MATERIAL SAFETY DATA SHEET (MSDS)

HIGH-ALLOYED STEEL CASTINGS
MSDS SC-000-002 Rev. 9

DATE ISSUED: **03/07**

PART I *What is the material and what do I need to know in an emergency?*

SECTION 1 — PRODUCT IDENTIFICATION & COMPANY INFORMATION

PRODUCT NAME:

HIGH-ALLOYED STEEL CASTINGS

OTHER DESIGNATIONS:

ASTM No's.:	**ACI ALLOY DESIGNATIONS (GRADES)**
A297 / A297M-84	HE, HF, HH, HI, HK, HL, HN, HT, HU, HW, HX, HP
A351 / A351M-84	CF3, CF3A, CF8, CF8A, CF3M, CF3MA, CF8M, CF8C, CF-10, CF-10M, CH8, CH10, CH20, CK20, HK30, HK40, HT30,CF10MC, CN7M, CG6MMN, CG8M
A447 / A447M-84	I, II
A451-80	CPF3, CPF3A, CPF3M, CPF8, CPF8A, CPF8M, CPF10, MC, CPH10, CPF8C, CPH8, CPK20, CPH20
A494 /A494M-84	CY-40, CW3-12MW, CW-7M, CW-2M, CW-6MC
A560 / A560-84	50 Cr-50 Ni-Cb, 50 Cr-50 Ni, 60 Cr-40 Ni
A608-79	HE35, HF30, HH30, HH33, HI35, HK30, HK40, HL30, HL40, HN40, HT50, HU50, HW50, HX50
A743 /A743M-84	CF-8, CG-12, CF-20-, CF-8M, CF-8C, CF-16F, CH-20, CK-20, CE-30, CF-3, CF-3M, CG6MMN CG-8M, CN-7M, CN-7MS, CW-12M, CY-40
A744 / A744M-84	CF-8, CF-8M, CF-8C, CF-3, CF-3M, CG-8M, CN-7M, CN-7NS, CW-12M, CY-40
Mil-S 867 A	I, II, III

MANUFACTURER'S NAME	STREET ADDRESS
EMERGENCY TELEPHONE NO.	MAILING ADDRESS
TELEPHONE NO.	CITY, STATE, ZIP CODE
FAX No.	E-MAIL ADDRESS / WEB SITE

SECTION 2 – HAZARD IDENTIFICATION

OVERVIEW:

There are no health hazards from these castings in solid form. The solid casting is not flammable.

Dust and fume from processing can cause irritation of eyes, skin and respiratory tract; lung disease and other systemic effects.

- Dust or fumes generated by machining, grinding, or welding of the casting may produce airborne contaminants, primarily chromium, manganese, nickel and iron. Also, see the MSDS for the welding material being used.
- Grinding castings that have not been cleaned or that contain embedded sand may generate significant amounts of dust containing free silica.
- Other toxic metals in the alloy that are present in small amounts in the casting should not represent a hazard if chromium, manganese, nickel and iron dust and fume are adequately controlled.

EYES: Grinding or machining of castings may generate flying metal particles that may cause eye irritation or injury.

SKIN: Dermatitis is possible from skin contact with nickel or chromium.

INGESTION: Ingestion of particulate can occur during activities such as eating, drinking and smoking, etc. Not normally applicable.

INHALATION:

Prolonged or repeated over exposure to dust or fumes from these casting may cause the following health effects:

Chromium, hexavalent: Lung and nasal cancer

Cobalt: Respiratory sensitization, asthma, scarring of the lungs and damage to the heart muscle.

Copper: Nose and throat irritation, metal fume fever and gastrointestinal tract irritation.

Iron: Overexposure to iron oxide fume over a long time can cause siderosis, sometimes called "iron pigmentation" of the lung. It can be seen on a chest x-ray but causes little or no disability.

Manganese: Central nervous system impairment

Nickel: Lung and nasal cancer

Silicon: Nose irritation

Tungsten: Irritation of the respiratory tract

Note: Prolonged breathing of excessive amounts of silica dust, which may be on or embedded in the surface of castings, can cause silicosis or other health effects including lung cancer

ENVIRONMENTAL EFFECTS:

No known significant environmental effects from a solid casting.

SECTION 3 — COMPOSITION / INFORMATION ON INGREDIENTS

Section 3A–Information on Ingredients

MATERIAL	Wt %	CAS NUMBER	ACGIH TLV mg/m³	OSHA PEL mg/m³
Chromium (Cr)	10.0-52.0	7440-47-3	0.5	1
Cobalt (Co)	0-2.5	7440-48-4		
Metal dust and fume			N/E	0.1
Elemental and inorganic compounds			0.02	N/E
Copper (Cu)	0-4.0	7440-50-8	1	1
Iron (Fe)	Remainder	7439-89-6	N/E	N/E
Manganese (Mn)	0.30-6.00	7439-96-5	N/E	N/E
Nickel (Ni)	10.0-72.0	7440-02-0	1.5	1.0
Niobium (Nb) / Columbium	0-1.2	7440-03-1	N/E	N/E
Silicon (Si)	0.50-3.5	7440-21-3		
Total dust			N/E	15
Respirable dust			N/E	5
Tantalum (as Ta)	0.1-1.0	7440-25-7		
Metal dust and Oxide dust			5.0	5.0
Tungsten (as W)	0-5.25	7440-33-7	N/E	N/E

Section 3B- Potential Byproducts of Welding, Cutting or Other Further Processing				
Chromium Compounds (as Cr)				
Chromium (II) inorganic compounds, as Cr		various	N/E	0.5
Chromium (III) inorganic compounds, as Cr		various	0.5	0.5
Chromium (VI) inorganic compounds, certain water insoluble		various	0.01	0.005
Chromium (VI) inorganic compounds, water soluble		various	0.5	0.005
Chromium (VI) all forms and compounds		various	N/E	0.005
Copper Compounds		7440-50-8		
Fume, as Cu		various	0.2	.1
Dusts and mists, as Cu		various	1	1
Iron Compounds				
Iron oxide (Fe_2O_3) fume		1309-37-1	N/E	10
Iron oxide (Fe_2O_3) respirable		1309-37-1	5	N/E
Manganese Compounds		7439-96-5		
Manganese fume and inorganic compounds			0.2	5 (C)
Nickel Compounds (as Ni)				
Insoluble inorganic compounds		various	0.2 (I)	1
Soluble inorganic compounds		various	0.1 (I)	0.5
Nickel oxide		1313-99-1	0.2 (I)	1
Tungsten Compounds (as W)		7440-33-7		
Metal & insoluble compounds, as W			5 / 10 (STEL)	N/E
Soluble compounds, as W			1 / 3 (STEL)	N/E

Section 3C–Carcinogen Classification of Ingredients/ Potential Byproducts

INGREDIENT/BYPRODUCT	OSHA	NTP	IARC	ACGIH	EPA	TARGET ORGAN
Chromium (metal)	NL	NL	3	A4	NL	Lung, Nasal
Chromium II, inorganic compounds	NL	NL	NL	NL	NL	
Chromium III, inorganic compounds	NL	NL	3	A4	D	
Chromium VI, (hexavalent)	Y	K	1	A1	NL	
Cobalt Alloys	NL	NL	NL	NL	NL	Lung
Cobalt and compounds	NL	NL	2B	NL	NL	
Cobalt and inorganic compounds, as Co	NL	NL	NL	A3	NL	
Copper	NL	NL	NL	NL	D	GI Tract
Iron	NL	NL	3	A4	NL	Lung
Manganese	NL	NL	NL	NL	D	Central Nervous System
Nickel (metal)	NL	R	2B	A5	NL	Lung, Nasal
Nickel, insoluble compounds	NL	K	NL	A1	NL	
Nickel, soluble compounds	NL	K	NL	A4	NL	
Nickel oxide	NL	K	1	A1	NL	
Niobium / Columbium	NL	NL	NL	NL	NL	
Silicon	NL	NL	NL	NL	NL	

Tantalum	NL	NL	NL	NL	NL	
Tungsten	NL	NL	NL	NL	NL	

OSHA – Occupational Safety & Health Administration
Y = Listed as a Human Carcinogen

NTP – National Toxicology Program
K = Know to be a Human Carcinogen
R = Reasonably Anticipated to be a Human Carcinogen (RAHC)

IARC – International Agency for Research on Cancer
1 = Carcinogen to Humans
2A = Probably Carcinogenic to Humans
2B = Possibly Carcinogenic to Humans
3 = Unclassified as Carcinogenicity in Humans
4 = Probably not Carcinogenic to Humans

NL = Not Listed

ACGIH – American Conference of Governmental Industrial Hygienists
A1 = Confirmed Human Carcinogen
A2 = Suspected Human Carcinogen
A3 = Confirmed Animal Carcinogen
A4 = Not Classifiable as a Human Carcinogen
A5 = Not Suspected as a Human Carcinogen

EPA – U.S. Environmental Protection Agency
A = Human Carcinogen
K = Known Human Carcinogen
D = Not Classified as to Human Carcinogenicity. No Data Available
B1 = Probable Human Carcinogen. Sufficient Evidence from Epidemiology Studies
L = Likely to Produce Cancer in Humans
B2 = Probable Human Carcinogen. Sufficient Evidence from Animal Studies

PART II *What should I do if a hazardous situation occurs?*

SECTION 4 — FIRST AID MEASURES

EYES:	Flush eyes with plenty of water or eye wash solution. Embedded metal particles should be removed by a trained individual such as a nurse or physician.
SKIN:	If a rash develops, seek medical attention.
INGESTION:	Not normally applicable.
INHALATION:	If problems develop move to fresh air and seek medical attention.

SECTION 5 — FIRE & EXPLOSION DATA

FLAMMABLE PROPERTIES:

Castings in a solid form will not burn or explode. However, finely divided metal dust may burn or explode.

EXTINGUISHING MEDIA :

Use fire-extinguishing media that are appropriate for fire in surrounding area.

PROTECTION OF FIREFIGHTERS:

Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate for the surrounding fire.

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Accidental release measures do not apply to solid castings. Dust collected from machining, welding, etc. may be classified as a waste. Consult federal, state and local regulations.

PART III *How can I prevent hazardous situations from occurring?*

SECTION 7 — HANDLING & STORAGE

RECOMMENDED STORAGE:

No special storage requirements needed.

PROCEDURES FOR HANDLING:

For castings with sharp edges, wear appropriate work gloves. When handling heavy castings wear appropriate foot protection.

SECTION 8 — EXPOSURE CONTROLS & PERSONAL PROTECTION

ENGINEERING CONTROLS:

No specific controls are needed when the casting is in a solid state. If welding, grinding or machining provide sufficient general ventilation and/or local exhaust to maintain concentrations below PEL's and TLV's. Refer to Section 3 for exposure guidelines.

If ventilation is not adequate, wear a NIOSH approved dust and fume respirator.

If work is to be done in a confined space use appropriate confined space procedures. Refer to OSHA Standard 29 CFR 1910.146.

Grinding castings that have not been cleaned or that contain embedded sand may generate significant amounts of dust containing free silica, which can cause silicosis. Good local ventilation is frequently required to prevent over-exposure in this situation. If good ventilation is not available, use a NIOSH approved respirator.

Other toxic metals in the alloy that are present in small amounts should not present a hazard if chromium, copper, iron, manganese and nickel dust and fume are adequately controlled.

PERSONAL PROTECTION:

Gloves:

Work gloves are advisable for handling castings.

Eye:

Safety glasses with side shields and/or face shield for particles (grinding). Welding goggles or welding helmet for cutting or welding.

Respiratory:

Wear NIOSH approved respirator for dusts or fumes if concentrations exceed the PEL or TLV.

Footwear:

Foot protection must be worn to protect against foot injury when heavy castings are handled.

Clothing:

Wear appropriate protective clothing if arc-air gouging, cutting or welding castings.

Other:

If noise is at or above 85dBA, hearing protection should be worn. Refer to OSHA Standard 29 CFR 1910.95.

SECTION 9 — PHYSICAL & CHEMICAL PROPERTIES

APPEARANCE /PHYSICAL STATE: Solid, silver gray in color.	
ODOR: None	VAPOR DENSITY: Not applicable
MELTING POINT: 2744-3199F (1504-1704C)	SPECIFIC GRAVITY: 0.28 lb/in^3 (7.74g/cm^3) for cast alloy steels
BOILING POINT: Variable depending on casting grade.	VAPOR PRESSURE: Not applicable
FLASH POINT: Not applicable for castings in solid form	EVAPORATION RATE: Not applicable
FLAMMABILITY: Not flammable	SOLUBILITY IN WATER: Insoluble
UPPER AND LOWER FLAMMABILITY LIMITS: Not applicable for castings in solid form	pH: Not applicable
AUTO IGNITION TEMPERATURE: Not applicable	PERCENT VOLATILE BY VOLUME: Not applicable
DECOMPOSITION TEMPERATURE: Not applicable	PARTITION COEFFICIENT: Not applicable

SECTION 10 — STABILITY & REACTIVITY

CHEMICALLY STABLE?

Yes

CONDITIONS TO AVOID: None	
INCOMPATIBILITY: Metal dust can burn or explode and must be protected from ignition sources such as grinding sparks, etc. Under some conditions, metal dust is incompatible with some oxidizing conditions and may be incompatible with oxidizers, acids and water and may ignite or explode.	
CONDITIONS OF REACTIVITY: None	IMPACT/SHOCK SENSITIVITY: Not applicable
HAZARDOUS DECOMPOSITION PRODUCTS: None	HAZARDOUS POLYMERIZATION: Not applicable

PART IV *Is there any other useful information about this material?*

SECTION 11 — TOXICOLOGICAL INFORMATION
No toxicological information is available for solid castings. There are extensive toxicological data available on the various components of this material. An adequate representation of all these data is beyond the scope of this document.
SECTION 12 — ECOLOGICAL INFORMATION
No ecological information is available for solid castings. There are extensive ecological data available on the various components of this material. An adequate representation of all these data is beyond the scope of this document.
SECTION 13 — DISPOSAL CONSIDERATIONS
Recover or recycle if possible. Dispose of according to federal, state and local regulations.
SECTION 14 — TRANSPORTATION INFORMATION

USA DEPARTMENT OF TRANSPORTATION (DOT) - HM181: Not regulated	
CANADIAN TRANSPORT DANGEROUS GOODS (TDG): Not regulated	SHIPPING NAME: Not regulated
HAZARD CLASS: Not regulated	UN (United Nations) / NA (North American) #: Not regulated
LABEL(S) REQUIRED? No	PACKING GROUP: Not regulated
INTERNATIONAL TRANSPORTATION REGULATIONS: Not applicable	SPECIAL SHIPPING INFORMATION: Not applicable

SECTION 15 — REGULATORY INFORMATION
USA – OSHA (Hazard Communication Standard): Reference 29 CFR 1910.1200 and 1910.1000. A finished casting is an article as defined in the OSHA Hazard Communication Standard 29CFR 1910.1200 (c). Dust or fumes generated by cleaning, machining, grinding, or welding of the casting may produce airborne contaminants, such as chromium, cobalt, copper, iron, manganese, nickel, silicon, tantalum and silica. For chromium references see 29 CFR 1910.1026.
USA – EPA (Toxic Substances Control Act – TSCA): All components of these products are on the TSCA inventory list or are excluded from listing. USA – EPA (SARA Title III) The following components, **Chromium, Cobalt, Copper, Manganese, and Nickel** make this product subject to reporting Requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 72. Quantity threshold amounts are 25,000 pounds for manufacturing, importing or processing and 10,000 pounds for otherwise used.
CANADA - WHMIS (Workplace Hazardous Materials Information System): This MSDS has been prepared according to the hazard criteria of the Controlled Product Regulations (CPR) and the MSDS contains the information required by the CPR.
CANADIAN DSL (Domestic Substance List) Inventory Status All components of these products are on the DSL Inventory.
CEPA (Canadian Environmental Protection Act): The components of these products are not on the CEPA Priorities Substances Lists

EINECS No. (European Inventory of Commercial Chemical Substances):
All components of these products are on the EINECS list.

RoHS (Restriction of Certain Hazardous Substances) Compliance
Castings comply with RoHS

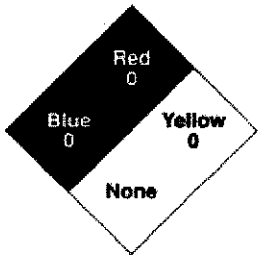
CALIFORNIA PROPOSITION 65 Compliance
WARNING: This product contains or produces chemicals known to the State of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code 25248.5 et seq.)

U.S. STATE REGULATORY INFORMATION
Some of the components listed in Section 3 above may be covered under specific state regulations.

SECTION 16 — OTHER INFORMATION

National Fire Protection Association (NFPA) RATINGS:
For Castings in Solid Form

Health:	Fire:	Reactivity	Specific Hazard
0	0	0	None



Health Hazard: (Blue)
0—(material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials);
1—(materials that on exposure under fire conditions could cause irritation or minor residual injury);
2—(materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury);
3—(materials that can on short exposure could cause serious temporary or residual injury);
4—(materials that under very short exposure causes death or major residual injury).

Flammability Hazard (Red)
0—minimal hazard);
1—(materials that require substantial pre-heating before burning);
2—(combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]);
3—(Class IB and IC flammable liquids with flash points below 38°C [100°F]);
4—(Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F].

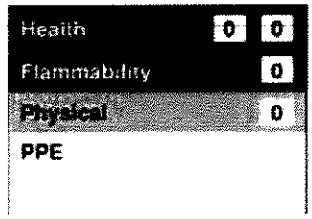
Reactivity Hazard: (Yellow)
0—(normally stable);
1—(material that can become unstable at elevated temperatures or which can react slightly with water);
2—(materials that are unstable but do not detonate or which can react violently with water);
3—(materials that can detonate when initiated or which can react explosively with water);
4—(materials that can detonate at normal temperatures or pressures).

Specific Hazard: (White)

Oxidizer	OXY
Acid	ACID
Alkali	ALK
Corrosive	COR
Use No Water	W
Radioactive	
Polymerizes	P

Hazardous Materials Information System (HMIS) RATINGS
For Castings in Solid Form

Health:	Flammability:	Physical Hazards
0	0	0



Health Hazard: (Blue)
0—(no significant risk to health);
1—(irritation or minor reversible injury possible);
2—(temporary or minor injury may occur);
3—(major injury likely unless prompt action is taken and medical treatment is given);
4—(life-threatening, major or permanent damage may result from single or repeated overexposures);
*—chronic health hazard.

Flammability: (Red)
0—(materials that will not burn);
1—(materials that must be preheated before ignition will occur);
2—(materials which must be moderately heated or exposed to high ambient temperatures before ignition will occur);
3—(materials capable of ignition under almost all normal temperature conditions);
4—(flammable gases, or very volatile flammable liquids with flash points below 73°F and boiling points below 100°F. Materials may ignite spontaneously with air. (Class IA)).

Physical Hazards: (Orange)
0—(materials that are normally stable, even under fire conditions and will **not** react with water, polymerize, decompose, condense, or self-react. Non-explosives);
1—(materials that are normally stable but can become unstable (self-react) at high temperatures and pressures. Materials may react non-violently with water or undergo hazardous polymerization in the absence of inhibitors);
2—(materials that are unstable and may undergo violent chemical changes at normal temperature and pressure with low risk for explosion. Materials may react violently with water or form peroxides upon exposure to air);
3—(materials that may form explosive mixtures with water and are capable of detonation or explosive reaction in the presence of a strong initiating source. Materials may polymerize, decompose, self-react, or undergo other chemical change at normal temperature and pressure with moderate risk of explosion);
4—(materials that are readily capable of explosive water reaction, detonation or explosive decomposition, polymerization, or self-reaction at normal temperature and pressure).

LABEL INFORMATION: The following hazard information is required for labels under OSHA Standard 29 CFR 1910.1200. Other label information may be added.

High-Alloyed Steel Castings

—CAUTION—

Grinding, welding or arc gouging of this casting creates dust or fumes containing substances listed below with corresponding possible health effects after prolonged or repeated overexposure.

Chromium, hexavalent: Dermatitis, lung and nasal cancer

Cobalt: Asthma, respiratory sensitization, damage to heart

Copper: Nose and throat irritation, metal fume fever

Iron: Overexposure to iron oxide fume over a long time can cause siderosis, sometimes called "iron pigmentation" of the lung. It can be seen on a chest x-ray but causes little or no disability.

Manganese: Central nervous system impairment.

Nickel: Dermatitis, lung and nasal cancer

Niobium / Columbium: Eye and skin irritation

Silicon: Skin, eye and nose irritation.

Tantalum: Dermatitis, upper respiratory irritation

Tungsten: Lower respiratory tract irritation, central nervous system impairment, pulmonary fibrosis

Wear eye protection

Wear a NIOSH approved respirator if dust or fume concentrations are excessive.

NOTE:

This data is offered in good faith as typical values and not as a product specification. No warranty either expressed or implied is hereby made. The recommended industrial hygiene and safe handling procedures are believed to be generally applicable. However, each user should review the recommendations in specific context of the intended use and determine if they are appropriate.

MSDS SHEET PREPARED BY:	DATE:
American Foundry Society, Inc. Occupational Safety & Health Committee (10-Q)	03/07