THE MFG. CO. requests the users of these products to study this Material Safety Data Sheet (MSDS) and the product labels and become fully aware of the product hazards and safety information. To promote the safe use of these products a user should (1) notify and train its employees, agents and contractors concerning the information on this MSDS and any product hazards and safety information, (2) furnish this same information to each of its customers for these products, and (3) request that such customers notify and train their employees and customers, for these products, of the same product hazards and safety information.
IMPORTANT: This section covers the materials from which this product is manufactured. The fumes and gases produced during normal use of these products are covered in Section 3. The term HAZARDOUS should be interpreted as a term required and defined by Laws, Statutes or Regulations, and does not necessarily imply the existence of any hazard when the products are used as directed by THE MFG. CO..

EXPOSURE LIMITS
(TWA in mg/m³ unless noted)

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS No.</th>
<th>Form</th>
<th>ACGIH_TLV</th>
<th>OSHA_PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>7429-90-5</td>
<td>Total Dust, Fume</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Respirable</td>
<td>----</td>
<td>5</td>
</tr>
<tr>
<td>Beryllium</td>
<td>7440-41-7</td>
<td>All compounds as Be</td>
<td>0.002, 0.01 (STEL)</td>
<td>0.002, 0.005 (ceiling); 0.025 (30 min peak/8 hr shift)</td>
</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>Fume</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dust/mist</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Iron</td>
<td>7439-89-6</td>
<td>Oxide Dust &amp; Fume (as Fe)</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Magnesium</td>
<td>7439-95-4</td>
<td>Oxide Fume</td>
<td>10</td>
<td>15 (Total Particulate)</td>
</tr>
<tr>
<td>Manganese</td>
<td>7439-96-5</td>
<td>Dust Fume</td>
<td>0.2</td>
<td>5 (Ceiling)</td>
</tr>
<tr>
<td>Silicon</td>
<td>7440-21-3</td>
<td>Total Dust</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Respirable</td>
<td>----</td>
<td>5</td>
</tr>
<tr>
<td>Titanium</td>
<td>7440-32-6</td>
<td>Oxide</td>
<td>10</td>
<td>15 (Total Dust)</td>
</tr>
<tr>
<td>Zinc</td>
<td>7440-66-6</td>
<td>Total Oxide Dust</td>
<td>--</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Respirable Oxide Dust</td>
<td>2, 10 (STEL)</td>
<td>5</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>Metals</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr II compounds</td>
<td>----</td>
<td>0.5 as Cr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr III compounds</td>
<td>0.5 as Cr</td>
<td>0.5 as Cr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr VI compounds*</td>
<td>0.05 as Cr</td>
<td>0.1 (ceiling) as CrO₃</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr VI compounds**</td>
<td>0.01 as Cr</td>
<td>0.1 (ceiling) as CrO₃</td>
</tr>
</tbody>
</table>

*(water soluble) **(certain water insoluble)

Possible hazards during processing by welding, or arc spray metallizing

<table>
<thead>
<tr>
<th>Component</th>
<th>ACGIH_TLV</th>
<th>OSHA_PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone</td>
<td>0.05 ppm</td>
<td>0.1 ppm</td>
</tr>
<tr>
<td>Nitric oxide</td>
<td>25 ppm</td>
<td>25 ppm</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>3.5 ppm (STEL)</td>
<td>5 ppm (ceiling)</td>
</tr>
<tr>
<td>Welding fumes</td>
<td>5 mg/m³</td>
<td>---</td>
</tr>
</tbody>
</table>

3. HAZARDS INFORMATION

EMERGENCY OVERVIEW

Solid, silvery, odorless. Non-flammable as supplied. Small chips, fine turnings, and dust from processing may ignite readily. Explosion/fire hazards may be present when (See Sections 5, 7 and 10 for additional information):

- Dust or fines are dispersed in the air.
- Fines or dust are in contact with other metal oxides (e.g., rust).
- Chips, fines, or dust are in contact with water
- Molten aluminum is in contact with water/moisture or other metal oxides.

Dust or fume from processing can cause eye, skin, or upper respiratory tract irritation; metal fume fever; lung diseases and other systematic effects.
Medical conditions aggravated by exposure to the product:

Chronic lung disease, skin rashes, and asthma.
**IARC CLASSIFICATIONS:**

- **Group 1:** The agent is carcinogenic to humans.
  - There is sufficient evidence that a casual relationship existed between exposure to the agent and human cancer.

- **Group 2B:** The agent is possibly carcinogenic to humans.
  - Generally includes agents for which there is limited evidence in humans in the absence of sufficient evidence in experimental animals.

### 4. FIRST AID MEASURES

**EYES:** Flush eyes with plenty of water or saline for at least 15 minutes. Consult a physician.

**SKIN:** Wash thoroughly with soap and water. Consult a physician if irritation persists.

**INHALATION:** Remove to fresh air. Check for clear airway, breathing, and presence of pulse. Provide CPR for persons without pulse or respirations. Consult a physician immediately.

### 5. FIRE FIGHTING MEASURES

**FLAMMABLE PROPERTIES:**
- Non-flammable as shipped. Small chips and dust from processing may ignite readily.

**FIRE/EXPLOSION:** May be a potential hazard under the following conditions:

- Ducts or fines dispersed in the air can be explosive.
- Chips, fines and dust in contact with water can generate flammable/explosive hydrogen gas. These gases could present an explosion hazard in confined or poorly ventilated spaces.
- Fines and dust in contact with certain metal oxides (e.g., rust). A thermite reaction, with considerable heat generation, can be initiated by a weak ignition source.
- Molten aluminum in contact with water/moisture or other metal oxides (e.g., rust). Moisture entrapped by molten aluminum can be explosive. Contact of molten aluminum with other metal oxides can initiate a thermite reaction.

**EXTINGUISHING MEDIA:** Use fire fighting methods and materials that are appropriate for surrounding fire. Use coarse water spray on chips or turnings. For fines, dust or molten aluminum, use Class D extinguishing agents.

**DO NOT** use halogenated extinguishing agents on small chips/fines. Do not use water in fighting fires around molten aluminum.

**FIRE FIGHTING INSTRUCTIONS:** Fire fighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

### 6. ACCIDENTAL RELEASE MEASURES

**SMALL/LARGE SPILL:** If molten: Contain the flow using dry sand or salt flux as a dam. Do not use shovels or hand tools to halt the flow of molten aluminum. Allow the spill to cool before remelting as scrap.

### 7. HANDLING AND STORAGE

Product should be kept dry. Avoid generating dust. Avoid contact with sharp edges or heated metal. Hot and cold aluminum are not visually different.

**REQUIREMENTS FOR PROCESSES WHICH GENERATE DUSTS OR FINES**

- If processing of these products includes operations where dust or extremely fine particulate is generated, obtain and follow the safety procedures and equipment guides contained in Aluminum Association Bulletin F1 and National Fire Protection Association (NFPA) brochures listed in Section 16. Use non-sparking handling equipment. Cover and reseal partially empty containers. Provide grounding and bonding where necessary to prevent accumulation of static charges during aluminum dust handling and transfer operations. (See Section 15).
- Local ventilation and vacuum systems must be designed to handle explosive dusts. Dry vacuums and electrostatic precipitators must not be used. Dust collection systems must be dedicated to aluminum dust only and should be clearly labeled as such. Do not co-mingle fines of aluminum with fines of iron, iron oxide (rust) or other metal oxides.
- Do not allow chips, fines or dust to contact water, particularly in enclosed areas.
- Avoid all ignition sources. Good housekeeping practices must be maintained.
REQUIREMENTS FOR REMELTING OF ALUMINUM SCRAP MATERIAL AND/OR INGOT

- Molten aluminum and water can be an explosive combination. The risk is greatest when there is sufficient molten aluminum to entrap or seal off the water. Water and other forms of contamination on or contained in aluminum scrap or remelt ingot are known to have caused explosions in melting operations. While the products may have minimal surface roughness and internal voids, there remains the possibility of moisture contamination or entrapment. If confined, even a few drops of water can lead to violent explosions.

- All tooling and containers which come in contact with molten aluminum must be preheated or specially coated and rust free. Molds and ladles must be preheated or oiled before casting. Any surfaces that may contact molten aluminum (i.e., concrete) should be specially coated.

- Drops of molten aluminum in water (e.g. from plasma arc cutting), while not normally an explosion hazard, can generate enough flammable hydrogen gas to present an explosion hazard. Circulation of the water and removal of the aluminum particles minimize the hazards.

During melting operations, the following minimum guidelines should be observed:

- Inspect all aluminum materials before furnace charging and completely remove surface contamination such as water, ice, snow, deposits of grease and oil or other surface contamination resulting from weather exposure, shipment, or storage.

- Store materials in dry, heated areas with any cracks or cavities pointed downwards.

- Preheat and dry large or heavy items such as ingot adequately before charging into a furnace containing molten aluminum. This is typically done by use of a drying oven or homogenizing furnace. The drying cycle should bring the internal metal temperature of the coldest item of the batch to 400°F and then hold at that temperature for 6 hours.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Use with adequate explosion-proof ventilation to meet the limits listed in Section 2.

RESPIRATORY PROTECTION: Use NIOSH-approved respiratory protection [dust, fume, high efficiency dust/fume mask for lead, or other (organic vapor)] as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the limits listed in Section 2.

EYE PROTECTION: Welders should use appropriate equipment (e.g. welder’s helmet, face shield, filter lens) to prevent eye irritation or flash burns.

SKIN PROTECTION: Wear impervious gloves to avoid any skin injury.

- The presence of airborne beryllium has been detected during the welding of aluminum alloys with beryllium content at only 0.002% by weight. In accordance with OSHA 29 CFR 1910.252: Welding or cutting operations involving beryllium-containing base or filler metals shall be done using local exhaust ventilation and airline respirators unless atmospheric tests under the most adverse conditions have established that the workers’ exposures is within the acceptable concentrations defined by 29 CFR 1910.1000. In all cases, workers in the immediate vicinity of the welding or cutting operations shall be protected as necessary by local exhaust ventilation or airline respirators.

- Good industrial hygiene practices, including reducing occupational exposures to as low as reasonably achievable, are recommended. Where employees are exposed to beryllium above the PEL or where excessive contamination of clothing with beryllium is possible, adequate protective clothing should be provided to prevent contamination of personal clothing. Personnel assigned to launder such clothing should be advised of beryllium’s presence and potential health effects.

- Sampling to establish lead level exposure is advised where exposure to airborne particulate or fumes is possible. Consult OSHA Lead Standard 29 CFR 1910.1025 for specific health/industrial hygiene precautions and requirements to follow when handling lead compounds.

9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPEARANCE:</td>
<td>Solid</td>
</tr>
<tr>
<td>BOILING POINT:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>FREEZE-MELT POINT:</td>
<td>970 °F - 1215 °F (521 °C - 657 °C)</td>
</tr>
<tr>
<td>VAPOR PRESSURE (mm):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>VAPOR DENSITY (air = 1):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY:</td>
<td>Not determined</td>
</tr>
<tr>
<td>DENSITY:</td>
<td>Approximately 0.1 lb./in</td>
</tr>
<tr>
<td>pH:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>ODOR:</td>
<td>None</td>
</tr>
<tr>
<td>ODOR THRESHOLD (ppm):</td>
<td>Not applicable</td>
</tr>
<tr>
<td>COEFFICIENT OF WATER/OIL DISTRIBUTION:</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
10. STABILITY AND REACTIVITY

Stable under normal conditions of use, storage, and transportation as shipped. Chips, fines, dust and molten aluminum are considerably more reactive with the following:

- **Water:** Slowly generates flammable/explosive hydrogen gas and heat. Generation rate is greatly increased with smaller particles (e.g., fines and dusts).
  
  Molten aluminum can react violently/explosively with water or moisture, particularly when the water is entrapped.

- **Heat:** Oxidizes at a rate dependent upon temperature and particle size.

- **Strong oxidizers:** Violent reaction with considerable heat generation.
  
  Can react explosively with nitrates (e.g., ammonium nitrate and fertilizers containing nitrate) when heated or molten.

- **Acids and alkalis:** Reacts to generate flammable/explosive hydrogen gas. Generation rate is greatly increased with smaller particles (e.g., fines and dusts).

- **Halogenated compounds:** Many halogenated hydrocarbons, including halogenated fire extinguishing agents, can react violently with finely divided aluminum.

- **Iron oxide (rust) and other metal oxides (e.g., copper and lead oxides):** A violent thermit reaction generating considerable heat can occur. Reaction with aluminum fines and dusts requires only very weak ignition sources for initiation.
  
  Molten aluminum can react violently without external ignition source.

- **Iron powder:** An explosive reaction forming hydrogen gas occurs when heated above 1470°F (600°C).

11. TOXICOLOGICAL INFORMATION

<table>
<thead>
<tr>
<th>Substance</th>
<th>Route of Administration</th>
<th>LD₅₀ or LC₁₀₀</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon</td>
<td>Oral rat</td>
<td>LD₅₀: 3160 mg/kg body weight</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>Oral rat</td>
<td>LD₅₀: 9000 mg/kg body weight</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>Intraperitoneal rabbit</td>
<td>LD₁₀₀: 20 mg/kg</td>
<td>No toxic effect noted</td>
</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL/CHEMICAL FATE INFORMATION: Not available.

13. DISPOSAL CONSIDERATION

Collect scrap for remelting and recycling. To maintain metal purity, it may be desirable to segregate this scrap from other alloys.

RCRA Status: Characterize in accordance with 40 CFR 261 or state equivalent.

14. TRANSPORT INFORMATION

USA DOT: Not Regulated - Enter the proper freight classification, "MSDS Number," and "Product Name" on the shipping paperwork.

Canadian TDG Hazard Class & PIN: Not regulated.
15. REGULATORY INFORMATION

All electrical equipment must be suitable for use in hazardous atmospheres involving aluminum powder in accordance with 29 CFR 1910.307. The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installation, which will meet this requirement.

U.S. Federal Regulations

TSCA STATUS: All components of this product are listed on the TSCA inventory.

CERCLA HAZARDOUS SUBSTANCES: Beryllium, Chromium, Chromium compounds, Copper, Lead, Manganese, Nickel, Zinc.

SARA TITLE III:

Section 311/312 Physical and Health Hazard Categories: Immediate (acute), delayed (chronic) if particulates/fumes are generated during processing.

Section 313 Toxic Chemicals: Aluminum (fume/dust), Beryllium, Chromium, Copper, Manganese, and Zinc (fume/dust).

State Regulations

PENNSYLVANIA "Special Hazardous Substance": Beryllium; Chromium compounds, hexavalent.

International Regulations

CANADIAN DOMESTIC SUBSTANCES LIST: All components of this product are listed on the Canadian DSL.

EUROPEAN COMMUNITY: All components of this product are listed on ECOIN, the European Core Inventory.

16. OTHER INFORMATION

STATUS: Changes in all Sections except 9 and 12.

- OSHA Standard 29 CFR 1910.252
- ANSI 249.1, Safety in Welding and Cutting
- NFPA 65, Standard for Processing and Finishing of Aluminum (NFPA phone: 800-344-3555)
- NFPA 70, Standard for National Electrical Code
- NFPA 77, Standard for Static Electricity
- Guide to Occupational Exposure Values-2003, Compiled by the American Conference of Governmental Industrial Hygienists (ACGIH).
- Dept. of Health and Human Services, NIOSH: Registry of Toxic Effects of Chemical Substances, 1985-86 Edition
INFORMATION HEREIN IS GIVEN IN GOOD FAITH AS AUTHORITATIVE AND VALID; HOWEVER, NO WARRANTY, EXPRESS OR IMPLIED, CAN BE MADE.

LEGEND:

ACGIH  American Conference of Governmental Industrial Hygienists
AICS  Australian Inventory of Chemical Substances
CAS  Chemical Abstract Services
CERCLA  Comprehensive Environmental Response, Compensation, & Liability Act
CFR  Code of Federal Regulations
DOT  Department of Transportation
DSL  Domestic Substances List (Canada)
ECOIN  European Core Inventory
EPA  Environmental Protection Agency
IARC  International Agency for Research on Cancer
LC₅₀  Lethal Concentration (50 percent kill)
LC₅₀  Lowest published lethal concentration
LD₅₀  Lethal dose (50 percent kill)
LD₅₀  Lowest published lethal dose
MIG  Metal Inert Gas
NFPA  National Fire Protection Association
NIOSH  National Institute for Occupational Safety and Health
NTP  National Toxicology Program
OSHA  Occupational Safety and Health Administration
PEL  Permissible Exposure Limit
PIN  Product Identification Number
RCA  Resource Conservation and Recovery Act
SARA  Superfund Amendments and Reauthorization Act
STEL  Short Term Exposure Limit
TCLP  Toxic Chemicals Leachate Program
TDG  Transportation of Dangerous Goods
TIG  Tungsten Inert Gas
TLV  Threshold Limit Value
TSCA  Toxic Substances Control Act
TWA  Time weighted Average