# *MATERIAL SAFETY DATA SHEET*

## *SECTION 1 - PRODUCT IDENTIFICATION AND USE*

***GENERIC MSDS FOR:*** *Iron-Base Alloys*

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

***TELEPHONE NO:*** (613) 968-3481

***DATE PREPARED:*** January 30, 2007
***EXPIRATION DATE:*** January 30, 2010

***PRODUCT IDENTIFIER:*** ***Fe 100*** 

***PRODUCT USE:*** Wear- and Corrosion-Resistant Components.

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 the potential simultaneous exposure to many constituent metals.

## *SECTION 2 - HAZARDOUS INGREDIENTS*

| Hazardous Ingredient | Symbol | CAS Number | NIOSH RTECS No. | LD50 – mg/Kg | LC50 |
|---|---|---|---|---|---|
| Carbon | C | 7440-44-0 | FF 5250100 | 10,000, Rat, Oral | Not Available |
| Cobalt | Co | 7440-48-4 | GF 8750000 | 6,170, Rat, Oral | 10 mg/L/1H, Rat |
| 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 | 984, Rat, 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 | 9,000, Rat, Oral | Not Available |
| Silicon | Si | 7440-21-3 | VW 0400000 | 3, 160, Rat, Oral | 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 | Delcrome 93 | Delcrome W & 90 | SS: 304, 309, 310. ASTM: CF-8, CF-16. CH-20 CK-20 CF-8C | Tristelle TS-1 TS-2 TS-3 | SS: 316, 317. ASTM: CF-3M CF-8M CG-8M CG-3M | SS: 20-CB-3. & ASTM: CN-7M. | Ferralium 255. CD 4MCu. 17-4PH 15-4PH AMS: 5342, 5355. | Norem: 02, B1, B4. | SS: 410, 440C. ASTM: CA-15, CA-40. AMS: 5350, 5352. | Mul-timet N155 & 716. | ASTM: CA-6NM |
| C | 3–3.5 | 2–3 | .01–.2 | 0.5–3.5 | < 1 | < .1 | < .1 | .1–1.5 | .1–1 | .1–1 | < .1 |
| Co | 6–6.5 | – | – | 8–15 | – | – | – | 0–11 | – | 10–21 | – |
| Cr | 17–19 | 26–31 | 18–30 | 25–40 | 18–22 | 19–21 | 15–27 | 15–27 | 11–18 | 20–27 | 11–14 |
| Cu | – | – | – | – | – | 3–4 | 1–4 | – | – | – | – |
| Fe | 45–55 | 60–70 | 60–75 | 35–55 | 60–75 | 60–75 | 70–80 | 45–65 | 80–90 | 15–30 | 75–85 |
| Mn | – | .5–1.5 | .5–1.5 | – | .5–1.5 | 1–2 | .1–2 | 4–9 | .1–1 | .5–1.5 | .1–1 |
| Mo | 15–17 | – | .1–.5 | – | 2–4 | 2–3 | 0–4 | 1–3 | – | 2–4 | .4–1 |
| Ni | – | .1–1 | 9–30 | 5–15 | 9–13 | 24–30 | 4–7 | 0–6 | – | 19–25 | 3–5 |
| Si | .1–1 | .1–1 | .5–2 | 3–6 | .5–1.5 | .1–1 | .1–2 | 2.5–5.5 | .1–1 | .1–1 | .1–1 |
| V | 1.5–2.5 | .1–1 | – | – | – | – | – | – | – | – | – |
| W | – | – | – | – | – | – | – | – | – | 2–3 | – |

## *SECTION 3 - PHYSICAL DATA*

Alloy Designations

| | Delcrome 93 | Delcrome W & 90 | SS: 304, 309, 310. ASTM: CF-8, CF-16. CH-20 CK-20 CF-8C | Tristelle TS-1 TS-2 TS-3 | SS: 316, 317. ASTM: CF-3M CF-8M CG-8M CG-3M | SS: 20-CB-3 & ASTM: CN-7M | Ferralium 255. CD 4MCu. 17-4PH 15-4PH AMS: 5342, 5355. | Norem: 02, B1, B4. | SS: 410, 440C. ASTM: CA-15, CA-40. AMS: 5350, 5352. | Mul-timet N155 & 716. | ASTM: CA-6NM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Density**: | | | | | | | | | | | |
| - lb/in³ | .281 | .274 | .280 | .26 | .280 | .289 | .282 | .281 | .275-.280 | .295 | .278 |
| - gm/cm³ | 7.78 | 7.58 | 7.75 | 7.20 | 7.75 | 8.00 | 7.81 | 7.81 | 7.61-7.75 | 8.17 | 7.70 |
| **Melting Point**: °F | 2080-2200 | 2500-2550 | 2500-2650 | 2300- 2600 | 2550 | 2650 | 2550-2650 | 2400- 2600 | 2650-2800 | 2350-2500 | 2750 |
| °C | 1138-1204 | 1371-1399 | 1371-1454 | 1260-1427 | 1399 | 1454 | 1399-1454 | 1316-1427 | 1454-1538 | 1288-1371 | 1510 |

**Physical State** – Solid
**Odour** – None
**Colour** – Grey
**Odour Threshold** – Not Applicable
**Vapour Pressure** – Not Applicable
**Vapour Density** – Not Applicable
**Boiling Point** – Not Applicable
**PH** – Not Applicable
**Evaporation Rate** – Not Applicable
**Freezing Point** – See Melting Point
**Specific Gravity** – See Density
**Coefficient of Water/Oil Dist.** – Not Applic.

## *SECTION 4 - FIRE AND EXPLOSION DATA*

**Conditions of Flammability** – Non-Flammable
**Means of Extinction** – Not Applicable
**Flashpoint & Method of Determination** – Not Applicable
**Upper Flammable Limit** – Not Applicable
**Lower Flammable Limit** – Not Applicable
**Autoignition Temperature** – Not Applicable
**Explosion Data** – Sensitivity to:
- Mechanical Impact – Not Applicable
- Static Discharge – Not Applicable

***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*

**Conditions of Instability** – Stable.
**Incompatible With** – May react with acids to produce hydrogen gas.
**Conditions of Reactivity** – Stable under ambient temperature and pressure.
**Hazardous Decomposition Products** – Metal oxides & fumes under extreme heat.

## *SECTION 6 - TOXICOLOGICAL PROPERTIES*

**Teratogenicity** – Not Available.
**Respiratory Sensitization** – Not Available.
**Reproductive Toxicity** – Not Available.
**Toxicologically Synergistic Products** – Not Available.
**Mutagenicity** – Not Available.

***GENERAL HEALTH HAZARDS:*** Under normal handling and use of this material, there are few health hazards. However, machining, grinding, 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, 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, chromium, 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. 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):***

| | | | ACGIH TLV-TWA | Carcinogen Designation | |
|---|---|---|---|---|---|
| **Symbol** | **Constituent** | **Form** | **(mg/m³)** | **ACGIH** | **IARC** |
| C | Carbon | Black | 3.5 | A4 | 2B |
| Co | Cobalt | Metal<br>and Compounds | 0.02 | A3 | 2B |
| Cr | Chromium | Metal<br>Hexavalent (Insoluble) | 0.5<br>0.01 | A4<br>A1 | 3<br>1 |
| Cu | Copper | Oxide/Fume<br>Dusts | 0.2<br>1 | –<br>– | –<br>– |
| Fe | Iron | Oxide | 5 | A4 | 3 |
| Mn | Manganese | | 0.2 | – | – |
| Mo | Molybdenum | Metal, Insoluble Compounds<br>Soluble Compounds & Total Dust | 10<br>5 | – | – |
| Ni | Nickel | Metal<br>Insoluble Compounds<br>Soluble Compounds | 1.5 - I<br>0.2 - I<br>0.1 - I | A5<br>A1<br>A4 | 2B<br>1<br>1 |
| Si | Silicon | | – | – | – |
| V | Vanadium | Pentoxide | 0.05 - R<br>As the Pentoxide | A4 | 2B |
| W | Tungsten | Metal and Insoluble Compounds<br>Soluble Compounds | 5 (STEL = 10)<br>1 (STEL = 3) | –<br>– | –<br>– |

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*

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|---|---|
| ***STORAGE/HANDLING PRECAUTIONS:*** | In solid form, this material poses no special problems. This product must be handled according to the size, shape and quantity of material involved. |
| ***LEAK OR SPILL:*** | Not Applicable. |
| ***VENTILATION:*** | To control exposure to airborne dust, fume and particulate when machining, grinding, welding, etc., on these materials, 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.<br><br>***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*

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|---|---|
| ***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 for at least 5 minutes. 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*

| | |
|---|---|
| ***PREPARED BY:*** | J. Davies - Engineering Manager |
| ***TELEPHONE:*** | (613) 968-3481. |
| ***DATE PREPARED:*** | January 30, 2007 |
| ***EXPIRATION DATE:*** | January 30, 2010 |