SAFETY DATA SHEET

CS0017
ALUMINIUM WIRE COIL

Place and date of issue:
Villaverla: 29.05.2017

Section 1: Identification of the substance / mixture and of the Company

1.1 Identification of the product, substance or mixture

Product identifier: 802062, 802064, 804069, 804072
(wires and rods for MIG and TIG arc welding in aluminium alloy.).

1.2 Relevant identified uses of the substance or mixture and uses advised against

SU15: fabricated metal products, excluding machinery and equipment.
PC38: welding and brazing products.

1.3 Details of the supplier of the safety data sheet

Supplier	TELWIN SPA
Street address	Via della Tecnica, 3
Country	36030 VILLAVERLA (VI)
Telephone number	+39 0445 858811
Fax	+39 0445 858800
* e-mail address	telwin@telwin.com

1.4 Emergency telephone number

+39 0445 858811 (working hours)

Section 2: Hazards identification

2.1 Classification of the substance or mixture

The product is not classified as hazardous pursuant to the Directives 67/548/EEC and 1999/45/EC, and/or regulation (CE) 1272/2008 (CLP) (and subsequent amendments and adaptations).

2.2 Label elements

Pictograms:	not applicable
Warnings:	not applicable
Risk phrases R:	not applicable
Safety advice S:	Refer to the product as sold: keep out of reach of children (P102). Read the warnings before use (P103).

The product does not require hazard labelling according to point 1.3.4, Annex 1 of regulation (CE) 1272/2008 and subsequent amendments and adaptations.

2.3 Other hazards

None.

Section 3: Composition/information on ingredients

3.1 Substances

Information not relevant

3.2 Mixtures

Chemical analysis

	CAS	S-AL.99,7	S-AL.99,5Ti	S-AL.SI.5	S-AL.SI.12	S-AlSi10Cu4	S-AlMg3	S-AL-MG-5	S-ALMG4,5MN	S-ALMg4,5MNZR	S-5556A
AWS/ASTM		**---**	**---**	**ER4043**	**ER4047**	**ER4145**	**---**	**ER5356**	**ER5183**	**---**	**ER5556A**
Si	7440-21-3	0,20≤	0,30≤	4,50–5,50	11,0–13,0	9,3–10,7	0,40≤	0,25≤	0,25≤	0,25≤	0,25≤
Fe	7439-89-6	0,25≤	0,40≤	0,40≤	0,50≤	0,8≤	0,40≤	0,40≤	0,40≤	0,40≤	0,40≤
Cu	7440-50-8	0,04≤	0,05≤	0,05≤	0,05≤	3,3-4,7	0,10≤	0,05≤	0,05≤	0,05≤	0,10≤
Mn	7439-96-5	0,03≤	---	0,03	0,1 – 0,4	0,1	0,015	0,01	0,1 – 0,4	0,5 – 1,0	_
Mg	7439-95-4	0,03≤	---	0,05≤	0,15≤	0,15≤	0,50≤	0,10-0,20	0,60-1,0	0,60-1,0	0,60-1,0
Ga, V	7440-62-2	0,05≤	---	---	---	---	---	---	---	---	---
Cr	7440-40-3	---	---	---	---	0,15≤	0,30≤	0,10-0,30	0,05-0,25	0,05-0,25	0,05-0,20
Zn	7440-66-6	0,04≤	0,07≤	0,10≤	0,10≤	0,20≤	0,20≤	0,10≤	0,25≤	0,25≤	0,25≤
Ti	7440-32-6	0,03≤	0,10–0,20	0,15≤	0,15≤	---	0,15≤	0,07-0,15	0,10-0,15	0,15≤	0,05-0,20
Zr	7440-67-7	---	---	---	---	---	---	---	---	0,08-0,20	---
Be	7440-41-7	0,0003≤	0,0003≤	0,0003≤	0,0003≤	0,0003≤	0,0003≤	0,0003≤	0,0003≤	0,0003≤	0,0003≤
ALTRI - each	---	0,03≤	0,03≤	0,05≤	0,05≤	0,05≤	0,05≤	0,05≤	0,05≤	0,05≤	0,05≤
ALTRI - tot	---	---	---	0,15≤	0,15≤	0,15≤	0,15≤	0,15≤	0,15≤	0,15≤	0,15≤
ALUMINIUM	7429-90-5	≥99,70	≥99,5	remain.	remain.	remain.	remain.	remain.	remain.	remain.	remain.

Legend:
CAS: not applicable.
EINECS: not applicable.

The product does not contain substances classified as being hazardous to human health or the environment pursuant to 67/548/EEC and/or Regulation (CE) 1272/2008 (CLP), and subsequent amendments and adaptations since, outside the planned use of the product, the individual elements cannot be separated using mechanical procedures.

Section 4: First aid measures

The following measures outlined refer to problems that can arise during the welding process, not to the product as such, in the event of non-compliance with minimum health and safety specifications.

4.1 Description of first aid measures

Inhalation – Signs and symptoms of inhalation can include: dizziness, sensation of discomfort, dehydration or throat irritation. In such cases, move away from the exposure zone and deep breath fresh air. In the event of considerable inhalation of welding fumes, consult a doctor.
Contact with skin and eyes –
Skin: wash carefully with detergent soap.
Eyes: wash eyes with running water; in the most serious cases, consult a doctor.
Ingestion – unlikely due to the shape of the product. The product can irritate the gastrointestinal tract. If necessary, consult a doctor.
Note for specialist – Treat symptomatically. Symptoms can be delayed over time.
General warnings – consult a doctor if any discomfort should develop. Consult a doctor in the event of burns, independent of the degree of seriousness. Show this safety data sheet to the doctor.

4.2 Most important symptoms and effects, both acute and delayed

The measures outlined below refer to problems which can occur during the welding procedure, each time the minimum provisions for health and safety are not met, and do not refer to the product as supplied.
- Aluminium is welded in an inert and protective atmosphere, for example argon or helium, using the MIG or TIG method. Welding generates fumes and intense, ultra-violet radiation, which forms oxides, ozone and nitrogen. Ultra-violet radiation coming from welding can also cause burning of the skin and eyes.
- Exposure to low levels of ozone can cause eye, nose and throat irritation. Its inhalation can cause oppression, headache, shortness of breath, coughing, sneezing, nausea and tightening of the oral cavities. The symptoms disappear as soon as you move away from the exposure.
- High level exposure to ozone can cause acute breathing problems with shortness of breath, pulmonary changes, haemorrhages and pulmonary oedema (fluid on lungs). The symptoms of pulmonary oedema can be delayed by one or more hours. Exposure of animal or human tissue to high concentrations of ozone have highlighted chromosome changes, affecting reproduction, blood and death due to pulmonary congestion.
- Nitrogen oxides can cause irritation of the eyes, skin (if wet), and infection of the respiratory tract. Exposure to high levels of nitrogen oxide can cause delayed pulmonary oedema (fluid on lungs) which can be fatal. Nitrogen nitrate can cause methemoglobin formation, which reduces the ability of the blood to carry oxygen to the tissues. Chronic exposure can cause pulmonary fibrosis.
- Over exposure to magnesium oxides can cause infections of the respiratory tract, irritation and temperature, chills, shortness of breath and sickness (temperature due to metal fumes). Temporary symptoms can include temperature, vomiting and muscle pains.
- Chronic exposure to inert silicon dust can increase resistance to air intake and contribute to form chronic bronchitis. Intra-tracheal intake of silicon in laboratory rabbits produced serious pulmonary injuries.
- Exposure to zinc oxide fumes following burning, welding and work on liquid metals can cause temperature, chills, shortness of breath and sickness (temperature caused by metal fumes), as well as irritation of the upper respiratory tract. Temporary symptoms can include temperature, chills, nausea, vomiting and muscle pains. Exposure to dust and particulate poses a low risk for health.
- Hexavalent chromium (Chromium VI) can cause asthma, kidney damage, primary dermal irritation, sensitising dermatitis, skin ulceration and pulmonary oedema (fluid on lungs). Chronic inhalation or over exposure was associated with lung, nose and gastrointestinal cancer. Hexavalent chromium is listed as carcinogenic to humans by the IARC (Group 1) = the agent is carcinogenic to humans. Chromium and some of its derivatives are listed as carcinogenic by the NTP. Hexavalent chromium compounds can be generated during welding operations where metal contains chromium. A significant quantity of chromium in the fumes can be hexavalent chromium; the latter has very low exposure limits, no more than 0.005 mg/m^3 (5µg/m^3).
- The potential damage deriving from over exposure to copper fumes can occur during welding, oxy-fuel welding, cutting, etc. Over exposure to copper dust/mist can cause irritation of the eyes, skin and inflammation of the upper respiratory tract. Chronic over exposure can cause blood disorders (anaemia), as well as discolouration of hair and skin. Over exposure to copper fumes can irritate the upper respiratory tract, cause nausea, temperature, chills, shortness of breath and sickness (temperature from metal fumes).
- Nickel fumes and dust can sensitise the skin, causing allergic contact dermatitis and conjunctivitis. Chronic inhalation of high levels of nickel can cause irritation of the respiratory tract and the lungs, pulmonary fibrosis, perforation of the nasal septum, sinusitis, respiratory sensitisation and asthma. Nickel compounds are listed by the NTP and listed, as carcinogenic to humans, by the IARC (Group 1) = the agent is carcinogenic to humans. Nickel is a possible carcinogenic agent to humans, as defined by the IARC (Group 2B) = the agent is possibly carcinogenic to humans.
- Beryllium can cause irritating dermatitis, allergic contact dermatitis and granuloma of the skin. Inhalation of excessive levels of beryllium can cause acute pneumonia (inflammation of lung tissue). Beryllium can cause sensitisation of the lungs in susceptible individuals. Chronic inhalation of fumes and dust by these sensitised individuals can cause serious, progressive illness called CBD (Chronic Beryllium Disease). This illness is often incorrectly diagnosed as sarcoidosis, but it is an allergic reaction where the lung tissues inflame. This inflammation, at times accompanied by fibrosis, reduces assimilation of oxygen in the blood cells. CBD can, at times, be fatal. Inhalation of beryllium has caused lung tumours in animals. Beryllium is signalled by the NTP and is recognised as a carcinogenic agent to humans by the IARC (Group 1) = the agent is carcinogenic to humans.

- Dust and inorganic fumes from lead are listed as possibly carcinogenic to humans by the IARC, Group 2B = the agent is possibly carcinogenic to humans. Over exposure to lead fumes and dust can weaken the extremities (peripheral neuropathy), upset stomach, problems in the kidneys, liver and central nervous system, blood and tissues producing blood, as well as the reproductive organs. Over exposure to lead was associated with effects on human reproduction (for example: reduced fertility and foetal damage in pregnant women exposed to the agent). Lead is an accumulating toxic metal via inhalation or ingestion.

4.3 Indication of any immediate medical attention and special treatment needed

None.

Section 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media: dust or foam. Sand.

Unsuitable extinguishing media: you are not advised to use water or halogen extinguishing media.

5.2 Special hazards arising from the substance or mixture

The product can be hazardous in the following conditions:
- Dust and particulate dispersed in the air can be explosive.
- Drops, particulate and dust in contact with water can generate flammable/explosive hydrogen. This gas can present a hazard of explosion in closed or poorly ventilated environments.
- Dust and particulate in contact with certain metal oxides (e.g. rust). An exothermic reaction can be triggered thanks to a small ignition source.
- Molten aluminium, in contact with water/humidity, or other metal oxides (example: rust). Humidity trapped in the molten aluminium can be explosive. In contact with other metal oxides, molten aluminium can start an exothermic reaction.

Hazardous combustion products: packaging can be flammable and therefore normal precautions must be taken for fire prevention.

5.3 Advice for firefighters

Special means of protection: in the event of fire, use protective clothing and a breathing apparatus.
Specific methods: none.

Section 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Not applicable, because the product is solid and non-hazardous. However, welders must wear normal protective clothing and, for the eyes, protective equipment in certified material for electric arc welding. Avoid dust inhalation and contact with eyes and skin.

6.2 Environmental precautions

Not applicable because the product is solid and non-hazardous.

6.3 Methods and material for containment and cleaning up

Not applicable, because the product is solid and non-hazardous.

6.4 Reference to other sections

Section number 8.

Section 7: Handling and storage

7.1 Precautions for safe handling

Solid, high density product; handle with care.

7.2 Conditions for safe storage, including any incompatibilities

Store in its original packaging, in dry locations away from atmospheric agents. Avoid thermal shock. Storage in unsuitable environments can cause surface oxidation phenomena, which can damage the quality of the material.

7.3 Specific end use(s).

Not established.

Section 8: Exposure controls/personal protection

8.1 Control parameters

TLV-TWA exposure limit valves: not applicable. Reference is suggested to the limits of each component in the welding fumes.

8.2 Exposure controls

8.2.1 *Occupational exposure monitoring*: during usage, protect your body and eyes from light emissions and welding fumes as they can represent sources of danger.

8.2.2 Individual protection measures:
Respiratory protection: depending on the welding activity and the surrounding environment, use respiratory protection suitable for welding activities. Use adequate ventilation and/or an adequate fume extractor.
Hand protection: use gloves suitable for welding activities that protect against heat and UV rays.
Eye protection: use protective goggles and masks equipped with filters to block light emissions, IR and UV rays that can develop during welding.
Skin protection: wear protective clothing for the body, hands and head; use safety shoes capable of protecting against radiation, sparks and electric shock. Avoid wearing clothing with grease or combustible substance stains which could catch fire.

8.2.3 Environmental exposure controls: use adequate ventilation and/or an adequate gas extractor

Section 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

PROPERTIES	VALUE
Appearance:	solid wires and rods in aluminium alloy, silver coloured, with a diameter between 0.8mm and 5.0mm
Odour:	none
pH:	not available
Melting point:	from 570°C to 660°C.
Boiling point:	about 2500°C (depending on the alloy)
Flash point:	not applicable
Evaporation rate:	not applicable
Flammability:	none
Upper/lower flammability or explosive limits:	not applicable
Vapour pressure:	$2{,}4 \cdot 10^{-5}$ Pa.

Vapour density:	not available
Relative density:	2.7g/cm^3
Solubility	none
Partition coefficient:	not applicable
Auto-ignition temperature:	not applicable
Decomposition temperature:	not applicable
Viscosity:	none
Explosive properties:	none
Oxidising properties:	none

9.2 Other information

Not available.

Section 10: Stability and reactivity

10.1 Reactivity

Avoid contact with acids or bases that can generate hazardous gases.

10.2 Chemical stability

Aluminium wires and rods are stable in a normal environment.

10.3 Possibility of hazardous reactions

With acids or bases that can react and release hazardous gases.

10.4 Conditions to avoid

Do not touch, with nude hands, the wire or the rods during welding, since there is a risk of burns or electric shock. Use protective gloves.

10.5 Incompatible materials

Acids or bases can react and generate hazardous gases.

10.6 Hazardous decomposition products

None.

Section 11: Toxicological information

11.1 Information on toxicological effects

11.1.1 Substances: the product as such is not in any way toxic. Fumes and gases develop during welding, whose composition depends on various factors: basic material used, welding process and procedures, etc. Other conditions which can influence their composition are: substances in the basic material and on its surface, number of welders and volume of the work area, quality and quantity of ventilation.

			Limit values (mg/m3) according to	
	CAS No.	**Format**	**ACGIH TLV-TWA**	**OSHA PEL**
Aluminium	7429-90-5	Total dust/fume Breathable	1	15 5
Beryllium and beryllium compounds	7440-41-7	All compounds of Be	0,00005	0.002, 0.005 ceiling 0.025 for 30 min.
Chromium	7440-47-3	Metal Cr II Compounds CR III Compounds CR VI Water soluble compounds CR VI Non-water soluble compounds	0,5 --- 0,5 as Cr 0,05 as Cr 0,01 as Cr	1 0.5 as Cr 0.5 as Cr 0.005 as Cr VI 0.005 as Cr VI
Copper	7440-50-8	Fumes Dust/ mist	0,2 1	0,1 1
Iron	7439-89-6	Oxide dust and fumes (as Fe)	5 (breathable)	10
Lead	7439-92-1	Organic and elementary compounds	0.05 as Pb	0,05 as Pb
Magnesium	7439-95-4	Fumes and oxides	10 (inspirable)	15 (total particulate)
Manganese	7439-96-5	Fumes	0,2	5 (ceiling)
Nickel	7440-02-0	Metal Soluble inorganic compounds Non-soluble inorganic compounds	1,5 as Ni 0,1 as Ni 0,2 as Ni	1 as Ni 1 as Ni 1 as Ni
Silicon	7440-21-3	Total dust Breathable	TLV Withdrawn ---	15 5
Vanadium	7440-62-2	Breathable dust Fumes	0.05 as V_2O_5 (inhalable)	0.5 (ceiling) as V_2O_5 0.1 (ceiling) as V_2O_5
Zinc	7440-66-6	Oxides, fumes Total oxide dust Total breathable dust	--- --- 2, 10 (STEL)	5 15 5
Zirconium	7440-67-7	Elementary	5, 10 (STEL)	5 (compounds only)

The above values were generated in laboratory conditions on flat, clean and uncoated base metal, in aluminum, using solder values recommended by the manufacturer; therefore they are indicative of a reasonably expected level of smoke. The current levels of smoke produced in a normal working environment, in practice, depend on the welding parameters, also from other conditions, and therefore may be higher or lower than those indicated. Higher levels of fumes can be produced if the welded metal is contaminated with dirt, oil, grease, or coated, or when using different base metals, or even using incorrect welding parameters. The only way to determine the composition and amount of fumes and gases to which the welders are exposed is to take air samples from the inside of the protective helmet if used, or from the area where the welder usually breathes. In these cases, individual smoke measurements should be performed using recognized standards of sampling and analysis. On the basis of the results obtained, additional smoke smoke control tests may be required to ensure that all smoke constituents are kept under control and below exposure limits.

Carcinogenic classifications:

Element	OSHA	NTP	IARC	Target body
Chromium	N	Y	3	Lungs
Hexavalent chromium	N	Y	1	Lungs
Lead	N	N	2B	Lungs, stomach
Nickel	N	Y	1	Lungs, stomach

Legend:
N = Not considered a human carcinogen.
Y = Considered a human carcinogen.
IARC codes to highlight human carcinogenicity: 1 = Positive; 2A = Likely; 2B = Possible; 3 = Not classified; 4 = Negative likelihood.

11.1.7 Information on most likely exposure routes:
Inhalation: slight over exposures to welding fumes can create situations of discomfort such as temperatures from metal fumes, dizziness, dehydration or nose, mouth and eye irritation, and can aggravate breathing problems such as asthma and emphysema. Welding of aluminium and spray-arc metallization can generate ozone; over exposure to ozone can irritate mucous membrane and can cause irritation, congestion and oedemas. Welding fumes are defined as possibly carcinogenic for people by the IARC (group 2B): suspected carcinogenic agent.
Ingestion: no information available regarding toxicological effects due to ingestion of the product.

Carcinogenic ACGIH:

Aluminium (CAS 7429-90-5): A4 not classifiable as a human carcinogen
Lead (CAS 7439-92-1): A3 confirmed animal carcinogen, unknown relevance on humans.

IARC Monographs. General carcinogenicity assessment:

Lead (CAS 7439-92-1): 2B Possible carcinogen for humans.

US NTP Report on carcinogens: expected carcinogens:

Lead (CAS 7439-92-1): expected carcinogen.

Contact with eyes or skin: effects deriving from exposure to UV rays from the electric arc can cause conjunctivitis or burn skin.

Section 12: Ecological information

12.1 Toxicity

Use according to good working practices, avoiding release of the product in the environment. The product does not have inhibitory effects on the activity of micro-organisms.

12.2 Persistence and degradability

The product does not contain substances for which information was supplied on their ability to degrade in certain environmental circumstances following biodegradation or other processes such as oxidation or hydrolysis.

12.3 Bioaccumulative potential

Not established.

12.4 Mobility in soil

The product does not contain substances for which information was supplied on their distribution in environmental departments or data relevant to their absorption/desorption.

12.5 Results of PBT and vPvB assessment

Not established.

12.6 Other adverse effects

Not established.

Section 13: Disposal considerations

13.1 Waste treatment methods

Dispose of product residue and waste according to legislation
Waste disposal EWC code:
120113: welding waste
120103: non-ferrous metal filings and turnings.

Section 14: Transport information

Transport: the product is not classified as hazardous goods for road, rail, sea and air transport.

14.1 UN number

Not applicable.

14.2 UN proper shipping name

Not applicable.

14.3 Transport hazard class(es)

Not applicable.

14.4 Packing group

Not applicable.

14.5 Environmental hazards

None

14.6 Special precautions for user

None

14.7 Transport in bulk

Not applicable.

Section 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Classification according to Directive 1272/2008/EEC: not classified.

15.2 Chemical safety assessment

Not applicable.

Section 16: Other information

Prior to using this product in any new process or experiment, in-depth research must be conducted on safety and compatibility of the product with the materials. The supplier company cannot be held liable for any damage caused by use of the product in incorrect applications and/or differing from those planned. This safety data sheet has been compiled in compliance with the European Directives in force and applies to all countries that have implemented these directives in their national legislation. The data contained are those currently outlined in the specialist technical literature; the information in this sheet is only for information purposes and does not substitute standards and provisions issued by public organisations. The information has been supplied to protect health and safety in the workplace; no liability can be accepted for any damage from use of this information differing from that stated. This data sheet cancels and replaces all previous reviews.

GENERAL BIBLIOGRAPHY

1. Directive 1999/45/EC and subsequent amendments.
2. Directive 67/548/EEC and subsequent amendments and adaptations (annulled).
3. Regulation CE 1907/2006 of the European Parliament (REACH).
4. Regulation CE 1272/2008 of the European Parliament (CLP).
5. Regulation CE 790/2009 of the European Parliament (I Atp. CLP).
6. Regulation CE 453/2010 of the European Parliament (Safety Data Sheets).
7. ACGIH: American Conference of Government Industrial Hygienists.
8. TLV: Threshold Limit Value.
9. TWA: Time-Weighted Average.
10. CAS: Chemical Abstract Service.
11. EINECS: European Inventory of Existing Commercial Chemical Substances.
12. PBT: Persistent, Bioaccumulating and Toxic.
13. vPvB: very Persistent and very Bioaccumulating.

Note for user:
The information contained in this safety data sheet is based on the knowledge available to us on the version date. The user must ensure suitability and completeness of information relative to the specific product use.
This document must not be interpreted as a warranty of any specific property of the product.
Since use of the product is not directly under the control of the supplier, the user is obliged to follow, under his responsibility, valid laws and regulations on hygiene and safety. Supplier cannot assume any liability on the exactness of the data contained in this safety data sheet.
The user is exclusively responsible for knowing what material to use for his work. Each material can present unknown dangers and therefore must be used with caution. Even if some dangers were identified in this safety data sheet, this does not guarantee others do not exist.

ANNEX 1

EXPOSURE SCENARIO

Welding/brazing produces fumes which can have harmful effects on health and the environment. Fumes are a varying mixture of gases and fine particles which, if inhaled or ingested, can cause a risk to health. The degree of risk depends on fume composition, its concentration and duration of exposure. Fume composition depends on the material processed, the process and the filler metal used, the coatings on the base material such as paint, galvanising, plating oil or contaminants, coming from degreasing or cleaning activities. A systematic approach is necessary to ascertain exposure, taking into consideration the particular operating surroundings for the operator and ancillary staff exposed to these fumes.
Considering the emission of fumes when welding, brazing or cutting of metals, it is recommended to (1) arrange risk management measures by applying general information and guidelines provided by this exposure scenario and (2) using the information provided in SDS, in compliance with Directive 1907/2006 and subsequent integrations and/or amendments (REACH).
The operator should ensure the risk coming from the welding fumes for his health and safety is eliminated or reduced to the minimum. The following principles should be applied:
a) Select the applicable process/material combinations with the lowest class, whenever possible;
b) Set the welding process with the lowest emission parameters;
c) Apply the relevant collective protection measures in compliance with the class no. In general, the use of PPE is taken into consideration after all the other measures have been applied.
d) Wear personal protective equipment in compliance with the work cycle.
In addition, compliance with the national standards and regulations regarding welder exposure to welding fumes will be verified.

Risk management for individual processes/base material combinations

Class [1]	Welding Process (according to ISO 4063)	Base Materials	Remarks	Ventilation / Extraction/ Filtration [2]	PPE[3] DC<15%	PPE[3] DC>15%
Non-confined space [10]						
I	GTAW *141* SAW *12* Autogeneous *3* PAW *15* ESW/EGW *72/73* Resistance *2* Stud welding 78 Solid state *521* Gases Brazing 9	All	Except Aluminium	GV low[4]	n.r.	n.r.
II	GTAW *141*	Aluminium	Except Cd-alloys	GV low[4]	n.a.	FFP2[5]
III	GMAW *131/135*	All	Except Cu-, Be-, V-alloys	GV low[4] LEV low[6]	Improved helmet	FFP2[5]
IV	All processes class I	Painted / primed / oiled	No Pb containing primer	GV low[4]		
	All processes class III	Painted / primed / oiled	No Pb containing primer	GV low[4] LEV low[6]	FFP2[5]	FFP3, TH2/P2 , or LDH2[11]
V	MMAW *111*	Stainless steel, Ni-, Be-, and V-alloys	n.a.	LEV low[6]	TH3/P3, LDH3[9]	TH3/P3, LDH3[9]
	FCAW *136/137*	Stainless steel, Mn- and Ni alloys				
	GMAW *131*	Cu-alloys				
	Powder Plasma Arc *152*	Stainless steel, Mn-, Ni-, and Cu- alloys				
Closed system or Confined space [10]						
I	Laser *52* Electron Beam *51*	All	Closed system	GV medium[7]	n.a.	n.a.
VIII	All	All	Confined space	LEV high[8] - External air flow	LDH3[9]	LDH3[9]

Legend:
1 Class: approximate ranking to mitigate risk by selecting process/material combinations with the lowest value.
2 Recommended values to comply with national maximum allowable limits. The extracted fumes, for any material with the exception of unalloyed iron and aluminium will be filtered before being released into the atmosphere.
3 Personal protective equipment (PPE) required to avoid exceeding the national exposure limit value (DC: work cycle, expressed in 8 hours).
4 General ventilation (GV) low. With the addition of local exhaust ventilation (LEV) and air extracted to the outside, the GV or LEV capacity can be reduced by 1/5 of the original requirement.
5 Filtering mask (FFP2)
6 When an alloy consumable is used, measures are required as in class V.
7 Medium general ventilation (GV) (double if compared to Low).
8 High local exhaust ventilation (LEV), extraction at source (includes table, hood, arm or torch extraction).
9 Helmet with powered filters (TH3/P3), or helmet with air recirculation (LDH3).
10 A confined space, despite its name, is not necessarily small. Examples of confined spaces include ships, silos, vats, vaults, tanks, etc.
11 Filtering mask (FFP3), helmet with active filters (TH2/P2) or helmet with air recirculation (LDH2).

In the above table “Risk Management for individual processes/base material combinations”, reference is made to the following standards for personal and collective protection measures:

ISO 4063	Welding and allied processes - Nomenclature of processes and relevant numerical coding
EN ISO 15012-1:2006	Health and safety in welding and allied techniques - Requirements, testing and marking of equipment for air filtering - Part 1: Testing of the separation efficiency for welding fumes.
EN ISO 15012-2:2008	Health and safety in welding and allied techniques - Requirements, testing and marking of equipment for air filtering - Part 2: Determination of the minimum air volume flow rate of captor hoods and nozzles.
EN 149:2009	Respiratory protective devices - Filtering half masks to protect against particles - Requirements, testing, marking (FFP1 - FFP2 – FFP3).
EN 1835:2001	Respiratory protective devices - Light duty construction compressed air line breathing apparatus incorporating a helmet or a hood - Requirements, testing, marking (LDH1 - LDH2 - LDH3).
EN 12941:2009	Respiratory protective devices - Powered filtering devices incorporating a helmet or a hood - Requirements, testing, marking (TH1 - TH2 - TH3).

EN 143:2007	Respiratory protective devices - Particle filters - Requirements, testing, marking (P1, P2, P3).
Directive 1998/24/EC	Article 6.2 on the protection of health and safety of workers from the risks related to chemical agents at work.
BGR 190	Benutzung von Atemschutzgeräten (Berufsgenossenschaftliche Regel für Sicherheit und Gesundheit bei der Arbeit).
TRGS 528	Schweisstechnische Arbeiten (Technische Regeln für Gefahrstoffe).