LEAD-FREE SOLDER POWDER
SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: A Tin-Copper-Silver Solder Powder. This SDS applies to the following grades of Lead-Free Solder Powder:
- LF-2
- LF-3

Trade Names and Synonyms: None.

Manufacturer:
Teck Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:
Teck Advanced Materials Inc.
13670 Danielson Street
Suite H & I
Poway, CA 92064

Preparer:
Teck Metals Ltd.
Suite 3300 – 550 Burrard Street
Vancouver, British Columbia
V6C 0B3

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Product Use: Solder powder.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

Health		Physical	Environmental
Acute Toxicity (Oral, Inhalation)	– Does not meet criteria	Does not meet criteria for any Physical Hazard	**Aquatic Toxicity – Long Term - Category 4**
Skin Corrosion/Irritation	– Does not meet criteria		
Eye Damage/Eye Irritation	– Does not meet criteria		
Respiratory or Skin Sensitization	– Does not meet criteria		
Mutagenicity	– Does not meet criteria		
Carcinogenicity	– Does not meet criteria		
Reproductive Toxicity	– Does not meet criteria		
Specific Target Organ Toxicity			
Acute Exposure	– Does not meet criteria		
Chronic Exposure	– Does not meet criteria		

LABEL:

Symbols: None	**Signal Word: None**
Hazard Statements	**Precautionary Statements:**
May cause long-lasting harmful effects to aquatic life.	Avoid release to the environment. Dispose of contents/containers according to local regulations.

Emergency Overview: A fine metal powder that does not burn in a fire but will melt readily at temperatures above 210°C to form a molten metal pool. This product is relatively non-toxic to humans, and poses little immediate hazard to personnel or the environment in an emergency situation.

Potential Health Effects: Pure tin, copper and silver are relatively non-toxic to humans. This product may cause mild local irritation to eyes, nose, throat and upper airways, particularly if the product is heated to the point of fuming. Tin, copper and silver are not listed as carcinogens by OSHA, NTP, IARC, ACGIH or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: The metals contained in this product could be toxic to aquatic and terrestrial organisms if present in ionic form. However, in this alloyed form they are not readily bio-available to the environment (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	CAS Registry No.	CONCENTRATION (% wt./wt.)
Tin	7440-31-5	LF-2 – 95.5% / LF-3 – 94.5%
Silver	7440-22-4	LF-2 – 3.5% / LF-3 – 3.5%
Copper	7440-50-8	LF-2 – 1% / LF-3 – 2%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Mild eye irritation, redness. Gently brush product off face if necessary. Do not rub eye(s). Let the eye(s) water naturally for a few minutes. Look right and left, then up and down. If particle/dust does not dislodge, cautiously rinse eye(s) with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, get medical advice/attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Symptoms:* Skin soiling, mild irritation. Wash gently and thoroughly with lukewarm, gently flowing water and non-abrasive soap for 5 minutes, or until product is removed. If skin irritation occurs or you feel unwell, get medical advice/attention. *Molten Metal:* Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: *Symptoms:* Coughing and irritation of nose and throat in heavy dust clouds. Remove source of exposure or move person to fresh air and keep comfortable for breathing. Seek medical attention if you feel unwell.

Ingestion: *Symptoms:* Stomach upset, nausea. If you feel unwell or are concerned, get medical advice/attention.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not considered a fire or explosion hazard. However, the powder has a relatively low melting point (210 - 215°C) and may readily form a molten metal pool when involved in a fire.

Extinguishing Media: Apply dry sand, dolomite, graphite, powdered sodium chloride, or special dry powder extinguishing media (i.e. Class D extinguisher). Do NOT use water, carbon dioxide, foam or Halons, especially for fires involving molten metal.

Fire Fighting: Fire fighters should be fully-trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Clean up spilled material, observing precautions in Section 8, Personal Protection and using methods which will minimize dust generation (e.g., vacuum solids, dampen material and shovel or wet sweep). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labelled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Personal Precautions: Protective clothing, gloves, and a respirator are recommended for persons responding to an accidental release (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact as well. Safety type boots are recommended.

Environmental Precautions: In this alloy form, tin, silver and copper have limited bio-availability and pose no immediate ecological risk. However, processing of the product or its extended exposure in aquatic and terrestrial environments may lead to the release of these metals in bioavailable forms. Contamination of water and soil by this product should be prevented.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling: Keep container closed when not in use. Use with adequate ventilation.

Conditions for Safe Storage: Store in a dry, covered area away from incompatible materials. No special packaging materials are required.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Tin	2 mg Sn/m^3	2 mg Sn/m^3	2 mg Sn/m^3
Silver	0.10 mg Ag/m^3	0.01 mg Ag/m^3	0.01 mg Ag/m^3
Copper	0.2 mg Cu/m^3 fume	0.1 mg Cu/m^3 fume	0.1 mg Cu/m^3 fume
	1.0 mg Cu/m^3 dusts/mists	1.0 mg Cu/m^3 dusts/mists	1.0 mg Cu/m^3 dusts/mists

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.

ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit.

The OSHA PEL final rule limits for tin, inorganic compounds (except oxides) (as Sn) is 2 mg/m^3. Note that the OSHA PEL final rule limits are currently non-enforceable due to a court decision. The OSHA PEL transitional limits therefore remain in force at present. The transitional PEL is also 2 mg/m^3 for tin, inorganic compounds (except tin oxides). OSHA does not give a specific PEL for tin oxides but NIOSH and ACGIH give a time-weighted average exposure limit of 2 mg/m^3 for tin oxides.

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of dust and/or fumes in the working environment well below recommended occupational exposure limits for tin, silver and copper. Supply sufficient replacement air to make up for air removed by the exhaust system.

Protective Clothing: Gloves and coveralls, shop coat or other work clothing with long sleeves are recommended to prevent prolonged or repeated direct skin contact when this solder powder is processed. Eye protection should be worn to prevent exposure to powder or fume. Safety type boots are recommended.

Respirators: Where fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 or 100 particulate filter cartridge).

General Hygiene Considerations: Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Fine silver metallic to grey metallic powder	**Odour:** None	**Odour Threshold:** Not applicable	**pH:** Not applicable
Vapour Pressure: Negligible at 20°C	**Vapour Density:** Not applicable	**Melting Point/Range:** 210 – 215°C	**Boiling Point/Range:** 2270°C (Tin)
Relative Density (Water = 1)**:** 7.3 – 7.4	**Evaporation Rate:** Not applicable	**Coefficient of Water/Oil Distribution:** Not applicable	**Solubility:** Insoluble in water
Flash Point: None	**Flammable Limits (LEL/UEL):** Not applicable.	**Auto-ignition Temperature:** Not applicable	**Decomposition Temperature:** Not applicable.

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: This material is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or run-away reactions will not occur. Oxidizes slowly, especially in the presence of moisture.

Incompatibilities: Always keep product dry. Avoid contact with strong acids or alkalis. Incompatible with strong oxidizing agents such as chlorine, fluorine, bromine, and interhalogens such as bromine trifluoride, as well as sodium, potassium and barium peroxide, sodium or potassium chlorate, fused ammonium nitrate and turpentine, magnesium, acetylene gas.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting and electric arc welding will generate metal oxide fume. The particle size of metal fumes is largely within the respirable size range, which increases the likelihood of inhalation and deposition of the fume within the body.

SECTION 11. TOXICOLOGICAL INFORMATION

General: The inhalation route is by far the most significant route in the occupational setting. Ingestion is a possible minor secondary route of exposure. Metal fume fever may result from significant overexposure to lead free solder fumes.

Acute:
Skin/Eye: Contact with lead-free solder powder or fume may cause local mechanical irritation but would not cause tissue damage. There have been limited reports of allergic contact dermatitis following exposure to powdered silver, silver solutions, and dental amalgams.

Inhalation: Acute inhalation of dusts and particularly fumes may result in irritation of the nose, throat and upper respiratory passages. Symptoms may include discomfort, coughing, tingling sensation, sneezing and/or shortness of breath and wheezing. Acute overexposure to copper dust or fume can result in the condition called metal fume fever. The symptoms of metal fume fever will occur within 3 to 10 hours, and include immediate dryness and irritation of the throat, sweet metallic taste, tightness of the chest, and coughing which may later be followed by flu-like symptoms of fever, malaise, perspiration, frontal headache, muscle cramps, low back pain, occasionally blurred vision, nausea, and vomiting. The symptoms are temporary and generally disappear without medical intervention within 24 to 48 hours of onset. There are no recognized complications, after affects, or chronic affects that result from this condition. Extremely high exposures to silver oxide fumes have caused lung damage with pulmonary edema, but this ingredient is present at such a low concentration that exposures of this magnitude would be unlikely.

Ingestion: Ingestion may irritate the stomach resulting in possible headache, metallic taste, nausea and vomiting.

Chronic: There is no chronic form of metal fume fever but in rare instances an acute incident may be followed by complaints such as bronchitis or pneumonia. Chronic exposure to tin dust or fumes is known to cause a benign pneumoconiosis (stannosis) characterized by progressive X-ray changes of the lung while exposure continues, but without any distinctive fibrosis or scarring of the lungs and without any evidence of disability. Prolonged exposure to silver dust may cause a bluish or greyish pigmentation to the skin, eyes and mucous membranes. Copper may also cause skin and hair discoloration. However, both metals are present only at low concentrations in the solder powder. Tin, copper and silver are not listed as human carcinogens by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

Animal Toxicity:

Hazardous Ingredient:	Acute Oral Toxicity:	Acute Dermal Toxicity:	Acute Inhalation Toxicity:
Tin	LD_{50} >2,000 mg/kg†	LD_{50} >2,000 mg/kg*	LC_{50} >4.75 mg/L‡
Silver	LD_{50} >5,000 mg/kg†	LD_{50} >2,000 mg/kg*	LC_{50} >5.16 mg/L‡
Copper	LD_{50} >5,000 mg/kg††	LD_{50} >2,000 mg/kg*	LC_{50} >5.11 mg/L‡

† LD_{50}, Rat, Oral, * LD_{50}, Rat, Dermal, ‡ LC_{50}, Rat, Inhalation, 4 hour
†† LD_{50}, Mouse, Oral

SECTION 12. ECOLOGICAL INFORMATION

The metals contained in this product are not directly bio-available and pose no immediate ecological risk. However, they may become such through oxidation or processing of the product. Compounds of copper, silver and tin are highly toxic to aquatic and terrestrial organisms.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME ..... Not regulated.
TRANSPORT CANADA / U.S. DOT CLASSIFICATION ..... Not applicable.
PRODUCT IDENTIFICATION NUMBER ..... Not applicable
MARINE POLLUTANT..... No
IMO CLASSIFICATION ..... Not regulated

SECTION 15. REGULATORY INFORMATION

U.S.
Ingredients Listed on TSCA Inventory ..... Yes
Hazardous Under Hazard Communication Standard..... Yes
CERCLA Section 103 Hazardous Substances

Tin	No	RQ: N/A
Copper	Yes	RQ: 5,000lbs.
Silver	Yes	RQ: 1,000lbs.

EPCRA Section 302 Extremely Hazardous Substance:..... No ingredients qualify.
EPCRA Section 311/312 Hazard Categories: ..... No hazard categories apply.
EPCRA Section 313 Toxic Release Inventory:

Copper	CAS No. 7440-50-8	Percent by Weight: 1.0-2.0%
Silver	CAS No. 7440-22-4	Percent by Weight: 3.5%

SECTION 16. OTHER INFORMATION

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The information in this Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, Seventh Edition including updates.
- American Conference of Governmental Industrial Hygienists, 2018 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Government Industrial Hygienists, 2018, Guide to Occupational Exposure Values.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition (P. G. Urben, Ed.) 1995.
- Canadian Centre for Occupational Health and Safety (CCOHS) CHEMINFO Chemical Substance On-Line Data Base.
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Étain (Tin), 2000-01.
- European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
- Industry Canada, SOR/2015-17, 11 February 2015, Hazardous Products Regulations.
- International Chemical Safety Cards (WHO/IPCS/ILO), ICSC: 1535: Tin Metal (Oct 2004).
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank.
- Patty's Toxicology, 5th Edition, (E. Bingham, B. Cohrssen & C.H. Powell, Ed.) 2001.
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards. On-line edition.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

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