

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Trade name 4043 Aluminum Welding and Metallizing Wire

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

Product type This product is a continuous solid metal wire.

Use Arc Welding

1.3. Details of the supplier of the safety data sheet

SDS created by Jeffrey Freiburger

Supplier AlcoTec Wire Corporation

Street address 2750 Aero Park Drive
MI 49686-9263 Traverse City
USA

Telephone 1-800-228-0750

Web site <http://www.alcotec.com>

Email alcotec@alcotec.com

1.4. Emergency telephone number

Emergency phone number (717)637-8911 or (800)424-9300

Available outside office hours No

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Description In the form these substances are present in this product they do not contribute to a hazard classification of the product. The product is not classified

2.2. Label elements

The product do not require labeling

2.3. Other hazards

When this product is used in a welding process, the most important hazards are welding fumes, heat, radiation and electric shock. Avoid exposure to brazing and welding fumes, radiation, spatter, electric shock, heated materials and dust. Overexposure to cutting, scarfing and welding fumes may result in symptoms like metal fume fever, dizziness, nausea, dryness or irritation of the nose, throat or eyes.

Overexposure to cutting, scarfing and welding fumes may affect pulmonary function. Persons with a pacemaker should not go near welding or cutting operations until they have consulted their doctor and obtained information from the manufacturer of the device.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

| <i>Chemical name</i> | <i>CAS No. EC No. REACH No.</i> | <i>Concentration</i> | <i>Classification</i> | <i>H-phrase</i> |
|-------------------------------|--|----------------------|-----------------------|-----------------|
| Aluminum | 7429-90-5 231-072-3 - | >99% | - | - |
| Silicon | 7440-21-3 231-130-8 - | 4,5 - 6% | - | - |
| Iron | 7439-89-6 231-096-4 01-2119462838 - 24 | <0,8% | - | - |
| Copper | 7440-50-8 231-159-6 01-2119480154 - 42 | <0,3% | - | - |
| Titanium | 7440-32-6 231-142-3 - | <0,2% | - | - |
| Zinc | 7440-66-6 - - | <0,1% | - | - |
| magnesium powder (pyrophoric) | 7439-95-4 231-104-6 - | <0,05% | - | - |
| Manganese | 7439-96-5 231-105-1 01-2119449803 - 34 | <0,05% | - | - |

Substance additional information

Ingredients not listed shall not exceed 0.05% by weight individually, Total combination of ingredients not listed shall not exceed 0.15% by weight. Beryllium shall not exceed 0.0003% by weight.

SECTION 4: First aid measures

4.1. Description of first aid measures

No first aid measures should be required for this product as shipped. ELECTRIC SHOCK can kill. Disconnect and turn off the power. Use a nonconductive material to pull victim away from contact with live parts or wires. If not breathing, begin artificial respiration, preferably mouth-to-mouth. If no detectable pulse, begin Cardio Pulmonary Resuscitation (CPR).

Inhalation

If breathing has stopped, perform artificial respiration and obtain medical assistance immediately! If breathing is difficult, provide fresh air and call physician.

Skin contact

For skin burns from arc radiation, promptly flush with cold water. Get medical attention for burns or irritations that persist. To remove dust or particles wash with mild soap and water.

Eye contact

For radiation burns due to arc flash, see physician. To remove dusts or fumes flush with water for at least fifteen minutes. If irritation persists, obtain medical assistance.

Ingestion

According to experience not expected.

4.2. Most important symptoms and effects, both acute and delayed

No first aid measures should be required for this product as shipped.

Inhalation

Overexposure to welding fumes may result in symptoms like metal fume fever, dizziness, nausea, dryness or irritation of the nose, throat or eyes. Chronic overexposure to welding fumes may affect pulmonary function.

Skin contact

ARC RAYS and SPARKS can injure eyes and burn skin.

Eye contact

ARC RAYS and SPARKS can injure eyes and burn skin.

Ingestion

According to experience not expected.

4.3. Indication of any immediate medical attention and special treatment needed

Not applicable

SECTION 5: Firefighting measures

5.1. Extinguishing media

Not applicable

5.2. Special hazards arising from the substance or mixture

No specific recommendations for welding consumables. Welding arcs and sparks can ignite combustible and flammable materials. Use the extinguishing media recommended for the burning materials and fire situation.

5.3. Advice for firefighters

**Special protective equipment
for fire-fighters**

Wear self-contained breathing apparatus as fumes or vapors may be harmful.

SECTION 6:Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions: refer to section 8.

6.2. Environmental precautions

Refer to Section 13.

6.3. Methods and material for containment and cleaning up

Solid objects may be picked up and placed into a container. Liquids or pastes should be scooped up and placed into a container. Wear proper protective equipment while handling these materials. Do not discard as refuse.

6.4. Reference to other sections

Refer to Section 8 and Section 13.

SECTION 7:Handling and storage

7.1. Precautions for safe handling

**Preventive handling
precautions**

Handle with care to avoid stings and cuts. Wear gloves when handling welding consumables. Avoid exposure to dust. Do not ingest. Some individuals can develop an allergic reaction to certain materials. Retain all warning and identity labels.

7.2. Conditions for safe storage, including any incompatibilities

Keep separate from chemical substances like acids and strong bases, which could cause chemical reactions.

7.3. Specific end use(s)

Arc Welding

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure limits

Use industrial hygiene monitoring equipment to ensure that exposure does not exceed applicable national exposure limits. The following limits can be used as guidance. Unless noted, all values are for 8 hour time weighted averages (TWA). For information about welding fume analysis refer to Section 10.

National occupational exposure limits

| CAS No. | EC No. | Exposure Limit Values ppm / mg/m ³ | Short term exposure limit ppm / mg/m ³ | Ceiling Limit Value ppm / mg/m ³ | Country |
|---|--------|--|--|--|---------|
| Please Reference Appendix to Section 8.1 National Exposure Limits at end of document. | | | | | |

8.2. Exposure controls

Not applicable

Other

Avoid exposure to brazing and welding fumes, radiation, spatter, electric shock, heated materials and dust. Train welders to avoid contact with live electrical parts and insulate conductive parts.

Ventilation

Use respirator or air supplied respirator when welding or brazing in a confined space, or where local exhaust or ventilation is not sufficient to keep exposure values within safe limits. Use special care when welding painted or coated steels since hazardous substances from the coating may be emitted. Ensure sufficient ventilation, local exhaust, or both, to keep welding fumes and gases from breathing zone and general area.

Personal protective equipment

Wear hand, head, eyes, ear and body protection like welders gloves, helmet or face shield with filter lens, safety boots, apron, arm and shoulder protection. Keep protective clothing clean and dry.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

| | |
|---|------------------------|
| Appearance | Silver grey |
| Appearance, colour | Not applicable |
| Appearance, physical state | Not applicable |
| Auto-ignition temperature | Not applicable |
| Decomposition temperature | Not applicable |
| Evaporation rate | Not applicable |
| Explosive properties | Not applicable |
| Flammability (solid, gas) | Not applicable |
| Flash point | Not applicable |
| Initial boiling point and boiling range | Not applicable |
| Melting point / freezing point | 970 - 1515 °F |
| Odour | None |
| Odour treshold | Not applicable |
| Oxidising properties | Not applicable |
| Partition coefficient: n -octanol / water | Not applicable |
| pH value | Not applicable |
| Relative density | 0.1 lb/in ³ |
| Solubility | Not applicable |
| Solubility in water | None |
| Upper / lower flammability or explosive limits | Not applicable |
| Vapour density | Not applicable |
| Vapour pressure | Not applicable |
| Viscosity | Not applicable |

9.2. Other information

Not applicable

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity The product is non-reactive under normal conditions of use, storage, and transport.

10.2. Chemical stability

Chemical stability Stable at normal conditions

10.3. Possibility of hazardous reactions

Not applicable

10.4. Conditions to avoid

Conditions to avoid Incompatible with strong acids and oxidizing agents. This product is only intended for normal welding purposes.

10.5. Incompatible materials

Incompatible materials Incompatible with strong acids and oxidizing agents.

10.6. Hazardous decomposition products

Hazardous decomposition products When this product is used in a welding process, hazardous decomposition products would include **products** those from the volatilization, reaction or oxidation of the materials listed in Section 3 and those from the base metal and coating. *Other*

Refer to applicable national exposure limits for fume compounds, including those exposure limits for fume compounds found in Section 8.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Information on toxicological effects Inhalation of welding fumes and gases can be dangerous to your health. Classification of welding fumes is difficult because of varying base materials, coatings, air contamination and processes. The International Agency for Research on Cancer has classified welding fumes as possibly carcinogenic to humans (Group 2B).

acute toxicity Overexposure to welding fumes may result in symptoms like metal fume fever, dizziness, nausea, dryness or irritation of the nose, throat or eyes.

skin corrosion/irritation Not applicable

serious eye damage/irritation

| | |
|--|----------------|
| respiratory or skin sensitisation | Not applicable |
| germ cell mutagenicity | Not applicable |
| carcinogenicity | Not applicable |
| reproductive toxicity | Not applicable |
| STOT-single exposure | Not applicable |
| STOT-repeated exposure | Not applicable |
| aspiration hazard | |

Other

| | |
|-------------------------|--|
| Long term effect | Chronic toxicity: Overexposure to welding fumes may affect pulmonary function. |
|-------------------------|--|

SECTION 12: Ecological information

12.1. Toxicity

| | |
|-----------------|---|
| Toxicity | Welding consumables and materials could degrade/weather into components originating from the consumables or from the materials used in the welding process. Avoid exposure to conditions that could lead to accumulation in soils or groundwater. |
|-----------------|---|

12.2. Persistence and degradability

Not applicable

12.3. Bioaccumulative potential

Not applicable

12.4. Mobility in soil

Not applicable

12.5. Results of PBT and vPvB assessment

Not applicable

12.6. Other adverse effects

Not applicable

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Disposal considerations

Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal and local regulations. Use recycling procedures if available. Residues from welding consumables and processes could degrade and accumulate in soils and groundwater.

SECTION 14: Transport information

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

Not applicable

14.6. Special precautions for user

Not applicable

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable

SECTION 15: Regulatory information

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

Not applicable

15.2. Chemical safety assessment

Not applicable

Other

Canada: WHMIS classification: Class D; Division 2, Subdivision A - Canadian Environmental Protection Act (CEPA): All constituents of these products are on the Domestic Substance List (DSL). USA EPA Toxic Substance Control Act: All constituents of these products are on the TSCA inventory list or are excluded from listing. This product contains or produces a chemical known to the state of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code § 25249.5 et seq.) Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center and to your Local Emergency Planning Committee. SDS Developed in accordance with EU Regulation (EC) No. 1907/2006 (REACH).

SECTION 16:Other information'

This Safety Data Sheet has been revised due to modifications to Sections 1-16.

Changes to previous revision

American National Standard Z49.1 "Safety in Welding and Cutting", ANSI/AWS F1.5 "Methods for Sampling and Analyzing Gases from Welding and Allied Processes", Refer to ESAB "Welding and Cutting - Risks and Measures", F52-529 "Precautions and Safe Practices for Electric Welding and Cutting" and F2035 "Precautions and Safe Practices for Gas Welding, Cutting and Heating" available from ESAB, and to: www.esab.com

References to key literature and data sources

Other

Manufacturer's notes

ESAB requests the users of this product to study this Safety Data Sheet (SDS) and become aware of product hazards and safety information. To promote safe use of this product a user should: -notify its employees, agents and contractors of the information on this SDS and any product hazards/safety information. -furnish this same information to each of its customers for this product. -request such customers to notify employees and customers for the same product hazards and safety information. The information herein is given in good faith and based on technical data that ESAB believes to be reliable. Since the conditions of use is outside our control, we assume no liability in connection with any use of this information and no warranty, expressed or implied is given. Contact ESAB for more information.

Appendix to Section 8.1 National Exposure Limits

| Nickel (7440-02-0) | | |
|--|---|---|
| Austria Austria | TEL TRK (mg/m ³) OEL chemical category (AT) | 0,5 mg/m ³ (dust, inhalable fraction) Group A1 Carcinogen dust/aerosol, Respiratory sensitizer dust, Skin sensitizer |
| Belgium Bulgaria Bulgaria | Limit value (mg/m ³) OEL TWA (mg/m ³) Bulgaria - BEI | 1 mg/m ³ 0,05 mg/m ³ 45 µg/l (Medium: urine - Time: after several shifts - Parameter: Nickel) |
| Croatia Croatia | GVI (granična vrijednost izloženosti) (mg/m ³) OEL chemical category (HR) | 0,5 mg/m ³ Carcinogen category 3 |
| France France | VME (mg/m ³) OEL chemical category (FR) | 1 mg/m ³ 1 mg/m ³ (metal gratings) Carcinogen category 2 |
| Greece | OEL TWA (mg/m ³) | 1 mg/m ³ |
| USA ACGIH | ACGIH TWA (mg/m ³) | 1,5 mg/m ³ (inhalable fraction) |
| Latvia | OEL TWA (mg/m ³) | 0,05 mg/m ³ |
| Spain Spain | VLA-ED (mg/m ³) OEL chemical category (ES) | 1 mg/m ³ (manufacturing, commercialization and use restrictions according to REACH) C1A, Sensitizer |
| Switzerland Switzerland Switzerland | VME (mg/m ³) OEL chemical category (CH) Switzerland - BEI | 0,5 mg/m ³ (inhalable dust) Category C3 carcinogen, Sensitizer 45 µg/l (Medium: urine - Time: end of shift, and after several shifts (for long- term exposures) - Parameter: Nickel (N)) |
| United Kingdom United Kingdom United Kingdom | WEL TWA (mg/m ³) WEL STEL (mg/m ³) WEL chemical category | 0,5 mg/m ³ 1,5 mg/m ³ (calculated) Potential for cutaneous absorption |
| Czech Republic Czech Republic Czech Republic | Expoziční limity (PEL) (mg/m ³) OEL chemical category (CZ) Czech Republic - BEI | 0,5 mg/m ³ Sensitizer 0,077 µmol/mmol Creatinine (Medium: urine - Time: discretionary - Parameter: Nickel) 0,04 mg/g Kreatinin (Medium: urine - Time: discretionary - Parameter: Nickel) |
| Denmark | Grænseværdie (langvarig) (mg/m ³) | 0,05 mg/m ³ (dust and powder) |
| Estonia Estonia | OEL TWA (mg/m ³) OEL chemical category (ET) | 0,5 mg/m ³ Sensitizer |
| Finland Finland | HTP-arvo (8h) (mg/m ³) Finland - BEI | 0,01 mg/m ³ 0,1 µmol/l (Medium: urine - Time: end of shift at end of workweek - Parameter: Nickel) |
| Hungary Hungary | MK-érték OEL chemical category (HU) | 0,1 mg/m ³ Carcinogenic substance, Sensitizer |
| Ireland Ireland | OEL (8 hours ref) (mg/m ³) OEL (15 min ref) (mg/m ³) | 0,5 mg/m ³ 1,5 mg/m ³ (calculated) |
| Lithuania | IPRV (mg/m ³) | 0,5 mg/m ³ |

Appendix to Section 8.1 National Exposure Limits

| Chromium (7440-47-3) | | |
|----------------------------------|---|--|
| EU | IOELV TWA (mg/m ³) | 2 mg/m ³ |
| Austria | MAK (mg/m ³) | 2 mg/m ³ |
| Belgium | Limit value (mg/m ³) | 0,5 mg/m ³ |
| Bulgaria | OEL TWA (mg/m ³) | 2,0 mg/m ³ |
| Croatia | GVI (granična vrijednost izloženosti) (mg/m ³) | 2 mg/m ³ |
| Cyprus | OEL TWA (mg/m ³) | 2 mg/m ³ |
| France France | VME (mg/m ³) France - BEI | 2 mg/m ³ (indicative limit) 0,01 mg/g Kreatinin (Medium: urine - Time: augmented during shift - Parameter: Total Chromium (Background noise on non-exposed subjects (soluble aerosol)) 0,03 mg/g Kreatinin (Medium: urine - Time: end of shift at end of workweek - Parameter: Total Chromium (Background noise on non-exposed subjects (soluble aerosol))) |
| Germany | TRGS 900 Occupational exposure limit value (mg/m ³) | 2 mg/m ³ (inhalable fraction) |
| Gibraltar | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Greece | OEL TWA (mg/m ³) | 1 mg/m ³ |
| USA ACGIH | ACGIH TWA (mg/m ³) | 0,5 mg/m ³ |
| Italy | OEL TWA (mg/m ³) | 0,5 mg/m ³ |
| Latvia Latvia | OEL TWA (mg/m ³) Latvia - BEI | 2 mg/m ³ 10 µg/g creatinine (Medium: urine - Time: change of shift - Parameter: Chromium (reference value for total Chromium concentration for occupationally unexposed population in blood <0.5µg/L, and in urine 0.5 g/L) |
| Spain | VLA-ED (mg/m ³) | 2 mg/m ³ (indicative limit value) |
| Switzerland | VME (mg/m ³) | 0,5 mg/m ³ (inhalable dust) |
| Switzerland | OEL chemical category (CH) | Sensitizer |
| Netherlands | Grenswaarde TGG 8H (mg/m ³) | 0,5 mg/m ³ |
| United Kingdom United Kingdom | WEL TWA (mg/m ³) WEL STEL (mg/m ³) | WEL TWA (mg/m ³) 0,5 mg/m ³ |
| Czech Republic | Expoziční limity (PEL) (mg/m ³) | 1,5 mg/m ³ (calculated) |
| Denmark | Grænseværdie (langvarig) (mg/m ³) | 0,5 mg/m ³ (dust) |
| Estonia | OEL TWA (mg/m ³) | 0,5 mg/m ³ (powder) |
| Finland | HTP-arvo (8h) (mg/m ³) | 2 mg/m ³ |

Appendix to Section 8.1 National Exposure Limits

| Chromium (7440-47-3) | | |
|-----------------------------|--|--|
| Hungary | AK-érték | 0,005 mg/m ³ |
| Hungary | OEL chemical category (HU) | 2 mg/m ³ |
| Ireland | OEL (8 hours ref) (mg/m ³) | Sensitizer |
| Ireland | OEL (15 min ref) (mg/m ³) | 2 mg/m ³ |
| Lithuania | IPRV (mg/m ³) | 6 mg/m ³ (calculated) |
| Luxembourg | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Malta | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Norway | Grønseverdier (AN) (mg/m ³) | 2 mg/m ³ |
| Norway | Grønseverdier (Korttidsverdi) (mg/m ³) | 0,5 mg/m ³ |
| Poland | NDS (mg/m ³) | 0,5 mg/m ³ |
| Romania | OEL TWA (mg/m ³) | 0,5 mg/m ³ |
| Romania | OEL chemical category (RO) | 0,05 mg/m ³ (from metallurgy) 2 mg/m ³ (metallic) |
| Romania | Romania - BEI | Carcinogen from metallurgy |
| Slovenia | OEL TWA (mg/m ³) | 10 µg/g creatinine (Medium: urine - Time: during working hours - Parameter: Chrome) 30 µg/g creatinine (Medium: urine - Time: end of work week - Parameter: Chrome) |
| Sweden | nivågränsvärde (NVG) (mg/m ³) | 2 mg/m ³ |
| Portugal | OEL TWA (mg/m ³) | 0,5 mg/m ³ (total dust) |
| Portugal | OEL chemical category (PT) | 2 mg/m ³ (indicative limit value) |
| | | |

| Copper (7440-50-8) | | |
|---------------------------|--|--|
| Austria | MAK (mg/m ³) | 1 mg/m ³ (inhalable fraction) 0,1 mg/m ³ (respirable fraction, smoke) |
| Austria | MAK Short time value (mg/m ³) | 4 mg/m ³ (inhalable fraction) 0,4 mg/m ³ (respirable fraction, smoke) |
| Belgium | Limit value (mg/m ³) | 0,2 mg/m ³ (fume) 1 mg/m ³ (dust and mist) |
| Bulgaria | OEL TWA (mg/m ³) | 0,1 mg/m ³ (metal vapor) |
| Croatia | GVI (granična vrijednost izloženosti) (mg/m ³) | 0,2 mg/m ³ (fume) 1 mg/m ³ (dust) |
| Croatia | KGVI (kratkotrajna granična vrijednost izloženosti) (mg/m ³) | 2 mg/m ³ (dust and fume) |
| France | VLE (mg/m ³) | 2 mg/m ³ (dust) |
| France | VME (mg/m ³) | 0,2 mg/m ³ (fume) 1 mg/m ³ (dust) |

Appendix to Section 8.1 National Exposure Limits

| Copper (7440-50-8) | | |
|---------------------------|--|---|
| Greece | OEL TWA (mg/m ³) | 0,2 mg/m ³ (fume) 1 mg/m ³ (dust) |
| Greece | OEL STEL (mg/m ³) | 2 mg/m ³ (dust) |
| USA ACGIH | ACGIH TWA (mg/m ³) | 0,2 mg/m ³ (fume) |
| Latvia | OEL TWA (mg/m ³) | 0,5 mg/m ³ |
| Spain | VLA-ED (mg/m ³) | 0,2 mg/m ³ (fume) 1 mg/m ³ (dust and mist) |
| Switzerland | VLE (mg/m ³) | 0,2 mg/m ³ (inhalable dust) |
| Switzerland | VME (mg/m ³) | 0,1 mg/m ³ (inhalable dust) |
| Netherlands | Grenswaarde TGG 8H (mg/m ³) | 0,1 mg/m ³ (inhalable fraction) |
| United Kingdom | WEL TWA (mg/m ³) | 1 mg/m ³ (dust and mists) 0,2 mg/m ³ (fume) |
| United Kingdom | WEL STEL (mg/m ³) | 0,6 mg/m ³ (calculated-fume) 2 mg/m ³ (dust and mist) |
| Czech Republic | Expoziční limity (PEL) (mg/m ³) | 1 mg/m ³ (dust) 0,1 mg/m ³ (fume) |
| Denmark | Grænseværdie (langvarig) (mg/m ³) | 1,0 mg/m ³ (dust and powder) 0,1 mg/m ³ (fume) |
| Estonia | OEL TWA (mg/m ³) | 1 mg/m ³ (total dust) 0,2 mg/m ³ (respirable dust) |
| Finland | HTP-arvo (8h) (mg/m ³) | 1 mg/m ³ 0,1 mg/m ³ (respirable dust and fume) |
| Hungary | AK-érték | 1 mg/m ³ 0,1 mg/m ³ (fume) |
| Hungary | CK-érték | 4 mg/m ³ 0,4 mg/m ³ (fume) |
| Ireland | OEL (8 hours ref) (mg/m ³) | 0,2 mg/m ³ (fume) 1 mg/m ³ (dust and mist) |
| Ireland | OEL (15 min ref) (mg/m ³) | 0,6 mg/m ³ (calculated-fume) 2 mg/m ³ (dust and mist) |
| Lithuania | IPRV (mg/m ³) | 1 mg/m ³ (inhalable fraction) 0,2 mg/m ³ (respirable fraction) |
| Norway | Grenseverdier (AN) (mg/m ³) | 0,1 mg/m ³ (fume) 1 mg/m ³ (dust) |
| Norway | Grenseverdier (Korttidsverdi) (mg/m ³) | 0,1 mg/m ³ (fume) 1 mg/m ³ (dust) |
| Poland | NDS (mg/m ³) | 0,2 mg/m ³ |
| Romania | OEL TWA (mg/m ³) | 0,50 mg/m ³ (powder) |
| Romania | OEL STEL (mg/m ³) | 0,20 mg/m ³ (fume) 1,50 mg/m ³ (dust) |

Appendix to Section 8.1 National Exposure Limits

| Copper (7440-50-8) | | |
|---------------------------|---|---|
| Slovakia | NPHV (priemerná) (mg/m ³) | 1 mg/m ³ (dust) 0,1 mg/m ³ (fume) |
| Slovakia | NPHV (Hraničná) (mg/m ³) | 2 mg/m ³ (dust) 0,2 mg/m ³ (fume) |
| Slovenia | OEL TWA (mg/m ³) | 1 mg/m ³ (inhalable fraction) 0,1 mg/m ³ (respirable fraction, fume) |
| Slovenia | OEL STEL (mg/m ³) | 4 mg/m ³ (inhalable fraction) 0,4 mg/m ³ (respirable fraction, fume) |
| Sweden | nivågränsvärde (NVG) (mg/m ³) | 1 mg/m ³ (total dust) 0,2 mg/m ³ (respirable dust) |
| Portugal | OEL TWA (mg/m ³) | 0,2 mg/m ³ (fume) 1 mg/m ³ (dust and mist) |

| Chromium (7440-47-3) | | |
|-----------------------------|--|---|
| EU | IOELV TWA (mg/m ³) | 2 mg/m ³ |
| Austria | MAK (mg/m ³) | 2 mg/m ³ |
| Belgium | Limit value (mg/m ³) | 0,5 mg/m ³ |
| Bulgaria | OEL TWA (mg/m ³) | 2,0 mg/m ³ |
| Croatia | GVI (granična vrijednost izloženosti) (mg/m ³) | 2 mg/m ³ |
| Cyprus | OEL TWA (mg/m ³) | 2 mg/m ³ |
| France | VME (mg/m ³) | 2 mg/m ³ (indicative limit) |
| France | France - BEI | 0,01 mg/g Kreatinin (Medium: urine - Time: augmented during shift - Parameter: Total Chromium (Background noise on non-exposed subjects (soluble aerosol)) 0,03 mg/g Kreatinin (Medium: urine - Time: end of shift at end of workweek - Parameter: Total Chromium (Background noise on non-exposed subjects (soluble aerosol)) |
| Germany | TRGS 900 Occupational exposure limit value (mg/m ³) | 2 mg/m ³ (inhalable fraction) |
| Gibraltar | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Greece | OEL TWA (mg/m ³) | 1 mg/m ³ |
| USA ACGIH | ACGIH TWA (mg/m ³) | 0,5 mg/m ³ |
| Italy | OEL TWA (mg/m ³) | 0,5 mg/m ³ |

Appendix to Section 8.1 National Exposure Limits

| Chromium (7440-47-3) | | |
|----------------------------------|--|--|
| Latvia Latvia | OEL TWA (mg/m ³) Latvia - BEI | 2 mg/m ³ 10 µg/g creatinine (Medium: urine - Time: change of shift - Parameter: Chromium (reference value for total Chromium concentration for occupationally unexposed population in blood <0.5µg/L, and in urine 0.5 g/L) |
| Spain | VLA-ED (mg/m ³) | 2 mg/m ³ (indicative limit value) |
| Switzerland Switzerland | VME (mg/m ³) OEL chemical category (CH) | 0,5 mg/m ³ (inhalable dust) Sensitizer |
| Netherlands | Grenswaarde TGG 8H (mg/m ³) | 0,5 mg/m ³ |
| United Kingdom United Kingdom | WEL TWA (mg/m ³) WEL STEL (mg/m ³) | 0,5 mg/m ³ 1,5 mg/m ³ (calculated) |
| Czech Republic | Expoziční limity (PEL) (mg/m ³) | 0,5 mg/m ³ (dust) |
| Denmark | Grænseværdie (langvarig) (mg/m ³) | 0,5 mg/m ³ (powder) |
| Estonia | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Finland | HTP-arvo (8h) (mg/m ³) | 0,005 mg/m ³ |
| Hungary Hungary | AK-érték OEL chemical category (HU) | 2 mg/m ³ Sensitizer |
| Ireland Ireland | OEL (8 hours ref) (mg/m ³) OEL (15 min ref) (mg/m ³) | 2 mg/m ³ 6 mg/m ³ (calculated) |
| Lithuania | IPRV (mg/m ³) | 2 mg/m ³ |
| Luxembourg | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Malta | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Norway Norway | Grenseverdier (AN) (mg/m ³) Grenseverdier (Korttidsverdi) (mg/m ³) | 0,5 mg/m ³ 0,5 mg/m ³ |
| Poland | NDS (mg/m ³) | 0,5 mg/m ³ |
| Romania Romania Romania | OEL TWA (mg/m ³) OEL chemical category (RO) Romania - BEI | 0,05 mg/m ³ (from metallurgy) 2 mg/m ³ (metallic) Carcinogen from metallurgy 10 µg/g creatinine (Medium: urine - Time: during working hours - Parameter: Chrome) 30 µg/g creatinine (Medium: urine - Time: end of work week - Parameter: Chrome) |

Appendix to Section 8.1 National Exposure Limits

| Chromium (7440-47-3) | | |
|-----------------------------|---|--|
| Slovenia | OEL TWA (mg/m ³) | 2 mg/m ³ |
| Sweden | nivågränsvärde (NVG) (mg/m ³) | 0,5 mg/m ³ (total dust) |
| Portugal | OEL TWA (mg/m ³) | 2 mg/m ³ (indicative limit value) |
| Portugal | OEL chemical category (PT) | A4 - Not Classifiable as a Human Carcinogen |

| Carbon monoxide (630-08-0) | | |
|-----------------------------------|--|---|
| Austria | MAK (mg/m ³) | 33 mg/m ³ |
| Austria | MAK (ppm) | 30 ppm |
| Austria | MAK Short time value (mg/m ³) | 66 mg/m ³ |
| Austria | MAK Short time value (ppm) | 60 ppm |
| Belgium | Limit value (mg/m ³) | 29 mg/m ³ |
| Belgium | Limit value (ppm) | 25 ppm |
| Bulgaria | OEL TWA (mg/m ³) | 40 mg/m ³ |
| Bulgaria | OEL STEL (mg/m ³) | 200 mg/m ³ |
| Bulgaria | Bulgaria - BEI | 5 % (Medium: blood - Time: at the end of exposure or end of shift - Parameter: Carboxyhemoglobin) |
| Croatia | GVI (granična vrijednost izloženosti) (mg/m ³) | 35 mg/m ³ |
| Croatia | GVI (granična vrijednost izloženosti) (ppm) | 30 ppm |
| Croatia | KGVI (kratkotrajna granična vrijednost izloženosti) (mg/m ³) | 232 mg/m ³ |
| Croatia | KGVI (kratkotrajna granična vrijednost izloženosti) (ppm) | 200 ppm |
| Croatia | OEL chemical category (HR) | Reproductive Toxin category 1 |

| Carbon monoxide (630-08-0) | | |
|-----------------------------------|---|--|
| Croatia | Croatia - BEI | 12,5 ml/l (Medium: blood - Time: at the end of the shift - Parameter: Carbon monoxide (Smoking significantly increases the occurrence)) (Medium: blood - Time: at the end of the shift - Parameter: Carboxyhemoglobin (Smoking significantly increases the occurrence)) 18 ppm (Medium: final exhaled air - Time: at the end of the shift - Parameter: Carbon monoxide (Smoking significantly increases the occurrence)) |
| France | VME (mg/m ³) | 55 mg/m ³ |
| France | VME (ppm) | 50 ppm |
| France | OEL chemical category (FR) | Reproductive Toxin category 1A |
| France | France - BEI | (Medium: blood - Parameter: Carbon monoxide) 3,5 % of hemoglobin (Medium: blood - Time: end of shift - Parameter: Carboxyhemoglobin (Background noise on nonexposed subjects, Non-specific (observed after the exposure to other substances))) |
| Germany | TRGS 900 Occupational exposure limit value (mg/m ³) | 35 mg/m ³ (The risk of damage to the embryo or fetus cannot be excluded even when AGW and BGW values are observed) |
| Germany | TRGS 900 Occupational exposure limit value (ppm) | 30 ppm (The risk of damage to the embryo or fetus cannot be excluded even when AGW and BGW values are observed) |
| Germany | TRGS 903 (BGW) | 5 % (Medium: whole blood - Time: end of shift - Parameter: CO-Hb (derivation of biological threshold limit due to acute toxic effects)) |
| Greece | OEL TWA (mg/m ³) | 55 mg/m ³ |
| Greece | OEL TWA (ppm) | 50 ppm |
| Greece | OEL STEL (mg/m ³) | 330 mg/m ³ |
| Greece | OEL STEL (ppm) | 300 ppm |

Appendix to Section 8.1 National Exposure Limits

| Carbon monoxide (630-08-0) | | |
|-----------------------------------|---|--|
| USA ACGIH | ACGIH TWA (ppm) | 25 ppm |
| Latvia | OEL TWA (mg/m ³) | 20 mg/m ³ |
| Spain | VLA-ED (mg/m ³) | 29 mg/m ³ |
| Spain | VLA-ED (ppm) | 25 ppm |
| Spain | OEL chemical category (ES) | TR1A |
| Spain | Spain - BEI | (Medium: blood - Time: end of shift - Parameter: Carboxyhemoglobin) 20 ppm (Medium: alveolar air - Time: end of shift - Parameter: CO) |
| Switzerland | VLE (mg/m ³) | 70 mg/m ³ |
| Switzerland | VLE (ppm) | 60 ppm |
| Switzerland | VME (mg/m ³) | 35 mg/m ³ |
| Switzerland | VME (ppm) | 30 ppm |
| Switzerland | Switzerland - BEI | 5 % (Medium: whole blood - Time: end of shift - Parameter: Carbon monoxide in hemoglobin (N, T, X) |
| Netherlands | Grenswaarde TGG 8H (mg/m ³) | 29 mg/m ³ |
| United Kingdom | WEL TWA (mg/m ³) | 35 mg/m ³ |
| United Kingdom | WEL TWA (ppm) | 30 ppm |
| United Kingdom | WEL STEL (mg/m ³) | 232 mg/m ³ |
| United Kingdom | WEL STEL (ppm) | 200 ppm |
| Czech Republic | Expoziční limity (PEL) (mg/m ³) | 30 mg/m ³ |
| Czech Republic | Czech Republic - BEI | 5 % of hemoglobin (Medium: blood - Time: end of shift - Parameter: Carbonylhemoglobin) |
| Denmark | Grænseværdie (langvarig) (mg/m ³) | 29 mg/m ³ |
| Denmark | Grænseværdie (langvarig) (ppm) | 25 ppm |
| Estonia | OEL TWA (mg/m ³) | 40 mg/m ³ 25 mg/m ³ (in exhaust) |
| Estonia | OEL TWA (ppm) | 35 ppm 20 ppm (in exhaust) |
| Estonia | OEL STEL (mg/m ³) | 120 mg/m ³ |
| Estonia | OEL STEL (ppm) | 100 ppm |

Appendix to Section 8.1 National Exposure Limits

| Carbon monoxide (630-08-0) | | |
|-----------------------------------|--|---|
| Estonia | OEL chemical category (ET) | Reproductive toxin |
| Finland | HTP-arvo (8h) (mg/m ³) | 35 mg/m ³ |
| Finland | HTP-arvo (8h) (ppm) | 30 ppm |
| Finland | HTP-arvo (15 min) | 87 mg/m ³ |
| Finland | HTP-arvo (15 min) (ppm) | 75 ppm |
| Hungary | AK-érték | 33 mg/m ³ |
| Hungary | CK-érték | 66 mg/m ³ |
| Hungary | OEL chemical category (HU) | Repr1A |
| Ireland | OEL (8 hours ref) (mg/m ³) | 23 mg/m ³ |
| Ireland | OEL (8 hours ref) (ppm) | 20 ppm |
| Ireland | OEL (15 min ref) (mg/m ³) | 115 mg/m ³ |
| Ireland | OEL (15 min ref) (ppm) | 100 ppm |
| Lithuania | IPRV (mg/m ³) | 40 mg/m ³ 25 mg/m ³ (if the sources are from engines exhaust gases) |
| Lithuania | IPRV (ppm) | 35 ppm 20 ppm (if the sources are from engines exhaust gases) |
| Lithuania | TPRV (mg/m ³) | 120 mg/m ³ (including if the sources are from engines exhaust gases) |
| Lithuania | TPRV (ppm) | 100 ppm (including if the sources are from engines exhaust gases) |
| Lithuania | OEL chemical category (LT) | Reproductive toxin |
| Norway | Grenseverdier (AN) (mg/m ³) | 29 mg/m ³ |
| Norway | Grenseverdier (AN) (ppm) | 25 ppm |
| Norway | Grenseverdier (Korttidsverdi) (mg/m ³) | 29 mg/m ³ (listed in the List of Administrative Norms. Written instructions shall be prepared for work in CO atmosphere if the STEL limit is exceeded) |
| Norway | Grenseverdier (Korttidsverdi) (ppm) | 25 ppm (listed in the List of Administrative Norms. Written instructions shall be prepared for work in CO atmosphere if the STEL limit is exceeded) |
| Poland | NDS (mg/m ³) | 23 mg/m ³ |
| Poland | NDSCh (mg/m ³) | 117 mg/m ³ |

Appendix to Section 8.1 National Exposure Limits

| Carbon monoxide (630-08-0) | | |
|-----------------------------------|---|--|
| Romania | OEL TWA (mg/m ³) | 20 mg/m ³ |
| Romania | OEL TWA (ppm) | 17,5 ppm |
| Romania | OEL STEL (mg/m ³) | 30 mg/m ³ |
| Romania | OEL STEL (ppm) | 26 ppm |
| Slovakia | NPHV (priemerná) (mg/m ³) | 35 mg/m ³ |
| Slovakia | NPHV (priemerná) (ppm) | 30 ppm |
| Slovakia | NPHV (Hraničná) (mg/m ³) | 70 mg/m ³ |
| Slovakia | Slovakia - BEI | 5 % of hemoglobin (Medium: blood - Time: end of exposure or work shift - Parameter: Carboxyhemoglobin) |
| Slovenia | OEL TWA (mg/m ³) | 35 mg/m ³ |
| Slovenia | OEL TWA (ppm) | 30 ppm |
| Slovenia | OEL STEL (mg/m ³) | 70 mg/m ³ |
| Slovenia | OEL STEL (ppm) | 60 ppm |
| Slovenia | OEL chemical category (SL) | Category 1A |
| Sweden | nivågränsvärde (NVG) (mg/m ³) | 25 mg/m ³ (total of CO) 40 mg/m ³ |
| Sweden | nivågränsvärde (NVG) (ppm) | 35 ppm 20 ppm (total of CO) |
| Sweden | kortidsvärde (KTV) (mg/m ³) | 120 mg/m ³ |
| Sweden | kortidsvärde (KTV) (ppm) | 100 ppm |
| Portugal | OEL TWA (ppm) | 25 ppm |

| Ozone (10028-15-6) | | |
|---------------------------|--|-----------------------|
| Austria | MAK (mg/m ³) | 0,2 mg/m ³ |
| Austria | MAK (ppm) | 0,1 ppm |
| Austria | MAK Short time value (mg/m ³) | 0,4 mg/m ³ |
| Austria | MAK Short time value (ppm) | 0,2 ppm |
| Austria | OEL chemical category (AT) | Group B Carcinogen |
| Bulgaria | OEL TWA (mg/m ³) | 0,2 mg/m ³ |
| Bulgaria | OEL STEL (mg/m ³) | 0,6 mg/m ³ |
| Croatia | KGVI (kratkotrajna granična vrijednost izloženosti) (mg/m ³) | 0,4 mg/m ³ |

Appendix to Section 8.1 National Exposure Limits

| Ozone (10028-15-6) | | |
|---------------------------|---|---|
| Croatia | KGVI (kratkotrajna granična vrijednost izloženosti) (ppm) | 0,2 ppm |
| France | VLE (mg/m ³) | 0,4 mg/m ³ |
| France | VLE (ppm) | 0,2 ppm |
| France | VME (mg/m ³) | 0,2 mg/m ³ |
| France | VME (ppm) | 0,1 ppm |
| Greece | OEL TWA (mg/m ³) | 0,2 mg/m ³ |
| Greece | OEL TWA (ppm) | 0,1 ppm |
| Greece | OEL STEL (mg/m ³) | 0,6 mg/m ³ |
| Greece | OEL STEL (ppm) | 0,3 ppm |
| USA ACGIH | ACGIH TWA (ppm) | 0,05 ppm (heavy work) 0,08 ppm (moderate work) 0,10 ppm (light work) 0,20 ppm (heavy, moderate or light workloads, <=2 hours) |
| Latvia | OEL TWA (mg/m ³) | 0,1 mg/m ³ |
| Spain | VLA-ED (mg/m ³) | 0,1 mg/m ³ (heavy work) 0,16 mg/m ³ (moderate work) 0,2 mg/m ³ (light work) 0,4 mg/m ³ (heavy, moderate or light work <=2 hours) |
| Spain | VLA-ED (ppm) | 0,05 ppm (heavy work) 0,08 ppm (moderate work) 0,1 ppm (light work) 0,2 ppm (heavy, moderate or light work <=2 hours) |
| Switzerland | VLE (mg/m ³) | 0,2 mg/m ³ |
| Switzerland | VLE (ppm) | 0,1 ppm |
| Switzerland | VME (mg/m ³) | 0,2 mg/m ³ |
| Switzerland | VME (ppm) | 0,1 ppm |
| Switzerland | OEL chemical category (CH) | Category C3 carcinogen |
| Netherlands | Grenswaarde TGG 8H (mg/m ³) | 0,12 mg/m ³ (1 hour) |
| United Kingdom | WEL STEL (mg/m ³) | 0,4 mg/m ³ |
| United Kingdom | WEL STEL (ppm) | 0,2 ppm |
| Czech Republic | Expoziční limity (PEL) (mg/m ³) | 0,1 mg/m ³ |
| Denmark | Grænseværdie (ceiling) (mg/m ³) | 0,2 mg/m ³ |

Appendix to Section 8.1 National Exposure Limits

| Ozone (10028-15-6) | | |
|---------------------------|--|--|
| Denmark | Grænseværdie (ceiling) (ppm) | 0,1 ppm |
| Estonia | OEL TWA (mg/m ³) | 0,2 mg/m ³ |
| Estonia | OEL TWA (ppm) | 0,1 ppm |
| Estonia | OEL Ceiling (mg/m ³) | 0,6 mg/m ³ |
| Estonia | OEL Ceiling (ppm) | 0,3 ppm |
| Finland | HTP-arvo (8h) (mg/m ³) | 0,1 mg/m ³ |
| Finland | HTP-arvo (8h) (ppm) | 0,05 ppm |
| Finland | HTP-arvo (15 min) | 0,4 mg/m ³ |
| Finland | HTP-arvo (15 min) (ppm) | 0,2 ppm |
| Hungary | AK-érték | 0,2 mg/m ³ |
| Hungary | CK-érték | 0,2 mg/m ³ |
| Ireland | OEL (8 hours ref) (ppm) | 0,05 ppm (heavy work) 0,08 ppm (moderate work) 0,10 ppm (light work) 0,20 ppm (heavy, moderate or light workloads <= 2 hours) |
| Ireland | OEL (15 min ref) (ppm) | 0,15 ppm (calculated) 0,24 ppm (calculated) 0,30 ppm (calculated) 0,60 ppm (calculated) |
| Lithuania | IPRV (mg/m ³) | 0,2 mg/m ³ |
| Lithuania | IPRV (ppm) | 0,1 ppm |
| Lithuania | NRV (mg/m ³) | 0,6 mg/m ³ |
| Lithuania | NRV (ppm) | 0,3 ppm |
| Norway | Grenseverdier (AN) (mg/m ³) | 0,2 mg/m ³ |
| Norway | Grenseverdier (AN) (ppm) | 0,1 ppm |
| Norway | Grenseverdier (Korttidsverdi) (mg/m ³) | 0,2 mg/m ³ |
| Norway | Grenseverdier (Korttidsverdi) (ppm) | 0,1 ppm |
| Poland | NDS (mg/m ³) | 0,15 mg/m ³ |
| Romania | OEL TWA (mg/m ³) | 0,10 mg/m ³ |
| Romania | OEL TWA (ppm) | 0,05 ppm |
| Romania | OEL STEL (mg/m ³) | 0,20 mg/m ³ |
| Romania | OEL STEL (ppm) | 0,1 ppm |
| Slovakia | NPHV (priemerná) (mg/m ³) | 0,2 mg/m ³ |

Appendix to Section 8.1 National Exposure Limits

| Ozone (10028-15-6) | | |
|---------------------------|---|---|
| Slovakia | NPHV (priemerná) (ppm) | 0,1 ppm |
| Slovakia | NPHV (Hraničná) (mg/m ³) | 0,4 mg/m ³ |
| Slovenia | OEL TWA (mg/m ³) | 0,2 mg/m ³ |
| Slovenia | OEL TWA (ppm) | 0,1 ppm |
| Slovenia | OEL STEL (mg/m ³) | 0,2 mg/m ³ |
| Slovenia | OEL STEL (ppm) | 0,1 ppm |
| Sweden | nivågränsvärde (NVG) (mg/m ³) | 0,2 mg/m ³ |
| Sweden | nivågränsvärde (NVG) (ppm) | 0,1 ppm |
| Sweden | takgränsvärde (TGV) (mg/m ³) | 0,6 mg/m ³ |
| Sweden | takgränsvärde (TGV) (ppm) | 0,3 ppm |
| Portugal | OEL TWA (ppm) | 0,05 ppm (heavy work) 0,08 ppm (moderate work) 0,10 ppm (light work) 0,20 ppm (heavy, moderate or light work, less than or equal to 2 hours) |
| Portugal | OEL chemical category (PT) | A4 - Not Classifiable as a Human Carcinogen |

| Welding fumes (RR-00009-9) | | |
|-----------------------------------|--|---|
| Austria | MAK (mg/m ³) | 5 mg/m ³ (respirable fraction) |
| Belgium | Limit value (mg/m ³) | 5 mg/m ³ (except if otherwise specified) |
| France | VME (mg/m ³) | 5 mg/m ³ (total particulates) |
| Czech Republic | Expoziční limity (PEL) (mg/m ³) | 5,0 mg/m ³ (particles) |
| Ireland | OEL (8 hours ref) (mg/m ³) | 5 mg/m ³ |
| Ireland | OEL (15 min ref) (mg/m ³) | 15 mg/m ³ (calculated) |
| Norway | Grenseverdier (AN) (mg/m ³) | 5 mg/m ³ (not otherwise specified) |
| Norway | Grenseverdier (Korttidsverdi) (mg/m ³) | 10 mg/m ³ (Fumes/Metal fumes containing various substances where each Norm of each substance is observed in addition to the Norm of the Welding fumes) |