AFROX

MATERIAL SAFETY DATA SHEET

STAINLESS STEEL ELECTRODES

1. PRODUCT AND COMPANY DESIGNATION

Product Name: STAINLESS STEEL WELDING ELECTRODES
Product Specification: AWS/ASME SFA 5.4
Product Classification & Brands: The following Afrox, Superweld and Rockweld electrodes are covered by this MSDS:

* E307: Rockweld 307
* E308L/308Mo : Afrox 308L, RSQ, Superweld 308L, Rockweld 308H
* E309/309L/309Mo/309MoL: Afrox 309L, FA 09, 309Mo,309MoL, Superweld 309L,
* E310: Afrox 310
* E316L: Afrox 316L, Superweld 316L
* E317: Rockweld 317L
* E312: Afrox 312, Versaweld, Superweld 312
* E410NiMo: Afrox E3Cr12
* E347: Rockweld 347
* E2209: Rockweld 2209

Recommended use: Manual Metal Arc (MMA) Welding of stainless steels
Supplier: Afrox
Address: P.O. Box 207, Germiston, 1400.
Telephone number: 086 020202
Telefax: (011) 821-3066

2. DETAILS OF COMPOSITION

These electrodes consist of a stainless steel inner core with a flux coating. The stainless steel inner core is an uncoated solid 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, and other siliceous materials all 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 data sheet are given below.

TABLE 1: COMPOSITION DATA

Stainless steel core	%C	%Si	% Mn	% Cr	% Ni	% Mo	% Cu	%Fe
Ranges	0.01-0.20	0.90 max	0.3-7.0	0-32	0-25	0-5.2	0-0.5	balance

TABLE 2: COMPOSITION DATA

Flux coating	E308L, 308H, 309L, 310, 347	E308Mo, E309Mo/L, 316L, 317L	E2209	E410NiMo	CAS No.
Limestone and/or Calcium Carbonate	0-20	0-20	5-10	0-22	1317-65-3
Mica (total inhalable dust) (respirable dust)	0-13	0-12	-	0-12	12001-26-2
Kaolin (respirable dust)	0-15	0-15		0-15	1332-58-7
Cellulose (total inhalable dust) (respirable dust)	0-2	0-2	-	-	9004-34-6
Mineral Silicates (total inhalable dust) (respirable dust)	0-30	0-30	15-25	0-15	1332-58-7 1344-95-2
Inorganic Fluorides (as F)	0-6	0-6	5-15	0-21	16984-48-8
Manganese and its Inorganic compounds (as Mn)	0-5	0-5	<3	0-5	7439-96-5 and others
Aluminium (total inhalable dust) (respirable dust)	0-2	0-2	-	0-2	7429-90-5
Rutile/ Titanium oxide (total inhalable dust) (respirable dust)	0-45	0-45	20-40	0-45	13463-67-7
Nickel and its inorganic compounds (soluble, as Ni) (insoluble, as Ni)	0-15	0-15	<5	0-15	
Silicon and Silicon alloys, (as Si) (total inhalable dust) (respirable dust)	0-5	0-5	-	0-5	7440-21-3
Molybdenum compounds (as Mo) (soluble compounds) (insoluble compounds)	-	0-5	-	0-2	
Chromium Chromium III compounds Chromium VI compounds	0-30	0-30	20-30	0-30	7440-47-3
Antimony oxide	0-2	0-2	-	0-2	7440-36-0
Silicate Binders	0-25	0-25	<5	0-25	1344-09-8
Others			Cu <3		

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.
Some low levels of dust may be produced during handling. DO NOT BREATHE THE DUST.
When using these electrodes as part of the welding process additional potential hazards are likely. These are:

- Electric shock from the welding equipment or electrode. This can be fatal.
- Hot metal spatter and heat, 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, and the arc radiation. These consist of:
  - 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.

  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 FUME 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 electrode 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 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 PREVENTION MEASURES

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

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. Manufacturer's guidelines for the use of electrical welding machines 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 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.
For stainless steel electrodes, the main constituents of the fume will be iron, chromium, manganese, nickel, sodium, potassium and calcium oxides, fluorides and silicates, mainly in the form of complex oxides and other 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 dissociation of some of the flux constituents.
Fume composition data for some common stainless steel electrodes are given below, and the individual exposure limits for the constituents (when specified) are also given.
Fume exposure should be controlled to below the recognised exposure limit for each of the individual constituents, and to below 5 mg/m^3 for the total particulate fume.

TABLE 3: FUME COMPOSITION DATA (WT %)

	% Fe*	% Mn*	% Si*	% Cr*	% Ni*	% Mo*	% Cu	% Na*	% K*	% Ca*	%F*
Typical range for common stainless steel electrodes	4-16	1-12	0-13	4-13	0-6	<1	<0.2	1-15	1-29	1-9	8-23

TABLE 4: HAZARDOUS FUME COMPONENTS

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)	-		
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	
Chromium VI compounds (as Cr)		0.05	
Chromium III compounds (as Cr)		0.05	
Nickel and its inorganic compounds (as Ni) water soluble water insoluble		1 0.1 0.2	
Molybdenum compounds (as Mo) soluble insoluble		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		
Copper Fume	7440-50-8	0.2	

Units are in mg/m^3, except when stated otherwise

The fume analysis for the stainless steel electrodes covered by this data sheet, when used for welding clean, uncoated stainless steel of matching composition, indicates that as long as the 5 mg/m3 total fume exposure limits are met, fume levels of the other constituents will generally be below their respective exposure limits.
The exceptions are manganese, chromium and nickel as these have low exposure limits, and additional controls to their individual limits may be required.
THE FUME LEVELS GIVEN ABOVE WERE GENERATED UNDER LABORATORY CONDITIONS WHEN WELDING CLEAN STAINLESS STEEL OF SIMILAR COMPOSITION TO THE ELECTRODE BEING USED, AND USING THE MANUFACTURERS RECOMMENDED WELDING PARAMETERS. THEY 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 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 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/m3 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.

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.

Protection of Body and Skin

Suitable clothes for welding should be worn such as non light reflective fireproof overalls, leather apron, welding helmet, 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-worker should also wear suitable hand protection against hot metal, sparks and spatter.

Eye Protection

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.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	Solid
Colour	Generally greyish, but other colours can be present
Form	Metal wire with flux coating
Odour	Odourless
pH	Not available
Vapour pressure	Not relevant
Vapour Density	Not relevant
Boiling point/ range	Not relevant
Melting Point	~1500ºC
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 electrodes 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 electrodes

Iron

One of the main components of fume generated by welding stainless 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 stainless 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 stainless steel electrodes, 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 stainless steel welding.
Molybdenum
Molybdenum is of low toxicity, and no specific health effects would be expected from exposure to it in welding fume.
Copper
Copper is one of the main causes 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
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 (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 (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 electrodes' components (cellulose and carbonates).

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 electrodes covered by this data sheet can produce carbon dioxide gas, which is dangerous to the ozone layer.

13. DISPOSAL DATA
Packaging, stub ends and slag residue 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
- OHSAct No 85 of 1993 General Safety Regulation 9.
- SABS 0238 (SANS 10238) Welding and Thermal Cutting Processes – Health and Safety.

16. OTHER INFORMATION
The customer should provide this Materials Safety Data Sheet to any person involved in the materials use or further distribution. Afrox requests the users (or distributors) of this product to read this Materials Safety Data Sheet carefully before usage. Further information can be obtained from the American National Standard Z49.1 Safety in Welding and Cutting.

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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