MATERIAL SAFETY DATA SHEET

FOR WELDING CONSUMABLES AND RELATED PRODUCTS

CONFORMS TO WHMIS - WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM

SECTION I - PRODUCT IDENTIFICATION AND USE

PRODUCT IDENTIFIER: FERRITIC STEEL ALLOYS

PRODUCT USE: SMAW, GTAW, GMAW, FCAW, SAW

PRODUCT TYPES:

GROUP A : MILD STEEL COVERED WIRE
- 6010, 6011, 6012, 6013, 6014, 7010, 7014, 7016, 7018, 7024, S1012, S1012HS, S1018XLM

GROUP B : MILD STEEL SOLID WIRE
- 70S-2, 70S-3, 70S-6, RG-45, RG-60, RG-65, L12, M12K, H14, 802, S1012, S1015

GROUP C : LOW ALLOY COVERED WIRE
- 7010-A1, 7015-C2L, 7018-A1, 7018-A1 Mo, 7018-A1 XLM, 7018M, 8015-B2L, 8016-C3, 8018-B2, 8018-B2L, 8018-C1, 8018-C2, 8018-C3, 8018-CM, 8018G, 9015-B3L, 9018-B3, 9018-B3L, 9018CM, 9018-D1, 9018M, 10016-D2, 10018-D2, 10018M, 11018M, 12018M, 4130, 4340, SST-1E, SBU-1E

GROUP D : LOW ALLOY SOLID WIRE
- 80S-D2, 80S-B2, 521(G), 80S-B2L, 521GL, 80S-Ni1, 80S-Ni2, 80S-Ni3, 90S-B2L, 90S-B3, 90S-B3L, 90S-CM, 4130, 100S-1, 110S-1, 120S-1, Ni-1, Ni-2, Ni-3, Ni-4, A1, A2, A3, B2, B3, B6, F1, F2, F3, F4, F5, F6

GROUP E : CHROMIUM COVERED WIRE
- 410, 410Ni, 410NiMo, 414, 502, 505

GROUP F : CHROMIUM SOLID WIRE
- 409Cb, 410, 410NiMo, 420, 430, 446, 502, 505, 521, 8620

GROUP G : HIGH ALLOY COVERED WIRE
- S2000, S2500, S3000

GROUP H : HIGH ALLOY SOLID WIRE
- S2000-S, S2500, S3000-S

GROUP I : HIGH ALLOY FLUX-CORED WIRE
- S2000-0, S3000

GROUP J : STEEL FLUX-CORED WIRE
- 70T-1, 70T-2, 70T-4, 70T-5, 70T-6, 70T-7, 70T-9, 71T-1, 71T-8, 71T8-K6, 71T-GS, 71T-11, 80T-A1, 80T1-Ni1, 80T5-B2, 80T5-B2L, 81T1-B2, 88CM, 81T1-Ni2, 90T1-B3, 90T1-B3L, 90T5-Ni3, 91T1-B3, 91T1-K2, 100T-CM, 100T1-K3, 100T5-D2, 101T1-K7, 110T1-K3, 110T5-K3, 110T5-K4, 120T5-K4, 410T-1, 410T-3, 410NiMoT-1, 502T-1, 505T-1, 505-9CM, 4130LNN, SST-0

SUPPLIER NAME:	SABALLOY INC
STREET ADDRESS:	13315 – 146 STREET
CITY, PROVINCE:	EDMONTON, ALBERTA
POSTAL CODE:	T5L 4S8
EMERGENCY TELEPHONE NUMBER:	(780) 454-0010

SECTION II - HAZARDOUS INGREDIENTS

NOTE: THE TERM "HAZARDOUS" SHOULD BE INTERPRETED AS A TERM REQUIRED AND DEFINED IN THE HAZARDOUS PRODUCTS ACT AND DOES NOT NECESSARILY IMPLY THE EXISTENCE OF ANY HAZARD.

IMPORTANT - THIS SECTION COVERS THE MATERIALS FROM WHICH THESE PRODUCTS ARE MANUFACTURED AND ARE APPLICABLE TO DUST GENERATED BY MECHANICAL CUTTING OR GRINDING.

- FUMES AND GASES PRODUCED DURING WELDING ARE COVERED IN SECTION V – REACTIVITY DATA

GROUP A - MILD STEEL COVERED WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
ALUMINUM, DUST as Al	7429 – 90 – 5	0.05 – 0.15	10 / N.AV.	N.AV. / N.AV.
CALCIUM CARBONATE	1317 – 65 – 3	1 – 10	10 / N.AV.	6450mg / Kg RAT, ORAL / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 0.5	1 / N.AV.	N.AV. / N.AV.
FLUORIDE, as F	7782 – 41 – 4	0 – 4	2.5 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	97 – 99	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as MN	7439 – 96 – 5	0 – 1.5	5 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 1.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP B – MILD STEEL SOLID WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
ALUMINUM, DUST as Al	7429 – 90 – 5	0.05 – 0.15	10 / N.AV.	N.AV. / N.AV.
COPPER DUST, as Cu	7440 – 50 – 8	0 – 0.5	1 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	97 – 99	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn	7439 – 96 – 5	0.5 – 1.5	5 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 1.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP C – LOW ALLOY COVERED WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
CALCIUM CARBONATE	1317 – 65 – 3	1 – 10	10 / N.AV.	6450 mg / Kg RAT, ORAL / N.AV.
CHROMIUM, METAL	7440 – 47 – 3	0 – 3	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 3	1 / N.AV.	N.AV. / N.AV.
FLUORIDE, as F	7782 – 41 – 4	3 – 4	2.5 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	70 – 98	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn	7439 – 96 – 5	0 – 3	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 2	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	0 – 4	0.05 / N.AV.	N.AV. / N.AV.
SILICA, CRYSTALLINE CRYSTOBALITE, RESPIRABLE DUST	14464 – 46 – 1	18 – 22	0.05 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 3	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP D – LOW ALLOY SOLID WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
ALUMINUM, DUST as Al	7429 – 90 – 5	0 – 1	10 / N.AV.	N.AV. / N.AV.
CHROMIUM, METAL	7440 – 47 – 3	0 – 3	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 1	1 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	70 – 98	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as MN	7439 – 96 – 5	0 – 3	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 1.5	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	0 – 4	0.05 – N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 2	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP E – CROMIUM COVERED WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
ALUMINUM, DUST as Al	7429 – 90 – 5	0 – 1	10 / N.AV.	N.AV. / N.AV.
CALCIUM CARBONATE	1317 – 65 – 3	1 – 10	10 / N.AV.	6450 mg / Kg RAT, ORAL / N.AV.
CHROMIUM, METAL	7440 – 47 – 3	4.5 – 15	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 2.5	1 / N.AV.	N.AV. / N.AV.
FLUORIDE, as F	7782 – 41 – 4	3 – 4	2.5 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	80 – 98	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn	7439 – 98 – 7	0 – 2.5	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 4.7	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	0 – 5	0.05 / N.AV.	N.AV. / N.AV.
SILICA, CRYSTALLINE CRYSTOBALITE, RESPIRABLE DUST	14464 – 46 – 1	18 – 22	0.05 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 2.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP F – SOLID WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
ALUMINUM, DUST as Al	7429 – 90 – 5	0 – 1	10 / N.AV.	N.AV. / N.AV.
CHROMIUM, METAL	7440 – 47 – 3	4.5 – 15	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 2.5	1 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	80 – 94	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn	7439 – 96 – 5	0 – 2.5	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 4.7	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	0 – 5	0.05 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 2.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP G – HIGH ALLOY COVERED WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
CALCIUM CARBONATE	1317 – 65 – 3	1 – 10	10 / N.AV.	6450 mg / Kg RAT, ORAL / N.AV.
CHROMIUM, METAL	7440 – 47 – 3	15 – 30	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 3	1 / N.AV.	N.AV. / N.AV.
FLUORIDE, as F	7782 – 41 – 4	3 – 4	2.5 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	45 – 70	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn DUST AND COMPOUNDS	7439 – 96 – 5	1 – 10	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 4	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	8 – 15	0.05 / N.AV.	N.AV. / N.AV.
SILICA, CRYSTALLINE CRYSTOBALITE, RESPIRABLE DUST	14464 – 46 – 1	18 – 22	0.05 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 3	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP H – HIGH ALLOY SOLID WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
CHROMIUM, METAL	7440 – 47 – 3	15 – 30	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 3	1 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	45 – 70	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn DUST AND COMPOUNDS	7439 – 96 – 5	1 – 10	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 4	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	8 – 15	0.05 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 3	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP I – HIGH ALLOY FLUX-CORED WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
CALCIUM CARBONATE	1317 – 65 – 3	1 – 10	10 / N.AV.	6450 mg / Kg RAT, ORAL / N.AV.
CHROMIUM, METAL	7440 – 47 – 3	15 – 30	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 3	1 / N.AV.	N.AV. / N.AV.
FLUORIDE, as F	7782 – 41 – 4	3 – 4	2.5 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	45 – 70	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn	7439 – 98 – 5	1 – 10	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 4	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	8 – 15	0.05 / N.AV.	N.AV. / N.AV.
SILICA, CRYSTALLINE CRYSTOBALITE, RESPIRABLE DUST	14464 – 46 – 1	18 – 22	0.05 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 3	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP J – STEEL FLUX-CORED WIRE

INGREDIENT	CAS #	% WT.	TWA / STEL	LD50 / LC50
CALCIUM CARBONATE	1317 – 65 – 3	1 – 10	10 / N.AV.	6450 mg / Kg RAT, ORAL / N.AV.
CHROMIUM, METAL	7440 – 47 – 3	0 – 3	0.5 / N.AV.	N.AV. / N.AV.
COPPER, DUST, as Cu	7440 – 50 – 8	0 – 3	1 / N.AV.	N.AV. / N.AV.
FLUORIDE, as F	7782 – 41 – 4	3 – 4	2.5 / N.AV.	N.AV. / N.AV.
IRON, as IRON OXIDE	1309 – 37 – 1	70 – 98	5 / N.AV.	N.AV. / N.AV.
MANGANESE, as Mn	7439 – 96 – 5	0 – 3	5 / N.AV.	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS, as Mo	7439 – 98 – 7	0 – 2	5 / N.AV.	N.AV. / N.AV.
NICKEL, METAL	7440 – 02 – 0	0 – 4	0.05 / N.AV.	N.AV. / N.AV.
SILICA, CRYSTALLINE CRYSTOBALITE, RESPIRABLE DUST	14464 – 46 – 1	18 – 22	0.05 / N.AV.	N.AV. / N.AV.
SILICON	7440 – 21 – 3	0 – 3	10 / N.AV. (NOTE A)	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	0 – 3.5	10 / N.AV. (NOTE A)	N.AV. / N.AV.

NOTE: TWA / STEL ARE IN mg / m3

WHERE STEL IS N.AV., EXCURSIONS IN WORKER EXPOSURE LEVEL MAY EXCEED 3 TIMES THE TWA FOR NO MORE THAN A TOTAL OF 30 MINUTES DURING A WORKDAY, AND UNDER NO CIRCUMSTANCES SHOULD THEY EXCEED 5 TIMES THE TWA, PROVIDED THE TWA IS NOT EXCEEDED.

A) TOTAL DUST, CONTAINING NO ASBESTOS AND 1% CRYSTALLINE SILICA

SECTION III – PHYSICAL DATA

PHYSICAL STATE: SOLID

APPEARANCE: METAL WIRE OF VARIOUS DIAMETERS, BARE WIRE OR COATED WITH FLUX,

NOTE: OTHER PHYSICAL DATA IS NOT APPLICABLE OR NOT AVAILABLE.

SECTION IV - FIRE AND EXPLOSION DATA

WELDING CONSUMABLES AND RELATED PRODUCTS AS SHIPPED ARE NON-FLAMMABLE, NON-EXPLOSIVE, AND NON-HAZARDOUS UNTIL WELDED. WELDING ARCS AND THE RESULTING SPARKS CAN IGNITE COMBUSTIBLES AND FLAMMABLE PRODUCTS.

SECTION V - REACTIVITY DATA

CHEMICAL STABILITY: STABLE

INCOMPATIBILITY WITH: AVOID CONTACT WITH ACIDS OR BASES

CONDITION OF REACTIVITY: STABLE UNDER AMBIENT TEMPERATURE

AND PRESSURE

HAZARDOUS DECOMPOSITION PRODUCTS: METAL OXIDES AND FUMES

WELDING FUMES AND GASES CANNOT BE CLASSIFIED SIMPLY. THE COMPOSITION AND QUANTITY OF BOTH ARE DEPENDENT UPON THE METAL BEING WELDED, THE PROCESS, PROCEDURES, AND ELECTRODES USED. OTHER CONDITIONS WHICH ALSO INFLUENCE THE COMPOSITION AND QUANTITY OF THE FUMES AND GASES TO WHICH WORKERS MAY BE EXPOSED INCLUDED: COATINGS ON THE METAL BEING WELDED (SUCH AS PAINT, PLATING OR GALVANIZING), THE NUMBER OF WELDERS AND THE VOLUME OF WORK AREA, THE QUALITY AND AMOUNT OF VENTILATION, THE POSITION OF THE WELDER'S HEAD WITH RESPECT TO THE FUME PLUME, AS WELL AS THE PRESENCE OF CONTAMINANTS IN THE ATMOSPHERE (SUCH AS CHLORINATED HYDROCARBON VAPORS FROM CLEANING AND DEGREASING ACTIVITIES).

GROUP A - MILD STEEL COVERED WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
ALUMINUM, FUME, as Al	7429 – 90 – 5	5 / N.AV.	N.AV. / N.AV.
CALCIUM FLUORIDE as FLUORIDE	7789 – 75 – 5	2.5 (F) / N.AV.	4250 mg / Kg RAT, ORAL / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
HYDROGEN FLUORIDE as FLUORIDE	7664 – 39 – 3	2.6 / N.AV. (NOTE B)	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP B – MILD STEEL SOLID WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
ALUMINUM, FUME, as Al	7429 – 90 – 5	5 / N.AV.	N.AV. / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP C – LOW ALLOY COVERED WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
CALCIUM FLUORIDE as FLUORIDE	7789 – 75 – 5	2.5 (F) / N.AV.	4250 mg / Kg RAT, ORAL / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
HYDROGEN FLUORIDE as FLUORIDE	7664 – 39 – 3	2.6 / N.AV. (NOTE B)	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NICKEL, SOLUBLE COMPOUNDS, as Ni	7440 – 02 – 0	0.05 / N.AV.	N.AV. / N.AV.
NITRIC OXIDE	10102 – 43 – 9	31 / N.AV.	N.AV. / 315 ppm (15min) RABBIT, INHALATION
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP D – LOW ALLOY SOLID WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
ALUMINUM, FUME, as Al	7429 – 90 – 5	5 / N.AV.	N.AV. / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NICKEL, SOLUBLE COMPOUNDS, as Ni	7440 – 02 – 0	0.05 / N.AV.	N.AV. / N.AV.
NITRIC OXIDE	10102 – 43 – 9	31 / N.AV.	N.AV. / 315 ppm (15min) RABBIT, INHALATION
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.

GROUP E – CHROMIUM COVERED WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
ALUMINUM, FUME, as Al	7429 – 90 – 5	5 / N.AV.	N.AV. / N.AV.
CALCIUM FLUORIDE as FLUORIDE	7789 – 75 – 5	2.5(F) / N.AV.	4250 mg / Kg RAT, ORAL / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
HYDROGEN FLUORIDE as FLUORIDE	7664 – 39 – 3	2.6 / N.AV. (NOTE B)	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NITRIC OXIDE	10102 – 43 – 9	31 / N.AV.	N.AV. / 315 ppm (15min) RABBIT, INHALATION
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP F – CHROMIUM SOLID WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
ALUMINUM, FUME, as Al	7429 – 90 – 5	5 / N.AV.	N.AV. / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NICKEL, SOLUBLE COMPOUNDS, as Ni	7440 – 02 – 0	0.05 / N.AV.	N.AV. / N.AV.
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP G – HIGH ALLOY COVERED WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
CALCIUM FLUORIDE as FLUORIDE	7789 – 75 – 5	2.5 (F) / N.AV.	4250 mg/Kg RAT, ORAL / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
HYDROGEN FLUORIDE as FLUORIDE	7664 – 39 – 3	2.6 / N.AV. (NOTE B)	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NICKEL, SOLUBLE COMPOUNDS, as Ni	7440 – 02 – 0	0.05 / N.AV.	N.AV. / N.AV.
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP H – HIGH ALLOY SOLID WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE as WELDING FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NICKEL, SOLUBLE COMPOUNDS, as Ni	7440 – 02 – 0	0.05 / N.AV.	N.AV. / N.AV.
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP H – HIGH ALLOY SOLID WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
CALCIUM FLUORIDE as FLUORIDE	7789 – 75 – 5	2.5 (F) / N.AV.	4250 mg/Kg RAT, ORAL / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
HYDROGEN FLUORIDE as FLUORIDE	7664 – 39 – 3	2.6 / N.AV. (NOTE B)	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NICKEL, as Ni	7440 – 02 – 0	0.05 / N.AV.	N.AV. / N.AV.
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

GROUP J – STEEL FLUX-CORED WIRE

INGREDIENT	CAS #	TWA / STEL	LD50 / LC50
CALCIUM FLUORIDE as FLUORIDE	7789 – 75 – 5	2.5 (F) / N.AV.	4250 mg/Kg RAT, ORAL / N.AV.
CARBON DIOXIDE	124 – 38 – 9	9000 / 54000	N.AV. / N.AV.
CARBON MONOXIDE	630 – 08 – 0	57 / 458	N.AV. / N.AV.
CHROMIUM (CROMATES) CROMIUM (VI), as Cr	7440 – 47 – 3	0.05 / N.AV.	80 mg / Kg RAT, ORAL / N.AV.
COPPER, FUME, as Cu	7440 – 50 – 8	0.2 / N.AV.	N.AV. / N.AV.
HYDROGEN FLUORIDE as FLUORIDE	7664 – 39 – 3	2.6 / N.AV. (NOTE B)	N.AV. / N.AV.
IRON OXIDE FUME as Fe	1309 – 37 – 1	5 / N.AV.	5500 mg / Kg RAT, INTRAPERITONEAL / N.AV.
MANGANESE, as FUME	7439 – 96 – 5	1 / 3	N.AV. / N.AV.
MOLYBDENUM, SOLUBLE COMPOUNDS as Mo	7439 – 98 – 7	5 / N.AV.	N.AV. / N.AV.
NICKEL, as Ni	7440 – 02 – 0	0.05 / N.AV.	N.AV. / N.AV.
NITRIC OXIDE	10102 – 43 – 9	31 / N.AV.	N.AV. / 315 ppm (15min) RABBIT, INHALATION
NITROGEN DIOXIDE	10102 – 44 – 0	5.6 / 9.4	N.AV. / 88 ppm / 4hrs RAT, INHALATION
OZONE	10028 – 15 – 6	0.2 / N.AV.	N.AV. / N.AV.
SILICA, AMORPHOUS PRECIPITATED SILICA	112926 – 00 – 8	10 / N.AV.	N.AV. / N.AV.
TITANIUM DIOXIDE	13463 – 67 – 7	10 / N.AV. (NOTE A)	N.AV. / N.AV.

NOTE: TWA / STEL ARE IN mg / m3

WHERE STEL IS N.AV., EXCURSIONS IN WORKER EXPOSURE LEVEL MAY EXCEED 3 TIMES THE TWA FOR NO MORE THAN A TOTAL OF 30 MINUTES DURING A WORKDAY, AND UNDER NO CIRCUMSTANCES SHOULD THEY EXCEED 5 TIMES THE TWA, PROVIDED THE TWA IS NOT EXCEEDED.

A) TOTAL DUST, CONTAINING NO ASBESTOS AND 1% CRYSTALLINE SILICA
B) CEILING LIMIT, NOT A TIME WEIGHTED AVERAGE, IN mg / m3

SECTION VI - TOXICOLOGICAL PROPERTIES

ROUTE OF ENTRY:	INHALATION (PRIMARY) SKIN AND EYES
EFFECTS OF ACUTE EXPOSURE:	WELDING FUMES MAY RESULT IN DISCOMFORT SUCH AS DIZZINESS, NAUSEA, OR DRYNESS OR IRRITATION OF NOSE, THROAT, EYES.
EFFECTS OF CHRONIC EXPOSURE:	WELDING FUMES CAN CAUSE LUNG DAMAGE AND DAMAGE TO OTHER ORGANS

SECTION VII - PREVENTATIVE MEASURES

PERSONAL PROTECTIVE EQUIPMENT:

PERSONAL PROTECTIVE CLOTHING – WEAR HAND, HEAD, AND BODY PROTECTION WHICH HELP TO PREVENT INJURY FROM RADIATION, SPARKS, AND ELECTRICAL SHOCK. AT A MINIMUM THIS INCLUDES WELDER'S GLOVES AND A PROTECTIVE FACE SHIELD, AND MAY INCLUDE ARM PROTECTORS, APRONS HATS, SHOULDER PROTECTION, AS WELL AS DARK SUBSTANTIAL CLOTHING. TRAIN WELDERS NOT TO TOUCH LIVE ELECTRICAL PARTS AND TO INSULATE THEMSELVES FROM WORK AND GROUND.

RESPIRATORY PROTECTION – USE APPROVED FUME RESPIRATOR OR AIR SUPPLIED RESPIRATOR WHEN WELDING IN CONFINED SPACE OR WHERE EXHAUST OR VENTILATION DOES NOT KEEP EXPOSURE BELOW TLV'S.

EYE PROTECTION – WEAR HELMET OR USE FACE SHIELD WITH FILTER LENS. AS A RULE OF THUMB, START WITH A SHADE THAT IS TOO DARK TO SEE THE WELD ZONE. THEN GO TO A LIGHTER SHADE (A LOWER NUMBER SHADE) WHICH GIVES SUFFICIENT VIEW OF THE WELD ZONE. (SEE W117.2 SAFETY IN WELDING, CUTTING AND ALLIED PROCESSES PUBLISHED BY THE CANADIAN STANDARD ASSOCIATION)

SPECIAL PRECAUTIONS – READ AND UNDERSTAND THE MANUFACTURER'S PRODUCT DATA SHEET. MAINTAIN EXPOSURE BELOW THE TLV'S. USE INDUSTRIAL HYGIENE MONITORING TO ENSURE THAT YOUR USE OF THIS PRODUCT DOES NOT CREATE EXPOSURE WHICH EXCEED TLV'S. ALWAYS USE EXHAUST VENTILATION.

ENGINEERING CONTROLS:	USE ENOUGH VENTILATION, LOCAL EXHAUST AT THE ARC, OR BOTH, TO KEEP THE FUMES AND GASES BELOW TLV'S IN THE WORKER'S BREATHING ZONE AND THE GENERAL AREA. TRAIN WELDERS TO KEEP THEIR HEADS

	OUT OF THE FUMES.
LEAK AND SPILL PROCEDURE:	NOT APPLICABLE
WASTE DISPOSAL:	PREVENT WASTE FROM CONTAMINATING SURROUNDING ENVIRONMENT. DISCARD PRODUCT, RESIDUE, DISPOSABLE CONTAINER OR LINER IN AN ENVIRONMENTALLY ACCEPTABLE MANNER, IN FULL COMPLIANCE WITH FEDERAL, AND LOCAL REGULATIONS.
HANDLING PROCEDURES AND EQUIPMENT:	REFER TO PERSONAL PROTECTIVE EQUIPMENT
STORAGE REQUIREMENTS:	DRY AT ROOM TEMPERATURE. HUMIDITY SHOULD BE BELOW 70% AND TEMPERATURE WITHIN THE LIMITS 5 TO 50 DEGREES CELSIUS.
SPECIAL SHIPPING INFORMATION:	NOT APPLICABLE

SECTION VIII - FIRST AID MEASURES

INHALATION:	REMOVE FROM EXPOSURE AND SEEK IMMEDIATE MEDICAL AID. IF VICTIM IS UNCONSCIOUS, ADMINISTER OXYGEN. IF NOT BREATHING, RESUSCITATE IMMEDIATELY. EMPLOY FIRST AID TECHNIQUES SUCH AS RECOMMENDED BY ST. JOHN'S AMBULANCE.
EYES & SKIN:	WASH EYES AND SKIN WITH WATER, TO REMOVE DUST. IF IRRITATION PERSISTS AFTER EXPOSURE, CONSULT A PHYSICIAN.
SPECIAL MEASURES:	READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTIONS AND THE PRECAUTIONARY LABEL ON THE PRODUCT.

SECTION IX – ADDITIONAL INFORMATION

ABBREVIATIONS

CAS #	- CHEMICAL ABSTRACTS SERVICE #
%WT.	- PERCENTAGE WEIGHT OF PRODUCT
TWA	- TIME-WEIGHTED AVERAGE - CONCENTRATION FOR A NORMAL 8 HOUR WORKDAY AND A 40 HOUR WORKWEEK, TO WHICH NEARLY ALL WORKERS MAY BE EXPOSED, DAY AFTER DAY, WITHOUT EFFECT.
STEL	- SHORT TERM EXPOSURE LIMIT - CONCENTRATION IN A 15 MINUTE

TIME-WEIGHTED AVERAGE WHICH SHOULD NOT BE EXCEEDED AT ANY TIME DURING A WORKDAY EVEN IF THE 8 HOUR TIME-WEIGHTED AVERAGE IS WITHIN THE TLV.

CEILING LIMIT	- THE CONCENTRATION THAT SHOULD NOT BE EXCEEDED DURING ANY PART OF THE WORKING EXPOSURE.
mg / m3	- MILLIGRAMS OF SUBSTANCE PER CUBIC METER OF AIR
LD50	- LETHAL DOSE, 50TH PERCENTILE
LC50	- LETHAL CONCENTRATION, 50TH PERCENTILE NOTE: LD50 AND LC50 INDICATE THE SHORT TERM TOXICITY OF A CHEMICAL TO TEST ANIMALS. THE SMALLER THE LD50 AND LC50, THE GREATER THE TOXICITY.
ppm	- PARTS OF VAPOR OR GAS PER MILLION PARTS OF CONTAMINATED AIR BY VOLUME AT 25 DEGREES CELSIUS AND 760 TORR.
N.AV.	- NOT AVAILABLE
ACGIH	- AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS
TLV	- THRESHOLD LIMIT VALUE - AIRBORNE EXPOSURE LIMIT RECOMMENDED BY THE ACGIH.

REFERENCES

1) WHMIS CORE MATERIAL MANUAL, JANUARY 1991 EDITION

2) 1991-1992 THRESHOLD LIMIT VALUES for Chemical Substances and Physical Agents and BIOLOGICAL EXPOSURE INDICES, ACGIH

3) Documentation of the THRESHOLD LIMIT VALUES and BIOLOGICAL EXPOSURE INDICES, SIXTH EDITION, 1991, VOLUME 1, ACGIH

4) MATERIAL SAFETY DATA SHEET - INORGANIC and ORGANIC MATERIALS by GENIUM PUBLISHING CORPORATION

SECTION X - PREPARATION DATE OF MSDS

SABALLOY INC. BELIEVES THIS DATA TO BE ACCURATE. HOWEVER, SABALLOY INC. CANNOT MAKE ANY EXPRESSED OR IMPLIED WARRANTY AS TO THIS INFORMATION.

PREPARED BY:	SABALLOY INC.
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DATE PREPARED:	JUNE 1, 1995/98/01/JULY 3 2002 JUNE 1, 2004 (No Change) JUNE 1, 2007 (No Change) JAN 31, 2008 (No Change) JAN 31, 2009 (No Change) FEB 1, 2011 (No Change) JULY 1, 2011 (No Change) JAN 1,2012 (NO CHANGE) FEB 1, 2013 (NO CHANGE) JAN 1,2014 (No Change) FEB 1, 2016 (NO CHANGE)