Safety Data Sheets

This package contains four (4) safety data sheets.

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SECTION 1: IDENTIFICATION

Product Identifier: **High Performance, Stainless Steel and Related Alloys,** designated as follows:
Stainless Steel and Related Alloys: 201; 254 SMO; 301; 301 AL; 301Si; 302; 303; 303 SE; 304; 304 L; 304 LV; 304 V; 3049; 305; 30512; 308; 309; 309 S; 309 SCB; 310; 310 S; 316; 316 L; 316 LN; 316 LS; 316 Ti; 317; 317 L; 321; 330; 347; 384; 405; 409; 410; 410 S; 414; 416; 416 SE; 420; 420 A; 420 HC; 420 LC; 420 MO; 430; 430Li; 434; 436; 439; 440 A; 440 C; 441; 442; 444; 446; 18 SR[1];Carpenter 20 CB3[2]; Carpenter 455[2]; Custom 450; 18-9LW[1]; 19-90L[4]; Greek Ascology; AL-6XN[4]; AL29-4C, 904L; CS22[1], Duplex 2205, 2304 & 2507
High Manganese Alloys: Nitronic 32[1]; Nitronic 33[1]; Nitronic 40 (21-6-9)[1]; Nitronic 50[1]; Nitronic 60[1].
Precipitation Hardening and High Iron Alloys: A 286[4]; AM-350[4]; 17-4PH[1]; 17-7PH[1]; PH 15-7MO[1].
Electronic Alloys: Ulbravar 29-17 (Alloy 2917); Ulbraseal 36 (Alloy 36); Ulbraseal 42 (Alloy 42) Ulbraseal 46 (Alloy 46); Ulbraseal 52.
Nickel, Nickel Based and Nickel-Iron-Chromium Alloys: 80Ni-20 Cr; Ni 200; Ni 201; Ni 233; Ni 270; Hastelloy B3[5];Hastelloy B2[5]; Hastelloy C-4[5]; Hastelloy C276[5]; Hastelloy C22[5]; Hastelloy G-3[5]; Hastelloy G-30[5]; Hastelloy X[5]; Haynes 214[5]; Haynes 230[5]; Haynes 242[5]; Haynes 282[5]; HR 120[5]; Inconel 600[3];Inconel 601[3];Inconel 617[3];Inconel 625[3]; Inconel 702[3]; Inconel 718[3]; Inconel 722[3]; Inconel X-750[3]; Incoloy 800[3]; Incoloy 801[3]; Incoloy 825[3]; Nimonic 75[3]; Monel 400[3]; Monel 401[3]; Monel R405[3]; Monel K500[3];Ni-Span-C 902[3]; Permanickel[3];Waspaloy[6]
Cobalt Based Superalloys and Related Alloys: L-605 (Haynes 25)[5]; Haynes 188[5]; N 155; ULMET
Product Form: Metal Alloy/Mixture
Intended Use of the Product: Solid stainless steel and related products, various uses
Supplier's Details: **Ulbrich Stainless Steels & Special Metals, Inc.**
153 Washington Avenue, P.O. Box 294,
North Haven, CT USA, 06473-1191
Phone Number (203) 239-4481 • (800) 243-1676
SDS Technical Contact Weekdays (203) 265-8299
FAX: (203) 239-7479 • E-Mail: information@ulbrich.com
Emergency Telephone Number (203) 239-4481; Chemtrec 800-424-9300

SECTION 2: HAZARDS IDENTIFICATION

Classification (GHS-US): As shipped, uncoated alloys are articles that do not present a hazard to human health by inhalation or ingestion. However, cutting, grinding, welding, etc. may produce dust, particulate or fume that presents health hazards related to constituents detailed in section 3.

Acute toxicity - Oral	Category 4
Respiratory sensitization	Category 1B
Skin sensitization	Category 1
Carcinogenicity	Category 1B
Reproductive toxicity	Category 2
Specific target organ toxicity (repeated exposure)	Category 1
Cobalt alloys and Waspaloy[5] only – Chronic aquatic toxicity	Category 4

Label Elements:

Emergency Overview

Signal Word: Danger
Hazard statements:
Harmful if swallowed
May cause allergy or asthma symptoms or breathing difficulties if inhaled
May cause an allergic skin reaction
May cause cancer
Causes damage to the respiratory tract prolonged or repeated exposure if inhaled.
Suspected of damaging fertility or the unborn child
Cobalt alloys and Waspaloy[5] only – May cause long lasting harmful effects to aquatic toxicity

Appearance Various massive product **Physical state** Solid **Odor** Odorless

Precautionary Statements - Prevention	**Precautionary Statements - Response**
Do not breathe dusts / fume / gas / mist / vapor / spray. Do not handle until all safety precautions have been read and understood Wear protective gloves / protective clothing / eye protection / face protection. Use personal protective equipment as required Take off and wash contaminated clothing before reuse.	If exposed, concerned, experiencing respiratory symptoms, or feel unwell: Get medical advice/attention. IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell. If experiencing respiratory symptoms: Call a POISON CENTER or doctor/physician. If on skin: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention

STORAGE	**DISPOSAL**
Store away from acids and incompatible materials. Store locked up Store in accordance with federal/state and local regulations.	Metal scrap should be recycled whenever possible Dispose of in accordance with federal/state or local regulations.

Hazards not otherwise classified: None Known, No data available
Unknown acute toxicity statement (mixture): None Known, No data available

SECTION 3: COMPOSITION/ INFORMATION ON INGREDIENTS

STAINLESS STEEL ALLOYS

ALLOY	UNS No.	CONSTITUTENT(S) % Maximum unless otherwise shown.												
		C	Mn	Si	Cr	Ni	Mo	Fe	Nb + Ta	Ti	P	Cu	Other	Other
201	S0100	0.15	5.5/7.5	1.0	16.0/18.0	3.5/5.5		BAL						
254 SMO	S31254	0.02	1.0	0.8	19.5/20.5	17.5/18.5	6.0/6.5	BAL			0.03	0.5/1.0		
301	830100	0.15	2.0	1.0	16.0/18.0	6.0/8.0		BAL			0.45			
301 AL	830100	0.15	2.0	1.0	16.0/18.0	6.0/8.0		BAL						
301Si	S30116	0.15	2.0	1.3	16.0/18.0	6.0/8.0	0.75	BAL			0.04	0.75		
302	S30200	0.15	2.0	1.0	17.0/19.0	7.0/10.0	0.75	BAL			0.04			
302 HQ	S30230	0.08	2.0	1.0	17.0/19.0	8.0/10.0		BAL			0.045	3.0-4.0		
303	S30300	0.15	2.0	1.0	17.0/19.0	8.0/10.0		BAL			0.02			
303 SE	S30323	0.15	2.0	1.0	17.0/19.0	8.0/10.0		BAL			0.17		Se 0.15/0.35	
304	S30400	0.08	2.0	1.0	18.0/20.0	8.0/10.5		BAL						
304 L	S30403	0.03	2.0	1.0	18.0/20.0	8.0/12.0		BAL						
304 LV		0.03	2.0	1.0	18.0/20.0	8.0/10.5		BAL						
304 V		0.08	2.0	1.0	18.0/20.0	8.0/9.5		BAL			0.04			
3049		0.10	2.0	0.75	18.0/20.0	9.0/10.5		BAL			0.045			
305	S30500	0.12	2.0	1.0	17.0/19.0	10.5/13.0		BAL						
30512		0.12	2.0	1.0	17.0/19.0	12.0/13.0	0.75	BAL			0.04	0.75		
308	S30800	0.08	2.0	1.0	19.0/21.0	10.0/12.0		BAL						
309	S30900	0.20	2.0	1.0	22.0/24.0	12.0/15.0		BAL						
309 S	S30908	0.08	2.0	1.0	22.0/24.0	12.0/15.0		BAL						
309 SCB		0.08	2.0	0.75	22.0/24.0	12.0/16.0		BAL	10XC/1.1 max		0.75			
310	S31000	0.25	2.0	1.5	24.0/26.0	19.0/22.0		BAL			0.045			
310 S	S31008	0.08	2.0	1.5	24.0/26.0	19.0/22.0		BAL						
316	S31600	0.08	2.0	1.0	16.0/18.0	10.0/14.0	2.0/3.0	BAL						
316 L	S31603	0.03	2.0	1.0	16.0/18.0	10.0/14.0	2.0/3.0	BAL						
316 LN		0.02	2.0	0.75	16.0/18.0	10.0/14.0	2.0/3.0	BAL						
316 LS BioDur		0.03	2.0	0.75	17.0/19.0	13.0/15.0	2.2/3.5	BAL			0.025	0.5		
316 Ti	S31635	0.08	2.0	1.0	16.0/18.0	10.0/14.0	2.0/3.0	BAL		0.07	0.045	0.075		
317	S31700	0.08	2.0	1.0	18.0/20.0	11.0/15.0	3.0/4.0	BAL						
317 L	S31703	0.03	2.0	1.0	18.0/20.0	11.0/15.0	3.0/4.0	BAL						
321	S32100	0.08	2.0	1.0	17.0/19.0	9.0/12.0		BAL		5XC/0.7max				
330	N08330	0.08	2.0	0.75/1.5	17.0/20.0	34.0/37.0		BAL						
347	S34700	0.08	2.0	1.0	17.0/19.0	9.0/13.0		BAL	10XC min					
384	S38400	0.08	2.0	1.0	15.0/17.0	17.0/19.0		BAL						
405	S40500	0.08	1.0	1.0	11.5/14.5	0.5		BAL			0.04		Al 0.10/0.30	
409	S40900	0.08	1.0	1.0	10.5/11.75			BAL		6XCmin/0.75				
410	S41000	0.15	1.0	1.0	11.5/13.5			BAL						
410 S	S41008	0.08	1.0	1.0	11.5/14.5	0.6		BAL		0.2	0.04			
414	S41400	0.15	1.0	1.0	11.5/13.5	1.25/2.5		BAL						
416	S41600	0.15	1.25	1.0	12.0/14.0			BAL						
416 SE	S41623	0.15	1.25	1.0	12.0/14.0			BAL		0.15 min				
420	S42000	0.15 min	1.0	1.0	12.0/14.0	0.5	0.5	BAL						
420 A		0.25	1.0	1.0	12.0/14.0	1.0		BAL			0.04			
420 HC		0.15	1.0	1.0	12.0/14.0	0.5		BAL			0.04			
420 LC	S42000	0.27	1.0	1.0	12.0/14.0	0.5	0.5	BAL			0.04	0.5	Al 0.15	
420 MO		0.30/0.40	1.0	1.0	12.0/14.0	0.5	0.5/1.75	BAL		0.05	0.04	0.5		
430	S4300	0.12	1.0	1.0	16.0/18.0	0.5	0.5	BAL		0.5			Al 0.15	
430Li	S43000	0.022	1.0	1.0	16.0/18.0	0.5	0.5	BAL			0.04	0.5		
434	S43400	0.12	1.0	1.0	16.0/18.0		0.75/1.25	BAL		0.5	0.04			
436	S43600	0.12	1.0	1.0	16.0/18.0		0.75/1.25	BAL	5XC/0.80 max		0.04			
439	S43035	0.04	1.0	0.6	17.0/18.0	0.5		BAL		0.2/0.6				
440 A	A44002	0.60/0.75	1.0	1.0	16.0/18.0		0.75	BAL						
440 C	S44004	0.95/1.2	1.0	1.0	16.0/18.0		0.75	BAL			0.04			
441	S44100	0.03	1.0	1.0	17.5/19.0	1.0		BAL	9XC+3/1.0 max	0.1/0.6	0.04			
442	S44200	0.20	1.0	1.0	18.0/23.0			BAL						
444	S44400	0.025	1.0	1.0	17.5/19.5	1.0	1.75/2.5	BAL	0.8		0.04			
446	S44600	0.20	1.50	1.0	23.0/27.0			BAL						
A 286[4]	K66286	0.08	2.0	1.0	13.5/16.0	24.0/27.0	1.0/1.75	BAL		1.9/2.3	0.04		Al 0.35	V 0.5
AM-350[4]	S35000	0.07/0.11	0.5/1.25	0.50	16.0/17.0	4.0/5.0	2.5/3.25	BAL			0.04			
PH 15-7 MO[1]	S15700	0.09	1.0	1.0	14.0/16.0	6.5/7.75	2.0/3.0	BAL			0.04		Al 0.75/1.5	
17-4 PH[1]	S17400	0.07	1.0	1.0	15.0/17.5	3.0/5.0		BAL	0.45		0.04	3.0/5.0		
17-7 PH[1]	S17700	.09	1.0	1.0	16.0/18.0	6.5/7.75		BAL			0.04		Al 0.75/1.5	
18 SR[1]	N/L	0.02	0.50	1.0	17.0/19.0	0.50		BAL		3.0/6.0			Al 1.0/2.0	
18-9LW[1]	N/L	0.10	2.0	1.0	17.0/19.0	8.0/10.0	0.5	BAL	0.5	1.4		3.0/4.0		
19-90L[4]	K63198	0.28/0.35	0.75/1.5	0.3/0.8	18.0/21.0	8.0/11.0	1.0/1.75	BAL	0.25/0.60	0.1/0.35	0.04	0.50	W 1.0/1.75	
CARPENTER 20 CB3[2]	N08020	0.06	2.0	1.0	19.0/21.0	32.5/35.0	2.0/3.0	BAL	8XC/1.0 max		0.035	3.0/4.0		
CARPENTER 455[2]		0.10	1.0	1.0	11.5	8.0/9.0	0.50	BAL		1.0/2.0		2.0/3.0		
CUSTOM 450	S45000	0.05	1.0	1.0	14/16	5/7	0.5/1	75			0.03	1.25/1.75		
GREEK ASCOLOGY	F41800	0.15/0.2	0.50	0.5	12.0/14.0	2.0	0.50	BAL			0.03		W 2.5/3.5	V 2.2
AL-6XN[4]	N08367	0.03	2.0	1.0	20.0/22.0	23.5/25.5	6.0/7.0	BAL				0.75		
AL 29-4C[4]	S44735	0.03	1.0	1.0	30	1.0	4.2	BAL	6XC+N min	1.0	0.04			
904L	N08904	0.02	2.0	1.0	23.0	28.0	5.0				0.045	2.0		
CHROMESHIELD[1] 22		0.02	0.40	0.4	21.5/22	0.40	0.03/0.5	BAL		0.20	0.03	0.45/0.75		Nb 4.0
DUPLEX 2205	S2205	0.03	2.0	1.0	22.0/23.0	4.5/6.5	3.0/3.5	BAL			0.03			
DUPLEX 2304	S2304	0.03	2.5	1.0	21.5/24.5	3.0/5.5	0.05/0.6	BAL			0.04	0.05/0.6		
DUPLEX 2507	S32750	0.03	1.2	0.8	24.0/26.0	6.0/8.0	3.0/5.0	BAL			0.035	0.50		
CAS Number		7440-44-0	7439-96-5	7440-21-3	7440-47-3	7440-02-0	7439-98-7	7439-89-6	Cb 7440-03-1 Ta 7440-25-7	7440-32-6	7723-14-0	7440-50-8	Se 7782-49-2 Al 7429-90-5 W 7440-33-7	Co 7440-48-4 V 7440-62-2 Nb 7440-03-1

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

HIGH MANGANESE ALLOYS

ALLOY	UNS No.	C	Mn	Si	Cr	Ni	Mo	Fe	Nb + Ta	Ti	P	Al	V
NITRONIC 32[1]	S24100	10	12.0	5	18.0	1.6		BAL					
NITRONIC 33[1]	S24000	0.06	13.0	0.5	18.0	3.0		BAL					
NITRONIC 40[1]	S21904	0.08	8.0/10.0	1.0	18.0/20.0	5.0/7.0		BAL					
NITRONIC 50[1]	S20910	0.06	4.0/6.0	10	20.5/23.5	11.5/13.5	1.5/3.0	BAL	0.1/0.3				0.1/0.3
NITRONIC 60[1]	S21800	0.10	7.0/9.0	3.5/4.5	16.0/18.0	8.0/9.0	0.75	BAL	0.1	0.05	0.04	0.35	0.1/0.5
CAS Number		7440-44-0	7439-96-5	7440-21-3	7440-47-3	7440-02-0	7439-98-7	7439-89-6	Cb 7440-03-1 Ta 7440-25-7	7440-32-6	7723-14-0	7429-90-5	7440-62-2

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

ELECTRONIC ALLOYS

ALLOY	UNS No.	CONSTITUENT(S) % Maximum unless otherwise												
		C	Mn	Si	Cr	Ni	Co	Cu	Fe	Al	Mo	Ti	Mg	Zr
ULBRASEAL36	K93601	0.03	0.30	0.20	0.10	36.0	0.05	0.15	BAL	0.01				
ULBRASEAL42	K94100	0.05	0.80	0.30	0.25	41.0			BAL	0.10				
ULBRASEAL46		0.05	0.80	0.30	0.25	46.0			BAL	0.10				
ULBRASEAL52	K95050	0.05	0.60	0.30	0.25	50.5			BAL	0.10				
ULBRAVAR29-17	K94610	0.04	0.50	0.20	0.20	29.0	17.0	0.20	BAL	0.10	0.20	0.10	0.10	0.10
CAS Number		7440-44-0	7439-96-5	7440-21-3	7440-47-3	7440-02-0	7440-48-4	7440-50-8	7439-89-6	7429-90-5	7439-98-7	7440-32-6	7439-95-4	7440-67-7

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

NICKEL, NICKEL BASED, NICKEL-IRON-CHROMIUM AND COPPER NICKEL ALLOYS

ALLOY	UNS No.	CONSTITUTENT(S) % Maximum unless otherwise shown														
		C	Mn	Fe	Si	Cu	Cr	Al	Ti	Ni	Mo	Nb + Ta	Co	W	Other	Other
80Ni-20Cr	N/L	0.15	2.5	1.0	0.75/1.60		19.0/21.0			BAL						
CN 715	C71500	0.05	1.0	1.0		BAL				33			1.0			Zn 1.0
Ni 200	N0220	0.08	0.18	0.2	0.15	0.13				BAL						
Ni 201	N02201	0.01	0.18	0.2	0.18	0.13				BAL						
Ni 233	N/L	0.10	0.30	0.10	0.10	0.10			0.005	BAL						
Ni 270	N02270	0.01	0.001	0.003	0.001	0.001	0.001		0.001	BAL						
INCONEL 600[3]	N06600	0.08	0.5	8.0	0.25	0.25	15.5			BAL						
INCONEL 601[3]	N06601	0.05	0.5	14.1	0.25	0.50	23.0	1.35		BAL						
INCONEL 617[3]	N06617	0.07	0.5	1.5	0.5	0.20	22.0	1.20	0.3	52.0	9.0		1.25			
INCONEL 625[3]	N06625	0.05	0.25	2.5	0.25		21.5	0.2	0.2	BAL	9.0	3.65				
INCONEL 702[3]	N/L	0.05	0.5	1.0	0.35	0.25	15.5	3.25	0.63	BAL						
INCONEL 718[3]	N07718	0.08	0.35	BAL	0.35	0.30	17.0/21.0	0.2/0.8	0.65/1.15	50/55	2.8/3.3	4.75/5.5	1.0			
INCONEL 722[3]	N/L	0.08	1.0	5.0/9.0	0.70	0.50	14.0/17.0	0.4/1.0	2.0/2.75	BAL			1.0			
INCONEL X-750[3]	N07750	0.08	0.35	5.0/9.0	0.35	0.50	14.0/17.0	0.4/1.0	2.25/2.75	BAL		.7/1.2	1.0			
INCOLOY 800[3]	N08800	0.10	0.75	39/46	0.50	0.38	19/23	0.15/0.6	0.15/0.6	30/35						
INCOLOY 801[3]	N08801	0.05	1.0	44/48	0.5	0.25	19/22		1.1	BAL		0.2	1.0		Zr 0.01	V 0.2
INCOLY 825[3]	N08825	0.05	0.10	22/30	0.5	1.5/3.0	19.5/23.5	0.2	0.6/1.2	38/46	2.5/3.5	0.5				
NI-SPAN-C 902[3]	N09902	0.06	80	BAL	1.0		4.9/5.75	0.3/0.8	2.2/2.75	BAL			2.5	3.0/4.5		V 0.35
HASTELLOY B2[5]	N10665	0.02	1.0	2.0	0.10	0.5	1.0			BAL	26.0/30.0		1.0	0.5		
HASTELLOY B3[5]	N10675	0.02	3.0	1.5	0.10	0.2	1.0/3.0		0.20	BAL	27.0/32.0	0.2	1.0	3.0	Zr 0.01	V 0.2
HASTELLOY C-4	N06455	0.01	1.0	3.0	0.08		14.0/18.0			BAL	14.0/17.0		3.0		P 0.025	
HASTELLOY C276[5]	N10276	0.01	1.0	4.0/7.0	0.08		14.5/16.5			BAL	15.0/17.0		2.5	3.0/4.5		V 0.35
HASTELLOY C22[5]	W86022	0.015	0.50	2.0/6.0	0.08		20.0/22.5			BAL	12.5/14.5		2.5	2.5/3.5		V 0.35
HASTELLOY G3[5]	N06985	0.015		18/21	1.0	2.5	21/23.5			BAL	6.0/8.0	0.5	5.0	W 1.5	P 0.04	
HASTELLOY G30[5]	N06030	0.03	1.5	13.0/17.0	0.80	1.0/2.4	28.0/31.5			BAL	4.0/6.0	0.3/1.5	5.0	1.5/4.0		
HASTELLOY X[5]	N06002	0.05/0.15	1.0	17.0/20.0	1.0	0.50	20.5/23.0	0.50	0.15	BAL	8.0/10.0		0.5/10.0	17.0/20.0		
HAYNES 214[5]	N/L	0.15	0.2	2.0/6.0	0.10		15.0/17.0	4.0/5.0	0.10	BAL	0.10		0.10	0.10		
HAYNES 230[5]	N/L	0.05/0.15	1.0	17.0/20.0	1.0		20.5/23.0			BAL	8.0/10.0		0.5/2.5	0.2/1.0		
HAYNES 242[5]	N10242	0.03	0.8	2.0	0.4	0.5	7/9	0.5		BAL	24.0/26.0		1.0			
HAYNES 282[5]	N07718	0.06	0.3	1.5	0.15		19.0/21.0	1.0/2.0	3.0	BAL	8.0/9.0		9.0/11.0	0.50		
HR 120	N08120	0.05	0.75	30/35	0.6		25	0.1		BAL	2.5	0.7	3	2.5		
Permanickel 300[3]	N03300	0.4	0.50	0.60	0.35	0.25			0.2/0.6	97min					Mg 0.5	
NIMONIC 75[3]	N06075	0.12	1.0	3.0	1.0	0.25	19.0/21.0			BAL						
MONEL 400[3]	N04400	0.30	2.0	2.5	0.5	28/34				BAL						
MONEL 401[3]	N04400	0.10	2.25	0.75	0.25	BAL				40/45						
MONEL R405[3]	N04405	0.15	1.0	1.25	0.25	31.5				BAL						
MONEL K500[3]	N05500	0.13	0.75	1.0	0.25	29.5		2.73	0.60	BAL						
WASPALOY[6]	N07001	0.02/0.10	0.1	2.0	0.15	0.10	18.0/21.0	1.2/3.0	2.75/4.0	BAL	3.5/5.0		12.0/15.0		Zr .02/.08	
CAS Number		7440-44-0	7439-96-5	7439-89-6	7440-21-3	7440-50-8	7440-47-3	7429-90-5	7440-32-6	7440-02-0	7439-98-7	Ta 7440-03-1 Nb 7440-25-7	7440-48-4	7440-33-7	Zr 7440-67-7 P 7723-14-0 Mg7439-95-4	V 7440-62-2 Zn 7440-66-6

COBALT BASED SUPERALLOYS AND RELATED ALLOYS

ALLOY	UNS No.	CONSTITUTENT(S) % Maximum unless otherwise shown.														
		C	Mn	P	S	Si	Cr	Ni	Co	Fe	W	Ti	Cu	Mo	Nb + Ta	Other
L-605 HAYNES 25[5]	R30605	0.05/0.15	1.0/2.0	0.04	0.03	0.40	19.0/21.0	9.0/11.0	BAL	3.0	14.0/16.0					
HAYNES 188[5]	R30188	0.05/0.15	1.25	0.02	0.015	0.2/0.5	20.0/24.0	20.0/24.0	BAL	3.0	13.0/16.0					
MP35N	R30035	0.02	0.15	0.015	0.01	0.15	19.0/21.0	33.0/37.0	BAL	1.0		1.0		9.0/10.5		
N-155	R30155	0.08/0.16	1.0/2.0	0.04	0.04	1.0	20.0/22.5	19.0/21.0	18.5/21.0	BAL	2.0/3.0		0.50	2.5/3.5	0.75/1.25	
ULMET	231233	0.06	0.08			0.3	26	9	BAL	3.0	2			5		
CAS Number		7440-440	7439-96-5	7723-14-0	7704-34-9	7440-21-3	7440-47-3	7440-02-0	7440-48-4	7439-89-6	7440-33-7	7440-32-6	7440-50-8	7439-98-7	Ta 7440-25-7 Nb 7440-03-1	

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

All commercial metals may contain small amounts of various elements (less than 0.1%) in addition to those specified. These small quantities frequently originate in the raw material used.

4. FIRST AID MEASURES

Description of necessary measures:

Inhalation: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed, concerned, experiencing respiratory symptoms, or feel unwell: Get medical advice/attention or call a poison center or doctor/physician.

Eye Contact: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if in eyes: Rinse cautiously with water for 15 minutes. Remove contact lenses, if present and easy to do. Do not allow victim to rub or keep eyes tightly shut. Continue rinsing. If eye irritation persists, get medical advice/ attention.

Skin Contact: If on skin: Wash thoroughly after handling. Wash with plenty of water. If irritation or rash occurs: Get medical advice, attention. Skin cuts and abrasions can be treated by standard first aid or medical treatment. Quickly remove dust contaminated clothing but do not shake clothing.

Ingestion: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if swallowed: Call a poison center or doctor/physician if you feel unwell. Rinse mouth. If exposed, concerned or feel unwell: Get medical advice/attention.

Most important symptoms/effects both acute and delayed

Symptoms: May cause allergic skin reaction. May cause acute gastrointestinal effects if swallowed.

Note to Physicians: Treat symptomatically

5. FIRE FIGHTING MEASURES

Flash Point (With Test Method)	None	
Flammable (Explosive) Limits V/V%	LEL: None	UEL: None

Extinguishing Media	Do not spray water on burning metal as a violent explosion may result. This product is not flammable in the form it is sold. May be flammable if there are finely divided pieces resulting from processing of this product. Carbon dioxide is not effective in extinguishing burning metals. Do not spray water on burning metal as an explosion may occur. Use class "D" fire extinguisher, smother with dry sand, or salt (NaCl).
Specific Hazards Rising From The Chemical	No unusual fire or explosion hazards from solid alloys in massive form. Dust, chips, thin strips, etc. created by grinding or processing can ignite if a substantial number of small particles are dispersed or adequate ignition source is present. The hazard increases with finer particles. An explosion may follow a fire initiated in a mass of wet metal fines. The explosive characteristics of such material is caused by the steam and hydrogen generated within the burning mass. Metals may react exothermically with acids and oxidizers.
Special Protective Equipment and Precautions For Fire-Fighters:	Self-contained NIOSH approved respiratory protection and full protective clothing should be worn when fumes and/or smoke from fire are present. Heat and flames cause emittance of acrid smoke and fumes. Do not release runoff from fire control methods to sewers or waterways. Firefighters should wear full face-piece self-contained breathing apparatus and chemical protective clothing with thermal protection. Direct water stream will scatter and spread flames and, therefore, should not be used.

6. ACCIDENTAL MATERIAL RELEASE OR SPILL CONTROL MEASURES

In solid form this material poses no special clean-up problems. If this material is in powder or dust form, do not dry sweep. Notify safety personnel. Clean-up should be conducted with a grounded vacuum system utilizing high efficiency particulate air (HEPA) filtration. Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air, land and water. Cleanup personnel should protect against dust inhalation and skin or eye contact, follow handling precautions below, and use non-sparking tools. Properly label all materials collected in waste container. Follow applicable OSHA regulations (29 CFR), EPA regulations (40 CFR)), Canadian Workplace Hazardous Materials Information System (WHMIS) Regulations, and other regulatory requirements.

7. HANDLING AND STORAGE

Handling Precautions	Wear cut resistant gloves and clothing to avoid cuts. Metal in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may suddenly uncoil to try to lay flat in a long strip when banding is cut or other forces are released. Measures should be taken to ensure that uncoiling will not occur. Machining of alloys may result in fine turnings, chips, dust, or fumes. Small diameter materials may be combustible or flammable. Keep this material away from any source of ignition. Keep fines and turnings completely dry or very wet (more than 25% water content by weight) for handling safety. Explosions can result from ignition of powder or machining fines containing moisture. Fires and explosions can result from dispersing fines and dust in air, especially if confined. Avoid these conditions. Avoid dust inhalation and eye or skin contact. Wear personal protective equipment to prevent contact with skin and eyes (Section 8). Practice good personal hygiene after handling, especially before eating, drinking, smoking, or applying cosmetics.
Storage Precautions	In solid form this material poses no special problems. Avoid breathing dust or fume. If the use of this material produces dust or fume, use appropriate ventilation controls, personal protective equipment or both.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation	Local exhaust ventilation should be used to control exposure to airborne dust and fume emissions near the source (during crushing, grinding, welding, etc.). Assure exposure is less than regulatory limits.
Respiratory Protection	None required as shipped, if processing emits welding fumes, airborne dusts or similar hazards use NIOSH approved respirator as specified by an industrial hygienist/safety professional. Obtain medical approval for respirator users. Use a welding or air supplied respirator where local exhaust or ventilation does not keep exposure below overexposure limits.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION (CONTINUED)

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 dusts and powders.

Skin Protection	Wear gloves as necessary to prevent metal cuts, skin abrasions and skin contact. Protective clothing such as arm, foot, body protection etc., may be required during handling operations as appropriate for the exposure.
Recommended Monitoring Procedures	No medical surveillance required while working with metal in massive form. If processing creates dust, fume or other hazard, conduct industrial hygiene evaluation of processes. Follow requirements for medical surveillance of product constituents, compounds and fume if welding fume, dust or other hazards are created by customer processing or handling.

Occupational Exposure Limits (OELs): This product in the physical form it is sold does not present an inhalation hazard. However, operations including, but not limited to, cutting, welding, and grinding may produce fumes and/or particulates. The following exposure limits are for the constituents of the materials under these and similar processes.

Constituents	OSHA PEL [1]	ACGIH TLV [2]
OSHA ACGIH Particulate: No Limit Established	15 mg/m^3, total dust (PNOR) 5 mg/m^3, respirable fraction (PNOR)	10 mg/m^3 (as inhalable fraction, PNOS) 3 mg/m^3 (as respirable fraction, PNOS)
Aluminum (Al)	15 mg/m^3 (as total dust) 5 mg/m^3 (as respirable fraction)	1 mg/m^3 respirable fraction
Boron (B)	15 mg/m^3 (as total dust, boron oxide)	10 mg/m^3 (as boron oxide)
Cobalt (Co)	0.1 mg/m^3 (as dust & fume)	0.02 mg/m3
Chromium (Cr)	0.5 mg/m^3 (as Cr II & III compounds) 1 mg/m^3 (as Cr, metal & insoluble salts) 0.005 mg/m^3 (as Cr VI compounds)	0.5 mg/m^3 (as Cr metal and Cr III compounds) 0.05 mg/m^3 (as Cr VI, water soluble compounds) 0.01 mg/m^3 (as Cr VI, insoluble compounds)
Copper (Cu)	0.1 mg/m^3 (as fume, Cu) 1 mg/m^3 (as dusts & mists, Cu)	0.2 mg/m^3 (as fume) 1 mg/m^3 (as dusts & mists, Cu)
Iron (Fe)	10 mg/m^3 (as iron oxide fume)	5 mg/m^3 (as iron oxide dust and fume)
Magnesium (Mg)	15 mg/m^3 (as magnesium oxide)	10 mg/m^3 (as magnesium oxide)
Manganese (Mn)	"C" 5.0 mg/m^3 (as Fume & Mn compounds)	0.02 mg/m^3 (as respirable fraction), 0.1 mg/m^3 (as inhalable fraction)
Molybdenum(Mo)	15 mg/m^3 (as total dust, soluble compounds) 5 mg/m^3 (as respirable fraction)	10 mg/m^3 (as Mo metal & insoluble compounds, inhalable fraction) 3 mg/m^3 (as Mo metal & insoluble compounds, respirable fraction) 0.5 mg/m^3 (as Mo soluble compounds, respirable fraction)
Nickel (Ni)	1.0 mg/m^3 (as Ni metal & insoluble compounds)	1.5 mg/m^3 (as inhalable fraction Ni metal)
Niobium(Nb)/ Columbium(Cb)	NE	NE
Phosphorus elemental (P)	0.1 mg/m^3	0.02 ppm (0.1 mg/m^3)
Selenium (Se)	0.2 mg/m^3	0.2 mg/m^3
Silicon (Si)	15 mg/m^3 (total dust) 5 mg/m^3 (as respirable fraction)	NE
Tantalum (Ta)	5 mg/m3	NE
Tungsten (W)	NE	5 mg/m^3 Insoluble compounds (STEL 10) 1 mg/m^3 Soluble compounds (STEL 3)
Titanium (Ti)	NE	NE
Tin, inorganic compounds(Sn)	2 mg/m^3	2 mg/m^3
Vanadium (V)	"C" 0.5 mg/m^3 (as V2O5 respirable dust) "C" 0.1 mg/m^3 (as V2O5 fume)	0.05 mg/m^3 (as V2O5, respirable dust & fume)
Zinc (Zn)	5 mg/m^3 (as zinc oxide)	2 mg/m^3 (as zinc oxide)
Zirconium (Zr)	5 mg/m^3	5 mg/m^3 STEL: 10 mg/m^3

NE - None Established, if none established, see "Particulate Where No Limit Has Been Established" in first row or specific compounds created by welding, etc.

Notes:

1. OSHA PELs (Permissible Exposure Limits) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A ("C") designation denotes a Ceiling Limit, which should not be exceeded during any part of the workday unless otherwise noted. A Short Term Exposure Limit (STEL) is a 15-minute exposure, which should not be exceeded.
2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. ACGIH TLVs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
3. The National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH-REL): Compendium of Policy and Statements. NIOSH, Cincinnati, OH (1992). NIOSH is the federal agency designated to conduct research relative to occupational safety and health. As is the case with ACGIH TLVs, NIOSH RELs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
4. Inhalable fraction. The concentration of inhalable particulate is to be determined from the fraction passing a size-selector per OSHA, ACGIH and other regulatory agencies.
5. PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts not listed specifically by substance name are covered by the PNOR limit which is the same as the inert or nuisance dust limit.
6. Respirable fraction - The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH TLVs® and BEIs®.
7. PNOS (Particles Not Otherwise Specified). Particles not specified are covered by the PNOS limit.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Solid	Appearance and Color: Silver /Gray Color	Odor: No Odor Odor Threshold: Not Available
pH: Not Available	Evaporation Rate: Not Available	
Boiling Range: Not Available	Vapor Pressure (Mmhg): Not Available	Initial Boiling Point: Not Available
Melting Point: 900°F - 3200°F	Vapor Density (Air=1): Not Available	Specific Gravity (H2O=1): 7.5 - 8.0
Flash Point: None	% Volatiles By Volume: None	Auto-Ignition Temperature: Not Available
Relative Density: Not Available	Evaporation Rate: Not Available	Decomposition Temperature: Not Available
Solubility In Water = None	Flammable Limits V/V% LEL: None	UEL: None
Viscosity: Not Available	Partial Coefficient: N-Octanol/ Water: Not Available	

10. Stability and Reactivity

Reactivity	Hazardous reactions should not occur under normal conditions.
Stability/ Chemical Stability	These alloys are stable materials under normal handling and storage conditions.
Possibility of Hazardous Reactions	Should not occur to solid metal under normal handling and storage conditions.
Conditions to Avoid	Avoid strong acids or bases. Avoid creating or spreading dust. Sparks, heat, open flame and other sources of ignition.

Incompatible Materials	Dissolves in hydrofluoric acid. Ignites in the presence of fluorine. When heated above 200°C, may react exothermically with chlorine, bromine, halocarbons, carbon tetrachloride, Freon, carbon tetrafluoride, acetylene, acids and oxidizers. Corrosion is unlikely, however, if it does occur, hydrogen might be evolved, causing a potentially explosive environment.
Hazardous Decomposition Products	Solid metal is stable but may decompose from combustion and/or chemical reaction. This may produce various hazardous materials such as elemental metals, metal oxides, carbon dioxide, carbon monoxide, sulfur compounds, metal compounds including hexavalent chromium, titanium dioxide, vanadium pentoxide and acids.

11. TOXICOLOGICAL INFORMATION

Eye: Rabbit (cobalt) unknown amount produced severe reaction with abscess involving lens, ciliary body, vitreous humor and retina.

Skin: Nickel-containing alloys may cause sensitization by skin contact.

Ingestion:	Guinea Pig (nickel): LD_{Lo}: 5 mg/kg Mouse (boron): LD_{50}: 560 mg/kg Rat (cobalt): LD_{50}: 6,171 mg/kg Rat (Iron): LD50: 30,000 mg/kg Rat (manganese) LD50: 9,000 mg/kg	Rat (Titanium): LD_{50}: >5,000 mg/kg Rabbit (Silicon Dioxide): LD_{50}: >5,000 mg/kg Rabbit (cobalt)): LD_{50}: 750 mg/kg Human (copper): TD_{Lo}: 120 µg/kg, affects the gastrointestinal tract (nausea or vomiting). Human (chromium): LD_{Lo}: 71 mg/kg
Inhalation:	Rabbit (nickel): TC_{Lo}: 130 µg/m^3 35 weeks (intermittent) - 6 hours Human (chromium VI): TC_{Lo}: 110 µg/m^3 3 years (continuous) tumorigenic (carcinogenic per RTECS) Pig (cobalt): TC_{LO}: 100 µg/m^3/6 hours for 13 weeks (intermittent) Human (manganese): TC_{Lo}: 2300µg/m^3 Rat (titanium): LC_{50}: >6,820 mg/ m^3	
Subchronic:	Rat (molybdenum) inhalation: 12-16 g/m^3/1 hour/30 days, resulted in slight growth depression, and thickening of the intra-alveolar septa, which contained connective tissue fibers.	
Other:	Dog (nickel) Intravenous: LD_{Lo}: 10 mg/kg Rat (chromium), Implant: TD_{Lo}: 1200 µg/kg intermittent over 6 weeks. Rat (cobalt) intramuscular: 126 mg/kg, tumorigenic at site of application. Rabbit (molybdenum) intra-tracheal: LD_{Lo}: 70 mg/kg produced focal fibrosis (pneumoconiosis).	
Carcinogenicity	Nickel, cobalt and chromium are listed as carcinogens by IARC. Nickel and cobalt are listed as carcinogens by NTP and OSHA.	
Teratology:	Rat (nickel) oral: TDLo: 158 mg/kg Rat (molybdenum) oral: 5800 µg/kg given to female 30 weeks prior to mating and during days 1-20 of pregnancy caused specific musculoskeletal system development abnormalities.	
Reproduction:	Rat (molybdenum) oral: 6050 µg/kg given to female 35 weeks prior to mating produced pre-, and post-implantation mortality. Rat (cobalt) unspecified exposure route, 0.05 mg/kg continuous, administered throughout gestation to female was embryotoxic.	
Mutagenicity:	Hamster (chromium III) lung cell: 34 mg/L caused sister chromatid exchange. Human (cobalt) DNA damage: Human Leukocyte 3mg/L. Human (Chromium VI) DNA damage: Human Leukocyte 50µmol/L.	

Welding Fumes: Follow OSHA and NIOSH methods for monitoring of welding fumes to determine exposure potential.

Reproductive toxicity Possible risk of impaired fertility. STOT - single exposure Product not classified.	STOT - repeated exposure Causes disorder and damage to the: Respiratory System. Aspiration hazard Product not classified.

12. ECOLOGICAL INFORMATION

In solid form these alloys pose no special environmental problems. Metal powders or dusts may have significant impact on air, land and water quality. Airborne emissions, spills, and releases to the environment (discharge to streams, sewer systems, surface soil, etc.) should be controlled immediately.

Manganese undergoes complex geochemical cycling, and can accumulate in the top layer of sediment in lakes.

In water, molybdenum will precipitate out with natural calcium. Soil levels should not exceed 50 ppm to avoid problems with livestock. Molybdenum; (fathead minnow), LC_{50}: 370 mg/L/96 hours. Terrestrial plants can contain enough molybdenum to be toxic to animals but still grow normally.

Environmental Fate: In water, cobalt is adsorbed greatly to hydrolysate or oxidate sediments. It may be taken into solution in small amounts through bacteriological activity. In water, molybdenum will precipitate out with natural calcium. 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.

Ecotoxicity: Few plants accumulate cobalt at greater than 100 ppm, the level at which severe phytoxicity would occur. The potential for bioaccumulation of cobalt by aquatic and terrestrial organisms is low with trophic transfer factors less than 1. Little tendency for chromium III bioaccumulation in the food chain.

The half-life of chromium in soils may be several years.

13. DISPOSAL CONSIDERATIONS

Whenever possible, recover alloys for reuse or recycling. Solid metal is not a hazardous waste per U.S. E.P.A. If material has been processed, analyze and dispose of waste material in accordance with local, state, or federal regulations. For specific labeling, packing, storage, transportation, and disposal procedures, contact an Environmental Engineer or consultant familiar with waste disposal regulations.

14. TRANSPORT INFORMATION

As sold, these solid alloys are not regulated by the U.S. Department of Transportation and the International Air Transport Association.
Note: metals transported in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may uncoil to try to lay flat in a long strip when banding is cut or other forces are released; uncoiling can be sudden and catastrophic and measures should be taken to ensure that uncoiling will not occur.

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

Shipping Name	None as sold, however, if 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. and U.S. DOT (49 CFR 173).

Identification	Not Available (Determine by test results)
Hazard Class	Not Available (Determine by test results)
Label(s)	Not Available (Determine by test results)

15. REGULATORY INFORMATION

SPECIFIC U.S. EPA REGULATIONS: Toxic Substance Control Act: Components of this material (see section 3) are listed in the TSCA inventory.
CERCLA: Components of this material (section 3) are listed as Hazardous Substances
EPA Superfund Amendment and Reauthorization Act (SARA) of 1986 Section 311/312(SARA Title III): Components of this material (section 3) are listed in SARA Title III, Section 311/312
EPA, SARA Section 313: Components of this material (section 3) are listed Section 313 and subject to Toxic Release Inventory reporting.
SARA Title III Hazard Categorization: Dust and fume are categorized as an immediate (acute) health hazard and a delayed (chronic) health hazard as defined by 40 CFR 370. Product is not categorized as a fire hazard, reactivity hazard or pressure release hazard.

CALIFORNIA PROPOSITION 65: Listed components known by the state to cause cancer, include Metallic Nickel. As sold, nickel is in alloy form. See section 3 for other constituents including Cobalt (metal powder). During welding, processing etc., may produce oxides and other compounds of the metals listed in section 3 which are listed in California's "Safe Drinking Water and Toxic Enforcement Act of 1986" (Proposition 65) including hexavalent chromium.

16. OTHER INFORMATION

Revision Date: March 30, 2019

This information is designed only as guidance for safe handling, use, storage, transportation, and disposal and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Information contained herein is believed to be true and accurate at the date of its publication, 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.

HEXAVALENT CHROMIUM: Hexavalent Chromium is not a constituent component of uncoated Stainless Steels. Stainless Steels are iron-based alloys that contain chromium. It is this addition of chromium that gives stainless steel its unique corrosion resistant properties through the formation of an invisible and adherent chromium-rich oxide surface film. The vast majority of chromium in stainless and other specialty steels is in the metallic/elemental form *(zero valence state). A small amount of trivalent chromium (oxide) is formed on the surface of specialty steels and is crucial for protecting the alloy from corrosion. Hexavalent chromium, which is associated with certain adverse health effects, is not a constituent of stainless or other specialty steels. It can also be formed by welding on stainless steel. The high temperatures involved result in oxidation that converts the chromium to a hexavalent state.

WEEE/ROHS/ END OF LIFE VEHICLES, AND THE JAPANESE GREEN PROCUREMENT INITIATIVE: Uncoated stainless and specialty steels are generally in conformance with the requirements of the European Union's legislation on waste electrical and electronic equipment ("WEEE"; Directive 2002/53/EC) and its companion directive on the restriction on hazardous substances used in EEE ("RoHS": Directive 2002/95/EC & 2003/11/EC), as well as EU Directive 2000/53EC on End of Life Vehicles, and the Japanese Green Procurement Initiative. Compare the constituents listed in section 3 to the constituents in the various regulations to determine conformance with regulations.

This information is designed only as guidance for safe handling, use, storage, transportation, and disposal and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Information contained herein is believed to be true and accurate at the date of its publication, 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.

Trademarks: Several materials described in these Safety Data Sheets are proprietary alloys produced under license from various manufacturers. They are identified by the following subscript numbers:

[1]Registered Trademark of AK Steel Corporation
[2]Registered Trademark of Carpenter Technology Corporation
[3]Registered Trademark of Special Metals Corporation
[4]Registered Trademark of ATI Allegheny Companies
[5]Registered Trademark of Haynes International, Inc.
[6]Registered Trademark of United Technologies Corporation

Ulbrich Stainless Steels & Special Metals, Inc.
Safety Data Sheet (SDS) 002

SECTION 1: IDENTIFICATION

Product Identifier: Titanium, Aluminum, Tantalum, Niobium and Zirconium Based Alloys, **designated as follows:**
Titanium & Titanium Based Alloys: GRADE I-25A/35A, GRADE II -40A, GRADE III -55A, GRADE IV-70A/75A, GRADE V--6A1-4V, GRADE IX - 3-2.5, GRADE 21-Beta 21S, 15-3-3-3, 15P, 6-2-4-2, NITINOL, 3AI-2.5V
Aluminum Alloys: 1100, 1050, 1070, 3003, 3004, 3105, 5005, 5052, 5083, 5182, 5454, 5754, 6061
Zirconium, Niobium: (Synonym – Columbium)
Tantalum, and Sintered Tantalum
Product Form: Metal Alloy/Mixture
Intended Use of the Product: Solid metal products, various uses
Supplier's Details: **Ulbrich Stainless Steels & Special Metals, Inc.**
153 Washington Avenue, P.O. Box 294,
North Haven, CT USA, 06473-1191
Phone Number 203-239-4481 • 800-243-1676•
SDS Technical Contact Weekdays (203) 265-8299
FAX: (203) 239-7479 • E-Mail: information@ulbrich.com
Emergency Telephone Number 203- 239-4481; Chemtrec 800-424-9300

SECTION 2: HAZARDS IDENTIFICATION

Classification (GHS-US): As shipped, uncoated alloys are articles that do not present a hazard to human health by inhalation or ingestion. However, cutting, grinding, welding, etc. may produce dust, particulate or fume that presents health hazards related to constituents detailed in section 3.

Label Elements:
Signal word, hazard statement(s), symbols and precautionary statement(s):

Hazard Symbol	Hazard Classification	Signal Word	Hazard Statement(s)
	Single Target Organ Toxicity (STOT) Repeat Exposure -2	**Warning**	May cause damage to respiratory tract, liver and kidney through prolonged or repeated inhalation exposure. If converted to small particles during further processing, handling, or by other means, may form combustible dust concentrations in air.
NA	Eye Irritation Combustible Dust		Causes eye irritation. If converted to small particles during further processing, handling, or by other means, may form combustible dust concentrations in air.
Prevention	Do not breathe dusts / fume / mist. Wear protective gloves / protective clothing / eye protection / face protection. Contaminated work clothing must not be allowed out of the workplace. Do not handle until all safety precautions have been read and understood. Do not eat, drink or smoke when using this product.		
Response	Get medical advice/attention if you feel unwell.		
Storage	Store in accordance with federal, state and other regulations. Dust, powder and strips are combustible and may form explosive mixtures with air or fluids. Store locked up.		
Disposal	Metal scrap should be recycled whenever possible. Dispose of in accordance with federal, state and other regulations.		

Hazards not otherwise classified: None Known
Unknown acute toxicity statement (mixture): None Known

Primary Entry Routes	Not considered a physical or health hazard in the solid form that it is sold. However, operations such as abrading, burning, welding, sawing, brazing, grinding, cutting, polishing, and machining that results in the creation of dust or elevated temperatures may cause eye, skin, and respiratory tract irritation and other hazards described in this document. Entry Routes for Dust: Inhalation, Skin, Eye for all components; Ingestion for Molybdenum, Chromium & Vanadium
Target Organs	Target Organs for Dust - Respiratory System, Skin, Eyes, NOTE: Liver and Kidney for Molybdenum
Effects of Overexposure Acute Chronic	EYES: Dust may cause mechanical irritation. DERMAL: Dust may cause mechanical irritation. Chromium, molybdenum and vanadium are skin irritants. INHALATION: Excessive exposure to high concentrations of dust may cause irritation to the mucous membranes of the upper respiratory tract. Excessive inhalation of fumes of freshly formed metal oxide particles sized below 1.5 microns from many metals can produce an acute reaction known as "metal fume fever". Symptoms consist of chills and fever (very similar to and easily confused with flu symptoms), metallic taste in the mouth, dryness and irritation of the throat followed by weakness and muscle pain. The symptoms come on in a few hours after excessive exposures and usually last from 12 to 48 hours. Titanium dioxide and Chromium may cause pulmonary fibrosis and permanent damage. Vanadium Pentoxide may cause green tongue, metallic taste, eczema, cough, fine rales, wheezing, bronchitis, and dyspnea (breathing difficulty). INGESTION: Ingestion of harmful amounts of this product as distributed is unlikely due to its solid insoluble form. Ingestion of dust may cause nausea or vomiting. Titanium Dioxide: The signs and symptoms of chronic exposure to titanium dioxide include X-ray evidence of mild fibrosis, dyspnea, cough, and declines in pulmonary function. Aluminum: Aluminum dusts/fines are a low health risk by inhalation and should be treated as a nuisance dust. Aluminum dust is a respiratory and eye irritant. Tin: Exposure to dust and fume of tin (oxide) is recognized to result in a benign pneumoconiosis called stannosis. Molybdenum: Certain handling operations, such as burning and welding, may generate both insoluble molybdenum compounds (metal and molybdenum dioxide) and soluble molybdenum compounds (molybdenum trioxide).

Effects of Overexposure	Molybdenum compounds generally exhibit a low order of toxicity with the trioxide the more toxic. However, some reports indicate that the dust of the molybdenum metal, molybdenum dioxide and molybdenum trioxide may cause eye, skin, nose, throat irritation, anorexia, diarrhea, weight loss; listlessness; liver, kidney damage in animals. Chromium: The health hazards associated with exposure to chromium are dependent upon its oxidation state. The metal form (as it exists in this product) is of very low toxicity. The hexavalent form that may be formed during welding activities primarily, is very toxic. Repeated or prolonged exposure to hexavalent chromium compounds may cause respiratory irritation, nosebleeds, ulceration and perforation of the nasal septum. Industrial exposure to certain forms of hexavalent chromium has been related to an increased incidence of cancer. Iron Oxide: Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in the development of a benign pneumoconiosis, called siderosis, which is observable as an X-ray change. No physical impairment of lung function has been associated with siderosis. Inhalation of excessive concentrations of ferric oxide may enhance the risk of lung cancer development in workers exposed to pulmonary carcinogens Vanadium: Excessive long term or repeated exposures to vanadium compounds, especially the pentoxide, may result in chronic pulmonary changes such as emphysema or bronchitis.
Carcinogenic References	Titanium dioxide: The International Agency for Rearch on Cancer (IARC) identifies Titanium Dioxide as Group 3 carcinogens, not classifiable as to their human carcinogenicity. Chromium: The International Agency for Research on Cancer (IARC) identifies chromium metal and trivalent chromium compounds as Group 3 carcinogens, not classifiable as to their human carcinogenicity. Hexavalent chromium is listed by IARC as Group 1 carcinogen that are carcinogenic to humans. Iron oxide: The International Agency for Research on Cancer (IARC) identifies Titanium Dioxide as Group 3 carcinogens, not classifiable as to their human carcinogenicity.
Medical Conditions Aggravated by Exposure	Chronic respiratory disease, impaired pulmonary function and conditions such as asthma, emphysema, chronic bronchitis, etc., may be aggravated or damaged by exposure to dust or fumes if excessive concentrations are inhaled. If prior damage or disease to the neurological, circulatory, hematologic or renal systems has occurred, proper screening or examinations should be conducted on individuals who may be exposed.

SECTION 3: COMPOSITION/ INFORMATION ON INGREDIENTS

ALUMINUM ALLOY	UNS No.	CONSTITUTENT(S) % Maximum unless otherwise shown.									
		Mg	Mn	Cr	Cu	Al	Si	Fe	Zn	V	Other
1100	A91100				0.12	99.0 min.					
1050	A91050	0.05	0.05		0.05	99.1	0.25	0.4	0.07		Ti 0.05
1070	A91070	0.03	0.03		0.04	99.7	0.25	0.25	0.04	0.05	Ti 0.3
3003	A93003		1.2		0.12	98.6 min.					
3004	A93004	1.2	1.2			97.8					
3105	A93105	0.5	0.55			99.0					
5005	A95005	0.8				99.2 min.					
5052	A95052	2.5		0.25		97.2 min.					
5083	A95083	4.4	0.7		0.15	94.7					
5182	A95182	4.5	0.35			95.2					
5454	A95454	2.7	0.8	0.12		96.3					
5754	A95754	3.2	0.5			95.5	0.4	0.4			
6061	A96061	0.8/1.2	0.15	0.04/0.35	0.15/0.4	95.8/98.6			0.25		
CAS Number		7439-95-4	7439-96-5	7440-47-3	7440-50-8	7429-90-5	7440-21-3	7439-89-6	7440-66-6	7440-62-2	Ti 7440-32-6

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

TITANIUM BASED ALLOY	UNS No.	CONSTITUENT(S) %Maximum unless otherwise shown									
		C	N	Fe	H	Ti	V	Al	Tin	Other	Other
GRADE I-25A/35A		0.10	0.03	0.20	0.01	BAL					
GRADE II -40A	R50400	0.08	0.03	0.30	0.0125	BAL					
GRADE III -55A	R50550	0.08	0.05	0.30	0.015	BAL					
GRADE IV-70A/75A	R50700	0.08	0.05	0.50	0.015	BAL					
GRADE V--6A1-4V	R56400	0.08	0.05	0.25	0.015	BAL	3.5/4.5	5.75/6.75			
GRADE IX - 3-2.5	R56320	0.10	0.03	0.25	0.15	BAL	2.0/3.0	2.5/3.5			
GRADE 21-Beta 21S	R58210	0.05	0.05	0.4	0015	BAL		2.5/3.5		Co 2.4/3.2	Mo 14/16
15-3-3-3	R58153	0.05	0.05	0.25	0015	BAL	14.0/16.0	2.5/3.5	2.5/3.5	Cr 2.5/3.5	
15P		0.08	0.03	0.30	0.015	BAL					Pd 0.12/0.25
TITANIUM 6-2-4-2	R54620 R54621	0.08	0.01/0.013	0.25	0015	BAL		5.5/6/5	1.8/2.2		Mo 1.8/2.2 Zr 3.60/4.40
NITINOL	N01555					44/45				Ni 55/56	
3Al-2.5V	R56320	0.05	0.02	0.30	0.015	BAL	2.0/3.0	2.5/3.5			
CAS Number		7440-44-0	7727-37-9	7439-89-6	1333-74-0	7440-32-6	7440-62-2	7429-90-5	7440-31-5	Co 7440-48-4 Cr 7440-47-3 Ni 7440-02-0	Mo 7439-98-7 Pd 7440-05-3 Sn 7440-31-5

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

ALLOY	UNS No.	CONSTITUENT(S)% Ranges unless otherwise shown							
		Zr	Niobium	Tantalum	Molybdenum	Iron	Titanium	Nickel:	Tungsten
ZIRCONIUM 702	S20100	99/100							
NIOBIUM TYPE I (SYNONYM–COLUMBIUM)	R04210		99/100						
NIOBIUM TYPE II (SYNONYM-COLUMBIUM)	R04300		99/100						
TANTALUM	R05200		0.10	BAL	0.020	0.010	0.010	0.010	0.05
SINTERED TANTALUM	R05400		0.10	BAL	0.020	0.010	0.010	0.010	0.05
CAS Number		7440-67-7	7440-03-1	7440-25-7:	7439-98-7	7439-89-6	7440-32-6	7440-02-0	7440-33-7

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

All commercial metals may contain small amounts of various elements (less than 0.1%), in addition to those specified. These small quantities frequently originate in the raw material used.

4. FIRST AID MEASURES

Description of necessary measures:
Inhalation: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed, concerned, experiencing respiratory symptoms, or feel unwell: Get medical advice/attention or call a poison center or doctor/physician.
Eye Contact: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if in eyes: Rinse cautiously with water for 15 minutes. Remove contact lenses, if present and easy to do. Do not allow victim to rub or keep eyes tightly shut. May cause conjunctivitis with repeated exposures. If eye irritation persists, get medical advice/ attention.
Skin Contact: If on skin: Wash thoroughly after handling with plenty of water. If irritation or rash occurs, get medical advice/attention. Skin cuts and abrasions can be treated by first aid or medical treatment. Quickly remove dust contaminated clothing but do not shake clothing.
Ingestion: As sold/shipped in solid form, not a likely form of exposure. However, during welding, grinding, burning, etc., if swallowed, call a poison center or physician if you feel unwell and rinse mouth. If exposed, concerned or feel unwell: Get medical advice/attention.

Most important symptoms/effects, acute and delayed (chronic):
Inhalation: As sold/shipped, solid metal is not likely to present an acute or chronic health effect.
Eye: As sold/shipped, solid metal is not likely to present an acute or chronic health effect. See component effects.
Skin: As sold/shipped, solid metal is not likely to present an acute or chronic health effect. See component effects.
Ingestion: As sold/shipped, solid metal is not likely to present an acute or chronic health effect. See component effects.

However, during further processing (welding, grinding, etc.) individual components may illicit an acute or chronic health effect. Refer to Section 11-Toxicological Information.
Immediate Medical Attention and Special Treatment: None Known

5. FIRE FIGHTING MEASURES

Flash Point (With Test Method): None in solid form	FLAMMABLE (EXPLOSIVE) LIMITS V/V%: LEL: None UEL: None

Extinguishing Media	Not flammable in the form of this product as distributed. Flammable as finely divided pieces resulting from processing. Use **Type D** fire extinguisher. Carbon dioxide is not effective in extinguishing burning metals.
Special Firefighting Procedures	Do not spray water on burning metal as an explosion may occur. To extinguish a metal fire, smother with dry sand, salt (NaCl) or other class "D" fire extinguishing powder.
Unusual Fire and Explosion Hazards	Intense heat. Dust, chips, thin strips, etc. created by grinding or processing can ignite if a substantial number of small particles are dispersed or adequate ignition source is present. The hazard increases with finer particles. An explosion may follow a fire initiated in a mass of wet metal fines. The explosive characteristics of such material is caused by the steam and hydrogen generated within the burning mass. Do not allow dust, chips, thin strips, etc. to accumulate, it can be pyrophoric. Contact with water or steam above 704^{o}C causes a violent reaction.
Hazardous Combustion Products	Various metal oxides, carbon dioxide, carbon monoxide, sulfur compounds including titanium dioxide - an IARC Group 2B carcinogen; hexavalent chromium may cause lung, nasal, and/or sinus cancer; vanadium pentoxide affects eyes, skin, respiratory system; zinc, copper, magnesium, or cadmium fumes may cause metal fume fever. Soluble molybdenum compounds may cause lung irritation.
Incompatibility (Materials To Avoid)	Reacts with acids, bases, oxidizing agents, alcohols, metal oxides, halogenated hydrocarbons, halogens, especially fluorine. Dangerous fire hazard in the form of dust when exposed to heat, flame or by chemical reaction with oxidizing agents. May be an explosion hazard in the form of dust by chemical reaction with air, alkali hydroxide, chromate, dichromate, molybdates, sulfates, tungstates, borax, CCl4, copper oxide, lead, lead oxide, phosphorous, KClO3, KNO3, nitryl fluoride. Do not allow dusts or other fines to accumulate. Molten metal may react violently with water and liberate hydrogen. When heated above 200°C, reacts exothermically with chlorine, bromine, halocarbons, carbon tetrachloride, carbon tetrafluoride, Freon, acetylene, acids and oxidizers. In some cases, an ignitable corrosion product containing fine particulate forms on the surface of the metal. This film can be rendered non-flammable by oxidation treatments such as specific heat treatments.

6. ACCIDENTAL MATERIAL RELEASE OR SPILL CONTROL MEASURES

In solid form this material poses no special clean-up problems. If this material is in powder or dust form, do not dry sweep. Notify safety personnel. Clean-up should be conducted with a grounded vacuum system utilizing high efficiency particulate air (HEPA) filtration. Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air, land and water. Cleanup personnel should protect against dust inhalation and skin or eye contact, follow handling precautions and use non-sparking tools. Properly label all waste materials and follow applicable OSHA regulations (29 CFR), EPA regulations (40 CFR) and other regulatory requirements.

7. HANDLING AND STORAGE

Handling Precautions	Wear cut resistant gloves and clothing to avoid cuts. Metal in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may suddenly uncoil to try to lay flat in a long strip when banding is cut or forces are released. Ensure that uncoiling will not occur. Machining of alloys may result in fine turnings, chips, dust, or fumes. Small diameter materials may be combustible or flammable. Keep this material away from any source of ignition. Keep fines and turnings completely dry or very wet (more than 25% water content by weight) for handling safety. Explosions can result from ignition of powder or machining fines containing moisture. Fires and explosions can result from dispersing fines and dust in air, especially if confined. Avoid these conditions. Avoid dust inhalation and eye or skin contact, wear personal protective equipment (Section 8). Practice good personal hygiene after handling.
Storage Precautions	In solid form this material poses no special problems. Avoid breathing dust or fume. If the use of this material produces dust or fume, use appropriate ventilation controls, personal protective equipment or both.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation	Local exhaust ventilation should be used to control exposure to airborne dust and fume emissions near the source (during crushing, grinding, welding, etc.). Assure exposure is less than regulatory limits.
Respiratory Protection	None required as shipped, if processing emits welding fumes airborne dusts or similar hazards use NIOSH approved respirators as specified by an industrial hygienist or safety professional. Obtain medical approval for users of negative pressure devices. Use a welding fume respirator or an air supplied respirator where local exhaust or ventilation does not keep exposure below overexposure limits.
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 dusts and powders.
Skin Protection	Wear gloves as necessary to prevent metal cuts, skin abrasions and skin contact. Protective clothing such as arm, foot, body protection etc., may be required during handling operations as appropriate for the exposure.
Recommended Monitoring Procedures	No medical surveillance required while working with metal in massive form. If processing creates dust, fume or other hazard, conduct industrial hygiene evaluation of processes. Follow requirements for medical surveillance of product constituents, compounds and fume if welding fume, dust or other hazards are created by customer processing or handling.

Occupational Exposure Limits (OELs): This product in the physical form it is sold does not present an inhalation hazard. However, operations including, but not limited to, cutting, welding, and grinding may produce fumes and/or particulates. The following exposure limits are for the constituents of the materials under these and similar processes.

Constituents	OSHA PEL [1]	ACGIH TLV [2]
OSHA ACGIH Particulate: No Limit Established	15 mg/m^3, total dust (PNOR) 5.0 mg/m^3, respirable fraction (PNOR)	10 mg/m^3 (as inhalable fraction, PNOS) 3 mg/m^3 (as respirable fraction, PNOS)
Aluminum (Al)	15 mg/m³ (as total dust) 5 mg/m³ (as respirable fraction)	1 mg/m³ respirable fraction
Cobalt (Co)	0.1 mg/m^3 (as dust & fume)	0.02 mg/m3
Chromium (Cr)	0.5 mg/m³ (as Cr II & III compounds) 1 mg/m³ (as Cr, metal & insoluble salts) 0.005 mg/m³ (as Cr VI compounds)	0.5 mg/m³ (as Cr metal and Cr III compounds) 0.05 mg/m³ (as Cr VI, water soluble compounds) 0.01 mg/m³ (as Cr VI, insoluble compounds)
Copper (Cu)	0.1 mg/m³ (as fume, Cu) 1.0 mg/m³ (as dusts & mists, Cu)	0.1 mg/m³ (as fume) 1 mg/m³ (as dusts & mists, Cu)
Iron (Fe)	10 mg/m³ (as iron oxide fume)	5 mg/m³ (as iron oxide dust and fume)
Magnesium (Mg)	15 mg/m^3 (as magnesium oxide)	10 mg/m^3 (as magnesium oxide)
Manganese (Mn)	"C" 5.0 mg/m³ (as Fume & Mn compounds)	0.2 mg/m³
Molybdenum(Mo)	15 mg/m³ (as total dust, soluble compounds) 5 mg/m³ (as respirable fraction)	10 mg/m³ (as Mo insoluble compounds, inhalable fraction) 3 mg/m³ (as Mo insoluble compounds, respirable fraction) 0.5 mg/m³ (as Mo soluble compounds, respirable fraction)
Nickel (Ni)	1.0 mg/m³ (as Ni metal & insoluble compounds)	1.5 mg/m³ (as inhalable fraction Ni metal) 0.2 Insoluble compounds 0.1 Soluble compounds
Niobium(Nb)/ Columbium(Cb)	NE	NE
Silicon (Si)	15 mg/m³ (total dust, PNOR) 5 mg/m³ (as respirable fraction, PNOR)	NE
Titanium (Ti)	NE	NE
Tin, inorganic compounds(Sn)	2 mg/m^3	2 mg/m^3
Vanadium (V)	"C" 0.5 mg/m³ (as V2O5 respirable dust) "C" 0.1 mg/m³ (as V2O5 fume)	0.05 mg/m³ (as V_2O_5, inhalable fraction)
Zinc (Zn)	5 mg/m^3 (Zinc Oxide)	2 mg/m^3 (Zinc Oxide)
Zirconium (Zr)	5 mg/m^3	5 mg/m^3 STEL: 10 mg/m^3

NE - None Established, if none established, see "Particulate Where No Limit Has Been Established" in first row or specific compounds created by welding, etc.

Notes:

1. OSHA PELs (Permissible Exposure Limits) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A ("C") designation denotes a Ceiling Limit, which should not be exceeded during any part of the workday unless otherwise noted. A Short Term Exposure Limit (STEL) is a 15-minute exposure, which should not be exceeded.
2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. ACGIH TLVs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
3. The National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH-REL): Compendium of Policy and Statements. NIOSH, Cincinnati, OH (1992). NIOSH is the federal agency designated to conduct research relative to occupational safety and health. As is the case with ACGIH TLVs, NIOSH RELs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
4. Inhalable fraction. The concentration of inhalable particulate is to be determined from the fraction passing a size-selector per OSHA, ACGIH and other regulatory agencies.
5. PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts not listed specifically by substance name are covered by the PNOR limit which is the same as the inert or nuisance dust limit.
6. Respirable fraction - The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH 2014 TLVs® and BEIs® Appendix D, paragraph C
7. PNOS (Particles Not Otherwise Specified). Particles not specified are covered by the PNOS limit.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Solid -	APPEARANCE AND COLOR: Silver /Gray Color
ODOR: None	ODOR THRESHOLD: Not Available
pH: Not Available	EVAPORATION RATE: Not Available
BOILING Range: Not Available	INITIAL BOILING POINT: Not Available
MELTING POINT: 900°F - 3200°F	VAPOR PRESSURE (mmHg): Not Available
SPECIFIC GRAVITY (H2O=1): >3	VAPOR DENSITY (AIR=1): Not Available
EVAPORATION RATE: Not Available	% VOLATILES BY VOLUME: None

9. PHYSICAL AND CHEMICAL PROPERTIES (CONTINUED)

FLASH POINT: None	FLAMMABLE LIMITS V/V% LEL: None UEL: None
RELATIVE DENSITY: Not Available	PARTIAL COEFFICIENT: N-OCTANOL/ WATER: Not Available
SOLUBILITY IN WATER = Negligible	AUTO-IGNITION TEMPERATURE: Not Available
VISCOSITY: Not Available	DECOMPOSITION TEMPERATURE: Not Available

10. STABILITY AND REACTIVITY

REACTIVITY	Hazardous reactions should not occur with solid product under normal conditions.
STABILITY/ CHEMICAL STABILITY	These alloys are stable materials under normal handling and storage conditions.
CONDITIONS TO AVOID	Avoid strong acids or bases. Avoid creating or spreading dust. Sparks, heat, open flame and other sources of ignition. Avoid contact with carbon monoxide, particularly at temperatures between 50°C and 300° C, to prevent formation of nickel carbonyl which is toxic and a carcinogen. Halogenated hydrocarbons can react violently with finely divided aluminum.
INCOMPATIBILE MATERIALS	If dusts or finely divided materials are produced, avoid strong oxidizers – violent reaction with heat generation. Acids and Alkalis – reacts to generate hydrogen. Water and aluminum mixtures may be hazardous when confined due to hydrogen generation. If corrosion occurs, hydrogen might be evolved, causing a potentially explosive environment in confined areas. Hydrofluoric acid or hydrofluoric-nitric acid mixtures rapidly dissolve alloys. Niobium and Zirconium alloys will ignite in cold fluorine and above 200°C will react exothermically with chlorine, bromine, fluorine, iodine, and halocarbons such as carbon tetrachloride, carbon tetrafluoride and freons. Nitryl-fluoride, FNO2 will initiate a reaction at room temperature to produce a glowing or white incandescence.
HAZARDOUS DECOMPOSITION PRODUCTS	Solid metal will not decompose without combustion and/or chemical reaction. Products include elemental metals, metal oxides, metal compounds including products listed in handling precautions (section 7) and decomposition products (directly above).
POSSIBILITY OF HAZARDOUS REACTIONS	Should not occur with solid metal.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA	Eye: Rabbit (cobalt) unknown amount produced severe reaction with abscess involving lens, ciliary body, vitreous humor and retina.	
	Skin: No data.	
	Ingestion:	Guinea Pig (nickel): LD_{Lo}: 5 mg/kg Mouse (boron): LD_{50}: 560 mg/kg Rat (cobalt): LD_{50}: 6,171 mg/kg Rabbit (cobalt)): LD_{50}: 750 mg/kg Human (copper): TD_{Lo}: 120 µg/kg, affects the gastrointestinal tract (nausea or vomiting). Human (chromium): LD_{Lo}: 71 mg/kg Rat (Iron): LD50: 30,000 mg/kg Rat (manganese) LD50: 9,000 mg/kg Rabbit (Silicon Dioxide): LD_{50}: >5,000 mg/kg Rat (Titanium): LD_{50}: >5,000 mg/kg
	Inhalation:	Rabbit (nickel): TCLo: 130 µg/m3 35 weeks (intermittent) - 6 hours Human (chromium VI): TC_{Lo}: 110 µg/m^3 3 years (continuous) tumorigenic (carcinogenic per RTECS) Pig (cobalt): TC_{LO}: 100 µg/m^3/6 hours for 13 weeks (intermittent) Human (manganese): TC_{Lo}: 2300µg/m^3 Rat (titanium): LC_{50}: >6,820 mg/ m^3
	Subchronic:	Rat (molybdenum) inhalation: 12-16 g/m^3/1 hour/30 days, resulted in slight growth depression, and thickening of the intra-alveolar septa, which contained connective tissue fibers.
	Other:	Dog (nickel) Intravenous: LD_{Lo}: 10 mg/kg Rat (chromium), Implant: TD_{Lo}: 1200 µg/kg intermittent over 6 weeks. Rat (cobalt) intramuscular: 126 mg/kg, tumorigenic at site of application. Rabbit (molybdenum) intra-tracheal: LD_{Lo}: 70 mg/kg produced focal fibrosis (pneumoconiosis).
	Nickel alloys and hexavalent chromium compounds are listed as carcinogens by IARC. 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, North Carolina 27709.	
	Welding Fumes: Follow OSHA and NIOSH methods for monitoring of welding fumes to determine exposure potential.	
	Teratology:	Rat (nickel) oral: TDLo: 158 mg/kg Rat (molybdenum) oral: 5800 µg/kg given to female 30 weeks prior to mating and during days 1-20 of pregnancy caused specific musculoskeletal system development abnormalities.
	Reproduction:	Rat (molybdenum) oral: 6050 µg/kg given to female 35 weeks prior to mating produced pre-, and post-implantation mortality. Rat (cobalt) unspecified exposure route, 0.05 mg/kg continuous, administered throughout gestation to female was embryotoxic.
	Mutagenicity:	Hamster (chromium III) lung cell: 34 mg/L caused sister chromatid exchange. Human (cobalt) DNA damage: Human Leukocyte 3mg/L. Human (Chromium VI) DNA damage: Human Leukocyte 50µmol/L.

12. ECOLOGICAL INFORMATION

In solid form these alloys pose no special environmental problems. Metal powders or dusts may have significant impact on air, land and water quality. Airborne emissions, spills, and releases to the environment (discharge to streams, sewer systems, surface soil, etc.) should be controlled immediately.

Ecotoxicity: Few plants accumulate cobalt at greater than 100 ppm, the level at which severe phytoxicity would occur. The potential for bioaccumulation of Cobalt by both aquatic and terrestrial organisms is low with trophic transfer factors less than 1. There is little tendency for chromium III bioaccumulation along the food chain. Terrestrial plants can contain enough molybdenum to be toxic to animals but still grow normally.

Molybdenum; (fathead minnow), LC_{50}: 370 mg/L/96 hours. Terrestrial plants can contain enough molybdenum to be toxic to animals but still grow normally.

Environmental Fate: In water, cobalt is adsorbed greatly to hydrolysate or oxidate sediments. It may be taken into solution in small amounts through bacteriological activity. In water, molybdenum will precipitate out with natural calcium. 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.

Manganese undergoes complex geochemical cycling, and can accumulate in the top layer of sediment in lakes. In water, molybdenum will precipitate out with natural calcium. Soil levels should not exceed 50 ppm to avoid problems with livestock.

13. DISPOSAL CONSIDERATIONS

Whenever possible, recover alloys for reuse or recycling. Solid metal is not a hazardous waste per U.S. E.P.A. If material has been processed, analyze and dispose of waste material in accordance with local, state, or federal regulations. For specific labeling, packing, storage, transportation, and disposal procedures, contact an Environmental Engineer or consultant familiar with waste disposal regulations.

14. TRANSPORT INFORMATION

As sold, these solid alloys are not regulated by the U.S. Department of Transportation and the International Air Transport Association. Note: metals transported in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may uncoil to try to lay flat when banding is cut or forces are released; this can be sudden and catastrophic and measures should be taken to ensure that uncoiling will not occur.

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

Shipping Name	Not applicable, however, 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

SPECIFIC U.S. EPA REGULATIONS: Toxic Substance Control Act: Components of this material (see section 3) are listed in the TSCA inventory.

CERCLA: Components of this material (section 3) are listed as Hazardous Substances

EPA Superfund Amendment and Reauthorization Act (SARA) of 1986 Section 311/312(SARA Title III): Components of this material (section 3) are listed in SARA Title III, Section 311/312

EPA, SARA Section 313: Components of this material (section 3) are listed Section 313 and subject to Toxic Release Inventory reporting.

SARA Title III Hazard Categorization: Dust and fume are categorized as an immediate (acute) health hazard and a delayed (chronic) health hazard as defined by 40 CFR 370. Product is not categorized as a fire hazard, reactivity hazard or pressure release hazard.

16. OTHER INFORMATION

Revision Date: March 30, 2019

This information is designed only as guidance for safe handling, use, storage, transportation, and disposal and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Information contained herein is believed to be true and accurate at the date of its publication, 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

Trademarks: Several materials described in these Safety Data Sheets are proprietary alloys produced under license from various manufacturers. They are identified by the following subscript numbers:

[1]Registered Trademark of AK Steel Corporation
[2]Registered Trademark of Carpenter Technology Corporation
[3]Registered Trademark of Special Metals Corporation
[4]Registered Trademark of ATI Allegheny Companies
[5]Registered Trademark of Haynes International, Inc.
[6]Registered Trademark of United Technologies Corporation

Ulbrich Stainless Steels & Special Metals, Inc.
Safety Data Sheet (SDS) 003

SECTION 1: IDENTIFICATION

Product Identifier: **Carbon Steels** designated as follows: AISI-SAE 1050; 1006; 1008; 1010; 1040; 1065; 1070; 1074; 1075; 1095

Notice on Coated Materials: This SDS is for uncoated materials. Ulbrich occasionally has material coated for customers. Purchasers of coated materials should assure that they have the SDS for the coated material that they purchase.

Product Form: Metal Alloy/Mixture

Intended Use of the Product: Carbon steel, various uses

Supplier's Details: Ulbrich Stainless Steels & Special Metals, Inc.
153 Washington Avenue, P.O. Box 294,
North Haven, CT USA, 06473-1191
Phone Number (203) 239-4481 • (800) 243-1676
SDS Technical Contact Weekdays (203) 265-8299
FAX: (203) 239-7479 • E-Mail: information@ulbrich.com
Chemtrec 800-424-9300
Emergency Telephone Number (203) 239-4481

SECTION 2: HAZARDS IDENTIFICATION

Classification (GHS-US): As shipped, uncoated alloys are articles that do not present a hazard to human health by inhalation or ingestion. However, cutting, grinding, welding, etc. may produce dust, particulate or fume that presents health hazards related to constituents detailed in section 3.

Label Elements: Signal word, hazard statement(s), symbols and precautionary statement(s):

SYMBOLS	HAZARD CLASSIFICATION	SIGNAL WORD	HAZARD STATEMENTS
	Carcinogenicity - 2 Specific Target Organ Toxicity (STOT) Repeat Exposure -1	Danger	Dust/fumes suspected of causing cancer via inhalation. Inhalation of dust/fumes causes damage to respiratory tract through prolonged or repeated exposure.
	Skin Sensitization - 1		Dust/fumes may cause an allergic skin reaction.
NA	Eye Irritation - 2B		Causes Eye Irritation

PRECAUTIONARY STATEMENT(S)

Do not handle until all safety precautions have been read and understood.
Avoid breathing dust/fumes.
Use personal protective equipment as required.
If exposed or concerned: Get medical advice/attention.

STORAGE	DISPOSAL
Store locked up. Store away from strong oxidizers, acids and incompatible materials. Dust and/or powders may form explosive mixtures with air or fluids. Store in accordance with federal/ provincial/state or local regulations.	Metal scrap should be recycled whenever possible Dispose of in accordance with federal, state and other regulations

Medical Conditions Aggravated By Exposure: If excessive concentrations of dust or welding fume are inhaled, individuals with impaired pulmonary function, disease, respiratory condition, etc. may incur further damage. Individuals who may have an allergy or sensitivity to metals may encounter skin rash or dermatitis. If prior damage or disease to neurological, circulatory, hematologic or renal systems has occurred, proper screening/examinations should be conducted on exposed individuals.

Hazards not otherwise classified: None Known, No data available
Unknown acute toxicity statement (mixture): None Known, No data available

SECTION 3: COMPOSITION/ INFORMATION ON INGREDIENTS

STANDARD CARBON STEELS

ALLOY	UNS No.	CONSTITUENT(S) % Maximum unless otherwise shown.					
AISI-SAE		C	Mn	Fe	P	Other	Other
1006	G10060	0.08	0.25/0.40	BAL	P 0.04		
1008	G10080	0.10	0.30/0.50	BAL	P 0.05		
1010	G10100	0.08/0.13	0.30/0.60	BAL	P 0.04		
1040	G10400	0.36/.44	0.60/0.90	BAL	P 0.04		
1050	G10500	0.4/0.55	0.60/0.90	BAL			
1065	G10650	0.60/0.70	0.60/0.90	BAL			
1070	G10700	0.65/0.75	0.60/0.90	BAL			
1074	G10740	0.70/0.80	0.50/0.80	BAL			
1075	61 0750	0.70/0.80	0.40/0.70	BAL			
1095	G10950	0.90/1.03	0.30/0.50	BAL			
CAS Number		7440-44-0	7439-96-5	7439-89-6	7723-14-0		

BAL = Balance Min = minimum Max = maximum x/x = minimum to maximum

All commercial metals may contain trace amounts of various elements (less than 0.1%) in addition to those specified. These small quantities frequently originate in the raw material used.

4. FIRST AID MEASURES

Description of necessary measures:

Inhalation: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed, concerned, experiencing respiratory symptoms, or feel unwell: Get medical advice/attention or call a poison center or doctor/physician.

Eye Contact: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if in eyes: Rinse cautiously with water for 15 minutes. Remove contact lenses, if present and easy to do. Do not allow victim to rub or keep eyes tightly shut. Continue rinsing. If eye irritation persists, get medical advice/ attention.

Skin Contact: If on skin: Wash thoroughly after handling. Wash with plenty of water. If irritation or rash occurs: Get medical advice, attention. Skin cuts and abrasions can be treated by standard first aid or medical treatment. Quickly remove dust contaminated clothing but do not shake clothing.

Ingestion: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if swallowed: Call a poison center or doctor/physician if you feel unwell. Rinse mouth. If exposed, concerned or feel unwell: Get medical advice/attention.

Most important symptoms/effects, acute and delayed (chronic):

Symptoms: May cause allergic skin reaction. May cause acute gastrointestinal effects if swallowed.

Note to Physicians: Treat symptomatically

5. FIRE FIGHTING MEASURES

FLASH POINT (WITH TEST METHOD)	None	
FLAMMABLE (EXPLOSIVE) LIMITS V/V%	LEL: None	UEL: None

Suitable (and unsuitable) Extinguishing Media: Not Applicable for solid carbon steel as sold/shipped. Use extinguishers appropriate for surrounding materials.

Specific Hazards arising from the chemical: Not Applicable for solid carbon steel as sold/shipped. When burned, toxic smoke, fume and vapor may be emitted.

Special protective equipment and precautions for fire-fighters: Self-contained NIOSH approved respiratory protection and full protective clothing should be worn when fumes and/or smoke from fire are present. Heat and flames cause emittance of acrid smoke and fumes. Do not release runoff from fire control methods to sewers or waterways. Firefighters should wear full face-piece self-contained breathing apparatus and chemical protective clothing with thermal protection. Direct water stream will scatter and spread flames and, therefore, should not be used.

6. ACCIDENTAL MATERIAL RELEASE OR SPILL CONTROL MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Not Applicable for solid carbon steel as sold/shipped. For spills involving finely divided particles, clean-up personnel should be protected against contact with eyes and skin. If material is in a dry state, avoid inhalation of dust.

Methods and materials for containment and clean up: Not Applicable for solid carbon steel as sold/shipped. Collect material in appropriate, labeled containers for recovery or disposal in accordance with federal, state, and local regulations. Follow applicable OSHA regulations (29 CFR 1910.120) and all other pertinent state and federal requirements.

7. HANDLING AND STORAGE

Handling Precautions	Wear cut resistant gloves and clothing to avoid cuts. Metal in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may suddenly uncoil to try to lay flat in a long strip when banding is cut or other forces are released. Measures should be taken to ensure that uncoiling will not occur. Machining of alloys may result in fine turnings, chips, dust, or fumes. Small diameter materials may be combustible or flammable. Keep this material away from any source of ignition. Keep fines and turnings completely dry or very wet (more than 25% water content by weight) for handling safety. Explosions can result from ignition of powder or machining fines containing moisture. Fires and explosions can result from dispersing fines and dust in air, especially if confined. Avoid these conditions. Avoid dust inhalation and eye or skin contact. Wear personal protective equipment to prevent contact with skin and eyes (Section 8). Practice good personal hygiene after handling, especially before eating, drinking, smoking, or applying cosmetics.
Storage Precautions	In solid form this material poses no special problems. Avoid breathing dust or fume. If the use of this material produces dust or fume, use appropriate ventilation controls, personal protective equipment or both.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation Local exhaust ventilation should be used to control exposure to airborne dust and fume emissions near the source (during crushing, grinding, welding, etc.). Assure exposure is less than regulatory limits.

Respiratory Protection None required as shipped, if processing emits welding fumes, airborne dusts or other hazards use NIOSH approved respirator as specified by an industrial hygienist or safety professional. Obtain medical approval for users of respirators. Use a welding fume respirator or air supplied respirator where local exhaust or ventilation does not keep exposure below overexposure limits.

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 dusts and powders.

Skin Protection Wear gloves as necessary to prevent metal cuts, skin abrasions and skin contact. Protective clothing such as arm, foot, body protection etc., may be required during handling operations as appropriate for the exposure.

Recommended Monitoring Procedures No medical surveillance required while working with metal in massive form. If processing creates dust, fume or other hazard, conduct industrial hygiene evaluation of processes. Follow requirements for medical surveillance of product constituents, compounds and fume if welding fume, dust or other hazards are created by customer processing or handling.

Occupational Exposure Limits (OELs): This product in the physical form it is sold does not present an inhalation hazard. However, operations including, but not limited to, cutting, welding, and grinding may produce fumes and/or particulates. The following exposure limits are for the constituents of the materials under these and similar processes.

Constituents	OSHA PEL [1]	ACGIH TLV [2]
OSHA ACGIH Particulate: No Limit Established	15 mg/m^3, total dust (PNOR) 5.0 mg/m^3, respirable fraction (PNOR)	10 mg/m^3 (as inhalable fraction, PNOS) 3.0 mg/m^3 (as respirable fraction, PNOS)
Carbon (C)	N/A	N/A
Iron (Fe)	10 mg/m^3 (as iron oxide fume)	5.0 mg/m^3 (as iron oxide dust and fume)
Manganese (Mn)	"C" 5.0 mg/m^3 (as Fume & Mn compounds)	0.02 mg/m^3 (as respirable fraction), 0.1 mg/m^3 (as inhalable fraction)
Phosphorus elemental (P)	0.1 mg/m^3	0.02 ppm (0.1mg/m^3)

NE - None Established, if none established, see "Particulate Where No Limit Has Been Established" in first row or specific compounds created by welding, etc.

Notes:

1. OSHA PELs (Permissible Exposure Limits) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A ("C") designation denotes a Ceiling Limit, which should not be exceeded during any part of the workday unless otherwise noted. A Short Term Exposure Limit (STEL) is a 15-minute exposure, which should not be exceeded.
2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. ACGIH TLVs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
3. The National Institute for Occupational Safety and Health Recommended Exposure Limits (NIOSH-REL): Compendium of Policy and Statements. NIOSH, Cincinnati, OH (1992). NIOSH is the federal agency designated to conduct research relative to occupational safety and health. As is the case with ACGIH TLVs, NIOSH RELs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
4. Inhalable fraction. The concentration of inhalable particulate is to be determined from the fraction passing a size-selector per OSHA, ACGIH and other regulatory agencies.
5. PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts not listed specifically by substance name are covered by the PNOR limit which is the same as the inert or nuisance dust limit.
6. Respirable fraction - The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH 2014 TLVs® and BEIs® Appendix D, paragraph C
7. PNOS (Particles Not Otherwise Specified). Particles not specified are covered by the PNOS limit.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Solid	APPEARANCE AND COLOR: Metallic Gray Color
ODOR: Odorless	ODOR THRESHOLD: Not Available
pH: Not Available	EVAPORATION RATE: Not Available
BOILING Range: Not Available	INITIAL BOILING POINT: Not Available
MELTING POINT: 1000°F - 3200°F	VAPOR PRESSURE (mmHg): Not Available
SPECIFIC GRAVITY (H2O=1): 7.5 - 8.0	VAPOR DENSITY (AIR=1): Not Available
EVAPORATION RATE: Not Available	% VOLATILES BY VOLUME: None
FLASH POINT: None	FLAMMABLE LIMITS V/V% LEL: None UEL: None
RELATIVE DENSITY: Not Available	PARTIAL COEFFICIENT: N-OCTANOL/ WATER: Not Available
SOLUBILITY IN WATER = None	AUTO-IGNITION TEMPERATURE: Not Available
VISCOSITY: Not Available	DECOMPOSITION TEMPERATURE: Not Available

10. STABILITY AND REACTIVITY

REACTIVITY	Hazardous reactions should not occur under normal conditions.
STABILITY/ CHEMICAL STABILITY	These alloys are stable materials under normal handling and storage conditions.
CONDITIONS TO AVOID	Avoid strong acids or bases. Avoid creating or spreading dust. Sparks, heat, open flame and other sources of ignition.
INCOMPATIBILE MATERIALS	Strong acids, strong bases, strong oxidizers. Alkalis. Metal oxides. Water, humidity. Corrosive substances in contact with metals may produce flammable hydrogen gas.
HAZARDOUS DECOMPOSITION PRODUCTS	Solid metal will not decompose without combustion and/or chemical reaction. Elemental metals, metal oxides, metal compounds including chromium compounds, acids.
POSSIBILITY OF HAZARDOUS REACTIONS	Should not occur.

11. TOXICOLOGICAL INFORMATION

Information on Toxicological Effects - Product LD50 and LC50 Data: Not available Skin Corrosion/Irritation: Not classified Aspiration Hazard: Not classified Carcinogenicity: Not classified. Reproductive Toxicity: Not classified. Germ Cell Mutagenicity: Not classified Teratogenicity: Not classified Serious Eye Damage/Irritation: Not classified Respiratory or Skin Sensitization: Not classified. Symptoms/injuries after ingestion: Ingestion is likely to be harmful or have adverse effects. Specific Target Organ Toxicity (Repeated Exposure): Not classified.	Specific Target Organ Toxicity (Single Exposure): Not classified Symptoms/injuries after inhalation: Inhalation of dusts/fumes can cause metal fume fever. Symptoms include metallic or sweet taste in the mouth, sweating, headache, throat irritation, fever, chills, thirstiness, muscle aches, nausea, vomiting, weakness, fatigue, and shortness of breath. Dust may cause irritation to, nose, throat and lungs. Symptoms/Injuries After Skin Contact: May cause an allergic skin reaction. Dust from physical alteration of this product causes skin irritation. Causes severe skin burns. Contact with fumes or metal powder will irritate skin. Contact with hot, molten metal will cause thermal burns. Dust may cause irritation in skin folds or by contact in combination with tight clothing. Danger from flying particles or slag is possible. Symptoms/injuries after eye contact: dust may cause mechanical eye & other irritation. Chronic Symptoms: In massive form, no hazard exists. If physically altered to present slivers, dusts, fumes, etc.: Inhalation of iron oxide fumes undergoing decomposition may cause irritation and flu-like symptoms. Manganese: Chronic exposure can cause inflammation and scarring of the lungs.

12. ECOLOGICAL INFORMATION

In solid form these alloys pose no special environmental problems. Metal powders or dusts may have an impact on air, land and water quality. Airborne emissions, spills, and releases to the environment (discharge to streams, sewer systems, surface soil, etc.) should be controlled immediately.

Manganese undergoes complex geochemical cycling, and can accumulate in the top layer of sediment in lakes. In water, molybdenum will precipitate out with natural calcium. Soil levels should not exceed 50 ppm to avoid problems with livestock.

13. DISPOSAL CONSIDERATIONS

Whenever possible, recover alloys for reuse or recycling. Solid metal is not a hazardous waste per U.S. E.P.A. If material has been processed, analyze and dispose of waste material in accordance with local, state, or federal regulations. For specific labeling, packing, storage, transportation, and disposal procedures, contact an Environmental Engineer or consultant familiar with waste disposal regulations.

14. TRANSPORT INFORMATION

As sold, these solid alloys are not regulated by the U.S. Department of Transportation or the International Air Transport Association. Note: metals transported in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may uncoil to try to lay flat when banding is cut or other forces are released; measures should be taken to ensure that uncoiling will not occur.

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

SHIPPING NAME	Not Available for solid alloys. 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

SPECIFIC U.S. EPA REGULATIONS	Toxic Substance Control Act: Components of this material (see section 3) are listed in the TSCA inventory. CERCLA: Components of this material (section 3) are listed as Hazardous Substances EPA Superfund Amendment and Reauthorization Act (SARA) of 1986 Section 311/312(SARA Title III): Components of this material (section 3) are listed in SARA Title III, Section 311/312 EPA, SARA Section 313: Components of this material (section 3) are listed Section 313 and subject to Toxic Release Inventory reporting. SARA Title III Hazard Categorization: Dust and fume are categorized as an immediate (acute) health hazard and a delayed (chronic) health hazard as defined by 40 CFR 370. Product is not categorized as a fire hazard, reactivity hazard or pressure release hazard.

16. OTHER INFORMATION

Revision Date: March 30, 2019

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[4]Registered Trademark of ATI Allegheny Companies
[5]Registered Trademark of Haynes International, Inc.
[6]Registered Trademark of United Technologies Corporation

Ulbrich Stainless Steels & Special Metals, Inc.
Safety Data Sheet (SDS) 004

SECTION 1: IDENTIFICATION

Product Identifier: **Copper, Brass and Phosphor Bronze Alloys,** designated as follows: ETP Copper and OFHC Copper (UNS C11000 and UNS C10200); Brass (UNS C21000, C22000, C22600, C23000 C24000 C26000 C27200); Phosphor Bronze (UNS C50500, C50700, C51000, C51100, C51900, C52100 and C52400)

Intended Use of the Product: Metal products, various uses

Supplier's Details: **Ulbrich Stainless Steels & Special Metals, Inc.**
153 Washington Avenue, P.O. Box 294,
North Haven, CT USA, 06473-1191
Phone Number (203) 239-4481 • (800) 243-1676
FAX: (203) 239-7479 • E-Mail: information@ulbrich.com
Emergency Telephone Number (203) 239-4481; Chemtrec 800-424-9300

SECTION 2: HAZARDS IDENTIFICATION

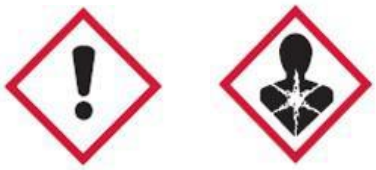
Classification (GHS-US): As shipped, uncoated alloys are articles that do not present a hazard to human health by inhalation or ingestion. However, cutting, grinding, welding, etc. may produce dust, particulate or fume that presents health hazards related to constituents detailed in section 3.

Specific Target Organ Toxicity (Repeated Exposure) - Category 1
Eye Damage/Irritation - Category 2B
Respiratory Sensitizer - Category 1
Skin Sensitizer - Category 1
Germ Cell Mutagenicity - Category 2
Carcinogenicity - Category 1B
Toxic to Reproduction - Category 1A

Label Elements:

Emergency Overview

Signal Word: Danger



Hazard statements:
May cause allergy or asthma symptoms or breathing difficulties if inhaled.
May cause an allergic skin reaction.
Suspected of causing genetic defects.
May cause cancer.
May damage fertility or the unborn child.
Causes damage to respiratory system through prolonged or repeated exposure.
Harmful if swallowed
Causes eye irritation.

Appearance Various massive product | Physical state Solid | Odor Odorless

Precautionary Statements - Prevention
Wear protective gloves/protective clothing/eye protection/face protection.
Do not breathe dust/fume.
In case of inadequate ventilation wear respiratory protection.
Contaminated work clothing should not be allowed out of the workplace.
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Avoid release to the environment
Take off and wash contaminated clothing before reuse.

Precautionary Statements - Response
In case of fire: Use Class D agent to extinguish.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists get medical advice/attention.
IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms: Call a poison center/doctor.
IF ON SKIN: Wash with plenty of soap and water. If skin irritation or rash occurs: Get medical advice/attention. Wash contaminated clothing before reuse.
If exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.

STORAGE	DISPOSAL
Store locked up. Store away from acids and incompatible materials. Store in accordance with federal/state or other regulations. Dust and/or powders may form explosive mixtures with air or fluids.	Metal scrap should be recycled whenever possible Dispose of in accordance with applicable federal, state and other regulations

Hazards not otherwise classified: None Known, No data available

Unknown acute toxicity statement (mixture): None Known, No data available

SECTION 3: COMPOSITION/ INFORMATION ON INGREDIENTS

ALLOY	UNS No.	CONSTITUTENT(S) % Nominal unless otherwise shown.				
		Cu	Sn	Zn	Pb	P
Phosphor Bronze 505	C50500	98.75	1.25	<0.3	0.0-0.05	<0.35
Phosphor Bronze 507	C50700	98	2	<0.3	0.0-0.05	<0.35
Phosphor Bronze 510	C51000	95	5	<0.3	0.0-0.05	<0.35
Phosphor Bronze 511	C51100	96	4	<0.3	0.0-0.05	<0.35
Phosphor Bronze 519	C51900	94	6	<0.2	0.0-0.05	<0.15
Phosphor Bronze 521	C52100	92	8	<0.2	0.0-0.05	<0.35
Phosphor Bronze 524	C52400	90	10	<0.2	0.0-0.05	<0.35
ETP Copper	C11000	>99.9				
Oxygen Free Copper	C10200	>99.9				
Brass 210	C21000	95		4-6	0.0-0.05	
Brass 220	C22000	90		9-11	0.0-0.05	
Brass 226	C22600	88		11-14	0.0-0.05	
Brass 230	C23000	85		14-16	0.0-0.05	
Brass 240	C24000	80		18.5-21.5	0.0-0.05	
Brass 260	C26000	70		30	0.04-0.07	
Brass 272	C27200	63		37	0.05-0.08	
CAS Number		7440-50-8	7440-31-5	7440-66-6	7439-92-1	7723-14-0

>Greater Than < Less Than x-x = minimum to maximum

All commercial metals may contain trace amounts of various elements (less than 0.1%) in addition to those specified. These small quantities frequently originate in the raw material used.

4. FIRST AID MEASURES

Eye Contact:	Immediately flush out fume and dust particles with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If eye irritation develops, call a physician at once.
Skin Contact:	If exposed to dust or fumes, wash skin with plenty of water. Remove contaminated clothing and shoes and launder before reuse. If skin irritation or rash develops and persists or recurs, get medical advice/attention.
Inhalation:	If symptoms of lung irritation occur (coughing, wheezing or breathing difficulty), remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep affected person warm and at rest. Get medical advice/attention.
Ingestion:	Not a likely route of exposure for finished metal alloy. If dust is ingested, immediately drink water to dilute. Consult a physician if symptoms develop.

Description of necessary measures:

Inhalation: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if inhaled: Remove person to fresh air and keep comfortable for breathing. If exposed, concerned, experiencing respiratory symptoms, or feel unwell: Get medical advice/attention or call a poison center or doctor/physician.

Eye Contact: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if in eyes: Rinse cautiously with water for 15 minutes. Remove contact lenses, if present and easy to do. Do not allow victim to rub or keep eyes tightly shut. Continue rinsing. If eye irritation persists, get medical advice/ attention.

Skin Contact: If on skin: Wash thoroughly after handling. Wash with plenty of water. If irritation or rash occurs: Get medical advice/ attention. Skin cuts and abrasions can be treated by standard first aid or medical treatment. Quickly remove dust contaminated clothing but do not shake clothing.

Ingestion: As sold/shipped material is in solid form, not a likely form of exposure. However, during processing (welding, grinding, burning, etc.), if swallowed: Call a poison center or doctor/physician if you feel unwell. Rinse mouth. If exposed, concerned or feel unwell: Get medical advice/attention.

Note to Physicians: There is no specific antidote to the active ingredients in this product; use symptomatic treatment. Refer to Section 11-TOXICOLOGY INFORMATION.

Immediate Medical Attention and Special Treatment: None Known

5. FIRE FIGHTING MEASURES

FLASH POINT (WITH TEST METHOD)	None	
FLAMMABLE (EXPLOSIVE) LIMITS V/V%	LEL: None	UEL: None

EXTINGUISHING MEDIA	Not flammable in the form of this product as distributed. Flammable as finely divided pieces resulting from processing of this product. Type D fire extinguisher. Carbon dioxide is not effective in extinguishing burning metals.
SPECIAL FIREFIGHTING PROCEDURES	Do not spray water on burning metal as an explosion may occur. To extinguish a metal fire, smother with dry sand, salt (NaCl) or other class "D" fire extinguishing powder.
UNUSUAL FIRE AND EXPLOSION HAZARDS	No unusual fire or explosion hazards from solid alloys in massive form. Dust, chips, thin strips, etc. created by grinding or processing can ignite if a substantial number of small particles are dispersed or adequate ignition source is present. The hazard increases with finer particles. An explosion may follow a fire initiated in a mass of wet metal fines. The explosive characteristics of such material is caused by the steam and hydrogen generated within the burning mass. Metals may react exothermically with acids and oxidizers. Do not spray water on burning metal as a violent explosion may result. In molten state: reacts violently with water (moisture).
HAZARDOUS COMBUSTION PRODUCTS	Various metal oxides are hazardous. Also, may cause metal fume fever.
INCOMPATIBILITY (MATERIALS TO AVOID)	Strong acids, strong bases, strong oxidizers. Alkalis. Metal oxides. Water, humidity. Corrosive substances in contact with metals may produce flammable hydrogen gas.

6. ACCIDENTAL MATERIAL RELEASE OR SPILL CONTROL MEASURES

In solid form this material poses no special clean-up problems. If this material is in powder or dust form, do not dry sweep. Clean-up should be conducted with a grounded vacuum system utilizing high efficiency particulate air (HEPA) filtration. Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air, land and water. Prevent entry to sewers and public waters. Cleanup personnel should protect against dust inhalation and skin or eye contact, follow handling precautions below, and use non-sparking tools. Properly label all materials collected in waste container. Follow applicable OSHA regulations (29 CFR), EPA regulations (40 CFR)), Canadian Workplace Hazardous Materials Information System (WHMIS) Regulations, and other regulatory requirements.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS	Wear cut resistant gloves and clothing to avoid cuts. Metal in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may suddenly uncoil to try to lay flat in a long strip when banding is cut or other forces are released. Measures should be taken to ensure that uncoiling will not occur. Machining of alloys may result in fine turnings, chips, dust, or fumes. Small diameter materials may be combustible or flammable. Keep this material away from any source of ignition. Explosions can result from ignition of powder or machining fines containing moisture. Fires and explosions can result from dispersing fines and dust in air, especially if confined. Avoid these conditions. Avoid dust inhalation and eye or skin contact. Wear personal protective equipment to prevent contact with skin and eyes (Section 8). Practice good personal hygiene after handling, especially before eating, drinking, smoking, or applying cosmetics.
STORAGE PRECAUTIONS	In solid form this material poses no special problems. Avoid breathing dust or fume. If the use of this material produces dust or fume, use appropriate ventilation controls, personal protective equipment or both.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

VENTILATION	Local exhaust ventilation should be used to control exposure to airborne dust and fume emissions near the source (during crushing, grinding, welding, etc.). Assure exposure is less than regulatory limits.
RESPIRATORY PROTECTION	None required as shipped, if processing emits welding fumes, airborne dusts or similar hazards use NIOSH approved respirator as specified by an industrial hygienist/safety professional. Obtain medical approval for respirator users. Use a welding or air supplied respirator where local exhaust or ventilation does not keep exposure below overexposure limits.
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 dusts and powders.
SKIN PROTECTION	Wear gloves as necessary to prevent metal cuts, skin abrasions and skin contact. Protective clothing such as arm, foot, body protection etc., may be required during handling operations as appropriate for the exposure.
RECOMMENDED MONITORING PROCEDURES	No medical surveillance required while working with metal in massive form. If processing creates dust, fume or other hazard, conduct industrial hygiene evaluation of processes. Follow requirements for medical surveillance of product constituents, compounds and fume if welding fume, dust or other hazards are created by customer processing or handling.

Occupational Exposure Limits (OELs): This product in the physical form it is sold does not present an inhalation hazard. However, operations including, but not limited to, cutting, welding, and grinding may produce fumes and/or particulates. The following exposure limits are for the constituents of the materials under these and similar processes.

Constituents	OSHA PEL [1]	ACGIH TLV [2]
OSHA ACGIH Particulate: No Limit Established	15 mg/m^3, total dust (PNOR) 5 mg/m^3, respirable fraction (PNOR)	10 mg/m^3 (as inhalable fraction, PNOS) 3.0 mg/m^3 (as respirable fraction, PNOS)
Copper (Cu)	0.1 mg/m^3 (as fume, Cu) 1.0 mg/m^3 (as dusts & mists, Cu)	0.2 mg/m^3 (as fume) 1.0 mg/m^3 (as dusts & mists, Cu)
Lead (Pb)	50 µg/m^3 TWA (as Pb) 30 µg/m^3 Action Level (as Pb)	0.05 mg/m^3
Phosphorus elemental (P)	0.1 mg/m^3	0.02 ppm (0.1mg/m^3)
Tin, inorganic compounds(Sn)	2 mg/m^3	2 mg/m^3
Zinc (Zn)	5 mg/m^3	2 mg/m^3

NE - None Established, if none established, see "Particulate Where No Limit Has Been Established" in first row or specific compounds created by welding, etc.

Notes:

1. OSHA PELs (Permissible Exposure Limits) are 8-hour TWA (time-weighted average) concentrations unless otherwise noted. A ("C") designation denotes a Ceiling Limit, which should not be exceeded during any part of the workday unless otherwise noted. A Short Term Exposure Limit (STEL) is a 15-minute exposure, which should not be exceeded.
2. Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are 8-hour TWA concentrations unless otherwise noted. ACGIH TLVs are for guideline purposes only and as such are not legal, regulatory limits for compliance purposes.
3. Inhalable fraction. The concentration of inhalable particulate is to be determined from the fraction passing a size-selector per OSHA, ACGIH and other regulatory agencies.
4. PNOR (Particulates Not Otherwise Regulated). All inert or nuisance dusts not listed specifically by substance name are covered by the PNOR limit which is the same as the inert or nuisance dust limit.
5. Respirable fraction - The concentration of respirable dust for the application of this limit is to be determined from the fraction passing a size-selector with the characteristics defined in the ACGIH TLVs® and BEIs®.
6. PNOS (Particles Not Otherwise Specified). Particles not specified are covered by the PNOS limit.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Solid	APPEARANCE AND COLOR: Reddish/Brown Metal Color
ODOR: No Odor	ODOR THRESHOLD: Not Available
pH: Not Available	EVAPORATION RATE: Not Available
BOILING Range: Not Available	INITIAL BOILING POINT: Not Available
MELTING POINT: 800°F - 2000°F	VAPOR PRESSURE (mmHg): Not Available
SPECIFIC GRAVITY (H2O=1): 8.0 - 9.0	VAPOR DENSITY (AIR=1): Not Available
EVAPORATION RATE: Not Available	% VOLATILES BY VOLUME: None

9. PHYSICAL AND CHEMICAL PROPERTIES (CONTINUED)

FLASH POINT: None	FLAMMABLE LIMITS V/V% LEL: None UEL: None
RELATIVE DENSITY: Not Available	PARTIAL COEFFICIENT: N-OCTANOL/ WATER: Not Available
SOLUBILITY IN WATER = None	AUTO-IGNITION TEMPERATURE: Not Available
VISCOSITY: Not Available	DECOMPOSITION TEMPERATURE: Not Available

10. STABILITY AND REACTIVITY

REACTIVITY	Hazardous reactions should not occur under normal conditions.
STABILITY/ CHEMICAL STABILITY	These alloys are stable materials under normal handling and storage conditions.
CONDITIONS TO AVOID	Avoid strong acids or bases. Avoid creating or spreading dust. Sparks, heat, open flame and other sources of ignition.
INCOMPATIBILE MATERIALS	The corrosion-resistant alloys were designed for use in, and possess outstanding resistance to, mineral acids. To a lesser extent, the high temperature alloys also withstand these acids. Be aware, however, that if corrosion does occur, hydrogen might be evolved, causing a potentially explosive environment in confined, closed systems.
HAZARDOUS DECOMPOSITION PRODUCTS	Solid metal will not decompose without combustion and/or chemical reaction. Various elemental metals, metal oxides, metal compounds including chromium compounds, acids.
POSSIBILITY OF HAZARDOUS	Should not occur.

11. TOXICOLOGICAL INFORMATION

POTENTIAL EXPOSURE ROUTES: For dust: ingestion, inhalation, and eye contact. For fume: inhalation and eye contact. The finished alloy metal is not hazardous.

For Product: The toxicological properties of this product have not been thoroughly investigated.		For Components, Dusts or Fumes		
		Copper	Lead	Zinc
Oral LD_{50}	Believed to be moderately toxic	3.5 mg/kg (mouse, intraperitoneal)	No data	No data
Dermal LD_{50}	Believed to be > 2 g/kg	375 mg/kg (rabbit, subcutaneous)	No data	No data
Inhalation LC_{50}	Believed to be slightly to moderately toxic	No data	No data	No data
Irritation	Believed to be an eye and respiratory irritant	Respiratory irritant	Not irritating	Eye irritant

SUBCHRONIC/ CHRONIC TOXICITY: No information for product. Lead has caused blood, kidney and nervous system damage in laboratory animals.
CARCINOGENICITY: This product is not known or reported to be carcinogenic. The International Agency for Research on Cancer (IARC) lists lead as possibly carcinogenic to humans, group 2B.
MUTAGENICITY: This product is not known or reported to be mutagenic. Lead has been shown to be mutagenic in several in vitro assays.
REPRODUCTIVE, TERATOGENICITY, OR DEVELOPMENTAL EFFECTS: This product is not known or reported to cause reproductive or developmental effects. Lead has been shown to affect fetal development including birth defects and reduce male reproductive function in laboratory animals.
NEUROLOGICAL EFFECTS: This product is not known or reported to cause neurological effects. Lead has caused peripheral and central nervous system damage and behavioral effects in laboratory animals.
NTERACTIONS WITH OTHER CHEMICALS WHICH ENHANCE TOXICITY: None known or reported.

12. ECOLOGICAL INFORMATION

In solid form these alloys pose no special environmental problems. Metal powders or dusts may have significant impact on air, land and water quality. Airborne emissions, spills, and releases to the environment (discharge to streams, sewer systems, surface soil, etc.) should be controlled immediately.
ECOTOXICITY: No data is available on this product. Individual constituents are as follows:
Copper: The toxicity of copper to aquatic organisms varies significantly not only with the species, but also with the physical and chemical characteristics of the water, such as its temperature, hardness, turbidity and carbon dioxide content. Copper concentrations varying from 0.1 to 1.0 mg/l have been found by various investigators to be not toxic for most fish. However, concentrations of 0.015 to 3.0 mg/l have been reported as toxic, particularly in soft water to many kinds of fish, crustaceans, mollusks, insects, and plankton.
Lead: LC50 (48 hrs.) to bluegill (Lepomis macrochirus) is reported to be 2-5 mg/l. Lead is toxic to waterfowl.
MOBILITY: Dissolved lead may migrate through soil.
PERSISTANCE/DEGRADABILITY: Lead may persist and accumulate in the environment.
BIOACCUMULATION: No data

13. DISPOSAL CONSIDERATIONS

Whenever possible, recover alloys for reuse or recycling. Solid metal is not a hazardous waste per U.S. E.P.A. If material has been processed, analyze and dispose of waste material in accordance with local, state, or federal regulations. For specific labeling, packing, storage, transportation, and disposal procedures, contact an Environmental Engineer or consultant familiar with waste disposal regulations.

14. TRANSPORT INFORMATION

As sold, these solid alloys are not regulated by the U.S. Department of Transportation and the International Air Transport Association. **Note**: metals transported in coiled form may be under tension and represent a source of potential energy due to the tension induced by coiling; it may uncoil to try to lay flat in a long strip when banding is cut or other forces are released; uncoiling can be sudden and catastrophic and measures should be taken to ensure that uncoiling will not occur.

The following information should be used by individuals with "Function-specific Training" required by U.S. Department of Transportation 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)

15. REGULATORY INFORMATION

SPECIFIC U.S. EPA REGULATIONS: Toxic Substance Control Act: Components of this material (see section 3) are listed in the TSCA inventory.
CERCLA: Components of this material (section 3) are listed as Hazardous Substances
EPA Superfund Amendment and Reauthorization Act (SARA) of 1986 Section 311/312(SARA Title III): Components of this material (section 3) are listed in SARA Title III, Section 311/312
EPA, SARA Section 313: Components of this material (section 3) are listed Section 313 and subject to Toxic Release Inventory reporting.
SARA Title III Hazard Categorization: Dust and fume are categorized as an immediate (acute) health hazard and a delayed (chronic) health hazard as defined by 40 CFR 370. Product is not categorized as a fire hazard, reactivity hazard or pressure release hazard.

16. OTHER INFORMATION

Revision Date: March 30, 2019

This information is designed only as guidance for safe handling, use, storage, transportation, and disposal and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Information contained herein is believed to be true and accurate at the date of its publication, 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.

WEEE/ROHS/ END OF LIFE VEHICLES, AND THE JAPANESE GREEN PROCUREMENT INITIATIVE: Uncoated stainless and specialty steels are generally in conformance with the requirements of the European Union's legislation on waste electrical and electronic equipment ("WEEE"; Directive 2002/53/EC) and its companion directive on the restriction on hazardous substances used in EEE ("RoHS": Directive 2002/95/EC & 2003/11/EC), as well as EU Directive 2000/53EC on End of Life Vehicles, and the Japanese Green Procurement Initiative.

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