ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel

Safety Data Sheet (SDS)

Section 1 – Identification

1(a) Product Identifier used on Label: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel
1(b) Other means of identification: AKS-011
1(c) Recommended use of the chemical and restrictions on use: None
1(d) Name, address, and telephone number:
   AK Steel
   9227 Centre Point Drive
   West Chester, Ohio 45069
   Phone number: 513 425-5000 (information)
   513 425-5104 (Health & Safety)
1(e) Emergency phone number: 800 331-5050

Section 2 – Hazard(s) Identification

2(a) Classification of the chemical: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel is considered an article under Reach regulation (REACH REGULATION (EC) No 1907/2006) and is not subject to classification under CLP regulation (REGULATION (EC) No 1272/2008). However, ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel is not exempt as an article under OSHA's Hazard Communication Standard (29 CFR 1910.1200) due to its downstream use, thus this product is considered a mixture and a hazardous material. Therefore, the categories of Health Hazards as defined in “GLOBAL HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS (GHS), Third revised edition ST/SG/AC.10/30/Rev. 3” United Nations, New York and Geneva, 2009 have been evaluated. Refer to Section 3, 8 and 11 for additional information.
2(b) Signal word, hazard statement(s), symbols and precautionary statement(s):

<table>
<thead>
<tr>
<th>Hazard Symbol</th>
<th>Hazard Classification</th>
<th>Signal Word</th>
<th>Hazard Statement(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carcinogenicity - 2</td>
<td></td>
<td>Suspected of causing cancer.</td>
</tr>
<tr>
<td></td>
<td>Reproductive Toxicity - 2</td>
<td>Danger</td>
<td>Suspected of damaging fertility or the unborn child.</td>
</tr>
<tr>
<td></td>
<td>Single Target Organ Toxicity (STOT)</td>
<td>Repeat Exposure -1</td>
<td>Causes damage to lungs and central nervous system through prolonged or repeated inhalation exposure.</td>
</tr>
<tr>
<td></td>
<td>Acute Toxicity-Oral - 4</td>
<td></td>
<td>Harmful if swallowed.</td>
</tr>
<tr>
<td></td>
<td>Skin Sensitization - 1</td>
<td></td>
<td>May cause an allergic skin reaction.</td>
</tr>
<tr>
<td></td>
<td>STOT Single Exposure - 3</td>
<td></td>
<td>May cause respiratory irritation.</td>
</tr>
<tr>
<td></td>
<td>Eye Irritation - 2B</td>
<td></td>
<td>Causes eye irritation.</td>
</tr>
</tbody>
</table>

Precautionary Statement(s):

Do not breathe dusts / fume / gas / mist / vapor / spray.
Wear protective gloves / protective clothing / eye protection / face protection.
Contaminated work clothing must not be allowed out of the workplace.
Use only outdoors or in well ventilated areas.
Wash thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not eat, drink or smoke when using this product.

If inhaled: Remove person to fresh air and keep comfortable for breathing.
If exposed, concerned or feel unwell: Get medical advice/attention.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
If on skin: Wash with plenty of water. If irritation or rash occurs: Get medical advice/attention. Take off and wash contaminated clothing before reuse.
If swallowed: Call a poison center or doctor/physician if you feel unwell. Rinse mouth.

2(c) Hazards not otherwise classified: None Known
2(d) Unknown acute toxicity statement (mixture): None Known

Section 3 – Composition/Information on Ingredients

3(a-c) Chemical name, common name (synonyms), CAS number and other identifiers, and concentration:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>EC Number</th>
<th>% by volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>7439-89-6</td>
<td>231-096-4</td>
<td>&gt;95</td>
</tr>
<tr>
<td>Manganese</td>
<td>7439-96-5</td>
<td>231-105-1</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>231-111-4</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Silicon</td>
<td>7440-21-3</td>
<td>231-130-8</td>
<td>&lt;1.0</td>
</tr>
</tbody>
</table>
ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel

Safety Data Sheet

Section 3 – Composition/Information on Ingredients (continued)

3(a-c) Chemical name, common name (synonyms), CAS number and other identifiers, and concentration (continued):

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS Number</th>
<th>EC Number</th>
<th>% by volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metallic Coating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>7440-66-6</td>
<td>231-175-3</td>
<td>100</td>
</tr>
</tbody>
</table>

EC - European Community
CAS - Chemical Abstract Service

Notes:
- Commercial steel products contain small amounts of various elements in addition to those specified. These small quantities frequently referred to as “trace” or “residual” elements, generally originate in the raw materials used and/or are alloying metals. Individual trace elements vary in concentration by weight, and may include aluminum, boron, calcium, carbon, columbium (niobium), copper, molybdenum, phosphorus, sulfur, titanium, and vanadium.
- Percentages are expressed as typical ranges or maximum concentrations of trace elements for the purpose of communicating the potential hazards of the finished product. Consult product specifications for specific composition information.
- The product will typically have a light coating of oil to prevent corrosion.
- * % Weight for individual components for the metallic coating, not the base metal and coating. ZINCGRIP® Electrosmooth Steel contains 60 grams/square meter of zinc coating per side.

Section 4 – First-aid Measures

4(a) Description of necessary measures:
- Inhalation: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped is not a likely form of exposure. However during further processing (welding, grinding, burning, etc.), if inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed, concerned or feel unwell: Get medical advice/attention.
- Eye Contact: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped is not a likely form of exposure. However during further processing (welding, grinding, burning, etc.), if in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue Rinsing. If eye irritation persists: Get medical advice attention. If exposed, concerned or feel unwell: Get medical advice/attention.
- Skin Contact: If on skin: Wash thoroughly after handling. Wash with plenty of water. If irritation or rash occurs: Get medical advice/attention. Take off and wash contaminated clothing before reuse. If exposed, concerned or feel unwell: Get medical advice/attention.
- Ingestion: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped is not a likely form of exposure. However during further processing (welding, grinding, burning, etc.), if swallowed: Call a poison center or doctor/physician if you feel unwell. Rinse mouth. If exposed, concerned or feel unwell: Get medical advice/attention.

4(b) Most important symptoms/effects, acute and delayed (chronic):
- Inhalation: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped is not likely to present an acute or chronic health effect.
- Eye: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped is not likely to present an acute or chronic health effect.
- Skin: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped is not likely to present an acute or chronic health effect.
- Ingestion: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped is not likely to present an acute or chronic health effect.

However during further processing (welding, grinding, burning, etc.) individual components may illicit an acute or chronic health effect. Refer to Section 11-Toxicological Information.

4(c) Immediate Medical Attention and Special Treatment: None Known

Section 5 – Fire-fighting Measures

5(a) Suitable (and unsuitable) Extinguishing Media: Not Applicable for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped. Use extinguishers appropriate for surrounding materials.
5(b) Specific Hazards arising from the chemical: Not Applicable for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped. When burned, toxic smoke, fume and vapor may be emitted.
5(c) Special protective equipment and precautions for fire-fighters: Self-contained NIOSH approved respiratory protection and full protective clothing should be worn when fumes and/or smoke from fire are present. Heat and flames cause emittance of acrid smoke and fumes. Do not release runoff from fire control methods to sewers or waterways. Firefighters should wear full face-piece self-contained breathing apparatus and chemical protective clothing with thermal protection. Direct water stream will scatter and spread flames and, therefore, should not be used.

Section 6 - Accidental Release Measures

6(a) Personal Precautions, Protective Equipment and Emergency Procedures: Not Applicable for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped. For spills involving finely divided particles, clean-up personnel should be protected against contact with eyes and skin. If material is in a dry state, avoid inhalation of dust.
6(b) Methods and materials for containment and clean up: Not Applicable for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped. Collect material in appropriate, labeled containers for recovery or disposal in accordance with federal, state, and local regulations. Follow applicable OSHA regulations (29 CFR 1910.120) and all other pertinent state and federal requirements.
Section 7 - Handling and Storage

7(a) Precautions for safe handling: Not Applicable for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped, however further processing (welding, burning, grinding, etc.) with the potential for generating high concentrations of airborne particulates should be evaluated and controlled as necessary. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use only outdoors or in well ventilated areas. Practice good housekeeping. Avoid breathing metal fumes and/or dust. Do not eat, drink or smoke when using this product. Cut resistant gloves and sleeves should be worn when working with steel products.

7(b) Conditions for safe storage, including any incompatibilities: Store away from acids and incompatible materials.

Section 8 - Exposure Controls / Personal Protection

8(a) Occupational Exposure Limits (OELs): ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped in its physical form does not present an inhalation, ingestion or contact hazard, nor would any of the following exposure data apply. However, operations such as burning, welding (high temperature), sawing, brazing, machining, grinding, etc. may produce fumes and/or particulates. The following exposure limits are offered as reference for an experienced industrial hygienist to review.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>OSHA PEL 1</th>
<th>ACGIH TLV 2</th>
<th>NIOSH REL 3</th>
<th>IDLH 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>10 mg/m³ (as iron oxide fume)</td>
<td>5.0 mg/m³ (as iron oxide and dust)</td>
<td>5.0 mg/m³ (as iron oxide dust and fume)</td>
<td>2,500 mg Fe/m³</td>
</tr>
<tr>
<td>Manganese</td>
<td>(C) 5.0 mg/m³ (as Fume &amp; Mn compounds)</td>
<td>0.2 mg/m³</td>
<td>(C) 5.0 mg/m³</td>
<td>500 mg Mn/m³</td>
</tr>
<tr>
<td>Nickel</td>
<td>1.0 mg/m³ (as Ni metal &amp; insoluble compounds)</td>
<td>1.5 mg/m³ (as inhalaable fraction Ni metal)</td>
<td>0.015 mg/m³ (as Ni metal &amp; insoluble and soluble compounds)</td>
<td>10 mg/m³ (as Ni)</td>
</tr>
<tr>
<td>Silicon</td>
<td>15 mg/m³ (total dust, PNOR)</td>
<td>5.0 mg/m³ (as respirable fraction, PNOR)</td>
<td>10 mg/m³</td>
<td>5.0 mg/m³ (as respirable dust)</td>
</tr>
</tbody>
</table>

1. OSHA Permissible Exposure Limits (PELs) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A (C) designation denotes a ceiling limit, which should not be exceeded during any part of the working exposure unless otherwise noted. A Peak is defined as the acceptable maximum peak for a maximum duration above the ceiling concentration for an eight-hour shift. A skin notation refers to the potential significant contribution to the overall exposure by the cutaneous route, either by contact with vapors or, of probable greater significance, by direct skin contact with the substance. A Short Term Exposure Limit (STEL) is defined as a 15-minute exposure, which should not be exceeded at any time during a workday. An Action level (AL) is used by OSHA and NIOSH to express a health or physical hazard. They indicate the level of a harmful or toxic substance/activity, which requires medical surveillance, increased industrial hygiene monitoring, or biological monitoring. Action Levels are generally set at one half of the PEL but the actual level may vary from standard to standard. The intent is to identify a level at which the vast majority of randomly sampled exposures will be below the PEL.

2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. A Short Term Exposure Limit (STEL) is defined as the maximum concentration to which workers can be exposed for a short period of time (15 minutes) for only four times throughout the day with at least one hour between exposures. A “skin” notation refers to the potential significant contribution to the overall exposure by the cutaneous route, either by contact with vapors or, of probable greater significance, by direct skin contact with the substance. ACGIH-TLVs are only recommended guidelines based upon consensus agreement of the membership of the ACGIH. As such, the ACGIH TLVs are for guidance use purposes and are not legal regulatory limits for compliance purposes. The TLVs are designed for use by individuals trained in the discipline of industrial hygiene relative to the evaluation of exposure to various chemical or biological substances and physical agents that may be found in the workplace.

3. The National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH-REL) - Compendium of Policy and Statements. NIOSH, Cincinnati, OH (1992). NIOSH is the federal agency designated to conduct research relative to occupational safety and health. As is the case with ACGIH TLVs, NIOSH RELs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.

4. The “immediately dangerous to life or health air concentration values (IDLHs)” are used by NIOSH as part of the respirator selection criteria and were first developed in the mid-1970’s by NIOSH. The Documentation for Immediately Dangerous to Life or Health Concentrations (IDLHs) is a compilation of the rationale and sources of information used by NIOSH during the original determination of 387 IDLHs and their subsequent review and revision in 1994.

5. Inhaleable fraction. The concentration of inhalable particulate for the application of this TLV is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH 2015 TLVs® and HEIs® (Biological Exposure Indices) Appendix D, paragraph A.

6. PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by a limit which is the same as the inert or nuisance dust limit of 15 mg/m³ for total dust and 5 mg/m³ for the respirable fraction.

8(b) Appropriate Engineering Controls: Use controls as appropriate to minimize exposure to metal fumes and dusts during handling operations. Provide general or local exhaust ventilation systems to minimize airborne concentrations. Local exhaust is necessary for use in enclosed or confined spaces. Provide sufficient general/local exhaust ventilation in pattern/volume to control inhalation exposures below current exposure limits.

8(c) Individual Protection Measures:
- Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use only a NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. Concentration in air of the various contaminants determines the extent of respiratory protection needed. Half-face, negative-pressure, air-purifying respirator equipped with P100 filter is acceptable for concentrations up to 10 times the exposure limit. Full-face, negative-pressure, air-purifying respirator equipped with P100 filter is acceptable for concentrations up to 50 times the exposure limit. Protection by air-purifying negative-pressure and powered air respirators is limited. Use a positive-pressure-demand, full-face, supplied air respirator or self-contained breathing apparatus (SCBA) for concentrations above 50 times the exposure limit. If exposure is above the IDLH (Immediately dangerous to life or health) for any of the constituents, or there is a possibility of an uncontrolled release or exposure levels are unknown, then use a positive-demand, full-face, supplied air respirator with escape bottle or SCBA.
Section 8 - Exposure Controls / Personal Protection (continued)

8(c) Individual Protection Measures (continued):

- Respiratory Protection (continued):
  Warning! Air-purifying respirators both negative-pressure, and powered-air do not protect workers in oxygen-deficient atmospheres.

- Eyes: Wear appropriate eye protection to prevent eye contact. For operations which result in elevating the temperature of the product to or above its melting point or result in the generation of airborne particulates, use safety glasses to prevent eye contact. Contact lenses should not be worn where industrial exposures to this material are likely. Use safety glasses or goggles as required for welding, burning, sawing, brazing, grinding or machining operations.

- Skin: Wear appropriate personal protective clothing to prevent skin contact. Cut resistant gloves and sleeves should be worn when working with steel products. For operations which result in elevating the temperature of the product to or above its melting point or result in the generation of airborne particulates, use protective clothing, and gloves to prevent skin contact. Protective gloves should be worn as required for welding, burning or handling operations. Contaminated work clothing must not be allowed out of the workplace.

- Other protective equipment: An eyewash fountain and deluge shower should be readily available in the work area.

Section 9 - Physical and Chemical Properties

9(a) Appearance (physical state, color, etc.): Solid, Metallic Gray
9(b) Odor: Odorless
9(c) Odor Threshold: NA
9(d) pH: NA
9(e) Melting Point/Freezing Point: 2795°F, 1530°C (Approximate as Fe) (787°F for Zinc)
9(f) Initial Boiling Point and Boiling Range: ND
9(g) Flash Point: NA
9(h) Evaporation Rate: NA
9(i) Flammability (solid, gas): Non-flammable, non-combustible
9(j) Upper/lower Flammability or Explosive Limits: NA
9(k) Vapor Pressure: NA
9(l) Vapor Density (Air = 1): NA
9(m) Relative Density: >1.0 SG
9(n) Solubility(ies): Water Insoluble

Section 10 - Stability and Reactivity

10(a) Reactivity: Not Determined (ND) for product in a solid form. Do not use water on molten metal.
10(b) Chemical Stability: Steel products are stable under normal storage and handling conditions.
10(c) Possibility of hazardous reaction: None Known
10(d) Conditions to Avoid: Storage with strong acids or calcium hypochlorite.
10(e) Incompatible Materials: Will react with strong acids to form hydrogen. Iron oxide dusts in contact with calcium hypochlorite evolve oxygen and may cause an explosion.
10(f) Hazardous Decomposition Products: Thermal oxidative decomposition of steel products can produce fumes containing oxides of iron and manganese as well as other alloying elements.

Section 11 - Toxicological Information

11(a-e) Information on toxicological effects: The following toxicity data has been determined for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel when further processed using the information available for its components applied to the guidance on the preparation of an SDS under the GHS requirements of OSHA and the EU CPL:

<table>
<thead>
<tr>
<th>Hazard Classification</th>
<th>Hazard Category</th>
<th>Hazard Symbols</th>
<th>Signal Word</th>
<th>Hazard Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Toxicity Hazard (covers Categories 1-4)</td>
<td>NA*</td>
<td>4</td>
<td>!</td>
<td>Warning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Harmful if swallowed.</td>
</tr>
<tr>
<td>Eye Damage/ Irritation (covers Categories 1, 2A and 2B)</td>
<td>NA*</td>
<td>2B</td>
<td>No Pictogram</td>
<td>Warning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Causes eye irritation.</td>
</tr>
<tr>
<td>Skin/Dermal Sensitization (covers Category 1)</td>
<td>NA*</td>
<td>1</td>
<td>!</td>
<td>Warning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>May cause an allergic skin reaction.</td>
</tr>
<tr>
<td>Carcinogenicity (covers Categories 1A, 1B and 2)</td>
<td>NA*</td>
<td>2</td>
<td>!</td>
<td>Warning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Suspected of causing cancer.</td>
</tr>
<tr>
<td>Toxic Reproduction (covers Categories 1A, 1B and 2)</td>
<td>NA*</td>
<td>2</td>
<td>!</td>
<td>Warning</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Suspected of damaging fertility or the unborn child.</td>
</tr>
</tbody>
</table>
### Section 11 - Toxicological Information (continued):

<table>
<thead>
<tr>
<th>Hazard Classification</th>
<th>Hazard Category</th>
<th>Hazard Symbols</th>
<th>Signal Word</th>
<th>Hazard Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specific Target Organ Toxicity (STOT) following Single Exposure</strong> (covers Categories 1-3)</td>
<td>NA*</td>
<td>3'</td>
<td>Warning</td>
<td>May cause respiratory irritation.</td>
</tr>
<tr>
<td><strong>STOT following Repeated Exposure</strong> (covers Categories 1 and 2)</td>
<td>NA*</td>
<td>1'</td>
<td>Danger</td>
<td>Causes damage to lungs and central nervous system through prolonged or repeated inhalation exposure.</td>
</tr>
</tbody>
</table>

*Not Applicable - Semi-formed steel products are considered articles under Reach regulation (REACH REGULATION (EC) No 1907/2006) and are not subject to classification under CLP regulation (REGULATION (EC) No 1272/2008).

Toxicological data listed below are presented regardless to classification criteria. Individual hazard classification categories where the toxicological information has met or exceeded a classification criteria threshold are listed above.

- **a.** No LC50 or LD50 has been established for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel. The following data has been determined for the components:
  - **Iron:** Rat LD50 = 98.6 g/kg (REACH)  
    - Rat LD50 = 1060 mg/kg (IUCCLID)  
    - Rat LD50 = 9854 mg/kg (IUCCLID)  
    - Rabbit LD50 > 890 mg/kg (IUCCLID)  
    - Guinea Pig LD50 = 20 g/kg (TOXNET)
  - **Nickel:** LD50 > 9000 mg/kg (Oral/Rat)  
  - **Silicon:** LD50 = 1160 mg/kg (Oral/Rat)  
  - **Manganese:** Rat LD50 > 2000 mg/kg (REACH)  
  - Rat LD50 > 9000 mg/kg (NLM Toxnet)

- **b.** No Skin (Dermal) Irritation data available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a mixture or its individual components.

- **c.** No Eye Irritation data available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a mixture. The following Eye Irritation information was found for the components:
  - **Iron:** Causes eye irritation.
  - **Silicon:** Slight eye irritation in rabbit protocol.
  - **Nickel:** Slight eye irritation from particulate abrasion only.

- **d.** No Skin (Dermal) Sensitization data available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a mixture. The following Skin (Dermal) Sensitization information was found for the components:
  - **Nickel:** May cause allergic skin sensitization.

- **e.** No Respiratory Sensitization data available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a mixture or its components.

- **f.** No Germ Cell Mutagenicity data available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a mixture. The following Mutagenicity and Genotoxicity information was found for the components:
  - **Iron:** IUCCLID has found some positive and negative findings in vitro.
  - **Nickel:** EU RAR has found positive results in vitro and in vivo but insufficient data for classification.

- **g.** Carcinogenicity: IARC, NTP, and OSHA do not list ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as carcinogens. The following Carcinogenicity information was found for the components:
  - **Welding Fumes - IARC Group 2B carcinogen, a mixture that is possibly carcinogenic to humans.**
  - **Nickel and certain nickel compounds – Group 2B - metallic nickel Group 1 - nickel compounds ACGIH confirmed human carcinogen. Nickel – EURAR Insufficient evidence to conclude carcinogenic potential in animals or humans; suspect carcinogen classification Category 2 Suspected of causing cancer.

- **h.** No Toxic Reproduction data available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a mixture. The following Toxic Reproductive information was found for the components:
  - **Nickel:** Effects on fertility.

- **i.** No Specific Target Organ Toxicity (STOT) following a Single Exposure data available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a mixture. The following STOT following a Single Exposure data was found for the components:
  - **Iron:** Irritating to Respiratory tract.

- **j.** No Specific Target Organ Toxicity (STOT) following Repeated Exposure data was available for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a whole. The following STOT following Repeated Exposure data was found for the components:
  - **Nickel:** Rat 4 wk inhalation LOEL 4 mg/m³ Lung and Lymph node histopathology. Rat 2 yr inhalation LOEL 0.1 mg/m³ Pigment in kidney, effects on hematopoiesis spleen and bone marrow and adrenal tumor. Rat 13 Week Inhalation LOAEC 1.0 mg/m³ Lung weights, and Alveolar histopathology.
  - **Manganese:** Inhalation of metal fumes - Degenerative changes in human Brain; Behavioral: Changes in motor activity and muscle weakness (Whitlock et al., 1966).
The following health hazard information is provided regardless to classification criteria and is based on the individual component(s) and potential resultant components from further processing:

**Acute Effects:**

- **Inhalation:** Excessive exposure to high concentrations of metal dust may cause irritation to the eyes, skin and mucous membranes of the upper respiratory tract. Excessive inhalation of fumes of freshly formed metal oxide particles sized below 1.5 micrometer and usually between 0.02-0.05 micrometers from many metals can produce an acute reaction known as “metal fume fever”. Symptoms consist of chills and fever (very similar to and easily confused with flu symptoms), metallic taste in the mouth, dryness and irritation of the throat followed by weakness and muscle pain. The symptoms come on in a few hours after excessive exposures and usually last from 12 to 48 hours. Long-term effects from metal fume fever have not been noted. Freshly formed oxide fumes of manganese and copper have been associated with causing metal fume fever.
- **Eye:** Excessive exposure to high concentrations of metal dust may cause irritation to the eyes.
- **Skin:** Skin contact with metal dusts may cause irritation or sensitization, possibly leading to dermatitis. Skin contact with metallic fumes and dusts may cause physical abrasion.
- **Ingestion:** Ingestion of harmful amounts of this product as distributed is unlikely due to its solid insoluble form. Ingestion of metal dust may cause nausea or vomiting.

**Acute Effects by component:**

- **Iron and iron oxides:** Iron is harmful if swallowed, causes skin irritation, and causes eye irritation. Contact with iron oxide has been reported to cause skin irritation and serious eye damage. Particles of iron or iron compounds, which become imbedded in the eye, may cause rust stains unless removed fairly promptly.
- **Manganese and manganese oxides:** Manganese and Manganese oxide is harmful if swallowed.
- **Nickel and nickel oxides:** Nickel may cause allergic skin sensitization. Nickel oxide may cause an allergic skin reaction.
- **Silicon and silicon oxides:** May be harmful if swallowed.

**Delayed (chronic) Effects by component:**

- **Iron and iron oxides:** Chronic exposure of excessive concentrations of iron oxide fumes or dusts may result in the development of a benign pneumoconiosis, called siderosis, which is observable as an X-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of ferric oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. Iron oxide is listed as a Group 3 (not classifiable) carcinogen by the International Agency for Research on Cancer (IARC).
- **Manganese and manganese oxides:** Chronic exposure to high concentrations of manganese fumes and dusts may adversely affect the central nervous system with symptoms including languor, sleepiness, weakness, emotional disturbances, spastic gait, mask-like facial expression and paralysis. Animal studies indicate that manganese exposure may increase susceptibility to bacterial and viral infections. Occupational overexposure (Manganese) is a progressive, disabling neurological syndrome that typically begins with relatively mild symptoms and evolves to include altered gait, fine tremor, and sometimes, psychiatric disturbances. May cause damage to lungs with repeated or prolonged exposure. Neurobehavioral alterations in worker populations exposed to manganese oxides include: speed and coordination of motor function are especially impaired.
- **Nickel and nickel oxides:** Exposure to nickel dusts and fumes can cause sensitization dermatitis, respiratory irritation, asthma, pulmonary fibrosis, edema, and may cause nasal or lung cancer in humans. Nickel causes damage to lungs through prolonged or repeated inhalation exposure. IARC lists nickel and certain nickel compounds as Group 2B carcinogens (sufficient animal data). ACGIH 2013 TLVs® and BEIs® lists insoluble nickel compounds as confirmed human carcinogens. Nickel is suspected of damaging the unborn child.
- **Silicon and silicon oxides:** Silicon dusts are a low health risk by inhalation and should be treated as a nuisance dust. Eye contact with pure material can cause particulate irritation. Skin contact with silicon dusts may cause physical abrasion.

**Section 12 - Ecological Information**

12(a) Ecotoxicity (aquatic & terrestrial): No Data Available for ZINCGRIP® ElectrosMOOTH Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped. However, individual components of the product when processed have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife as follows:

- **Iron Oxide:** LC50 >1000 mg/L; Fish 48 h-EC50 > 100 mg/L (Currenta, 2008k); 96 h-LC50 ≥ 50,000 mg/L. Test substance: Bayferrox 130 red (95 – 97% Fe2O3; < 4% SiO2 and Al2O3) (Bayer, 1989a).
- **Nickel Oxide:** IUCLID found LC50 in fish, invertebrates and algae > 100 mg/L.

12(b) Persistence & Degradability: No Data Available for ZINCGRIP® ElectrosMOOTH Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped or individual components.

12(c) Bioaccumulative Potential: No Data Available for ZINCGRIP® ElectrosMOOTH Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped or individual components.

12(d) Mobility (in soil): No data available for ZINCGRIP® ElectrosMOOTH Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as sold/shipped. However, individual components of the product have been found to be absorbed by plants from soil.

12(e) Other adverse effects: None Known
Section 12 - Ecological Information (continued)

Additional Information:
Hazard Category: Not Reported
Hazard Symbol: No Symbol
Hazard Statement: No Statement

Section 13 - Disposal Considerations

Disposal: Steel scrap should be recycled whenever possible. Product dusts and fumes from processing operations should also be recycled, or classified by a competent environmental professional and disposed of in accordance with applicable federal, state or local regulations.

Container Cleaning and Disposal: Follow applicable federal, state and local regulations. Observe safe handling precautions. European Waste Catalogue (EWC): 16-01-17 (ferrous metals), 12-01-99 (wastes not otherwise specified), 16-03-04 (off specification batches and unused products), or 15-01-04 (metallic packaging).

Please note this information is for ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel in its original form. Any alterations can void this information.

Section 14 - Transport Information

14 (a-g) Transportation Information:
US Department of Transportation (DOT) under 49 CFR 172.101 does not regulate ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a hazardous material. All federal, state, and local laws and regulations that apply to the transport of this type of material must be adhered to.

Shipping Name: Not Applicable (NA)
Classification Code: NA
UN No.: NA
Packing Group: NA
DOT/IMO Label: NA
Special Provisions (172.102): NA

Packaging Authorizations
a) Exceptions: NA
b) Group: NA
c) Authorization: NA

Quantity Limitations
a) Passenger, Aircraft, or Railcar: NA
b) Cargo Aircraft Only: NA
Vessel Stowage Requirements
a) Vessel Stowage: NA
b) Other: NA

DOT Reportable Quantities: NA

Regulations Concerning the International Carriage of Dangerous Goods by Road (ADR) does not regulate ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a hazardous material.

Shipping Name: Not Applicable (NA)
Classification Code: NA
UN No.: NA
Packing Group: NA
ADR Label: NA
Special Provisions: NA
Limited Quantities: NA

Packaging
a) Packing Instructions: NA
b) Special Packing Provisions: NA
c) Mixed Packing Provisions: NA

Portable Tanks & Bulk Containers
a) Instructions: NA
b) Special Provisions: NA

Limited Quantities: NA

International Air Transport Association (IATA) does not regulate ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a hazardous material.

Shipping Name: Not Applicable (NA)
Class/Division: NA
Hazard Label (s): NA
UN No.: NA
Packing Group: NA
Excepted Quantities (EQ): NA

Passenger & Cargo Aircraft Limited Quantity (EQ)
Pkg Inst: NA
Max Net Qty/Pkg: NA

Cargo Aircraft Only
Pkg Inst: NA
Max Net Qty/Pkg: NA

Special Provisions: NA
ERG Code: NA

Transport Dangerous Goods (TDG) Classification: ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel does not have a TDG classification.

Section 15 - Regulatory Information

Regulatory Information: The following listing of regulations relating to an AK Steel product may not be complete and should not be solely relied upon for all regulatory compliance responsibilities. This product and/or its constituents are subject to the following regulations:

OSHA Regulations: Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-2, Z-3): The product, ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel as a whole is not listed. However, individual components of the product are listed: Refer to Section 8, Exposure Controls and Personal Protection.
Section 15 - Regulatory Information (continued)

EPA Regulations: The product, ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel is not listed as a whole. However, individual components of the product are listed:

<table>
<thead>
<tr>
<th>Components</th>
<th>Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manganese</td>
<td>CAA, SARA 313, SDWA</td>
</tr>
<tr>
<td>Nickel</td>
<td>CAA, CERCLA, CWA, SARA 313</td>
</tr>
</tbody>
</table>

SARA 311/312 Potential Hazard Categories: Immediate Acute Health Hazard; Delayed Chronic Health Hazard.

<table>
<thead>
<tr>
<th>Components</th>
<th>Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manganese</td>
<td>CAA, SARA 313, SDWA</td>
</tr>
<tr>
<td>Nickel</td>
<td>CAA, CERCLA, CWA, SARA 313</td>
</tr>
</tbody>
</table>

State Regulations: The product, ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-to-Know Act and 40 CFR part 372:

<table>
<thead>
<tr>
<th>CAS #</th>
<th>Chemical Name</th>
<th>Percent by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>7439-96-5</td>
<td>Manganese</td>
<td>2.0 max</td>
</tr>
<tr>
<td>7440-02-0</td>
<td>Nickel</td>
<td>0.15 max</td>
</tr>
</tbody>
</table>

Other Regulations:

WHMIS Classification (Canadian): The product, ZINCGRIP® Electrosmooth Steel, ZINCGRIP® Steel and ZINCGRIP® Galvannealed Steel is not listed as a whole. However individual components are listed.

Prepared By: AM Health and Safety, Inc
Original Issue Date: 08/01/2002
Revised Date: 04/29/2015

Additional Information:

National Fire Protection Association (NFPA)

Health Hazard 1
Fire Hazard 0
Physical Hazard 0

Health Hazard 1: Denotes possible chronic hazard if airborne dusts or fumes are generated. Irritation or minor reversible injury possible.
Fire Hazard 0: Materials that will not burn.
Physical Hazard 0: Materials that are normally stable, even under fire conditions, and will not react with water, polymerize, decompose, condense, or self-react. Non-explosives.
### ABBREVIATIONS/ACRONYMS:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACGIH</td>
<td>American Conference of Governmental Industrial Hygienists</td>
</tr>
<tr>
<td>BEIs</td>
<td>Biological Exposure Indices</td>
</tr>
<tr>
<td>CAS</td>
<td>Chemical Abstracts Service</td>
</tr>
<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensation, and Liability Act</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CNS</td>
<td>Central Nervous System</td>
</tr>
<tr>
<td>GL, GIT</td>
<td>Gastro-Intestinal, Gastro-Intestinal Tract</td>
</tr>
<tr>
<td>HMIS</td>
<td>Hazardous Materials Identification System</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agency for Research on Cancer</td>
</tr>
<tr>
<td>LC50</td>
<td>Median Lethal Concentration</td>
</tr>
<tr>
<td>LD50</td>
<td>Median Lethal Dose</td>
</tr>
<tr>
<td>LDₐ₀</td>
<td>Lowest Dose to have killed animals or humans</td>
</tr>
<tr>
<td>LEL</td>
<td>Lower Explosive Limit</td>
</tr>
<tr>
<td>LOEL</td>
<td>Lowest Observed Effect Level</td>
</tr>
<tr>
<td>LOAEC</td>
<td>Lowest Observable Adverse Effect Concentration</td>
</tr>
<tr>
<td>µg/m³</td>
<td>microgram per cubic meter of air</td>
</tr>
<tr>
<td>mg/m³</td>
<td>milligram per cubic meter of air</td>
</tr>
<tr>
<td>mppcf</td>
<td>million particles per cubic foot</td>
</tr>
<tr>
<td>MSHA</td>
<td>Mine Safety and Health Administration</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NIF</td>
<td>No Information Found</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute for Occupational Safety and Health</td>
</tr>
<tr>
<td>NTP</td>
<td>National Toxicology Program</td>
</tr>
<tr>
<td>ORC</td>
<td>Organization Resources Counselors</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PEL</td>
<td>Permissible Exposure Limit</td>
</tr>
<tr>
<td>PNOR</td>
<td>Particulate Not Otherwise Regulated</td>
</tr>
<tr>
<td>PNOC</td>
<td>Particulate Not Otherwise Classified</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>RTECS</td>
<td>Registry of Toxic Effects of Chemical Substances</td>
</tr>
<tr>
<td>SARA</td>
<td>Superfund Amendment and Reauthorization Act</td>
</tr>
<tr>
<td>SCBA</td>
<td>Self-contained Breathing Apparatus</td>
</tr>
<tr>
<td>SDS</td>
<td>Safety Data Sheet</td>
</tr>
<tr>
<td>STEL</td>
<td>Short-term Exposure Limit</td>
</tr>
<tr>
<td>TLV</td>
<td>Threshold Limit Value</td>
</tr>
<tr>
<td>TWA</td>
<td>Time-weighted Average</td>
</tr>
<tr>
<td>UEL</td>
<td>Upper Explosive Limit</td>
</tr>
</tbody>
</table>

**Disclaimer:** This information covers AK Steel products as delivered from an AK Steel facility, but does not include chemicals that may be applied by subsequent handlers and/or distributors of the product. This could include a variety of materials including oils, paints, galvanization, etc. that are not included in the Safety Data Sheet (SDS). Additionally, specialty orders may require application of coating materials not listed in this SDS. SDS’s for any AK Steel applied specialty coating will be supplied separately. The information in this SDS was obtained from sources or is based upon data which we believe to be reliable; however, the information is provided without any representation or warranty, expressed or implied, regarding the accuracy or correctness of the information or whether other measures may be required under particular conditions. The conditions or methods of handling, storage, use, and disposal of the product are beyond our control and may be beyond our knowledge. AK Steel expressly disclaims all liability for loss, damage, or expense arising out of or in any way connected with the handling, storage, use or disposal of this product.