

# MALINCO.

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## Section 1: Identification of the Substance/Mixture and of the Company Undertaking H3098-8

**Product Name:** Titanium Alloys

**Trade Name:** T100 ALLOYS

HAYNES® Ti-3Al-2.5V alloy  
HAYNES® Ti-15-3 alloy  
HAYNES® Ti-6Al-4V alloy  
HAYNES® Ti Grade 7 alloy

See Alloys listed in Section 3

**Chemical Family:** Alloy

**Manufacturer MSDS Number:** H3098-8

**Manufacturer Name:** Haynes International, Inc.

**Manufacturer Address 1:** SAFETY DEPARTMENT  
3786 SECOND STREET  
ARCADIA, LOUISIANA 71001-9701

NORTH AMERICA INFORMATION: 1-318-513-7500  
EUROPE INFORMATION: 011-44-161-230-7777

EMERGENCY PHONE NUMBERS:  
HAYNES: 765-456-6894  
CHEMTREC: 800-424-9300  
(24-hour contact for Health & Transportation Emergencies)

**Supplier:** Malin Co.  
5400 Smith Road.  
Brook Park, Ohio 44142  
**Phone:** (216) 267-9080  
**Revision Date:** 01/28/2013  
**Supersedes:** 09/11/2012

**Notes from Section 1:** CHEMICAL NAME: See Section 3 for Alloy Designations

FORMULA: Alloys composed of varying concentrations of elements listed in Section 3.

### EMERGENCY OVERVIEW:

Titanium alloys exist as a silver grey solid or as a dust or fume. Exposure to dust or fume may cause irritation of the eyes, skin and respiratory tract. Fine particulates dispersed in air present an explosion hazard. Under normal handling and use of the solid form of this material there are few health hazards. Cutting, welding, melting, grinding, etc., of these materials will produce dust, fume, or particulate containing the component elements of these materials. Exposure to the dust, fume, or particulate may present significant health hazards which are referable to the elemental constituents in Section 2.

This Safety Data Sheet (SDS) provides information on a specific group of manufactured metal products. Since these metal products share a common physical nature and constituents, the data presented are applicable to all alloys identified. This document was prepared to meet the requirements of the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals, OSHA's Hazard Communication Standard, 29 CFR 1910.1200, the Canadian Workplace Hazardous Materials Information System (WHMIS), and European Economic Community (EEC) Directives. Ingredients reportable per Section 313 of SARA are marked with an (\*); See Section 15 for an explanation. The following titanium alloys are found on this SDS:

### T100 ALLOYS

HAYNES® Ti-3Al-2.5V alloy  
HAYNES® Ti-15-3 alloy  
HAYNES® Ti-6Al-4V alloy  
HAYNES® Ti Grade 7 alloy

Hazardous Materials Information System (HMIS):

Health: 1\*, 0\*\*

Flammability: 4\*, 0\*\*

Reactivity: 3\*, 0\*\*

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\* Dust/Fume  
\*\* Solid

SDS IDENTIFICATION NUMBER: This replaces H3098-7

## Section 2: Hazards Identification

H3098-8



### Signal Words:

SW001 - Danger  
SW002 - Warning

### Emergency Overview Potential Health Effects Physical Hazard Environmental Hazard

#### Titanium (Ti):

##### Reproductive Toxicity:

Rat, oral: 158 mg/kg (multi-generation of females) caused fetotoxicity and fetal death.

#### Aluminum (Al)\*:

##### Route of Exposure:

PRIMARY ROUTE(S) OF EXPOSURE:  
INHALATION  
INGESTION  
SKIN  
EYES

##### Acute Health Effects:

EFFECTS OF OVEREXPOSURE TO METAL DUST, FUME OR PARTICULATE MATERIAL CONSISTING OF SECTION 3 CONSTITUENTS AND/OR COMPOUNDS:  
Titanium & Titanium Oxide: Titanium compounds are relatively inert. Dust and fume particulates are considered as nuisance dust.

Aluminum & Aluminum Oxides: Aluminum particles - eye irritant. Dust and fume particles are classified as nuisance dust.

Vanadium & Vanadium Pentoxide: Vanadium and Vanadium pentoxide: discomfort to eye, skin, and upper respiratory tract, cough, throat and eye irritation.

Chromium & Chromium Oxide: Chromium and chromium oxide: Allergic reactions leading to dermatitis. Eye, skin and respiratory irritant.

Tin: Eye and skin irritation.

##### Acute Eye Effects:

Particulate metal (dust, fume, or powder) can cause eye irritation and inflammation of the conjunctiva. Avoid inserting fingers into the eye socket if the hand or clothing is contaminated with metal particulate.

##### Acute Skin Effects:

Titanium does not irritate the skin as evidenced by its use in skin medications. Skin contact with metal dust, fume, or powder may cause, in some sensitive individuals, an allergic response if elements such as chromium and vanadium are present. In the form of metal dust or powder, skin contact or abrasion may also cause irritation or dermatitis.

HAYNES® Ti-3Al-2.5V, Ti-15-3, and Ti-6Al-4V, alloys: Warning, may cause an allergic skin reaction. Skin sensitization, Category 1B.

HAYNES® Ti Grade 7. Classified as not harmful to skin.

##### Acute Ingestion Effects:

Hand, clothing, food, and drink contact with metal dust, fume, or powder can cause ingestion of particulate during hand to mouth activities such as drinking, smoking, nail biting, etc. Titanium is not readily absorbed through the gastrointestinal (GI) tract. Vanadium may cause diarrhea and cramping. Chromium may severely irritate the GI tract and damage kidneys.

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HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: Warning, Harmful if swallowed. Acute toxicity, Category 4.

HAYNES® Ti Grade 7 alloy: Warning may be harmful if swallowed. Acute toxicity, Category 5.

## Acute Inhalation Effects:

Inhalation of metal dust, fume, or powder may result from melting, dross handling, casting, welding, thermal cutting, grinding, crushing, or similar operations. Inhaled particulate may irritate the respiratory tract. HAYNES® Ti-15-3 alloy: Danger, May cause cancer, Category 1A.

HAYNES® Ti-3Al-2.5V, and Ti-6Al-4V Warning, Harmful if inhaled, Category 4.

HAYNES® Ti Grade 7 alloy: May be harmful if inhaled, Category 5.

## Chronic Health Effects:

Hot processes involving HAYNES® Ti-15-3 alloy that result in melting or welding may create hexavalent chromium-containing fume. Repeated exposure to hexavalent chromium is associated with cancer of the respiratory tract. There is some evidence that repeated inhalation of titanium dioxide fume can cause deposits of titanium in the lungs which could produce lung fibrosis and chronic bronchitis. These changes have not been shown to be carcinogenic.

## EFFECTS OF OVEREXPOSURE TO METAL DUST, FUME OR PARTICULATE MATERIAL CONSISTING OF SECTION 3 CONSTITUENTS AND/OR COMPOUNDS:

Titanium & Titanium Oxide: Titanium dioxide – chronic, bronchitis slight lung fibrosis

Aluminum & Aluminum Oxides: None known at this time.

Vanadium & Vanadium Pentoxide: Vanadium: irritation of upper respiratory tract. Nasal catarrh, green tongue, cough, throat and eye irritation. Vanadium pentoxide: nose bleeds, chronic bronchitis and allergic skin sensitization in some people.

Chromium & Chromium Oxide: HAYNES® Ti-15-3 alloy ONLY: Hexavalent Chromium (Cr VI) LISTED AS A HUMAN CARCINOGEN BY IARC AND NTP. Allergic skin sensitization.

Tin: Benign pneumoconiosis (stannosis).

## Carcinogenicity:

Hexavalent chromium oxides that are found in welding fumes are considered carcinogens because they are so classified by IARC and/or NTP. Detailed information from these sources may be obtained from the following: IARC Monographs on the evaluation of carcinogenic risk of Chemicals to Man; and the NTP annual report on carcinogens, NTP Public Information Office, MD B204 Box 12233, Research Triangle Park, NC 27709.

## Teratogenicity:

No Data

## Mutagenicity:

No Data

HMIS Special  
HMIS PPE  
HMIS Physical  
HMIS Health Chronic  
HMIS Health  
HMIS Fire  
NFPA Fire  
NFPA Health  
NFPA Other  
NFPA Reactivity

## Aluminum (Al)\*:

## Note:

Product exposure scenarios include metal dust, fume, or powder resulting from melting, dross handling, casting, welding, thermal cutting, grinding, hot milling, crushing, or similar operations. These products can create

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metal oxides during welding, thermal cutting, melting, casting, hot rolling or milling, and similar hot processes.

## Section 3: Composition/Information on Ingredients

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Ingredient Name	CAS Number	Ingredient Percent	EC Number	Comments
Aluminum (Al)*	7429-90-5		231-90-5	
Chromium (Cr)*	7440-47-3		215-607-8	
Iron (Fe)	1309-37-1		231-096-4	
Tin (Sn)	7440-31-5		231-141-8	
Titanium (Ti)	7440-32-6		231-142-3	
Vanadium (V)	7440-62-2		215-239-8	
Palladium	7440-05-3		231-115-6	

### Palladium:

#### Notes:

NIOSH\*1 RTECS NUMBER: RT3480500

Ti Grade 7: 0.12 - 0.25%

### Titanium (Ti):

#### Notes:

NIOSH\*1 RTECS NUMBER: XR1700000

Ti-3Al-2.5V (4400): 94.5%

Ti-6Al-4V (4500): 90.0%

Ti-15-3 (4150): 76.0%

Ti Grade 7: 99%

### Iron (Fe):

#### Notes:

NIOSH\*1 RTECS NUMBER: N07400000

Ti-3Al-2.5V (4400): 0.30% Max

Ti-6Al-4V (4500): 0.30% Max

Ti-15-3 (4150): 0.25% Max

Ti Grade 7: 0.30% Max

### Chromium (Cr)\*:

#### Notes:

NIOSH\*1 RTECS NUMBER: BG4200000

Ti-15-3 (4150): 3.0%

### Aluminum (Al)\*:

#### Notes:

NIOSH\*1 RTECS NUMBER: BD0330000

Ti-3Al-2.5V (4400): 3.0%

Ti-6Al-4V (4500): 6.0%

Ti-15-3 (4150): 3.0%

Density (lb/cu in):

Ti-3Al-2.5V (4400): 0.162

Ti-6Al-4V (4500): 0.160

Ti-15-3 (4150): 0.172

Ti Grade 7: 0.163

Melting Point (deg F):

Ti-3Al-2.5V (4400): -3100

Ti-6Al-4V (4500): -3000

Ti-15-3 (4150): -2900

Ti Grade 7: 3030

\* Reportable ingredients per Section 313 of SARA. (See Section 15)

See Section 16 for footnotes

#### Comments:

Product exposure scenarios include metal dust, fume, or powder resulting

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from melting, gross handling, casting, welding, thermal cutting, grinding, hot milling, crushing, or similar operations. These products can create metal oxides during welding, thermal cutting, melting, casting, hot rolling or milling, and similar hot processes.

## Tin (Sn):

### Notes:

NIOSH\*1 RTECS NUMBER: XP7320000

Ti-15-3 (4150): 3.0%

## Vanadium (V):

### Notes:

NIOSH\*1 RTECS NUMBER: YW1355000

Ti-3Al-2.5V (4400): 3%

Ti-6Al-4V (4500): 4.0%

Ti-15-3 (4150): 15.0%

## Section 4: First Aid Measures

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Eye Contact:	Do not allow victim to rub or keep eyes tightly shut. Dust or powder should be flushed from the eyes with copious amounts of clean water. If irritation persists obtain medical assistance.
Skin Contact:	Skin cuts and abrasions can be treated by standard first aid. Skin contamination with dust or powder can be removed by washing with soap and water. If irritation persists, obtain medical assistance. Do not shake clothing. Launder clothing before re-use.
Inhalation:	Breathing difficulty caused by inhalation of dust or fume requires removal to fresh air. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.
Ingestion:	Never give anything by mouth to an unconscious person. Contact a poison control center. Unless the poison control center advises otherwise, inducement of vomiting is not necessary unless large amounts are ingested. Obtain medical assistance at once.

## Section 5: Firefighting Measures

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Flash Point:	V/V%: None
Upper Flammable Limit:	FLAMMABLE (EXPLOSIVE) LIMITS: None
Lower Flammable Limit:	FLAMMABLE (EXPLOSIVE) LIMITS: None
Extinguishing Media:	The solid wrought product forms of these alloys are noncombustible, therefore; use extinguishing media appropriate to the surrounding fire. For dust and powder forms of this material see the following.
Hazardous Combustion Byproducts:	Various metal oxides, carbon dioxide, carbon monoxide.
Fire Fighting Instructions:	If these materials are reduced to powder form, caution must be used to prevent fire or explosion. To extinguish a metal powder fire, use a suitable class "D" fire extinguishing powder (or talc, sand). Do NOT use water, carbon dioxide, or halogenated fire extinguishing agents.

## NFPA Health

## NFPA Fire

## NFPA Reactivity

## NFPA Other

### Unusual Fire Hazards:

No unusual fire or explosion hazards are associated with the solid wrought product forms of these materials. However, most finely divided forms (i.e., waste products such as grindings, machining chips and powders) of titanium alloys are flammable in air. Flammability is dependent upon particle size and surface area. Coarse particles (greater than 100 um) show no tendency to ignite. Dust created by a process(s) should be tested to determine if it is a flammable solid.

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## Section 6: Accidental Release Measures

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**Spill Cleanup Measures:** In solid form this material poses no special clean-up problems. If this material is in powder or dust form, clean-up should be conducted with a vacuum system utilizing a high efficiency particulate air (HEPA) filtration system. Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air and water. Properly label all materials collected in waste container. Follow applicable OSHA regulations (29 CFR 1910.120), Canadian Workplace Hazardous Materials Information System (WHMIS) Regulations, or other regulatory requirements.

## Section 7: Handling and Storage

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**Handling:** HANDLING PRECAUTIONS: This product must be handled according to the size, shape, and quantity of material involved. Solid metal may require use of hoists, cranes, etc. Powders should be moved or transported to minimize spill or release potential.

**Storage:** STORAGE PRECAUTIONS: In solid form this material poses no special problems. Store metal and metal powder in a dry area. Do not store adjacent to mineral acids. Fine metal powder and fine particulate waste should be stored wet (> 20% water), kept away from heat or an open flame.

## Section 8: Exposure Controls/Personal Protection

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**Engineering Controls:** Local exhaust ventilation should be used to control exposure to airborne dust and fume emissions near the source (during melting, welding, cutting, grinding, etc.) below the occupational exposure limits cited.

**Hand Protection:** PROTECTIVE GLOVES: Wear gloves to prevent metal cuts and skin abrasions particularly during handling of wrought forms, solid metal sheet, strip, or tube. Wear thermal insulated gloves during handling of heated materials.

**Eye Protection:** Wear safety glasses when risk of eye injury is present particularly during machining, grinding, welding, powder handling, etc. Contact lenses should not be worn if working with metal dust and powders.

**Respiratory Protection:** Use NIOSH approved respirators as specified by an industrial hygienist or qualified safety professional. Lung function tests are recommended for users of negative pressure devices. Use a fume respirator or an air supplied respirator where local exhaust or ventilation does not keep exposure below the occupational exposure limits for air contamination.

**Other Protective:** Protective clothing such as uniforms, disposable coveralls, safety shoes, etc., may be required during metal handling operations as appropriate to the circumstances of exposure.

### Exposure limit

**Notes from Section 8:** RECOMMENDED MONITORING PROCEDURES:  
ENVIRONMENTAL SURVEILLANCE: Exposure to the elements identified in Section 3 can be best determined by having air samples taken in the employee breathing zone, work area, or department.

MEDICAL SURVEILLANCE: Lung function tests, chest x-rays and routine physical examinations may be useful to determine effects of dust or fume exposure.

OCCUPATIONAL EXPOSURE LIMITS (as mg/m<sup>3</sup>)<sup>2</sup>

See section 16 for footnotes

### Exposure Guidelines - Ingredient Based:

#### Aluminum (Al)\*:

**USA - OSHA - PEL:** OSHA PEL<sup>3</sup>:  
Total Dust, as Al: 15,  
Respirable Dust, as Al: 5<sup>5</sup>

**ACGIH - TLV - TWA:** ACGIH® TLV®-TWA<sup>4</sup>:

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Welding Fume, as Al: 5

## Chromium (Cr)\*:

### USA - OSHA - PEL:

OSHA PEL<sup>3</sup>:  
Metal: 1  
Chromium (II & III) Compounds, as Cr: 0.5  
Chromium (VI) Compounds, as Cr(VI): 0.005

### ACGIH® TLV® - TWA:

ACGIH® TLV®-TWA<sup>4</sup>:  
Metal and Cr, III compounds, as Cr: 0.5; Water-Soluble Cr VI  
compounds, as Cr(VI): 0.05  
Water Insoluble CR VI cp, as Cr (VI): 0.01

Total chromium in urine = 25 ug/l<sup>6</sup>

## Iron (Fe):

### USA - OSHA - PEL:

OSHA PEL<sup>3</sup>:  
Oxide Fume: 10

### ACGIH® TLV® - TWA:

ACGIH® TLV®-TWA<sup>4</sup>:  
Oxide Dust and Fume, as Fe: 5

## Tin (Sn):

### USA - OSHA - PEL:

OSHA PEL<sup>3</sup>:  
Metals as Sn: 2.0  
Oxides as Sn: 2.0

### ACGIH® TLV® - TWA:

ACGIH® TLV®-TWA<sup>4</sup>:  
Metals, as Sn: 2.0  
Oxides and inorganic compounds, as Sn: 2.0

## Titanium (Ti):

### USA - OSHA - PEL:

OSHA PEL<sup>3</sup>:  
Total Oxide: 15

### ACGIH® TLV® - TWA:

ACGIH® TLV®-TWA<sup>4</sup>:  
Total Oxide: 10

## Vanadium (V):

### USA - OSHA - PEL:

OSHA PEL<sup>3</sup>:  
Respirable Dust as V<sub>2</sub>O<sub>5</sub>: 0.5<sup>5</sup> Ceiling  
Fume, as V<sub>2</sub>O<sub>5</sub>: 0.1 Ceiling

### ACGIH® TLV® - TWA:

ACGIH® TLV®-TWA<sup>4</sup>:  
Respirable Dust & Fume, as V<sub>2</sub>O<sub>5</sub>: 0.05<sup>5</sup>

In urine = 50 ug/g creatinine<sup>7</sup>

## Palladium:

### USA - OSHA - PEL:

OSHA PEL<sup>3</sup>:  
Not Established

### ACGIH® TLV® - TWA:

ACGIH® TLV®-TWA<sup>4</sup>:  
Not Established

## Section 9: PHYSICAL AND CHEMICAL PROPERTIES

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Physical State:	Solid
Color:	Silver Gray Color or No Color
pH:	Not Applicable
Melting Temperature:	(deg F): Ti-3Al-2.5V (4400): -3100 Ti-6Al-4V (4500): -3000 Ti-15-3 (4150): -2900 Ti Grade 7: 3030

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Boiling Temperature:	Not Applicable
Flash Point:	V/V%: None
Lower Flammable Limit:	FLAMMABLE (EXPLOSIVE) LIMITS: None
Upper Flammable Limit:	FLAMMABLE (EXPLOSIVE) LIMITS: None
Vapor Pressure:	(mmHg): Not Applicable
Vapor Density:	(AIR=1): Not Applicable
Density:	(lb/cu in): Ti-3Al-2.5V (4400): 0.162 Ti-6Al-4V (4500): 0.160 Ti-15-3 (4150): 0.172 Ti Grade 7: 0.163
Solubility in Water:	None
Specific Gravity:	See Section 3
Evaporation Rate:	Not Applicable
Percent Volatile:	BY VOLUME: None
Note from Section 9:	SUBLIMES @: Not Applicable

## Section 10: STABILITY AND REACTIVITY

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Chemical Stability:	In their wrought product form, these alloys are stable. However, finely divided DRY PARTICLES of titanium alloys are classified as PYROFORIC materials. Pyroforic materials spontaneously ignite and burn when in contact with air.
Conditions To Avoid:	Avoid contact with strong mineral acids and oxidizing agents which may generate hydrogen gas; the evolution of hydrogen may be an explosion hazard. Extreme caution is recommended in handling titanium alloys exposed to red fuming nitric acid; the reaction residue is considered an explosive.
Incompatible Materials:	Avoid contact with strong mineral acids and oxidizing agents which may generate hydrogen gas; the evolution of hydrogen may be an explosion hazard. Extreme caution is recommended in handling titanium alloys exposed to red fuming nitric acid; the reaction residue is considered an explosive.
Reactivity:	In their wrought product form, these alloys are stable. However, finely divided DRY PARTICLES of titanium alloys are classified as PYROFORIC materials. Pyroforic materials spontaneously ignite and burn when in contact with air.
Hazardous Decomposition Products:	Various elemental metals and metal oxides may be generated from welding, cutting, grinding, melting, or dress handling operations. Refer to Section 8 for permissible exposure limits. The occupational exposure limits given in SDS HW-7031 for Welding Products and Thermal Spray Wire also apply.
Hazardous Polymerization:	POSSIBILITY OF HAZARDOUS REACTIONS: In the absence of moisture, titanium burns slowly but produces a lot of heat. Titanium can burn in nitrogen and carbon dioxide atmospheres above 1,562 deg F (850 deg C). Titanium dust layers will not ignite in pure argon or helium atmospheres, but will ignite in 50% air + 50% argon or helium atmosphere. The minimum energy of electrical condenser discharge sparks required for ignition of a dust cloud is 10 millijoules; and 8 millijoules for a dust layer.

## Section 11: TOXICOLOGICAL INFORMATION

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### Titanium (Ti):

Ingestion Toxicity:	Rat, oral, LD50 >5,000 mg/kg.
Inhalation Toxicity:	Rat LC50 > 6,820 mg/m3
Reproductive Toxicity:	Rat, oral: 158 mg/kg (multi-generation of females) caused fetotoxicity and fetal death.

### Chromium (Cr)\*:

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Ingestion Toxicity	Human, oral, LDLo = 71 mg/kg
Aluminum (Al)*:	
Route of Exposure:	PRIMARY ROUTE(S) OF EXPOSURE: INHALATION INGESTION SKIN EYES
Acute Health Effects:	EFFECTS OF OVEREXPOSURE TO METAL DUST, FUME OR PARTICULATE MATERIAL CONSISTING OF SECTION 3 CONSTITUENTS AND/OR COMPOUNDS: Titanium & Titanium Oxide: Titanium compounds are relatively inert. Dust and fume particulates are considered as nuisance dust.  Aluminum & Aluminum Oxides: Aluminum particles - eye irritant. Dust and fume particles are classified as nuisance dust.  Vanadium & Vanadium Pentoxide: Vanadium and Vanadium pentoxide: discomfort to eye, skin, and upper respiratory tract, cough, throat and eye irritation.  Chromium & Chromium Oxide: Chromium and chromium oxide: Allergic reactions leading to dermatitis. Eye, skin and respiratory irritant.  Tin: Eye and skin irritation.
Acute Inhalation Effects:	Inhalation of metal dust, fume, or powder may result from melting, dross handling, casting, welding, thermal cutting, grinding, crushing, or similar operations. Inhaled particulate may irritate the respiratory tract. HAYNES® Ti-15-3 alloy: Danger, May cause cancer, Category 1A.  HAYNES® Ti-3Al-2.5V, and Ti-6Al-4V Warning, Harmful if inhaled, Category 4.  HAYNES® Ti Grade 7 alloy: May be harmful if inhaled, Category 5.
Acute Skin Effects:	Titanium does not irritate the skin as evidenced by its use in skin medications. Skin contact with metal dust, fume, or powder may cause, in some sensitive individuals, an allergic response if elements such as chromium and vanadium are present. In the form of metal dust or powder, skin contact or abrasion may also cause irritation or dermatitis.  HAYNES® Ti-3Al-2.5V, Ti-15-3, and Ti-6Al-4V, alloys: Warning, may cause an allergic skin reaction. Skin sensitization, Category 1B.  HAYNES® Ti Grade 7. Classified as not harmful to skin.
Acute Ingestion Effects:	Hand, clothing, food, and drink contact with metal dust, fume, or powder can cause ingestion of particulate during hand to mouth activities such as drinking, smoking, nail biting, etc. Titanium is not readily absorbed through the gastrointestinal (GI) tract. Vanadium may cause diarrhea and cramping. Chromium may severely irritate the GI tract and damage kidneys.  HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: Warning, Harmful if swallowed. Acute toxicity, Category 4.  HAYNES® Ti Grade 7 alloy: Warning may be harmful if swallowed. Acute toxicity, Category 5.
Acute Eye Effects:	Particulate metal (dust, fume, or powder) can cause eye irritation and inflammation of the conjunctiva. Avoid inserting fingers into the eye socket if the hand or clothing is contaminated with metal particulate.
Carcinogenicity:	Hexavalent chromium oxides that are found in welding fumes are considered carcinogens because they are so classified by IARC and/or NTP. Detailed information from these sources may be obtained from the following: IARC Monographs on the evaluation of carcinogenic risk of Chemicals to Man; and the NTP annual report on carcinogens, NTP Public Information Office, MD B204 Box 12233, Research Triangle Park, NC 27709.

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Mutagenicity: No Data

Teratogenicity: No Data

## Vanadium (V):

Acute Toxicity: Rabbit LD50 59 mg/kg

Inhalation Toxicity: Human, inhalation, TDLo = 4 µg/kg, affected the lungs, thorax, or respiration (sputum, cough) and sense organs.

## Potential Health Effects

### Titanium (Ti):

Notes from Section 11: Tumorigenicity: Rat, intramuscular: 114 mg/kg administered intermittently for 77 weeks caused lymphomas including Hodgkin's disease and tumors at site of injection.

### Aluminum (Al)\*:

Notes from Section 11: MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:  
Individuals who may have had an allergic reaction or sensitivity to metals such as chromium, tin and vanadium may encounter skin rash or dermatitis if skin contact with this product occurs. Persons with impaired pulmonary function, airway diseases and conditions such as asthma, emphysema, chronic bronchitis, etc., may incur further disability if excessive concentrations of dust or fume are inhaled. If prior damage or disease to the Neurologic (nervous), Circulatory, Hematologic (blood) or Renal (kidney) systems has occurred, proper screening or examinations should be conducted on individuals who may be exposed to further risk if handling and use of this material causes excessive exposure.

## Section 12: Ecological Information

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### Aluminum (Al)\*:

Ecotoxicity: In solid form this material poses no special environmental problems. Metal powders or dusts may have significant impact on air and water quality. Airborne emissions, spills and releases to the environment (discharge to streams, sewer systems, ground water, surface soil, etc.) should be controlled immediately. If such potential for a spill or release exists it is advisable to develop an emergency spill response plan. Titanium – Environmental effects: no information found. Vanadium pentoxide – Ecotoxicity: 55 ppm/96 hours/fathead minnows/TLm/hard water; 13 ppm/96 hours/fathead minnows/TL2m/soft water. GHS classification "Harmful to aquatic life", acute category 3. In water, chromium III oxide is expected to eventually precipitate to sediments. In air, chromium III oxide is primarily removed by fallout and precipitation. Soils with a high chromium content (>0.2%) are expected to be infertile. The half-life of chromium in soils may be several years.

## Section 13: DISPOSAL CONSIDERATIONS

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### Waste Disposal:

Titanium alloys are recyclable and every measure should be made to reclaim rather than dispose. If necessary, dispose of waste material in accordance with state or federal regulations. For specific labeling, packing, storage, transportation, and disposal procedures, contact an Environmental Engineer or a consultant familiar with waste disposal regulations.

## Section 14: TRANSPORT INFORMATION

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### Transportation:

As a wrought product, these alloys are not regulated by the U.S. Department of Transportation (DOT) and the International Air Transport Association (IATA).

The following information should be used by individuals with "Function-specific

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Training" required by 49 CFR 172.704, and Dangerous Goods Regulations published by the International Air Transport Association (IATA).

SHIPPING NAME: If alloy dust or powder is created, it may be a flammable solid or spontaneously combustible material (DOT hazard class 4.1 and 4.2, respectively). A sample of metal powder should be tested according to the U.N. manual of tests and criteria. See 49 CFR 173.124 (a) and (b).

IDENTIFICATION NUMBER: Not Available (Determine by test results)

HAZARD CLASS: Not Available (Determine by test results)

LABEL(S) REQUIRED: Not Available (Determine by test results)

Notes from Section 14:

TRANSPORTATION INFORMATION (Not Meant to be All Inclusive)

## Section 15: REGULATORY INFORMATION

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### Regulatory - Product Based:

**OSHA 29 CFR 1200:** Listed as air contaminants (29 CFR 1910.1000). Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

**TSCA 8(b): Inventory Status:** Components of this material are listed on the TSCA inventory.

**Section 302:** Extremely Hazardous Substance (40 CFR 355): Not Listed

**Section 312 Hazard Category:** SARA HAZARD CATEGORY: Listed below are the hazard categories for Sections 311 and 312 of the Superfund Amendment and Preauthorization Act of 1986 (SARA Title III):

Immediate Hazard  
Delayed Hazard

**Section 313 Toxic Release Form:** Chemicals subject to the reporting requirements of Section 313 or Title III of SARA and 40 CFR Part 372: Aluminum (as a fume or dust), chromium.

**State:** California's Safe Drinking Water and Toxic Enforcement Act of 1986" (Proposition 65)

Welding, thermal cutting, and melting these products may produce hexavalent chromium compounds which are known to the State of California to cause cancer. State of California, Health and Welfare Agency, 1600 Ninth Street, Room 450, Sacramento, CA 95914.

Pennsylvania Worker and Community Right to Know: Aluminum, Chromium, and Vanadium (fume or dust) are designated environmental hazards on the Hazardous Substance List. Title 34, Part XIII, Chapter 323.

**Canada WHMIS:** Canada WHMIS These products have been classified in accordance with the hazard criteria of the CPR, and the SDS contains all of the information required by the CPR.

WHMIS Classification: Class D2B "Toxic Material"

**Notes 1:** Labeling in Accordance with the GHS:  
The following hazard classification and risk phrases required by the GHS apply only to welding fumes and particulate created by these products.

Classification: HAYNES® Ti-3Al-2.5V, and Ti-6Al-4V Warning, Harmful if inhaled, Category 4.

HAYNES® Ti-15-3: Danger, May cause cancer by inhalation, Category 1A; Warning, May cause an allergic skin reaction, Category 1B.

HAYNES® Ti Grade 7 alloy: May be harmful if inhaled, May be harmful if swallowed Acute toxicity, Category 5.

HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: Warning, Harmful

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if swallowed. Acute toxicity, Category 4.

HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: Warning, Causes mild skin irritation, Category 3.

HAYNES® Ti-15-3 alloy: Warning, may cause an allergic skin reaction. Skin sensitization Category 1B.

HAYNES® Ti Grade 7. Classified as not harmful to skin.

## Regulatory - Ingredient Based:

### Chromium (Cr)\*:

Section 304

CERCLA: Hazardous Substance (40 CFR 302.4): Chromium

## Section 16: Additional Information

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### Label Text:

#### LABEL INFORMATION:

HAYNES® HIGH PERFORMANCE - TITANIUM ALLOYS  
Ti-3Al-2.5V; Ti-6Al-4V; Ti-15-3; Ti Grade 7

### Label Hazard Warning:

The following hazard classification and risk phrases required by the Globally Harmonized System (GHS) apply only when these products create fume and particulate when subjected to melting, dress handling, casting, welding, thermal cutting, grinding, hot milling, crushing, or similar operations.

Danger, May cause cancer by inhalation, Category 1A; Warning, May cause an allergic skin reaction, Category 1B: HAYNES® Ti-15-3 alloy.

Warning: Harmful if inhaled, Category 4: HAYNES® Ti-3Al-2.5V, and Ti-6Al-4V alloys.

May be harmful if inhaled, May be harmful if swallowed Acute toxicity, Category 5: HAYNES® Ti Grade 7 alloy.

Warning, Harmful if swallowed. Acute toxicity, Category 4: HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys.

Warning, Causes mild skin irritation, Category 3: HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys.

Warning, may cause an allergic skin reaction. Skin sensitization Category 1B. HAYNES® Ti-15-3 alloy.

Classified as not harmful to skin: HAYNES® Ti Grade 7 alloy.

Classified as Harmful to aquatic life, Category 3: HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys.

#### DANGER WARNING

See Manufacturer MSDS of Pictogram

### Label Precautions:

#### Notice:

- The titanium alloy products identified above may contain, in varying concentrations, the following elemental constituents: aluminum, chromium, iron, palladium, tin, titanium, and vanadium.

- Hexavalent chromium oxides that may be found in welding fume are considered carcinogens because they are so classified by the National Toxicology Program (NTP) and the International Agency for Research on Cancer (IARC).

- Avoid breathing dust of fume. If the use of this material produces dust or fume, use appropriate ventilation controls, personal protective equipment or both. For additional information refer to the Safety Data Sheet (SDS H3098) for this product.

#### Notice!

FINELY DIVIDED TITANIUM POWDER AND DUST ARE POTENTIAL FIRE AND EXPLOSION HAZARDS WHEN EXPOSED TO A HEAT



SOURCE OR FLAME. DO NOT USE WATER OR A CO<sub>2</sub> EXTINGUISHER TO CONTROL A TITANIUM FIRE. THE APPLICATION OF WATER OR CO<sub>2</sub> TO BURNING TITANIUM CAN CAUSE AN EXPLOSION. METAL AND DUST FIRES CAN BE EFFECTIVELY CONTROLLED BY:

- 1) SMOTHERING WITH TALC, OR SODIUM CHLORIDE,
- 2) SMOTHERING THE FIRE WITH A SALT FLUX, SUCH AS POTASSIUM CHLORIDE, MAGNESIUM CHLORIDE, OR CALCIUM FLUORIDE OR,
- 3) OTHER SUITABLE CLASS "D" FIRE EXTINGUISHING POWDERS.

**Label First Aid:**

(The following instructions apply only to dust and welding fume forms of the product):

**Inhalation:** Breathing difficulty caused by inhalation of dust or fume requires removal to fresh air. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.

**Ingestion:** Never give anything by mouth to an unconscious person. Contact a poison control center. Unless the poison control center advises otherwise, inducement of vomiting is not necessary unless large amounts are ingested. Obtain medical assistance at once.

**Skin:** Skin cuts and abrasions can be treated by standard first aid. Skin contamination with dust or powder can be removed by washing with soap and water. If irritation persists, obtain medical assistance. Do not shake clothing. Launder clothing before re-use.

**Eyes:** Do not allow victim to rub or keep eyes tightly shut. Dust or powder should be flushed from the eyes with copious amounts of clean water. If irritation persists obtain medical assistance.

**Revision Date:**

01/28/2013  
Supersedes: 09/11/2012

**Revision Notes:**

SDS STATUS: This SDS replaces the September 11, 2012 revision for Titanium Alloys.

**Author:**

Shaw Environmental, Inc.

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**Notes from Section 16:**

Hazardous Materials Information System (HMIS):

Health: 1\*, 0\*\*  
Flammability: 4\*, 0\*\*  
Reactivity: 3\*, 0\*\*

\* Dust/Fume

\*\*Solid

<sup>^1</sup> NIOSH RTECS Number: The National Institute for Occupational Safety & Health (NIOSH) Registry of Toxic Effects of Chemical Substances (RTECS) Access number for a specific element or compound's toxicological data.

<sup>^2</sup> Mg/m<sup>3</sup> = milligrams per cubic meter. Many substances do not have a unique exposure limit. The absence of an exposure limit does not lessen consideration for exposure risk. In the absence of specific information, professional judgment may be required.

<sup>^3</sup> OSHA PEL: the Occupational Safety & Health Administration (OSHA) Permissible Exposure Limit (PEL) unless noted otherwise is an 8-hour time weighted average (TWA). Ceiling limits are listed for some materials that

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should not be exceeded at any time.

<sup>4</sup> ACGIH TLV®: The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV®) - ACGIH also recommends a short term exposure limit (STEL) for certain substances (which are a 15-minute TWA) during the shift.

<sup>5</sup> Respirable fraction of particulate - see the ACGIH-TLV® booklet for a definition.

<sup>6</sup> ACGIH® TLV®- Biological Exposure Determinant for Chromium (VI), water soluble fume. Total chromium in urine measured at the end of the shift at the end of the workweek = 25 µg/L. Total chromium increase during a shift = 10 µg/L.

<sup>7</sup> ACGIH® TLV®- Biological Exposure Determinant for Vanadium Pentoxide. Vanadium in urine determination, measured at the end of shift at the end of the workweek.

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