

SAFETY DATA SHEET

HAYNES
International
HAYNES INTERNATIONAL, INC.
Titanium Alloys
SAFETY DEPARTMENT
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SDS IDENTIFICATION NUMBER

H3098-11

This replaces H3098-10

PREVIOUS
REVISION DATE
 January 29, 2016

DATE REVISED
 January 29, 2025

EMERGENCY PHONE NUMBERS

HAYNES: 765-456-6894, or

 (North America) CHEMTREC: 800-424-9300
 (24-hour contact for Health & Transportation Emergencies)

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), European Economic Community (EEC) Directives, UK COSHH-HSE, and other jurisdictions that have adopted the GHS. Ingredients reportable per Section 313 of SARA are marked with an (*) in Section 3; 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-6Al-4V alloy

HAYNES® Ti-15-3 alloy

HAYNES® Ti Grade 7 alloy

Hazardous Materials
Information System (HMIS)
 Health 1* 0**
 Flammability 0* 0**
 Reactivity 0* 0**

 * Dust/Fume
 **Solid
1. PRODUCT IDENTIFICATION

CHEMICAL NAME: See Section 3 for Alloy Designations

CHEMICAL FAMILY: Alloy

TRADE NAME: See Alloys listed in Section 3

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

Under normal handling and use, the solid form of these products is not classified as a hazardous substance by the GHS. These products can create metal dust and metal oxide fume during welding, thermal and mechanical cutting, melting, casting, cross handling, hot rolling or milling, grinding, and similar processes. Such processing of Haynes products 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 related to the elemental constituents in Section 3.

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This SDS is available in the English, French, German, Spanish, Italian, Czech, Japanese, Korean, and Chinese languages.

2. HAZARDS IDENTIFICATION (Continued)

2.1 GHS Hazard Classification – Signal Word, Classification, and Category Statements (separate classifications are provided for each Haynes® product or product groups)

HAYNES® Ti-15-3 alloy: **Danger:** Carcinogenicity (Category 1A)

H350 May cause cancer

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

Warning: Skin sensitization, (Category 1B)

H317 May cause an allergic skin reaction

HAYNES® Ti-3Al-2.5V and Ti-6Al-4V alloys: **Warning:** Acute toxicity, inhalation (Category 4)

H332 Harmful if inhaled

HAYNES® Ti Grade 7 alloy: Acute toxicity, inhalation (Category 5)

H333 May be harmful if inhaled

HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: **Warning:** Acute toxicity, oral (Category 4)

H302 Harmful if swallowed

HAYNES® Ti Grade 7 alloy: **Warning:** Acute toxicity, oral (Category 5)

H303 May be harmful if swallowed

HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: **Warning:** Skin irritation (Category 3)

H316 Causes mild skin irritation

HAYNES® Ti Grade 7 alloy. Not classified as harmful to skin.

None

2.2 Label Elements and Hazards

Precautionary Statements and Symptoms

HAYNES® Ti-15-3 alloy: P201 Obtain special instructions before use.

HAYNES® Ti-15-3 alloy: P202 Do not handle until all safety precautions have been read and understood.

HAYNES® Ti-15-3 alloy: P280 Wear protective gloves, clothing, eye and/or face protection.

HAYNES® Ti-15-3 alloy: P308 + P313 If exposed or concerned, get medical advice/attention.

HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: P302 + P332 Harmful if swallowed or if inhaled.

P272 Contaminated work clothing should not be allowed out of the workplace.

P280 Wear protective gloves, clothing, eye and/or face protection.

HAYNES® Ti-3Al-2.5V, Ti-6Al-4V, and Ti-15-3 alloys: P 261 Avoid breathing dust or fume.



Hazards not otherwise classified or not covered by GHS

INHALATION: Inhalation of metal dust, fume, or powder may result from melting, gross handling, casting, welding, thermal cutting, grinding, crushing, or similar operations. Inhaled particulate may irritate the respiratory tract.

INGESTION: 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.

SKIN: 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.

EYES: 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.

CHRONIC 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		ACUTE:	CHRONIC:
	Titanium and Titanium Oxide	Titanium compounds are relatively inert. Dust and fume particulates are considered as nuisance dust.	Titanium dioxide – chronic bronchitis slight lung fibrosis
	Aluminum and Aluminum Oxides	Aluminum particles - eye irritant. Dust and fume particles are classified as nuisance dust.	None known at this time.
	Vanadium and Vanadium Pentoxide	Discomfort to eye, skin, and upper respiratory tract. Cough, throat and eye irritation.	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 and Chromium Oxide	Allergic reactions leading to dermatitis. Eye, skin and respiratory irritant.	HAYNES® Ti-15-3 alloy ONLY: Hexavalent Chromium (Cr VI); listed as A human carcinogen by IARC and NTP. Allergic skin sensitizer.
	Tin	Eye and skin irritation.	Benign pneumoconiosis (stannosis).

3. COMPOSITION/ INFORMATION ON INGREDIENTS

Nominal percent of elemental Constituent(s) for each alloy	Ti-3Al-2.5V (4400)	Ti-6Al-4V (4500)	Ti-15-3 (4150)	Ti Grade 7			CAS NUMBER	EC Number	NIOSH ¹ RTECS NUMBER
Aluminum (Al)*	3.0	6.0	3.0				7429-90-5	231-90-5	BD0330000
Chromium (Cr)*	-	-	3.0				7440-47-3	215-607-8	BG4200000
Iron (Fe)	0.30 Max	0.30 Max	0.25 Max	0.30 Max			1309-37-1	231-096-4	N07400000
Tin (Sn)	-	-	3.0				7440-31-5	231-141-8	XP7320000
Titanium (Ti)	94.5	90.0	76.0	99			7440-32-6	231-142-3	XR1700000
Vanadium (V)	3	4.0	15.0				7440-62-2	215-239-8	YW1355000
Palladium				0.12-0.25			7440-05-3	231-115-6	RT3480500
Density (lb/cu in)	0.162	0.160	0.172	0.163			See Section 16 for footnotes		
Melting Point (EF)	-3100	-3000	-2900	3030					

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

4. FIRST AID MEASURES

INHALATION	P304+313 + P340 Breathing difficulty caused by inhalation of dust or fume requires person's removal to fresh air and keep comfortable for breathing. P311 + P342 If experiencing respiratory symptoms, call a poison center, and get medical advice/attention. 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. P 321+ P352 Skin contamination with dust or powder can be removed by washing with soap and plenty of water. P 302 + P310 +313 Immediately call a poison center, and get medical advice/attention. P333 If irritation or rash occurs, obtain medical assistance. P362 Take off contaminated clothing, but do not shake clothing. P364 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.

5. FIRE FIGHTING MEASURES

5.1 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.
5.2 SPECIFIC HAZARDS	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.
5.3 ADVICE FOR FIREFIGHTERS	No unusual fire or explosion hazards are associated with the solid wrought product forms of these materials. However, finely divided forms (i.e., waste products such as grindings, machining chips and powders) of titanium alloys have the potential to be combustible. Flammability is dependent upon particle size and surface area. Dust created by a process(s) should be tested to determine if it is a flammable solid, see Section 10.

HAZARDOUS COMBUS- TION PRODUCTS	Various metal oxides, carbon dioxide, carbon monoxide.			
6. ACCIDENTAL RELEASE MEASURES				
In solid form, this material poses no special clean-up problems.				
6.1 Personnel Precautions, protective equipment, and emergency procedures: Remove non-emergency personnel to safety. Emergency responders should wear respiratory protection if exposed to metal dust.				
6.2 Environmental Precautions: Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air and water.				
6.3 Methods for Cleaning Up 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.. Properly label all materials collected in waste container.				
6.4 References: Follow applicable OSHA regulations (29 CFR 1910.120), Canadian Workplace Hazardous Materials Information System (WHMIS) Regulations, or other regulatory requirements.				
7. HANDLING AND STORAGE				
7.1 PRECAUTIONS FOR SAFE HANLDRING	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.			
7.2 CONDITIONS FOR SAFE STORAGE INCLUDING INCOMPAT- IBILITIES	In solid form, this material poses no special problems. P405: Store metal dust and fume locked up 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.			
8. EXPOSURE CONTROLS/PERSONAL PROTECTION				
8.1 OCCUPATOINAL EXPOSURE LIMITS (as mg/m³) ² (See section 16 for footnotes)				
Constituents	CAS NUMBER	U.S.OSHA PEL³	ACGIH® TLV®-TWA ⁴	United Kingdom⁸
Aluminum (Al)	7429-90-5	Total Dust, as Al: 15, Respirable Dust, as Al: 5 ⁵	Metal, as Al: 1 ⁵	Inhalable Dust, as Al: 10, Respirable Dust, as Al: 4 ⁵
Chromium (Cr)	7440-47-3	Metal: 1 Chromium (II & III) Compounds, as Cr: 0.5 Chromium (VI) Compounds, as Cr(VI): 0.005	Metal and Cr. III compounds, as Cr: 0.5; Cr VI compounds,: 0.00002 Total chromium in urine = 25 µg/l ⁶	Metal: 0.5 Chromium (II & III) Compounds, as Cr: 0.5 Chromium (VI) Compounds, as Cr(VI): 0.01
Iron (Fe)	1309-37-1	Oxide Fume: 10	Oxide Dust and Fume, as Fe: 5 ⁵	Oxide Fume: 5
Tin (Sn)	7440-31-5	Metals as Sn: 2.0	Metals, as Sn: 2.0 Oxides and inorganic compounds, as Sn: 2.0	Metals as Sn: 2.0
Titanium (Ti)	7440-32-6	Total Oxide: 15	Total Oxide: 10	Inhalable Dust, as Ti: 10, Respirable Dust, as Ti: 4 ⁵
Vanadium (V)	7440-62-2	Respirable Dust as V₂O₅: 0.5 ⁵ Ceiling Fume, as V₂O₅: 0.1 Ceiling	Inhalable Fume, as V₂O₅: 0.05 In urine = 50 µg/g creatinine ⁷	0.05
Palladium	7440-05-3	Not Established	Not Established	Not Established
8.2 Exposure Controls				
8.2 EXPOSURE AND 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.			
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.	
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.	
OTHER PROTECTIVE EQUIPMENT	Protective clothing such as uniforms, disposable coveralls, safety shoes, etc., may be required during metal handling operations as appropriate to the circumstances of exposure.	
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.	MEDICAL SURVEILLANCE: Lung function tests, chest x-rays and routine physical examinations may be useful to determine effects of dust or fume exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES		
MELTING POINT: See Section 3		VAPOR DENSITY (AIR=1): Not Applicable
SUBLIMES @: Not Applicable		SPECIFIC GRAVITY: See Section 3
BOILING POINT: Not Applicable		pH = Not Applicable
EVAPORATION RATE: Not Applicable		SOLUBILITY IN WATER = None
VAPOR PRESSURE (mmHg): Not Applicable		% VOLATILES BY VOLUME: None
PHYSICAL STATE: Solid - Silver Gray Color or No Color		PARTICLE CHARACTERISTICS: Varies
10. STABILITY AND REACTIVITY		
10.1 and 10.2 REACTIVITY AND STABILITY	In their wrought product form, these alloys are stable. For those processes that create a dust form of these products, Haynes recommends a dust sample be tested to determine if the dust is combustible or explosible according to the National Fire Protection Association (NFPA) Standard 654.	
10.3 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 °F (850 °C). Titanium dust layers will not ignite in pure argon or helium atmospheres but will ignite in 50% air + 50% argon or helium atmosphere.	
10.4 and 10.5 INCOMPATIBILITY AND 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.	
10.6 HAZARDOUS DECOMPOSITION PRODUCTS	Various elemental metals and metal oxides may be generated from welding, cutting, grinding, melting, or dross handling operations. Refer to Section 8 for occupational exposure limits. The occupational exposure limits given in SDS HW-7031 for Welding Products and Thermal Spray Wire also apply.	
11. TOXICOLOGICAL INFORMATION		
TOXICITY DATA	Titanium Rat, oral, LD ₅₀ >5,000 mg/kg. Rat LC ₅₀ >6,820 mg/m ³ Tumorigenicity: Rat, intramuscular: 114 mg/kg administered intermittently for 77 weeks caused lymphomas including Hodgkin's disease and tumors at site of injection.	
	Vanadium Rabbit LD ₅₀ 59 mg/kg Human, inhalation, TD _{Lo} = 4 µg/kg, affected the lungs, thorax, or respiration (sputum, cough) and sense organs.	
	Chromium Human, oral, LD _{Lo} = 71 mg/kg,	
	Teratology: No Data	
	Reproduction: Titanium: Rat, oral: 158 mg/kg (multi-generation of females) caused fetotoxicity and fetal death.	
	Mutagenicity: No Data	
CARCINOGENIC REFERENCES	Hexavalent chromium oxides 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.	
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.	

12. ECOLOGICAL INFORMATION

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.

13. DISPOSAL CONSIDERATIONS

Titanium alloys are recyclable and every measure should be made to reclaim rather than dispose. P 501: 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.


14. TRANSPORTATION INFORMATION (Not Meant to be All Inclusive)

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

The following information should be used by individuals with "Function-specific Training" required by 49 CFR 172.704, and Dangerous Goods Regulations published by the International Air Transport Association (IATA) and IMDG.

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)

15. REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS	<p>OSHA: Listed as air contaminants (29 CFR 1910.1000). Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).</p> <p>TSCA (Toxic Substance Control Act): Components of this material are listed on the TSCA inventory.</p> <p>CERCLA: Hazardous Substance (40 CFR 302.4): Chromium Extremely Hazardous Substance (40 CFR 355): Not Listed</p> <p>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: X Delayed Hazard: X Fire Hazard: - Pressure Hazard: - Reactivity Hazard: -</p> <p>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.</p>
UNITED STATES STATE-SPECIFIC REGULATIONS	<p> Welding, thermal cutting, and melting these products can expose you to chemicals including hexavalent chromium, cobalt, nickel, and titanium, which are known to the State of California to cause cancer. For more information, go to www.P65Warnings.ca.gov. 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.</p>

15. REGULATORY INFORMATION (Continued)

UNITED KINGDOM, EU, and OTHER INTERNATIONAL REGULATIONS

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 alloys: Warning: Harmful if inhaled, Category 4.

HAYNES® Ti-15-3 alloy: Danger: May cause cancer by inhalation, Category 1A;

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 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 alloy. Classified as not harmful to skin.

Canada WHIMS 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.

UNITED KINGDOM, EU, and OTHER INTERNATIONAL REGULATIONS

International Inventories

Europe (EINECS), China (IECSC), Korea (KECL), Japan (ENCS), Canada (DSL/NDSL), Australia AIIIC, US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710).

Component	CAS No	EINECS	TSCA	IECSC	DSL	KECL	ENCS	AIIIC
Aluminum (Al)	7429-90-5	231-072-3	Listed	Listed	Listed	Listed	-	Listed
Chromium (Cr)	7440-47-3	231-157-5	Listed	Listed	Listed	Listed	-	Listed
Iron (Fe)	1309-37-1	215-168-2	Listed	Listed	Listed	Listed	-	Listed
Tin (Sn)	7440-31-5	231-141-8	Listed	Listed	Listed	Listed	-	Listed
Titanium	7440-32-6	241-036-9	Listed	Listed	Listed	Listed	-	Listed
Vanadium (V)	7440-62-2	231-171-1	Listed	Listed	Listed	Listed	-	Listed
Palladium	7440-05-3	231-115-6	Listed	Listed	Listed	Listed	-	Listed

Authorization/Restrictions according to EU REACH Not applicable

Seveso III Directive (2012/18/EC)

Regulation (EC) No 649/2012 of the European Parliament and of the Council of 4 July 2012 concerning the export and import of dangerous chemicals: Not applicable.

Contains component(s) that meet a 'definition' of per & poly fluoroalkyl substance (PFAS)? Not applicable

The contents and format of this SDS are in accordance with EEC Commission Directive 2008/1272/EC, and EEC Commission Regulation 1907/2006/EC (REACH) Annex II. This product is classified according to Regulation (EC) Number 2020/878.

Take note of Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work.

16. OTHER INFORMATION

SDS STATUS

This SDS replaces the January 29, 2016 revision for Titanium Alloys.

The above information has been prepared by APTIM, Inc., under contract with Haynes International and is a compilation of information from various sources believed to be accurate. As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any material described herein. Information contained herein is believed to be true and accurate, but all statements or suggestions are made without warranty, expressed or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof. Compliance with all applicable Federal, State, and local laws and regulations remain the responsibility of the user.

- ¹ 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.
- ² Mg/m³ = milligrams contaminant per cubic meter of air. 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.
- ³ 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 should not be exceeded at any time.
- ⁴ 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.
- ⁵ Respirable fraction of particulate - see the ACGIH-TLV® booklet for a definition.
- ⁶ 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.
- ⁷ ACGIH® TLV®- Biological Exposure Determinant for Vanadium Pentoxide. Vanadium in urine determination, measured at the end of shift at the end of the workweek.
- ⁸ United Kingdom Health and Safety Executive, EH40/2005 (Fourth Edition 2020) Workplace exposure limits

LABEL INFORMATION

HAYNES® HIGH PERFORMANCE - TITANIUM ALLOYS

Ti-3Al-2.5V; Ti-6Al-4V; Ti-15-3; Ti Grade 7

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, dross handling, casting, welding, thermal cutting, grinding, hot milling, crushing, or similar operations.

Danger: May cause cancer by inhalation.

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

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

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

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

Warning: May cause an allergic skin reaction. **Skin sensitization:** 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

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid breathing dust or fume.

Wear safety glasses. Cut-resistant gloves and respiratory protection may be required for specific jobs. Contaminated work clothing should not be allowed out of the workplace.

If exposed or concerned, get medical advice. Whenever possible recover alloys for reuse or recycling. If necessary, dispose of waste material in accordance with local, state or federal regulations.


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 and keep comfortable for breathing. If experiencing respiratory symptoms, call a poison center, and get medical advice/attention. 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 plenty of water. Immediately call a poison center, and get medical advice/attention. If irritation or rash occurs, obtain medical assistance. Take off contaminated clothing, but 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.

WARNING:  Welding, thermal cutting, and melting these products can expose you to chemicals including hexavalent chromium, cobalt, nickel, and titanium, which are known to the State of California to cause cancer. For more information, go to www.P65Warnings.ca.gov.

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 or 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 CO₂ EXTINGUISHER TO CONTROL A TITANIUM FIRE. THE APPLICATION OF WATER OR CO₂ 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.

HAYNES
International

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