



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards. This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard (29 CFR 1910.1200). Other government regulations must be reviewed for applicability to these products.

WARNING: PRODUCT COMPONENTS PRESENT HEALTH AND SAFETY HAZARDS. READ AND UNDERSTAND THIS MATERIAL SAFETY DATA SHEET (M.S.D.S.). ALSO, FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES. This product may contain Chromium and/or Nickel which are listed by OSHA, NTP, or IARC as being a carcinogen or potential carcinogen. Use of this product may expose you or others to fumes and gases at levels exceeding those established by the American Conference of Governmental Industrial Hygienists (ACGIH) or the Occupational Safety and Health Administration (OSHA). The information contained herein relates only to the specific product. If the product is combined with other materials, all component properties must be considered. **BE SURE TO CONSULT THE LATEST VERSION OF THE MSDS. MATERIAL SAFETY DATA SHEETS ARE AVAILABLE FROM J.W. HARRIS CO., INC.** salesinfo@jwharris.com 513-754-2000 www.jwharris.com

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PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED):	PERFECT CIRCLE® E71T-GS, E70T-1, E71T-1, E71T-1M, E71T-9, E71T-9M E71T-12, E71T-12M FLUX CORED WELDING WIRE
CHEMICAL NAME/CLASS:	Metal Alloy
SYNOMYS:	Not Applicable
PRODUCT USE:	Metal Welding
DOCUMENT NUMBER:	0183
SUPPLIER/MANUFACTURER'S NAME:	J.W. HARRIS CO, INC.
ADDRESS:	4501 Quality Place, Mason, Ohio 45040
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
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DATE OF PREPARATION:	FAX 513-754-8778 March 13, 2003

2. COMPOSITION and INFORMATION ON INGREDIENTS

NOMINAL COMPOSITION WEIGHT % Bare rod or Wire and Flux Core										
TRADE NAME	Fe	CaCO ₃	Si	Mo	Al	Mn	Mg	MgO	Cu	SiO ₂
PERFECT CIRCLE® E70T-1, E71T-1, E71T-1M, E71T-9, E71T-9M, E71T-12, E71T-12M	75-95	< 2	< 4	< 1	< 2	< 4.5		< 3	< 1	< 2
E71T-GS	75-95	< 2	< 2		< 5	< 2	< 3			

TRADE NAME	BaF ₂	TiO ₂	CaF	LiF	SrF ₂
PERFECT CIRCLE® E70T-1, E71T-1, E71T-1M E71T-9, E71T-9M, E71T-12, E71T-12M		< 10	< 5	< 2	
E71T-GS	5-15	< 4	1-10	< 2	< 2

2. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH mg/m ³	OTHER mg/m ³
			TWA mg/m ³	STEL mg/m ³	TWA mg/m ³	STEL mg/m ³		
Aluminum (Al) (exposure limits are for Aluminum, metal dust and welding fumes, as Al)	7429-90-5	See Table Previous Page	10 (metal dust) 5 (welding fumes)	NE	15 [metal dust] (total dust), 5 [metal dust, fumes] (respirable dust)	NE	NE	NIOSH REL: TWA = 10 [metal dust](Total Dust), 5 [metal dust & fumes](Respirable Fraction) DFG MAK: TWA = 1.5 [metal dust](Respirable fraction)
Barium Fluoride (BaF) (exposure limits are for Barium soluble compounds, as Ba)	7787-32-8	See Table Previous Page	0.5, A4 (Not Classifiable as a Human Carcinogen)	NE	0.5	NE	50 (as Ba)	NIOSH REL: TWA = 0.5 DFG MAKs: TWA = 0.5 (Inhalable fraction) PEAK = 2•MAK 30 min., average value Carcinogen: EPA-D, EPA-NL, TLV-A4
Calcium Carbonate (CaCO ₃)	471-34-1	See Table Previous Page	10	NE	15 (Total dust) 5 (Respirable fraction)	NE	NE	NIOSH REL: TWA = 10 (Total dust); 5 (Respirable fraction)
Copper (Cu) (exposure limits are for "Copper fume, & dusts & mists, as Cu")	7440-50-8	See Table Previous Page	0.2 (fume) 1 (dusts & mists)	NE	0.1 (fume) 1 (dusts & mists)	NE	100	NIOSH REL: TWA = 0.1 DFG MAK: TWA = 0.1 [fumes] (Respirable Fraction), 1 [dusts & mists] (Inhalable Fraction) PEAK = 2•MAK 30 min., average value Carcinogen: EPA-D (dusts & mists)
Fluorspar (CaF) (exposure limits are for particulates, not otherwise classified, PNOC)	7789-75-5	See Table Previous Page	10 (Inhalable Fraction) 3 (Respirable Fraction)	NE	15 or 50 mppcf (Total Dust) 5 or 15 mppcf (Respirable Fraction)	NE	NE	DFG MAKs: TWA = 4 (Inhalable Fraction); 1.5 (MAK measured as the Respirable Fraction of the Aerosol)
Iron (Fe) (exposure limits are for Iron Oxide dust and fume as Fe)	7439-89-6	See Table Previous Page	5, A4 (Not Classifiable as a Human Carcinogen)	NE	10	NE	2500	NIOSH RELs: TWA = 5 DFG MAKs: TWA = 1.5 (Inhalable Fraction) Carcinogen: IARC-3, TLV-A4
Lithium Fluoride (exposure limits are for Fluorides, as F)	7789-24-4	See Table Previous Page	2.5, A4 (Not Classifiable as a Human Carcinogen)	NE	2.5	NE	NE	NIOSH RELs: TWA = 2.5 DFG MAKs: TWA = 2.5 (Inhalable Fraction) PEAK = 5•MAK 30 min., average value DFG MAK Pregnancy Risk Classification: C Carcinogen: IARC-3, TLV-A4
Magnesium (Mg)	7439-95-4	See Table Previous Page	NE	NE	NE	NE	NE	DFG MAKs: TWA = 4 (Inhalable Fraction), 1.5 (Respirable Fraction)

NE = Not Established.

See Section 16 for Definitions of Terms Used.

NOTE (1): The ACGIH has an established exposure limit for Welding Fumes, Not Otherwise Classified. The Threshold Limit Value is 5 mg/m³. NIOSH classifies welding fumes as carcinogens. Single values shown are maximum, unless otherwise noted.

NOTE (2): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

2. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH mg/m ³	OTHER mg/m ³
			TWA mg/m ³	STEL mg/m ³	TWA mg/m ³	STEL mg/m ³		
Magnesium Oxide (MgO) (exposure limits are for Magnesium Oxide, fume)	1309-48-4	See Table Page 1	10	NE	15, skin (Total Particulate) 10 (vacated 1989 PEL)	NE	750	NE
Manganese (Mn) (exposure limits are for Manganese, elemental, inorganic compounds, and fume, as Mn)	7439-96-5	See Table Page 1	0.2	NE	1 (vacated 1989 PEL)	5 ceiling 3 (vacated 1989 PEL)	500	NIOSH REL: TWA = 1 STEL = 3 DFG MAK: TWA = 0.5 (Inhalable Fraction) PEAK = 10•MAK 30 min., average value DFG MAK Pregnancy Risk Classification: C Carcinogen: EPA-D
Molybdenum (Mo) (exposure limits are for Molybdenum, metal and insoluble compounds, as Mo)	7439-98-7	See Table Page 1	10, NIC - 3 (Respirable Fraction) NIC -10 (Inhalable Fraction)	NE	10 (vacated 1989 PEL)	NE	5000 (as Mo)	DFG MAK: TWA = 4 (Inhalable Fraction)
Silica	14808-60-7	See Table Page 1	0.05 (Respirable Fraction) A2 (Suspected Human Carcinogen)	NE	<u>30 mg/m³ (Total dust)</u> <u>% SiO₂ + 2</u> <u>250 mppcf (Respirable dust)</u> <u>% SiO₂ +5</u> or <u>10 mg/m³ (Respirable dust)</u> <u>% SiO₂ + 2</u> 0.1 (vacated 1989 PEL)		25	NIOSH REL: TWA = 0.05 (Respirable dust) DFG MAK: TWA = 0.15 (Respirable fraction) Carcinogen: IARC-1, MAK-1, NIOSH-Ca, NTP-R, TLV-A2
Silicon	7440-21-3	See Table Page 1	10	NE	15 (Total dust) 5 (Respirable fraction) 10 (Total dust) (vacated 1989 PEL)	NE	NE	NIOSH REL: TWA = 10 (Total dust); 5 (Respirable fraction)
Strontium Fluoride (exposure limits are for Fluorides, as F)	7783-48-4	See Table Page 1	2.5, A4 (Not Classifiable as a Human Carcinogen)	NE	2.5	NE	NE	NIOSH RELs: TWA = 2.5 DFG MAKs: TWA = 2.5 (Inhalable Fraction) PEAK = 5•MAK 30 min., average value Carcinogen: IARC-3, TLV-A4
Titanium Dioxide	13463-67-7	See Table Page 1	10, A4 (Not Classifiable as a Human Carcinogen)	NE	15 (Total dust) 10 (vacated 1989 PEL)	NE	5000	NIOSH REL: Reduce to lowest feasible level (LOQ 0.2 mg/m ³) DFG MAK: TWA = 1.5 (Respirable Fraction) DFG MAK Pregnancy Risk Classification: C Carcinogen: IARC-3, NIOSH-Ca, TLV-A4

NE = Not Established.

NIC = Notice of Intended Change

See Section 16 for Definitions of Terms Used.

NOTE (1): The ACGIH has an established exposure limit for Welding Fumes, Not Otherwise Classified. The Threshold Limit Value is 5 mg/m³. NIOSH classifies welding fumes as carcinogens. Single values shown are maximum, unless otherwise noted.

NOTE (2): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: These products consist of odorless, carbon steel sheath, with a flux core, which have a metallic luster. There are no immediate health hazards associated with these products. These products are not reactive. If involved in a fire, these products may generate irritating fumes and a variety of metal oxides. Finely divided dusts of these products may result in explosive air/dust mixtures. Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:

During welding operations, the most significant route of over-exposure is via inhalation of fumes.

INHALATION: Inhalation of large amounts of particulates generated by these products during welding operations may be physically irritating and cause deposits of dust in nasal passages. Inhalation of large amounts of dusts or fumes of Iron, the main component of these products, can cause iron pneumoconiosis. Inhalation of dusts and fumes of Iron can also cause metal fume fever. Symptoms of metal fume fever include flu-like symptoms, metallic taste, fever, chills, cough, weakness, chest pain, muscle pain, cardiac abnormalities, and increased white blood cell count. Damage to lungs can occur. Symptoms of metal fume fever can be delayed 24-48 hours. Thermal decomposition can result in generation of fluoride compounds, which in high enough concentration, can cause burns to the respiratory system and possible pulmonary edema in severe cases.

Chronic inhalation of dusts and fumes of Iron, the main component of these products can result in deposition of iron in body tissues (siderosis), with symptoms of fibrosis of the pancreas, diabetes mellitus and liver cirrhosis. Chronic inhalation of fumes of Manganese can cause a condition known as "Manganism". Symptoms include central nervous system effects such as tremors, muscle weakness, and behavioral changes. Chronic inhalation of fumes of Calcium Carbonate, a minor component of this product, can result in a condition known as hypercalcemia, characterized by elevated serum calcium levels, increased density of the skeleton, mental deterioration and possible adverse effects on the renal system. Refer to Section 10 (Stability and Reactivity) for information on the specific composition of welding fumes and gases.

CONTACT WITH SKIN or EYES: Contact of the rod form of these products with the skin is not anticipated to be irritating. Contact with the rod form of these products can be physically damaging to the eye. Fumes generated during welding operations can be irritating to the skin and eyes. Symptoms of skin over-exposure may include irritation and redness; prolonged or repeated skin over-exposures may lead to dermatitis. These products also contain a low level of Fluorspar, a fluoride compound. Thermal decomposition of this compound can generate fluoride compounds, which are toxic and can cause burns in extreme cases. Burns from fluoride compounds can be delayed. Contact with the molten core wire or rods will burn contaminated skin or eyes.

SKIN ABSORPTION: Skin absorption is not known to be a significant route of over-exposure for any component of these products.

INGESTION: Ingestion is not anticipated to be a route of occupational exposure for this product.

INJECTION: Though not a likely route of occupational exposure for these products, injection (via punctures or lacerations in the skin) may cause local reddening, tissue swelling, and discomfort.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Symptoms associated with over-exposure to these products and the fumes generated during welding operations are as follows:

ACUTE: Inhalation of large amounts of particulates generated by these products during metal processing operations may be physically irritating and cause deposits of dust in nasal passages. Inhalation of dusts and fumes of Iron (the main component of these products) can cause metal fume fever. Contact with the molten material will burn contaminated skin or eyes. In extreme cases, burns may occur from contact with fluoride compounds that are generated during thermal decomposition.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH

(BLUE)

0

FLAMMABILITY

(RED)

0

REACTIVITY

(YELLOW)

0

PROTECTIVE EQUIPMENT

X

EYES	RESPIRATORY	HANDS	BODY
See Section 8	See Section 8		

For routine industrial applications for the rods

See Section 16 for Definition of Ratings

3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Chronic skin over-exposure to the fumes of these products during welding operations may produce dermatitis (red, inflamed skin). Repeated or prolonged over-exposures, via inhalation, to the dusts generated by these products may cause pulmonary fibrosis (scarring of lung tissue). Chronic inhalation of fumes or dusts of the components of these products can result in conditions such as hypercalcemia, and manganism. Adverse effects or damage to the liver, lungs, pancreas, renal system and central nervous system can occur.

TARGET ORGANS: For fumes: ACUTE: Skin, eyes, respiratory system. CHRONIC: Skin, central nervous system, pancreas and liver.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and MSDS to health professional with victim.

SKIN EXPOSURE: If fumes generated by welding operations involving this product contaminate the skin, begin decontamination with running water. If molten material contaminates the skin, immediately begin decontamination with cold, running water. Minimum flushing is for 15 minutes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If fumes generated by welding operations involving this product enter the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INHALATION: If fumes generated by welding operations involving this product are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions.

INGESTION: If swallowed call physician immediately! Do not induce vomiting unless directed by medical personnel. Rinse mouth with water if person is conscious. Never give fluids or induce vomiting if person is unconscious, having convulsions, or not breathing.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Skin, respiratory disorders, pancreas and liver disorders may be aggravated by prolonged over-exposures to the dusts or fumes generated by these products.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not flammable.

AUTOIGNITION TEMPERATURE: Not flammable.

FLAMMABLE LIMITS (in air by volume, %):

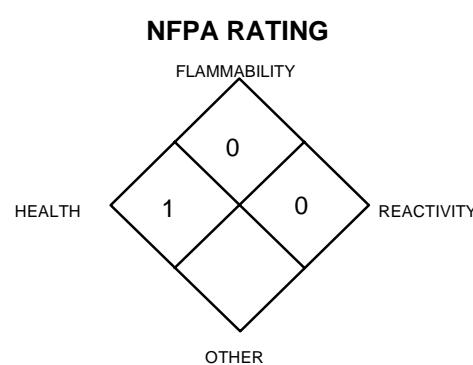
Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: These products are not flammable; use fire-extinguishing agents appropriate for surrounding materials.

Water Spray: YES

Carbon Dioxide: YES



Halon: YES

Foam: YES

Dry Chemical: YES

Other: Any "ABC" Class

UNUSUAL FIRE AND EXPLOSION HAZARDS When involved in a fire, these products may decompose and produce iron fumes, a variety of nickel, iron and a variety of metal compounds and metal oxides. The hot material can present a significant thermal hazard to firefighters.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Not applicable.

See Section 16 for
Definition of Ratings

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Not applicable

PART III How can I prevent hazardous situations from occurring?

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat or drink while handling this product. Use ventilation and other engineering controls to minimize potential exposure to this product.

STORAGE AND HANDLING PRACTICES: All employees who handle this product should be trained to handle it safely. Use in a well-ventilated location. Avoid breathing fumes of this product during welding operations. Open containers on a stable surface. Packages of this product must be properly labeled. When this product is used during welding operations, follow the requirements of the Federal Occupational Safety and Health Welding and Cutting Standard (29 CFR 1910 Subpart Q) and the safety standards of the American National Standards Institute for welding and cutting (ANSI Z49.1). Store packages in a cool, dry location. Store away from incompatible materials (see Section 10, Stability and Reactivity).

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Not applicable.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided in Section 2 (Composition and Information on Ingredients). Prudent practice is to ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain airborne contaminant concentrations below guidelines listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed (i.e. a Weld Fume Respirator, or Air-Line Respirator for welding in confined spaces), U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Respiratory Protection is recommended to be worn during welding operations. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following are NIOSH recommendations for respirator selection for Welding fumes, based on NIOSH REL:

CONCENTRATION RESPIRATORY EQUIPMENT FOR WELDING FUMES

At Concentrations above the NIOSH REL, or where there is no REL, at any Detectable Concentration: Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode; or any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape: Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter; or any appropriate escape-type, self-contained breathing apparatus

NOTE: IDLH Concentration: Potential NIOSH carcinogen. [Not determined yet].

EYE PROTECTION: Safety glasses. When these products are used in conjunction with welding, wear safety glasses, goggles, or face-shield with filter lens of appropriate shade number (per ANSI Z49.1-1988, "Safety in Welding and Cutting").

HAND PROTECTION: Wear gloves for routine industrial use. When these products are used in conjunction with welding, wear gloves that protect from sparks and flame (per ANSI Z49.1-1988, "Safety in Welding and Cutting").

BODY PROTECTION: Use body protection appropriate for task.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for elemental iron:

RELATIVE VAPOR DENSITY (air = 1): Not applicable.

EVAPORATION RATE (nBuAc = 1): Not applicable.

SPECIFIC GRAVITY @ 20°C (water = 1): 7.86

FREEZING/MELTING POINT: 1535°C (2789.6°F)

SOLUBILITY IN WATER: Insoluble.

PH: Not applicable.

VAPOR PRESSURE, mm Hg @ 1787°C: 1

BOILING POINT: 3000°C (5432°F)

ODOR THRESHOLD: Not applicable.

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT): Not applicable.

The following information is for the products:

APPEARANCE AND COLOR: These odorless products consist of carbon steel sheath, with a flux core, which have a metallic luster.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Fluoride and calcium compounds and metal oxides.

NOTE: The composition and quality of welding fumes and gases are dependent upon the metal being welded, the process, the procedure, and the electrodes used. Other conditions that could also influence the composition and quantity of fumes and gases to which workers may be exposed include the following: any coatings on metal being welded (e.g. paint, plating, or galvanizing), the number of welders and the volume of the work area, the quality of ventilation, the position of the welder's head with respect to the fume plume, and the presence of other contaminants in the atmosphere. When the electrode is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 2 (Composition and Information on Ingredients). Fume and gas decomposition products, and not the ingredients in the electrode, are important. Concentration of the given fume or gas component may decrease or increase by many times the original concentration. New compounds in the electrode may form. Decomposition products of normal operations include not only those originating from volatilization, reaction, or oxidation of the product's components but also those from base metals and any coating (as noted previously). The best method to determine the actual composition of generated fumes and gases is to take an air sample from inside the welder's helmet if worn or in breathing zone. For additional information, refer to the American Welding Society Publication, "Fumes and Gases in the Welding Environment".

MATERIALS WITH THESE PRODUCTS ARE INCOMPATIBLE: As solids, these products will be attacked by strong acids, strong bases, hydrogen peroxide (52% or greater- in presence of manganese dioxide). Hot iron wire burns in chlorine gas. Dusts of these products would be incompatible with strong oxidizers, acetaldehyde, ammonium peroxodisulfate, chloroformamidinium, chloric acid, ammonium nitrate, halogens, dinitrogen tetroxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, and sodium carbide.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid uncontrolled exposure to extreme temperatures and incompatible materials.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Presented below are human toxicological data available for the components of these products present in concentration greater than 1%. Other data for animals are available for the components of these products, but are not presented in this Material Safety Data Sheet.

IRON: TDLo (oral, child) = 77 mg/kg; BAH, gastrointestinal tract, blood effects	MANGANESE: TCLo (inhalation-man) 2.3 mg/m ³ Brain and Central Nervous System effects	TITANIUM DIOXIDE: Standard Draize Test (Skin-Human) 300 mg/3 days-intermittent: Mild irritation effects
COPPER: TDLo (Oral-Human) = 120 mg/kg: Gastrointestinal tract effects	SILICA: TCLo (inhalation, human) = 16 mppcf/ 8 hours/ 17.9 years/ intermittent; pulmonary system effects LCLo (inhalation, human) = 300 µg/m ³ / 10 years/ intermittent; systemic effects	

SUSPECTED CANCER AGENT: The components of these products are listed as follows:

BARIUM FLUORIDE (as a Barium Compound): EPA-D (Not Classifiable as to Human Carcinogenicity); EPA-NL (Not Likely to be Carcinogenic in Humans); ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

COPPER: EPA-D [dusts & mists] (Not Classifiable as to Human Carcinogenicity)

FLUOROSPAR (as a Fluoride Compound): IARC-3 Possibly Carcinogenic to Humans; ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

IRON (as Iron Oxide): IARC-3 Possibly Carcinogenic to Humans; ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

LITHIUM FLUORIDE (as a Fluoride Compound): IARC-3 Possibly Carcinogenic to Humans; ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

MANGANESE: EPA-D (Not Classifiable as to Human Carcinogenicity)

SILICA: ACGIH TLV-A2 (Suspected Human Carcinogen); IARC-1 (Carcinogenic to Humans); NIOSH-Ca (Potential Occupational Carcinogen with no Further Categorization); NTP-R (Reasonably Anticipated to be a Human Carcinogen (limited evidence of carcinogenicity from studies in humans, which indicates that causal relationship is credible); MAK-1 (Substances that Cause Cancer in Man and Which Can Be Assumed to Make a Significant Contribution to Cancer Risk). The information on quartz is pertinent to inhalation of quartz particulates, which is not a likely route of exposure for this component as it exists in this product.

STRONTIUM FLUORIDE (as a Fluoride Compound): IARC-3 Possibly Carcinogenic to Humans; ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

TITANIUM DIOXIDE: IARC Group 3 (Not Classifiable as to Carcinogenicity to Humans), NIOSH-Ca (Potential Occupational Carcinogen with no further categorization), ACGIH-TLV-A4 (Not Classifiable as a Human Carcinogen)

The other components of these products are not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, and CAL/OSHA and therefore are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Dusts or fumes of these products may be irritating to contaminated skin and eyes. Fumes may be irritating to the respiratory system.

11. TOXICOLOGICAL INFORMATION (Continued)

SENSITIZATION TO THE PRODUCT: No components of these products are known to be skin or respiratory sensitizers.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of these products and their components on the human reproductive system.

Mutagenicity: These products are not reported to produce mutagenic effects in humans.

Embryotoxicity These products are not reported to produce embryotoxic effects in humans.

Teratogenicity: These products are not reported to cause teratogenic effects in humans. Animal teratogenic data are available for the Copper, Fluorospar (calcium fluoride) and Barium Fluoride components of these products; these data were obtained during clinical studies on specific animal tissues exposed to high doses of these compounds.

Reproductive Toxicity: These products are not reported to cause reproductive effects in humans. Animal reproductive data are available for the Copper and Fluorospar (calcium fluoride) components of these products; these data were obtained during clinical studies on specific animal tissues exposed to high doses of these compounds.

A mutagen is a chemical, which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical, which causes damage to a developing embryo (i.e., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical, which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance, which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES: The following BEIs are applicable to Fluorides; Barium Fluoride (a component of these products).

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
FLUORIDES		
• Fluorides in urine	• Prior to shift • End of shift	• 3 mg/g creatinine • 10 mg/g creatinine

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: The components of these products occur naturally in the environment and are expected to persist in the environment for an extended period of time. Components of these products will react with water and air to form a variety of stable metal oxides.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: These products are not expected to cause adverse effects on plant or animal life. Animal studies on copper, manganese indicate various health effects after ingestion and exposures.

EFFECT OF CHEMICAL ON AQUATIC LIFE: These products are not expected to cause adverse effects on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

EPA WASTE NUMBER: Wastes of this product should be tested per the Toxicity Characteristic Leaching Procedures requirements of RCRA to determine if such wastes meet the following characteristics: D005 (Barium) 100 mg/L (Regulated Level).

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS NOT HAZARDOUS (Per 49 CFR 172.101) BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Not applicable.

HAZARD CLASS NUMBER and DESCRIPTION: Not applicable.

UN IDENTIFICATION NUMBER: Not applicable.

PACKING GROUP: Not applicable.

DOT LABEL(S) REQUIRED: Not applicable.

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER, 2000: Not applicable.

MARINE POLLUTANT: No component of this product is designated as a marine pollutant by the Department of Transportation (49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This material is not considered as dangerous goods, per regulations of Transport Canada.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this product are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Aluminum (fume or dust)	NO	NO	YES
Manganese	NO	NO	YES
Copper	NO	YES	YES
Barium Fluoride, as Barium Compounds	NO	NO	YES; category code N040

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for any component of this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Copper = 5000 lbs (2270 kg)

OTHER U.S. FEDERAL REGULATIONS: Not applicable.

U.S. STATE REGULATORY INFORMATION: The components of these products are covered under specific State regulations, as denoted below:

Alaska-Designated Toxic and Hazardous Substances: Magnesium Oxide, Manganese, Copper, and Titanium Dioxide.

California-Permissible Exposure Limits for Chemical Contaminants: Aluminum, Calcium Carbonate, Magnesium Oxide, Manganese, Molybdenum, Copper, Silica, Silicon, and Titanium Dioxide.

Florida-Substance List: Magnesium, Magnesium Oxide, Manganese, Molybdenum, and Copper.

Illinois-Toxic Substance List: Aluminum, Magnesium Oxide, Manganese, Molybdenum, Copper, Silica, Silicon, and Titanium Dioxide.

Kansas-Section 302/313 List: Aluminum, Manganese, Copper, and Titanium Dioxide.

Massachusetts-Substance List: Magnesium, Magnesium Oxide, Manganese, Molybdenum, and Silica.

Michigan - Critical Materials Register: Copper.

Minnesota-List of Hazardous Substances: Aluminum, Magnesium Oxide, Manganese, Molybdenum, Copper, Silicon, and Titanium Dioxide.

Missouri-Employer Information/Toxic Substance List: Aluminum, Magnesium Oxide, Manganese, Molybdenum, Copper, Silica, Silicon, and Titanium Dioxide.

New Jersey-Right to Know Hazardous Substance List: Aluminum, Calcium Fluoride, Magnesium, Magnesium Oxide, Manganese, Copper, Molybdenum, Silica, and Titanium Dioxide.

North Dakota-List of Hazardous Chemicals, Reportable Quantities: Copper.

Pennsylvania-Hazardous Substance List: Aluminum, Magnesium, Magnesium Oxide, Manganese, Molybdenum, Copper, Silica, and Titanium Dioxide.

Rhode Island-Hazardous Substance List: Aluminum, Magnesium, Magnesium Oxide, Manganese, Molybdenum, Copper, Silicon, and Titanium Dioxide.

Texas-Hazardous Substance List: Magnesium Oxide, Manganese, Molybdenum, Copper, Silica, and Titanium Dioxide.

West Virginia-Hazardous Substance List: Magnesium Oxide, Manganese, Molybdenum, and Copper.

Wisconsin-Toxic and Hazardous Substances: Magnesium Oxide, Manganese, Copper, Molybdenum, and Titanium Dioxide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this product is on the California Proposition 65 List. **WARNING:** This product, when used for welding may produce fumes or gases containing chemicals, known to the State of California to cause cancer, and/or birth defects (or other reproductive harm.)

15. REGULATORY INFORMATION (Continued)

LABELING (Precautionary Statements):

WARNING:

PROTECT yourself and others. Read and understand this information.

FUMES AND GASES can be hazardous to your health.

ARC RAYS can injure your eyes and burn skin.

ELECTRIC SHOCK can kill.

- Before use, read and understand the manufacturer's instructions. Material Safety Data Sheets (MSDSs), and your employer's safety policies.
- Keep your head out of the fumes.
- Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area.
- Wear correct eye, ear, and body protection.
- See American National Standard Z49.1 *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126. OSHA Safety and Health Standards, 29 CFR 1910, available from the U.S. Government Printing Office, Washington, DC 20402.

DO NOT REMOVE THIS INFORMATION

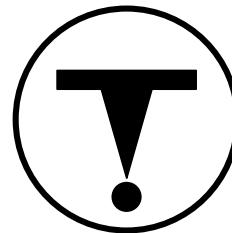
ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of these products are on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The Barium Fluoride, Fluorspar (Calcium Fluoride) and Strontium Fluoride components of this product as inorganic fluoride compounds, are on the CEPA First Priority Substances List (PSL), and is considered "toxic".

CANADIAN WHMIS SYMBOLS: D2B - Materials Causing Other Toxic Effects Poisonous and infectious material. Materials causing other toxic effects.



16. OTHER INFORMATION

DATE OF PRINTING:

April 22, 2004

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard (29 CFR 1910.1200). Other government regulations must be reviewed for applicability to this product. The information contained herein relates only to the specific products. If the products are combined with other materials, all component properties must be considered. To the best of the J.W. Harris Company, Inc.'s knowledge, the information and recommendations contained in this publication are reliable and accurate as of the date of issue. However, accuracy, suitability, or completeness are not guaranteed, and no warranty, guarantee, or representation, expressed or implied, is made by J.W. Harris Co., Inc. as to the absolute correctness or sufficiency of any representation contained in this and other publications; J.W. Harris Co., Inc. assumes no responsibility in connection therewith; nor can it be assumed that all acceptable safety measures may not be required under particular or exceptional conditions or circumstances. Data may be changed from time to time. Be sure to consult the latest edition.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these, which are commonly used, include the following:

CAS #: This is the Chemical Abstract Service Number, which uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance, which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (*Federal Register*: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL, which was vacated by Court Order. **IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called Recommended Exposure Levels (**RELS**). When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: 0 (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: 0 (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds is presented. Definitions of some terms used in this section are:

LD₅₀ - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TD_{Lo}**, the lowest dose to cause a symptom and **TCL_o** the lowest concentration to cause a symptom; **TDo**, **LD_{Lo}**, and **LDo**, or **TC**, **TCo**, **LCL_o**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**.

IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **Ecological Information:** **EC** is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **U.S.:** **EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the Comprehensive Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute (**ANSI Z129.1**). **CANADA:** **CEPA** is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDSL** are the Canadian Domestic/Non-Domestic Substances Lists. **The CPR is the Canadian Product Regulations.** This section also includes information on the precautionary warnings, which appear, on the materials package label.