

CROWN ALLOYS

COMPANY

MATERIAL SAFETY DATA SHEET

Section 1 - COMPANY AND MATERIAL IDENTIFICATION

PRODUCT TYPE: All purpose brazing flux specifically designed for malleable and gray cast irons.

TRADE NAME: TIGER FLUX #4

SPECIFICATION: N/A

CLASSIFICATION: N/A

VENDOR: Crown Alloys Company

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Madison Heights, MI. 48071

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Emergency 24 hour telephone #
CHEMTREC (800) 424-9300

WEBSITE: www.crownalloys.com

DATE: August 18, 2006

Section 2 - HAZARDOUS INGREDIENTS

IMPORTANT! This section covers the material from which these products are manufactured. The fumes and gases produced when welding with normal use of these products are covered in Section 5 & 6.

Ingredient	CAS No.	OSHA – TWA PEL,mg/m ³	(ACGIH – TWA) ¹ TLV,mg/m ³	Wt. %
Boric Acid	10043-35-3	15.0 (total dust) 5.0 (respirable dust) 10.0 (Cal OSHA/PEL)	10.0	65.0 - 75.0
Manganese Dioxide	1313-13-9	5.0 Ceiling (for manganese compounds as Mn)	0.2 for manganese (elemental and organic compounds as Mn)	2.0 max.
Sodium Tetraborate Decahydrate	1303-96-4	10.0 (total dust) 5.0 (Cal OSHA/PEL)	5.0	20.0 - 35.0

Other ingredients, if any, are not on the lists of hazardous materials and are classified as trade secret. NIOSH classifies welding fumes as carcinogens.
¹The ACGIH has an established exposure limit for Welding Fumes, Not Otherwise Classified. That Threshold Limit Value is 5 mg/m³.

HMIS RATING (Hazardous Materials Information System)

Health (blue) - 1 (See Sections 6 and 9)	Flammability (red) - 0	Reactivity (yellow) - 1	Protective Equipment - X (See Section 7)
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Health Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; one time overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal).

Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]).

Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

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Section 3 - PHYSICAL and CHEMICAL CHARACTERISTICS

APPEARANCE AND COLOR:

- Gray crystalline powder with no characteristic odor.

The following information is for boric acid, a main component of Tiger Flux #4.

SOLUBILITY IN WATER: 4.7% @ 20°C
27.5% @ 100°C

pH @ 20°C: 6.1 (0.1% solution)

5.1 (1.0% solution)

3.7 (4.7% solution)

VAPOR PRESSURE: (mm Hg): Negligible

SPECIFIC GRAVITY @ 20°C (water = 1): 1.51

MOLECULAR WEIGHT: 61.84

MELTING POINT: 170.9°C (340°F) heated in closed space

Section 4 - FIRE and EXPLOSION HAZARD DATA

NATIONAL FIRE PROTECTION ASSOCIATION:

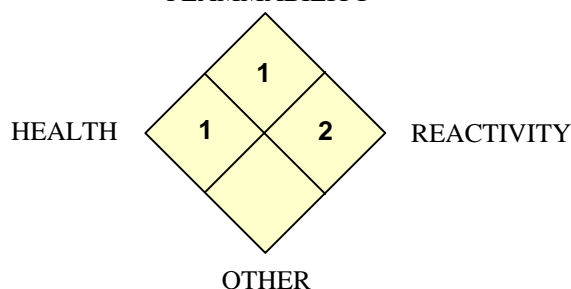
Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure cause serious temporary or residual injury); 4 (materials that under very short exposure causes death or major residual injury).

Flammability Hazard: Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

Reactivity Hazard: Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

NFPA RATING

FLAMMABILITY



FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): N/A Upper (UEL): N/A

AUTO IGNITION TEMPERATURE: None

FLASH POINT: N/A

FIRE EXTINGUISHING MATERIALS: Dry chemical, foam or carbon dioxide.

FLAMMABILITY CLASSIFICATION: (29 CFR 1910.1200): Non-flammable solid.

GENERAL HAZARD: Not combustible, but the **manganese dioxide** is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. The **manganese dioxide** will increase the flammability of any combustible material.

Brazing flame, welding arc and sparks can ignite combustibles and flammables. Refer to American National Standard Z49.1 "Safety in Welding and Cutting" and "Safe Practices" Code: SP, published by the American Welding Society for fire prevention during the use of welding, brazing and allied procedures.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Reaction with strong reducing agents, such as metal hydrides or alkali metals, will generate hydrogen gas, which could create an explosive hazard.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear NIOSH/MSHA approved Self-Contained Breathing Apparatus and full protective equipment. Chemical resistant clothing may be necessary. If possible, prevent run-off water from entering storm drains, bodies of water or other environmentally sensitive areas.

Section 5 - STABILITY AND REACTIVITY DATA

STABILITY: At room temperature the **boric acid** is a stable product, but when heated it loses water, first forming metaboric acid, and on further heating it is converted into boric oxide. At room temperature the **sodium tetraborate decahydrate** is a stable product, but when heated it loses water, eventually forming anhydrous borax.

HAZARDOUS DECOMPOSITION PRODUCTS: If the **Tiger Flux #4** reacts with strong reducing agents, such as metal hydrides or alkali metals, hydrogen gas will be generated, which could create an explosive hazard. Toxic metal fumes may form when heated to decomposition.

MATERIALS WITH WHICH THIS PRODUCT IS INCOMPATIBLE AND CONDITIONS TO AVOID: **Tiger Flux #4** reacts as a weak acid which may cause corrosion of base metals. Reaction with strong reducing agents, such as metal hydrides or alkali metals, will generate hydrogen gas, which could create an explosive hazard. Also the **manganese dioxide** is incompatible with easily oxidizable materials, sulfur, sulfides, phosphides, hypophosphites, chlorates, peroxides, aluminum powder, rubidium acetylide, potassium azide, chlorine trifluoride. Reacts with hydrochloric acid to form corrosive chlorine gas. Heating or rubbing **manganese dioxide** material with organic materials can cause a fire hazard.

Hazardous Decomposition Products

Brazing/soldering fumes and gases can not be classified simply. The composition and quantity of both are dependent upon the type of flux, the metal being soldered/brazed and the rods 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 soldered/brazed (such as paint, plating, or galvanizing), the number of welders, the volume of the work area, the quality and the amount of ventilation, the position of the welder's head with respect to the gas plume, the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities), the process and procedures, as well as the soldering/brazing consumables.

When this flux is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredient listed in Section 2. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 2, plus those from the base metal, coatings, etc., as noted above. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from an arc, in addition to the shielding gases like argon and helium, whenever they are employed.

One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample inside the welder's helmet if worn or in the worker's breathing zone. See ANSI/AWS F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes" and "Characterization of Arc Welding Fume" available from the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

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Section 6 - HEALTH HAZARD DATA

- **Medical conditions aggravated by exposure to this product:** Persons with impaired respiratory function, psychiatric or neurological disturbances, and nutritional deficiencies may be more susceptible to the effect of this substance.
- **EYES:** Contact with this flux is generally non-irritating to eyes, however excessive exposures may cause irritation, redness and pain.
- **SKIN:** This flux does not cause irritation to intact skin. However, if the **Tiger Flux #4** is absorbed through large areas of damaged skin, delayed effects of skin redness and peeling may occur.
- **INGESTION:** This flux is not intended for ingestion. The **Tiger Flux #4** has a low acute toxicity. Small amounts (e.g. a teaspoonful) swallowed accidentally are not likely to cause effects; swallowing amounts larger than that may cause gastrointestinal symptoms such as nausea, vomiting and diarrhea. Animal ingestion studies in several species, at high doses, indicate that the **Tiger Flux #4** causes reproductive and developmental effects (testes are the target organs in male animals). Although they are poorly absorbed through the intestines, inorganic manganese salts may produce hypoglycemia and decreased calcium blood levels should absorption occur.
- **INHALATION:** During brazing and soldering operations, the most significant route of *overexposure* is via inhalation of fumes. Some of the health effects are listed below:
 - **SHORT TERM (ACUTE):** Occasional mild irritation effects to nose and throat may occur from inhalation of **Tiger Flux #4** dust at levels greater than 10mg/m³. Because of the presence of **manganese dioxide**, inhalation can cause a flu-like illness (metal fume fever). This 24 to 48 hour illness is characterized by chills, fever, aching muscles, dryness in the mouth and throat and headache. May irritate the respiratory tract. May increase the incidence of upper respiratory infections (pneumonia). Absorption of inorganic manganese salts through the lungs is poor but may occur in chronic poisoning.
 - **LONG TERM (CHRONIC):** **Tiger Flux #4** is not a known carcinogen. A human study of occupational exposure to **Tiger Flux #4** dust showed no adverse effect on reproduction. Large amounts of the **Tiger Flux #4** can be harmful to plants and other species. Therefore, releases to the environment should be minimized. *Chronic manganese poisoning* can result from excessive inhalation and ingestion exposure and involves impairment of the central nervous system. Early symptoms include sluggishness, sleepiness, and weakness in the legs. Advanced cases have shown fixed facial expression, emotional disturbances, spastic gait, and falling. Illness closely resembles Parkinson Disease. Kidney effects, blood changes and manganese psychosis also may occur as a result of *chronic exposure*. *Chronic inhalation exposure* can cause lung damage.

Section 7 - PRECAUTIONS FOR SAFE HANDLING & USE/APPLICABLE

CONTROL MEASURES

VENTILATION AND ENGINEERING CONTROLS: Maintain exposures below the acceptable exposure levels (see Section 2). Use industrial hygiene air monitoring to ensure that your use of this product does not create exposures that exceed the recommended exposure limits. Always use exhaust ventilation in user operations such as high temperature cutting, grinding, welding, brazing and soldering. Train the welder to keep his head out of the fume plume. Maintain air flow away from the user to remove all fumes and dusts, so that the PEL is never exceeded. Adhere to Environmental regulations for exhausts. Confined spaces require adequate ventilation and/or air supplied respirators. Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1, *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126 and OSHA Publication 2206 (29CFR1910), US Government Printing Office, Washington, D.C. 20402 for more details on many of the following.

RESPIRATORY PROTECTION: Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below PEL's (see Section 2). Use only NIOSH approved respirators in accordance with 29 CFR 1910.134 – Respiratory Protection. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

FOR MAXIMUM SAFETY, BE CERTIFIED FOR AND WEAR A RESPIRATOR AT ALL TIMES WHEN WELDING OR BRAZING OR SOLDERING!

EYE PROTECTION: Ensure eyewash/safety shower stations are available near areas where these products are used. Wear safety glasses, goggles or face-shield with filter lens of appropriate shade number (per ANSI Z49.1-1988, "Safety in Welding and Cutting"). Goggles must be chemically tight safety goggles. Do NOT wear contact lenses.

PROTECTIVE CLOTHING: Protective gloves are recommended that are chemical and acid impervious. Since soldering involves high temperatures, be sure the gloves are designed for high temperature applications to prevent burns.

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash hands after handling this product. Do not eat or drink while handling this product. Do not smoke or apply cosmetics in areas where exposures exist.

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain the spill and then absorb, sweep-up and dispose of material. Flush the area to a chemical sewer. If the **Tiger Flux #4** is spilled in water, advise local water authority that none of the affected water should be used for irrigation or for the abstraction of potable water until natural dilution returns the boron value to its normal environmental background level. The **Tiger Flux #4** is a non-hazardous waste when spilled or disposed of, as defined in the Resource Conservation and Recovery Act (RCRA) regulations (40 CFR 261).

WASTE DISPOSAL METHOD: Prevent waste from contaminating surrounding environment. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal, state and local regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Store the flux at ambient conditions. Keep under extremely dry and controlled conditions. This flux will naturally absorb moisture and cake solid. Wash thoroughly after handling to remove all residue. Professionally wash contaminated clothing before re-use. Material will naturally absorb moisture and cake solid. Existing lung disorders will have increased toxic susceptibility.

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Section 8 - FIRST AID MEASURES

- **EYE EXPOSURE:** Flush eyes with plenty of water or saline for at least 15 minutes to remove all residue. If irritation persists for more than 30 minutes, seek medical attention.
- **SKIN EXPOSURE:** Wash thoroughly with soap and water. If a rash or burn develops, consult a physician.
- **INHALATION EXPOSURE:** If symptoms such as nose or throat irritation are observed, remove person to fresh air. If not breathing, administer artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
- **INGESTION EXPOSURE:** Swallowing small quantities (one teaspoon) will cause no harm to healthy adults. If larger amounts are ingested, give two glasses of water to drink and seek medical attention. Never give anything by mouth to an unconscious person. Get medical attention.
- **RECOMMENDATIONS TO PHYSICIANS:** Observation only is required for adult ingestion range of 4-8 grams of the **Tiger Flux #4**. For ingestion of larger amounts, maintain adequate kidney function and force fluids. Gastric lavage is recommended for symptomatic patients only. Hemodialysis should be reserved for massive acute ingestion or patients with renal failure. Boron analyses of urine or blood are only useful for documenting exposure and should not be used to evaluate severity of poisoning or to guide treatment.

Section 9 – TOXICOLOGICAL INFORMATION

Below are human and animal toxicological data available for the components of this product present in concentrations greater than 1%.

BORIC ACID: (CAS No. 10043-35-3) LD ₅₀ (oral, rat) = 3,500 to 4,100 mg/kg	MANGANESE DIOXIDE: (CAS No. 1313-13-9) LD ₅₀ (oral, rat) = 3478 mg/kg	SODIUM TETRABORATE DECAHYDRATE: (CAS No. 1303-96-4) LD ₅₀ (oral, rat) = 4,500 to 5,000 mg/kg
BORIC ACID: (CAS No. 10043-35-3) LC ₅₀ (inhalation, rat) = greater than 2.0 mg/L or g/m ³ .		LC ₅₀ (inhalation, rat) = greater than 2.0 mg/L or g/m ³ .

REPRODUCTIVE/DEVELOPMENTAL TOXICITY: Animal feeding studies in rat, mouse and dog, at high doses, have demonstrated effects on fertility and testes. **Boric acid** studies in rat, mouse and rabbit, at high doses, demonstrate developmental effects on the fetus, including fetal weight loss and minor skeletal variations. The doses administered were many times in excess of those to which humans would normally be exposed. **Manganese dioxide** may damage the reproductive system. It has shown teratogenic effects in laboratory animals.

CARCINOGENICITY/MUTAGENICITY: No evidence of carcinogenicity in mice. No mutagenic activity was observed for **boric acid** in a battery of short-term mutagenicity assays.

HUMAN DATA: Human epidemiological studies show no increase in pulmonary disease in occupational populations with *chronic exposures* to **boric acid dust** and **sodium borate dust**. A recent epidemiology study under the conditions of normal occupational exposure to **borate dusts** indicated no effect on fertility.

Section 10 – REGULATORY INFORMATION

WHMIS CLASSIFICATION: **Boric Acid** is classified as Class D-Division 2A under Canadian WHMIS guidelines.

CHEMICAL INVENTORY LISTING: **Boric Acid** (CAS No. 10043-35-3) appears on several chemical inventory lists (including the EPA TSCA inventory, Canadian DSL, European EINECS, Japanese MITI, Australian and Korean lists) under the CAS No. representing the anhydrous form of this inorganic salt.

RCRA: **Boric Acid** is not listed as a hazardous waste under any sections of the Resource Conservation and Recovery Act (RCRA) or regulations (40 CFR 261 et seq).

SUPERFUND: CERCLA/SARA: **Boric Acid** is not listed under CERCLA (Comprehensive Environmental Response Compensation and Liability Act) or its 1986 amendments, SARA (Superfund Amendments and Reauthorization Act), including substances listed under Section 313 of SARA, Toxic Chemicals, 42 USC 11023, 40 CFR 372.65, Section 302 of SARA. Extremely Hazardous Substances, 42 USC 11002, 40 CFR 355, or the CERCLA Hazardous Substances list, 42 USC 9604, 40 CFR 302. The **manganese dioxide** is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Section 11 – DEFINITIONS OF TERMS

CAS No. - Chemical Abstracts Service Number PEL - Permissible Exposure Level TLV - Threshold Limit Value

TWA - Time Weighted Average STEL - Short Term Exposure Limit IARC – International Agency for Research on Cancer

NIOSH – National Institute of Occupational Safety and Health OSHA – U.S. Occupational Safety and Health Administration

TDLo – the lowest dose to cause a symptom TCLo – the lowest concentration to cause a symptom

TD₀, LDLo, and LD₀, or TC, TCo, LCLo, and LCo – the lowest dose (or concentration) to cause lethal or toxic effects.

SARA – Superfund Amendments and Reauthorization Act ACGIH – American Conference of Governmental Industrial Hygienists

LD₅₀ & LC₅₀ – These values are the amount of a substance given to the stated species that causes 50% of that species to die.

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