

# Material Safety Data Sheet

According to the EC Directive 93/112

## MSDS No. **BW006 Bare Aluminium Welding Rods and Electrodes**

Rev 0 17.01.05

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### 1. Product and company designation

**Product Name:** BARE ALUMINIUM WELDING RODS AND ELECTRODES

**Product Brands:** BOC 1050, 4043, 5356.

**Product Specification:** AWS/ASME A5.10

**Product Classification:** ER110, ER4043, ER5356.

**Recommended use:** Gas Metal Arc, Gas Tungsten Arc, and Oxy Fuel Gas welding of Aluminium

**Supplier:** BOC Customer Service Centre

**Address:** Priestley Road, Worsley, Manchester M28 2UT

**Telephone number:** 0800 111 333

**Emergency Telephone number** 0800 111 333

**Fax:** 0800 111 555

### 2. Details of composition

These wires and rods are made from solid aluminium alloys, either continuously wound on reels, spools or in bulk packs, or supplied in straight cut lengths. The composition of the alloys varies depending on the classification.

Details of the contents of the wire and rod consumables covered by this data sheet are given below.

TABLE 1: APPROXIMATE COMPOSITION OF CONSUMABLES (WT %)

AWS Specification	Class	Al	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti
A5.10	4043	Bal.	4.5-6.0	0.8	0.30	0.05	0.05	-	0.10	0.20
A5.10	5356	Bal.	0.25	0.4	0.1	0.05-0.20	4.5-5.5	0.05-0.20	0.10	0.06-0.20
A5.10	others	Bal.	13.0	0.8	6.8	1.0	5.5	0.35	0.25	0.30

Single values indicate maximum allowed

### 3. Hazards identification

There are no recognised hazards associated directly with unused welding consumables prior to welding. Packaged consumables may be heavy, and should be handled and stored with care. FOLLOW MANUAL HANDLING REGULATIONS.

Wire wound on reels or spools, or supplied in bulk packages can be coiled under tension. Take care to avoid the wire uncoiling rapidly when released. WEAR GLOVES AND EYE PROTECTION

When using these consumables as part of the welding process additional potential hazards are likely:

Electric shock from the welding equipment or electrode. This can be fatal.

Hot metal spatter and heat from the electric arc and the welding flame, which can cause burns to the hand and body, and may cause fire if in contact with combustible materials.

UV, IR and light radiation from the arc, which can produce 'arc eye' and possible eye damage to unprotected eyes. WEAR SUITABLE PROTECTIVE EQUIPMENT.

Fumes produced from the welding consumable, material being welded, the arc radiation and the welding flame:

- Particulate fume such as complex metal oxides and silicates from the weld materials.
- Gaseous fume such as ozone and nitrogen oxides from the action of arc radiation on the atmosphere, and carbon monoxide and dioxide from oxidation of carbon in the components, and from the flame combustion products.
- SHORT TERM INHALATION OF THESE FUMES AND GASES MAY LEAD TO IRRITATION OF THE NOSE, THROAT AND EYES.
- LONG TERM OVEREXPOSURE OR INHALATION OF HIGH LEVELS OF FUMES MAY RESULT IN HARMFUL EFFECTS TO THE RESPIRATORY SYSTEM, CENTRAL NERVOUS SYSTEM AND LUNGS.
- LOCAL EXTRACTION AND /OR VENTILATION SHOULD BE USED TO ENSURE THAT ALL HAZARDOUS INGREDIENTS IN THE FUME ARE KEPT BELOW THEIR INDIVIDUAL OCCUPATIONAL EXPOSURE STANDARDS IN THE WELDER'S AND OTHER WORKERS' BREATHING ZONES.

NOTE: If welding is performed on plated or coated materials such as galvanised steel, excessive fume may be produced which contains additional hazardous components, and may result in metal fume fever and other health effects.

### 4. First aid measures

No first aid measures should be required for the unused wire and rod consumables. During welding:

#### Inhalation

If breathing is difficult, bring the patient in fresh air; breathe in fresh air deeply.

#### For skin burns

Submerge affected area in cold water until burning sensation ceases and refer for immediate medical attention.

#### For eye effects such as arc eye and dusts

Irrigate eye with sterile water, cover with damp dressing and refer for immediate medical attention if irritation persists.

#### Ingestion

Ingestion is considered unlikely due to product form. However, if swallowed do not induce vomiting. Seek medical attention. Advice to doctor: treat symptomatically.

#### Electric shock

If necessary resuscitate and seek immediate medical attention.

## 5. Fire prevention measures

No specific measures required for the welding consumable prior to welding.

Welding should not be carried out in the presence of flammable materials, vapours, tanks, cisterns and pipes and other containers which have held flammable substances unless these have been checked and certified safe.

## 6. Measures in case of unintentional release

No specific actions for welding consumable prior to use.

Welding in proximity to stored or used halogenated solvents may produce toxic and irritant gases. Prohibit welding in areas where these solvents are used.

## 7. Handling and storage (for safety)

No special precautions are required for these welding consumables.

Welding wires and rods are dense materials and can give rise to a handling hazard when reels, spools, bulk packs and multiple packages are lifted or handled incorrectly or with poor lifting posture.

Good practice for handling and storage should be adopted to prevent physical injuries.

## 8. Exposure prevention / Controls / Personal protection

### Exposure Prevention

Welders should not touch live electrical parts, and should insulate themselves from the work and the ground. Welders should not touch hot parts of the consumable, the torch assembly or the components being welded, and should avoid contact with the welding flame. Manufacturer's guidelines for the use of electrical welding machines, gas cylinders, gas control equipment and gas welding equipment should be observed at all times.

Welders and co-workers should be educated about the health hazards associated with welding fume, and trained to keep their heads out of the fume plume.

During welding, fumes and gases will be produced and emitted from the welding process. The content of the fume is dependent on the wire or rod type, shielding gas (if used) and base material being welded. The amount and concentration of fume generated is dependent on factors such as current, voltage (when electric arc welding), gas flow settings, flame size and type (when gas welding), welding practices and number of welders in a given area. By following recommended welding practices, fume production can sometimes be minimised.

For the solid aluminium wires and rods covered by this data sheet, the main constituents of the fume will be aluminium, manganese, magnesium and copper oxides and silicates, mainly in the form of complex compounds. There will also be smaller amounts of other complex metal oxides and silicates.

Gaseous ozone and nitrous oxides are also formed by arc radiation, and carbon monoxide and carbon dioxide can also be present due to oxidation of carbon in the components, and from the flame combustion products. In some cases ozone levels can be high, and additional controls may be needed.

Fume Composition data for the main solid aluminium wires and rods are given below.

Fume exposure should be controlled to below the recognised exposure limit for each of the individual constituents, and to below 5 mgm/m<sup>3</sup> for the total particulate fume.

TABLE 2: FUME COMPOSITION DATA (WT%)

Classification	Al	Fe	Mn	Cr	Cu	Mg	Zn
4043	Bal.	1-3	<1	<1	<1	<1	<1
5356	Bal.	<1	<1	<1	<1	1.5-3.5	<1
Others	Bal.	<1*	0-10*	<1*	0-5*	1-5*	<1*

\* indicates estimate, based on consumable composition

TABLE 3: HAZARDOUS FUME COMPONENTS

Welding fume component	CAS No.	OEL <sup>1</sup> 8hr TWA	STEL <sup>1</sup> 15min TWA
Total welding fume (particulate)	-	5	
Aluminium Oxides	1344-28-1		
Total inhalable dust		10	
Respirable dust		4	
Iron oxide fume (as Fe)	1309-37-1	5	10
Manganese and its inorganic compounds (as Mn)	7439-96-5	0.5	
Silica, amorphous			
(total inhalable dust)	-	6	
(respirable dust)		2.4	
Chromium VI compounds (as Cr)		0.05	
Chromium III compounds (as Cr)		0.5	
Copper, fume	7440-50-8	0.2	
Zinc oxide, fume	1314-13-2	5	10
Carbon Dioxide	124-38-9	5000ppm	15000ppm
Carbon Monoxide	630-08-0	30ppm	200ppm
Nitrogen dioxide (NO <sub>2</sub> )	10102-44-0	3ppm	5ppm
Ozone (O <sub>3</sub> )	10028-15-6	0.2 ppm	0.2 ppm
Nitrogen monoxide (NO)	10102-43-9	25ppm	35ppm

Units are in mgm/m<sup>3</sup> except when stated otherwise. For UK only.

\* Please refer to <http://www.hse.gov.uk/pubns/chan28.htm> & <http://www.hse.gov.uk/pubns/chan29.htm>

The fume analyses for the solid aluminium wires and rods covered by this data sheet, and used for welding clean, uncoated aluminium indicate that as long as the 5 mgm/m<sup>3</sup> total fume exposure limits are met, fume levels of the other constituents will generally be below their respective exposure limits.

The exceptions are manganese and copper, ozone and nitrogen dioxide (when electric arc welding), and carbon monoxide (when gas welding). These all have low exposure limits and additional controls may be required.

THE FUME LEVELS GIVEN ABOVE WERE GENERATED UNDER LABORATORY CONDITIONS WHEN WELDING CLEAN, PLAIN UNCOATED ALUMINIUM UNDER THE MANUFACTURERS RECOMMENDED WELDING PARAMETERS, AND ARE INDICATIVE OF REASONABLY EXPECTED FUME LEVELS. ACTUAL FUME LEVELS WILL VARY IN PRACTICE, DEPENDING ON THE WELDING PARAMETERS AND OTHER CONDITIONS, AND MAY BE HIGHER OR LOWER THAN THOSE LISTED ABOVE.

ADDITIONAL FUME MAY ARISE WHEN THESE WIRES AND RODS ARE USED TO WELD CONTAMINATED BASE MATERIALS, COATED OR PLATED STEELS, OTHER METALS AND ALLOYS, OR WHEN INCORRECT WELDING CONDITIONS ARE USED.

THE ONLY ACCURATE WAY TO DETERMINE THE COMPOSITION AND QUANTITY OF FUMES AND GASES TO WHICH WORKERS ARE EXPOSED IS TO TAKE AIR SAMPLES FROM INSIDE THE WELDERS HELMET, IF WORN, OR IN THE WORKER'S BREATHING ZONES.

Individual fume measurements should be made in these cases using recognised sampling and analysis standards. Based on the results of these measurements, additional fume controls may be required to ensure that all the fume constituents are controlled below their exposure limits.

## Controls

Good general ventilation, and/or local fume extraction at the arc or flame should be used to control the fumes and gases produced during welding to below their individual recognised exposure limits when measured in the welder's and co-workers' breathing zone. In addition the ventilation and extraction should also be sufficient to ensure that the total particulate fume levels are reduced below 5mgm/m<sup>3</sup> when measured in the breathing zone.

1

In confined spaces where ventilation is not adequate, an air fed breathing system should be used. All precautions for working in confined space should be observed. Refer to:

Safe work in confined spaces Free HSE leaflet INDG258 HSE Books 1999. Also available in priced packs ISBN 0 7176 1442 5.

Safe work in confined spaces: Approved code of practice, regulations and guidance L101 HSE Books 1997 ISBN 0 7176 1405 0

Where fume levels exceed the recognised exposure limits, respiratory protection may be required in the form of a Class P2 (metal fume) respirator.

## Personal Protection

Welders and co-workers in the vicinity should wear protective clothing and eye protection appropriate to the welding process being used, as specified by local standards.

### Protection of Body and Skin

Suitable clothes for welding should be worn such as non light reflective fireproof overalls, leather apron, welding helmet (for arc welding), suitable head protection and welding goggles (for gas welding), leather boots spats and gloves.

### Protection of Hands

Welders should wear suitable hand protection such a welding gloves or gauntlets of a suitable standard. Co-workers should also wear suitable hand protection against hot metal, sparks and spatter.

### Eye Protection

As appropriate for the welding process being used, welders should wear a welding helmet or welding goggles fitted with the correct optical welding filter for the operation. Suitable protective welding screens and goggles should be provided, and used by others working in the same area.

## 9. Physical and chemical properties

**Physical state:** Solid

**Colour:** Generally white metallic or light grey

**Form:** metal wire or rods

**Odour:** Odourless

**PH:** Not available

**Vapour pressure:** Not relevant

**Vapour Density:** Not relevant

**Boiling point / range:** Not relevant

**Melting Point:** ~700°C

**Solubility in water:** Insoluble

**Density:** Not available

**Explosive / ignition point:** Non flammable. No fire or explosion hazard exists

## 10. Stability and reactivity

There are no stability or reactivity hazards from welding wires or rods as supplied.

Hazardous decomposition products such as metal oxide fumes and gases (see Section 8) are produced during welding.

## 11. Toxicity data

Welding fumes if inhaled can potentially produce several differing health effects caused by the metal containing particles and the gases produced during the welding process, both of which are present in the 'fumes'. The exact nature of any likely health effect is dependent on the consumable, material being welded, weld process, all of which affect fume quantity and composition, as well as the use of adequate ventilation, respirators, or breathing equipment as circumstances require.

Inhalation of the fumes/gases produced during welding may lead to irritation to the nose throat and eyes. The range of health effects include respiratory effects with symptoms such as asthma, impaired respiratory and lung function, chronic bronchitis, metal fume fever, pneumoconiosis, possible emphysema and acute pulmonary oedema.

Other potential health effects at elevated levels of exposure include central nervous effects possible lung cancer, bone disease, skin and fertility effects. Which of these health effects is potentially likely is related to the fume composition, and this needs to be consulted with the specific toxicity data below to assess the health risk when using any particular welding process.

Unprotected skin exposed to UV and IR radiation from the welding arc may burn or redden, and UV radiation is potentially a carcinogen. UV radiation can affect the unprotected eye by producing an acute condition known as 'arc eye'.

*Specific effects relevant to major particulate and gaseous fume constituents produced when welding with these wires and rods*

### **Aluminium**

Aluminium has been associated with a type of lung pneumoconiosis named 'Shavers disease' and a possible causative agent of Alzheimer's disease. In both cases any association with this and welding fume exposure is unproven.

### **Iron**

Iron oxide is generally considered a nuisance material and unlikely to cause any significant health effects. The fume particles however accumulate in the lungs and lead to a benign pneumoconiosis called siderosis.

### **Manganese**

Manganese compounds are found in aluminium alloy welding fumes. Manganese is mainly a systemic chronic toxin, although exposure to high particulate concentrations can cause some respiratory irritation.

Overexposure or inhalation of excessive amounts of manganese has been shown to affect pulmonary function, blood and may cause irreversible central nervous system damage (manganism) which resembles Parkinsons disease. Symptoms of manganism include tremors, impaired speech, facial expression changes, slow clumsy movements and eventually impaired walking. The symptoms are typically not apparent for several years.

### **Silica**

Silica is found in welding fumes produced by aluminium alloy wires and rods, and is produced mainly as amorphous silica. This form of silica has not been associated to any significant degree with lung pneumoconiosis which is associated with crystalline forms of silica.

### **Chromium**

Chromium can exist in differing forms in welding fume and this can determine the potential health effects. Chromium can produce respiratory effects such as nasal ulceration and possible lung cancer. It can also cause contact skin dermatitis.

The most toxic form of chromium is hexavalent chromium (Cr6+) which is classified as a human carcinogen. The other main form of chromium found in welding fumes (Cr3+) is considerably less toxic and is not classified as a carcinogen. Both types of chromium can be found in the fume from some of these wires and rods.

### **Copper and Zinc**

Copper and zinc in welding fume is the main cause of any metal fume fever observed during welding. Metal fume fever is a delayed respiratory effect produced by inhalation of fume. Symptoms include sweating, chills, fever, muscle aches and high temperature. These acute symptoms normally alleviate within 24-48 hours.

### **Ozone and Nitrogen oxides.**

In electric arc welding, these gases are formed due to interactions of the arc with the surrounding air. Both gases can produce eye, respiratory and lung irritation and also can produce longer term lung effects such as decreased lung capacity, chronic bronchitis, and emphysema. Of particular concern with both gases is that exposure to high levels (eg due to build up in confined spaces) can result in acute lung effects such as delayed pulmonary oedema.

### **Carbon monoxide and carbon dioxide.**

Carbon monoxide (CO) is a chemical asphyxiant and its toxicity is due to its affinity for oxygen carrying blood haemoglobin causing fatigue, weakness, dizziness and eventual unconsciousness and possible death. Carbon dioxide (CO<sub>2</sub>) is mainly an asphyxiant but can exert some toxic properties by increasing pulse and heart rate. During the normal uses of these wires and rods, these gases can be produced by oxidation of carbon in the components and from the flame combustion products.

## **12. Ecological data**

The welding process produces particulate fumes and gases which may cause long term adverse effects in the environment if released directly into the atmosphere. Welding fumes from the normal use of the aluminium wires and rods covered by this data sheet can produce carbon dioxide gas, which is dangerous to the ozone layer.

## **13. Disposal data**

Packaging and wire/rod scrap should be disposed of as general waste or recycled. No special precautions are required for this product.

## **14. Transport information**

No special requirements are necessary in transporting these products

## **15. Regulations**

- Health and Safety at Work Act 1974.
- The Management of Health and Safety at Work regulations 1992.
- L5 Control of substances hazardous to health. The Control of Substances Hazardous to Health Regulations 2002. Approved codes of practice and guidance. (ISBN 0717625346).
- Guidance Note EH40 – Occupational Exposure Limits (ISBN 0717621944).
- BS EN ISO 10882-1:2001 - health and safety in welding and allied processes - sampling of airborne particles and gases in the operator's breathing zone - part 1: sampling of airborne particles
- HSG 37 – An Introduction to Local Exhaust Ventilation. (ISBN 0717610012).
- L25 Personal protective equipment at work. Guidance on Regulations. Personal Protective Equipment at Work Regulations 1992. (ISBN 0717604152).
- L23 Manual handling. Manual Handling Operations Regulations 1992 (as amended)
- BS EN 169:2002 – Personal eye-protection - filters for welding and related techniques - transmittance requirements and recommended use
- BS EN 379:2003 – Personal eye-protection - automatic welding filters.
- BS EN 12477:2001 Protective Gloves For Welders.
- HSG 118 – Electrical Safety in Arc Welding (ISBN 0717607046).

## **16. Other information**

The customer should provide this Materials Safety Data Sheet to any person involved in the materials use or further distribution. BOC Limited requests the users (or distributors) of this product to read this Materials Safety Data Sheet carefully before usage.

The information contained in this Material Safety Data Sheet relates only to the specific materials designated and may not be valid for such material used in combination with any other material or in any process.

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