

MATERIAL SAFETY DATA SHEET

STAINLESS STEEL ALLOYS

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Stainless Steel Alloys

Note: Stainless Steel alloys in their usual solid form and under normal conditions do not present an inhalation, ingestion, or contact health hazard or fire or explosion hazard. Operations such as welding, sawing, brazing, burning, grinding, cutting, abrasive blasting, heat treating, pickling, machining, or similar operations may generate dust, fumes, chips, or machine turnings that may create a health or fire or explosion hazard. This MSDS does not apply to Stainless Steel alloys in powdered forms.

Manufacturer's Name:
 Wyman-Gordon Company
 244 Worcester Street
 North Grafton, MA 01536-8001

Emergency Phone Number:
 (508) 839-4441
Telephone Number for Information
 (508) 839-4441

SECTION 2: COMPOSITION AND INFORMATION ON INGREDIENTS: The chemical composition of Stainless Steel alloys will vary by the alloy grade. Approximate weight percent (WT. %) ranges are shown below. Refer to product specification for exact composition.

Contains the following alloys:

13-8	310	431	Greek Ascoloy
15-5	316	440c	Jethete
15-5 PH	317	654	M152
17-4	321	31803	S. Duplex
17-4 PH	347	32760	FCT
303	347c	Am 355	FCWT
304	410	Aremet	Mararing Steel
309	420	Duplex	

Iron (Fe)	Nickel (Ni)	Chromium (Cr)	Manganese (Mn)	Molybdenum (Mo)	Copper (Cu)	Aluminum (Al)	Vanadium (V)	Cobalt (Co)	Tungsten (W)
0-90	1-22	0-40	0-25	0-30	0-10	0-10	0-3	0-20	0-5
Carbon (C)	Silicon (Si)	Sulfur (S)	Titanium (Ti)	Phosphorus (P)	Columbium / Niobium (Nb)	Tantalum (Ta)			
0-3	0-5	0-0.5	0-5	0-0.5	0-2	0-1			

OCCUPATIONAL EXPOSURE LIMITS

Ingredient	CAS Number	Classified as Carcinogen	PEL (2008) (8-Hour TWA)	TLV (2007) (8-Hour TWA)
Iron (as Fe) (as Fe ₂ O ₃)	7439-89-6 1309-37-1	None Found	PEL Vacated 1989 Oxide Fume 10 mg/m ³	Dust & Fume 5 mg/m ³
Nickel (as Ni)	7440-02-0	IARC Group 2	1.0 mg/m ³	1.5 mg/m ³
Chromium (as Cr metal) (as Cr III) (as Cr VI)	7440-47-3	IARC Class 3 IARC Class 3 IARC Class 1, Yes NTP	1.0 mg/m ³ 0.5 mg/m ³ 5.0 µg/m ³ Action Level = 2.5 µg/m ³	0.5 mg/m ³ 0.5 mg/m ³ 0.01 mg/m ³ (Insoluble) 0.05 mg/m ³ Water Soluble
Manganese (as Mn)	7439-96-5	RTECS Contains Tumorigenic and/or carcinogenic and/or neoplastic data for components in this product	Fume 5.0 mg/m ³ (Ceiling)	0.2 mg/m ³ Manganese and inorganic compounds as Mn
Molybdenum (as Mo)	7439-98-7	None Found	Total Dust 15 mg/m ³ (Insoluble)	Insoluble 10 mg/m ³
Copper (as Cu)	7440-50-8	None Found	Dust & Mist 1.0 mg/m ³ Fume 0.1 mg/m ³	Dust & Mist 1.0 mg/m ³ Fume 0.2 mg/m ³
Aluminum (as Al)	7429-90-5	None Found	Total Dust 15 mg/m ³ Respirable Dust 5 mg/m ³	Metal Dust 10 mg/m ³ Welding Fume 5 mg/m ³
Vanadium (as V) (as V ₂ O ₅)	7440-62-2 1314-62-1	None Found	None Listed Respirable Dust 0.5 mg/m ³ (Ceiling) Fume 0.1 mg/m ³ (Ceiling)	None Listed Fume & Dust 0.05 mg/m ³
Cobalt (as Co)	7440-48-4	IARC Group 2	0.1 mg/m ³ (Metal, dust & fume)	0.02 mg/m ³ Cobalt and inorganic compounds as Co
Tungsten (as W)	7440-33-7	None Found	None Listed	Insoluble 5 mg/m ³
Carbon	1333-86-4	None Found	3.5 mg/m ³	3.5 mg/m ³
Silicon	7440-21-03	None Found	15 mg/m ³ Total Dust 5 mg/m ³ Respirable	Dust 10 mg/m ³ Respirable 5 mg/m ³
Sulfur	7704-34-9	None Found	None Listed (PEL Vacated 1989)	None Listed
Titanium (as Ti) (as TiO ₂)	7440-32-6 13463-67-7	None Found IARC Group 3	None Listed Total Dust 15 mg/m ³	None Listed 10 mg/m ³
Phosphorus	7723-14-0	None Found	0.1 mg/m ³	0.1 mg/m ³
Niobium	7440-03-1	None Found	None Listed	None Listed
Tantalum (as Ta)	7440-25-7	None Found	5 mg/m ³	5 mg/m ³

SECTION 3: HAZARDS IDENTIFICATION (See Note in Section 1)

Carcinogenicity: IARC, NTP, and OSHA do not list Stainless Steel alloy as a carcinogen. Nickel, chromium, and cobalt metal contained in Stainless Steel alloys is classified as possibly carcinogenic by IARC. Chromium is also classified by NTP as carcinogenic. Hexavalent chromium though not present in the alloy may be formed during welding or other thermal processes.

Routes of Entry/Exposure: Stainless Steel alloys in their usual solid form and under normal conditions do not present an inhalation, ingestion, or contact health hazard. Inhalation may occur if dust or fumes are generated. Skin absorption is not likely to occur but irritation may occur when in contact with the skin. Ingestion is not likely to occur.

Target Organs: Lungs, nasal cavity, kidney, liver, blood, central nervous system, eyes and skin.

Short-Term (Acute) Effects of Overexposure:

Eyes: Dusts or fumes can cause irritation with burning and tearing.

Inhalation: Dusts or fumes can cause irritation and dryness of the nose and throat, coughing, bronchitis, pneumonia, chest pain, and pulmonary edema. Flu-like symptoms such as fever and chills may occur a few hours after excessive exposure.

Skin: Dusts or fumes can cause irritation with itching. Dermatitis may occur.

Ingestion: Metallic taste, weight loss, and abdominal pain may occur.

Long-Term (Chronic) Effects of Overexposure: No significant adverse health effects found in literature search specific to Stainless Steel alloys. Chronic exposure to certain metals in Stainless Steel alloys may cause non-progressive pulmonary fibrosis or chronic bronchitis when overexposed to elevated dust or fume concentrations. Other symptoms include shortness of breath, cough, chest tightness, and wheezing without impairment. Central nervous system effects, kidney, and liver damage may occur from excessive exposure to dust or fumes. Dermatitis and allergic sensitization have been reported.

Conditions Aggravated By Exposure: Persons with sensitive skin or allergies to metals may be aggravated by exposure. Persons with respiratory problems may also be aggravated by exposure.

Also See TOXICOLOGICAL INFORMATION (Section 11)

SECTION 4: FIRST AID MEASURES

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids apart to ensure flushing of entire eye surface. Seek medical attention after flushing eyes with water.

Inhalation: Get person out of contaminated area to fresh air. If breathing has stopped, give artificial respiration and seek medical attention immediately.

Skin: Wash contaminated areas with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and wash before reuse. Seek medical attention if any irritation or redness occurs.

Ingestion: Seek medical attention immediately. Never give anything by mouth to an unconscious person.

Get appropriate in-plant, paramedic, or community medical support after first aid is given.

Note to Physicians: Treat Symptomatically.

SECTION 5: FIRE FIGHTING MEASURES (See Note in Section 1)

Autoignition Temperature: Autoignition will not occur for solid metal alloy.

Flammable Limits: Not tested

Extinguishing Media: Use appropriate extinguisher for surrounding materials when solid alloy is involved. Use Class D fire extinguishers for fires involving powders or dust.

Special Fire Fighting Procedures: Wear self-contained breathing apparatus with full facepiece operated in positive pressure mode and full turn-out gear.

Unusual Fire and Explosion Hazards: No fire or explosion hazard with solid metal alloys. A severe fire hazard may exist when fine turnings or chips are produced and during disposal of scrap containing chips or fines. Dry Stainless Steel alloy powder can be ignited by a match or small spark. Use of water on finely divided alloy may cause explosive hydrogen gas and heat to be evolved. Toxic metal fumes of nickel, chromium, aluminum, vanadium, iron, copper, and manganese may be emitted..

SECTION 6: ACCIDENTAL RELEASE MEASURES (See Note in Section 1)

Should spills of dust occur, use vacuum cleaner rated to clean up explosive dust and equipped with High Efficiency Particulate (HEPA) filters to clean minor spills. Do not sweep or use compressed air to clean up spills. Dispose of spilled material in accordance with local, state, and federal regulations.

SECTION 7: HANDLING AND STORAGE

Handling Precautions: Avoid generation of dust. Use good housekeeping practices if dusts are formed to prevent accumulation. Use appropriate personal protection. Contact qualified safety and health specialists to review usage and possible exposures.

Storage Requirements: Store in cool, dry, and well ventilated area away from incompatibles. Protect from physical damage and contact with water.

Regulatory Requirements: Follow OSHA, EPA, and DOT requirements.

SECTION 8: EXPOSURE CONTROLS, PERSONAL PROTECTION (See Note in Section 1)

Air Monitoring: Air monitoring should be performed by a professional industrial hygienist to determine the level of exposure. Results from monitoring will help to determine the appropriate personal protective clothing and equipment required.

Respiratory Protection: Air monitoring will help determine if and what level of respiratory protection is required. A respiratory protection program must be implemented if respirators are required (29 CFR 1910.134). Half face air purifying respirators with high efficiency particulate (HEPA) filters can be used when airborne concentrations do not exceed ten (10) times the Equivalent Exposure for PELs or TLVs.

Protective Clothing: Normal work clothes may be worn when airborne exposures are within allowable limits and contact with dust is not likely to occur. Use a qualified safety and health specialist to perform a hazard assessment (29 CFR 1910.133).

Engineering Controls: Local exhaust ventilation should be used whenever feasible to capture dust or fumes before reaching workers' breathing zone. Local exhaust design should follow ACGIH Ventilation Manual guidelines. Use vacuum cleaners rated to clean up explosive dust and equipped with High Efficiency Particulate (HEPA) filters to clean work surfaces and protective clothing before removal. Use non-sparking metal equipment.

Work Practices: Food and beverages should not be consumed, tobacco products should not be present or used, and cosmetics should not be applied in areas where dust is present. Workers should wash their hands and face prior to eating, drinking, smoking, or applying cosmetics and at the end of the work shift. Adequate washing facilities should be available and used by workers. Keep work areas free of waste.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Stainless Steel alloys are solid at room temperatures with a metallic silver or gray color. No odor.

Melting Point: NT for alloy (2650°F for nickel)

Specific Gravity: NT

Vapor Pressure: NA

Evaporation Rate: NA

Vapor Density: NA

Solubility in Water: Insoluble

Percent Volatile: Nil

pH: NA

SECTION 10: STABILITY AND REACTIVITY (See Note in Section 1)

Stability: Stainless Steel Alloys are stable at room temperature under normal storage and handling conditions.

Conditions Contributing to Instability: Avoid creating dusty airborne conditions. Violent explosion can occur when water comes in contact with molten metal.

Incompatibility: Avoid contact with acids and fluorine. Reacts with hydrazine, hydrazoic acid, performic acid, and potassium permanganate (NFPA 491M). Powdered metal reacts violently with ammonium nitrate, fluorine, sulfur, and selenium when heated (NFPA 481M).

Hazardous Decomposition Products: Toxic metal oxide fumes.

Conditions Contributing to Hazard Polymerization: None Known

SECTION 11: TOXICOLOGICAL INFORMATION (See Note in Section 1)

Eye Effects: No known human testing.

Skin Effects: May cause contact dermatitis in sensitized individuals (Ni)

Acute Inhalation Effects: Rat, oral, LD_{Lo}: 5 mg/kg (Ni);

Rat, unreported, LD₅₀: 27500 µg/kg (Cr)

Rat, oral, LD₅₀: 6171 mg/kg (Co)

Chronic Effects: Rat, inhalation, TC_{Lo}: 100 µg/m³/24 hrs/ 17 weeks (Ni)

Rat, inhalation, TC_{Lo}: 200 mg/m³/17 weeks (Co)

Carcinogenicity: Human Limited Evidence, IARC Group 2B (Ni);

Known to be carcinogenic by NTP (as Cr).

Teratogenicity: Rat, oral, TD_{Lo}: 158 mg/kg (Ni)

Mutagenicity: Hamster, morphological transformation: 400 mg/L (Ni)

Tumorigenic: Rat, subcutaneous, TD_{Lo}: 3000 mg/kg/6 weeks (Ni)

Rat, intravenous, TD_{Lo} 2160 µg/kg/6 weeks (Cr)

See NIOSH, RTECS QR5950000 (nickel), GB4200000 (chromium), NO7400000 (iron oxide), QA4680000 (molybdenum), GL5325000 (copper), BD0330000 (aluminum), YW1355000 (vanadium), GF8750000 (cobalt), and OO9275000 (manganese) for additional toxicity data.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity: There is little tendency for bioaccumulation along food chain. Alloy may persist in the environment for long periods based upon the corrosive resistance, insolubility in water, and non-biodegradable properties.

Environmental Degradation: In fresh and salt water, Stainless Steel Alloys will eventually form metal oxides and precipitate in sediments.

SECTION 13: DISPOSAL CONSIDERATIONS

Dispose of spilled material in accordance with local, state, and federal regulations. Solid waste generated from product processing should be classified by a competent environmental professional and disposed, processed, or recycled in accordance with federal, state, and local regulations.

SECTION 14: TRANSPORTATION INFORMATION

DOT Transportation Data: Stainless Steel Alloys are not listed in 49 CFR 172.101

SECTION 15: REGULATORY INFORMATION

The OSHA PELs are included in Section 2. The Stainless Steel alloys contain toxic chemicals subject to the reporting requirements of SARA Title III Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (40 CFR 372). This law requires certain manufacturers to report annual emissions of specific toxic chemical and chemical categories. Aluminum as a fume or dust, vanadium, molybdenum trioxide, and chromium are listed as Section 313 toxic chemicals. The Stainless Steel alloys may also require notification under SARA Title III Section 311/312 if inventories exceed the Threshold Planning Quantity. Your State Emergency Planning Committee should be contacted to determine if the Threshold Planning Quantity reporting requirements for your state are lower than EPA reporting requirements. The following table represents current EPA requirements.

	Aluminum (Al)	Vanadium (V)	Nickel (Ni)	Copper (Cu)	Manganese (Mn)	Molybdenum (Mo)	Chromium (Cr)
CAS Numbers	7429-90-5 (as Al) 1344-28-1 (as Al ₂ O ₃)	7440-62-2 (as V)	7440-02-0 (as Ni)	77440-50-8 (as Cu)	7439-96-5 (as Mn)	7439-98-7 (as Mo) 1313-27-5 (as MoO ₃)	7440-47-3 (as Cr) 1308-38-9 (as Cr ₂ O ₃)
SARA 313	Y (only as fume or dust)	Y (as fume or dust)	Y	Y	Y	Y (only as MoO ₃)	Y
SARA 302 EHS TPQ (lbs)	NA	10,000 as part of alloy	NA	NA	NA	NA	NA
RCRA Hazardous Waste No.	NA	NA	NA	NA	NA	NA	D007
RCRA Hazardous Waste Code	NA	NA	NA	NA	NA	NA	E
CERCLA RQ (lbs)	NA	NA	100 *	5,000 *	NA	NA	5,000 * (as Cr)

	Iron (Fe)	Tantalum (Ta)	Tungsten (W)	Titanium (Ti)	Silicon (Si)	Phosphorus (P)	Carbon (C)
CAS Numbers	1309-37-1 (as Fe)	7440-25-7 (as Ta)	7440-33-7 (as W)	7440-32-6 (as Ti)	7440-21-3 (as Si)	7723-14-0 (as P)	1333-86-4 (as C)
SARA 313	NA	NA	NA	NA	NA	Y	NA
SARA 302 EHS TPQ (lbs)	NA	NA	NA	NA	NA	1/100	NA
RCRA Hazardous Waste No.	NA	NA	NA	NA	NA	NA	NA
RCRA Hazardous Waste Code	NA	NA	NA	NA	NA	NA	NA
CERCLA RQ (lbs)	NA	NA	NA	NA	NA	1	NA

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	Cobalt (Co)	Niobium (Nb)	Sulfur (S)
CAS Numbers	7440-48-4 (as Co)	7440-03-1 (as Nb)	7446-09-5 (as S)
SARA 313	Y	NA	NA
SARA 311/312 TPQ (lbs)	NA	NA	NA
RCRA Hazardous Waste No.	NA	NA	NA
RCRA Hazardous Waste Code	NA	NA	NA
CERCLA RQ (lbs)	NA	NA	NA

* = CERCLA reporting required only if diameter of particles released is less than 100 micrometers.

SARA Categories: Immediate (acute) health hazard and Delayed (Chronic) health hazard. Reactive hazard if in molten state.

IN ACCORDANCE WITH 40 CFR 372.45 SUPPLIER NOTIFICATION, WYMAN-GORDON COMPANY IS NOTIFYING YOU THAT METAL ALLOYS YOU RECEIVE FROM US MAY CONTAIN TOXIC CHEMICALS WHICH ARE SUBJECT TO THE REPORTING REQUIREMENTS OF SARA 313 OF THE EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT OF 1986. POTENTIAL REPORTABLE TOXIC CHEMICALS AND CAS NUMBERS INCLUDE: ALUMINUM (FUME OR DUST) (7429-90-5), CHROMIUM (7440-47-3), COBALT (7440-48-4), COPPER (7440-50-8), MANGANESE (7439-96-5), MOLYBDENUM (7439-98-7), NICKEL (7440-02-0), PHOSPHORUS (7723-14-0) AND VANADIUM (FUME OR DUST) (7440-62-2).

SECTION 16: OTHER INFORMATION

Abbreviations:

PEL = Permissible Exposure Limit	TLV = Threshold Limit Value
STEL = Short Term Exposure Limit	oz = ounce
ft ³ = cubic foot	mg = milligram (1/1,000 of a gram) (454 grams in one pound)
m ³ = cubic meter	NA = Not Applicable
NT = Not Tested	Nil = Negligible
C = Ceiling	TWA = Time Weighted Average
CAS = Chemical Abstract Service	RCRA = Resource Conservation and Recovery Act (40 CFR 261)
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act (40 CFR 302)	SARA = Superfund Amendments and Reauthorization Act (40 CFR 372)
TPQ = Threshold Planning Quantity	RQ = Reportable Quantities
H = Acute Hazardous Waste	Y = Yes
E = Toxicity Characteristic Waste	I = Ignitable Waste
LD50 = Lethal Dose for 50% of species tested	R = High Risk Potential (HRP)
LDLo = Lowest published lethal dose	TD50 = Toxic Dose for 50% of species tested
IARC = International Agency for Research on Cancer	TDL _o = Lowest Published Toxic Dose
Group 1 - Human Sufficient Evidence	NTP = National Toxicology Program
Group 2B - Human Limited Evidence	NFPA = National Fire Protection Association
Group 3 - Human Inadequate Evidence	NIOSH = National Institute of Occupational Safety and Health
BEI = Biological Exposure Index	RTECS = Registry of Toxic Effects of Chemical Substances

References:

The information contained on this Material Safety Data Sheet (MSDS) is believed to be correct as it was obtained from sources which we believe are reliable, including:

OSHA Regulations, Title 29 Part 1910 BEI's, 1991	American Conference of Government Industrial Hygienists TLV and
ACGIH Documentation of TLV's and BEI's, 1991, 2007	NIOSH <i>Occupational Diseases—A Guide to Their Recognition</i>
NIOSH RTECS	NIOSH Pocket Guide 4/99
NIOSH Criteria Documents Plus CD-ROM, 12/96	NIOSH Health Hazard Evaluations, CD-ROM 7/97
NIOSHITIC	SAX's <i>Dangerous Properties of Industrial Materials</i> , CD-ROM
Patty's Industrial Hygiene and Toxicology, CD-ROM	Hawley's <i>Condensed Chemical Dictionary</i> , CD-ROM
Handbook of Environmental Data on Organic Chemicals	EPA Regulations, Title 40, Parts 261, 304, 368, 372
Hazardous Materials Handbook	Toxicology Profiles, Agency for Toxic Substances and Disease Registry, PHS
IARC 7th Annual Report on Carcinogens	NTP Annual Report on Carcinogens, National Technical Information
Service	
American Industrial Hygiene Association Journal	<i>Chemical Protective Clothing Performance Index Book</i> , J. Wiley and Sons
<i>Toxicology, The Basic Science of Poisons</i> , McGraw-Hill	<i>Industrial Toxicology, Safety, & Health Applications in the Workplace</i> , Van Nostrand
	Occupational Health Guidelines for Chemical Hazards, NIOSH/OSHA

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Date Revised: October, 2009