

Material Safety Data Sheet

Stainless Steels

J.M. Tull Metals Company, Inc.

4400 Peachtree Industrial Blvd.
P.O. Box 4725
Norcross, GA 30091
(770) 368-4311

Section 1 - Product Identification

Manufacturer's Name: Various	Date Prepared: 1-Mar-97
Product Name / Trade Name: Stainless Steels	Common Alloy / Grade: Bar, Sheet, Plate, Tubing, Pipe and Structural

Section 2 - Hazardous Ingredients / Identity Information Product Identification

Note: Products under normal conditions do not represent an inhalation, ingestion, or contact health hazard.

Ingredient (1)		CAS No.	Wt. % (2)	Permissible Air Level (3)	
				OSHA PEL	ACGIH TLV
Aluminum (Al)	(dust, fume)	7429-90-5	.01-.05	15	10, 5
Aluminum oxide	(fume)	1344-28-1		5	-
				Not established	10
Carbon (C)	(as carbon black)	1333-86-4	.03-2.0	3.5	3.5
Carbon monoxide		630-08-0		50 ppm, 55	25 ppm, 29
Carbon dioxide		124-38-9		5000 ppm, 9000	5000 ppm, 9000
Chromium (Cr)	(metals)	7440-47-3	10-27	1	0.5
	(Cr II compounds)			0.5 as Cr	-
	(Cr III compounds)			0.5 as Cr	0.5 as Cr
	(Cr VI cmpds-soluble)			0.1 ceiling as CrO3	0.5 as Cr
	(Cr VI cmpds-insoluble)			0.1 ceiling as CrO3	0.1 as Cr
Cobalt (Co)	(metal, dust & fume)	7440-48-4	.01-.75	0.1	0.02
Copper (Cu)	(dust & mist-inhalable particulate)	7440-50-8	.18-4.5	1	(1)
	(fume & respirable fraction)			0.1	(0.2)
Iron (Fe)		7439-89-6	Balance	Not established	Not established
Iron oxide	(dust & fume)	1309-37-1		10	5
Manganese (Mn)	(compounds and fume)	7439-96-5	2-10	5 ceiling	0.2
Molybdenum (Mo)	(soluble compounds)	7439-98-7	.04-5	5	5
	(insoluble compounds/dust)			15	10
Nickel (Ni)	(metal)	7440-02-0	.12-34	1	0.5
	(soluble compounds)			1	0.5
	(insoluble compounds)			1	0.1
Nitrogen (N)		7727-37-9	.01-.06	Not established	Not established
Nitric oxide		10102-43-9		25 ppm, 30	25 ppm, 31
Nitrogen dioxide		10102-44-0		5 ppm, 9 ceiling	3 ppm, 5.6
Oil Mist, mineral		8012-95-1		5	5
Oil Mist, mineral	containing a total of 15 PAH's listed as carcinogens by the NTP			Not established	0.005
Oxygen (O)		7782-44-7		Not established	Not established
Ozone		10028-15-6		0.1 ppm, 0.2	0.1 ppm ceiling
Phosphorous (P)	(yellow)	7723-14-0	.01-.06	0.1	0.1
Selenium (Se)	(and compounds)	7782-49-2	.01-0.3	0.2	0.2
Silicon (Si)	(dust and fume)	7440-21-3	.15-2.0	15	10
	(respirable fraction)			5	Not established
Sulfur (S)		7440-34-9	.01-.06	Not established	
Sulfur dioxide		7446-09-5		5 ppm, 13	2 ppm, 5.2
Tantalum (Ta)	(metal & oxide dusts)	1314-61-0	0.1-1.1	5	5
Titanium (Ti)		7440-32-6	.01-.70	Not established	
Titanium dioxide	(total dust)	13463-67-7		15	10
Welding fumes				Not established	5

Note: The above listing is a summary of elements used in alloying stainless steels. Various grades will contain different combinations of these elements. Other trace elements may also be present in minute amounts. Values shown are applicable to component elements.

Section 3 - Physical Data

Material is (normal conditions):	Solid	Appearance and Color:	Silver-Metallic, Odorless
Melting Point (Base Metal):	2400-2800 F	Vapor Pressure (mm Hg):	N/A
Boiling Point (Base Metal):	N/A	Vapor Density (Air =1):	N/A
Solubility in Water:	N/A	Evaporation Rate:	N/A
Specific Gravity (H ₂ O=1):	~8		

Section 4 - Fire and Explosion Hazard Data

Note: Products in the solid state present no fire or explosion hazard. Small chips, fines and dust may ignite readily.

Flash Point:	N/A	Flammable Limits:	N/A	LEL:	N/A	UEL:	N/A
--------------	-----	-------------------	-----	------	-----	------	-----

Extinguishing Media:

Dry powdered dolomite, dry sand or dry graphite; DO NOT USE water on molten metal.

Special Fire Fighting Procedures:

Use self-contained NIOSH breathing apparatus in pressure and demand mode.

Unusual Fire and Explosion Hazards:

DO NOT USE water on molten metal. Use coarse water spray on chips, turnings, etc. DO NOT USE halogenated extinguishing agents on small chips or fines.

Additional Information:

Arc or spark generated when welding or burning could be a source of ignition for combustion and flammable materials. Dust clouds may be explosive; prevent formation. Molten aluminum may also react violently with rust and certain metal oxides (i.e. Cu, Fe, Pb).

Section 5 - Reactivity Data

Stability:	Stable	Conditions to Avoid:	Make certain any material to be re-melted is free of moisture.
------------	--------	----------------------	--

Incompatibility (Materials to Avoid):

Halogenated acids & solvents, bromates, iodates, aluminum nitrate.

Hazardous Decomposition or Byproducts:

Metallic dust or fumes may be produced during welding, burning, grinding and possibly machining. Refer to ANSI Z49.1.

Hazardous Polymerization:

Will not Occur

Conditions to Avoid:

Aluminum particles coming into contact with copper, lead or iron oxides can react vigorously if source of ignition or intense heat.

Section 6 - Health Hazard Data

Note: Products in their usual physical form do not pose any health hazards. However, operations such as burning, welding, sawing, brazing or grinding may result in the following effects if exposures exceed permissible limits.

Route(s) of Entry:	Inhalation: Yes	Skin Contact: Yes	Eye Contact: Yes	Ingestion: No
--------------------	-----------------	-------------------	------------------	---------------

Health Hazards:

Acute: Excess exposure to all metallic fumes and dusts may result in irritation of eyes nose and throat. Also high concentrations of fumes and dusts of iron-oxide, manganese and copper may result in metal fume fever.

Chronic: Chronic and prolonged inhalation of high concentrations of fumes or dust of the following elements may lead to the conditions listed opposite the element:

Aluminum May initiate fibrotic changes to lung tissue, irritation of the eyes, nose and throat. Particles Al deposited in the eye may cause irreversible tissue damage of the cornea. Al salts may causes dermatitis, eczema, conjunctivitis and irritation of the mucus membranes of the upper respiratory tract. Long-term inhalation exposure to Al dusts or fumes has been associated with a fibrotic lung condition known as Shaver's disease. Al dust/fines and fumes are a low health risk by inhalation. For standard operations (milling, cutting, grinding), aluminum dust should be treated as a nuisance dust as defined by the ACGIH. Welding aluminum, plasma arc cutting, and arc spray metalizing can generate ozone. Excessive exposure to aluminum fume and dust has been associated with lung disease, but this effect is probably due to simultaneous silica exposure.

Carcinogenicity: N/A NTP? No IARC? A4* OSHA Regulated? No
*(for aluminum oxide)

Carbon Elemental carbon, as it exists in this product, is of very low toxicity; no chronic debilitating symptoms indicated. 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: N/A NTP? No IARC? A4* OSHA Regulated? No
*(for carbon black)

Chromium Cr fumes and dusts can cause sensitization dermatitis, inflammation and/or ulceration of upper respiratory tract, lesions of the skin and mucus membranes, and possibly cancer of the nasal passages or lungs-bronchogenic carcinoma.

Carcinogenicity: N/A NTP? No IARC? A4 OSHA Regulated? No

Hexavalent Chromium (Chromium VI)	Chromium VI can cause asthma, kidney damage, primary irritant dermatitis, sensitization dermatitis, skin ulceration, and pulmonary edema (fluid in the lungs). Chronic inhalation or overexposure has been associated with lung, nasal, and gastrointestinal cancer. Hexavalent chromium is listed as carcinogenic to humans by IARC. Chromium and some of its compounds are listed as carcinogenic by the NTP. Carcinogenicity: Yes NTP? 1 IARC? A1 OSHA Regulated? No
Cobalt	Inhalation of Co dust may cause an asthma-like disease with cough and dyspnea, respiratory tract irritation and hypersensitization dermatitis. Chronic overexposure to Co dust and fume may result in polythemia, hyperplasia of bone marrow and thyroid gland, pericardial effusion and damage to pancreas alpha cells. Animal studies have shown that particulate is an acutely irritating substance and industrial exposures, possibly combined with small amounts of silica, are reported capable of producing serious pneumoconiosis which is initially of an insidious nature. Carcinogenicity: N/A NTP? No IARC? A3 OSHA Regulated? No
Copper	No chronic debilitating symptoms indicated. Inhalation of Cu dusts, fumes and mists may cause irritation of the eyes, nose and throat and a flu-like illness called metal fume fever. Early symptoms of metal fume fever include a metallic or sweet taste in the mouth, dryness and irritation of the throat and coughing. These symptoms may progress to shortness of breath, headache, fever, chills, muscle aches, nausea, vomiting, weakness, fatigue and profuse sweating. The attack may last 6-48 hours and is more likely to occur after a period away from the job. Chronic overexposure to copper fumes may result in blood disorders (anemia). Repeated or prolonged exposure to Cu fumes may cause discoloration of hair, hands, and soles of the feet (keratinization). Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No
Iron	No chronic debilitating symptoms indicated. Subjecting Fe and alloys containing Fe to high temperatures (such as occurs during welding) will cause the formation of iron oxide. High exposures to iron oxide dust or fumes can cause x-ray changes (siderosis or iron pigmentation) in the lungs as a result of long-term exposure. Siderosis is a benign condition and is not associated with pulmonary fibrosis (scarring of the lung). Ingestion of high levels of iron oxide can cause gastrointestinal irritation, bleeding and systemic toxicity. Carcinogenicity: N/A NTP? No IARC? A4* OSHA Regulated? No *(for iron oxide)
Lead	Lead is an accumulated poison. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, constipation, abdominal pains and decreasing appetite. The effects are reversible and complete recovery is possible. Inhalation of large amounts of lead may lead to seizures, coma and death. Chronic or acute inhalation exposures to the fumes or dusts of inorganic lead compounds (such as lead oxide) can adversely affect several organ systems including the nervous system, the gastrointestinal system, the hematological system and renal system. The early effects are characterized by fatigue, constipation, muscle aches, abdominal pains, and decreased appetite. Later signs and symptoms can include anemia, pallor, a "lead Line" on the gums, and reduced hand-grip strength. Lead colic produces intense abdominal cramping which can be accompanied by constipation, nausea, and vomiting. A condition called "wrist drop" can develop if the peripheral nervous system is affected. Severe central nervous system effects (referred to as lead encephalopathy) usually only occur after heavy and rapid lead exposures. Signs and symptoms may include headache, dizziness, convulsions, delirium, coma, and possibly death. Long-term exposures can also produce kidney damage with possible decreased renal function leading to such conditions called stannosis. Alcohol ingestion and physical exertion may bring on symptoms. Continued exposure can result in decreased fertility and/or increased chances of miscarriage or birth defects. Lead inorganic dust and fume is listed as possibly carcinogenic by IARC. Carcinogenicity: N/A NTP? No IARC? A3 OSHA Regulated? No
Lead chromate	Anemia, urinary dysfunction, weakness, constipation, nausea, nervous disorder, peripheral neuropathy and chromosomal changes. Carcinogenicity: Yes NTP? No IARC? A2 OSHA Regulated? No
Manganese	Mn intoxication is usually due to the oxide or salts of Mn, elemental Mn exhibits very low toxicity. Manganese oxide fumes can act as minor irritants to the eyes and respiratory tract and metal fume fever. Both acute and chronic exposures may adversely affect the central nervous system (manganism), pneumonitis (inflammation of lung tissue), and may cause fibrosis (scarring of lung tissue), and reproductive disorders (impotence) in males. Early symptoms may include weakness in lower extremities, sleepiness, salivation, nervousness and apathy. Bronchitis, pneumonitis, lack of coordination resembling Parkinson's disease (apathy, weakness, etc.). The central nervous system is the chief site of the injury, and there may be adverse blood and kidney effects. Chronic manganese poisoning is not a fatal disease although it is extremely disabling. Some individuals may be hypersusceptible to manganese. Freshly formed manganese fume has caused fever and chills similar to metal fume fever. Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No

Molybdenum	Dust of metallic Mo has caused difficulty breathing, general weakness, pain in chest, joints, hands and feet, expectoration, fatigue, headache, anorexia, possible liver and kidney damage and bone deformity. Mo has caused anemia and poor growth in experimental animals. Mo may also cause pneumoconiosis and irritation to lungs and eyes. In rats, dusts of metallic Mo have caused growth depression and thickening of intraalveolar septa, which contained connective tissue fibers. Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No
Nickel	Skin contact with nickel and its compounds may cause allergic dermatitis. The resulting skin rash is often referred to as "nickel itch," which usually occurs when the skin is moist. Ni metal is listed as a possibly carcinogenic to humans by IARC. Ni fumes and dusts can cause skin sensitization and allergic contact dermatitis. Ni and its compounds may also produce eye irritation, particularly on the inner surfaces of the eyelids (i.e. the conjunctiva). Chronic inhalation of high levels of Ni can cause irritation of airways and lungs, lung fibrosis (scarring of the lungs), nasal septum perforation, nasal sinusitis, respiratory sensitization and asthma. Ni compounds have caused cancer of the lungs, larynx, and paranasal sinuses in lab animals Carcinogenicity: Yes NTP? 2 IARC? No* OSHA Regulated? No *(ACGIH has published notice of intended change to A4 for soluble and A1 for insoluble compounds)
Nitrogen	Oxides of nitrogen can cause irritation of the eyes, skin (when moist), and upper respiratory tract. Exposure to high levels of nitrogen oxides can cause delayed pulmonary edema (fluid in the lungs) which may be fatal. Nitric oxide can cause formation of methemoglobin which decreases the blood's ability to carry oxygen. Chronic overexposure can cause pulmonary fibrosis (scarring of the lungs). Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No
Oil coating	Some products are supplied with an oil coating or have residual oil from the manufacturing process. Prolonged or repeated skin contact with oil may result in skin irritation, dermatitis, or both. Untreated mildly refined mineral oils have produced skin tumors on repeated applications to laboratory animals. They are listed as carcinogenic on the NTP and IARC. If the product is heated well above the ambient temperatures or machined, oil vapor or mist may be generated. Overexposure to oil mist or vapor may cause asthma, bronchitis, respiratory tract irritation and neurological effects such as headaches, dizziness, drowsiness and central nervous system depression. Carcinogenicity: N/A NTP? No IARC? No* OSHA Regulated? No *(ACGIH has published notice of intended change to A1 for oils containing a total of 15 polynuclear aromatic hydrocarbons (PAH's) listed as carcinogens by the U.S. NTP)
Oxygen	Oxygen can cause irritation of the eyes, skin (when moist), and upper respiratory tract. Exposure to high levels of nitrogen oxides can cause delayed pulmonary edema (fluid in the lungs) which may be fatal. Nitric oxide can cause formation of methemoglobin which decreases the blood's ability to carry oxygen. Chronic overexposure can cause pulmonary fibrosis (scarring of the lungs). Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No
Ozone	Overexposure to ozone can result in mucus membrane and respiratory tract irritation. Severe overexposures can cause pulmonary edema (fluid in the lungs). Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No
Phosphorous	Chronic and prolonged inhalation of high concentrations of fumes or dust may cause necrosis of the mandible. Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No
Selenium	Chronic inhalation of high concentrations of fumes and dust are associated with 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: N/A NTP? No IARC? No OSHA Regulated? No
Silicon	No chronic debilitating symptoms indicated. Chronic exposure to inert dusts of silicon can cause increased airways resistance and contribute to chronic bronchitis. Accumulation in lungs may be responsible for benign pneumoniosis, but is not considered to be responsible for pulmonary functional impairment or respiratory symptoms. Intracheal administration of silicon in rabbits produced significant pulmonary lesions. Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No
Sulfur	Chronic and prolonged inhalation of high concentrations of fumes or dust, as sulfur dioxide , may lead to edema of the lungs. Carcinogenicity: N/A NTP? No IARC? A4* OSHA Regulated? No *(for sulfur dioxide)
Tantalum	No chronic debilitating symptoms indicated. Carcinogenicity: N/A NTP? No IARC? No OSHA Regulated? No

Titanium	Chronic and prolonged inhalation of high concentrations of fumes or dust may result in pulmonary irritation without disabling pneumoconiosis. Titanium dioxide is considered a nuisance particulate and may cause irritation of the eyes, nose and throat. Excessive exposure in humans may result in slight changes in the lungs. At extremely high concentrations, titanium dioxide has induced lung cancer in rats and is listed as carcinogen by NIOSH. Carcinogenicity: N/A NTP? No IARC? A4* OSHA Regulated? No *(for titanium dioxide)
Welding fumes -	Welding fumes cannot be classified simply. The composition and quantity of both are dependent on the alloy being welded and the process and electrodes used. Reliable analysis of fumes cannot be made without considering the nature of the welding process and system being examined; reactive metals and alloys such as aluminum and titanium are arc-welded in a protective, inert atmosphere such as argon. These arcs create relatively little fume, but they do create an intense radiation which can produce ozone. Similar processes are used to arc-weld steels, also creating a relatively low level of fumes. Ferrous alloys also are arc-welded in oxidizing environments that generate considerable fume and can produce carbon monoxide instead of ozone. Such fumes generally are composed of discrete particles of amorphous slags containing iron, manganese, silicon, and other metallic constituents depending on the alloy system involved. Chromium and nickel compounds are found in fumes when stainless steels are arc-welded. Some coated and flux-cored electrodes are formulated with fluorides and the fumes associated with them can contain significantly more fluorides than oxides. Because of the above factors, arc-welding fumes frequently must be tested for individual constituents that are likely to be present to determine whether specific TLV's are exceeded. Conclusions based on inhalable concentration are generally adequate if no toxic elements are present in welding rod, metal, or metal coating and conditions are not conducive to the formation of toxic gases. Are listed as possibly carcinogenic to humans by IARC. Carcinogenicity: See above NTP? No IARC? No OSHA Regulated? No

Additional Information:

Aluminum dust/fines and fumes are low health risk by inhalation. For standard operations (i.e. machining, cutting, grinding), aluminum should be treated as a nuisance dust and is so defined by the American Conference of Government Industrial Hygienists (ACGIH).

In welding, precautions should be taken for airborne contaminants which may originate from components of the welding rod. Recent epidemiological studies of workers melting and working alloys containing nickel and chromium have found no increased risk of cancer. Chromium and nickel and their components are listed in the 3rd Annual Report on carcinogens, as prepared by the National Toxicology Program (NTP) and by the International Agency for Research on Cancer (IARC).

Welding of **aluminum alloys** may generate carbon monoxide, carbon dioxide, ozone nitrogen oxides, infrared radiation and ultraviolet radiation.

Since **lead** is a cumulative toxic metal by inhalation or ingestion, appropriate industrial precautions to guard against these two routes of exposure need to be taken when handling these alloys. Sampling to establish the lead level exposure to airborne particulate or fumes is possible. Consult OSHA Lead standard 29 CFR 1910.1025 for specific health/industrial hygiene precautions and requirements to follow when handling lead compounds.

NTP (National Toxicology Program) Classifications:

Group 1: Known to be carcinogenic; sufficient evidence from human studies.

Group 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) Classifications:

Group A1 - Confirmed Human Carcinogen: The agent is carcinogenic to humans based on the weight of evidence from epidemiologic studies of, or convincing clinical evidence in, exposed humans.

Group A2 - Suspected Human Carcinogen: The agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are considered relevant to worker exposure. Available epidemiologic studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans.

Group A3 - Animal Carcinogen: The agent is carcinogenic in experimental animals at dose levels, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that are not relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

Group A4 - Not Classifiable as a Human Carcinogen: There are inadequate data on which to classify the agent in terms of its Carcinogenicity in humans and/or animals.

Group A5 - Not Suspected as a Human Carcinogen: The agent is not suspected to be a human carcinogen on the basis of properly conducted epidemiologic studies in humans.

Signs and Symptoms of Exposure:

Typical symptoms consist of a metallic taste in the mouth, dryness of the throat, chills, fever and influenza-like symptoms, usually lasting from 12 to 48 hours.



Medical Conditions Generally Aggravated by Exposure: