide until the completion of the brazing cycle. There is a limit to the amount of oxide that the flux can dissolve. The longer the heating cycle the more likely it is that the flux will become exhausted and the residues and components exhibit a blackened appearance. There is no fixed time for which a flux will be effective since this is dependent on the operating temperature, volume of flux and the type of parent metal.

For short rapid heating cycles it may be possible to use a flux above its recommended maximum working temperature. With long heating cycles additional flux may be added during brazing. However, flux exhaustion may occur and the use of flux with a higher working range would be recommended.

Using Flux as a Temperature Guide

During heating it is possible to use the flux as a temperature guide. Once the flux becomes a clear fluid it is an indication that brazing temperature has been approached.

Flux residue removal

In most cases flux residues should be removed after brazing as they can be corrosive. See page 11 for correct removal method.

EASY-FLO™ TENACITY™

flux selector chart

Flux plays a vital role in virtually all air brazing processes. Selecting a flux to match the specific requirements of application, brazing filler metal, parent materials and heating methods, is vital to obtain the best possible results. Johnson Matthey offers a wide range of fluxes, which can lead to improved quality through selecting the optimum flux for any application.

Filler Metal Melting Range	Standard Recommendation	Situation Where Alternative Flux May Improve Brazing	Alternative Flux For This Situation
		For Particular Parent Metals	
Melts below 750˚C	Easy-flo™ Flux Powder Easy-flo™ 100 Flux Paste	For brazing copper and copper alloys	Easy-flo™ Low Temperature Grade Flux Paste
		For brazing ferrous alloys	Easy-flo™ 100 Flux Paste
		For brazing stainless steel components	Easy-flo™ Stainless Steel Grade Flux Powder or Paste
		For copper based parent metals containing 2-10% aluminium	Easy-flo™ Aluminium Bronze Grade Flux Paste
		For tungsten carbide, PCD and cast iron	Tenacity™ No.6 Flux Powder
		For tungsten carbide, PCD and cast iron where paste is required	Tenacity™ No.6 Flux Paste
		For Specific Heating Situations or Application Methods	
		Rapid heating cycles – especially induction heating	Easy-flo™ Low Temperature Grade Flux Paste
		Application by dipping	Easy-flo™ Medium Temperature Grade Flux Paste
		Where good vertical hold during heating steel components is required	Easy-flo™ High Temperature Grade Flux Paste
		For tungsten carbide, PCD and cast iron where a dispensible grade of paste is required	Tenacity™ No.6 Dispensible Flux Paste
		Where one flux is required to deal with several different heating methods used in production	Easy-flo™ 100 Flux Paste
		For Particular Parent Metals	
Melts between 750 and 775˚C	Easy-flo™ High Temperature Grade Flux Paste	For stainless steel where overheating occurs	Tenacity™ No. 5 Flux Powder
		For large copper alloy components or where extra flux life is needed	Tenacity™ No. 4A Flux Powder
		For Specific Heating Situations or Application Methods	
		For rapid heating and shorter heating cycles	Easy-flo™ Low Temperature Grade Flux Paste Easy-flo™ Flux Powder Easy-flo™ 100 Flux Paste

Filler Metal Melting Range	Standard Recommendation	Situation Where Alternative Flux May Improve Brazing	Alternative Flux For This Situation
		For Particular Parent Metals	
Melts between 775 and 850˚C	Tenacity™ No 5 Flux Powder	For refractory metals/stainless steel where filler metal wetting is a problem but interfacial corrosion* is not a factor	Tenacity™ No 5A Flux Powder (*seek advice on this point)
		For Specific Heating Situations or Application Methods	
	Tenacity™ No 5 Flux Powder	Where overheating or extended heating may occur	Tenacity™ No.125 Flux Powder or Paste
		For Particular Parent Metals	
Melts between 900 and 1000˚C	Tenacity™ No.20 Flux Powder	For tungsten carbide to steel and especially for use with JM Bronze™ filler metals	Tenacity™ No.125 Powder or Paste
	Tenacity™ No.125 Flux Powder	For mild or carbon steel pipework in bronze or braze welding operations	Tenacity™ No.20 Flux Powder
		For Specific Heating Situations or Application Methods	
Melts between 850 and 1200˚C	Tenacity™ No.125 Flux Powder	Furnace brazing in a reducing atmosphere, partial pressure inert gas or vacuum	Flux is not normally required

key to flux residue removal

	Residues are generally soluble in hot water (~60 ˚C). Immerse for ~30 minutes.
	Brush in a stream of warm water.
NaOH	Residues are virtually insoluble in water. Immerse in a warm 10% sodium hydroxide solution.
	Residues are insoluble in water. Grit blasting or other mechanical means of removal are necessary.
H_2SO_4	Residues are virtually insoluble in water. Immerse in a warm 10% sulphuric acid solution.

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