Weldability Sif

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SIF ALUMIN

Brazing and Low Temperature Welding of Aluminium

The Process

For decades, Sif have worked to ease the once difficult process of joining aluminium. Their innovations have made the brazing and low temperature welding of aluminium and a wide range of aluminium alloys achievable with the use of Sifalumin rods and Sif Aluminium fluxes.

With Sifalumin No 16 and Sifbronze Aluminium Flux any competent welder can produce strong, sound and neat joints which only a welder with years experience could match by fusion welding. The melting point of Sifalumin No 16 is 80°C below that of pure aluminium. This means that perfect joints can be made in commercial purity aluminium and most of the popular aluminium alloys without melting the parent metal.

Many different wrought alloys are now being joined by aluminium brazing, and low-temperature welding of castings is common.

The Advantages

Sifalumin No 16 makes brazing aluminium just like brazing any other metal. The molten brazing metal is drawn into the joint by capillary action, giving the following advantages over fusion welding:

- It is cheaper, quicker and easier.
- There is perfect penetration throughout the joint.
- No flux is trapped in the joint.
- Heavy surplus deposits are avoided.
- Very thin sections can be joined.
- A wide variety of joints can be employed, giving more scope to the designer.
- Sharp edges and corners near the joint are not destroyed.
- Undercutting and collapsing is avoided.

Joints in aluminium brazed with Sifalumin No 16 are as strong as welded joints, possessing the approximate strength of the annealed parent metal.

There are no galvanic corrosion effects after brazing, and the joints need very little finishing.

They are neat, with an excellent colour match, and if the job has been properly carried out there should be no blisters, crinkling or roughness.

Alloys that can be joined by Brazing

From the table overleaf it can be seen that the list of alloys to which this process can be applied covers many of the most important light alloy materials used in industry.

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Difficulties do occur with alloys containing Magnesium and 2 percent of this element is about the limit for easy brazing. Most Duralumin alloys can be brazed but the effects of heat on these specially treated alloys must be borne in mind, and will ultimately decide whether the process should be used.

Brazeable Alloys

Nominal Composition	GB Equiv.	Current Standard	Sif Product	Brazeability
99.5% Purity Aluminium	GIB / NG3	EN ISO 18273 S Al 1070	Sifalumin 14	Easily Brazed
95% Purity, 5% Silicon	NG21	EN ISO 18273 S Al 4043A	Sifalumin 15	Brazeable
82% Purity, 12% Silicon	NG2	EN 1044 AL 104	Sifalumin 16	Brazeable

When NOT to use Aluminium Brazing

Brazing of alloys with magnesium contents higher than 2% should not be attempted.

Alloys high in Silicon are also unbrazeable because of their lower melting points (>12% Si).

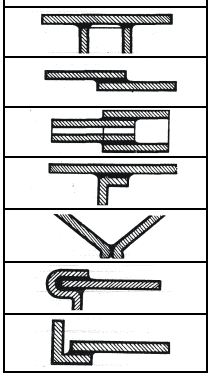
Brazing is not recommended where parts are to be anodized or anodize-dyed after joining, since the treatment causes slight attack of the brazing alloy, giving an undesirable colour contrast.

Nor should it be used in the fabrication of vessels and tanks used for handling and storing certain sour chemicals such as Nitric acid, since corrosion would occur at the brazed joint.

Joint Preparation

Parts should be clean and bright. With new stock metal de-greasing with benzene or trychlorethylene or washing in hot soapy water will usually suffice. In other cases, particularly with alloys containing Magnesium, wire brushing is essential.

The Joint



Brazing should be carried out as soon as possible after cleaning.

Some types of joint suitable for brazing are shown here. Laps are better than butt joints, but the amount of overlap should be kept as small as possible to ensure complete penetration of the joint.

A good mechanical fit of parts is essential. Non-uniform clearances along the joint are detrimental and will lead to inconsistent results and poor joint appearance.

In the case of sleeve and similar type joints, a small lead-in groove should be arranged wherever possible as this will assist in the penetration of the brazing alloy and make for a neat joint.

Brazing Technique

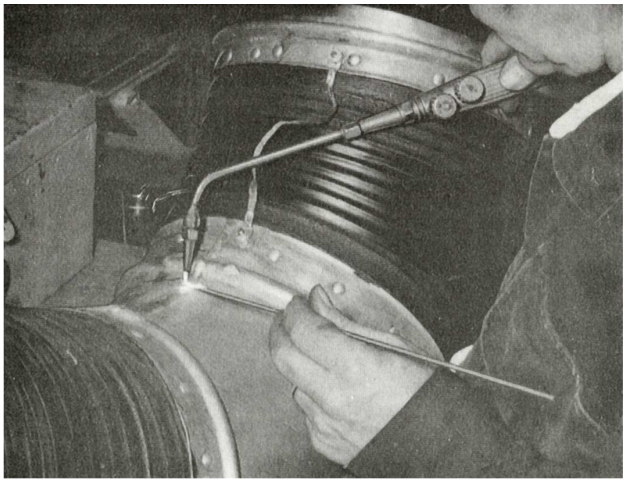
Sifbronze Aluminium Flux can be applied either before heating of the joint as a paste made up with water or alcohol, on the heated end of the brazing rod. The joint should first be pre-heated. This produces no colour change in aluminium and the correct brazing temperature is determined by the melting of the flux.

If the flux is being applied on the end of the rod, the joint surface should be touched with it from time to time until it melts and flows freely along the joint.

If the flux paste method is being used the flux will cake, darken slightly and then melt. The rod should be applied only when it has melted and flows freely.

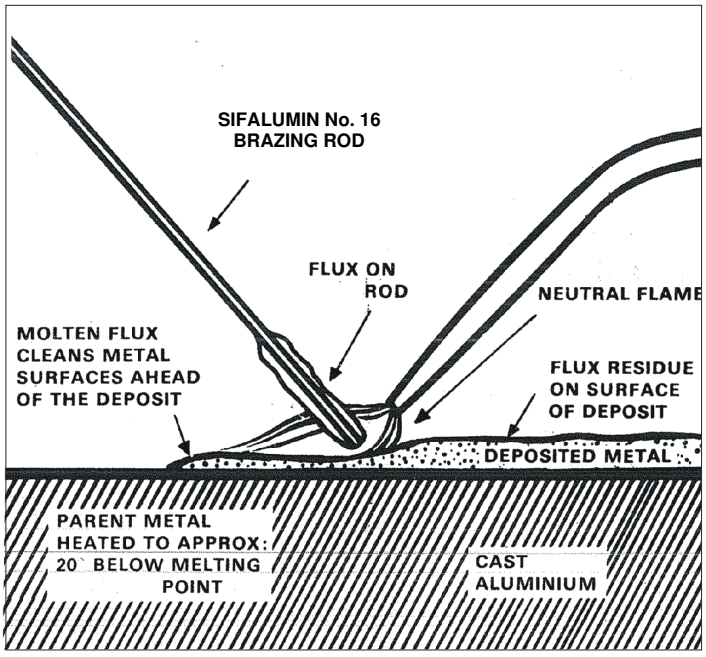
The Sifalumin No 16 brazing rod should then be applied. Rod and blowpipe angles are much the same as for welding, but the technique of brazing consists of moving the blowpipe backwards and forwards fairly rapidly in the line and direction of brazing. With parts of dissimilar thickness the pre-heating flame should be played mostly on the thicker section and a proper heat balance obtained before brazing is started.

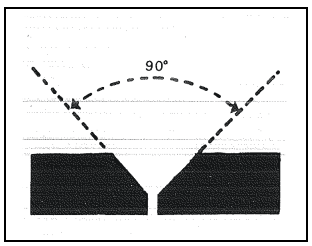
Whenever possible, however, sections should be "mated" at the joints to give equality of section.

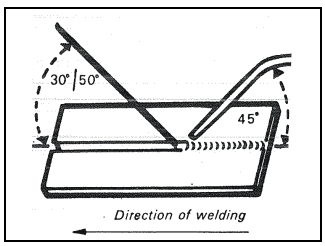


For repetition work other methods of pre-heating, such as air and gas torches etc, may be used. It is possible to speed up production by arranging procedures so that one or two assemblies are being pre-heated while others are being brazed.

Care should be taken to ensure that the pre-heating is not unduly prolonged, as this can result in overheating of the flux and of the brazing alloy where pre-placed rings are used. Overheating in these circumstances can destroy the characteristics of the brazing alloy, causing it to refuse to melt.







JIGS	FUELS
Jigs can be used when fabricating frames and repetitive parts, but the joint should "float" – that is, it should not be in contact with the metal of the jig. If it is in contact a "backing strip" effect is produced, and the resulting heat dissipation creates a time lag. Distortion or even collapse of the top surface may take place as a result of the effort to achieve penetration.	Various types of fuel gas can be used with oxygen, but oxy-acetylene is the fastest and most suitable. Other flames give slower heating and so reduce the risk of localised fusion, but they cause greater heat spread, distortion and other problems.
GOGGLES	**THE FLAME**
Blue goggles are most suitable for aluminium brazing, as they filter off much of the yellow glare from the flux which tends to mask operations.	A neutral to very slightly carburising flame is recommended for brazing with Sifalumin No. 16, the envelope being used for pre-heating. Low gas pressures and a soft flame are necessary in all cases, with nozzle size about the same as for ordinary welding.

Flux Residue

Aluminium brazing flux is highly corrosive, and the residue should always be removed within half an hour of brazing.

Wire brushing in nearly boiling water is effective where joints are accessible, and the use of a steam jet is also very effective.

Treatment for a short period in a 5% Nitric acid solution may be required for cleaning inaccessible joints.

Preparation and set up is exactly the same as for ordinary fusion welding, but as welding is carried out in most cases without melting the parent metal the work is greatly simplified and the risk of distortion, sagging and collapse reduced.

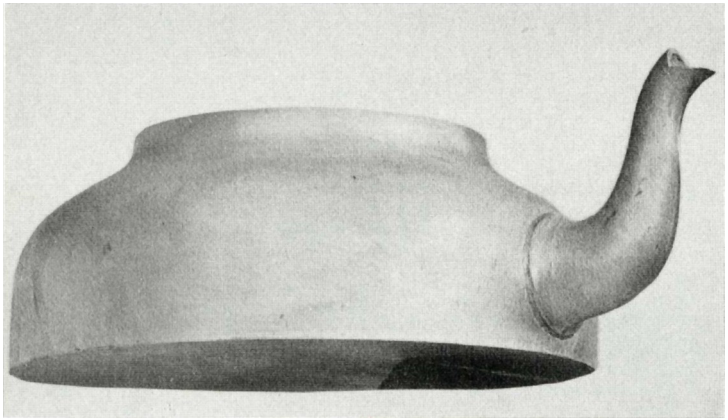
Sifalumin No. 16 can be applied successfully to many different types of casting though in the case of those made of alloys of the B.S/L 33 type the process becomes fusion welding because of the narrow margin between the melting points of the casting and the filler rod.

Procedure

Parts should be cleaned and prepared with a 90% "V" in the usual way. The work should be pre-heated to between 350°C and 400°C, though with small castings and extremities this can often be dispensed with.

Rod and blowpipe angles and the welding procedure, using a soft, neutral flame are as shown. The speed of forward travel is governed by the heat in the casting, rate of metal deposition and the thickness of the weld deposit required.

Parts should be cooled very slowly after welding and all traces of residual flux removed as soon as possible.



Typical Example of a Sifalumin Brazed Component

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