



MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

Manufacturer : US Drop Forge Co.
1366 Auburn Road
Woolwich Township, NJ 08085
Emergency Phone : (856) 467-0500

Product Name: Steel Forgings
All Grades (See Attachment)
Product Class: Fabricated Metal (Solid)
Issue Date : December 2007

II. HAZARDOUS INGREDIENTS

Component	Cas Number	Exposure Form	OSHA-PEL 8 HR. (mg/m3)	ACGIH-TLV TWA 8 HR. (mg/m3)	ACGIH-STEL 8 HR TWA (mg/m3)
Aluminum (Al)	(7429-90-5)	Dust	-	10.0	20.0
		Fume	-	5.0	-
Cadmium (Cd)	(7440-43-9)	Dust	.2	0.05	0.2
		Fume	0.1	0.05*	-
Carbon (C)	(7440-44-0)	As carbon black	3.5	3.5	7.0
Chromium (Cr)**	(7440-47-3)	As soluble Cr salts	0.5	0.5	-
		As soluble Cr salts	1.0	0.5	-
Cobalt (Co)	(7440-48-4)		0.1	0.1a	0.1
Copper (Cu)	(7440-50-8)	Dust	1.0	1.0	2.0
		Fume	0.1	0.2	-
Iron (Fe)	(7439-89-6)	As Iron	-	5.0	-
		As Iron oxide fume	10.0	5.0	10.0
Lead (Pb)	(7439-92-1)		0.05	0.15	0.45
Magnesium (Mg)	(7439-95-4)	As magnesium oxide Fume	15.0	10.0	-
Manganese (MN)	(7439-95-5)	Dust	5.0*	5.0*	-
		Fume	5.0*	1.0	3.0
Molybdenum (Mo)	(7439-98-7)	Soluble compounds	5.0	5.0	-
		InSoluble compounds	15.0	10.0	20.0
Nickel (Ni)**	(7440-02-0)		1.0	1.0	0.3
Nitrogen (N)	(7727-37-9)		5ppm	9.0	-
Phosphorus (P)	(7723-14-0)		0.1	0.1	-
Silicon (Si)	(7740-21-3)	Total Dust	15.0	10.0	20.0
		Respirable Dust	5.0	5.0	20.0
Silver (AG)	(7440-22-4)		0.01	0.1	-
Sulphur (S)	(7704-34-9)	As sulphur dioxide	13.0	5.0	-
Tantalum (Ta)	(7440-25-7)		5.0	5.0	-
Tin (Sn)	(7440-31-5)		2.0	2.0	4.0
Titanium (Ti)	(7440-32-6)	As Titanium dioxide	15.0	10.0	-
Tungsten (W)	(7440-33-7)	Insoluble compounds	-	5.0	-
Vanadium (V)	(7440-62-2)	As vanadium pentoxide, Dust	0.5*	0.05	-
		Fume	0.1*	0.05	-
Zinc (Zn)	(7440-66-6)	As zinc oxide, Dust	-	b	-
		Fume	5.0	5.0	10.0

Notes: a - ACGIH has published a TLV of 0.05 mg/m3 in their notice of intended changes.
 b - TLV = 5.0 mg/m3 respirable dust, 10.0 mg/m3 total dust
 * - Denotes ceiling limit
 ** - Known or suspected carcinogen in the form of fume or dust. See Sec. VI.

No permissible exposure limits (PEL), threshold limit value(TLV), or short term exposure levels (STEL) exist for forgings in their supplied form. The values shown above are applicable to the component elements only, Various combinations of some of these elements are present in all grades of forgings to various degrees. More specific information on a particular grade may be obtained by contacting US Drop Forge Co.

III. PHYSICAL DATA

Carbon steel forgings turn reddish brown as a result of oxidation.

Melting Point	: Aluminum Alloys - 1000 °F min. All other grades - 2350 °F min.
Boiling Point:	: Extremely high (Aluminum Alloys - 4000 °F min.)
Specific Gravity	: Aluminum Alloys - approx. 3 : All other grades - approx. 7.5 - 8.5
Vapor Pressure	: 1mm Hg @ 2340 °F (Aluminum)
Percent Volatile by volume	: N/A
Solubility in water	: Negligible
Appearance & Odor	: Odorless solid metallic articles with gray, silver, copper, brass, or blackish color depending on grade of material and heat treatment or surface condition.

IV. FIRE & EXPLOSION DATA

Forgings are not considered to be combustible in the forms supplied. During subsequent processing (welding, burning, grinding, cutting, abrasive blasting, heat treatment, pickling, or similar operations), the generation of dust or fumes in extremely high concentrations under severe conditions may or may not present fire and/or explosion hazards. Such processing should be performed in well-ventilated areas to minimize any potential hazards.

Flammable Limits	: N/A
Flash Point	: N/A
Unusual Fire or Explosion Hazards	: Always avoid pouring water or other liquids on molten metal
Extinguishing Media	: Methods/materials applicable to surrounding area.
Special Fire Fighting Procedures	: Use self-contained breathing apparatus for protection against degradation products. Use fire fighting techniques/media applicable to surrounding materials.
ALUMINUM: small chips, fine turnings, and dust may ignite readily. Use dry sand or Class D extinguishing agents.	
DO NOT use halogenated extinguishing agents on small chips or fines. Dust clouds may be explosive. Molten aluminum may explode on contact with water or other liquids.	

V. REACTIVITY DATA

Stability	: Considered stable
Hazardous Decomposition Prod.	:Metallic oxides
Hazardous Polymerization	: Will not occur
Materials to avoid	: Strong acids,bases,and oxidizers. Molten metal will react violently with water
Conditions to Avoid	: Excessive generation of airborne dust,which may pose moderate fire and/or explosion data

VI. HEALTH HAZARD DATA

The health effects/signs and symptoms listed on pages 3 and 4 would result primarily through exposure to or inhalation of dust or fumes. Ingestion is highly improbable. Absorption through the skin is virtually impossible, excepting for splinters, which should be removed promptly. Cuts should be cleaned and dressed immediately, and your physician should be contacted to determine need for further treatment, i.e. tetanus vaccination.

Aluminum (Al) Particles of aluminum deposited in the eye may cause irreversible tissue damage of the cornea. Al salts may cause dermatitis, eczema, conjunctivitis, and irritation of the mucous membranes of the upper respiratory tract. Long-term inhalation exposure to Al dusts or fumes has been associated with a fibrotic lung condition known as Shaver's disease; however, the evidence for this is not conclusive since affected workers were exposed to other substances (such as silica) as well. Symptoms of this condition may include shortness of breath, cough, and fatigue.

Chromium (Cr) The toxicity and health hazards of chromium are heavily dependent upon its oxidation state. The elemental (as in the metal), divalent, and trivalent forms are of very low toxicity. The hexavalent form (such as occurs in chromates and chromic acid) is very toxic and can produce both acute and chronic effects. Adverse effects on the skin may include ulcerations, irritative dermatitis, and allergic skin reactions. Adverse effects on the respiratory system may include bronchospasm, edema, hypersecretion, bronchitis, irritation, allergic asthmatic reactions, and ulceration and perforation of the nasal septum. Respiratory symptoms may include coughing and wheezing, shortness of breath, and nasal itch. Eye irritation or inflammation can also be produced. Exposure to some hexavalent chromium compounds have also been shown to be associated with an increased risk of lung cancer.

Cobalt (Co) Cobalt dust and fume is mildly irritating to the eyes, skin, and upper respiratory tract. An allergic dermatitis may be produced especially in skin areas subject to friction such as the creases of the elbow, knee, neck, and ankles. Inhalation of Co dust and fume may result in an asthma-like respiratory disease with symptoms such as cough and shortness of breath. In some instances, this condition progress to interstitial pneumonia with marked fibrosis. As a result, permanent disability or even death may occur.

Copper (Cu) Inhalation of Cu fume may cause irritation of the eyes, nose, and throat and a flu-like illness called metal fume fever. Signs and symptoms of metal fume fever include fever, muscle aches, nausea, chills, dry throat, cough and weakness. Cu fume may also produce a metallic or sweet taste. Repeated or prolonged exposure to Cu fume may cause discoloration of the skin and hair.

Iron (Fe) Subjecting iron and alloys containing iron to high temperatures (such as occur during welding) will cause the formation of iron oxide. Long-term exposure to iron oxide fumes or dusts has been associated with a benign lung condition known as siderosis, which is observable as an X-ray change. No physical impairment of lung function has been linked to siderosis.

Lead (Pb) Chronic or acute inhalation exposures to the fumes or dusts of inorganic lead compounds (such as lead oxide) can adversely affect several organ systems including the nervous system, the gastrointestinal system, the hematological system, and the renal system. The early effects are characterized by fatigue, constipation, muscle aches, abdominal pains, and decreased appetite. Later signs and symptoms can include anemia, pallor, a "lead-line" on the gums, and reduced hand-grip strength. Lead colic produces intense abdominal cramping, which can be accompanied by constipation, nausea, and vomiting. A condition called "wrist-drop" can develop if the peripheral nervous system is affected. Severe central nervous system effects (referred to as lead encephalopathy) usually only occur after heavy and rapid lead exposures. Signs and symptoms may include headache, dizziness, convulsions, delirium, coma, and possibly death. Long-term lead exposures can also produce kidney damage with possible decreased renal function leading to such conditions as uremia.

Manganese (Mn) Mn intoxication is usually due to the oxide or salts of Mn, elemental Mn exhibits very low toxicity. The dusts or fumes can act as minor irritants to the eyes and respiratory tract. Both acute and chronic exposures may adversely affect the central nervous system (CNS), but symptoms are more likely to occur after at least one or two years of prolonged or repeated exposures. Early symptoms may include weakness in lower extremities, sleepiness, salivation, nervousness, and apathy. In more advanced stages, severe muscular incoordination, impaired speech, spastic walking, mask-like facial expression and uncontrollable laughter may occur. Manganese fumes have also been reported to result in metal fume fever, a flu-like syndrome with symptoms such as dizziness, chills, fever, headache, and nausea. An increased incidence of pneumonia, bronchitis, and pneumonitis has been reported in some worker populations exposed to manganese. Animal studies indicate that manganese exposure may increase susceptibility to bacterial and viral infections.

Molybdenum (Mo) Mo and its compounds generally exhibit a low order of toxicity; however, soluble compounds (such as Mo trioxide) are considerably more toxic. Molybdenum trioxide may produce irritation of the eyes, nose and throat. In animals, soluble Mo compounds have also caused weight loss, diarrhea, loss of coordination, pneumoconiosis (accumulation of particles in the lungs), breathing difficulties, anemia, and colic. Animal data also suggest that repeated exposures might be associated with gout. Pneumoconiosis with X-ray findings and subjective symptoms has been observed in a small number of workers exposed to metallic molybdenum and Mo trioxide; however, no physical impairment of lung function has been linked to this condition.

Nickel (Ni) Ni fumes and dusts are respiratory irritants and may cause a severe pneumonitis. Skin contact with nickel and its compounds may cause an allergic dermatitis. The resulting skin rash is often referred to as "nickel itch". Ni and its compounds may also produce eye irritation, particularly on the inner surfaces of edipemiology studies have linked nickel and certain nickel compounds to an increased incidence of cancer of the lungs and nasal passages.

Silicon (Si) This is considered to be a nuisance particulate by ACGIH.

Tantalum (Ta) Metallic tantalum and its oxides have a relatively low order of toxicity. Although some animal experiments have suggested that inhalation of Ta or its oxides may produce benign and non-fibrotic pulmonary effects, no adverse effects have been reported as a result of industrial exposures. There have been some reports of adverse skin reactions due to tantalum; however, most evidence indicates that Ta is relatively inert with respect to skin contact.

Tin (Sn) The toxicity of inorganic tin compounds is generally low. Exposure to the dust or fumes of tin oxides can result in a benign pneumoconiosis called stannosis. No tissue reaction or pulmonary dysfunction has been associated with this lung condition.

Titanium (Ti) Titanium and its compounds are, in general, considered to be physiologically inert and of very low toxicity. Titanium dioxide dust has been reported to be a mild pulmonary irritant in humans. Most animal experiments have shown that inhalation of Ti and its oxides result in mild or transient effects on the respiratory system. Titanium dioxide is considered to be a nuisance particulate by ACGIH.

Vanadium (V) Vanadium compounds (especially V pentoxide) are irritants to the eyes, respiratory tract, and to a less frequent extent—the skin. Eye symptoms may include excessive tearing and a burning sensation. Skin rashes, which may be allergic in nature, resemble eczema and may itch intensely. Excessive inhalation exposures, even after brief periods, may result in inflammation of the nasal passages, sore throat, cough, tracheitis, bronchitis, wheezing, and chest pain. Excessive long- term or repeated exposures may result in more severe effects such as pulmonary edema, pneumonia, chronic bronchitis, and recurring episodes of labored breathing. Workers exposed to excessive levels of vanadium often show a greenish discoloration of the tongue.

Zinc (Zn) Subjecting zinc or alloys containing zinc to high temperatures (such as occurs during welding) will cause the formation of zinc oxide. Exposure to zinc oxide fumes or dusts can result in a flu-like illness called metal fume fever. Early symptoms may include a sweet or metallic taste in the mouth, dryness and irritation of the throat, and coughing. These symptoms may progress to shortness of breath, headache, fever, chills, muscle aches, nausea, vomiting, weakness, fatigue, and profuse sweating. The symptoms may last 6 - 48 hours and is more likely to occur after a period away from the job.

First Aid:

Eye Contact : Flush well with running water. Get medical attention.

Skin Contact : Wash exposed area well with soap and water.

Inhalation : Remove to fresh air. Provide artificial respiration or oxygen if necessary.
Get medical attention.

Ingestion : Get medical attention.

VII. SPILL PROCEDURES

No special precautions are necessary for spills of bulk material. If large quantities of dust are spilled, remove by vacuuming or wet-sweeping to prevent heavy concentration of airborne dust. Clean-up personnel should wear respirators and protective clothing.

Dispose of material in accordance with federal, state, and local regulations. Many steel products may be salvaged for reuse or recycling.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: Use general and local exhaust ventilation to keep airborne dust or fumes below established TLV's. Employees should wear NIOSH approved respirators for protection against dust or fumes when established TLV's are exceeded. The TLV for total dust is 10 mg/m³ and for respirable dust the TLV is 5 mg/m³.

Protective Equipment: Approved safety goggles should be worn during operations creating eye hazards. A welding hood should be worn when welding or burning. Use gloves and other protective clothing as required.

Other: Principles of good personal hygiene should be followed prior to changing into street clothes or eating. Food should not be consumed in the work area.

IX. SPECIAL PRECAUTIONS

- Minimize and control operations producing dust and fume.
- Use good housekeeping practices to prevent accumulation of dust and fume.
- Store material away from incompatible materials.

X. TRANSPORTATION

Ship according to Department of Transportation Regulations.

XI. DISCLAIMER

US Drop Forge Co. makes no warranties, expressed or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose.

The information contained in the Material Safety Data Sheet (MSDS) is believed to be correct, but no representations, guarantees, or warranties of any kind are made as to its accuracy, suitability for particular applications, hazards connected with the use of the material or the results to be obtained from the use thereof. User assumes all risk and liability of any use, processing or handling of any material. Variations in methods, conditions, equipment used to store, handle, or process the material are solely the responsibility of the user and remain at its sole discretion.

As sold, the product described in this MSDS is considered by US Drop Forge Co. to be an "article" within the meaning of Title 29 of the Code of Federal Regulation, section 1910.1200 et seq. this MSDS is intended to be used solely for the purpose of satisfying informational request made pursuant to that requirement. it is not intended to preempt, replace or expand the terms contained in US Drop Forge Co. Condition of Sale. Compliance with all applicable, federal, state, and local laws and regulations remains the responsibility of the user to provide a safe work place, to examine all aspects of an operation, and to determine if or where precautions, in addition to those described herein, are required.



**US Drop Forge Co.
Material Safety Data Sheet**

" ATTACHMENT A"

The purpose of this attachment is to assist the readers of our MSDS in determining the relative concentrations of the component elements (listed in Section II) present in any given alloy grade of forgings supplied by US Drop Forge Company. We have included most of the grades commonly produced, as well as many of the grades produced on a less frequent basis. The grades have been consolidated into ten alloy groups, which are listed below as reference to the table which appears on the next page.

<u>Alloy group</u>	<u>Includes following grade</u>
1	A105, A350-LF2 & LF3 (carbon steel grades)
2	A182 F5, F5a, F9, F91, F92
3	A182 F11, F12, F22
4	A182 F6a (410), Type 405
5	A182 F304, F310, F316, F321, F347, F317, Alloy 20, RA330, F904L, F62 Including available low and high carbon grades
6	Inc 600, Inc 601, 625, 800, 800H, 800HT, 825, Hastelloy B-2, C-276 and C-22
7	Aluminum Alloys 6061, 5083, 5086
8	Copper-Nickel 70/30 & 90/10
9	Monel 400 (B164 class A, UNS alloy N04400)
10	Nickel 200 and Nickel 201

More specific information regarding the concentration of elements in a specific alloy may be obtained by reviewing the material specification in question or the certification furnished by us at the time of shipment (if requested). If none of these materials are available, please feel free to contact us directly for any desired information.

There may be times when we are called upon to furnish an alloy of special nature that is not covered by this attachment. Component element information will gladly be furnished on any such furnished grade upon request.

Please bear in mind that the values shown in the table represent maximum concentrations present. In many instances, the actual concentrations will be considerably less.

The materials listed in this Material Safety Data Sheet comply with the Federal Clean Air Act of 1990 and are "free from" products containing Class I and Class II ozone-depleting substances.

The materials listed in this material safety data sheet comply with the "Coalition of Northeastern Governors" and contain less than the "part per million" allowable maximum limits for heavy metal concentrations for packaging and disposal compliances.

COMPONENT ELEMENT CONCENTRATION BY ALLOY GROUP

(Figures represent maximum percent present unless indicated otherwise)

ELEMENT	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6	GROUP 7	GROUP 8	GROUP 9	GROUP 10
C	.35	.25	.20	.15	.15	.15	NP	NP	.30	.15
Mn	1.35	.60	.30-.80	1.00	2.00	1.50	.15	1.00	2.00	.35
P	.040	.040	.040	.040	.045	.040	NP	NP	NP	NP
S	.050	.030	.040	.030	.035	.030	NP	NP	.50	.35
Si	.35	1.00	1.00	1.00	1.50	1.00	.80	NP	.50	.35
Ni	3.75h	.50	NP	.50	8.0-38.0	30.0 MIN	NP	9.0-33.0	63.0 MIN	99.0 MIN
Cr	NP	4.0-10.0	1.0-2.5	11.5-14.5	16.0-26.0	14.0-23.5a	.04-.35	NP	NP	NP
Mo	NP	.44-1.10	.44-1.13	NP	.40	30.0	NP	NP	NP	NP
Al	NP	NP	NP	10-.30	NP	.60	REM.	NP	NP	NP
Co	NP	NP	NP	NP	NP	2.5	NP	See Ni	NP	NP
Cu	NP	NP	NP	NP	4.0	3.0	NP	65.0 MIN	28.0-34.0	.25
Fe	REM.	REM	REM.	REM.	REM.	b	.70	.4-1.8	2.50	.40
Pb	NP	NP	NP	NP	NP	NP	NP	.05	NP	NP
Mg	NP	NP	NP	NP	NP	NP	.80-4.5	NP	NP	NP
N	NP	NP	NP	NP	.10c	NP	NP	NP	NP	NP
Ag	NP	NP	NP	NP	NP	NP	NP	See Cu	NP	NP
Ta	NP	NP	NP	NP	1.10d	4.15e	NP	NP	NP	NP
Sn	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Ti	NP	NP	NP	NP	.70f	1.2	NP	NP	NP	NP
V	NP	NP	NP	NP	NP	.35	NP	NP	NP	NP
W	NP	NP	NP	NP	NP	3.0-4.5g	NP	NP	NP	NP
Zn		NP	NP	NP	NP	NP	.25	1.0	NP	NP

a: Except Hastelloy B-2 which contains 1.0% max Cr.

b: Inc 600 series = 5.0-10.0, Inc 800 = 39.5 min, Inc 825 = 22.0 min, Hastelloy B-2 , C-276, and C-22 = 7.0 max

c: Present in T317L only

d: Value includes Columbium, present in Type 347 and Alloy 20 only

e: Present in Inc 625 only

f: Present in Type 321 only

g: Present in Hastelloy C-276 only

h: Present in Grade LF-3 only

k: Used as a surface coating only. Coating thickness typically 0.0002" - 0.0003"

NP: Not published in raw material supplier's test report and/or material specification. Element may be present in trace amounts (typically less than 0.3%)

REM: Remainder