Health & Safety Information

Introduction

In general welding consumables can be classified as non-hazardous as they are metal rods covered with an inert flux coating, bare or copper coated wires, or granular fluxes, basically a mixture of crushed minerals. Exceptions to these are certain fluxes used in the brazing process and although mentioned in this document are covered by individual Safety Data sheets obtainable from your supplier.
When used in the welding process several identifiable hazards exists, associated with heat, light and fume emitted during the welding process. This document is intended to bring to the users attention the hazards and recommended practice to enable the consumables to be used safely.

Composition

Although welding consumables are considered non hazardous the following compositional information is provided as a general guide to the make up of the various consumable types involved in arc welding.

(a) Manual Metal Arc Consumables

Manual Metal Arc welding electrodes consist of a metal core wire coated with a flux covering. The coating of rutile mild steel electrodes contains approximately 50% rutile sand; ferro-manganese; carbonates in the form of magnesite or chalk; the coating may contain mineral aluminium silicates, such as china clay, talc, felspar or mica. About 10-15% (wet weight) of a silicate binder (water glass) is used to produce a paste which is extruded onto a mild steel core wire and dried.
Iron powder rutile types contain similar materials and approximately 50% iron powder with a corresponding reduction in the other constituents.
In basic mild steel electrodes the mineral silicates and rutile sand are replaced wholly or in part by calcium fluoride and calcium carbonate or similar materials.
Rutile and basic electrodes for the deposition of alloyed weld metal are formulated similarly to the above with the addition of appropriate alloying elements to the coating and/or core wire.
In cellulosic electrodes the rutile sand is replaced wholly or in part by cellulose material and an increased quantity of water glass, similar carbonates, mineral silicates and ferro-manganese form the balance.

(b) Metal Inert Gas Consumables

Semi-automatic MIG welding consumables are bare wires deposited with an inert gas shield. Variations of the process include the use of flux cored tubular wires with a metal powder or flux in fill, use of gas mixtures in which all or part of the gas is active rather than inert and the use of self-shielded flux-cored wires.

Solid wire MIG consumables for the welding of mild and low alloy steels either have a protective copper coating or are bare wires with no copper coating. They conform to

various grades contained in BS EN 440 (formerly BS 2901: Pt 1) or equivalent specifications. Consumable wires for the welding of stainless steels, copper, aluminium and nickel alloys are not copper coated and conform to BS 2901 Parts 2, 3, 4 & 5 respectively. Tubular wires generally consist of a mild steel tube containing powder filling, the main constituents of which are some or all of the following: iron, manganese, nickel, copper, silicon, chromium, molybdenum as alloy and deoxidising elements. In addition the powder may include titanium dioxide, calcium carbonate or calcium fluoride.

(c) Tungsten Inert Gas Consumables

In the TIG process the heat necessary to melt and fuse the joint area is generated by an arc maintained between the end of a non-consumable tungsten electrode and the work-piece. The weld area is protected from the atmosphere by an inert gas shield supplied through the welding torch. Filler metal may be added into the molten pool to fill the joint but because the filler is not transferred across the arc little particulate fume is generated. Measurements of fume generation rate in an enclosed Swedish box type apparatus have shown that the process emits less than 0.5g/hr of fume (this is 30-100 times less than typical MIG emission rates).
In areas of good ventilation these fume emission rates would not result in a significant concentration of particulate welding fume in the welders breathing zone.
The gases ozone, nitrogen dioxide and nitric oxide may be produced by the action of the electric arc or the radiation from it on the surrounding air, and the likelihood of this occurring increases with increasing welding current, particularly when welding stainless steels and aluminium.
Typical compositions for TIG consumables are shown in Table 9.

(d) Submerged Arc Welding Consumables

In the submerged arc process the welding arc is maintained below a layer of granulated flux. The wire consumables for welding mild and low alloy steels conform to compositions such as those within BS EN 756 (formerly BS 4165). Solid wires for the welding of stainless steels are also supplied, conforming generally with AWS stainless steel specifications e.g. 308L, 316L, 309, 347. Typical solid wire compositions are shown in Table 7.
Some hardfacing consumables are tubular wires containing some or all of the following: iron, manganese, nickel, chromium, copper, silicon, molybdenum, vanadium, tungsten, carbon.
Submerged arc fluxes are mixtures of minerals with, in some cases, additions of deoxidising and/or alloying constituents. The composition of fluxes (fused or agglomerated) is usually expressed in terms of the equivalent percentage of individual oxides, such as aluminium oxide, magnesium oxide, silicon dioxide, manganese oxide plus calcium fluoride. Typical flux compositions are shown in Table 8.
The submerged arc process itself evolves very little fume by virtue of the fact that during normal operation the arc is submerged beneath a burden of granulated flux. Fluxes which contain fluorides may liberate some inorganic fluoride during welding, but due to the mode of operation there is usually no hygienic significance because of the distance between the arc and the operator.
Fluxes may cause dust, and adequate care and good housekeeping must be exercised in their handling in order to avoid any possibility of excessive dust concentrations in the atmosphere, for example, when filling hoppers.

(e) Oxy-fuel (Gas) Welding Consumables

Very little fume is evolved from gas welding or brazing consumables during normal use, and in open shop conditions, mechanical ventilation or fume extraction is not usually necessary.
Typical analyses of bare rods are given in Table 9.
For composition of fluxes see their individual safety data sheets.
The fluxes of Fluxobronze Super and Fluxobronze K are mixtures of potassium borates and boric acid.
Saffire Aluminium Brazing and Saffire Aluminium Welding Fluxes contain sodium chloride, potassium chloride, lithium chloride and sodium aluminium fluoride. The flux powder should not be inhaled, ingested or swallowed. It must be kept away from food, drink and animal feeding stuffs.
Saffire Copper Silver Flux contains borax, boric acid and sodium chloride.
Saffire Cast Iron Flux contains sodium carbonate, sodium bicarbonate, borax and boric acid.
Saffire Unibronze Flux is a mixture of borax and boric acid.
Fluxes may be corrosive towards metal. They should not be allowed to come into contact with acids or other chemical substances with which a reaction may occur.

Hazard Identification

There are no recognised hazards associated directly with welding consumables. Hazards do however arise when the consumables are used as part of the welding operation. The major hazards to health are:

1) Light - welding generates ultra violet light which can damage the eyes and skin of the operator and people in the vicinity. Wear appropriate eye and body protection and screen off areas where welding is being performed.

2) Heat - welding generates heat in the parent materials and the welding consumables up to their melting temperatures, often in excess of 1000ºC. The heat generated can result in the components remaining hot for a considerable time following the completion of the welding process and the necessary procedure should be adopted to identify such components.

3) Fume - welding generates fume which consists of various airborne substances (fine particles or gases) which may increase hazards to health when they are inhaled or swallowed. The degree of hazard to the welder depends upon the composition of the fume, the concentration in the air that he is breathing and the time for which he is exposed to it.

4) Shock - electric shock can kill.

First-aid Measures

Arc-eye - Irrigate eye with water, cover with a damp/wet dressing and seek medical attention.

Burns - Submerge affected area in cold water until burning sensation ceases and seek medical attention.

Inhalation - If breathing is difficult move to fresh air and seek medical attention.

Electrocution - Do not put yourself at risk. Follow your own company's health and safety procedure for dealing with electric shock. Seek urgent medical attention

Fire-fighting Measures

None specific to welding consumables.

Accidental Release Measures

None applicable.

Handling and Storage

Special safety precautions are not required for the storage and handling of welding consumables, although obviously fluxes should not be ingested nor allowed to come into contact with food.
Skin contact does not normally present a hazard, though it is always possible that occasional individuals may exist who are allergic to substances normally considered inert, e.g. cases of allergy to nickel have been reported arising from the wearing of nickel bracelets, however we know of no such cases where welding consumables have been identified as the cause.
Welding consumables are dense materials and normal practice should be adopted in handling and storage to prevent physical injuries.
Caution should be adopted when handling spooled wire as the wire is wound tightly on to the spool and may spring when the fastening is released.

Exposure Controls and Personal Protection

Welders should wear the normal protective clothing and eye protection appropriate to arc welding. Under certain circumstances particularly with some high alloyed electrodes, the slag formed on the weld bead can detach and fly off in pieces, presenting a burn hazard to eyes and skin. Those in close proximity to welds should protect themselves from the danger of flying slag.
No fumes or gases are evolved by welding consumables at normal ambient temperatures, but in use (welding), fumes can be evolved. Ventilation and/or fume extraction must be adequate to keep fume concentration within safe limits.
The Control of Substances Hazardous to Health (COSHH) regulations provide a frame-work to help protect the health of people in their work place including the hazards from exposure to welding fume. COSHH lays down a sensible step-by-step approach to the necessary precautions, setting out essential measures that Employers and Employees should take.

Complying with COSHH involves:

Assessing the health risk against the occupational exposure limit (OEL) 5mg/m^3 for simple welding fume, ref. EH 40 current edition, and for complex fume EH 54.
Deciding what action to take.
Preventing or controlling exposure.
Ensuring control measures are maintained.
Monitoring exposure.
Informing, instructing and training employees about the risks and the precautions needed.

It is the responsibility of the user/employer under the Health & Safety at Work Act and the COSHH regulations that limits are not exceeded. The fume analysis cannot be used to assess the concentration of total welding fume to which a welder is exposed. Assessment of the possible exposure of the welder must be carried out by a competent person.

Physical and Chemical Properties

Not applicable to hazard information.

Stability and Reactivity

Welding consumables are stable under normal conditions and do not present a fire or explosion risk. They should not be allowed to come into contact with acids or other substances which are corrosive to metals , nor with oxidising agents, or other chemical substances with which a reaction may occur.

Toxicological Information

Effects from excessive exposure to fume arising from inadequate ventilation may become apparent at the time of welding or shortly afterwards or at some later date. Some of the effects are summarised below. It is unlikely that any one person could suffer all the effects listed at any one time, arising from exposure from any one consumable. Here it is important to note that workers other than welders may also come into contact with the products of welding fume:-

(a) Irritation of the Respiratory Tract

This is the effect of dust or fume on the lining of the respiratory tract and can cause dryness of the throat, tickling, coughing, chest tightness, wheezing and difficulty in breathing. In its most acute form it can cause the lungs to become full of fluid. The effects will vary with exposure, concentration and type of irritant.

(b) Metal Fume Fever

The inhalation of freshly formed metallic oxides such as those of zinc, chromium, nickel, copper and manganese may lead to an acute influenza like illness termed metal fume fever.

(c) Systemic Poisoning

This can result from the inhalation or swallowing of substances such as fluorides, hexavalent chromium, lead and barium.

(d) Long Term Effects

It is possible that certain constituents of welding fume such as hexavalent chromium and nickel may be carcinogenic and until there is definite information about this it is wise to treat them as such.

(e) Fibrosis

This is the formation of fibrous or scar tissue in the lungs. It is the result of a reaction between dust or fume with the lung tissue. There are various types depending on the nature of the substance involved and duration of exposure.
In all cases of doubt concerning physiological response to welding pollutants, medical advice should be sought promptly.

Ecological Information

The gases nitrogen monoxide, nitrogen dioxide and ozone may sometimes be produced by the action of the electric arc or the radiation from it on the surrounding air. These gases do not arise from the welding consumable and are not usually a problem in MMA welding under conditions of normal ventilation. MIG welding is more likely to give rise to these gases, particularly at high current levels, and ozone generation may be increased by the presence of argon or helium in the atmosphere around the arc. Carbon monoxide may be produced by the decomposition of carbon dioxide in the shielding gas or of carbonates in flux cored wires.
In any welding operation other possible sources of atmospheric contamination may be present, for example, coatings, paint or traces of oil or of de-greasing agents on work being welded, or substances arising from other operations in the vicinity, in addition to any fume arising from the welding consumables. Advice regarding the nature and extent of any possible hazard which might arise directly or indirectly from such substances or sources should always be obtained from the manufacturer of each product.

Disposal Considerations

Adopt good practice when disposing of stub ends, unused welding consumables, fluxes and packaging materials. No special procedures exist and disposal by recycling should be adopted wherever possible.

Transport Information

Not applicable.

Regulatory Information

Health and Safety at Work etc Act 1974
The Management of Health and Safety at Work Regulations 1992
Personal Protective Equipment at Work Regulations 1992
The Control of Substances Hazardous to Health Regulations 1994

Guidance note EH40 -	Occupational Exposure Limits
Guidance note EH54 -	Assessment of exposure to fume from welding and allied processes
Guidance note EH55 -	Control of exposure to fume from welding, brazing and similar processes
WMA leaflet 236 -	Hazards from welding fumes Incorporating WMA leaflet 237 - The arc welder at work
BS 6691 Pt 2: 1986 -	Fume from welding and allied processes.

Other Information

Fume

The tables in this leaflet give the chemical composition of the particulate fume evolved during the use of the range of welding consumables, analysis being of fume generated in an enclosed Swedish box type apparatus and using a compatible base plate.
The chemical composition of the fume is expressed as weight percent of elements, as is conventional, rather than as oxides and silicates and the other complex forms as they actually exist in the fume. The analysis is not a complete analysis, the balance of the fume from the MMA process, for example, consisting of complex oxides and silicates of some or all the slag-forming constituents of the electrode coating such as sodium, potassium, calcium, magnesium, aluminium, titanium, which are usually treated together as a residual fraction of inert inorganic fume.

The recommended limit on the concentration of welding fume (or any other atmospheric contaminant) in the air breathed by any person is defined by the Health & Safety Executive in a list of Occupational Exposure Limits (guidance note EH40). This guidance note is revised annually and reference should always be the most recent edition. A long term exposure limit (8 hr TWA value) of 5 mg/m^3 for particulate welding fume is included in the current list.

The analysis of fume from electrodes and wires for welding mild and some low alloy steels and aluminium alloys indicates that at a total particulate fume concentration of 5mg/m^3 no individual constituent of the fume will exceed its own recommended limit. These consumables can be found in Tables 1 and 2. There are, however, consumables which give fume containing elements such as chromium, nickel, manganese and copper in sufficient quantities that even at 5mg/m^3 their own limits would be exceeded. In these cases a greater degree of fume control or protection is required to ensure that welders and others are not exposed to excessive amounts of these elements. Consumables giving fume of this nature are listed in Tables 3 to 6, which also include guidance on the maximum concentration of total particulate fume allowable in order to protect workers from the main constituent (e.g. chromium) present in the fume.

The figures quoted in these tables are theoretical maximum concentrations, but at very low values, for accuracy with gravimetric determinations, sampling would have to be carried out for long periods, perhaps even over a complete working day. In these instances it is suggested that chemical analysis for the main constituent elements of concern might be a more practical approach.

MUREX Welding Consumables

Table 1 Fume analysis for MMA Electrodes where control of total welding fume to 5mg/m³ will ensure that no constituent of the fume will exceed its own recommended limit.

	Fume Analysis (wt %)						
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Castcraft*	2	0.2	2.5	0.1	0.1	0.1	5
Celtian	40	3.5	0.1	<0.1	0.2	0.1	-
Cinex	2	0.2	2.5	0.1	<0.1	0.1	5
Fastex 5	30	5	0.1	<0.1	0.1	0.1	-
Ferex Super	19	3.5	<0.1	<0.1	<0.1	0.1	18
Ferex Universal	21	7	<0.1	<0.1	0.1	0.3	10
Ferex 7016	12	5	<0.1	0.1	<0.1	0.1	13
Ferex 7016-1Ni	7	4	0.2	<0.1	<0.1	0.2	12
Ferex 7018LT	20	5	0.1	<0.1	<0.1	0.4	18
Ferroloid 1	2	0.4	1	0.1	2	0.1	5
Ferroloid 3	3	0.4	1.5	0.1	<0.1	0.1	5
Ferromax	28	5	0.1	0.1	<0.1	0.2	4
Fortrex NQ1	8	5	0.1	<0.1	<0.1	0.1	9
Fortrex NQ2	7	6	0.1	<0.1	<0.1	0.1	8
Fortex 7018	13	6	0.2	<0.1	0.1	0.4	16
Fortex 8018-C1	15	3.5	0.1	<0.1	<0.1	0.1	14
Gravitex	27	7	<0.1	<0.1	<0.1	0.1	-
Groovex	31	16	<0.1	<0.1	<0.1	<0.1	-
Hi-Trex 7016-C1L	8	3	0.1	<0.1	<0.1	0.6	14
Hi-Trex 8016G	17	9	0.1	<0.1	<0.1	0.2	5
Mirrospeed	30	7	0.1	<0.1	0.1	0.1	-
Murex Ferrospeed*	32	6	<0.1	<0.1	<0.1	<0.1	-
Murex 6010*	54	6	<0.1	<0.1	<0.1	0.3	-
Murex 6013*	35	5	<0.1	<0.1	<0.1	<0.1	-
Murex 7010 A1*	57	5	<0.1	<0.1	0.2	<0.1	-
Murex 7010 G*	40	6	0.1	<0.1	<0.1	<0.1	-
Murex 8010*	42	8	0.2	<0.1	<0.1	<0.1	-
Satinex	27	7	<0.1	<0.1	0.1	<0.1	-
Super Fastex	21	5	<0.1	<0.1	<0.1	<0.1	-
Vodex	35	5	<0.1	<0.1	0.1	0.1	-
Vortic Marine	40	5	0.1	0.1	0.1	0.1	-
Zodian Super	30	6	0.1	<0.1	0.1	<0.1	-
Zodian Universal	30	7	0.1	<0.1	0.1	0.1	-

* Denotes information has changed since last issued.

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Table 2 Fume analysis for MIG/MAG consumables where control of total welding fume to 5mg/m³ will ensure that no constituent of fume will exceed its own recommended limit.

	Fume Analysis (wt %)							
Wire	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**	**Al_2O_3**
Bostrand BW1	55	7	<0.1	<0.1	<0.1	0.1	-	-
Bostrand BW20	62	15	<0.1	<0.1	<0.1	0.2	-	-
Bostrand BW100	50	11.5	0.7	0.2	<0.1	<0.1	-	-
Bostrand LW1	55	6.5	<0.1	<0.1	1.1	0.1	-	-
Bostrand LW2*	55	6.5	<0.1	<0.1	1.1	0.1	-	-
Bostrand MS65	54	9	<0.1	<0.1	1	0.1	-	-
Bostrand 20	62	15	<0.1	<0.1	1.5	0.2	-	-
Bostrand 41	55	9	0.2	1.5	2	0.3	-	-
Bostrand 42	53	6	0.3	2	2.2	0.1	-	
Bostrand 281	2	0.1	-	-	0.05	-	-	83
Bostrand 286	1	0.1	-	-	0.04	-	-	80
Bostand 2861	1	0.1	-	-	0.04	-	-	80
Corofil B54Ni	44	7	0.8	<0.1	<0.1	0.2	13	-
Corofil B55	28	8	-	-	<0.1	0.1	13	-
Corofil B61-Ni 1	36	8	0.1	<0.1	<0.1	0.1	7	-
Corofil B65	17	14	1	1	<0.1	0.1	13	-
Corofil CrMo 1	25	11	0.01	0.06	0.1	0.2	11	-
Corofil CrMo 2.5	33	9	<0.1	2	<0.1	0.2	9	-
Corofil NQ1	39	8	0.4	<0.1	0.1	0.1	-	-
Corofil NQ2	32	9	<0.1	<0.1	<0.1	0.1	10	-
Corofil R56	27	18	0.4	<0.1	0.1	0.1	-	-
Corofil R56XL	24	8	<0.1	<0.1	<0.1	0.2	-	-
Corofil R58	36	12	<0.1	<0.1	0.2	0.2	-	-
Corofil R59Ni	39	8	0.4	<0.1	0.1	0.1	-	-
Corofil R59Ni SR*	39	8	0.4	<0.1	0.1	0.1	-	-
Corofil R60Ni 2	27	7	0.8	<0.1	0.1	0.1	<0.1	-
Corofil R62	39	11	<0.1	<0.1	0.1	0.1	-	-
Coromig Mo 0.5	45	14	0.1	0.1	0.1	0.2	-	-
Coromig NiMo	47	12	1	<0.1	<0.2	<0.1	-	-
Coromig Ni 2.5	50	8	1	0.1	0.1	<0.1	-	-
Coromig 18	49	9	<0.1	<0.1	1	<0.1	-	-
Coromig 57	49	11	<0.1	<0.1	<0.1	<0.1	-	-
Coromig 58	53	12	0.1	<0.1	0.2	0.2	-	-
Murair A1	18	1	<0.1	<0.1	<0.1	0.1	8	-
Murair A2	32	6	0.4	0.1	<0.1	0.1	-	-
Murair A350	10	3	0.1	1	<0.1	0.2	8	-
Murair A650	34	4	0.1	2	0.1	0.1	11	-

* Denotes information has changed since last issued.

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Table 3 Fume analysis for MMA Electrodes where the fume contains hexavalent chromium compounds for which a long term exposure limit of 0.05mg/m³ is included in Guidance Note EH40.

	Fume Analysis (wt %)						
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Armex 2	18	9	2	8	0.2	0.2	6
Armex 2PR	5	2	0.5	5	<0.1	<0.1	3
Armoid 1	12	6	1	4	0.1	0.1	11
Cobalarc 1A*	12	2	0.1	2	<0.1	0.1	11
Hardcraft*	30	6	<0.1	1.8	<0.1	<0.1	-
Hardex 350	38	8	0.1	2	<0.1	<0.1	-
Hardex 650	39	9	0.1	2.5	<0.1	<0.1	-
Hardex 650B	25	4	0.1	2	<0.1	0.1	14
Hardex 800	27	2.5	0.1	3	<0.1	0.1	9
Hardex MnP	8	11	0.5	8	0.1	0.3	8
Nicrex E308L	6	3	0.4	5	<0.1	0.1	4
Nicrex E309L*	3	3	0.5	6	<0.1	<0.1	14
Nicrex E309MoL	5	4	1	7	0.1	0.1	16
Nicrex E312	12	12	1.5	12.5	<0.1	0.1	10
Nicrex E316L	6	3	0.6	4	<0.1	0.1	7
Nicrex E347	6	2	0.4	5	<0.1	0.1	5
Nicrex UE1*	8	13	0.5	3.5	0.1	0.3	-
Nicrex 1	12	8	2	7	0.1	0.3	20
Weldall*	4	3	0.3	5	0.1	0.3	-

* Denotes information has changed since last issued.

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Table 4 Fume analysis for MIG/MAG consumables where the fume contains chromium for which long term exposure limits of 0.5mg/m³ for divalent and trivalent compounds and 0.05mg/m³ for hexavalent compounds are included in Guidance Note EH40.

	Fume Analysis (wt %)						
Wire	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Bostrand 308LSi	41	4	6	11	0.2	0.1	-
Bostrand 309L*	34	7	7	16	0.2	0.1	-
Bostrand 309LSi	34	7	7	16	0.2	0.1	-
Bostrand 316LS1	30	7	6	8	0.9	0.1	-
Bostrand 347Si	34	6	6	10	0.2	0.1	-
Corofil 308L	9	9	1.3	4.8	0.1	<0.1	<0.1
Corofil 309L	9	9	2	6.7	0.1	<0.1	<0.1
Corofil 316L	9	10	1.6	4.7	0.1	<0.1	<1
Corofil 347	14	9	1.8	6	0.1	<0.1	<0.1
Corofil 20/9/3	11	11	0.6	6	0.1	<0.1	13
Corofil P308L	10	7	1.8	10.6	0.1	<0.1	6.7
Corofil P309L	11	6.4	2.2	11.7	0.1	<0.1	6.4
Corofil P316L	10	6.6	2.1	10.4	0.1	<0.1	6.5
Coromoid 1*	28	16	4	14	0.2	0.1	-
Murair A CrC	24	<1	0.1	13	<0.1	<0.1	-
Murair 20/9/3	13	4	1.6	7.5	<0.1	<0.1	13

* Denotes information has changed since last issued.

Table 5 Fume analysis for MMA and MIG consumables where the fume contains copper for which a long term exposure limit of 0.2mg/m³ is included in Guidance Note EH40.

	Fume Analysis (wt %)						
Consumable	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Bostrand 200	0.3	<0.1	<0.1	<0.1	75	<0.1	-
Bostrand 231	0.2	1	0.2	<0.1	73	<0.1	-
Bostrand 241	0.3	0.6	<0.1	<0.1	75	<0.1	-
Bostrand AT210	2	0.1	0.2	<0.1	80	<0.1	-
Bostrand AT246	5	1	0.5	<0.1	75	<0.1	-
Bronzoid	0.2	2.5	<0.1	<0.1	37	<0.1	13

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Table 6 Fume analysis for MMA and MIG consumables where the fume contains nickel (exposure limit 0.5mg/m³) and/or manganese (exposure limit 1mg/m³) and /or chromium (exposure limit 0.5mg/m³ or 0.05mg/m³).

Fume Analysis (wt %)							
Consumable	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Hardex MnNi	26	25	2	<0.1	0.1	0.1	-
Murair A MnNi	35	22	1.3	1.4	<0.1	<0.1	4
Nyloid 2	4	9	14	4	<0.1	0.6	14

Table 7

Typical Wire Composition wt%									
Wire	**C**	**Mn**	**Si**	**S**	**P**	**Ni**	**Cr**	**Mo**	**Nb**
Bostrand S1	0.07	0.5	0.02	0.015	0.01	-	-	-	-
Bostrand S2	0.1	1	0.25	0.01	0.01	-	-	-	-
Bostrand S2-2Ni	0.1	1	0.2	0.01	0.01	2.3	-	-	-
Bostrand S2-1CM	0.1	1	0.2	0.01	0.01	-	1.3	0.6	-
Bostrand WBQ	0.13	1.7	0.3	0.01	0.01	-	-	-	-
Bostrand WB3*	0.13	1.7	0.3	0.01	0.01	-	-	-	-
Bostrand S3Mo	0.12	1.5	0.15	0.015	0.015	-	-	0.5	-
Bostrand S3Ni	0.1	1.6	0.2	0.01	0.01	1.3	-	-	-
Bostrand S3-1Ni1/4Mo	0.1	1.4	0.25	0.01	0.01	0.95	-	0.25	-
Bostrand S4	0.12	2	0.1	0.015	0.015	-	-	-	-
Bostrand S4Mo	0.12	2	0.1	0.015	0.015	-	-	0.5	-
Bostrand 308L	0.02	1.6	0.4	0.015	0.015	10	20	-	-
Bostrand 309	0.03	1.7	0.4	0.015	0.02	13.5	24	-	-
Bostrand 316L	0.02	1.6	0.4	0.015	0.021	12	18.5	2.7	-
Bostrand 347	0.05	1.4	0.35	0.008	0.01	9.5	19.5	-	0.76

Table 8

Typical Flux Composition wt%				
Flux	**CaO + MgO**	**SiO_2 + TiO_2**	**MnO + Al_2O_3**	**CaF_2**
Muraflux 50	13	39	44	2
Muraflux A80*	35	38	22	3
Satinarc BX100	5	30	57	6
Satinarc BX200	25	20	36	16
Satinarc BX300	42	14	16	26
Satinarc BX400	38	14	20	26
Satinarc BX600	29	32	21	14

* Denotes information has changed since last issued.

Table 9

TIG & GAS RODS typical composition wt%

Rod	C	Mn	Si	Ni	Cr	Mo	Nb	Cu	Al	Sn	Zn	Fe	Pb	Mg	Ag	Other
Aluminium 5%magnesium	-	0.1-0.2	<0.25	-	0.05-0.2	-	-	<0.05	Rem	-	<0.1	<0.4	-	4.5-5.5	-	-
Aluminium 5.3%magnesium	-	0.6-1	<0.25	-	0.05-0.2	-	-	<0.1	Rem	-	<0.2	<0.4	-	5-5.5	-	-
Aluminium 5% silicon	-	<0.5	4.5-5.5	-	-	-	-	<0.05	Rem	-	<0.1	<0.4	-	<0.05	-	-
Aluminium 10% silicon	-	<0.05	11-13	-	-	-	-	<0.05	Rem	-	<0.1	<0.6	-	<0.05	-	-
Aluminium bronze 90/10	-	<1	<0.1	<1	-	-	-	Rem	9-11	-	<0.2	0.75-1.5	<0.007	-	-	-
Argofil	-	0.15-0.35	0.2-0.35	<0.1	-	-	-	98.5	-	0.5-1	-	-	-	-	-	-
Copper coated mild steel	<0.1	<0.6	<0.06	<0.25	-	-	-	<0.45	-	-	-	Rem	-	-	-	-
Copper phosphorus 93/7	-	-	-	-	-	-	-	Rem	-	-	-	-	-	-	-	~ 7% P
Copper Silver	-	-	-	<0.1	-	-	-	98.5	-	<0.01	-	<0.03	<0.01	-	0.05-1.2	-
Fluxobronze K*	-	-	0.3	-	-	-	-	60	-	-	Rem	-	-	-	-	-
Fluxbronze Super*	-	-	0.3	-	-	-	-	60	-	-	Rem	-	-	-	-	-
Low carbon steel	<0.12	0.85-1.2	0.2-0.35	-	-	-	-	<0.4	-	-	<0.07	Rem	-	-	-	-
Manganese bronze	-	0.01-0.5	0.04-0.15	0.2-0.8	-	-	-	56-60	-	0.8-1.1	Rem	0.25-1.2	<0.05	-	-	-
Medium carbon steel	0.25-0.3	1.3-1.6	0.3-0.5	-	-	-	-	<0.45	-	-	-	Rem	-	-	-	-
Nickel bronze	-	<0.5	0.15-0.5	8-11	-	-	-	46-50	<0.03	<0.5	Rem	<0.5	<0.03	-	-	-
Pipewelding steel	0.1-0.2	1.6-1.8	0.1-0.35	-	-	-	-	<0.45	-	-	-	Rem	-	-	-	-
Pure Aluminium	-	<0.05	<0.25	-	-	-	-	<0.05	<99.5	-	<0.07	<0.4	-	<0.05	-	-
Silicon bronze	-	-	0.3	-	-	-	-	60	-	-	Rem	-	<0.03	-	-	
Silver braze 2	-	-	-	-	-	-	-	Rem	-	-	-	-	-	-	1.8-2.2	~6.5% P
Stainless 18/8-308L	<0.025	1.2-2	0.3-0.65	9-11	19.5-21	<0.5	-	<0.5	-	-	-	Rem	-	-	-	-
Stainless 23/12-309	<0.12	1-2.5	0.3-0.6	12-14	23-25	<0.5	-	<0.5	-	-	-	Rem	-	-	-	-
Stainless 18/8/3Mo-316L	<0.025	1.2-2	0.3-0.65	11-13	18-19	2.5-3.0	-	<0.5	-	-	-	Rem	-	-	-	-
Stainless 18/8 Nb-347	<0.07	1-1.8	0.3-0.65	9-10	19-21.5	<0.5	<1	<0.5	-	-	-	Rem	-	-	-	-
Saffire 22/9/3L	<0.02	1.6	0.5	9	22	3	-	-	-	-	-	-	-	-	-	-
Saffire AT246*	-	0.6-3.5	-	4.0-5.5	-	-	-	Rem	8.5-9.5	-	<0.1	3.0-5.0	<0.02	-	-	-
Super silicon cast iron	3-3.8	0.5-1	2.4-3.5	-	<0.15	-	-		-	-	-	Rem	-	-	-	-
Supersteel	<0.07	0.9-1.4	0.4-0.7	-	-	-	-	<0.45	0.05-0.15	-	-	Rem	-	-	-	-
1Cr 1/2Mo	<0.12	0.4-1.6	0.2-0.9	-	1.2-1.5	0.45-0.65	-	<0.4	-	-	-	Rem	-	-	-	-
2Cr 1Mo	<0.12	0.4-1.6	0.7-0.9	-	2-2.7	0.9-1.1	-	<0.4	-	-	-	Rem	-	-	-	-
9Cr 1Mo	<0.1	<0.6	<0.7	<0.5	8-10.5	0.8-1.2	-	<0.5	-	-	-	Rem	-	-	-	-

* Denotes information has changed since last issued.

MUREX

ESAB Welding Consumables

Table 1 Fume analysis for MMA Electrodes where control of total welding fume to 5mg/m³ will ensure that no constituent of the fume will exceed its own recommended limit.

	Fume Analysis (wt %)							
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**	**Al**
OK 21.03 Cutmat	31	16	<0.1	<0.1	<0.1	<0.1	-	-
OK 33.80 Femax	30	7	<0.1	<0.1	<0.1	<0.1	-	-
OK 43.23 Smoothtrode	20	9	0.1	0.1	0.1	<0.1	-	-
OK 43.24 Silkmat	24	7	<0.1	<0.1	<0.1	<0.1	-	-
OK 46.00 Mildtrode	35	5	<0.1	<0.1	<0.1	<0.1	-	-
OK 46.68 Versimat	27	7	<0.1	<0.1	0.1	0.1	-	-
OK 48.00 Unitrode	19	4	<0.1	<0.1	<0.1	<0.1	18	-
OK 48.04 Unitrode	23	5	<0.1	<0.1	<0.1	<0.1	18	-
OK 53.08 Hytuf 1Ni	9	5	0.1	<0.1	<0.1	0.2	7	-
OK 49.20 Losilmat	22	12	<0.1	<0.1	0.1	0.2	-	-
OK 53.88 Hytrode	7	4	<0.1	<0.1	<0.1	0.3	15	-
OK 55.00 Tensitrode	17	5	<0.1	<0.1	<0.1	<0.1	20	-
OK 73.08	22	5	<0.1	<0.1	0.6	<0.1	18	-
OK 73.69 8018-C1	18	3	0.3	<0.1	<0.1	<0.1	17	-
OK 74.56 Molytrode	20	4	<0.1	<0.1	<0.1	<0.1	18	-
OK 74.78 Tensitrode	13	6	<0.1	<0.1	<0.1	<0.1	20	-
OK 74.86 Tensitrode	18	7	0.1	0.1	<0.1	<0.1	20	-
OK 75.65	19	4	0.2	<0.1	<0.1	<0.1	19	-
OK 75.75	16	6	0.2	0.1	<0.1	<0.1	21	-
OK 75.76 Tensitrode	13	5	0.2	0.3	<0.1	0.2	14	-
OK 76.19 Chromotrode	19	6	0.1	0.3	<0.1	0.4	7	-
OK 76.28 Chromotrode	18	4	<0.1	0.6	<0.1	<0.1	20	-
OK 78.12	17	7	0.4	<0.1	<0.1	<0.1	13	-
OK 92.18 Castmat Ni	2	0.2	2.5	0.1	0.1	0.1	5	-
OK 92.58 Castmat NiFe	3	0.4	1.5	0.1	2	0.1	5	-
OK 92.78 Castmat NiCu	2	1.4	1	0.1	2	0.1	5	-
OK 96.50 Almintrode	0.1	0.1	<0.1	<0.1	<0.1	<0.1	20	21

ESAB

Table 2 Fume analysis for MIG/MAG consumables where control of total welding fume to 5mg/m³ will ensure that no constituent of fume will exceed its own recommended limit.

	Fume Analysis (wt %)								
Wire	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**	**Al_2O_3**	**B***
OK Autrod 12.51	55	6.5	-	-	1.1	-	-		
OK Autrod 12.64	49	9	<0.1	<0.1	1	<0.1	-		
OK Autrod 13.13	59	10	0.2	0.2	-	-	-		
OK Autrod 13.08	62	16	-	-	1.5	-	-		
OK Autrod 13.09*	55	7	<0.1	<0.1	0.6	0.1	-		
OK Autrod 13.26	66	5	0.4	0.1	1	<0.1	-		
OK Autrod 13.28	50	7	1	<0.1	<0.1	<0.1	-		
OK Autrod 13.29	50	11.5	0.7	0.2	1.5	<0.1	-		
OK Tubrod 14.00	49	11	<0.1	<0.1	<0.1	<0.1	-		
OK Tubrod 14.01*	43	13	0.1	0.1	1.5	0.3	-		
OK Tubrod 14.02	45	14	0.1	0.1	0.1	0.2	-		
OK Tubrod 14.03	47	12	1	<0.1	0.2	<0.1	-		
OK Tubrod 14.04	50	8	1	0.1	0.1	<0.1	2		
OK Tubrod 14.05*	50	8	0.5	0.1	0.1	0.1	2		
OK Tubrod 14.12	60	6.6	-	<0.1	0.1	<0.1	-		
OK Tubrod 14.13	49	11	<0.1	<0.1	<0.1	<0.1	-		
OK Tubrod 14.16*	50	3	<0.1	<0.1	<0.1	<0.1	5		15
OK Tubrod 14.17	32	5	0.4	0.1	<0.1	0.1	-		
OK Tubrod 14.18	18	0.5	<0.1	<0.1	<0.1	<0.1	8		
OK Tubrod 15.00	28	8	<0.1	<0.1	<0.1	0.1	13		
OK Tubrod 15.11*	27	7	0.8	<0.1	0.1	0.1	-		
OK Tubrod 15.12	36	12	0.1	0.1	0.2	0.2	-		
OK Tubrod 15.14	24	8	<0.1	<0.1	<0.1	0.2	-		
OK Tubrod 15.15	27	18	<0.1	<0.1	0.1	0.1	-		
OK Tubrod 15.17	39	8	0.4	<0.1	0.1	0.1	-		
OK Tubrod 15.18	37	7	<0.1	<0.1	0.1	<0.1	5		
OK Tubrod 15.20	25	11	0.1	0.6	0.1	0.2	11		
OK Tubrod 15.22	33	9	<0.1	2	<0.1	0.2	9		
OK Tubrod 15.24	36	8	0.1	<0.1	<0.1	0.1	7		
OK Tubrod 15.25	44	7	0.8	<0.1	0.1	0.2	13		
OK Tubrodur 15.40	38	0.1	0.8	0.1	0.1	-			
OK Tubrodur 15.41	10	3	0.1	1	<0.1	0.2	8		
OK Tubrodur 15.52	34	0.1	2	0.1	0.1	11			
OK Tubrodur 15.60#	35	22	1.3	1.4	<0.1	<0.1	4		
OK Autrod 18.04	2	0.1	-	-	0.5	-	-	83	
OK Autrod 18.01	1	0.1	-	-	0.4	-	-	80	
OK Autrod 18.15*	1	0.1	-	-	0.4	-	-	80	
OK Autrod 18.16*	0.2	0.2	-	-	-	0.1	-	92	

Fume contains manganese which has an exposure limit of 1mg/m³. * Denotes information has changed since last issued.

ESAB

Table 3 Fume analysis for MMA Electrodes where the fume contains hexavalent chromium compounds for which a long term exposure limit of 0.05mg/m³ is included in Guidance Note EH40.

	Fume Analysis (wt %)						
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
OK 61.25	5	3	0.4	4	<0.1	<0.1	32
OK 61.30	5	3	0.4	6	<0.1	0.1	12
OK 61.35	5	4	0.4	3	<0.1	<0.1	30
OK 61.41	5	3	0.4	7	<0.1	<0.1	20
OK 61.80	7	6	0.6	5	<0.1	0.1	14
OK 61.85	5	5	1	5	<0.1	<0.1	35
OK 63.20	4	3	0.4	5	<0.1	0.1	14
OK 63.30	6	3	0.6	6	<0.1	0.1	16
OK 63.34	12	3	1.3	7	<0.1	<0.1	10
OK 63.35	5	3	0.4	5	<0.1	<0.1	27
OK 63.41	4	3	0.4	5	<0.1	<0.1	24
OK 63.80	7	7	0.8	6	<0.1	<0.1	12
OK 64.30	6	3	0.6	5	<0.1	0.1	16
OK 67.15	4	5	1	5	<0.1	<0.1	23
OK 67.50	5	3	1.5	6	0.3	0.1	15
OK 67.53	5.2	3.3	0.5	5	<0.1	0.1	12
OK 67.55	8	3	0.9	6	<0.1	<0.1	25
OK 67.60	3	3	0.5	6	<0.1	<0.1	14
OK 67.70	6	5	0.6	7	<0.1	0.1	14
OK 67.71	6	4	0.5	6	<0.1	<0.1	22
OK 67.75	4	8	0.4	4	<0.1	<0.1	26
OK 68.15	11	2	0.4	3	<0.1	<0.1	26
OK 68.53	9	3	0.1	9	<0.1	<0.1	13
OK 68.55	12	3	1.1	6	<0.1	<0.1	20
OK 68.81	9	6	1.2	9	<0.1	<0.1	14
OK 68.82	13	12	1.6	12	<0.1	0.1	12
OK 69.33	5	5	1	7	0.6	0.2	21
OK 76.12 Chromotrode	41	7	0.8	1.2	<0.1	0.1	<1
OK 76.22 Chromotrode	20	10	<0.1	3	<0.1	<0.1	14
OK 76.35	21	3	<0.1	2	<0.1	<0.1	18
OK 83.28 Hardmat 300	26	3	<0.1	1.5	<0.1	<0.1	12
OK 84.52	39	2	<0.1	7	<0.1	<0.1	6
OK 84.58 Weartrode	30	2	<0.1	4.5	<0.1	<0.1	11
OK 92.15	1	4	4	2.6	<0.1	<0.1	30
OK 92.26	1	6	3.3	1.8	<0.1	<0.1	25
OK 92.45	1	1	3.1	4	<0.1	<0.1	32
OK 92.55	2	6	13	5	<0.1	<0.1	20

ESAB

Table 4 Fume analysis for MIG consumables where the fume contains chromium for which long term exposure limits of 0.5mg/m³ for divalent and trivalent compounds and 0.05ml/m³ for hexavalent compounds, are included in Guidance Note EH40.

	Fume Analysis (wt %)						
Wire	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
OK Autrod 16.11	34	6	6	11	0.2	0.1	-
OK Autrod 16.12	41	4	6	11	0.2	0.1	-
OK Autrod 16.32	30	7	6	8	0.2	0.1	-
OK Autrod 16.51	34	7	7	16	0.2	0.1	-
OK Autrod 16.53*	36	6	7.8	7.6	0.5	<0.1	0.4
OK Autrod 16.70	25	14	6	13	0.2	<0.1	-
OK Autrod 16.75	30	10	4	23	0.1	0.1	-
OK Tubrod 14.20	12	8	1	8	0.4	<0.1	11
OK Tubrod 14.21	20	16	3.2	11	0.7	<0.1	5
OK Tubrod 14.22	11	7	1.3	7	0.4	<0.1	8
OK Tubrod 14.27	9	6	1	9	0.2	0.1	8
OK Tubrod 14.30	9	9	1.3	4.8	0.1	<0.1	0.1
OK Tubrod 14.31	9	10	1.6	4.7	0.6	<0.1	0.1
OK Tubrod 14.32	9	9	2	6.7	0.1	<0.1	0.1
OK Tubrod 14.34	17	13	1.2	11.5	0.1	<0.1	9
OK Tubrod 14.37	16	5	1.1	7.2	0.1	<0.1	-
OK Tubrod 14.75	13	4	1.6	7.5	<0.1	<0.1	13
OK Tubrodur 14.70	24	<1	0.1	13	<0.1	<0.1	-

* Denotes information has changed since last issued.

ESAB

Table 7 Typical composition of ESAB Submerged Arc Welding Wires (wt%).

Typical Wire Composition (wt %)								
Wire	**C**	**Mn**	**Si**	**Ni**	**Cr**	**Mo**	**Cu**	**Nb**
OK Autrod 12.10	0.1	0.5	0.07	-	-	-	-	-
OK Autrod 12.20	0.1	1	0.1	-	-	-	-	-
OK Autrod 12.22	0.1	1	0.25	-	-	-	-	-
OK Autrod 12.32	0.1	1.5	0.25	-	-	-	-	-
OK Autrod 12.34	0.1	1.5	0.15	-	-	0.5	-	-
OK Autrod 12.40	0.12	2	0.15	-	-	-	-	-
OK Autrod 13.10	0.11	0.7	0.18	-	1.2	0.5	-	-
OK Autrod 13.20SC	0.1	0.6	0.12	-	2.35	1	-	-
OK Autrod 13.24	0.1	1.4	0.25	0.95	-	0.25	-	-
OK Autrod 13.27	0.1	1	0.13	2.3	-	-	-	-
OK Autrod 13.30	0.1	1.5	0.16	1.5	-	-	-	-
OK Autrod 13.36S	0.1	1	0.15	0.8	-	-	0.4	-
OK Autrod 13.40	0.1	1.6	0.24	0.98	-	0.58	-	-
OK Autrod 13.43	0.1	1.4	0.2	2.4	0.7	0.5	-	-
OK Autrod 16.10	0.03	1.6	0.4	10	20	-	-	-
OK Autrod 16.11	0.06	1.7	0.4	10	20	-	-	0.8
OK Autrod 16.30	0.03	1.7	0.4	12	19	2.8	-	-
OK Autrod 16.35	0.05	1.6	0.4	12	19	2.8	-	-
OK Autrod 16.53	0.03	1.7	0.4	13	24	-	-	-
OK Autrod 16.54	0.02	1.5	0.5	12	22	2.5	-	-
OK Autrod 16.86	0.01	1.7	0.4	9	23	3.2	-	-
OK Autrod 16.88	0.01	0.4	0.4	10	25	4	-	-
OK Autrod 19.82	0.02	0.4	0.1	Rem	22	9	-	3.6
OK Autrod 19.85	0.03	3	0.4	Rem	20	2	-	2.5

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Table 8 Typical Submerged Arc Welding Flux Compositions (wt%)

Flux	Typical Flux Composition (wt %)				
	CaO + MgO	SiO_2 + TiO_2	MnO + Al_2O_3	CaF_2	Fe-Cr
OK Flux 10.10	8(MgO)	-	25 (Al_2O_3)	63	-
OK Flux 10.16	-	15	30	50	-
OK Flux 10.37	-	10	40	50	-
OK Flux 10.40	10	45	40	5	-
OK Flux 10.45	5	40	45	5	-
OK Flux 10.47	15	15	40	25	-
OK Flux 10.50	30	20	30	20	-
OK Flux 10.61	40	15	15	25	-
OK Flux 10.62	35	15	20	25	-
OK Flux 10.63	35	15	20	25	-
OK Flux 10.71	25	20	35	15	-
OK Flux 10.75	30	20	25	20	-
OK Flux 10.81	5	30	55	5	-
OK Flux 10.90	30	35	20	10	2
OK Flux 10.91	30	30	20	10	-
OK Flux 10.92	30	35	20	10	-
OK Flux 10.93	-	10	40	50	-
OK Flux 10.94	-	10	35	50	-
OK Flux 10.96	20	35	15	10	15

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Table 9 Typical composition of ESAB OK Tigrods (wt%)

Typical Wire Composition (wt %)										
Rod	**C**	**Mn**	**Si**	**Ni**	**Cr**	**Mo**	**Cu**	**Nb**	**Al**	**Mg**
OK Tigrod 06.45	0.1	1.4	0.8	-	-	-	-	-	0.1	-
OK Tigrod 06.47	0.1	1.2	0.4	-	-	-	-	-	-	-
OK Tigrod 13.08	0.1	1.8	0.8	-	-	0.5	-	-	-	-
OK Tigrod 13.09	0.1	1.2	0.7	<0.1	0.1	0.5	-	-	-	-
OK Tigrod 13.12	0.1	1	0.7	-	1.2	0.5	-	-	-	-
OK Tigrod 13.22	0.1	1.2	0.8	-	2.4	1	-	-	-	-
OK Tigrod 13.26	0.1	1.4	0.8	0.8	-	-	0.3	-	-	-
OK Tigrod 13.28	0.1	1.1	0.6	2.3	-	-	-	-	-	-
OK Tigrod 13.38	0.1	0.5	0.4	0.8	9	1	-	<0.1	-	-
OK Tigrod 16.10	0.02	1.8	0.4	10	20	-	-	-	-	-
OK Tigrod 16.21	0.06	1.4	0.4	9.5	20	-	-	0.8	-	-
OK Tigrod 16.30	0.02	1.8	0.4	13	18	2.8	-	-	-	-
OK Tigrod 16.53	0.02	1.6	0.4	13	24	-	-	-	-	-
OK Tigrod 16.86	0.02	1.6	0.4	9	23	2.9	-	-	-	-
OK Tigrod 16.88	0.02	0.4	0.4	9.5	25	4	-	-	-	-
OK Tigrod 18.01	-	-	-	-	-	-	-	-	>99.5	-
OK Tigrod 18.04	-	-	5	-	-	-	-	-	93	-
OK Tigrod 18.05	-	-	12	-	-	-	-	-	88	-
OK Tigrod 18.15	-	-	-	-	-	-	-	-	94	5
OK Tigrod 18.16	-	0.8	0.2	-	0.2	-	-	-	93	4.8
OK Tigrod 18.20	-	0.7	-	-	0.1	-	-	-	93	5.3
OK Tigrod 19.82	0.02	0.4	0.1	Rem	22	9	-	3.9	-	-
OK Tigrod 19.85	0.03	3	0.4	Rem	20	2	-	2.5	-	-

FILARC Welding Consumables

Table 1 Fume analysis for MMA Electrodes where control of total welding fume to 5mg/m^3 will ensure that no constituent of fume will exceed its own recommended limit.

	Fume Analysis (wt %)						
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Filarc 46	30	6	0.1	0.1	0.1	0.1	-
Filarc 68	33	4	0.1	0.1	0.1	0.1	-
Filarc 78	26	6	0.1	0.1	0.1	0.1	-
Filarc 43G	30	6	0.1	0.1	0.1	0.1	-
Filarc 48G	28	5	0.1	0.1	0.1	0.1	-
Filarc C23S	26	6	0.1	0.1	0.1	0.2	-
Filarc 27	12	4	<0.1	<0.1	0.1	<0.1	14
Filarc 27P	25	5	<0.1	<0.1	0.2	<0.1	6
Filarc C57	18	4.5	<0.1	<0.1	<0.1	0.2	13
Filarc 35S	17	4	<0.1	<0.1	<0.1	0.1	14
Filarc 36S	11	2.5	<0.1	<0.1	0.1	<0.1	16
Filarc 56S	8	3	0.1	0.1	0.1	0.1	18
Filarc 56R	12	4	<0.1	0.6	<0.1	0.5	15
Filarc 75	11	2	0.2	<0.1	0.2	0.1	16
Filarc 75S	13	4	0.2	<0.1	<0.1	0.2	17
Filarc 76S	13	6	0.2	0.2	<0.1	<0.1	17
Filarc 86M*	8	2	<0.1	<0.1	0.8	<0.1	19
Filarc 87	15	2	0.2	<0.1	<0.1	0.1	18
Filarc 88	12	4	<0.1	<0.1	<0.1	<0.1	20
Filarc 88S	7	4	0.2	<0.1	<0.1	<0.1	15
Filarc 98	15	4	0.2	<0.1	<0.1	<0.1	14
Filarc 98S	12	5	<0.1	<0.1	<0.1	<0.1	20
Filarc 107	18	7	0.1	<0.1	<0.1	<0.1	20
Filarc 108	13	5	0.2	<0.1	<0.1	<0.1	15
Filarc 118	17	7	0.4	<0.1	<0.1	<0.1	13
Filarc 802*	7	0.5	5	<0.1	<0.1	<0.1	35
Filarc KV2	14	4	0.1	0.1	0.1	0.1	17
Filarc KV3	12	4	<0.1	0.1	<0.1	0.1	16
Filarc KV3L	12	4	<0.1	0.1	<0.1	0.1	16
Filarc KV4L	11	4	0.1	0.6	0.1	0.1	18
Filarc GO	31	16	<0.1	<0.1	<0.1	<0.1	-

* Denotes information has changed since last issued.

Table 2 Fume analysis for MIG/MAG consumables where control of total welding fume to 5mg/m³ will ensure that no constituent of fume will exceed its own recommended limit.

	Fume Analysis (wt %)						
Wire	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
PZ6000	55	6.5	<0.1	<0.1	1.1	<0.1	-
PZ6000S	55	6.5	<0.1	<0.1	1.1	<0.1	-
PZ6013	59	5	0.6	0.1	0.9	0.1	-
PZ6040	52	7	1	<0.1	<0.1	<0.1	-
PZ6041	62	15	0.1	0.1	0.1	0.2	-
PZ6042	55	9	0.2	1.5	2	0.3	-
PZ6043	53	6	0.3	2	2.2	0.5	-
PZ6044	55	10	0.1	5	2	0.3	-
PZ6047	50	11.5	0.7	0.2	<0.1	<0.1	-
PZ6103	53	10.2	<0.1	<0.1	0.3	<0.1	-
PZ6104	54	9.4	0.4	<0.1	<0.1	<0.1	-
PZ6111	44	9.1	<0.2	<0.1	0.1	<0.1	9
PZ6113	39	8.7	<0.1	<0.1	0.1	<0.2	4
PZ6125	28	10	0.2	<0.1	<0.1	<0.1	10
PZ6129Ni	33	11.6	0.3	<0.1	0.1	<0.1	17
PZ6130	53	8.3	<0.1	<0.1	0.2	<0.1	11
PZ6132	34	9.3	<0.2	0.1	<0.1	<0.1	-
PZ6138	39	11.1	0.4	<0.1	<0.1	<0.1	4
PZ6140	49	9.1	0.4	<0.1	0.4	<0.1	16
PZ6145	31	11.5	<0.1	<0.1	<0.1	0.1	11
PZ6203	40	10	<0.1	1.9	<0.1	<0.1	12
PZ6205	40	6.9	<0.1	0.5	<0.1	<0.1	7

Table 3 Fume analysis for MMA Electrodes where the fume contains hexavalent chromium compounds for which a long term exposure limit of 0.05mg/m³ is included in Guidance Note EH40.

	Fume Analysis (wt %)						
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Filarc KV5L	12	5	0.1	0.6	0.1	0.1	18
Filarc KV7	12	4	0.1	2	0.1	0.1	20
Filarc RS308LC	6.4	2.9	0.49	5	<0.1	0.1	15
Filarc RS347LC	8.2	5.6	0.81	6	<0.1	0.8	12
Filarc RS316LC	5.7	2.6	0.56	5.6	<0.1	0.7	15
Filarc RS309LC	4.3	3.5	0.55	7	<0.1	0.4	14
Filarc RS309Mo-LC	4.7	3.6	0.45	7.3	<0.1	0.2	15

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Table 4 Fume analysis for MIG/MAG consumables where the fume contains chromium for which long term exposure limits of 0.5mg/m³ for divalent and trivalent compounds and 0.05ml/m³ for hexavalent compounds are included in Guidance Note EH14.

	Fume Analysis (wt %)						
Wire	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
PZ6061	41	4	8	11	<0.1	0.1	-
PZ6065	30	7	8	8	<0.1	0.1	-
PZ6066*	30	10	4	23	0.1	0.1	-
PZ6072	34	6	6	10	0.2	0.1	-
PZ6165*	31	4	<0.1	18	<0.1	<0.1	-
PZ6430S	9	9	1.3	4.8	0.1	<0.1	-
PZ6433S	9	10	1.6	4.7	0.6	<0.1	-
PZ6435S	9	9	2	6.7	0.1	<0.1	-

* Denotes information has changed since last issued.

Table 9 Typical composition of FILARC TIG rods (wt%)

	Typical Wire Composition (wt %)									
Rod	**C**	**Mn**	**Si**	**Ni**	**Cr**	**Mo**	**Nb**	**Cu**	**Al**	**Fe**
PZ6500	0.1	1.5	0.8	-	-	-	-	0.2	-	-
PZ6501	-	0.7	-	10	-	-	-	Rem	-	1.6
PZ6502	-	0.6	-	30	-	-	-	Rem	-	0.8
PZ6510	0.05	1.3	0.6	-	-	-	-	0.2	0.1	-
PZ6512	0.08	1.4	0.8	0.8	-	-	-	0.4	-	-
PZ6513	0.09	1	0.5	0.9	-	-	-	0.2	-	-
PZ6540	0.09	1	0.6	2.5	-	-	-	0.2	-	-
PZ6541	0.08	1.1	0.6	-	0.1	0.5	-	0.2	-	-
PZ6542	0.09	1	0.6	-	1.2	0.5	-	0.2	-	-
PZ6543	0.07	1	0.6	-	2.5	1	-	0.2	-	-
PZ6544	0.06	0.7	0.5	-	5.7	0.5	-	0.2	-	-
PZ6561	0.02	1.7	0.5	10	20	-	-	0.1	-	-
PZ6565	0.02	1.8	0.5	12	18.5	2.8	-	0.1	-	-
PZ6572	0.05	1.5	0.5	10	20	-	0.5	0.1	-	-
PZ6579	0.09	2.2	0.5	13	24	-	-	0.1	-	-

ARCOS Welding Consumables

Table 1 Fume analysis for MMA Electrodes where control of total welding fume to 5mg/m³ will ensure that no constituent of fume will exceed its own recommended limit.

	Fume Analysis (wt %)						
Electrode	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
Fleetweld 5B	54	6	<0.1	<0.1	0.3	0.3	-
Hyweld 70 Plus	13	6	0.2	<0.1	0.1	0.4	16
Navalend 25	30	6	0.1	<0.1	0.1	<0.1	-
Normend T	43	7	<0.1	<0.1	<0.1	<0.1	-
Nufive	52	6	<0.1	<0.1	<0.1	0.1	-
Pipeweld 7010B	40	6	0.1	<0.1	<0.1	<0.1	-
Pipeweld 8010B	42	8	0.2	<0.1	<0.1	<0.1	-
Shield Arc 85B	57	5	<0.1	<0.1	0.2	<0.1	-
Silvac	22	5	<0.1	<0.1	<0.1	<0.1	-
V117	48	6	<0.1	<0.1	<0.1	0.1	-
Volumend 16	21	5	<0.1	<0.1	<0.1	0.1	-

Table 2 Fume analysis for MIG/MAG consumables where control of total welding fume to 5mg/m³ will ensure that no constituent of fume will exceed its own recommended limit.

	Fume Analysis (wt %)						
Wire	**Fe**	**Mn**	**Ni**	**Cr**	**Cu**	**Pb**	**F**
C2	51	11	<0.1	<0.1	1	<0.1	-
C3	54	9	<0.1	<0.1	1	<0.1	-
MIG 21	55	6.5	<0.1	<0.1	1.1	0.1	-