

SAFETY DATA SHEET (SDS)
CARBON AND LOW ALLOY STEEL ELECTRODES
Please ensure that this SDS is received by the appropriate persons

Review Date: 22/11/2022 v01

Emergency: 0860 02 02 02

Document Number: AFX-SDS-0091

1. PRODUCT AND COMPANY IDENTIFICATION

Product CARBON STEEL/LOW ALLOY WELDING ELECTRODES

Product Code AWS/ASME SFA 5.1 and SFA 5.5

Trade Name The following Afrox electrodes are covered by this SDS:
 * E6013: Vitemax, ARCMate 6013, Transarc 6013
 * E7024: Afrolux
 * E7018: LH 7018-1, 78MR, Ferron 1, Transarc 7018-1
 * E7018-A1: KV2,
 * E8018-B2: KV5, KV5L
 * E8018: 88D3, 88C1
 * E9018: KV3, 98
 * E11018:118

Recommended Use Manual Metal Arc (MMA) Welding of carbon/Low Alloy steels

Company Identification African Oxygen Limited
 Grayston Office Park Building 7
 128 Peter Road Sandown, Sandton, 2196
 Tel. No: (011) 490-0400
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www.afrox.com

Emergency Numbers **0860 02 02 02 (Afrox)**

Vapour Inhalation

- 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.
- Particulate fume such as complex metal oxides, fluorides, 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 the dissociation of some flux constituents during welding.
- 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.

2. HAZARD IDENTIFICATION

Classification

- Classification under South African Hazardous Chemical Substances Regulations subsequently amended. (HCS)
- Classification under the Globally Harmonized System of classification and labelling of chemicals (GHS)

Emergency Overview

Colour: Generally greyish, but other colours can be present
 Odour: Odourless
 Taste: Not applicable
 Physical State: Solid
 Form: Metal wire with flux coating

Main Hazards

- When using these electrodes as part of the welding process additional potential hazards are likely.
- Electric shock from the welding equipment or electrode. This can be fatal.
- There are no recognised hazards associated directly with unused welding consumables prior to welding.

Adverse Health Effects

- Some low levels of dust may be produced during handling. Do not breathe the dust.

Chemical Hazards

- Hot metal spatter and heat during welding may cause fire if in contact with combustible materials.

Biological Hazards

- Fumes produced from the welding consumable, material being welded, and the arc radiation.

Eye Contact

- UV, IR, and light radiation from the arc, which can produce 'arc eye' and possible eye damage to unprotected eyes. Wear suitable protective equipment.

Skin Contact

- No known effect associated with unused welding consumables prior to welding.
- Hot metal spatter and heat can cause burns to the hand and body during welding.

Ingestion

- Considered unlikely due to product form.

GHS Classification

- Not classified as hazardous according to applicable GHS hazard classification criteria.

GHS Pictogram

- Not applicable

GHS Signal Words

- Not applicable

GHS Hazard Statements

- Not applicable

GHS Precautionary Statements

- Not applicable

Storage:

- Not applicable

Prevention:

- Not applicable

Response:

- Not applicable

Disposal

- Not applicable

Other Hazards that do not result in classification

- Packaged consumables may be heavy and should be handled and stored with care. Follow Manual Handling Regulations.

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3. COMPOSITION OF INGREDIENTS

Chemical name These electrodes consist of a mild steel inner core with a flux coating. The mild steel inner core is an uncoated solid steel rod. The flux coatings vary depending on the type of electrode, and contain varying amounts of metal powders, ferro-alloy powders, mineral ores, inorganic oxides, carbonates and fluorides, cellulosic compounds and other siliceous materials mixed together with liquid silicate binders.

Specific details of the contents of the core wire and flux coating for the electrode types covered by this Safety Data Sheet are provided in Table 1 and Table 2 below.

CAS No Various: refer to Table 2 below

UN No Not applicable

ERG No Not applicable

Hazard class Not applicable

TABLE 1: CORE WIRE COMPOSITION DATA (WT %)

Mild steel core Typical	Fe	Mn	Cr	Ni	Cu	Si
	98-99	<0.6	<0.1	<0.1	<0.1	<0.2

TABLE 2: COATING COMPOSITION DATA (WT %)

Flux coating	Rutile 6013	Basic Low Hydrogen E7018, 8018, 9018, 11018	Rutile Iron Powder E7024	Cas No.
Limestone and/or Calcium Carbonate	<10	20-55	<10	1317-65-3
Magnesite (total inhalable dust) (respirable dust)	<5	-	-	546-93-0
Cellulose (total inhalable dust) (respirable dust)	<15	-	-	9004-34-6
Iron Oxides (as Fe)	<10	<10	<10	1309-37-6
Inorganic Fluorides (as F)	<10	10-30	<10	16984-48-8
Iron powder	<10	10-35	10-60	7439-89-6
Manganese and its Inorganic compounds (as Mn)	5-15	<15	<15	7439-96-5 & other
Rutile / Titanium Dioxide (total inhalable dust) (respirable dust)	15-60	<15	10-30	13463-67-7
Flux coating	Rutile 6013	Basic Low Hydrogen E7018, 8018, 9018, 11018	Rutile Iron Powder E7024	Cas No
Silicon and Silicon Alloys (as Si)	-	<10	<5	7440-21-3
Silicate Binders	<15	<15	<15	1344-09-8

Mica (total inhalable dust) (respirable dust)	<20	<5	<5	12001-26-2
Quartz/Silica Respirable crystalline	<15	5-60	<10	14808-60-7
Kaolin (respirable dust)	<20	-	<5	1332-58-7
Other Mineral Silicates	5-30	5-10	5-30	1332-58-7
Nickel		<1		
Chromium or its compounds (as Cr)		<4		
Molybdenum (as Mo)		<2		
Vanadium (V ₂ O ₅)		<0.5		

4. FIRST AID

- No first aid measures should be required for the unused electrode consumables.

GHS

Precautionary Statements

Storage:

- Not applicable

Prevention:

- Not applicable

Response:

- Not applicable

Disposal

- Not applicable

Other Hazards that do not result in classification

- Packaged consumables may be heavy and should be handled and stored with care. Follow Manual Handling Regulations.

First aid measures during welding:

Inhalation

- If breathing is difficult, bring the patient to an open area with fresh air; breathe in fresh air deeply.

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 detached flux coating is 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-FIGHTING

Suitable extinguishing media

- No specific measures required for the welding consumable prior to welding. Use extinguishing media appropriate for surrounding fire.

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Unsuitable extinguishing media	- None
Specific Hazards	- 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.
Special fire-fighting procedures	- Evacuate all personnel from the danger area. Follow fire-fighting procedures appropriate for surrounding fire.
Special protective equipment for firefighters	- Firefighters should use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, Self-contained Breathing Apparatus.

6. ACCIDENTAL RELEASE

Personal precautions, protective equipment and emergency procedures	- 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. - Provide adequate ventilation.
Environmental Precautions	- Avoid release to the environment. Prevent further leakage or spillage, if safe to do so. - Do not contaminate water sources or sewer.
Methods and material for containment and cleaning up	- Absorb with sand or other inert absorbent. - Clean up spills immediately, observing personal protective equipment precautions. Prevent product from entering any drains, sewers or water sources

7. HANDLING AND STORAGE

Safe Handling	- No special precautions are required for these welding consumables. - Welding electrodes are dense materials and can give rise to a handling hazard when multiple packages of the electrodes are lifted or handled incorrectly or with poor lifting posture. Good practice for handling and storage should be adopted to prevent physical injuries.
Conditions for safe storage, including any incompatibilities	- Store in closed, original container in a dry place. Store in accordance with local/regional/national regulations. - Keep out of reach of children
Technical Measures/ Storage conditions	- No special precautions are required for these welding consumables.

8. EXPOSURE CONTROLS

Occupational Exposure Hazards	- Welders should not touch live electrical parts and should insulate themselves from the work and the ground. - During welding, fumes and gases will be produced and emitted from the welding process. The content of the fume is dependent on the electrode type and base material being welded. The amount and concentration of fume generated is dependent on factors such as current, voltage, welding practices and number of welders in a given area. By following recommended welding practices, fume production can sometimes be minimised. Refer to Table 3 and 4 below for Fume Composition Data and Hazardous Fume Components.
Engineering Control Measures	For electrical hazard: - Manufacturer's guidelines for the use of electrical welding machines should always be observed. For fume hazard: - Good general ventilation, and/or local fume extraction at the arc 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 5mg/m ³ when measured in the breathing zone. - 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 OHSAct No. 85 of 1993 General Safety Regulation 9. For further information see the American National Standard Z49.1 Safety in Welding and Cutting and SABS 0238 (SANS 10238) Welding and Thermal Cutting Processes – Health and Safety. - Where fume levels exceed the recognised exposure limits, respiratory protection may be required in the form of a Class P2 (metal fume) respirator. 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. - For carbon steel electrodes, the main constituents of the fume will be iron, manganese, sodium, potassium and calcium oxides, fluorides, and silicates, mainly in the form of complex oxides and other compounds. There will also

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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 dissociation of some of the flux constituents.
- Fume composition data for the major carbon steel electrodes are provided in Table 3 below, and the individual exposure limits for the constituents (when specified) are provided in Table 4.
- Fume exposure should be controlled to below the recognised exposure limit for each of the individual constituents, and to below 5 mg/m³ for the total particulate fume.

TABLE 3: FUME COMPOSITION DATA (WT%)

Electrode Type	% Fe	% Mn	% Si	% Mg	% Ni	% Cr	% Ti	% Cu	% Na	% K	% Ca	% F
C-steel, rutile E6013	15-65	4-9	2-11	0.3	-	-	3-6	0.1	0-3	5-20	0-5	0-1
C-steel, basic, E7018	10-30	3-9	1-8	<1	-	-	0.7	0.1	5-15	2-20	8-20	5-25
C-Steel, iron powder Rutile E7024	25-55	4-15	1-15	0.1	-	-	1.1	0.1	5-10	1-5	5-10	0-2
Low Hydrogen E7018, 8018, 9018, 11018	14-20	5-7	-	-	<0.5	0.1-1.5	-	<0.2	-	-	-	14-18

TABLE 4: HAZARDOUS FUME COMPONENTS (WT%)

Welding Fume Component	Cas. No	OEL 8hr TWA	STEL 15min TWA
Total welding fume (particulate)	-	5	
Iron oxide fume (as Fe)	1309-37-1	5	10
Manganese and its inorganic compounds (as Mn)	7439-96-5	1.0	3
Silica, amorphous (total inhalable dust) (respirable dust)	-		
Magnesium oxide (as Mg) (total inhalable dust) (fume and respirable dust)	1309-48-4	10	
Titanium dioxide (total inhalable dust) (respirable dust)	13463-67-7	10	
Calcium Oxide	1305-78-8	2	
Calcium Silicate (total inhalable dust) (respirable dust)	1344-95-2		
Fluoride, inorganic (as F)	16984-48-8	2.5	
Nitrogen dioxide (NO ₂)	10102-44-0	5.6	9.4
Ozone (O ₃)	10028-15-6	0.2	
Nitrogen monoxide (NO)	10102-43-9		
Chromium IV Compounds (as Cr)		0.05	
Chromium III Compounds (as Cr)		0.05	
Nickel and its inorganic Compounds (as Ni) Water Soluble		0.1	
Water Insoluble		0.2	
Molybdenum Compounds (as Mo) Soluble		5	
Insoluble			

Units are in mg/m³, except when stated otherwise

- The fume analyses for the carbon steel electrodes covered by this Safety Data Sheet, and used for welding clean, uncoated plain carbon steels, indicate that provided the 5 mg/m³ total fume exposure limits are met, fume levels of the other constituents will generally be below their respective exposure limits.
- An exception is manganese, as this has a low exposure limit, and additional controls to limit this may be required.
- The fume levels presented in Table 4 were generated under laboratory conditions when welding clean, plain carbon steel 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 electrodes 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 welder's 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.

Personal Protection

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

Eyes

- Welders should wear a welding helmet fitted with the appropriate optical welding filter for the operation. Suitable protective welding screens and goggles should be provided and used by others working in the same area.

Hands

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

Body protection

- Suitable clothes for welding should be worn such as non-light reflective fireproof overalls, leather apron, welding helmet, leather boots, spats and gloves.

Feet

- Welders and co-workers should wear safety shoes while handling welding consumables and during welding.

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9. PHYSICAL AND CHEMICAL PROPERTIES

Name	CARBON STEEL/LOW ALLOY WELDING ELECTRODES
Chemical Symbol	Mixture of substances
Physical state	Solid
Form:	Metal wire with flux coating
Colour:	Generally greyish, but other colours can be present
Odour:	Odourless
Odour Threshold:	Not applicable
pH:	No data available
Melting Point:	~1500°C
Boiling Point:	Not applicable
Sublimation Point:	Not applicable
Critical Temp. (°C):	Not applicable
Flash Point:	Not applicable
Evaporation Rate:	Not applicable
Flammability (solid, gas):	Non-flammable solid
Flammability limit - upper (%):	Not applicable
Flammability limit - lower (%):	Not applicable
Vapour pressure:	Not applicable
Vapour density (air=1)	Not applicable
Relative density:	No data available
Solubility(ies)	
Solubility in Water:	Insoluble
Partition coefficient (n- octanol/water):	No data available
Autoignition Temperature:	Not self-igniting
Decomposition Temperature:	No data available
Viscosity	
Kinematic viscosity:	No data available
Dynamic viscosity:	No data available
Explosive properties:	Not applicable
Oxidising Properties:	Not applicable
Molecular weight	Various, per electrode type

10. STABILITY AND REACTIVITY

Reactivity	- There are no reactivity hazards from electrodes as supplied.
Chemical stability	- There are no stability hazards from electrodes as supplied.
Possibility of hazardous reactions	- There is no possibility of hazardous reactions from electrodes as supplied.
Conditions to avoid	- Open flames and high energy ignition sources.
Incompatible Materials	- No reaction with any common materials in dry or wet conditions.
Hazardous Decomposition of Products	- Hazardous decomposition products such as metal oxide fumes and gases (see Section 8) are produced during welding.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity	Refer to "Other Relevant Toxicity Information"
Skin & eye contact	Refer to "Other Relevant Toxicity Information"
Chronic Toxicity	Refer to "Other Relevant Toxicity Information"
Carcinogenicity	Refer to "Other Relevant Toxicity Information"
Mutagenicity	Refer to "Other Relevant Toxicity Information"
Reproductive Hazards	Refer to "Other Relevant Toxicity Information"

Other Relevant Toxicity Information

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, the material being welded and the 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

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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 electrodes:

Iron

The chief component of fume generated by welding carbon steels is iron oxide.

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 also found in carbon steel 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.

Fluorides

The main source of fluorides is from the flux coatings on some welding electrodes such as basic types (E7016 and 7018) and this produces mainly fluoride particulate fume. Fluorides are respiratory irritants and if absorbed through inhalation can lead to bone disease known as fluorosis.

Silica

Silica is found in welding fumes produced by fluxes and flux coatings 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.

Rutile sand

Mainly present as Titanium dioxide which is a respiratory irritant but in effect mainly a nuisance material of low toxicity.

Chromium

Chromium can exist in differing forms in welding fumes 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 are found in the fume

from this product.

Nickel

The main health effects of nickel are skin dermatitis (nickel 'itch') and it being classified as a potential human lung carcinogen. It may also cause nasal cancer. Similar to chromium, nickel exists in the fume produced from welding.

Molybdenum

Molybdenum is of low toxicity, and no specific health effects would be expected from exposure to it in welding fume.

Ozone and Nitrogen oxides.

These gases are formed due to interactions of the arc with the surrounding air of the welding arc. 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 (e.g. 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 (CO2) is mainly an asphyxiant but can exert some toxic properties by increasing pulse and heart rate. These gases are mainly formed through decomposition of some electrode components (cellulose and carbonates).

12. ECOLOGICAL INFORMATION

Toxicity - No relevant information available.

Persistence and degradability - No relevant information available.

Mobility in soil - No relevant information available.

Ecology - soil - No relevant information available.

Results of PBT and vPvB assessment
 - Not classified as persistent, bioaccumulating and toxic (PBT)
 - Not classified as persistent, very persistent and very bioaccumulating (vPvB)

Other adverse effects - Water hazard (self-assessment). Slightly hazardous for water.

Effect on ozone layer - 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 basic electrodes covered by this Safety Data Sheet can produce carbon dioxide gas, which is dangerous to the ozone layer.

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Effect on the global warming No relevant information available.

13. DISPOSAL CONSIDERATIONS

Disposal Methods - Stub ends and slag residue should be disposed of as general waste.
 - Fume collected from extraction units and from cleaning operations will contain heavy metal compounds and should be disposed of in accordance with local regulations

Disposal of Packaging - Packaging can be recycled.

14. TRANSPORT INFORMATION

Road Transportation

UN No. Not applicable
Shipping Name Welding consumables
ERG No. Not applicable
Class Not applicable
Subsidiary Risk Not applicable
Hazchem Warning Not applicable
 No special requirements are necessary in transporting these products.

Sea Transportation

IMDG Not applicable
Shipping Name Welding consumables
ERG No. Not applicable
Class Not applicable
Subsidiary Risk Not applicable
Label Not applicable
 No special requirements are necessary in transporting these products.

Air Transportation

ICAO/IATA Code Not applicable
Class Not applicable
Subsidiary risk Not applicable
Packaging instructions No special requirements are necessary in transporting these products.
Maximum quantity allowed No special requirements are necessary in transporting these products.

15. REGULATORY INFORMATION

SANS 11014:2010 Edition 1 Safety Data Sheet for chemical products - Content and order of sections
SANS 10228:2012 Edition 6 The identification and classification of dangerous goods for transport by road and rail modes

SANS 10234:2019 Edition 2 Globally Harmonized System of Classification and Labelling of Chemicals (GHS)
SUPPLEMENT TO SANS 10234 Edition 1 List of classification and labelling of chemicals in accordance with the Globally Harmonized System (GHS)
SANS 10238 Welding and Thermal Cutting Processes – Health and Safety.

16. OTHER INFORMATION

- Ensure all national/local regulations are observed.
- Regularly check supplier's information sources for updated versions of SDS's.
- The customer should provide this Safety Data Sheet to any person involved in the materials use or further distribution.
- The information contained in this 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.
- Further information can be obtained from the American National Standard Z49.1 Safety in Welding and Cutting.
- SANS 10234-Globally Harmonized System of Classification and Labelling of Chemicals data book

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Bibliography

- National Institute for Standards and Technology (NIST) Standard Reference Database Number 69.
- The ESIS (European chemical Substances 5 Information System) platform of the former European Chemicals Bureau (ECB) ESIS (<http://ecb.jrc.ec.europa.eu/esis/>).
- The European Chemical Industry Council (CEFIC) ERICards.
- United States of America's National Library of Medicine's toxicology data network
- TOXNET (<http://toxnet.nlm.nih.gov/index.html>)

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