Brazing Materials & Applications

Material Safety Data Sheet 1100/105
Appendix B - Cadmium Containing Brazing Alloys

Issue No 3/March 2000

Cadmium Containing Brazing Alloys

1. Identification of Substance This Product Safety Data Sheet gives specific information on Cadmium containing silver brazing alloys.

2. Composition

Alloy	Ag	Cu	Zn	Cd	Ni	Mn	Melting Range °C	BS1845 (1984)	BS EN 1044 (1999)
Easy-flo	50	15	16	19	-	-	620-630	AG1	AG301
Easy-flo No.2	42	17	16	25	-	-	608-617	AG2	AG303
DIN Argo-flo	40	19	21	20	-	-	595-630	-	AG304
Argo-flo	38	20	22	20	-	-	608-655	AG3	
Mattibraze 34	34	25	20	21	-	-	612-668	AG11	AG305
Argo-swift	30	28	21	21	-	-	607-685	AG12	AG306
Argo-bond	23	35	27	15	-	-	616-735	-	
Easy-flo No.3	50	15.5	15.5	16	3	-	634-656	AG9	AG351
Argo-braze 50	50	13.5	15.5	16	3	2	639-668	-	
*Easy-flo Trifoil C	50	15	16	19	-	-	620-630	-	
+Easy-flo Trifoil CN	50	15	16	19	-	-	620-630	-	

** Alloy contains central copper core* *+ Alloy contains central copper-nickel core*

3. Hazard Identification

The only potential health hazards involved with this product arise from its use. On heating, metal and metal oxide fumes may be evolved but are unlikely to exceed the above stated OES's under normal conditions. However, severe overheating could lead to the emission of fumes in harmful concentrations. Metal fume fever can be caused by exposure to excessive fumes of copper and and zinc oxide. Symptoms are similar to those of influenza and often appear after a latent period of up to 10 hours. They normally disappear after 24 hours with rest.

COSHH Regulations list the exposure limits for cadmium oxide as a MAXIMUM EXPOSURE LIMIT (MEL) which must never be exceeded. Short exposures to high levels of cadmium oxide can lead to pulmonary oedema and may be fatal. Prolonged or repeated over exposure to cadmium oxide fume is reported as causing renal damage. There is a symptomless latent period and any person thought to have been over exposed to cadmium oxide fume should be kept under observation for 48 hours.

Cadmium Oxide fume is reported as being carcinogenic and may cause cancer by inhalation.

N.B. All alloys in Section 2 contain cadmium

4. First Aid Measures

Metal oxide fume can be irritating to the upper respiratory tract, nose and throat. In powder form metal dust will irritate the eyes and is harmful if ingested.

Inhalation Fumes may be evolved at brazing temperatures which will irritate nose, throat and respiratory organs. Remove patient to fresh air. In acute cases apply artificial respiration. Summon medical aid if necessary.

Ingestion Not applicable. However if the alloy in powder form is ingested, rinse mouth with water and give patient water or milk to drink. Do not induce vomiting. Summon medical aid.

Eyes Not applicable. However, if the alloy is in powder form and dust gets into the eyes, irrigate with water or isotonic saline for up to 20 minutes. Seek medical attention if there is any hint of eye damage.

Skin Wash hands with soap and water after handling brazing alloy. If any skin irritation develops, seek medical advice.

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5. Fire Fighting Measures

Non-flammable. Use extinguishing medium suitable for surrounding fire but exercise care with water if molten metal is present. Use full personal protection with breathing apparatus in a fire as harmful fumes may be evolved from the molten alloy.

6. Accidental Release Measures

Material may be collected for re-use or scrap as required. If alloy is in powder form avoid getting dust in the eyes or breathing metal dust.

7. Handling and Storage

Handling Use in a well ventilated area with local extraction systems. Do not inhale any fumes evolved during use. Wash hands thoroughly with soap and water after handling the brazing alloy, particularly before eating or smoking.

Storage No special requirements - store in cool, dry conditions. Keep powder containers closed.

8. Exposure Controls and Personal Protection

UK Occupational Exposure Standards are:

Element	Long Term 8-hour TWA* Value	Short Term 15 minute Value
Silver **	0. 1mg/m^3	-
Copper Fume (as Copper)	0.2mg/m^3	-
Zinc Oxide Fume	5.0mg/m^3	10mg/m^3
Cadmium Oxide Fume (as Cadmium) †	0.025mg/m^3	0.05mg/m^3
Manganese Fume (as Manganese)	1.0mg/m^3	3.0mg/m^3
Nickel †	0.5mg/m^3	-

** Time Weighted Average ** Under review † Maximum Exposure Level*

Local extraction should always be used when brazing with cadmium bearing alloys. Consideration should be given to monitoring of the atmosphere in the workplace where brazing is carried out and to the use of personal air sampling devices for individual operators. If a risk of inhalation exists personal respiratory protection should be worn. Safety glasses should be worn as well as gloves if required. Wash hands after using this material. The use of protective clothing is recommended.

9. Physical and Chemical Properties

Appearance	Silver/Copper/Brass coloured metal depending on composition.
Odour	None
pH	Not applicable
Melting point	As shown in Section 2
Flash point	Not applicable
Flammability	Non flammable

10. Stability and Reactivity

No reaction with air or water. Avoid contact with acids

11. Toxicological Data

Material not classified as toxic. No other data available.

12. Ecological Information

As far as is known, no threat is posed to the environment by this material.

13. Disposal Considerations

According to local and national regulations. Recommended method: as scrap for refining.

14. Transport Information

Not classified for land, sea or air transport. No UN No's have been issued for these alloys.

15. Regulatory Information

Material classification		Harmful
Risk Phrases	R20	Harmful by inhalation
Safety Phrases	S20/21	When using do not eat, drink or smoke
	S23	Do not breathe fumes
	S36/37/39	Wear suitable protective clothing, gloves and eye/face protection
	S38	In case of insufficient ventilation wear suitable respiratory equipment

On label alloy is stated to be **"Contain Cadmium".** Users are warned that on heating product may give off fumes hazardous to health and to use adequate ventilation.

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16. Other Information

Johnson Matthey Data Sheet 1100:105
"***Health and Safety in Brazing***".

Guidance Note EH1
"Cadmium - Health and Safety Precautions" HSE 1995.

Guidance Note EH54
"Assessment of Exposure to fume from welding and allied processes" HSE 1990.

Guidance Note EH55
"The control of exposure to fume from welding, brazing and similar processes" HSE 1990.

Guidance Note EH60
"***Nickel and its inorganic compounds: health and safety precautions***" HSE 1991.

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Brazing Materials & Applications

Material Safety Data Sheet 1100/105
Cadmium Free Brazing Alloys

Issue No 3/March 2000

Brazing is firmly established throughout the world as a reliable, simple and safe method of joining metal components. However as brazing operations entail the raising of components to elevated temperatures and the use of alloys and fluxes that contain volatile constituents, a regard must be paid to safety precautions at the brazing work bench.

Many of the recommendations in this document are common sense, others are not so obvious. It is important that management, safety officers and individual brazing operators make themselves fully conversant with all of these safety precautions and so minimise the chance of accidents occurring.

General Precautions

The most versatile brazing alloys are those based on the silver-copper-cadmium-zinc or silver-copper-zinc systems. They are all distinguished by their low melting points and good flow properties. They should never be overheated. Overheating is bad brazing practice and is likely to result in poor joints and increased evolution of fume. Metal and metal oxide fumes are irritating and can be harmful to health. Cadmium oxide fumes are particularly poisonous.

Operator well-being and safety will result from following the precautions given in this document and basic rules of safe brazing practice.

Potential health and safety problems in brazing may arise in the following areas:-

1 Metal and metal oxide fumes from the brazing alloys
2 Fumes from heating the flux
3 Fumes from brazing torches
4 Equipment used to effect the brazed joint

Recommended safety precautions and working practices on each of these are given below.

Section 1: Metal and Metal Oxide Fumes

1.1 General

All brazing operations raise the temperature of the filler metal above its melting point hence it is unavoidable that metal fume (as the oxide of the elements present) will be evolved.

The Health and Safety Executive in their Guidance Note EH40 list Occupational Exposure Standards (OESs) for metals commonly used in brazing alloys and these are given in specific product safety data sheets.

1.2 Specific Hazards
Cadmium Oxide

Cadmium Oxide fume will always be evolved to some extent during brazing with alloys from the silver-copper-cadmium-zinc range. The Control of Substances Hazardous to Health (COSHH) Regulations list the exposure limits for Cadmium Oxide as a MAXIMUM EXPOSURE LEVEL (MEL) which must never be exceeded. The level present in the workplace must always be as low as practicable. The use of local extraction is virtually obligatory when brazing with cadmium containing alloys.

Short exposures to high levels of cadmium oxide fume can lead to pulmonary oedema and may be fatal. Prolonged or repeated over exposure to cadmium oxide fume is reported as causing renal damage. There is a symptomless latent period and any person thought to have been over exposed to cadmium oxide fume should be kept under observation for 48 hours.

Cadmium Oxide fume is reported as carcinogenic and may cause cancer by inhalation.

The likelihood of any problems occurring under normal brazing conditions is very limited and are normally the result of extremely poor brazing practice. These conditions would include severe overheating of the molten alloy using an intense heat source such as oxy-acetylene, brazing in an enclosed or ill ventilated area where fume build up is possible; or brazing without flux cover.

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If cadmium containing alloys are felt likely to cause a health hazard then consideration should be given to the use of a cadmium free alloy from the Johnson Matthey Silver-flo range. These alloys may still contain cadmium as an impurity, but at a very low controlled limit of 0.025% maximum. This level allows brazing to be carried out under normal conditions of ventilation without the need for local exhaust ventilation as far as cadmium oxide fume is concerned. There could, of course, be other factors which would make local exhaust ventilation necessary.

If brazing is to be carried out where ventilation is poor, such as an enclosed pipe joint or any similar situation, then brazing of any kind, or welding, must be carried out with the operator using breathing equipment, in conformance to factory regulations for working in confined spaces.

Copper Oxide & Zinc Oxide

Copper and zinc oxide fumes under normal conditions are unlikely to be a problem but, if excessive, are irritating and can cause metal fume fever. Symptoms of metal fume fever are similar to those of influenza and often appear after a latent period of up to 10 hours; they will normally disappear after 24 hours with rest. Zinc oxide can also be irritating to the nose, mouth and throat.

Diphosphorus Pentoxide

On overheating of phosphorus containing alloys corrosive diphosphorus pentoxide fumes may be evolved which are irritating to mucous membranes, the respiratory system, eyes and skin. Contact between the fume and perspiration may produce a mildly acidic reaction causing irritation of the eyes, skin and mucous membrane.

1.3 Atmospheric Sampling

Workshop personnel who may be exposed to excessive fumes during brazing operations should undergo tests of their working zone using personal air sampling equipment to ensure that MELs and OESs are not exceeded. Alternatively portable detection devices may be used to monitor the atmosphere during brazing operations. There are an increasing number of companies specialising in environmental monitoring who can undertake the necessary testing. Where local exhaust ventilation is installed regular checks on air flows and capture velocities should be made as required under HSE regulations.

Section 2: Fluxes

2.1 Skin Contact

The Johnson Matthey Range of brazing fluxes is based on fluorides, fluoroborates, borates, fluorosilicates and chlorides of potassium with additions of boric acid and borax.

On prolonged contact, these fluxes are moderately irritating to skin. Extra care should be taken if the skin is broken as immediate irritation will occur. If the irritation becomes a problem, operators should use barrier creams. Any cuts or abrasions, however slight, should be covered with an adhesive dressing. The use of flux paste eliminates the contact which could occur when mixing a flux powder with water before use. The use of impervious gloves e.g. rubber or latex is recommended to prevent skin contact.

Tests have shown the fluxes are irritant to the eyes. If flux does come into contact with the eyes they should be irrigated immediately with water or isotonic saline for up to 20 minutes. Medical attention should be sought if there is any suspicion of eye damage.

2.2 Oral Ingestion

Fluxes are harmful if ingested. They should be kept out of the reach of children and away from food, drink and animal feeding stuffs. It is advisable not to smoke when using these materials. Before meals, hands must be washed and fingernails cleaned. In the event of flux being swallowed, a doctor should be called and, meanwhile, the patient should drink plenty of water or milk with calcium carbonate (chalk) mixed in. Do not induce vomiting.

If powder fluxes are used, they should be mixed in a special flux tray. Flux should never be put in a container such as a cup, a mug or a bottle which might be used for drinking or other purposes. Empty flux containers must not be used for the storage of foodstuffs e.g. sugar, coffee, powdered milk etc.

2.3 Flux Fumes

On heating, flux will fume slightly. With overheating, the fume will increase. Fumes generated include Hydrogen Fluoride, Fluorine and Boron Trifluoride. Without adequate ventilation, or as the result of bad brazing practice, fume can cause irritation of nasal passages and eyes.

The workpiece should not be overheated and operators should avoid standing directly over the work. Any annoyance from fumes can be minimised by using workshops with high roofs, good local ventilation and efficient extraction systems.

2.4 Inhalation

In acute cases, remove to fresh air, apply artificial respiration and oxygen and summon medical aid. Continue observation for 48 hours. (Note: Poisoning by inhalation may also result from brazing metal fume or torch gases).

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Section 3: Fumes from Brazing Torches

Torch fumes will be burnt gases, primarily oxides of carbon and nitrogen which are unlikely to cause problems in well ventilated conditions.

Section 4: Brazing Equipment

Although brazing is a reliable, simple and safe method of joining metal components, there are a number of basic precautions to follow when brazing.

- Brazing stations should be made from non flammable materials and suitable refractory brick.
- Hot brazed components must only be handled with pliers or tongs unless gloves are worn.

4.1 Hand & Fixed Torch Brazing

A torch should always be pointed away from the operator or other people when being lit.
Fixed torches should be lit from the side or from below. Do not reach over one unlit torch to light another. It is usual for all the torches in a system to light simultaneously, and very severe burns to the forearm can result.

4.2 Induction Brazing

Never touch the work coil while the machine is working. Although work coils are often water cooled, when machines have been recently switched off the coils retain enough heat to cause a minor burn if they are touched.

Hands should never be inserted into a work coil if a ring, a watch, a metal bracelet or any other metal object is worn. The object will heat up rapidly and cause an extremely severe burn.

4.3 Furnace Brazing

Controlled atmosphere furnaces usually have a curtain of burning gases at the inlet and outlet doors. Since these flames are often colourless and virtually invisible, a piece of iron or steel gauze should be hung in the flame path, this will glow brightly when a flame is present.

Care should be taken when components are removed from a furnace or from a conveyor belt or container, since they may still be hot.

4.4 Resistance Heating

The hot electrodes should never be touched.

The electrical apparatus and the equipment which regulates the flow of a controlled atmosphere gas (if one is used) should be set and adjusted only by competent personnel.

4.5 Salt Bath Brazing

The parts must be completely dry before they are immersed in the bath. Any water on them is converted immediately into steam, causing a minor explosion in the bath and throwing out droplets of molten salt. The salt sticks to virtually anything it touches and can cause very severe skin burns.

The components should be lowered very slowly into the bath to avoid splashing the molten salt. Salt residues should be scrubbed off the hands before meals and at the end of the day. The controls that govern the heat input to the salt bath should be set and adjusted only by competent personnel.

4.6 General

Mechanised brazing operations should always be set and adjusted by competent personnel. If machines fail to operate or operate incorrectly local supervision should always be notified immediately.

Section 5: Safety Precautions

Operator well-being and safety will result from observing the following basic precautions:

- Wear suitable protective clothing. Gloves are recommended to prevent skin contact with flux powders and pastes.
- Always wear safety glasses or goggles. Suitable tinted glasses should be worn if glare from brazing torches is a problem.
- Local extraction should always be used when brazing with cadmium containing alloys. Good ventilation is essential in all brazing operations.

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- Avoid standing with the face directly over the workpiece. All brazing atmospheres should be monitored to ensure OESs and MELs are not being exceeded.
- Welding techniques must not be used when brazing. For example, the direct heating of a pool of molten brazing alloy must be avoided.
- Brazing in confined spaces should only be carried out using suitable breathing apparatus.
- Health and Safety information on specific alloys and fluxes showing current OESs and MELs is available on request.

Material Safety Data Sheet

The following General Material Safety Data Sheets are appendices to this data sheet

Appendix A Cadmium Free Brazing Alloys
Appendix B Cadmium Containing Brazing Alloys
Appendix C Phosphorus Containing Brazing Alloys
Appendix D Brazing Fluxes

Individual Material Safety Data Sheets appertaining to products not covered by the appendices above are available on request.

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