

GAS AND TIG

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WELDING RODS

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# Guide to Using Your Murex Consumables Catalogue

## All Weld Mechanical Properties

The mechanical properties of the deposited weld metal shown in this catalogue refer to all weld metal properties when deposited in the flat position. These may have little relevance to the properties of a real joint achieved in practice, since this will depend on the dilution from the base material, welding position, bead sequence and heat input. Apart from their use for quality control purposes, the mechanical properties of the all weld metal test provide the designer with an initial guide to the selection of welding consumables.

This is particularly important with regard to Charpy impact grading. Thus, consumables which have the highest grade are more likely to offer better Charpy properties when used in practice. They will not necessarily give the same level of Charpy results in a welded joint as they do in an all weld metal test piece.

# Health & Safety Information

## Welding Fume

Welding fume consists of various airborne substances (fine particles or gases) which may increase hazards to health when they are inhaled or swallowed. The degree of hazard to the welder depends upon the composition of the fume, the concentration in the air that he is breathing and the time for which he is exposed to it.

No fumes or gases are evolved by MMA, MIG or TIG, SAW or gas welding consumables at normal ambient temperatures, but in use (welding), fumes can be evolved.

Table 1 shows typical wire analysis.

## Occupational Exposure Limits

The recommended limit on the concentration of welding fume (or any other atmospheric contaminant) in the air breathed by any person is defined by the Health & Safety Executive in a list of Occupational Exposure Limits (guidance note EH40). This guidance note is revised annually and reference should always be the most recent edition. A long term exposure limit (8 hr TWA value) of  $5 \text{ mg/m}^3$  for particulate welding fume is included in the current list.

It is the responsibility of the user/employer under the Health & Safety at Work Act and the Control of Substances Hazardous to Health (COSHH) regulations that limits are not exceeded. The fume analysis cannot be used to assess the concentration of total welding fume to which a welder is exposed. Assessment of the possible exposure of the welder must be carried out by a competent person.

## Hazards of Excessive Exposure

Effects from excessive exposure to fume arising from inadequate ventilation may become apparent at the time of welding or shortly afterwards or at some later date. Some of the effects are summarised below, and here it is important to note that workers other than welders may also come into contact with the products of welding fume:-

### (a) Irritation of the Respiratory Tract

This is the effect of dust or fume on the lining of the respiratory tract and can cause dryness of the throat, tickling, coughing, chest tightness, wheezing and difficulty in breathing. In its most acute form it can cause the lungs to become full of fluid. The effects will vary with exposure, concentration and type of irritant.

### (b) Metal Fume Fever

The inhalation of freshly formed metallic oxides such as those of zinc, chromium, nickel, copper, manganese may lead to an acute influenza like illness termed metal fume fever.

### (c) Systemic Poisoning

This can result from the inhalation or swallowing of substances such as fluorides, hexavalent chromium, lead and barium.

### (d) Long Term Effects

It is possible that certain constituents of welding fume such as hexavalent chromium and nickel may be carcinogenic and until there is definite information about this it is wise to treat them as such.

#### (e) Fibrosis

This is the formation of fibrous or scar tissue in the lungs. It is the result of a reaction between dust or fume with the lung tissue. There are various types depending on the nature of the substance involved and duration of exposure.

In all cases of doubt concerning physiological response to welding pollutants, medical advice should be sought promptly.

#### Tungsten Inert Gas Consumables

In the TIG process the heat necessary to melt and fuse the joint area is generated by an arc maintained between the end of a non-consumable tungsten electrode and the workpiece. The weld area is protected from the atmosphere by an inert gas shield supplied through the welding torch. Filler metal may be added into the molten pool to fill the joint but because the filler is not transferred across the arc little particulate fume is generated. Measurements of fume generation rate in an enclosed Swedish box type apparatus have shown that the process emits less than 0.5g/hr of fume (this is 30-100 times less than typical MIG emission rates).

In areas of good ventilation these fume emission rates would not result in a significant concentration of particulate welding fume in the welders breathing zone.

The gases ozone, nitrogen dioxide and nitric oxide may be produced by the action of the electric arc or the radiation from it on the surrounding air, and the likelihood of this occurring increases with increasing welding current, particularly when welding stainless steels and aluminium.

Typical compositions for Murex TIG consumables are shown on the product range pages of this catalogue

#### Handling and Storage

With regard to storage and handling we do not consider that any special safety precautions are required. Hands should be washed thoroughly before all meal breaks. Skin contact does not normally present a hazard, though it is always possible that occasional individuals may be found who are allergic to substances normally regarded as inert (e.g. cases of allergy to nickel have been reported arising from the wearing of nickel bracelets). However we do not know of any such cases in which welding consumables have been identified as the cause of an allergic response.

Consumables are dense materials and even small packets are relatively heavy. They should not be left in positions where physical injury or accidents could result.

#### Fire/Explosion Hazard

Welding consumables are non inflammable under ordinary conditions and do not present a fire or explosion risk. Welding consumables should not be allowed to come into contact with acids or other corrosive substances or with oxidising agents, nor with any other chemical substance with which a reaction may occur.

#### Personal Protection/Ventilation

Welders should wear the normal protective clothing and eye protection appropriate to electric arc welding.

Ventilation and/of fume extraction must be adequate to keep fume concentration within safe limits.

### Note on other Atmospheric Pollutants

In any welding operation other possible sources of atmospheric contamination may be present, for example, coatings, paint or traces of oil or of degreasing agents on work being welded, or substances arising from other operations in the vicinity, in addition to any fume arising from the welding consumables. Advice regarding the nature and extent of any possible hazard which might arise directly or indirectly from such substances or sources should always be obtained from the manufacturer of each product. Occupational exposure limits for a large number of substances are listed in "Guidance Note EH40".

### Further Information

Additional information and technical advice on products included in this book may be obtained from:

Murex Welding Products Ltd.,  
Hertford Road,  
Waltham Cross,  
Herts EN8 7RP.

Tel: 01992 710000

Welding Manufacturers Association leaflet 236 "Hazards from Welding Fume," which gives some more general information about welding fume, is also available on request. Guidance Note EH40 (Occupational Exposure Limits), EH54 (Assessment of exposure to fume from welding and allied processes) and EH55 (Control of exposure to fume from welding, brazing and similar processes) are available from HMSO book shops.

Table 1. Typical Composition of Murex Saffire Gas and TIG Rods

Consumable	Typical Wire Composition (wt%)																
	C	Mn	Si	Ni	Cr	Mo	Cu	Zr	Al	Mg	Zn	Ti	Sn	P	Ag	Fe	
Copper Coated Mild Steel	0.08	0.5	0.06				0.3										
Medium Carbon Steel	0.27	1.5	0.4				0.3										
Low Carbon Steel	0.09	1.0	0.3				0.3										
Super Steel	0.06	1.2	0.6				0.3	0.07	0.1			0.1					
Pipewelding Steel	0.13	1.7	0.3				0.3										
18/8-308L	0.01	1.8	0.4	10	20		0.1										
18/8/3Mo-316L	0.02	1.8	0.5	12	19	2.8											
23/12-309	0.02	1.6	0.4	13	24												
Aluminium 5% Silicon			5.0						94								
Aluminium 5% Magnesium		0.15							94	5.0							
Silicon Bronze			0.3				59				39						
Fluxobronze K			0.3				59				39						
Fluxobronze S			0.3				59				39						
Nickel Bronze			0.4	10			48				41						
Manganese Bronze		0.2	0.1				60				39		0.15				
Copper Phosphorus							92								7.4		
Silver Braze 2							90							6.5	2		
Agofil		0.3	0.3				98										
Aluminium Bronze 90/10							88		10								1

## Saffire Copper Coated Mild Steel

### Description and applications

Saffire Copper Coated Mild Steel is a general purpose low carbon steel rod for high grade oxy-acetylene welding of mild steel and wrought iron. It is widely used in the automobile, heating and ventilation, and chemical plant industries. No flux is required. The rods melt at 1490 C.

### Chemical composition (wire)

C	0.12 max
Si	0.10 max
Mn	0.60 max
S	0.040 max
P	0.040 max
Ni	0.25 max
Cu	0.45 max (includes coating)

### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire Medium Carbon Steel

BS2901: Part 1 1983 : A16 (Tig rods)

BS1453: 1972 (1987) : A16 (Gas rods)

### Description and applications

Saffire Medium Carbon Steel is for oxy-acetylene (no flux required) or TIG (with argon shielding gas) welding of mild and medium tensile steels. The melting point of the rod is 1400 C.

### Chemical composition (wire)

C	0.25-0.30
Si	0.30-0.50
Mn	1.30-1.60
S	0.040 max
P	0.040 max
Cu	0.45 max (includes coating)

### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire Low Carbon Steel

EN 1668 : W 42 6 W0

### Description and applications

Saffire Low Carbon Steel is a copper-coated low carbon double-deoxidised filler wire for TIG (with argon shielding gas) or oxy-acetylene (without flux) welding mild steels.

### Chemical composition (wire)

C	0.07-0.12
Si	0.15-0.50
Mn	0.80-1.20
S	0.025 max
P	0.025 max
Cr	0.15 max
Ni	0.15 max
Cu	0.45 max (includes coating)

### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire Super Steel

AWS A/SFA 5.18-79 : ER70S-2

EN 1668 : W 42 5 W2Ti

### Description and applications

Saffire Super Steel is a triple-deoxidised copper-coated mild steel filler rod particularly suited to TIG welding (with argon shielding gas) root runs in pipes. The rods may also be used without flux for oxy-acetylene welding. Typical all-weld metal ultimate tensile strength is 630 N/mm<sup>2</sup>.

### Chemical composition (wire)

C	0.04-0.07
Si	0.40-0.70
Mn	0.90-1.40
S	0.035 max
P	0.025 max
Al	0.05-0.15
Ti	0.05-0.15
Zr	0.02-0.12
Cu	0.50 max (includes coating)

### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire Pipewelding Steel

### Description and applications

Saffire Pipewelding Steel is a low carbon, high grade filler rod for oxy-acetylene welding steel pipes and mains, including high pressure air and steam pipelines. No flux is needed. The melting point of the rod is 1450 C.

### Chemical composition (wire)

C	0.11-0.15
Si	0.20-0.35
Mn	1.65-1.80
S	0.040 max
P	0.040 max
Cu	0.45 max (includes coating)

### Rod sizes

Diameter (mm)	2.4	3.2
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## Saffire 18/8-308L

AW S A/SFA 5.9-93 : ER308L  
EN 12072 : W 19 9 L

### Description and applications

Saffire 18/8-308L is a low carbon austenitic stainless steel filler rod for welding steels of similar composition (18% chromium, 8% nickel) e.g. AISI 304L, Werkstoff Nrs 1.4550 (X6 CrNiNb 18 10) and 1.6905 (X10 CrNiNb 18 10). The recommended shielding gas is argon or argon/5% hydrogen. Rod ends are flattened and stamped with the grade EA 4316 308L.

### Chemical composition (wire)

C 0.025 max  
Si 0.30-0.65  
Mn 1.2-2.0  
S 0.020 max  
P 0.025 max  
Cr 19.5-21.0  
Ni 9.0-11.0  
Mo 0.5 max  
Cu 0.5 max  
P+S 0.050 max

### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire 18/8/3Mo-316L

AW S A/SFA 5.9-93 : ER316L  
EN 12072 : W 19 12 3 L

### Description and applications

Saffire 18/8/3Mo-316L is a low carbon austenitic stainless steel filler rod for welding steels of similar composition (19% chromium, 12% nickel, 3% molybdenum) e.g. AISI 316L, Werkstoff Nr 1.4583 (X10 CrNiMoNb 18 12). The recommended shielding gas is argon or argon/5% hydrogen. Rod ends are flattened and stamped with the grade EA 4430 316L.

### Chemical composition (wire)

C 0.025 max  
Si 0.30-0.65  
Mn 1.2-2.0  
S 0.020 max  
P 0.025 max  
Cr 18.0-20.0  
Ni 11.0-13.0  
Mo 2.5-3.0  
Cu 0.5 max

### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire 23/12-309

AW S A/SFA 5.9-81 : ER309  
EN 12072 : G 23 12 L

### Description and applications

Saffire 23/12-309 is a nominal 23% chromium, 12% nickel austenitic stainless steel filler rod suitable for TIG welding steels of similar composition. The rod is also ideal for joining dissimilar steel combinations such as mild or low alloy steel to stainless or manganese steel. It may also be used for difficult to weld steels where cold cracking is a danger. Shielding gas is argon or argon/5% hydrogen. Do not use Ar/5%H<sub>2</sub> on steels susceptible to cold cracking.

### Chemical composition (wire)

C	0.12 max
Si	0.30-0.60
Mn	1.0-2.5
S	0.030 max
P	0.030 max
Cr	23.0-25.0
Ni	12.0-14.0
Mo	0.5 max
Cu	0.5 max

### Rod sizes

Diameter (mm)	1.6	2.4
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# Gas & TIG Welding Rods

## Aluminium

### Saffire Aluminium 5% Silicon

BS2901: Part 4 1990 : 4043A (TIG rods)  
BS1453: 1972 (1987) : 4043A (Gas rods)  
AWS A/SFA 5.10-92 : ER4043  
DIN 1732 (1988) : SG-AlSi5

#### Description and applications

Saffire Aluminium 5% Silicon is suitable for welding a wide range of aluminium alloys except for those with magnesium as a main addition. The recommended shielding gas for TIG welding is argon, and the recommended flux for oxy-acetylene welding is Saffire Aluminium Welding Flux.

#### Chemical composition (wire)

Si 4.5-5.5  
Mn 0.05 max  
Cr 0.05 max  
Cu 0.05 max  
Ti 0.15 max  
Zn 0.10 max  
Mg 0.05 max  
Fe 0.40 max

#### Rod sizes

Diameter (mm) 1.6 2.4 3.2

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### Saffire Aluminium 5% Magnesium

BS2901: Part 4 1990 : 5356 (TIG rods)  
BS1453: 1972 (1987) : 5356 (Gas rods)  
AWS A/SFA 5.10-92 : ER5356  
DIN 1732 (1988) : SG-ALMg5

#### Description and applications

Saffire Aluminium 5% Magnesium is suitable for welding wrought and cast aluminium alloys containing up to 5% magnesium. The recommended shielding gas for TIG welding is argon, and the recommended flux for oxy-acetylene welding is Saffire Aluminium Welding Flux.

#### Chemical composition (wire)

Si 0.25 max  
Mn 0.10-0.20  
Cr 0.05-0.20  
Cu 0.05 max  
Ti 0.06-0.15  
Zn 0.10 max  
Mg 4.5-5.5  
Fe 0.40 max

#### Rod sizes

Diameter (mm) 1.6 2.4 3.2

## Saffire Silicon Bronze

BS1453: 1972 (1987) : C2

### Description and applications

Saffire Silicon Bronze is a deoxidised 60/40 copper/zinc alloy, suitable for general purpose bronze-welding and brazing of sheet, tube and extruded sections. The rod may also be used for TIG welding of brass using an AC supply. Saffire Silicon Bronze has a melting point of 875 C. The ends of the rods are colour coded blue.

### Chemical composition (wire)

Si	0.2-0.5
Cu	58.5-61.5
Al	0.03 max
Pb	0.03 max
Sn	0.5 max
Zn	Balance

### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire Fluxobronze K

BS1453: 1972 (1987) : C2

Flux Colour : White in a knurled yellow rod

### Description and applications

Saffire Fluxobronze K is a ready-fluxed silicon bronze rod with similar composition to that of Saffire Fluxobronze S, but with less flux. The filler is impregnated with flux via the knurls of the core rod. It is suitable for welding brass and general purpose brazing of copper and steel. Saffire Fluxobronze K is a fast flowing rod, with a melting point of 875 C.

### Chemical composition (wire)

Si	0.20-0.40
Cu	58.5-61.5
Al	0.01 max
Pb	0.02 max
Sn	0.20-0.50
Zn	balance

### Rod sizes

Diameter (mm)	2.4	3.2
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### Saffire Fluxobronze S

BS1453: 1972 (1987) : C2  
Flux Colour : White

#### Description and applications

Saffire Fluxobronze S is a fully flux-coated silicon bronze brazing rod, recommended for bronze-welding copper sheet and tubes, deep-drawn steels and brass. It is used in the automobile industry to braze high pressure steel joints, and to braze carbide tips to drill bits. The rod is tolerant to varying flame conditions, and may be used without additional flux. The melting point of the rod is 875 C.

#### Chemical composition (wire)

Si	0.20-0.40
Cu	58.5-61.5
Al	0.01 max
Pb	0.02 max
Sn	0.20-0.50
Zn	balance

#### Rod sizes

Diameter (mm)	2.4	3.2
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### Saffire Nickel Bronze

BS1453: 1972 (1987) : C5

#### Description and applications

Saffire Nickel Bronze is a 10% nickel alloy rod which is particularly suitable for bronze-welding or brazing steel and malleable iron. The deposit work hardens and is suitable for building up worn gear teeth, valve seats and bearings. Saffire Nickel Bronze should be used in conjunction with Saffire Unibronze flux. The melting point of the rod is 910 C.

#### Chemical composition (wire)

Si	0.15-0.50
Mn	0.5 max
Ni	8.0-11.0
Cu	46.0-50.0
Al	0.03 max
Fe	0.5 max
Pb	0.03 max
Sn	0.50 max
Zn	balance

#### Rod sizes

Diameter (mm)	1.6	2.4	3.2
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## Saffire Manganese Bronze

### Description and applications

Saffire Manganese Bronze is a high tensile filler rod for bronze-welding cast or malleable iron, and for building up worn surfaces. The rod is used extensively in maintenance shops and in motor car manufacture. It may also be used for TIG welding, using an argon shielding gas. The melting point of the rod is 895 C.

### Chemical composition (wire)

Si	0.1-0.15
Mn	0.15-0.2
Cu	59.5-60.5
Fe	0.05 max
Sn	0.1-0.2
Zn	balance

### Rod sizes

Diameter (mm)	3.0
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## Saffire Copper Phosphorus 93/7

To be used in conjunction with Saffire Copper Silver flux

### Description and applications

Saffire Copper Phosphorus is a low melting point copper alloy rod which is used as an alternative to low silver content brazing alloys. When used for welding or brazing copper to copper, no flux is required. The deposit has good electrical conductivity and is corrosion resistant, but is not recommended for direct application to steel, cast iron or nickel. Melting point 705 C.

### Chemical composition (wire)

P	7.0-7.8
Al	0.01 max
Pb	0.02 max
Zn	0.05 max
Cd	0.025 max
Cu	balance

### Rod sizes

Diameter (mm)	2.4	3.2
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## Saffire Silver Braze 2

### Description and applications

Saffire Silver Braze 2 is an inexpensive silver bearing copper-phosphorus alloy for brazing joints on copper, brass and bronze where a thin-flowing low temperature ductile alloy is required. It is widely used in maintenance and production line applications, and is recommended for intricate assemblies and capillary work as experienced in the electrical industry. It should not be used on nickel or ferrous metals, or for applications exposed to sulphurous gases or oxidising conditions where temperatures exceed 200 C. It should be used with Saffire Copper Silver flux. The melting point of the rod is 740 C.

### Chemical composition (wire)

P	6.1-6.9
Al	0.01 max
Pb	0.02 max
Zn	0.05 max
Ag	1.8-2.2
Cd	0.025 max
Cu	balance

### Rod sizes

Diameter (mm)	1.5	3.0
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# Brazing & Bronze Welding Rods

## Copper Alloys

### Saf fire Argofil

AWS A/SFA 5.7-77 : ER Cu  
BS2901: Part 3 1990 : C7

#### Description and applications

Saf fire Argofil is a high quality 98.5% copper filler rod for TIG welding copper, using argon as the shielding gas.

#### Chemical composition (wire)

Si	0.10-0.50
Mn	0.1-0.5
P	0.015 max
Ni	0.10 max
Cu	98.0 min
Sn	1.0 max
Pb	0.010 max
Al	0.01 max
Fe	0.03 max
As	0.05 max
Sb	0.005 max
Bi	0.0030 max

#### Rod sizes

Diameter (mm) 2.4 3.2

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### Saf fire Aluminium Bronze 90/10

BS2901: Part 3 1990 : C13

#### Description and applications

Saf fire Aluminium Bronze 90/10 is intended for welding mild steel, cast iron, copper and manganese bronze where service conditions demand resistance to shock, fatigue or seawater corrosion. Typical applications include propellers, underwater pumps, pipes and valves. Argon is the recommended shielding gas. The rods may also be used for oxy-acetylene welding.

#### Chemical composition (wire)

Si	0.10 max
Mn	1.0 max
Ni	1.0 max
Al	9.0-11.0
Pb	0.007 max
Fe	0.75-1.5
Zn	0.20 max
Cu	balance

#### Rod sizes

Diameter (mm) 3.2

# Brazing & Bronze Welding Rods

## Flux

### Saffire Unibronze Flux

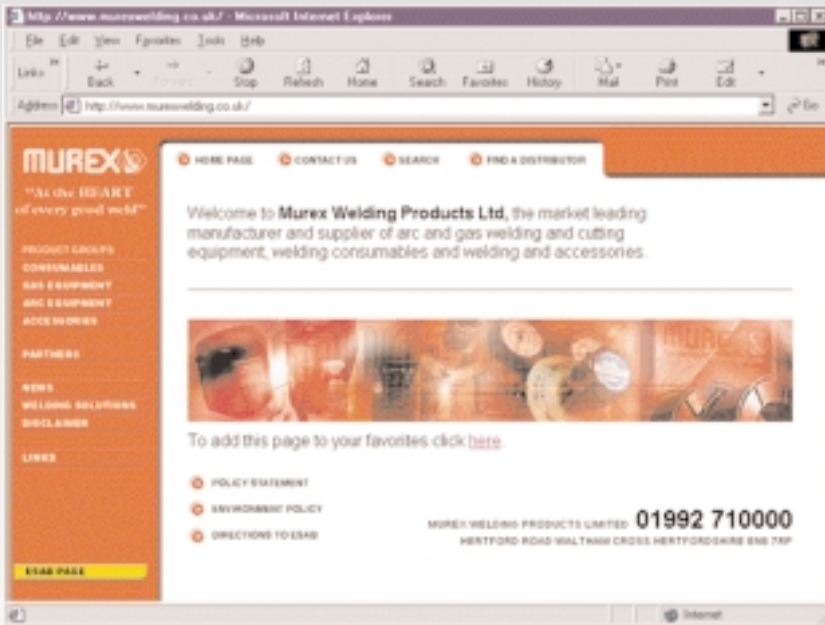
#### Description and applications

Saffire Unibronze flux is a general purpose light blue flux powder with a melting point of approx 875 C. It is recommended for use when bronze-welding copper and when welding copper alloys (including brass) using Saffire Silicon Bronze rods. It may be used with Saffire Manganese Bronze rods when bronze-welding cast or malleable iron, and with Saffire Nickel Bronze rods to bronze-weld stainless steel.

#### Packaging

Weight:	0.4kg (400g) tin
	25kg drum





#### Contact Details

Murex Welding Products are available from a Nationwide Distributor Network. For Information about Murex Welding Products call us on 01992 710000, visit your local Murex Distributor or visit the Murex Welding Products Web Site: [www.murexwelding.co.uk](http://www.murexwelding.co.uk)

#### Additional Material

In addition to welding consumables Murex Welding Products Limited also offer a comprehensive range of:-  
 Arc & Gas Welding and Cutting Equipment  
 Gas Welding and Cutting Equipment  
 Welding Accessories



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In the interest of continuous improvement MUREX reserves the right to change the specifications or design of any of its products without prior notice