

# SAFETY DATA SHEET

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name:** Fleetweld® 35

**Product Size:** 5/32" (4.0 mm)

**Other means of identification**

**SDS number:** 200000000582

**Recommended use and restriction on use**

**Recommended use:** SMAW (Shielded Metal Arc Welding)

**Restrictions on use:** Not known. Read this SDS before using this product.

**Manufacturer/Importer/Supplier/Distributor Information**

**Company Name:** The Lincoln Electric Company  
**Address:** 22801 Saint Clair Avenue  
Cleveland, Ohio 44117  
USA  
**Telephone:** +1 (216) 481-8100  
**Contact Person:** Safety Data Sheet Questions: [www.lincolnelectric.com/sds](http://www.lincolnelectric.com/sds)  
Arc Welding Safety Information: [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety)  
SDS@lincolnelectric.com

**Company Name:** Lincoln Electric Mexicana S.A. de C.V.  
**Address:** Calz. Azcapotzalco La Villa No. 869  
Delegacion Azcapotzalco 02300 Mexico, D.F.  
Mexico  
**Telephone:** +1 52 55 5063 0030  
**Contact Person:** Safety Data Sheet Questions: [www.lincolnelectric.com/sds](http://www.lincolnelectric.com/sds)  
Arc Welding Safety Information: [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety)  
SDS@lincolnelectric.com

**Company Name:** The Lincoln Electric Company of Canada LP  
**Address:** 179 Wicksteed Avenue  
Toronto, Ontario M4G 2B9  
Canada  
**Telephone:** +1 (416) 421-2600  
**Contact Person:** Safety Data Sheet Questions: [www.lincolnelectric.com/sds](http://www.lincolnelectric.com/sds)  
Arc Welding Safety Information: [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety)  
SDS@lincolnelectric.com

**Emergency telephone number:**

USA/Canada/Mexico +1 (888) 609-1762  
Americas/Europe +1 (216) 383-8962  
Asia Pacific +1 (216) 383-8966  
Middle East/Africa +1 (216) 383-8969

**3E Company Access Code:** 333988

## 2. HAZARDS IDENTIFICATION

Classified according to the criteria of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), The United States Occupational Safety and Health Administration's Hazard Communication Standard (29 CFR 1910.1200), Canada's Hazardous Product Regulations and Mexico's Harmonized System for the Identification and Communication of Hazards and Risks from Hazardous Chemicals in the Workplace.

**Hazard Classification** Not classified as hazardous according to applicable GHS hazard classification criteria.

**Label Elements**

**Hazard Symbol:** No symbol  
**Signal Word:** No signal word.  
**Hazard Statement:** Not applicable  
**Precautionary Statements:** Not applicable

**Other hazards which do not result in GHS classification:** Electrical Shock can kill. If welding must be performed in damp locations or with wet clothing, on metal structures or when in cramped positions such as sitting, kneeling or lying, or if there is a high risk of unavoidable or accidental contact with work piece, use the following equipment: Semiautomatic DC Welder, DC Manual (Stick) Welder, or AC Welder with Reduced Voltage Control.

Arc rays can injure eyes and burn skin. Welding arc and sparks can ignite combustibles and flammable materials. Overexposure to welding fumes and gases can be hazardous. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using this product. Refer to Section 8.

**Substance(s) formed under the conditions of use:** The welding fume produced from this welding electrode may contain the following constituent(s) and/or their complex metallic oxides as well as solid particles or other constituents from the consumables, base metal, or base metal coating not listed below.

Chemical Identity	CAS-No.
Carbon dioxide	124-38-9
Carbon monoxide	630-08-0
Nitrogen dioxide	10102-44-0
Ozone	10028-15-6
Manganese	7439-96-5

**3. COMPOSITION / INFORMATION ON INGREDIENTS**

**Reportable Hazardous Ingredients Mixtures**

Chemical Identity	CAS number	Content in percent (%)*
Iron	7439-89-6	80 - <100%
Cellulose, pulp	65996-61-4	1 - <5%
Sodium silicate	1344-09-8	1 - <5%
Titanium dioxide (naturally occurring)	13463-67-7	1 - <5%
Manganese	7439-96-5	0.1 - <1%
Magnesite	546-93-0	0.1 - <1%
Titanium dioxide (synthetic)	13463-67-7	0.1 - <1%
Iron oxide	1309-37-1	0.1 - <1%
Potassium oxide	12136-45-7	0.1 - <1%

Potassium carbonate	584-08-7	0.1 - <1%
Carbon	7440-44-0	0.1 - <1%

\* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

**Composition Comments:** The term “Hazardous Ingredients” should be interpreted as a term defined in Hazard Communication standards and does not necessarily imply the existence of a welding or allied process hazard. The product may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 and 8 for more information.

**4. FIRST AID MEASURES**

**Ingestion:** Avoid hand, clothing, food, and drink contact with fluxes, metal fume or powder which can cause ingestion of particulate during hand to mouth activities such as drinking, eating, smoking, etc. If ingested, do not induce vomiting. Contact a poison control center. Unless the poison control center advises otherwise, wash out mouth thoroughly with water. If symptoms develop, seek medical attention at once.

**Inhalation:** Move to fresh air if breathing is difficult. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.

**Skin Contact:** Remove contaminated clothing and wash the skin thoroughly with soap and water. For reddened or blistered skin, or thermal burns, obtain medical assistance at once.

**Eye contact:** Dust or fume from this product should be flushed from the eyes with copious amounts of clean, tepid water until transported to an emergency medical facility. Do not allow victim to rub or keep eyes tightly closed. Obtain medical assistance at once.

Arc rays can injure eyes. If exposed to arc rays, move victim to dark room, remove contact lenses as necessary for treatment, cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

**Most important symptoms/effects, acute and delayed**

**Symptoms:** Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. Refer to Section 11 for more information.

**Hazards:** The hazards associated with welding and its allied processes such as soldering and brazing are complex and may include physical and health hazards such as but not limited to electric shock, physical strains, radiation burns (eye flash), thermal burns due to hot metal or spatter and potential health effects of overexposure to fumes, gases or dusts potentially generated during the use of this product. Refer to Section 11 for more information.

**Indication of immediate medical attention and special treatment needed**

**Treatment:** Treat symptomatically.

**5. FIRE-FIGHTING MEASURES**

**General Fire Hazards:** As shipped, this product is nonflammable. However, welding arcs, sparks, open flames, and hot surfaces associated with welding, brazing, and soldering can ignite combustible and flammable materials. Implement fire protection measures according to the place of use risk assessment, local regulations, and all relevant safety standards. Read and understand the American National Standard Z49.1, "Safety in Welding, Cutting, and Allied Processes," and the National Fire Protection Association NFPA 51B, "Standard for Fire Prevention during Welding, Cutting, and Other Hot Work," before using this product.

**Suitable (and unsuitable) extinguishing media**

**Suitable extinguishing media:** As shipped, the product will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.

**Unsuitable extinguishing media:** Do not use water jet as an extinguisher, as this will spread the fire.

**Specific hazards arising from the chemical:** Welding arc and sparks can ignite combustibles and flammable products.

**Special protective equipment and precautions for fire-fighters**

**Special fire-fighting procedures:** Use standard firefighting procedures and consider the hazards of other involved materials.

**Special protective equipment for fire-fighters:** Selection of respiratory protection for fire fighting: follow the general fire precautions indicated in the workplace. Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

**6. ACCIDENTAL RELEASE MEASURES**

**Personal precautions, protective equipment and emergency procedures:** If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8.

**Methods and material for containment and cleaning up:** Absorb with sand or other inert absorbent. Stop the flow of material, if this is without risk. Clean up spills immediately, observing precautions in the personal protective equipment in Section 8. Avoid generating dust. Prevent product from entering any drains, sewers or water sources. Refer to Section 13 for proper disposal.

**Environmental Precautions:** Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water sources or sewer. Environmental manager must be informed of all major spillages.

**7. HANDLING AND STORAGE**

**Precautions for safe handling:** Prevent formation of dust. Provide appropriate exhaust ventilation at places where dust is formed. Read and understand the manufacturer's instruction and the precautionary label on the product. Refer to Lincoln Safety Publications at [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety), ISO/TR 18786:2014, ISO/TR 13392:2014, American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" published by the American Welding Society, <http://pubs.aws.org> and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, [www.gpo.gov](http://www.gpo.gov).

**Conditions for safe storage,** Store in closed original container in a dry place. Store in accordance with

including any incompatibilities: local/regional/national regulations. Store away from incompatible materials.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### Control Parameters

#### Occupational Exposure Limits: US

Chemical Identity	Type	Exposure Limit Values	Source
Titanium dioxide (naturally occurring)	IDLH	5,000 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Titanium dioxide (naturally occurring) - Total dust.	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Titanium dioxide (naturally occurring) - Respirable fraction.	TWA	5 mg/m3	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (naturally occurring) - Total dust.	TWA	50 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (naturally occurring) - Respirable fraction.	TWA	15 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (naturally occurring) - Total dust.	TWA	15 mg/m3	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (naturally occurring) - Respirable finescale particles	TWA	2.5 mg/m3	US. ACGIH Threshold Limit Values (01 2022)
Titanium dioxide (naturally occurring) - Respirable nanoscale particles	TWA	0.2 mg/m3	US. ACGIH Threshold Limit Values (01 2022)
Manganese - Fume. - as Mn	Ceiling	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	STEL	3 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Manganese	IDLH	500 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	US. ACGIH Threshold Limit Values (01 2025)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	US. ACGIH Threshold Limit Values (01 2025)
Magnesite - Total dust.	TWA	15 mg/m3	US. OSHA Table Z-3 (29 CFR 1910.1000) (09 2016)
	TWA	50 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (09 2016)
Magnesite - Respirable particles	TWA	3 mg/m3	US. ACGIH Threshold Limit Values (01 2021)
Magnesite - Inhalable particles.	TWA	10 mg/m3	US. ACGIH Threshold Limit Values (01 2021)
Magnesite - Respirable fraction.	TWA	15 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (09 2016)
	TWA	5 mg/m3	US. OSHA Table Z-3 (29 CFR 1910.1000) (09 2016)
Magnesite - Total	REL	10 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Magnesite - Respirable.	REL	5 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Magnesite - Total dust.	PEL	15 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Magnesite - Respirable fraction.	PEL	5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)

Titanium dioxide (synthetic)	IDLH	5,000 mg/m <sup>3</sup>	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Titanium dioxide (synthetic) - Total dust.	PEL	15 mg/m <sup>3</sup>	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Titanium dioxide (synthetic) - Respirable fraction.	TWA	5 mg/m <sup>3</sup>	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (synthetic) - Total dust.	TWA	50 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (synthetic) - Respirable fraction.	TWA	15 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (synthetic) - Total dust.	TWA	15 mg/m <sup>3</sup>	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Titanium dioxide (synthetic) - Respirable finescale particles	TWA	2.5 mg/m <sup>3</sup>	US. ACGIH Threshold Limit Values (01 2022)
Titanium dioxide (synthetic) - Respirable nanoscale particles	TWA	0.2 mg/m <sup>3</sup>	US. ACGIH Threshold Limit Values (01 2022)
Iron oxide - Dust and fume. - as Fe	REL	5 mg/m <sup>3</sup>	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Iron oxide - Fume.	PEL	10 mg/m <sup>3</sup>	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Iron oxide - Respirable fraction.	TWA	5 mg/m <sup>3</sup>	US. ACGIH Threshold Limit Values (01 2010)
Iron oxide - Total dust.	TWA	50 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Iron oxide - Respirable fraction.	TWA	5 mg/m <sup>3</sup>	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
	TWA	15 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Iron oxide - Total dust.	TWA	15 mg/m <sup>3</sup>	US. OSHA Table Z-3 (29 CFR 1910.1000) (03 2016)
Iron oxide	IDLH	2,500 mg/m <sup>3</sup>	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Carbon - Total dust.	TWA	50 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (2000)
Carbon - Respirable fraction.	TWA	5 mg/m <sup>3</sup>	US. OSHA Table Z-3 (29 CFR 1910.1000) (2000)
Carbon - Respirable particles	TWA	3 mg/m <sup>3</sup>	US. ACGIH Threshold Limit Values (03 2014)
Carbon - Total dust.	TWA	15 mg/m <sup>3</sup>	US. OSHA Table Z-3 (29 CFR 1910.1000) (2000)
Carbon - Respirable fraction.	TWA	15 millions of particles per cubic foot of air	US. OSHA Table Z-3 (29 CFR 1910.1000) (2000)
Carbon - Inhalable particles.	TWA	10 mg/m <sup>3</sup>	US. ACGIH Threshold Limit Values (03 2014)
Carbon - Total dust.	PEL	15 mg/m <sup>3</sup>	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
Carbon - Respirable fraction.	PEL	5 mg/m <sup>3</sup>	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)

**Occupational Exposure Limits: Canada**

Chemical Identity	Type	Exposure Limit Values	Source
Titanium dioxide (naturally occurring)	TWA	10 mg/m <sup>3</sup>	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Titanium dioxide (naturally occurring) - Total dust.	TWA	10 mg/m <sup>3</sup>	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)

Titanium dioxide (naturally occurring) - Respirable fraction.	TWA	3 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
Titanium dioxide (naturally occurring)	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Titanium dioxide (naturally occurring) - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (09 2017)
Titanium dioxide (naturally occurring) - Respirable finescale particles	TWA	2.5 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2022)
Titanium dioxide (naturally occurring) - Respirable nanoscale particles	TWA	0.2 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2022)
Titanium dioxide (naturally occurring)	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Manganese - as Mn	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (06 2015)
	TWA	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (08 2020)
Manganese - Respirable. - as Mn	TWA	0.02 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (06 2022)
Manganese - as Mn	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Manganese - Inhalable - as Mn	TWA	0.1 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (09 2024)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2025)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2025)
Manganese - Inhalable aerosol fraction	TWA	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (02 2024)
Manganese - Respirable aerosol fraction	TWA	0.05 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (02 2024)
Magnesite - Respirable fraction.	TWA	3 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (06 2020)
Magnesite - Respirable	TWA	3 mg/m3	Canada. Ontario OELs. (Control of

particles			Exposure to Biological or Chemical Agents), as amended (01 2020)
	TWA	3 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (01 2019)
Magnesite - Total	TWA	10 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (08 2020)
Magnesite - Inhalable particles.	TWA	10 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2021)
Magnesite - Total dust.	TWA	10 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (06 2020)
Magnesite - Respirable particles	TWA	3 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2021)
Magnesite - Inhalable particles.	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)
Magnesite	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Magnesite - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (09 2017)
Magnesite	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Magnesite - Respirable fraction.	TWA	3 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)
Magnesite - Inhalable fraction.	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)
Titanium dioxide (synthetic)	TWA	10 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
Titanium dioxide (synthetic) - Total dust.	TWA	10 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
Titanium dioxide (synthetic) - Respirable fraction.	TWA	3 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
Titanium dioxide (synthetic)	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Titanium dioxide (synthetic) - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (09 2017)
Titanium dioxide (synthetic) - Respirable finescale particles	TWA	2.5 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2022)
Titanium dioxide (synthetic) - Respirable nanoscale particles	TWA	0.2 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2022)
Titanium dioxide (synthetic)	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety

			Regulations, 1996, Table 21), as amended (04 2021)
Iron oxide - Dust. - as Fe	TWA	5 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
Iron oxide - Fume. - as Fe	STEL	10 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	5 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
Iron oxide	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
Iron oxide - Respirable fraction.	TWA	5 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
Iron oxide - Dust and fume. - as Fe	TWA	5 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (09 2017)
Iron oxide - Respirable fraction.	TWA	5 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)
Iron oxide - Dust and fume. - as Fe	15 MIN ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Iron oxide - Respirable.	TWA	5 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (08 2020)
Iron oxide - Dust and fume. - as Fe	8 HR ACL	5 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Iron oxide	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Carbon - Respirable particles	TWA	3 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)
Carbon - Inhalable particles.	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)
Carbon - Total dust.	TWA	10 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (06 2020)
Carbon - Respirable fraction.	TWA	3 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (06 2020)
Carbon - Inhalable particles.	TWA	10 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Carbon - Respirable particles	TWA	3 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	3 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
Carbon - Total	TWA	10 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (08 2020)
Carbon - Total dust.	TWA	10 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (09 2017)

Carbon - Inhalable fraction.	15 MIN ACL	20 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Carbon - Respirable fraction.	15 MIN ACL	6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Carbon - Inhalable fraction.	8 HR ACL	10 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Carbon - Respirable fraction.	8 HR ACL	3 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Carbon - Inhalable fraction.	TWA	10 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)
Carbon - Respirable fraction.	TWA	3 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (01 2020)

### Occupational Exposure Limits: Mexico

Chemical Identity	Type	Exposure Limit Values	Source
Iron - as Fe	VLE-PPT	1 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Titanium dioxide (naturally occurring)	VLE-PPT	10 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Manganese - as Mn	VLE-PPT	0.2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Magnesite - Respirable fraction.	VLE-PPT	3 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Magnesite - Inhalable fraction.	VLE-PPT	10 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Titanium dioxide (synthetic)	VLE-PPT	10 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Iron oxide - Respirable fraction.	VLE-PPT	5 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Carbon - Inhalable fraction.	VLE-PPT	10 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Carbon - Respirable fraction.	VLE-PPT	3 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)

### Additional exposure limits under the conditions of use: US

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	TWA	5,000 ppm	US. ACGIH Threshold Limit Values (12 2010)
	STEL	30,000 ppm	US. ACGIH Threshold Limit Values (12 2010)

				2010)
	PEL	5,000 ppm	9,000 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	30,000 ppm	54,000 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	REL	5,000 ppm	9,000 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	IDLH	40,000 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Carbon monoxide	TWA	25 ppm		US. ACGIH Threshold Limit Values (12 2010)
	PEL	50 ppm	55 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL	35 ppm	40 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	Ceil_Time	200 ppm	229 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	IDLH	1,200 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Nitrogen dioxide	TWA	0.2 ppm		US. ACGIH Threshold Limit Values (02 2012)
	Ceiling	5 ppm	9 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	STEL	1 ppm	1.8 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	IDLH	20 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
	IDLH	13 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Ozone	PEL	0.1 ppm	0.2 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	Ceil_Time	0.1 ppm	0.2 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	TWA	0.05 ppm		US. ACGIH Threshold Limit Values (03 2014)
	TWA	0.10 ppm		US. ACGIH Threshold Limit Values (03 2014)
	TWA	0.08 ppm		US. ACGIH Threshold Limit Values (03 2014)
	IDLH	5 ppm		US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
	TWA	0.20 ppm		US. ACGIH Threshold Limit Values (02 2020)
Manganese - Fume. - as Mn	Ceiling		5 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	REL		1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
	STEL		3 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards, as amended (2005)
Manganese	IDLH		500 mg/m3	US. NIOSH. Immediately Dangerous to Life or Health (IDLH) Values (10 2017)
Manganese - Respirable fraction. - as Mn	TWA		0.02 mg/m3	US. ACGIH Threshold Limit Values (01 2025)
Manganese - Inhalable fraction. - as Mn	TWA		0.1 mg/m3	US. ACGIH Threshold Limit Values (01 2025)

**Additional exposure limits under the conditions of use: Canada**

Chemical Identity	Type	Exposure Limit Values		Source
Carbon dioxide	STEL	30,000 ppm	54,000 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	5,000 ppm	9,000 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table

				2), as amended (07 2009)
	TWA	5,000 ppm		Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	STEL	15,000 ppm		Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	5,000 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
	STEL	30,000 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
	STEL	30,000 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	TWA	5,000 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	8 HR ACL	5,000 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	30,000 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	5,000 ppm	9,000 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (09 2017)
	STEL	30,000 ppm	54,000 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (09 2017)
Carbon monoxide	TWA	25 ppm	29 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	25 ppm		Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	STEL	100 ppm		Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	25 ppm		Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2011)
	TWA	25 ppm		Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (07 2010)
	8 HR ACL	25 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	190 ppm		Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	35 ppm		Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (04 2022)
	STEL	175 ppm		Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (04 2022)
Nitrogen dioxide	STEL	5 ppm	9.4 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	3 ppm	5.6 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table

			2), as amended (07 2009)
	CEILING	1 ppm	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	0.2 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2012)
	STEL	5 ppm	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	TWA	3 ppm	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (11 2010)
	8 HR ACL	3 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	5 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	3 ppm 5 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (04 2022)
Ozone	STEL	0.3 ppm 0.6 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	0.1 ppm 0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (07 2009)
	TWA	0.05 ppm	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	0.1 ppm	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	0.08 ppm	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	0.2 ppm	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (07 2007)
	TWA	0.1 ppm 0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (07 2010)
	STEL	0.3 ppm 0.6 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (07 2010)
	15 MIN ACL	0.15 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	8 HR ACL	0.05 ppm	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	CEILING	0.1 ppm 0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (12 2008)
	TWA	0.05 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
	TWA	0.08 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (03 2014)
	TWA	0.10 ppm	Canada. Manitoba OELs (Reg. 217/2006,

			The Workplace Safety And Health Act), as amended (03 2014)
	TWA	0.20 ppm	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (02 2020)
Manganese - as Mn	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	15 MIN ACL	0.6 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (05 2009)
	TWA	0.2 mg/m3	Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents), as amended (06 2015)
	TWA	0.2 mg/m3	Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2), as amended (08 2020)
Manganese - Respirable. - as Mn	TWA	0.02 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (06 2022)
Manganese - as Mn	8 HR ACL	0.2 mg/m3	Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21), as amended (04 2021)
Manganese - Inhalable - as Mn	TWA	0.1 mg/m3	Canada. British Columbia OELs: Table of Exposure Limits for Chemical Biological Substances (Workers Compensation Board); as amended (09 2024)
Manganese - Inhalable fraction. - as Mn	TWA	0.1 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2025)
Manganese - Respirable fraction. - as Mn	TWA	0.02 mg/m3	Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act), as amended (01 2025)
Manganese - Inhalable aerosol fraction	TWA	0.2 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (02 2024)
Manganese - Respirable aerosol fraction	TWA	0.05 mg/m3	Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety), as amended (02 2024)

**Additional exposure limits under the conditions of use: Mexico**

Chemical Identity	Type	Exposure Limit Values	Source
Carbon dioxide	VLE-CT	30,000 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
	VLE-PPT	5,000 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Carbon monoxide	VLE-PPT	25 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Nitrogen dioxide	VLE-PPT	0.2 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Ozone	VLE-P	0.1 ppm	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended (04 2014)
Manganese - as Mn	VLE-PPT	0.2 mg/m3	Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control), as amended

(04 2014)

**Appropriate Engineering Controls**

**Ventilation:** Use enough ventilation and local exhaust at the arc, flame or heat source to keep the fumes and gases from the worker's breathing zone and the general area. Train the operator to keep their head out of the fumes. **Keep exposure as low as possible.**

**Individual protection measures, such as personal protective equipment (PPE)****General information:**

**Exposure Guidelines:** To reduce the potential for overexposure, use controls such as adequate ventilation and personal protective equipment (PPE). Overexposure refers to exceeding applicable local limits, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) or the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PELs). Workplace exposure levels should be established by competent industrial hygiene assessments. Unless exposure levels are confirmed to be below the applicable local limit, TLV or PEL, whichever is lower, respirator use is required. Absent these controls, overexposure to one or more compound constituents, including those in the fume or airborne particles, may occur resulting in potential health hazards. According to the ACGIH, TLVs and Biological Exposure Indices (BEIs) "represent conditions under which ACGIH believes that nearly all workers may be repeatedly exposed without adverse health effects." The ACGIH further states that the TLV-TWA should be used as a guide in the control of health hazards and should not be used to indicate a fine line between safe and dangerous exposures. See Section 10 for information on constituents which have some potential to present health hazards. Welding consumables and materials being joined may contain chromium as an unintended trace element. Materials that contain chromium may produce some amount of hexavalent chromium (CrVI) and other chromium compounds as a byproduct in the fume. In 2018, the American Conference of Governmental Industrial Hygienists (ACGIH) lowered the Threshold Limit Value (TLV) for hexavalent chromium from 50 micrograms per cubic meter of air (50 µg/m<sup>3</sup>) to 0.2 µg/m<sup>3</sup>. At these new limits, CrVI exposures at or above the TLV may be possible in cases where adequate ventilation is not provided. CrVI compounds are on the IARC and NTP lists as posing a lung cancer and sinus cancer risk. Workplace conditions are unique and welding fume exposures levels vary. Workplace exposure assessments must be conducted by a qualified professional, such as an industrial hygienist, to determine if exposures are below applicable limits and to make recommendations when necessary for preventing overexposures.

**Eye/face protection:**

Wear helmet or use face shield with filter lens shade number 12 or darker for open arc processes – or follow the recommendations as specified in ANSI Z49.1, Section 4; ISO/TR 18786:2014, based on your process and settings. No specific lens shade recommendation for submerged arc or electroslag processes. Shield others by providing appropriate screens and flash goggles.

**Skin Protection****Hand Protection:**

Wear protective gloves. Suitable gloves can be recommended by the glove supplier.

**Other:**

**Protective Clothing:** Wear hand, head, and body protection which help to prevent injury from radiation, open flames, hot surfaces, sparks and electrical shock. See Z49.1, ISO/TR 18786:2014, ISO/TR 13392:2014. At a minimum, this includes welder's gloves and a protective face shield when welding, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing when welding, brazing and soldering.

Wear dry gloves free of holes or split seams. Train the operator not to permit electrically live parts or electrodes from contacting the skin . . . or clothing or gloves if they are wet. Insulate yourself from the work piece and ground using dry plywood, rubber mats or other dry insulation.

**Respiratory Protection:**

Keep your head out of fumes. Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area. An approved respirator should be used unless exposure assessments are below applicable exposure limits.

Workplace exposure levels should be established by competent industrial hygiene assessments. Unless exposure levels are confirmed to be below the applicable local limit, TLV or PEL, whichever is lower, respirator use is required.

**Hygiene measures:**

Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Determine the composition and quantity of fumes and gases to which workers are exposed by taking an air sample from inside the welder's helmet if worn or in the worker's breathing zone. Improve ventilation if exposures are not below limits. See ISO 10882-1:2024; ANSI/AWS F1.1, F1.2, F1.3 and F1.5, available from the American Welding Society, [www.aws.org](http://www.aws.org).

**9. PHYSICAL AND CHEMICAL PROPERTIES**

<b>Appearance:</b>	Steel rod with extruded flux coating.
<b>Physical state:</b>	solid
<b>Form:</b>	solid
<b>Color:</b>	No data available.
<b>Odor:</b>	No data available.
<b>Odor threshold:</b>	No data available.
<b>pH:</b>	No data available.
<b>Melting point/freezing point:</b>	No data available.
<b>Initial boiling point and boiling range:</b>	No data available.
<b>Flash Point:</b>	No data available.
<b>Evaporation rate:</b>	No data available.
<b>Flammability (solid, gas):</b>	No data available.
<b>Upper/lower limit on flammability or explosive limits</b>	
<b>Flammability limit - upper (%):</b>	No data available.
<b>Flammability limit - lower (%):</b>	No data available.
<b>Explosive limit - upper:</b>	No data available.
<b>Explosive limit - lower:</b>	No data available.
<b>Vapor pressure:</b>	No data available.
<b>Vapor density:</b>	No data available.
<b>Density:</b>	No data available.
<b>Relative density:</b>	No data available.
<b>Solubility(ies)</b>	
<b>Solubility in water:</b>	No data available.
<b>Solubility (other):</b>	No data available.
<b>Partition coefficient (n-</b>	No data available.

octanol/water):

**Auto-ignition temperature:** No data available.

**Decomposition temperature:** No data available.

**Viscosity:** No data available.

## 10. STABILITY AND REACTIVITY

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

**Chemical Stability:** Material is stable under normal conditions.

**Possibility of hazardous reactions:** None under normal conditions.

**Conditions to avoid:** Avoid heat or contamination.

**Incompatible Materials:** Strong acids. Strong oxidizing substances. Strong bases.

**Hazardous Decomposition Products:** Fumes and gases from welding and its allied processes such as brazing and soldering cannot be classified simply. The composition and quantity of both are dependent upon the metal to which the joining or hot work is applied, the process, procedure - and where applicable - the electrode or consumable 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 or worked (such as paint, plating, or galvanizing), the number of operators and the volume of the work area, the quality and amount of ventilation, the position of the operator'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.)

In cases where an electrode or other applied material is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients 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. Reasonably expected fume constituents produced during arc welding and brazing include the oxides of iron, manganese and other metals present in the welding consumable or base metal. Hexavalent chromium compounds may be in the welding or brazing fume of consumables or base metals which contain chromium. Gaseous and particulate fluoride may be in the fume of consumables or flux materials which contain fluoride. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc associated with welding.

## 11. TOXICOLOGICAL INFORMATION

**General information:**

The International Agency for Research on Cancer (IARC) has determined welding fumes and ultraviolet radiation from welding are carcinogenic to humans (Group 1). According to IARC, welding fumes cause cancer of the lung and positive associations have been observed with cancer of the kidney. Also according to IARC, ultraviolet radiation from welding causes ocular melanoma. IARC identifies gouging, brazing, carbon arc or plasma arc cutting, and soldering as processes closely related to welding. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using this product.

**Information on likely routes of exposure**

- Inhalation:** Potential chronic health hazards related to the use of welding consumables are most applicable to the inhalation route of exposure. Refer to Inhalation statements in Section 11.
- Skin Contact:** Arc rays can burn skin. Skin cancer has been reported.
- Eye contact:** Arc rays can injure eyes.
- Ingestion:** Health injuries from ingestion are not known or expected under normal use.

**Symptoms related to the physical, chemical and toxicological characteristics**

- Inhalation:** Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects.

**Information on toxicological effects****Acute toxicity (list all possible routes of exposure)****Oral**

- Product:** Not classified
- Specified substance(s):**
- |   |   |
|---|---|
| Iron                                      | LD 50 (Rat): 98.6 g/kg LD 50 (Rat): 98.6 g/kg     |
| Sodium silicate                           | LD 50 (Rat): 1.1 g/kg LD 50 (Rat): 3,400 mg/kg    |
| Titanium dioxide<br>(naturally occurring) | LD 50 (Rat): > 5,000 mg/kg                        |
| Manganese                                 | LD 50 (Rat): > 2,000 mg/kg                        |
| Magnesite                                 | LD 50 (Rat): > 2,000 mg/kg                        |
| Titanium dioxide<br>(synthetic)           | LD 50 (Rat): > 5,000 mg/kg                        |
| Iron oxide                                | LD 50: > 5,000 mg/kg                              |
| Potassium oxide                           | LD 50 (Rat): > 2,000 mg/kg                        |
| Potassium carbonate                       | LD 50 (Rat): 1,870 mg/kg LD 50 (Rat): 2,000 mg/kg |
| Carbon                                    | LD 50 (Rat): > 2,000 mg/kg                        |

**Dermal**

- Product:** Not classified
- Specified substance(s):**
- |   |                                  |
|---|----------------------------------|
| Iron                                      | LD 50: 2,000 mg/kg               |
| Sodium silicate                           | LD 50 (Rat): > 5,000 mg/kg       |
| Titanium dioxide<br>(naturally occurring) | LD 50 (Hamster): >= 10,000 mg/kg |
| Titanium dioxide<br>(synthetic)           | LD 50 (Hamster): >= 10,000 mg/kg |
| Potassium oxide                           | LD 50: 5,000 mg/kg               |

Potassium carbonate LD 50 (Rabbit): > 2,000 mg/kg LD 50 (Rabbit): > 2,000 mg/kg

**Inhalation**

**Product:** Not classified  
**Specified substance(s):**  
 Iron LC 50): 2,070 mg/m3  
 Sodium silicate LC 50 (Rat, 4 h): > 2.06 mg/l  
 Titanium dioxide LC 50 (Rat, 4 h): 3.43 mg/l  
 (naturally occurring)  
 Manganese LC 50 (Rat, 4 h): > 5.14 mg/l  
 Titanium dioxide LC 50 (Rat, 4 h): 5.09 mg/l  
 (synthetic)  
 Iron oxide Discriminating dose: (Rat, 4 h): 5.05 mg/l  
 Potassium oxide LC 50): 86.96 mg/m3  
 Potassium carbonate LC 50 (Rat): > 4.96 mg/l  
 Carbon LC 100 (Rat, 1 h): 235 mg/l

**Repeated dose toxicity**

**Product:** Not classified  
**Specified substance(s):**  
 Manganese NOAEL (Rat(Female, Male), Inhalation): 0.5 µg/l Inhalation Experimental study, Key

**Skin Corrosion/Irritation**

**Product:** Not classified  
**Specified substance(s):**  
 Manganese in vivo (Rabbit, 24 - 72 h): Experimental study, Key

**Serious Eye Damage/Eye Irritation**

**Product:** Not classified

**Respiratory or Skin Sensitization**

**Product:** Not classified  
**Specified substance(s):**  
 Iron Skin sensitization:, in vivo (Guinea pig): Not sensitising  
 Titanium dioxide Skin sensitization:, in vivo (Guinea pig): Not sensitising  
 (naturally occurring)  
 Titanium dioxide Skin sensitization:, in vivo (Guinea pig): Not sensitising  
 (synthetic)  
 Iron oxide Skin sensitization:, in vivo (Guinea pig): Not sensitising  
 Potassium oxide Skin sensitization:, in vivo (Guinea pig): Not sensitising  
 Potassium carbonate Skin sensitization:, in vivo (Guinea pig): Not Classified

**Carcinogenicity**

**Product:** Arc rays: Skin cancer has been reported.

**IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:**

Titanium dioxide Overall evaluation: 2B. Possibly carcinogenic to humans.  
 (naturally occurring)  
 Titanium dioxide Overall evaluation: 2B. Possibly carcinogenic to humans.  
 (synthetic)

**US. National Toxicology Program (NTP) Report on Carcinogens:**

No carcinogenic components identified

**US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053), as amended:**

No carcinogenic components identified

**Germ Cell Mutagenicity****In vitro****Product:** Not classified**In vivo****Product:** Not classified**Reproductive toxicity****Product:** Not classified**Specific Target Organ Toxicity - Single Exposure****Product:** Not classified**Specific Target Organ Toxicity - Repeated Exposure****Product:** Not classified**Aspiration Hazard****Product:** Not classified**Other effects:**

Organic polymers may be used in the manufacture of various welding consumables. Overexposure to their decomposition byproducts may result in a condition known as polymer fume fever. Polymer fume fever usually occurs within 4 to 8 hours of exposure with the presentation of flu like symptoms, including mild pulmonary irritation with or without an increase in body temperature. Signs of exposure can include an increase in white blood cell count. Resolution of symptoms typically occurs quickly, usually not lasting longer than 48 hours.

**Symptoms related to the physical, chemical and toxicological characteristics under the condition of use****Inhalation:****Specified substance(s):**

Manganese

Overexposure to manganese fumes may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremor. This condition can be irreversible.

**Additional toxicological Information under the conditions of use:****Acute toxicity****Oral****Specified substance(s):**

Manganese

LD 50 (Rat, Female): &gt; 2,000 mg/kg

**Inhalation****Specified substance(s):**

Carbon dioxide

LC Lo (Human, 5 min): 90000 ppm

Carbon monoxide

LC 50 (Rat, 4 h): 1300 ppm

Gas: LC 50 (Rat, 4 h): 1807 ppm

Nitrogen dioxide

LC 50 (Rat, 4 h): 88 ppm

LC 50 (Mouse, 10 min): 1000 ppm

Ozone

LC Lo (Human, 30 min): 50 ppm

Gas: LC 50 (Rat, 4 h): 9 ppm

Manganese

Dust: LC 50 (Rat, 4 h): &gt; 5.14 mg/l

**Skin Corrosion/Irritation****Specified substance(s):**

Manganese

in vivo (Rabbit, 24 - 72 h): Experimental study, Key

**Other effects:**

**Specified substance(s):**

Carbon dioxide	Asphyxia
Carbon monoxide	Carboxyhemoglobinemia
Nitrogen dioxide	Lower respiratory tract irritation
Manganese	Blood Central nervous system Kidneys Respiratory system

**12. ECOLOGICAL INFORMATION**

**Ecotoxicity**

**Acute hazards to the aquatic environment:**

**Fish**

<b>Product:</b>	Not classified.
<b>Specified substance(s):</b>	
Iron	LC 50 (Pimephales promelas, 96 h): 14.4 mg/l
Sodium silicate	LC 50 (Danio rerio, 96 h): 3,185 mg/l
Titanium dioxide (naturally occurring)	LC 50 (Pimephales promelas, 96 h): > 1,000 mg/l
Manganese	LC 50 (Oncorhynchus mykiss, 96 h): > 3.6 mg/l
Magnesite	LC 50 (Pimephales promelas, 96 h): 2,120 mg/l
Titanium dioxide (synthetic)	LC 50 (Oryzias latipes, 96 h): 155 mg/l
Iron oxide	LC 50 (Oncorhynchus mykiss, 96 h): 18.29 mg/l
Potassium oxide	LC 50 (Various, 96 h): 16,062.827 mg/l
Potassium carbonate	LC 50 (Oncorhynchus mykiss, 96 h): 68 mg/l

**Aquatic Invertebrates**

<b>Product:</b>	Not classified.
<b>Specified substance(s):</b>	
Iron	EC 50 (Daphnia magna, 48 h): > 100 mg/l
Sodium silicate	EC 50 (Daphnia magna, 48 h): 1,700 mg/l
Titanium dioxide (naturally occurring)	EC 50 (Daphnia magna, 48 h): 19.3 mg/l
Manganese	EC 50 (Daphnia magna, 48 h): > 1.6 mg/l
Titanium dioxide (synthetic)	EC 50 (Daphnia magna, 48 h): 27.8 mg/l
Iron oxide	EC 50 (Daphnia magna, 48 h): > 100 mg/l
Potassium oxide	EC 50 (Daphnia magna, 48 h): 660 mg/l
Potassium carbonate	EC 50 (Daphnia pulex, 48 h): 200 mg/l

**Chronic hazards to the aquatic environment:**

**Fish**

<b>Product:</b>	Not classified.
<b>Specified substance(s):</b>	
Iron oxide	EC 50 (Danio rerio): 36.06 mg/l

**Aquatic Invertebrates**

<b>Product:</b>	Not classified.
<b>Specified substance(s):</b>	
Iron	EC 50 (Leptophlebia marginata): 50.12 mg/l
Titanium dioxide (naturally occurring)	EC 50 (Daphnia magna): 66.1 mg/l
Titanium dioxide (synthetic)	NOEC (Daphnia magna): 30 mg/l
Iron oxide	NOEC (Arrenurus manubriator): 800 mg/l
Potassium oxide	NOEC (Daphnid): 273.134 mg/l

**Toxicity to Aquatic Plants**

**Product:** Not classified.

**Persistence and Degradability****Biodegradation**

**Product:** No data available.

**Bioaccumulative potential****Bioconcentration Factor (BCF)**

**Product:** No data available.

**Mobility in soil:** No data available.

**13. Disposal considerations**

**General information:** The generation of waste should be avoided or minimized whenever possible. When practical, recycle in an environmentally acceptable, regulatory compliant manner. Dispose of non-recyclable products in accordance with all applicable Federal, State, Provincial, and Local requirements.

**Disposal instructions:** Dispose of this material and its container to hazardous or special waste collection point.

**Contaminated Packaging:** Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

**14. TRANSPORT INFORMATION****DOT**

UN number or ID number:  
UN Proper Shipping Name: NOT DG REGULATED  
Transport Hazard Class(es)  
Class: NR  
Label(s): –  
Packing Group: –  
Marine Pollutant: No

**IMDG**

UN number or ID number:  
UN Proper Shipping Name: NOT DG REGULATED  
Transport Hazard Class(es)  
Class: NR  
Label(s): –  
EmS No.:  
Packing Group: –  
Marine Pollutant: No

**IATA**

UN number or ID number:  
Proper Shipping Name: NOT DG REGULATED  
Transport Hazard Class(es):  
Class: NR  
Label(s): –  
Packing Group: –  
Marine Pollutant: No

Cargo aircraft only: Allowed.

**TDG**

UN number or ID number:  
UN Proper Shipping Name: NOT DG REGULATED  
Transport Hazard Class(es)  
Class: NR  
Label(s): –  
Packing Group: –  
Marine Pollutant: No

**15. REGULATORY INFORMATION****US Federal Regulations****TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)**

None present or none present in regulated quantities.

**US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053), as amended**

None present or none present in regulated quantities.

**CERCLA Hazardous Substance List (40 CFR 302.4):****Chemical Identity**

Manganese

**Reportable quantity**

Included in the regulation but with no data values. See regulation for further details.

**Superfund Amendments and Reauthorization Act of 1986 (SARA)****Hazard categories**

Not classified

Not classified

**SARA 302 Extremely Hazardous Substance**

None present or none present in regulated quantities.

**SARA 304 Emergency Release Notification**

None present or none present in regulated quantities.

**SARA 311/312 Hazardous Chemical****Chemical Identity****Threshold Planning Quantity****SARA 313 (TRI Reporting)**

None present or none present in regulated quantities.

**Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)**

None present or none present in regulated quantities.

**Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):**

None present or none present in regulated quantities.

**US State Regulations****US. California Proposition 65**



**WARNING:** This product can expose you to chemicals including, Titanium dioxide (naturally occurring), Titanium dioxide (synthetic), which is [are] known to the State of California to cause cancer.

For more information go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

**WARNING:** 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 Section 25249.5 et seq.)

**WARNING:** Cancer and Reproductive Harm – [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

**US. New Jersey Worker and Community Right-to-Know Act**  
**Chemical Identity**

**US. Massachusetts RTK - Substance List**

No ingredient regulated by MA Right-to-Know Law present.

**US. Pennsylvania RTK - Hazardous Substances**  
**Chemical Identity**

Titanium dioxide (naturally occurring)

**US. Rhode Island RTK**

No ingredient regulated by RI Right-to-Know Law present.

**Canada Federal Regulations**

**List of Toxic Substances (CEPA, Schedule 1)**

**Chemical Identity**

Magnesite  
Iron oxide  
Carbon

**Export Control List (CEPA 1999, Schedule 3)**

Not Regulated

**National Pollutant Release Inventory (NPRI)**

**Canada. National Pollutant Release Inventory (NPRI) Substances, Part 5, VOCs with Additional Reporting Requirements**

NPRI PT5                      Not Regulated

**Canada. National Pollutant Release Inventory (NPRI) (Schedule 1, Parts 1-4)**

NPRI                              Not Regulated

**Greenhouse Gases**

Not Regulated

**Controlled Drugs and Substances Act**

CA CDSI                      Not Regulated

CA CDSII                      Not Regulated

CA CDSIII                      Not Regulated

CA CDSIV                      Not Regulated

CA CDSV                      Not Regulated

**Precursor Control Regulations**

Not Regulated

**Mexico. Substances subject to reporting for the pollutant release and transfer registry (PRTR):** Not applicable

**Inventory Status:**

Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	One or more components are not listed or are exempt from listing.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	One or more components are not listed or are exempt from listing.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	One or more components are not listed or are exempt from listing.
Japan Pharmacopoeia Listing:	One or more components are not listed or are exempt from listing.
Mexico INSQ:	One or more components are not listed or are exempt from listing.
Ontario Inventory:	On or in compliance with the inventory
Taiwan Chemical Substance Inventory:	On or in compliance with the inventory
Australia Industrial Chem. Act (AIC):	On or in compliance with the inventory
Switzerland New Subs Notified/Registered:	One or more components are not listed or are exempt from listing.
Thailand Existing Chemical Inv. List:	One or more components are not listed or are exempt from listing.
Vietnam National Chemical Inventory:	On or in compliance with the inventory

**16. OTHER INFORMATION****Definitions:**

**Revision Date:** 03/07/2026

**Further Information:** Additional information is available by request.

**Disclaimer:** The Lincoln Electric Company urges each end user and recipient of this SDS to study it carefully. See also [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety). If necessary, consult an industrial hygienist or other expert to understand this information and safeguard the environment and protect workers from potential hazards associated with the handling or use of this product. This information is believed to be accurate as of the revision date shown above. However, no warranty, expressed or implied, is given. Because the conditions or methods of use are beyond Lincoln Electric's control, we assume no liability resulting from the use of this product. Regulatory requirements are subject to change and may differ between various locations. Compliance with all applicable Federal, State, Provincial, and local laws and regulations remain the responsibility of the user.

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