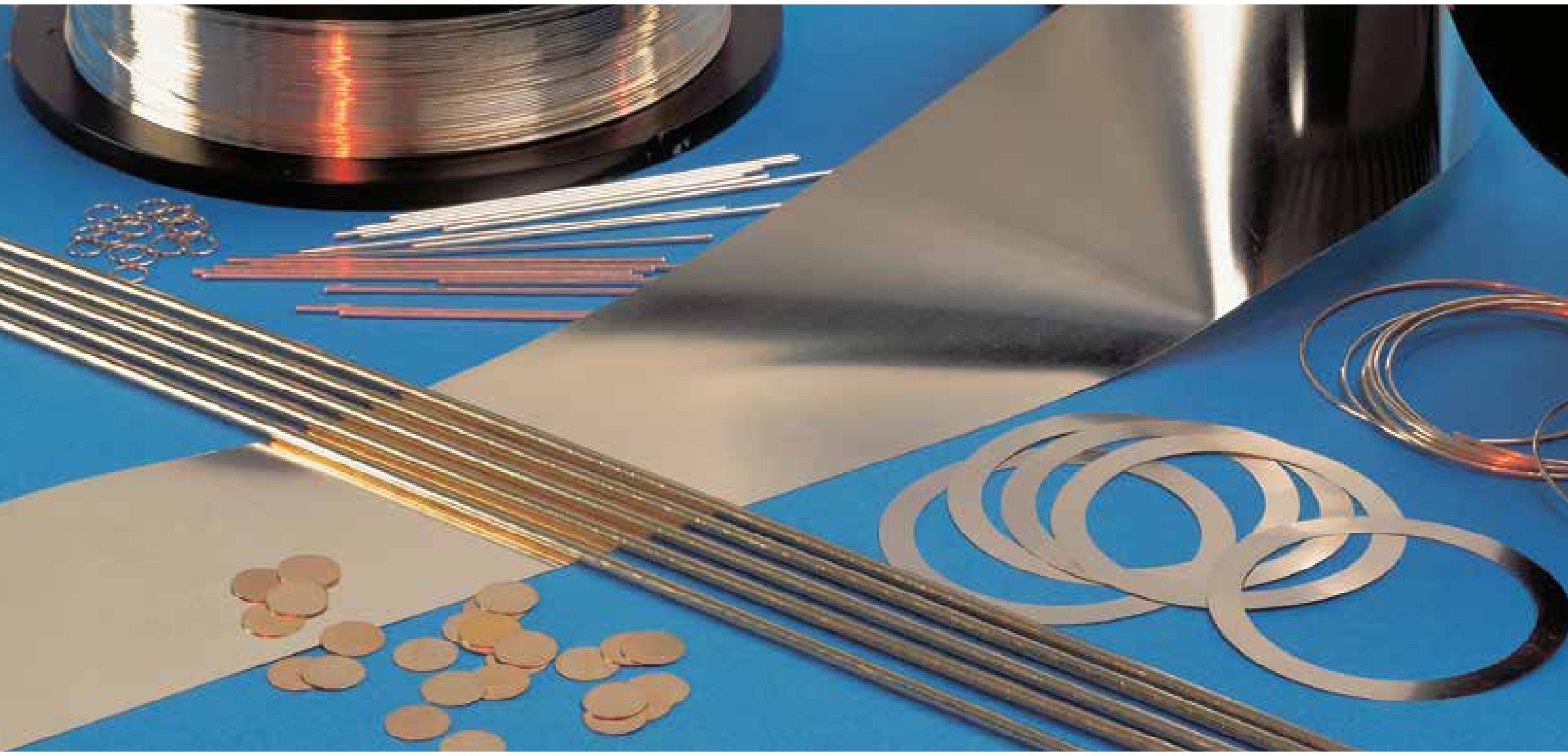
Johnson Matthey
Metal Joining



# ARGO-BRAZE™

## FOR BRAZING OF STAINLESS STEEL JOINTS FOR WET ENVIRONMENTS

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## PRODUCTS AT A GLANCE

### Compositions

The Argo-braze™ products in this brochure have the following compositions:

| Alloy System | Additional elements |
|---|---|
| Ag Cu Ni | In Sn |

Argo-braze™ 632 is supplied to ISO17672 Ag 463. Argo-braze™ 56 is a proprietary Johnson Matthey product.

### Uses for the Products

These specialised Argo-braze™ products are used specifically where there is a need to braze stainless steel and the resulting joints will be subject to aqueous environments in service. This includes both the internal and external part of the joint on a combination of stainless steel and the following materials

- Steel (carbon/low alloy, tool and stainless)
- Tungsten carbide and tungsten carbide backed poly-crystalline diamond
- Copper and copper alloys including brass, bronze, nickel silver and aluminium-bronze

### Conditions for Use

The Argo-braze™ products are intended for use by brazing in air using a hand torch, fixed burner system, high frequency induction or resistance heating methods.

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

## SPECIALIZED CORROSION RESISTANT FILLER METALS

These products are used to offer maximum protection against interfacial corrosion in a silver brazed joint on stainless steel exposed to aqueous environments.

### Argo-braze™ 56

**Specification**

| Ag | Cu | Ni | In | Sn |
|---|---|---|---|---|
| 56 | 27.25 | 2.25 | 14.5 | - |

| | |
|---|---|
| **Melting Range °F** | 1112-1312 |
| **AMS/AWS A5.8** | - |
| **EN1044: 1999** | AG403 |
| **ISO 17672:2010** | Next revision |

**Description**

Argo-braze™ 56 was formulated to overcome potential problems of interfacial corrosion on stainless steel components exposed to wet conditions in service. It contains nickel, which has been found to promote resistance to this type of corrosion whilst excluding zinc, which may promote it. Argo-braze™ 56 contains indium, which reduces the melting temperature making it somewhat easier to use than Argo-braze™ 632. It has a long melting range and poor flow characteristics giving rise to large fillets around the joints.

**Product Forms**

Cd Free

### Argo-braze™ 632

**Specification**

| Ag | Cu | Ni | In | Sn |
|---|---|---|---|---|
| 63 | 28.5 | 2.5 | - | 6 |

| | |
|---|---|
| **Melting Range °F** | 1275-1475 |
| **AMS/AWS A5.8** | 4774, BAg-21 |
| **EN1044: 1999** | - |
| **ISO 17672:2010** | Ag 463 |

**Description**

Argo-braze™ 632 was formulated to overcome potential problems of interfacial corrosion on stainless steel components exposed to wet conditions in service. It contains nickel, which has been found to promote resistance to this type of corrosion whilst excluding zinc, which may promote it. It has a long melting range and poor flow characteristics giving rise to large fillets around the joints. The relatively high brazing temperature and poor flow make it more difficult to use than conventional silver brazing filler metals.

**Product Forms**

Cd Free

## TECHNICAL CONSIDERATIONS FOR USING ARGO-BRAZE™ 632 & ARGO-BRAZE™ 56

### Brazing Technique

Before application of these filler metals the joint area should be at brazing temperature to avoid problems with liquation in which the low melting constituent of the alloy flows first before the alloy is fully molten. A rapid heating method such as induction or an oxy-acetylene torch helps to avoid the problem.
Argo-braze™ 632 and Argo-braze™ 56 both have long melting ranges and poor flow characteristics giving rise to large fillets around the joints.
Pre-placement of the filler metal requires the heating method to be rapid to prevent liquation.

### Recommended Flux

On small components Mattiflux™ Stainless Steel Grade Flux or Mattiflux™ Flux Paste are recommended. Where prolonged heating is required Tenacity™ No.5 Flux Powder should be used. See Johnson Matthey Brazing Fluxes brochure for details of these products.

**Caution: -** Boron containing fluxes such as Tenacity™ No.5A Flux Powder, Tenacity™ No.6 Flux Powder or Paste and Tenacity™ No.3A should be avoided as boron is known to promote the onset of interfacial corrosion in silver brazed joints.

# ARGO-BRAZE™

TECHNICAL

## INTERFACIAL CORROSION

Interfacial corrosion is a particular type of failure where silver brazed joints in stainless steel are exposed to water, aqueous solutions or humidity in service. Care must be exercised when selecting alloys for brazing stainless steel where the completed joints will be exposed to these conditions.

Joint failure can be rapid and take only a few months and occurs at the brazing filler metal/stainless steel interface. This phenomenon is commonly referred to as crevice corrosion, but more correctly should be called interfacial corrosion.

### Conditions That Produce Interfacial Corrosion - Service Environment

To produce a joint failure by interfacial corrosion at least one member of the joint must be made from a stainless steel, the brazing filler metal must be susceptible to this form of attack and the joint must be exposed to damp or wet environments in service.

Research into interfacial corrosion has been conducted using tap water, aqueous solutions of acids and aqueous solutions containing sodium chloride. All of these solutions produced failure on those joints brazed with susceptible alloys. Work carried out by Johnson Matthey Metal Joining suggests that most aqueous solutions will produce failures on susceptible joints to a greater or lesser degree. Joints exposed to the weather have also failed, but only after several years of exposure.

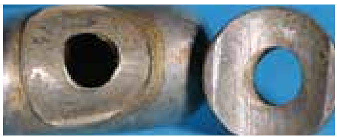
### Materials Affected by Interfacial Corrosion

All types of stainless steel are susceptible to attack by interfacial corrosion. The nickel-free, or low nickel ferritic and martensitic type stainless steels (e.g. Types 403, 410, 416, 420, 430, 431) are most susceptible to interfacial corrosion and suffer a more rapid rate of attack than the austenitic steel grades (e.g. Types 302, 303, 304, 316, 321).

Failures with ferritic stainless steels have been reported within as little as a few days, while the austenitic steels under the same conditions have resisted attack for periods in excess of a few months. Austenitic grades of stainless steel are more resistant but failures are still common.

### The Effects of Interfacial Corrosion

Interfacial corrosion results in failure of a joint with corrosion running across the joint interface. Often a failed joint does not appear to have been brazed properly in the first place. Although, if the joint had been tested after brazing, it would have had adequate strength. It is typical that the extreme outer edge of the brazing filler metal will remain attached to the parent materials giving a 'halo' effect. It is sometimes possible to see the first signs of interfacial corrosion attack within as little as 30 minutes, as small rust spots begin to form towards the edge of the filler metal deposit. Over time the rust spots grow forming a continuous band of corrosion.



### Filler Metals Resistant to Interfacial Corrosion

In addition to Argo-braze™ 632 and Argo-braze™ 56 there are also a number of other filler metals which offer protection against interfacial corrosion.

| Filler Metal Type | Filler Metal Product | Resistant | Comments |
|---|---|---|---|
| Soft Solders | Silver-tin soft solder - P40™<br>Copper-tin soft solder - 99C™, 97C™ | Yes | Lower strength and service temperature than a brazed joint. |
| Silver based | Matti-sil™ Products | No | Matti-sil™ filler metals are least resistant to interfacial corrosion |
| | Argo-braze™ Products -<br>Argo-braze™ 502, Argo-braze™ 40 | Yes/No | Argo-braze™ products containing nickel offer greater resistance particularly on austenitic steels. |
| Palladium based | Pallabraze™ Products | Yes | Cost and the brazing process (furnace brazing) are considerations |
| Gold based | Orobraze™ Products | Yes | Cost and the brazing process (furnace brazing) are considerations |
| Nickel based | Nickelbraze™ HTN Products | Yes | The brazing process (furnace brazing) is a consideration |
| Copper based | B Bronze™ and C Bronze™ | Yes | The brazing process (furnace brazing) is a consideration |

### Other Methods of Prevention

Protection can also be provided by the application of a coating, which will prevent the service environment coming in contact with the brazing filler metal. Plating may be considered but care is necessary since joints may be produced that are partially corroded as a result of attack from the plating solution. An application of soft solder over the brazing filler metal is one method, which has also been adopted.

### Summary

Interfacial corrosion is a complex phenomenon, which is not completely understood. Consequently a positive guarantee that any particular joint will not fail cannot be made. Wherever it is likely to be a service hazard and the application is of a critical nature then tests should be conducted. If the application is not critical, one of the recommended alloys, which appears to offer resistance under most conditions, should be used. It should be noted that brazed joints can have different service environments on the inside and outside of the joint.

Johnson Matthey
Metal Joining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