MATERIAL SAFETY DATA SHEET

FEB 2 5 2001

SECTION 1 - PRODUCT IDENTIFICATION AND USE

GENERIC MSDS FOR: *Nickel-Base Alloys*

SUPPLIER & MANUFACTURER: ***Deloro Stellite Inc.***
471 Dundas Street E.
Belleville, Ontario
Canada K8N 1G2

TELEPHONE NO: (613) 968-3481

PRODUCT IDENTIFIER: ***Ni 100***

These metal products have a common physical nature and similar composition; the physical data applies to the indicated concentration ranges. However, the degree of health risk depends on the manner of use, the specific composition of the alloy, and how the manner of use results in the exposure of the user to the various components. This needs to be evaluated in the user's workplace, considering the potential simultaneous exposure to many constituent metals.

SECTION 2 - HAZARDOUS INGREDIENTS

Hazardous Ingredient	Symbol	CAS Number	NIOSH RTECS No.	LD50 – mg/Kg	LC50
Aluminum	Al	7429-90-5	BD 0330000	None	Not Available
Boron	B	7440-42-8	ED 7350000	300, Mammal, Oral	Not Available
Carbon	C	7440-44-0	FF 5250100	440, Mouse, Intravenous	Not Available
Cobalt	Co	7440-48-4	GF 8750000	6,170, Rat, Oral	Not Available
Chromium	Cr	7440-47-3	GB 4200000	None available	Not Available
Copper	Cu	7440-50-8	GL 5325000	3.5, Mouse, Intraperitoneal	Not Available
Iron	Fe	7439-89-6	NO 4565500	20,000, Guinea Pig, Oral	Not Available
Manganese	Mn	7439-96-5	OO 9275000	9,000, Rat, Oral	Not Available
Molybdenum	Mo	7439-98-7	QA 4680000	None available	Not Available
Nickel	Ni	7440-02-0	QR 5950000	250, Rat, Intraperitoneal	Not Available
Silicon	Si	7440-21-3	VW 0400000	3,160, Rat, Oral	Not Available
Titanium	Ti	13463-67-7	XR 2275000	None available	Not Available
Vanadium	V	7440-62-2	YW 1355000	59, Rabbit, Subcutaneous	Not Available
Tungsten	W	7440-33-7	YO 7175000	2,000, Rat, Unreported	Not Available

NOTE: Even where there are no reported LD50 or LC50 values, there can be toxic effects from these elements. See Section 6.

PERCENTAGE OF HAZARDOUS INGREDIENTS IN VARIOUS ALLOYS:

	Alloy Designations											
Elements	Nistelle: C, CSp, S, C-4C, C-22C. ASTM: CW6M, CW2M, CW12M, CW12MW.	N-12MV Alloy B Nistelle B-2C	Nistelle D	Nistelle 230	Nistelle X	Nistelle G-30C	Nistelle 3858	Stoody: 40G, 41, 41C, 41H, 45. Deloro: 40, 50, 60.	IN 625, Deloro 2265A	IN 718	Rene 41	Tribaloy 700, 745.
Al	–	–	–	.2–.5	–	–	5–7	–.	.01–.4	.4–.7	1–2	–
B	–	–	–	–	–	–	< .1	1–4	–	–	–	–
C	< .1	< .1	< .1	.05–.15	.01–.2	< .1	.05–.25	.1–1	.1–1	< .1	< .1	< .1
Co	.1–1	0–2.5	.1–1	1–3	.5–2.5	.1–1	–	.1–1	.1–.15	.1–1	10–12	< 3
Cr	15–23	0–1	.1–1	20–24	20–23	27–32	12–14	6–13	20–36	17–21	18–20	14–25
Cu	–	–	2–4	–	–	1.5–2.5	< .5	–	.01–.3	< .1	< .1	–
Fe	.1–7	0–7	1–2	1–3	17–20	14–17	< 3	1–6	1–5	15–20	1–5	< 3
Mn	.1–1	0–1	.1–1	.1–1	.1–1	.1–1	< .3	–	.1–.5	.1–.3	.01–.5	< .5
Mo	12–20	26–30	.1–1	1–3	8–10	4–6	3.5–5.5	–	8–12	2–4	9–11	25–35
Ni	40–70	55–75	70–90	50–70	40–60	60–80	65–80	60–80	50–75	50–55	40–60	30–60
Si	.1–1	0–1	9–11	.1–1	.1–1	.1–1	< .5	1–5	.1–1	.1–.5	.01–.5	.1–5
Ti	–	–	–	–	–	–	.5–1	–	.01–.40	.5–1.5	3–4	–
V	.01–.4	0–1	–	–	–	–	–	–	–	–	–	–
W	.1–6	–	–	13–15	.2–1	2–3	–	–	–	–	–	–

SECTION 3 - PHYSICAL DATA

Alloy Designations

	Nistelle: C, CSp, S, C-4C, C-22C. ASTM: CW6M, CW2M, CW12M, CW12MW.	N-12MV Alloy B Nistelle B-2C	Nistelle D	Nistelle 230	Nistelle X	Nistelle G-30C	Nistelle 3858	Stoody: 40G, 41, 41C, 41H, 45. Deloro: 40, 50, 60.	IN 625, Deloro 2265A	IN 718	Rene 41	Tribaloy 700, 745.
Density:												
- lb/in³	.323	.334	.297	.319	.297	.305	.289	.282	.305	.297	.298	.315
- gm/cm³	8.94	9.25	8.22	8.83	8.22	8.44	8.00	7.81	8.44	8.22	8.25	8.72
Melting Point:												
- °F	2300 to 2400	2400 to 2475	2000 to 2050	2375 to 2500	2300 to 2500	2300 to 2450	2300 to 2400	1750 to 1850	2250 to 2450	2300 to 2450	2400 to 2500	2250 to 2400
- °C	1260 to 1316	1316 to 1357	1093 to 1121	1302 to 1371	1260 to 1371	1260 to 1343	1260 to 1316	954 to 1010	1232 to 1343	1260 to 1343	1316 to 1371	1232 to 1316

Physical State - Solid; Colour - Grey; Odour - None.

SECTION 4 - FIRE AND EXPLOSION DATA

Non-Flammable; Flashpoint - None.

HAZARDOUS COMBUSTION PRODUCTS: Various elemental metals and metal oxides may be generated during welding or other melting operations. Refer to Section 6 for permissible exposure limits.

SECTION 5 - REACTIVITY DATA

These alloys are stable materials. However, contact with mineral acids and oxidizing agents should be avoided, as this may cause hydrogen gas to be generated, and hydrogen may be an explosion hazard.

SECTION 6 - TOXICOLOGICAL PROPERTIES

GENERAL HEALTH HAZARDS: Under normal handling and use of this material, there are few health hazards. However, machining, welding, etc., of this material can produce dust, fume, or particulate containing the component alloy elements. Particulates may present health hazards if they enter the body by one of the listed routes **in amounts exceeding the exposure limits.**

PRIMARY ROUTE(S) OF EXPOSURE: ***INHALATION:*** Inhalation of metal particulates may result from welding, grinding or similar operations which generate airborne material.
INGESTION: This is not a normal route of entry. Hand, clothing and food or drink contaminated with metal dust or particulate can cause metal ingestion during hand-to-mouth activities such as eating, drinking, smoking and nail biting.
SKIN: Irritation, allergic dermatitis or sensitization may occur from some components.
EYE: Contamination by airborne particulates or soiled fingers may result in abrasion or irritation.

EFFECTS OF OVER-EXPOSURE: ***ACUTE:***
Inhalation: Short, intensive exposure to copper, chromium and manganese may cause metal fume fever – a flu-like illness. Some forms of chromium, nickel, cobalt and tungsten carbides may cause asthma. Cobalt, chromium, boron, copper, vanadium, molybdenum, nickel and manganese are respiratory irritants.

Ingestion: Although an unlikely route of over-exposure, ingestion of cobalt, copper and vanadium may cause nausea, vomiting, diarrhea and abdominal pain.
Skin: Contact with copper, vanadium and nickel may cause dermatitis. Exposure to cobalt may cause dermatitis and other allergic skin reactions. Dermal exposure to manganese may result in increased sweating. Boron and vanadium exposure may cause irritation.
Eye: Particulates may cause irritation due to mechanical abrasion. Severe irritation or allergic conjunctivitis may result from contact with cobalt. Exposure to copper may irritate the eyes.

CHRONIC: Chronic health effects specific to an element may be difficult to detect due to the numerous elements in this alloy. Chronic inhalation effects may include chronic obstructive lung disease, pulmonary fibrosis, rhinitis and/or bronchitis. Chronic occupational exposure to cobalt has been associated with polycythemia (an increase in the total cell mass of the blood), bloody urine, and goitre (enlargement of the thyroid gland).

EXPOSURE LIMITS (ACGIH TLV) and CARCINOGENICITY CLASSIFICATIONS (ACGIH and IARC):

Symbol	Constituent	Form	ACGIH TLV-TWA (mg/m^3)	Carcinogen Designation	
				ACGIH	IARC
Al	Aluminum	Metallic	10	–	–
		Welding Fume	5	–	–
B	Boron	Oxide	10	–	–
C	Carbon	Black	3.5	A4	2B
Co	Cobalt	Metal	0.02	A3	
		and Compounds			2B
Cr	Chromium	Metal	0.5	A4	3
		Hexavalent (Insoluble)	0.01	A1	1
Cu	Copper	Oxide/Fume	0.2	–	–
		Dusts	1	–	–
Fe	Iron	Oxide	5	A4	–
Mn	Manganese		0.2	–	–
Mo	Molybdenum	Metal, Insoluble Compounds	10	–	–
			NoIC: I - 10, R - 3		
Ni	Nickel	Metal	1.5 - I	A5	2B
		Insoluble Compounds	0.2 - I	A1	1
		Soluble Compounds	0.1 - I	A4	1
Si	Silicon		10	–	–
Ti	Titanium		10	A4	3
V	Vanadium	Pentoxide	0.5 - R	A4	–
			As the Pentoxide		
W	Tungsten	Metal and Insoluble Compounds	5 (STEL = 10)	–	–
		Soluble Compounds	1 (STEL = 3)	–	–

I = "Inhalable"; R = "Respirable".
ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value;
TWA = Time-Weighted Average; STEL = Short-Term Exposure Limit.
IARC: International Agency for Research in Cancer.

ACGIH Classification:
A1 - Confirmed Human Carcinogen.
A2 - Suspected Human Carcinogen.
A3 - Confirmed Animal Carcinogen With Unknown Relevance to Humans.
A4 - Not Classifiable as to Human Carcinogen.
A5 - Not Suspected as a Human Carcinogen.

IARC Classification:
Group 1 - Carcinogenic to Humans.
Group 2A - Probably Carcinogenic to Humans.
Group 2B - Possibly Carcinogenic to Humans.
Group 3 - Not Classified as to Human Carcinogenicity.
Group 4 - Probably Not Carcinogenic to Humans.

CARCINOGENICITY: Some of the elements in this alloy have been identified as a cancer risk by The International Agency for Research on Cancer (IARC). Exposure to cobalt, cobalt compounds, nickel, nickel compounds, and hexavalent chromium may cause or contribute to an increased risk in cancer among workers.

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

SECTION 7 - PREVENTATIVE MEASURES

VENTILATION: To control exposure to airborne dust, fume and particulate, maintain the working environment below the recommended exposure limits by use of adequate ventilation.

RESPIRATORY: If ventilation is not adequate to maintain levels below the exposure limits, respiratory protection should be used. NIOSH-approved respirators with a high efficiency particulate air purifying filter are recommended.

SKIN: Leather or rubber gloves are recommended to avoid prolonged contact with the skin, and to prevent metal cuts and abrasions. Skin contact can be minimized by the use of clean, protective coveralls.

EYE: Wear safety glasses or goggles when particulates are generated.

RECOMMENDED MONITORING PROCEDURES: ***ENVIRONMENTAL SURVEILLANCE:*** Exposure to the elements identified in Section 2 can be best determined by having air samples taken in the employee breathing zone, work area or department.

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

WASTE DISPOSAL: It is the ultimate responsibility of the waste generator to determine at the time of disposal whether the product meets any hazardous waste criteria. Follow all applicable Federal, Provincial and Local regulations regarding waste management methods.

SECTION 8 - FIRST AID MEASURES

INHALATION: Breathing difficulty caused by inhalation of dust, fumes or particulate requires removal to fresh air. If breathing does not improve, contact a physician.

INGESTION: If conscious, have the person swallow copious amounts of water. Contact a physician.

SKIN: Wash contaminated area with water; remove contaminated clothing, and shower. If irritation persists, seek medical attention.

EYE: Irrigate with copious amounts of water. If irritation persists, seek medical assistance. Contact lenses should not be worn if working with metal dusts and powders.

SECTION 9 - PREPARATION DATE OF MSDS

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DATE PREPARED: January, 2001