# SAFETY DATA SHEET

## SECTION 1: IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

### 1.1 Product Identifier

| | |
|---|---|
| **Trade Name** | Welding Fluxes |
| **Classification** | EN 760 for submerged arc welding fluxes for stainless steel and nickel base alloys |
| **Product Type** | Submerged Arc or Electroslag Strip and Wire fluxes |
| **Product Identifiers** | Refer to Section 16 for full list |
| **SDS Date** | January 1, 2014 |

### 1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advised Against

| | |
|---|---|
| **Product Use**: | Welding Fluxes |
| **Uses Advised Against:** | Use only as indicated for welding operations |

### 1.3 Details of the Supplier of the Substance or Mixture

| | | |
|---|---|---|
| **Manufacturer:** | Sandvik Wire and Heating Technologies<br>P.O. Box 1220<br>Scranton, PA 18501-1220 | Sandvik Materials Technology<br>SE-811 81 Sandviken<br>Sweden |
| **Telephone:** | +1 (570) 585-7500 | +46 26 260000 |
| **Email:** | wire-welding_products.smt@sandvik.com | |

### 1.4 Emergency Telephone Number

| | |
|---|---|
| **Emergency Spill Information** | +1 (570) 585-7500 (United States)<br>+46 26 260000 (Sweden) |
| **Other Product Information:** | www.smt.sandvik.com |

## SECTION 2: HAZARDS IDENTIFICATION

### 2.1 Classification of the Substance or Mixture

**CLP/GHS Classification (1272/2008):**
Acute Toxicity Category 4 (H302)
Skin Irritation Category 2 (H315)
Skin Sensitization Category 1 (H317)
Eye Damage Category 1 (H318)
Specific Target Organ Toxicity - Single Exposure Category 3 (H335)
Carcinogenicity Category 1A (H350)
Specific Target Organ Toxicity – Repeat Exposure Category 1 (H372)
Specific Target Organ Toxicity – Repeat Exposure Category 2 (H373)

**EU Classification (67/548/EEC):** Harmful (Xn), Irritant (Xi), Carcinogen Category 3, R40, R20/22, R37/38, R41, R43, R48/20/22
See Section 16 for full text of EU Classifications.

**2.2 Label Elements**

**Danger!**

Contains chromium, nickel, crystalline silica, titanium dioxide, manganese, barium oxide, calcium oxide

Hazard Phrases:
H302 Harmful if swallowed.
H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H318 Causes serious eye damage.
H335 May cause respiratory irritation.
H350 May cause cancer.
H372 Causes damage to respiratory system through prolonged or repeated exposure.
H373 May cause damage to brain and nervous system through prolonged or repeated exposure.

Precautionary Phrases:
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust, fume or gas.
P264 Wash thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P272 Contaminated work clothing should not be allowed out of the workplace.
P280 Wear protective gloves, protective clothing, eye protection or face protection.
P301 + P312 IF SWALLOWED: Call a POISON CENTER if you feel unwell.
P330 Rinse mouth.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P333 + P313 If skin irritation or rash occurs: Get medical attention.
P362 + P364 Take off contaminated clothing and wash it before reuse.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER.
P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a POISON CENTER if you feel unwell.
P308 + P313 IF exposed or concerned: Get medical attention.
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P405 Store locked up.
P501 Dispose of contents and container in accordance with local and national regulations.

**2.3 Other Hazards:** None

## SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

**3.2 Mixtures**

| Chemical Name | CAS No. / EINECS No. / REACH Reg. No. | % (w/w) | EU Classification (67/548/EEC) | CLP/GHS Classification (1272/2008) |
|---|---|---|---|---|
| Calcium Fluoride ($CaF_2$) | 7789-75-5 / 232-188-7 | 1-<75 | Not dangerous | Not hazardous |
| Alumina ($Al_2O_3$) | 1344-28-1 215-691-6 | 10-<60 | Not dangerous | Not Hazardous |
| Calcium Oxide (CaO) | 1305-78-8 215-138-9 | 0-60 | Xi, R37/38, R41 | Skin Irrit 2 (H315) Eye Dam 1 (H318) STOT SE 3 (H335) |
| Magnesium Oxide | 1309-48-4 / 215-171-9 | 0-<40 | Not dangerous | Not hazardous |
| Barium Oxide (BaO) | 1304-28-5 / 215-127-9 | 0-30 | Xn, Xi R20/22, R41, R38 | Acute Tox 3(H301) Acute Tox 4 (H332) Skin Irrit 2 (H315) Eye Dam 1 (H318) |
| Titanium Dioxide ($TiO_2$) | 13463-67-7 / 236-675-5 | 0-20 | Not dangerous | Carc 2 (H351) |
| Zirconium Dioxide (ZrO2) | 1314-23-4 / 215-227-2 | 0-20 | Not dangerous | Not hazardous |
| Aluminum (Al) | 7429-90-5 / 231-072-3 | 0-10 | Not dangerous | Not Hazardous |
| Manganese (Mn) | 7439-96-5 / 231-105-1 | 0-10 | Xn R48/20/22 | STOT RE 2 (H373) |
| Silica ( $SiO_2$) (quartz) | 14808-60-7 / 238-878-4 | <1-25 | Xn, R48/20 | Carc 1A (H350), STOT RE1 (H372) |
| Sodium (Na) | 7440-23-5 / 231-132-9 | 0-10 | Not dangerous | Not Hazardous |
| Limestone (CaCo3) | 1317-65-3 / 215-279-6 | 0-<10 | Not dangerous | Not hazardous |
| Kaolin | 1332-58-7 / 310-194-1 | 0-<10 | Xn R48/20 | STOT RE 1 (H372) |
| Nickel (Ni) | 7440-02-0 / 231-111-4 / 01-2119438727-29 | 0-5 | Carc. Cat. 3, T R40, R43, R48/23 | Skin Sens 1 (H317) Carc 1B (H350) STOT RE 1 (H372) |
| Chromium (Cr) | 7440-47-3 / 231-157-5 / 01-2119485652-31 | 0-5 | Not dangerous | Not hazardous |
| Molybdenum (Mo) [1)] | 7439-98-7 / 231-107-2 / 01-2119472304-43 | 0-5 | Not dangerous | Not hazardous |
| Iron (Fe) | 7439-89-6 / 231-096-4 | 0-<5 | Not dangerous | Not hazardous |
| Potassium Silicate (KSiO2) | 1312-76-1 / 215-199-1 | 0-<5 | C, Xi R34, R37 | Met. Corr. 1 (H290), Skin Corr. 1B (H314), Eye Dam 1 (H318), STOT SE. 3 (H335) |
| Sodium Silicate (NaSiO2) | 1344-09-8 / 215-687-4 | 0-<5 | C, Xi R34, R37 | Met. Corr. 1 (H290), Skin Corr. 1B (H314), Eye Dam 1 (H318), STOT SE. 3 (H335) |

| | | | | |
|---|---|---|---|---|
| Potassium (K) | 7440-09-7 / 231-119-8 | 0-1 | Not dangerous | Not hazardous |
| Hexavalent Chromium (fume constituent) | 1333-82-0 / 215-607-8 | Varies | Carc. Cat. 1; Muta. Cat. 2; Repr. Cat. 3; T+, C, N R24/25, R26, R35, R42/43, R45, R46, R48/23, R62, R50/53 | Acute Tox 3 (H301), Acute Tox. 2 (H310, H330), Skin Corr 1A (H314), Resp Sens 1 (H334), Skin Sens 1 (H317), Repr 2 (H360), Muta 1B (H340, Carc 1A (H350), STOT RE 1 (H372), Aquatic Acute 1 (H400). Aquatic Chronic 1 (H410) |

See Section 16 for full text of GHS and EU Classifications.

**FUME CONSTITUENTS FORMED IN USE**

The following are typical constituents of welding fumes and gases. When the flux is consumed, the fume and gas decomposition products generated are different in percent and form than ingredients listed above. Decomposition products of normal operation include those originating from the volatilization reaction, or oxidation of the materials shown above, plus those from the base metal and coating, etc. which may include paint, plating, galvanizing, or phosphate coatings on steels which would produce phosphine gas and other contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities which may be decomposed by the arc into toxic gases such as phosgene).

**Fume Constituent (Gases)**

| **Chemical Name** | **CAS No. / EINECS No. / REACH Reg. No.** | **EU Classification (67/548/EEC)** | **CLP/GHS Classification (1272/2008)** |
|---|---|---|---|
| Carbon Dioxide ($CO_2$) | 124-38-9 / 204-696-9 | Not dangerous | Press. Gas. (H280) |
| Carbon Monoxide (CO) | 630-08-0 / 211-128-3 | Repr. Cat. 1;F+, T R12, R48/23, R61 | Flam. Gas 1 (H220)<br>Press. Gas (H280)<br>Repr. 1A (H360)<br>Acute Tox. 3 (H331)<br>STOT RE 1 (H372) |
| Dinitrogen Tetroxide ($N_2O_4$) | 10544-72-6 / 234-126-4 | O, T+, C R8, R26, R34 | Press. Gas (H280)<br>Oxid. Gas 1 (H270)<br>Acute Tox. 2 (H330)<br>Skin Corr. 1B (H314) |
| Hydrogen Fluoride (HF) | 7664-39-3 / 231-634-8 | T+, C R26/27/28, R35 | Acute Tox. 2 (H330)<br>Acute Tox. 1 (H310)<br>Acute Tox. 2 (H300)<br>Skin Corr. 1A (H314) |
| Nitric Oxide (NO) | 10102-43-9 / 233-271-0 | O, T+, C R8, R26, R34 | Press. Gas (H280)<br>Oxid. Gas 1 (H270)<br>Acute Tox. 1 (H330)<br>Skin Corr. 1B (H314) |
| Nitrogen Dioxide ($NO_2$) | 10102-44-0 / 233-272- | O, T+, C R8, R26, R34 | Press. Gas (H280)<br>Oxid. Gas 1 (H270)<br>Acute Tox. 2(H330)<br>Skin Corr. 1B (H314) |

| | | | |
|---|---|---|---|
| Ozone ($O_3$) | 10028-15-6 / 233-069-2 | O, T+, Xi, N R8, R26, R36/37/38, R50 | Oxid. Gas 1 (H270)<br>Acute Tox. 1 (H330)<br>Eye Irrit. 2 (H319)<br>Skin Irrit. 2 (H315)<br>STOT SE 3 (H335)<br>Aquatic Acute 1 (H400) |
| Phosgene ($COCl_2$) | 75-44-5 / 200-870-3 | T+, C R26, R34 | Press. Gas (H280)<br>Acute Tox. 2 (H330)<br>Skin Corr. 1B (H314) |
| Phosphine ($PH_3$) | 7803-51-2 / 232-260-8 | F+, T+, C, N R12, R17, R26, R34, R50 | Flam. Gas 1 H220)<br>Press. Gas (H280)<br>Acute Tox. 2 (H330)<br>Skin Corr. 1B (H314)<br>Aquatic Acute 1 (H400) |

**Fume Constituents (Solids)**

| **Chemical Name** | **CAS No. / EINECS No. / REACH Reg. No.** | **EU Classification (67/548/EEC)** | **CLP/GHS Classification (1272/2008)** |
|---|---|---|---|
| Aluminum Fumes | 7429-90-5 / 231-072-3 | Not dangerous | Not hazardous |
| Barium Oxide | 1304-28-5 / 215-127-9 | Xn, Xi R20/22, R41, R38 | Acute Tox 3(H301)<br>Acute Tox 4 (H332)<br>Skin Irrit 2 (H315)<br>Eye Dam 1 (H318) |
| Calcium Fluoride ($CaF_2$) | 7789-75-5 / 232-188-7 | Not dangerous | STOT RE 1(H372) |
| Calcium Oxide | 1305-78-8 / 215-138-9 | Xi, R37/38, R41 | Skin Irrit 2 (H315)<br>Eye Dam 1 (H318)<br>STOT SE 3 (H335) |
| Chromates ($CrO_3$) | 1333-82-0 / 215-607-8 | Carc. Cat. 1; Muta. Cat. 2; Repr. Cat. 3; T+, C, N R24/25, R26, R35, R42/43, R45, R46, R48/23, R62, R50/53 | Acute Tox 3 (H301),<br>Acute Tox. 2 (H310, H330),<br>Skin Corr 1A (H314)<br>Resp Sens 1 (H334)<br>Skin Sens 1 (H317)<br>Repr 2 (H360)<br>Muta 1B (H340)<br>Carc 1A (H350)<br>STOT RE 1 (H372)<br>Aquatic Acute 1 (H400)<br>Aquatic Chronic 1 (H410) |
| Iron Oxide ($Fe_2O_3$) | 1309-37-1 / 215-168-2 | Not dangerous | STOT RE 1 (H372) |
| Manganese Tetraoxide ($Mn_3O_4$) | 1317-35-7 / 215-266-5 | Not dangerous | STOT RE 2 (H373) |
| Magnesium Oxide | 1309-48-4 / 215-171-9 | Not dangerous | Not hazardous |
| Molybdenum Trioxide ($MoO_3$) [1)] | 1313-27-5 / 215-204-7 | Not dangerous | Not hazardous |

| Chemical Name | CAS No. / EINECS No. / REACH Reg. No. | EU Classification (67/548/EEC) | CLP/GHS Classification (1272/2008) |
|---|---|---|---|
| Nickel Oxide (NiO) | 1314-06-3 / 215-217-8 | Carc. Cat. 3, T R40, R43, R48/23 | Skin Sens 1 (H317)<br>Carc 1B (H350)<br>STOT RE 1 (H372) |
| Silicon Dioxide ($SiO_2$) (quartz) | 14808-60-7 / 238-878-4 | Xn R48/20 | STOT RE 1 (H372)<br>Carc 1 (H350) |
| Sodium Oxide (NaO) | 1313-59-3 / 215-208-9 | C R34 | Skin Corr 1B (H314) |
| Potassium Oxide (KO) | 12136-45-7 / 235-227-6 | C R34 | Skin Corr 1B (H314) |
| Titanium Dioxide ($TiO_2$) | 13463-67-7 / 236-675-5 | Not dangerous | Carc 2 (H351) |
| Zirconium Dioxide ($ZrO_2$) | 1314-23-4 / 215-227-2 | Not dangerous | Not hazardous |

[1)] Only in Molybdenum-alloyed grades.

**Refer to Section 8 for occupational exposure limits.**

## SECTION 4: FIRST AID MEASURES

### 4.1 Description of First Aid Measures

**First Aid:**

No first aid should be needed when handling unused welding consumables. The following first aid should be used when the product is being welded:

**Eye contact:** If eye irritation occurs, flush eyes immediately with water while holding open eyelids. Get medical attention if irritation persists.

**Skin contact:** None normally needed. Get immediate medical attention for treatment of burns.

**Inhalation:** Remove victim to fresh air. Give artificial respiration if needed. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

**Ingestion:** Ingestion is unlikely due to physical form. If swallowed, do not induce vomiting. Rinse mouth with water. Seek medical attention.

**See Section 11 for more detailed information on health effects.**

**4.2 Most Important symptoms and effects, both acute and delayed:** No adverse effects are expected from welding consumables until they are welded. Inhalation of welding fumes may cause dizziness, nausea, or dryness or irritation of nose, throat, or eyes. Arc rays may injure eyes and burn skin. Hexavalent chromium compounds, nickel metal and compounds and respirable crystalline silica are listed in the National Toxicology Program (NTP) Annual Report on Carcinogens, found to be a human carcinogen in the International Agency for Research on Cancer (IARC) Monographs, or listed by OSHA/ACGIH as potential carcinogens. Prolonged or repeated exposure

to welding fumes causes damage to respiratory system and lungs. Prolonged or repeated exposure to welding fumes may cause damage to brain and nervous system. Prolonged or repeated exposure to welding fumes may cause siderosis (iron deposits in lungs), liver or kidney damage, skin and respiratory sensitization (allergic reaction) and affect pulmonary function.

**4.3 Indication of any immediate medical attention and special treatment needed**: If eye or skin burns occur, get immediate medical attention.

## SECTION 5: FIREFIGHTING MEASURES

**5.1 Extinguishing Media:** Use media appropriate for the surrounding fire.

**5.2 Special Hazards Arising from the Substance or Mixture**

**Unusual Fire and Explosion Hazards:** Welding arc and sparks can ignite combustibles and flammables. Refer to American National Z49.1 for fire prevention during the use of welding and allied procedures.
**Combustion Products:** Typical combustion products are listed in Section 3.

**5.3 Advice for Fire-Fighters:** Self-contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals. Determine the need to evacuate or isolate the area according to your local emergency plan.

## SECTION 6: ACCIDENTAL RELEASE MEASURES

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**6.1 Personal Precautions, Protective Equipment and Emergency Procedures:**

None needed under normal conditions of use.

**6.2 Environmental Precautions:**

Avoid release into the environment. Report spill as required by local and national regulations.

**6.3 Methods and Material for Containment and Cleaning Up:**

Pick up and return to container for use.

**6.4 Reference to Other Sections:**
Refer to Section 8 for personal protective equipment and Section 13 for disposal information.

## SECTION 7: HANDLING and STORAGE

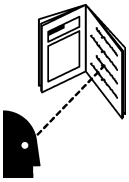
**7.1 Precautions for Safe Handling**:
Avoid breathing welding fumes. Keep your head out of the fumes. Use with enough ventilation or exhaust at the arc, or both, to keep fumes and gases below the occupational exposure limits in your breathing zone and the general area. Use air sampling to determine the need for corrective action. (Refer to Section 10 for additional information).

Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Fumes from welding and oxygen depletion can alter the air quality causing injury or death.

Take appropriate precautions to prevent fires and explosion.

Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1, Safety in Welding and Cutting, published by the American Welding Society, P.O. Box 351040, Miami, FL 33135; and OSHA Publication 2206 (29CRF 1910), U.S. Government Printing Office, Washington, DC 20402, for more information. In the United States assure compliance with the OSHA Standard on Chromium (VI), 29CFR 1910.1026. In Germany, see BGV D1 'Provisions for Safety and Health at work'. In the

United Kingdom, see WMA Publication 236 and 237, "Hazards from Welding fume". In Canada, see CSA Standard CAN/CSA-W117.2-01 "Safety in Welding, Cutting and Allied Processes".



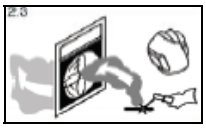
Before use, read instruction manual.

Electric shock can kill.

Arc rays can injure eyes and burn skin.

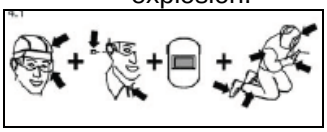
Fumes and gases can be hazardous to your health.

Sparks and splatter can cause fire or explosion.



Use ventilating fan to remove fumes.

Wear dry insulating gloves. Do not touch electrode with bare hand. Do not wear wet or damaged gloves.



Arc rays can burn eyes and injure skin.

**7.2 Conditions for Safe Storage, Including any Incompatibilities**:
Store in a dry area to protect product quality.

**7.3 Specific end use(s):**
**Industrial uses:** Welding fluxes
**Professional uses:** Welding fluxes

## SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

**8.1 Control Parameters: Refer to country specific regulations for exposure limits not provided below.**

| Chemical Name | US OSHA PEL | US ACGIH TLV | German OEL | Brazil OEL |
|---|---|---|---|---|
| Alumina (Al2O3) | 5 mg/m$^3$ TWA (respirable fraction)<br>15 mg/m$^3$ TWA (total dust) | 1 mg/m$^3$ TWA (respirable fraction) | 1.5 mg/m$^3$ TWA (respirable fraction)<br>4 mg/m$^3$ TWA (inhalable dust) | None Established |
| Aluminum (Al) | 5 mg/m$^3$ TWA (respirable fraction)<br>15 mg/m$^3$ TWA (total dust) | 1 mg/m$^3$ TWA (respirable fraction) | 1.5 mg/m$^3$ TWA (respirable fraction)<br>4 mg/m$^3$ TWA (inhalable dust) | None Established |
| Barium Oxide (BaO) | 0.5 mg/m$^3$ TWA | 0.5 mg/m$^3$ TWA | 0.5 mg/m$^3$ TWA (inhalable fraction) | None Established |
| Calcium Oxide (CaO) | 5 mg/m$^3$ TWA | 2 mg/m$^3$ TWA | None Established | None Established |
| Calcium Fluoride ($CaF_2$) (as F) | 2.5 mg/m$^3$ TWA | 2.5 mg/m$^3$ TWA | 1 mg/m$^3$ TWA (inhalable fraction)<br>4 mg/m$^3$ STEL (inhalable fraction) | None Established |
| Chromium (Cr) (as metal) | 1 mg/m$^3$ TWA | 0.5 mg/m$^3$ TWA | 2 mg/m$^3$ TWA (inhalable fraction) | None Established |
| Hexavalent Chromium (fume constituent) | 0.05 mg/m$^3$ TWA | 0.01 mg/m$^3$ TWA (insoluble compounds)<br>0.05 mg/m$^3$ TWA (water soluble compounds | None Established | None Established |
| Iron (Fe) | 10 mg/m$^3$ TWA (as fume) | 5 mg/m$^3$ TWA (respirable) (as iron oxide) | None Established | None Established |
| Kaolin | 5 mg/m$^3$ TWA (respirable fraction)<br>15 mg/m$^3$ TWA (total dust) | 2 mg/m$^3$ TWA (respirable fraction) | 4 mg/m$^3$ TWA (inhalable dust) | None Established |

| Chemical Name | US OSHA PEL | US ACGIH TLV | German OEL | Brazil OEL |
|---|---|---|---|---|
| | | | | |
| Limestone ($CaCO_3$) | 5 mg/m$^3$ TWA (respirable fraction)<br>15 mg/m$^3$ TWA (total dust) | None Established | 4 mg/m$^3$ TWA (inhalable dust) | None Established |
| Magnesium Oxide | 15 mg/m$^3$ TWA (fume) (total particulate) | 10 mg/m$^3$ TWA (inhalable fraction) | 1.5 mg/m$^3$ TWA (respirable fraction)<br>4 mg/m$^3$ TWA (inhalable dust) | None Established |
| Manganese (Mn) | 5 mg/m$^3$ Ceiling Limit | 0.02 mg/m$^3$ (respirable)<br>0.1 mg/m$^3$ (inhalable) | 0.2 mg/m$^3$ TWA (inhalable)<br>0.02 mg/m$^3$ TWA (respirable fraction) | None Established |
| Molybdenum (Mo) [1)] | 15 mg/m$^3$ TWA (total dust) | 3 mg/m$^3$ TWA (respirable fraction)<br>10 mg/m$^3$ TWA (inhalable) | None Established | None Established |
| Nickel (Ni) (elemental) | 1 mg/m$^3$ TWA | 1.5 mg/m$^3$ TWA (inhalable) | None Established | None Established |
| Potassium (K) | None Established | None Established | None Established | None Established |
| Potassium SIlicate | 5 mg/m$^3$ TWA (respirable fraction)<br>15 mg/m$^3$ TWA (total dust) | None Established | 4 mg/m$^3$ TWA (inhalable dust) | None Established |
| Sodium (Na) | None Established | None Established | None Established | None Established |
| Sodium Silicate | 5 mg/m$^3$ TWA (respirable fraction)<br>15 mg/m$^3$ TWA (total dust) | None Established | 4 mg/m$^3$ TWA (inhalable dust) | None Established |
| Silica ( $SiO_2$) (quartz) | 10 / (%$SiO_2$+2) (respirable fraction) TWA<br>30 / (%$SiO_2$+2) (total dust) TWA | 0.025 mg/m$^3$ TWA (respirable) | None Established | None Established |
| Titanium Dioxide ($TiO_2$) | 15 mg/m$^3$ TWA (total dust) | 10 mg/m$^3$ TWA | None Established | None Established |
| Zirconium Dioxide (ZrO2) | 5 mg/m$^3$ TWA | 5 mg/m$^3$ TWA<br>10 mg/m$^3$ STEL | 1 mg/m$^3$ TWA (inhalable fraction) (insoluble compounds) | None Established |

| Chemical Name | EU IOEL | UK OEL | French OEL | China OEL |
|---|---|---|---|---|
| Alumina (Al2O3) | None Established | 4 mg/m$^3$TWA (respirable fraction)<br>10 mg/m$^3$TWA (inhalable) | 10 mg/m$^3$ TWA (respirable fraction) | 4 mg/m$^3$ TWA |
| Aluminum (Al) | None Established | 4 mg/m$^3$TWA (respirable fraction)<br>10 mg/m$^3$TWA (inhalable) | 10 mg/m$^3$ TWA | 3 mg/m$^3$ TWA |
| Barium Oxide (BaO) | 0.5 mg/m$^3$ TWA (as soluble compounds | 0.5 mg/m$^3$ TWA (as soluble compounds | 0.5 mg/m$^3$ TWA (as soluble compounds | 0.5 mg/m$^3$ -TWA<br>1.5 mg/m$^3$ STEL |
| Calcium Oxide (CaO) | None Established | 2 mg/m$^3$ TWA | 2 mg/m$^3$ TWA | 2 mg/m$^3$ TWA |
| Calcium Fluoride ($CaF_2$) (as F) | 2.5 mg/m$^3$ TWA | 2.5 mg/m$^3$ TWA | 2.5 mg/m$^3$ TWA | 2 mg/m$^3$ TWA |
| Chromium (Cr) | 2 mg/m$^3$ TWA | 0.5 mg/m$^3$ TWA | 2 mg/m$^3$ TWA | 2 mg/m$^3$ TWA (inhalable fraction) |
| Hexavalent Chromium (fume constituent) | None Established | 0.05 mg/m$^3$ TWA | 0.05 mg/m3 TWA<br>0.1 mg/m$^3$STEL | 0.05 mg/m$^3$ TWA |
| Iron (Fe) | None Established | 5 mg/m$^3$ TWA<br>10 mg/m$^3$ STEL (as iron oxide fume) | | None Established |
| Kaolin | None Established | 2 mg/m$^3$ TWA (respirable fraction) | 10 mg/m$^3$ TWA (total dust) | 8 mg/m$^3$ TWA (total dust) |
| Limestone ($CaCO_3$) | None Established | 4 mg/m$^3$ TWA (respirable fraction)<br>10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA (total dust) | 4 mg/m$^3$ TWA (respirable dust)<br>8 mg/m$^3$ TWA (total dust) |
| Magnesium Oxide | None Established | 4 mg/m$^3$ TWA (respirable fraction)<br>10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA (respirable fraction) | 10 mg/m$^3$ TWA (fume) |

| | | | | |
|---|---|---|---|---|
| Manganese (Mn) | None Established | 0.5 mg/m$^3$ TWA | 1 mg/m$^3$ TWA | 0.15 mg/m$^3$ TWA |
| Molybdenum (Mo) [1)] | None Established | 10 mg/m$^3$ TWA (inhalable fraction) 20 mg/m$^3$ STEL (inhalable fraction) | 5 mg/m$^3$ TWA 10 mg/m$^3$ STEL (soluble compounds) | 6 mg/m$^3$ TWA |
| Nickel (Ni) | None Established | 0.5 mg/m$^3$ TWA (as insoluble nickel) 0.1 mg/m$^3$ TWA (as soluble nickel) | 1 mg/m$^3$ TWA | 1 mg/m$^3$ TWA |
| Potassium (K) | None Established | None Established | None Established | None Established |
| Potassium Silicate | None Established | 4 mg/m$^3$ TWA (respirable fraction) 10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA (total dust) | 8 mg/m$^3$ TWA (total dust) (as PNOR) |
| Sodium (Na) | None Established | None Established | None Established | None Established |
| Sodium Silicate | None Established | 4 mg/m$^3$ TWA (respirable fraction) 10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA (total dust) | 8 mg/m$^3$ TWA (total dust) (as PNOR) |
| Silica ( $SiO_2$) (quartz) | None Established | 0.1 mg/m$^3$ TWA (respirable fraction) | 0.1 mg/m$^3$ TWA (respirable fraction) | 0.5 mg/m$^3$TWA 0.2 mg/m$^3$ STEL |
| Titanium Dioxide ($TiO_2$) | None Established | 4 mg/m$^3$ TWA (respirable fraction) 10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA | 8 mg/m$^3$ TWA |
| Zirconium Dioxide ($ZrO_2$) | None Established | 5 mg/m$^3$ TWA ( 10 mg/m$^3$ STEL | None Established | 5 mg/m$^3$ TWA 10 mg/m$^3$ STEL |

**The following are the occupational exposure limits for the typical decomposition products.**

| **GASES** | | | | |
|---|---|---|---|---|
| **Fume Constituent** | **US OSHA PEL** | **US ACGIH TLV** | **German OEL** | **Brazil OEL** |
| Carbon Dioxide ($CO_2$) | 5,000 ppm TWA | 5,000 ppm TWA 30,000 ppm STEL | 5,000 ppm TWA | 3900 ppm TWA |
| Carbon Monoxide (CO) | 50 ppm TWA | 25 ppm TWA | 35 mg/m3 TWA | 39 ppm TWA |
| Dinitrogen Tetroxide ($N_2O_4$) | None Established | None Established | None Established | None Established |
| Hydrogen Fluoride (HF) | 3 ppm TWA | 0.5 ppm TWA 2 ppm Ceiling | 1 ppm TWA | 2.5 ppm TWA |
| Nitric Oxide (NO) | 25 ppm TWA | 25 ppm TWA | 0.5 ppm TWA | 20 ppm TWA |
| Nitrogen Dioxide ($NO_2$) | 5 ppm Ceiling Limit | 0.2 ppm TWA | 0.5 ppm TWA | 4 ppm Ceiling |
| Ozone ($O_3$) | 0.1 ppm TWA | 0.1 ppm TWA *** | None Established | 0.08 ppm TWA |
| Phosgene ($COCl_2$) * | 0.1 ppm TWA | 0.1 ppm TWA | 0.1 ppm TWA | 0.08 ppm TWA |
| Phosphine ($PH_3$) ** | 0.3 ppm TWA | 0.3 ppm TWA 1 ppm STEL | 0.1 ppm TWA | 0.23 ppm TWA |

| **GASES** | | | | |
|---|---|---|---|---|
| **Fume Constituent** | **EU IOEL** | **UK OEL** | **French OEL** | **China PEL** |
| Carbon Dioxide ($CO_2$) | 5,000 ppm TWA | 5,000 ppm TWA 15,000 ppm STEL | 5,000 ppm TWA | 9000 mg/m3 TWA 18,000 mg/m3 STEL |
| Carbon Monoxide (CO) | None Established | 30 ppm TWA 200 ppm STEL | 50 ppm TWA | 20 mg/m3 TWA 30 mg/m3 STEL |
| Dinitrogen Tetroxide ($N_2O_4$) | None Established | None Established | None Established | None Established |
| Hydrogen Fluoride (HF) | 1.8 ppm TWA 3 ppm STEL | 1.5 mg/m3 TWA 3 mg/m3 STEL | 1.8 ppm TWA 3 ppm STEL | 2 mg/m3 MAC (Ceiling) |
| Nitric Oxide (NO) | 25 ppm TWA | 1 ppm STEL | 25 ppm TWA | 15 mg/m3 TWA |
| Nitrogen Dioxide ($NO_2$) | None Established | None Established | 3 ppm STEL | 5 mg/m3 TWA 10 mg/m3 STEL |
| Ozone ($O_3$) | None Established | 0.2 ppm STEL | 0.1 ppm TWA 0.2 ppm STEL | 0.3 mg/m3 TWA |
| Phosgene ($COCl_2$) * | 0.02 ppm TWA 0.4 ppm STEL | 0.02 ppm TWA, 0.06 ppm STEL | 0.02 ppm TWA 0.1 ppm STEL | 0.5 mg/m3 MAC (Ceiling) |
| Phosphine ($PH_3$) ** | 0.1 ppm TWA 0.2 ppm STEL | 0.1 ppm TWA, 0.2 ppm STEL | 0.1 ppm TWA 0.2 ppm STEL | 0.3 mg/m3 MAC (Ceiling) |

| **SOLIDS** | | | | |
|---|---|---|---|---|
| **Fume Constituents** | **US OSHA PEL** | **US ACGIH TLV** | **German OEL** | **Brazil OEL** |
| Aluminum Fumes | None Established | None Established | None Established | None Established |
| Barium Oxide (BaO) | 0.5 mg/m$^3$ TWA | 0.5 mg/m$^3$ TWA | 0.5 mg/m$^3$ TWA (inhalable fraction) | None Established |
| Calcium Fluoride ($CaF_2$) (as F) | 2.5 mg/m3 TWA | 2.5 mg/m3 TWA | None Established | None Established |
| Calcium Oxide (CaO) | 5 mg/m$^3$ TWA | 2 mg/m$^3$ TWA | None Established | None Established |
| Chromates ($CrO_3$) (CrVI) | 0.005 mg/m3 TWA (as CrVI)<br>0.0025 action level | 0.05 mg/m$^3$ TWA water soluble(as Cr)<br>0.01 mg/m3 TWA certain water insoluble (as Cr) | None Established | None Established |
| Iron Oxide | 10 mg/m$^3$ TWA (as fume) | 5 mg/m$^3$ TWA (respirable) | None Established | None Established |
| Manganese Tetraoxide ($Mn_3O_4$) (as Mn fume) | 5 mg/m$^3$ Ceiling Limit | 0.02 mg/m3 (respirable)<br>0.1 mg/m3 (inhalable) | 0.2 mg/m3 TWA (inhalable)<br>0.02 TWA (respirable fraction) | None Established |
| Magnesium Oxide (MgO) | None Established | 4 mg/m$^3$ TWA (respirable fraction)<br>10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA (respirable fraction) | None Established |
| Molybdenum Trioxide ($MoO_3$) [1] (as Mo) [1] | 15 mg/m$^3$ TWA (total dust) | 3 mg/m3 TWA (respirable fraction)<br>10 mg/m3 TWA (inhalable) | None Established | None Established |
| Nickel Oxide (NiO) (as nickel) | 1 mg/m$^3$ TWA | 0.2 mg/m3 TWA (inhalable) | None Established | None Established |
| Silicon Dioxide ($SiO_2$) (quartz) | 10 mg/m$^3$ (respirable fraction)<br>%$SiO_2$+2 TWA<br>30 (total dust)<br>%$SiO_2$+2 TWA | 0.025 mg/m3 TWA (respirable fraction) | None Established | None Established |
| Sodium Oxide (NaO) | None Established | None Established | None Established | None Established |
| Potassium Oxide (KO) | None Established | None Established | None Established | None Established |
| Titanium Dioxide ($TiO_2$) | 15 mg/m$^3$ TWA (total dust) | 10 mg/m$^3$ TWA | None Established | None Established |
| Zirconium Dioxide ($ZrO_2$) | 5 mg/m$^3$ TWA | 5 mg/m$^3$ TWA<br>10 mg/m$^3$ STEL | 1 mg/m$^3$ TWA (inhalable fraction) (insoluble compounds) | None Established |

| **SOLIDS** | | | | |
|---|---|---|---|---|
| **Fume Constituents** | **EU IOEL** | **UK OEL** | **French OEL** | **China OEL** |
| Aluminum Fumes | None Established | None Established | 5 mg/m$^3$ TWA (as welding fumes) | None Established |
| Barium Oxide (BaO) | 0.5 mg/m$^3$ TWA (as soluble compounds | 0.5 mg/m$^3$ TWA (as soluble compounds | 0.5 mg/m$^3$ TWA (as soluble compounds | 0.5 mg/m$^3$ TWA<br>1.5 mg/m$^3$ STEL |
| Calcium Fluoride ($CaF_2$) (as F) | 2.5 mg/m$^3$ TWA | 2.5 mg/m$^3$ TWA | 2.5 mg/m$^3$ TWA | 2 mg/m$^3$ TWA |
| Calcium Oxide (CaO) | None Established | 2 mg/m$^3$ TWA | 2 mg/m$^3$ TWA | 2 mg/m$^3$ TWA |
| Chromates ($CrO_3$) (CrVI) | None Established | 0.05 mg/m$^3$ TWA | 0.001 mg/m$^3$ TWA<br>0.005 mg/m$^3$ STEL | 0.05 mg/m$^3$ TWA |
| Iron Oxide | None Established | 5 mg/m$^3$ TWA<br>10 mg/m$^3$ STEL | None Established | None Established |
| Manganese Tetraoxide ($Mn_3O_4$) (as Mn) | None Established | 0.5 mg/m$^3$ TWA | 1 mg/m$^3$ TWA | 0.15 mg/m$^3$ TWA |
| Magnesium Oxide (MgO) | None Established | 4 mg/m$^3$ TWA (respirable fraction)<br>10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA (respirable fraction) | 10 mg/m$^3$ TWA (fume) |
| Molybdenum Trioxide ($MoO_3$) [1] (as Mo) | None Established | 10 mg/m$^3$ TWA (inhalable fraction)<br>20 mg/m$^3$ STEL (inhalable fraction) | 5 mg/m$^3$ TWA<br>10 mg/m$^3$ STEL (as Mo soluble compounds) | 4 mg/m$^3$ TWA (as soluble compounds) |
| Nickel Oxide (NiO) (as nickel) | None Established | 0.5 mg/m$^3$ TWA (as insoluble nickel)<br>0.1 mg/m$^3$ TWA (as soluble nickel) | 1 mg/m$^3$ TWA | 1 mg/m$^3$ TWA |
| Silicon Dioxide ($SiO_2$) (quartz) | None Established | 0.1 mg/m$^3$ TWA (respirable fraction) | 0.1 mg/m$^3$ TWA (respirable fraction) | 0.5 mg/m$^3$ TWA<br>0.2 mg/m$^3$ STEL |

| | | | | |
|---|---|---|---|---|
| Sodium Oxide (NaO) | None Established | None Established | None Established | None Established |
| Potassium Oxide (KO) | None Established | None Established | None Established | None Established |
| Titanium Dioxide ($TiO_2$) | None Established | 4 mg/m$^3$ TWA (respirable fraction) 10 mg/m$^3$ TWA (inhalable fraction) | 10 mg/m$^3$ TWA | 8 mg/m$^3$ TWA |
| Zirconium Dioxide ($ZrO_2$) | None Established | 5 mg/m$^3$ TWA ( 10 mg/m$^3$ STEL | None Established | 5 mg/m$^3$ TWA 10 mg/m$^3$ STEL |

[1)] Only in Molybdenum alloyed grades.

* May result from contact with chlorinated hydrocarbon vapors.
** May result from welding on phosphate coated steels.
******* For light work: 0.1ppm; for moderate work: 0.08ppm; and for heavy work: 0.05ppm of $O_3$.

**Definitions**

OEL – Occupation Exposure Limit - An occupational exposure limit is an upper limit on the acceptable concentration of a hazardous substance in the workplace. It is typically set by national authorities and enforced by legislation to protect occupational safety and health.

IOELV - Indicative Occupational Exposure Limit Values – An exposure limit established by the European Union under Article 3 of the Chemical Agents Directive (98/24/EC). Member states are required to consider IOELVs when establishing national occupational exposure limits.

PEL - Permissible Exposure Limit - OSHA (29CFR 1910) – An exposure limit that is published and enforced by OSHA as a legal standard.

STEL - Short Term Exposure Limit -OSHA (29CFR 1910) – A 15-minute time weighted average exposure which should not be exceeded at any time during a work day.

TLV - Threshold Limit Value – American Conference of Governmental Industrial Hygienists – Time weighted average (TWA) concentration for a normal 8-hour work day and a 40-hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

**8.2 Exposure Controls:**

**Recommended Monitoring Procedures:** Particulates are collected on filters and analyzed by AA or ICP. Refer to professional industrial or occupational hygienist for sampling and analytical methods. Certain regulations require periodic monitoring.

**Appropriate Engineering Controls:** Use enough ventilation, local exhaust at the arc, or both, to keep the fumes and gases below occupational exposure limits in the workers' breathing zone and the general area. Train each welder to keep his/her head out of the fumes. Refer to ANSI Z49.1 and other applicable regulations for additional information.

**Personal Protective Measurers**

**Eye/face Protection:** Safety glasses should be worn when submerged arc welding. For submerged arc weldin care must be taken to maintain flux burden over the weld pool to prevent arc flashing. For Electroslag welding, there is no flux burden over the molten weld pool, therefore it is recommended to use a lens filter as dark as possible without obstructing the view of the weld pool.

**Skin Protection:** Impervious clothing is recommended to avoid skin contact.

**Hands:** Welders gloves required to protect hands and arms from radiation, sparks, and electric shock.

**Respiratory Protection:** Use a respirable fume respirator or air-supplied respirator when welding in confined

area, or where local exhaust or ventilation does not keep exposure below occupational exposure limits. Respirator selection and use should be based on contaminant type, form and concentration. Follow applicable regulations and good Industrial Hygiene practice.

**Other protection:** Wear head, hand, and body protection to help prevent injury from radiation, sparks, and electric shock. At a minimum, this includes welder's gloves and a protective face shield, and may include arm protectors, aprons, hats, shoulder protection, and dark substantial clothing. Train each welder not to touch live electrical parts, and to insulate his/her person from work and ground.

## SECTION 9: PHYSICAL and CHEMICAL PROPERTIES

### 9.1 Information on basic Physical and Chemical Properties

Strip and wire fluxes consist of mineral mixtures agglomerated with a silicate waterglass binder.

**Appearance:** Grey or brown granular powder.
**Odor Threshold:** Not applicable
**Melting/Freezing Point:** Not applicable
**Flash Point:** Not flammable
**Lower Flammability Limit:** Not applicable
**Upper Flammability Limit:** Not applicable
**Vapor Density(Air=1):** Not applicable
**Solubility:** Insoluble in water
**Autoignition Temperature:** Not applicable
**Viscosity:** Not applicable
**Oxidizing Properties:** Not applicable
**Molecular Formula:** Mixture

**Odor:** Odorless
**pH:** Not applicable
**Boiling Point:** Not applicable
**Evaporation Rate:** Not applicable
**Vapor Pressure:** Not applicable

**Relative Density:** Not available
**Octanol/Water Partition Coefficient:** Not applicable
**Decomposition Temperature:** Not applicable
**Explosive Properties:** None
**Specific Gravity ($H_2O$= 1):** Not available
**Molecular Weight:** Mixture

**9.2 Other Information:** None

## SECTION 10: STABILITY and REACTIVITY

**10.1 Reactivity:** Not reactive under normal conditions.

**10.2 Chemical Stability:** Stable.

**10.3 Possibility of Hazardous Reactions:** None known.

**10.4 Conditions to Avoid:** None known.

**10.5 Incompatible Materials:** None known. Welding arc and sparks can ignite combustibles and flammables. Refer to American National Z49.1 for fire prevention during the use of welding and allied procedures.

**10.6 Hazardous Decomposition Products:** Welding fumes and gases cannot be classified simply. The composition and quantity of both are dependent upon the metal being welded, and the process, procedures, and electrodes used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded (such as paint, plating, galvanizing, or phosphate coatings on steels which would produce phosphine gas), the number of welders and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities which may be decomposed by the arc into toxic gases such as phosgene).

When the electrode is consumed, the fume and gas decomposition products generated are different in percent and form than ingredients in the manufactured product. Typical decomposition is also listed in Section 3. Decomposition products of normal operation include those originating from the volatilization reaction, or oxidation of the materials shown in Section 3, plus those from the base metal and coating, etc., as noted above.

One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample inside the welder's helmet, if worn, or in the worker's breathing zone. See ANSI/AWS F1.1, available from the American Welding Society, P.O. Box 351040, Miami, FL 33135.

## SECTION 11: TOXICOLOGICAL INFORMATION

### 11.1 Information on Toxicological Effects:

**Potential Health Effects:** Welding consumables are not hazardous until welded. When this product is used for welding, hazardous fumes and gases may be created. Other factors to consider include the base metal and the base metal coatings (such as paint, plating, galvanizing, or phosphate coatings).

**Electric arc welding may create one or more of the following health hazards:**

**Eye Contact:** Arc rays (ultraviolet light) can cause eye injury.

**Skin contact:** Arc rays may cause skin burns. Electric shock can kill. Skin contact with metal powder residue may cause irritation or skin sensitization.

**Inhalation:** Inhalation of gas and fumes may be hazardous. Over exposure to welding fumes may result in discomfort, such as dizziness, nausea, or dryness or irritation of nose, throat, or eyes.

**Ingestion:** Swallowing may cause gastrointestinal disturbances or obstruction.

**Chronic Toxicity:** Prolonged or repeated exposure to welding fumes causes damage to respiratory system, Prolonged or repeated to welding fumes may cause damage to brain and nervous system. Prolonged or repeated exposure to welding fumes may cause siderosis (iron deposits in lungs), liver or kidney damage, skin and respiratory sensitization (allergic reaction), and affect pulmonary function.

**Acute toxicity:** No acute toxicity data available for the product. Product oral acute toxicity estimate (ATE) is 333 mg/kg

Ingredient Toxicity Values
Alumina: Oral rat LD50 > 10000 mg/kg, Inhalation rat LC50 7.6 mg/L/1 hr
Aluminum: Oral rat LD50 > 15900 mg/kg (structurally similar chemical), Inhalation rat LC50 > 0.888 mg/L/4hr
Barium Oxide: No toxicity data available
Calcium Fluoride: Oral rat LD50 > 2000 mg/kg; Inhalation rat LC50 > 5070 mg/m³/4 hr
Calcium Oxide: Oral rat LD50 > 2000 mg/kg
Chromium: Oral rat LD50 >5000 mg/kg; Inhalation rat LC50 > 5.41 mg/L (structurally similar chemical)
Hexavalent Chromium: Oral rat LD50 52 mg/kg; Inhalation rat LC50 167 mg/m³/4 hr, Dermal rabbit 57 mg/kg
Iron: Oral rat LD50 98.6 g/kg
Kaolin: Oral rat LD50 >5000 mg/kg
Limestone: No toxicity data available
Magnesium Oxide: Oral rat LD50 > 2000 mg/kg, Inhalation rat LC50 > 2.1 mg/L/4 hr. (structurally similar chemical)
Manganese: Oral rat LD50 > 2000 mg/kg; Inhalation rat LC50 > 5.14 mg/L/4 hr
Molybdenum: Oral rat LD50 4461 mg/kg; Inhalation rat LC50 5.1 mg/L/4 hr; Dermal rabbit LD50> 2000 mg/kg
Nickel: Oral rat LD50 >9000 mg/kg; Inhalation rat LC50 >10.2 mg/L/1 hr
Potassium: No toxicity data available
Potassium Silicate: Oral rat LD50 >5000 mg/kg; Inhalation rat LC50 > 2.06 mg/L/4hr; Dermal rat LD50 >5000 mg/kg.

Silica, quartz: No toxicity data available
Sodium: No toxicity data available
Sodium Silicate: Oral rat LD50 3400 mg/kg; Inhalation rat LC50 > 2.06 mg/L/4 hr (structurally similar chemical); Dermal rat LD50 >5000 mg/kg (structurally similar chemical)
Titanium Dioxide: Oral rat LD50 >5000 mg/kg; Inhalation rat LC50 > 6.82 mg/L/4 hr
Zirconium Dioxide: Oral rat LD50 > 5000 mg/kg, Inhalation rat LC50 > 4.3 mg/L/4 hr.

**Skin corrosion/irritation:** Hexavalent chromium is corrosive to rabbit skin. Potassium silicate and sodium silicate are not irritating at the levels present in the product based on studies with laboratory animals. None of the other components are irritating or corrosive to rabbit skin.

**Eye damage/ irritation:** Hexavalent chromium is corrosive to rabbit eye. Barium oxide and calcium oxide are severely irritating to rabbit eyes. None of the other components are irritating or corrosive to rabbit eyes.

**Respiratory Irritation:** No data available. Dust may cause mechanical irritation.

**Respiratory Sensitization:** Hexavalent chromium has been shown to cause respiratory sensitization in humans.

**Skin Sensitization:** Hexavalent chromium is known to cause sensitization in guinea pig maximization tests and in the mouse ear swelling test. Nickel has been shown to cause skin sensitization in humans

**Germ Cell Mutagenicity:** Hexavalent chromium has been shown to cause mutagenic activity in in vitro and in vivo assays.

**Carcinogenicity:** Hexavalent chromium compounds, nickel metal and compounds and respirable crystalline silica are listed in the National Toxicology Program (NTP) Annual Report on Carcinogens, found to be human carcinogens in the International Agency for Research on Cancer (IARC) Monographs, or listed by OSHA/ACGIH as potential carcinogens.

**Reproductive Toxicity:** Studies with hexavalent chromium with mice have shown significant developmental effects at levels that were not maternally toxic.

**Specific Target Organ Toxicity:**

**Single Exposure:** No data available.

**Repeat Exposure:** Nickel was shown to cause serious effects of the lung, including chronic inflammation and fibrosis, alveolar proteinosis and granulomatous inflammation and increased nickel blood levels. Excessive inhalation of respirable crystalline silica dust may cause may cause a progressive, disabling and sometimes fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness and reduced pulmonary function. Prolonged or repeated exposure to manganese may cause damage to the brain and nervous system with symptoms of muscle stiffness, lack of coordination, tremors, and difficulties with breathing or swallowing.

## SECTION 12: ECOLOGICAL INFORMATION

**12.1 Toxicity:** No toxicity data available for the product.

Ingredient Aquatic Toxicity Values
Alumina: No data available.
Aluminum: No data available.
Barium Oxide: No data available.
Calcium Fluoride: No toxicity data available
Calcium Oxide: 96 hr LC50 Oncorhynchus mykiss 50.6 mg/L, 48 hr LC50 daphnia magna 49.1 mg/L, 72 hr EC50 Pseudokirchnerella subcapitata 184.57 mg/L (structurally similar chemical)
Chromium: No data available
Iron: No data available

Kaolin: No data available
Limestone: No data available
Magnesium Oxide: 96 hr LC50 Oncorhynchus mykiss 775.8 mg/L, 48 hr LC50 daphnia magna 284.76 mg/L, 72 hr EC50 Scenedesmus subspicatus > 100 mg/L (structurally similar chemical)
Manganese: 96 hr LC50 Oncorhynchus mykiss > 3.6 mg/L; 48 hr EC50 daphnia magna >1.6 mg/L; 72 hr EC50 desmodesmus subspicatus 4.5 mg/L
Molybdenum: 96 hr LC50 Pimephales promelas 609.1 mg/L; 48 hr LC50 daphnia magna 2729.4 mg/L
Nickel: 96 hr LC50 Oncorhynchus mykiss 15.3 mg/L
Potassium: No data available
Potassium Silicate: 48 hr LC50 Leuciscus idus > 146 mg/L; 24 hr EC50 daphnia magna > 146 mg/L
Silica, quartz: No toxicity data available
Sodium: No data available
Sodium Silicate: 96 hr LC50 Danio rerio 1108 mg/L; 48 hr LC50 daphnia magna 1700 mg/L; 72 hr EC50 d esmodesmus subspicatus 207 mg/L
Titanium Dioxide: 72 hr EC50 Pseudokirchnerella subcapitata 61 mg/L
Zirconium Dioxide: 96 hr LC50 danio rerio > 100 mg/L; 48 hr EC50 daphnia magna >100 mg/L

**12.2 Persistence and degradability:** Biodegradation is not applicable to inorganic substances.

**12.3 Bioaccumulative Potential:** No data available.

**12.4 Mobility in Soil:** No data available.

**12.5 Results of PVT and vPvB assessment:** Not required.

**2.6 Other Adverse Effects:** No data available.

## SECTION 13: DISPOSAL CONSIDERATIONS

**13.1 Waste Treatment Methods:**
Dispose in accordance with local and national regulations. Prevent waste from contaminating the surrounding environment. Discard any product, residue, disposable container, or liner in an environmentally accepted manner, in full compliance with federal, state, and local regulations

## SECTION 14: TRANSPORTATION INFORMATION

| | 14.1 UN Number | 14.2 UN Proper Shipping Name | 14.3 Hazard Class(s) | 14.4 Packing Group | 14.5 Environmental Hazards |
|---|---|---|---|---|---|
| **US DOT** | | Not Regulated | | | |
| **Canadian TDG** | | Not Regulated | | | |
| **EU ADR/RID** | | Not Regulated | | | |
| **IMDG** | | Not Regulated | | | |
| **IATA/ICAO** | | Not Regulated | | | |

**14.6 Special Precautions for User:** None

**14.7 Transport in Bulk According to Annex III MARPOL 73/78 and the IBC Code:** Not applicable – product is transported only in packaged form.

## SECTION 15: REGULATORY INFORMATION

### 15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Substance or Mixture

**US Regulations**

**CERCLA 103 Reportable Quantity:** These products are not subject to CERCLA reporting requirement.

**SARA Hazard Category (311/312):** Acute Health Hazard, Chronic Health Hazard

**SARA 313:** This product contains the following chemicals subject to SARA Title III Section 313 Reporting requirements:

| | | |
|---|---|---|
| Aluminum | 7429-90-5 | 1-10% |
| Alumina | 1344-28-1 | 10-40% |
| Barium Oxide * | 1304-28-5 | 5-30% |
| Chromium* | 7440-47-3 | 0-5% |
| Manganese* | 7440-96-5 | 1-10% |
| Nickel* | 7440-02-0 | 0-5% |

* This includes all compounds of these elements.

**Section 302 Extremely Hazardous Substances (TPQ):** None

**California Proposition 65:** This product contains chromium, nickel and crystalline silica, which are known to the State of California to cause cancer.

**Canada:**

**Canadian WHMIS Classification:** Class D-2-A (Very Toxic Material causing other toxic effects)

This MSDS has been prepared according to the criteria of the Controlled Products Regulation (CPR) and the MSDS contains all of the information required by the CPR.

**EU Regulations:**

**EU RoHS:** Finished welds using Sandvik welding consumables are RoHS compliant. Sandvik Stainless Steel Welding Products contain Chromium. When welded Sandvik Stainless Steel Welding Products will produce Cr VI (hexavalent chrome), however, the weld deposit does not contain Cr VI as it will all be in the zero valent state or as Cr III as an oxide. Finished products manufactured using Sandvik Stainless Steel Welding Products will not contain Cr VI.

**EU SVHC**: These products do not contain substances identified as Substances of Very High Concern when sold. Hexavalent chromium may be produced during the welding process but is not present in the finished weld.

**International Chemical Inventories**

**US EPA Toxic Substances Control Act (TSCA) Status:** All of the components of this product are listed on the TSCA inventory or exempt.

**Australia:** All of the components in this product are listed on the Australian Inventory of Chemical Substances (AICS) or exempt.

**Canadian Environmental Protection Act:** All of the components in this product are listed on the Domestic Substances List (DSL) or exempt.

**China:** All of the components in this product are listed on the Inventory of Existing Chemical Substances in China (IECSC) or exempt.

**European Union:** All the components in this product are listed on the EINECS inventory or exempt.

**Japan:** All of the components in this product are listed on the Japanese Existing and New Chemical Substances (ENCS) inventory or exempt.

**Korea:** All of the components in this product are listed on the Korean Existing Chemicals List (KECL) or exempt**.**

**New Zealand:** All of the components in this product are listed on the New Zealand Inventory of Chemicals (NZIoC) or exempt**.**

**Philippines:** All of the components of this product are listed on the Philippines Inventory of Chemicals and Chemical Substances (PICCS) or exempt.

**Taiwan:** All of the components of this product are listed on the National Existing Chemical Inventory (NECI) in Taiwan or exempt.

## SECTION 16: OTHER INFORMATION

Product Identifiers:
34SF, NiCr-3SF, NiCu-7SF, 37S, 59S, 34WF, 35WF, NiCr-3WF, NiCu-7SF, 47S, 49S, 57S, 31S, 15W, 15WGB, 10SWQ, 37S, 34S, 16S, 105W, 505W, 52W, 485

SDS Date of Preparation/Revision: January 1, 2014
SDS Revision History: Convert to GHS. Changes to all Sections.

EU Classes and Risk Phrases for Reference (See Sections 2 and 3)
Carc. Cat. 1 Carcinogen Category 1
Carc. Cat. 3 Carcinogen Category 3
Muta. Cat. 2 Mutagen Category 2
Repr. Cat. 3 Reproductive Toxicity Category 3
T Toxic
T+ Very Toxic
C Corrosive
Xi Irritant
Xn Harmful
N Dangerous for the Environment
R20/22 Harmful by inhalation and if swallowed.
R24/25 Toxic in contact with skin and if swallowed.
R26 Very toxic by inhalation.
R35 Causes severe burns.
R38 Irritating to skin.
R37/38 Irritating to respiratory system and skin.
R40 Possible risk of cancer.
R41 Risk of serious damage to eyes.
R42/43 May cause sensitization by inhalation and skin contact.
R43 May cause sensitization by skin contact.
R45 May cause cancer.
R46 May cause heritable genetic damage.
R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R48/20/22 Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R62 Possible risk of impaired fertility.
R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

CLP/GHS Classification and H Phrases for Reference (See Section 3)
Met Corr 1 Corrosive to Metals Category 1
Press Gas Pressurized Gas
Flam Gas 1 Flammable Gas Category 1
Oxid Gas 1 Oxidizing Gas Category 1
Acute Tox. 1 Acute Toxicity Category 1
Acute Tox. 2 Acute Toxicity Category 2
Acute Tox. 3 Acute Toxicity Category 3
Acute Tox. 4 Acute Toxicity Category 4
Eye Damage Category 1
Eye Irritation Category 2
Skin Corr 1A Skin Corrosion Category 1A
Skin Corr 1B Skin Corrosion Category 1B
Skin Irrit. 2 Skin Irritation Category 2
Resp Sens 1 Respiratory Sensitization Category 1
Skin Sens 1 Skin Sensitization Category 1
Repr 1A Reproductive Toxicity Category 1A
Repr 2 Reproductive Toxicity Category 2
Muta 1B Germ Cell Mutagenicity Category 1B
Carc 1A Carcinogenicity Category 1A
Carc 1B Carcinogenicity Category 1B
Carc 1 Carcinogenicity Category 1
Carc 2 Carcinogenicity Category 2
STOT SE 3 Specific Target Organ Toxicity – Single Exposure Category 3
STOT RE 1 Specific Target Organ Toxicity – Repeat Exposure Category 1
STOT RE 2 Specific Target Organ Toxicity – Repeat Exposure Category 2
Aquatic Acute 1 Aquatic Acute Toxicity Category 1
Aquatic Chronic 1 Aquatic Chronic Toxicity Category 1

H220 Extremely flammable gas
H270 May cause or intensify fire; oxidizer
H290 May be corrosive to metals.
H280 Contains gas under pressure; may explode if heated
H301 Toxic if swallowed.
H310 Fatal in contact with skin.
H314 Causes severe skin burns and eye damage.
H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H318 Causes serious eye damage.
H319 Causes serious eye irritation.
H330 Fatal if inhaled.
H331 Toxic if inhaled
H332 Harmful if inhaled.
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H335 May cause respiratory irritation.
H340 May cause genetic defects.
H350 May cause cancer.
H351 Suspected of causing cancer.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H373 May cause damage to organs through prolonged or repeated exposure.
H400 Very toxic to aquatic life.
H410 Very toxic to aquatic life with long lasting results.

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