



1. PRODUCT IDENTIFICATION

This MSDS applies to all established steel grades distributed by Crucible Service Centers. Specific percent components for each element can be obtained from the certificate of test.

Supersedes: December 1998 Prepared By: Crucible Service Centers Division
Reissued: [Redacted] Safety/Health Department

Telephone For Information: (315) 487-0800 Extension 718 (John Pirman, Quality Assurance Manager)
Emergency Telephone: [Redacted]

HMIS Rating: Health = 1 Flammability = 0 Reactivity = 0
WHMIS Rating (Canada): Class D - Division 2 - Sub Division A
Untested Mixture Containing a Toxic Material

2. HAZARDOUS INGREDIENTS

----- % WEIGHT -----							
ALLOY ELEMENTS	CAS NO.	HIGH SPEED	TOOL STEEL	300 STAINLESS	400 STAINLESS	VALVE STEEL	ALLOY STEEL
ALUMINUM*+	7429-90-5	<0.1	<3.0	<1.0	<0.5	<0.5	<1.0
CARBON	7440-44-0	<4.0	<4.0	<0.5	<4.0	<1.0	<0.70
CHROMIUM*	7440-47-3	<5.0	<13.0	<26.0	<27.0	<23.0	<2.0
COBALT*	7440-48-4	<15.0	<11.0	<0.5	<0.5	<0.5	<0.50
COLUMBIUM	7440-03-1	<0.1	<0.1	<2.0	<2.5	<2.5	<0.10
COPPER*	7440-50-8	<0.5	<1.5	<4.0	<5.0	<0.5	<0.50
IRON	1309-37-1	<75.0	<90.0	<90.0	<60.0	<60.0	<99.0
LEAD*	7439-92-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.35
MANGANESE*	7439-96-5	<1.0	<3.0	<6.0	<3.0	<13.0	<2.0
MOLYBDENUM	7439-98-7	<11.0	<10.0	<4.0	<3.5	<1.0	<1.0
NICKEL*	7440-02-0	<1.0	<18.0	<37.0	<5.0	<15.0	<4.0
SELENIUM*	7782-49-2	<0.1	<2.0	<0.5	<0.5	<0.1	<0.10
SILICON	7440-21-3	<1.0	<5.0	<2.0	<2.0	<4.0	<0.40
TITANIUM	7440-32-6	<0.1	<0.1	<1.0	<0.5	<0.5	<0.10
TUNGSTEN	7440-33-7	<19.0	<11.0	<0.5	<4.0	<3.0	<0.10
VANADIUM	7440-62-2	<10.0	<18.0	<0.5	<10.0	<0.5	<0.30

* SARA Title III, Section 313, Toxic Chemical. These chemicals are subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and 40 CFR 372. Please note if you repackage or otherwise redistribute this product to industrial customers, a notice similar to this one must be sent to those customers.

+ Regulated, under Section 313, as fume or dust.



3. PHYSICAL DATA

BOILING POINT: NA
MELTING POINT: 2600°F - 2800°F
VAPOR PRESSURE (mm Hg): NA
VAPOR DENSITY (Air = 1): NA

SPECIFIC GRAVITY (H₂O = 1.0): 7.4 - 8.7
EVAPORATION RATE (BUTYL ACETATE = 1.0): NA
SOLUBILITY IN WATER: Insoluble
APPEARANCE AND ODOR: Solid, odorless metal

4. FIRE AND EXPLOSION DATA

FLASH POINT: NA
FLAMMABLE LIMITS: NA
UNUSUAL FIRE AND EXPLOSION HAZARDS: NA

SPECIAL FIRE FIGHTING PROCEDURES: NA
LEL/UEL: NA
EXTINGUISHING MEDIA: NA

5. REACTIVITY DATA

STABILITY: Chemically stable

CONDITIONS TO AVOID: Avoid exposure to generated dust and/or fume

INCOMPATIBILITY (MATERIALS TO AVOID): Reacts with strong acids to generate hydrogen gas

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: Metallic oxides

HAZARDOUS POLYMERIZATION: Will not occur

6. HEALTH HAZARD DATA

PRIMARY ROUTE OF EXPOSURE: Inhalation of fumes from welding or burning; dusts from grinding or cutting.

ROUTES OF ENTRY: Inhalation: YES Skin: NO Ingestion: NO Eyes: YES

HEALTH HAZARDS (Acute and Chronic)

Note: Steel products in their usual physical form do not pose any health hazards. However, when subjected to welding, burning, sawing, brazing, grinding, etc. potentially hazardous fumes or dust may be generated. The above operations should be performed in well-ventilated areas. The primary route of exposure is from inhalation of fumes and dusts.

The effects of overexposure to the various metal fumes and dusts, which may be generated from this product, and the associated health effects from overexposure are as follows:

ACUTE: Excessive inhalation of metallic fumes and dusts may be irritating to respiratory passages. Excessive inhalation of fumes from many metals can produce an acute reaction known as "metal fume fever". Symptoms consist of chills and fever (very similar and easily confused with flu symptoms), a metallic taste in the mouth, and dryness and irritation of the throat. The symptoms come on 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. Iron oxide, copper, and manganese have been associated with causing metal fume fever.

High concentrations of metallic fumes and dusts can result in irritation of the eyes, skin, mucous membranes, and other forms of physical irritation.

ALLOY ELEMENTS	CAS NO.	OSHA PEL	ACGIH TLV
ALUMINUM	7429-90-5	15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction)	10 mg/m ³ (metal dust) 5 mg/m ³ (welding fume)
CARBON	7440-44-0	3.5 mg/m ³ (as carbon black)	3.5 mg/m ³ (as carbon black)
CHROMIUM	7440-47-3	1 mg/m ³	0.5 mg/m ³
COBALT	7440-48-4	0.1 mg/m ³	0.02 mg/m ³
COLUMBIUM	7440-03-1	15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction)	10 mg/m ³ (total dust) 3 mg/m ³ (respirable fraction) (particulate not otherwise classified)
COPPER	7440-50-8	0.1 mg/m ³ (fume) 1 mg/m ³ (dust)	0.2 mg/m ³ (fume) 1 mg/m ³ (dust)
IRON	1309-37-1	10 mg/m ³ (as iron oxide)	5 mg/m ³ (as iron oxide)
LEAD	7439-92-1	0.05 mg/m ³	0.15 mg/m ³
MANGANESE	7439-96-5	5 mg/m ³ (dust)(Ceiling Limit) 1 mg/m ³ (fume) 3 mg/m ³ (fume)(STEL)	0.2 mg/m ³ (dust) 1 mg/m ³ (fume) 3 mg/m ³ (fume)(STEL)
MOLYBDENUM	7439-98-7	10 mg/m ³ (as MO and insoluble compounds)	10 mg/m ³ (as MO and insoluble compounds)
NICKEL	7440-02-0	1 mg/m ³ (metal and insoluble compounds)	1 mg/m ³ (metal and insoluble compounds)
SELENIUM	7782-49-2	0.2 mg/m ³	0.2 mg/m ³
SILICON	7440-21-3	15 mg/m ³ (total dust)	10 mg/m ³ (total dust)
TITANIUM	7440-32-6	15 mg/m ³ (total dust) as TiO ₂	10 mg/m ³ (total dust as TiO ₂)
TUNGSTEN	7440-33-7	15 mg/m ³ (total dust) 5 mg/m ³ (Respirable dust) (Insoluble compounds)	5 mg/m ³ 10 mg/m ³ (STEL) (Insoluble compounds)
VANADIUM	7440-62-2	0.5 mg/m ³ (respirable dust as V ₂ O ₅) 0.1 mg/m ³ (fume as V ₂ O ₅)	0.05 mg/m ³ (respirable fraction as V ₂ O ₅)

NTP = NATIONAL TOXICOLOGY PROGRAM

- 1: Known to be carcinogenic; sufficient evidence from human studies.
- 2: Reasonably anticipated to be a carcinogen; limited evidence from studies in humans or sufficient evidence from studies in experimental animals.

IARC = INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

- 1: Carcinogenic to humans; sufficient evidence of carcinogenicity.
- 2A: Probably carcinogenic to humans; limited human evidence, sufficient evidence in experimental animals.
- 2B: Possibly carcinogenic to humans; limited evidence in human in the absence of sufficient evidence in experimental animals.
- 3: Not classified as to carcinogenicity to humans.
- 4: Probably not carcinogenic to humans.

CHRONIC: Chronic inhalation of high concentrations of metallic fumes and dusts are associated with the following conditions:

ALUMINUM: Excessive exposure to aluminum metal fumes and dust has been associated with scarring of the lung tissue, and respiratory irritation, but this effect may be due to simultaneous silica exposure.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

A

A

CARBON: Elemental carbon, as it exists in this product, is of very low toxicity. Health hazard data presented here is based on exposures to carbon black, not carbon as it is found in this product. Chronic inhalation exposure to carbon black may result in temporary or permanent damage to lungs and heart. Pneumoconiosis has been found in workers engaged in the production of carbon black. Skin conditions such as inflammation of the hair follicles, and oral mucosal lesions have also been reported from skin exposure.

CARCINOGENICITY: NA NTP: NO IARC: 3* OSHA REGULATED: NO
* (for Carbon Black.)

CHROMIUM: The health hazards associated with exposure to chromium are dependent on its oxidation state. The metal form (chromium as it exists in this product) is of very low toxicity. Welding fume generated from high chromium stainless steel may contain hexavalent chromium. This water-soluble hexavalent form is considerably more toxic. Adverse effects of the hexavalent form on the skin may include ulcerations, dermatitis, and allergic skin reactions. Inhalation of hexavalent chromium compounds can result in ulceration and perforation of the mucous membranes of the nasal septum, irritation of the pharynx and larynx, asthmatic bronchitis, bronchospasm and edema. Respiratory symptoms may include coughing and wheezing, shortness of breath and nasal itch. Eye irritation or inflammation may also result. The NTP lists hexavalent chromium as a known human carcinogen. Chromium metal is listed as not classifiable as to carcinogenicity to humans.

CARCINOGENICITY: YES NTP: NO* IARC: 3* OSHA REGULATED: NO
* (Hexavalent Chromium NTP: 1, IARC: 1)

COBALT: Inhalation of cobalt metal fumes and dust causes irritation of the nose and throat. Cobalt dust may cause an asthma-like disease with symptoms ranging from cough, chronic bronchitis, shortness of breath and labored breathing, to decreased pulmonary function, nodular scarring of the lung tissue, permanent disability and death. Exposure to cobalt may cause weight loss, dermatitis (inflammation of the skin) and respiratory hypersensitivity. Although cobalt is not listed by NTP or OSHA as a carcinogen, some data suggests that cobalt is an experimental carcinogen in laboratory animals. The author finds that the current OSHA limit of 0.1 mg/m^3 is not protective of worker health.

CARCINOGENICITY: NA NTP: NO IARC: 2B OSHA REGULATED: NO

COLUMBIUM (NIOBIUM): Columbium, when inhaled, is retained mainly in the lungs, and secondarily in bones. It interferes with calcium as an activator of enzyme systems. In laboratory animals, inhalation of niobium nitride and/or pentoxide leads to scarring of the lungs at exposure levels of 40 mg/m^3 . Columbium is a moderate eye irritant and a powerful skin irritant in laboratory animals.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

COPPER: Industrial exposure to copper fumes, dusts and/or mists results in metal fume fever, nausea, irritation of upper respiratory tract, and irritation of nasal mucous membranes. Chronic poisoning could aggravate individuals who suffer from Wilson's disease, a genetic condition characterized by liver cirrhosis, brain damage, nerve damage, kidney disease, and copper deposition in the cornea (eye).

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

IRON: Iron oxide can be generated during arc welding of this product. Chronic inhalation of excessive concentrations of iron oxide fumes and dusts may result in 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 iron oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens. Acute exposure to the eyes may result in mild conjunctivitis.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

LEAD: Chronic exposure to high concentrations of lead fumes and dusts may result in headaches, vomiting, delirium/hallucinations, convulsions, coma, and death from exhaustion and respiratory failure. The risk is higher for workers at primary melting refineries than for workers exposed to alloys that contain lead.

CARCINOGENICITY: NA NTP: NO IARC: 2B OSHA REGULATED: NO

MANGANESE: Chronic exposure to high concentrations of manganese fumes and dusts may increase the incidence of pneumonia and lung damage and may adversely affect the central nervous system with symptoms including sleepiness, weakness, emotional disturbances, spastic walk, mask-like facial expression and paralysis.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

MOLYBDENUM: Dust of metallic molybdenum has caused difficulty breathing, general weakness, dizziness, chest pain, expectoration, fatigue, headache, anorexia, and joint and muscle pain. Molybdenum has caused anemia and poor growth in experimental animals. Molybdenum may also cause pneumoconiosis and irritation to the lungs and eyes. In rats, dusts of metallic molybdenum have caused growth depression and thickening of intraalveolar septa, which contained connective tissue fibers.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

NICKEL: Nickel fumes are respiratory irritants and have been a known cause of asthma, pneumonia, pulmonary edema and pulmonary fibrosis in welders using nickel alloys. Airborne nickel contaminated dusts are regarded as capable of producing lung cancer. The risk is higher for workers at primary nickel smelters and refineries than for workers exposed to nickel alloys. Skin contact may cause an allergic rash. Nickel itch is the dermatitis resulting from sensitization to nickel. Itching can occur up to 7 days before skin eruption occurs. The primary skin eruption is reddening, or infection of the hair follicles, which may be followed by skin ulceration. Nickel sensitivity, once acquired, is apparently not lost.

CARCINOGENICITY: YES NTP: 2 IARC: 2B OSHA REGULATED: NO

SELENIUM: Overexposure of selenium fumes may produce accumulation of fluid in the lungs, garlic breath, bronchitis, pneumonitis, bronchial asthma, nausea, chills, fever, headache, sore throat, shortness of breath, conjunctivitis, vomiting, abdominal pain, diarrhea and enlarged liver. Selenium is an eye and upper respiratory irritant and a sensitizer. Overexposure may result in red staining of the nails, teeth, and hair. Selenium dioxide reacts with moisture to form selenious acid which is corrosive to the skin and eyes.

CARCINOGENICITY: NA NTP: NO IARC: 3 OSHA REGULATED: NO

SILICON: Elementary silicon is an inert material. Slight pulmonary lesions have been reported in laboratory animals from injections of silicon dust within the trachea. Silicon dust has little adverse affect on lungs and does not appear to produce significant organic disease or toxic effects when exposures are kept under the TLV. Silicon may cause chronic respiratory effects if repeated overexposure occurs.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

TITANIUM: Elemental titanium is an inert material. Titanium dioxide may be generated in welding fumes from this product. At extremely high concentrations titanium dioxide has induced lung cancer in rats. Titanium dioxide dust is a mild pulmonary, eye and skin irritant. Rats exposed to titanium dioxide developed small focal areas of emphysema which were attributable to large deposits of dust. Excessive exposure in humans may result in slight changes in the lungs. The dusts of titanium dioxide can be placed in the nuisance category.

CARCINOGENICITY: NA NTP: NO IARC: 3* OSHA REGULATED: NO

*(for Titanium Dioxide)

TUNGSTEN: Chronic exposure to tungsten dust has been reported to cause pulmonary fibrosis, characterized by cough, labored breathing, and wheezing. Dermatitis (inflammation of the skin), primarily on the sides of the neck, inner forearm, and the backs of the hands, was also reported. Dusts of tungsten pose a hazard considered to be somewhat greater than that of nuisance dust.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

(A)

VANADIUM: The health hazards associated with exposure to vanadium are dependant on its oxidation state. This product contains elemental vanadium. Elemental vanadium could be oxidized to vanadium pentoxide during welding. The pentoxide form is more toxic than the elemental form. Chronic exposure to vanadium pentoxide dust and fumes may cause severe irritation of the eyes, skin, upper respiratory tract, persistent inflammation of the trachea and bronchi, pulmonary edema, and systemic poisoning. Signs and symptoms of overexposure include; conjunctivitis, nasopharyngitis, cough, labored breathing, rapid heart beat, lung changes, chronic bronchitis, skin pallor, greenish-black tongue and an allergic skin rash.

CARCINOGENICITY: NA NTP: NO IARC: NO OSHA REGULATED: NO

THIS PRODUCT AS A MIXTURE HAS NOT BEEN DETERMINED TO BE CARCINOGENIC. HOWEVER, INDIVIDUAL COMPONENTS, NICKEL, CERTAIN CHROMIUM AND COBALT COMPOUNDS, AND TITANIUM DIOXIDE HAVE BEEN ASSOCIATED WITH CARCINOGENICITY.

7. PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: NA

WASTE DISPOSAL METHOD: Dusts, etc. - follow Federal, State, and Local regulations regarding disposal.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Use good housekeeping practices to prevent accumulations of dusts and to keep airborne dust concentrations at a minimum.

8. CONTROL MEASURES - ALWAYS CONSULT A PROFESSIONAL HYGIENIST

RESPIRATORY PROTECTION: If fumes, misting or dust conditions occur, consult a professional Industrial Hygienist. Provide NIOSH approved respirators.

VENTILATION: Use general or local exhaust ventilation to keep airborne concentrations of dust and fumes below the TLV. Consult a professional Industrial Hygienist.

GLOVES: Gloves and barrier creams may be necessary to prevent skin sensitization and dermatitis (inflammation of the skin)

EYE PROTECTION: Safety glasses should be worn when grinding or cutting; face shields should be worn when welding or burning.

WORK/HYGIENIC PRACTICES: As required.

9. ADDITIONAL INFORMATION

CONTACT: Quality Assurance Department
Crucible Service Centers
P.O. Box 991
Camillus, New York 13031-0991

TELEPHONE: (315) 487-0800, Extension 718

As defined by OSHA, a STEL (Short Term Exposure Limit) is the employee's fifteen minute, time-weighted average exposure, which must not be exceeded at any time during a workday. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and should not occur more than 4 times per day, with an hour between successive exposures.

Coatings may be applied to the product for protective purposes. The possible presence of coatings should be recognized and considered when evaluating potential employee hazards and exposures during dust/fume generating activities. Applicable coating MSDS's are available upon request.