

Our Mission Statement

Pyrotek is a leading international company supplying customers with performance improving technical products, integrated systems and consulting services worldwide. Our mission is to provide innovative solutions to customer needs utilizing our global resources. We are committed to:

- Customer satisfaction.
- Employee development.
- Profitable growth.
- Integrity.
- Reliability, quality and service.
- Environmental awareness.
- Partnerships with customers and suppliers.

Our Dedication to You

Our commitment to customer service began with the company's inception in 1956. Today you can depend on Pyrotek for innovative solutions to your high-temperature material requirements.

Safety Data Sheets

Current material safety datasheets are available from your Pyrotek technical specialist, or by email to SDS@pyrotek.com.

Patents

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INTRODUCTION

Safety Designations

In this manual, the following marking conventions are used to focus on certain subjects or actions.

NOTE:

Highlights important or special information.

CAUTION: Possible Equipment Damage -

Provides information to avoid harm to the equipment.

WARNING: Personnel Hazard -

Alerts to avoid a situation that has a potential to cause serious bodily injury or death.

Preface

This manual describes the operation of specific equipment. The information in this manual is important for proper and safe operations. Also, ensure the workplace is adequately illuminated, and that the workplace is clean and safe

Trademarks

The following trademarks are referenced in this manual.

- ISOMAG® and RFM® are registered trademarks of Pyrotek.
- PROMALIGHT® is a registered trademark of Promat, an etex company.

Document Revisions

Please provide Pyrotek Corporate Marketing with any suggestion or change you may have for improvement to the contents of this document.

Revision	Date	Reason
	September 2020	Initial publication.

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BM-2197689	Bill of Material, Cover Insulation Assembly
2197689	Cover Insulation Assembly
BM-2193588	Bill of Material, Furnace Cover Lift Assembly
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2199394	Hydraulic Schematic
2195675	Pneumatic Schematic
2101858	Retrieving Tongs
2174331	Skimmer Spoon
2189315	Bent Scraper
2194950	8" Scraper Tool
2194951	3" Scraper Tool



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BULLETIN

- Mohawk, Custom Lift for SNIF Furnace - Model ZZ307E1-CE
- AEG Thyro A Thyristor Power Controller Operating Instructions
- Drager Polytron 7000 Bulletin
- Drager Polytron 7000 **** Only with Program CD

MOTOR/DRIVE

- ABB ACS355 User Manual **** Only with Program CD
- Baldor A-C Motors Instruction Manual MN-440

VALVES

- Parker Gold Ring™, Solenoid Valves
- Swagelok, Ball Valves - 40 Series
- Swagelok B Series Bellow Sealed Valves
- Swagelok Indicator Switch for Pneumatically AP Valves

REGULATORS

- Norgren, Miniature Regulators R06
- Norgren, Pressure Regulators 11-002
- Swagelok Pressure Regulators MS-02-230
- Veriflo Regulators

FLOWMETERS

- ABB Instrumentation Instruction Bulletin 10A6100
- ABB Instrumentation Instruction Manual V/A Master Flowmeters 10A4500/10A4600
- Brooks Instrument Model: SLA5800

MISCELLANEOUS

- Barksdale Inc., Pressure Switches
- Cutler-Hammer Ground Fault Monitor D64RPB100 Instruction Manual
- Swagelok, N-986 Filters
- Siemens SISTOP Power Supply

INTRODUCTION:**SPINNING NOZZLE INERT FLOTATION PROCESS AND APPARATUS:**

The SNIF® NEO SP-30iF is a single-stage refining furnace for processing molten aluminum. It is composed of a replaceable monolithic inner lining with insulating refractory boards, encased inside of a steel shell.

The temperature of the molten aluminum is controlled by a heating system that is designed to provide sufficient power to keep the metal in a molten state during the idle periods, at a set temperature. This furnace is not designed to heat the metal while casting. The immersion heating system is controlled by the PLC and utilizes one pair of resistive heating elements enclosed in a single ceramic sheath that is mounted through the cover of the unit.

The refining process consists of a single NEO SNIF® SHEER spinning nozzle assembly that injects a mixture of an inert process gas with a small amount of chlorine gas into the molten metal. The unique design of the spinning nozzle shears the gas stream into fine bubbles and disperses them evenly throughout the chamber. The inert process gas is used to remove dissolved hydrogen from the melt and to float inclusions from the metal.

The addition of a small percentage of chlorine gas will aid in the removal of alkali and alkaline metals such as sodium, lithium and calcium, by a chemical reaction that will form salts. These salts will float to the dross layer on the metal surface. Chlorine also enhances the non-wetted characteristics of the dross and aids in the inclusion removal.



1.1 APPARATUS:

This system consists of the following major components:

- A.** NEO SNIF® SP-30iF Refining Furnace Shell Assembly
Furnace Static Capacity:
1670 lbs [758 kg]

Maximum Furnace Refining Capacity:
30,000 lb/hr [13,608 kg/hr]
- B.** Cover Insulation Assembly
- C.** Lift Mast Assembly, ZZ307-E1-CE, 24 VDC CONTROL.
- D.** SNIF® NEO SHEER Spinning Nozzle Assembly, Fin Cooled
- E.** Inert Control Panel Assembly, MFC
- F.** Chlorine Control Panel Assembly MFC
- G.** Electrical/Furnace Control Panel Assembly, HMI & PLC Control
- H.** Furnace Transformer
- I.** Furnace SCR Junction Box Assembly, Immersion



1.2 GAS SUPPLY REQUIREMENTS:

A. MAIN INERT (ARGON):

Supply: 350 scfh @ 70-90 psig

[9.20 Nm³/hr @ 4.9-6.3 kg/cm²]

Purity: 99.996% pure with less than 3 ppm of moisture and less than 5 ppm of oxygen.

Dew point less than -92°F [-69°C]

B. CHLORINE: (HIGH PURITY):

Supply: 17 scfh @ 30 psig [0.45 Nm³/hr @ 2.1 kg/cm²]

Purity: 99.5% high purity grade with less than 100 ppm of moisture with a minimum check temperature of 40°F [4.5°C]

Dew point less than -44°F [-42°C]

B. PROCESS GAS (ARGON/CHLORINE):

Combined Maximum Process Flow Rate & Pressure to:

Each Spinning Nozzle:

367 scfh @ 20 psig [9.65 Nm³/hr @ 1.4 kg/cm²]

C. AUXILIARY INERT (ARGON):

Supply: 12 scfh @ 30 psig [0.32 Nm³/hr @ 2.1 kg/cm²]

Purity: 99.996% pure with less than 3 ppm of moisture and less than 5 ppm of oxygen.

Dew point less than -92°F [-69°C]

D. COVER LIFT MAST (PLANT AIR)

Supply: 60-90 psig [4.2-6.3 kg/cm²]

If required a moisture filter should be supplied and installed by the customer.

1.3 SYSTEM POWER REQUIREMENTS:

A. FURNACE HEATING CAPACITY POWER RATING:

25 kVA 240 Volts

B. FURNACE COVER LIFT ASSEMBLY

400 VAC, 3 Phase, 50 Hz, 15 Amps

C. NEO SPINNING NOZZLE MOTORS:

400 VAC, 3 Phase, 50 Hz, 7.5 kW

D. INERT CONTROL PANEL:

Internal Panel Control Voltage: 24 VDC

E. CHLORINE CONTROL PANEL:

Internal Panel Control Voltage: 24 VDC

F. ELECTRICAL/FURNACE CONTROL PANEL ASSEMBLY

400 VAC, 3 Phase, 50 Hz, 100 Amps

G. FURNACE TRANSFORMER:

Rated Power: 25 kVA, 50 Hz

Primary Supply Voltage: 360/380/**400**/415 VAC 3-Phase 50 Hz

Secondary Output Voltage: One (1) 230V Single Phase Circuit



1.4 TYPICAL UNIT DESCRIPTIONS USED:

°C = degree Celsius

°F = degree Fahrenheit

atm = atmosphere

ft³ = cubic feet

hp = horse power

hr = hour

Hz = hertz

in = Inch

kg = kilogram

kg/cm² = kilogram (of force) per square centimeter

kVA = kilovolt ampere

lbs. = pound

mA = milliampere

mm = millimeter

Nm³/hr = normal cubic meter per hour

psi = pounds (of force) per square inch

psia = pounds (of force) per square inch absolute

psid = pounds (of force) per square inch differential

psig = pounds (of force) per square inch gauge

scfh = standard cubic feet per hour

scfm = standard cubic feet per minute

1.5 CONVERSION

- A. DENSITY $\sim 1 \text{ lb/ft}^3 = 16.018 \text{ kg/m}^3$
- B. FLUID FLOW $\sim 1 \text{ Nm}^3/\text{hr} = 38.044 \text{ scfh}$
- C. LENGTH $\sim 1" = 1 \text{ inch} = 25.4 \text{ mm}$
- D. MASS $\sim 1 \text{ kg} = 2.204 \text{ lbs}$
- E. $1 \text{ ton} = 0.9702 \text{ metric ton} = 2000 \text{ lbs}$
- F. POWER $\sim 1 \text{ hp} = 0.7457 \text{ kVA}$
- G. PRESSURE $\sim 1 \text{ atm} = 0 \text{ psig} = 14.696 \text{ psia} = 1.0332 \text{ kg/cm}^2 = 1.01325 \text{ bar}$
- H. $1 \text{ kg/cm}^2 = 14.223 \text{ psia}$
- I. TEMPERATURE $\sim T^\circ\text{C} = (5/9)(T^\circ\text{F}-32)$
- J. $T^\circ\text{F} = (9/5)T^\circ\text{C}+32$
- K. VOLUME $\sim 1 \text{ Nm}^3 = 35.3147 \text{ ft}^3$



There are several precautionary (Danger, Warning and Caution) labels located on most of the SNIF® Equipment. Refer to the Table of Contents, Drawing List for the proper location of specific labels. If any label is missing, Order a replacement by referring to the part number on the Bill of Materials. To order replacement labels, follow the same procedure used to order your SNIF® Spare Parts.

2.1 GASES:

- A.** Argon and nitrogen are inert colorless, odorless, and tasteless gases. Argon makes up approximately 1% of the air and nitrogen about 78%. Both nitrogen and argon can displace air. A potentially hazardous low oxygen condition could exist in low pit areas or confined spaces in the event of an inert gas line rupture. This is especially true of argon, which is heavier than air. A high concentration of inert gas resulting in low oxygen levels could cause
- B.** DANGER: CHLORINE IS A POISONOUS GAS. Extreme caution is needed while working with it. Consult information furnished by your chlorine supplier for safety precautions. Properly flush the chlorine control tubing and equipment with inert gas prior to doing any maintenance work on the panel.
- C.** Avoid breathing fumes generated by the dross when de-drossing or performing maintenance on the furnace interior, i.e., nozzle and thermocouple replacement, cleaning, etc.



2.2 BURN HAZARDS:

- A.** Wear proper protective clothing, in compliance with customer's in-house safety department procedure and codes during operation and maintenance of the SNIF® Apparatus. Such precautionary clothing should prevent or minimize potential burn hazards. Always wear safety glasses when working on or around the SNIF® Equipment. A face shield should be worn when de-drossing or cleaning the furnace interior.
- B.** The interior portions of the furnace cover must be clean to allow for unobstructed flow of cover gas. Periodically clean the cover gas ports located on top of the cover with a rod.
- C.** All tools (especially de-drossing tools) must be preheated prior to insertion in the aluminum bath. The accumulation of both dross and flux on the tools could adsorb moisture when cool. A metal splash may occur if the tools, with dross or flux on them, are inserted into the aluminum bath without preheating them first.
- D.** Preheat nozzles and thermocouple protection tubes before insertion into the aluminum bath. This procedure will "drive off" any adsorbed moisture and prevent a metal splash. Refer to Section 7 for details.
- E.** Any foreign object must be preheated prior to insertion in the aluminum bath.
- F.** Removed nozzles from the aluminum bath are extremely hot and must be stored in protective enclosures while they cool to room temperature. This will prevent accidental burns to passing personnel.
- G.** Be aware of pressure build up within the refining chambers when clearing the chamber vent cap, located on the cover. A sudden release of hot gases may result.
- H.** On units equipped with rotating covers, the cover and heating elements will be hot. Rope off the area around the cover to prevent personnel from coming into contact with the hot surfaces. Do not keep Material, which could burn, in this area.

2.3 ELECTRICAL HAZARDS:

- A.** The Pyrotek, Inc. SNIF[®] System has two (2) electrical power sources, the Electrical Control Panel and the Furnace Control Panel. Shut off and Lock out power at the Electrical Control Panel and the Furnace Control Panel to ensure complete electrical deactivation of the SNIF[®] System when servicing the equipment.
- B.** Always keep the system electrically grounded. A potential electric hazard is present around connections and motors. Be sure that the power to these components is off before servicing.
- C.** Turn off the Electrical Control Panel motor circuit breakers before disconnecting the motor electrical connectors for either nozzle motor. This could prevent an electric shock.
- D.** Turn off and lock the Furnace Control Panel, before performing any maintenance on the heating elements or with components in the Furnace Junction Box. Never open the secondary windings of the current transformers while the primary is carrying current to the heating element. This could result in a dangerously high voltage in the current transformer windings.



2.4 PINCH POINTS:

- A.** On furnaces equipped with hydraulically lifted covers, the area around the furnace should be clear of personnel while the cover is in motion. While on the push buttons used to activate the cover should be located at a point, which allows the furnace to be in sight at all times.
- B.** On furnaces equipped with rotating covers, keep free the area around the unit and mast of personnel and material. Install alarm to warn personnel in the area that the cover or furnace is in motion.
- C.** Personnel should not stand on the cover while it is in the raised position or in motion.
- D.** On furnaces, which have been equipped with the tilting option, the area around the furnace should be clear of personnel while the furnace is in motion. As with the cover, the controls used to activate the furnace tilting should be located at a point which allows the furnace to be in sight at all times while the furnace is in motion.
- E.** Read and understand the tilting and draining procedure located in the Operations section of this manual prior to tilting the furnace.
- F.** Prior to tilting the furnace with metal, plug the inlet trough, raise the cover and rotate away from the furnace.
- G.** Tilt and drain the furnace install furnace safety supports if it has to remain in the tilted position for any length of time. If for any reason the personnel are working under the furnace in the tilted position, install the safety support props located on the tilting pedestal.



BNZ Materials, Inc.

SAFETY DATA SHEET

Section 1.

Identification

GHS product identifier: Transite® HT

**Other means
Of identification:** None

Product type: Calcium Silicate Board

SDS No.: BNZ-20-202

Relevant identified uses of the substance or mixture and uses advised against:

Identified uses: Industrial heat processing and fire protection

Uses advised against: None known

Supplier: BNZ Materials, Inc.
6901 S. Pierce St., Suite 260
Littleton, CO 80128

Technical Support: 800-955-8650
www.bnzmaterials.com

**Emergency telephone
Number:** CHEMTREC - 800-424-9300 or 703-741-5970 (Outside USA and Canada – collect calls accepted). 24 Hour service.

Section 2.

Hazards Identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

**Classification of the
substance or mixture:** CARCINOGENICITY - Category 1A
SPECIFIC TARGET ORGAN TOXICITY (STOT) REPEATED EXPOSURE – Category 1 (Respiratory System)

Skin Irritant – Category 2
Eye Irritant – Category 2B
Percentage of the mixture consisting of ingredient(s) of unknown toxicity: 0%

GHS label elements

Hazard pictograms :



Signal word : Danger

Hazard statements : May cause cancer.

Precautionary statements

- Prevention :** Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wear protective gloves, protective clothing, eye protection, face protection
Wash thoroughly after handling.
Wear protective gloves
Wear eye / face protection.
- Response :** If exposed or concerned: Get medical advice/attention.
If on skin: Wash with plenty of water.
If skin irritation occurs: Get medical advice/attention.
Take off contaminated clothing and wash before reuse.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/attention.
- Storage :** Store locked up.
- Disposal :** Dispose of contents and container in accordance with all local, regional, national and international regulations.
- Supplementary Information** Use precautions if exposure exceeds the established OSHA limits.
This material does not present a hazard unless dust is generated from processing operations.
- Hazards not otherwise Classified** None known

Section 3.	Composition/Information on Ingredients
-------------------	---

Substance or mixture: Mixture

Other means of identification None

CAS number/other identifiers

CAS number : Mixture
Product code : None

Ingredient name	CAS number	%
Calcium Silicate	1344-95-2	55 – 75
Calcium metasilicate (wollastonite)	13983-17-0	20 – 40
Natural organic fibers	65996-61-4	0 – 5
Crystalline Silica (quartz)	14808-60-7	0.1 – 1

Any concentration shown as a range it to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4.

First Aid Measures

Description of necessary first aid measures

Inhalation:	Remove victim to fresh air. Drink plenty of water and blow nose to evacuate remaining dust. If coughing or irritation persist seek medical attention.
Eye contact:	Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Rinse for at least 15 minutes. If irritation persists seek medical attention.
Skin contact:	Gently wash with plenty of soap and water after each exposure. If skin becomes irritated and irritation persists seek medical attention.
Ingestion	If prolonged irritation to gastrointestinal tract or mouth persist seek medical attention.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Inhalation :	Respirable airborne particles may cause temporary irritation to the lungs and upper respiratory system.
Skin contact:	Prolonged exposure may cause dryness or irritation to the skin.
Eye contact:	Will cause mechanical irritation to the eyes. May cause moderate to severe eye irritation and dryness.
Ingestion:	May cause irritation to gastrointestinal tract or mouth.

Over-exposure signs/symptoms

Inhalation:	Adverse symptoms may include the following: Irritation, shortness of breath, chest pain
Eye contact:	Adverse symptoms may include the following: Irritation Dryness
Skin contact:	Adverse symptoms may include the following: Irritation Dryness
Ingestion:	Adverse symptoms may include the following: Irritation Stomach pains

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician: Medical conditions which may be aggravated by exposure include dry skin, dermatitis, and pre-existing lung conditions such as bronchitis, emphysema, and asthma. Cigarette smoking may increase the risk of silicosis, bronchitis, pneumoconiosis, and lung cancer in persons exposed to crystalline silica.

Specific treatments: No specific treatment.

Protection of first-aiders:. No action shall be taken involving any personal risk or without suitable training
Wear a suitable NIOSH-approved dust mask.
Wash contaminated clothing before re-use.

Section 5.

Firefighting Measures

Specific hazards arising from the chemical: None known other than those represented elsewhere in this SDS.

Hazardous thermal decomposition products Decomposition products may include the following materials:

- Calcium Silicates
- Crystalline Silica

Special protective actions for firefighters Material will not burn.
Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire.
No action shall be taken involving any personal risk or without suitable training.
No special firefighting equipment is necessary.

Special protective equipment for fire-fighters Firefighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6.

Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

For non-emergency Personnel No action shall be taken involving any personal risk or without suitable training.
Evacuate surrounding areas.
Keep unnecessary and unprotected personnel from entering.
Do not touch or walk through spilled material.
Provide adequate ventilation.
Wear appropriate respirator when ventilation is inadequate.
Put on appropriate personal protective equipment.

For emergency responders

If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions

Avoid dispersion of material and runoff and contact with soil, waterways, drains and sewers.
This material does not pose a significant threat to the environment

Methods and materials for containment and cleaning up

Small spill

Stop source of spill .
Avoid creating airborne dust
Use dust suppressant as necessary
Place material into closed waste disposal container.
Any sweeper or vacuum should be equipped with High Efficiency Particulate (HEPA) filter.
Dispose of using a licensed waste disposal contractor.

Large spill

Stop source of spill.
Avoid creating airborne dust
Use dust suppressant as necessary
Place material into closed waste disposal container.

Any sweeper or vacuum should be equipped with High Efficiency Particulate (HEPA) filter.
Dispose of using a licensed waste disposal contractor.
Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7.

Handling and Storage

Protective measures for safe handling

Protective Measures: Calcium silicate boards do not present a hazard in their intact state.
Minimize dust generation during cutting, milling, or grinding.
Use appropriate respiratory protection if dust is present above the established exposure limits.

Advice on general occupational hygiene

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed.
Workers should wash hands and face before eating, drinking and smoking.
Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
During initial exposure to service temperatures, smoke may be emitted which can cause transitory irritation to the lungs and upper respiratory system.

Conditions for safe storage,
including any
incompatibilities

Store in accordance with local regulations.
Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink.

Section 8.	Exposure Controls/Personal Protection
-------------------	--

Control parameters

Occupational exposure limits:

US Occupational Safety and Health Administration Permissible Exposure Limit (OSHA PEL):

Irritant (Nuisance) Dust (all components except crystalline silica):	5 mg/m ³
Crystalline Silica	
Permissible Exposure Limit	50 µg/m ³
Action Level	25 µg/m ³

(See 29 CFR 1910.1053, effective June 23, 2018. Regulation contains additional requirements, including written exposure plan, medical exams, training, and recordkeeping.)

(See 29 CFR 1910.1000 Table Z-3)

American Conference of Governmental and Industrial Hygienists Threshold Limit Value (ACGIH TLV®):

Calcium silicate	10 mg/m ³
Calcium metasilicate (wollastonite)	3 mg/m ³
Crystalline Silica	0.025 mg/m ³

Note: TLV® and PEL values are for eight hour exposures, unless noted.

Appropriate

Engineering controls: If user operations generate dust, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
Power equipment should be fitted with a properly designed dust collection device.

Environmental

Exposure controls: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene Measures: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.
Appropriate techniques should be used to remove potentially contaminated clothing.
Wash contaminated clothing before reusing.
Ensure that eyewash stations and safety showers are close to the workstation location.

Skin Protection

Respiratory Protection: Wear a NIOSH-approved dust mask to limit exposure to product dust.
Higher dust levels may require use of a half or full mask respirator with dust filters.
Use local exhaust if necessary to lower dust levels.
Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Eye/Face Protection: Wear safety glasses with side shields or goggles complying with an approved standard to avoid exposure to dust.

Hand Protection: Protective gloves should be worn when handling and to avoid abrasion or drying of skin.

Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved.

Other Skin Protection: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved.

Section 9.

Physical and Chemical Properties

Appearance

Physical State	Solid sheets
Color	Gray
Odor	None
Odor Threshold	Not Applicable
pH	Not Applicable
Melting Point	> 2300 °F (1260 °C)
Boiling Point	N/A
Flash Point	None
Burning Time	Not applicable
Specific Gravity	1.5 – 1.7
Burning Rate	Not applicable
Evaporation Rate	0 (butyl acetate = 1)
Flammability (solid, gas)	Not applicable
Lower Explosive (flammable) Limit	Not available

Upper Explosive (flammable) Limit	Not available
Vapor Pressure	Not applicable
Vapor Density	Not applicable
Relative Density	Not available
Solubility	Not available
Solubility in Water	Slight
Partition coefficient: n-octanol/water	Not available
Auto-ignition Temperature	Not available
Decomposition Temperature	Not available
SADT	Not available
Viscosity	Not available

Section 10.

Stability and Reactivity

Reactivity: This product is normally not reactive.

Chemical stability: The product is stable under normal conditions of use.

Possibility of

Hazardous Reactions: Under normal conditions of storage and use, hazardous reactions will not occur.
Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to Avoid: Avoid strong acids and ammonium salts. Contact with strong oxidizing agents (such as fluorine, chlorine trifluoride) may present a fire hazard.

Incompatible

Materials: Reactive or incompatible with the following materials:
Hydrofluoric acid, fluorine, chlorine trifluoride, oxygen difluoride

Hazardous Decomposition

Products Crystalline silica will dissolve in hydrofluoric acid and produce silicon tetrafluoride, a corrosive gas.

Section 11.

Toxicological Information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
None Known	--	--	--	--
	--	--	--	--

Irritation/Corrosion: Not available

Sensitization Not available

Mutagenicity Not available

Carcinogenicity: Not available

Reproductive toxicity Not available

Teratogenicity Not available

**Specific target organ toxicity
(single exposure)** Not available

**Specific target organ toxicity
(repeated exposure)** This material contains Crystalline Silica, which is known to cause silicosis. Silicosis is a rapidly progressive, non-cancerous lung disease that is often fatal.

Aspiration hazard Not available

**Information on the likely
routes of exposure** Routes of entry anticipated: Oral, Dermal, Inhalation.

Potential acute health effects

Inhalation : Respirable airborne particles may cause temporary irritation to the lungs and upper respiratory system.

Skin contact: Prolonged exposure may cause dryness or irritation to the skin.

Eye contact: Will cause mechanical irritation to the eyes. May cause moderate to severe eye irritation and dryness.

Ingestion: May cause irritation to gastrointestinal tract or mouth.

Symptoms related to the physical, chemical and toxicological characteristics

Inhalation: Adverse symptoms may include the following:
Irritation

Eye contact: Adverse symptoms may include the following:
Irritation
Dryness

Skin contact: Adverse symptoms may include the following:
Irritation
Dryness

Ingestion: Adverse symptoms may include the following:

Irritation
Stomach pains

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects: Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects: Not available.

Potential delayed effects : Not available.

Potential chronic health effects: Not available

General: No other known significant effects or critical hazards.

Carcinogenicity: Crystalline silica – long term overexposure may cause permanent and irreversible lung damage, including silicosis, and increase the risk of lung cancer, kidney, and liver damage. Silicosis is a rapidly progressive, non-cancerous lung disease that is often fatal.

IARC (International Agency for Research on Cancer) 014808-60-7 Silica dust, crystalline, in the form of quartz or cristobalite - Group 1 (Sup 7, 68,100C, 2012)

National Toxicology Program (NTP) Report on Carcinogens Silica, Crystalline (Respirable Size) - Known To Be Human Carcinogen

OSHA: Crystalline Silica classified as a Category 1A Carcinogen

Mutagenicity: No known significant effects or critical hazards.

Teratogenicity: No known significant effects or critical hazards.

Developmental: No known significant effects or critical hazards.

Fertility effects: No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12.

Ecological Information

Toxicity Not available.

Persistence and Degradability: Not available.

Bioaccumulative Potential: Not available.

Mobility in soil

Soil/water partition coefficient (K_{OC}): Not available

Other adverse effects: Most of the ingredients in this product are naturally occurring minerals, and, unless contaminated in service, are not hazardous to the environment.

Section 13.

Disposal Considerations

Disposal methods: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14.

Transport Information

	DOT Classification	TDG Classification	IMDG	IATA
UN Number	Not Regulated	Not Regulated	Not Regulated	Not Regulated

Special precautions for user:

Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage

Section 15.

Regulatory Information

U.S. Federal regulations

TSCA 8(a) CDR Exempt/Partial exemption: Not applicable
United States inventory (TSCA 8b): All components are listed.

Clean Air Act Section 112

(b) Hazardous Air

Pollutants (HAPs): Not listed

Clean Air Act Section 602

Class I Substances: Not listed

Clean Air Act Section 602

Class II Substances: Not listed

DEA List I Chemicals

(Precursor Chemicals): Not listed

DEA List II Chemicals

(Essential Chemicals): Not listed

SARA 302/304

Composition/information on ingredients: No components are listed.

SARA 304 RQ: Not applicable.

SARA 311/312

Classification :

	Immediate (acute) Health Hazard	Delayed (chronic) Health Hazard	Fire Hazard	Reactivity Hazard	Sudden Release of Pressure
	Yes	Yes	No	No	No

Section 313 listed: No

Listed material/compound: Not Applicable

State regulations

New York: Crystalline Silica

New Jersey: Crystalline Silica

Pennsylvania: Crystalline Silica

Massachusetts: Crystalline Silica

Rhode Island: Crystalline Silica

California Prop. 65: This product contains the following substances known to the State of California to cause cancer: Crystalline silica

International Lists

DSL (Canada) All ingredients are listed, or exempt from inclusion, on the Canadian Domestic Substances List (DSL).

WHMIS 2015 (Canada): See Section 2

Australia inventory (AICS):	Not determined.
China inventory (IECSC):	Not determined.
Japan inventory:	Not determined.
Korea inventory:	Not determined.
Malaysia Inventory (EHS Register):	Not determined.
New Zealand Inventory of Chemicals (NZIoC):	Not determined.
Philippines inventory (PICCS):	Not determined.
Taiwan inventory (CSNN):	Not determined.

Chemical Weapons Convention List Schedule I Chemicals: Not listed

Chemical Weapons Convention List Schedule II Chemicals: Not listed

Chemical Weapons Convention List Schedule III Chemicals: Not listed

DSCL (Europe): R48/20: Harmful – Danger of serious damage to health by prolonged exposure through inhalation.
R36: Irritating to the eyes
R39: Danger of serious irreversible side effects.
R45: May cause cancer.

Section 16.

Other Information

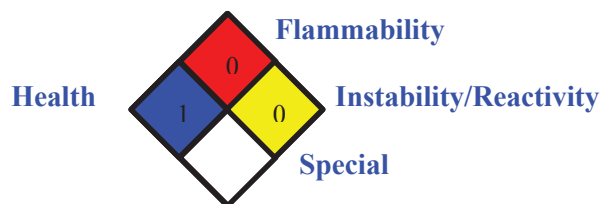
Hazardous Material Information System (U.S.A.)

Health	2
Flammability	0
Physical Hazards	0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

DISCLAIMER – BNZ Materials, Inc., (BNZ) believes the information contained in this Safety Data Sheet (SDS) to be accurate and reliable as of the date of issue, and is provided in good faith as a service to our customers and to comply with applicable laws. This document is intended as a guide for the safe handling, storage, and use of this material under normal conditions of use. No representation, warranty, or guarantee, either express or implied, is intended or given. BNZ does not accept any liability for any loss, injury, or damage resulting from the use of this product.

History

Date of issue/Date of revision:

November 7, 2018

Date of previous issue:

October 28, 2015

Changes :

Added new OSHA exposure limit for crystalline silica
Modifications to meet Canadian WHMIS 2015 requirements.
Routine review and update

Prepared by:

T Square Associates, Inc.
www.tsquare.us



SAFETY DATA SHEET

THE DOW CHEMICAL COMPANY

Product name: DOWSIL™ 736 Heat Resistant Sealant

Issue Date: 03/15/2018
Print Date: 03/25/2018

THE DOW CHEMICAL COMPANY encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

1. IDENTIFICATION

Product name: DOWSIL™ 736 Heat Resistant Sealant

Recommended use of the chemical and restrictions on use
Identified uses: Adhesive, binding agents

COMPANY IDENTIFICATION

THE DOW CHEMICAL COMPANY
2030 WILLARD H DOW CENTER
MIDLAND MI 48674-0000
UNITED STATES

Customer Information Number:

800-258-2436
SDSQuestion@dow.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: CHEMTREC +1 800-424-9300
Local Emergency Contact: 800-424-9300

2. HAZARDS IDENTIFICATION

Hazard classification

This material is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Label elements

Precautionary statements

Prevention
Use only outdoors or in a well-ventilated area.

Other hazards

No data available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical nature: Silicone elastomer

This product is a mixture.
Contains no hazardous ingredients according to GHS

4. FIRST AID MEASURES

Description of first aid measures

General advice:

If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air; if effects occur, consult a physician.

Skin contact: Wash off with plenty of water.

Eye contact: Flush eyes thoroughly with water for several minutes. Remove contact lenses after the initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

Ingestion: No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed: Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed

Notes to physician: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIREFIGHTING MEASURES

Suitable extinguishing media: Water spray Alcohol-resistant foam Carbon dioxide (CO₂) Dry chemical

Unsuitable extinguishing media: None known.

Special hazards arising from the substance or mixture

Hazardous combustion products: Carbon oxides Silicon oxides

Unusual Fire and Explosion Hazards: Exposure to combustion products may be a hazard to health.

Advice for firefighters

Fire Fighting Procedures: Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Use water spray to cool unopened containers. Remove undamaged containers from fire area if it is safe to do so. Evacuate area.

Special protective equipment for firefighters: Wear self-contained breathing apparatus for firefighting if necessary. Use personal protective equipment.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Follow safe handling advice and personal protective equipment recommendations.

Environmental precautions: Discharge into the environment must be avoided. Prevent further leakage or spillage if safe to do so. Retain and dispose of contaminated wash water. Local authorities should be advised if significant spillages cannot be contained.

Methods and materials for containment and cleaning up: Soak up with inert absorbent material. Local or national regulations may apply to releases and disposal of this material, as well as those materials and items employed in the cleanup of releases. You will need to determine which regulations are applicable. For large spills, provide dyking or other appropriate containment to keep material from spreading. If dyked material can be pumped, Clean up remaining materials from spill with suitable absorbent. Sections 13 and 15 of this SDS provide information regarding certain local or national requirements.

See sections: 7, 8, 11, 12 and 13.

7. HANDLING AND STORAGE

Precautions for safe handling: Take care to prevent spills, waste and minimize release to the environment. Handle in accordance with good industrial hygiene and safety practice. Use only with adequate ventilation. See Engineering measures under EXPOSURE CONTROLS/PERSONAL PROTECTION section.

Conditions for safe storage: Keep in properly labelled containers. Store in accordance with the particular national regulations.

Do not store with the following product types: Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

If exposure limits exist, they are listed below. If no exposure limits are displayed, then no values are applicable.

Although some of the components of this product may have exposure guidelines, no exposure would be expected under normal handling conditions due to the physical state of the material.

Exposure controls

Engineering controls: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations. Local exhaust ventilation may be necessary for some operations.

Individual protection measures

Eye/face protection: Use safety glasses (with side shields).

Skin protection

Hand protection: Chemical protective gloves should not be needed when handling this material. Consistent with general hygienic practice for any material, skin contact should be minimized.

Other protection: No precautions other than clean body-covering clothing should be needed.

Respiratory protection: Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, wear respiratory protection when adverse effects, such as respiratory irritation or discomfort have been experienced, or where indicated by your risk assessment process. For most conditions no respiratory protection should be needed; however, if discomfort is experienced, use an approved air-purifying respirator.

The following should be effective types of air-purifying respirators: Organic vapor cartridge.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state	paste
Color	red
Odor	acetic acid
Odor Threshold	No data available
pH	Not applicable
Melting point/range	No data available
Freezing point	No data available
Boiling point (760 mmHg)	Not applicable
Flash point	Not applicable
Evaporation Rate (Butyl Acetate = 1)	Not applicable
Flammability (solid, gas)	Not classified as a flammability hazard
Lower explosion limit	No data available
Upper explosion limit	No data available
Vapor Pressure	Not applicable
Relative Vapor Density (air = 1)	No data available
Relative Density (water = 1)	1.04
Water solubility	No data available
Partition coefficient: n-octanol/water	No data available
Auto-ignition temperature	No data available
Decomposition temperature	No data available
Dynamic Viscosity	Not applicable
Kinematic Viscosity	Not applicable

Explosive properties	Not explosive
Oxidizing properties	The substance or mixture is not classified as oxidizing.
Molecular weight	No data available
Particle size	No data available

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10. STABILITY AND REACTIVITY

Reactivity: Not classified as a reactivity hazard.

Chemical stability: Stable under normal conditions.

Possibility of hazardous reactions: Can react with strong oxidizing agents. When heated to temperatures above 150 °C (300 °F) in the presence of air, product can form formaldehyde vapours. Safe handling conditions may be maintained by keeping vapour concentrations within the occupational exposure limit for formaldehyde.

Conditions to avoid: None known.

Incompatible materials: Oxidizing agents

Hazardous decomposition products: Formaldehyde.

11. TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity

Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

As product: Single dose oral LD50 has not been determined.

Based on information for component(s):

LD50, Rat, > 5,000 mg/kg Estimated.

Acute dermal toxicity

Prolonged skin contact is unlikely to result in absorption of harmful amounts.

As product: The dermal LD50 has not been determined.

Based on information for component(s):

LD50, > 2,000 mg/kg Estimated.

Acute inhalation toxicity

Brief exposure (minutes) is not likely to cause adverse effects.

As product: The LC50 has not been determined.

Skin corrosion/irritation

Prolonged contact is essentially nonirritating to skin.

Serious eye damage/eye irritation

May cause slight temporary eye irritation.

Corneal injury is unlikely.

May cause mild eye discomfort.

Sensitization

For skin sensitization:

Contains component(s) which did not cause allergic skin sensitization in guinea pigs.

For respiratory sensitization:

No relevant information found.

Specific Target Organ Systemic Toxicity (Single Exposure)

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)

For this family of materials:

Based on available data, repeated exposures are not anticipated to cause significant adverse effects.

Contains an additional component(s) that is/are encapsulated in the product and are not expected to be released under normal processing conditions or foreseeable emergency.

Carcinogenicity

For this family of materials: Did not cause cancer in long-term animal studies which used routes of exposure considered relevant to industrial handling. Positive results have been reported in other studies using routes of exposure not relevant to industrial handling.

Contains an additional component(s) that is/are encapsulated in the product and are not expected to be released under normal processing conditions or foreseeable emergency.

Teratogenicity

For this family of materials: Did not cause birth defects or any other fetal effects in laboratory animals.

Reproductive toxicity

For this family of materials: In animal studies, did not interfere with reproduction.

Mutagenicity

For this family of materials: In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.

Aspiration Hazard

Based on physical properties, not likely to be an aspiration hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

Toxicity

No data available.

Persistence and degradability

No data available.

Bioaccumulative potential

No data available.

Mobility in soil

No data available.

13. DISPOSAL CONSIDERATIONS

Disposal methods: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Recycler. Reclaimer. Incinerator or other thermal destruction device. For additional information, refer to: Handling & Storage Information, MSDS Section 7 Stability & Reactivity Information, MSDS Section 10 Regulatory Information, MSDS Section 15

Treatment and disposal methods of used packaging: Empty containers should be recycled or otherwise disposed of by an approved waste management facility. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. Do not re-use containers for any purpose.

14. TRANSPORT INFORMATION

DOT

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

Not regulated for transport

**Transport in bulk
according to Annex I or II
of MARPOL 73/78 and the
IBC or IGC Code**

Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Not regulated for transport

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

15. REGULATORY INFORMATION

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

No SARA Hazards

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Section 313

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Section 103

Calculated RQ exceeds reasonably attainable upper limit.

Components	CASRN	RQ (RCRA Code)
Acetic acid	64-19-7	5000 lbs RQ
Acetic anhydride	108-24-7	5000 lbs RQ

Pennsylvania Right To Know

The following chemicals are listed because of the additional requirements of Pennsylvania law:

Components	CASRN
Polydimethylsiloxane hydroxy-terminated	70131-67-8
Silicon dioxide	7631-86-9

California Prop. 65

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

United States TSCA Inventory (TSCA)

All components of this product are in compliance with the inventory listing requirements of the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

16. OTHER INFORMATION

Hazard Rating System**NFPA**

Health	Flammability	Instability
0	1	0

HMIS

Health	Flammability	Physical Hazard
0/	1	0

Revision

Identification Number: 2786729 / A001 / Issue Date: 03/15/2018 / Version: 4.0

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Information Source and References

This SDS is prepared by Product Regulatory Services and Hazard Communications Groups from information supplied by internal references within our company.

THE DOW CHEMICAL COMPANY urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.

US

MATERIAL SAFETY DATA SHEET

MANUFACTURER NAME: *DU-CO CERAMICS COMPANY, INC.*
ADDRESS: *155 SOUTH REBECCA STREET*
SAXONBURG, PA 16056
TELEPHONE: *(724) 352-1511*

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SECTION I: PRODUCT IDENTIFICATION

TRADE NAMES: *STEATITE, CORDIERITE, MAGNESIUM OXIDE,
ALUMINA, FORSTERITE,
MACHINABLE CERAMIC INSULATORS*

CHEMICAL NAMES: *L-3 STEATITE, L-5 STEATITE, CORDIERITE,
MAGNESIUM OXIDE, ALUMINA, FORSTERITE*

CHEMICAL FAMILY: *INORGANIC MAGNESIUM ALUMINUM SILICATES*

CHEMICAL STRUCTURE: *PROPRIETARY*

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SECTION II: HAZARDOUS INGREDIENTS

<u>INGREDIENT</u>	<u>TYPICAL</u>	<u>OCCUPATIONAL EXPOSURE LIMIT</u>
<i>QUARTZ</i>	<i>0 – 3.0%</i>	<i>6 MG/M3 (TWA)</i>

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SECTION III: PHYSICAL DATA

BOILING POINT: *N/A* **SPECIFIC GRAVITY:** *2.0 – 4.0*

VAPOR PRESSURE: *N/A* **MELT POINT:** *OVER 2400° F*

SOLUBILITY IN WATER: *N/A* **VAPOR DENSITY:** *N/A*

PERCENT VOLATILE: *10%* **EVAPORATION RATE:** *N/A*

APPEARANCE & ODOR: *FORMED ROD, BAR, TUBES AND SHAPES.*
NO ODOR COLORS: WHITE, IVORY, BLUE, CHOCOLATE BROWN AND BLACK.

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SECTION IV: FIRE AND EXPLOSION DATA

FLASH POINT: *NONE* **EXTINGUISHING MEDIA:** *ANY*

SPECIAL FIRE FIGHTING PROCEDURES: *NONE*

USUAL FIRE OR EXPLOSION HAZARDS: *NONE*

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**SECTION V: HEALTH HAZARD DATA
EMERGENCY AID PROCEDURE**

INHALATION: *MOVE TO FRESH AIR, CONSULT PHYSICIAN AS NECESSARY,
AVOID PROLONGED EXPOSURE TO DUST.*

INGESTION: *N/A*

EYE CONTACT: *FLUSH WITH WATER, CONSULT PHYSICIAN AS NECESSARY.*

SKIN CONTACT: *WASH WITH WATER.*

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SECTION VI: CONDITIONS FOR SAFE USE

RESPIRATORY PROTECTION: *USE NIOSH/MSHA RESPIRATOR IF DUST IS
PRESENT.*

EYE PROTECTION: *RECOMMENDED IF SHATTERING IS POSSIBLE.*

OTHER PROTECTIVE CLOTHING: *NONE REQUIRED*

VENTILATION REQUIREMENTS: *USE LOCAL EXHAUST TO REMOVE DUST.*

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SECTION VII: REACTIVITY DATA

HAZARDOUS POLYMERIZATION: *NONE*

HAZARDOUS DECOMPOSITION: *NONE*

STABILITY: *STABLE*

CONDITIONS TO AVOID: *NONE*

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SECTION VIII: REACTIVITY DATA

STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED: *VACUUM
OR WET SWEEP TO AVOID DUST TO BECOME AIRBORNE.*

WASTE DISPOSAL: *DISPOSE OF ACCORDING TO FEDERAL, STATE AND LOCAL
REGULATIONS.*

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SECTION IX: SPECIAL PRECAUTIONS

SPECIAL PRECAUTIONS FOR HANDLING AND STORAGE: *STORE IN A DRY
AREA. LIMIT THE CREATION OR PROLONGED INHALATION OF DUST.*

OTHER PRECAUTIONS: *ARTICLES MAY SHATTER IF DROPPED OR JARRED.
AVOID HANDLING OF SHARP EDGES.*

1. Identification

Product identifier GRAFSTAR™ Graphite Shapes - 114 Treated - All Grades

Other means of identification

SDS number 4054

Recommended use Aluminum Refining Equipment

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer/Supplier GrafTech International Holdings Inc. or affiliate
Suite 300 Park Center I
6100 Oak Tree Boulevard
Independence, Ohio 44131
+1 216-676-2000

Contact person Product Responsibility Manager +1-216-676-2304

E-mail sds@graftech.com

Emergency telephone number For Chemical Emergency ONLY, call CHEMTREC at:
+1-800-424-9300 or +1-703-527-3887

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Hazard symbol None.

Signal word None.

Hazard statement The mixture does not meet the criteria for classification.

Precautionary statement

Prevention Observe good industrial hygiene practices.

Response Wash hands after handling.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Graphite	7782-42-5	> 96
Aluminum trimetaphosphate		< 4

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	The product is immiscible with water and will sediment in water systems. Stop the flow of material, if this is without risk. Following product recovery, flush area with water. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Avoid prolonged exposure. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Graphite (CAS 7782-42-5)	PEL	5 mg/m ³	Respirable fraction.
		15 mg/m ³	Total dust.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value
Graphite (CAS 7782-42-5)	TWA	15 mppcf

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Graphite (CAS 7782-42-5)	TWA	2 mg/m ³	Respirable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
Graphite (CAS 7782-42-5)	TWA	2.5 mg/m ³	Respirable.

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves. Suitable gloves can be recommended by the glove supplier.
Skin protection	
Other	Wear suitable protective clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Various geometric shapes
Physical state	Solid.
Form	Solid.
Color	Black.
Odor	Odorless.
Odor threshold	Not available.
pH	Not applicable.
Melting point/freezing point	> 5000 °F (> 2760 °C)
Initial boiling point and boiling range	Not applicable.
Flash point	Not applicable.
Evaporation rate	Not applicable.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not applicable.
Flammability limit - upper (%)	Not applicable.
Vapor pressure	Not applicable.
Vapor density	Not applicable.
Relative density	1.73
Solubility(ies)	
Solubility (water)	Insoluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not applicable.
Decomposition temperature	Not applicable.
Viscosity	Not available.
Other information	
Bulk density	0.95 - 1.2 g/cc
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
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Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Chlorine.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.

Symptoms related to the physical, chemical and toxicological characteristics
Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity

Components	Species	Test Results
Graphite (CAS 7782-42-5)		
Acute		
<i>Oral</i>		
LD50	Rat	> 10000 mg/kg

Skin corrosion/irritation
Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation
Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.

Germ cell mutagenicity
No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity
This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

NTP Report on Carcinogens

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Reproductive toxicity
This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure
Not classified.

Specific target organ toxicity - repeated exposure
Not classified.

Aspiration hazard
Not an aspiration hazard.

Chronic effects
Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity
The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability
No data is available on the degradability of this product.

Bioaccumulative potential
No data available.

Mobility in soil
The product is insoluble in water.

Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.
13. Disposal considerations	
Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)
Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations

US. Massachusetts RTK - Substance List

Graphite (CAS 7782-42-5)

US. New Jersey Worker and Community Right-to-Know Act

Graphite (CAS 7782-42-5)

US. Pennsylvania Worker and Community Right-to-Know Law

Graphite (CAS 7782-42-5)

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 24-May-2016

Revision date -

Version # 01

NFPA ratings

**Disclaimer**

GRAFTECH INTERNATIONAL HOLDINGS INC. ADVISES THE USERS OF THIS PRODUCT TO STUDY THIS SAFETY DATA SHEET (SDS) AND BECOME AWARE OF PRODUCT HAZARDS AND SAFETY INFORMATION. TO PROMOTE SAFE USE OF THIS PRODUCT, USERS SHOULD NOTIFY THEIR EMPLOYEES, AGENTS AND CONTRACTORS OF THE INFORMATION ON THIS SDS AND ANY PRODUCT HAZARDS AND SAFETY INFORMATION.

This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

1. Identification

Product identifier	GREENSET-94 P
Other means of identification	
Brand Code	5618
Recommended use	For Industrial Use Only
Recommended restrictions	Users should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	HarbisonWalker International
Address	1305 Cherrington Parkway, Suite 100 Moon Township, Pennsylvania 15108 US
Telephone	General Phone: 412-375-6600
Website	www.thinkHWI.com
Emergency phone number	CHEMTREC 24 HOUR 1-800-424-9300 EMERGENCY #

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Skin corrosion/irritation	Category 1A
	Serious eye damage/eye irritation	Category 1
	Carcinogenicity	Category 1A
	Specific target organ toxicity, repeated exposure	Category 1
Environmental hazards	Not classified.	
OSHA defined hazards	Not classified.	
Label elements		



Signal word	Danger
Hazard statement	Causes severe skin burns and eye damage. Causes serious eye damage. May cause cancer. Causes damage to organs through prolonged or repeated exposure.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust/fume/gas/mist/vapors/spray. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection.
Response	If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Wash contaminated clothing before reuse.
Storage	Store in a manner to minimize airborne dust.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.

Supplemental information

Users should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Overexposure to the respirable dust of crystalline silica (quartz or cristobalite, less than or equal to 5 microns in size) may lead to silicosis in humans, which is a progressive and irreversible lung disease. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
ALUMINA, TABULAR-48 MESH		1344-28-1	60 - 80
Aluminium Tris(Dihydrogen Phosphate)		13530-50-2	2.5 - 10
Orthophosphoric Acid		7664-38-2	2.5 - 10
Boric Acid		10043-35-3	1 - 2.5
Quartz (SiO ₂)		14808-60-7	0.1 - 1
Other components below reportable levels			10 - 20

Crystalline silica may be present at low concentrations; most of this is encapsulated in the coarse aggregate or as part of the clays or sands.

4. First-aid measures

Inhalation

Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact

Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.

Eye contact

Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.

Ingestion

Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Most important symptoms/effects, acute and delayed

Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Prolonged exposure may cause chronic effects.

Indication of immediate medical attention and special treatment needed

Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim under observation. Symptoms may be delayed.

General information

IF exposed or concerned: Get medical advice/attention. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media

Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media

Not available.

Specific hazards arising from the chemical

Not applicable.

Special protective equipment and precautions for firefighters

Not available.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Material can be slippery when wet. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use. Put material in suitable, covered, labeled containers. For waste disposal, see section 13 of the SDS.

Environmental precautions

Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage**Precautions for safe handling**

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Do not breathe dust. Do not breathe dust. Do not get in eyes, on skin, or on clothing. When using, do not eat, drink or smoke. Should be handled in closed systems, if possible. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Store locked up. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection**Occupational exposure limits**

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
ALUMINA, TABULAR-48 MESH (CAS 1344-28-1)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
Orthophosphoric Acid (CAS 7664-38-2)	PEL	1 mg/m3	
Quartz (SiO2) (CAS 14808-60-7)	PEL	0.05 mg/m3	

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
ALUMINA, TABULAR-48 MESH (CAS 1344-28-1)	TWA	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.
Quartz (SiO2) (CAS 14808-60-7)	TWA	0.1 mg/m3	Respirable.
		2.4 mppcf	Respirable.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
ALUMINA, TABULAR-48 MESH (CAS 1344-28-1)	TWA	1 mg/m3	Respirable fraction.
Aluminium Tris(Dihydrogen Phosphate) (CAS 13530-50-2)	TWA	1 mg/m3	Respirable fraction.
Boric Acid (CAS 10043-35-3)	STEL	6 mg/m3	Inhalable fraction.
	TWA	2 mg/m3	Inhalable fraction.
Orthophosphoric Acid (CAS 7664-38-2)	STEL	3 mg/m3	
	TWA	1 mg/m3	
Quartz (SiO2) (CAS 14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
Aluminium Tris(Dihydrogen Phosphate) (CAS 13530-50-2)	TWA	2 mg/m3	
Orthophosphoric Acid (CAS 7664-38-2)	STEL	3 mg/m3	
Quartz (SiO2) (CAS 14808-60-7)	TWA TWA	1 mg/m3 0.05 mg/m3	Respirable dust.

Biological limit values

No biological exposure limits noted for the ingredient(s).

Exposure guidelines

Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled. Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled. Occupational Exposure Limits are not relevant to the current physical form of the product.

Appropriate engineering controls

Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection

Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection

Wear appropriate chemical resistant gloves.

Other

Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.

Respiratory protection

Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits.

Thermal hazards

Wear appropriate thermal protective clothing, when necessary.



General hygiene considerations

Observe any medical surveillance requirements. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state

Solid.

Form

Solid. Paste.

Color

Not available.

Odor

Not available.

Odor threshold

Not available.

pH

Not available.

Melting point/freezing point

Not available.

Initial boiling point and boiling range

Not available.

Flash point

Not available.

Evaporation rate

Not available.

Flammability (solid, gas)

Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)

Not available.

Flammability limit - upper (%)

Not available.

Explosive limit - lower (%)

Not available.

Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Acids. Chlorine. Incompatibility is based strictly upon potential theoretical reactions between chemicals and may not be specific to industrial application exposure.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns.

Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.
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Information on toxicological effects

Acute toxicity	Not known.
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Components	Species	Test Results
Boric Acid (CAS 10043-35-3)		
<u>Acute</u>		
Inhalation		
LC50	Rat	> 0.002 mg/l, 4 Hours

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Causes severe skin burns and eye damage.
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Serious eye damage/eye irritation	Causes serious eye damage.
--	----------------------------

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
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Skin sensitization	This product is not expected to cause skin sensitization.
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Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
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Carcinogenicity

In 1997, IARC (the International Agency for Research on Cancer) concluded that crystalline silica inhaled from occupational sources can cause lung cancer in humans. However in making the overall evaluation, IARC noted that "carcinogenicity was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monographs on the evaluation of the carcinogenic risks of chemicals to humans, Silica, silicates dust and organic fibres, 1997, Vol. 68, IARC, Lyon, France.) In June 2003, SCOEL (the EU Scientific Committee on Occupational Exposure Limits) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis (and, apparently, not in employees without silicosis exposed to silica dust in quarries and in the ceramic industry). Therefore, preventing the onset of silicosis will also reduce the cancer risk..." (SCOEL SUM Doc 94-final, June 2003) According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits. May cause cancer. Occupational exposure to respirable dust and respirable crystalline silica should be monitored and controlled.

IARC Monographs. Overall Evaluation of Carcinogenicity

Quartz (SiO₂) (CAS 14808-60-7)

1 Carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens

Quartz (SiO₂) (CAS 14808-60-7)

Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Reproductive toxicity

This product is not expected to cause reproductive or developmental effects.

Developmental effects

Quartz (SiO₂)

0

Developmental effects - EU category

Quartz (SiO₂)

0

Embryotoxicity

Quartz (SiO₂)

0

Reproductivity

Quartz (SiO₂)

0

Specific target organ toxicity - single exposure

Not classified.

Specific target organ toxicity - repeated exposure

Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

Not an aspiration hazard.

Chronic effects

Causes damage to organs through prolonged or repeated exposure. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity

The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability

No data is available on the degradability of this product.

Bioaccumulative potential

No data available.

Mobility in soil

No data available.

Other adverse effects

No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions

This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

Hazardous waste code

Since this product is used in several industries, no Waste Code can be provided by the supplier. The Waste Code should be determined in arrangement with your waste disposal partner or the responsible authority.

Waste from residues / unused products

Not available.

Contaminated packaging

Not available.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All chemical substances in this product are listed on the TSCA chemical substance inventory where required.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Orthophosphoric Acid (CAS 7664-38-2) Listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
ALUMINA, TABULAR-48 MESH	1344-28-1	60 - 80

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

Orthophosphoric Acid (CAS 7664-38-2) High priority

US state regulations WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Quartz (SiO₂) (CAS 14808-60-7) Listed: October 1, 1988

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Boric Acid (CAS 10043-35-3)
Orthophosphoric Acid (CAS 7664-38-2)
Quartz (SiO₂) (CAS 14808-60-7)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	03-25-2015
Revision date	06-06-2018
Version #	04
Disclaimer	This information is based on our present knowledge on creation date. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.
Revision information	Composition/information on ingredients: Component information

SAFETY DATA SHEET

Silicon Nitride based Ceramics

Issue Date : 20th September 2014

1. Product and Company Identification

Product Name : Silicon Nitride base Ceramics "Sialon, Super-Sialon"
(Product Code Name : HCN10
HSN60 HSN65 HSN70 HSN75 HSN80)
Manufacturer's Name : Hitachi Metals, Ltd.
Address : 1-100 Hibikimachi, Wakamatsu-ku, Kitakyushu-shi 808-0021 Japan
Section in Charge : Ceramics Dept. Hibiki-Works
TEL No. : +81-93-751-1867
FAX No. : +81-93-751-1884
Recommendation of the Uses : parts for structures

2. Hazards Identification

GHS-Classification : Not applicable
GHS-Symbol : Not applicable
Signal word : Not applicable
Most Important Hazards : Not applicable
- Physical and Chemical Hazards : Not applicable
- Adverse Human Health Hazards : Fragment and Dust can cause irritation of Skin and eyes
- Environmental Effects : Not applicable
- Other adverse Hazards : Not applicable

3. Composition / Information on Ingredients

Substance / Mixture : Mixture
Chemical Name : Silicon Nitride based Ceramics
Chemical Formula : Refer below table
Ingredients and Composition : Refer below table
CAS No. : Refer below table
Hazardous Ingredients : Not applicable

Ingredient	Chemical Formula	CAS No	ISHL No (Occupational Health and Safety Law)	(the Chemical Substances Control Law)	Composition mass%
Silicon Nitride	Si ₃ N ₄	12033-89-5	Not applicable	(1)-493	50-95
Yttrium Oxide	Y ₂ O ₃	1314-36-9	Appendix9 54	(1)-560	0-20
Aluminum Nitride	AlN	24304-00-5	Not applicable	(1)-19	0-10
Silicon Oxide	SiO ₂	7631-86-9	Appendix9 312	(1)-548	0-10
Aluminum Oxide	Al ₂ O ₃	1344-28-1	Appendix9 189	(1)-23	0-10
Magnesium Oxide	MgO	1309-48-4	Not applicable	(1)-465	0-5
Titanium Oxide	TiO ₂	13463-67-7	Appendix9 191	(1)-558	0-5

4. First-Aid Measures

- In case of Inhalation : There is no possibility to absorb in generally
- In case of Skin Contact : When the symptoms such as rash were seen, the diagnosis of the doctor is received promptly.
- In case of Eye Contact : When fragments get into eyes, it is washed away with clean water without rubbing it.
The diagnosis of the doctor is received as needed.
- In case of Ingestion : When possible, the diagnosis of the doctor is received after having vomited.

5. Fire-Fighting Measures

- Suitable Extinguishing Media : Generally, it is non-inflammable, and there is no likelihood of the ignition.

6. Accidental Release Measures

- Methods for Removal : Not applicable. Because this is an article.
- Personal Precautions : Not applicable. Because this is an article.
- Environmental Precautions : Not applicable. Because this is an article.
- Methods for Correction, Cleaning up and Disposal : Dispose as industrial waste.

7. Handling and Storage

- Handling :
- Technical Advice : Control outbreak of the dust as wet method at the time of cutting, machining and so on.
- Technical Measures : When dust occurs by cutting machining and so on, take the treatment of the local return air based on the law about the dust. When it is used in molten metal, remove moisture beforehand. Preheat it for thermal shock palliation.
- Safe Handling Advice : Use the protective equipment such as safety helmet, goggle, gloves, dust respirator, a face guard, the apron depending on a situation.
Do not touch the sharp site barehanded.
Avoid mechanical and thermal shock.

- Storage :
- Technical Measures : Keep it so that mechanical and thermal shock does not increase.
Avoid a humid place.
- Storage Conditions : Avoid a humid place.
- Incompatible Products : Not applicable
- Packaging Materials : The container packaging material which does not increase mechanical shock is used.

8. Exposure Controls / Personal Protection

- Exposure Limit Values : Not applicabl
- Personal Protective Equipment : Following equipments are recommended according to actual works.

- Respiratory Protection : Dust-protective mask is recommended when dusts are produced in such cases as machining and cutting.
- Hand Protection : Protective gloves are recommended when handling sharp parts such as a cutting edge and fractured surface.
- Eye Protection : Safety glasses with side or goggles are recommended in such case as machining and cutting.
- Skin and Body Protection : Wear protective shoes on the supposition of a falling object.

9. Physical and Chemical Properties

Physical State	: (Solid, Liquid or Gas) Solid
Form	: Different form depending on a kind of products
Color	: White, Gray, Black
Odor	: Odorless
pH	: No data
Melting Point	: No data
Boiling Point	: No data
Vapor pressure	: No data
Density	: 2.8~3.5 g/cm ³
Flammability	: None
Flash Point	: None
Ignition temperature	: None
Explosion Properties	: Not applicable
Solubility in Water	: Insoluble

10. Stability and Reactivity

Stability : Mechanical shock and thermal shock may break it. It is chemically stable under the usual environment.

Reactivity : [I] It dissolves in an acid and an alkali in very small quantities.

- Condition to Avoid : Mechanical shock should be avoided. Rapid heating and rapid cooling also should be avoided when using at high temperature.
- Hazardous Decomposition Products : No data

11. Toxicological Information

Acute Toxicity	: No data
(Oral, Dermal, Inhalative ; LD50 or ATE _{mix})	
Irritation and corrosion to the Skin	: No data
Irritation and damage to Eyes	: No data
Sensitisation to the Skin	: No data
Sensitisation to Inhaler	: No data
Repeated Toxicity	: No data
- Sub-acute Toxicity (Oral, Dermal, Inhalative) :No data	
- Sub-chronic Toxicity (Oral, Dermal, Inhalative): No data	
- Chronic Toxicity (Oral, Dermal, Inhalative): No data	
Carcinogenicity	: No data
Mutagenicity	: No data
Reproduction Toxicity	: No data
Specific Target Organ Toxicity (STOT)	: No data

- Single Exposure : No data
 - Repeated Exposure : No data
- Metabolism : No data

12. Ecological Information

- Ecotoxicity : No data
- Acute Fish Toxicity (LC50) : No data
 - Acute daphnia toxicity (EC50) : No data
 - Acute algae toxicity (LC50) : No data
- Mobility in Soil : No data
- Persistence / Degradability : No data
- Physical and photo-chemical Degradation : No data
 - Biodegradation : No data
- Bioaccumulation : No data
- Partition coefficient n-octanol /water : No data
 - Bioconcentration factor (BCF) : No data
- Longterm Ecotoxicity : No data
- Longterm fish toxicity (LC50) : No data
 - Chronic daphnia toxicity (EC50) : No data
- Other Data (ex. Ecological Limit) : No data

13. Disposal Considerations

- Disposal Methods : Must be disposed as industrial waste on the basis of local regulations.
Be careful if you are pulverized, because there is a possibility that is scattered. Therefore, please use the protective equipment such as safety helmet, safety glasses, gloves, dust masks, face protection.
- Disposal Regulations : Please observe the law on industrial waste and related ordinances of municipalities and prefectures.
- Contaminated Packaging: Please dispose as industrial waste on the basis of local regulations.

14. Transport Information

- No transport regulations in Japan. In other region, follow the local regulations.
- Proper Shipping Name : Not applicable
- UN Class : Not applicable
- UN Number : Not applicable
- Marine Pollutant : Not applicable
- Regulations for Transport : Not applicable
- Specific Precautionary Transport Measures and Conditions : Avoid rough handling.
Avoid mechanical impact.

15. Regulatory Information

- Yttrium oxide : The substances are defined in the Article 57-2 of the Act, and the Yttrium oxide is listed by No.54 in Appended Table 9 in the Article 18-2 of the Enforcement Order as "Dangerous or Harmful Substances to Be Notified their Names, etc."

Silicon oxide : The substances are defined in the Article 57-2 of the Act, and the Silicon oxide is listed by No.312 in Appended Table 9 in the Article 18-2 of the Enforcement Order as "Dangerous or Harmful Substances to Be Notified their Names, etc."

Aluminum Oxide : The substances are defined in the Article 57-2 of the Act, and the Aluminum oxide is listed by No.189 in Appended Table 9 in the Article 18-2 of the Enforcement Order as "Dangerous or Harmful Substances to Be Notified their Names, etc."

Titanium Oxide : The substances are defined in the Article 57-2 of the Act, and the Titanium oxide is listed by No.191 in Appended Table 9 in the Article 18-2 of the Enforcement Order as "Dangerous or Harmful Substances to Be Notified their Names, etc."

16. Other Information

Handle with care of this SDS Information :

The information contained herein are based on all the information and data that we can obtain as of the data issued. However we are not able to investigate all documents and it may some omissions from information. There are also changed by the new knowledge and release.

If you wish to use in important applications, we recommend that you check by the test. Let me tell you further that we do not give guarantee regarding the contents or physical or chemical properties.

This material is molded article, you do not need to issue SDS point of view of chemical substance control law. We provide you with any information in order to get safety treatment and concern for environment.



HOUGHTON

Revision Date 08-26-2018

Version 4

SAFETY DATA SHEET

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Code(s)	07130000-M
Product Name	COSMOLUBRIC HF-130
Recommended Use	Hydraulic Fluid
Uses advised against	Any other purpose.

Manufacturer, Importer, Supplier

Houghton International Inc.	Houghton Canada
Madison & Van Buren Aves.	915 Meyerside Drive
Valley Forge, PA 19482	Mississauga
Telephone: 610-666-4000 FAX: 610-666-1376	ON
Website: www.houghtonintl.com	L5T 1R8
Customer Service: 888-459-9844	

Emergency telephone number

United States of America/Canada : 3E Company - 1-866-519-4752 (Code 333938)

SECTION 2: HAZARDS IDENTIFICATION

Classification

This product is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200) and the Workplace Hazardous Materials Information System (WHMIS) 2015

Not classified

Label elements

Precautionary Statements

Precautionary Statements - Prevention

Not applicable

Precautionary Statements - Response

Not applicable

Hazards not otherwise classified (HNOC)

Health	Not Applicable.
Physical	Not Applicable.

Other Information

Not applicable

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

This product is a mixture. Health hazard information is based on its ingredients.

The product contains no substances known to be hazardous to health in concentrations which need to be taken into account.

SECTION 4: FIRST AID MEASURES**Description of first-aid measures**

General advice	If symptoms persist, call a physician.
Inhalation	Move to fresh air.
Skin contact	Wash off immediately with soap and plenty of water. Remove and wash contaminated clothing before re-use.
Eye contact	Rinse thoroughly with plenty of water, also under the eyelids. Keep eye wide open while rinsing.
Ingestion	Clean mouth with water and afterwards drink plenty of water. Do not induce vomiting without medical advice.
Protection of First-aiders	Use personal protective equipment.

Most important symptoms and effects, both acute and delayed

Main Symptoms	None
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Indication of immediate medical attention and special treatment needed

Notes to physician	Treat symptomatically.
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SECTION 5: FIRE FIGHTING MEASURES**Extinguishing media****Suitable Extinguishing Media**

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment:., Use CO2, dry chemical, or foam, Water spray or fog

Extinguishing media which shall not be used for safety reasons

None

Special hazards arising from the substance or mixture**Special Hazard**

This material creates a fire hazard because it floats on water.

Hazardous decomposition products

None under normal use

Advice for firefighters**Special protective equipment for fire-fighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Ensure adequate ventilation.

Advice for non-emergency personnel Material can create slippery conditions.

Advice for emergency responders For personal protection see section 8.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not flush into surface water or sanitary sewer system.

Methods and materials for containment and cleaning up

Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Dike to collect large liquid spills. After cleaning, flush away traces with water.

Reference to other sections

See Section 8/12/13 for additional information

SECTION 7: HANDLING AND STORAGE

Precautions for safe handling

Ensure adequate ventilation. Use only in area provided with appropriate exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Technical measures/Storage conditions

Keep container tightly closed in a dry and well-ventilated place. Keep at temperatures between 5 and 40 °C.

Recommended Shelf Life

Shelf life 12 months.

Incompatible materials

Strong oxidizing agents, Strong acids, Strong bases

Specific end uses

Specific use(s) Hydraulic Fluid

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Exposure controls

Engineering Measures	Showers
	Eyewash stations
	Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/Face Protection	Safety glasses with side-shields.
Skin and body protection	Wear protective gloves/clothing.
Respiratory protection	No special protective equipment required. In case of mist, spray or aerosol exposure wear suitable personal respiratory protection and protective suit.
Hygiene measures	Handle in accordance with good industrial hygiene and safety practice.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES**Information on basic physical and chemical properties**

Physical state	liquid	Appearance	clear amber
Odor	ester-like	Odor threshold	Not Determined

<u>Property</u>	<u>Values</u>	<u>Remarks</u>
pH	Not applicable	
Melting point / freezing point	Not Determined	
Boiling point / boiling range	Not Determined	
Flash point	304 °C / 579 °F	Cleveland Open Cup
Evaporation rate	Not Determined	
Flammability (solid, gas)	Not Determined	
Flammability Limit in Air		
Upper flammability limit:	Not Determined	
Lower flammability limit:	Not Determined	
Vapor pressure	Not Determined	
Vapor density	Not Determined	
Relative density	0.92	@15.5°C
Solubility(ies)	Insoluble in water	
Partition coefficient	Not Determined	
Autoignition temperature	Not Determined	
Decomposition temperature	Not Determined	
Kinematic viscosity	Not Determined	
Explosive properties	Not applicable	
Oxidizing Properties	Not applicable	

Other Information

Viscosity, kinematic (100°C)	Not Determined	
Pour Point	Not Determined	
VOC Content (ASTM E-1868-10)	1 g/L	ASTM E-1868-10
VOC content	Not Determined	

SECTION 10: STABILITY AND REACTIVITY**Reactivity**

None under normal use conditions

Chemical stability

Stable under normal conditions

Possibility of hazardous reactions

None under normal use conditions

Conditions to avoid

Do not freeze.

Incompatible materials

Strong oxidizing agents. Strong acids. Strong bases.

Hazardous decomposition products

None under normal use conditions

SECTION 11: TOXICOLOGICAL INFORMATION**Information on likely routes of exposure**

Product Information	There is no data available for this product.
Inhalation	Based on available data, the classification criteria are not met
Eye contact	Based on available data, the classification criteria are not met
Skin contact	Based on available data, the classification criteria are not met
Ingestion	Based on available data, the classification criteria are not met
Component Information	Non-hazardous ingredients

Information on toxicological effects

Symptoms	No information available.
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Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation	Based on available data, the classification criteria are not met.
Serious eye damage/eye irritation	Based on available data, the classification criteria are not met
Sensitization	Based on available data, the classification criteria are not met.
Germ cell mutagenicity	Based on available data, the classification criteria are not met.
Carcinogenicity	Based on available data, the classification criteria are not met.
Reproductive toxicity	Based on available data, the classification criteria are not met.
Specific target organ toxicity (single exposure)	Based on available data, the classification criteria are not met.
Specific target organ toxicity (repeated exposure)	Based on available data, the classification criteria are not met.
Aspiration hazard	Based on available data, the classification criteria are not met.

SECTION 12: ECOLOGICAL INFORMATION**Ecotoxicity**

No special environmental measures are necessary

Persistence and degradability No information available.

Bioaccumulation

Mobility The product is insoluble and floats on water. Is not likely mobile in the environment due its low water solubility.

Other adverse effects No information available

SECTION 13: DISPOSAL CONSIDERATIONS**Waste treatment methods**

Waste Disposal Methods Dispose of in accordance with federal, state and local regulations.

Contaminated packaging Observe all label precautions until container is cleaned, reconditioned or destroyed.

SECTION 14: TRANSPORT INFORMATION

DOT Not Regulated

TDG Not Regulated

IATA Not Regulated

IMDG Not Regulated

SECTION 15: REGULATORY INFORMATION**International Inventories**

Inventory information may be utilizing alternative CAS#s or exemptions beyond those stated within this document For further information, please contact: ProductStewardship@houghtonintl.com

TSCA	Complies
DSL	All Components are NOT on the Chemical Inventory
AICS	Complies
PICCS	Complies
KECL	Complies
IECSC	Complies
ENCS	Does not Comply
TCSI	Does not Comply
NZIoC	Does not Comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

AICS - Australian Inventory of Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

ENCS - Japan Existing and New Chemical Substances

TCSI - Taiwan National Existing Chemical Inventory

NZIoC - New Zealand Inventory of Chemicals

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

- No EPCRA 311/312 hazards

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Chemical name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Cyclohexane	1000 lb			X
Styrene	1000 lb			X

CERCLA

To the best of our knowledge, this product does not contain chemicals at levels which require reporting under this regulation, Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

SCAQMD Rule 1144

The sale or distribution in the SCAQM District of California for metal working fluids or direct-contact lubricants is allowed if EITHER the VOC of the product itself OR the VOC of the diluted product at the point of use is less than the following limits: (1) 75 g VOC/L for metal forming, metal removal, metal treating; (2) 50 g VOC/L for metal protection, direct-contact lubricant. The VOC of this product as sold is: 1 g/L gVOC/L (ASTM E-1868-10)

California Proposition 65

WARNING: This product contains a chemical(s) known to the State of California to cause cancer and/or birth defects or other reproductive harm.

Chemical name	CAS No	California Prop. 65
Styrene	100-42-5	Carcinogen

International Regulations

Ozone-depleting substances (ODS)

Not applicable

Persistent Organic Pollutants

Not applicable

Chemicals Subject to Prior Informed Consent (PIC)

Not applicable

Other Information

Not applicable

SECTION 16: OTHER INFORMATION**Key or legend to abbreviations and acronyms used in the safety data sheet**

STOT SE - Specific target organ systemic toxicity (Single exposure)
STOT RE - Specific target organ systemic toxicity (repeated exposure)
VOC - Volatile organic compounds
NIOSH IDLH: Immediately Dangerous to Life or Health

Revision Date 08-26-2018

Revision Note Not applicable

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

1. Identification

Product identifier	ARMORLITE 85AL
Other means of identification	
Brand Code	183A
Recommended use	For Industrial Use Only
Recommended restrictions	Users should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

Manufacturer/Supplier information

Manufacturer

Company name	HarbisonWalker International
Address	1305 Cherrington Parkway, Suite 100 Moon Township, Pennsylvania 15108 US
Telephone	General Phone: 412-375-6600
Website	www.thinkHWI.com
Emergency phone number	CHEMTREC 24 HOUR 1-800-424-9300 EMERGENCY #

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Carcinogenicity	Category 1A
	Specific target organ toxicity, repeated exposure	Category 2
Environmental hazards	Not classified.	
OSHA defined hazards	Not classified.	
Label elements		



Signal word	Danger
Hazard statement	May cause cancer. May cause damage to organs through prolonged or repeated exposure.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust/mist. Do not breathe dust. Wear protective gloves/protective clothing/eye protection.
Response	If concerned: Get medical advice/attention. Get medical advice/attention if you feel unwell.
Storage	Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	Users should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Overexposure to the respirable dust of crystalline silica (quartz or cristobalite, less than or equal to 5 microns in size) may lead to silicosis in humans, which is a progressive and irreversible lung disease. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Mullite		1302-93-8	20 - 40
Cement, Alumina, Chemicals		65997-16-2	10 - 20
Amorphous Silica	SILICA, AMORPHOUS, FUMED SILICA (CRYSTALLINE FREE)	7631-86-9	2.5 - 10
Cristobalite		14464-46-1	2.5 - 10
Kyanite		1302-76-7	2.5 - 10
Quartz (SiO ₂)		14808-60-7	2.5 - 10
Aluminium Oxide (Non-Fibrous)		1344-28-1	1 - 2.5
Fumes, Silica		69012-64-2	1 - 2.5
Titanium Dioxide		13463-67-7	1 - 2.5
Trade Secret*		Proprietary*	1 - 2.5
Other components below reportable levels			20 - 40

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Do not rub eyes. Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Dusts may irritate the respiratory tract, skin and eyes. Prolonged exposure may cause chronic effects.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	If concerned: Get medical advice. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Use fire-extinguishing media appropriate for surrounding materials.
Unsuitable extinguishing media	Not available.
Specific hazards arising from the chemical	Not applicable.
Special protective equipment and precautions for firefighters	Not available.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not breathe dust. Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Stop the flow of material, if this is without risk. Collect dust using a vacuum cleaner equipped with HEPA filter. Large Spills: Wet down with water and dike for later disposal. Shovel the material into waste container. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal.
Environmental precautions	Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Minimize dust generation and accumulation. Provide appropriate exhaust ventilation at places where dust is formed. Do not breathe dust. Do not breathe dust. Avoid prolonged exposure. Should be handled in closed systems, if possible. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Store locked up. Store in original tightly closed container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
Titanium Dioxide (CAS 13463-67-7)	PEL	15 mg/m3	Total dust.
TRADE SECRET	PEL	2.5 mg/m3	

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value	Form
TRADE SECRET	TWA	2.5 mg/m3	Dust.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Amorphous Silica (CAS 7631-86-9)	TWA	0.8 mg/m3	
		20 mppcf	
Cristobalite (CAS 14464-46-1)	TWA	0.15 mg/m3	Total dust.
		0.05 mg/m3	Respirable.
		1.2 mppcf	Respirable.
Fumes, Silica (CAS 69012-64-2)	TWA	0.8 mg/m3	
		20 mppcf	
Quartz (SiO2) (CAS 14808-60-7)	TWA	0.3 mg/m3	Total dust.
		0.1 mg/m3	Respirable.
		2.4 mppcf	Respirable.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)	TWA	1 mg/m3	Respirable fraction.
Cristobalite (CAS 14464-46-1)	TWA	0.025 mg/m3	Respirable fraction.
Kyanite (CAS 1302-76-7)	TWA	1 mg/m3	Respirable fraction.
Mullite (CAS 1302-93-8)	TWA	1 mg/m3	Respirable fraction.
Quartz (SiO2) (CAS 14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.
Titanium Dioxide (CAS 13463-67-7)	TWA	10 mg/m3	
TRADE SECRET	TWA	2.5 mg/m3	

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
Amorphous Silica (CAS 7631-86-9)	TWA	6 mg/m3	
Cristobalite (CAS 14464-46-1)	TWA	3 fibers/cm3	Fiber.
		3 fibers/cm3	Dust.

Components	Type	Value	Form
Biological limit values ACGIH Biological Exposure Indices Components	Fumes, Silica (CAS 69012-64-2)	TWA	5 mg/m3
	Quartz (SiO2) (CAS 14808-60-7)	TWA	5 mg/m3
	TRADE SECRET	TWA	6 mg/m3
	TRADE SECRET	TWA	0.05 mg/m3
	Respirable dust:	TWA	2.5 mg/m3
* - For sampling details, please see the source document.			
Exposure guidelines			
Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled.			
Appropriate engineering controls			
Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If engineering measures are not sufficient to maintain concentrations of dust particulates below the Occupational Exposure Limit (OEL), suitable respiratory protection must be worn. If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits.			
Individual protection measures, such as personal protective equipment			
Eye/face protection			
Chemical respirator with organic vapor cartridge, full facepiece, dust and mist filter.			
Skin protection			
Hand protection			
Other			
Respiratory protection			
Use of an impervious apron is recommended.			
Wear appropriate chemical resistant gloves.			
Thermal hazards			
Wear appropriate thermal protective clothing, when necessary.			



General hygiene considerations

Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Solid.
Physical state	Solid Powder.
Form	Solid Powder.
Color	Not available.
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Explosive limit - lower (%) Not available.

Explosive limit - upper (%) Not available.

Vapor pressure Not available.

Vapor density Not available.

Relative density Not available.

Solubility(ies)

Solubility (water) Not available.

Partition coefficient (n-octanol/water) Not available.

Auto-ignition temperature Not available.

Decomposition temperature Not available.

Viscosity Not available.

10. Stability and reactivity

Reactivity The product is stable and non-reactive under normal conditions of use, storage and transport.

Chemical stability Material is stable under normal conditions.

Possibility of hazardous reactions No dangerous reaction known under conditions of normal use.

Conditions to avoid Contact with incompatible materials.

Incompatible materials Fluorine. Chlorine.
Incompatibility is based strictly upon potential theoretical reactions between chemicals and may not be specific to industrial application exposure. Contact your sales representative for clarification.

Hazardous decomposition products No hazardous decomposition products are known.

11. Toxicological information**Information on likely routes of exposure**

Inhalation May cause damage to organs through prolonged or repeated exposure by inhalation. Dust may irritate respiratory system. Prolonged inhalation may be harmful.

Skin contact Dust or powder may irritate the skin.

Eye contact Dust may irritate the eyes.

Ingestion Expected to be a low ingestion hazard.

Symptoms related to the physical, chemical and toxicological characteristics Dusts may irritate the respiratory tract, skin and eyes.

Information on toxicological effects

Acute toxicity Not available.

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity

In 1997, IARC (the International Agency for Research on Cancer) concluded that crystalline silica inhaled from occupational sources can cause lung cancer in humans. However in making the overall evaluation, IARC noted that "carcinogenicity was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monographs on the evaluation of the carcinogenic risks of chemicals to humans, Silica, silicates dust and organic fibres, 1997, Vol. 68, IARC, Lyon, France.) In June 2003, SCOEL (the EU Scientific Committee on Occupational Exposure Limits) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis (and, apparently, not in employees without silicosis exposed to silica dust in quarries and in the ceramic industry). Therefore, preventing the onset of silicosis will also reduce the cancer risk..." (SCOEL SUM Doc 94-final, June 2003) According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits. May cause cancer. Occupational exposure to respirable dust and respirable crystalline silica should be monitored and controlled.

IARC Monographs. Overall Evaluation of Carcinogenicity

Amorphous Silica (CAS 7631-86-9)	3 Not classifiable as to carcinogenicity to humans.
Cristobalite (CAS 14464-46-1)	1 Carcinogenic to humans.
Fumes, Silica (CAS 69012-64-2)	3 Not classifiable as to carcinogenicity to humans.
Quartz (SiO ₂) (CAS 14808-60-7)	1 Carcinogenic to humans.
Titanium Dioxide (CAS 13463-67-7)	2B Possibly carcinogenic to humans.
TRADE SECRET (CAS Proprietary)	3 Not classifiable as to carcinogenicity to humans.

US. National Toxicology Program (NTP) Report on Carcinogens

Cristobalite (CAS 14464-46-1)	Known To Be Human Carcinogen.
Quartz (SiO ₂) (CAS 14808-60-7)	Reasonably Anticipated to be a Human Carcinogen.
	Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity

This product is not expected to cause reproductive or developmental effects.

Developmental effects

Quartz (SiO₂) 0

Developmental effects - EU category

Quartz (SiO₂) 0

Embryotoxicity

Quartz (SiO₂) 0

Reproductivity

Quartz (SiO₂) 0

Specific target organ toxicity - single exposure

Not classified.

Specific target organ toxicity - repeated exposure

May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard

Not an aspiration hazard.

Chronic effects

May cause damage to organs through prolonged or repeated exposure. Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity

The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability

No data is available on the degradability of this product.

Bioaccumulative potential

No data available.

Mobility in soil

No data available.

Other adverse effects

No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions

This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

Hazardous waste code

Not applicable.

Waste from residues / unused products Not available.

Contaminated packaging Not available.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
One or more components are not listed on TSCA.
All chemical substances in this product are listed on the TSCA chemical substance inventory where required.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Aluminium Oxide (Non-Fibrous)	1344-28-1	1 - 2.5

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. Massachusetts RTK - Substance List

Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)
Amorphous Silica (CAS 7631-86-9)
Cristobalite (CAS 14464-46-1)
Fumes, Silica (CAS 69012-64-2)
Quartz (SiO₂) (CAS 14808-60-7)

Titanium Dioxide (CAS 13463-67-7)

US. New Jersey Worker and Community Right-to-Know Act

Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)

Amorphous Silica (CAS 7631-86-9)

Cristobalite (CAS 14464-46-1)

Fumes, Silica (CAS 69012-64-2)

Quartz (SiO₂) (CAS 14808-60-7)

Titanium Dioxide (CAS 13463-67-7)

TRADE SECRET (CAS Proprietary)

US. Pennsylvania Worker and Community Right-to-Know Law

Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)

Amorphous Silica (CAS 7631-86-9)

Cristobalite (CAS 14464-46-1)

Fumes, Silica (CAS 69012-64-2)

Quartz (SiO₂) (CAS 14808-60-7)

Titanium Dioxide (CAS 13463-67-7)

TRADE SECRET (CAS Proprietary)

US. Rhode Island RTK

Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)

US. California Proposition 65

This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Quartz (SiO₂) (CAS 14808-60-7)

Listed: October 1, 1988

Titanium Dioxide (CAS 13463-67-7)

Listed: September 2, 2011

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 09-26-2014

Revision date 11-12-2015

Version # 03

Disclaimer This information is based on our present knowledge on creation date. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Revision Information Composition / Information on Ingredients: Ingredients
Composition/information on ingredients: Composition comments
Regulatory information: California Prop 65
Regulatory information: US state regulations

1. Identification

Product identifier	GREENLITE-45-L AL; GREENLITE-45-L AL PLUS
Other means of identification	
Brand Code	5517, 5518
Recommended use	For Industrial Use Only
Recommended restrictions	Users should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

Manufacturer/Supplier information

Manufacturer

Company name	HarbisonWalker International
Address	1305 Cherrington Parkway, Suite 100 Moon Township, Pennsylvania 15108 US
Telephone	General Phone: 412-375-6600
Website	www.thinkHWI.com
Emergency phone number	CHEMTREC 24 HOUR 1-800-424-9300 EMERGENCY #

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Carcinogenicity	Category 1A
	Specific target organ toxicity, repeated exposure	Category 2
Environmental hazards	Not classified.	
OSHA defined hazards	Not classified.	
Label elements		



Signal word	Danger
Hazard statement	May cause cancer. May cause damage to organs through prolonged or repeated exposure.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust/mist. Do not breathe dust. Wear protective gloves/protective clothing/eye protection.
Response	If concerned: Get medical advice/attention. Get medical advice/attention if you feel unwell.
Storage	Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	Users should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Overexposure to the respirable dust of crystalline silica (quartz or cristobalite, less than or equal to 5 microns in size) may lead to silicosis in humans, which is a progressive and irreversible lung disease. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Cement, Alumina, Chemicals		65997-16-2	20 - 40
Mullite		1302-93-8	10 - 20
Amorphous Silica	SILICA, AMORPHOUS, FUMED SILICA (CRYSTALLINE FREE)	7631-86-9	2.5 - 10
Barium Sulfate		7727-43-7	2.5 - 10
Cristobalite		14464-46-1	2.5 - 10
Quartz (SiO ₂)		14808-60-7	2.5 - 10
Fumes, Silica		69012-64-2	1 - 2.5
TRADE SECRET*		Proprietary*	1 - 2.5
Aluminium Oxide (Non-Fibrous)		1344-28-1	0 - 0.1
Other components below reportable levels			20 - 40

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Do not rub eyes. Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Dusts may irritate the respiratory tract, skin and eyes. Prolonged exposure may cause chronic effects.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	If concerned: Get medical advice. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Use fire-extinguishing media appropriate for surrounding materials.
Unsuitable extinguishing media	Not available.
Specific hazards arising from the chemical	Not applicable.
Special protective equipment and precautions for firefighters	Not available.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not breathe dust. Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Stop the flow of material, if this is without risk. Collect dust using a vacuum cleaner equipped with HEPA filter. Large Spills: Wet down with water and dike for later disposal. Shovel the material into waste container. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal.
Environmental precautions	Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Minimize dust generation and accumulation. Provide appropriate exhaust ventilation at places where dust is formed. Do not breathe dust. Do not breathe dust. Avoid prolonged exposure. Should be handled in closed systems, if possible. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Store locked up. Store in original tightly closed container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Barium Sulfate (CAS 7727-43-7)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
TRADE SECRET	PEL	2.5 mg/m3	

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value	Form
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TRADE SECRET	TWA	2.5 mg/m3	Dust.
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US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
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Amorphous Silica (CAS 7631-86-9)	TWA	0.8 mg/m3	
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Cristobalite (CAS 14464-46-1)	TWA	20 mppcf 0.15 mg/m3	Total dust.
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Fumes, Silica (CAS 69012-64-2)	TWA	0.05 mg/m3 1.2 mppcf 0.8 mg/m3	Respirable. Respirable.
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Quartz (SiO2) (CAS 14808-60-7)	TWA	20 mppcf 0.3 mg/m3	Total dust.
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		0.1 mg/m3 2.4 mppcf	Respirable. Respirable.
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US. ACGIH Threshold Limit Values

Components	Type	Value	Form
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Barium Sulfate (CAS 7727-43-7)	TWA	5 mg/m3	Inhalable fraction.
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Cristobalite (CAS 14464-46-1)	TWA	0.025 mg/m3	Respirable fraction.
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Mullite (CAS 1302-93-8)	TWA	1 mg/m3	Respirable fraction.
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Quartz (SiO2) (CAS 14808-60-7)	TWA	0.025 mg/m3	Respirable fraction.
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TRADE SECRET	TWA	2.5 mg/m3	
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US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
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Amorphous Silica (CAS 7631-86-9)	TWA	6 mg/m3	
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Barium Sulfate (CAS 7727-43-7)	TWA	5 mg/m3	Respirable.
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		10 mg/m3	Total
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Cristobalite (CAS 14464-46-1)	TWA	3 fibers/cm3	Dust.
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		3 fibers/cm3	Fiber.
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		5 mg/m3	Fiber, total
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		5 mg/m3	fibers, total dust
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* - For sampling details, please see the source document.	TRADE SECRET	3 mg/l	Fluoride	Urine	*
		2 mg/l	Fluoride	Urine	*
	ACGIH Biological Exposure Indices				
	Components				
	Value				
	Determinant	Specimen	Sampling Time		
	Biological limit values				
	Fumes, Silica (CAS 69012-64-2)	TWA	6 mg/m3	Respirable dust.	
	Quartz (SiO2) (CAS 14808-60-7)	TWA	0.05 mg/m3		
	TRADE SECRET	TWA	2.5 mg/m3		
	ACGIH Biological Exposure Indices				
	Components				
	Value				
	Determinant	Specimen	Sampling Time		
	TRADE SECRET				
	3 mg/l				
	Fluoride				
	Urine				
	*				
2 mg/l					
Fluoride					
Urine					
*					

* - For sampling details, please see the source document.

Exposure guidelines

Appropriate engineering controls

Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled.

Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If engineering measures are not sufficient to maintain concentrations of dust particulates below the Occupational Exposure Limit (OEL), suitable respiratory protection must be worn. If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits.

Individual protection measures, such as personal protective equipment

Eye/face protection

Chemical respirator with organic vapor cartridge, full facepiece, dust and mist filter.

Skin protection

Hand protection

Wear appropriate chemical resistant gloves.

Other

Respiratory protection

Use of an impervious apron is recommended.

Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits.

Thermal hazards

Wear appropriate thermal protective clothing, when necessary.



General hygiene considerations

Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state

Solid.

Form

Solid Powder.

Color

Not available.

Odor

Not available.

Odor threshold

Not available.

pH

Not available.

Melting point/freezing point

Not available.

Initial boiling point and boiling range

Not available.

Flash point

Not available.

Evaporation rate

Not available.

Flammability (solid, gas)

Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.

Vapor pressure Not available.

Vapor density Not available.

Relative density Not available.

Solubility(ies)

Solubility (water) Not available.

Partition coefficient (n-octanol/water) Not available.

Auto-ignition temperature Not available.

Decomposition temperature Not available.

Viscosity Not available.

10. Stability and reactivity

Reactivity The product is stable and non-reactive under normal conditions of use, storage and transport.

Chemical stability Material is stable under normal conditions.

Possibility of hazardous reactions No dangerous reaction known under conditions of normal use.

Conditions to avoid Contact with incompatible materials.

Incompatible materials Powerful oxidizers. Chlorine.
Incompatibility is based strictly upon potential theoretical reactions between chemicals and may not be specific to industrial application exposure. Contact your sales representative for clarification.

Hazardous decomposition products No hazardous decomposition products are known.

11. Toxicological information**Information on likely routes of exposure**

Inhalation	May cause damage to organs through prolonged or repeated exposure by inhalation. Dust may irritate respiratory system. Prolonged inhalation may be harmful.
Skin contact	Dust or powder may irritate the skin.
Eye contact	Dust may irritate the eyes.
Ingestion	Expected to be a low ingestion hazard.

Symptoms related to the physical, chemical and toxicological characteristics Dusts may irritate the respiratory tract, skin and eyes.

Information on toxicological effects

Acute toxicity Not available.

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity

In 1997, IARC (the International Agency for Research on Cancer) concluded that crystalline silica inhaled from occupational sources can cause lung cancer in humans. However in making the overall evaluation, IARC noted that "carcinogenicity was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monographs on the evaluation of the carcinogenic risks of chemicals to humans, Silica, silicates dust and organic fibres, 1997, Vol. 68, IARC, Lyon, France.) In June 2003, SCOEL (the EU Scientific Committee on Occupational Exposure Limits) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis (and, apparently, not in employees without silicosis exposed to silica dust in quarries and in the ceramic industry). Therefore, preventing the onset of silicosis will also reduce the cancer risk..." (SCOEL SUM Doc 94-final, June 2003) According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits. May cause cancer. Occupational exposure to respirable dust and respirable crystalline silica should be monitored and controlled.

IARC Monographs. Overall Evaluation of Carcinogenicity

Amorphous Silica (CAS 7631-86-9)	3 Not classifiable as to carcinogenicity to humans.
Cristobalite (CAS 14464-46-1)	1 Carcinogenic to humans.
Fumes, Silica (CAS 69012-64-2)	3 Not classifiable as to carcinogenicity to humans.
Quartz (SiO ₂) (CAS 14808-60-7)	1 Carcinogenic to humans.
TRADE SECRET (CAS Proprietary)	3 Not classifiable as to carcinogenicity to humans.

US. National Toxicology Program (NTP) Report on Carcinogens

Cristobalite (CAS 14464-46-1)	Known To Be Human Carcinogen.
	Reasonably Anticipated to be a Human Carcinogen.
Quartz (SiO ₂) (CAS 14808-60-7)	Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity

This product is not expected to cause reproductive or developmental effects.

Developmental effects

Quartz (SiO ₂)	0
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Developmental effects - EU category

Quartz (SiO ₂)	0
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Embryotoxicity

Quartz (SiO ₂)	0
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Reproductivity

Quartz (SiO ₂)	0
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Specific target organ toxicity - single exposure

Not classified.

Specific target organ toxicity - repeated exposure

May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard

Not an aspiration hazard.

Chronic effects

May cause damage to organs through prolonged or repeated exposure. Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity

The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability

No data is available on the degradability of this product.

Bioaccumulative potential

No data available.

Mobility in soil

No data available.

Other adverse effects

No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions

This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

Hazardous waste code

Not applicable.

Waste from residues / unused products Not available.

Contaminated packaging Not available.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
One or more components are not listed on TSCA.
All chemical substances in this product are listed on the TSCA chemical substance inventory where required.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Barium Sulfate (CAS 7727-43-7) Listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories Immediate Hazard - No
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)
Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)
Not listed.

US. Massachusetts RTK - Substance List

Amorphous Silica (CAS 7631-86-9)
Barium Sulfate (CAS 7727-43-7)
Cristobalite (CAS 14464-46-1)
Fumes, Silica (CAS 69012-64-2)
Quartz (SiO₂) (CAS 14808-60-7)

US. New Jersey Worker and Community Right-to-Know Act

Amorphous Silica (CAS 7631-86-9)
Barium Sulfate (CAS 7727-43-7)
Cristobalite (CAS 14464-46-1)
Fumes, Silica (CAS 69012-64-2)
Quartz (SiO₂) (CAS 14808-60-7)
TRADE SECRET (CAS Proprietary)

US. Pennsylvania Worker and Community Right-to-Know Law

Amorphous Silica (CAS 7631-86-9)
Barium Sulfate (CAS 7727-43-7)
Cristobalite (CAS 14464-46-1)
Fumes, Silica (CAS 69012-64-2)
Quartz (SiO₂) (CAS 14808-60-7)
TRADE SECRET (CAS Proprietary)

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Quartz (SiO ₂) (CAS 14808-60-7)	Listed: October 1, 1988
Titanium Dioxide (CAS 13463-67-7)	Listed: September 2, 2011

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 05-18-2015

Revision date 10-29-2015

Version # 02

Disclaimer This information is based on our present knowledge on creation date. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Revision Information This document has undergone significant changes and should be reviewed in its entirety.

1. Identification

Product identifier	GREENSET-85 P
Other means of identification	
Brand Code	5616
Recommended use	For Industrial Use Only
Recommended restrictions	Users should be informed of the potential presence of respirable dust and respirable crystalline silica as well as their potential hazards. Appropriate training in the proper use and handling of this material should be provided as required under applicable regulations.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	HarbisonWalker International
Address	1305 Cherrington Parkway, Suite 100 Moon Township, Pennsylvania 15108 US
Telephone	General Phone: 412-375-6600
Website	www.thinkHWI.com
Emergency phone number	CHEMTREC 24 HOUR 1-800-424-9300 EMERGENCY #

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Skin corrosion/irritation	Category 1A
	Serious eye damage/eye irritation	Category 1
	Carcinogenicity	Category 1A
	Specific target organ toxicity, repeated exposure	Category 1
Environmental hazards	Not classified.	
OSHA defined hazards	Not classified.	
Label elements		



Signal word	Danger
Hazard statement	Causes severe skin burns and eye damage. Causes serious eye damage. May cause cancer. Causes damage to organs through prolonged or repeated exposure.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust/fume/gas/mist/vapors/spray. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing/eye protection/face protection.
Response	If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Wash contaminated clothing before reuse.
Storage	Store away from incompatible materials.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Aluminium Oxide (Non-Fibrous)		1344-28-1	60 - 80
Aluminium Tris(Dihydrogen Phosphate)		13530-50-2	2.5 - 10
Amorphous Silica	SILICA, AMORPHOUS, FUMED SILICA (CRYSTALLINE FREE)	7631-86-9	2.5 - 10
Orthophosphoric Acid		7664-38-2	2.5 - 10
Diiron Trioxide		1309-37-1	1 - 2.5
Kaolin		1332-58-7	1 - 2.5
Titanium Dioxide		13463-67-7	1 - 2.5
Boric Acid		10043-35-3	0.1 - 1
Cristobalite		14464-46-1	0.1 - 1
Quartz (SiO ₂)		14808-60-7	0.1 - 1
Other components below reportable levels			10 - 20

Crystalline silica may be present at low concentrations; most of this is encapsulated in the coarse aggregate or as part of the clays or sands.

4. First-aid measures

Inhalation

Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact

Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.

Eye contact

Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.

Ingestion

Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Most important symptoms/effects, acute and delayed

Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Prolonged exposure may cause chronic effects.

Indication of immediate medical attention and special treatment needed

Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim under observation. Symptoms may be delayed.

General information

IF exposed or concerned: Get medical advice/attention. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media

Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media

Not available.

Specific hazards arising from the chemical

Not applicable.

Special protective equipment and precautions for firefighters

Not available.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Material can be slippery when wet. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use. Put material in suitable, covered, labeled containers. For waste disposal, see section 13 of the SDS.

Environmental precautions

Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage**Precautions for safe handling**

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Do not breathe dust. Do not breathe dust. Do not get in eyes, on skin, or on clothing. When using, do not eat, drink or smoke. Should be handled in closed systems, if possible. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection**Occupational exposure limits**

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
Cristobalite (CAS 14464-46-1)	PEL	0.05 mg/m3	
Diiron Trioxide (CAS 1309-37-1)	PEL	10 mg/m3	Fume.
Kaolin (CAS 1332-58-7)	PEL	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
Orthophosphoric Acid (CAS 7664-38-2)	PEL	1 mg/m3	
Quartz (SiO ₂) (CAS 14808-60-7)	PEL	0.05 mg/m3	
Titanium Dioxide (CAS 13463-67-7)	PEL	15 mg/m3	Total dust.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)	TWA	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.
Amorphous Silica (CAS 7631-86-9)	TWA	0.8 mg/m3	
		20 mppcf	
Cristobalite (CAS 14464-46-1)	TWA	0.05 mg/m3	Respirable.
		1.2 mppcf	Respirable.
Diiron Trioxide (CAS 1309-37-1)	TWA	5 mg/m3	Respirable fraction.
		15 mg/m3	Total dust.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.
Kaolin (CAS 1332-58-7)	TWA	5 mg/m3	Respirable fraction.

US. OSHA Table Z-3 (29 CFR 1910.1000)

Components	Type	Value	Form
Quartz (SiO ₂) (CAS 14808-60-7)	TWA	15 mg/m ³	Total dust.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.
		0.1 mg/m ³	Respirable.
Titanium Dioxide (CAS 13463-67-7)	TWA	2.4 mppcf	Respirable.
		5 mg/m ³	Respirable fraction.
		15 mg/m ³	Total dust.
		50 mppcf	Total dust.
		15 mppcf	Respirable fraction.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
Aluminium Oxide (Non-Fibrous) (CAS 1344-28-1)	TWA	1 mg/m ³	Respirable fraction.
Aluminium Tris(Dihydrogen Phosphate) (CAS 13530-50-2)	TWA	1 mg/m ³	Respirable fraction.
Boric Acid (CAS 10043-35-3)	STEL	6 mg/m ³	Inhalable fraction.
Cristobalite (CAS 14464-46-1)	TWA	2 mg/m ³	Inhalable fraction.
	TWA	0.025 mg/m ³	Respirable fraction.
Diiron Trioxide (CAS 1309-37-1)	TWA	5 mg/m ³	Respirable fraction.
Kaolin (CAS 1332-58-7)	TWA	2 mg/m ³	Respirable fraction.
Orthophosphoric Acid (CAS 7664-38-2)	STEL	3 mg/m ³	
Quartz (SiO ₂) (CAS 14808-60-7)	TWA	1 mg/m ³	
	TWA	0.025 mg/m ³	Respirable fraction.
Titanium Dioxide (CAS 13463-67-7)	TWA	10 mg/m ³	

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Components	Type	Value	Form
Aluminium Tris(Dihydrogen Phosphate) (CAS 13530-50-2)	TWA	2 mg/m ³	
Amorphous Silica (CAS 7631-86-9)	TWA	6 mg/m ³	
Diiron Trioxide (CAS 1309-37-1)	TWA	5 mg/m ³	Dust and fume.
Kaolin (CAS 1332-58-7)	TWA	5 mg/m ³	Respirable.
		10 mg/m ³	Total
Orthophosphoric Acid (CAS 7664-38-2)	STEL	3 mg/m ³	
Quartz (SiO ₂) (CAS 14808-60-7)	TWA	1 mg/m ³	
	TWA	0.05 mg/m ³	Respirable dust.

Biological limit values

No biological exposure limits noted for the ingredient(s).

Exposure guidelines

Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled. Occupational exposure to nuisance dust (total and respirable) and respirable crystalline silica should be monitored and controlled. Occupational Exposure Limits are not relevant to the current physical form of the product.

Appropriate engineering controls

Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles) and a face shield.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.
Respiratory protection	Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.



General hygiene considerations

Observe any medical surveillance requirements. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state	Solid.
Form	Solid. Paste.
Color	Not available.
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	Not available.
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.

Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.

Solubility(ies)

Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available.

Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.

Other information

Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
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Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Acids. Chlorine. Incompatibility is based strictly upon potential theoretical reactions between chemicals and may not be specific to industrial application exposure.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns.
Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.

Information on toxicological effects

Acute toxicity	Not known.
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Components	Species	Test Results
Boric Acid (CAS 10043-35-3)		
<u>Acute</u>		
Inhalation		
LC50	Rat	> 0.002 mg/l, 4 Hours

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation	Causes severe skin burns and eye damage.
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Serious eye damage/eye irritation	Causes serious eye damage.
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Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.

Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
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Carcinogenicity	In 1997, IARC (the International Agency for Research on Cancer) concluded that crystalline silica inhaled from occupational sources can cause lung cancer in humans. However in making the overall evaluation, IARC noted that "carcinogenicity was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." (IARC Monographs on the evaluation of the carcinogenic risks of chemicals to humans, Silica, silicates dust and organic fibres, 1997, Vol. 68, IARC, Lyon, France.) In June 2003, SCOEL (the EU Scientific Committee on Occupational Exposure Limits) concluded that the main effect in humans of the inhalation of respirable crystalline silica dust is silicosis. "There is sufficient information to conclude that the relative risk of lung cancer is increased in persons with silicosis (and, apparently, not in employees without silicosis exposed to silica dust in quarries and in the ceramic industry). Therefore, preventing the onset of silicosis will also reduce the cancer risk..." (SCOEL SUM Doc 94-final, June 2003) According to the current state of the art, worker protection against silicosis can be consistently assured by respecting the existing regulatory occupational exposure limits. May cause cancer. Occupational exposure to respirable dust and respirable crystalline silica should be monitored and controlled.
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IARC Monographs. Overall Evaluation of Carcinogenicity

Amorphous Silica (CAS 7631-86-9)	3 Not classifiable as to carcinogenicity to humans.
Cristobalite (CAS 14464-46-1)	1 Carcinogenic to humans.
Diiron Trioxide (CAS 1309-37-1)	3 Not classifiable as to carcinogenicity to humans.
Quartz (SiO2) (CAS 14808-60-7)	1 Carcinogenic to humans.
Titanium Dioxide (CAS 13463-67-7)	2B Possibly carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens

Cristobalite (CAS 14464-46-1)

Known To Be Human Carcinogen.

Quartz (SiO₂) (CAS 14808-60-7)

Reasonably Anticipated to be a Human Carcinogen.

Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Developmental effects

Quartz (SiO₂)

0

Developmental effects - EU category

Quartz (SiO₂)

0

Embryotoxicity

Quartz (SiO₂)

0

Reproductivity

Quartz (SiO₂)

0

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard Not an aspiration hazard.

Chronic effects Causes damage to organs through prolonged or repeated exposure. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

Hazardous waste code Since this product is used in several industries, no Waste Code can be provided by the supplier. The Waste Code should be determined in arrangement with your waste disposal partner or the responsible authority.

Waste from residues / unused products Not available.

Contaminated packaging Not available.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code Not applicable.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All chemical substances in this product are listed on the TSCA chemical substance inventory where required.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Orthophosphoric Acid (CAS 7664-38-2) Listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
 Delayed Hazard - Yes
 Fire Hazard - No
 Pressure Hazard - No
 Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical No

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Aluminium Oxide (Non-Fibrous)	1344-28-1	60 - 80

Other federal regulations**Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List**

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

FEMA Priority Substances Respiratory Health and Safety in the Flavor Manufacturing Workplace

Orthophosphoric Acid (CAS 7664-38-2) High priority

US state regulations WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substanceQuartz (SiO₂) (CAS 14808-60-7) Listed: October 1, 1988

Titanium Dioxide (CAS 13463-67-7) Listed: September 2, 2011

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Boric Acid (CAS 10043-35-3)

Cristobalite (CAS 14464-46-1)

Orthophosphoric Acid (CAS 7664-38-2)

Quartz (SiO₂) (CAS 14808-60-7)

Titanium Dioxide (CAS 13463-67-7)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes

Country(s) or region	Inventory name	On inventory (yes/no)*
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	03-25-2015
Revision date	06-06-2018
Version #	03
Disclaimer	This information is based on our present knowledge on creation date. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.
Revision information	Product and Company Identification: Product Codes Hazard(s) identification: Storage Hazard(s) identification: Supplemental information Composition/information on ingredients: Component information Handling and storage: Conditions for safe storage, including any incompatibilities

SAFETY DATA SHEET

Effective Date: 08/31/2015

1. IDENTIFICATION

(a) Product identifier used on the label **ISAform MW**

(b) Other means of identification **ISAbord MW**

(c) Recommended use of the chemical and restrictions on use

- **Primary Use:** Mineral Wool materials are used primarily in industrial high temperature insulating applications. Examples include heat shields, heat containment, gaskets, expansion joints, industrial furnaces, ovens, kilns, boilers and other process equipment. Mineral Wool based products are not intended for direct sale to the general public.

- **Secondary Use:** Conversion into wet and dry mixtures and articles (refer to section 8).

- **Tertiary Use:** Installation, removal (industrial and professional) / Maintenance and service life (industrial and professional) (refer to section 8).

Uses Advised Against

Spraying of dry product.

d) Name, address, and telephone number **Insulation Specialties of America, Inc.**

1095 Kabert Drive

Wanatah, IN 46390

Product Stewardship Information Hotline

1-800-322-2293 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)

For additional SDSs call Insulation Specialties of America Inc. at (219) 733-2502

(e) Emergency Phone Number: **CHEMTREC will provide assistance for chemical emergencies. Call 1-800-424-9300**

2. HAZARDS IDENTIFICATION

(a) Classification of the chemical in accordance with paragraph (d) of §1910.1200

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC Group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D).

(b) Signal word, hazard statement(s), symbol(s) and precautionary statement(s) in accordance with paragraph (f) of §1910.1200

Under OSHA HCS 2012, Mineral Wool is classified as a category 1A carcinogen.

Hazard Pictogram



Signal Word

Warning

Hazard Statements

Suspected of causing cancer by inhalation.

Precautionary statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see section 8 of the Safety Data Sheet.

If concerned about exposure, get medical advice.

Store in a manner to minimize airborne dust.

Dispose of waste in accordance with local, state and federal regulations.

Supplementary Information

May cause temporary mechanical irritation to exposed eyes, skin or respiratory tract.

Minimize exposure to airborne dust.

(c) Describe any hazards not otherwise classified that have been identified during the classification process

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure. These effects are usually temporary.

(d) Mixture rule

Not applicable.

3. COMPOSITION / INFORMATION ON INGREDIENTS

(a) Chemical and (b) Common Name	(c) CAS Number	% BY WEIGHT
Viterous Fibers, slag and or basalt (mixture)	56780-58-6	20-40
Silica (amorphous)	112926-00-8	5-15
Starch	9005-25-8	3-10

***Synonyms:** Alumino Silicate Wool (ASW), synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF), high temperature insulation wool (HTIW)

(d) Impurities and stabilizing additives

Not applicable.

4. FIRST AID MEASURES**(a) Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion****SKIN**

Handling of this material may generate mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin.

EYES

In case of eye contact flush abundantly with water; have eye bath available. Do not rub eyes.

NOSE AND THROAT

If these become irritated move to a dust free area, drink water and blow nose.

If symptoms persist, seek medical advice.

(b) Most important symptoms/effects, acute and delayed

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure. These effects are usually temporary.

(c) Indication of immediate medical attention and special treatment needed, if necessary**NOTES TO PHYSICIANS**

Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

(a) Suitable (and unsuitable) extinguishing media

Use extinguishing agent suitable for surrounding combustible materials.

(b) Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products):

Non-combustible products, class of reaction to fire is zero.

Packaging and surrounding materials may be combustible.

Thermal decomposition of binder from fires or from first heat of product may release smoke, carbon monoxide, and carbon dioxide. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition of binder. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity or an asthmatic-type response.

(c) Special protective equipment and precautions for fire-fighters

NFPA Codes: Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

(a) Personal precautions, protective equipment, and emergency procedures

Minimize airborne dust. Compressed air or dry sweeping should not be used for cleaning. See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines.

(b) Methods and materials for containment and cleaning up

Frequently clean the work area with vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

7. HANDLING AND STORAGE

(a) Precautions for safe handling

Handle fiber carefully to minimize airborne dust. Limit use of power tools unless in conjunction with local exhaust ventilation. Use hand tools whenever possible.

(b) Conditions for safe storage, including any incompatibilities

Store in a manner to minimize airborne dust.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

(a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available

<u>Components</u>	<u>OSHA PEL</u>	<u>NIOSH REL</u>	<u>ACGIH TLV</u>	<u>MANUFACTURER REG</u>
Fiberglass Wool	None established*	None established*	1 f/cc TLV, 8-hr. TWA	0.5 f/cc, 8-hr. TWA**
Silica (amorphous)	20 mppcf or 80 mg/m ³ /		10 mg/m ³	None established
Starch	% SiO ₂ 5 mg/m ³ PEL (resp. dust) 15 mg/m ³ PEL (total dust)		10 mg/m ³	None established

**In the absence of an OSHA PEL, HTIW Coalition has adopted a recommended exposure guideline (REG), as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see "Rationale for the Recommended Exposure Guideline" at page 34 of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf.

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: California, 0.2 f/cc; Canadian provincial OELs ranging from 0.2 to 1.0 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and determining their relative applicability to the workplace is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

(b) Appropriate engineering controls

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

(c) Individual protection measures, such as personal protective equipment

Skin Protection

Wear personal protective equipment (e.g gloves), as necessary to prevent skin irritation.

Washable or disposable clothing may be used. If possible, do not take unwashed clothing home.

If soiled work clothing must be taken home, employees should be informed on best practices to minimize non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, and rinse washer before washing other household clothes).

Eye Protection

As necessary, wear goggles or safety glasses with side shields.

Respiratory Protection

When engineering and/or administrative controls are insufficient to maintain workplace concentrations below the 0.5 f/cc REG or a regulatory OEL, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. A NIOSH certified respirator with a filter efficiency of at least 95% should be used. The 95% filter efficiency recommendation is based on NIOSH respirator selection logic sequence for exposure to manmade mineral fibers. Pursuant to NIOSH recommendations, N-95 respirators are appropriate for exposures up to 10 times the NIOSH Recommended Exposure Limit (REL). With respect to RCF, both the NIOSH REL and the industry REG have been set at 0.5 fibers per cubic centimeter of air (f/cm³). Accordingly, N-95 would provide the necessary protection for exposures up to 5 f/cm³. Further, the Respirator Selection Guide published by 3M Corporation, the primary respirator manufacturer, specifically recommends use of N-95 respirators for RCF exposures. In cases where exposures are known to be above 5.0 f/cm³, 8 hour TWA, a filter efficiency of 100% should be used. Other factors to consider are the NIOSH filter series N, R or P -- (N) Not resistant to oil, (R) Resistant to oil and (P) oil Proof. These recommendations are not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

Other Information

- Concentrations based upon an eight-hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.
- The manufacturer recommends the use of a full-facepiece air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica.

9. PHYSICAL AND CHEMICAL PROPERTIES

(a) Appearance	White, fibrous wool	(j) Upper/lower flammability or explosive limits	Not applicable
(b) Odor	Odorless	(k) Vapor pressure	Not applicable
(c) Odor threshold	Not applicable	(l) Vapor density	Not applicable
(d) pH	Not applicable	(m) Relative density	2.50 – 2.75
(e) Melting point	1150° C (2102° F)	(n) Solubility	Insoluble
(f) Initial boiling point	Not applicable	(o) Partition coefficient: n-	Not

and boiling range		octanol/water	applicable
(g) Flash point	Not applicable	(p) Auto-ignition temperature	Not applicable
(h) Evaporation rate	Not applicable	(q) Decomposition temperature	Not applicable
(i) Flammability	Not applicable	(r) Viscosity	Not applicable

10. STABILITY AND REACTIVITY

(a) Reactivity	non-reactive.
(b) Chemical stability	stable and inert.
(c) Possibility of hazardous reactions	None
(d) Conditions to avoid	Please refer to handling and storage advice in Section 7
(e) Incompatible materials	None
(f) Hazardous decomposition products	Thermal decomposition of binder from fires or from first heat of product may release smoke, carbon monoxide, and carbon dioxide. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition of binder. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity or an asthmatic-type response.

11. TOXICOLOGICAL INFORMATION

For more details on scientific publications referenced in this SDS see

<http://www.htiwoalition.org/publications.html>

(a) through (d)

TOXICOKINETICS, METABOLISM AND DISTRIBUTION

Basic Toxicokinetics

Exposure is predominantly by inhalation or ingestion. Man-made vitreous fibers of a similar size to RCF have not been shown to migrate from the lung and/or gut and do not become located in other organs of the body.

Human Toxicological Data/Epidemiology Data

In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S.A; this epidemiological study has been ongoing for 25 years and medical surveillance of RCF workers continues. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in the U.S.A. and Europe have demonstrated an absence of interstitial fibrosis. In the European study a reduction of lung capacity among smokers has been identified, however, based on the latest results from a longitudinal study of workers in the U.S.A. with over 17-year follow-up, there has been no accelerated rate of loss of lung function (McKay et al. 2011).

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the U.S.A. longitudinal study.

The U.S.A. mortality study showed no excess mortality related to all deaths, all cancer, or malignancies or diseases of the respiratory system including mesothelioma (LeMasters et al. 2003).

Information on Toxicological Effects

- *Acute toxicity: short term inhalation*

No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.

- *Acute toxicity: oral*

No data available: Repeated dose studies have been carried out using gavage. No effect was found.

- *Skin corrosion/irritation*

Not a chemical irritant according to test method OECD no. 404.

- *Serious eye damage/irritation*

Not possible to obtain acute toxicity information due to the morphology and chemical inertness of the substance.

- *Respiratory or skin sensitization*

No evidence from human epidemiological studies of any respiratory or skin sensitization potential.

- *Germ cell mutagenicity/genotoxicity*

Method: In vitro micronucleus test

Species: Hamster (CHO)

Dose: 1-35 mg/ml

Routes of administration: In suspension

Results: Negative

- *Carcinogenicity*

Method: Inhalation, multi-dose

Species: Rat

Dose: 3 mg/m³, 9 mg/m³ and 16 mg/m³

Routes of administration: Nose only inhalation

Results: Fibrosis just reached significant levels at 16 and 9 mg/m³ but not at 3 mg/m³. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation, single dose

Species: Rat

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: Rats were exposed to a single concentration of 200 WHO fibers/ml specially prepared RCF for 24 months. High incidence of exposure-related pulmonary neoplasms (bronchoalveolar adenomas and carcinomas) was observed. A small number of mesotheliomas were observed in each of the fiber exposure groups (Mast et al 1995a).

Method: Inhalation, single dose

Species: Hamster

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: Hamsters were exposed to a single concentration of 260 WHO fibers/ml specially

prepared RCF for 18 months and developed lung fibrosis, a significant number of pleural mesotheliomas (42/102) but no primary lung tumors (McConnell et al 1995).

Method: Inhalation, single dose

Species: Rat

Dose: RCF1: 130 F/ml and 50 mg/m³ (25% of non fibrous particles)

RCF1a: 125 F/ml and 26 mg/m³ (2% of non fibrous particles)

Routes of administration: Nose only inhalation

Results: Rats were exposed to RCF1 and RCF1a for 3 weeks. The objective of the study was to compare lung retention and biological effects of the original RCF1 compared to RCF1a. The main difference of these 2 samples was the non-fibrous particle content of respectively 25% versus 2%. The post treatment observation was 12 months. Alveolar clearance was barely retarded after RCF1A exposure. After RCF1 exposure, however, a severe retardation of clearance was observed. (Bellmann et al 2001).

After intraperitoneal injection of ceramic fibers into rats in three experiments (Smith et al 1987, Pott et al 1987, Davis et al 1984), mesotheliomas were found in the abdominal cavity in two studies, while the third report (Pott et al 1987) had incomplete histopathology. Only a few mesotheliomas were found in the abdominal cavity of hamsters after intraperitoneal injection in one experiment (Smith et al 1987). However, the ceramic fibers tested were of relatively large diameter. When rats and hamsters were exposed via intraperitoneal injection, tumor incidence was related to fiber length and dose (Smith et al 1987, Pott et al 1987, Miller et al 1999, Pott et al 1989). (From SCOEL publication (EU Scientific Committee on Occupational Exposure Limits) SCOEL/SUM/165, September 2011).

- *Reproductive toxicity*

Method: Gavage

Species: Rat

Dose: 250mg/kg/day

Routes of administration: Oral

Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

- *STOT-Single exposure*

Not applicable

- *STOT-Repeated exposure*

Not applicable

- *Aspiration hazard*

Not applicable

See the following review publications for a summary and discussion:

Interpretation of these animal experiments is complex and there is not complete agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utell and Maxim 2010.

Other information

Numerous studies indicate the relevance of biopersistence as a determinant of toxic effects of fiber exposure. (Maxim et al 2006).

Irritant Properties

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans. Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber

exposure.

(e) International Agency for Research on Cancer and National Toxicology Program

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION (Non-mandatory)

(a) Ecotoxicity (aquatic and terrestrial, where available)	No known aquatic toxicity.
(b) Persistence and degradability	These products are insoluble materials that remain stable over time and are chemically identical to inorganic compounds found in the soil and sediment; they remain inert in the natural environment.
(c) Bioaccumulative potential	No bioaccumulative potential.
(d) Mobility in soil	No mobility in soil.
(e) Other adverse effects (such as hazardous to the ozone layer)	No adverse effects of this material on the environment are anticipated.

13. DISPOSAL CONSIDERATIONS (Non-mandatory)

WASTE MANAGEMENT

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL

This product, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION (Non-mandatory)

(a) UN number	Not Applicable
(b) UN proper shipping name	Not Applicable
(c) Transport hazard class(es)	Not Applicable
(d) Packing group, if applicable	Not Applicable
(e) Environmental hazards (e.g., Marine pollutant (Yes/No))	Not a marine pollutant
(f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code)	Not Applicable
(g) Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises	Not Applicable

Canadian TDG Hazard Class & PIN: Not regulated

Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15. REGULATORY INFORMATION (Non-mandatory)

UNITED STATES REGULATIONS

EPA	<p>Superfund Amendments and Reauthorization Act (SARA) Title III - this product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).</p> <p>Hazard Categories: Immediate Hazard – No Delayed Hazard – Yes Fire Hazard – No Pressure Hazard – No Reactivity Hazard – No</p> <p>Toxic Substances Control Act (TSCA) - RCF is not required to be listed on the TSCA inventory.</p> <p>Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Clean Air Act (CAA) - this product contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.</p>
OSHA	Comply with Hazard Communication Standards 29 CFR 1910.1200 and 29 CFR 1926.59 and the Respiratory Protection Standards 29 CFR 1910.134 and 29 CFR 1926.103.
California	“Ceramic fibers (airborne particles of respirable size)” is listed in Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986 as a chemical known to the State of California to cause cancer.
Other States	RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada Canadian Workplace Hazardous Materials Information System (WHMIS) – Classified as Class D2A – Materials Causing Other Toxic Effects

Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

Europe Integration of RCF into ANNEX XV of the REACH Regulation

RCF is classified under the CLP (classification, labelling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

16. OTHER INFORMATION

Product Stewardship Program

Unifrax I LLC has established a program to provide customers with up-to-date information regarding the proper use and handling of refractory ceramic fiber. In addition, Unifrax has also established a program to monitor airborne fiber concentrations at customer facilities. If you would like more information about this program, please call the Product Stewardship Information Hotline at 1-800-322-2293.

In 2002, OSHA endorsed a five year voluntary product stewardship program called PSP 2002. On May 23, 2007, HTIW Coalition's predecessor, RCFC, and its member companies renewed this voluntary product stewardship agreement with OSHA. On April 16, 2012, HTIW Coalition renewed this agreement.

This new five year program, called PSP 2012, continues and builds upon the earlier programs. PSP 2012 is a highly acclaimed, multifaceted strategic risk management initiative designed specifically to reduce workplace exposures to refractory ceramic fiber (RCF). For more information regarding PSP 2012, please visit <http://www.htiwcoalition.org>

Hazardous Materials Identification System (HMIS) Hazard Rating

HMIS Health 1* (* denotes potential for chronic effects)
HMIS Flammability 0
HMIS Reactivity 0
HMIS Personal Protective Equipment X (To be determined by user)

Additional Information on After Service Material

As produced, all RCF fibers are vitreous (glassy) materials which do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline phase silica may begin to form at approximately 1100° C (2012° F). When the glass RCF fibers devitrify, they form a mixed mineral crystalline silica containing dust. The crystalline silica is trapped in grain boundaries within a matrix predominately consisting of mullite. The occurrence and extent of crystalline

phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents or furnace contaminants. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied." IARC also studied mixed mineral crystalline silica containing dusts such as coal dusts (containing 5 – 15 % crystalline silica) and diatomaceous earth without seeing any evidence of disease. (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the USEPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 micrograms/cm² - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 micrograms/cm²).

DEFINITIONS

ACGIH:	American Conference of Governmental Industrial Hygienists
ADR:	Carriage of Dangerous Goods by Road (International Regulation)
CAA:	Clean Air Act
CAS:	Chemical Abstracts Service
CERCLA:	Comprehensive Environmental Response, Compensation and Liability Act
DSL:	Domestic Substances List
EPA:	Environmental Protection Agency
EU:	European Union
f/cc:	Fibers per cubic centimeter
HEPA:	High Efficiency Particulate Air
HMIS:	Hazardous Materials Identification System
IARC:	International Agency for Research on Cancer
IATA:	International Air Transport Association
IMDG:	International Maritime Dangerous Goods Code
mg/m³:	Milligrams per cubic meter of air
mmpcf:	Million particles per cubic meter
NFPA:	National Fire Protection Association
NIOSH:	National Institute for Occupational Safety and Health
OSHA:	Occupational Safety and Health Administration
29 CFR 1910.134 & 1926.103:	OSHA Respiratory Protection Standards
29 CFR 1910.1200 & 1926.59:	OSHA Hazard Communication Standards
PEL:	Permissible Exposure Limit (OSHA)
PIN:	Product Identification Number
PNOC:	Particulates Not Otherwise Classified
PNOR:	Particulates Not Otherwise Regulated
PSP:	Product Stewardship Program
RCRA:	Resource Conservation and Recovery Act
REL:	Recommended Exposure Limit (NIOSH)

RID:	Carriage of Dangerous Goods by Rail (International Regulations)
SARA:	Superfund Amendments and Reauthorization Act
SARA Title III:	Emergency Planning and Community Right to Know Act
SARA Section 302:	Extremely Hazardous Substances
SARA Section 304:	Emergency Release
SARA Section 311:	MSDS/List of Chemicals and Hazardous Inventory
SARA Section 312:	Emergency and Hazardous Inventory
SARA Section 313:	Toxic Chemicals and Release Reporting
STEL:	Short Term Exposure Limit
SVF:	Synthetic Vitreous Fiber
TDG:	Transportation of Dangerous Goods
TLV:	Threshold Limit Value (ACGIH)
TSCA:	Toxic Substances Control Act
TWA:	Time Weighted Average
WHMIS:	Workplace Hazardous Materials Information System (Canada)

Revision Summary: Updated SDS to align with OSHA HCS 2012.

Revision Date: 06/1/2015

SDS Prepared By: Insulation Specialties of America, Inc. Management Department.

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this SDS. Therefore, given the summary nature of this document, Insulation Specialties of America, Inc. does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.



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1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

Trade name: Kanthal A1, A, AE, AF, AMR, AX2, D, DT, LT
Product type: Resistance Heating Alloy
Manufacturer/Supplier: Sandvik Heating Technology AB
Box 502
734 27 Hallstahammar
0220-210 00
E-mail: infokanthal@sandvik.com
Emergency telephone: 112

2. HAZARDS IDENTIFICATION

Symbol: T Toxic
R-value: R40 Limited evidence of a carcinogenic effect
R43 May cause sensitization by skin contact
R48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation
Injurious to health properties: Nickel limited evidence of a carcinogenic effect.
Nickel may cause sensitization by skincontact.
Chromium may cause contact eczema.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Compounds	EINECS-no.	CAS-no	Content %	Symbol/R-value
Nickel	231-111-4	7440-02-0	Max 1	Canc 3 T R40 R43 R48/23
Chromium	231-157-5	7440-47-3	9-24	
Aluminium	231-072-3	7429-90-5	Max 7	
Iron	231-096-4	7439-89-6	Balance	

4. FIRST AID MEASURES

Inhalation: Move to fresh air.
Skin contact: Wash with soap and water.
Eye contact: Rinse immediately with water for several minutes, with eyelids held open.
Ingestion: Not a normal route of exposure.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media:
Use suitable extinguishing media for surrounding materials and type of fire.

Extinguishing media which shall not be used for safety reasons:
None known.



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Special exposure hazards arising from the substance or preparation itself, combustion products, resulting gases:

None known.

Special protective equipment for firefighters:

Wear fully protective impervious suit.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:

Use protective clothing and gloves. Also see p.8

Environmental precautions:

-

Methods for cleaning up:

-

7. HANDLING AND STORAGE

Handling:

Follow generally accepted industrial practice for good hygiene.

Storage:

Keep dry.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure limit values

Hygiene standards and exposure limits may differ from country to country. Check those currently applying in your country and comply with regulations. Examples of exposure limit applying Sweden are given below:

Compound	Exposure limit	Type of value
Nickel	0,5 mg/m ³	NGV (Total)
Chromium	0,5 mg/m ³	NGV (Total)
Aluminium	2 mg/m ³	NGV (Respirable)
	5 mg/m ³	NGV (Total)

NGV="Level Limit Value", sanitary limit value for exposure during one working day.

Exposure controls

Preventive action:

Good general ventilation is recommended.

Respiratory protection:

Use when necessary.

Hand protection:

Protective gloves, avoid skin contact.

Eye protection:

Wear safety glasses when tooling.

Skin protection:

Wear suitable protective clothing and protective shoes.



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9. PHYSICAL AND CHEMICAL PROPERTIES

Form:	Solid, metal
Colour:	Metallic
Odour:	Odourless
Density:	~ 7g/cm ³
Melting point (approx):	~1400-1430°C, ~2550-2610°F
Water solubility:	Insoluble

10. STABILITY AND REACTIVITY

Conditions to avoid:

-

Materials to avoid:

-

Hazardous decomposition products:

-

11. TOXICOLOGICAL INFORMATION

Inhalation:	Dust may cause sensitive persons problem with respiration.
Skin contact:	May cause contact eczema and allergy when repeatedly skin contact.
Eye contact:	Product dust may cause temporary mechanical eye irritation.
Ingestion:	Not a normal route of exposure.

Nickel

Nickel is the most commonly occurring contact allergen. According to surveys from the USA, Italy, Denmark, Finland and Sweden, 8-22 % of women and 0.3-3 % of men develop hypersensitivity to nickel (National Chemicals Inspectorate, Sweden, 1995). The main method of exposure is contact with metallic nickel and/or nickel alloys.

Exposure to nickel has been linked to a risk of lung cancer and nasal cancer, but it has not been possible to identify the form in which nickel is carcinogenic.

The EU has classified metallic nickel as Category 3 carcinogens with an R40 risk phrase – Limited evidence of a carcinogenic effect.

Chromium

Prolonged contact with chromium compounds or with materials containing chromium can cause allergic reactions. Based on research, it is believed that this only occurs with contact with chromium (VI). Allergic skin reactions are particularly common in work places where work involves the handling of chromates, dichromates and chromic acid fumes, but chromium allergies have also been observed in housewives, cement workers, furriers and joiners (National Chemicals Inspectorate, Sweden, 1995). One type of contact eczema, 'cement eczema', is thought to be caused by chromium (VI) in cement.

People who have developed chromium allergies also tend to be hypersensitive to other metals, mainly nickel and cobalt (National Chemicals Inspectorate, Sweden, 1995).



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12. ECOLOGICAL INFORMATION

No data available.

13. DISPOSAL CONSIDERATIONS

Disposal in accordance with all applicable local and national regulations.

14. TRANSPORT INFORMATION

Road transport (ADR) Not classified as dangerous in the meaning of transport regulations.

15. REGULATORY INFORMATION

Symbol: T Toxic

R-value: R40 Limited evidence of a carcinogenic effect.
R43 May cause sensitization by skin contact.
R48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation

S-value: S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection
S 45 In case of accident or if you feel unwell, seek medical advice immediately. Show the label where possible.

16. OTHER INFORMATION

Information in this Safety Data Sheet is based on the form the product is released on the market.

List of relevant R phrases:

R40 Limited evidence of a carcinogenic effect.
R43 May cause sensitization by skin contact.
R48/23 Toxic: danger of serious damage to health by prolonged exposure through inhalation


Reference:

Kemikalieinspektionen (1995) Hazard Assessments - Chemical Substances Selected in the Swedish Sunset Project. Supplement to KemI Report 13/94. KemI Report No 12/95.

Waltersson, Eva (1999) Environment research team. Chromium, Nickel, Molybdenum. In village and environment. A collection of facts of flow, quantities and effects in Sweden.

Revision:

Revised in accordance with REACH- regulation.

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SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY/UNDERTAKING

1.1 Product identifier:	LyTherm® Refractory Media (All grades are listed at the end of the SDS)
1.2 Relevant identified uses of the substance or mixture and uses advised against:	Thermal Barrier Application.
1.3 Details of the supplier of the safety data sheet	
Name:	Lydall Performance Materials, Inc.
Address:	134 Chestnut Hill Road Rochester, NH USA 03867
Telephone number:	1-603-332-4600/4605
Fax number:	1-603-332-9602
E-mail:	info@lydall.com
1.4 Emergency Telephone Number:	1-603-332-4600/4605 (8 AM – 5 PM)
Fax Number: 1-603-332-9602	

SECTION 2: HAZARDS IDENTIFICATION

2.1 Classification of the Substance or Mixture

MOST IMPORTANT HAZARD:	The product does not present any hazard for final use. However, where a workplace assessment indicates there is a potential for a combustible dust hazard, the release of product dust during manufacturing or handling, respirable glass wool and ceramic fibers may be released and result in the classification of the product as hazardous.
Adverse human health effects:	Product dust may be irritating to eyes, skin and respiratory system. Prolonged inhalation of respirable glass wool and ceramic fibers is suspected to cause cancer.
Environmental effects:	Presents no particular risk to the environment, provided the recommendations concerning disposal (see section 13) and any applicable national or local regulations are complied with.
Physical and chemical hazards - Fire or explosion:	May form combustible dust concentrations in air during processing.
Classification of the product:	According to European regulations (67/548/EEC), this product is classified as Manufactured Article
OSHA/CLP/GHS Classification:	Carcinogen Category 1B Combustible dust
EU Classification (67/548/EEC):	Carc. Cat 2, T R49 (Dust generated from processing)

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2.2 Label Elements

- Hazard pictograms:



- Signal words:

- Hazard statements:

- Precautionary statements:

Danger! Contains refractory ceramic fiber respirable size
H350: May cause cancer by inhalation
May form combustible dust concentrations in air during processing.
P201: Obtain special instructions before use
P202: Do not handle until all safety precautions have been read and understood
P280: Wear eye protection, protective clothing, and protective gloves.
P308+P313: IF exposed or concerned: Get medical advice
P501: Dispose of container and contents to approved disposal site in accordance with all local and national regulations.

2.3 Other Hazards:

None.

Refer to Section 16 for Full Text of EU Classes and R Phrases.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Substance name	Contents	CAS No.	EINECS No.	Classification
Refractories, Fibers, Aluminosilicate	0-95%	142844-00-6	604-314-4	Carc. Cat 2; T R49
Aluminum Oxide (fibrous) polycrystalline	0-94%	1344-28-1	215-691-6	Carc. 1B H350 Carc. Cat 3, Xi, R38, R40
Polymer Binder	0-15%	Proprietary	Proprietary	Carc. 2 H351 Not classified as dangerous
Special Purpose Glass Fiber Respirable Size	0-10%	65997-17-3	266-046-0	Carc. Cat 3, Xi, R38, R40 Carc. 2 H351

See Section 16 for full text of GHS and EU Classifications.

SECTION 4: FIRST AID MEASURES

4.1 Description of First Aid Measures

Eye contact:


Do not rub your eyes. Dust particles may cause abrasive eye injury. Flush eyes with water, holding the eyelids apart for several minutes. Get medical attention if irritation persists.

Skin contact:

Do not rub or scratch. Rinse exposed skin with cold water then wash skin with soap and water. Do not use hot water as that opens skin pores and may increase fiber penetration and irritation. Remove contaminated clothing and launder before re-use. Get medical attention if irritation persists.

Lydall Performance Materials, Inc.

134 Chestnut Hill Road Rochester, NH 03867 USA

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Inhalation: Remove victim to fresh air. Drink water to clear throat and blow nose to remove dust. Get medical attention if irritation persists.

Ingestion: If small quantities are swallowed, rinse out mouth with water. Drink plenty of water to help reduce irritation. If large amounts are swallowed or if irritation or discomfort occurs, get medical attention.

4.2 Most Important symptoms and effects, both acute and delayed: May cause eye irritation. May cause mild skin and respiratory irritation. Suspected of causing cancer.

4.3 Indication of any immediate medical attention and special treatment needed: No immediate treatment is normally required.

See Section 11 for more detailed information on health effects.

SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing Media: Use water, water fog, carbon dioxide, foam or dry chemical.

5.2 Special Hazards Arising from the Substance or Mixture: This product is not classified as flammable or combustible. However, where a workplace assessment indicates there is a potential for a combustible dust hazard: Dust generated in cutting or other processing of this material may present a potential fire and explosion hazard if suspended in air at high concentrations. Settled dust presents a fire hazard. Re-suspension of the dust into the air by vibration, traffic, material handling, etc. in high concentrations in the presence of an ignition source could result in a dust explosion. Minimize the generation and accumulation of dust.


5.3 Advice for Fire-Fighters: Firefighters should wear full emergency equipment and NIOSH approved positive pressure self-contained breathing apparatus for all fires involving chemical products.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal Precautions, Protective Equipment and Emergency Procedures: Wear appropriate protective clothing and equipment (see section 8). Avoid contact with skin, eyes or clothing. Do not breathe dust.

6.2 Environmental Precautions: Avoid release to the environment.

6.3 Methods and Material for Containment and Cleaning Up: Pick up material and place into a container for disposal. Where a workplace assessment indicates there is a potential for a combustible dust hazard: Wet down and collect in a manner to minimize the generation of airborne dusts or vacuum with a high efficiency vacuum cleaner. If a vacuum is used, explosion proof equipment is required. Nonsparking tools should be used. Dust deposits should not be allowed to accumulate on surfaces, as these may form an

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explosive mixture if they are released into the atmosphere in sufficient concentrations. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air).

6.4 Reference to Other Sections:

Refer to Section 8 for personal protective equipment and Section 13 for disposal information.

SECTION 7: HANDLING and STORAGE

7.1 Precautions for Safe Handling

Avoid contact with eyes, skin and clothing. Avoid creating and breathing dusts. Wear protective clothing and equipment as described in Section 8. Use only with adequate ventilation. Do not eat, drink or smoke when using this material. Launder contaminated clothing before re-use. Wash thoroughly with soap and water after handling. Minimize the generation and accumulation of dust. Where a workplace assessment indicates there is a potential for a combustible dust hazard: Keep dust away from open flames, hot surfaces and sources of ignition. Follow good housekeeping practices to keep surfaces, including areas overhead such as piping, drop ceilings, ductwork, etc. free from settled dust. Dry powders can build static electricity charges when subjected to friction of transfer and in mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres.

Empty containers retain product residues. Follow all SDS precautions in handling empty containers.

7.2 Conditions for Safe Storage, Including any Incompatibilities:

Store in a dry, well-ventilated area.

7.3 Specific end use(s):

Filter media for the manufacture of air filters.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control Parameters:

Refractories, Fibers, Aluminosilicate	5 mg/m3 (respirable) 15 mg/m3 (total dust) TWA OSHA PEL 0.2 f/cc TWA ACGIH TLV 0.5 f/cc TWA RCFC* recommended 1 fibre/mL TWA UK OEL 0.1 fibre.cm3 VME France 0.25 respirable fibers/mL Germany
Aluminum Oxide (fibrous) polycrystalline	5 mg/m3 (respirable) 15 mg/m3 (total dust) TWA OSHA PEL 0.5 f/cc TWA manufacturer recommended
Polymer Fiber and Binder (as particulates not otherwise classified)	5 mg/m3 (respirable) 15 mg/m3 (total dust) TWA OSHA PEL
Special Purpose Glass Fiber Respirable Size	5 mg/m3 (respirable) 15 mg/m3 (total dust) TWA OSHA PEL 1 f/cc TWA OSHA HSP* 1 f/cc TWA ACGIH TLV 5 mg/m3 or 2 fibre/mL TWA UK OEL 1 fibre.cm-3 VME France 0.25 respirable fibers/mL Germany

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* HSPP = OSHA voluntary Health and Safety Partnership Program
Note: If not listed above, refer to local regulations for specific country exposure limits

8.2 Exposure Controls:

- Engineering Measures:

Use with adequate local exhaust ventilation to minimize exposures. Provide local exhaust ventilation where product is cut or processed in a manner that generates dust. Where a workplace assessment indicates there is a potential for a combustible dust hazard: It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e. there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

- Respiratory Protection:

If the occupational exposure limits are exceeded or irritation is experienced, wear an approved particulate respirator. Selection of respiratory protection depends on the contaminant type, form and concentration. Select and use in accordance with all applicable regulations (in the US follow OSHA 1910.134) and good Industrial Hygiene practice.

- Hand Protection:

Wear protective gloves to minimize skin contact. Barrier creams may be useful in reducing irritation.

- Eye/face Protection:

Wear safety glasses with side shields or dust proof goggles.

- Other Protective Clothing or Equipment:

Clothing with long sleeves and pants should be worn to avoid skin contact. Washing facilities should be available in the work area. Work clothing should be laundered separately from normal clothing.

SECTION 9: PHYSICAL and CHEMICAL PROPERTIES

9.1 Information on basic Physical and Chemical Properties

Appearance:	White bonded web.
Odor:	Odorless.
Odor Threshold:	Not determined
pH:	Not applicable
Melting/Freezing Point:	>700°C (>1,292°F) (glass fiber)
Boiling Point:	Not applicable
Flash Point:	Not applicable
Evaporation Rate:	Not applicable
(n-butylacetate =1)	
% Volatile by Volume:	0%
Lower Flammability Limit:	Not applicable
Upper Flammability Limit:	Not applicable
Vapor Pressure:	Not applicable
Vapor Density(Air=1):	Not applicable
Solubility:	Insoluble
Autoignition	Not applicable

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Temperature:	
Decomposition Temperature:	Not determined
Viscosity:	Not applicable
Explosive Properties:	If assessed as a combustible dust hazard: High concentrations of dust in the presence of an ignition source could result in a dust explosion.
Oxidizing Properties:	Not applicable
Specific Gravity (H ₂ O= 1):	Not determined
Molecular Formula:	Not determined
Molecular Weight:	Not determined

9.2 Other Information: None.

SECTION 10: STABILITY and REACTIVITY

10.1 Reactivity:	This material is not reactive under normal conditions.
10.2 Chemical Stability:	Stable
10.3 Possibility of Hazardous Reactions:	Will not occur.
10.4 Conditions to Avoid:	Avoid dust formation.
10.5 Incompatible Materials:	Avoid strong acids.
10.6 Hazardous Decomposition Products:	Thermal decomposition of polymer binder will generate oxides of carbon, fluorine, hydrogen fluoride and various hydrocarbons.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on Toxicological Effects: Potential Health Effects:

Eye Contact:	Dust may cause mechanical irritation and possible injury.
Skin Contact:	Dust may cause mechanical irritation.
Inhalation:	Dust may cause nose, throat and upper respiratory tract irritation. Symptoms include coughing, sneezing and scratchy throat.
Ingestion:	May cause irritation of the mouth and intestinal tract.
Acute toxicity:	No specific data is available
Skin corrosion/irritation:	Not a skin corrosive.
Eye damage/irritation:	Dust may cause mechanical irritation and possible injury.
Respiratory Irritation:	Dust may be irritating to the respiratory system.
Respiratory Sensitization:	Not a respiratory sensitizer.
Skin Sensitization:	Not a skin sensitizer.
Germ Cell Mutagenicity:	Not classified a germ cell mutagen.
Carcinogenicity:	Glass wool including special purpose glass fibers (respirable size) are classified by NTP as reasonably anticipated to be a carcinogen. IARC has classified special purpose glass fibers as group 2B, possibly carcinogenic to humans. ACGIH has classified special purpose glass fibers as A3, confirmed animal carcinogen with

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unknown relevance to humans. Mineral wool (special purpose glass fibers) is classified as a category 3 carcinogen in the EU CLP. OSHA has not classified special purpose glass fibers. Ceramic fibers (respirable size) are classified by NTP as reasonably anticipated to be a carcinogen. IARC has classified refractory ceramic fibers as group 2B, possibly carcinogenic to humans. Refractory ceramic fibers are classified as a category 2 carcinogen in the EU CLP. Both IARC and NTP have classified respirable crystalline silica as a known human carcinogen. ACGIH has classified refractory ceramic fibers and cristobalite as A2, suspected human carcinogens. OSHA has not classified ceramic fibers or crystalline silica. None of the other components is classified as a carcinogen by IARC, NTP, ACGIH or OSHA. None of the other components is classified as a carcinogen by IARC, NTP, ACGIH, OSHA or the EU CLP.

Specific Target Organ Toxicity:

Single Exposure: No data available.
Repeat Exposure: No data available.

SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity:

No data available.

12.2 Persistence and degradability:

No data available.

12.3 Bioaccumulative Potential:

No data available.

12.4 Mobility in Soil:

No data available.

12.5 Results of PVT and vPvB assessment:

Not required.

12.6 Other Adverse Effects:

None.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste Treatment Methods:


Dispose in accordance with local, state and national regulations.

SECTION 14: TRANSPORTATION INFORMATION

	14.1 UN Number	14.2 UN Proper Shipping Name	14.3 Hazard Class(s)	14.4 Packing Group	14.5 Environmental Hazards
US DOT	N/A	Not classified for transport	N/A	N/A	N/A
Canadian TDG	N/A	Not classified for transport	N/A	N/A	N/A
EU ADR/RID	N/A	Not classified for transport	N/A	N/A	N/A
IMDG	N/A	Not classified for transport	N/A	N/A	N/A
IATA/ICAO	N/A	Not classified for transport	N/A	N/A	N/A

14.6 Special Precautions for User: None

14.7 Transport in Bulk According to Annex III MARPOL 73/78 and the IBC Code: Not determined.

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SECTION 15: REGULATORY INFORMATION

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Substance or Mixture

U.S. REGULATIONS:

CERCLA: This product is not subject to CERCLA reporting requirements. Many states have more stringent release reporting requirements. Report spills required under federal, state and local regulations.

SARA TITLE III:

Hazard Category For Section 311/312: This product is a manufactured article and not subject to reporting.

Section 313 Toxic Chemicals: This product contains the following chemicals subject to Annual Release Reporting Requirements Under SARA Title III, Section 313 (40 CFR 372): None.

Section 302 Extremely Hazardous Substances (TPQ): None.

U.S. STATE REGULATIONS:

California Proposition 65: This product contains special purpose glass fiber and ceramic fibers (airborne particles of respirable size) which are known to the State of California to cause cancer. This product may also contain trace amounts of formaldehyde which is known to the State of California to cause cancer.

INTERNATIONAL REGULATIONS:

RoHS (Restriction on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations): This product is RoHS compliant.

EU Labeling: Finished product is an article and no labeling is required.

REACH: This product is an article and not subject to registration.

Canadian WHMIS: If dust is generated in processing this dust would be classified as Class D-2-A (eye, skin and respiratory irritant, carcinogen).

INTERNATIONAL INVENTORIES

US Toxic Substances Control Act Inventory (TSCA): This product is an article and not subject to TSCA.

EU Chemical Inventory (EINECS)/REACH: This product is considered an article under EINECS and REACH.

Australian Inventory of Chemical Substances: This product is an article and not subject to chemical notification requirements.

China Inventory of Existing Chemicals and Chemical Substances: This product is an article and not subject to chemical notification requirements.

Japanese Existing and New Chemical Substances: This product is an article and not subject to chemical notification requirements.

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Korean Existing Chemicals List: This product is an article and not subject to chemical notification requirements.

Philippine Inventory of Chemicals and Chemical Substances: This product is an article and not subject to chemical notification requirements.

Canadian CEPA New Chemical Notification: This product is an article and not subject to new chemical notification.

New Zealand: This product is an article and not subject to new chemical notification.

SECTION 16: OTHER INFORMATION

Refer to NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, for safe handling.

SDS Date of preparation/revision: 3-Aug-2017: Added grade 3000-LK.

Revision History:

16-Jun-2017: Updated combustible dust statement and removed 800 number.

2-Sep-2016: Added grade 550-LK.

15-Apr-2015: Update to GHS SDS.

2-Mar-2012: Section 1: Product use and product name change. Section 16: Addition of product grades.

EU Classes and Risk Phrases for Reference (See Sections 2 and 3)

Carc Cat 2 Carcinogen Category 2

Carc Cat 3 Carcinogen Category 3

Xi Irritant

R38 Irritating to skin.

R40 Limited evidence of a carcinogenic effect.

R49 May cause cancer by inhalation.

CLP/GHS Classification and H Phrases for Reference (See Section 3)

Carc.1B Carcinogen Category 1B

Carc. 2 Carcinogen Category 2

H351: Suspected of causing cancer.

Grade List: 155, 167, 167-1, 196, 550-LF, 550-LJ, 550-LK, 880-LAH, 880-LFH, 880-LJH, 970-LA, 970-LAH, 970-LF, 970-LFH, 970-LJ, 970-LJH, 970-LK, 970-LKH, 971-LAH, 971-LFH, 1530-LA, 1530-LAR, 1530-LF, 1530-LJ, 1530-MI, 1535-GC, 1535-LK, 3000-LF, 3000-LFH, 3000-LJ, 3000-LJH, 3000-LK, Rollboard 1/8, Rollboard 1/10, and Rollboard 1/16.

Disclaimer

The information presented on this SDS (1) provides details on material identity, manufacturer/supplier information, hazard characterization and prevention, emergency response and other specialized information, (2) is considered to be accurate to the best of our knowledge, information and belief as of the date of publication, (3) is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release of the material named, (4) should be read and used in conjunction with the company's relevant literature, (5) relates only to the specific material designated and may not be valid for such material used in combination with any other material or process and (6) is provided without warranty, expressed or implied, in law or in fact, of merchantability or fitness for a particular purpose.

This document does not constitute a product specification and should not be relied on as such.

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		Date: 3-Aug-2017
		Supersedes: 16-Jun-2017
LyTherm® Refractory Media		LYDALL

Pyrotherm L20M and L23R Boards

Revision Date: 2018-08-17

Revision Number: 5

Classification	PPE	Transport Symbols

1. Identification of the Substance/Preparation and of the Company/Undertaking

Product identifier

Product Name

Pyrotherm L20M and L23R Boards

Other means of identification

Commodity code

04018-L16M

Synonym

No Synonym

Recommended use of the chemical and restrictions on use

Product use

A rigid, high temperature ceramic fiber board for backup insulation. Pyrotherm L23R is manufactured with an exterior surface lightly rigidized. Refractory Ceramic Fiber (RCF) materials are used primarily in industrial high temperature insulating applications up to 1400 C. RCF based products are not intended for direct sale to the general public.

Uses advised against

Not fit for use in anything related to human consumption.

Details of the supplier

Corporate office:
Pyrotek Inc.
705 West 1st Ave
Spokane, WA 99201-3909
United States

Phone 1: (509) 926-6212
Phone 2: 1-800-PYROTEK
Fax: (509) 927-2408
Email: SDS@pyrotek.com

Emergency Telephone Number

CHEMTREC North America (800) 424-9300, CHEMTREC Outside North America +1 703 527 3887

2. Hazards Identification

Classification

Carcinogenicity	Category 1B
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Label Elements

Danger

Hazard statements

May cause cancer



Precautionary Statements - Prevention

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Wear protective gloves/protective clothing/eye protection/face protection
In case of inadequate ventilation wear respiratory protection

Precautionary Statements - Response

IF exposed or concerned: Get medical advice/attention

Precautionary Statements - Storage

Store in a manner to minimize airborne dust.

Precautionary Statements - Disposal

Dispose of contents/container in accordance with local, regional, national, and international regulations as applicable

Hazards not otherwise classified (HNOC)

May cause temporary mechanical irritation to exposed eyes, skin, or respiratory tract.

Other Information

6.6 % of the mixture consists of ingredient(s) of unknown toxicity

3. Composition/information on Ingredients

Chemical name	CAS No	Weight-%	Classification
Refractory Ceramic Fibre (RCF)	142844-00-6	70 - 95 %	Carc. 1B (H350i)
Starch	9005-25-8	1 - 10 %	-
Silica Gel	112926-00-8	5 - 25 %	-

Further information

Synthetic vitreous fibers (SVF) are fibrous inorganic substances classified into three general groups: fibrous glass (glasswool and glass filament), mineral wool (rockwool and slagwool), and refractory ceramic fibers (RCF). Devitrification (conversion of fibers to a crystalline state) may occur when SVF materials are exposed to high temperatures producing disordered crystalline silica forms.

The exact percentage (concentration) of composition is not shown due to component range variations, withheld or trade secret ingredients.

4. First Aid Measures

General advice	If symptoms persist, call a physician. Show this safety data sheet to the doctor in attendance.
Skin Contact	Wash off with soap and water. Do not rub. Treat irritated or desiccated skin with hydrating skin cream. If skin irritation persists, call a physician.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not rub. If symptoms persist, call a physician.
Inhalation	Remove to fresh air. Get person to drink water to clear throat and blow nose to evacuate dust and fibers. If symptoms persist, call a physician.
Ingestion	Not a normal route of exposure. Consult a physician if necessary.
Notes to Physician	Treat symptomatically. Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.
Protection of first-aiders	Use personal protective equipment.

5. Fire-Fighting Measures

Flammable properties

None known.

Suitable Extinguishing Media

Use extinguishing measures that are appropriate to local circumstances and the surrounding fire.

Unsuitable Extinguishing Media

None known.

Specific hazards arising from the chemical

No information available.

Hazardous combustion products Binder decomposition results in the following. Carbon monoxide. Carbon dioxide (CO₂).
Ventilate. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity, or an asthmatic-type response.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Avoid dust formation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Use personal protective equipment.

Environmental Precautions

Do not flush into surface water or sanitary sewer system. Avoid dust formation.

Methods and material for containment and cleaning up

Pick up and arrange disposal without creating airborne dust. Vacuum or wet sweep. Avoid dust formation. Do not use compressed air or dry sweeping for cleaning.

Other Information

Do not create a powder cloud by using a brush or compressed air.

7. Handling and Storage

Precautions for safe handling

Ensure adequate ventilation. Wear personal protective equipment. Avoid dust formation.

Conditions for safe storage, including any incompatibilities

Keep containers tightly closed in a dry, cool and well-ventilated place. Keep in properly labelled containers. Store in original container. Do not re-use empty containers.

Materials to avoid

Hydrofluoric acid. Phosphoric acid. Hydrochloric acids. Sulfuric acid. Alkalis.

8. Exposure controls/Personal Protection

Control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico
Refractory Ceramic Fibre (RCF)	TWA: 0.2 fiber/cm ³	0.1 f/cm ³	Not Listed	Not Listed
Starch	TWA: 10 mg/m ³	TWA: 15 mg/m ³ TWA: 5 mg/m ³	Not Listed	Not Listed
Silica Gel	10 mg/m ³	20 mmpcf or 80 mg/m ³ / % SiO ₂	Not Listed	TWA: 10 mg/m ³

Chemical name	Canada - Alberta	Canada - British Columbia	Canada - Ontario	Canada - Quebec
Refractory Ceramic Fibre (RCF)	TWA: 0.2 fibre/cm ³	TWA: 0.2 fibre/cm ³	TWA: 0.5 fibre/cm ³	TWA: 1 fibre/cm ³
Starch	TWA: 10 mg/m ³	TWA: 10 mg/m ³ TWA: 3 mg/m ³	TWA: 10 mg/m ³	TWA: 10 mg/m ³
Silica Gel	Not Listed	TWA: 4 mg/m ³ TWA: 1.5 mg/m ³	Not Listed	TWA: 6 mg/m ³

Chemical name	Argentina	Brazil	Chile	Venezuela
Refractory Ceramic Fibre (RCF)	TWA: 0.2 fiber/cm ³	Not Listed	Not Listed	Not Listed
Starch	TWA: 10 mg/m ³	Not Listed	Not Listed	TWA: 10 mg/m ³
Silica Gel	TWA: 10 mg/m ³	Not Listed	TWA: 8 mg/m ³	TWA: 10 mg/m ³

Appropriate engineering controls

Engineering Controls

Provide appropriate exhaust ventilation at places where dust is formed. Use engineering controls and material handling equipment to minimize airborne fiber emissions.

Individual protection measures, such as personal protective equipment

Eye Protection	Safety glasses with side-shields, Do not wear contact lenses, In case of dust, use:, Tightly fitting safety goggles.
Hand Protection	Protective gloves.
Skin Protection	Protective clothing as (when) required, Protective gloves.
Respiratory protection	Respirator must be worn if exposed to dust, At concentrations of dust below the limit value, a respirator with dustfilter P2/FFP2 is recommended. At concentrations of dust over the limit value, use a respirator with dustfilter P3/FFP3 and at concentrations 10 times the limit value, use a TMP2P / TH3P, N, R or P95 Series Respirator, Manufacturer recommends the use of a full-facepiece air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica.

General industrial hygiene practice

When using, do not eat, drink or smoke. Regular cleaning of equipment, work area and clothing. Contaminated work clothing should not be allowed out of the workplace. Remove and wash contaminated clothing before re-use. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday. Eyewash station recommended.

9. Physical and Chemical Properties

Information on basic physical and chemical properties

Physical state	Solid	Odor	Odorless
Appearance	Board, Fibrous	Odor threshold	Not applicable
Color	White		

<u>Property</u>	<u>Values</u>	<u>Remarks • Methods</u>
pH	Not applicable	
Melting point / freezing point	1760 °C / 3200 °F	
Boiling point / boiling range	Not applicable	
Flash point	Nonflammable	None known
Evaporation rate		

Flammability Limit in Air	
Upper flammability limit:	Not applicable
Lower flammability limit:	Not applicable
Vapor pressure	Not applicable
Vapor density	
Specific gravity	2.5 - 2.75
Water solubility	Insoluble in water
Solubility(ies)	Not applicable
Partition coefficient	
Autoignition temperature	Not applicable
Decomposition temperature	No data available
Kinematic viscosity	
Dynamic viscosity	
Explosive properties	Non explosive

Other Information

VOC Content (%)	Not applicable
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10. Stability and Reactivity

Reactivity

Chemical stability

Stable under normal conditions.

Possibility of Hazardous Reactions

Hazardous polymerization does not occur.

Conditions to Avoid

Avoid dust formation.

Incompatible materials

Hydrofluoric acid. Phosphoric acid. Hydrochloric acids. Sulfuric acid. Alkalis.

Hazardous Decomposition Products

Thermal decomposition can lead to release of irritating gases and vapors. Carbon oxides. Initial heating may release irritating gases and fumes. Ventilate room until fumes have disappeared. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity, or an asthmatic-type response.

11. Toxicological Information

Information on likely routes of exposure

Eye Contact	Contact with eyes may cause irritation.
Skin Contact	Substance may cause slight skin irritation.
Ingestion	Not a normal route of exposure.
Inhalation	May cause irritation of respiratory tract.

Information on toxicological effects

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Mutagenic effects	Method: In vitro micronucleus test. Species: Hamster (CHO). Does: 1-35 mg/l. Route of administration: In suspension. Results: Negative.
Reproductive Effects	Method: Gavage. Species: Rat. Dose: 250 mg/kg/day. Routes of administration: Oral. Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.
STOT - single exposure	None known.
STOT - repeated exposure	None known.
Chronic Toxicity	

RCF HEALTH DATA SUMMARY: Epidemiological studies of RCF production workers have indicated no increased incidence of respiratory disease nor other significant health effects. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

RCF TOXICOLOGY: Early animal studies of RCF effects by intraperitoneal and intrapleural injections, as well as by inhalation, resulted in mostly negative results. In an effort to eliminate any questions posed by the results of these early studies, a definitive Maximum Tolerated Dose Study (MTD) by nose only, lifetime inhalation in rats and hamsters, was designed in the 1980s. The MTD study appeared to confirm that RCF was an animal carcinogen under certain test conditions, e.g., extremely high concentrations of approximately 200 f/cc inhaled directly into the lungs. A later review of the MTD pathology indicated that the animals' lungs were likely overloaded because of large quantities of non-fibrous particles, and that this overload condition was likely responsible for the disease observed. In fact, evaluation of the aerosol samples used confirmed the presence of significant quantities of particulate matter. In a subsequent multi-dose animal inhalation

study at 25 f/cc, 75 f/cc, and 115 f/cc; a no observed effect level (NOEL) was found at 25 f/cc. This level is 50 times the RCFC recommended REG of 0.5 f/cc for humans.

RCF EPIDEMIOLOGY: In order to determine possible human health effects following RCF exposure, the University of Cincinnati in the United States and the Institute of Occupational Medicine (IOM) in Europe have conducted medical surveillance studies on RCF workers in U.S. and European manufacturing facilities. The University of Cincinnati study has been in progress for over 20-years, collecting data from respiratory questionnaires, lung function tests, chest X-rays, exposure monitoring, and worker mortality. The results of this study of RCF plant workers exposed from 1953 to the present have shown (LeMasters et al, 2003): The initial cross-sectional spirometry studies in the U.S. (LeMasters et al. 1998) and Europe (Cowie et al. 2001) revealed lung function decrements in the RCF-exposed cohort that were associated with heavier historical exposures. Subsequently, longitudinal studies have revealed no RCF exposure related decrements in lung function associated with current exposure levels. Through 1996, pleural plaques seen on chest X-rays in 2.7% of the workers. Pleural plaques are considered a marker of exposure and not disease. The prevalence of pleural plaques has remained relatively constant over time, perhaps as a result of lower current exposure levels. Thus, this long term epidemiology study has demonstrated an absence of interstitial fibrosis, no increased mortality risk and no decrement in lung function associated with current exposures.

Method: inhalation, multi-dose. Species: Rat. Dose: 3 mg/m³, 9 mg/m³, 16 mg/m³. Routes of administration: nose only inhalation. Results: Fibrosis just reached significant levels at 9 & 16 mg/m³. None of the parenchymal tumor incidences were higher than historical control values.

Method: inhalation, single dose. Species: Rat. Dose: 30 mg/m³. Routes of administration: nose only inhalation. Results: Rats were exposed to single concentration of 200 WHO fibers/ml specially prepared RCF for 24 months. High incidence of exposure-related pulmonary neoplasms (bronchoalveolar adenomas and carcinomas) was observed. A small number of mesotheliomas were observed in each of the fiber exposure groups.

Method: inhalation, single dose. Species: Hamster. Dose: 30 mg/m³. Routes of administration: nose only inhalation. Results: Hamsters were exposed to a single concentration of 260 WHO fibers/ml specially prepared RCF for 18 months and developed lung fibrosis, a significant number of pleural mesotheliomas (42/102) but no primary lung tumors.

Method: Inhalation, single dose. Species: Rat. Dose: RCF1 130 F/ml and 50 mg/m³ (25% non-fibrous particles). RCF1a: 125 F/ml and 26 mg/m³ (2% non-fibrous particles). Routes of administration: nose only inhalation. Results: Rats were exposed to RCF1 and RCF1A for 3 weeks. The post-treatment observation was 12 months. Alveolar clearance was barely retarded after RCF1a exposure. After RCF1 exposure, however, a severe retardation of clearance was observed.

After intraperitoneal injection of ceramic fibers into rats in 3 experiments (Smith et al 1987, Pott et al 1987, Davis et al 1984), mesotheliomas were found in the abdominal cavity in two studies, while the third report (Pott) had incomplete histopathology. Only a few mesotheliomas were found in the abdominal cavity of hamsters after intraperitoneal injection (Smith). However, the ceramic fibers tested were of relatively large diameter. When rats and hamsters were exposed via intraperitoneal injection, tumor incidence was related to fiber length and dose.

Numerical measures of toxicity **Product Information**

Unknown acute toxicity

6.6 % of the mixture consists of ingredient(s) of unknown toxicity

The following values are calculated based on chapter 3.1 of the GHS document:

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Refractory Ceramic Fibre (RCF)	-	-	-
Starch	-	-	-
Silica Gel	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 2.2 mg/L (Rat) 1 h

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen:

Chemical name	IARC	NTP	OSHA	Mexico
Refractory Ceramic Fibre (RCF)	Group 2B	Reasonably Anticipated	Present	Not Listed
Starch	Not Listed	Not Listed	Not Listed	Not Listed
Silica Gel	Not Listed	Not Listed	Not Listed	Not Listed

Chemical name	Argentina	Chile	Venezuela
Refractory Ceramic Fibre (RCF)	A2	Not Listed	Present
Starch	Not Listed	Not Listed	Present
Silica Gel	Not Listed	Not Listed	Not Listed

IARC (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP (National Toxicology Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

OSHA (Occupational Safety and Health Administration of the US Department of Labor)

X - Present

12. Ecological Information

Ecotoxicity

82.3 % of the mixture consists of component(s) of unknown hazards to the aquatic environment

Component	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Refractory Ceramic Fibre (RCF) 142844-00-6 (70 - 95 %)	No data available			No data available
Starch 9005-25-8 (1 - 10 %)	No data available			No data available
Silica Gel 112926-00-8 (5 - 25 %)	440: 72 h Pseudokirchneriella subcapitata mg/L EC50	5000: 96 h Brachydanio rerio mg/L LC50 static		7600: 48 h Ceriodaphnia dubia mg/L EC50

Persistence and degradability

These products are insoluble materials that remain stable over time and are chemically identical to inorganic compounds found in the soil and sediment; they remain inert in the natural environment.

Bioaccumulation

None known.

Mobility in Environmental Media

None known.

Ozone depletion potential (ODP)

Not applicable.

13. Disposal Considerations

Waste disposal methods

Dispose of in accordance with federal, state and local regulations. Dusts could contain respiratory hazards such as respirable crystalline silica. To prevent wastematerials becoming airborne during waste generation, storage, transportation, and disposal, proper dust control measures are recommended.

Contaminated packaging

Empty containers should be taken for local recycling, recovery or waste disposal. Product packaging may contain residue. Do not reuse.

Other information

According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used.

14. Transport Information

DOT

Not regulated

15. Regulatory Information

International Inventories

Chemical name	TSCA	EINECS	ELINCS	DSL	NDSL	PICCS	ENCS	China	AICS	KECL
Refractory Ceramic Fibre (RCF)	-	-	-	-	-	-	-	X	-	-
Starch	X	X	-	X	-	X	X	X	X	X
Silica Gel	-	-	-	X	-	X	X	X	X	X

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

16. Other Information**After Service Removal**

Precautionary measures to be taken after service and upon removal: As produced, synthetic vitreous fibers (SVF) and crystalline silica (SiO₂) are typically vitreous (glassy) materials which, upon continued exposure to elevated temperatures (above 900°C) might devitrify as described in Section 3. High concentrations of fibers and other dusts may be generated when after-service products are mechanically disturbed during operations such as wrecking and removal. These dusts may contain crystalline silica, which some authorities have classified as a carcinogen. Therefore, take measures to reduce dust emissions, and wear appropriate respirator to minimize exposure and comply with local regulatory limits.

Revision Date:

2018-08-17

Reason for Revision

Routine review with applicable updates to better reflect product.

Disclaimer:



Pyrotek Incorporated, and its affiliates and subsidiaries ("Pyrotek"), believe that the information contained in this Safety Data Sheet ("SDS") is accurate as of the revision date. The American English translation precedes all other translations. However, Pyrotek makes no representations as to the completeness or accuracy of this information and makes NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED. The information in this SDS relates only to the specific material designated herein, and may not be valid where such product is used in combination with any other materials or in any process. The health and safety data contained herein may not be adequate for all individuals and/or situations. All materials may present unknown hazards. It is the user's obligation to evaluate and use this information and/or the product safely and in compliance with all applicable laws and regulations. In no event will Pyrotek be responsible for damages of any nature whatsoever resulting from the use of, or reliance upon, the information contained herein.

End of SDS

Mastic 85

Revision Date: 2018-10-24

Revision Number: 11

Classification	PPE	Transport Symbols
		

1. Identification of the Substance/Preparation and of the Company/Undertaking

Product identifier

Product Name

Mastic 85

Other means of identification

Commodity code

02008-M85

Synonym

Insural Mastic 85

Product description

This MSDS supports the product as a non-cast powder or granular material, or a mastic or moldable material.

Recommended use of the chemical and restrictions on use

Product use

Asbestos-free durable and insulating refractory composition designed for the fabrication of launders; and the jointing, bedding, and patching of precast refractory shapes.

Uses advised against

Not fit for use in anything related to human consumption.

Details of the supplier

Pyrotek Scandinavia AB
Box 53
66821 Ed
Sweden

Phone: (46) (0)534-62000
Fax: (46) (0)534-62001
Email: MSDS@pyrotek.com
REACH email: REACH@pyrotek.com

Emergency Telephone Number

CHEMTREC North America (800) 424-9300, CHEMTREC Outside North America +1 703 527 3887

2. Hazards Identification

Classification

Carcinogenicity	Category 1A
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Label Elements

Danger

Contains:

Refractory Ceramic Fibre (RCF).

Hazard statements

May cause cancer



Precautionary Statements - Prevention

Obtain special instructions before use

Do not handle until all safety precautions have been read and understood

Wear protective gloves/protective clothing/eye protection/face protection

Precautionary Statements - Response

IF exposed or concerned: Get medical advice/attention

Precautionary Statements - Storage

Store locked up

Precautionary Statements - Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

None known

Other Information

May be harmful in contact with skin

0 % of the mixture consists of ingredient(s) of unknown toxicity

3. Composition/information on Ingredients

Chemical name	CAS No	Weight-%	Classification
Refractory Ceramic Fibre (RCF)	142844-00-6	5 - 25 %	Carc. 1B (H350i)
Calcium Fluoride	7789-75-5	1 - 10 %	-
Silica, Crystalline - Cristobalite	14464-46-1	< 0.5 %	-
Silica, Crystalline - Quartz	14808-60-7	< 0.5 %	STOT RE 2 (H373)

Further information

This product contains Refractory Ceramic Fibres (RCF), Index Number 650-017-00-8 (CLP Annex VI), CAS number: 142844-00-6, also known under the trade name Fiberfrax®. Fiberfrax® is a trademark of the Unifrax Corporation and have been registered successfully with ECHA under the following registration number: 01-2119458050-50-xxxx. Use of the products is restricted to "professional users" for application as thermal insulation, heat shields, heat containment, gaskets and expansion joints at temperatures up to 1260°C (2300°F) in industrial furnaces, ovens, kilns, boilers and other process equipment and in the aerospace and automotive industries. Products are not intended for direct sale to the general public.. Synthetic vitreous fibers (SVF) are fibrous inorganic substances classified into three general groups: fibrous glass (glasswool and glass filament), mineral wool (rockwool and slagwool), and refractory ceramic fibers (RCF). Devitrification (conversion of fibers to a crystalline state) may occur when SVF materials are exposed to high temperatures producing disordered crystalline silica forms.

The exact percentage (concentration) of composition is not shown due to component range variations, withheld or trade secret ingredients.

4. First Aid Measures

General advice	Show this safety data sheet to the doctor in attendance. If symptoms persist, call a physician.
Skin Contact	Wash off with soap and water. Do not rub. If skin irritation persists, call a physician.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Do not rub. If symptoms persist, call a physician.
Inhalation	Remove to fresh air. If symptoms persist, call a physician.
Ingestion	Clean mouth with water and drink afterwards plenty of water. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Consult a physician.
Notes to Physician	Treat symptomatically.
Protection of first-aiders	Use personal protective equipment.

5. Fire-Fighting Measures

Flammable properties

Not flammable.

Suitable Extinguishing Media

Dry chemical. Carbon dioxide (CO₂). Water spray. Alcohol resistant foam. Water. Dry powder. pellets.

Unsuitable Extinguishing Media

None known.

Specific hazards arising from the chemical

No information available.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation.

Environmental Precautions

Prevent further leakage or spillage if safe to do so.

Methods and material for containment and cleaning up

Pick up and arrange disposal without creating airborne dust. Avoid dust formation. Vacuum or wet sweep.

7. Handling and Storage

Precautions for safe handling

Avoid dust formation. Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Keep containers tightly closed in a cool, well-ventilated place. Keep in properly labelled containers. Do not freeze. Storage between 39-90 °F (4-32 °C).

Materials to avoid

Strong acids.

8. Exposure controls/Personal Protection

Control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico
Refractory Ceramic Fibre (RCF)	TWA: 0.2 fiber/cm ³	0.1 f/cm ³	Not Listed	Not Listed
Calcium Fluoride	Not Listed	TWA: 2.5 mg/m ³	Not Listed	Not Listed
Silica, Crystalline - Cristobalite	TWA: 0.025 mg/m ³	PEL (Quartz)/2	Not Listed	TWA: 0.05 mg/m ³
Silica, Crystalline - Quartz	TWA: 0.025 mg/m ³ (respirable fraction)	10/(%SiO ₂ +2) respirable dust 0.1 mg/m ³ TWA (respirable dust)	0.05 mg/m ³ TWA (respirable dust)	TWA: 0.1 mg/m ³

Chemical name	Canada - Alberta	Canada - British Columbia	Canada - Ontario	Canada - Quebec
Refractory Ceramic Fibre (RCF)	TWA: 0.2 fibre/cm ³	TWA: 0.2 fibre/cm ³	TWA: 0.5 fibre/cm ³	TWA: 1 fibre/cm ³
Calcium Fluoride	Not Listed	Not Listed	Not Listed	Not Listed
Silica, Crystalline - Cristobalite	TWA: 0.025 mg/m ³	TWA: 0.025 mg/m ³	TWA: 0.05 mg/m ³	TWA: 0.05 mg/m ³
Silica, Crystalline - Quartz	TWA: 0.025 mg/m ³	TWA: 0.025 mg/m ³	TWA: 0.10 mg/m ³	TWA: 0.1 mg/m ³

Chemical name	Argentina	Brazil	Chile	Venezuela
Refractory Ceramic Fibre (RCF)	TWA: 0.2 fiber/cm ³	Not Listed	Not Listed	Not Listed
Calcium Fluoride	Not Listed	Not Listed	Not Listed	Not Listed
Silica, Crystalline - Cristobalite	TWA: 0.05 mg/m ³	Not Listed	TWA: 0.04 mg/m ³	TWA: 0.025 mg/m ³
Silica, Crystalline - Quartz	TWA: 0.05 mg/m ³	Not Listed	TWA: 0.08 mg/m ³	TWA: 0.025 mg/m ³

Appropriate engineering controls

Engineering Controls

Ensure adequate ventilation, especially in confined areas when mist is present. Mechanical ventilation and local exhaust is recommended.

Individual protection measures, such as personal protective equipment

Eye Protection

Safety glasses with side-shields.

Hand Protection

Protective gloves.

Skin Protection

Long sleeved clothing.

Respiratory protection

Respiratory protection is not necessary for normal handling of material which does not release dust, Dust mask EN149 - P3/FFP3 or (P2/FFP2) under dusty conditions.

General industrial hygiene practice

When using, do not eat, drink or smoke. Wash hands before breaks and at the end of workday. Work clothes should be cleaned to remove excess fibers before being taken off (e.g. use vacuum cleaner, not compressed air).

9. Physical and Chemical Properties

Information on basic physical and chemical properties

Physical state	Solid form	Odor	Odorless
Appearance	Paste	Odor threshold	Not applicable
Color	White		

<u>Property</u>	<u>Values</u>	<u>Remarks • Methods</u>
pH	Not applicable	
Melting point / freezing point	-1 °C	
Boiling point / boiling range	< 98 °C	
Flash point	Nonflammable	None known
Evaporation rate		
Flammability Limit in Air		None known
Upper flammability limit:	Not applicable	
Lower flammability limit:	Not applicable	
Vapor pressure	Not applicable	
Vapor density		
Specific gravity	No data available	
Water solubility	No data available	
Solubility(ies)	Not applicable	
Partition coefficient		
Autoignition temperature	Not applicable	
Decomposition temperature	No data available	
Kinematic viscosity		
Dynamic viscosity		
Explosive properties	Non explosive	

Other Information

VOC Content (%)	Not applicable
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10. Stability and Reactivity

Reactivity

Stable

Chemical stability

Stable under normal conditions.

Possibility of Hazardous Reactions

Hazardous polymerization does not occur.

Conditions to Avoid

Avoid dust formation. Keep product dry before exposure to molten metal. Explosion may result from sudden generation of steam.

Incompatible materials

Strong acids.

Hazardous Decomposition Products

Respirable fibers, formed by high temperature cycles may be released during after-service removal. See sections 3 and 16.

11. Toxicological Information

Information on likely routes of exposure

Eye Contact	Contact with eyes may cause irritation.
Skin Contact	May cause eye/skin irritation.

**Ingestion
Inhalation**

Ingestion may cause irritation to mucous membranes.
May cause irritation of respiratory tract.

Information on toxicological effects**Delayed and immediate effects as well as chronic effects from short and long-term exposure**
Mutagenic effects
STOT - single exposure
STOT - repeated exposure
Chronic Toxicity

None known.
None known.
Respiratory System.

RCF HEALTH DATA SUMMARY: Epidemiological studies of RCF production workers have indicated no increased incidence of respiratory disease nor other significant health effects. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

RCF EPIDEMIOLOGY: In order to determine possible human health effects following RCF exposure, the University of Cincinnati in the United States and the Institute of Occupational Medicine (IOM) in Europe have conducted medical surveillance studies on RCF workers in U.S. and European manufacturing facilities. The University of Cincinnati study has been in progress for over 20-years, collecting data from respiratory questionnaires, lung function tests, chest X-rays, exposure monitoring, and worker mortality. The results of this study of RCF plant workers exposed from 1953 to the present have shown (LeMasters et al, 2003): The initial cross-sectional spirometry studies in the U.S. (LeMasters et al. 1998) and Europe (Cowie et al. 2001) revealed lung function decrements in the RCF-exposed cohort that were associated with heavier historical exposures. Subsequently, longitudinal studies have revealed no RCF exposure related decrements in lung function associated with current exposure levels. Through 1996, pleural plaques seen on chest X-rays in 2.7% of the workers. Pleural plaques are considered a marker of exposure and not disease. The prevalence of pleural plaques has remained relatively constant over time, perhaps as a result of lower current exposure levels. Thus, this long term epidemiology study has demonstrated an absence of interstitial fibrosis, no increased mortality risk and no decrement in lung function associated with current exposures.

RCF TOXICOLOGY: Early animal studies of RCF effects by intraperitoneal and intrapleural injections, as well as by inhalation, resulted in mostly negative results. In an effort to eliminate any questions posed by the results of these early studies, a definitive Maximum Tolerated Dose Study (MTD) by nose only, lifetime inhalation in rats and hamsters, was designed in the 1980s. The MTD study appeared to confirm that RCF was an animal carcinogen under certain test conditions, e.g., extremely high concentrations of approximately 200 f/cc inhaled directly into the lungs. A later review of the MTD pathology indicated that the animals' lungs were likely overloaded because of large quantities of non-fibrous particles, and that this overload condition was likely responsible for the disease observed. In fact, evaluation of the aerosol samples used confirmed the presence of significant quantities of particulate matter. In a subsequent multi-dose animal inhalation study at 25 f/cc, 75 f/cc, and 115 f/cc; a no observed effect level (NOEL) was found at 25 f/cc. This level is 50 times the RCF recommended REG of 0.5 f/cc for humans.

Numerical measures of toxicity
Product Information

Unknown acute toxicity 0 % of the mixture consists of ingredient(s) of unknown toxicity

The following values are calculated based on chapter 3.1 of the GHS document:

ATEmix (oral) 8947 mg/kg
 ATEmix (dermal) 2941 mg/kg
 ATEmix (inhalation-dust/mist) 30 mg/l

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Refractory Ceramic Fibre (RCF)	-	-	-
Calcium Fluoride	= 4250 mg/kg (Rat)	-	-
Silica, Crystalline - Cristobalite	-	-	-
Silica, Crystalline - Quartz	500 mg/kg Rat	-	-

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen:

Chemical name	IARC	NTP	OSHA	Mexico
Refractory Ceramic Fibre (RCF)	Group 2B	Reasonably Anticipated	Present	Not Listed
Calcium Fluoride	Not Listed	Not Listed	Not Listed	Not Listed
Silica, Crystalline - Cristobalite	Group 1	Known	Present	Not Listed
Silica, Crystalline - Quartz	Group 1	Known	Present	Not Listed

Chemical name	Argentina	Chile	Venezuela
Refractory Ceramic Fibre (RCF)	A2	Not Listed	Present
Calcium Fluoride	Not Listed	Not Listed	Not Listed
Silica, Crystalline - Cristobalite	Not Listed	A1	Not Listed
Silica, Crystalline - Quartz	A2	A1	Present

IARC (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP (National Toxicology Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

OSHA (Occupational Safety and Health Administration of the US Department of Labor)

X - Present

12. Ecological Information

Ecotoxicity

25.8 % of the mixture consists of component(s) of unknown hazards to the aquatic environment

Component	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Refractory Ceramic Fibre (RCF) 142844-00-6 (5 - 25 %)	No data available			No data available
Calcium Fluoride 7789-75-5 (1 - 10 %)	No data available			No data available
Silica, Crystalline - Cristobalite 14464-46-1 (< 0.5 %)	No data available			No data available
Silica, Crystalline - Quartz 14808-60-7 (< 0.5 %)	No data available			No data available

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Mobility in Environmental Media

No information available.

Ozone depletion potential (ODP)

Not applicable.

13. Disposal Considerations

Waste disposal methods

Disposal of waste material must be by plastic bag, minimum 0.05 mm thickness, to prevent generation or release of airborne dust. Non-contaminated product may be returned to the manufacturer for proper disposal.

Contaminated packaging

Empty containers should be taken for local recycling, recovery or waste disposal.

Other information

According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. Dispose of packings and packing waste in accordance with guideline 94/62/EC of the council and the European Parliament of December 20, 1994 as well as the packaging regulation 2004/12/EG of February 11, 2004 and Directive 2005/20/EC from March 9, 2005.

14. Transport Information

DOT

Not regulated

ADR

Not regulated

15. Regulatory Information

International Inventories

Chemical name	TSCA	EINECS	ELINCS	DSL	NDSL	PICCS	ENCS	China	AICS	KECL
Refractory Ceramic Fibre (RCF)	-	-	-	-	-	-	-	X	-	-
Calcium Fluoride	X	X	-	X	-	X	X	X	X	X
Silica, Crystalline - Cristobalite	X	X	-	X	-	X	X	X	X	X
Silica, Crystalline - Quartz	X	X	-	X	-	X	X	X	X	X

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

USA

Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product may contain a chemical or chemicals, if listed below, which are subject to the reporting requirements of the Act and Title 40n of the Code of Federal Regulations, Part 372:

SARA 311/312 Hazardous Categorization

Chemical name	CERCLA/SARA 302 TPQ	OSHA PRINT THRESHOLD
Refractory Ceramic Fibre (RCF) (CAS #: 142844-00-6)		0.1
Silica, Crystalline - Cristobalite (CAS #: 14464-46-1)		0.1
Silica, Crystalline - Quartz (CAS #: 14808-60-7)		0.1

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product contains the following HAPs:

State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals:

Chemical name	California Prop. 65	Type
Refractory Ceramic Fibre (RCF) (CAS #: 142844-00-6)	Carcinogen	-
Calcium Fluoride (CAS #: 7789-75-5)	Not Listed	-
Silica, Crystalline - Cristobalite (CAS #: 14464-46-1)	Not Listed	-
Silica, Crystalline - Quartz (CAS #: 14808-60-7)	Not Listed	-

State Right-to-Know

CANADA

Chemical name	WHMIS
Refractory Ceramic Fibre (RCF) (CAS #: 142844-00-6)	Non-controlled
Calcium Fluoride (CAS #: 7789-75-5)	Non-controlled
Silica, Crystalline - Cristobalite (CAS #: 14464-46-1)	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.) D2A (Crystalline silica exists in various forms. Consult the WHMIS classifications of the following forms: Crystalline silica, cristobalite (14464-46-1), Crystalline silica, quartz (14808-60-7), Crystalline silica, tridymite (15468-32-3), Crystalline silica, tripoli (1317-95-9))
Silica, Crystalline - Quartz (CAS #: 14808-60-7)	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health

	Canada's WHMIS Division website.) D2A (Crystalline silica exists in various forms. Consult the WHMIS classifications of the following forms: Crystalline silica, cristobalite (14464-46-1), Crystalline silica, quartz (14808-60-7), Crystalline silica, tridymite (15468-32-3), Crystalline silica, tripoli (1317-95-9))
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16. Other Information

After Service Removal

Precautionary measures to be taken after service and upon removal: As produced, synthetic vitreous fibers (SVF) and crystalline silica (SiO₂) are typically vitreous (glassy) materials which, upon continued exposure to elevated temperatures (above 900°C) might devitrify as described in Section 3. High concentrations of fibers and other dusts may be generated when after-service products are mechanically disturbed during operations such as wrecking and removal. These dusts may contain crystalline silica, which some authorities have classified as a carcinogen. Therefore, take measures to reduce dust emissions, and wear appropriate respirator to minimize exposure and comply with local regulatory limits.

Revision Date:

2018-10-24

Reason for Revision

Routine review with applicable updates to better reflect product.

Disclaimer:

Pyrotek Incorporated, and its affiliates and subsidiaries ("Pyrotek"), believe that the information contained in this Safety Data Sheet ("SDS") is accurate as of the revision date. The American English translation precedes all other translations. However, Pyrotek makes no representations as to the completeness or accuracy of this information and makes **NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED**. The information in this SDS relates only to the specific material designated herein, and may not be valid where such product is used in combination with any other materials or in any process. The health and safety data contained herein may not be adequate for all individuals and/or situations. All materials may present unknown hazards. It is the user's obligation to evaluate and use this information and/or the product safely and in compliance with all applicable laws and regulations. In no event will Pyrotek be responsible for damages of any nature whatsoever resulting from the use of, or reliance upon, the information contained herein.



End of SDS



Promasil 1000

Revision Date: 2019-02-08

Revision Number: 3

Classification	PPE	Transport Symbols
	 	

1. Identification of the Substance/Preparation and of the Company/Undertaking

Product identifier

Product Name

Promasil 1000

Other means of identification

Commodity code

01020 - PRO1000

Synonym

No Synonym

Recommended use of the chemical and restrictions on use

Product use

Calcium silicate insulation board.

Uses advised against

Not fit for use in anything related to human consumption.

Details of the supplier

Corporate office:
Pyrotek Inc.
705 West 1st Ave
Spokane, WA 99201-3909
United States

Phone 1: (509) 926-6212
Phone 2: 1-800-PYROTEK
Fax: (509) 927-2408
Email: SDS@pyrotek.com

Emergency Telephone Number

CHEMTREC North America (800) 424-9300, CHEMTREC Outside North America +1 703 527 3887

2. Hazards Identification

Classification

This product is a manufactured article, not a substance nor a preparation.

Label Elements

Hazards not otherwise classified (HNOC)

None known

Other Information

3. Composition/information on Ingredients

Chemical name	CAS No	Weight-%	Classification
Calcium Silicate	1344-95-2	70 - 95 %	-

The exact percentage (concentration) of composition is not shown due to component range variations, withheld or trade secret ingredients.

4. First Aid Measures

Skin Contact	Wash off immediately with plenty of water. If skin irritation persists, call a physician.
Eye Contact	Wash off with plenty of water. If symptoms persist, call a physician.
Inhalation	Remove to fresh air. If symptoms persist, call a physician.
Ingestion	Clean mouth with water and drink afterwards plenty of water.
Notes to Physician	Treat symptomatically.

5. Fire-Fighting Measures

Flammable properties

Not flammable.

Suitable Extinguishing Media

Use extinguishing measures that are appropriate to local circumstances and the surrounding fire.

Unsuitable Extinguishing Media

None known.

Specific hazards arising from the chemical

No information available.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation.

Environmental Precautions

None known.

Methods and material for containment and cleaning up

Avoid dust formation. Vacuum or wet sweep.

7. Handling and Storage

Precautions for safe handling

Avoid dust formation.

Conditions for safe storage, including any incompatibilities

Keep containers tightly closed in a dry, cool and well-ventilated place.

Materials to avoid

Strong acids.

8. Exposure controls/Personal Protection

Control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico
Calcium Silicate	Not Listed	TWA: 15 mg/m ³ (total dust) TWA: 5 mg/m ³ (respirable dust)	Not Listed	TWA: 10 mg/m ³

Chemical name	Canada - Alberta	Canada - British Columbia	Canada - Ontario	Canada - Quebec
Calcium Silicate	TWA: 10 mg/m ³	TWA: 10 mg/m ³ TWA: 3 mg/m ³	TWA: 10 mg/m ³	TWA: 10 mg/m ³

Chemical name	Argentina	Brazil	Chile	Venezuela
Calcium Silicate	TWA: 10 mg/m ³	Not Listed	Not Listed	TWA: 10 mg/m ³

Appropriate engineering controls

Engineering Controls Ensure adequate ventilation, especially in confined areas when mist is present.

Individual protection measures, such as personal protective equipment

Eye Protection	Tightly fitting safety goggles.
Hand Protection	Protective gloves.
Skin Protection	Long sleeved clothing.
Respiratory protection	Respiratory protection is not necessary for normal handling of material which does not release dust, Respirator must be worn if exposed to dust, During machining operations.

General industrial hygiene practice

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. Physical and Chemical Properties

Information on basic physical and chemical properties

Physical state	Solid	Odor	Odorless
Appearance	Board	Odor threshold	Not applicable
Color	White		

<u>Property</u>	<u>Values</u>	<u>Remarks • Methods</u>
pH	Not applicable	
Melting point / freezing point	Not applicable	
Boiling point / boiling range	Not applicable	
Flash point	Not flammable	None known
Evaporation rate		
Flammability Limit in Air		
Upper flammability limit:	Not applicable	
Lower flammability limit:	Not applicable	
Vapor pressure	Not applicable	
Vapor density		
Specific gravity	0.24	
Water solubility	No data available	
Solubility(ies)	Not applicable	
Partition coefficient		
Autoignition temperature	Not applicable	
Decomposition temperature	No data available	
Kinematic viscosity		
Dynamic viscosity		
Explosive properties	Non explosive	

Other Information

VOC Content (%) No information available

10. Stability and Reactivity

Reactivity

Chemical stability

Stable under recommended storage conditions.

Possibility of Hazardous Reactions

Hazardous polymerization does not occur.

Conditions to Avoid

Avoid dust formation.

Incompatible materials

Strong acids.

Hazardous Decomposition Products

None known.

11. Toxicological Information

Information on likely routes of exposure

Eye Contact	May cause slight irritation. Contact with eyes may cause irritation.
Skin Contact	None known.
Ingestion	None known.
Inhalation	May cause irritation of respiratory tract.

Information on toxicological effects

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Mutagenic effects	None known.
STOT - single exposure	None known.
STOT - repeated exposure	None known.
Chronic Toxicity	None known

Numerical measures of toxicity

Product Information

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Calcium Silicate	= 3400 mg/kg (Rat)	-	-

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen:

Chemical name	IARC	NTP	OSHA	Mexico
Calcium Silicate	Not Listed	Not Listed	Not Listed	A4 - Not classifiable as a human carcinogen

Chemical name	Argentina	Chile	Venezuela
Calcium Silicate	Not Listed	Not Listed	Present

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP (National Toxicology Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

OSHA (Occupational Safety and Health Administration of the US Department of Labor)

X - Present

12. Ecological Information

Ecotoxicity

Component	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Calcium Silicate 1344-95-2 (70 - 95 %)	No data available			No data available

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Mobility in Environmental Media

No information available.

Ozone depletion potential (ODP)

Not applicable.

13. Disposal Considerations

Waste disposal methods

Dispose of in accordance with federal, state and local regulations.

Contaminated packaging

Empty containers should be taken for local recycling, recovery or waste disposal.

Other information

According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Dispose of packings and packing waste in accordance with guideline 94/62/EC of the council and the European Parliament of December 20, 1994 as well as the packaging regulation 2004/12/EG of February 11, 2004 and Directive 2005/20/EC from March 9, 2005.

14. Transport Information

DOT

Not regulated

15. Regulatory Information

International Inventories

Chemical name	TSCA	EINECS	ELINCS	DSL	NDSL	PICCS	ENCS	China	AICS	KECL
Calcium Silicate	X	X	-	X	-	X	X	X	X	X

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

USA**Federal Regulations****SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product may contain a chemical or chemicals, if listed below, which are subject to the reporting requirements of the Act and Title 40n of the Code of Federal Regulations, Part 372:

SARA 311/312 Hazardous Categorization**Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)**

This product contains the following HAPs:

State Regulations**California Proposition 65**

This product contains the following Proposition 65 chemicals:

Chemical name	California Prop. 65	Type
Calcium Silicate (CAS #: 1344-95-2)	Not Listed	-

State Right-to-Know**CANADA**

Chemical name	WHMIS
Calcium Silicate (CAS #: 1344-95-2)	Uncontrolled product according to WHMIS classification criteria

16. Other Information

Promasil® is a registered trademark of Promat.

Revision Date: 2019-02-08

Reason for Revision Converted from another language.

Disclaimer:

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End of SDS

United States of America



California Proposition 65



Treated Graphite

Revision Date: 2018-11-23

Revision Number: 3

Classification	PPE	Transport Symbols
	 	

1. Identification of the Substance/Preparation and of the Company/Undertaking

Product identifier

Product Name

Treated Graphite

Other means of identification

Commodity code

14013 - TG

Synonym

Treated Graphite Grade ZX, SST

Recommended use of the chemical and restrictions on use

Product use

Machined graphite components.

Uses advised against

Not fit for use in anything related to human consumption.

Details of the supplier

Corporate office:
Pyrotek Inc.
705 West 1st Ave
Spokane, WA 99201-3909
United States

Phone 1: (509) 926-6212
Phone 2: 1-800-PYROTEK
Fax: (509) 927-2408
Email: SDS@pyrotek.com

Emergency Telephone Number

CHEMTREC North America (800) 424-9300, CHEMTREC Outside North America +1 703 527 3887

2. Hazards Identification

Classification

This product is a manufactured article, not a substance nor a preparation. This article is classified as not hazardous.

Label Elements

Hazards not otherwise classified (HNOC)

None known

Other Information

3. Composition/information on Ingredients

Chemical name	CAS No	Weight-%	Classification
Inorganic Filler - Mixture	Proprietary	1 - 10 %	-
Graphite	7782-42-5	70 - 95 %	Comb. dust

Further information

This graphite parts have a proprietary surface treatment during manufacturing applied to enhance surface hardness, non-wetting properties and extend product service life. This treatment has been fully cured and fired, and poses no physical hazard or health risk to employees under conditions of normal use.

The exact percentage (concentration) of composition is not shown due to component range variations, withheld or trade secret ingredients.

4. First Aid Measures

Skin Contact	Wash off immediately with soap and plenty of water removing all contaminated clothes and shoes. Consult a physician if necessary.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.
Inhalation	Remove to fresh air. If symptoms persist, call a physician.
Ingestion	Drink 1 or 2 glasses of water. Remove from exposure, lie down. Consult a physician.
Notes to Physician	Treat symptomatically.

5. Fire-Fighting Measures

Flammable properties

Not flammable.

Suitable Extinguishing Media

Water spray. Dry chemical. pellets. Carbon dioxide (CO₂).

Unsuitable Extinguishing Media

None known.

Specific hazards arising from the chemical

Dust may form explosive mixture in air.

Protective equipment and precautions for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Use personal protective equipment.

Environmental Precautions

No special environmental precautions required. Local authorities should be advised if significant spillages cannot be contained.

Methods and material for containment and cleaning up

Vacuum or wet sweep. Shovel or sweep up.

7. Handling and Storage

Precautions for safe handling

Take precautionary measures against static discharges. Avoid dust formation. Do not breathe dust.

Conditions for safe storage, including any incompatibilities

Keep in a dry place. Fragile, do not drop. Do not re-use empty containers.

Materials to avoid

Strong oxidizing agents. Reducing agents.

8. Exposure controls/Personal Protection

Control parameters

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico
Inorganic Filler - Mixture	Not Listed	Not Listed	Not Listed	Not Listed
Graphite	TWA: 2 mg/m ³ (all forms except graphite fibers, respirable fraction)	TWA: 15 mg/m ³ (synthetic, total dust) TWA: 5 mg/m ³ (synthetic, respirable fraction)	2.5 mg/m ³ TWA (natural, respirable dust)	TWA: 2 mg/m ³

Chemical name	Canada - Alberta	Canada - British Columbia	Canada - Ontario	Canada - Quebec

Inorganic Filler - Mixture	Not Listed	Not Listed	Not Listed	Not Listed
Graphite	TWA: 2 mg/m ³	TWA: 2 mg/m ³	TWA: 2 mg/m ³	TWA: 2 mg/m ³

Chemical name	Argentina	Brazil	Chile	Venezuela
Inorganic Filler - Mixture	Not Listed	Not Listed	Not Listed	Not Listed
Graphite	TWA: 2 mg/m ³	Not Listed	TWA: 1.75 mg/m ³	TWA: 2 mg/m ³

Appropriate engineering controls

Engineering Controls Ensure adequate ventilation, especially in confined areas when mist is present.

Individual protection measures, such as personal protective equipment

Eye Protection	Safety glasses with side-shields.
Hand Protection	Protective gloves.
Skin Protection	Long sleeved clothing.
Respiratory protection	Respiratory protection is not necessary for normal handling of material which does not release dust, Dust safety masks are recommended when the dust concentration is more than exposure limit.

General industrial hygiene practice

Handle in accordance with good industrial hygiene and safety practice. Regular cleaning of equipment, work area and clothing.

9. Physical and Chemical Properties

Information on basic physical and chemical properties

Physical state	Solid	Odor	Odorless
Appearance	Shapes	Odor threshold	Not applicable
Color	Dark, Grey, Black		

<u>Property</u>	<u>Values</u>	<u>Remarks • Methods</u>
pH	Not applicable	
Melting point / freezing point	Not applicable	
Boiling point / boiling range	Not applicable	
Flash point	Not flammable	None known
Evaporation rate		

Flammability Limit in Air	
Upper flammability limit:	Not applicable
Lower flammability limit:	Not applicable
Vapor pressure	Not applicable
Vapor density	
Specific gravity	No data available
Water solubility	Insoluble in water
Solubility(ies)	Not applicable
Partition coefficient	
Autoignition temperature	Not applicable
Decomposition temperature	No data available
Kinematic viscosity	
Dynamic viscosity	
Explosive properties	Non explosive

Other Information

VOC Content (%)	Not applicable
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10. Stability and Reactivity

Reactivity

Chemical stability

Stable.

Possibility of Hazardous Reactions

Hazardous polymerization does not occur.

Conditions to Avoid

None.

Incompatible materials

Strong oxidizing agents. Reducing agents.

Hazardous Decomposition Products

Hydrocarbons. Carbon oxides. Sodium oxides.

11. Toxicological Information

Information on likely routes of exposure

Eye Contact	Dust from dried product will be mild mechanical irritant to skin, eyes and upper respiratory system.
Skin Contact	May cause sensitization by skin contact.
Ingestion	Not a normal route of exposure.
Inhalation	Not a normal route of exposure.

Information on toxicological effects

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Mutagenic effects	None known.
STOT - single exposure	None known.
STOT - repeated exposure	None known.
Chronic Toxicity	None known

Numerical measures of toxicity

Product Information

Component Information

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Inorganic Filler - Mixture	-	-	-
Graphite	> 10000 mg/kg (Rat)	-	-

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen:

Chemical name	IARC	NTP	OSHA	Mexico
Inorganic Filler - Mixture	Not Listed	Not Listed	Not Listed	Not Listed
Graphite	Not Listed	Not Listed	Not Listed	Not Listed

Chemical name	Argentina	Chile	Venezuela
Inorganic Filler - Mixture	Not Listed	Not Listed	Not Listed
Graphite	Not Listed	Not Listed	Not Listed

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP (National Toxicology Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen
OSHA (Occupational Safety and Health Administration of the US Department of Labor)
X - Present

12. Ecological Information

Ecotoxicity

Component	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Inorganic Filler - Mixture (1 - 10 %)	No data available			No data available
Graphite 7782-42-5 (70 - 95 %)	No data available			No data available

Persistence and degradability

No information available.

Bioaccumulation

No information available.

Mobility in Environmental Media

No information available.

Ozone depletion potential (ODP)

Not applicable.

13. Disposal Considerations

Waste disposal methods

Dispose of in accordance with federal, state and local regulations.

Contaminated packaging

Empty containers should be taken for local recycling, recovery or waste disposal.

Other information

According to the European Waste Catalogue, Waste Codes are not product specific, but application specific. Waste codes should be assigned by the user based on the application for which the product was used. Dispose of packings and packing waste in accordance with guideline 94/62/EC of the council and the European Parliament of December 20, 1994 as well as the packaging regulation 2004/12/EG of February 11, 2004 and Directive 2005/20/EC from March 9, 2005.

14. Transport Information

DOT

Not regulated

15. Regulatory Information

International Inventories

Chemical name	TSCA	EINECS	ELINCS	DSL	NDSL	PICCS	ENCS	China	AICS	KECL
Inorganic Filler - Mixture	-	-	-	-	-	-	-	-	-	-
Graphite	X	X	-	X	-	X	-	X	X	X

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

USA**Federal Regulations****SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product may contain a chemical or chemicals, if listed below, which are subject to the reporting requirements of the Act and Title 40n of the Code of Federal Regulations, Part 372:

SARA 311/312 Hazardous Categorization**Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)**

This product contains the following HAPs:

State Regulations**California Proposition 65**

This product contains the following Proposition 65 chemicals:

Chemical name	California Prop. 65	Type
Inorganic Filler - Mixture (CAS #:)	Not Listed	-
Graphite (CAS #: 7782-42-5)	Not Listed	-

State Right-to-Know**CANADA**

Chemical name	WHMIS
Inorganic Filler - Mixture (CAS #:)	Non-controlled
Graphite (CAS #: 7782-42-5)	D2A (natural); D2B (synthetic) Uncontrolled product according to WHMIS classification criteria

16. Other Information

Revision Date: 2018-11-23

Reason for Revision Routine review with applicable updates to better reflect product.

Disclaimer:

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End of SDS

Safety Data Sheet



Section 1: Identification

Product identifier

Product Name • **Recast Locem FS**

Product Code • 165007

Relevant identified uses of the substance or mixture and uses advised against

Recommended use • Refractory applications

Details of the supplier of the safety data sheet

Manufacturer • Reno Refractories, Inc.
P O Box 201
Morris, AL 35116
United States
www.renorefractories.com
sales@renorefractories.com

Telephone (General) • 205-647-0240

Emergency telephone number

Manufacturer • 1-800-262-8200 - CHEMTREC

Section 2: Hazard Identification

United States (US)

According to: OSHA 29 CFR 1910.1200 HCS

Classification of the substance or mixture

OSHA HCS 2012 • Carcinogenicity 1A
Specific Target Organ Toxicity Repeated Exposure 1

Label elements

OSHA HCS 2012

DANGER



Hazard statements • May cause cancer.
Causes damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention • Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust.

Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Wear protective gloves, clothing , and eye/face protection , .

Response • IF exposed or concerned: Get medical advice/attention.

Storage/Disposal • Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Other hazards

OSHA HCS 2012

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Canada

According to: WHMIS

Classification of the substance or mixture

WHMIS

- Other Toxic Effects - D2A
Other Toxic Effects - D2B

Label elements

WHMIS



WHMIS

- Other Toxic Effects - D2A
Other Toxic Effects - D2B

Other hazards

WHMIS

- In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

Section 3 - Composition/Information on Ingredients

Substances

- Material does not meet the criteria of a substance.

Mixtures

Composition					
Chemical Name	Identifiers	%	LD50/LC50	Classifications According to Regulation/Directive	Comments
Amorphous/fused silica	CAS:60676-86-0	57.4% TO 62%	NDA	OSHA HCS 2012: Not Classified	NDA
Cement, alumina, chemicals	CAS:65997-16-2	7.4% TO 14%	NDA	OSHA HCS 2012: Not Classified	NDA
Mullite	CAS:1302-93-8	9.24% TO 12.32%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Amorphous silica fume	CAS:69012-64-2	3% TO 8%	NDA	OSHA HCS 2012: STOT RE 1 (Lungs)	NDA
Aluminum oxide	CAS:1344-28-1	0.985% TO 6%	Inhalation-Rat LC50 • 0.2 mg/L 5 Hour(s) 28 Week(s)	OSHA HCS 2012: Not Classified	NDA
Silica, amorphous	CAS:7631-86-9	0.009% TO 3.764%	NDA	OSHA HCS 2012: Not Classified	NDA

Non Wetting Agent	Proprietary	0.94% TO 2.925%	Ingestion/Oral-Rat LD50 • 4250 mg/kg	OSHA HCS 2012: Not Classified	NDA
Aluminum(III) silicate (2:1)	CAS:1302-76-7	0% TO 1.425%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Quartz	CAS:14808-60-7	0% TO 0.78%	NDA	OSHA HCS 2012: Carc. 1A; STOT RE 1 (Lungs)	NDA
Cristobalite	CAS:14464-46-1	0.036% TO 0.6695%	NDA	OSHA HCS 2012: Carc. 1A	NDA
1-Propene, homopolymer	CAS:9003-07-0	< 0.15%	Ingestion/Oral-Rat LD50 • >8 g/kg	OSHA HCS 2012: Not Classified	NDA
Dispsering Agent 1	Proprietary	< 0.1395%	Ingestion/Oral-Rat LD50 • 3120 mg/kg Skin-Rabbit LD50 • >4640 mg/kg	OSHA HCS 2012: Eye Irrit. 2A; Skin Irrit. 2; STOT SE 3: Resp. Irrit.;	NDA
Limestone	CAS:1317-65-3	0.01% TO 0.087%	NDA	OSHA HCS 2012: Exposure limits	NDA
Titanium dioxide	CAS:13463-67-7	< 0.075%	NDA	OSHA HCS 2012: Exposure limits	NDA
Diphosphoric acid, sodium salt (1:4)	CAS:7722-88-5	< 0.0075%	Ingestion/Oral-Rat LD50 • 4 g/kg	OSHA HCS 2012: Exposure limits	NDA
Formaldehyde	CAS:50-00-0	< 0.000015%	Ingestion/Oral-Rat LD50 • 100 mg/kg Inhalation-Rat LC50 • 203 mg/m ³ Skin-Rabbit LD50 • 270 mg/kg	OSHA HCS 2012: Exposure limits	NDA

Section 4: First-Aid Measures

Description of first aid measures

Inhalation

- Move victim to fresh air. Administer oxygen if breathing is difficult. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Skin

- In case of contact with substance, immediately flush skin with running water for at least 20 minutes. If skin irritation occurs: Get medical advice/attention.

Eye

- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.

Ingestion

- Rinse mouth. Do not give anything by mouth to an unconscious person. Get medical attention immediately.

Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

Indication of any immediate medical attention and special treatment needed

Notes to Physician

- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Section 5: Fire-Fighting Measures

Extinguishing media

Suitable Extinguishing Media • Material is non-combustible. In case of fire use media as appropriate for surrounding fire.

Unsuitable Extinguishing Media • None known.

Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards • None known.

Hazardous Combustion Products • None known.

Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.

Section 6 - Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

- Personal Precautions** • Isolate hazard area and deny entry to unauthorized and/or unprotected personnel. Do not walk through spilled material. Ensure adequate ventilation to remove vapors, fumes, dust etc. Wear appropriate personal protective equipment, avoid direct contact.
- Emergency Procedures** • Ventilate closed spaces before entering. Isolate hazard area and deny entry to unauthorized and/or unprotected personnel.

Environmental precautions

- No specific actions or treatments recommended related to exposure to this material.

Methods and material for containment and cleaning up

- Containment/Clean-up Measures** • Avoid generating dust.
FOR SMALL SPILLS: Clean with a vacuum with a filtration system sufficient to remove and prevent recirculation of crystalline silica (a vacuum equipped with a high-efficiency particulate air (HEPA) filter is recommended).
FOR LARGE SPILLS: Use a fine spray or mist to control dust creation and carefully scoop or shovel into clean dry container for later reuse or disposal.
If, an appropriate vacuum is unavailable, only wet-clean-up methods should be used (i.e. misting). Moisture should be added as necessary to reduce exposure to airborne respirable silica dust.

Section 7 - Handling and Storage

Precautions for safe handling

- Handling** • Use good safety and industrial hygiene practices. Use only in well ventilated areas. Wear appropriate personal protective equipment, avoid direct contact. Wear long sleeves and/or protective coveralls. Do not breathe dust. Avoid contact with skin, eyes, and clothing. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Contaminated clothing must be vacuumed before removal. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reuse. Wash thoroughly after handling.

Conditions for safe storage, including any incompatibilities

- Storage** • Store in a covered location. Keep container closed. Keep from freezing. Storage and work area should be periodically cleaned to minimize dust accumulation.

Section 8 - Exposure Controls/Personal Protection

Control parameters

Exposure Limits/Guidelines						
	Result	ACGIH	Canada Manitoba	Canada Ontario	Canada Quebec	Mexico

Quartz (14808-60-7)	TWAs	0.025 mg/m3 TWA (respirable fraction)	Not established	0.10 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.1 mg/m3 TWAEV (respirable dust)	0.1 mg/m3 TWA LMPE-PPT (respirable fraction)
Formaldehyde (50-00-0)	Ceilings	0.3 ppm Ceiling	Not established	1.5 ppm Ceiling	2 ppm Ceiling; 3 mg/m3 Ceiling	2 ppm Ceiling; 3 mg/m3 Ceiling
	Designated Substances	Not established	Present	Not established	Not established	Not established
	STELs	Not established	Not established	1.0 ppm STEL	Not established	Not established
Diphosphoric acid, sodium salt (1:4) (7722-88-5)	TWAs	Not established	Not established	5 mg/m3 TWA	5 mg/m3 TWAEV	Not established
Limestone (1317-65-3)	STELs	Not established	Not established	Not established	Not established	20 mg/m3 STEL [LMPE-CT]
	TWAs	Not established	Not established	Not established	10 mg/m3 TWAEV (Limestone, containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m3 TWA LMPE-PPT
Cristobalite (14464-46-1)	TWAs	0.025 mg/m3 TWA (respirable fraction)	Not established	0.05 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.05 mg/m3 TWAEV (respirable dust)	0.05 mg/m3 TWA LMPE-PPT (respirable fraction)
Titanium dioxide (13463-67-7)	STELs	Not established	Not established	Not established	Not established	20 mg/m3 STEL [LMPE-CT] (as Ti)
	TWAs	10 mg/m3 TWA	Not established	10 mg/m3 TWA	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m3 TWA LMPE-PPT (as Ti)
Aluminum oxide (1344-28-1)	TWAs	1 mg/m3 TWA (respirable fraction) <i>as Aluminum insoluble compounds</i>	Not established	1 mg/m3 TWA (respirable) <i>as Aluminum insoluble compounds</i>	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust, as Al)	10 mg/m3 TWA LMPE-PPT
Amorphous silica fume (69012-64-2)	TWAs	Not established	Not established	2 mg/m3 TWA (respirable, listed under Silica fume)	2 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, respirable dust)	2 mg/m3 TWA LMPE -PPT; 10 mg/m3 TWA LMPE-PPT (inhalable particulate); 3 mg/m3 TWA LMPE- PPT (respirable particulate)
		10 mg/m3 TWA			10 mg/m3 TWAEV (including dust, inert	

Cement, alumina, chemicals	TWAs	(inhalable particles, recommended); 3 mg/m3 TWA (respirable particles, recommended) <i>as Particulates not otherwise classified (PNOC)</i>	Not established	10 mg/m3 TWA (inhalable); 3 mg/m3 TWA (respirable) <i>as Particulates not otherwise classified (PNOC)</i>	or nuisance particulates; containing no Asbestos and <1% Crystalline silica, total dust) <i>as Particulates not otherwise classified (PNOC)</i>	Not established
Amorphous/fused silica (60676-86-0)	TWAs	Not established	Not established	0.1 mg/m3 TWA (respirable)	0.1 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, respirable dust)	0.1 mg/m3 TWA LMPE-PPT; 10 mg/m3 TWA LMPE-PPT (inhalable particulate); 3 mg/m3 TWA LMPE-PPT (respirable particulate)

Exposure Limits/Guidelines (Con't.)

	Result	NIOSH	OSHA
Quartz (14808-60-7)	TWAs	0.05 mg/m3 TWA (respirable dust)	Not established
Formaldehyde (50-00-0)	STELs	Not established	2 ppm STEL (see 29 CFR 1910.1048)
	TWAs	0.016 ppm TWA	0.75 ppm TWA
	Ceilings	0.1 ppm Ceiling (15 min)	Not established
Diphosphoric acid, sodium salt (1:4) (7722-88-5)	TWAs	5 mg/m3 TWA	Not established
Silica, amorphous (7631-86-9)	TWAs	6 mg/m3 TWA	Not established
Limestone (1317-65-3)	TWAs	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
Cristobalite (14464-46-1)	TWAs	0.05 mg/m3 TWA (respirable dust)	Not established
Titanium dioxide (13463-67-7)	TWAs	Not established	15 mg/m3 TWA (total dust)
Aluminum oxide (1344-28-1)	TWAs	Not established	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
Cement, alumina, chemicals	TWAs	Not established	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction) <i>as Particulates not otherwise classified (PNOC)</i>

Exposure Control Notations

Mexico

- Aluminum oxide (1344-28-1): **Carcinogens:** (A4 - Not classifiable as a human carcinogen)
- Titanium dioxide (13463-67-7): **Carcinogens:** (A4 - Not classifiable as a human carcinogen)
- Formaldehyde (50-00-0): **Carcinogens:** (A2 - Suspected human carcinogen)

Canada Ontario

- Cristobalite (14464-46-1): **Designated Substances:** (0.05 mg/m3 TWA (respirable fraction, listed under Silica, crystalline))
- Quartz (14808-60-7): **Designated Substances:** (0.10 mg/m3 TWA (respirable fraction, listed under Silica, crystalline))

Canada Quebec

- Quartz (14808-60-7): **Carcinogens:** (C2 carcinogen - effect suspected in humans)
- Formaldehyde (50-00-0): **Carcinogens:** (C2 carcinogen - effect suspected in humans)

ACGIH

- Aluminum oxide as Aluminum insoluble compounds: **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Titanium dioxide (13463-67-7): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Cristobalite (14464-46-1): **Carcinogens:** (A2 - Suspected Human Carcinogen)
- Quartz (14808-60-7): **Carcinogens:** (A2 - Suspected Human Carcinogen)
- Formaldehyde (50-00-0): **Carcinogens:** (A2 - Suspected Human Carcinogen) | **Sensitizers:** (Sensitizer)

Exposure Limits Supplemental

OSHA

- Cristobalite (14464-46-1): **Mineral Dusts:** $((1/2)(30)/(\%SiO_2 + 2) \text{ mg/m}^3 \text{ TWA, total dust; } (1/2)(250)/(\%SiO_2 + 5) \text{ mppcf TWA, respirable fraction; } (1/2)(10)/(\%SiO_2 + 2) \text{ mg/m}^3 \text{ TWA, respirable fraction})$
- Quartz (14808-60-7): **Mineral Dusts:** $((30)/(\%SiO_2 + 2) \text{ mg/m}^3 \text{ TWA, total dust; } (250)/(\%SiO_2 + 5) \text{ mppcf TWA, respirable fraction; } (10)/(\%SiO_2 + 2) \text{ mg/m}^3 \text{ TWA, respirable fraction})$
- Amorphous/fused silica (60676-86-0): **Mineral Dusts:** $((80)/(\% SiO_2) \text{ mg/m}^3 \text{ TWA; } 20 \text{ mppcf TWA})$
- Silica, amorphous (7631-86-9): **Mineral Dusts:** $(20 \text{ mppcf TWA; } (80)/(\% SiO_2) \text{ mg/m}^3 \text{ TWA})$

ACGIH

- Aluminum oxide as Aluminum insoluble compounds: **TLV Basis - Critical Effects:** (pneumoconiosis; lower respiratory tract irritation; neurotoxicity)
- Titanium dioxide (13463-67-7): **TLV Basis - Critical Effects:** (lower respiratory tract irritation) | **Notice of Intended Changes (TLVs):** (1 mg/m³ TWA (respirable fraction); A3 - confirmed animal carcinogen with unknown relevance to humans; TLV basis: lower respiratory tract irritation, pneumoconiosis)
- Cristobalite (14464-46-1): **TLV Basis - Critical Effects:** (lung cancer; pulmonary fibrosis)
- Quartz (14808-60-7): **TLV Basis - Critical Effects:** (lung cancer; pulmonary fibrosis)
- Formaldehyde (50-00-0): **TLV Basis - Critical Effects:** (eye and upper respiratory tract irritation)

Exposure controls

Engineering Measures/Controls

- Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment). Collection systems must be designed and maintained to prevent the accumulation and recirculation of respirable silica into the workplace.

Personal Protective Equipment

Respiratory

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face

- Wear protective eyewear (goggles, face shield, or safety glasses).

Hands

- Wear appropriate gloves.

Skin/Body

- Wear long sleeves and/or protective coveralls.

General Industrial Hygiene Considerations

- Do not breathe dust. Avoid contact with skin, eyes or clothing. Do not remove dusts from clothing by blowing or shaking. Do not eat, drink or smoke during work. Wash thoroughly after handling. Handle in accordance with good industrial hygiene and safety practice.

Environmental Exposure Controls

- Follow best practice for site management and disposal of waste. Dispose of in an approved landfill.

Key to abbreviations

ACGIH = American Conference of Governmental Industrial Hygiene

NIOSH = National Institute of Occupational Safety and Health

STEL = Short Term Exposure Limits are based on 15-minute exposures

TWAEV = Time-Weighted Average Exposure Value

OSHA = Occupational Safety and Health Administration

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

Information on Physical and Chemical Properties

Material Description			
Physical Form	Solid	Appearance/Description	Gray granular dry powder with an earthy odor.
Color	Gray	Odor	Earthy
Particulate Size	600 µ	Odor Threshold	No data available
General Properties			
Boiling Point	No data available	Melting Point/Freezing Point	No data available
Decomposition Temperature	No data available	pH	No data available
Specific Gravity/Relative Density	= 2.53 Water=1	Water Solubility	Negligible < 0.1 %
Viscosity	No data available		
Volatility			
Vapor Pressure	No data available	Vapor Density	No data available
Evaporation Rate	No data available	VOC (Wt.)	0 %
VOC (Vol.)	0 %		
Flammability			
Flash Point	No data available	UEL	No data available
LEL	No data available	Autoignition	No data available
Flammability (solid, gas)	No data available		
Environmental			
Octanol/Water Partition coefficient	No data available		

Section 10: Stability and Reactivity

Reactivity

- No dangerous reaction known under conditions of normal use.

Chemical stability

- Stable under normal temperatures and pressures.

Possibility of hazardous reactions

- Hazardous polymerization will not occur.

Conditions to avoid

- No data available

Incompatible materials

- No data available

Hazardous decomposition products

- No data available

Section 11 - Toxicological Information

Information on toxicological effects

Components		
Cristobalite (0.036% TO 0.6695%)	14464-46-1	Acute Toxicity: Inhalation-Human TClO • 16 mppcf 8 Hour(s) 17.9 Year(s)-Intermittent; <i>Lungs, Thorax, or Respiration:Fibrosis, focal (pneumoconiosis); Lungs, Thorax, or Respiration:Cough; Lungs, Thorax, or Respiration:Dyspnea;</i> Multi-dose Toxicity: Inhalation-Mouse TClO • 43 mg/m ³ 5 Hour(s) 9 Day(s)-Intermittent; <i>Lungs, Thorax, or Respiration:Pleural effusion; Lungs, Thorax, or Respiration:Other changes</i>
Silica, amorphous (0.009% TO 3.764%)	7631-86-9	Irritation: Eye-Rabbit • 25 mg 24 Hour(s) • Mild irritation
Dispsering Agent 1 (< 0.1395%)	Proprietary	Acute Toxicity: Ingestion/Oral-Rat LD50 • 3120 mg/kg; <i>Behavioral:Somnolence (general depressed activity); Behavioral:Coma;</i> Irritation: Skin-Rabbit • 500 mg 24 Hour(s) • Moderate irritation
Non Wetting Agent (0.94% TO 2.925%)	Proprietary	Acute Toxicity: Ingestion/Oral-Rat LD50 • 4250 mg/kg; <i>Behavioral:Somnolence (general depressed activity); Behavioral:Ataxia; Lungs, Thorax, or Respiration:Respiratory depression;</i> Reproductive: Intraperitoneal-Mouse TDLo • 3200 mg/kg (9D preg); <i>Reproductive Effects:Effects on Fertility:Post-implantation mortality</i>
1-Propene, homopolymer (< 0.15%)	9003-07-0	Acute Toxicity: Ingestion/Oral-Rat LD50 • >8 g/kg

GHS Properties	Classification
Acute toxicity	OSHA HCS 2012 • No data available
Skin corrosion/Irritation	OSHA HCS 2012 • No data available
Serious eye damage/Irritation	OSHA HCS 2012 • No data available
Skin sensitization	OSHA HCS 2012 • No data available
Respiratory sensitization	OSHA HCS 2012 • No data available
Aspiration Hazard	OSHA HCS 2012 • No data available
Carcinogenicity	OSHA HCS 2012 • Carcinogenicity 1A
Germ Cell Mutagenicity	OSHA HCS 2012 • No data available
Toxicity for Reproduction	OSHA HCS 2012 • No data available
STOT-SE	OSHA HCS 2012 • No data available
STOT-RE	OSHA HCS 2012 • Specific Target Organ Toxicity Repeated Exposure 1

Target Organs

Route(s) of entry/exposure

Medical Conditions

Aggravated by Exposure

Potential Health Effects

Inhalation

Acute (Immediate)

Chronic (Delayed)

- [[206]]
- Inhalation, Skin, Eye, Ingestion
- Any pre-existing conditions of the lungs. Disorders of the lungs.

- Nuisance dust may affect the lungs but reactions are typically reversible.
- Chronic overexposure to dust containing respirable sized crystalline silica can cause delayed lung injury (silicosis). Inhalation of dust containing crystalline silica pulmonary diseases such as asthma and lung disorder associated with smoking.

Skin

Acute (Immediate)

Chronic (Delayed)

- Exposure to dust may cause mechanical irritation.
- No data available.

Eye

Acute (Immediate)

- Excessive concentrations of nuisance dust in the workplace may reduce visibility and

- may cause unpleasant deposits in eyes.
- No data available.
- Chronic (Delayed)**
- Ingestion**
- Acute (Immediate)**
- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.
 - No data available.
- Chronic (Delayed)**
- Carcinogenic Effects**
- May cause cancer. IARC studies have shown sufficient evidence from animal studies to categorize crystalline silica as a group 1 carcinogen.

Carcinogenic Effects				
	CAS	OSHA	IARC	NTP
Quartz	14808-60-7	Not Listed	Group 1-Carcinogenic	Known Human Carcinogen
Formaldehyde	50-00-0	Specifically Regulated Carcinogen	Group 1-Carcinogenic	Known Human Carcinogen
Cristobalite	14464-46-1	Not Listed	Group 1-Carcinogenic	Not Listed
Titanium dioxide	13463-67-7	Not Listed	Group 2B-Possible Carcinogen	Evidence of Carcinogenicity

Key to abbreviations

LD = Lethal Dose

TC = Toxic Concentration

TD = Toxic Dose

Section 12 - Ecological Information

Toxicity

- Material data lacking.

Persistence and degradability

- Material data lacking.

Bioaccumulative potential

- Material data lacking.

Mobility in Soil

- Material data lacking.

Other adverse effects

- No studies have been found.

Section 13 - Disposal Considerations

Waste treatment methods

Product waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	UN	UN proper shipping	Transport hazard class	Packing	Environmental
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	number	name	(es)	group	hazards
DOT	NDA	Not Regulated	NDA	NDA	NDA
TDG	NDA	Not Regulated	NDA	NDA	NDA
IATA/ICAO	NDA	Not Regulated	NDA	NDA	NDA

Special precautions for user • None specified.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code • No data available

Section 15 - Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications • Chronic

State Right To Know				
Component	CAS	MA	NJ	PA
Aluminum oxide	1344-28-1	Yes	Yes	Yes
Amorphous/fused silica	60676-86-0	Yes	Yes	No
Cristobalite	14464-46-1	Yes	Yes	Yes
Diphosphoric acid, sodium salt (1:4)	7722-88-5	Yes	Yes	Yes
Formaldehyde	50-00-0	Yes	Yes	Yes
Limestone	1317-65-3	Yes	Yes	Yes
Quartz	14808-60-7	Yes	Yes	Yes
Silica, amorphous	7631-86-9	Yes	Yes	Yes
Titanium dioxide	13463-67-7	Yes	Yes	Yes
Dispsering Agent 1	Proprietary	Yes	No	Yes

Inventory				
Component	CAS	Canada DSL	Canada NDSL	TSCA
Aluminum oxide	1344-28-1	Yes	No	Yes
Amorphous/fused silica	60676-86-0	Yes	No	Yes
Cristobalite	14464-46-1	Yes	No	Yes
Diphosphoric acid, sodium salt (1:4)	7722-88-5	Yes	No	Yes
Formaldehyde	50-00-0	Yes	No	Yes
Limestone	1317-65-3	No	Yes	Yes
Quartz	14808-60-7	Yes	No	Yes
Silica, amorphous	7631-86-9	Yes	No	Yes
Titanium dioxide	13463-67-7	Yes	No	Yes
Dispsering Agent 1	Proprietary	Yes	No	Yes

Canada

Labor

Canada - WHMIS - Classifications of Substances

• Dispersing Agent 1	Proprietary	Not Listed
• Formaldehyde	50-00-0	A, B1, D1A, D2A, D2B; B3, D1A, D2A, D2B, E (regulated under Formol) D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Titanium dioxide, mixture containing on Health Canada's WHMIS Division website.)
• Titanium dioxide	13463-67-7	D2B
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Uncontrolled product according to WHMIS classification criteria
• Aluminum oxide	1344-28-1	D2A
• Limestone	1317-65-3	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Cristobalite	14464-46-1	Uncontrolled product according to WHMIS classification criteria
• Silica, amorphous	7631-86-9	Uncontrolled product according to WHMIS classification criteria
• Amorphous/fused silica	60676-86-0	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Quartz	14808-60-7	

Canada - WHMIS - Ingredient Disclosure List

• Dispersing Agent 1	Proprietary	Not Listed
• Formaldehyde	50-00-0	0.1 %
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	1 %
• Aluminum oxide	1344-28-1	1 %
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	1 %
• Silica, amorphous	7631-86-9	1 %
• Amorphous/fused silica	60676-86-0	1 %
• Quartz	14808-60-7	1 %

Environment

Canada - CEPA - Priority Substances List

• Dispersing Agent 1	Proprietary	Not Listed
• Formaldehyde	50-00-0	Priority Substance List 2 (substance considered toxic)

• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

Canada - CEPA - Schedule I - List of Toxic Substances

• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

Canada New Brunswick

Environment

Canada - New Brunswick - Ozone Depleting Substances - Schedule B

• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

United States

Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	1000 lb TQ
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - OSHA - Specifically Regulated Chemicals

• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	2 ppm STEL (See 29 CFR 1910.1048, 15 min); 0.5 ppm Action Level (See 29 CFR

		1910.1048); 0.75 ppm TWA (See 29 CFR 1910.1048)
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

Environment

U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants

• Dispsering Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities

• Dispsering Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	100 lb final RQ; 45.4 kg final RQ
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs

• Dispsering Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	100 lb EPCRA RQ
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs

• Dispsering Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	500 lb TPQ
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed

• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed
U.S. - CERCLA/SARA - Section 313 - Emission Reporting		
• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	0.1 % de minimis concentration
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	1.0 % de minimis concentration (fibrous forms)
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed
U.S. - RCRA (Resource Conservation & Recovery Act) - Basis for Listing - Appendix VII		
• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	Included in waste streams: K009, K010, K038, K040, K156, K157
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed
U.S. - RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261		
• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	waste number U122
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed
U.S. - RCRA (Resource Conservation & Recovery Act) - U Series Wastes - Acutely Toxic Wastes & Other Hazardous Characteristics		
• Dispensing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	waste number U122
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed

• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	carcinogen, initial date 1/1/88 (gas)
• Titanium dioxide	13463-67-7	carcinogen, initial date 9/2/11 (airborne, unbound particles of respirable size)
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	carcinogen, initial date 10/1/88 (airborne particles of respirable size)

U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)

• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	40 µg/day NSRL (gas)
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

United States - Pennsylvania

Labor

U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

• Dispersing Agent 1	<i>Proprietary</i>	
• Formaldehyde	50-00-0	
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances

• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Formaldehyde	50-00-0	
• Titanium dioxide	13463-67-7	Not Listed

• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Quartz	14808-60-7	Not Listed

Other Information

- WARNING: This product contains a chemical known to the State of California to cause cancer.

Section 16 - Other Information

Revision Date	• 26/April/2018
Last Revision Date	• 19/April/2017
Preparation Date	• 03/June/2013
Disclaimer/Statement of Liability	• The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release. Reno Refractories MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the product is fit for a particular purpose and suitable for user's method of use or application. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key to abbreviations

NDA = No data available

Safety Data Sheet

**Section 1: Identification****Product identifier**

Product Name • REFCAST Hot Floor
Product Code • 101807

Relevant identified uses of the substance or mixture and uses advised against

Recommended use • Refractory applications

Details of the supplier of the safety data sheet

Manufacturer • Reno Refractories, Inc.
PO Box 201
Morris, AL 35116
United States
www.renorefractories.com
sales@renorefractories.com
Telephone (General) • 205-647-0240

Emergency telephone number

Manufacturer • 1-800-262-8200 - CHEMTREC

Section 2: Hazard Identification**United States (US)**

According to OSHA 29 CFR 1910.1200 HCS

Classification of the substance or mixture

OSHA HCS 2012 • Skin Corrosion 1 - H314
Serious Eye Damage 1 - H318
Carcinogenicity 1A - H350
Specific Target Organ Toxicity Repeated Exposure 1 - H372

Label elements

OSHA HCS 2012

DANGER

Hazard statements • Causes severe skin burns and eye damage. - H314
Causes serious eye damage - H318
May cause cancer. - H350
Causes damage to organs - Lungs through prolonged or repeated exposure via Inhalation - H372

Precautionary statements

Mixtures

- Material does not meet the criteria of a substance.

Substances

Section 3 - Composition/Information on Ingredients

Other hazards

- In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

Label elements



- Other Toxic Effects - D2A Corrosive - E

Classification of the substance or mixture

- Other Toxic Effects - D2A Corrosive - E

Canada
According to WHMIS

Other hazards

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Storage/Disposal

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations. - P501

Response

- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. - P304+P340
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. - P303+P361+P353

Prevention

- Obtain special instructions before use. - P201
Do not handle until all safety precautions have been read and understood. - P202
Do not breathe dust. - P260
Wash thoroughly after handling. - P264
Do not eat, drink or smoke when using this product. - P270

Composition					
Chemical Name	Identifiers	%	LD50/LC50	Classifications According to Regulation/Directive	Comments
Mullite	CAS:1302-93-8	39.65% TO 41.6%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Portland cement	CAS:65997-15-1	19.635% TO 24%	NDA	OSHA HCS 2012: Skin Corr. 1B; Eye Dam. 1	NDA
Cristobalite	CAS:14464-46-1	9.15% TO 16.015%	NDA	OSHA HCS 2012: Carc. 1A	NDA
Aluminum(III) silicate (2:1)	CAS:1302-76-7	10.2% TO 14.25%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Silica, amorphous	CAS:7631-86-9	6.1% TO 12.8%	NDA	OSHA HCS 2012: Not Classified	NDA
Quartz	CAS:14808-60-7	0.621% TO 1.814%	NDA	OSHA HCS 2012: Carc. 1A; STOT RE 1 (Lungs, Inhl)	NDA
Calcium sulfate	CAS:7778-18-9	0.84% TO 1.625%	NDA	OSHA HCS 2012: STOT SE 3: Resp. Irrit.	NDA
Titanium dioxide	CAS:13463-67-7	0.12% TO 0.7775%	NDA	OSHA HCS 2012: Carc. 2	NDA
Wetting Agent	Proprietary	< 0.1496%	Ingestion/Oral-Rat LD50 • 3800 mg/kg	OSHA HCS 2012: Not Classified	NDA
Sodium hydroxide	CAS:1310-73-2	< 0.0675%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA
Calcium oxide	CAS:1305-78-8	< 0.025%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA
Aluminum oxide	CAS:1344-28-1	< 0.005%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA
Iron oxide	CAS:1309-37-1	< 0.0025%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA
Formaldehyde	CAS:50-00-0	< 0.000085%	Ingestion/Oral-Rat LD50 • 100 mg/kg Inhalation-Rat LC50 • 250 ppm 4 Hour(s) Skin-Rabbit LD50 • 270 mg/kg	OSHA HCS 2012: Exposure limit(s)	NDA

Section 4: First-Aid Measures

Description of first aid measures

Inhalation

- Move victim to fresh air. Administer oxygen if breathing is difficult. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Skin

- In case of contact with substance, immediately flush skin with running water for at least 20 minutes. If skin irritation occurs: Get medical advice/attention.

Eye

- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.

Ingestion

- Rinse mouth. Do not give anything by mouth to an unconscious person. Get medical attention immediately.

Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

Indication of any immediate medical attention and special treatment needed

Notes to Physician

- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Section 5: Fire-Fighting Measures

Extinguishing media

Suitable Extinguishing Media • Material is non-combustible. In case of fire use media as appropriate for surrounding fire.

Unsuitable Extinguishing Media • None known.

Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards • None known.

Hazardous Combustion Products • None known.

Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.

Section 6 - Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Personal Precautions • Isolate hazard area and deny entry to unauthorized and/or unprotected personnel. Do not walk through spilled material. Wear appropriate personal protective equipment, avoid direct contact. Ensure adequate ventilation to remove vapors, fumes, dust etc.

Emergency Procedures • Ventilate closed spaces before entering. Isolate hazard area and deny entry to unauthorized and/or unprotected personnel.

Environmental precautions

- No specific actions or treatments recommended related to exposure to this material.

Methods and material for containment and cleaning up

Containment/Clean-up Measures • Avoid generating dust.
FOR SMALL SPILLS: Clean with a vacuum with a filtration system sufficient to remove and prevent recirculation of crystalline silica (a vacuum equipped with a high-efficiency particulate air (HEPA) filter is recommended).
FOR LARGE SPILLS: Use a fine spray or mist to control dust creation and carefully scoop or shovel into clean dry container for later reuse or disposal.
If, an appropriate vacuum is unavailable, only wet-clean-up methods should be used (i.e. misting). Moisture should be added as necessary to reduce exposure to airborne respirable silica dust.

Section 7 - Handling and Storage

Precautions for safe handling

Handling • Use good safety and industrial hygiene practices. Do not use in areas without adequate ventilation. Do not breathe dust. Avoid contact with skin, eyes, and clothing. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Wear long sleeves and/or protective coveralls. Wash thoroughly after handling. Contaminated clothing must be vacuumed before removal. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reuse.

Conditions for safe storage, including any incompatibilities

Storage • Store in a covered location. Keep container closed. Keep from freezing. Storage and work area should be periodically cleaned to minimize dust accumulation.

Section 8 - Exposure Controls/Personal Protection

Control parameters

Exposure Limits/Guidelines						
	Result	ACGIH	Canada Ontario	Canada Quebec	Mexico	NIOSH
Formaldehyde (50-00-0)	Ceilings	0.3 ppm Ceiling	1.5 ppm Ceiling	2 ppm Ceiling; 3 mg/m ³ Ceiling	2 ppm Ceiling; 3 mg/m ³ Ceiling	0.1 ppm Ceiling (15 min)
	STELs	Not established	1.0 ppm STEL	Not established	Not established	Not established
	TWAs	Not established	Not established	Not established	Not established	0.016 ppm TWA
Iron oxide (1309-37-1)	STELs	Not established	Not established	Not established	10 mg/m ³ STEL [LMPE-CT] (as Fe)	Not established
	TWAs	5 mg/m ³ TWA (respirable fraction)	5 mg/m ³ TWA (respirable)	5 mg/m ³ TWAEV (dust and fume, as Fe); 10 mg/m ³ TWAEV (containing no Asbestos and <1% Crystalline silica, regulated under Rouge, total dust)	5 mg/m ³ TWA LMPE-PPT	5 mg/m ³ TWA (dust and fume, as Fe)
Aluminum oxide (1344-28-1)	TWAs	Not established	Not established	10 mg/m ³ TWAEV (containing no Asbestos and <1% Crystalline silica, total dust, as Al)	10 mg/m ³ TWA LMPE-PPT	Not established
Calcium oxide (1305-78-8)	TWAs	2 mg/m ³ TWA	2 mg/m ³ TWA	2 mg/m ³ TWAEV	2 mg/m ³ TWA LMPE-PPT	2 mg/m ³ TWA
Sodium hydroxide (1310-73-2)	Ceilings	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling
Titanium dioxide (13463-67-7)	STELs	Not established	Not established	Not established	20 mg/m ³ STEL [LMPE-CT] (as Ti)	Not established
	TWAs	10 mg/m ³ TWA	10 mg/m ³ TWA	10 mg/m ³ TWAEV (containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m ³ TWA LMPE-PPT (as Ti)	Not established
Quartz (14808-60-7)	TWAs	0.025 mg/m ³ TWA (respirable fraction)	0.10 mg/m ³ TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.1 mg/m ³ TWAEV (respirable dust)	0.1 mg/m ³ TWA LMPE-PPT (respirable fraction)	0.05 mg/m ³ TWA (respirable dust)
Calcium sulfate (7778-18-9)	TWAs	10 mg/m ³ TWA (inhalable fraction)	10 mg/m ³ TWA (inhalable)	10 mg/m ³ TWAEV (containing no Asbestos and <1% Crystalline silica, total dust); 5 mg/m ³ TWAEV (containing no Asbestos and <1% Crystalline silica, respirable dust)	10 mg/m ³ TWA LMPE-PPT (inhalable fraction)	10 mg/m ³ TWA (total dust); 5 mg/m ³ TWA (respirable dust)

Silica, amorphous (7631-86-9)	TWAs	Not established	Not established	Not established	Not established	6 mg/m3 TWA
Cristobalite (14464-46-1)	TWAs	0.025 mg/m3 TWA (respirable fraction)	0.05 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.05 mg/m3 TWAEV (respirable dust)	0.05 mg/m3 TWA LMPE-PPT (respirable fraction)	0.05 mg/m3 TWA (respirable dust)
Portland cement (65997-15-1)	STELs	Not established	Not established	Not established	20 mg/m3 STEL [LMPE-CT]	Not established
	TWAs	1 mg/m3 TWA (particulate matter containing no asbestos and <1% crystalline silica, respirable fraction)	1 mg/m3 TWA (containing no Asbestos and <1% Crystalline silica, respirable)	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust); 5 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, respirable dust)	10 mg/m3 TWA LMPE-PPT	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)

Exposure Limits/Guidelines (Con't.)

	Result	OSHA
Formaldehyde (50-00-0)	STELs	2 ppm STEL (see 29 CFR 1910.1048)
	TWAs	0.75 ppm TWA
Iron oxide (1309-37-1)	TWAs	10 mg/m3 TWA (fume); 15 mg/m3 TWA (total dust, listed under Rouge); 5 mg/m3 TWA (respirable fraction, listed under Rouge)
Aluminum oxide (1344-28-1)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
Calcium oxide (1305-78-8)	TWAs	5 mg/m3 TWA
Sodium hydroxide (1310-73-2)	TWAs	2 mg/m3 TWA
Titanium dioxide (13463-67-7)	TWAs	15 mg/m3 TWA (total dust)
Calcium sulfate (7778-18-9)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
Portland cement (65997-15-1)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)

Exposure controls

Engineering Measures/Controls

- Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment)

are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment). Collection systems must be designed and maintained to prevent the accumulation and recirculation of respirable silica into the workplace.

Personal Protective Equipment

Respiratory

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face

- Wear protective eyewear (goggles, face shield, or safety glasses).

Hands

- Wear appropriate gloves.

Skin/Body

- Wear long sleeves and/or protective coveralls.

General Industrial Hygiene Considerations

- Do not breathe dust. Avoid contact with skin, eyes or clothing. Do not remove dusts from clothing by blowing or shaking. Do not eat, drink or smoke during work. Wash thoroughly after handling. Handle in accordance with good industrial hygiene and safety practice.

Environmental Exposure Controls

- Follow best practice for site management and disposal of waste. Dispose of in an approved landfill.

Key to abbreviations

ACGIH = American Conference of Governmental Industrial Hygiene

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

STEL = Short Term Exposure Limits are based on 15-minute exposures

TWAEV = Time-Weighted Average Exposure Value

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

Information on Physical and Chemical Properties

Material Description			
Physical Form	Solid	Appearance/Description	Gray granular dry powder with an earthy odor.
Color	Gray	Odor	Earthy
Particulate Size	600 µ	Odor Threshold	No data available
General Properties			
Boiling Point	No data available	Melting Point	No data available
Decomposition Temperature	No data available	pH	Not relevant
Specific Gravity/Relative Density	2.08 Water=1	Water Solubility	Negligible < 0.1 %
Viscosity	No data available		
Volatility			
Vapor Pressure	No data available	Vapor Density	No data available
Evaporation Rate	No data available		
Flammability			
Flash Point	Not relevant	UEL	Not relevant
LEL	Not relevant	Autoignition	No data available
Flammability (solid, gas)	No data available		
Environmental			
Octanol/Water Partition coefficient	No data available		

Section 10: Stability and Reactivity

Reactivity

- No dangerous reaction known under conditions of normal use.

Chemical stability

- Stable under normal temperatures and pressures.

Possibility of hazardous reactions

- Hazardous polymerization will not occur.

Conditions to avoid

- No data available

Incompatible materials

- No data available

Hazardous decomposition products

- No data available

Section 11 - Toxicological Information

Information on toxicological effects

Components		
Silica, amorphous (6.1% TO 12.8%)	7631-86-9	Irritation: Eye-Rabbit • 25 mg 24 Hour(s) • Mild irritation
Titanium dioxide (0.12% TO 0.7775%)	13463-67-7	Irritation: Skin-Human • 300 µg 3 Day(s)-Intermittent • Mild irritation; Multi-dose Toxicity: Inhalation-Rat TCLo • 250 mg/m ³ 6 Hour(s) 4 Week(s)-Intermittent; <i>Lungs, Thorax, or Respiration</i> : Chronic pulmonary edema; Lungs, Thorax, or Respiration:Other changes
Wetting Agent (< 0.1496%)	Proprietary	Acute Toxicity: Ingestion/Oral-Rat LD50 • 3800 mg/kg

GHS Properties	Classification
Acute toxicity	OSHA HCS 2012 • Data lacking
Aspiration Hazard	OSHA HCS 2012 • Data lacking
Carcinogenicity	OSHA HCS 2012 • Carcinogenicity 1A
Germ Cell Mutagenicity	OSHA HCS 2012 • Data lacking
Skin corrosion/Irritation	OSHA HCS 2012 • Skin Corrosion 1
Skin sensitization	OSHA HCS 2012 • Data lacking
STOT-RE	OSHA HCS 2012 • Specific Target Organ Toxicity Repeated Exposure 1
STOT-SE	OSHA HCS 2012 • Data lacking
Toxicity for Reproduction	OSHA HCS 2012 • Data lacking
Respiratory sensitization	OSHA HCS 2012 • Data lacking
Serious eye damage/Irritation	OSHA HCS 2012 • Serious Eye Damage 1

Target Organs

- Lungs

Route(s) of entry/exposure

- Inhalation, Skin, Eye, Ingestion

Medical Conditions Aggravated by Exposure

- Any pre-existing conditions of the lungs. Disorders of the lungs.

Potential Health Effects

Inhalation**Acute (Immediate)**

- Nuisance dust may affect the lungs but reactions are typically reversible.

Chronic (Delayed)

- Chronic overexposure to dust containing respirable sized crystalline silica can cause delayed lung injury (silicosis). Inhalation of dust containing crystalline silica pulmonary diseases such as asthma and lung disorder associated with smoking.

Skin**Acute (Immediate)**

- Causes severe skin burns and eye damage. Exposure to dust may cause mechanical irritation.

Chronic (Delayed)

- No data available.

Eye**Acute (Immediate)**

- Causes serious eye damage. Excessive concentrations of nuisance dust in the workplace may reduce visibility and may cause unpleasant deposits in eyes.

Chronic (Delayed)

- No data available.

Ingestion**Acute (Immediate)**

- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.

Chronic (Delayed)

- No data available.

Carcinogenic Effects

- May cause cancer. IARC studies have shown sufficient evidence from animal studies to categorize crystalline silica as a group 1 carcinogen.

Carcinogenic Effects				
	CAS	OSHA	IARC	NTP
Formaldehyde	50-00-0	Specifically Regulated Carcinogen	Group 1-Carcinogenic	Known Human Carcinogen
Titanium dioxide	13463-67-7	Not Listed	Group 2B-Possible Carcinogen	Evidence of Carcinogenicity
Quartz	14808-60-7	Not Listed	Group 1-Carcinogenic	Known Human Carcinogen
Cristobalite	14464-46-1	Not Listed	Group 1-Carcinogenic	Not Listed

Key to abbreviations

LD = Lethal Dose

TC = Toxic Concentration

Section 12 - Ecological Information**Toxicity**

- Material data lacking.

Persistence and degradability

- Material data lacking.

Bioaccumulative potential

- Material data lacking.

Mobility in Soil

- Material data lacking.

Other adverse effects

- No studies have been found.

Section 13 - Disposal Considerations

Waste treatment methods

Product waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	UN number	UN proper shipping name	Transport hazard class (es)	Packing group	Environmental hazards
DOT	NDA	Not Regulated	NDA	NDA	NDA
TDG	NDA	Not Regulated	NDA	NDA	NDA
IATA/ICAO	NDA	Not Regulated	NDA	NDA	NDA

Special precautions for user • None specified.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code • No data available

Section 15 - Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications • Acute, Chronic

State Right To Know				
Component	CAS	MA	NJ	PA
Aluminum oxide	1344-28-1	Yes	Yes	Yes
Calcium oxide	1305-78-8	Yes	Yes	Yes
Cristobalite	14464-46-1	Yes	Yes	Yes
Formaldehyde	50-00-0	Yes	Yes	Yes
Portland cement	65997-15-1	Yes	Yes	Yes
Potassium oxide	12136-45-7	No	Yes	No
Quartz	14808-60-7	Yes	Yes	Yes
Silica, amorphous	7631-86-9	Yes	Yes	Yes
Sodium hydroxide	1310-73-2	Yes	Yes	Yes
Sodium sulfate	7757-82-6	Yes	No	Yes
Titanium dioxide	13463-67-7	Yes	Yes	Yes

Inventory			
Component	CAS	Canada DSL	TSCA
Aluminum oxide	1344-28-1	Yes	Yes
Calcium oxide	1305-78-8	Yes	Yes
Cristobalite	14464-46-1	Yes	Yes
Formaldehyde	50-00-0	Yes	Yes
Portland cement	65997-15-1	Yes	Yes
Potassium oxide	12136-45-7	Yes	Yes

Quartz	14808-60-7	Yes	Yes
Silica, amorphous	7631-86-9	Yes	Yes
Sodium hydroxide	1310-73-2	Yes	Yes
Sodium sulfate	7757-82-6	Yes	Yes
Titanium dioxide	13463-67-7	Yes	Yes

Canada

Labor

Canada - WHMIS - Classifications of Substances

• Potassium oxide	12136-45-7	E
• Portland cement	65997-15-1	E
• Formaldehyde	50-00-0	A, B1, D1A, D2A, D2B; B3, D1A, D2A, D2B, E (regulated under Formol)
• Calcium oxide	1305-78-8	E E (including 0.04% in aqueous solution, 0.08%, 0.4% in aqueous solution, 2%, 2.5%, 4% in aqueous solution, 5%, 10%, 16%, 20%, 40%, 50% in aqueous solution, 8.7N)
• Sodium hydroxide	1310-73-2	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Titanium dioxide, mixture containing on Health Canada's WHMIS Division website.)
• Titanium dioxide	13463-67-7	Uncontrolled product according to WHMIS classification criteria
• Aluminum oxide	1344-28-1	Uncontrolled product according to WHMIS classification criteria
• Sodium sulfate	7757-82-6	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Cristobalite	14464-46-1	Uncontrolled product according to WHMIS classification criteria
• Silica, amorphous	7631-86-9	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Quartz	14808-60-7	

Canada - WHMIS - Ingredient Disclosure List

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	0.1 %
• Calcium oxide	1305-78-8	1 %
• Sodium hydroxide	1310-73-2	1 %
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	1 %
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	1 %
• Silica, amorphous	7631-86-9	1 %
• Quartz	14808-60-7	1 %

Environment

Canada - CEPA - Priority Substances List

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	Priority Substance List 2 (substance considered toxic)
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

Canada - CEPA - Schedule I - List of Toxic Substances

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

United States

Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	1000 lb TQ
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed

• Quartz	14808-60-7	Not Listed
U.S. - OSHA - Specifically Regulated Chemicals		
• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	2 ppm STEL (See 29 CFR 1910.1048, 15 min); 0.5 ppm Action Level (See 29 CFR 1910.1048); 0.75 ppm TWA (See 29 CFR 1910.1048)
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

Environment**U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants**

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	100 lb final RQ; 45.4 kg final RQ
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	1000 lb final RQ; 454 kg final RQ
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	100 lb EPCRA RQ
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed

• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	500 lb TPQ
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Section 313 - Emission Reporting

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	0.1 % de minimis concentration
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	1.0 % de minimis concentration (fibrous forms)
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - RCRA (Resource Conservation & Recovery Act) - Basis for Listing - Appendix VII

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	Included in waste streams: K009, K010, K038, K040, K156, K157
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	waste number U122
• Calcium oxide	1305-78-8	Not Listed

• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - RCRA (Resource Conservation & Recovery Act) - U Series Wastes - Acutely Toxic Wastes & Other Hazardous Characteristics

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	waste number U122
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	carcinogen, initial date 1/1/88 (gas)
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	carcinogen, initial date 9/2/11 (airborne, unbound particles of respirable size)
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	carcinogen, initial date 10/1/88 (airborne particles of respirable size)

U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	40 µg/day NSRL (gas)
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

United States - Pennsylvania

Labor

U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	
• Sodium sulfate	7757-82-6	(solution)
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances

• Potassium oxide	12136-45-7	Not Listed
• Portland cement	65997-15-1	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Quartz	14808-60-7	Not Listed

Other Information

- WARNING: This product contains a chemical known to the State of California to cause cancer.

Section 16 - Other Information

Last Revision Date

- 30/June/2014

Preparation Date

- 01/June/2009

Disclaimer/Statement of Liability

- The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release. Reno Refractories MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the product is fit for a particular purpose and suitable for user's method of use or application. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key to abbreviations

NDA = No data available

Safety Data Sheet



Section 1: Identification

Product identifier

Product Name • **Refcast Locem 31/70 AL**

Product Code • 153007

Relevant identified uses of the substance or mixture and uses advised against

Recommended use • Refractory applications

Details of the supplier of the safety data sheet

Manufacturer • Reno Refractories, Inc.
P O Box 201
Morris, AL 35116
United States
www.renorefractories.com
sales@renorefractories.com

Telephone (General) • 205-647-0240

Emergency telephone number

Manufacturer • 1-800-262-8200 - CHEMTREC

Section 2: Hazard Identification

United States (US)

According to: OSHA 29 CFR 1910.1200 HCS

Classification of the substance or mixture

OSHA HCS 2012 • Specific Target Organ Toxicity Repeated Exposure 1

Label elements

OSHA HCS 2012

DANGER



Hazard statements • May cause damage to organs - lungs through prolonged or repeated exposure

Precautionary statements

Prevention • Do not breathe dust.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.

Response • IF ON SKIN: Wash with plenty of soap and water.
Specific treatment, see supplemental first aid information.

Take off contaminated clothing and wash before reuse.
If skin irritation occurs: Get medical advice/attention.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If eye irritation persists: Get medical advice/attention.
IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.
Get medical advice/attention if you feel unwell.

Storage/Disposal • Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Other hazards

OSHA HCS 2012

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Canada

According to: WHMIS

Classification of the substance or mixture

WHMIS

- Other Toxic Effects - D2B

Label elements

WHMIS



- Other Toxic Effects - D2B

WHMIS

Other hazards

WHMIS

- In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

Section 3 - Composition/Information on Ingredients

Substances

- Material does not meet the criteria of a substance.

Mixtures

Composition				
Chemical Name	Identifiers	%	LD50/LC50	Classifications According to Regulation/Directive
Mullite	CAS:1302-93-8	54.81% TO 56.55%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)
Aluminum oxide	CAS:1344-28-1	19.35% TO 23%	NDA	OSHA HCS 2012: Not Classified - Criteria not met
Silica, amorphous	CAS:7631-86-9	< 8.59%	NDA	OSHA HCS 2012: Data Lacking
Cement, alumina, chemicals	CAS:65997-16-2	5% TO 7%	NDA	OSHA HCS 2012:
Amorphous silica fume	CAS:69012-64-2	3% TO 7%	NDA	OSHA HCS 2012: STOT RE 1 (Lungs)
Non-Wetting Agent	Proprietary	1.88% TO 4.88%	Ingestion/Oral-Rat LD50 • 4250 mg/kg	OSHA HCS 2012: WHMIS: Other Toxic Effects - D2B

Amorphous/fused silica	CAS:60676-86-0	< 0.48%	NDA	OSHA HCS 2012: Data Lacking
Quartz	CAS:14808-60-7	< 0.301%	NDA	OSHA HCS 2012: Carc. 2
Iron oxide	CAS:1309-37-1	< 0.24%	NDA	OSHA HCS 2012: Data Lacking
Limestone	CAS:1317-65-3	< 0.15%	NDA	OSHA HCS 2012: WHMIS: Other Toxic Effects - D2A
Triphosphoric acid, sodium salt (1:5)	CAS:7758-29-4	0.093% TO 0.1395%	Ingestion/Oral-Rat LD50 • 3120 mg/kg	OSHA HCS 2012: Eye Irrit. 2A; Skin Irrit. 2; STOT SE 3: Resp. Irrit.
Sodium hydroxide	CAS:1310-73-2	< 0.13%	NDA	OSHA HCS 2012: Skin Corr. 1B; Eye Dam. 1
Cristobalite	CAS:14464-46-1	< 0.0975%	NDA	OSHA HCS 2012: Carc. 1A
Zirconium oxide	CAS:1314-23-4	< 0.085%	NDA	OSHA HCS 2012: WHMIS:
Calcium oxide	CAS:1305-78-8	< 0.085%	NDA	OSHA HCS 2012: Skin Irrit. 2; Eye Irrit. 2; STOT SE 3: Resp. Irrit.
Magnesium oxide	CAS:1309-48-4	< 0.06%	NDA	OSHA HCS 2012: Not Classified
Blancol	CAS:9084-06-4	0.0173% TO 0.044%	Ingestion/Oral-Rat LD50 • 3800 mg/kg	OSHA HCS 2012: None
Sodium poly acrylate	CAS:9003-04-7	0.01% TO 0.04%	Ingestion/Oral-Rat LD50 • 5 g/kg	OSHA HCS 2012: Eye Dam. 1; Skin Irrit. 2
Titanium dioxide	CAS:13463-67-7	0.022% TO 0.028%	NDA	OSHA HCS 2012: WHMIS: Other Toxic Effects - D2A
Citric acid	CAS:77-92-9	0.01% TO 0.02%	Ingestion/Oral-Mouse LD50 • 5040 mg/kg	OSHA HCS 2012: Eye Dam. 1; Skin Irrit. 2
Potassium oxide	CAS:12136-45-7	0.011% TO 0.014%	NDA	OSHA HCS 2012: WHMIS:
Diphosphoric acid, sodium salt (1:4)	CAS:7722-88-5	0.001% TO 0.0075%	Ingestion/Oral-Rat LD50 • 4 g/kg	OSHA HCS 2012: Skin Irrit. 2; Eye Irrit. 2A; STOT RE 2 (Lungs)
Sodium sulfate	CAS:7757-82-6	0.0014% TO 0.0045%	Ingestion/Oral-Mouse LD50 • 5989 mg/kg	OSHA HCS 2012: Not Classified
Sodium trimetaphosphate	CAS:7785-84-4	0.001% TO 0.003%	Ingestion/Oral-Mouse LD50 • 10300 mg/kg	OSHA HCS 2012: Not Classified
Formaldehyde	CAS:50-00-0	<= 0.000025%	Ingestion/Oral-Rat LD50 • 100 mg/kg Inhalation-Rat LC50 • 250 ppm 4 Hour(s) Skin-Rabbit LD50 • 270 mg/kg	OSHA HCS 2012: Acute Tox. 3 (Oral, Dermal); Acute Tox. 2 (Inhalation); Skin Sens. 1A; Eye Dam. 1; Skin Corr. 1A; Carc. 1A; Muta. 1B

Section 4: First-Aid Measures

Description of first aid measures

Inhalation

- Move victim to fresh air. Give artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult. Get medical attention immediately.

Skin

- In case of contact with substance, immediately flush skin with running water for at least 20 minutes. If skin irritation occurs: Get medical advice/attention.

Eye

- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.

Ingestion

- Rinse mouth. Do not give anything by mouth to an unconscious person. Get medical attention immediately.

Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

Indication of any immediate medical attention and special treatment needed

Notes to Physician

- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to material other than this product may have occurred.

Section 5: Fire-Fighting Measures

Extinguishing media

Suitable Extinguishing Media • Material is non-combustible. In case of fire use media as appropriate for surrounding fire.

Unsuitable Extinguishing Media • None known.

Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards • None known.

Hazardous Combustion Products • None known.

Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.

Section 6 - Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Personal Precautions • Isolate hazard area and deny entry to unauthorized and/or unprotected personnel. Do not touch or walk through spilled material. Ensure adequate ventilation to remove vapors, fumes, dust etc.

Emergency Procedures • Ventilate closed spaces before entering. Isolate hazard area and deny entry to unauthorized and/or unprotected personnel.

Environmental precautions

- No specific actions or treatments recommended related to exposure to this material.

Methods and material for containment and cleaning up

Containment/Clean-up Measures • Avoid generating dust.
FOR SMALL SPILLS: Clean with a vacuum with a filtration system sufficient to remove and prevent recirculation of crystalline silica (a vacuum equipped with a high-efficiency particulate air (HEPA) filter is recommended).
FOR LARGE SPILLS: Use a fine spray or mist to control dust creation and carefully scoop or shovel into clean dry container for later reuse or disposal.
If, an appropriate vacuum is unavailable, only wet-clean-up methods should be used (i.e. misting). Moisture should be added as necessary to reduce exposure to airborne respirable silica dust.

Section 7 - Handling and Storage

Precautions for safe handling

Handling

- Do not breathe dust. Avoid contact with skin, eyes, and clothing. Minimize dust generation and accumulation. Use good safety and industrial hygiene practices. Routine housekeeping should be instituted to ensure that dusts do not accumulate on

surfaces. Wear long sleeves and/or protective coveralls. Contaminated clothing must be vacuumed before removal. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reuse. Wash thoroughly after handling. Do not use in areas without adequate ventilation.

Conditions for safe storage, including any incompatibilities

Storage

- Store in a covered location. Keep container closed. Keep from freezing. Storage and work area should be periodically cleaned to minimize dust accumulation.

Section 8 - Exposure Controls/Personal Protection

Control parameters

Exposure Limits/Guidelines						
	Result	ACGIH	Canada Ontario	Canada Quebec	Mexico	NIOSH
Formaldehyde (50-00-0)	Ceilings	0.3 ppm Ceiling	1.5 ppm Ceiling	2 ppm Ceiling; 3 mg/m ³ Ceiling	2 ppm Ceiling; 3 mg/m ³ Ceiling	0.1 ppm Ceiling (15 min)
	STELs	Not established	1 ppm STEL	Not established	Not established	Not established
	TWAs	Not established	Not established	Not established	Not established	0.016 ppm TWA
Diphosphoric acid, sodium salt (1:4) (7722-88-5)	TWAs	Not established	5 mg/m ³ TWA	5 mg/m ³ TWAEV	Not established	5 mg/m ³ TWA
Titanium dioxide (13463-67-7)	STELs	Not established	Not established	Not established	20 mg/m ³ STEL [PPT-CT] (as Ti)	Not established
	TWAs	10 mg/m ³ TWA	10 mg/m ³ TWA	10 mg/m ³ TWAEV (containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m ³ TWA VLE-PPT (as Ti)	Not established
Magnesium oxide (1309-48-4)	TWAs	10 mg/m ³ TWA (inhalable particulate matter)	10 mg/m ³ TWA (inhalable)	10 mg/m ³ TWAEV (fume, as Mg)	10 mg/m ³ TWA VLE-PPT (fume, as Mg)	Not established
Calcium oxide (1305-78-8)	TWAs	2 mg/m ³ TWA	2 mg/m ³ TWA	2 mg/m ³ TWAEV	2 mg/m ³ TWA VLE-PPT	2 mg/m ³ TWA
Cristobalite (14464-46-1)	TWAs	0.025 mg/m ³ TWA (respirable particulate matter)	0.05 mg/m ³ TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.05 mg/m ³ TWAEV (respirable dust)	0.05 mg/m ³ TWA VLE-PPT (respirable fraction)	0.05 mg/m ³ TWA (respirable dust)
Sodium hydroxide (1310-73-2)	Ceilings	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling	2 mg/m ³ Ceiling
Limestone (1317-65-3)	STELs	Not established	Not established	Not established	20 mg/m ³ STEL [PPT-CT]	Not established
	TWAs	Not established	Not established	10 mg/m ³ TWAEV (Limestone, containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m ³ TWA VLE-PPT	10 mg/m ³ TWA (total dust); 5 mg/m ³ TWA (respirable dust)
	STELs	Not established	Not established	Not established	10 mg/m ³ STEL [PPT-CT] (as Fe)	Not established
				5 mg/m ³ TWAEV (dust and fume, as		

Iron oxide (1309-37-1)	TWAs	5 mg/m3 TWA (respirable particulate matter)	5 mg/m3 TWA (respirable)	Fe); 10 mg/m3 TWA EV (containing no Asbestos and <1% Crystalline silica, regulated under Rouge, total dust)	5 mg/m3 TWA VLE- PPT	5 mg/m3 TWA (dust and fume, as Fe)
Quartz (14808-60-7)	TWAs	0.025 mg/m3 TWA (respirable particulate matter)	0.10 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.1 mg/m3 TWA EV (respirable dust)	0.1 mg/m3 TWA VLE- PPT (respirable fraction)	0.05 mg/m3 TWA (respirable dust)
Amorphous/fused silica (60676-86-0)	TWAs	Not established	0.1 mg/m3 TWA (respirable)	0.1 mg/m3 TWA EV (containing no Asbestos and <1% Crystalline silica, respirable dust)	0.1 mg/m3 TWA VLE- PPT; 10 mg/m3 TWA VLE-PPT (inhalable particulate); 3 mg/m3 TWA VLE-PPT (respirable particulate)	Not established
Amorphous silica fume (69012-64-2)	TWAs	Not established	2 mg/m3 TWA (respirable, listed under Silica fume)	2 mg/m3 TWA EV (containing no Asbestos and <1% Crystalline silica, respirable dust)	2 mg/m3 TWA VLE- PPT; 10 mg/m3 TWA VLE-PPT (inhalable particulate); 3 mg/m3 TWA VLE-PPT (respirable particulate)	Not established
Silica, amorphous (7631-86-9)	TWAs	Not established	Not established	Not established	Not established	6 mg/m3 TWA
Aluminum oxide (1344-28-1)	TWAs	Not established	Not established	10 mg/m3 TWA EV (containing no Asbestos and <1% Crystalline silica, total dust, as Al)	10 mg/m3 TWA VLE- PPT	Not established

Exposure Limits/Guidelines (Con't.)

	Result	OSHA
Formaldehyde (50-00-0)	STELs	2 ppm STEL (see 29 CFR 1910.1048)
	TWAs	0.75 ppm TWA
Titanium dioxide (13463-67-7)	TWAs	15 mg/m3 TWA (total dust)
Magnesium oxide (1309-48-4)	TWAs	15 mg/m3 TWA (fume, total particulate)
Calcium oxide (1305-78-8)	TWAs	5 mg/m3 TWA
Cristobalite (14464-46-1)	TWAs	50 µg/m3 TWA (listed under Respirable crystalline silica)
Sodium hydroxide (1310-73-2)	TWAs	2 mg/m3 TWA
Limestone (1317-65-3)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
Iron oxide (1309-37-1)	TWAs	10 mg/m3 TWA (fume); 15 mg/m3 TWA (total dust, listed under Rouge); 5 mg/m3 TWA (respirable fraction, listed under Rouge)
Quartz (14808-60-7)	TWAs	50 µg/m3 TWA (listed under Respirable crystalline silica)

Aluminum oxide (1344-28-1)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
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Exposure Control Notations

Mexico

- Aluminum oxide (1344-28-1): **Carcinogens:** (A4 - Not classifiable as a human carcinogen)
- Iron oxide (1309-37-1): **Carcinogens:** (A4 - Not classifiable as a human carcinogen)
- Formaldehyde (50-00-0): **Carcinogens:** (A2 - Suspected human carcinogen)
- Titanium dioxide (13463-67-7): **Carcinogens:** (A4 - Not classifiable as a human carcinogen)

Canada Ontario

- Cristobalite (14464-46-1): **Designated Substances:** (0.05 mg/m3 TWA (respirable fraction, listed under Silica, crystalline))
- Quartz (14808-60-7): **Designated Substances:** (0.10 mg/m3 TWA (respirable fraction, listed under Silica, crystalline))

Canada Quebec

- Quartz (14808-60-7): **Carcinogens:** (C2 carcinogen - effect suspected in humans)
- Formaldehyde (50-00-0): **Carcinogens:** (C2 carcinogen - effect suspected in humans)

ACGIH

- Cristobalite (14464-46-1): **Carcinogens:** (A2 - Suspected Human Carcinogen)
- Quartz (14808-60-7): **Carcinogens:** (A2 - Suspected Human Carcinogen)
- Iron oxide (1309-37-1): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Magnesium oxide (1309-48-4): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Formaldehyde (50-00-0): **Carcinogens:** (A2 - Suspected Human Carcinogen) | **Sensitizers:** (dermal sensitizer; respiratory sensitizer)
- Titanium dioxide (13463-67-7): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)

Exposure Limits Supplemental

OSHA

- Silica, amorphous (7631-86-9): **Mineral Dusts:** (20 mppcf TWA; (80)/(% SiO₂) mg/m3 TWA)
- Cristobalite (14464-46-1): **Mineral Dusts:** ((1/2)(250)/(%SiO₂ + 5) mppcf TWA, respirable fraction; (1/2)(10)/(%SiO₂ + 2) mg/m3 TWA, respirable fraction)
- Amorphous/fused silica (60676-86-0): **Mineral Dusts:** ((80)/(% SiO₂) mg/m3 TWA; 20 mppcf TWA)
- Quartz (14808-60-7): **Mineral Dusts:** ((250)/(%SiO₂ + 5) mppcf TWA, respirable fraction; (10)/(%SiO₂ + 2) mg/m3 TWA, respirable fraction)

ACGIH

- Cristobalite (14464-46-1): **TLV Basis - Critical Effects:** (lung cancer; pulmonary fibrosis)
- Quartz (14808-60-7): **TLV Basis - Critical Effects:** (lung cancer; pulmonary fibrosis)
- Iron oxide (1309-37-1): **TLV Basis - Critical Effects:** (pneumoconiosis)
- Sodium hydroxide (1310-73-2): **TLV Basis - Critical Effects:** (eye, skin and upper respiratory tract irritation)
- Calcium oxide (1305-78-8): **TLV Basis - Critical Effects:** (upper respiratory tract irritation)
- Magnesium oxide (1309-48-4): **TLV Basis - Critical Effects:** (metal fume fever; upper respiratory tract irritation)
- Formaldehyde (50-00-0): **TLV Basis - Critical Effects:** (eye and upper respiratory tract irritation) | **Notice of Intended Changes (TLVs):** (0.1 ppm TWA; 0.3 ppm STEL; dermal and respiratory sensitizer; A1 - confirmed human carcinogen; TLV basis: eye and upper respiratory tract irritation; upper respiratory tract cancer)
- Titanium dioxide (13463-67-7): **TLV Basis - Critical Effects:** (lower respiratory tract irritation)

Exposure controls

Engineering Measures/Controls

- Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment). Collection systems must be designed and maintained to prevent the accumulation and recirculation of respirable silica into the workplace.

Personal Protective Equipment

Respiratory

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-

purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face	• Wear protective eyewear (goggles, face shield, or safety glasses).
Hands	• Wear appropriate gloves.
Skin/Body	• Wear long sleeves and/or protective coveralls.
General Industrial Hygiene Considerations	• Avoid breathing dust. Avoid contact with skin, eyes or clothing. Do not remove dusts from clothing by blowing or shaking. Do not eat, drink or smoke during work. Wash hands before eating, drinking, or smoking. Wash thoroughly after handling. Handle in accordance with good industrial hygiene and safety practice.
Environmental Exposure Controls	• Follow best practice for site management and disposal of waste. Dispose of in an approved landfill.

Key to abbreviations

ACGIH = American Conference of Governmental Industrial Hygiene

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

STEL = Short Term Exposure Limits are based on 15-minute exposures

TWAEV = Time-Weighted Average Exposure Value

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

Information on Physical and Chemical Properties

Material Description			
Physical Form	Solid	Appearance/Description	Gray granular dry powder with an earthy odor.
Color	Gray	Odor	Earthy
Particulate Size	600 µm	Odor Threshold	No data available
General Properties			
Boiling Point	No data available	Melting Point/Freezing Point	No data available
Decomposition Temperature	No data available	pH	No data available
Specific Gravity/Relative Density	= 2.53 Water=1	Water Solubility	Negligible
Viscosity	No data available		
Volatility			
Vapor Pressure	No data available	Vapor Density	No data available
Evaporation Rate	No data available	VOC (Wt.)	0 %
Flammability			
Flash Point	No data available	UEL	No data available
LEL	No data available	Autoignition	No data available
Flammability (solid, gas)	Not flammable.		
Environmental			
Octanol/Water Partition coefficient	No data available		

Section 10: Stability and Reactivity

Reactivity

- No dangerous reaction known under conditions of normal use.

Chemical stability

- Stable under normal temperatures and pressures.

Possibility of hazardous reactions

- Hazardous polymerization not indicated.

Conditions to avoid

- None known.

Incompatible materials

- None known.

Hazardous decomposition products

- None known.

Section 11 - Toxicological Information

Information on toxicological effects

Components		
Quartz (< 0.301%)	14808-60-7	Tumorigen / Carcinogen: Inhalation-Rat TCLo • 50 mg/m ³ 6 Hour(s) 71 Week(s)-Intermittent; <i>Tumorigenic:Carcinogenic by RTECS criteria; Liver:Tumors</i>
Sodium hydroxide (< 0.13%)	1310-73-2	Irritation: Eye-Rabbit • 50 µg 24 Hour(s) • Severe irritation; Skin-Rabbit • 500 mg 24 Hour(s) • Severe irritation
Formaldehyde (<= 0.000025%)	50-00-0	Acute Toxicity: Ingestion/Oral-Rat LD50 • 100 mg/kg; Inhalation-Rat LC50 • 250 ppm 4 Hour(s); Skin-Rabbit LD50 • 270 mg/kg; Irritation: Eye-Rabbit • 750 µg 24 Hour(s) • Severe irritation; Skin-Rabbit • 2 mg 24 Hour(s) • Severe irritation; Multi-dose Toxicity: Skin-Woman TCLo • 1 pph 48 Hour(s)-Continuous; <i>Skin and Appendages:After topical exposure:Dermatitis, allergic;</i> Mutagen: Unscheduled DNA synthesis • Ingestion/Oral-Rat • 55 mg/kg; Sperm Morphology • Ingestion/Oral-Rat • 200 mg/kg; Micronucleus test • Inhalation-Human • 0.985 mg/m ³ 8 Hour(s) 8.5 Year(s)

GHS Properties	Classification
Acute toxicity	OSHA HCS 2012 • No data available
Skin corrosion/Irritation	OSHA HCS 2012 • No data available
Serious eye damage/Irritation	OSHA HCS 2012 • No data available
Skin sensitization	OSHA HCS 2012 • No data available
Respiratory sensitization	OSHA HCS 2012 • No data available
Aspiration Hazard	OSHA HCS 2012 • No data available
Carcinogenicity	OSHA HCS 2012 • No data available
Germ Cell Mutagenicity	OSHA HCS 2012 • No data available
Toxicity for Reproduction	OSHA HCS 2012 • No data available
STOT-SE	OSHA HCS 2012 • No data available
STOT-RE	OSHA HCS 2012 • Specific Target Organ Toxicity Repeated Exposure 1

Target Organs

- Lungs

Route(s) of entry/exposure

- Inhalation, Skin, Eye, Ingestion

Medical Conditions

Aggravated by Exposure

- Any pre-existing conditions of the lungs. Disorders of the lungs.

Potential Health Effects

Inhalation

Acute (Immediate)

- Exposure to dust may cause irritation.

Chronic (Delayed)

- Chronic overexposure to dust containing respirable sized crystalline silica can cause delayed lung injury (silicosis). Inhalation of dust containing crystalline silica pulmonary diseases such as asthma and lung disorder associated with smoking.

Skin

Acute (Immediate)

- Causes skin irritation. Exposure to dust may cause irritation.

Chronic (Delayed)

- No data available.

Eye

Acute (Immediate)

- Causes serious eye irritation. Excessive concentrations of nuisance dust in the workplace may reduce visibility and may cause unpleasant deposits in eyes.

Chronic (Delayed)

- No data available.

Ingestion

Acute (Immediate)

- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.

Chronic (Delayed)

- No data available.

Carcinogenic Effects

- This material does contain components that may cause cancer, however based on regulatory criteria this material is not classified as a carcinogen.

Carcinogenic Effects				
	CAS	OSHA	IARC	NTP
Formaldehyde	50-00-0	Specifically Regulated Carcinogen	Group 1-Carcinogenic	Known Human Carcinogen
Cristobalite	14464-46-1	Not Listed	Group 1-Carcinogenic	Not Listed
Quartz	14808-60-7	Not Listed	Group 1-Carcinogenic	Known Human Carcinogen

Section 12 - Ecological Information

Toxicity

- Material data lacking.

Persistence and degradability

- Material data lacking.

Bioaccumulative potential

- Material data lacking.

Mobility in Soil

- Material data lacking.

Other adverse effects

- No studies have been found.

Section 13 - Disposal Considerations

Waste treatment methods

Product waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	UN number	UN proper shipping name	Transport hazard class (es)	Packing group	Environmental hazards
DOT	NDA	Not regulated	NDA	NDA	NDA
TDG	NDA	Not regulated	NDA	NDA	NDA
IATA/ICAO	NDA	Not regulated	NDA	NDA	NDA

Special precautions for user • None known.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code • Not relevant.

Section 15 - Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications • Chronic

State Right To Know				
Component	CAS	MA	NJ	PA
1-Propene, homopolymer	9003-07-0	No	No	No
Aluminum oxide	1344-28-1	Yes	Yes	Yes
Amorphous/fused silica	60676-86-0	Yes	Yes	No
Blancol	9084-06-4	No	No	No
Non-Wetting Agent	<i>Proprietary</i>	No	No	No
Calcium oxide	1305-78-8	Yes	Yes	Yes
Cement, alumina, chemicals	65997-16-2	No	No	No
Citric acid	77-92-9	No	No	No
Cristobalite	14464-46-1	Yes	Yes	Yes
Diphosphoric acid, sodium salt (1:4)	7722-88-5	Yes	Yes	Yes
Formaldehyde	50-00-0	Yes	Yes	Yes
Iron oxide	1309-37-1	Yes	Yes	Yes
Limestone	1317-65-3	Yes	Yes	Yes
Magnesium oxide	1309-48-4	Yes	Yes	Yes
Mullite	1302-93-8	No	No	No
Potassium oxide	12136-45-7	No	Yes	No
Quartz	14808-60-7	Yes	Yes	Yes
Amorphous silica fume	69012-64-2	No	No	No
Silica, amorphous	7631-86-9	Yes	Yes	Yes
Sodium hydroxide	1310-73-2	Yes	Yes	Yes
Sodium poly acrylate	9003-04-7	No	No	No
Sodium sulfate	7757-82-6	Yes	No	Yes

Sodium trimetaphosphate	7785-84-4	Yes	No	Yes
Titanium dioxide	13463-67-7	Yes	Yes	Yes
Triphosphoric acid, sodium salt (1:5)	7758-29-4	Yes	No	Yes
Zirconium oxide	1314-23-4	Yes	No	No

Inventory				
Component	CAS	Canada DSL	Canada NDSL	TSCA
1-Propene, homopolymer	9003-07-0	Yes	No	Yes
Aluminum oxide	1344-28-1	Yes	No	Yes
Amorphous/fused silica	60676-86-0	Yes	No	Yes
Blancol	9084-06-4	Yes	No	Yes
Non-Wetting Agent	<i>Proprietary</i>	Yes	No	Yes
Calcium oxide	1305-78-8	Yes	No	Yes
Cement, alumina, chemicals	65997-16-2	Yes	No	Yes
Citric acid	77-92-9	Yes	No	Yes
Cristobalite	14464-46-1	Yes	No	Yes
Diphosphoric acid, sodium salt (1:4)	7722-88-5	Yes	No	Yes
Formaldehyde	50-00-0	Yes	No	Yes
Iron oxide	1309-37-1	Yes	No	Yes
Limestone	1317-65-3	No	Yes	Yes
Magnesium oxide	1309-48-4	Yes	No	Yes
Mullite	1302-93-8	Yes	No	Yes
Potassium oxide	12136-45-7	Yes	No	Yes
Quartz	14808-60-7	Yes	No	Yes
Amorphous silica fume	69012-64-2	Yes	No	Yes
Silica, amorphous	7631-86-9	Yes	No	Yes
Sodium hydroxide	1310-73-2	Yes	No	Yes
Sodium poly acrylate	9003-04-7	Yes	No	Yes
Sodium sulfate	7757-82-6	Yes	No	Yes
Sodium trimetaphosphate	7785-84-4	Yes	No	Yes
Titanium dioxide	13463-67-7	Yes	No	Yes
Triphosphoric acid, sodium salt (1:5)	7758-29-4	Yes	No	Yes
Zirconium oxide	1314-23-4	Yes	No	Yes

Canada

Labor

Canada - WHMIS 1988 - Classifications of Substances

• Sodium poly acrylate	9003-04-7	Not Listed
• BlancoI	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	E
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	Proprietary	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	B1, D1A, D2A, D2B; B3, D1A, D2A, D2B, E (regulated under Formol)
• Calcium oxide	1305-78-8	E
• Iron oxide	1309-37-1	Uncontrolled product according to WHMIS classification criteria
• Magnesium oxide	1309-48-4	Uncontrolled product according to WHMIS classification criteria
• Sodium hydroxide	1310-73-2	E (including 0.04% in aqueous solution, 0.04N, 0.08%, 0.4% in aqueous solution, 2%, 2.5%, 4% in aqueous solution, 5%, 10%, 16%, 20%, 40%, 50% in aqueous solution, 8.7N)
• Titanium dioxide	13463-67-7	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Titanium dioxide, mixture containing on Health Canada's WHMIS Division website.)
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	D2B (listed under Sodium pyrophosphate)
• Aluminum oxide	1344-28-1	Uncontrolled product according to WHMIS classification criteria
• Limestone	1317-65-3	D2A
• Citric acid	77-92-9	E (including 40%)
• Sodium sulfate	7757-82-6	Uncontrolled product according to WHMIS classification criteria
• Cristobalite	14464-46-1	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Silica, amorphous	7631-86-9	Uncontrolled product according to WHMIS classification criteria
• Amorphous/fused silica	60676-86-0	Uncontrolled product according to WHMIS classification criteria
		Uncontrolled product

• Zirconium oxide	1314-23-4	according to WHMIS classification criteria
• Quartz	14808-60-7	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• 1-Propene, homopolymer	9003-07-0	Uncontrolled product according to WHMIS classification criteria

Canada - WHMIS 1988 - Ingredient Disclosure List

• Sodium poly acrylate	9003-04-7	Not Listed
• Blancol	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	0.1 %
• Calcium oxide	1305-78-8	1 %
• Iron oxide	1309-37-1	1 %
• Magnesium oxide	1309-48-4	1 %
• Sodium hydroxide	1310-73-2	1 %
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	1 %
• Aluminum oxide	1344-28-1	1 %
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	1 %
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	1 %
• Silica, amorphous	7631-86-9	1 %
• Amorphous/fused silica	60676-86-0	1 %
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	1 %
• 1-Propene, homopolymer	9003-07-0	Not Listed

Environment

Canada - CEPA - Priority Substances List

• Sodium poly acrylate	9003-04-7	Not Listed
• Blancol	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	Priority Substance List 2 (substance considered toxic)

• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

Canada - CEPA - Schedule I - List of Toxic Substances

• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

United States

Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed

• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	1000 lb TQ
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - OSHA - Specifically Regulated Chemicals

• Sodium poly acrylate	9003-04-7	Not Listed
• Blancol	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	2 ppm STEL (See 29 CFR 1910.1048, 15 min); 0.5 ppm Action Level (See 29 CFR 1910.1048); 0.75 ppm TWA (See 29 CFR 1910.1048)
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

Environment

U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants

• Sodium poly acrylate	9003-04-7	Not Listed
• Blancol	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities

• Sodium poly acrylate	9003-04-7	Not Listed
• Blancol	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	100 lb final RQ; 45.4 kg final RQ
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	1000 lb final RQ; 454 kg final RQ
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed

• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs

• Sodium poly acrylate	9003-04-7	Not Listed
• Blancol	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	100 lb EPCRA RQ
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs

• Sodium poly acrylate	9003-04-7	Not Listed
• Blancol	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	500 lb TPQ
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed

• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed
U.S. - CERCLA/SARA - Section 313 - Emission Reporting		
• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	0.1 % de minimis concentration
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	1.0 % de minimis concentration (fibrous forms)
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed
U.S. - RCRA (Resource Conservation & Recovery Act) - Basis for Listing - Appendix VII		
• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	Included in waste streams: K009, K010, K038, K040, K156, K157
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed

• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261

• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	waste number U122
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - RCRA (Resource Conservation & Recovery Act) - U Series Wastes - Acutely Toxic Wastes & Other Hazardous Characteristics

• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	waste number U122
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed

• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	carcinogen, 1/1/1988 (gas)
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	carcinogen, 9/2/2011 (airborne, unbound particles of respirable size)
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)

• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed

• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	40 µg/day NSRL (gas)
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

United States - Pennsylvania

Labor

U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

• Sodium poly acrylate	9003-04-7	Not Listed
• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	(solution)
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances

• Sodium poly acrylate	9003-04-7	Not Listed
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• Blanco	9084-06-4	Not Listed
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Sodium trimetaphosphate	7785-84-4	Not Listed
• Triphosphoric acid, sodium salt (1:5)	7758-29-4	Not Listed
• Non-Wetting Agent	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Formaldehyde	50-00-0	
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Limestone	1317-65-3	Not Listed
• Citric acid	77-92-9	Not Listed
• Sodium sulfate	7757-82-6	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Amorphous/fused silica	60676-86-0	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed
• 1-Propene, homopolymer	9003-07-0	Not Listed

Other Information

- WARNING: This product contains a chemical known to the State of California to cause cancer.

Section 16 - Other Information

Revision Date • 26/April/2018

Last Revision Date • 08/May/2017

Preparation Date • 01/June/2009

Disclaimer/Statement of Liability • The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release. Reno Refractories MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the product is fit for a particular purpose and suitable for user's method of use or application. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key to abbreviations

NDA = No data available

Safety Data Sheet



Section 1: Identification

Product identifier

Product Name • **Recast LoCem 7020**

Product Code • 166207

Relevant identified uses of the substance or mixture and uses advised against

Recommended use • Refractory applications

Details of the supplier of the safety data sheet

Manufacturer • Reno Refractories, Inc.
P O Box 201
Morris, AL 35116
United States
www.renorefractories.com
sales@renorefractories.com

Telephone (General) • 205-647-0240

Emergency telephone number

Manufacturer • 1-800-262-8200 - CHEMTREC

Section 2: Hazard Identification

United States (US)

According to: OSHA 29 CFR 1910.1200 HCS

Classification of the substance or mixture

OSHA HCS 2012 • Specific Target Organ Toxicity Repeated Exposure 1

Label elements

OSHA HCS 2012

DANGER



Hazard statements • Causes damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention • Do not breathe dust.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.

Response • Get medical advice/attention if you feel unwell.

Storage/Disposal • Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Other hazards

OSHA HCS 2012

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Canada

According to: WHMIS

Classification of the substance or mixture

WHMIS

- Other Toxic Effects - D2B

Label elements

WHMIS



WHMIS

- Other Toxic Effects - D2B

Other hazards

WHMIS

- In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

Section 3 - Composition/Information on Ingredients

Substances

- Material does not meet the criteria of a substance.

Mixtures

Composition					
Chemical Name	Identifiers	%	LD50/LC50	Classifications According to Regulation/Directive	Comments
Mullite	CAS:1302-93-8 EC Number:215-113-2	46.11% TO 49.59%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Silicon carbide	CAS:409-21-2	17.46% TO 23%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Aluminum oxide	CAS:1344-28-1	7.88% TO 13.01%	Inhalation-Rat LC50 • 0.2 mg/L 5 Hour(s) 28 Week(s)	OSHA HCS 2012: Not Classified	NDA
Cement, alumina, chemicals	CAS:65997-16-2	3% TO 10%	NDA	OSHA HCS 2012: Not Classified	NDA
Silica, amorphous	CAS:7631-86-9	< 7.41%	NDA	OSHA HCS 2012: Not Classified	NDA
Amorphous silica fume	CAS:69012-64-2	1.8% TO 7%	NDA	OSHA HCS 2012: STOT RE 1 (Lungs)	NDA
Non Wetting Agent	Proprietary	0.96% TO 3%	NDA	OSHA HCS 2012: Not Classified	NDA
Quartz	CAS:14808-60-7	< 0.296%	NDA	OSHA HCS 2012: Exposure limits	NDA
Dispersing Agent 1	Proprietary	< 0.186%	Ingestion/Oral-Rat LD50 • 3120 mg/kg Skin-Rabbit LD50 • >4640 mg/kg	OSHA HCS 2012: Eye Irrit. 2A; Skin Irrit. 2; STOT SE 3: Resp. Irrit.;	NDA

Cristobalite	CAS:14464-46-1	< 0.0855%	NDA	OSHA HCS 2012: Exposure limits	NDA
Zirconium oxide	CAS:1314-23-4	0.081% TO 0.085%	NDA	OSHA HCS 2012: WHMIS:	NDA
Sodium hydroxide	CAS:1310-73-2	0.062% TO 0.068%	NDA	OSHA HCS 2012: WHMIS: Corrosive - E	NDA
Calcium oxide	CAS:1305-78-8	0.02% TO 0.03%	NDA	OSHA HCS 2012: WHMIS: Corrosive - E	NDA
Titanium dioxide	CAS:13463-67-7	0.022% TO 0.028%	NDA	OSHA HCS 2012: WHMIS: Other Toxic Effects - D2A	NDA
Potassium oxide	CAS:12136-45-7	0.011% TO 0.014%	NDA	OSHA HCS 2012: WHMIS:	NDA
Diphosphoric acid, sodium salt (1:4)	CAS:7722-88-5	< 0.01%	Ingestion/Oral-Rat LD50 • 4 g/kg	OSHA HCS 2012: Exposure limits	NDA
Iron oxide	CAS:1309-37-1	< 0.0025%	NDA	OSHA HCS 2012: WHMIS:	NDA

Section 4: First-Aid Measures

Description of first aid measures

Inhalation

- Move victim to fresh air. Administer oxygen if breathing is difficult. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Skin

- In case of contact with substance, immediately flush skin with running water for at least 20 minutes. If skin irritation occurs: Get medical advice/attention.

Eye

- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.

Ingestion

- Rinse mouth. Do not give anything by mouth to an unconscious person. Get medical attention immediately.

Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

Indication of any immediate medical attention and special treatment needed

Notes to Physician

- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to material other than this product may have occurred.

Section 5: Fire-Fighting Measures

Extinguishing media

Suitable Extinguishing Media • Material is non-combustible. In case of fire use media as appropriate for surrounding fire.

Unsuitable Extinguishing Media • None known.

Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards • None known.

Hazardous Combustion Products • None known.

Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.

Section 6 - Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Personal Precautions

- Isolate hazard area and deny entry to unauthorized and/or unprotected personnel. Do not walk through spilled material. Ensure adequate ventilation to remove vapors, fumes, dust etc. Wear appropriate personal protective equipment, avoid direct contact.

Emergency Procedures

- Ventilate closed spaces before entering. Isolate hazard area and deny entry to unauthorized and/or unprotected personnel.

Environmental precautions

- No specific actions or treatments recommended related to exposure to this material.

Methods and material for containment and cleaning up

Containment/Clean-up Measures

- Avoid generating dust.
FOR SMALL SPILLS: Clean with a vacuum with a filtration system sufficient to remove and prevent recirculation of crystalline silica (a vacuum equipped with a high-efficiency particulate air (HEPA) filter is recommended).
FOR LARGE SPILLS: Use a fine spray or mist to control dust creation and carefully scoop or shovel into clean dry container for later reuse or disposal.
If, an appropriate vacuum is unavailable, only wet-clean-up methods should be used (i.e. misting). Moisture should be added as necessary to reduce exposure to airborne respirable silica dust.

Section 7 - Handling and Storage

Precautions for safe handling

Handling

- Use good safety and industrial hygiene practices. Use only in well ventilated areas. Wear appropriate personal protective equipment, avoid direct contact. Wear long sleeves and/or protective coveralls. Do not breathe dust. Avoid contact with skin, eyes, and clothing. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Contaminated clothing must be vacuumed before removal. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reuse. Wash thoroughly after handling.

Conditions for safe storage, including any incompatibilities

Storage

- Store in a covered location. Keep container closed. Keep from freezing. Storage and work area should be periodically cleaned to minimize dust accumulation.

Section 8 - Exposure Controls/Personal Protection

Control parameters

Exposure Limits/Guidelines						
	Result	ACGIH	Canada Ontario	Canada Quebec	Mexico	NIOSH
Iron oxide (1309-37-1)	STELs	Not established	Not established	Not established	10 mg/m ³ STEL [LMPE-CT] (as Fe)	Not established
	TWAs	5 mg/m ³ TWA (respirable fraction)	5 mg/m ³ TWA (respirable)	5 mg/m ³ TWAEV (dust and fume, as Fe); 10 mg/m ³ TWAEV (containing no Asbestos and <1% Crystalline silica, regulated under Rouge, total dust)	5 mg/m ³ TWA LMPE- PPT	5 mg/m ³ TWA (dust and fume, as Fe)

Diphosphoric acid, sodium salt (1:4) (7722-88-5)	TWAs	Not established	5 mg/m3 TWA	5 mg/m3 TWAEV	Not established	5 mg/m3 TWA
Calcium oxide (1305-78-8)	TWAs	2 mg/m3 TWA	2 mg/m3 TWA	2 mg/m3 TWAEV	2 mg/m3 TWA LMPE-PPT	2 mg/m3 TWA
Titanium dioxide (13463-67-7)	STELs	Not established	Not established	Not established	20 mg/m3 STEL [LMPE-CT] (as Ti)	Not established
	TWAs	10 mg/m3 TWA	10 mg/m3 TWA	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m3 TWA LMPE-PPT (as Ti)	Not established
Sodium hydroxide (1310-73-2)	Ceilings	2 mg/m3 Ceiling	2 mg/m3 Ceiling	2 mg/m3 Ceiling	2 mg/m3 Ceiling	2 mg/m3 Ceiling
Cristobalite (14464-46-1)	TWAs	0.025 mg/m3 TWA (respirable fraction)	0.05 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.05 mg/m3 TWAEV (respirable dust)	0.05 mg/m3 TWA LMPE-PPT (respirable fraction)	0.05 mg/m3 TWA (respirable dust)
Quartz (14808-60-7)	TWAs	0.025 mg/m3 TWA (respirable fraction)	0.10 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.1 mg/m3 TWAEV (respirable dust)	0.1 mg/m3 TWA LMPE-PPT (respirable fraction)	0.05 mg/m3 TWA (respirable dust)
Non Wetting Agent (Proprietary)	TWAs	5 mg/m3 TWA (inhalable fraction, particulate matter containing no asbestos and <1% crystalline silica)	10 mg/m3 TWA (particulate matter containing no Asbestos and <1% Crystalline silica)	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust); 5 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, respirable dust)	Not established	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)
Amorphous silica fume (69012-64-2)	TWAs	Not established	2 mg/m3 TWA (respirable, listed under Silica fume)	2 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, respirable dust)	2 mg/m3 TWA LMPE-PPT; 10 mg/m3 TWA LMPE-PPT (inhalable particulate); 3 mg/m3 TWA LMPE-PPT (respirable particulate)	Not established
Silica, amorphous (7631-86-9)	TWAs	Not established	Not established	Not established	Not established	6 mg/m3 TWA
Aluminum oxide (1344-28-1)	TWAs	Not established	Not established	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust, as Al)	10 mg/m3 TWA LMPE-PPT	Not established
	STELs	Not established	Not established	Not established	20 mg/m3 STEL [LMPE-CT]	Not established
		10 mg/m3 TWA (nonfibrous, inhalable fraction, particulate matter containing no	10 mg/m3 TWA (non-fibrous, containing no Asbestos and <1%			

Silicon carbide (409-21-2)	TWAs	asbestos and <1% crystalline silica); 3 mg/m3 TWA (nonfibrous, respirable fraction, particulate matter containing no asbestos and <1% crystalline silica); 0.1 fiber/cm3 TWA (as determined by the membrane filter method at 400-450X magnification (4-mm objective), using phase-contrast illumination., respirable fibers, including whiskers, length >5 µm, aspect ratio ≥3:1)	Crystalline silica, inhalable); 3 mg/m3 TWA (non-fibrous, containing no Asbestos and <1% Crystalline silica, respirable); 0.1 fibre/cm3 TWA (fibrous, including whiskers, fibres >5 µm in length and an aspect ratio ≥3:1 as determined by the membrane filter method at 400-450 times magnification (4 -mm objective), using phase-contrast illumination, respirable)	10 mg/m3 TWAEV (non fibrous, containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m3 TWA LMPE -PPT	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)
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Exposure Limits/Guidelines (Con't.)

	Result	OSHA
Iron oxide (1309-37-1)	TWAs	10 mg/m3 TWA (fume); 15 mg/m3 TWA (total dust, listed under Rouge); 5 mg/m3 TWA (respirable fraction, listed under Rouge)
Calcium oxide (1305-78-8)	TWAs	5 mg/m3 TWA
Titanium dioxide (13463-67-7)	TWAs	15 mg/m3 TWA (total dust)
Sodium hydroxide (1310-73-2)	TWAs	2 mg/m3 TWA
Non Wetting Agent (Proprietary)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
Aluminum oxide (1344-28-1)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)
Silicon carbide (409-21-2)	TWAs	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)

Exposure Control Notations

Canada Ontario

- Cristobalite (14464-46-1): **Designated Substances:** (0.05 mg/m3 TWA (respirable fraction, listed under Silica, crystalline))
- Quartz (14808-60-7): **Designated Substances:** (0.10 mg/m3 TWA (respirable fraction, listed under Silica, crystalline))

Canada Quebec

- Quartz (14808-60-7): **Carcinogens:** (C2 carcinogen - effect suspected in humans)

ACGIH

- Cristobalite (14464-46-1): **Carcinogens:** (A2 - Suspected Human Carcinogen)
- Quartz (14808-60-7): **Carcinogens:** (A2 - Suspected Human Carcinogen)
- Silicon carbide (409-21-2): **Carcinogens:** (A2 - Suspected Human Carcinogen (fibrous, including whiskers))
- Titanium dioxide (13463-67-7): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)
- Iron oxide (1309-37-1): **Carcinogens:** (A4 - Not Classifiable as a Human Carcinogen)

Exposure Limits Supplemental

OSHA

- Cristobalite (14464-46-1): **Mineral Dusts:** ((1/2)(30)/(%SiO₂ + 2) mg/m3 TWA, total dust; (1/2)(250)/(%SiO₂ + 5) mppcf TWA, respirable fraction; (1/2)(10)/(%SiO₂ + 2) mg/m3 TWA, respirable fraction)
- Quartz (14808-60-7): **Mineral Dusts:** ((30)/(%SiO₂ + 2) mg/m3 TWA, total dust; (250)/(%SiO₂ + 5) mppcf TWA, respirable fraction; (10)/(%SiO₂

+ 2) mg/m3 TWA, respirable fraction)

•Silica, amorphous (7631-86-9): **Mineral Dusts:** (20 mppcf TWA; (80)/(%) SiO2) mg/m3 TWA)

ACGIH

•Cristobalite (14464-46-1): **TLV Basis - Critical Effects:** (lung cancer; pulmonary fibrosis)

•Quartz (14808-60-7): **TLV Basis - Critical Effects:** (lung cancer; pulmonary fibrosis)

•Silicon carbide (409-21-2): **TLV Basis - Critical Effects:** (upper respiratory tract irritation (nonfibrous); cancer (fibrous, including whiskers); mesothelioma (fibrous, including whiskers))

•Non Wetting Agent (Proprietary): **TLV Basis - Critical Effects:** (pneumoconiosis)

•Titanium dioxide (13463-67-7): **TLV Basis - Critical Effects:** (lower respiratory tract irritation)

•Calcium oxide (1305-78-8): **TLV Basis - Critical Effects:** (upper respiratory tract irritation)

•Sodium hydroxide (1310-73-2): **TLV Basis - Critical Effects:** (eye, skin and upper respiratory tract irritation)

•Iron oxide (1309-37-1): **TLV Basis - Critical Effects:** (pneumoconiosis)

Exposure controls

Engineering Measures/Controls

- Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment). Collection systems must be designed and maintained to prevent the accumulation and recirculation of respirable silica into the workplace.

Personal Protective Equipment

Respiratory

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face

- Wear protective eyewear (goggles, face shield, or safety glasses).

Hands

- Wear appropriate gloves.

Skin/Body

- Wear long sleeves and/or protective coveralls.

General Industrial Hygiene Considerations

- Do not breathe dust. Avoid contact with skin, eyes or clothing. Do not remove dusts from clothing by blowing or shaking. Do not eat, drink or smoke during work. Wash thoroughly after handling. Handle in accordance with good industrial hygiene and safety practice.

Environmental Exposure Controls

- Follow best practice for site management and disposal of waste. Dispose of in an approved landfill.

Key to abbreviations

ACGIH = American Conference of Governmental Industrial Hygiene

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

STEL = Short Term Exposure Limits are based on 15-minute exposures

TWAEV = Time-Weighted Average Exposure Value

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

Information on Physical and Chemical Properties

Material Description			
Physical Form	Solid	Appearance/Description	Gray granular dry powder with an earthy odor.
Color	Gray	Odor	Earthy

Particulate Size	600 µ	Odor Threshold	No data available
General Properties			
Boiling Point	No data available	Melting Point/Freezing Point	No data available
Decomposition Temperature	No data available	pH	Not relevant
Specific Gravity/Relative Density	= 2.53 Water=1	Water Solubility	Negligible < 0.1 %
Viscosity	No data available		
Volatility			
Vapor Pressure	No data available	Vapor Density	No data available
Evaporation Rate	No data available	VOC (Wt.)	0 %
VOC (Vol.)	0 %		
Flammability			
Flash Point	Not relevant	UEL	Not relevant
LEL	Not relevant	Autoignition	No data available
Flammability (solid, gas)	No data available		
Environmental			
Octanol/Water Partition coefficient	No data available		

Section 10: Stability and Reactivity

Reactivity

- No dangerous reaction known under conditions of normal use.

Chemical stability

- Stable under normal temperatures and pressures.

Possibility of hazardous reactions

- Hazardous polymerization will not occur.

Conditions to avoid

- No data available

Incompatible materials

- No data available

Hazardous decomposition products

- No data available

Section 11 - Toxicological Information

Information on toxicological effects

Components		
Silica, amorphous (< 7.41%)	7631-86-9	Irritation: Eye-Rabbit • 25 mg 24 Hour(s) • Mild irritation
Dispersing Agent 1 (< 0.186%)	Proprietary	Acute Toxicity: Ingestion/Oral-Rat LD50 • 3120 mg/kg; Behavioral: Somnolence (general depressed activity); Behavioral: Coma; Irritation: Skin-Rabbit • 500 mg 24 Hour(s) • Moderate irritation

GHS Properties	Classification
Acute toxicity	OSHA HCS 2012 • No data available
Skin corrosion/Irritation	OSHA HCS 2012 • No data available

Serious eye damage/Irritation	OSHA HCS 2012 • No data available
Skin sensitization	OSHA HCS 2012 • No data available
Respiratory sensitization	OSHA HCS 2012 • No data available
Aspiration Hazard	OSHA HCS 2012 • No data available
Carcinogenicity	OSHA HCS 2012 • No data available
Germ Cell Mutagenicity	OSHA HCS 2012 • No data available
Toxicity for Reproduction	OSHA HCS 2012 • No data available
STOT-SE	OSHA HCS 2012 • No data available
STOT-RE	OSHA HCS 2012 • Specific Target Organ Toxicity Repeated Exposure 1

Target Organs

- [[206]]

Route(s) of entry/exposure

- Inhalation, Skin, Eye, Ingestion

Medical Conditions

Aggravated by Exposure

- Any pre-existing conditions of the lungs. Disorders of the lungs.

Potential Health Effects

Inhalation

Acute (Immediate)

- Nuisance dust may affect the lungs but reactions are typically reversible.

Chronic (Delayed)

- Chronic overexposure to dust containing respirable sized crystalline silica can cause delayed lung injury (silicosis). Inhalation of dust containing crystalline silica pulmonary diseases such as asthma and lung disorder associated with smoking.

Skin

Acute (Immediate)

- Exposure to dust may cause mechanical irritation.

Chronic (Delayed)

- No data available.

Eye

Acute (Immediate)

- Excessive concentrations of nuisance dust in the workplace may reduce visibility and may cause unpleasant deposits in eyes.

Chronic (Delayed)

- No data available.

Ingestion

Acute (Immediate)

- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.

Chronic (Delayed)

- No data available.

Carcinogenic Effects

- This material does contain components that may cause cancer, however based on regulatory criteria this material is not classified as a carcinogen.

Carcinogenic Effects			
	CAS	IARC	NTP
Cristobalite	14464-46-1	Group 1-Carcinogenic	Not Listed
Quartz	14808-60-7	Group 1-Carcinogenic	Known Human Carcinogen

Key to abbreviations

LD = Lethal Dose

Section 12 - Ecological Information

Toxicity

- Material data lacking.

Persistence and degradability

- Material data lacking.

Bioaccumulative potential

- Material data lacking.

Mobility in Soil

- Material data lacking.

Other adverse effects

- No studies have been found.

Section 13 - Disposal Considerations

Waste treatment methods

Product waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	UN number	UN proper shipping name	Transport hazard class (es)	Packing group	Environmental hazards
DOT	NDA	Not Regulated	NDA	NDA	NDA
TDG	NDA	Not Regulated	NDA	NDA	NDA
IATA/ICAO	NDA	Not Regulated	NDA	NDA	NDA

Special precautions for user

- None specified.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

- No data available

Section 15 - Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications

- Chronic

State Right To Know				
Component	CAS	MA	NJ	PA
Aluminum oxide	1344-28-1	Yes	Yes	Yes
Non Wetting Agent	Proprietary	Yes	Yes	Yes
Calcium oxide	1305-78-8	Yes	Yes	Yes
Cement, alumina, chemicals	65997-16-2	No	No	No
Cristobalite	14464-46-1	Yes	Yes	Yes
Diphosphoric acid, sodium salt (1:4)	7722-88-5	Yes	Yes	Yes
Iron oxide	1309-37-1	Yes	Yes	Yes
Mullite	1302-93-8	No	No	No

Potassium oxide	12136-45-7	No	Yes	No
Quartz	14808-60-7	Yes	Yes	Yes
Amorphous silica fume	69012-64-2	No	No	No
Silica, amorphous	7631-86-9	Yes	Yes	Yes
Silicon carbide	409-21-2	Yes	Yes	Yes
Sodium hydroxide	1310-73-2	Yes	Yes	Yes
Titanium dioxide	13463-67-7	Yes	Yes	Yes
Dispersing Agent 1	<i>Proprietary</i>	Yes	No	Yes
Zirconium oxide	1314-23-4	Yes	No	No

Inventory			
Component	CAS	Canada DSL	TSCA
Aluminum oxide	1344-28-1	Yes	Yes
Non Wetting Agent	<i>Proprietary</i>	Yes	Yes
Calcium oxide	1305-78-8	Yes	Yes
Cement, alumina, chemicals	65997-16-2	Yes	Yes
Cristobalite	14464-46-1	Yes	Yes
Diphosphoric acid, sodium salt (1:4)	7722-88-5	Yes	Yes
Iron oxide	1309-37-1	Yes	Yes
Mullite	1302-93-8	Yes	Yes
Potassium oxide	12136-45-7	Yes	Yes
Quartz	14808-60-7	Yes	Yes
Amorphous silica fume	69012-64-2	Yes	Yes
Silica, amorphous	7631-86-9	Yes	Yes
Silicon carbide	409-21-2	Yes	Yes
Sodium hydroxide	1310-73-2	Yes	Yes
Titanium dioxide	13463-67-7	Yes	Yes
Dispersing Agent 1	<i>Proprietary</i>	Yes	Yes
Zirconium oxide	1314-23-4	Yes	Yes

Canada

Labor

Canada - WHMIS - Classifications of Substances

• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	E
• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Calcium oxide	1305-78-8	E
• Iron oxide	1309-37-1	Uncontrolled product according to WHMIS classification criteria E (including 0.04% in aqueous

• Sodium hydroxide	1310-73-2	solution, 0.04N, 0.08%, 0.4% in aqueous solution, 2%, 2.5%, 4% in aqueous solution, 5%, 10%, 16%, 20%, 40%, 50% in aqueous solution, 8.7N)
• Titanium dioxide	13463-67-7	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Titanium dioxide, mixture containing on Health Canada's WHMIS Division website.)
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	D2B (listed under Sodium pyrophosphate)
• Aluminum oxide	1344-28-1	Uncontrolled product according to WHMIS classification criteria
• Non Wetting Agent	<i>Proprietary</i>	Uncontrolled product according to WHMIS classification criteria
• Silicon carbide	409-21-2	Uncontrolled product according to WHMIS classification criteria
• Cristobalite	14464-46-1	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Silica, amorphous	7631-86-9	Uncontrolled product according to WHMIS classification criteria
• Zirconium oxide	1314-23-4	Uncontrolled product according to WHMIS classification criteria
• Quartz	14808-60-7	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
Canada - WHMIS - Ingredient Disclosure List		
• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Calcium oxide	1305-78-8	1 %
• Iron oxide	1309-37-1	1 %
• Sodium hydroxide	1310-73-2	1 %
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	1 %

• Aluminum oxide	1344-28-1	1 %
• Non Wetting Agent	<i>Proprietary</i>	Not Listed
• Silicon carbide	409-21-2	Not Listed
• Cristobalite	14464-46-1	1 %
• Silica, amorphous	7631-86-9	1 %
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	1 %

United States

Environment

U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities

• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Sodium hydroxide	1310-73-2	1000 lb final RQ; 454 kg final RQ
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Non Wetting Agent	<i>Proprietary</i>	Not Listed
• Silicon carbide	409-21-2	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed

U.S. - CERCLA/SARA - Section 313 - Emission Reporting

• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	1.0 % de minimis concentration (fibrous forms)
• Non Wetting Agent	<i>Proprietary</i>	Not Listed
• Silicon carbide	409-21-2	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Dispersing Agent 1	<i>Proprietary</i>	Not Listed
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Sodium hydroxide	1310-73-2	Not Listed
• Titanium dioxide	13463-67-7	carcinogen, 9/2/2011 (airborne, unbound particles of respirable size)
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	Not Listed
• Non Wetting Agent	<i>Proprietary</i>	Not Listed
• Silicon carbide	409-21-2	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	carcinogen, 10/1/1988 (airborne particles of respirable size)

United States - Pennsylvania

Labor

U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

• Cement, alumina, chemicals	65997-16-2	Not Listed
• Potassium oxide	12136-45-7	Not Listed
• Dispersing Agent 1	<i>Proprietary</i>	
• Mullite	1302-93-8	Not Listed
• Amorphous silica fume	69012-64-2	Not Listed
• Calcium oxide	1305-78-8	Not Listed
• Iron oxide	1309-37-1	Not Listed
• Sodium hydroxide	1310-73-2	
• Titanium dioxide	13463-67-7	Not Listed
• Diphosphoric acid, sodium salt (1:4)	7722-88-5	Not Listed
• Aluminum oxide	1344-28-1	
• Non Wetting Agent	<i>Proprietary</i>	Not Listed
• Silicon carbide	409-21-2	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Zirconium oxide	1314-23-4	Not Listed
• Quartz	14808-60-7	Not Listed

Other Information

- WARNING: This product contains a chemical known to the State of California to cause cancer.

Section 16 - Other Information

Revision Date	• 26/April/2018
Last Revision Date	• 16/February/2016

Preparation Date

- 01/June/2009

Disclaimer/Statement of Liability

- The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release. Reno Refractories MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the product is fit for a particular purpose and suitable for user's method of use or application. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key to abbreviations

NDA = No data available

Safety Data Sheet



Section 1: Identification

Product identifier

Product Name • **Reflite 30-90**

Product Code • 139407

Relevant identified uses of the substance or mixture and uses advised against

Recommended use • Refractory applications

Details of the supplier of the safety data sheet

Manufacturer • Reno Refractories, Inc.
PO Box 201
Morris, AL 35116
United States
www.renorefractories.com
sales@renorefractories.com

Telephone (General) • 205-647-0240

Emergency telephone number

Manufacturer • 1-800-262-8200 - CHEMTREC

Section 2: Hazard Identification

United States (US)

According to OSHA 29 CFR 1910.1200 HCS

Classification of the substance or mixture

OSHA HCS 2012 • Carcinogenicity 1A - H350
Specific Target Organ Toxicity Repeated Exposure 1 - H372

Label elements

OSHA HCS 2012

DANGER



Hazard statements • May cause cancer. - H350
Causes damage to organs - lungs through prolonged or repeated exposure - H372

Precautionary statements

Prevention • Obtain special instructions before use. - P201
Do not handle until all safety precautions have been read and understood. - P202
Do not breathe dust. - P260
Wash thoroughly after handling. - P264

Do not eat, drink or smoke when using this product. - P270
Wear protective gloves/protective clothing/eye protection/face protection. - P280
Response • IF exposed or concerned: Get medical advice/attention. - P308+P313
Get medical advice/attention if you feel unwell. - P314

Storage/Disposal • Dispose of content and/or container in accordance with local, regional, national, and/or international regulations. - P501

Other hazards

OSHA HCS 2012

- Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Canada

According to WHMIS

Classification of the substance or mixture

WHMIS

- Other Toxic Effects - D2A

Label elements

WHMIS



- Other Toxic Effects - D2A

Other hazards

WHMIS

- In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

Section 3 - Composition/Information on Ingredients

Substances

- Material does not meet the criteria of a substance.

Mixtures

Composition					
Chemical Name	Identifiers	%	LD50/LC50	Classifications According to Regulation/Directive	Comments
Aluminum(III) silicate (2:1)	CAS:1302-76-7	32.3% TO 38%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Cement, alumina, chemicals	CAS:65997-16-2	10% TO 27%	NDA	OSHA HCS 2012: Not Classified	NDA
Mullite	CAS:1302-93-8	14.95% TO 16.25%	NDA	OSHA HCS 2012: STOT RE 2 (Lungs)	NDA
Perlite	CAS:93763-70-3	7% TO 8.5%	NDA	OSHA HCS 2012: Not Classified	NDA
Cristobalite	CAS:14464-46-1	3.45% TO 6.29%	NDA	OSHA HCS 2012: Carc. 1A	NDA
Silica, amorphous	CAS:7631-86-9	2.3% TO 5%	NDA	OSHA HCS 2012: Not Classified	NDA

Aluminum oxide	CAS: 1344-28-1	<= 4%	NDA	OSHA HCS 2012: Not Classified	NDA
Titanium dioxide	CAS: 13463-67-7	0.38% TO 2.033%	NDA	OSHA HCS 2012: Carc. 2	NDA
Sodium silicate	CAS: 1344-09-8	0% TO 0.3468%	Ingestion/Oral-Rat LD50 • 1960 mg/kg Skin-Rabbit LD50 • >4640 mg/kg	OSHA HCS 2012: Skin Irrit 2, Eye Irrit 2, Acute Tox 4 (orl)	NDA
1-Propene, homopolymer	CAS: 9003-07-0	0% TO 0.1287%	Ingestion/Oral-Rat LD50 • >8 g/kg	OSHA HCS 2012: Not Classified	NDA
Zirconium	CAS: 7440-67-7	0% TO 0.102%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA
Magnesium oxide	CAS: 1309-48-4	0% TO 0.081%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA
Quartz	CAS: 14808-60-7	<= 0.04%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA
Iron oxide	CAS: 1309-37-1	0% TO 0.003%	NDA	OSHA HCS 2012: Exposure limit(s)	NDA

Section 4: First-Aid Measures

Description of first aid measures

Inhalation

- Move victim to fresh air. Administer oxygen if breathing is difficult. Give artificial respiration if victim is not breathing. Get medical attention immediately.

Skin

- In case of contact with substance, immediately flush skin with running water for at least 20 minutes. If skin irritation occurs: Get medical advice/attention.

Eye

- In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.

Ingestion

- Rinse mouth. Do not give anything by mouth to an unconscious person. Get medical attention immediately.

Most important symptoms and effects, both acute and delayed

- Refer to Section 11 - Toxicological Information.

Indication of any immediate medical attention and special treatment needed

Notes to Physician

- All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Section 5: Fire-Fighting Measures

Extinguishing media

- Suitable Extinguishing Media** • Material is non-combustible. In case of fire use media as appropriate for surrounding fire.

- Unsuitable Extinguishing Media** • None known.

Special hazards arising from the substance or mixture

- Unusual Fire and Explosion Hazards** • None known.

- Hazardous Combustion Products** • None known.

Advice for firefighters

- Wear positive pressure self-contained breathing apparatus (SCBA).

Structural firefighters' protective clothing will only provide limited protection. Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.

Section 6 - Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Personal Precautions

- Isolate hazard area and deny entry to unauthorized and/or unprotected personnel. Do not touch or walk through spilled material. Ensure adequate ventilation to remove vapors, fumes, dust etc.

Emergency Procedures

- Ventilate closed spaces before entering. Isolate hazard area and deny entry to unauthorized and/or unprotected personnel.

Environmental precautions

- No specific actions or treatments recommended related to exposure to this material.

Methods and material for containment and cleaning up

Containment/Clean-up Measures

- Avoid generating dust.
FOR SMALL SPILLS: Clean with a vacuum with a filtration system sufficient to remove and prevent recirculation of crystalline silica (a vacuum equipped with a high-efficiency particulate air (HEPA) filter is recommended).
FOR LARGE SPILLS: Use a fine spray or mist to control dust creation and carefully scoop or shovel into clean dry container for later reuse or disposal.
If, an appropriate vacuum is unavailable, only wet-clean-up methods should be used (i.e. misting). Moisture should be added as necessary to reduce exposure to airborne respirable silica dust.

Section 7 - Handling and Storage

Precautions for safe handling

Handling

- Do not breathe dust. Wash thoroughly after handling. Do not use in areas without adequate ventilation. Avoid contact with skin, eyes, and clothing. Minimize dust generation and accumulation. Use good safety and industrial hygiene practices. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Wear long sleeves and/or protective coveralls. Contaminated clothing must be vacuumed before removal. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reuse.

Conditions for safe storage, including any incompatibilities

Storage

- Store in a covered location. Keep container closed. Keep from freezing. Storage and work area should be periodically cleaned to minimize dust accumulation.

Section 8 - Exposure Controls/Personal Protection

Control parameters

Exposure Limits/Guidelines						
	Result	ACGIH	Canada Ontario	Canada Quebec	Mexico	NIOSH
Iron oxide (1309-37-1)	STELs	Not established	Not established	Not established	10 mg/m3 STEL [LMPE-CT] (as Fe)	Not established
	TWAs	5 mg/m3 TWA (respirable fraction)	5 mg/m3 TWA (respirable)	5 mg/m3 TWAEV (dust and fume, as Fe); 10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, regulated under Rouge, total dust)	5 mg/m3 TWA LMPE- PPT	5 mg/m3 TWA (dust and fume, as Fe)

Zirconium as Zirconium compounds	STELs	10 mg/m3 STEL	10 mg/m3 STEL	10 mg/m3 STEV	10 mg/m3 STEL [LMPE-CT] (as Zr) <i>as Zirconium compounds</i>	10 mg/m3 STEL
	TWAs	5 mg/m3 TWA	5 mg/m3 TWA	5 mg/m3 TWAEV	5 mg/m3 TWA LMPE-PPT (as Zr) <i>as Zirconium compounds</i>	5 mg/m3 TWA
Magnesium oxide (1309-48-4)	TWAs	10 mg/m3 TWA (inhalable fraction)	10 mg/m3 TWA (inhalable)	10 mg/m3 TWAEV (fume, as Mg)	10 mg/m3 TWA LMPE-PPT (fume, as Mg)	Not established
Quartz (14808-60-7)	TWAs	0.025 mg/m3 TWA (respirable fraction)	0.10 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.1 mg/m3 TWAEV (respirable dust)	0.1 mg/m3 TWA LMPE-PPT (respirable fraction)	0.05 mg/m3 TWA (respirable dust)
Titanium dioxide (13463-67-7)	STELs	Not established	Not established	Not established	20 mg/m3 STEL [LMPE-CT] (as Ti)	Not established
	TWAs	10 mg/m3 TWA	10 mg/m3 TWA	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust)	10 mg/m3 TWA LMPE-PPT (as Ti)	Not established
Silica, amorphous (7631-86-9)	TWAs	Not established	Not established	Not established	Not established	6 mg/m3 TWA
Cristobalite (14464-46-1)	TWAs	0.025 mg/m3 TWA (respirable fraction)	0.05 mg/m3 TWA (designated substances regulation, respirable, listed under Silica, crystalline)	0.05 mg/m3 TWAEV (respirable dust)	0.05 mg/m3 TWA LMPE-PPT (respirable fraction)	0.05 mg/m3 TWA (respirable dust)
Aluminum oxide (1344-28-1)	TWAs	1 mg/m3 TWA (respirable fraction) <i>as Aluminum insoluble compounds</i>	1 mg/m3 TWA (respirable) <i>as Aluminum insoluble compounds</i>	10 mg/m3 TWAEV (containing no Asbestos and <1% Crystalline silica, total dust, as Al)	10 mg/m3 TWA LMPE-PPT	Not established
Perlite (93763-70-3)	TWAs	Not established	10 mg/m3 TWA (containing no Asbestos and <1% Crystalline silica)	Not established	10 mg/m3 TWA LMPE-PPT	10 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable dust)
Cement, alumina, chemicals as Particulates not otherwise classified (PNOC)	TWAs	10 mg/m3 TWA (inhalable particles, recommended); 3 mg/m3 TWA (respirable particles, recommended) <i>as Particulates not otherwise classified (PNOC)</i>	10 mg/m3 TWA (inhalable); 3 mg/m3 TWA (respirable) <i>as Particulates not otherwise classified (PNOC)</i>	10 mg/m3 TWAEV (including dust, inert or nuisance particulates; containing no Asbestos and <1% Crystalline silica, total dust) <i>as Particulates not otherwise classified (PNOC)</i>	Not established	Not established

Exposure Limits/Guidelines (Con't.)		
	Result	OSHA
Iron oxide (1309-37-1)	TWAs	10 mg/m ³ TWA (fume); 15 mg/m ³ TWA (total dust, listed under Rouge); 5 mg/m ³ TWA (respirable fraction, listed under Rouge)
Zirconium	TWAs	5 mg/m ³ TWA (as Zr) <i>as Zirconium compounds</i>
Magnesium oxide (1309-48-4)	TWAs	15 mg/m ³ TWA (fume, total particulate)
Titanium dioxide (13463-67-7)	TWAs	15 mg/m ³ TWA (total dust)
Aluminum oxide (1344-28-1)	TWAs	15 mg/m ³ TWA (total dust); 5 mg/m ³ TWA (respirable fraction)
Cement, alumina, chemicals	TWAs	15 mg/m ³ TWA (total dust); 5 mg/m ³ TWA (respirable fraction) <i>as Particulates not otherwise classified (PNOC)</i>

Exposure controls

Engineering Measures/Controls

- Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values. Ensure that dust handling systems (such as exhaust ducts, dust collectors, vessels and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is not leakage from the equipment). Collection systems must be designed and maintained to prevent the accumulation and recirculation of respirable silica into the workplace.

Personal Protective Equipment

Respiratory

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face

- Wear protective eyewear (goggles, face shield, or safety glasses).

Hands

- Wear appropriate gloves.

Skin/Body

- Wear long sleeves and/or protective coveralls.

General Industrial Hygiene Considerations

- Do not breathe dust. Avoid contact with skin, eyes or clothing. Do not remove dusts from clothing by blowing or shaking. Do not eat, drink or smoke during work. Wash thoroughly after handling. Handle in accordance with good industrial hygiene and safety practice.

Environmental Exposure Controls

- Follow best practice for site management and disposal of waste. Dispose of in an approved landfill.

Key to abbreviations

ACGIH = American Conference of Governmental Industrial Hygiene

STEL = Short Term Exposure Limits are based on 15-minute exposures

NIOSH = National Institute of Occupational Safety and Health

OSHA = Occupational Safety and Health Administration

TWAEV = Time-Weighted Average Exposure Value

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

Section 9 - Physical and Chemical Properties

Information on Physical and Chemical Properties

Material Description			
Physical Form	Solid	Appearance/Description	Gray granular dry powder with an earthy odor.
Color	Gray	Odor	Earthy
Particulate Size	600 µ	Odor Threshold	No data available
General Properties			
Boiling Point	No data available	Melting Point	No data available
Decomposition Temperature	No data available	pH	No data available
Specific Gravity/Relative Density	2.53 Water=1	Density	No data available
Water Solubility	Negligible < 0.1 %	Viscosity	No data available
Explosive Properties	No data available		
Volatility			
Vapor Pressure	No data available	Vapor Density	No data available
Evaporation Rate	No data available	VOC (Wt.)	0 %
Flammability			
Flash Point	No data available	UEL	No data available
LEL	No data available	Autoignition	No data available
Flammability (solid, gas)	Not flammable.		
Environmental			
Octanol/Water Partition coefficient	No data available		

Section 10: Stability and Reactivity

Reactivity

- No dangerous reaction known under conditions of normal use.

Chemical stability

- Stable under normal temperatures and pressures.

Possibility of hazardous reactions

- Hazardous polymerization will not occur.

Conditions to avoid

- No data available

Incompatible materials

- No data available

Hazardous decomposition products

- No data available

Section 11 - Toxicological Information

Information on toxicological effects

Component Name	CAS	Data
Silica, amorphous (2.3% TO 5%)	7631-86-9	Irritation: eye-rbt 25 mg/24H MLD
Perlite (7% TO 8.5%)	93763-70-3	Acute Toxicity: orl-mus LD50:12960 mg/kg
Titanium dioxide (0.38% TO 2.033%)	13463-67-7	Irritation: skn-hmn 300 ug/3D-I MLD; Tumorigen/Carcinogen: ihl-rat TCLo:250 mg/m3/6H/2Y-I
1-Propene, homopolymer (0% TO 0.1287%)	9003-07-0	Acute Toxicity: orl-rat LD50:>8 gm/kg
Sodium silicate (0% TO 0.3468%)	1344-09-8	Acute Toxicity: orl-rat LD50:1960 mg/kg; skn-rbt LD50:>4640 mg/kg; Irritation: eye-rbt 10 mg/24H SEV; skn-rbt 500 mg/24H SEV

GHS Properties	Classification
Acute toxicity	OSHA HCS 2012 • No data available
Aspiration Hazard	OSHA HCS 2012 • No data available
Carcinogenicity	OSHA HCS 2012 • Carcinogenicity 1A
Germ Cell Mutagenicity	OSHA HCS 2012 • No data available
Skin corrosion/Irritation	OSHA HCS 2012 • No data available
Skin sensitization	OSHA HCS 2012 • No data available
STOT-RE	OSHA HCS 2012 • Specific Target Organ Toxicity Repeated Exposure 1
STOT-SE	OSHA HCS 2012 • No data available
Toxicity for Reproduction	OSHA HCS 2012 • No data available
Respiratory sensitization	OSHA HCS 2012 • No data available
Serious eye damage/Irritation	OSHA HCS 2012 • No data available

Target Organs

Route(s) of entry/exposure

Medical Conditions

Aggravated by Exposure

Potential Health Effects

Inhalation

Acute (Immediate)

Chronic (Delayed)

- Lungs
- Inhalation, Skin, Eye, Ingestion
- Any pre-existing conditions of the lungs. Disorders of the lungs.

- Nuisance dust may affect the lungs but reactions are typically reversible.
- Chronic overexposure to dust containing respirable sized crystalline silica can cause delayed lung injury (silicosis). Inhalation of dust containing crystalline silica pulmonary diseases such as asthma and lung disorder associated with smoking.

Skin

Acute (Immediate)

Chronic (Delayed)

- Exposure to dust may cause mechanical irritation.
- No data available.

Eye

Acute (Immediate)

Chronic (Delayed)

- Excessive concentrations of nuisance dust in the workplace may reduce visibility and may cause unpleasant deposits in eyes.
- No data available.

Ingestion

Acute (Immediate)

Chronic (Delayed)

- Excessive concentrations of nuisance dust in the workplace may cause mechanical irritation to mucous membranes.
- No data available.

Carcinogenic Effects

- May cause cancer. IARC studies have shown sufficient evidence from animal studies to categorize crystalline silica as a group 1 carcinogen.

Carcinogenic Effects			
	CAS	IARC	NTP
Quartz	14808-60-7	Group 1-Carcinogenic	Known Human Carcinogen
Titanium dioxide	13463-67-7	Group 2B-Possible Carcinogen	Evidence of Carcinogenicity
Cristobalite	14464-46-1	Group 1-Carcinogenic	Not Listed

Key to abbreviations

MLD = Mild

TC = Toxic Concentration

LD = Lethal Dose

SEV = Severe

Section 12 - Ecological Information

Toxicity

- Material data lacking.

Persistence and degradability

- Material data lacking.

Bioaccumulative potential

- Material data lacking.

Mobility in Soil

- Material data lacking.

Other adverse effects

- No studies have been found.

Section 13 - Disposal Considerations

Waste treatment methods

Product waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport Information

	UN number	UN proper shipping name	Transport hazard class (es)	Packing group	Environmental hazards
DOT	NDA	Not regulated	NDA	NDA	NDA
TDG	NDA	Not regulated	NDA	NDA	NDA
IATA/ICAO	NDA	Not regulated	NDA	NDA	NDA

Special precautions for user

- None known.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

- Not relevant.

Section 15 - Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications • No data available

State Right To Know				
Component	CAS	MA	NJ	PA
Aluminum oxide	1344-28-1	Yes	Yes	Yes
Cristobalite	14464-46-1	Yes	Yes	Yes
Magnesium oxide	1309-48-4	Yes	Yes	Yes
Perlite	93763-70-3	Yes	Yes	Yes
Quartz	14808-60-7	Yes	Yes	Yes
Silica, amorphous	7631-86-9	Yes	Yes	Yes
Sodium carbonate (2:1)	497-19-8	No	No	No
Sodium silicate	1344-09-8	No	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes

Inventory			
Component	CAS	Canada DSL	TSCA
Aluminum oxide	1344-28-1	Yes	Yes
Cristobalite	14464-46-1	Yes	Yes
Magnesium oxide	1309-48-4	Yes	Yes
Perlite	93763-70-3	Yes	No
Quartz	14808-60-7	Yes	Yes
Silica, amorphous	7631-86-9	Yes	Yes
Sodium carbonate (2:1)	497-19-8	Yes	Yes
Sodium silicate	1344-09-8	Yes	Yes
Titanium dioxide	13463-67-7	Yes	Yes

Canada

Labor

Canada - WHMIS - Classifications of Substances

• Perlite	93763-70-3	D2A (expanded, containing >0.1% Crystalline silica); Uncontrolled product according to WHMIS classification criteria (expanded)
• Magnesium oxide	1309-48-4	Uncontrolled product according to WHMIS classification criteria
• Titanium dioxide	13463-67-7	D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Titanium dioxide, mixture containing on Health

• Aluminum oxide	1344-28-1	Canada's WHMIS Division website.) Uncontrolled product according to WHMIS classification criteria
• Aluminum oxide as Aluminum insoluble compounds		Not Listed
• Sodium carbonate (2:1)	497-19-8	D2B, E D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Cristobalite	14464-46-1	
• Silica, amorphous	7631-86-9	Uncontrolled product according to WHMIS classification criteria
• Sodium silicate	1344-09-8	D2B (SiO ₂ :Na ₂ O ratio >2.4:1); E (SiO ₂ :Na ₂ O ratio <2.4:1) D2A (In certain cases, this classification does not apply. For more information, consult the section Substance Specific Issues - Silica, crystalline, encapsulated on Health Canada's WHMIS Division website.)
• Quartz	14808-60-7	

Canada - WHMIS - Ingredient Disclosure List

• Perlite	93763-70-3	Not Listed
• Magnesium oxide	1309-48-4	1 %
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	1 %
• Aluminum oxide as Aluminum insoluble compounds		Not Listed
• Sodium carbonate (2:1)	497-19-8	1 %
• Cristobalite	14464-46-1	1 %
• Silica, amorphous	7631-86-9	1 %
• Sodium silicate	1344-09-8	Not Listed
• Quartz	14808-60-7	1 %

United States

Environment

U.S. - CERCLA/SARA - Section 313 - Emission Reporting

• Perlite	93763-70-3	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	1.0 % de minimis concentration (fibrous forms)
• Aluminum oxide as Aluminum insoluble compounds		Not Listed
• Sodium carbonate (2:1)	497-19-8	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Sodium silicate	1344-09-8	Not Listed
• Quartz	14808-60-7	Not Listed

United States - California

Environment

U.S. - California - Proposition 65 - Carcinogens List

• Perlite	93763-70-3	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Titanium dioxide	13463-67-7	carcinogen, initial date 9/2/11 (airborne, unbound particles of respirable size)
• Aluminum oxide	1344-28-1	Not Listed
• Aluminum oxide as Aluminum insoluble compounds		Not Listed
• Sodium carbonate (2:1)	497-19-8	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Sodium silicate	1344-09-8	Not Listed
• Quartz	14808-60-7	carcinogen, initial date 10/1/88 (airborne particles of respirable size)

United States - Pennsylvania

Labor

U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

• Perlite	93763-70-3	Not Listed
• Magnesium oxide	1309-48-4	Not Listed
• Titanium dioxide	13463-67-7	Not Listed
• Aluminum oxide	1344-28-1	
• Aluminum oxide as Aluminum insoluble compounds		Not Listed
• Sodium carbonate (2:1)	497-19-8	Not Listed
• Cristobalite	14464-46-1	Not Listed
• Silica, amorphous	7631-86-9	Not Listed
• Sodium silicate	1344-09-8	Not Listed
• Quartz	14808-60-7	Not Listed

Section 16 - Other Information

Last Revision Date

- 04/February/2014

Preparation Date

- 01/June/2009

Disclaimer/Statement of Liability

- The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release. Reno Refractories MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the product is fit for a particular purpose and suitable for user's method of use or application. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Key to abbreviations

NDA = No data available

SAFETY DATA SHEET

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

1.1 Product Identifier

Trade Names:

**PYROLITE; PYROBOARD; PYROBOARD GH;
FORMCAST 60; FORMCAST 75; FORMCAST 110**

Substance Name:

Mixture containing Refractory Ceramic Fibers (RCF)/Alumino-Silicate Wools (ASW)

Index Number: 650-017-00-8 (CLP Annex VI)

CAS Number: 142844-00-6

CAS Name: refractories, fibers, aluminosilicate

Registration Number: 01-2119458050-50-000x

1.2 Relevant Identified Uses

Refractory shapes for "professional users" in industrial applications involving high temperature, heat treating, and molten metal processing.

1.3 Details of the Supplier of the SDS



P.O. Box 287

Howell, MI 48844

(517) 223-3787, (517) 338-5062, fax

info@rexmaterials.com

1.4 Emergency Telephone Number

Chemtrec North America: (800) 424-9300

Chemtrec Outside North America: +1 (703) 527-3887

2. HAZARDS IDENTIFICATION

2.1 Classification of the Substance or Mixture

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). Under OSHA HCS 2012, RCF is classified as a Category 2 carcinogen.

2.2 Labeling Elements

2.2.1 Hazard Pictogram



2.2.2 Signal Word

Warning

2.2.3 Hazard Statements

Suspected of causing cancer by inhalation.

2.2.4 Precautionary Statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see section 8 of the Safety Data Sheet

If concerned about exposure, get medical advice.

Store in a manner to minimize airborne dust.

Dispose of waste in accordance with local, state and federal regulations.

2.3 Other Hazards

Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

2.4 Hazardous Materials Identification System (HMIS)

Health: 1* Flammability: 0 Reactivity: 0 Personal Protection Index: X (Employer Determined)

(* denotes potential for chronic effects)

3. COMPOSITION/INFORMATION ON INGREDIENTS

Name	CAS No	Index or EINECS No.	Weight %	Classification HCS 2012
RCF/ASW	142844-00-6	650-017-00-8	40-95	Category 2 carc.
Amorphous Silica	7631-86-9	231-545-4	0-60	not classified
Inert Materials	na	na	0-40	na

4. FIRST AID MEASURES

4.1 Description of First Aid Measures

4.1.1 Inhalation:

If respiratory tract irritation develops, move the person to a dust free location. Get medical attention if the irritation continues. See Section 8 for additional measures to reduce or eliminate exposure.

4.1.2 Eye Contact:

If eyes become irritated, flush immediately with large amounts of lukewarm water. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

4.1.3 Skin Irritation:

Handling of this material may cause mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful.

4.1.4 Ingestion:

If gastrointestinal tract irritation develops, move the person to a dust free environment.

4.2 Most Important Symptoms and Effects, Both Acute and Delayed

Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

4.3 Indication of any Immediate Medical Attention and Special Treatment Needed.

Treat symptomatically. Skin and respiratory effects are the result of temporary, mild mechanical irritation; exposure does not result in allergic manifestations.

5. FIREFIGHTING MEASURES

5.1 Extinguishing Media

Products are non-combustible. Use extinguishing media suitable for type of surrounding combustible materials.

5.2 Special Hazards Arising from the Substance or Mixture

See Section 10.6 (due to starch burnout).

5.3 Advice for Firefighters

Use protective equipment and precautions appropriate for type of surrounding fire.

5.4 National Fire Protection Association (NFPA) Codes

Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures

Avoid dust formation. Use protective equipment and evacuate unnecessary personnel if appropriate. See Section 8, Exposure Controls/Personal Protection.

6.2 Environmental Precautions

None known.

6.3 Methods for Cleaning Up

Pick up and arrange disposal with minimal dust creation. Vacuum (HEPA) or wet sweep as appropriate. Do not use compressed air for clean up.

7. HANDLING AND STORAGE

7.1 Precautions for Safe handling

Avoid dust formation and its accumulation. Handle in accordance with good industrial hygiene and safety practices. Limit the use of power tools unless in conjunction with local exhaust ventilation. Wear personal protective equipment as outlined in Section 8.2.2.

7.2 Conditions for Safe Storage, Including and Incompatibilities

Keep dry. Protect against water and moisture. Product packaging may contain residue. Do not reuse. Minimize dust emissions during unpacking.

7.3 Specific End Use(s)

See Section 1.2.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control Parameters

Industrial hygiene standards and occupational exposure limits vary between countries and local jurisdictions. Check which exposure levels apply to your facility and comply with local regulations. A qualified industrial hygienist can assist with specific workplace evaluation including recommendations for respiratory protection. Examples of national exposure limits are provided in the table below.

	Exposure Limits		
	RCF/ASW	Amorphous Silica	Inert Materials
US OSHA	na*	80 mg/m ³ / % SiO ₂	5 mg/m ³ (resp.)
ACGIH	0.2 f/cc	10 mg/m ³	10 mg/m ³
Argentina	0.2 f/cc	na	10 mg/ m ³
Australia	0.5 f/cc	2 mg/m ³	10 mg/ m ³
Austria	0.5 f/cc	0.3 mg/m ³	6 mg/ m ³
Belgium	0.5 f/cc	na	3 mg/ m ³
Canada	0.2-1.0 f/cc	na	na
Denmark	1.0 f/cc	na	5 mg/ m ³
Egypt	na	na	na
EU	na	na	na
Finland	0.2 f/cc	na	na
France	0.1 f/cc	na	5 mg/ m ³
Germany	0.2 f/cc	4 mg/m ³	3 mg/ m ³
Hungary	na	na	na
Iceland	1.0 f/cc	na	na
India	na	10 mg/m ³	na
Italy	0.2 f/cc	na	3 mg/ m ³
Poland	0.5 f/cc	na	na
Spain	0.5 f/cc	na	3 mg/ m ³
Sweden	0.2 f/cc	na	5 mg/ m ³
The Netherlands	0.5 f/cc	na	5 mg/ m ³
UK	1.0 f/cc	6 mg/m ³	4 mg/ m ³
United Arab Emirates	na	na	na
Venezuela	0.2 f/cc	na	na

* Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. In the absence of an OSHA PEL, the HTIW Coalition has adopted a recommended exposure guideline (REG) of 0.5 f/cc, as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see "Rationale for the Recommended Exposure Guideline" at Attachment II of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf.

8.2 Exposure Controls

8.2.1 Appropriate Engineering Controls:

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne particulate emissions. If necessary, consult an industrial hygienist to design workplace controls and practices.

8.2.2 Personal Protection Equipment:

Respiratory Protection:

When engineering and/or administrative controls are insufficient, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

Eye Protection:

Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

Skin Protection:

Wear gloves, head coverings, and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employers should ensure employees are thoroughly trained on the best practices to minimize or avoid non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR:	white, gray, or tan board or shape / no odor
pH:	na
MELTING POINT:	>1650° C (3002° F)
BOILING POINT:	na
FLASH POINT:	na
EVAPORATION RATE:	na
FLAMMABILITY:	non-flammable
EXPLOSIVE LIMITS:	not explosive
VAPOR PRESSURE:	na
VAPOR DENSITY (Air = 1):	na
BULK DENSITY:	0.2-1.2 g/cc
SOLUBILITY (%):	insoluble
PARTITION COEFFICIENT:	na
AUTO-IGNITION TEMPERATURE:	na
DECOMPOSITION TEMPERATURE:	na (see Section 10.6)
VISCOSITY:	na for a solid

10. STABILITY AND REACTIVITY

10.1 Reactivity

None.

10.2 Chemical Stability

Stable under conditions of normal use.

10.3 Possibility of Hazardous Reactions

None.

10.4 Conditions to Avoid

None. Please refer to handling and storage advice in Section 7.

10.5 Incompatible Materials

None.

10.6 Hazardous Decomposition Products

During the first exposure to temperatures above about 200°C (392°F), an organic binder, if present, may start to oxidize releasing smoke, carbon monoxide, and carbon dioxide. Use adequate ventilation or other precautions to avoid exposure to resultant vapors. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity, or an asthmatic-type response.

Exposure to temperatures above approximately 1000°C (1832°F) may lead to the formation of crystalline silica. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" material. Please refer to Section 11.4 for more information on "after-service" RCF.

11. TOXICOLOGICAL INFORMATION

Pyrolite, Pyroboard, and Formcast products vary in hardness and friability. Especially if cut, ground, or otherwise broken up, exposure may be possible, predominantly by inhalation or ingestion of the dusts. The primary and most significant constituent of the dust is RCF/ASW, so the toxicological information provided below is exclusively related to RCF/ASW.

HEALTH DATA SUMMARY

Epidemiological studies that include most people who have ever worked in domestic RCF production have indicated no increased incidence of respiratory disease or other significant health effects in occupationally exposed workers. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

11.1 Toxicokinetics, Metabolism and Distribution

11.1.1 Basic Toxicokinetic

Exposure is predominantly by inhalation or ingestion. Man made vitreous fibers of a similar size to RCF/ASW have not been shown to migrate from the lung and/or gut and do not become located in other parts of the body. When compared to many naturally occurring minerals, RCF/ASW has a low ability to persist and accumulate in the body (half-life of long fibers (>20 µm) in 3 week rat inhalation test is approx. 60 days).

11.1.2 Human Toxicological data

In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in Europe and USA have demonstrated an absence of interstitial fibrosis and no decrement in lung function associated with current exposures, but have indicated a reduction of lung capacity among smokers.

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the USA longitudinal study.

The USA mortality study did not show evidence of increased lung tumor development either in the lung parenchyma or in the pleura.

11.2 Information on Toxicological effects

Acute toxicity: short term inhalation

No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.

Acute toxicity: oral

No data available: Repeated dose studies have been carried out using gavage. No effect was found.

Skin corrosion/irritation:

Not a chemical irritant according to test method OECD no. 404

Serious eye damage/irritation:

Not possible to obtain acute toxicity information due to the nature of the substance

Respiratory or skin sensitization

No evidence from human epidemiological studies of any respiratory or skin sensitization potential

Germ cell mutagenicity

Method: In vitro micronucleus test

Species: Hamster (CHO)

Dose: 1-35 mg/ml

Routes of administration: In suspension

Results: Negative

Carcinogenicity

Method: Inhalation. Multi-dose

Species: Rat,

Dose: 3 mg/m³, 9 mg/m³ and 16 mg/m³

Routes of administration: Nose only inhalation

Results: Fibrosis just reached significant levels at 16 and 9 mg/m³ but not at 3 mg/m³. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation. Single dose

Species: Rat

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: This study was designed to test the chronic toxicity and carcinogenicity of RCF at extreme exposures. Tumor incidence (incl. mesothelioma) was raised at this dose level. The presence of overload conditions (only detected after the experiment was completed), whereby the delivered dose exceeded the clearance capability of the lung, makes meaningful conclusions in terms of hazard and risk assessment difficult.

Method: Inhalation. Single dose

Species: Hamster

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: This low quality study in hamsters (no justification for exposure concentration used and pre existing and concurrent infections in the test animals) produced mesothelial lesions of uncertain significance. Subsequent studies in hamsters with glass fibers indicated that the lung burdens of RCF in this experiment were between 5 and 10 times more than that needed to produce overload, and the results are therefore difficult to interpret.

There are reports of injection studies with some similar materials. While some intraperitoneal injection (IP) studies reported the development of tumors in rats, the relationship of these results to classification remains controversial. Interpretation of these animal experiments is complex, and there is not agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utel and Maxim 2010.

Reproductive toxicity;

Method: Gavage

Species: Rat

Dose: 250 mg/kg/day

Routes of administration: Oral

Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

STOT-Single exposure; NA
STOT-Repeated exposure; NA
Aspiration hazard: NA

11.3 Irritant Properties

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans. Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

11.4 Other Information

After-service RCF may contain various crystalline phases, generally confined to a thin layer of material at the "hot-face" side of these products. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the EPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 microg/cm²; by comparison, pure quartz or cristobalite, two of the primary phases of silica, were significantly active at much lower levels circa 20 microg/cm².

11.5 International Agency for Research on Cancer and National Toxicology Program

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION

These products are inert materials that remain stable overtime. They are insoluble in the natural environment and are chemically identical to inorganic compounds found in the soil and sediment. No adverse effects on the environment have been identified or are anticipated.

13. DISPOSAL CONSIDERATIONS

13.1 Waste Treatment

Waste from these products may be generally disposed of at a landfill which has been licensed for this purpose. Unless wetted, such a waste may be dusty and should be properly sealed in containers for disposal. At some authorized disposal sites, dusty waste may be treated differently in order to ensure they are dealt with promptly and to avoid being wind blown. This product, as manufactured, is not classified as a listed or characteristic hazardous waste according to U. S. Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements.

Under U. S. Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

13.2 Additional Information

When disposing of waste and assigning European Waste Code, any possible contamination during use will need to be considered and expert guidance sought as necessary. Please check for any national and/or regional regulations, and refer to the European list (Decision No 2000/532/CE as modified) to identify appropriate waste numbers.

14. TRANSPORT INFORMATION

Not classified as dangerous goods under relevant international transport regulations (ADR, RID, ICAO/IATA, IMDG, ADN).

15. REGULATORY INFORMATION

15.1 U.S. Regulations

EPA:

Superfund Amendments and Reauthorization Act (SARA) Title III - This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).

Hazard Categories

Immediate Hazard – No

Delayed Hazard – Yes

Fire Hazard – No

Pressure Hazard – No

Reactivity Hazard - No

Toxic Substances Control Act (TSCA) – RCF has been assigned a CAS number; however, it is a simple mixture and therefore not required to be listed on the TSCA inventory. Other substances in this product are listed, as required, on the TSCA inventory. The components of RCF are listed on the inventory.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the **Clean Air Act (CAA)** RCF contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.

OSHA:

Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

California:

"Ceramic fibers (airborne particles of respirable size)" is listed in **Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.

Other States:

RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

15.2 European Regulations

RCF is classified under the CLP (classification, labeling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

15.3 Canadian Regulations

Canadian Workplace Hazardous Materials Information System (WHMIS) - RCF is classified as Class D2A – Materials Causing Other Toxic Effects.

Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL).

16. OTHER INFORMATION

16.1 Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
ADR	Transport by road, Council Directive 94/55/EC
ASW	Alumino-Silicate Wool
CARE	Controlled and Reduced Exposure
CAS	Chemical Abstracts Service
CLP	Regulation (EC) No 1272/2008 on Classification, Labeling and Packaging of substances and mixtures
DSL	Domestic Substance List
EEA	European Economical Area
ECFIA	European Ceramic Fibre Industry Association
EINECS	European Inventory of Existing Chemical Substances
EPA	Environmental Protection Agency
EU	European Union
f/cc	fibers per cubic centimeter
g/cc	grams per cubic centimeter
GHS	Globally Harmonized System of Classification and Labeling Chemicals
HCS 2012	Hazard Communication Standard of 2012
HNOC	Hazards Not Otherwise Classified
HTIWC	High Temperature Insulating Wool Coalition
IARC	International Agency for Research on Cancer
ICAO/IATA	Regulations relating to transport by air
IMDG	Regulations relating to transport by sea
mg/ m ³	milligrams per cubic meter
na	not available or not appropriate
OSHA	the U.S. Occupational Safety and Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCF	Refractory Ceramic Fiber
REACH	Regulation (EC) No 1907/2006 dated 18 December 2006 on Registration, Evaluation, Authorization and Restriction of Chemicals
RID	Transport by rail, Council Directive 96/49/EC
SARA	Superfund Amendment and Reauthorization Act
SDS	Safety Data Sheet (replaces MSDS, Material Safety Data Sheet)
STOT	Specific Target Organ systemic Toxicity
WHMIS	Workplace Hazardous Materials Information System

16.2 References

“Good Working Practices,” HTIW Coalition, July 2012, htiwcoalition.org
“CARE Guidance Documents,” ECFIA industrial hygiene guidance programme, ecfia.eu
“Hazards from the Use of Refractory Ceramic Fibre,” HSE 267 (1998)
Numerous other publications can be found at the websites of ECFIA and HTIWC.

16.3 Revision Summary

Rev 5 comprehensive revision to align with HCS 2012

The information contained herein is presented in good faith and is believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information available to them in their efforts to assure the health and safety of their employees and the proper use of the product. Given the summary nature of this document, Rex Materials Group does not make any warranty (express or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user. Further, Rex Materials Group disclaims any responsibility for damage or injury resulting from abnormal use of the product, failure to adhere to recommended practices, or any hazards inherent in the nature of the product.

SAFETY DATA SHEET

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

1.1 Product Identifier

Trade Names:

**PYROFORM HP; PYROFORM HP-45; PYROFORM PC;
PYROFORM PC-45; PYROLITE ADVANTAGE; PYROLITE
PLUS; PYROBOARD ADVANTAGE; PYROBOARD PLUS;
CA-10**

Substance Name:

**Mixture containing Refractory Ceramic Fibers (RCF)/Alumino-
Silicate Wools (ASW)**

Index Number: 650-017-00-8 (CLP Annex VI)

CAS Number: 142844-00-6

CAS Name: refractories, fibers, aluminosilicate

Registration Number: 01-2119458050-50-000x

1.2 Relevant Identified Uses

Refractory shapes for "professional users" in industrial applications involving high temperature, heat treating, and molten metal processing.

1.3 Details of the Supplier of the SDS



P.O. Box 287

Howell, MI 48844

(517) 223-3787, (517) 338-5062, fax

info@rexmaterials.com

1.4 Emergency Telephone Number

Chemtrec North America: (800) 424-9300

Chemtrec Outside North America: +1 (703) 527-3887

2. HAZARDS IDENTIFICATION

2.1 Classification of the Substance or Mixture

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). Under OSHA HCS 2012, RCF is classified as a Category 2 carcinogen.

2.2 Labeling Elements

2.2.1 Hazard Pictogram



2.2.2 Signal Word

Warning

2.2.3 Hazard Statements

Suspected of causing cancer by inhalation.

2.2.4 Precautionary Statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see section 8 of the Safety Data Sheet

If concerned about exposure, get medical advice.

Store in a manner to minimize airborne dust.

Dispose of waste in accordance with local, state and federal regulations.

2.3 Other Hazards

Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

2.4 Hazardous Materials Identification System (HMIS)

Health: 1* Flammability: 0 Reactivity: 0 Personal Protection Index: X (Employer Determined)

(* denotes potential for chronic effects)

3. COMPOSITION/INFORMATION ON INGREDIENTS

Name	CAS No	Index or EINECS No.	Weight %	Classification HCS 2012
RCF/ASW	142844-00-6	650-017-00-8	40-95	Category 2 carc.
Amorphous Silica	7631-86-9	231-545-4	0-60	not classified
Inert Materials	na	na	0-40	na

4. FIRST AID MEASURES

4.1 Description of First Aid Measures

4.1.1 Inhalation:

If respiratory tract irritation develops, move the person to a dust free location. Get medical attention if the irritation continues. See Section 8 for additional measures to reduce or eliminate exposure.

4.1.2 Eye Contact:

If eyes become irritated, flush immediately with large amounts of lukewarm water. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

4.1.3 Skin Irritation:

Handling of this material may cause mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful.

4.1.4 Ingestion:

If gastrointestinal tract irritation develops, move the person to a dust free environment.

4.2 Most Important Symptoms and Effects, Both Acute and Delayed

Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

4.3 Indication of any Immediate Medical Attention and Special Treatment Needed.

Treat symptomatically. Skin and respiratory effects are the result of temporary, mild mechanical irritation; exposure does not result in allergic manifestations.

5. FIREFIGHTING MEASURES

5.1 Extinguishing Media

Products are non-combustible. Use extinguishing media suitable for type of surrounding combustible materials.

5.2 Special Hazards Arising from the Substance or Mixture

See Section 10.6 (due to burnout and possible fluoride fumes).

5.3 Advice for Firefighters

Use protective equipment and precautions appropriate for type of surrounding fire.

5.4 National Fire Protection Association (NFPA) Codes

Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures

Avoid dust formation. Use protective equipment and evacuate unnecessary personnel if appropriate. See Section 8, Exposure Controls/Personal Protection.

6.2 Environmental Precautions

None known.

6.3 Methods for Cleaning Up

Pick up and arrange disposal with minimal dust creation. Vacuum (HEPA) or wet sweep as appropriate. Do not use compressed air for clean up.

7. HANDLING AND STORAGE

7.1 Precautions for Safe handling

Avoid dust formation and its accumulation. Handle in accordance with good industrial hygiene and safety practices. Limit the use of power tools unless in conjunction with local exhaust ventilation. Wear personal protective equipment as outlined in Section 8.2.2.

7.2 Conditions for Safe Storage, Including and Incompatibilities

Keep dry. Protect against water and moisture. Product packaging may contain residue. Do not reuse. Minimize dust emissions during unpacking.

7.3 Specific End Use(s)

See Section 1.2.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control Parameters

Industrial hygiene standards and occupational exposure limits vary between countries and local jurisdictions. Check which exposure levels apply to your facility and comply with local regulations. A qualified industrial hygienist can assist with specific workplace evaluation including recommendations for respiratory protection. Examples of national exposure limits are provided in the table below.

	RCF/ASW	Exposure Limits	
		Amorphous Silica	Inert Materials
US OSHA	na*	80 mg/m ³ / % SiO ₂	5 mg/m ³ (resp.)
ACGIH	0.2 f/cc	10 mg/m ³	10 mg/m ³
Argentina	0.2 f/cc	na	10 mg/ m ³
Australia	0.5 f/cc	2 mg/m ³	10 mg/ m ³
Austria	0.5 f/cc	0.3 mg/m ³	6 mg/ m ³
Belgium	0.5 f/cc	na	3 mg/ m ³
Canada	0.2-1.0 f/cc	na	na
Denmark	1.0 f/cc	na	5 mg/ m ³
Egypt	na	na	na
EU	na	na	na
Finland	0.2 f/cc	na	na
France	0.1 f/cc	na	5 mg/ m ³
Germany	0.2 f/cc	4 mg/m ³	3 mg/ m ³
Hungary	na	na	na
Iceland	1.0 f/cc	na	na
India	na	10 mg/m ³	na
Italy	0.2 f/cc	na	3 mg/ m ³
Poland	0.5 f/cc	na	na
Spain	0.5 f/cc	na	3 mg/ m ³
Sweden	0.2 f/cc	na	5 mg/ m ³
The Netherlands	0.5 f/cc	na	5 mg/ m ³
UK	1.0 f/cc	6 mg/m ³	4 mg/ m ³
United Arab Emirates	na	na	na
Venezuela	0.2 f/cc	na	na

* Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. In the absence of an OSHA PEL, the HTIW Coalition has adopted a recommended exposure guideline (REG) of 0.5 f/cc, as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see "Rationale for the Recommended Exposure Guideline" at Attachment II of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf.

8.2 Exposure Controls

8.2.1 Appropriate Engineering Controls:

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne particulate emissions. If necessary, consult an industrial hygienist to design workplace controls and practices.

8.2.2 Personal Protection Equipment:

Respiratory Protection:

When engineering and/or administrative controls are insufficient, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

Eye Protection:

Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

Skin Protection:

Wear gloves, head coverings, and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employers should ensure employees are thoroughly trained on the best practices to minimize or avoid non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR:	white, gray, or tan board or shape / no odor
pH:	na
MELTING POINT:	>1650° C (3002° F)
BOILING POINT:	na
FLASH POINT:	na
EVAPORATION RATE:	na
FLAMMABILITY:	non-flammable
EXPLOSIVE LIMITS:	not explosive
VAPOR PRESSURE:	na
VAPOR DENSITY (Air = 1):	na
BULK DENSITY:	0.2-1.2 g/cc
SOLUBILITY (%):	insoluble
PARTITION COEFFICIENT:	na
AUTO-IGNITION TEMPERATURE:	na
DECOMPOSITION TEMPERATURE:	na (see Section 10.6)
VISCOSITY:	na for a solid

10. STABILITY AND REACTIVITY

10.1 Reactivity

None.

10.2 Chemical Stability

Stable under conditions of normal use.

10.3 Possibility of Hazardous Reactions

None.

10.4 Conditions to Avoid

None. Please refer to handling and storage advice in Section 7.

10.5 Incompatible Materials

None.

10.6 Hazardous Decomposition Products

During the first exposure to temperatures above about 200°C (392°F), an organic binder, if present, may start to oxidize releasing smoke, carbon monoxide, and carbon dioxide. Exposure to temperatures above 1000° C (1832° F) may produce fluoride fumes. Use adequate ventilation or other precautions to avoid exposure to resultant vapors. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity, or an asthmatic-type response.

Exposure to temperatures above approximately 1000°C (1832°F) may lead to the formation of crystalline silica. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" material. Please refer to Section 11.4 for more information on "after-service" RCF.

11. TOXICOLOGICAL INFORMATION

Pyrolite, Pyroboard, and Pyroform products vary in hardness and friability. Especially if cut, ground, or otherwise broken up, exposure may be possible, predominantly by inhalation or ingestion of the dusts. The primary and most significant constituent of the dust is RCF/ASW, so the toxicological information provided below is exclusively related to RCF/ASW.

HEALTH DATA SUMMARY

Epidemiological studies that include most people who have ever worked in domestic RCF production have indicated no increased incidence of respiratory disease or other significant health effects in occupationally exposed workers. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

11.1 Toxicokinetics, Metabolism and Distribution

11.1.1 Basic Toxicokinetic

Exposure is predominantly by inhalation or ingestion. Man made vitreous fibers of a similar size to RCF/ASW have not been shown to migrate from the lung and/or gut and do not become located in other parts of the body. When compared to many naturally occurring minerals, RCF/ASW has a low ability to persist and accumulate in the body (half-life of long fibers (>20 µm) in 3 week rat inhalation test is approx. 60 days).

11.1.2 Human Toxicological data

In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in Europe and USA have demonstrated an absence of interstitial fibrosis and no decrement in lung function associated with current exposures, but have indicated a reduction of lung capacity among smokers.

The final report of the U.S. mortality study (LeMasters et al, 2017) concluded that "after 30 years of follow-up, no excess of lung cancers in the mortality study and no significant association with radiographic findings of interstitial fibrosis were found in this group of workers." The study also found a small incidence of other effects that appear unrelated to RCF exposure. The final mortality report did not change the current hazard classification for RCF.

11.2 Information on Toxicological effects

Acute toxicity: short term inhalation

No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.

Acute toxicity: oral

No data available: Repeated dose studies have been carried out using gavage. No effect was found.

Skin corrosion/irritation:

Not a chemical irritant according to test method OECD no. 404

Serious eye damage/irritation:

Not possible to obtain acute toxicity information due to the nature of the substance

Respiratory or skin sensitization

No evidence from human epidemiological studies of any respiratory or skin sensitization potential

Germ cell mutagenicity

Method: In vitro micronucleus test

Species: Hamster (CHO)

Dose: 1-35 mg/ml

Routes of administration: In suspension

Results: Negative

Carcinogenicity

Method: Inhalation. Multi-dose

Species: Rat,

Dose: 3 mg/m³, 9 mg/m³ and 16 mg/m³

Routes of administration: Nose only inhalation

Results: Fibrosis just reached significant levels at 16 and 9 mg/m³ but not at 3 mg/m³. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation. Single dose

Species: Rat

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: This study was designed to test the chronic toxicity and carcinogenicity of RCF at extreme exposures. Tumor incidence (incl. mesothelioma) was raised at this dose level. The presence of overload conditions (only detected after the experiment was completed), whereby the delivered dose exceeded the clearance capability of the lung, makes meaningful conclusions in terms of hazard and risk assessment difficult.

Method: Inhalation. Single dose

Species: Hamster

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: This low quality study in hamsters (no justification for exposure concentration used and pre existing and concurrent infections in the test animals) produced mesothelial lesions of uncertain significance. Subsequent studies in hamsters with glass fibers indicated that the lung burdens of RCF in this experiment were between 5 and 10 times more than that needed to produce overload, and the results are therefore difficult to interpret.

There are reports of injection studies with some similar materials. While some intraperitoneal injection (IP) studies reported the development of tumors in rats, the relationship of these results to classification remains controversial. Interpretation of these animal experiments is complex, and there is not agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utel and Maxim 2010.

Reproductive toxicity;

Method: Gavage

Species: Rat

Dose: 250 mg/kg/day

Routes of administration: Oral

Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

STOT-Single exposure; NA
STOT-Repeated exposure; NA
Aspiration hazard: NA

11.3 Irritant Properties

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans. Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

11.4 Other Information

After-service RCF may contain various crystalline phases, generally confined to a thin layer of material at the "hot-face" side of these products. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the EPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 microg/cm²; by comparison, pure quartz or cristobalite, two of the primary phases of silica, were significantly active at much lower levels circa 20 microg/cm².

11.5 International Agency for Research on Cancer and National Toxicology Program

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION

These products are inert materials that remain stable overtime. They are insoluble in the natural environment and are chemically identical to inorganic compounds found in the soil and sediment. No adverse effects on the environment have been identified or are anticipated.

13. DISPOSAL CONSIDERATIONS

13.1 Waste Treatment

Waste from these products may be generally disposed of at a landfill which has been licensed for this purpose. Unless wetted, such a waste may be dusty and should be properly sealed in containers for disposal. At some authorized disposal sites, dusty waste may be treated differently in order to ensure they are dealt with promptly and to avoid being wind blown. This product, as manufactured, is not classified as a listed or characteristic hazardous waste according to U. S. Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements.

Under U. S. Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

13.2 Additional Information

When disposing of waste and assigning European Waste Code, any possible contamination during use will need to be considered and expert guidance sought as necessary. Please check for any national and/or regional regulations, and refer to the European list (Decision No 2000/532/CE as modified) to identify appropriate waste numbers.

14. TRANSPORT INFORMATION

Not classified as dangerous goods under relevant international transport regulations (ADR, RID, ICAO/IATA, IMDG, ADN).

15. REGULATORY INFORMATION

15.1 U.S. Regulations

EPA:

Superfund Amendments and Reauthorization Act (SARA) Title III - This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).

Hazard Categories

Immediate Hazard – No

Delayed Hazard – Yes

Fire Hazard – No

Pressure Hazard – No

Reactivity Hazard - No

Toxic Substances Control Act (TSCA) – RCF has been assigned a CAS number; however, it is a simple mixture and therefore not required to be listed on the TSCA inventory. Other substances in this product are listed, as required, on the TSCA inventory. The components of RCF are listed on the inventory.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the **Clean Air Act (CAA)** RCF contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.

OSHA:

Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

California:

"Ceramic fibers (airborne particles of respirable size)" is listed in **Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.

Other States:

RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

15.2 European Regulations

RCF is classified under the CLP (classification, labeling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

15.3 Canadian Regulations

Canadian Workplace Hazardous Materials Information System (WHMIS) - RCF is classified as Class D2A – Materials Causing Other Toxic Effects.

Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL).

16. OTHER INFORMATION

16.1 Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
ADR	Transport by road, Council Directive 94/55/EC
ASW	Alumino-Silicate Wool
CARE	Controlled and Reduced Exposure
CAS	Chemical Abstracts Service
CLP	Regulation (EC) No 1272/2008 on Classification, Labeling and Packaging of substances and mixtures
DSL	Domestic Substance List
EEA	European Economical Area
ECFIA	European Ceramic Fibre Industry Association
EINECS	European Inventory of Existing Chemical Substances
EPA	Environmental Protection Agency
EU	European Union
f/cc	fibers per cubic centimeter
g/cc	grams per cubic centimeter
GHS	Globally Harmonized System of Classification and Labeling Chemicals
HCS 2012	Hazard Communication Standard of 2012
HNOC	Hazards Not Otherwise Classified
HTIWC	High Temperature Insulating Wool Coalition
IARC	International Agency for Research on Cancer
ICOA/IATA	Regulations relating to transport by air
IMDG	Regulations relating to transport by sea
mg/ m ³	milligrams per cubic meter
na	not available or not appropriate
OSHA	the U.S. Occupational Safety and Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCF	Refractory Ceramic Fiber
REACH	Regulation (EC) No 1907/2006 dated 18 December 2006 on Registration, Evaluation, Authorization and Restriction of Chemicals
RID	Transport by rail, Council Directive 96/49/EC
SARA	Superfund Amendment and Reauthorization Act
SDS	Safety Data Sheet (replaces MSDS, Material Safety Data Sheet)
STOT	Specific Target Organ systemic Toxicity
WHMIS	Workplace Hazardous Materials Information System

16.2 References

"Good Working Practices," HTIW Coalition, July 2012, htiwcoalition.org
"CARE Guidance Documents," ECFIA industrial hygiene guidance programme, ecfia.eu
"Hazards from the Use of Refractory Ceramic Fibre," HSE 267 (1998)
Numerous other publications can be found at the websites of ECFIA and HTIWC.

16.3 Revision Summary

Rev 5 comprehensive revision to align with HCS 2012

Rev 6 Section 11.1.2 update

The information contained herein is presented in good faith and is believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information available to them in their efforts to assure the health and safety of their employees and the proper use of the product. Given the summary nature of this document, Rex Materials Group does not make any warranty (express or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user. Further, Rex Materials Group disclaims any responsibility for damage or injury resulting from abnormal use of the product, failure to adhere to recommended practices, or any hazards inherent in the nature of the product.



SAFETY DATA SHEET

Phosphate Oxidation Retardant Graphite

Section 1. Identification

GHS product identifier : Phosphate Oxidation Retardant Graphite
Other means of identification : NOx – Treated, ENOx – Treated, Dilute, Sigraflex with Oxidation Retardant.
Code : MSDS 153, MSDS121
Product type : Solid.

Identified uses

Not available.

Manufacturer : SGL Carbon, LLC
10130 Perimeter Parkway
Suite 500, Charlotte, NC 28216
Tel: +1-704-593-5100

Supplier : Not available.

Emergency telephone number (with hours of operation) : CHEMTREC-CCN 20015: 1 800-424-9300
24/7

Section 2. Hazards identification

OSHA/HCS status : While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this SDS contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.

Classification of the substance or mixture : Not classified.

GHS label elements

Signal word : No signal word.

Hazard statements : No known significant effects or critical hazards.

Precautionary statements

Prevention : Not applicable.

Response : Not applicable.

Storage : Not applicable.

Disposal : Not applicable.

Hazards not otherwise classified (HNOC)

Physical hazards not otherwise classified (PHNOC) : None known.

Health hazards not otherwise classified (HHNOC) : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture
Other means of identification : NOx – Treated, ENOx – Treated, Dilute, Sigraflex with Oxidation Retardant.

CAS number/other identifiers

CAS number : Not applicable.
Product code : MSDS 153, MSDS121

There are no ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention if irritation occurs.
Inhalation : Remove to fresh air. Get medical attention if symptoms occur.
Skin contact : Wash contaminated skin with soap and water.
Ingestion : Wash out mouth with water.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Over-exposure signs/symptoms

Eye contact : No known significant effects or critical hazards.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically.
Specific treatments : No specific treatment.
Protection of first-aiders : No special protection is required.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : No specific fire or explosion hazard.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
phosphorus oxides
metal oxide/oxides

Special protective actions for fire-fighters : No special measures are required.

Special protective equipment for fire-fighters : Not required.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Put on appropriate personal protective equipment.

For emergency responders : Not required.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Spill : Pick-up spill and place back in container.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : No special handling or storage procedures required.

Section 8. Exposure controls/personal protection

Control parameters

United States

Occupational exposure limits

None.

Canada

Occupational exposure limits		TWA (8 hours)			STEL (15 mins)			Ceiling			Notations
Ingredient	List name	ppm	mg/m ³	Other	ppm	mg/m ³	Other	ppm	mg/m ³	Other	
Aluminium orthophosphate Graphite, synthetic	US ACGIH 4/2014	-	1	-	-	-	-	-	-	-	[a]
	BC 7/2013	-	1	-	-	-	-	-	-	-	[b]
	ON 1/2013	-	1	-	-	-	-	-	-	-	[a]
	US ACGIH 4/2014	-	2	-	-	-	-	-	-	-	[a]
	AB 4/2009	-	2	-	-	-	-	-	-	-	[c]
	BC 7/2013	-	2	-	-	-	-	-	-	-	[b]
	ON 1/2013	-	2	-	-	-	-	-	-	-	[a]
	QC 1/2014	-	2	-	-	-	-	-	-	-	[d]

Form: [a]Respirable fraction [b]Respirable [c]Respirable (all forms except graphite fibres) [d]Respirable dust

Mexico

Ingredient name	Exposure limits
Graphite, synthetic	NOM-010-STPS (Mexico, 9/2000). LMPE-PPT: 2 mg/m ³ 8 hours. ACGIH TLV (United States, 4/2014). TWA: 1 mg/m ³ 8 hours. Form: Respirable fraction
Aluminium orthophosphate	

Appropriate engineering controls

: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls

: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

Individual protection measures

Hygiene measures

: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.

Eye/face protection

: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts.

Skin protection

Hand protection

: Not required.

Body protection

: Not required.

Other skin protection

: Not required.

Respiratory protection

: Not required.

Section 9. Physical and chemical properties

Appearance

Physical state

: Solid.

Color

: Dark Gray to Black with a white cast.

Odor

: Not available.

Odor threshold

: Not available.

pH

: Not available.

Section 9. Physical and chemical properties

Melting point	: Not available.
Boiling point	: Not available.
Flash point	: Not available.
Evaporation rate	: Not available.
Flammability (solid, gas)	: Not available.
Lower and upper explosive (flammable) limits	: Not available.
Vapor pressure	: Not available.
Vapor density	: Not available.
Relative density	: Not available.
Solubility	: Not available.
Partition coefficient: n-octanol/water	: Not available.
Auto-ignition temperature	: Not available.
Decomposition temperature	: Not available.
Viscosity	: Not available.
Volatility	: Not available.
VOC (w/w)	: 0 % (w/w)

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: No specific data.
Incompatible materials	: Reactive or incompatible with the following materials: strong oxidizers.
Hazardous decomposition products	: Graphite combustion produces carbon monoxide, carbon dioxide and phosphorus oxides.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

There is no data available.

Irritation/Corrosion

There is no data available.

Sensitization

There is no data available.

Carcinogenicity

Classification

Section 11. Toxicological information

Product/ingredient name	OSHA	IARC	NTP	ACGIH	EPA	NIOSH
Aluminium orthophosphate	-	-	-	A4	-	-

Specific target organ toxicity (single exposure)

There is no data available.

Specific target organ toxicity (repeated exposure)

There is no data available.

Aspiration hazard

There is no data available.

Information on the likely routes of exposure : Not applicable.

Potential acute health effects

- Eye contact** : No known significant effects or critical hazards.
- Inhalation** : No known significant effects or critical hazards.
- Skin contact** : No known significant effects or critical hazards.
- Ingestion** : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

- Eye contact** : No known significant effects or critical hazards.
- Inhalation** : No known significant effects or critical hazards.
- Skin contact** : No known significant effects or critical hazards.
- Ingestion** : No known significant effects or critical hazards.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

- Potential immediate effects** : No known significant effects or critical hazards.
- Potential delayed effects** : No known significant effects or critical hazards.

Long term exposure

- Potential immediate effects** : No known significant effects or critical hazards.
- Potential delayed effects** : No known significant effects or critical hazards.

Potential chronic health effects

- General** : No known significant effects or critical hazards.
- Carcinogenicity** : No known significant effects or critical hazards.
- Mutagenicity** : No known significant effects or critical hazards.
- Teratogenicity** : No known significant effects or critical hazards.
- Developmental effects** : No known significant effects or critical hazards.
- Fertility effects** : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

There is no data available.

Section 12. Ecological information

Toxicity

There is no data available.

Persistence and degradability

There is no data available.

Bioaccumulative potential

There is no data available.

Mobility in soil

Soil/water partition coefficient (K_{oc}) : There is no data available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT	TDG / NOM-003-SCT	IMDG	IATA
UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.
UN proper shipping name	-	-	-	-
Transport hazard class(es)	-	-	-	-
Packing group	-	-	-	-
Environmental hazards	No.	No.	No.	No.
Additional information	-	-	-	-

AERG : Not applicable.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Section 14. Transport information

Transport in bulk according : Not available.
 to Annex II of MARPOL
 73/78 and the IBC Code

Section 15. Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

Clean Air Act Section 112 : Not listed
(b) Hazardous Air
Pollutants (HAPs)

Clean Air Act Section 602 : Not listed
Class I Substances

Clean Air Act Section 602 : Not listed
Class II Substances

DEA List I Chemicals : Not listed
(Precursor Chemicals)

DEA List I Chemicals : Not listed
(Precursor Chemicals)

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Not applicable.

SARA 313

No products were found.

State regulations

Massachusetts : The following components are listed: Graphite, synthetic

New York : None of the components are listed.

New Jersey : The following components are listed: Graphite, synthetic; Aluminium orthophosphate

Pennsylvania : The following components are listed: Graphite, synthetic

California Prop. 65

No products were found.

Canada

Canadian lists

Canadian NPRI : The following components are listed: Aluminium orthophosphate

CEPA Toxic substances : None of the components are listed.

Canada inventory : All components are listed or exempted.

International lists

National inventory

Australia : All components are listed or exempted.

China : All components are listed or exempted.

Europe : All components are listed or exempted.

Japan : Not determined.

Section 15. Regulatory information

Malaysia	: Not determined.
New Zealand	: All components are listed or exempted.
Philippines	: All components are listed or exempted.
Republic of Korea	: All components are listed or exempted.
Taiwan	: Not determined.

Section 16. Other information

History

Date of issue mm/dd/yyyy	: 03/15/2015
Version	: 1
References	:
Prepared by	: KMK Regulatory Services Inc.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

**Snoop®****Safety Data Sheet**

According to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830

Revision Date: 04/08/2016 Date of Issue: 04/08/2016

Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1. Product identifier**

Product Form : Mixture

Product Name : Snoop®

1.2. Relevant identified uses of the substance or mixture and uses advised against**1.2.1. Relevant identified uses**

Industrial/Professional use spec : For professional use only.

Use of the substance/mixture : Snoop® is a proprietary blend of water, non-ionic surfactants, and a bactericide.

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet**Company**

Swagelok Manufacturing Company, LLC

29495 F.A. Lennon Drive

Solon, Ohio 44139

440-519-4000

www.swagelok.com**1.4. Emergency telephone number**

Emergency number : CHEMTREC: (800) 424-9300

SECTION 2: Hazards identification**2.1. Classification of the substance or mixture**

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Not classified

Adverse physicochemical, human health and environmental effects

No additional information available

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

No labelling applicable

2.3. Other hazards

Other hazards not contributing to the classification : Exposure may aggravate pre-existing eye, skin, or respiratory conditions.

SECTION 3: Composition/information on ingredients**3.1. Substance**

Not applicable

3.2. Mixture

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
Water	(CAS No) 7732-18-5 (EC no) 231-791-2	> 99,44	Not classified
Benzenesulfonic acid, mono-C9-17-branched alkyl derivatives, isopropylamine salts	(CAS No) 68649-00-3 (EC no) 272-018-9	0,255	Not classified
Dodecylbenzenesulfonic acid, isopropylamine salt	(CAS No) 26264-05-1 (EC no) 247-556-2	0,207	Acute Tox. 4 (Oral), H302 Skin Irrit. 2, H315 Eye Irrit. 2, H319
1H-Benzotriazole	(CAS No) 95-14-7 (EC no) 202-394-1	< 0,1	Acute Tox. 4 (Oral), H302 Acute Tox. 4 (Inhalation:dust,mist), H332 Eye Irrit. 2, H319 Aquatic Chronic 2, H411

Full text of H-statements: see section 16

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general	: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).
First-aid measures after inhalation	: When symptoms occur: go into open air and ventilate suspected area. Obtain medical attention if breathing difficulty persists.
First-aid measures after skin contact	: Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation develops or persists.
First-aid measures after eye contact	: Rinse cautiously with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention.
First-aid measures after ingestion	: Rinse mouth. Do NOT induce vomiting. Obtain medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries	: Not expected to present a significant hazard under anticipated conditions of normal use.
Symptoms/injuries after inhalation	: Prolonged exposure may cause irritation.
Symptoms/injuries after skin contact	: Prolonged exposure may cause skin irritation.
Symptoms/injuries after eye contact	: May cause slight irritation to eyes.
Symptoms/injuries after ingestion	: Ingestion may cause adverse effects.
Chronic symptoms	: None expected under normal conditions of use.

4.3. Indication of any immediate medical attention and special treatment needed

If exposed or concerned, get medical advice and attention. If medical advice is needed, have product container or label at hand.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	: Water spray, dry chemical, foam, carbon dioxide.
Unsuitable extinguishing media	: Do not use a heavy water stream. Use of heavy stream of water may spread fire.

5.2. Special hazards arising from the substance or mixture

Fire hazard	: Not considered flammable but may burn at high temperatures.
Explosion hazard	: Product is not explosive.
Reactivity	: Hazardous reactions will not occur under normal conditions.

5.3. Advice for firefighters

Precautionary measures fire	: Exercise caution when fighting any chemical fire.
Firefighting instructions	: Use water spray or fog for cooling exposed containers.
Protection during firefighting	: Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures	: Avoid prolonged contact with eyes, skin and clothing. Avoid breathing (vapour, mist, spray).
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6.1.1. For non-emergency personnel

Protective equipment	: Use appropriate personal protection equipment (PPE).
Emergency procedures	: Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment	: Equip cleanup crew with proper protection.
Emergency procedures	: Upon arrival at the scene, a first responder is expected to recognize the presence of dangerous goods, protect oneself and the public, secure the area, and call for the assistance of trained personnel as soon as conditions permit. Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters.

6.3. Methods and material for containment and cleaning up

For containment	: Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams.
Methods for cleaning up	: Clean up spills immediately and dispose of waste safely. Transfer spilled material to a suitable container for disposal. Contact competent authorities after a spill.

6.4. Reference to other sections

See Section 8 for exposure controls and personal protection and Section 13 for disposal considerations.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed

: Handle in accordance with standard industrial practices, and ensure appropriate usage. Practice good housekeeping - spillage can be slippery on smooth surface

either wet or dry.

: Wash hands and other exposed areas with mild soap and water before eating,

drinking or smoking and when leaving work. Avoid prolonged contact with eyes,

skin and clothing. Avoid breathing vapours, mist, spray.

: Handle in accordance with good industrial hygiene and safety procedures.

7.2. Conditions for safe storage, including any incompatibilities

: Comply with applicable regulations.

: Keep container closed when not in use. Store in a dry, cool place. Keep/Store away

from direct sunlight, extremely high or low temperatures and incompatible

materials.

: Strong acids, strong bases, strong oxidisers, water-reactive materials.

7.3. Specific end use(s)

Incompatible products

Snoop® is a proprietary blend of water, non-ionic surfactants, and a bactericide.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

1H-Benzotriazole (95-14-7)	OEL TWA (mg/m³)	5 mg/m³
Latvia		

8.2. Exposure controls

Appropriate engineering controls

: Emergency eye wash fountains and safety showers should be available in the

immediate vicinity of any potential exposure. Ensure adequate ventilation,

especially in confined areas. Ensure all national/local regulations are observed.

: Gloves. Protective clothing. Protective goggles.



: Chemically resistant materials and fabrics.

: Wear protective gloves.

: Chemical safety goggles.

: Wear suitable protective clothing.

: If exposure limits are exceeded or irritation is experienced, approved respiratory

protection should be worn. In case of inadequate ventilation, oxygen deficient

atmosphere, or where exposure levels are not known wear approved respiratory

protection.

: When using, do not eat, drink or smoke.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state

: Liquid

Colour

: No data available

Odour

: No data available

Evaporation rate

: No data available

Melting point

: No data available

Boiling point

: No data available

Flash point

: No data available

Auto-ignition temperature

: No data available

Decomposition temperature

: No data available

Flammability (solid, gas)

Vapour pressure	: No data available
Relative vapour density at 20 °C	: No data available
Solubility	: No data available
Partition coefficient: n-octanol/water	: No data available
Viscosity	: No data available
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Hazardous reactions will not occur under normal conditions.

10.2. Chemical stability

Stable under recommended handling and storage conditions (see section 7).

10.3. Possibility of hazardous reactions

Hazardous polymerization will not occur.

10.4. Conditions to avoid

Direct sunlight, extremely high or low temperatures, and incompatible materials.

10.5. Incompatible materials

Strong acids, strong bases, strong oxidisers, water-reactive materials.

10.6. Hazardous decomposition products

None known.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Dodecylbenzenesulfonic acid, isopropylamine salt (26264-05-1)	
LD50 oral rat	1300 mg/kg
1H-Benzotriazole (95-14-7)	
LD50 oral rat	560 mg/kg
LD50 oral	560 mg/kg
LC50 inhalation rat (mg/l)	1910 mg/m ³ (Exposure time: 3 h)
LC50 inhalation rat (Dust/Mist - mg/l/4h)	1,43 mg/l/4h

Skin corrosion/irritation	: Not classified
Serious eye damage/irritation	: Not classified
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: Not classified
Specific target organ toxicity (repeated exposure)	: Not classified
Aspiration hazard	: Not classified
Symptoms/Injuries	: Prolonged exposure may cause irritation.
Symptoms/Injuries After Skin Contact	: Prolonged exposure may cause skin irritation.
Symptoms/Injuries After Eye Contact	: May cause slight irritation to eyes.
Symptoms/Injuries After Ingestion	: Ingestion may cause adverse effects.
Chronic Symptoms	: None expected under normal conditions of use.
Potential adverse human health effects and symptoms	: Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Not classified.

Snoop®

Safety Data Sheet

According to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830

1H-Benzotriazole (95-14-7)	
LC50 fish 1	39 mg/l (Exposure time: 96 h - Species: Oncorhynchus mykiss)
EC50 Daphnia 1	141,6 mg/l (Exposure time: 48 h - Species: water flea)

12.2. Persistence and degradability

Snoop®	
Persistence and degradability	Not established.

12.3. Bioaccumulative potential

Snoop®	
Bioaccumulative potential	Not established.

12.4. Mobility in soil

No additional information available

12.5. Results of PBT and vPvB assessment

No additional information available

12.6. Other adverse effects

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose of waste material in accordance with all local, national and international regulations.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

The shipping description(s) stated herein were prepared in accordance with certain assumptions at the time the SDS was authored, and can vary based on a number of variables that may or may not have been known at the time the SDS was issued. In accordance with ADR / RID / IMDG / IATA / ADN

ADR	IMDG	IATA	ADN	RID
14.1. UN number				
Not regulated for transport				
14.2. UN proper shipping name				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.3. Transport hazard class(es)				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.4. Packing group				
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
14.5. Environmental hazards				
Dangerous for the environment : No	Dangerous for the environment : No Marine pollutant : No	Dangerous for the environment : No	Dangerous for the environment : No	Dangerous for the environment : No

14.6. Special precautions for user

No additional information available

14.7. Transport in bulk according to Annex II of MARPOL and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

The following restrictions are applicable according to Annex XVII of the REACH Regulation (EC) No 1907/2006:

3.b. Substances or mixtures fulfilling the criteria for any of the following hazard classes or categories set out in Annex I to Regulation (EC) No 1272/2008: Hazard classes 3.1 to 3.6, 3.7 adverse effects on sexual function and fertility or on development, 3.8 effects other than narcotic effects, 3.9 and 3.10

Dodecylbenzenesulfonic acid, isopropylamine salt

Contains no substance on the REACH candidate list

Contains no REACH Annex XIV substances

Benzenesulfonic acid, mono-C9-17-branched alkyl derivatives, isopropylamine salts (68649-00-3)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

Dodecylbenzenesulfonic acid, isopropylamine salt (26264-05-1)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

1H-Benzotriazole (95-14-7)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

Water (7732-18-5)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.1.2. National regulations

No additional information available

15.2. Chemical safety assessment

No chemical safety assessment has been carried out.

SECTION 16: Other information

Revision date: : 04/08/2016

Data sources : According to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830

Full text of H- and EUH-statements:

Acute Tox. 4 (Inhalation:dust,mist)	Acute toxicity (inhalation:dust,mist) Category 4
Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Chronic 2	Hazardous to the aquatic environment — Chronic Hazard, Category 2
Eye Irrit. 2	Serious eye damage/eye irritation, Category 2
Skin Irrit. 2	Skin corrosion/irritation, Category 2
H302	Harmful if swallowed
H315	Causes skin irritation
H319	Causes serious eye irritation
H332	Harmful if inhaled
H411	Toxic to aquatic life with long lasting effects

EU GHS SDS

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

SAFETY DATASHEET

Following Regulation 1910.1200

SDS Number: MK203

Date of first issue: 12 March 1996

Date of last revision: 01 June 2015

1 - Identification of product**a - Product identifier used on the label**

Tradenames: BTU-Block Board, BTU-Block Flexible, BTU-Block Ladle Liner, BTU-Block Laminated Board, BTU-Block Panel, FireMaster FastDoor XL, FireMaster Marinelite,

b - Other means of identification

MICROPOROUS INSULATION

c - Recommended use of the chemical and restrictions on use

Application as thermal insulation, heat shields, heat containment, gaskets and expansion joints in industrial furnaces, ovens, kilns, boilers and other process equipment and in the aerospace, automotive and appliance industries, and as passive fire protection systems and firestops.
(Please refer to specific technical data sheets for more information)

d - Name, address, and telephone number

Morgan Advanced Materials
2730 Industrial Parkway
Elkhart, IN 46516
Telephone: 574-296-3500

Morgan Advanced Materials
P. O. Box 923; Dept. 300
Augusta, GA 30903-0923
Telephone: 706-796-4200

e - Emergency Phone Number

For Product Stewardship and Emergency Information:

Hotline - 1-800-722-5681

Fax - 706-560-4054

For additional SDSs and to confirm this is the most current SDS for the product, visit our web page www.morganthermalceramics.com or send a request to MT.NorthAmerica@morganplc.com

2 - Hazard Identification

a - Classification of the chemical in accordance with paragraph (d) of §1910.1200

b - Signal word, hazard statement(s), symbol(s) and precautionary statement(s) in accordance with paragraph (f) of §1910.1200

Hazard Pictogram



Signal Words

Warning

Hazard Statements

Suspected of causing cancer by inhalation.

Precaution Statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see Section 8 of the Safety Data Sheet.

If concerned about exposure, get medical advice.

Store in a manner to minimize airborne dust.

Dispose of waste in accordance with local, state and federal regulations.

May cause temporary mechanical irritation to exposed eyes, skin or respiratory tract.

Minimize exposure to airborne dust.

Emergency Overview

Dust and respirable fibers from this product may aggravate existing chronic lung conditions such as bronchitis, emphysema and asthma.

c - Describe any hazards not otherwise classified that have been identified during the classification process

d - Mixture Rule

Not applicable.

3 - Composition / Information On Ingredients

a - Composition table

COMPONENTS	CAS NUMBER	% BY WEIGHT
Silica Fume (Amorphous)	Proprietary	50 - 70
Titanium Dioxide	13463-67-7	20 - 30
Silicon Carbide	409-21-2	0 - 30
Alkaline-Earth Silicate Wool	436083-99-7	0 - 10
Fibrous Glass Filament	65997-17-3	0 - 5
Polyester Fiber	NONE	0 - 3

b - Common Name

(See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines)

d - Impurities and Stabilizing Additives

Not applicable.

4 - First-Aid measures

a - Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion

Eyes

If the eyes show inflammation due to mechanical irritation, flush with large amounts of water for at least 15 minutes.
Do not rub eyes.

Skin

If a skin rash develops due to mechanical irritation, wash the affected area gently with soap and water. A skin cream or lotion after washing may be helpful. Do not rub or scratch the exposed skin. Changing into clean clothing is recommended.

Respiratory Tract

If irritation or soreness occurs in the nose or throat, this can be alleviated by breathing fresh air. (See Section 8 for additional measures to reduce the occurrence of respiratory tract irritation caused by exposure.)

Gastrointestinal

Unlikely route of exposure.

c - Indication of immediate medical attention and special treatment needed, if necessary

5 - Fire-fighting measures

a - Suitable (and unsuitable) extinguishing media and

Use extinguishing media suitable for type of surrounding fire

c - Special Protective Equipment and Precautions for Firefighters

b - Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products):

None

6 - Accidental Release Measures

a - Personal precautions, protective equipment, and emergency procedures

Avoid creating airborne dust. Provide workers with respirators, if necessary (See Section 8). Follow routine housekeeping procedures. Where possible, use a HEPA vacuum to clean up the spilled material. If sweeping is necessary, use a dust suppressant and place material in closed containers. Do not use compressed air for clean-up. Avoid clean-up procedures that could result in water pollution.

b - Methods and materials for containment and cleaning up

Pick up large pieces and dispose in a closed container. Follow precaution stated in above section for clean up.

7 - Handling and storage

a - Precautions for safe handling

Limit the use of power tools unless in conjunction with local exhaust. Use hand tools whenever possible. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

b - Conditions for safe storage, including any incompatibilities

This product is stable under all conditions of storage. Store in original factory container in a dry area. Keep container closed when not in use. Do not reuse the container.

c - empty containers

Product packaging may contain residue. Do not reuse.

8 - Risk Management Measures / Exposures Controls / Personal Protection

a - OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available

EXPOSURE GUIDELINES			
MAJOR COMPONENT	OSHA PEL	ACGIH TLV	MANUFACTURER'S REG
Silica Fume (Amorphous)	(80 mg/m ³ + % SiO ₂) or 20 mppcf	2mg/m ³	NONE
Titanium Oxide	15 mg/m ³	Not Established	NONE
Silicon Carbide	15 mg/m ³ (total dust) 5 mg/m ³ (respirable dust)	10 mg/m ³ (inhalable dust) 3mg/m ³ (respirable dust)	NONE
Alkaline-Earth Silicate Wool ⁽¹⁾	Not Established	Not Established	1 f/cc, 8-hr TWA
Fibrous Glass Filament	Not Established	1 f/cc, 5 mg/m ³	NONE
⁽¹⁾ CAS definition: Alkaline Earth Silicate (AES) consisting of silica (50-82 wt %), calcia and magnesia (18-43 wt %), alumina, titania and zirconia (less than 6 wt %), and trace oxides. This CAS composition also covers Thermal Ceramics products Calcium- Magnesium-Silicate Wool (CAS no. 329211-92-9) and Calcium-Magnesium-Zirconium-Silicate Wool (CAS no. 308084-09-5).			
OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)			
Ontario Canada OEL: Continuous Filament Glass Fibers = 1 f/cc (F) or 5 mg/m ³ (Inhalable); Silica Fume = 2mg/m ³ .			
Industrial hygiene standards and occupational exposure limits vary between countries and local jurisdictions. Check which exposure levels apply to your facility and comply with local regulations. If no regulatory dust or other standards apply, a qualified industrial hygienist can assist with a specific workplace evaluation including recommendations for respiratory protection.			

b - Appropriate Engineering Controls

It is prudent to reduce exposure to respirable dusts to the lowest attainable level through the use of engineering controls such as ventilation and dust collection devices. Effective technologies to control respirable dust are available. These include local exhaust ventilation, point of generation dust collection, down draft workstations, emissions controlling tool designs and materials handling equipment. For further information call the Thermal Ceramics' Product Stewardship Hotline: (800-722-5681).

c - Individual protection measures, such as personal protective equipment

PPE - Skin

Wear long-sleeved, loose fitting clothing, gloves and hat as necessary to prevent skin irritation.

PPE - Eye

Wear goggles/safety glasses with sideshields

PPE – Respiratory

When engineering and/or administrative controls are insufficient to maintain workplace concentrations below the PEL/REG or OEL, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. A NIOSH certified respirator with a filter efficiency of at least 95% should be used. The 95% filter efficiency recommendation is based on NIOSH respirator selection logic sequence for exposure to particulates. Selection of filter efficiency (i.e. 95%, 99% or 99.97%) depends on how much filter leakage can be accepted and the concentration of airborne contaminants. Other factors to consider are the NIOSH filter series N, R or P. (N) **N**ot resistant to oil, (R) **R**esistant to oil and (P) oil **P**roof. These recommendations are not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified industrial hygienist.

9 - Physical and chemical properties

a - Appearance	Molded fibrous sheet or form
b -Odor	Not applicable
c - Odor Threshold	Not applicable
e- pH	Not applicable
d - Melting Point	>2000°F (1093°C)
f- Initial Boiling Point/Range	Not applicable
g- Flashpoint	Not applicable
h - Evaporation Rate	Not applicable
i - Flammability	Not applicable
j - Upper/Lower Flammability or Explosive Limits	Not applicable
k - VAPOR PRESSURE	Not applicable
l - VAPOR DENSITY	Not applicable
m - Solubility	Slight
n - Relative Density	Not applicable
o - Partition Coefficient: n-Octanol/water	Not applicable
p - Auto-ignition temperature	Not applicable
q - Decomposition Temperature	Not applicable
r - Viscosity	Not applicable

10 - Stability and Reactivity

a - Reactivity

None.

b - Chemical Stability

Stable under conditions of normal use.

c - Possibility of Hazardous Reaction

None

d - Conditions to Avoid

None

e - Incompatible Materials

Avoid contact with strong acids

f - Hazardous decomposition products

Upon heating above 1650° F (900° C) for sustained periods, AES wools begin to transform to mixtures of amorphous and crystalline phases.

11 - Toxicological information

a - TOXICOKINETICS, METABOLISM AND DISTRIBUTION

b - Acute Toxicity

c - Epidemiology

This material has not been the subject of an epidemiology study.

d - Toxicology

Silica, amorphous

Toxic effects described in animals from single inhalation exposures of amorphous silica include upper respiratory irritation, lung congestion, bronchitis, and emphysema. Repeated inhalation exposures at concentration of 50 or 150 mg/m³ produced increased lung weights and lung changes. No progressive pulmonary fibrosis was seen and the observed lung changes were reversible. No adverse effects were observed in this study at 10 mg/m³. No animal test reports are available to define the carcinogenic, mutagenic, or reproductive effects.

Titanium Dioxide

Titanium dioxide was reclassified by the IARC in 2006 as a "possibly carcinogenic to humans (Group 2B)". The classification was based on sufficient evidence in experimental animals but inadequate evidence in humans for the carcinogenicity of titanium dioxide. IARC indicated in the monograph that "the studies do not suggest an association between occupational exposure to titanium dioxide as it occurred in recent decades in Western Europe and North America and risk for cancer."

[IARC Monograph (Vol. 93)]

The US National Institute for Occupational Safety and Health (NIOSH) is currently reviewing the available toxicity data on titanium dioxide. On the recent draft Current Intelligence Bulletin (March, 2006), NIOSH recommends exposure limits of 1.5 mg/m³ for fine TiO₂ (particle greater than 0.1 µm in diameter) and 0.1 µg/m³ for ultrafine particles. The draft document states that the difference in the recommended limits reflect findings from studies, which suggest that ultrafine

TiO₂ particles may be more potent than fine TiO₂ particles at the same mass. It also indicated this may due to the fact, that the ultrafine particles have a greater surface area than the fine particles at the same mass.

Silicon Carbide

An animal study showed that, although exposure to silicon carbide alone produced no fibrosis of the lungs, exposure of guinea pigs infected with pulmonary tuberculosis to the extent that extensive fibrosis occurred. Guinea pigs exposed to silicon carbide dust and infected with the tubercle bacteria developed tuberculopneumoconiotic lesions. Miller and Sayers observed that silicon carbide dust administered by intraperitoneal injection to guinea pigs produced no reaction. A study in tungsten carbide industry workers concluded that exposure to silicon carbide was not a hazard unless the exposed workers already had pulmonary tuberculosis.

Fibrous Glass Filament (non-respirable)

IARC in June, 1987, categorized fiberglass continuous filament as not classifiable with respect to human carcinogenicity (Group 3). The evidence from human as well as animal studies was evaluated by IARC as insufficient to classify fiberglass continuous filament as a possible, probable, or confirmed cancer causing material.

AES Wools

AES contained in the products listed in the title have been designed to be rapidly cleared from lung tissue. This low biopersistence has been confirmed in many studies on AES using EU protocol ECB/TM/27(rev 7) and the German method specified in TRGS 905 (1999). When inhaled, even at very high doses, they do not accumulate to any level capable of producing a serious adverse biological effect. In lifetime chronic studies there was no exposure-related effect more than would be seen with any "inert" dust. Sub-chronic studies at the highest doses achievable produced at worst a transient mild inflammatory response. Fibers with the same ability to persist in tissue do not produce tumours when injected into the peritoneal cavity of rats.

International Agency for Research on Cancer and National Toxicology Program

Titanium dioxide was reclassified by the IARC in 2006 as a "possibly carcinogenic to humans (Group 2B)".

The classification was based on sufficient evidence in experimental animals but inadequate evidence in humans for the carcinogenicity of titanium dioxide.

The IARC classification are based on very specific evidence showing that high concentrations of pigment-grade (powdered) and ultrafine titanium dioxide dust caused respiratory tract cancer in rats exposed by inhalation and intratracheal instillation.

12 - Ecological information

a - Ecotoxicity (aquatic and terrestrial, where available)

These products are not reported to have any ecotoxicity effects.

c - Bioaccumulative potential

No information for the product.

d - Mobility in soil

No information for the product.

e - Other adverse effects (such as hazardous to the ozone layer)

No adverse effects of this material on the environment are anticipated.

13 - Disposal Considerations

Waste Management and Disposal

To prevent waste materials becoming airborne, a covered container or plastic bagging is recommended. Comply with federal, state and local regulations. Chemical additions, processing or otherwise altering this material may make the waste management information presented in this MSDS incomplete, inaccurate, or otherwise inappropriate.

Additional information

This product, as manufactured, is not classified as a listed or characteristic hazardous waste according to U. S. Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under U. S. Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14 - Transport information

a - UN number.

Hazard Class: Not Regulated United Nations (UN) Number: Not Applicable
Labels: Not Applicable North America (NA) Number: Not Applicable
Placards: Not Applicable Bill of Lading: Product Name

b - UN proper shipping name

Not applicable.

c - Transport hazard class(es)

Not applicable.

d - Packing group, if applicable

Not applicable.

e - Environmental hazards (e.g., Marine pollutant (Yes/No))

No.

f - Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code)

Not regulated.

g - Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises

Not applicable.

International

INTERNATIONAL

Canadian TDG Hazard Class & PIN: Not regulated

Not classified as dangerous goods under ADR (road), RID (train), IATA (air) or IMDG (ship).

15 - Regulatory information

15.1 - United States Regulations

UNITED STATES REGULATIONS

SARA Title III: This product does not contain any substances reportable under Sections 302, 304, 313 (40 CFR 372). Sections 311 and 312 apply.

OSHA: Comply with Hazard Communication Standards 29 CFR 1910.1200 and 29 CFR 1926.59 and Respiratory Protection Standards 29 CFR 1910.134 and 29 CFR 1926.103

TSCA: All substances contained in this product are listed in the TSCA Chemical Inventory.

CERCLA: AES wools contain fibers with an average diameter greater than one micron and thus is not considered a CERCLA hazardous substance.

CAA: AES wools contain fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant

15.2 - International Regulations

INTERNATIONAL REGULATIONS

Canada WHMIS: Titanium dioxide is classified as Class D2-A – Materials causing other toxic effects.

Canadian EPA: All substances in this product are listed, as required, on the Domestic Substance List (DSL).

European Union: These products are exonerated from any carcinogenic classification in the countries of the European Union under the provisions of Nota Q of the European Commission Directive 97/69/EC.

16 - Other Information

initial statement

Devitrification

PRECAUTIONARY MEASURES TO BE TAKEN AFTER SERVICE UPON REMOVAL

High temperature insulating wool (HTIW) is typically used in insulation applications to keep temperature exposure at 900°C or above in a closed space. The exposure temperature maximum occurs at the hot face surface of the insulation. The heat exposure on the insulation decreases from the hot face to the cold face as the insulation "insulates itself". As a result, only thin layers of the hot face surface of the insulation become devitrified and respirable dust generated during removal operations typically do not contain detectable levels of crystalline silica (CS).

Toxicological evaluation of the effect of the presence of CS in artificially heated HTIW material has not shown any increased toxicity in vitro and in vivo. The results from different factor combinations such as increased brittleness of fibers or micro crystals embedded in the glass structure of the fiber and therefore not biologically available, may explain the lack of toxicological effects. IARC evaluation as provided in Monograph 68 is not relevant since CS is not biologically available in after-service HTIW.

Product Stewardship Program

Morgan Thermal Ceramics www.morganthermalceramics.com

HMIS HAZARD RATING

TECHNICAL DATASHEETS

Wendy: Please insert TDSs

Revision Summary

In May 2015 this SDS has been updated to GHS format in conformance with US OSHA HCS 2012 (29CFR 1910.1200) and Canada Hazardous Products Act and the Hazardous Products Regulations.

MSDS prepared by

SDS Prepared By: MORGAN THERMAL CERAMICS ENVIRONMENTAL, HEALTH & SAFETY DEPARTMENT

Disclaimer

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this SDS. Therefore, given the summary nature of this document, Morgan Thermal Ceramics does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.



Safety Data Sheet

Section 1, Identification

Product identifier

Product Name: Ceramic Fiber Textile (Cloth, Tape, Twisted Rope, Round Braid, Square Braid, Sleeving, Yarn), product style code 3100, 3105, 3110, 3120, 3130, 3140, 3150, 3160

Chemical Name: Aluminosilicate Ceramic Fiber

Synonyms: Ceramic Fiber, Refractory Ceramic Fiber, RCF

Trade Name: CeraTex

Manufacturer/Supplier's Name: Mineral Seal Corporation

Address (Number, Street, City, State and ZIP Code): 1832 S. Research Loop, Tucson, AZ 85710

Emergency Telephone Number: (520) 885- 8228

Telephone Number for Information: (520) 885 - 8228

Recommended use: High temperature insulation and sealing applications.

Restrictions: Not established

Section 2, Hazard(s) identification

Hazard classification(Physical, Health, OSHA): OSHA Hazard Communication Standard (HCS) 2012 Category 2 carcinogen classification (IARC Group 2B)

Label elements

Hazard Symbol:



Signal Word: Warning

Hazard statement: Suspected cancer hazard by inhalation

Precautionary statement (Prevention, Response, Storage, Disposal):

Follow handling safety instructions in this Safety Data Sheet. Use respiratory protection as instructed. Minimize airborne dust in handling and storing. May cause mild and temporary irritation to eye, skin and upper respiratory tract upon contact or exposure.

Hazards not otherwise classified: Mild and temporary irritation to eye, skin and upper respiratory tract upon contact or exposure.

Section 3, Composition/information on ingredients

Including chemical ingredients and trade secret claims

Ingredient	CAS Number	%(By Weight)
Aluminosilicate Ceramic Fiber (Al ₂ SiO ₅)	142844-00-6	85%
Fiberglass filament	65997-17-3	Varies
Other components: binder material, reinforcement wire	N/D	Varies

Section 4, First-aid measures

First-aid measures:

RESPIRATORY TRACT IRRITATION:

Move the person to a dust free location. Get medical attention if the irritation continues.

EYE IRRITATION:

Flush with large amounts of water. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

SKIN IRRITATION:

For skin irritation, remove soiled clothing. Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful.

GASTROINTESTINAL IRRITATION:

Unlikely to happen. However, if gastrointestinal tract irritation develops, move the person to a dust free environment.

Most Important symptoms and effects, both acute and delayed: Mild and temporary irritation to eye, skin and upper respiratory upon contact or exposure.

Indication of any immediate medical attention and special treatment required: None

Other possible effects: None

Section 5, Fire-fighting measures

Suitable extinguishing media: Ceramic fiber is not flammable. Use extinguishing media suitable for type of surrounding fire. The product should be cooled with water

Specific hazards arising from the substance: None

Special protective equipment and actions for firefighters: None

Section 6, Accidental release measures

Personal precautions, protective equipment and emergency procedures: Avoid creating airborne dust. Use air purifying respirator if airborne dust presents (see section 8 for details)

Environmental precautions: Do not release the material to sewers or drains.

Methods and material for containment and cleaning up: Avoid creating airborne dust. Dust suppressing cleaning methods such as wet sweeping or vacuuming should be used to clean the work area. If vacuuming, the vacuum must be equipped with a HEPA filter. Compressed air or dry sweeping should not be used for cleaning.

Section 7, Handling and storage

Precautions for safe handling and storage: Handle ceramic fiber carefully. Avoid creating airborne dust. Use air purifying respirator if airborne dust presents (see section 8 for details). If power tools are used for handling ceramic fiber, high airborne dust may be generated, therefore local exhaust and other dust control measure should be implemented. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

Conditions for safe storage including any incompatibilities: Store in original container in a dry area. Keep container closed when not in use. No known incompatible substances under normal conditions.

Section 8, Exposure controls/personal protection

OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).

Occupational exposure limits

Ingredient	C.A.S. No.	Agency	Type Limit	Additional Comments
Aluminosilicate Ceramic Fiber (Al ₂ SiO ₅)	142844-00-6	OSHA ACGIH NIOSH Supplier	Not established TLV 0.2 f/cc, 8-hr. TWA 0.5 f/cc, 8-hr. TWA 0.5 f/cc, 8-hr, TWA	
Fiberglass	65997-17-3	OSHA	PEL 5 mg/m ³ respirable	

ACGIH : American Conference of Governmental Industrial Hygienists
AIHA : American Industrial Hygiene Association
CMRG : Chemical Manufacturer's Recommended Guidelines

TWA: Time-Weighted-Average
STEL: Short Term Exposure Limit
CEIL: Ceiling

Appropriate engineering controls: Local exhaust ventilation, dust collection, and other equipment designed to minimize dust.

Personal protective equipment (PPE) and protection measures:

Eye/face protection: If dusts or debris are generated during processing, wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards. Do not touch eyes with soiled body parts or materials.

Skin hand protection: Wear gloves, head coverings and washable or disposable full body clothing as necessary to prevent skin irritation. clothing may be used. Wash work clothing separately. Minimize or avoid non-work dust.

Respiratory protection: When exposure is under 0.5 f/cc, respiratory protection equipment is optional. When exposure is above 0.5f/cc limit, half -facepiece, or full-facepiece air purifying respirator equipped with a NIOSH certified P100 particulate filter cartridge or PAPR with tight-fitting full facepiece is recommended depending on the exposure level.

Section 9, Physical and chemical properties

ODOR AND APPEARANCE:	White, odorless, fibrous material
CHEMICAL FAMILY:	Vitreous Aluminosilicate Fibers
BOILING POINT:	N/A
WATER SOLUBILITY (%):	Not Soluble in Water
MELTING POINT:	1760° C (3200° F)
SPECIFIC GRAVITY:	2.50 - 2.75
VAPOR PRESSURE:	N/A
pH:	N/A
VAPOR DENSITY (Air = 1):	N/A
% VOLATILE:	N/A
MOLECULAR FORMULA:	Al ₂ SiO ₅

Section 10, Stability and reactivity

CHEMICAL STABILITY:	Stable under conditions of normal use
INCOMPATIBILITY:	Hydrofluoric, phosphoric acids and concentrated alkalis
CONDITIONS TO AVOID:	None.
HAZARDOUS DECOMPOSITION PRODUCTS:	None
HAZARDOUS POLYMERIZATION:	N/A

Section 11, Toxicological information

Signs and Symptoms of Exposure:

Inhalation and Respiratory Tract Irritation: Ceramic Fiber/RCF may cause temporary and mild irritation to respiratory tract if it is inhaled in sufficient quantity. Symptoms may include scratchiness of the nose or throat, cough or chest discomfort.

Skin Contact: Mild itchiness or irritation

Eye Contact: Mild eye irritation similar to symptoms caused by other debris

Ingestion: No adverse effects under normal exposure conditions

Toxicological Effects and Data:

There have been a number of long term on going toxicological studies designed to identify any potential health effects from refractory ceramic fiber (RCF) exposure. There is no evidence of acute toxicity resulted from RCF short term exposure through contact, inhalation, or ingestion.

Skin corrosion/irritation: No adverse effects are expected.

Serious eye damage/eye irritation: No adverse effects are expected.

Respiratory sensitization: No Data.

Skin sensitization: Not a skin sensitizer

Central Nervous System (CNS) Depression: Very unlikely, no data available

Peripheral Neuropathy: Very unlikely, no data available

Reproductive/Developmental Toxicity: No data

Germ cell mutagenicity: No data

Single exposure may cause target organ effects: No data

Prolonged or repeated exposure may cause target organ effects: No data

Aspiration hazard: Not classified.

Carcinogenicity and Long Term Health Effects:

A definitive Maximum Tolerated Dose Study (MTD) by nose only, lifetime inhalation in rats and hamsters appeared to confirm that RCF was an animal carcinogen under certain test conditions, e.g., extremely high concentrations of approximately 200 f/cc inhaled directly into the lungs. In one study, conducted by the Research and Consulting Company, (Geneva, Switzerland), rats and hamsters were exposed to 30 mg/m³ (about 200 fibers/cc) of specially-prepared RCF for 6 hours/day, 5 days/week, for up to 24 months. In rats, a statistically significant increase in lung tumors was observed; two mesotheliomas

(cancer of the pleural lining between the chest wall and lung) were also identified. Hamsters did not develop lung tumors; however, interstitial fibrosis and mesothelioma was found. Some, in the scientific community, have concluded that the "maximum tolerated dose" was exceeded and that significant particle contamination was a confounding issue; therefore, these study findings may not represent an accurate assessment of the potential for RCF to produce adverse health effects.

In a subsequent multi-dose animal inhalation study at 25 f/cc, 75 f/cc, and 115 f/cc found no statistically significant increase in lung cancer; a no observed effect level (NOEL) was found at 25 f/cc. This level is 50 times the HTIW Coalition recommended exposure guideline (REG) of 0.5 f/cc for humans.

Although studies, involving occupationally exposed workers, have not identified any increased incidence of respiratory disease, results from animal testing have been used as the basis for hazard classification. In each of the following cases, the conclusions are qualitative only and do not rest upon any quantitative analysis suggesting that the hazard actually may occur at current occupational exposure levels. In October 2001, the International Agency for Research on Cancer (IARC) confirmed that Group 2b (possible human carcinogen) remains the appropriate IARC classification for RCF.

Epidemiology

University of Cincinnati has been conducting a long term epidemiological studies of RCF human health effects, collecting data from respiratory questionnaires, lung function tests, chest X-rays, exposure monitoring, and worker mortality. The results of this study have shown (LeMasters et al, 2003) no excess mortality related to all deaths, all cancers, or lung cancer, no statistically significant increase in interstitial findings (fibrosis), and no mesotheliomas or increase in lung cancer.

Devitrification

As produced, all RCF fibers are vitreous (glassy) materials which do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline phase silica may begin to form at temperatures of approximately 1200° C (2192° F). When the glass RCF fibers devitrify, they form a mixed mineral crystalline silica containing dust. The crystalline silica is trapped in grain boundaries within a matrix predominately consisting of mullite. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied." IARC also studied mixed mineral crystalline silica containing dusts such as coal dusts (containing 5 – 15 % crystalline silica) and diatomaceous earth without seeing any evidence of disease. (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the USEPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or

no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 micrograms/cm² - by comparison, pure quartz or cristobalite were significantly active at much lower levels (about 20 micrograms/cm²).

Section 12, Ecological information

Ecotoxicity: Not an environmental hazard
Persistence and degradability: Not degradable
Bioaccumulative potential: Not applicable
Mobility in soil: No mobility in soil
Mobility in general: Not applicable
Other adverse effects: No known other adverse effects to the environment

Section 13, Disposal considerations

Disposal instructions: Dispose in approved landfill. This substance is not specifically listed as hazardous waste in federal regulations. To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended. For particular situation check federal, local, regional, state or provincial regulations to identify all applicable disposal requirements.

Hazardous waste code: Not established
Waste from residues / unused products: Follow the same disposal instructions for the product.
Contaminated packaging Dispose: Follow the disposal requirements for the packaging material.

Section 14, Transport information

Ceramic fiber is not regulated as dangerous goods by the following agencies: DOT, IATA, IMDG.
UN number: Not assigned
UN proper shipping name: Not specified
Transport hazard class(es): Not classified
Packing group, if applicable: Not applicable
Environmental hazards (e.g., Marine pollutant (Yes/No)): No
Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code): Not available
Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises: None

Section 15, Regulatory information

US Federal Regulations

- EPA: Superfund Amendments and Reauthorization Act (SARA) Title III - This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).
Toxic Substances Control Act (TSCA) - RCF has been assigned a CAS number; however, it is an "article" under TSCA and therefore exempt from listing on the TSCA inventory.
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Clean Air Act (CAA) - This product contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.
- OSHA: Comply with Hazard Communication Standards 29 CFR 1910.1200 and 29 CFR 1926.59 and the Respiratory Protection Standards 29 CFR 1910.134 and 29 CFR 1926.103.

US State Regulations

- California: Ceramic fibers (airborne particles of respirable size) is listed in Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986 as a chemical known to the State of California to cause cancer.
- Other States: RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

Canada

Canadian Workplace Hazardous Materials Information System (WHMIS) – Classified as Class D2A – Materials Causing Other Toxic Effects
Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

Europe

Integration of RCF/ASW in to ANNEXE XV of the REACH Regulation:
RCF is classified under the CLP (classification, labelling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers and zirconia aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economical Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers and zirconia aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers

or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

Other Regulations

IARC: The International Agency for Research on Cancer (IARC) confirmed that Group 2b (possible human carcinogen) remains the appropriate IARC classification for RCF including ceramic fiber. Possible cancer hazard by inhalation, especially when the fiber become cristobalite at high temperature above 1,800 F.

National Toxicology Program (NTP), classified respirable RCF and glasswool as substances reasonably anticipated to be carcinogens.

The American Conference of Governmental Industrial Hygienists (ACGIH) has classified RCF as "A2-Suspected Human Carcinogen."

Section 16, Other information

NFPA Hazard Classification

Health: 1 Flammability: 0 Instability: 0 Special Hazards: 0

Date of preparation/last revision: October 20, 2015

This Safety Data Sheet was prepared in accordance with OSHA 1910.1200 Hazard Communication Standard (HCS 2012).

DISCLAIMER: The information provided in this Safety Data Sheet (SDS) is believed to be correct as of the date of preparation and to the best of our knowledge. Mineral Seal Corporation (Minseal) makes no warranties. Users should use this information to make an independent determination of the safety of their workers and the environment. Users should provide the information in this form to their employees or contractors that are involved in handling of the substances. Users are responsible for determining whether the product is fit for a particular purpose and application.



SDS No. M0001

SAFETY DATA SHEET

Effective Date: 01/15/2018

1. IDENTIFICATION

(a) Product identifier used on the FIBERFRAX® CERAMIC FIBER PRODUCTS label

(b) Other means of identification **FIBERS**

FIBERFRAX® HIGH PURITY FIBERS: HP-ODB; Module Trim; MT-HP; HP-Chopped; H Bulk; Regular Bulk, Spun Bulk, Fiberfrax FPP Fiber.

FIBERFRAX® 6000 SERIES FIBERS: All bulk fibers from 6000-AAA to 6100-ZZZ, 6900-70A to 6900-99Z.

FIBERFRAX® 7000 SERIES FIBERS: 7000-AA to 7100-ZZ.

FIBERFRAX® MILLED FIBERS: EF-119; HP Ball Milled A; HP Ball Milled B; HP Ball Milled C/D

FIBERFRAX® HIGH INDEX FIBERS: W-657; W-707; W-758; HS-95C; MX-135-CW; MX-400-CW; HS-70; HS-70C.

FIBERFRAX® HSA™ FIBERS: HSA-K; HSA-HP.

FIBERFRAX® KAOLIN FIBERS: K-Chopped; KMTX; MT; MTX; MT-T; MX-150.

BLANKETS

Durablanket® AC; Durablanket® HP; Durablanket® HP-S; Durablanket® S; Durablanket® Strip; Tank Car Insulation; TCB; QSB600; QSB800; FIBERMAT®; LO-CON™ BLANKET, Fiberfrax® SP Mat

PAPERS

FIBERFRAX® BINDERLESS PAPERS: 972-AH; 972-FH; 972-JH; 882-FH; 882-JH; HSA-F without binder; HSA-J without binder.

(c) Recommended use of the chemical and restrictions on use

- **Primary Use:** Refractory Ceramic Fiber (RCF) materials are used primarily in industrial high temperature insulating applications. Examples include heat shields, heat containment, gaskets, expansion joints, industrial furnaces, ovens, kilns, boilers and other process equipment at applications up to 1400°C. RCF based products are not intended for direct sale to the general public. While RCFs are used in the manufacture of some consumer products, such as catalytic converter mats and wood burning stoves, the materials are contained, encapsulated, or bonded within the units.

- **Secondary Use:** Conversion into wet and dry mixtures and articles (refer to section 8).

- **Tertiary Use:** Installation, removal (industrial and professional) / Maintenance and service life (industrial and professional) (refer to section 8).

Uses Advised Against

Spraying of dry product.

d) Name, address, and telephone number Unifrax I LLC

600 Riverwalk Parkway, Suite 120
Tonawanda, NY 14150

Product Stewardship Information Hotline

1-800-322-2293 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)

For additional SDSs, visit our web page, <http://www.unifrax.com> or call Unifrax Customer Service at (716) 768-6500

(e) **Emergency Phone Number:** CHEMTREC will provide assistance for chemical emergencies. Call **1-800-424-9300**

2. HAZARDS IDENTIFICATION

(a) **Classification of the chemical**

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC Group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). WHMIS 2015 Carcinogenicity Category 2.

(b) **Signal word, hazard statement(s), symbol(s) and precautionary statement(s)**

Hazard Pictogram



Signal Word

Warning

Hazard Statements

Suspected of causing cancer by inhalation.

Precautionary statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see section 8 of the Safety Data Sheet.

If concerned about exposure, get medical advice.

Store in a manner to minimize airborne dust.

Dispose of waste in accordance with local, state and federal regulations.

Supplementary Information

May cause temporary mechanical irritation to exposed eyes, skin or respiratory tract.

Minimize exposure to airborne dust.

(c) **Describe any hazards not otherwise classified that have been identified during the classification process**

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure.

These effects are usually temporary.

(d) **Mixture rule**

Not applicable.

3. COMPOSITION / INFORMATION ON INGREDIENTS

(a) Chemical and (b) Common Name

Refractories, Fibers, Aluminosilicate

(c) CAS Number

142844-00-6

% BY WEIGHT

100

***Synonyms:** RCF, ceramic fiber, Alumino Silicate Wool (ASW), synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF), high temperature insulation wool (HTIW)

- (d) **Impurities and stabilizing additives**
Not applicable.

4. FIRST AID MEASURES

- (a) **Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion**

SKIN

Handling of this material may generate mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin.

EYES

In case of eye contact flush abundantly with water; have eye bath available. Do not rub eyes.

NOSE AND THROAT

If these become irritated move to a dust free area, drink water and blow nose.
If symptoms persist, seek medical advice.

- (b) **Most important symptoms/effects, acute and delayed**

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure.
These effects are usually temporary.

- (c) **Indication of immediate medical attention and special treatment needed, if necessary**

NOTES TO PHYSICIANS

Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

- (a) **Suitable (and unsuitable) extinguishing media**

Use extinguishing agent suitable for surrounding combustible materials.

- (b) **Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products):**

Non-combustible products, class of reaction to fire is zero.
Packaging and surrounding materials may be combustible.

- (c) **Special protective equipment and precautions for fire-fighters**

NFPA Codes: Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

- (a) **Personal precautions, protective equipment, and emergency procedures**

Minimize airborne dust. Compressed air or dry sweeping should not be used for cleaning. See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines.

- (b) **Methods and materials for containment and cleaning up**

Frequently clean the work area with appropriately filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

7. HANDLING AND STORAGE

(a) Precautions for safe handling

Handle fiber carefully to minimize airborne dust. Limit use of power tools unless in conjunction with local exhaust ventilation. Use hand tools whenever possible.

(b) Conditions for safe storage, including any incompatibilities

Store in a manner to minimize airborne dust.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

(a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available

<u>Components</u>	<u>OSHA PEL</u>	<u>NIOSH REL</u>	<u>ACGIH TLV</u>	<u>MANUFACTURER REG</u>
Refractory Ceramic Fiber (RCF)	None established*	0.5 f/cc, 8-hr. TWA	0.2 f/cc TLV, 8-hr. TWA	0.5 f/cc, 8-hr. TWA**

*Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally - Total Dust 15 mg/m³; Respirable Fraction 5 mg/m³.

**In the absence of an OSHA PEL, HTIW Coalition has adopted a recommended exposure guideline (REG), as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see "Rationale for the Recommended Exposure Guideline" at page 34 of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf.

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: California, 0.2 f/cc; Canadian provincial OELs ranging from 0.2 to 1.0 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and determining their relative applicability to the workplace is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

(b) Appropriate engineering controls

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

(c) Individual protection measures, such as personal protective equipment

Skin Protection

Wear personal protective equipment (e.g gloves), as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employees should be informed on best practices to minimize non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, and rinse washer before washing other household clothes).

Eye Protection

As necessary, wear goggles or safety glasses with side shields.

Respiratory Protection

When engineering and/or administrative controls are insufficient to maintain workplace concentrations below the 0.5 f/cc REG or a regulatory OEL, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. A NIOSH certified respirator with a filter efficiency of at least 95% should be used. The 95% filter efficiency recommendation is based on NIOSH respirator selection logic sequence for exposure to manmade mineral fibers. Pursuant to NIOSH recommendations, N-95 respirators are appropriate for exposures up to 10 times the NIOSH Recommended Exposure Limit (REL). With respect to RCF, both the NIOSH REL and the industry REG have been set at 0.5 fibers per cubic centimeter of air (f/cm³). Accordingly, N-95 would provide the necessary protection for exposures up to 5 f/cm³. Further, the Respirator Selection Guide published by 3M Corporation, the primary respirator manufacturer, specifically recommends use of N-95 respirators for RCF exposures. In cases where exposures are known to be above 5.0 f/cm³, 8 hour TWA, a filter efficiency of 100% should be used. Other factors to consider are the NIOSH filter series N, R or P -- (N) **N**ot resistant to oil, (R) **R**esistant to oil and (P) **P**roof. These recommendations are not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

Other Information

- Concentrations based upon an eight-hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.
- The manufacturer recommends the use of a full-facepiece air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica.

9. PHYSICAL AND CHEMICAL PROPERTIES

(a) Appearance	White, fibrous wool	(j) Upper/lower flammability or explosive limits	Not applicable
(b) Odor	Odorless	(k) Vapor pressure	Not applicable
(c) Odor threshold	Not applicable	(l) Vapor density	Not applicable
(d) pH	Not applicable	(m) Relative density	2.50 – 2.75
(e) Melting point	1760° C (3200° F)	(n) Solubility	Insoluble
(f) Initial boiling point and boiling range	Not applicable	(o) Partition coefficient: n-octanol/water	Not applicable
(g) Flash point	Not applicable	(p) Auto-ignition temperature	Not applicable
(h) Evaporation rate	Not applicable	(q) Decomposition temperature	Not applicable
(i) Flammability	Not applicable	(r) Viscosity	Not applicable

10. STABILITY AND REACTIVITY

(a) Reactivity	RCF is non-reactive.
(b) Chemical stability	As supplied RCF is stable and inert.
(c) Possibility of hazardous reactions	None
(d) Conditions to avoid	Please refer to handling and storage advice in Section 7
(e) Incompatible materials	None
(f) Hazardous decomposition products	None.

11. TOXICOLOGICAL INFORMATION

For more details on scientific publications referenced in this SDS see <http://www.htiwcoalition.org/publications.html>

(a) through (d)

TOXICOKINETICS, METABOLISM AND DISTRIBUTION

Basic Toxicokinetics

Exposure is predominantly by inhalation or ingestion. Man-made vitreous fibers of a similar size to RCF have not been shown to migrate from the lung and/or gut and do not become located in other organs of the body.

Human Toxicological Data/Epidemiology Data

In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S.A; this epidemiological study has been ongoing for 25 years and medical surveillance of RCF workers continues. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in the U.S.A. and Europe have demonstrated an absence of interstitial fibrosis. In the European study a reduction of lung capacity among smokers has been identified, however, based on the latest results from a longitudinal study of workers in the U.S.A. with over 17-year follow-up, there has been no accelerated rate of loss of lung function (McKay et al. 2011).

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the U.S.A. longitudinal study.

The final report of the USA mortality study (LeMasters et al., 2017) concluded that "after 30 years of follow-up, no excess of lung cancers in the mortality study and no significant association with radiographic findings of interstitial fibrosis were found in this group of workers." The study also found a small incidence of other effects that appear unrelated to RCF exposure. The final mortality report did not change the current hazard classification for RCF.

Information on Toxicological Effects

- *Acute toxicity: short term inhalation*
No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.
- *Acute toxicity: oral*
No data available: Repeated dose studies have been carried out using gavage. No effect was found.
- *Skin corrosion/irritation*
Not a chemical irritant according to test method OECD no. 404.
- *Serious eye damage/irritation*
Not possible to obtain acute toxicity information due to the morphology and chemical inertness of the

substance.

- *Respiratory or skin sensitization*
No evidence from human epidemiological studies of any respiratory or skin sensitization potential.
- *Germ cell mutagenicity/genotoxicity*
Method: In vitro micronucleus test
Species: Hamster (CHO)
Dose: 1-35 mg/ml
Routes of administration: In suspension
Results: Negative
- *Carcinogenicity*
Method: Inhalation, multi-dose
Species: Rat
Dose: 3 mg/m³, 9 mg/m³ and 16 mg/m³
Routes of administration: Nose only inhalation
Results: Fibrosis just reached significant levels at 16 and 9 mg/m³ but not at 3 mg/m³. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation, single dose

Species: Rat

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: Rats were exposed to a single concentration of 200 WHO fibers/ml specially prepared RCF for 24 months. High incidence of exposure-related pulmonary neoplasms (bronchoalveolar adenomas and carcinomas) was observed. A small number of mesotheliomas were observed in each of the fiber exposure groups (Mast et al 1995a).

Method: Inhalation, single dose

Species: Hamster

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: Hamsters were exposed to a single concentration of 260 WHO fibers/ml specially prepared RCF for 18 months and developed lung fibrosis, a significant number of pleural mesotheliomas (42/102) but no primary lung tumors (McConnell et al 1995).

Method: Inhalation, single dose

Species: Rat

Dose: RCF1: 130 F/ml and 50 mg/m³ (25% of non fibrous particles)

RCF1a: 125 F/ml and 26 mg/m³ (2% of non fibrous particles)

Routes of administration: Nose only inhalation

Results: Rats were exposed to RCF1 and RCF1a for 3 weeks. The objective of the study was to compare lung retention and biological effects of the original RCF1 compared to RCF1a. The main difference of these 2 samples was the non-fibrous particle content of respectively 25% versus 2%. The post treatment observation was 12 months. Alveolar clearance was barely retarded after RCF1A exposure. After RCF1 exposure, however, a severe retardation of clearance was observed. (Bellmann et al 2001).

After intraperitoneal injection of ceramic fibers into rats in three experiments (Smith et al 1987, Pott et al 1987, Davis et al 1984), mesotheliomas were found in the abdominal cavity in two studies, while the third report (Pott et al 1987) had incomplete histopathology. Only a few mesotheliomas were found in the abdominal cavity of hamsters after intraperitoneal injection in one experiment (Smith et al 1987). However, the ceramic fibers tested were of relatively large diameter. When rats and hamsters were exposed via intraperitoneal injection, tumor incidence was related to fiber length and dose (Smith et al 1987, Pott et al 1987, Miller et al 1999, Pott et al 1989). (From SCOEL publication (EU Scientific Committee on Occupational Exposure Limits) SCOEL/SUM/165, September 2011).

- *Reproductive toxicity*
Method: Gavage
Species: Rat

Dose: 250mg/kg/day

Routes of administration: Oral

Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

- *STOT-Single exposure*
Not applicable
- *STOT-Repeated exposure*
Not applicable
- *Aspiration hazard*
Not applicable

See the following review publications for a summary and discussion:

Interpretation of these animal experiments is complex and there is not complete agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utell and Maxim 2010.

Other information

Numerous studies indicate the relevance of biopersistence as a determinant of toxic effects of fiber exposure. (Maxim et al 2006).

Irritant Properties

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans. Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

(e) International Agency for Research on Cancer and National Toxicology Program

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION

(a) Ecotoxicity (aquatic and terrestrial, where available)	No known aquatic toxicity.
(b) Persistence and degradability	These products are insoluble materials that remain stable over time and are chemically identical to inorganic compounds found in the soil and sediment; they remain inert in the natural environment.
(c) Bioaccumulative potential	No bioaccumulative potential.
(d) Mobility in soil	No mobility in soil.
(e) Other adverse effects (such as hazardous to the ozone layer)	No adverse effects of this material on the environment are anticipated.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL

This product, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION

(a) UN number	Not Applicable
(b) UN proper shipping name	Not Applicable
(c) Transport hazard class(es)	Not Applicable
(d) Packing group, if applicable	Not Applicable
(e) Environmental hazards (e.g., Marine pollutant (Yes/No))	Not a marine pollutant
(f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code)	Not Applicable
(g) Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises	Not Applicable

Canadian TDG Hazard Class & PIN: Not regulated

Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15. REGULATORY INFORMATION

UNITED STATES REGULATIONS

EPA	<p>Superfund Amendments and Reauthorization Act (SARA) Title III - this product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).</p> <p>Hazard Categories: Immediate Hazard – No Delayed Hazard – Yes Fire Hazard – No Pressure Hazard – No Reactivity Hazard – No</p> <p>Toxic Substances Control Act (TSCA) - RCF is not required to be listed on the TSCA inventory.</p> <p>Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Clean Air Act (CAA) - this product contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.</p>
OSHA	Comply with Hazard Communication Standards 29 CFR 1910.1200 and 29 CFR 1926.59 and the Respiratory Protection Standards 29 CFR 1910.134 and 29 CFR 1926.103.
California	"Ceramic fibers (airborne particles of respirable size)" is listed in Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986 as a chemical known to the State of California to cause cancer.

Other States	RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.
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INTERNATIONAL REGULATIONS

Canada **Canadian Environmental Protection Act (CEPA)** - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

Europe **Integration of RCF into ANNEX XV of the REACH Regulation**

RCF is classified under the CLP (classification, labelling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

16. OTHER INFORMATION

Product Stewardship Program

Unifrax I LLC has established a program to provide customers with up-to-date information regarding the proper use and handling of refractory ceramic fiber. In addition, Unifrax has also established a program to monitor airborne fiber concentrations at customer facilities. If you would like more information about this program, please call the Unifrax Product Stewardship Information Hotline at **1-800-322-2293**.

The manufacturers of refractory ceramic fibers (RCF), who comprise the membership of the HTIW Coalition, remain committed to the continued protection of the health and safety of their employees and all others who use or handle RCF. Building on its prior commitment to voluntary product stewardship, the HTIW Coalition has recently renewed its comprehensive Product Stewardship Program (PSP) for RCF, known as PSP 2017.

PSP 2017 is the fourth iteration of the Coalition's RCF product stewardship program first endorsed by OSHA in 2002 as PSP 2002, renewed in 2007 as PSP-HTW and again in 2012 as PSP 2012. Like its predecessors, PSP 2017 is designed to encourage feasible and necessary control of fiber exposure in the workplace and thereby reduce any potential risk that could be posed by such exposure. For more information regarding this cooperative program that promotes the health and safety of fiber workers nationwide, please visit <http://www.htiwcoalition.org>.

Hazardous Materials Identification System (HMIS) Hazard Rating

HMIS Health	1* (* denotes potential for chronic effects)
HMIS Flammability	0
HMIS Reactivity	0
HMIS Personal Protective Equipment	X (To be determined by user)

Additional Information on After Service Material

As produced, all RCF fibers are vitreous (glassy) materials which do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline phase silica may begin to form at

approximately 1100° C (2012° F). When the glass RCF fibers devitrify, they form a mixed mineral crystalline silica containing dust. The crystalline silica is trapped in grain boundaries within a matrix predominately consisting of mullite. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents or furnace contaminants. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied." IARC also studied mixed mineral crystalline silica containing dusts such as coal dusts (containing 5 – 15 % crystalline silica) and diatomaceous earth without seeing any evidence of disease. (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the USEPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 micrograms/cm² - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 micrograms/cm²).

DEFINITIONS

ACGIH:	American Conference of Governmental Industrial Hygienists
ADR:	Carriage of Dangerous Goods by Road (International Regulation)
CAA:	Clean Air Act
CAS:	Chemical Abstracts Service
CERCLA:	Comprehensive Environmental Response, Compensation and Liability Act
DSL:	Domestic Substances List
EPA:	Environmental Protection Agency
EU:	European Union
f/cc:	Fibers per cubic centimeter
HEPA:	High Efficiency Particulate Air
HMIS:	Hazardous Materials Identification System
IARC:	International Agency for Research on Cancer
IATA:	International Air Transport Association
IMDG:	International Maritime Dangerous Goods Code
mg/m³:	Milligrams per cubic meter of air
mmpcf:	Million particles per cubic meter
NFPA:	National Fire Protection Association
NIOSH:	National Institute for Occupational Safety and Health
OSHA:	Occupational Safety and Health Administration
29 CFR 1910.134 & 1926.103:	OSHA Respiratory Protection Standards
29 CFR 1910.1200 & 1926.59:	OSHA Hazard Communication Standards
PEL:	Permissible Exposure Limit (OSHA)
PIN:	Product Identification Number
PNOC:	Particulates Not Otherwise Classified
PNOR:	Particulates Not Otherwise Regulated
PSP:	Product Stewardship Program
RCRA:	Resource Conservation and Recovery Act
REL:	Recommended Exposure Limit (NIOSH)

RID:	Carriage of Dangerous Goods by Rail (International Regulations)
SARA:	Superfund Amendments and Reauthorization Act
SARA Title III:	Emergency Planning and Community Right to Know Act
SARA Section 302:	Extremely Hazardous Substances
SARA Section 304:	Emergency Release
SARA Section 311:	MSDS/List of Chemicals and Hazardous Inventory
SARA Section 312:	Emergency and Hazardous Inventory
SARA Section 313:	Toxic Chemicals and Release Reporting
STEL:	Short Term Exposure Limit
SVF:	Synthetic Vitreous Fiber
TDG:	Transportation of Dangerous Goods
TLV:	Threshold Limit Value (ACGIH)
TSCA:	Toxic Substances Control Act
TWA:	Time Weighted Average
WHMIS:	Workplace Hazardous Materials Information System (Canada)

Revision Summary: Updated epidemiology summary information
Revision Date: 01/15/2018

SDS Prepared By: UNIFRAX RISK MANAGEMENT DEPARTMENT

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this SDS. Therefore, given the summary nature of this document, Unifrax I LLC does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.



SDS No. M0039

SAFETY DATA SHEET

Effective Date: 01/15/2018

1. IDENTIFICATION

(a) Product identifier used on the label **FIBERFRAX® DURABOARD® HD**

(b) Other means of identification

(c) Recommended use of the chemical and restrictions on use

- **Primary Use:** Refractory Ceramic Fiber (RCF) materials are used primarily in industrial high temperature insulating applications. Examples include heat shields, heat containment, gaskets, expansion joints, industrial furnaces, ovens, kilns, boilers and other process equipment at applications up to 1400°C. RCF based products are not intended for direct sale to the general public. While RCFs are used in the manufacture of some consumer products, such as catalytic converter mats and wood burning stoves, the materials are contained, encapsulated, or bonded within the units.
- **Secondary Use:** Conversion into wet and dry mixtures and articles (refer to section 8).
- **Tertiary Use:** Installation, removal (industrial and professional) / Maintenance and service life (industrial and professional) (refer to section 8).

Uses Advised Against

Spraying of dry product.

(d) Name, address, and telephone number

Unifrax I LLC
600 Riverwalk Parkway, Suite 120
Tonawanda, NY 14150

Product Stewardship Information Hotline
1-800-322-2293 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)

For additional SDSs, visit our web page, <http://www.unifrax.com> or call Unifrax Customer Service at (716) 768-6500

(e) Emergency Phone Number: CHEMTREC will provide assistance for chemical emergencies. Call **1-800-424-9300**

2. HAZARDS IDENTIFICATION

(a) Classification of the chemical

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC Group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). WHMIS 2015 Carcinogenicity Category 2.

(b) Signal word, hazard statement(s), symbol(s) and precautionary statement(s)

Hazard Pictogram

**Signal Word**

Warning

Hazard Statements

Suspected of causing cancer by inhalation.

Precautionary statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see section 8 of the Safety Data Sheet.

If concerned about exposure, get medical advice.

Store in a manner to minimize airborne dust.

Dispose of waste in accordance with local, state and federal regulations.

Supplementary Information

May cause temporary mechanical irritation to exposed eyes, skin or respiratory tract.

Minimize exposure to airborne dust.

(c) Describe any hazards not otherwise classified that have been identified during the classification process

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure.

These effects are usually temporary.

(d) Mixture rule

Not applicable.

3. COMPOSITION / INFORMATION ON INGREDIENTS

<u>(a) Chemical and (b) Common Name</u>	<u>(c) CAS Number</u>	<u>% BY WEIGHT</u>
Refractories, Fibers, Aluminosilicate	142844-00-6	60-65
Calcined kaolin clay	1332-58-7	15-20
Silica (amorphous)	7631-86-9	10-15
Starch	9005-25-8	5-10

***Synonyms:** RCF, ceramic fiber, Alumino Silicate Wool (ASW), synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF), high temperature insulation wool (HTIW)

(d) Impurities and stabilizing additives

Not applicable.

4. FIRST AID MEASURES

(a) Description of necessary measures, subdivided according to the different routes of exposure, i.e.,

inhalation, skin and eye contact, and ingestion

SKIN

Handling of this material may generate mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin.

EYES

In case of eye contact flush abundantly with water; have eye bath available. Do not rub eyes.

NOSE AND THROAT

If these become irritated move to a dust free area, drink water and blow nose.
If symptoms persist, seek medical advice.

(b) Most important symptoms/effects, acute and delayed

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure.
These effects are usually temporary.

(c) Indication of immediate medical attention and special treatment needed, if necessary

NOTES TO PHYSICIANS

Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

(a) Suitable (and unsuitable) extinguishing media

Use extinguishing agent suitable for surrounding combustible materials.

(b) Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products):

Non-combustible products, class of reaction to fire is zero.

Packaging and surrounding materials may be combustible.

Thermal decomposition of binder from fires or from first heat of product may release smoke, carbon monoxide, and carbon dioxide. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition of binder. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity or an asthmatic-type response.

(c) Special protective equipment and precautions for fire-fighters

NFPA Codes: Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

(a) Personal precautions, protective equipment, and emergency procedures

Minimize airborne dust. Compressed air or dry sweeping should not be used for cleaning. See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines.

(b) Methods and materials for containment and cleaning up

Frequently clean the work area with appropriately filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

7. HANDLING AND STORAGE

(a) Precautions for safe handling

Handle fiber carefully to minimize airborne dust. Limit use of power tools unless in conjunction with local exhaust ventilation. Use hand tools whenever possible.

(b) Conditions for safe storage, including any incompatibilities

Store in a manner to minimize airborne dust.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

(a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available

<u>Components</u>	<u>OSHA PEL</u>	<u>NIOSH REL</u>	<u>ACGIH TLV</u>	<u>MANUFACTURER REG</u>
Refractory Ceramic Fiber (RCF)	None established*	0.5 f/cc, 8-hr. TWA	0.2 f/cc TLV, 8-hr. TWA	0.5 f/cc, 8-hr. TWA**
Calcined kaolin clay	5 mg/m ³ PEL (resp. dust) 15 mg/m ³ PEL (total dust)		2 mg/m ³	None established
Silica (amorphous)	20 mppcf or 80 mg/m ³ / % SiO ₂		10 mg/m ³ .	None established
Starch	5 mg/m ³ PEL (resp. dust) 15 mg/m ³ PEL (total dust)		10 mg/m ³ .	None established

*Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally - Total Dust 15 mg/m³; Respirable Fraction 5 mg/m³.

**In the absence of an OSHA PEL, HTIW Coalition has adopted a recommended exposure guideline (REG), as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see "Rationale for the Recommended Exposure Guideline" at page 34 of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf.

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: California, 0.2 f/cc; Canadian provincial OELs ranging from 0.2 to 1.0 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and determining their relative applicability to the workplace is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

(b) Appropriate engineering controls

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

(c) Individual protection measures, such as personal protective equipment

Skin Protection

Wear personal protective equipment (e.g gloves), as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employees should be informed on best practices to minimize non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, and rinse washer before washing other household clothes).

Eye Protection

As necessary, wear goggles or safety glasses with side shields.

Respiratory Protection

When engineering and/or administrative controls are insufficient to maintain workplace concentrations below the 0.5 f/cc REG or a regulatory OEL, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. A NIOSH certified respirator with a filter efficiency of at least 95% should be used. The 95% filter efficiency recommendation is based on NIOSH respirator selection logic sequence for exposure to manmade mineral fibers. Pursuant to NIOSH recommendations, N-95 respirators are appropriate for exposures up to 10 times the NIOSH Recommended Exposure Limit (REL). With respect to RCF, both the NIOSH REL and the industry REG have been set at 0.5 fibers per cubic centimeter of air (f/cm³). Accordingly, N-95 would provide the necessary protection for exposures up to 5 f/cm³. Further, the Respirator Selection Guide published by 3M Corporation, the primary respirator manufacturer, specifically recommends use of N-95 respirators for RCF exposures. In cases where exposures are known to be above 5.0 f/cm³, 8 hour TWA, a filter efficiency of 100% should be used. Other factors to consider are the NIOSH filter series N, R or P -- (N) **Not** resistant to oil, (R) **Resistant** to oil and (P) **oil Proof**. These recommendations are not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

Other Information

- Concentrations based upon an eight-hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.
- The manufacturer recommends the use of a full-facepiece air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica.

9. PHYSICAL AND CHEMICAL PROPERTIES

(a) Appearance	White, fibrous wool	(j) Upper/lower flammability or explosive limits	Not applicable
(b) Odor	Odorless	(k) Vapor pressure	Not applicable
(c) Odor threshold	Not applicable	(l) Vapor density	Not applicable
(d) pH	Not applicable	(m) Relative density	2.50 – 2.75
(e) Melting point	1760° C (3200° F)	(n) Solubility	Insoluble
(f) Initial boiling point and boiling range	Not applicable	(o) Partition coefficient: n-octanol/water	Not applicable
(g) Flash point	Not applicable	(p) Auto-ignition temperature	Not applicable
(h) Evaporation rate	Not applicable	(q) Decomposition temperature	Not applicable
(i) Flammability	Not applicable	(r) Viscosity	Not applicable

10. STABILITY AND REACTIVITY

(a) Reactivity	RCF is non-reactive.
(b) Chemical stability	As supplied RCF is stable and inert.
(c) Possibility of hazardous reactions	None
(d) Conditions to avoid	Please refer to handling and storage advice in Section 7
(e) Incompatible materials	None
(f) Hazardous decomposition products	Thermal decomposition of binder from fires or from first heat of product may release smoke, carbon monoxide, and carbon dioxide. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition of binder. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity or an asthmatic-type response.

11. TOXICOLOGICAL INFORMATION

For more details on scientific publications referenced in this SDS see <http://www.htiwoalition.org/publications.html>

(a) through (d)

TOXICOKINETICS, METABOLISM AND DISTRIBUTION

Basic Toxicokinetics

Exposure is predominantly by inhalation or ingestion. Man-made vitreous fibers of a similar size to RCF have not been shown to migrate from the lung and/or gut and do not become located in other organs of the body.

Human Toxicological Data/Epidemiology Data

In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S.A; this epidemiological study has been ongoing for 25 years and medical surveillance of RCF workers continues. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in the U.S.A. and Europe have demonstrated an absence of interstitial fibrosis. In the European study a reduction of lung capacity among smokers has been identified, however, based on the latest results from a longitudinal study of workers in the U.S.A. with over 17-year follow-up, there has been no accelerated rate of loss of lung function (McKay et al. 2011).

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the U.S.A. longitudinal study.

The final report of the USA mortality study (LeMasters et al., 2017) concluded that "after 30 years of follow-up, no excess of lung cancers in the mortality study and no significant association with radiographic findings of interstitial fibrosis were found in this group of workers." The study also found a small incidence of other effects that appear unrelated to RCF exposure. The final mortality report did not change the current hazard classification for RCF.

Information on Toxicological Effects

- *Acute toxicity: short term inhalation*
No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.
- *Acute toxicity: oral*
No data available: Repeated dose studies have been carried out using gavage. No effect was found.
- *Skin corrosion/irritation*

Not a chemical irritant according to test method OECD no. 404.

- *Serious eye damage/irritation*
Not possible to obtain acute toxicity information due to the morphology and chemical inertness of the substance.
- *Respiratory or skin sensitization*
No evidence from human epidemiological studies of any respiratory or skin sensitization potential.
- *Germ cell mutagenicity/genotoxicity*
Method: In vitro micronucleus test
Species: Hamster (CHO)
Dose: 1-35 mg/ml
Routes of administration: In suspension
Results: Negative
- *Carcinogenicity*
Method: Inhalation, multi-dose
Species: Rat
Dose: 3 mg/m³, 9 mg/m³ and 16 mg/m³
Routes of administration: Nose only inhalation
Results: Fibrosis just reached significant levels at 16 and 9 mg/m³ but not at 3 mg/m³. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation, single dose

Species: Rat

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: Rats were exposed to a single concentration of 200 WHO fibers/ml specially prepared RCF for 24 months. High incidence of exposure-related pulmonary neoplasms (bronchoalveolar adenomas and carcinomas) was observed. A small number of mesotheliomas were observed in each of the fiber exposure groups (Mast et al 1995a).

Method: Inhalation, single dose

Species: Hamster

Dose: 30 mg/m³

Routes of administration: Nose only inhalation

Results: Hamsters were exposed to a single concentration of 260 WHO fibers/ml specially prepared RCF for 18 months and developed lung fibrosis, a significant number of pleural mesotheliomas (42/102) but no primary lung tumors (McConnell et al 1995).

Method: Inhalation, single dose

Species: Rat

Dose: RCF1: 130 F/ml and 50 mg/m³ (25% of non fibrous particles)

RCF1a: 125 F/ml and 26 mg/m³ (2% of non fibrous particles)

Routes of administration: Nose only inhalation

Results: Rats were exposed to RCF1 and RCF1a for 3 weeks. The objective of the study was to compare lung retention and biological effects of the original RCF1 compared to RCF1a. The main difference of these 2 samples was the non-fibrous particle content of respectively 25% versus 2%. The post treatment observation was 12 months. Alveolar clearance was barely retarded after RCF1A exposure. After RCF1 exposure, however, a severe retardation of clearance was observed. (Bellmann et al 2001).

After intraperitoneal injection of ceramic fibers into rats in three experiments (Smith et al 1987, Pott et al 1987, Davis et al 1984), mesotheliomas were found in the abdominal cavity in two studies, while the third report (Pott et al 1987) had incomplete histopathology. Only a few mesotheliomas were found in the abdominal cavity of hamsters after intraperitoneal injection in one experiment (Smith et al 1987). However, the ceramic fibers tested were of relatively large diameter. When rats and hamsters were exposed via intraperitoneal injection, tumor incidence was related to fiber length and dose (Smith et al 1987, Pott et al 1987, Miller et al 1999, Pott et al 1989). (From SCOEL publication (EU Scientific Committee on Occupational Exposure Limits) SCOEL/SUM/165, September 2011).

- *Reproductive toxicity*
Method: Gavage
Species: Rat
Dose: 250mg/kg/day
Routes of administration: Oral
Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.
- *STOT-Single exposure*
Not applicable
- *STOT-Repeated exposure*
Not applicable
- *Aspiration hazard*
Not applicable

See the following review publications for a summary and discussion:

Interpretation of these animal experiments is complex and there is not complete agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in

SCOEL/SUM/165 and in Utell and Maxim 2010.

Other information

Numerous studies indicate the relevance of biopersistence as a determinant of toxic effects of fiber exposure. (Maxim et al 2006).

Irritant Properties

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans. Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

(e) International Agency for Research on Cancer and National Toxicology Program

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION

(a) Ecotoxicity (aquatic and terrestrial, where available)	No known aquatic toxicity.
(b) Persistence and degradability	These products are insoluble materials that remain stable over time and are chemically identical to inorganic compounds found in the soil and sediment; they remain inert in the natural environment.
(c) Bioaccumulative potential	No bioaccumulative potential.

(d) Mobility in soil	No mobility in soil.
(e) Other adverse effects (such as hazardous to the ozone layer)	No adverse effects of this material on the environment are anticipated.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL

This product, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION

(a) UN number	Not Applicable
(b) UN proper shipping name	Not Applicable
(c) Transport hazard class(es)	Not Applicable
(d) Packing group, if applicable	Not Applicable
(e) Environmental hazards (e.g., Marine pollutant (Yes/No))	Not a marine pollutant
(f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code)	Not Applicable
(g) Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises	Not Applicable

Canadian TDG Hazard Class & PIN: Not regulated

Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15. REGULATORY INFORMATION

UNITED STATES REGULATIONS

EPA	<p>Superfund Amendments and Reauthorization Act (SARA) Title III - this product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).</p> <p>Hazard Categories: Immediate Hazard – No Delayed Hazard – Yes Fire Hazard – No Pressure Hazard – No Reactivity Hazard – No</p> <p>Toxic Substances Control Act (TSCA) - RCF is not required to be listed on the TSCA inventory.</p> <p>Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Clean Air Act (CAA) - this product contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.</p>
OSHA	Comply with Hazard Communication Standards 29 CFR 1910.1200 and 29 CFR 1926.59

California	and the Respiratory Protection Standards 29 CFR 1910.134 and 29 CFR 1926.103. "Ceramic fibers (airborne particles of respirable size)" is listed in Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986 as a chemical known to the State of California to cause cancer.
Other States	RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada **Canadian Environmental Protection Act (CEPA)** - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

Europe Integration of RCF into ANNEX XV of the REACH Regulation

RCF is classified under the CLP (classification, labelling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

16. OTHER INFORMATION

Product Stewardship Program

Unifrax I LLC has established a program to provide customers with up-to-date information regarding the proper use and handling of refractory ceramic fiber. In addition, Unifrax has also established a program to monitor airborne fiber concentrations at customer facilities. If you would like more information about this program, please call the Unifrax Product Stewardship Information Hotline at **1-800-322-2293**.

The manufacturers of refractory ceramic fibers (RCF), who comprise the membership of the HTIW Coalition, remain committed to the continued protection of the health and safety of their employees and all others who use or handle RCF. Building on its prior commitment to voluntary product stewardship, the HTIW Coalition has recently renewed its comprehensive Product Stewardship Program (PSP) for RCF, known as PSP 2017.

PSP 2017 is the fourth iteration of the Coalition's RCF product stewardship program first endorsed by OSHA in 2002 as PSP 2002, renewed in 2007 as PSP-HTW and again in 2012 as PSP 2012. Like its predecessors, PSP 2017 is designed to encourage feasible and necessary control of fiber exposure in the workplace and thereby reduce any potential risk that could be posed by such exposure. For more information regarding this cooperative program that promotes the health and safety of fiber workers nationwide, please visit <http://www.htiwcoalition.org>.

Hazardous Materials Identification System (HMIS) Hazard Rating

HMIS Health	1* (* denotes potential for chronic effects)
HMIS Flammability	0
HMIS Reactivity	0
HMIS Personal Protective Equipment	X (To be determined by user)

Additional Information on After Service Material

As produced, all RCF fibers are vitreous (glassy) materials which do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline phase silica may begin to form at approximately 1100° C (2012° F). When the glass RCF fibers devitrify, they form a mixed mineral crystalline silica containing dust. The crystalline silica is trapped in grain boundaries within a matrix predominately consisting of mullite. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents or furnace contaminants. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied." IARC also studied mixed mineral crystalline silica containing dusts such as coal dusts (containing 5 – 15 % crystalline silica) and diatomaceous earth without seeing any evidence of disease. (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the USEPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 micrograms/cm² - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 micrograms/cm²).

DEFINITIONS

ACGIH:	American Conference of Governmental Industrial Hygienists
ADR:	Carriage of Dangerous Goods by Road (International Regulation)
CAA:	Clean Air Act
CAS:	Chemical Abstracts Service
CERCLA:	Comprehensive Environmental Response, Compensation and Liability Act
DSL:	Domestic Substances List
EPA:	Environmental Protection Agency
EU:	European Union
f/cc:	Fibers per cubic centimeter
HEPA:	High Efficiency Particulate Air
HMIS:	Hazardous Materials Identification System
IARC:	International Agency for Research on Cancer
IATA:	International Air Transport Association
IMDG:	International Maritime Dangerous Goods Code
mg/m³:	Milligrams per cubic meter of air
mmpcf:	Million particles per cubic meter
NFPA:	National Fire Protection Association
NIOSH:	National Institute for Occupational Safety and Health
OSHA:	Occupational Safety and Health Administration
29 CFR 1910.134 & 1926.103:	OSHA Respiratory Protection Standards
29 CFR 1910.1200 & 1926.59:	OSHA Hazard Communication Standards
PEL:	Permissible Exposure Limit (OSHA)
PIN:	Product Identification Number
PNOC:	Particulates Not Otherwise Classified
PNOR:	Particulates Not Otherwise Regulated
PSP:	Product Stewardship Program
RCRA:	Resource Conservation and Recovery Act

REL:	Recommended Exposure Limit (NIOSH)
RID:	Carriage of Dangerous Goods by Rail (International Regulations)
SARA:	Superfund Amendments and Reauthorization Act
SARA Title III:	Emergency Planning and Community Right to Know Act
SARA Section 302:	Extremely Hazardous Substances
SARA Section 304:	Emergency Release
SARA Section 311:	MSDS/List of Chemicals and Hazardous Inventory
SARA Section 312:	Emergency and Hazardous Inventory
SARA Section 313:	Toxic Chemicals and Release Reporting
STEL:	Short Term Exposure Limit`
SVF:	Synthetic Vitreous Fiber
TDG:	Transportation of Dangerous Goods
TLV:	Threshold Limit Value (ACGIH)
TSCA:	Toxic Substances Control Act
TWA:	Time Weighted Average
WHMIS:	Workplace Hazardous Materials Information System (Canada)

Revision Summary: Updated epidemiology summary information

Revision Date: 01/15/2018

SDS Prepared By: UNIFRAX RISK MANAGEMENT DEPARTMENT

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this SDS. Therefore, given the summary nature of this document, Unifrax I LLC does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.



SDS No. M0055

SAFETY DATA SHEET

Effective Date: 01/15/2018

1. IDENTIFICATION

- (a) Product identifier used on the label **FIBERFRAX® HIGH PURITY PAPERS**
- (b) Other means of identification **550-F, 550-J, 550-K, 880-F, 880-J, 970-A, 970-F, 970-J, 970-K, Rollboard, HSA-F with binder, HSA-J with binder, QSP100, QSP300, QSP500, QSP1000.**
- (c) Recommended use of the chemical and restrictions on use
- **Primary Use:** Refractory Ceramic Fiber (RCF) materials are used primarily in industrial high temperature insulating applications. Examples include heat shields, heat containment, gaskets, expansion joints, industrial furnaces, ovens, kilns, boilers and other process equipment at applications up to 1400°C. RCF based products are not intended for direct sale to the general public. While RCFs are used in the manufacture of some consumer products, such as catalytic converter mats and wood burning stoves, the materials are contained, encapsulated, or bonded within the units.
 - **Secondary Use:** Conversion into wet and dry mixtures and articles (refer to section 8).
 - **Tertiary Use:** Installation, removal (industrial and professional) / Maintenance and service life (industrial and professional) (refer to section 8).
- Uses Advised Against**
Spraying of dry product.
- (d) Name, address, and telephone number
- Unifrax I LLC**
600 Riverwalk Parkway, Suite 120
Tonawanda, NY 14150
- Product Stewardship Information Hotline**
1-800-322-2293 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)
- For additional SDSs, visit our web page, <http://www.unifrax.com> or call Unifrax Customer Service at (716) 768-6500**
- (e) Emergency Phone Number: **CHEMTREC will provide assistance for chemical emergencies. Call 1-800-424-9300**

2. HAZARDS IDENTIFICATION

(a) Classification of the chemical

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC Group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). WHMIS 2015 Carcinogenicity Category 2.

(b) Signal word, hazard statement(s), symbol(s) and precautionary statement(s)

Hazard Pictogram

**Signal Word**

Warning

Hazard Statements

Suspected of causing cancer by inhalation.

Precautionary statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see section 8 of the Safety Data Sheet.

If concerned about exposure, get medical advice.

Store in a manner to minimize airborne dust.

Dispose of waste in accordance with local, state and federal regulations.

Supplementary Information

May cause temporary mechanical irritation to exposed eyes, skin or respiratory tract.

Minimize exposure to airborne dust.

(c) Describe any hazards not otherwise classified that have been identified during the classification process

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure.

These effects are usually temporary.

(d) Mixture rule

Not applicable.

3. COMPOSITION / INFORMATION ON INGREDIENTS

<u>(a) Chemical and (b) Common Name</u>	<u>(c) CAS Number</u>	<u>% BY WEIGHT</u>
Refractories, Fibers, Aluminosilicate	142844-00-6	85-95
Acrylic latex	28205-96-1	5-15

***Synonyms:** RCF, ceramic fiber, Alumino Silicate Wool (ASW), synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF), high temperature insulation wool (HTIW)

(d) Impurities and stabilizing additives

Not applicable.

4. FIRST AID MEASURES

(a) Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion**SKIN**

Handling of this material may generate mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin.

EYES

In case of eye contact flush abundantly with water; have eye bath available. Do not rub eyes.

NOSE AND THROAT

If these become irritated move to a dust free area, drink water and blow nose.

If symptoms persist, seek medical advice.

(b) Most important symptoms/effects, acute and delayed

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure.

These effects are usually temporary.

(c) Indication of immediate medical attention and special treatment needed, if necessary

NOTES TO PHYSICIANS

Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

5. FIRE FIGHTING MEASURES

(a) Suitable (and unsuitable) extinguishing media

Use extinguishing agent suitable for surrounding combustible materials.

(b) Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products):

Non-combustible products, class of reaction to fire is zero.

Packaging and surrounding materials may be combustible.

Thermal decomposition of binder from fires or from first heat of product may release smoke, carbon monoxide, carbon dioxide, oxides of nitrogen and small amounts of aromatic and aliphatic hydrocarbons. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition of binder. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity or an asthmatic-type response.

(c) Special protective equipment and precautions for fire-fighters

NFPA Codes: Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

(a) Personal precautions, protective equipment, and emergency procedures

Minimize airborne dust. Compressed air or dry sweeping should not be used for cleaning. See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines.

(b) Methods and materials for containment and cleaning up

Frequently clean the work area with appropriately filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

7. HANDLING AND STORAGE

(a) Precautions for safe handling

Handle fiber carefully to minimize airborne dust. Limit use of power tools unless in conjunction with local exhaust ventilation. Use hand tools whenever possible.

(b) Conditions for safe storage, including any incompatibilities

Store in a manner to minimize airborne dust.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

(a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available

<u>Components</u>	<u>OSHA PEL</u>	<u>NIOSH REL</u>	<u>ACGIH TLV</u>	<u>MANUFACTURER REG</u>
Refractory Ceramic Fiber (RCF)	None established*	0.5 f/cc, 8-hr. TWA	0.2 f/cc TLV, 8-hr. TWA	0.5 f/cc, 8-hr. TWA**
Acrylic latex	None established		None established	None established

*Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally - Total Dust 15 mg/m³; Respirable Fraction 5 mg/m³.

**In the absence of an OSHA PEL, HTIW Coalition has adopted a recommended exposure guideline (REG), as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see "Rationale for the Recommended Exposure Guideline" at page 34 of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf.

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: California, 0.2 f/cc; Canadian provincial OELs ranging from 0.2 to 1.0 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and determining their relative applicability to the workplace is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

(b) Appropriate engineering controls

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

(c) Individual protection measures, such as personal protective equipment

Skin Protection

Wear personal protective equipment (e.g gloves), as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employees should be informed on best practices to minimize non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, and rinse washer before washing other household clothes).

Eye Protection

As necessary, wear goggles or safety glasses with side shields.

Respiratory Protection

When engineering and/or administrative controls are insufficient to maintain workplace concentrations below the 0.5 f/cc REG or a regulatory OEL, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. A NIOSH certified respirator with a filter efficiency of at least 95% should be used. The 95% filter efficiency recommendation is based on NIOSH respirator selection logic sequence for exposure to manmade mineral fibers. Pursuant to NIOSH recommendations, N-95 respirators are appropriate for exposures up to 10 times the NIOSH Recommended Exposure Limit (REL). With respect to RCF, both the NIOSH REL and the industry REG have been set at 0.5 fibers per cubic centimeter of air (f/cm³). Accordingly, N-95 would provide the necessary protection for exposures up to 5 f/cm³. Further, the Respirator Selection Guide published by 3M Corporation, the primary respirator manufacturer, specifically recommends use of N-95 respirators for RCF exposures. In cases where exposures are known to be above 5.0 f/cm³, 8 hour TWA, a filter efficiency of 100% should be used. Other factors to consider are the NIOSH filter series N, R or P -- (N) **Not** resistant to oil, (R) **Resistant** to oil and (P) **oil Proof**. These recommendations are not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

Other Information

- Concentrations based upon an eight-hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.
- The manufacturer recommends the use of a full-facepiece air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear-out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica.

9. PHYSICAL AND CHEMICAL PROPERTIES

(a) Appearance	White, fibrous wool	(j) Upper/lower flammability or explosive limits	Not applicable
(b) Odor	Odorless	(k) Vapor pressure	Not applicable
(c) Odor threshold	Not applicable	(l) Vapor density	Not applicable
(d) pH	Not applicable	(m) Relative density	2.50 – 2.75
(e) Melting point	1760° C (3200° F)	(n) Solubility	Insoluble
(f) Initial boiling point and boiling range	Not applicable	(o) Partition coefficient: n-octanol/water	Not applicable
(g) Flash point	Not applicable	(p) Auto-ignition temperature	Not applicable
(h) Evaporation rate	Not applicable	(q) Decomposition temperature	Not applicable
(i) Flammability	Not applicable	(r) Viscosity	Not applicable

10. STABILITY AND REACTIVITY

- | | |
|--|--------------------------------------|
| (a) Reactivity | RCF is non-reactive. |
| (b) Chemical stability | As supplied RCF is stable and inert. |
| (c) Possibility of hazardous reactions | None |

(d) Conditions to avoid	Please refer to handling and storage advice in Section 7
(e) Incompatible materials	None
(f) Hazardous decomposition products	Thermal decomposition of binder from fires or from first heat of product may release smoke, carbon monoxide, carbon dioxide, oxides of nitrogen and small amounts of aromatic and aliphatic hydrocarbons. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition of binder. Exposure to thermal decomposition fumes may cause respiratory tract irritation, bronchial hyper-reactivity or an asthmatic-type response.

11. TOXICOLOGICAL INFORMATION

For more details on scientific publications referenced in this SDS see <http://www.htiwcoalition.org/publications.html>

(a) through (d)

TOXICOKINETICS, METABOLISM AND DISTRIBUTION

Basic Toxicokinetics

Exposure is predominantly by inhalation or ingestion. Man-made vitreous fibers of a similar size to RCF have not been shown to migrate from the lung and/or gut and do not become located in other organs of the body.

Human Toxicological Data/Epidemiology Data

In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S.A; this epidemiological study has been ongoing for 25 years and medical surveillance of RCF workers continues. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in the U.S.A. and Europe have demonstrated an absence of interstitial fibrosis. In the European study a reduction of lung capacity among smokers has been identified, however, based on the latest results from a longitudinal study of workers in the U.S.A. with over 17-year follow-up, there has been no accelerated rate of loss of lung function (McKay et al. 2011).

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the U.S.A. longitudinal study.

The final report of the USA mortality study (LeMasters et al., 2017) concluded that “after 30 years of follow-up, no excess of lung cancers in the mortality study and no significant association with radiographic findings of interstitial fibrosis were found in this group of workers.” The study also found a small incidence of other effects that appear unrelated to RCF exposure. The final mortality report did not change the current hazard classification for RCF.

Information on Toxicological Effects

- *Acute toxicity: short term inhalation*
No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.
- *Acute toxicity: oral*
No data available: Repeated dose studies have been carried out using gavage. No effect was found.
- *Skin corrosion/irritation*
Not a chemical irritant according to test method OECD no. 404.
- *Serious eye damage/irritation*
Not possible to obtain acute toxicity information due to the morphology and chemical inertness of the substance.
- *Respiratory or skin sensitization*
No evidence from human epidemiological studies of any respiratory or skin sensitization potential.

- Germ cell mutagenicity/genotoxicity*
 Method: In vitro micronucleus test
 Species: Hamster (CHO)
 Dose: 1-35 mg/ml
 Routes of administration: In suspension
 Results: Negative
- Carcinogenicity*
 Method: Inhalation, multi-dose
 Species: Rat
 Dose: 3 mg/m³, 9 mg/m³ and 16 mg/m³
 Routes of administration: Nose only inhalation
 Results: Fibrosis just reached significant levels at 16 and 9 mg/m³ but not at 3 mg/m³. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation, single dose
 Species: Rat
 Dose: 30 mg/m³
 Routes of administration: Nose only inhalation
 Results: Rats were exposed to a single concentration of 200 WHO fibers/ml specially prepared RCF for 24 months. High incidence of exposure-related pulmonary neoplasms (bronchoalveolar adenomas and carcinomas) was observed. A small number of mesotheliomas were observed in each of the fiber exposure groups (Mast et al 1995a).

Method: Inhalation, single dose
 Species: Hamster
 Dose: 30 mg/m³
 Routes of administration: Nose only inhalation
 Results: Hamsters were exposed to a single concentration of 260 WHO fibers/ml specially prepared RCF for 18 months and developed lung fibrosis, a significant number of pleural mesotheliomas (42/102) but no primary lung tumors (McConnell et al 1995).

Method: Inhalation, single dose
 Species: Rat
 Dose: RCF1: 130 F/ml and 50 mg/m³ (25% of non fibrous particles)
 RCF1a: 125 F/ml and 26 mg/m³ (2% of non fibrous particles)
 Routes of administration: Nose only inhalation
 Results: Rats were exposed to RCF1 and RCF1a for 3 weeks. The objective of the study was to compare lung retention and biological effects of the original RCF1 compared to RCF1a. The main difference of these 2 samples was the non-fibrous particle content of respectively 25% versus 2%. The post treatment observation was 12 months. Alveolar clearance was barely retarded after RCF1A exposure. After RCF1 exposure, however, a severe retardation of clearance was observed. (Bellmann et al 2001).

After intraperitoneal injection of ceramic fibers into rats in three experiments (Smith et al 1987, Pott et al 1987, Davis et al 1984), mesotheliomas were found in the abdominal cavity in two studies, while the third report (Pott et al 1987) had incomplete histopathology. Only a few mesotheliomas were found in the abdominal cavity of hamsters after intraperitoneal injection in one experiment (Smith et al 1987). However, the ceramic fibers tested were of relatively large diameter. When rats and hamsters were exposed via intraperitoneal injection, tumor incidence was related to fiber length and dose (Smith et al 1987, Pott et al 1987, Miller et al 1999, Pott et al 1989). (From SCOEL publication (EU Scientific Committee on Occupational Exposure Limits) SCOEL/SUM/165, September 2011).
- Reproductive toxicity*
 Method: Gavage
 Species: Rat
 Dose: 250mg/kg/day
 Routes of administration: Oral
 Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung.

Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

- *STOT-Single exposure*
Not applicable
- *STOT-Repeated exposure*
Not applicable
- *Aspiration hazard*
Not applicable

See the following review publications for a summary and discussion:

Interpretation of these animal experiments is complex and there is not complete agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utell and Maxim 2010.

Other information

Numerous studies indicate the relevance of biopersistence as a determinant of toxic effects of fiber exposure. (Maxim et al 2006).

Irritant Properties

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans. Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

(e) International Agency for Research on Cancer and National Toxicology Program

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION

(a) Ecotoxicity (aquatic and terrestrial, where available)	No known aquatic toxicity.
(b) Persistence and degradability	These products are insoluble materials that remain stable over time and are chemically identical to inorganic compounds found in the soil and sediment; they remain inert in the natural environment.
(c) Bioaccumulative potential	No bioaccumulative potential.
(d) Mobility in soil	No mobility in soil.
(e) Other adverse effects (such as hazardous to the ozone layer)	No adverse effects of this material on the environment are anticipated.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL

This product, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION

(a) UN number	Not Applicable
(b) UN proper shipping name	Not Applicable
(c) Transport hazard class(es)	Not Applicable
(d) Packing group, if applicable	Not Applicable
(e) Environmental hazards (e.g., Marine pollutant (Yes/No))	Not a marine pollutant
(f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code)	Not Applicable
(g) Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises	Not Applicable

Canadian TDG Hazard Class & PIN: Not regulated

Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15. REGULATORY INFORMATION

UNITED STATES REGULATIONS

EPA	Superfund Amendments and Reauthorization Act (SARA) Title III - this product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard). Hazard Categories: Immediate Hazard – No Delayed Hazard – Yes Fire Hazard – No Pressure Hazard – No Reactivity Hazard – No Toxic Substances Control Act (TSCA) - RCF is not required to be listed on the TSCA inventory. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Clean Air Act (CAA) - this product contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.
OSHA	Comply with Hazard Communication Standards 29 CFR 1910.1200 and 29 CFR 1926.59 and the Respiratory Protection Standards 29 CFR 1910.134 and 29 CFR 1926.103.
California	"Ceramic fibers (airborne particles of respirable size)" is listed in Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986 as a chemical known to the State of California to cause cancer.
Other States	RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada **Canadian Environmental Protection Act (CEPA)** - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

Europe **Integration of RCF into ANNEX XV of the REACH Regulation**

RCF is classified under the CLP (classification, labelling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

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16. OTHER INFORMATION

Product Stewardship Program

Unifrax I LLC has established a program to provide customers with up-to-date information regarding the proper use and handling of refractory ceramic fiber. In addition, Unifrax has also established a program to monitor airborne fiber concentrations at customer facilities. If you would like more information about this program, please call the Unifrax Product Stewardship Information Hotline at **1-800-322-2293**.

The manufacturers of refractory ceramic fibers (RCF), who comprise the membership of the HTIW Coalition, remain committed to the continued protection of the health and safety of their employees and all others who use or handle RCF. Building on its prior commitment to voluntary product stewardship, the HTIW Coalition has recently renewed its comprehensive Product Stewardship Program (PSP) for RCF, known as PSP 2017.

PSP 2017 is the fourth iteration of the Coalition's RCF product stewardship program first endorsed by OSHA in 2002 as PSP 2002, renewed in 2007 as PSP-HTW and again in 2012 as PSP 2012. Like its predecessors, PSP 2017 is designed to encourage feasible and necessary control of fiber exposure in the workplace and thereby reduce any potential risk that could be posed by such exposure. For more information regarding this cooperative program that promotes the health and safety of fiber workers nationwide, please visit <http://www.htiwcoalition.org>.

Hazardous Materials Identification System (HMIS) Hazard Rating

HMIS Health	1* (* denotes potential for chronic effects)
HMIS Flammability	0
HMIS Reactivity	0
HMIS Personal Protective Equipment	X (To be determined by user)

Additional Information on After Service Material

As produced, all RCF fibers are vitreous (glassy) materials which do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline phase silica may begin to form at approximately 1100° C (2012° F). When the glass RCF fibers devitrify, they form a mixed mineral crystalline silica containing dust. The crystalline silica is trapped in grain boundaries within a matrix predominately consisting of mullite. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents or furnace contaminants. The presence of

crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied." IARC also studied mixed mineral crystalline silica containing dusts such as coal dusts (containing 5 – 15 % crystalline silica) and diatomaceous earth without seeing any evidence of disease. (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the USEPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 micrograms/cm² - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 micrograms/cm²).

DEFINITIONS

ACGIH:	American Conference of Governmental Industrial Hygienists
ADR:	Carriage of Dangerous Goods by Road (International Regulation)
CAA:	Clean Air Act
CAS:	Chemical Abstracts Service
CERCLA:	Comprehensive Environmental Response, Compensation and Liability Act
DSL:	Domestic Substances List
EPA:	Environmental Protection Agency
EU:	European Union
f/cc:	Fibers per cubic centimeter
HEPA:	High Efficiency Particulate Air
HMIS:	Hazardous Materials Identification System
IARC:	International Agency for Research on Cancer
IATA:	International Air Transport Association
IMDG:	International Maritime Dangerous Goods Code
mg/m³:	Milligrams per cubic meter of air
mmpcf:	Million particles per cubic meter
NFPA:	National Fire Protection Association
NIOSH:	National Institute for Occupational Safety and Health
OSHA:	Occupational Safety and Health Administration
29 CFR 1910.134 & 1926.103:	OSHA Respiratory Protection Standards
29 CFR 1910.1200 & 1926.59:	OSHA Hazard Communication Standards
PEL:	Permissible Exposure Limit (OSHA)
PIN:	Product Identification Number
PNOC:	Particulates Not Otherwise Classified
PNOR:	Particulates Not Otherwise Regulated
PSP:	Product Stewardship Program
RCRA:	Resource Conservation and Recovery Act
REL:	Recommended Exposure Limit (NIOSH)
RID:	Carriage of Dangerous Goods by Rail (International Regulations)
SARA:	Superfund Amendments and Reauthorization Act
SARA Title III:	Emergency Planning and Community Right to Know Act
SARA Section 302:	Extremely Hazardous Substances
SARA Section 304:	Emergency Release
SARA Section 311:	MSDS/List of Chemicals and Hazardous Inventory
SARA Section 312:	Emergency and Hazardous Inventory
SARA Section 313:	Toxic Chemicals and Release Reporting

STEL:	Short Term Exposure Limit`
SVF:	Synthetic Vitreous Fiber
TDG:	Transportation of Dangerous Goods
TLV:	Threshold Limit Value (ACGIH)
TSCA:	Toxic Substances Control Act
TWA:	Time Weighted Average
WHMIS:	Workplace Hazardous Materials Information System (Canada)

Revision Summary: Updated epidemiology summary information

Revision Date: 01/15/2018

SDS Prepared By: UNIFRAX RISK MANAGEMENT DEPARTMENT

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this SDS. Therefore, given the summary nature of this document, Unifrax I LLC does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.

**SAFETY DATA SHEET****1. IDENTIFICATION****Product Group:** EXCELFRA[®]**Product Identifiers:** Excelfrax[®] 1800 Board
Excelfrax[®] 1800 Flexliner (encapsulated)
Excelfrax[®] 200 VIP (encapsulated)
Excelfrax[®] 1900 Panel**Recommended Use:** High Temperature Insulation**Manufacturer/Supplier:** Unifrax I LLC
600 Riverwalk Parkway, Suite 120
Tonawanda, NY 14150**Product Stewardship Information Hotline**
1-800-322-2293 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)For additional SDSs, visit our web page, <http://www.unifrax.com>, or call Unifrax Customer Service at (716) 768-6500**CHEMTREC Assist:** CHEMTREC will provide assistance for chemical emergencies. Call 1-800-424-9300**2. HAZARDS IDENTIFICATION**

Not Classified in accordance with paragraph (d) of OSHA HCS 2012 §1910.1200

Hazards Not Otherwise Classified:**Eye Contact:** May cause eye irritation.**Skin Contact:** Slight mechanical irritation is possible.**Inhalation:** Inhalation of dust may cause respiratory tract (nose, throat, lungs) irritation.**3. COMPOSITION / INFORMATION ON INGREDIENTS**

	CAS#	1800 Board	1800 Flexliner (encapsulated)	200 VIP (encapsulated)	1900 Panel
		% by Weight			
Amorphous silica	69012-64-2	80	50	80	80
Silicon carbide (nonfibrous)	409-21-2	15	-----	15	-----
Zirconium silicate	10101-52-7	-----	45	-----	15
Fibrous glass (continuous filament)	65997-17-3	5	-----	-----	-----
Aluminum oxide	1344-28-1	-----	5	-----	-----

4. FIRST AID MEASURES

RESPIRATORY TRACT (nose & throat) IRRITATION:

If respiratory tract irritation develops, move the person to a dust free location. Get medical attention if the irritation continues.

EYE IRRITATION:

If eyes become irritated, flush immediately with large amounts of lukewarm water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

SKIN IRRITATION:

Wash area of contact thoroughly with soap and water. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful.

GASTROINTESTINAL IRRITATION:

If gastrointestinal tract irritation develops, move the person to a dust free environment.

5. FIRE FIGHTING MEASURES

This product is non-combustible (does not burn).

6. ACCIDENTAL RELEASE MEASURES

Avoid creating airborne dust. Dust suppressing cleaning methods such as wet sweeping or vacuuming should be used to clean the work area. If vacuuming, the vacuum must be equipped with a HEPA filter. Compressed air or dry sweeping should not be used for cleaning.

7. HANDLING AND STORAGE

STORAGE

Store in a dry area.

HANDLING

Limit use of power tools unless in conjunction with local exhaust. Use hand tools whenever possible. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne particulate.

Respiratory Protection:

In case of dust formation, use a NIOSH approved respirator for nuisance dust.

EXPOSURE GUIDELINES

ALL PRODUCTS

COMPONENTS	OSHA PEL	ACGIH TLV
Silica, amorphous	20 mppcf or 80 mg/m ³ / % SiO ₂	10 mg/m ³

Excelfrax® 1800 Board

COMPONENTS	OSHA PEL	ACGIH TLV
Silicon carbide (nonfibrous)	15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction)	10 mg/m ³ TWA (inhalable fraction) 3 mg/m ³ (respirable fraction)
Fibrous glass (continuous filament)	1 fiber/cc	1 fiber/cc

Excelfrax® 1800 Flexliner (encapsulated)

COMPONENTS	OSHA PEL	ACGIH TLV
Aluminum oxide	15 mg/m ³ total dust 5 mg/m ³ respirable fraction	1 mg/m ³
Zircon silicate	15 mg/m ³ total dust 5 mg/m ³ respirable fraction	5 mg/m ³
Fibrous glass (continuous filament)	1 fiber/cc	1 fiber/cc

Excelfrax® 200 VIP (encapsulated)

COMPONENTS	OSHA PEL	ACGIH TLV
Silicon carbide (nonfibrous)	15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction)	10 mg/m ³ TWA (inhalable fraction) 3 mg/m ³ (respirable fraction)

Skin Protection:

Wear gloves, head coverings and full body clothing as necessary to prevent skin irritation. Barrier cream may be useful to prevent dryness of skin.

Eye Protection:

In case of dust formation, wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Off-white board	Upper/lower flammability or explosive limits	Not applicable
Odor	Odorless	Vapor pressure	Not applicable
Odor threshold	Not applicable	Vapor density	Not applicable
pH	Not applicable	Relative density	
		1800 Board	230 kg/m ³ (14.4 pcf)
		1800 Flexliner	365 kg/m ³ (22.8 pcf)
		200 VIP	280 kg/m ³ (17.5 pcf)
Melting point	>1200° C	Solubility	Insoluble
Initial boiling point and boiling range	Not applicable	Partition coefficient: n-octanol/water	Not applicable
Flash point	Not applicable	Auto-ignition temperature	Not applicable

Evaporation rate
Flammability

Not applicable
Not applicable

Decomposition temperature
Viscosity

Not applicable
Not applicable

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable under conditions of normal use.

INCOMPATIBILITY: None.

CONDITIONS TO AVOID: None.

HAZARDOUS DECOMPOSITION PRODUCTS:

Excelfrax® 1800 Board & Excelfrax® 200 VIP

At combustion, silicon carbide, silica, carbon dioxide, carbon monoxide, incompletely burnt hydrocarbons (in traces) may be formed. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition.

Excelfrax® 1800 Flexliner (encapsulated)

At combustion, zirconium compounds, aluminum oxide, silica, carbon dioxide, carbon monoxide, incompletely burnt hydrocarbons (in traces) may be formed. Use adequate ventilation or other precautions to eliminate exposure to vapors resulting from thermal decomposition.

HAZARDOUS POLYMERIZATION: Not Applicable.

11. TOXICOLOGICAL INFORMATION

The International Agency for Research on Cancer (IARC), has concluded that amorphous silica is "not classifiable as to its carcinogenicity to humans (Group 3)" based on "inadequate evidence in humans for the carcinogenicity of amorphous silica" and "inadequate evidence in experimental animals for the carcinogenicity of synthetic amorphous silica" (IARC Monograph 68, June 1997, p. 210-211).

EPIDEMIOLOGY:

IARC noted that "very little epidemiological evidence was available" for amorphous silica. In evaluating the results of three community-based case-control studies, IARC concluded that "no association was detected for mesothelioma with biogenic amorphous silica fibres." (IARC Monograph 68, June 1997, p. 208).

TOXICOLOGY:

A food-grade micronized synthetic amorphous silica was tested by oral administration to mice and rats. No increased incidence of tumors was seen. In another study in rats, using intrapleural implantation of two different preparations of synthetic amorphous silica, no increased incidence of tumors were observed (IARC Monograph 68, June 1997, p. 209).

Excelfrax® 1800 Board & Excelfrax® 1800 Flexliner contain fibrous glass (continuous filament). In case of dust formation, exposure to these fibers may occur. The fibers are not respirable, i.e. can not enter the lungs, due to their >3 micron length to diameter ratio. Glass filaments have been classified by IARC as not classifiable as to their carcinogenicity to humans (Group 3).

To obtain more health and safety related information, please call the toll free telephone number for the Unifrax Product Stewardship Program found in Section 16 - Other Information.

12. ECOLOGICAL INFORMATION

No ecological concerns have been identified.

13. DISPOSAL CONSIDERATIONS

This product is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Check local, regional, state or provincial regulations for applicable requirements for disposal. Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

BILL OF LADING DESCRIPTION (49 CFR 172.202): Exelfrax (NON-REGULATED)

UNITED NATIONS (UN) NUMBER: NOT APPLICABLE

NORTH AMERICA (NA) NUMBER: NOT APPLICABLE

15. REGULATORY INFORMATION

EPA: **Toxic Substances Control Act (TSCA)** - All substances in this product are listed, as required, on the TSCA inventory.

OSHA: Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

Canada: **Canadian Workplace Hazardous Materials Information System (WHMIS):**
No Canadian Workplace Hazardous Materials Information System (WHMIS) categories apply to this product.
Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

16. OTHER INFORMATION

Formation of crystalline silica (cristobalite) is possible after prolonged use (> 900°C). IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied" (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

Product Stewardship Program

Unifrax has established a program to provide customers with up-to-date information regarding the proper use and handling of this product. If you would like more information, please call the Unifrax Product Stewardship Information Hotline at 1-800-322-2293.

Revision Date: 01/16/2018

Revision Summary: Annual review.

SDS Prepared By: UNIFRAX RISK MANAGEMENT DEPARTMENT

DISCLAIMER

The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet. However, no warranty or representation, express or implied, is made as to the accuracy or completeness of the foregoing data and safety information. In addition, no responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.



SAFETY DATA SHEET

Alu-Dri Lt-Wt 85HS

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

PRODUCT NAME	Alu-Dri Lt-Wt 85HS
PRODUCT NO.	LEG30374
APPLICATION	Cement bonded insulating castable or gunmix.
SUPPLIER	VESUVIUS UK LIMITED 2 MIDLAND WAY BARLBOROUGH LINKS DERBYSHIRE UK S43 4XA Tel: 44 (0) 1246 571700 Fax: 44 (0) 1246 571701
EMERGENCY TELEPHONE	Fax: 44 (0) 1246 571971

Vesuvius USA Research Center 495, Emma Street Bettsville OH 44815 USA Tel: 1-419-986-5126	MANUFACTURER
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2 COMPOSITION/INFORMATION ON INGREDIENTS

Name	EC No.	CAS-No.	Content	Classification
CALCIUM ALUMINATE	266-045-5	65997-16-2	10-20%	-
CALCIUM FLUORIDE	232-188-7	7789-75-5	1-5%	-
CRISTOBALITE	238-455-4	14464-46-1	1-5%	-
KAOLINITE		1332-58-7	1-5%	-
MULLITE	215-113-2	1302-93-8	20-40%	-
QUARTZ	238-878-4	14808-60-7	1-5%	-
SILICA, AMORPHOUS	273-761-1	69012-64-2	5-10%	-
SILICA, FUSED	262-373-8	60676-86-0	1-5%	

The Full Text for all R-Phrases are Displayed in Section 16

COMPOSITION COMMENTS

Total crystalline silica: <10%

3 HAZARDS IDENTIFICATION

Not regarded as a health or environmental hazard under current legislation.

Any dust particulate produced from the usage of this product will consist mainly of alumina/aluminosilicate. Over exposure to this dust may cause irritation to the eyes and upper respiratory tract. Due to the presence of crystalline silica, care should be taken during operations which could lead to the generation of respirable dust. Long term over exposure to respirable crystalline silica may ultimately lead to the development of silicosis.

4 FIRST-AID MEASURES

INHALATION
Remove victim immediately from source of exposure. Get medical attention if any discomfort continues.

INGESTION
Rinse mouth thoroughly. Get medical attention if any discomfort continues.

SKIN CONTACT
Get medical attention if irritation persists after washing.

Alu-Dri Lt-Wt 85HS**EYE CONTACT**

Promptly wash eyes with plenty of water while lifting the eye lids. Get medical attention promptly if symptoms occur after washing.

5 FIRE-FIGHTING MEASURES**EXTINGUISHING MEDIA**

This product is not flammable. Use fire-extinguishing media appropriate for surrounding materials.

6 ACCIDENTAL RELEASE MEASURES**PERSONAL PRECAUTIONS**

Refer to section 8 of SDS for personal protection details.

SPILL CLEAN UP METHODS

Avoid dust formation. The product may be dampened with water to minimise the generation of airborne dust. No specific clean-up procedure noted.

7 HANDLING AND STORAGE**USAGE PRECAUTIONS**

Avoid handling which leads to dust formation. Use mechanical ventilation in case of handling which causes formation of dust. In 'Y' and 'SS' variants, beware of steel fibres within the dry mix and installed material.

STORAGE PRECAUTIONS

Store in a dry area away from extremes of temperature, which may cause damage to packing materials/pallets.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	Std	LT - ppm	LT - mg/m3	ST - ppm	ST - mg/m3
QUARTZ	MEL		0.3 mg/m3 resp.dust		No std.
CRISTOBALITE	MEL		0.3 mg/m3 resp.dust		No std.
KAOLINITE	OES		2 mg/m3 resp.dust		No std.
SILICA, AMORPHOUS	OES		2.4 mg/m3 resp.dust		No std.
SILICA, FUSED	OES		0.08 mg/m3 Resp Dust, HK		No std.

INGREDIENT COMMENTS

OES = Occupational Exposure Standard.

PROTECTIVE EQUIPMENT**PROCESS CONDITIONS**

Use engineering controls to reduce air contamination to permissible exposure level.

ENGINEERING MEASURES

Provide sufficient ventilation for operations causing dust formation.

RESPIRATORY EQUIPMENT

No specific recommendation made, but respiratory protection must be used if the general level exceeds the Recommended Occupational Exposure Limit

HAND PROTECTION

Protective gloves are recommended.

EYE PROTECTION

Wear dust resistant safety goggles where there is danger of eye contact.

OTHER PROTECTION

Use barrier creams to prevent skin contact. Overalls and safety footwear are recommended.

Alu-Dri Lt-Wt 85HS**HYGIENE MEASURES**

Wash at the end of each work shift and before eating, smoking and using the toilet.

9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Granular solid.
COLOUR	Buff to Brown
SOLUBILITY	Negligible solubility in water.
BULK DENSITY	1000 - 1400 kg/m3

10 STABILITY AND REACTIVITY**STABILITY**

Stable under normal temperature conditions.

MATERIALS TO AVOID

No incompatible materials noted.

HAZARDOUS DECOMPOSITION PRODUCTS

No hazardous decomposition products.

11 TOXICOLOGICAL INFORMATION**INHALATION**

Dust may irritate respiratory system or lungs.

INGESTION

No specific health warnings noted.

SKIN CONTACT

Prolonged contact may cause redness and irritation.

EYE CONTACT

Particles in the eyes may cause irritation and smarting.

12 ECOLOGICAL INFORMATION**ECOTOXICITY**

No negative effects on the aquatic environment are known.

13 DISPOSAL CONSIDERATIONS**DISPOSAL METHODS**

Uncontaminated product can be disposed of as non-hazardous waste in accordance with local regulations and statutory provisions. Before carrying out disposal operations, customers are advised to evaluate any changes to the product which may be induced by the introduction of substances and operating conditions not under the control of the vendor.

14 TRANSPORT INFORMATION

GENERAL	This product is not classified as hazardous for transport.	
ROAD TRANSPORT NOTES	Not Classified	
RAIL TRANSPORT NOTES	Not Classified.	
SEA TRANSPORT NOTES	Not Classified.	
AIR TRANSPORT NOTES	Not Classified.	

15 REGULATORY INFORMATION**RISK PHRASES**

NC Not classified.

SAFETY PHRASES

NC Not classified.

EU DIRECTIVES

91/155/EEC, 1999/45/EC, 2001/58/EC, 2001/59/EC, 2001/60/EC.

Alu-Dri Lt-Wt 85HS

STATUTORY INSTRUMENTS

Chemicals (Hazard Information and Packaging) Regulations. Control of Substances Hazardous to Health.

16 OTHER INFORMATION

REVISION DATE 10/01/2005

REV. NO./REPL. SDS GENERATED 1

RISK PHRASES IN FULL

NC Not classified.

DISCLAIMER

Information contained within this safety data sheet relates to such products and their intended usage. Every effort has been made to ensure that this information is correct and gives adequate safety margins in line with current knowledge. , It does not constitute a specification.



1 Identification

GHS Product Identifier

RS-BNCOAT

Other means of identification

Boron Nitride Paint

Recommended use of the chemical and restriction on use

Used primarily as a high temperature, anti-stick release agent in the Glass and Metals Industries.

Supplier's details

ZIRCAR Refractory Composites, Inc.

P.O. Box 489

Florida, NY 10921

1-845-651-2200 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)

For additional SDSs, visit our web page, <http://www.zrci.com> or email at sales@zrci.com

Emergency phone number

CHEMTREC will provide assistance for chemical emergencies. Call **1-800-424-9300**

2 Hazard(s) identification

Classification of the substance or mixture

Not classified as to its carcinogenicity by the **International Agency for Research on Cancer (IARC)** and is not listed by **OSHA**.

GHS label elements



Causes mild skin irritation

Use personal protective equipment as required.

IF ON SKIN: Gently wash with plenty of soap and water.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Other hazards which do not result in classification

Precautionary statements

Do not handle until all safety instructions have been read and understood.

Use respiratory protection as required; see section 8 of the Safety Data Sheet.

If concerned about exposure, get medical advice.
Store in a manner to minimize airborne dust.
Dispose of waste in accordance with local, state and federal regulations.

Supplementary Information

May cause temporary mechanical irritation to exposed eyes, skin or respiratory tract.
Minimize exposure to airborne dust.

Describe any hazards not otherwise classified that have been identified during the classification process

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure. effects are usually temporary.

3 Composition/information on ingredients

Description	CAS Number	EINECS Number	%	Note
Water	7732-18-5		65 - 70	
Boron Nitride	10043-11-5	233-136-6	23 - 28	
Aluminium Oxide	1344-28-1	215-691-6	3 - 5	

4 First-aid measures

Description of necessary first-aid measures

SKIN

Handling of this material may generate mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin.

EYE

In case of eye contact flush abundantly with water; have eye bath available. Do not rub eyes.

NOSE AND THROAT

If these become irritated move to a dust free area, drink water and blow nose.
If symptoms persist, seek medical advice.

Gastrointestinal

If gastrointestinal tract irritation develops, move the person to a dust free environment.

Most important symptoms/effects, acute and delayed

Mild mechanical irritation to skin, eyes and upper respiratory system may result from exposure.
These effects are usually temporary.

Indication of immediate medical attention and special treatment needed, if necessary

NOTES TO PHYSICIANS Skin and respiratory effects are the result of temporary, mild mechanical irritation; exposure does not result in allergic manifestations.

5 Fire-fighting measures

Suitable extinguishing media

Non-combustible products, class of reaction to fire is zero.
Packaging and surrounding materials may be combustible.
Use extinguishing agent suitable for surrounding combustible materials.

Special protective actions for fire-fighters

6 Accidental release measures

Personal precautions, protective equipment and emergency procedures

Minimize airborne dust. Compressed air or dry sweeping should not be used for cleaning. See Section 8 "Exposure Controls / Personal Protection" for exposure guidelines.

Environmental precautions

None.

Methods and materials for containment and cleaning up

Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris.

Do not use compressed air for clean-up.

7 Handling and storage

Precautions for safe handling

Handle fiber carefully to minimize airborne dust. Limit use of power tools unless in conjunction with local exhaust ventilation. Use hand tools whenever possible. (See section 8)

Service significantly above the product design temperature may increase friability and the possibility of generating airborne fibers or particulates. not considered problematic during use, airborne fibers may complicate removal activities. is recommended that product use be carefully matched to design parameters.

Product removal must consider the possibility of usage above design temperatures. See section 8 for appropriate respiratory protection during removal.

Conditions for safe storage, including any incompatibilities

Store in a manner to minimize airborne dust.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

8 Exposure controls/personal protection

Control parameters

OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available
Component

COMPONENT Alumina Oxide

OSHA PEL as 8 hr TWA	15/5 mg/m ³ Total dust/Respirable Fraction
ACGIH PEL as 8 hr TWA	10 mg/m ³ Inhalable particulate with no asbestos and <1% crystalline silica
Canadian PEL as TWA	5 mg/m ³
Carcinogenicity by ACGIH	Group A4, Not classifiable as a human carcinogen
MANUFACTURER	None Established

COMPONENT Boron Nitride

OSHA PEL as 8 hr TWA	None Established
NIOSH PEL as 8 hr TWA	None Established
Canadian PEL as TWA	None Established
ILDH Level by SCPC	None Established
Carcinogenicity by ACGIH	None Established
Manufacturer	None Established, Treat as Nuisance Dust, Total Dust 10 mg/m ₃

As with most industrial materials, it is prudent to minimize unnecessary exposure to respirable dusts. Note that Industrial hygiene standards and occupational exposure limits differ between countries and local jurisdictions. Check with your employer to identify any "respirable dust", "total dust" or "fiber" exposure standards to follow in your area. If no regulatory dust or fiber control standard apply, a qualified industrial hygiene professional can assist with a specific evaluation of workplace conditions and the identification of appropriate respiratory protection practices. In the absence of other guidance, the supplier has found that it is generally feasible to control occupational fiber exposure to 0.5 f/cc or less.

The evaluation of occupational exposure limits and determining their relative applicability to the workplace is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

Appropriate engineering controls

Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

Individual protection measures

Skin Protection

Wear gloves, head coverings and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employers should ensure employees are thoroughly trained on the best practices to minimize non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

Eye Protection

As necessary, wear goggles or safety glasses with side shields.

Respiratory Protection

When engineering and/or administrative controls are insufficient to maintain workplace concentrations below the applicable level, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. A NIOSH certified respirator with a filter efficiency of at least 95% should be used. The 95% filter efficiency recommendation is based on NIOSH respirator selection logic sequence for exposure to particulates. Selection of filter efficiency (i.e. 95%, 99% or 99.97%) depends on how much filter leakage can be accepted and the concentration of airborne contaminants. Other factors to consider are the NIOSH filter series N, R or P. (N)Not resistant to oil, (R)Resistant to oil and (P) oilProof. These recommendations are not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

9 Physical and chemical properties

Physical and chemical properties

(a) Appearance	White, slurry paint
(b) Odor	Nearly Odorless
(c) Odor threshold	Not applicable

(d) pH	2 - 4
(e) Melting point	2,973 °C (5,383 °F; 3,246 K) sublimates (cBN)
(f) Initial boiling point and boiling range	Approx 212 F
(g) Flash point	Not applicable
(h) Evaporation rate	Similar water
(i) Flammability	Not applicable
(j) Upper/lower flammability or explosive limits	Not applicable
(k) Vapor pressure	Not applicable
(l) Vapor density	<Air (Air = 1)
(m) Relative density	2.50 – 2.75
(n) Solubility	Insoluble
(o) Partition coefficient: n-octanol/water	Not applicable
(p) Auto-ignition temperature	Not applicable
(q) Decomposition temperature	Not applicable
(r) Viscosity	950 - 1150 Brookfield spindle 3 speed 60

10 Stability and reactivity

Reactivity

Non-reactive.

Chemical stability

Stable and Inert.

Possibility of hazardous reactions

None.

Conditions to avoid

Please refer to handling and storage advice in Section 7.

Incompatible materials

Powerful oxidizers; fluorine, chlorine trifluoride, manganese trioxide; oxygen difluoride, etc.

Hazardous decomposition products

None.

11 Toxicological information

Toxicological (health) effects

Not Applicable.

Numerical measures of toxicity (such as acute toxicity estimates)

Not Applicable.

Interactive effects

Not Applicable.

Where specific chemical data are not available

Not Applicable.

Mixtures

Not Applicable.

Mixture versus ingredient information

Not Applicable.

Other information

Not classified by OSHA.

Information on the likely routes of exposure

Not Applicable.

Symptoms related to the physical, chemical and toxicological characteristics

Not Applicable.

Delayed and immediate effects and also chronic effects from short and long term exposure

Not Applicable.

12 Ecological information

Toxicity

No known aquatic toxicity.

Persistence and degradability

These products are insoluble materials that remain stable over time and are chemically identical to inorganic compounds found in the soil and sediment; they remain inert in the natural environment.

Bioaccumulative potential

No bioaccumulative potential.

Mobility in soil

No mobility in soil.

Other adverse effects

No adverse effects of this material on the environment are anticipated.

13 Disposal considerations

Disposal methods

WASTE MANAGEMENT

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL

This product, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to

identify all applicable disposal requirements.

14 Transport information

UN Number

Not Applicable.

UN Proper Shipping Name

Not Applicable.

Transport hazard class(es)

Not Applicable.

Packing group, if applicable

Not Applicable.

Environmental hazards

Not a marine pollutant.

Special precautions for user

Not Applicable.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Canadian TDG Hazard Class & PIN: Not regulated

Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15 Regulatory information

Safety, health and environmental regulations specific for the product in question

UNITED STATES REGULATIONS

EPA: Superfund Amendments and Reauthorization Act (SARA) Title III - This product does not contain toxic chemicals reportable under Section 313 (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).

Toxic Substances Control Act (TSCA) - Not required to be listed on the TSCA inventory
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the **Clean Air Act (CAA)** - This product contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.

OSHA: Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

California: Product is NOT listed in **Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.

New Jersey, Right to Know Act: Aluminum oxide (CAS No. 1344-28-1) and Silica (amorphous) (CAS No. 60676-86-0), are found on the

New Jersey Hazardous Substance list and are subject to reporting under SARA and the New Jersey Worker and Community Right to Know Act.

Other States: These products are not known to be regulated by states other than New Jersey; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada: Canadian Workplace Hazardous Materials Information System (WHMIS) - Aluminum oxide (CAS No. 1344-28-1) and Silica (amorphous) (CAS No. 60676-86-0) are subject to disclosure under the Hazardous Products Act.

Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

Europe: The assessment of all available toxicological test data during the REACH registration process resulted in a “no classification” conclusion.

This product contains less than 1% nitric acid CAS# 7697-37-2.

RQ = 1000 lbs, TPQ = 1000 lbs.

Nitric acid is on the following regulatory lists:

Clean Water Act Section 311 Hazardous Substances

Comprehensive Environmental response, Compensation, and Liability Act (CERCLA)

Hazardous Substances

Superfund Amendments and Reauthorization Act (SARA) Title III

Section 302 Extremely Hazardous Substances

Section 313 Toxic Substances

Section 110 Priority List of CERCLA Hazardous Substances

OSHA Air Contaminants

Canadian WHMIS Disclosure List

Massachusetts Substance List

New Jersey Right to Know Hazardous Substance List

Pennsylvania Hazardous Substance List

TSCA INVENTORY: All substances contained in this product are listed in the Toxic Substances Control Act (TSCA) Chemical Substance Inventory

16 Other information

Other information

The HTIW Coalition and the U.S. Occupational Safety and Health Administration (OSHA) are partners in PSP HTW, a comprehensive, multi-faceted risk management program designed to control and reduce workplace exposures to high temperature insulation wools (HTIW). For more information regarding PSP HTW, please visit <http://www.htiwcoalition.org>

DEFINITIONS

ACGIH: American Conference of Governmental Industrial Hygienists

ADR: Carriage of Dangerous Goods by Road (International Regulation)

CAA: Clean Air Act

CAS: Chemical Abstracts Service

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act

DSL: Domestic Substances List

EPA: Environmental Protection Agency

EU: European Union

f/cc: Fibers per cubic centimeter

HEPA: High Efficiency Particulate Air

HMIS: Hazardous Materials Identification System

IARC: International Agency for Research on Cancer

IATA: International Air Transport Association

IMDG: International Maritime Dangerous Goods Code

mg/m³: Milligrams per cubic meter of air

mmpcf: Million particles per cubic meter

NFPA: National Fire Protection Association

NIOSH: National Institute for Occupational Safety and Health

OSHA: Occupational Safety and Health Administration

29 CFR 1910.134 & 1926.103: OSHA Respiratory Protection Standards

29 CFR 1910.1200 & 1926.59: OSHA Hazard Communication Standards

PEL: Permissible Exposure Limit (OSHA)

PIN: Product Identification Number

PNOC: Particulates Not Otherwise Classified

PNOR: Particulates Not Otherwise Regulated

PSP: Product Stewardship Program

RCRA: Resource Conservation and Recovery Act

REL: Recommended Exposure Limit (NIOSH)

RID: Carriage of Dangerous Goods by Rail (International Regulations)

SARA: Superfund Amendments and Reauthorization Act

SARA Title III: Emergency Planning and Community Right to Know Act

SARA Section 302: Extremely Hazardous Substances

SARA Section 304: Emergency Release

SARASection 311: MSDS/List of Chemicals and Hazardous Inventory

SARASection 312: Emergency and Hazardous Inventory

SARA Section 313: Toxic Chemicals and Release Reporting

STEL: Short Term Exposure Limit`

SVF: Synthetic Vitreous Fiber

TDG: Transportation of Dangerous Goods

TLV: Threshold Limit Value (ACGIH)

TSCA: Toxic Substances Control Act

TWA: Time Weighted Average

WHMIS: Workplace Hazardous Materials Information System (Canada)

Revision Summary:Updated SDS to align with OSHA HCS 2012. Replaces all previous MSDS.

Revision Date: 4-10-17

SDS Prepared By: ZIRCAR Refractory Composites, Inc.

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this SDS. Therefore, given the summary nature of this document, ZIRCAR Refractory Composites, Inc. does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.

PRIOR TO EQUIPMENT INSTALLATION

As an aid during the installation of this equipment, please refer to all reference drawings mentioned in this section as required. For the locations of these drawings, please refer to the Drawing List in the Table of Contents.

Any questions or problems that might occur should be directed to the Field Engineering Department at (914) 345-4743.

3.1 PRELIMINARY INSTALLATION:

- A.** Check all packing lists to make sure all of the parts have arrived.
- B.** Prior to installation, inspect all shipping containers and components for damage. For the new and existing control panels, inspect all gauges and flowmeters for damage. Be sure the gauges are reading zero and that the flowmeter tubes are not broken. Be sure that none of the components are damaged, especially the electronic components such as the **HMI** screen etc. The furnace cover and furnace shell should be reinspected once they have been removed from their crates. Check for damage to the refractory linings, damage to the existing spinning nozzle assemblies or any other visible damage. Please inform the Customer Service Department if any damages have been noted.
- C.** Make sure that there is a source of Cryogenic Argon with the volume and purity specifications recommended in Section 1.
- D.** The plug plate assembly that is usually shipped inserted into the cover insulation assembly from the factory is used for when there is no spinning nozzle installed during the preheat cycle and when repairing or replacing the spinning nozzle. Also, when removing the furnace from production for more than a month while servicing other components, such as the holding furnace, you will need to replace the spinning nozzle with the plug plate.

Note: Report all damage promptly to the carrier and a SNIF Customer Service Representative.



3.2 FURNACE SHELL AND COVER INSTALLATION:

NOTE: Refer to the recommended General Assembly drawings, Furnace Shell Assembly drawing and the Furnace Cover Lift Assembly drawing for details.

- A.** Position the furnace and cover in the required location. Align the furnace with the inlet and outlet troughing. Verify that there is no debris or foreign material, except charcoal, in the furnace. The charcoal is to remain in the **chamber** and is required during the preheat cycle of the furnace.
- B.** Verify that the furnace is level and at the proper elevation. Position sows in the appropriate areas for draining and dedrossing of the unit. The size of the sows should be determined by the static capacity of the SNIF[®] Unit as indicated in section 1 of this manual.
- C.** Verify The furnace cover should be positioned square on the furnace sill
- D.** Attach the inlet and outlet troughing to the furnace. The inlet troughing should be installed with a drain plug for draining the metal after a cast. A screen or filter sock should also be installed prior to each cast to prevent large particles from entering the furnace, which could result in breaking the **nozzle**. Ram the space between the customer trough and furnace trough with a high temperature non-wetted refractory material. This should be performed prior to the preheat in order for it to cure while the SNIF[®] furnace is being preheated.
- E.** Refer to the Furnace Shell Assembly Bill of Materials and drawing. Mount the side drain trough assembly (2195091) and a drain trough gasket (2195908) over one of the two lower side drains. Insert the T-Handle (2195088) side drain plug into the drain.

NOTE: A refractory cone (2191558) provided with the SNIF[®] system must be placed over the cast iron plug in order to seal the drain. The other lower drain hole should be plugged with the drain sealing kit (2195125) provided. This may have been sealed at the factory if it was already predetermined at the time of order. Mount the ladder (2199301) onto the side of the furnace as required. For the side mounted ladders, there are mounting brackets welded to both sides of the furnace.

3.3 FURNACE/COVER LIFT INSTALLATION:

Refer to the Furnace Cover Lift Assembly, General Assembly, and the Mohawk Cover Lift literature that is located in the **"Bulletins Section"** of this manual.

- A. Pedestal Installation:** Refer to the furnace installation dimensions drawing for part weights and pedestal assembly anchor bolt pattern. The pedestal assembly should be installed to the rear of the furnace with the spacing indicated on the installation drawing provided. Secure the pedestal assembly to the floor with anchor bolts (not supplied).
- B. Furnace Cover Lift (single mast) Assembly Installation:** The furnace cover lift assembly should be mounted in place with the hardware provided. Refer to the Furnace Installation Dimensions drawing for the proper spacing between the mast and the rear of the furnace wall. (The front of the mast is set at 9" [230mm] from the rear of the furnace wall.) The centerline of the mast should be inline with the centerline of the furnace as closely as possible. The mast should be shimmed as required to ensure that it is level from front to rear and side-to-side. Secure the mast by connecting the cover lift support brackets already welded to the mast, to the angle clips that are welded onto the rear wall of the furnace with the hardware provided. The furnace cover lift assembly mast base fasteners should be tightened to approximately 120 ft•lbs [165 N•m] of torque.
- C. Powering up the cover lift mast:**
 - 1. Refer to the General Assembly Interconnecting Wiring and Interconnecting Piping drawings. Connect a source of dry compressed air to the bulkhead fitting located on the lifting mast, run a short line of hose from the bulkhead to the cover lift safety latch regulator located on the mast. The minimum pressure required at the mast regulator is 60 psig [4.2 kg/cm²]. If sufficient air pressure is not available, because gas consumption is very low, the argon supply can be connected to this regulator. (Tap off before the SNIF[®] panels.)
 - 2. Mount the cover lift pushbutton station (small 3 button control box (2195993) in a location near the furnace that allows for an adequate view of the furnace and cover. Wire the cover lift control pushbuttons to the terminals inside the cover lift control box as indicated in the Mohawk Cover Lift literature that is located in the "Bulletins Section" of this manual. Verify that the motor is properly wired for the supply voltage, this is generally done at the factory if it known before shipping. Connect the plant power supply to the cover lift control box located on top of the lifting mast.
 - 3. Locate the (normally opened) limit switch that is mounted on the side of the lifting mast column. Adjust the limit switch arm against the bottom of the extension arm so that the switch is actuated (closed). Next you will need to run wires from the normally opened limit switch box to the SNIF[®] Electrical/Furnace control panel as indicated in the panel schematics. The limit switch is not used to regulate the operation of the cover lift assembly but to interlock the spinning nozzle when the cover begins to rise off of the furnace sill. After the cover lift system



is operational (steps D Thru H) raise and lower the cover to verify that the limit switch arm is adjusted so that the switch is actuated (closed) when in the full down position.

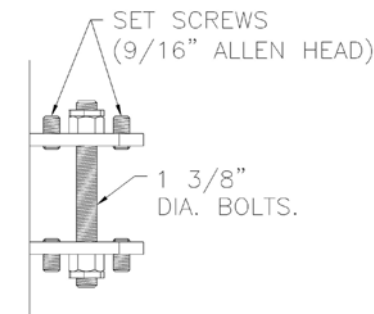
4. Verify the power supply in the cover lift electrical panel is receiving power.

D. Activating the hydraulic pump:

1. Refer to the Furnace Cover Lift Assembly drawing. If the hydraulic oil reservoir tank is shipped with a blank pipe plug, replace the pipe plug with the black vent plug provided. Fill the hydraulic power pack reservoir on the furnace cover lift assembly with hydraulic fluid to approximately one inch below the fill vent. The cover lift assembly should be operational (energized) at this time so that it can be raised and lowered independent of the cover.
 - ❖ **CAUTION: NOTE:** The downward travel of the carriage assembly is by gravity. Without the cover lift extension arm attached it WILL REQUIRE a considerable amount of weight to help lower the carriage assembly. BEFORE raising the carriage assembly, it is recommended that the cover be attached to the arm. On the single mast systems, the weight of the forked extension arm is enough weight to lower the carriage assembly.
2. The safety latch should also be checked for operation at this time. Press the "SAFETY-LATCH RELEASE" button. If the safety latch does not retract, it may be because insufficient pressure is supplied to the actuator cylinder. Increase the regulator pressure setting until the latch releases quickly once the "SAFETY-LATCH RELEASE" button is pressed between 60-90 psig. In the event of insufficient or no pressure, there is a manual release cable located on the lower portion of the carriage assembly.
3. By activating the pump, the carriage assembly will travel in the upward position. If it does not operate and the fluid reservoir is full, the rotation of the pump may be incorrect. Proper rotation is clockwise when viewed from the top. Look through the opening between the motor and the pump assembly to view the rotation of the pump. If rotation is correct, continue to operate the pump for another 30 seconds to ensure the lines are not vapor-locked. If you are NOT getting a pressure reading check to make sure that the hydraulic lines are not crossed. If the direction of rotation is incorrect, reverse the wires to switch the direction of rotation.

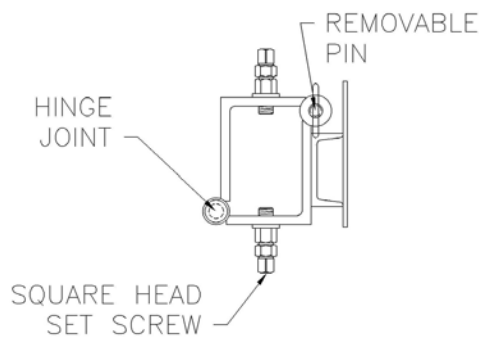
E. Installing the Cover Lift Extension Arm: Note: The SNIF® cover should be positioned and aligned properly on the top of the furnace before continuing.

1. Remove the two large bolts (1³/₈" [35mm] diameter) and back off on all eight of the setscrews located on the bracket on the cover lift carriage assembly.



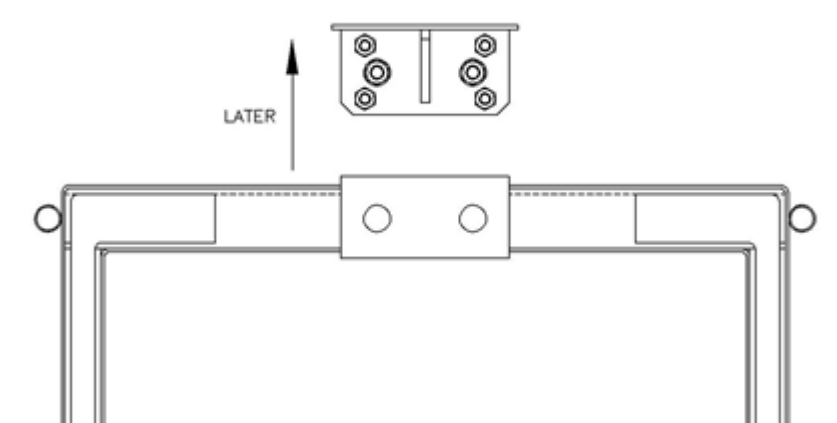
Cover-Lift Bracket & Bolts

2. Loosen only the bottom square head setscrews, located on the extension arm lift sockets that secure the cover lift extension arm onto the cover insulation assembly. Do not loosen the top setscrews for new installations; these are preset at the factory.



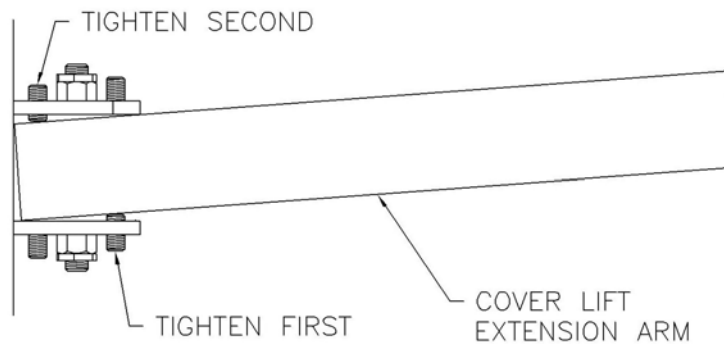
Hinged Lift Socket Cross-Section

3. Remove the hitch pins to allow the hinge joints to fully open. If the cover lift extension arm is not already installed in the lift sockets, use a crane or forklift to position the extension arm inside the hinge joints, but do not close the hinges. Leave the rear portion of the extension arm pulled away from the mast so the mast can be raised and lowered without obstruction.



Extension Arm Clear of Lift-Mast

4. Using the "UP" and "DOWN"/"SAFETY_LATCH RELEASE" pushbuttons, vertically align the moving carriage assembly on the mast with the cover lift extension arm. Next, the cover lift extension arm should be slid back into the bracket on the cover lift carriage assembly. The two large bolts ($1\frac{3}{8}$ " [35mm]) that were removed from the carriage bracket should be reinstalled at this time. These bolts should be tightened to at least 120 ft•lbs [165 N•m] of torque and locked with the jam nuts. Do not tighten the setscrews yet.
5. Tighten the bottom front two setscrews on the cover lift carriage assembly, and then tighten the top rear two setscrews. The cover lift extension arm should visibly tilt upwards. When the first four setscrews are fully tightened, tighten the other four setscrews. Secure all eight of the setscrews with the jam nuts.



Extension Arm Angled Up Before Attaching Cover

- F. Purging the Hydraulic Lines of Air:** While observing the cover lift extension arm, press the up pushbutton on the controls to raise the cover extension arm, this will energize the pump. Once the cover begins to move upwards, stop and lower it down, look at the fluid level site tube and make sure that the reservoir is still filled. After refilling the reservoir as required you can continue to raise the cover. When the cover lift extension arm assembly reaches its full height, continue to run the pump on for about 1-2 seconds, and then release the up button. Wait about 30-60 seconds, then cycle the pump back on for approximately 1-2 seconds and then release the up button. Run this on / off cycle about 3-6 times. This should purge any remaining air from the hydraulic system. The cover lift extension arm assembly should move smoothly while activating the up and down pushbuttons. After the lift has been operated for several up and down cycles, check the oil level with the cover lift extension arm in the full down position and refill if necessary. Remember to press the "SAFETY-LATCH RELEASE" button first followed by the "DOWN" button.
- G. Verifying the safety latch mechanism:** The safety latch should also be checked for proper operation at this time. Raise the cover by pressing the "UP" button. Press the "DOWN"

button only. The safety latch should engage and prevent the cover from lowering. The safety latch should be engaged prior to dedrossing or servicing the furnace with the cover in the raised position. Press the "UP" button in order to lift the cover about an inch [25mm]. Then first press the "SAFETY-LATCH RELEASE" button followed by the "DOWN" button. The cover should lower until either one is released. If the cover does not lower and stop properly, it may be because insufficient pressure is supplied to the actuator cylinder. Increase the regulator pressure setting until the latch releases quickly once the "SAFETY-LATCH RELEASE" button is pressed; between 60-90 psig. In the event of insufficient or no pressure, there is a manual release cable located on the lower portion of the carriage assembly.

H. Attaching the Cover to the Extension Arm & Verifying Cover Position:

1. Lower the cover lift extension arm into the extension arm lift sockets, then close and reinsert the hitch pins into the extension arm lift sockets.
2. Carefully raise the cover lift extension arm until it just touches the square head setscrews located on the extension arm lift sockets. Finally, retighten the bottom square head setscrews located on the cover extension arm lift sockets to 70-80ft•lbs [95-110 N•m] torque, and tighten the jam nuts to lock this setting. This should position the cover insulation assembly level with the sill in the full down position.
3. Verify that the wires from the normally opened limit switch box have been connected to the SNIF® Electrical/Furnace control panel as indicated in the panel schematics. Raise and lower the cover to verify that the limit switch arm is adjusted so that the switch is actuated (closed) when in the full down position.

I. Spinning Nozzle installation: If possible, install the spinning nozzle at this time. If the nozzle is not installed at this time, then securely place approximately 380-400 lbs [170-180 kg] in place of the spinning nozzle on top of the nozzle stand. **IMPORTANT NOTE:** The (normally opened) limit switch arm must be adjusted against the bottom of the cover lift extension arm so that it is actuated (closed) when the cover is on the sill of the furnace (full down position). Its purpose is to interlock the spinning nozzle, so it cannot be operated once the cover begins to lift (raise) off the furnace sill.

J. Cover insulation assembly alignment: General alignment of the furnace, cover, and cover lifting mast should now be checked for level and plumb and be readjusted if necessary. Raise and lower the cover checking for a smooth operation. Next raise the cover above the sill by about 8-10" [200-255mm]. Measure all four corners from the bottom of the cover insulation assembly angles (or channels), to the top of the furnace sill outer angles (or channels). The left and right side, and front and rear measurements should all be within a 1/8" [3mm] of each other, with the front of the cover positioned the same as the rear of the cover. This will allow the cover to sit level on the sill in the full down position. If the cover does not sit level on the sill, then refer to K, below for adjusting the cover.

K. Adjusting the furnace cover to sit level with the SNIF® sill (if necessary):

1. Raise the cover insulation assembly until it is about 8-10" [200-255mm] above the furnace sill and back off the jam nuts on all four bottom setscrews. Back out the four bottom setscrews by 1/2 turn.



- To RAISE the FRONT of the cover evenly, loosen the jam nuts on the top rear setscrews only, and then by equal amounts, back out the two top rear setscrews and retighten the four bottom setscrews.
 - To LOWER the FRONT of the cover evenly, loosen the jam nuts on the top rear setscrews only, back out only the bottom rear setscrews about 3 turns, this will allow the top rear setscrews to be turned in by equal amounts.
 - ❖ **NOTE:** One complete turn of the rear setscrews should raise/lower the front of the cover by $\sim 3/16$ " [5mm]. Lower the cover and verify that the cover steel on the port 1 & 4 sides have equal spacing from the edge of the furnace steel shell.
2. If the cover is now level and located into the proper position, then tighten all of the setscrews to 70-80 ft•lbs [95-110 N•m] of torque and tighten the jam nuts to lock this setting. This will secure the cover to the extension arm and prevent it from shifting. Run the cover up and down several times and recheck to make sure it that the cover maintains the proper level with the sill. If not repeat the leveling procedure.
- L. Final Check:** Verify the gasket material is forming a good seal with the sill of the SNIF[®] furnace when the leveling is complete. Replace any safety railings or chains that were removed during the installation of the cover. Verify the gas and electrical supply lines do not catch on the railings when the cover is raised to full height.

3.4 FURNACE SCR JUNCTION BOX INSTALLATION:

- A.** The Furnace SCR Junction Box should be mounted in a location close to the rear of the furnace in order to reduce the amount of high temperature cabling required. The furnace junction box, once positioned should be secured to the floor.
- B.** The wiring of the Furnace SCR Junction Box is described in Section 3.5.

3.5 ELECTRICAL/FURNACE CONTROL PANEL INSTALLATION:

Prior to doing the interconnections of the inert and chlorine control panels, and electrical/furnace control panel, the proper number and size wires, as indicated on the general assembly Interconnecting Wiring drawing, should be installed. In addition, the main supply to the panels should be locked out in the OFF position until all of the interconnecting wiring is finished. Refer to the electrical/furnace control panel specific details and schematics located in Section 5 of this manual.

Prior to doing any wiring in this panel, insure that all of the circuit breakers are in the off position.

- A.** Position the electrical/furnace control panel in a place that is easily accessible. The HMI operator screen (may be located on electrical panel door) should be positioned to allow operator access. Placing this panel as close as possible to the furnace and furnace transformer will limit the length of wires that need to be run and will provide easy visibility for monitoring. Install the heating elements into the heater tube assemblies that are located in the heater block area. Check and make sure that the plant supply power is off and locked out. Connect the main power wires to the circuit breaker located in the electrical/furnace control panel as indicated in the electrical schematics that are provided in Section 5.
- B.** Connect the power supply, to the terminals located in the electrical/furnace control panel. Connect the output of the panel to the primary side of the furnace transformer. Connect the secondary side of the furnace transformer to the terminals located inside of the SCR Junction box.
- C.** Thermocouple wiring: For the heating element thermocouple there is one type K thermocouple that is supplied for each heater. Wire the heating element thermocouple wire from each heater to the thermocouple input located in the Mast Terminal Box. Maintain correct polarity, the yellow lead is positive, and the red lead is negative. The furnace bath thermocouple (type K) needs to be installed through the cover insulation assembly on location using the "Bath Thermocouple Parts" listed on the General Assembly Bill of Materials. A graphite protection tube that is installed thru the cover insulation assembly protects the bath thermocouple. Wire the Furnace Bath Thermocouple located on the furnace cover insulation assembly to the thermocouple input located in the Mast Terminal Box. This thermocouple provides a signal for the main bath temperature control. This controller then provides an output to the SCR;s located in the SCR Junction Box. See also OMP-6119: 'Replacing the Bath Immersion Thermocouple w/ Graphite Protection Tube', located in the Alarms and Trouble Shooting Section of this manual.
- D.** Connecting the spinning nozzle motor cable to the terminals in the electrical/furnace control panel: Once the spinning nozzle is installed, run the nozzle motor cable, supplied by Pyrotek for this purpose, from the spinning nozzle located on the cover insulation assembly to the mast motor terminal box located on the cover lift mast. The cable should be long enough to allow the cover to be fully raised and not pull on the cable. The motor nozzle cable should



also be installed in such a way as to not interfere with the operation of the cover or be exposed to molten metal. Connect the four wires for the nozzle from the mast motor terminal box to the electrical/furnace control panel as indicated on the Electrical/ Furnace Control Panel Schematic.

- E.** Connect the wires from the electrical/furnace control panel to the terminals located in the inert and chlorine control panels as indicated in the schematics. The wires in this panel should be installed in such a way as to protect them in the event of a chlorine leak. Always maintain a common ground wire between the panels.
- F.** Connect the lifting mast limit switch wires to the proper terminals located inside the electrical/furnace control panel, as indicated in the schematics.
- G.** The electrical/furnace control panel is now ready for operation. The final checkout and testing should be done under the supervision of a SNIF[®] Systems Field Engineer during the start-up.

3.6 INERT CONTROL PANEL INSTALLATION:

Before making the final connections to the panels, the gas supply lines should be blown out and cleaned of all particulates and moisture. After the lines have been cleaned out, check each line for leaks with a pressure of 100 psig [7 Kg/cm²]. Refer to the general assembly Interconnecting Piping drawing, the Inert Control Panel Assembly drawing, and the Inert Piping Schematics located in this SNIF manual for additional details. NOTE: Pipe nipples or tees for connections to the lines are not supplied with the panel.

WARNING:

- A.** Install the panels in a location that is accessible for both viewing and adjustment of the gas flows.
- B.** Install the main supply gases as indicated on the Interconnecting Piping drawing and with the requirements listed in Section 1 of this manual.
- C.** Connect the piping as indicated in the Interconnecting Piping drawing and with the requirements listed in Section 1 of this manual.

NOTE: If the spinning-nozzle is not installed at this time remove the quick disconnect gas fittings from the steel body assembly and connect them to the appropriate hose. The quick disconnects can be reconnected to the steel body assembly once the nozzle is installed.

3.7 CHLORINE CONTROL PANEL INSTALLATION:

Before making the final connections to the panel, the gas supply lines should be blown out and cleaned of all particulates and moisture. After the lines have been cleaned out, check each line for leaks with a pressure of 100 psig [7 Kg/cm²]. The chlorine supply line should be leak checked in accordance with local and plant codes. Refer to the general assembly interconnecting piping drawing, the chlorine control panel assembly drawing, and the inert/chlorine piping schematics located in this manual for additional details.

- A.** Install the panel in a location that is accessible for both viewing and adjustment of the gas flows. The rear door of the panel also needs to have ample room for access for maintenance of the panel.
- B.** Install the two main supply gases as indicated on the interconnecting piping drawing and with the requirements listed in Section 1 of this manual. If the chlorine supply is “wet” or contains particulates, then a filter and dryer are required. Wet chlorine gas will contaminate the tubing and fittings and will reduce the life of the flowmeters.
- C.** Connect the Nozzle #1 chlorine output located on the top of the chlorine control panel to the remaining side of the tee that was installed on top of the inert control panel.
- D.** Prior to turning on the chlorine supply line to the panel, the internal lines should be leak checked with argon and tighten any fittings that might have loosened during shipping. After the chlorine is turned on, the panel should again be checked for leaks.
- E.** The customer must vent the chlorine pressure relief valve outlet port, located on the top of the control panel, to an approved location in accordance with the country national safety codes.

3.8 FURNACE PREHEAT:

Once the furnace junction box, electrical/furnace control panel, furnace transformer and gas control panel have been installed, the furnace can be preheated to its operating temperature. Refer to, OMP-6135: ‘Procedure for Preheating SNIF® Immersion Heated Furnaces’ for the preheat procedure located in the Alarms and Trouble Shooting Recommendations Section of this manual.

- A.** At this time, prior to heating up the furnace, the spinning nozzle assembly should be installed. Follow the procedure outlined in Section 7, for information on assembling and installing the spinning nozzle onto the cover insulation assembly. If the spinning nozzle is not installed at this time, the installation will have to wait until after the furnace contains molten metal.
- B.** If the spinning nozzle is not to be installed at this time, insert a blank plug plate into the spinning nozzle opening in the cover insulation assembly. Connect the main inert hose for the spinning nozzle to the fitting on the blank plug plate assembly and set the idle gas flow rate to 0.5 scfm [0.79 Nm³/h] for the preheat (argon only).



- C.** Using ceramic blanket to prevent air from entering the furnace, seal the trough openings located on the front of the unit. Verify that the side drains are properly sealed.
- D.** Follow the preheat schedule OMP-6135: 'Procedure for Preheating SNIF® Immersion Heated Furnaces' located in the Alarms and Trouble Shooting Recommendations Section of this manual.

WARNING: Once the preheat has started, at no time should the cover be raised, or the ceramic blanket remove from the trough openings. Allowing air into the furnace during the preheat can damage the graphite parts on the nozzle if it is installed. The cover should not be raised, or the furnace opened in any way until it is being filled with molten metal.

3.9 ELECTRICAL/FURNACE CONTROL PANEL SYSTEM CHECKOUT(PLC):

Once all of the wires are connected and the spinning nozzles are installed, the electrical/furnace control panel can be checked for proper operation. The spinning nozzle motor to shaft connections should be disconnected during this procedure to prevent damage to the graphite nozzle components.

The control panel has been completely checked and all of the components have been set and calibrated prior to shipment. No adjustments should be required.

Care should be taken at all times during the checkout, while power is being supplied to the panel. Qualified personnel should only do the checkout.

- A.** Turn on main supply power to the electrical/furnace control panel. Check the voltage supplied to the panel at the terminals located inside the panel. The voltage should be within 10% of the required voltage as indicated in the electrical/furnace control panel schematics.
- B.** If the supplied voltage is correct, turn on the circuit breakers in this panel. This will allow the control equipment to energize. At this time the PLC should be on. If any of the circuit breakers should trip when power is applied the first time, try to reset them. If they continue to trip this is may be an indication of a ground short located within the panel. Check for wires that may have loosened during shipping, also, check the interconnecting wires for ground faults.
- C.** Turn on all gas supplies. Check that the idle gas flow is set to 0.2 - 0.3 scfm [0.32-0.47 Nm³/h]. If it is not at this level, adjust the flow until it is properly set. The flowmeter for this is located inside the rear of the inert control panel. In addition, set the chlorine gas selector switch to the off position. Chlorine gas should not be turned on unless there is molten metal in the furnace.
- D.** Reset all of the "EMERGENCY STOP" buttons located on the electrical/furnace control panel. This will restart the PLC control. During this procedure alarm horns may come on, this is normal. Silence the alarm horn. If any of the warning lights for the gas panel are on, check the gas pressures and flows. Once the argon is above 35 psig [2.5 kg/cm²], some of the alarm messages will go off

- E.** Unless molten metal is already in the furnace and the motor is connected to the nozzle shaft, the nozzle failure alarm will have to be reset to prevent the alarm from sounding and the motor from automatically shutting off during testing. In addition, set the chlorine gas selector switch to the off position. Chlorine gas should not be turned on unless there is molten metal in the furnace.
- F.** Once all the alarms have been cleared, the operation of the panel can be checked. Before energizing the motor, the motor rotation direction must be verified.
- 1) **IMPORTANT STEP TO PREVENT EQUIPMENT DAMAGE:** Verify the motor coupling is open (disengaged from the nozzle) prior to energizing.
 - 2) Press the "IDLE ON" function key to start the motor.
 - a. The "NOZZLE SPEED" indicator should indicate the motor is running at the preset idle speed of 125-150 RPM.
 - b. Check that the motor is actually running. If the motor is not running, recheck that the wires have been installed properly. At this time, if the motor is still not operating, refer to the troubleshooting section of this manual for possible causes.
 - 3) Verify the motor is turning in the correct direction as viewed from the TOP of the motor. Refer to the general assembly Furnace Installation Dimension drawings for the correct rotation direction. Every system is unique, so it is important to verify the direction for each motor against the drawings. If a motor is turning in the incorrect direction, in the CABINET, reverse any two leads on a 3-phase motor to reverse the direction of motor rotation.

NOTE: When new motor / reducer assemblies are received, the motor rotation direction must be verified again. Wiring on replacement motors should be reversed at the MOTOR, not the cabinet. It is important ALL motors for a given rotation direction, including spares are identically wired to the connectors, as this will allow swap-out of motors without re-wiring.
 - 4) After motor rotation is verified, press the "STOP" function key. Once the motor has stopped, the coupling should be reconnected.
- G.** After reconnecting the nozzle to the motor, press the "IDLE" function key to restart the system. Using a digital tachometer verify that it is running at the indicated RPM.
- H.** After the motor is running at "IDLE", and with the nozzle speed control set for 250 RPM, depress the "PROCESS ON" function key. The following sequence of events should occur:
- 1) The motor should increase speed. If not, increase the speed potentiometer until the nozzle speed is increasing.
 - 2) After 20 seconds the main inert gas should start to flow. Adjust the gas flow to 3.0 scfm [4.7 Nm³/h]. Later, during processing of metal, the gas flow of argon will have to be readjusted to the flow rate required for the process.



- 3) Slowly increase the nozzle speed of the nozzle until it is up to 400 RPM. This should be done slowly with at least 60 seconds between changes to allow the graphite parts to wear together.
- I. Once the nozzle has stabilized at this RPM for several minutes, depress the "STOP" function key. Once this button is depressed the main inert gas will shut off and the motor will start to decelerate to 0 RPM.
- J. Depress the "IDLE" and "START" function keys several times, allowing the nozzle RPM readings to stabilize before pushing the "STOP" function key. The acceleration and deceleration of the motor should be at least 30 seconds to process speed. If it is not, refer to the vendor literature for the motor inverter supplied in this manual for the adjustment procedure. The motor inverter should be set with an acceleration and deceleration time of 60 sec for a maximum nozzle speed of 778 RPM (Maximum motor speed of 1750 RPM).

Inert and chlorine panels are designed to regulate the supply of inert gas and chlorine to the required flows and pressures for SNIF[®] operation. This is accomplished by the use of regulators, flow control valves, flowmeters and Mass Flow Devices (If equipped). These controls are located in the front of the panels and are labeled accordingly. Install the panels in a convenient area for easy access and operation. The separation of the gases into the two panels prevents any chlorine leaks that might develop, from damaging the remaining components in the system. The panels are provided with pre-wired sensors, valves, and mass flow device(s), if equipped, for connection to the main control panel, providing control via the system PLC and HMI.

4.1 INERT CONTROL PANELS:

The inert control panel consists of a cabinet with a door. Use the door to access and make adjustments for the pressures and flows of inert gas to the nozzles and for maintenance.

If equipped: the mass flow device(s) are mounted in the bottom of the cabinet. If the mass flow device(s) are bypassed the HMI will not be able to display the flow. Should it be required to remove any mass flow device for maintenance, bypass valves have also been installed in the panel.

Note: Mass flow device(s) are calibrated by the manufacturer and should be checked and re-calibrated once per year.

All of the supply and outlet connections for this panel are located on the top and clearly labeled.

SUPPLY PRESSURE REQUIREMENTS: A minimum of 70 psig (maximum of 125 psig) of inert pressure is required for this panel. This is for operation of the pilot operated valves located inside the cabinet. Valves are used to turn the process gas on and off. Failure to provide the minimum pressure will result in these valves failing to operate. Exceeding the maximum pressure can damage panel internal components.

A. MAIN INERT:

The main inert gas is used to remove the hydrogen from the metal. This is accomplished by adsorption and partial pressures. The gas is injected into each spinning nozzle that disperses the inert gas into small bubbles through the metal. The hydrogen is brought to the metal surface where it burns off when exposed to the oxygen in the atmosphere, thru the exhaust port.

During normal operation, the flow of gas is controlled by either a mass flow controller with set point entered into the HMI, or with flow control valves, that are located in the panel. The flow to each nozzle is monitored using a flowmeter on the front of the panel behind the door; the meter is visible through the window in the door.

When processing, the main inert flow is interlocked with the chlorine system, in such a way, that unless the main inert to the nozzle is greater than one scfm, the chlorine to that nozzle is prevented from coming on. The actual flow required for processing will be determined during the start-up. It depends on the flowrate and hydrogen levels of the incoming metal being treated. Typical flow is 2-4 scfm (3.1-6.3 Nm³/Hr.).



The calibrated pressure for each main inert flowmeter is 20 psig (1.4 kg/cm²). The flowmeter pressure is controlled with a pressure regulator, which is located and labeled on the front face of the panel.

B. IDLE INERT:

The idle gas is used to prevent metal from penetrating the bearing surface and cross drillings in the spinning nozzles. The flow for each nozzle is set at 0.2 scfm (0.32 Nm³/Hr.) at 10 psig (0.7 kg/cm²). The flow for each nozzle is monitored and controlled with flowmeters, flow control valves and a pressure regulator, that are installed in the cabinet. These flows have been preset, but may need a slight adjustment, during the initial setup.

C. AUXILIARY INERT:

The auxiliary inert is used as a backup gas in case there is a loss of the main gas supply to the panel. The purpose of this gas is to prevent damage to the nozzle in the event of a gas supply loss. The panel will automatically switch to auxiliary inert whenever it detects a pressure, below preset limit, on the supply. At this time on the electrical control panel, the main inert failure light will be on. During this period, normal processing mode is prohibited. If the system is processing at the time that this condition is detected, then the motors will shut off and the processing will stop until the main supply pressure has been restored. Typically, a cylinder with a regulator is recommended to be used for this gas. The supply pressure required is 25 psig.

4.2 EMERGENCY BYPASS:

The purpose of the emergency bypass is to avoid metal penetration into the spinning nozzle when changing a main inert component. The most appropriate time for this application is during scheduled maintenance or in between casts.

Operation:

- A) Turn the valve in the inert gas panel labeled "Emergency Bypass Valve".
- B) This will automatically divert the main inert gas through an orifice that will provide 0.2 scfm [0.32 Nm³/Hr.] to the nozzle.
- C) During this time you will have access to remove the following components:

Main Inert Controls:

- A) Main Inert Flowmeter
- B) Regulator
- C) Pressure Gauge
- D) Flow Control Valve
- E) Flow Switches
- F) Mass Flow Control Devices

Idle Inert Controls:

- A) Regulator
- B) Pressure Gauge
- C) Flow Control Valve
- D) Flowmeters



4.3 CHLORINE CONTROL PANEL:

The chlorine control panel consists of a cabinet with a door. Use the door to access and make adjustments for the pressures and flows of chlorine gas to the nozzle and for maintenance.

If equipped: The mass flow device(s) are mounted in the bottom of the cabinet. Should it be required to remove any mass flow device for maintenance, bypass valves have also been installed in the panel.

Note: Mass flow device are calibrated by the manufacturer and should be checked and re-calibrated once per year.

During normal operation, the chlorine is interlocked with the main inert flow. This interlock is designed such that if the inert gas flow is too low, less than one scfm, the chlorine flow will shut down.

At any time that the chlorine has been turned on for processing, once the process is either STOPPED or set to IDLE, an automatic flush of inert gas is started to flush any residual chlorine from the chlorine tubing and valves inside the panel. There will be an indicator on the HMI during the flush cycle.

All of the supply and outlet connections for this panel are located on the top and labeled.

SUPPLY PRESSURE REQUIREMENTS: A minimum of 70 psig (maximum of 125 psig) of inert pressure is required for this panel. This is for operation of the pilot operated valves located inside the cabinet. These valves are used to turn the process gas on and off. Failure to provide the minimum pressure will result in these valves failing to operate. Exceeding the maximum pressure can damage panel internal components.

A. CHLORINE:

The flow of chlorine is metered and controlled in the panel. It is then mixed with the main inert in the piping and hoses going from the panel to the spinning nozzle. The flow rate of chlorine is controlled by the mass flow controller(s) that are mounted inside the panel, with set points that are entered into the HMI or by rotameter mounted in the panel. There is one regulator located on the front of the panel for regulating the supply pressure down to the required 15 psig.

If equipped: The mass flow controller(s) can also be controlled manually. To control the flow manually the two bypass valves located in the cabinet must be set to "inactive". This activates the manual flow control valves located in the panel.

B. INERT GAS:

Inert gas is supplied to the chlorine panel for flushing the tubing and is used for activating the pilot operated valves that turn the chlorine on. The supply pressure to this panel must be at least 70 psig.

4.4 DESCRIPTION OF CONTROLS:

A. FLOWMETERS:

The flowmeters are used to monitor the flow of the main inert gas to each spinning nozzle. Each meter is calibrated for a certain pressure. The meters are dual scaled in increments of scfm and Nm³/Hr. The glass tube is in scfm and the metal scale in Nm³/Hr.

B. REGULATORS:

The regulator is used to regulate the supply pressures down to the required flowmeter pressures. To increase the pressure turn the regulator clockwise; to decrease the pressure turn the regulator counter clockwise.

C. FLOW CONTROL VALVES:

The flow control valves control the flow of each gas. To increase the flow turn the flow control valve counter clockwise. To decrease the flow turn the flow control valve clockwise.

D. PRESSURE GAUGES:

The pressure gauge is used to monitor the pressure of each gas. Each gauge is dual scaled in psig and kg/cm² or bars. There are gauges installed in the lower half of the panel, which monitor the supply pressures of each gas. There are also gauges installed to monitor the pressure of each flowmeter.

E. CHLORINE DETECTOR:

The panel contains a chlorine detector, which activates an alarm input to the PLC when chlorine is detected at 3 ppm. When the leak is repaired and the value decreases to 1 ppm the input will return to the safe condition.

F. MASS FLOW METERS (If Equipped):

The mass flow meters provide monitoring of the manually adjusted flow into the PLC and HMI. Feedback is by 4-20 mA inputs.

G. MASS FLOW CONTROLLERS (If Equipped):

The mass flow controllers allow control and monitoring of the flow through the PLC and HMI. Control and Feedback are by 4-20 mA inputs and outputs.



4.5 FLOWMETER PRESSURE & FLOW SPECIFICATIONS:

Flowmeter Description	Maximum Flow Rate		Metered Pressure	
	Scfm	Nm ³ /Hr.	psig	Kg/cm ²
Main Inert	8.5	13.4	20	1.4
Idle Inert	0.6	0.95	10	0.7
Chlorine	0.15	0.235	15	1.1

Flow Description	Typical Flow Rate		Metered Pressure	
	Scfm	Nm ³ /Hr.	Psig	Kg/cm ²
Idle Gas	0.2	0.32	10	0.7
Main Inert	2 - 4	3.1 - 6.3	20	1.4
Chlorine	*	*	15	1.1

* The main inert and chlorine flows are typically set during the commissioning of the SNIF[®] unit and is usually determined by the alloy processed and the inlet hydrogen and alkali and alkaline metal levels.

4.6 SUPPLY PRESSURES:

Supply pressures and flows are detailed in Section 1, Specifications.

SUPPLY PRESSURE REQUIREMENTS: A minimum of 70 psig (maximum of 125 psig) of inert pressure is required for each panel. This is for operation of the pilot operated valves located inside the cabinet. These valves are used to turn the process gas on and off. Failure to provide the minimum pressure will result in these valves failing to operate. Exceeding the maximum pressure can damage panel internal components.

4.7 FLOWMETER SCALE CALIBRATIONS:

Note: Metered pressures are set using the pressure regulator located in the lower section of the inert/chlorine control panel. If the regulated pressures are different from those indicated above, then the flow rate must be recalibrated.

$$0.634 \text{ scfm} = \text{one Nm}^3/\text{Hr.} \quad 14.2 \text{ psig} = 1 \text{ Kg/cm}^2$$

RECALIBRATING FLOW RATES: Use the following formulas:

Standard Cubic Feet per Minute (scfm):

$$Q_1 = \frac{Q_2}{\sqrt{\frac{P_2 + 14.7}{P_1 + 14.7}}}$$

Where: Q_1 = Actual Setting on Flowmeter (scfm)

Q_2 = Desired Flow Rate (scfm)

P_2 = New Operating Pressure (psig)

P_1 = Calibrated Pressure (psig)

14.7 = 1 Atmosphere (psia)

OR

Normal Cubic Meters per Hour (Nm³/Hr.):

$$Q_1 = \frac{Q_2}{\sqrt{\frac{P_2 + 1.035}{P_1 + 1.035}}}$$

Where: P_2 = New Operating Pressure (Kg/cm²)

P_1 = Calibrated Pressure (Kg/cm²)

1.035 = 1 Atmosphere (Kg/cm²)



ELECTRICAL CONTROL PANEL FEATURES

The electrical control panel is the central part of the SNIF® control system. A Siemens S7-1200 Programmable Logic Controller (PLC) manages the electrical control panel, which is connected to a Siemens TP-1200 Human Machine Interface (HMI). The HMI and PLC are networked through an ETHERNET connection. The operator may monitor the status of the SNIF® and all user-configurable functions may be managed by through the HMI.

Additionally, pushbuttons for process START, idle START (if present), and STOP, Alarm horn SILENCE, and an indicator and reset button for "Control Power ON" are mounted on the door of the HMI control panel along with an emergency stop (E-stop).

5.1 GENERAL SNIF ELECTRICAL CONTROL

A. FUSES AND CIRCUIT BREAKERS:

Most electrical components have fuses or circuit breakers to protect them. The fuses are located on the terminal strip and if a fuse opens an indicator, LED will illuminate. Some circuit breakers are located on the terminal strip or next to the component that they are protecting. If a breaker trips, it will be in the off position. Should either a fuse or circuit breaker trip, standard electrical troubleshooting techniques should be applied to determine and remedy the cause. The most common cause of this type of failure is a short circuit or a ground condition has occurred either in the wiring or in the component. Please refer to the electric schematic and vendor bulletins for the various components while troubleshooting problems.

B. EMERGENCY STOP (E-STOP) BUTTON:

Although there is minimal risk to personnel involved in most SNIF® equipment, the Emergency stop buttons are designed to stop all SNIF® equipment when pressed. The operator interface will alarm. To reset the E-Stop, turn the E-stop button until it releases and then press the white "control power on" button. Once the emergency stop has been reset, equipment will NOT automatically restart.



5.2 SNIF[®] PROCESS CONTROL, MONITORING, AND ALARMING:

A. MOTOR SPEED CONTROL:

The correct speed for a given application will be established during the startup of the unit and/or based on results of hydrogen testing.

The nozzle motor(s) are operated with AC motor inverter(s) located inside the electrical control panel and are used control nozzle speed. The motor drive communicates with the PLC with 4-20mA control loops. An OMP with motor drive configuration information is contained in back of the SNIF[®] Manual.

The motor speed control & feedback loop correlates to approximately 0-1800 RPM, 0-900 RPM or 0-778 RPM depending on whether a gear reducer is used and motor design.

The motor load feedback loop correlates to approximately 0-200%.

Note: The motor load is monitored only to assist in broken nozzle detection and variation between motors is considered NORMAL. If the nozzle load is below a pre-set load threshold for a pre-determined period of time, the PLC concludes the nozzle is broken and alarms the operator accordingly.

Once the PLC program detects a nozzle failure, the broken nozzle will stop rotating, and the argon gas to the nozzle will reduce to idle flow. If the SNIF[®] system has more than one nozzle, the other nozzle(s) will continue to operate until the process is stopped.

5.3 SNIF[®] HEATING CONTROL, MONITORING, AND ALARMING:

Each heater in the SNIF[®] system is controlled through an SCR power controller installed in the furnace junction box along with a ground fault monitor and associated equipment.

A. SCR POWER CONTROLLER (FURNACE / SCR PANEL):

For each heating element (1 per chamber), there is one (1) SCR power controller installed in the panel. The SCR controls the amount of power going to the heating element, which consists of two (2) SiC (Silicon Carbide) U shaped elements wired in series. The SCR is rated for a maximum capacity of 39.1 kW (170 AMPS @ 230 volts). The element pair is rated for 20 kW power output. Because of the difference between the SCR capacity and the heater element power rating, the SCR has been adjusted to limit the maximum power output to 20 kW.

As the heater elements age and the resistance changes, the SCR will automatically regulate the voltage to maintain a maximum power of 20 kW. As the voltage increases to overcome the increase in resistance, the amperage will decrease.

The element pair (assembly) should normally be replaced when it can no longer maintain its rated power of 20 kW when demanded. The relationship between Set Point (SP) and Present Value (PV) may be monitored through the HMI operator interface. In extreme cases, the system may detect this as an open heater element or be unable to maintain proper metal temperature.

B. OPEN (HEATER) ELEMENT DETECTION:

While the heater element resistance naturally changes over time, as with any heater, a sudden failure is also possible. To monitor this, if the system demands more than 10 kW (SP) of power from the SCR and reports less than 5 kW (PV) of power for an extended period of time, the system will detect an open heater element, even if the element is not totally open. Prior to element replacement, electrical personnel may wish to verify feedback values to ensure replacement is warranted.

C. GROUND FAULT MONITORING / ISOLATION FAULT DETECTION (FURNACE / SCR PANEL):

The furnace junction box contains a ground fault monitor for the immersion heater. If activated there is an indicating light for the heater, which will energize, an audible alarm will also sound. The SCR will be de-energized and the ground fault monitor will need to be manually reset.



5.4 HEATING SYSTEM THEORY OF OPERATION:

The SNIF® heating system has been designed to heat the metal to the required casting temperature prior to a cast and to maintain the temperature during the idle periods between casts. It is not designed to raise the metal temperature flowing the unit during a cast. Each pair of heating elements can maintain maximum of 20 kW power.

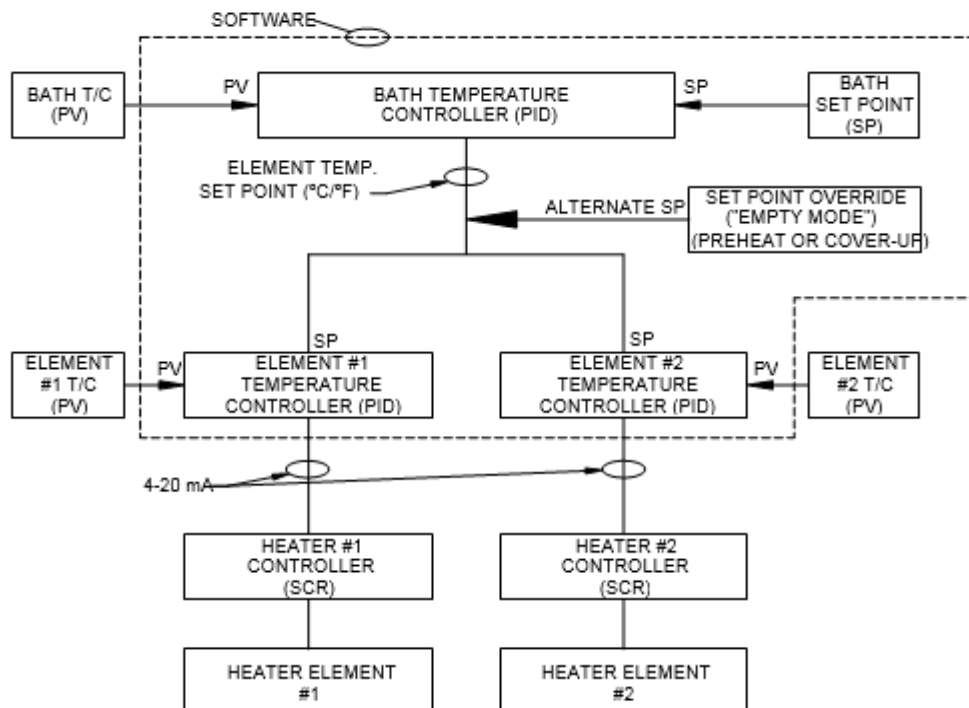
The actual temperature recovery rate of the unit will vary depending on age, unit size, heater element voltage, and maintenance. A typical temperature recovery for a new unit will be approximately 5°C -15°C/hr.

The heating system is designed to monitor and control the aluminum bath temperature at a target set point. This is performed by using the output of a single "BATH" controller for the system to set the "ELEMENT" controller (one per SCR).

During normal operation, the bath controller adjusts the target temperature of the heater elements to maintain proper metal temperature. Each element controller operates independently to maintain its respective heater element at the target temperature by adjusting the power demand to the SCR.

When the unit is in preheat mode, a manually input target element temperature overrides the bath controller output. Whenever the cover is raised or the unit is empty (no metal inside), each element is maintained at 850-900°C to prevent thermal shock damage to the ceramic immersion tube. Once the unit has been drained, the heating mode must be manually reset to normal mode.

Heating System (CASCADE) Control Schematic (Two Heaters Illustrated)



5.5 OPERATOR SCREENS (HMI SCREENS):

The HMI operator display is a SIEMENS TP-1200 TOUCH PANEL model that also can support connections of a USB mouse and USB keyboard. The selectable functions on the screen may be pressed directly, however depending on mounting location, connection of a mouse and keyboard may improve ease-of-use.

The main PLC panel and HMI display are the central parts of the SNIF® operating system. All system operation will normally be completed via the HMI, with the only exception being the cover lift and tilting functions due to safety concerns. Functions such as the following are controlled and accessed at the HMI.

- SNIF® Mode Control
- SNIF® Rotor Speed Control
- SNIF® Gas Flow Set point Monitoring (if equipped with flow monitoring devices)
- SNIF® Gas Flow Set point Control (if equipped with mass flow control devices)
- Heater System Control and set point adjustment
- Nozzle break detection.
- Alarming
- History view of recent alarms. (With SD memory card installed)

System control parameters are all accessed with various screens; the most viewed screen will likely be the "SNIF® STATUS" screen, which allows the operator to monitor both process parameters and heating system parameters. Pushbuttons allow the operator to navigate to other pages, which are more specific to various aspects of the SNIF® process.

Buttons to access the standard system pages are displayed on the top of all pages.

NOTE: Numerical fields with a WHITE background color are for viewing only (feedback only), while numerical fields with a BLUE background are fields where the user may change the value (such as set points).



MAIN SCREEN:

This screen is the default screen when the operator interface is loaded. In addition to the standard pages accessible from the navigation bar at the top, it is also possible to access other specialized pages.

From this page, it is possible to access other operator screens that allow monitoring and adjustment of specific parameters:

- **PROCESS SETPOINTS:** Rotor Speed, Gas Flow Adjustment, Heating Alarm Set points
 - Details are included later in this manual section.
- **SECURITY SETTINGS:** User Security Functions
 - The user security page allows different users to be setup at different access levels. Levels already setup include SUPERVISORS and ENGINEERS, which provide increasing levels of access. At this time, the supervisor level of access is not used.

User Name	Password (case sensitive)	Access
SUP	SUP	Supervisor Level (For access to nozzle break set point)
ENG	ENG	Engineer Level (Highest) (Configuration access)

- Note that the above password may be modified during the commissioning process and/or changed after shipment depending on specific needs.
 - Each user can have a unique user name, password, and group membership. Groups must be configured through the "TIA PORTAL" programming software (not supplied by SNIF). Automatic logoff time for each user can be also adjusted.
- **CLOSE INTERFACE:** Exit to the Windows CE Operating System
 - For system configuration and initial setup. To shut down the operator panel, the power supply must be disconnected.

MAIN SCREEN



PROCESS CONTROL:

This screen is accessible at any time by selecting the PROCESS CONTROL tab.

This page allows the operator to view system variables that are specific to the SNIF degassing process only without heating system information. The SNIF can be operated by pressing the PROCESS START or STOP buttons, which are displayed on this page.


A push button for IDLE START may also be present depending on unit design.

Additionally, some high-priority alarms and indications are specifically identified on this page and will appear if present. The popup alarm indications require more attention than most other alarms.

- MOTOR SPEED INDICATIONS
 - The actual (current) speed of each rotor is indicated on this screen.
- GAS FLOW INDICATOR(s):
 - For systems equipped with mass flow control (MFC) devices, the current gas flow may be viewed on and adjusted from the HMI screen.
 - Gas flow control is from the operator screen
 - If the controller (MFC) is bypassed, electronic flow control and measurement will be disabled. At this time, the manual flow control valve will be active and the flow may be measured using the glass-tube meter on the gas panel.
 - For all systems
 - The SNIF inert gas panel is equipped with a non-adjustable flow switch used as a permissive for chlorine usage. This switch is also used on mass flow systems in the event the mass flow device is bypassed. On systems without mass flow devices, the HMI display will indicate "ON" when there is detected argon gas flow through the panel. This indicator is only an indication of gas flow through the panel and does NOT detect leaks in the gas lines between the panels and the nozzles.
- CHLORINE INDICATOR:
 - Purging / Flush: Chlorine lines purging with inert gas. (Flush)
- NOZZLE BREAK INDICATORS
 - The alarm listing displays all alarms, however these high-priority alarms are specifically itemized on this page.

PROCESS CONTROL

NOUZ.ZASTAVENÍ					ALARMY
MENU	PROCESU	SNIF	TOPNĚHO ČLÁNKU		
STAV PROCESU SNIF					
	Tryska 1	Tryska 2	Tryska 3	START PROCESU	
Otáčky rotoru	000	000	000	ZASTAVENÍ PROCESU	
Točivý moment %	000	000	000		
PRŮTOK ARGONU (NM3/HOD)	000,0	000,0	000,0	SPUŠTĚNÍ NEČINNÉHO	
PRŮTOK CHLÓRU (NM3/HOD)	PROPLACH				
PROCES BĚŽÍ	PORUCHA TRYSKY 1	PORUCHA TRYSKY 2	PORUCHA TRYSKY 2	CHYBA HLAVNÍHO INTERNÍHO	
TRYSKY ZAKÁZÁNY: KRYT SNIF OTEVŘENÝ					

E-STOP					ALARMS
SCREEN	CONTROL	STATUS	CONTROL		
SNIF PROCESS STATUS					
	Nozzle 1	Nozzle 2	Nozzle 3	PROCESS START	
Rotor RPM	000	000	000	STOP	
Torque %	000	000	000		
Argon Flow (Nm3/hr)	000.0	000.0	000.0	IDLE START	
Chlorine Flow (Nm3/hr)	FLUSH				
PROCESS RUNNING	NOZZLE 1 BREAK	NOZZLE 2 BREAK	NOZZLE 2 BREAK	MAIN INERT FAILURE	
NOZZLES DISABLED: SNIF COVER OPEN					





SNIF® STATUS:

This screen displays all information that needs to be monitored during normal operation of the SNIF® equipment.

This data is duplicate data of information available on other screens; however, it allows the operator to view only the most important information on a single screen.

SNIF® STATUS

NOUZ.ZASTAVENÍ					ALARMY
MENU	PROCESU	SNIF	TOPNĚNO ČLÁNKU		
PROCES BĚŽÍ		PORUCHA TRYSKY 1	PORUCHA TRYSKY 2	PORUCHA TRYSKY 3	
CHYBA HLAVNÍHO INTERNÍHO		Tryska 1	Tryska 2	Tryska 3	
Otáčky rotoru		000	000	000	
PRŮTOK ARGONU (NM3/HOD)		000,0	000,0	000,0	
PRŮTOK CHLÓRU (NM3/HOD)		0,000			
Teplota kovu (oC)		0000			

E-STOP					ALARMS
SCREEN	CONTROL	STATUS	CONTROL		
PROCESS RUNNING		NOZZLE 1 BREAK	NOZZLE 2 BREAK	NOZZLE 3 BREAK	
MAIN INERT FAILURE		Nozzle 1	Nozzle 2	Nozzle 3	
Rotor RPM		000	000	000	
Argon Flow (Nm3/hr)		000.0	000.0	000.0	
Chlorine Flow (Nm3/hr)		0.000			
Metal Temp (°C)		0000			




HEATER CONTROL:

This screen allows the operator to view data specific to the heating system of the SNIF[®] equipment. Additionally, the TARGET METAL TEMPERATURE may be set on this page without a password.

- SP = SET POINT (Target) / PV = PRESENT VALUE (Actual)
- BATH Temp (Deg C): This is the metal temperature inside the SNIF[®] measured by the thermocouple mounted inside the graphite tube. When the unit is in preheat mode, the operator will set the target heating element temperature instead of the bath temperature.
- ELEMENT Temp (Deg C): This is the temperature inside the interior of the SNIF[®] heating element assembly mounted in the ceramic sheath. The bath temperature controller normally automatically controls this set point unless the unit is in preheating mode.
- Element Power (kW): This is the power delivered to the heating element. The Set Point will vary widely as the element temperature controller cycles. While this value does NOT need to be monitored normally, the data is provided to assist in heating system troubleshooting.
- With a supervisor password, the menus to activate preheat mode and tune the heating system may be accessed from this page.

HEATER CONTROL

NOUZ.ZASTAVENÍ					ALARMY
MENU	PROCESU	SNIF	TOPNĚNÍ ČLÁNKU		
STISKNĚTE NASTAVENÍ PRÁZDNÝ REŽIM		STISKNĚTE NASTAVENÍ TEPELNÝ ZÁMEK		RESET NA NORMÁLNÍ TEPELNÝ REŽIM PO PLNĚNÍ	
RESET DO NORMÁLNÍHO VYTÁPĚČÍHO režimu POUZE PO JEDNOTCE naplněné KOVEM A ZAVŘENO TOTO JE KRITICKÉ PRO ZABEZPEČENÍ TEPELNÉHO ÚRAZU KERAMICKÉMU OHŘEVU					
Prvek 1 Teplota		0000		0000	
Prvek 2 Teplota				0000	
Prvek 3 Teplota				0000	
ELEMENT 1 Výkon (kW)		0000		0000	
ELEMENT 2 Výkon (kW)		0000		0000	
ELEMENT 3 Výkon (kW)		0000		0000	
MENU REŽIMU PŘEDEHŘÍVÁNÍ			LADĚNÍ SYSTÉMU VYTÁPĚNÍ		

E-STOP					ALARMS
SCREEN	CONTROL	STATUS	CONTROL		
PRESS TO SET EMPTY MODE		PRESS TO SET THERMAL SHOCK MODE		RESET TO NORMAL HEATING MODE AFTER FILLING	
RESET TO NORMAL HEATING MODE ONLY AFTER UNIT FILLED WITH METAL AND CLOSED THIS IS CRITICAL TO PREVENT THERMAL SHOCK TO CERAMIC HEATER SHEATH					
ELEMENT 1 Temp		0000		0000	
ELEMENT 2 Temp				0000	
ELEMENT 3 Temp				0000	
ELEMENT 1 Power (kW)		0000		0000	
ELEMENT 2 Power (kW)		0000		0000	
ELEMENT 3 Power (kW)		0000		0000	
PREHEAT MODE MENU			HEATING SYSTEM TUNING		



ALARMS:

This screen allows operators to view all current alarms and unacknowledged alarms. Cleared acknowledged alarms are not displayed.

NOTE: The alarm history is logged and displayed ONLY if the "SD" Memory card is installed into the rear of the HMI operator interface.


The alarms are stored in a .CSV (Comma Delimited) File.

ALARM BACKGROUND COLOR KEY:

- **BRIGHT RED**: CURRENTLY ACTIVE ALARM, UNACKNOWLEDGED
- **WHITE**: CURRENTLY ACTIVE ALARM, ACKNOWLEDGED
- **DARK RED**: NO LONGER ACTIVE ALARM, UNACKNOWLEDGED
- **BLUE**: SELECTED ALARM

ALARMS

NOUZ.ZASTAVENÍ					ALARMY			
MENU	PROCESU	SNIF	TOPNETO ČLÁNKU					
31.12.2000		ALARMY			10:59:39			
<table border="1"><thead><tr><th>Čas</th><th>Stav</th><th>Text</th></tr></thead><tbody></tbody></table>						Čas	Stav	Text
Čas	Stav	Text						
HISTORIE ALARMŮ		ZTLUMIT SIRÉNU		POTVRZ ALARMU				

E-STOP					ALARMS			
SCREEN	CONTROL	STATUS	CONTROL					
12/31/2000		ALARMS			10:59:39 AM			
<table border="1"><thead><tr><th>Time</th><th>Status</th><th>Text</th></tr></thead><tbody></tbody></table>						Time	Status	Text
Time	Status	Text						
ALARM HISTORY		SILENCE HORN		ACK ALARM				


SNIF PREHEAT CONTROLS (FROM HEATING PAGE):

This screen requires a password for access and is where the SNIF[®] preheat mode is activated and deactivated. The target heating element temperature may be set from this page.

NOTE: While the preheat mode has been activated, the heating element target temperature may be changed by the operator from the HEATER CONTROL page without a password. A supervisor password is required to return the SNIF to normal heating mode after preheat has been completed.

SNIF PREHEAT CONTROLS

NOUZ.ZASTAVENÍ					ALARMY
MENU	PROCESU	SNIF	TOPNETO ČLÁNKU		
OVLÁDÁNÍ PŘEDEHŘÍVÁNÍ SNIF					
		NASTAVENÍ	AKT HOD		
Tepl LÁZNĚ		PŘEDEHŘÍVÁNÍ	0000		
Prvek 1 Teplota		0000	0000		
Prvek 2 Teplota			0000		
Prvek 3 Teplota			0000		
START RUČNÍ PŘEDCHOZÍ	AUTOMATICKÝ PŘEDCHOZÍ AKTIVNÍ	PŘEDCHOZÍ ČAS ZMĚNA (mín)	PAUZA AUTOMATICKÉ PŘEDCHOZÍ		
START AUTOMATICKÉ PŘEDCHOZÍ		000000	PŘEDCHOZÍ POZASTAVENO		
ZASTAVENÍ PŘEDCHOZÍ		PLÁN PODROBNOSTI	ŽIVOTOPIS AUTOMATICKÉ PŘEDCHOZÍ		

E-STOP					ALARMS
SCREEN	CONTROL	STATUS	CONTROL		
SNIF PREHEAT CONTROLS					
		SP	PV		
BATH Temp		PREHEAT	0000		
ELEMENT 1 Temp		0000	0000		
ELEMENT 2 Temp			0000		
ELEMENT 3 Temp			0000		
START MANJAL PREHEAT	AUTOMATIC PREHEAT ACTIVE	PREHEAT TIME REMAINING (min)	PAUSE AUTO PREHEAT		
START AUTO PREHEAT		000000	PREHEAT PAUSED		
STOP PREHEAT		SCHEDULE DETAILS	RESUME AUTO PREHEAT		



HEATING SYSTEM TUNING (FROM HEATING PAGE):



WARNING: This page is a CONFIGURATION PAGE that should be edited ONLY by personnel knowledgeable of process loop tuning parameters. NORMALLY if a previously functioning system stops working, tuning parameters are NOT the cause of problems.



Descriptions of tuning parameter functions are not described in detail due to the highly specialized nature of PID loop tuning. This screen requires a password for access.

For each controller (Bath, Element), the following parameters may be viewed or changed:

- SP = SET POINT (Target Temperature)
- PV = PRESENT VALUE (Actual Temperature)
- GAIN = Tuning Parameter, this is standard terminology
- INT Time = Integral Time, this is standard terminology
- Output = The bath controller will output 600-1100 Degrees C during normal operation. When the bath thermocouple is disconnected, the PID loop output is overridden to 900 Degrees C to prevent freezing of the metal.

HEATING SYSTEM TUNING

NOUZ.ZASTAVENÍ						ALARMY	
MENU		PROCESU		SNIF		TOPNETO ČLÁNKU	
REGULÁTOR LÁZNĚ							
NASTAVENÍ (oC)	000	GAIN	00,00				
AKT HOD (oC)	0000	INT Time	00,00	NASTAVENÍ VÝSTUPNÍ TEPLOTY (oC)	0000		
VÝKON OVLÁDÁNÍ KOUPELNĚ SNIF POKRYTÍ NEBO V PŘEDCHOZÍM REŽIMU							
ELEMENT # 1 OVLADAČ		ELEMENT # 2 OVLADAČ		ELEMENT # 3 OVLADAČ			
NASTAVENÍ (oC)	0000	NASTAVENÍ (oC)	0000	NASTAVENÍ (oC)	0000		
AKT HOD (oC)	0000	AKT HOD (oC)	0000	AKT HOD (oC)	0000		
GAIN	00,00	GAIN	00,00	GAIN	00,00		
INT Time (m)	00,00	INT Time (m)	00,00	INT Time (m)	00,00		
OUTPUT (SP) POWER (kW)	0000	OUTPUT (SP) POWER (kW)	0000	OUTPUT (SP) POWER (kW)	0000		
AKTUALNI (PV) NAPÁJENÍ (kW)	0000	AKTUALNI (PV) NAPÁJENÍ (kW)	0000	AKTUALNI (PV) NAPÁJENÍ (kW)	0000		

E-STOP						ALARMS	
SCREEN		CONTROL		STATUS		CONTROL	
BATH CONTROLLER							
SP (oC)	000	GAIN	00.00				
PV (oC)	0000	INT Time	00.00	OUTPUT TEMP SP (oC)	0000		
BATH CONTROLLER OUTPUT OVERRIDE SNIF COVER UP OR IN PREHEAT MODE							
ELEMENT #1 CONTROLLER		ELEMENT #2 CONTROLLER		ELEMENT #3 CONTROLLER			
SP (oC)	0000	SP (oC)	0000	SP (oC)	0000		
PV (oC)	0000	PV (oC)	0000	PV (oC)	0000		
GAIN	00.00	GAIN	00.00	GAIN	00.00		
INT Time (m)	00.00	INT Time (m)	00.00	INT Time (m)	00.00		
OUTPUT (SP) POWER (kW)	0000	OUTPUT (SP) POWER (kW)	0000	OUTPUT (SP) POWER (kW)	0000		
ACTUAL (PV) POWER (kW)	0000	ACTUAL (PV) POWER (kW)	0000	ACTUAL (PV) POWER (kW)	0000		



PROCESS SET POINTS / SET POINTS - PAGE 1 (ACCESSIBLE FROM MAIN SCREEN):

(Supervisor Level Password required)

This screen may require a password for access depending on plant policies.



This page allows a supervisor to adjust normal target process parameters such as Nozzle RPM and target process gas flow. These values should normally only be set by process personnel or during initial commissioning based on hydrogen test results.



A link to a chart showing appropriate relationships between nozzle speed and gas flow is provided as a convenience. This chart is also contained in the SNIF[®] Manual. This chart applies if gas flow control is manual OR with mass flow controllers.

- PROC RPM: Process mode target nozzle RPM
- Argon (Nm³/hr.): Process mode target argon (Normal Cubic Meters per Hour)
 - Only available if the unit is equipped with mass flow control devices
- Chlorine (Nm³/hr): Process mode target chlorine (Normal Cubic Meters per Hour)
 - Only available if the unit is equipped with mass flow control devices
 - ON/OFF Selection

On units equipped with Mass Flow Control devices, target flows for Argon gas flows may be set. These values should normally only be set by process personnel or during initial commissioning based on hydrogen test results.

PROCESS SET POINTS / SET POINTS - PAGE 1

NOUZ.ZASTAVENÍ					ALARMY
MENU	PROCESU	SNIF	TOPNĚNÍ ČLÁNKU		
NASTAVENÍ - STRANA 1					
GRAF RYCHLOST ROTORU Vs. PRŮTOK PLYNU	Tryska 1	Tryska 2	Tryska 3		
Proc. OTÁČKY	000	000	000		
ARGONU (NM3/HOD)	000,0	000,0	000,0		
CHLORU (NM3/HOD)	0,000				
	CHLÓR #1 ZAP				
	CHLÓR #1 VYP				
NASTAVENÍ STRANA 1		NASTAVENÍ STRANA 2		NASTAVENÍ VYTÁPĚNÍ	

E-STOP					ALARMS
SCREEN	CONTROL	STATUS	CONTROL		
SET POINTS - PAGE 1					
ROTOR SPEED Vs. GAS FLOW CHART	Nozzle 1	Nozzle 2	Nozzle 3		
Proc. RPM	000	000	000		
Argon (Nm3/hr)	000.0	000.0	000.0		
Chlorine (Nm3/hr)	0.000				
	CHLORINE #1 ON				
	CHLORINE #1 OFF				
SP PAGE 1		SP PAGE 2		HEATING SP	





SET POINTS - PAGE 2 (ACCESSIBLE FROM SET POINT PAGE 1):**(Engineer Level Password required)**

This screen allows an engineer to set a nozzle break alarm load threshold. The break load should be set below the normal process load, but over the load indicated by the motor drive when the motor-nozzle coupling is disconnected. This value is set during initial unit commissioning and may only require adjustment as the motor ages.

- The IDLE RPM may also be set from this page but should generally not be changed. On systems with multiple nozzles, the IDLE RPM is the same for all nozzles.

SET POINTS - PAGE 2 (ACCESSIBLE FROM SET POINT PAGE 1)

NOUZ.ZASTAVENÍ					ALARMY
MENU	PROCESU	SNIF	TOURNER ČLÁNKU		
NASTAVENÍ - STRANA 2					
KONFIGURACE SYSTÉMU (UVEDENÍ DO PROVOZU)	Tryska 1	Tryska 2	Tryska 3		
Porucha %	000	000	000		
Točivý moment %	000	000	000		
Volnoběžné otáčky	000				
<div> <div>NASTAVENÍ STRANA 1</div> <div>NASTAVENÍ STRANA 2</div> <div>NASTAVENÍ VYTÁPĚNÍ</div> </div>					

E-STOP					ALARMS
SCREEN	CONTROL	STATUS	CONTROL		
SET POINTS - PAGE 2					
SYSTEM CONFIG (COMMISSIONING)	Nozzle 1	Nozzle 2	Nozzle 3		
Break %	000	000	000		
Torque %	000	000	000		
Idle RPM	000				
<div> <div>SP PAGE 1</div> <div>SP PAGE 2</div> <div>HEATING SP</div> </div>					



HEATING ALARM SET POINTS (ACCESSIBLE FROM MAIN SCREEN OR SET POINT ADJUSTMENT SCREENS): (Engineer Level Password required)

This screen allows engineers to change alarm set points based on normally experienced temperatures specific to each customer process. Alarm set points should be set to prevent nuisance alarms.


The terminology HI, and HI-HI may be compared to a "HIGH" and "VERY HIGH" Alarm thresholds.


- HI Alarms are used on the SNIF® system to indicate system problems
- HI-HI alarms are generally used for open thermocouple alarming.
 - The HI-HI Alarm is set high (1190° C) to generally only detect an open (bad) thermocouple or input fault that is not process related.

NOTE: The LO bath temperature alarm should be set high enough to provide ample time to address a heating system failure prior to metal freezing but low enough to prevent nuisance alarms.

- Heating System During Casting Selector (ON/OFF)
 - The SNIF system is not designed to maintain or affect metal temperature during a cast. If the cast temperature is below the SNIF metal temperature set point, the heating elements will run at maximum power during the entire cast.
 - Because it may be possible to prolong heating element life by turning off the heating system when the SNIF system is in process mode, a selector button is provided to permit this option if desired.

HEATING ALARM SET POINTS (ACCESSIBLE FROM MAIN SCREEN)

NOUZ.ZASTAVENÍ					ALARMY
MENU	PROCESU	SNIF	TOPNÉHO ČLÁNKU		
NASTAVOVACÍ BODY PRO ALARM VYTÁPĚNÍ					
	Nízký	Vysoké	Příliš vysoké (přerušení T/C)		
Lázeň (oC)	000	000	0000		
Článek (oC)		0000	0000		
SYSTÉM VYTÁPĚNÍ BĚHEM LITÍ	TOPNÉ ČLÁNKY ZAP TOPNÉ ČLÁNKY VYP				
NASTAVENÍ STRANA 1		NASTAVENÍ STRANA 2		NASTAVENÍ VYTÁPĚNÍ	

E-STOP					ALARMS
SCREEN	CONTROL	STATUS	CONTROL		
HEATING ALARM SET POINTS					
	LO	HI	HI HI (Open T/C)		
Bath (°C)	000	000	0000		
Element (°C)		0000	0000		
HEATING SYSTEM DURING CASTING	HEATERS ON HEATERS OFF				
SP PAGE 1		SP PAGE 2		HEATING SP	



ALARM LISTING (FOR REFERENCE)

Alarm Name (English)	Czech
Main Inert Failure	Porucha na hlavním plynu
Chlorine Leak Alarm	Alarm úniku chlóru
Emergency Stop Activated	Aktivováno nouzové zastavení
Chlorine Pressure Failure	Chyba tlaku chlóru
Nozzle 1 BREAK	Porucha trysky 1
Nozzle 2 BREAK (If Present)	Porucha trysky 2
Nozzle 1 Drive Fault	Chyba pohonu trysky 1
Nozzle 2 Drive Fault (If Present)	Chyba pohonu trysky 2
Bath HI HI Temp (Open T/C)	Teplota lázně příliš vysoká (přerušení T/C) (přerušený nebo vadný termočlánek)
Bath HI Temp	Teplota lázně vysoká
Bath LO Temp	Teplota lázně nízká
Element 1 HI HI Temp (Open T/C)	Příliš vysoká teplota článku (přerušení T/C) (přerušený nebo vadný termočlánek)
Element 1 HI Temp	Vysoká teplota článku

7.1 SAFETY

- A.** Shut off electric power to the nozzle motors by stopping the motors. (Disconnect the drive power supply for DC motors). Breakers or Fused disconnects may be opened if desired once AC motors have been stopped.
- B.** Heavy gloves and eye protection should be worn.
- C.** Remove tripping hazards from the cover.
- D.** Be sure all guards are in place.
- E.** Inspect the process gas connection fitting for proper shutoff of inert gas flow when hoses are removed.
- F.** USE CARE WHEN REMOVING THE NOZZLES FROM THE SNIF UNIT. If there is metal buildup under the cover of the SNIF around the nozzles, it will tend to hold the nozzle in place. Refer to SNIF OMP-6139, SNIF cleaning and dedrossing procedure, for instructions on the safe completion of this task.
- G.** The cover nozzle opening should be closed with a blank plug plate immediately after the nozzle has been removed from the furnace to prevent objects from falling into the refining chamber.
- H.** Be aware of the hazards of hot graphite nozzle parts. Place the just removed nozzle in a screened area until cool enough to work on.



7.2 NOZZLE DESCRIPTION AND PARTS

A. Nozzle Operation

The fully assembled nozzle is constructed primarily of steel and graphite. During normal operation of the SNIF[®] unit, only the graphite portion of the nozzle is submerged in the liquid aluminum. Because there are gas spaces inside the graphite stator and rotor, the graphite internal parts must be kept clear of aluminum with "idle gas". Idle gas is the same argon gas used during degassing, but at a much lower flow rate. The purpose of this gas is to prevent the penetration of aluminum into the nozzle.

This means whenever the nozzle is inserted into or removed from the aluminum melt, the gas line MUST be connected to idle gas.

B. Nozzle Stand

A Nozzle Assembly stand should be used to properly and safely assemble the nozzle. The stand provides a stable platform for the nozzle to rest on during assembly as well as a safe place to allow removed, hot nozzles to cool. The nozzles can also be bolted to the assembly stand, which reduces the possibility of a falling nozzle during assembly. See the photograph below or drawing 2032121 included with the installation-drawing package.



Nozzle Stand with one nozzle in-place

C. Part Identification

For an itemized list of parts necessary for the nozzle assembly, refer to the Bill of Materials in the back of this section. The bill of materials and matching drawings can also be used to identify specific parts.

The nozzle can be divided into four sections, which can be separated easily during a nozzle rebuild.

a. Steel Body Assembly

1. Fin Cooled



(a1) Fin Cooled Steel Body Assembly

2. Air Cooled



(a2) Air Cooled



b. Motor / Motor Stand (& Lifting Bail)

(1) Motor Stand

(2) Motor Stand with Gear Reducer¹

(b1) Motor Stand



(b2) Motor Stand with Gear Reducer

¹ Some SNIF® units are equipped with gear reducers

During a normal nozzle rebuild, only the graphite consumables and Inconel shaft (Parts "c" and "d" below) must be fully disassembled for graphite replacement. The ceramic fiber insulation plug also needs replaced but can sometimes be reused. The bearing package, which is part of the steel body assembly, should also be inspected during nozzle assembly. Details on the bearing inspection procedure can be found later in this section.

- c. Graphite Stator / Fiber Insulation Plug
- d. Graphite Rotor/Shaft and Inconel Steel Drive Shaft



(c1)



(c2)



(d)

Nozzle Components

- (c1) Graphite Stator
- (c2) Fiber Insulation Plug (inverted)
- (d) Graphite Rotor / Shaft and Inconel Steel Shaft



7.3 ASSEMBLY AND INSTALLATION OF NEW NOZZLE

For disassembly instructions, proceed to Section 7.4 first

The installation steps are listed in the order of assembly; each part should be attached to the previously assembled portions of the nozzle.

Sections:

- A –Motor & Motor Support Stand Assembly
- B –Motor / Support Stand & Steel Body Assembly
- C –Graphite Stator, Fiber Insulation Plug
- D –Graphite Stator Installation
- E –Graphite Shaft & Inconel Shaft Assembly
- F –Shaft & Rotor Installation and Fastening

A. Motor Assembly

On all new units, the nozzle motor and wiring are shipped from SNIF® systems fully assembled and ready to operate. For maintenance and assembly instructions, please refer directly to the vendor literature located in the Motor/Drive section of the SNIF® Operating Manual.

The units with gear reducer ² apply to OMP-6123, SN-11 and SHEER Nozzle Motor and Gear Reducer Maintenance Recommendations, located in Section 10 of the SNIF® Operating Manual.

B. Motor & Motor Support Stand & Steel Body Assembly

1. Attaching the Motor Support Stand to the Motor

The motor support stand houses the coupling between the motor and the Inconel steel drive shaft, which turns the graphite rotor. Two expanded metal safety covers are located on opposite sides of the motor stand.

To connect the motor to the motor stand, use the four ½ " -13 x 1 ½"(full-thread) bolts, washers, and split washers, which are shipped with all new motor, support assemblies. This flange does NOT have to be disconnected each time a nozzle is rebuilt.

If the connection between the motor and the motor support stand is separated, the motor shaft and the Inconel steel shaft will need to be realigned to prevent excess equipment wear. Without using an alignment gauge, the two shafts can be self-aligned by leaving the four bolts slightly loose until the fully assembled and coupled nozzle can be operated for 10-30 minutes.

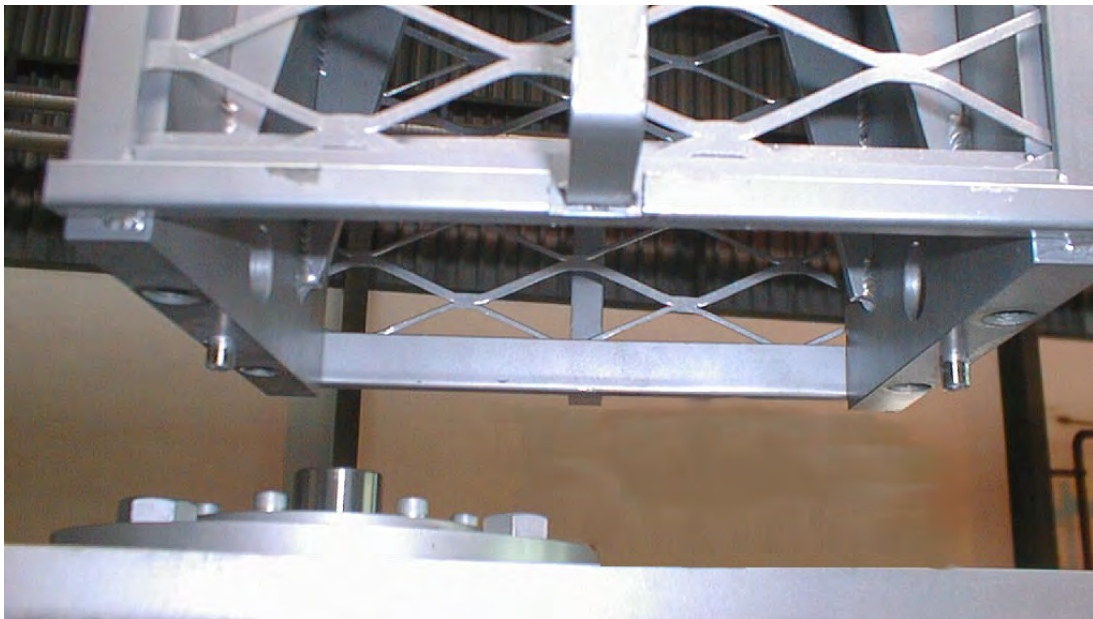
Operating the coupled nozzle with the bolts loose will allow the motor shaft to move into the correct alignment. Visually verify alignment and vibration after operation to prevent coupling insert wear.

² Only for the units with the gear reducer

2. Attaching the Steel Body Assembly to the Motor Support Stand

The steel body assembly is the interface between the drive assembly and the graphite parts. The steel body assembly is composed of the process gas port (and cooling air on older units) as well as the bearing assembly and gas seal. The rectangular plate on the top of the steel body assembly is the nozzle support plate, which is the main support point of the assembled nozzle during operation. The nozzle support plate is where the motor support stand connects to the steel body.

To allow easier access to the top of the bearing package as well as the coupling, the motor support stand can be disconnected from the steel body assembly without compromising the alignment of the drive shaft. Two positioning pins are located on the bottom of the motor support stand, which are milled to fit tightly in machined holes in the nozzle support plate.



Motor Support Stand (top) Over the Nozzle Support Plate (bottom)

(Note the positioning pins on each side of the motor support stand)

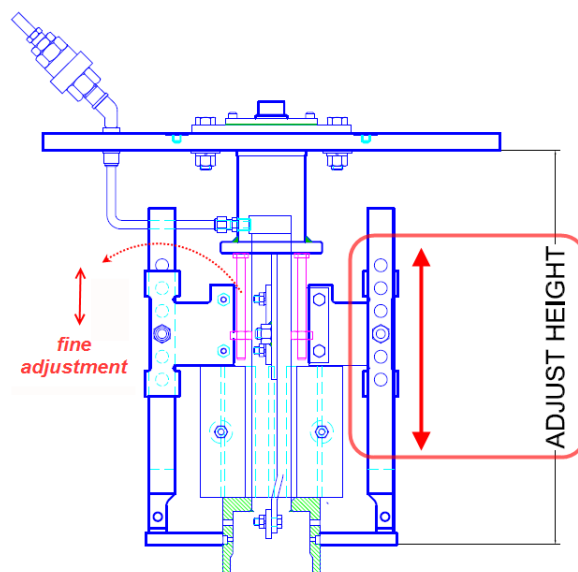
After using the positioning pins to locate the motor support stand in-place, four bolts (M12x1.75x40 Long) are used to fasten the parts. (Included w/motor stand)

The round plate on the bottom of the steel body assembly is shipped with four threaded rods, which are used to attach the ceramic fiber insulation plug.

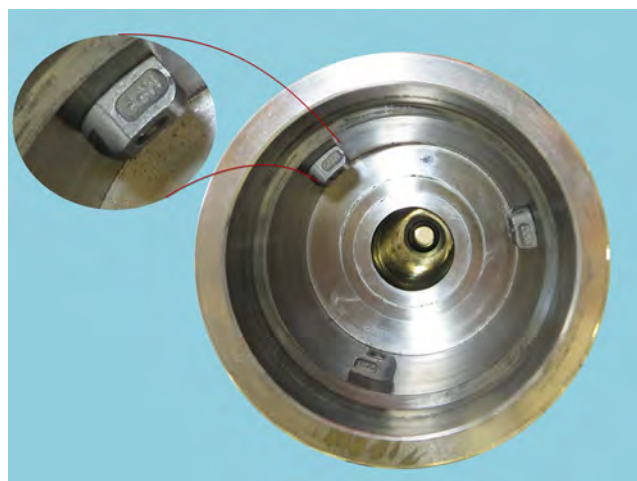


3. Adjusting the PLUG PLATE

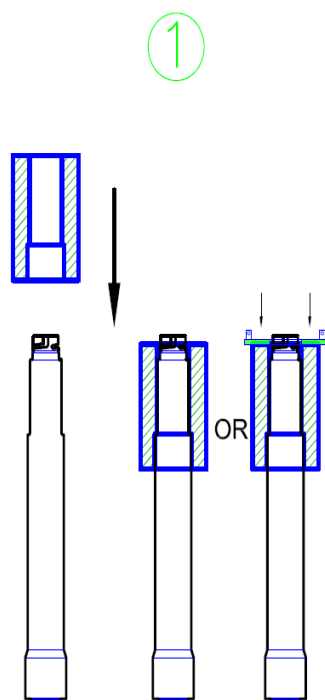
1. If plug plate limits the access to the screws on the socket housing as shown on the right, then adjust the steel body to have access to the screws



2. Apply RTV to the holes for insulation studs if 14 inch plug is used.
3. Slightly unscrew the setscrews so they clear the interior and do not prevent stator go inside the socket housing.
4. Confirm that all Location Pins are oriented horizontally and their directions are correct and all same.
5. Picture on the right hand side shows a pin orientation for CCW direction.



C. Graphite Stator, Fiber Insulation Plug Assembly



Step 1. Attaching the Ceramic Fiber Insulation

The ceramic fiber insulation plug in good condition reduces the amount of cold area on the bottom of the cover, which helps to reduce the dross buildup around the nozzle. If the insulation plug is in poor condition, cracked, or eroded, the ability for the plug to insulate heat transfer is compromised.

The ceramic fiber insulation plug also protects the steel body and the top of the cover from the heat of the molten aluminum below the cover. **The plug should be replaced whenever the physical condition of the existing plug is not good.**

Insert the self-supporting insulation plug from the top end of the graphite stator. Do not apply extra force from the top. It should sit free over the shoulder of graphite stator.

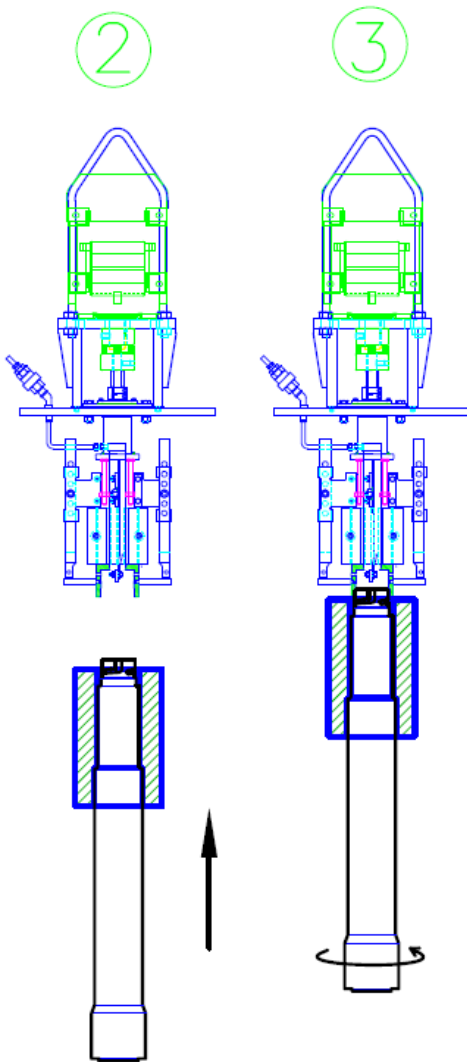
**** The illustration above and the following are proper for direct coupling, fin cooled Shur-Lok SNIF® systems. Refer to the operation manual for further and definite model and type.**

D. Graphite Stator Installation onto the Steel Body Assembly

The Shur-Lok stator uses grooved recesses to secure it to the steel body assembly. These grooves engage with pins on the inside surface of the steel body as pictured left.

Before installing the graphite stator, the pins on steel body should be inspected for burrs, old graphite, or rough edges. Pins should be installed according to Nozzle direction. Looking from the bottom, pins will indicate the direction of the Nozzle direction.





Step 2. To install, carefully line up the stator grooves with the pins lifting it up while turning to engage with the ramped area of the grooves. Turn until hand tight.

O'ring should be slightly lubricated to prevent dislocation and abrasion during torquing the stator.



STATORS can be rotated and locked in both ways depending on the system.

!!! Stator should be rotated in same direction as Nozzle rotation!!!

Step 3. Using the strap wrench, tighten the stator rotating all the way, until it physically stops. When stator stops turning, tighten the setscrews provided to prevent it from loosening. Process gas is sealed by means of the O-ring on top and it is acceptable to have a gap between steel socket and the stator.

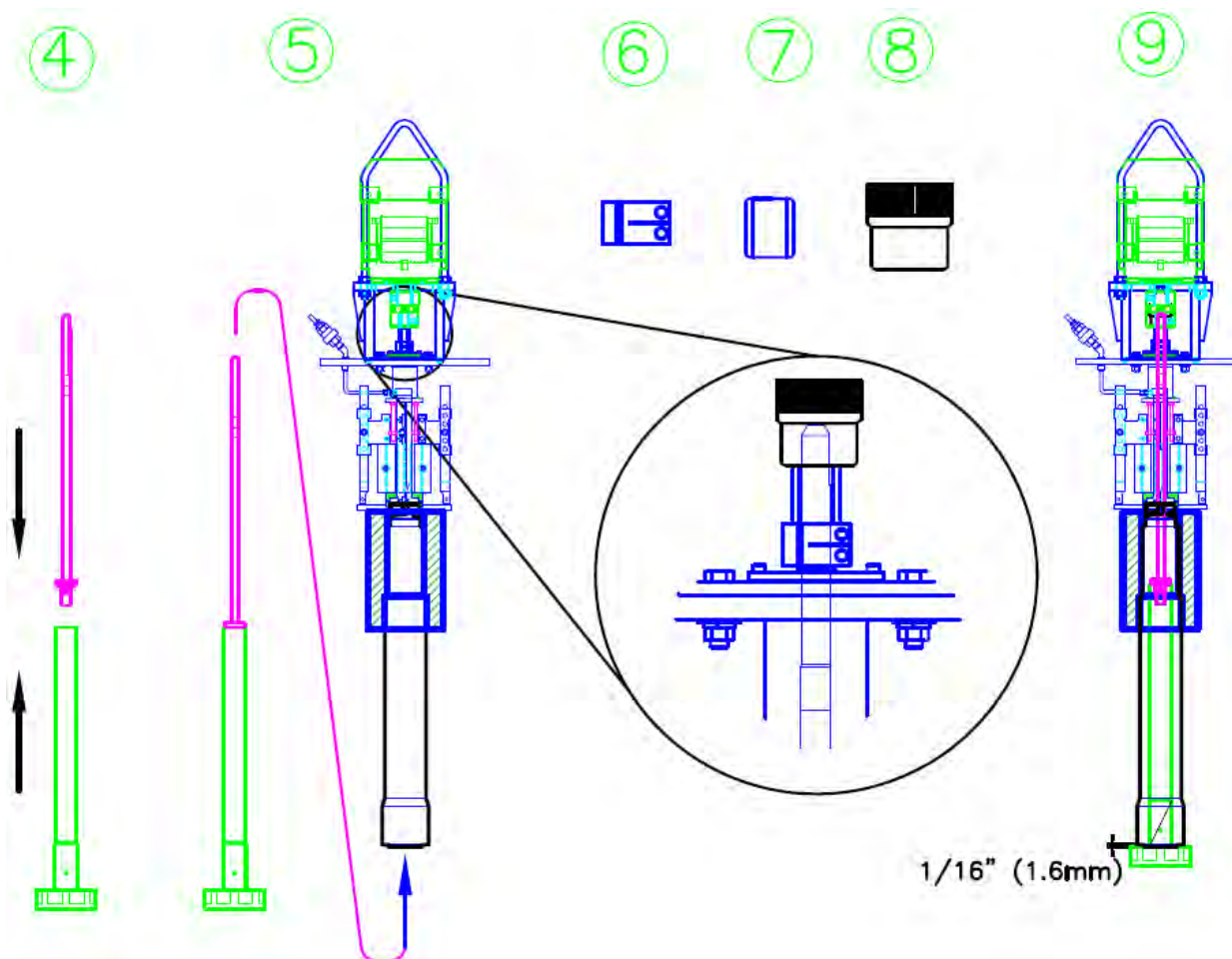
It is normal to have a gap between insulation plug and the plate at the end of this step. Do not use unnecessarily excessive amount of torque, otherwise groove angle might be damaged.

!!!! Use only SNIF® provided strap wrench to prevent over torqueing!!!!



E. Graphite Rotor & Shaft Assembly and Installation

The graphite rotor and graphite shaft come pre-assembled from the SNIF[®] factory and do not need to be connected during nozzle assembly. The Inconel steel drive shaft is reusable and should be kept for repeated use. A plastic spacer comes attached to the top of the rotor and should be used to properly gap the graphite rotor and stator.



Step 4. Assembling the shafts and rotor

The Inconel steel shaft and graphite rotor/shaft assembly must both be inserted into the nozzle from the bottom and must be assembled before insertion. The Inconel steel shaft is threaded to screw into the top of the graphite shaft. The direction of thread (CW/CCW) will depend on the individual design of each SNIF[®] unit.

Step 5. Inserting the shaft into the nozzle assembly

Prior to inserting the shaft, ensure the bearing package is in good condition. Refer to later in this section for directions on bearing package inspection and replacement. To reduce the possibility of O-ring seal damage, the tip of the Inconel steel shaft should be lubricated with high temperature silicon or Krytox Grease.



Gently insert the shaft assembly into the bottom of the stator until the plastic rotor spacers contact the bottom of the stator. Brace the rotor so it remains in this position until the fastening hardware (i.e. drive clamp) above the steel body has been assembled. **DO NOT TURN THE SHAFT OR ROTOR DURING THIS PROCEDURE, AS IT WILL UNSCREW THE STEEL SHAFT FROM THE GRAPHITE SHAFT.**

Step 6-7-8. Place the drive clamp, shaft spacer and shaft coupling over the end of the steel shaft.

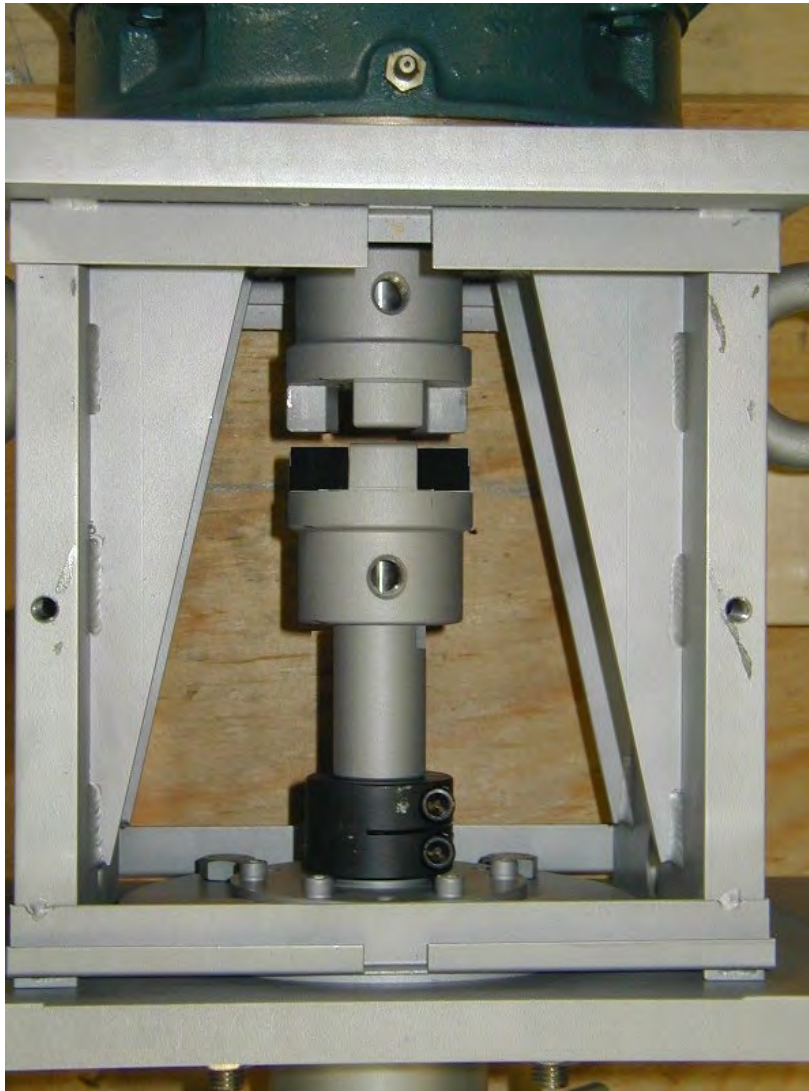


Photo of Uncoupled Nozzle & Hardware (Clamp, Spacer, Coupling)
(Coupling insert must be installed prior to installation of coupling)

Step 9. Tighten the hex head screws on the drive clamp and the motor coupling. DO NOT TURN THE SHAFT OR ROTOR. When the shaft is allowed to rest without support, the gap between the rotor and the stator should be filled with ONLY the plastic spacer. (If a piece of paper can fit between the spacer and the stator, the drive clamp should be loosened and the stator re-lifted tightly into place after confirming the graphite and Inconel shaft are properly fastened together).

F. Adjusting the Steel Body Assembly

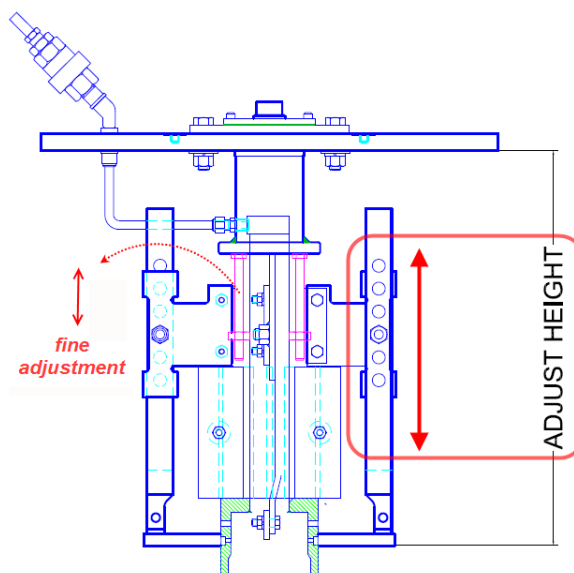
The flange at the bottom of the steel body assembly is the nozzle plug plate, which needs to be re-adjusted according to the height of the NOZZLE STAND HEIGHT ON THE COVER.

Measure the cover and adjust the plug plate 1 mm greater to assure that gasket will be compressed properly and steel body will be securely supported from the bottom end and will not vibrate.

Adjust the plug plate by means of switching to lower or upper holes on the links on the sides. Use the HEX HD CAP SCREWS for fine adjustment to accomplish desired height.

Lock the nuts to secure the setting after adjustment is finished.

Note that this adjustment also can be done after nozzle is installed on top of the cover.



G. Assembled Nozzle Inspection

The assembled nozzle should be inspected prior to installation. The important items to check for are:

1. Ease of rotation - Turn the nozzle FROM THE COUPLING (do not turn the nozzle by turning the graphite rotor, this will cause the graphite to unscrew)

The proper rotation direction is described as CCW (Counterclockwise as viewed from the top) or CW (Clockwise as viewed from the top) in the SNIF nozzle drawings. Turn the nozzle in this direction only.

2. On new units and new motors only, the shaft coupling should remain disconnected until the rotation direction of the motor has been verified.

Operation in the incorrect direction will result in unthreading of the drive shaft from the graphite shaft and rotor and possible loss of the nozzle graphite parts. To keep the coupling open with the parts assembled, slide the drive coupling (upper coupling) up the shaft until the coupling is separated



3. Gap between graphite rotor and graphite stator – The plastic spacer shipped with the nozzle should be used to properly gap the graphite.

No additional space should be between the plastic and graphite.

If a piece of paper can fit between the top of the plastic spacer and the graphite stator, the gap may be too large.

The gap of 1/16" (1.6mm) should only be followed when the spacer is not available.

The plastic spacer should be left on the nozzle and will burn up once immersed in aluminum.

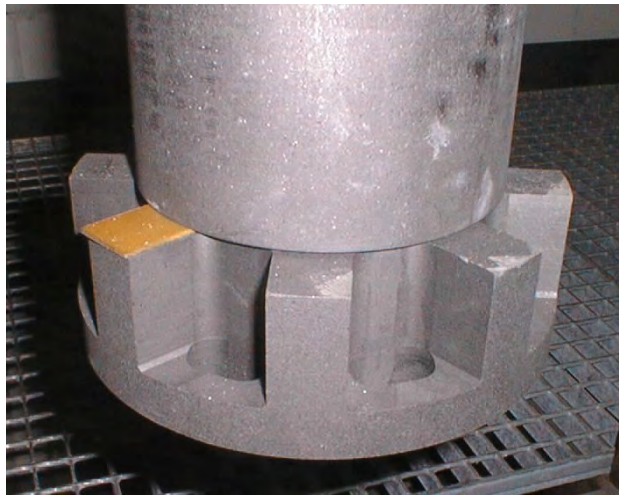


Photo of Plastic Spacer on Properly Assembled Nozzle

7.4 INSTALLING A SPINNING NOZZLE IN THE FURNACE

Note: For DC motor drive units, make sure the panel circuit breaker is shut off before disconnecting and connecting the motor plug. There is active voltage from the field and thermostat circuits even though the unit or motor drive breaker is off. This could cause arcing and electric shock and damage the motor drive unit if not done.

- A. Suspend the assembled nozzle above the furnace and align it with the hole in the furnace roof.
- B. Remove the blank plug plate from the hole in the furnace roof.
- C. Connect the process gas (and cooling air if equipped) to the new nozzle.
 - 1) Confirm the idle flowmeter(s) are reading: (.2 scfm, 10 psig),
(.32 Nm³/hr., .7 kg/cm²).
 - 2) Confirm the cooling air is discharging from the steel body assembly (units without cooling fins).
- D. Slowly lower the nozzle into the furnace until the bottom of the rotor is 2-3 inches (50-75 mm) above the melt surface.
- E. Preheat in this position for approximately 5 minutes to eliminate any moisture.
- F. Slowly lower the nozzle into the bath. Idle bubbles should be evident. If there are, no idle bubbles remove the nozzle immediately and check for leaks.
- G. The nozzle support plate should sit flat on the furnace nozzle stand. If necessary, loosen the plug plate clamp and adjust the plug plate position on the nozzle steel body assembly.
- H. Bolt the nozzle support plate to the furnace nozzle stand.
- I. Check that the plug plate has a gasket under it and is sitting tight against the furnace roof. Adjust the plug plate position if necessary. (Tighten down on the plug plate by using the jack down bolts on the plug plate clamp.)
- J. Connect the motor cable and restore power if disconnected.



7.5 REMOVING THE NOZZLE ASSEMBLY FROM THE FURNACE

USE CARE WHEN REMOVING THE NOZZLES FROM THE SNIF UNIT. If there is metal buildup under the cover of the SNIF around the nozzles, it will tend to hold the nozzle in place. Refer to SNIF OMP-6139, SNIF cleaning and dedrossing procedure, for instructions on the safe completion of this task.

- A. Stop the motor from turning.
 - For DC motors, turn off main power circuit breaker on the Electrical Control Panel.
 - For AC motors, isolate the motors, as plant policy requires.
- B. Disconnect the motor cable.
- C. Disconnect the nozzle assembly from the furnace cover by removing the four (4) half inch (1/2") bolts, which attach the mounting plate to the cover nozzle stand.
- D. Center the overhead crane hook above the nozzle assembly. Hook the cable to the motor lifting bail. Note: If the nozzle is tightly held in place by metal buildup on the underside of the cover, it may be necessary to use the nozzle stand lifting eyebolts.
- E. Free the plug plate from any cover deposit by gently rocking the nozzle assembly while inching up with the crane.
- F. Slowly lift the nozzle out of the furnace and STOP when the rotor has cleared the bath.
- G. Disconnect the air (non-cooling fin designs) and inert gas hoses from the steel body.
- H. Continue slowly lifting the nozzle assembly from the furnace.
- I. Immediately place the blank plug plate into the cover opening.

Place the nozzle assembly on the spare nozzle stand, and bolt down the nozzle stand with at least two bolts. Install safety screen around the HOT graphite.

7.6 NOZZLE DISASSEMBLY

To disassemble the nozzle, the assembly instructions can generally be followed in reverse order. The motor coupling and shaft hardware should be disconnected and then the graphite rotor and Inconel steel shaft should be removed. Removing the graphite rotor can often prove difficult and require special attention.

- A. Support the rotor by hand or place a stand below it. First, loosen the setscrews in the motor coupling and then the setscrews in the drive clamp. Pull out the graphite rotor / shaft assembly and the Inconel shaft, from the graphite stator.
- B. Check the condition of the "Bearing Assembly" by rotating the drive sleeve by hand and inspecting the "O"-ring located in the machined groove in the inside of the drive sleeve. Replace these parts if necessary. See the following sections for inspection and replacement instructions.
- C. **Graphite Stator Removal & Installation**
 - 1) Remove the shaft and rotor assembly and Inconel shaft.
 - 2) Loosen the stator setscrews. Unlock the graphite stator from the steel body using the strap wrench; Part Number 2110725 (RIGHT HAND LOCK). If the stator is broken at the lock, DO NOT USE AN EASY OUT! Instead, cut a groove across the broken face of the stator, insert a metal plate into the groove, and force the graphite out by turning the plate. (It may be necessary to remove the plug plate assembly by removing the four link bolts.)
 - 3) Remove the plug plate assembly from the used stator. Replace the refractory insulation if necessary.



7.7 BEARING ASSEMBLY REPLACEMENT: Part number 2110593

The bearing package and lower shaft gas seal should be replaced every three (3) months if using chlorine and every six (6) months if not. The bearing should also be replaced if the drive sleeve does not turn freely or if it turns too freely. There should be some drag on the bearings when turning the drive sleeve.

- A. The bearing package should be inspected on all nozzle assemblies during graphite replacement. This must be done prior to installation of the Inconel shaft.**

The gas seal "O"-rings (Part Number 691118) should also be replaced in the bearing package if either:

- 1) Chlorine gas was used in the SNIF® unit
- 2) The spinning nozzle was in operation for a period longer than one (1) month.
- 3) The "O" ring is damaged and no longer protrudes from the drive sleeve inner surface to provide a gas tight seal on the drive shaft.

- B. Remove the six cap screws (1) from the top flange.**

- C. Insert two cap screws in adjacent threaded holes (jackscrew holes) in the top flange and tighten down evenly. The bearing package assembly (2) will lift from the steel body.**



Bearing Package and typical "O"-Ring



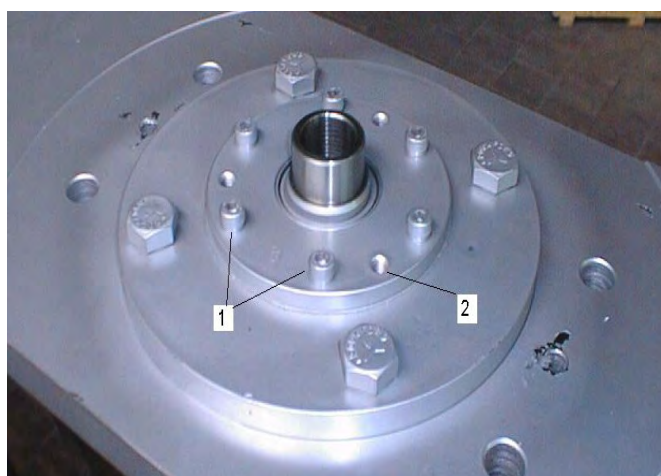
Rotary Seal Installed

For the SNIF® systems operating with Chlorine, it is recommended to install additional protection on lower end of Bearing Package, to minimize the risk of gas leak from the top of the bearing package, which may result in nozzle failure in the "idle" mode. An increase in motor load or vibration might indicate a need for replacement or maintenance of the bearing package.

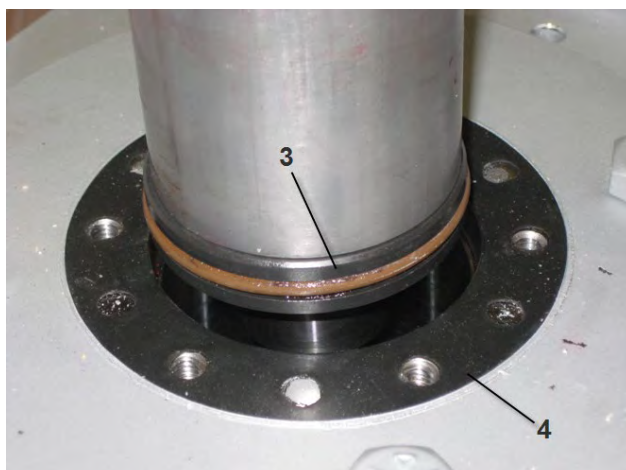
- D. The bearing package should rotate smoothly by hand. It is normal for drag to prevent the bearing from turning after turning pressure is no longer applied.
- E. Check that the "O"-rings are in place in the machined groove of the drive sleeve.

Note: When installing the new "O"-rings it is recommended to lubricate each "O" ring with a non-reactive high temperature Silicon or Krytox Grease to avoid damaging it when installing the Inconel shaft.

- F. Replace the gasket and install the replacement-bearing package into the steel body. Use the six cap screws to tighten the package into position.



View of Top of Steel Body Assembly
With Bearing Package Installed



Installation of Bearing Package
On Steel Body

- 1 = Cap Screw
- 2 = Jacking screw threaded hole
- 3 = Rotary Seal
- 4 = Gasket

7.8 NOZZLE OPERATION

A nozzle break alarm is designed to alert operators of a broken nozzle rotor condition through a low percent load or torque reading on AC motor systems or low amperes on DC motor units. A turbulent bath during processing caused by large bubbles of process gas also is an indication of a broken nozzle. Nozzle break alarms are also designed to reduce process gas flows to idle levels. If this alarm is not functioning correctly, it can lead to improper processing of metal and severe splashing of metal around the refining chamber.

Bearing Package Assembly should be checked for possible leaks before every nozzle change and on regular basis by means of using leak spray or soapy water.



8.1 PREPARING FOR A CAST:

- A.** Confirm that the nozzle is installed correctly and that all gas hoses are properly attached.
 - B.** Turn the system on a few minutes before beginning the cast and confirm the nozzle failure alarm circuit is not activated. This might cause metal come out from SNIF[®] outlet and inlet and make the troughs dirty, if Nozzles were stopped too early on previous cast. Nozzle should be stopped after it is confirmed that there is no metal in the launders.
- Note:** If the nozzle failure circuit is activated, observe the recommended procedures described in Section 10.
- C.** Confirm the bath thermocouple is operable and installed properly. Refer to OMP-6119 Replacing the Bath Immersion Thermocouple w/ Graphite Protection Tube.
 - D.** Install a filter sock in the inlet trough.
 - E.** Confirm that the cover vent is not blocked.
 - F.** If the unit must be drained and refilled to change alloy, refer to OMP-6009, Procedure for Draining, Cooling, and Removing a Heated SNIF[®] Furnace from the Casting Pit for details.

8.2 THE CASTING PROCESS:

The following is a brief description of the operations of a non-PLC controlled SNIF[®] Furnace, which employs chlorine as part of the process gas. Please refer to supplied documentation for operational variations. PLC Control Logic will parallel these operations but may result in different control functions and alarm indications. Refer to Manual Sections 4, 5 and 6 for the descriptions and operating procedures for the controls supplied with this unit.

- A.** Activate the "Process Start" control. The main inert flows came on at a reduced rate over 15 to 20 seconds to the predetermined set point. If the gas flow comes on too rapidly before the motor reaches, full speed it could cause excessive aluminum splash and buildup in the furnace interior. The opening rate of the valves is adjusted with the metering needle valve(s) located in the rear section of the control panel. Refer to the piping schematic in Section 4 of this manual.
- B.** Confirm the flows are set properly. A typical flow will be (2-4.5 scfm), (3.2- 7.1 Nm³/hr.) which is determined by the inlet hydrogen levels and casting rates. The model SNIF[®] Unit will also influence the setting of this parameter. This is a site-specific value determined by operating results.
- C.** Confirm the main inert pressure for each process line is at the required pressure. If not, turn the main inert regulator until the pressure gauge is reading the required pressure.

Required pressure is the pressure that the flow meter scale is calibrated at. It is written on the side of the glass tube, or the auxiliary conversion plate, unless it is mentioned on a tag plate next to pressure gauge.



- D.** If chlorine is to be used;
- Position the "Chlorine On/off" selector switch to the "On" position.
 - For the units controlled by the PLC, enable the chlorine from the HMI screen.
- The chlorine circuit will activate once the main inert reaches one scfm (1.6 Nm³/hr.). This is controlled using a preset flow switch located in each main inert flow line ahead of the flowmeter.
- E.** Adjust the chlorine pressure regulator until there is the required pressure on the chlorine flowmeter pressure gauge. Adjust the flows on the flowmeters using the flow regulating valves to the desired setting. Once set, the flows may only need slight adjustments on future casts.
- F.** A typical chlorine flow will be (.005-.01 scfm), (.008 Nm³/hr. - .015 Nm³/hr.) for remelt and higher for primary operations or customers that do not flux or pretreat the metal before entering the SNIF[®] Furnace. This will be a metallurgical decision with advice from SNIF[®] Field Engineering. (Refer to Section 8.8 for chlorine usage guidelines.)
- G.** Check that the nozzles have accelerated to the preset operating speed. The acceleration (and deceleration) should take approximately 60 seconds. If the acceleration rate is inappropriate, it can be adjusted using the programming section of the motor drive unit. Refer to the vendor literature contained in this manual. The speed range will be from 400-650 RPM depending on process gas flow rate. See the graphs at the end of this section, which correspond to your system.
- H.** Check that the nozzle motor load is correct on the "Motor Load" meter. The typical percentage load for a good nozzle is 30-50 % of load.
- Note:** A low reading below 10-15% load usually indicates a broken nozzle and will activate the alarm circuit and shut down the process. (Refer to the alarm information in Sections 5 and 10 for details.)

8.3 FURNACE HEATING CONTROLS:

- A.** Confirm the bath temperature is correct on the bath controller.

Note: During the cast, the bath controller will be displaying the temperature of the metal, which is flowing through the unit. This temperature is controlled by the holding or holder/melter furnace not by the SNIF[®] heating system. The SNIF[®] Furnace is not designed to heat the metal while casting. It is advisable not to have the SNIF[®] heating system on during a cast to prolong heating element and protection tube life.

- B.** The heating element controllers;

FOR HEATER BLOCK UNITS, "HB";

Confirm the element controller is set for (1470°F), (800°C) and reading correctly. Typically, during the cast if the elements are off the element controller or block temperature will read close to the SNIF[®] bath temperature.

If the elements are on, the block temperature will continue to heat up until it cycles at the set point. Again, this is typical while casting since the SNIF[®] will not heat the metal and the Bath Controller will never be satisfied or reach set point.

FOR IMMERSION SYSTEMS, "I";

Each of the immersion heaters utilizes a separate element controller. When properly configured, the element controller set points will be automatically controlled by the bath controller output. Typically, during the cast if the elements are off for an extended period of time, the element controller will read close to the SNIF[®] bath temperature.

Note: During a cast, if the metal temperature is below the bath temperature set point, the heater elements will generally be operating at 100%, and the bath temperature will not change. This is because the SNIF[®] heating system is not designed to heat metal during a cast.

8.4 FURNACE

- A.** Confirm there is no fuming coming out of the SNIF[®] during processing. In most cases, fuming is an indication that there is too much chlorine being used. In case of fuming turn down the chlorine flow or limit the chlorine usage to one nozzle. This should be done only after determining that this will have no effect on the metal quality.
- B.** Confirm the furnace is sealed properly with airlocks intact. During processing and idle, the furnace should be sealed to limit air getting into the furnace.

Note: There is a vent located on the furnace cover, which is used for the process gases to exit the furnace. This vent must be checked periodically and be kept open on daily basis.



8.5 AFTER A CAST:

- A.** Once casting is completed and the casting table broke away from the launders, drain the metal in the inlet and outlet troughs away from the SNIF® Furnace.
- B.** When there is no more metal left in the SNIF® troughs, press the "IDLE" or "STOP" pushbuttons. If process is stopped too early, metal will come out from SNIF® ports at the beginning of the next cast.
- C.** When necessary, clean the unit by following the recommended cleaning procedure later in this section (or OMP-6139, Cleaning and Dedrossing Procedure for 1-piece cover lifts). Cleaning is generally not necessary after every cast.
- D.** Observe OMP-6096 Dross Reduction Procedure with a 1 Piece Cover Lifter / Airlock Units, for sealing the SNIF® after a cast.
- E.** Review the status of the Inert, Chlorine and Electric Control Panels and confirm all parameters are normal:
 - 1. Ensure unit has been removed from process mode and placed into either idle or stop mode.
 - 2. Idle flow(s) are at 0.2 scfm, 10 psig, (.32 Nm³/hr., .7 kg/cm²)
 - 3. Cover gas can be eliminated (if present) when Furnace is filled with aluminum. Cover gas is only required right after the furnace is drained or tilted, or in case the cover seal /or airlocks are in bad condition. In this case, the cover gas can be adjusted to 60 scfh, 30 psig, (1.5 Nm³/hr., 2.1 kg/cm²).
 - 4. Chlorine flow is zero. Confirmed by visual inspection of the flowmeters.

8.6 OPERATING PROCEDURE FOR THE COVER LIFTING MECHANISM:

- A.** Be sure to wear the proper safety attire before operating this mechanism.
- B.** Make sure the nozzles are not spinning before raising the cover.
- C.** Confirm the safety latch cable is released to activate the safety bracket.
- D.** After checking for personnel clearances and for tools on or near the cover proceed to raise the cover by activating the COVER RAISE / COVER UP pushbutton.

FOR TILTING UNITS, "TD";

- A.** To tilt the unit, the FURNACE TILT pushbutton must be activated from any cover position. (The cover will raise until the carriage contacts the top limit switch)
- B.** To return a tilted unit to the ground and/or to lower the cover, press the COVER LOWER / FURNACE RETURN button until the system is in the desired position.

Note: Refer to OMP-6162, Tall Lift-Mast Operating Procedure for Tilting Units, in Section 10 of this Manual for additional details.

8.7 CLEANING AND DEDROSSING PROCEDURE:

- A.** Preheat the dedrossing and cleaning tools.
- B.** Press the up button until the cover is about 1 foot (~ 300 mm) off the sill. Use the scraper tool to remove metal splash build up from the cover. Excessive cover buildup can be due to metal freezing to the cover. This usually occurs from operating at low temperatures and a large distance from the metal operating level to the cover interface. Micro-spray from the argon bubble freezes to the cover. The most appropriate time to remove this build up is right after a cast has finished when it is the hottest
- C.** Raise the cover to its full height. For rotating covers, rotate the cover as desired.
Note: The bath low temperature alarm will sound because the bath thermocouple is out of the metal. Press the alarm silence button on the furnace control panel and continue with this operation.
- D.** Proceed to dedross and clean the unit per normal plant procedures.
Note: The cleaning frequency and amount of dross depends on how well the unit was sealed. Excessive dross buildup is an indication there is too much oxygen infiltration into the furnace headspace. In this case, confirm the unit is properly sealed especially during the idle times. Refer to 6096 for the recommended procedure.
- E.** For IMMERSION systems, periodic cleaning of the Sialon protection tubes will be necessary to maintain heating efficiency. Build up on the outside of the tube especially at the metal level will retard heat transfer to the bath. The supplied "V-curved" shaped cleaning tool (part #2200565) can be effective if used weekly. Care must be taken to avoid striking the tube during the cleaning operation.
- F.** Make sure your hands are clear and there are no obstacles on the furnace. For rotating units, return the cover to proper rotation position, and press the down button to lower the cover.
Note: Once the cover is lowered give some time for the bath thermocouple and metal temperature to equilibrate.

WARNING! Do not run the nozzles at Idle or Process Speed until they have been setting in the metal for approximately 5 minutes. You will risk snapping the shaft and rotor due to the metal being solidified between the shaft and rotor and the shaft.

Note: If dross accumulations require frequent cleaning, follow the dross reduction recommendations in OMP-6096, Dross Reduction Procedure with a 1 Piece Cover Lifter / Airlock Units to reduce the dross accumulation. Excessive dross buildup is an indication there is too much oxygen infiltration into the furnace headspace.



FOR TILTING UNITS, "TD";

Refer to OMP-6162, Tall Lift-Mast Operating Procedure for Tilting Units, in Section.10 of the SNIF® operating manual for additional details.

FOR UNITS WITH ROTATING COVERS, "RAC" or "RC";

Refer OMP-6150 Operating Procedure for SNIF® Rotating Lift Cover Assembly, in Section.10 of the SNIF® operating manual for additional details.

8.8 CHLORINE USAGE CALCULATIONS:

ALKALI METAL REMOVAL:

Chlorine flow is set based on dross, inclusion, and alkali metal levels. Nominally, the chlorine flow is set to 0.5-1% of the process gas flow (per nozzle) to dry the dross within the SNIF® System and to remove inclusions. Additional chlorine is used based on the required amount of alkali metal removal. The removal requirements should be determined from the final levels in the holder (prior to SNIF® treatment) and the required levels at the caster. The stoichiometric requirement can be calculated based on the incoming levels of alkali metals and the amount of removal required. In general, use a safety factor of 10 to 50% to determine the actual flow. Chlorine should not exceed 5% of the gas flow per nozzle. When chlorine fluxing occurs in the holder, the amount of chlorine used in the SNIF® may be reduced if there is chlorine carryover from the holder. In a multiple nozzle systems, splitting the chlorine evenly between the nozzles promotes more reactions that are effective. However, introducing the total chlorine flow through the first nozzle allows the final chambers to remove any excess chlorine and prevent chloride carryover. The general rules of thumb are;

- a) use as little chlorine as possible and
- b) If there is smoking from the openings on the SNIF®, too much chlorine is being used.

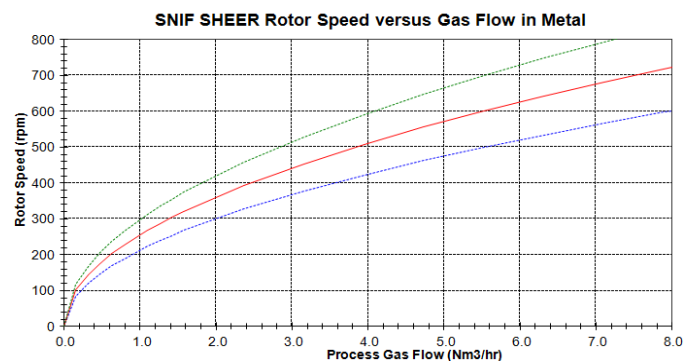
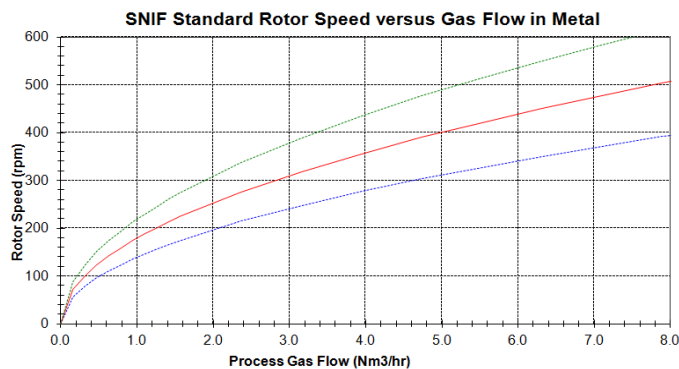
Note: Care should be taken in using chlorine in alloys, which contain high levels of magnesium (Mg) as the chlorine will react with the Mg.

INCLUSION REMOVAL:

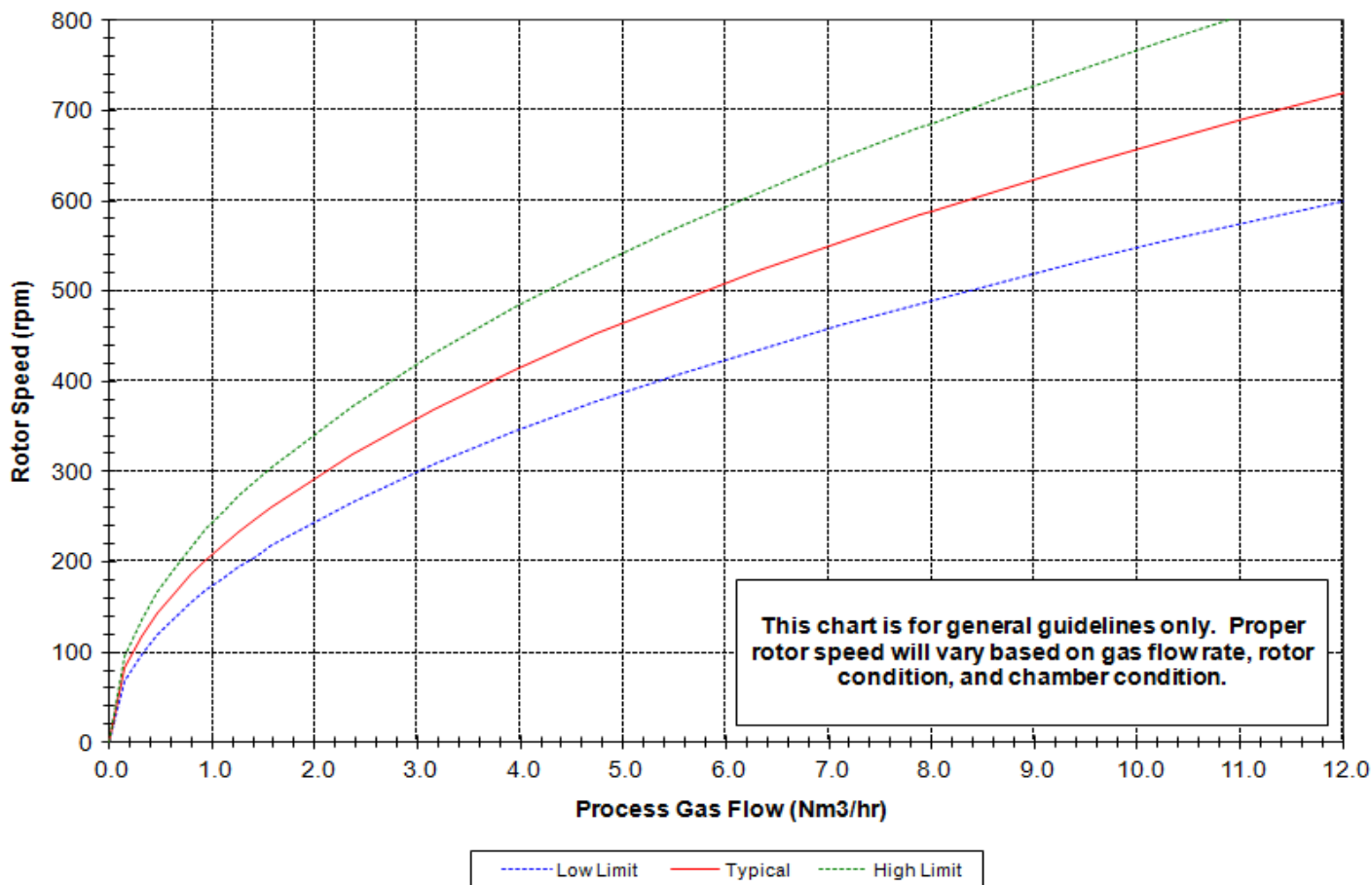
Generally, inclusion removal varies between 50 to 90% of all non-wetted inclusions >15µm when chlorine is used. 50-60% removal is nominal. Without chlorine, there is minimal inclusion removal (<10%). Wetted inclusions cannot be removed.

8.9 ARGON FLOW VS NOZZLE RPM:

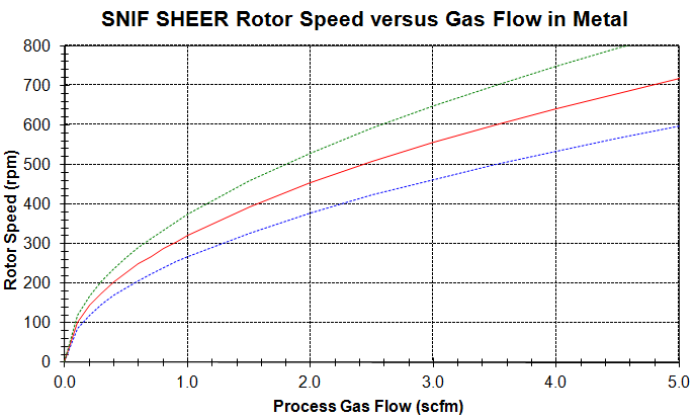
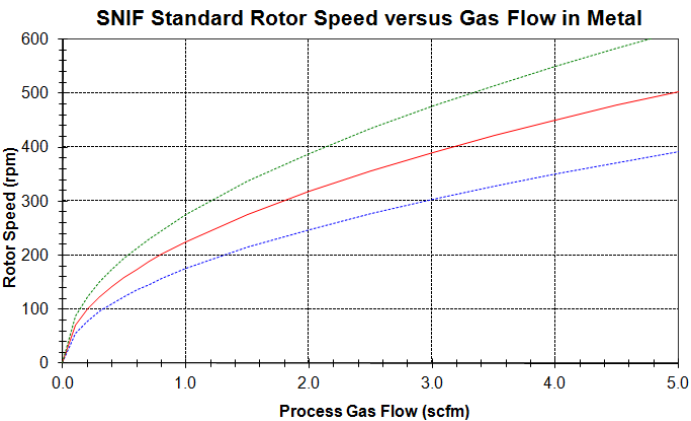
FOR METRIC SYSTEMS (Nm³/hr)



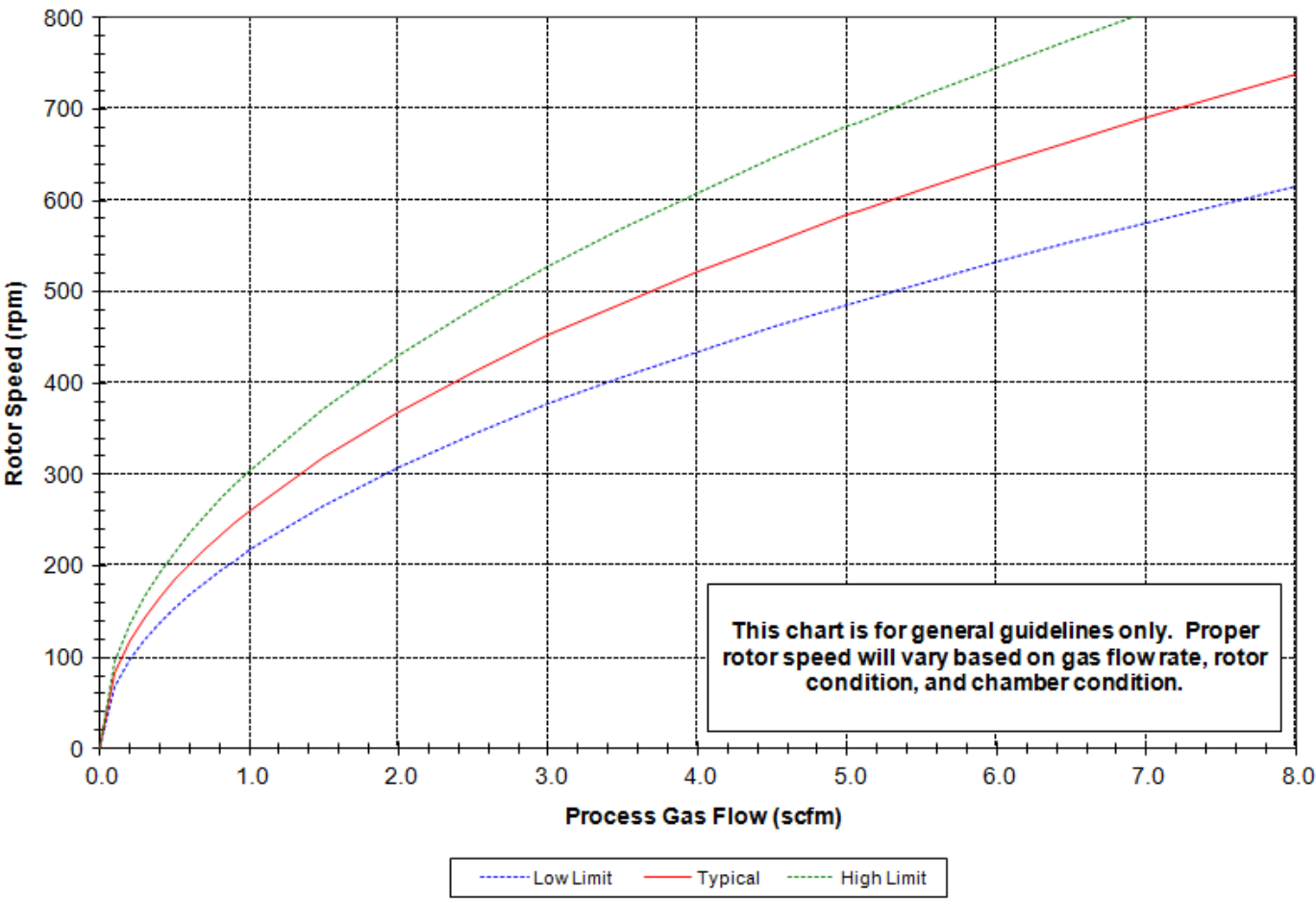
SNIF NEO Rotor Speed versus Gas Flow in Metal



FOR STANDARD SYSTEMS (scfm)



SNIF NEO Rotor Speed versus Gas Flow in Metal



9.1 PROCESS DESCRIPTION:

The SNIF[®] Furnace is a refining unit designed to handle a dynamic flow of aluminum. The unique nozzle design enables maximum refining capabilities with a minimum amount of argon and chlorine gas. The chamber is saturated with small bubbles from the sheering action of the spinning nozzle to enhance the surface area of each bubble. Each argon bubble may contains a small percentage of chlorine (depending on system design and settings). The argon will remove the hydrogen through adsorption and partial pressures, to the metal surface where it burns off after venting to the atmosphere. The chlorine will remove the alkali and alkaline metals in the form of salts where it will form as a dross layer on the metal surface. It will also remove nonmetallics such as oxide inclusions by the floatation process. Note that the amount of dross created from inclusions alone should be very small and that a majority of internal dross generation is the result of undesired oxygen penetration into the headspace of the unit.

9.2 FURNACE LIFE:

The life of the furnace depends on some basic functional practices such as dedrossing and cleaning the unit and maintaining a positive inert atmosphere by using airlocks and maintaining a cover seal. Replace damaged seals and airlocks in a timely fashion, and the cover vent port(s) must be kept clean on a regular basis. If air enters the furnace, it will form excessive aluminum oxide (dross) on the metal surface. It will also accumulate on the cover and sidewalls. This will reduce the refining capabilities of the furnace and shorten the life. The graphite components such as the spinning nozzles (stator and shaft/rotor) also have an affinity for oxygen and will oxidize if exposed at elevated temperatures. Excessive exposure of hot graphite (over 400°C) will result in a significantly shorter graphite component life span. Regular scheduled maintenance is also very important; refer to SNIF OMP-6138, Maintenance Schedule for SNIF Units, for details.

9.3 SNIF[®] FURNACE NOZZLES:

The life of the nozzle is dependent on the above factors, and keeping foreign material denser than aluminum from entering the furnace. If this occurs, a high failure rate of nozzles will be evident, possibly with damage on the leading edges of the rotors. To prevent this from occurring a sock and a drain plug is recommended in the inlet trough to the SNIF[®] Furnace.

Refer to Section 10 for Troubleshooting suggestions.



9.4 SNIF[®] FURNACE HEATING SYSTEM:

FOR THE HEATER BLOCK UNITS, "HB";

The heating system is designed to provide enough power to maintain and recover temperature during the idle periods not to heat the metal during a cast. The system contains electric bayonet style radiant heating elements that are installed in *stainless steel* protection tubes that are inserted into the graphite heater block.

The heat transfer to the metal occurs as the heat conducts through the graphite heater block below the idle level into the aluminum bath.

Therefore, there is no need to scrape the protective heater plate or area above the idle level if heat transfer becomes a problem. Periodic scraping of the block below the idle level may be necessary to restore the heating efficiency. Refer to OMP-6131 for heater block cleaning instructions.

Note: To maximize heating system life of heater block units it is recommended that at least the outside heating element protection tubes be removed for inspection annually. If there is evidence, of deformation or corrosion replace the defective tubes and inspect adjoining tubes.

While the tubes are removed, it is vital to protect the interior of the hot graphite block from oxidation. This can be accomplished temporarily by stuffing insulating blanket in the heater block hole. If the tube is to be removed permanently, the opening must be sealed by a non-porous heat resistant material. When replacing protection tubes the flange area of the tube must be tightly sealed to the mounting plate with gasket material or high temperature sealing compound.

FOR THE IMMERSION SYSTEMS, "i" ;

The heating system is designed to provide enough power to maintain and recover temperature during the idle periods, but not to heat the metal during a cast. The system contains electric bayonet style radiant heating elements, which are installed in *Sialon* protection sheaths. If possible, the bath temperature set point can be lowered to below the metal temperature once a cast has begun to reduce the duty cycle of the heating system. For ingot and billet casting operations, due to the short duration of the casts, this is less important than in continuous casting operations, which may cast for 24 hours or more at a time.

The heat transfer to the metal occurs as the heat radiates from the heating elements to the Sialon protection sheaths, which conduct heat into the aluminum bath below the idle level of aluminum. Refer to SNIF OMP-6110, Sialon Immersion Heater Assembly (SiC Models) for heater assembly instructions.

Periodic cleaning of the entire Sialon protection sheaths (e.g. wipe off with insulation blanket) may be necessary to restore the heating efficiency.

Note: *To maximize Sialon protection sheath life it is recommended to remove the heating elements for inspection annually. If there is evidence of deformation, oxidation, flaking or corrosion replaces the defective elements.*

It is NOT recommended to remove the Sialon Protection tubes from the cover unless broken or the cover is being taken out of service for a reline. If this is the case, refer to SNIF OMP-6149, Recovering and Cleaning Sialon Immersion Heater Tube for instructions.

Note: *Over extended periods of time (months or years), the heating elements on immersion systems will lose ability to generate heat as the chemical structure of the Silicon Carbide (SiC) heating elements break down. If an individual element is unable to achieve full power (20 kW on most systems) or the system is unable to maintain metal temperature while sending a 100% signal to the SCR, where it was previously capable, the elements probably require replacing. Refer to SNIF OMP-6110, Sialon Immersion Heater Assembly (SiC Models), for details on the assembly of the heating element apparatus.*

9.5 ELEMENT THERMOCOUPLE:

FOR THE HEATER BLOCK UNITS, "HB" ;

One type K thermocouple has been factory installed in the heater block. The controller uses this thermocouple to monitor the heater block (element) temperature. Depending on the size of the SNIF®, there are one or two spare holes to install the thermocouple.

Refer to the General Assembly drawing and Bill of Materials in Section 3 for the part number of your furnace.

FOR THE IMMERSION SYSTEMS, "i" ;

One (1) type K thermocouple is installed (by the customer) in each of the heating elements (one per ceramic tube). The elements control the high temperature set point for the elements. If any element reaches the high temperature set point, the power output from the SCR is disabled.

When cover is lifted for maintenance, all element temperature controllers switch to a secondary lower set point. If the temperature reaches an alarm value, the power to the element should shut off. If a thermocouple fails, the SCR will adjust to a pre-set power set point of 0-75%, depending on the installation, controller configuration, and element power ratings.



Refer to the General Assembly drawings and Bill of Materials in Section 3 for the part number of your model furnace.

9.6 BATH THERMOCOUPLE:

FOR THE HEATER BLOCK UNITS, "HB" ;

The K type bath thermocouple is installed through the cover into the molten metal.

The thermocouple is either a ceramic one-piece type K thermocouple or a sheathed type K thermocouple housed in a protection tube made of graphite or sialon. The SNIF® furnace is capable of using any of the three options (mounting hardware separate). Refer to the Bill of Materials for the style initially installed in your SNIF®.

FOR THE IMMERSION SYSTEMS, "I" ;

The K type bath thermocouple is installed through the cover into the molten metal. The thermocouple is protected by a graphite tube, which is also installed thru the cover.

This thermocouple provides a signal to the main bath temperature controller to match against the bath temperature set point. The bath controller provides power request signals to the element controller(s), which in-turn independently monitor and control each SCR located in the furnace panel. The SCR directly controls the percent power going to each heating element based on the request signal from the element controller.

The following general information describes the sequence of events and procedures to follow in an alarm condition. The SNIF® alarm circuits are designed to alert the operator of an alarm condition. Except for the main inert and nozzle break, alarms the alarm circuits will not shut down the SNIF® operation. If an alarm occurs it should not be ignored, but instead observe the recommended procedures described below. Alarm indications will vary with system options especially for PLC controlled units.

NOZZLE FAILURE ALARM AND NOZZLE BREAK TROUBLE SHOOTING		
PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
Nozzle Failure Alarm	The nozzle has broken which could be due to the possible causes mentioned below.	Confirm the % load, torque or amp reading is below the nozzle failure set point.
Oxidation of the graphite stator.	This is due to excessive oxygen levels beyond the tolerable limits of 0.5% in the furnace headspace during idle or process. (This also applies to oxidation of the graphite heater block.)	Confirm that the airlocks are installed properly and not damaged.
		Confirm that the inlet and outlet are closed (sealed properly with insulating blanket) when SNIF is empty.
		Confirm the hatch and/or cover are sealed properly.
		Confirm the cover gas ports are cleaned or rodded out. (if present)
		Confirm the nozzle plug plates are tightened down and compressed against a fiberfrax gasket. Use the adjusting bolts on each side of the split clamp on the steel body assembly.
		Monitor the level of oxygen during idle with an Oxygen Analyzer, which should be below 0.5 %.
Failures due to severed rotors or breaks at the threaded joint of the graphite shaft.	This can be due to material in the furnace, which is denser than aluminum and is indicated by chips out of the leading edge of the rotor vanes.	Observe the fishing procedure described in OMP-6012.
		Check acceleration and deceleration rate of nozzle motor.
Failures due to the nozzles seizing.	Metal filtration between the stator and shaft and rotor bearing surface: 1. Due to a leak in the process hose. 2. O-Ring damaged in the bearing package permitting the escape of idle gas.	Leak check the hose according to OMP-6028. Install new O-Ring, P/N 691118.
	Bearing seized in bearing package. Refer to Section 7, Bearing Package Replacement for the proper procedure.	Replace the Bearing Package, P/N 2110593.
	Gear Reducer seized.	Replace the Gear Reducer P/N 979989.



NOZZLE FAILURE ALARM AND NOZZLE BREAK TROUBLE SHOOTING continued		
PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
Stators Unscrewing.	Stator not torqued properly. Shur-LOK® connection is not locked properly	Observe the torquing procedure described in OMP-6022. Review Section-7
	Excessive nozzle vibration	Plug Plate not tightened down properly. Tighten down the plug plate onto a gasket with the torque down bolts located on the clamp for the plug plate assembly.
	Metal filtration in the nozzle graphite-bearing surface.	Observe the leak check procedure described in the OMP-6028.
Breaks at the stator threads, or Shur-LOK® connection	Operator banging the stator while cleaning the cover. Shur-LOK® pins are not lined up with entry grooves.	Use caution while cleaning the cover. Observe OMP-6096, for the cleaning procedure. Review Section-7
	Metal filtration into the nozzle-bearing surface, causing the shaft and rotor to seize to the stator creating stress and breakage of the stator threads.	Leak check the hose according to OMP-6028, or replace the O-Ring in the bearing package.
	Material in the furnace.	Refer to the fishing procedure described in OMP-6012.
Stripping at the threaded joint between the Inconel shaft and the graphite shaft and rotor.	Acceleration rate set to fast.	Set the acceleration rate for 60 seconds. Note: This adjustment is performed in the Motor Drive Unit.
	Material in the furnace.	Observe the fishing procedure described in OMP-6012.

GAS CONTROL PANEL ALARMS		
PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
Main Inert Failure is Indicated. Main Inert Pressure has dropped below 60 psig. (System will automatically revert to "Idle" mode and the auxiliary idle gas supply will be activated.)	Low pressure from supply	Record the supply pressure from the supply pressure gauge installed in the lower half of the control panel. Confirm the pressure is below 60 psig and it is not a false alarm or faulty pressure switch. Check for supply failure from cryogenic or manifold cylinder source
	Leak in the supply line.	Leak check the supply lines from the source to the inlet of the SNIF® Control Panel. A) Confirm there is an auxiliary source of argon installed into the auxiliary inert connection on top of the control panel or remove the nozzles from the metal. B) Turn off the supply valve at the source. C) Turn off the Main Inert and idle gas flow control valves at the Operators Process Control Panel or Inert Panel. D) Record the Main Inert Supply Pressure on the pressure gauge installed in the lower half of the SNIF® Control Panel. E) Let it set like this for at least 1 hour or whatever length of time possible. F) Leak check the lines with leak check solution. G) Record the pressure after the allotted time. H) If the pressure remained the same as before the valves were closed you can assume there is no leak. I) If the pressure dropped than you have a leak and must repair it.
	Faulty or regulator not set properly.	A) If the supply pressure is above 60 psig and still in an alarm condition, the alarm set point may be too high. Refer to OMP-6017. B) If the alarm set point cannot be lowered the Pressure Switch may be defective and it must be replaced.



GAS CONTROL PANEL ALARMS (continued)		
PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
¹ Cover Gas Failure is Indicated. Supply pressure has dropped below 60 psig, (4.2 kg/cm ²) DO NOT ABORT CAST.	1) Low pressure at outside Cryogenic Tank. 2) Faulty or improperly set regulator. 3) Leak in the supply line.	Same as above for the main inert failure, except an auxiliary bottle is not required during the leak check procedure.
² Cooling Air Supply Failure is indicated. Cooling Air regulated pressure has dropped below the differential setting 15 psig of the Differential Pressure Switch (DPS). DO NOT ABORT CAST.	The regulator could be bad or not set properly.	Turn the regulator clockwise until the regulated pressure is 60 psig on the Inert Panel Pressure Gauge.
	The supply cooling air pressure could be low.	Check the supply cooling air pressure using the supply pressure gauge installed in the lower half of the panel. If it is too low or below 80 psig, increase the pressure so there is at 80 psig registering on the supply pressure gauge.
		If you cannot increase the pressure, check the condition of the air compressor, or for a leak in the supply line.
Thermostat Light Indication. Motor has overheated. (DC Motors only.)	Motor windings or bearings.	Replace or repair motor.
	No cooling air.	Refer to above cooling air failure recommendations.
	Bearings in the bearing package are bad.	Replace Bearing Package, P/N 2110593.
Chlorine Leak is Indicated.	Loose connection causing corrosion of the tubing.	Tighten the loose connections.
		Leak check all the lines with ammonia after repairing leaks.
	Leak through the seals in the Chlorine 3-Way Ball Valve Pneumatic Actuators.	Replace the 3-Way Ball Valve or Pneumatic Actuator Assembly. Pneumatic Actuator, P/N 2116616 A) 3-Way Ball Valve, P/N 2107678 B) Limit Switch, P/N 2116629

¹ Only for covers with CoverGas protection available.

² The nozzles which have fin coolers instead of air supply will not have this alarm and the problem

FURNACE CONTROL PANEL ALARMS

PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
Open Element Failure is indicated.	Operating the element over its maximum rated temperature.	Check that heating element control temperature is set for; Max. 800°C for HB systems Max. 1075°C for Immersion systems Confirm the actual temperature display is not over the SP. If the set point is above the recommended limit set it to the required limit. If the actual temperature is above the set point, the controller will have to be calibrated or replaced. Refer to the OMP for your particular controller in Section 6 and/or the vendor literature located in the rear of the manual.
	Supply voltage is too high.	Confirm that the supply voltage (secondary side of the furnace transformer) meets the nominal heating element voltage.
	Element has grounded against the protection tube.	If the tube and/or heating element are damaged remove the tube and element from the furnace and replace with a new assembly. On HB units; if metal infiltrated into heater tube (through cracks in the graphite block) prepare for a Minor or Major Rebuild for R Furnace design and a Cartridge change for a P Furnace design. On Immersion units; if metal infiltrated into heater tube replace the heater tube and the heating elements. Investigate why tube got broken.
	Open fuse or wire.	Replace wire or fuse if open. If problems persists check all the above.

BATH TEMPERATURE HIGH OR LOW TEMPERATURE ALARM

PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
High/Low bath temperature is indicated.	Metal temperature during casting is above or below alarm set point.	Reset the alarm set point per your standard operating procedures.
	Open thermocouple triggering the high alarm (out of range reading).	Replace the thermocouple if it is open.
	Short in the thermocouple wire triggering the low alarm (low temperature reading).	Confirm a short by unplugging the thermocouple. If there is a temperature reading on the controller there is a short. Replace the thermocouple wire.
	Alarm set points are not within normal operating conditions causing nuisance alarms.	Confirm the alarm set points are set for appropriate alarm conditions.



FURNACE PROBLEMS		
PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
Poor temperature recovery.	Build up on the immersion heater tubes or graphite block, which is reducing the heat transfer capabilities.	Raise the cover and scrape the immersion heater tubes or scrape the contact surface of the graphite block. Avoid applying too much power while using metal tools to clean the immersion heater tubes. Strong and sharp impacts might break the Sialon tube. Refer to Section- 8.7.E
	Immersion heating elements are aging, Poor hot zone//cold zone segregation	Replace the Silicon carbide heating elements.
	Poor insulation on the furnace cover.	Insulate cover with layers of insulating blanket. The cover should be relined in the most convenient time.
	Hot spots on the furnace shell.	Typically, if there are hot spots on the furnace shell it is time for a cartridge change.
	Inlet and outlet are not closed (sealed properly with insulating blanket).	Confirm that the inlet and outlet are closed (sealed properly with insulating blanket) during idle periods or between casts.
Oxidation of the heater block. (On those furnaces, which have been equipped with a heater block).	Air filtration over the tolerable limits of 0.5% during the idle or operating mode. Due to the following: A) Inlet/Outlet left open during idle. B) Cover not sealed properly to the shell. C) Bath Thermocouple not sealed properly. D) Plug plated not sitting down tight on the cover. E) Frequent draining of the unit while not maintaining an inert atmosphere in the refining chamber(s).	Verify the airlocks (if equipped) are in good condition and not allowing air to enter the SNIF® between casts. Refer to OPM 6096 for additional information.
		Close the inlet/outlet with insulating blanket.
		Seal the heater compartment with high temperature caulking material.
		Confirm the plug plates are tightened down properly with a gasket installed under each.
		Prepare for a Minor or Major Rebuild for R Furnace design and a Cartridge change for a P Furnace design.

METALLURGICAL PROBLEMS

PROBLEM	POSSIBLE CAUSE	RECOMMENDATIONS
Not getting sufficient Alkali Metal removal: (Na, Li, Ca.).	Not using a sufficient amount of chlorine in the SNIF® Unit.	Calculate the required amount of chlorine to use in the SNIF® Unit based on the amount of impurities in the incoming metal to the SNIF® Furnace. This is typically performed using a stoichiometric calculation.
		Refer to Alkali Metal Removal in Section 8.10 for details.
Not getting sufficient Inclusion removal.	Excessive bath turbulence.	Check for proper process gas flow and nozzle rotation.
	Not enough Cl ₂ gas	A minimum 0.5% of Cl ₂ gas is needed to assure Inclusion Removal.
		Refer to Inclusion Removal in Section 8.10 for details.
Not removing sufficient hydrogen.	Not using a sufficient amount of main inert due to the following reasons: A) Instrumentation, to monitor the main inert, is not calibrated properly. B) Leak in the process hose. C) Humidity has increased in the atmosphere. D) Main Inert escaping from the nozzle-bearing package or between the stator and the steel body assembly. E) Insufficient furnace fluxing and instrumentation not calibrated properly. F) Nozzle not properly installed. G) Broken or worn nozzles.	Increase the main inert flows and nozzle speeds until you are at the required levels of hydrogen removal. Typically the limit which satisfies most cast houses is .1cc/100g/Al.
		Check the accuracy of the instrumentation, which is used to monitor the main inert gas. Refer to Section 4 for the type of monitoring equipment used for your unit and the calibration procedures specified in that section.
		If the humidity becomes a problem you can cover the troughs or inert them with argon. The other option is to increase the main inert flows as described in step 1.
		Confirm the nozzle is assembled correctly and there are no leaks from the bearing package. Refer to Electrical Control Panel Alarms and Section 7 for the nozzle assembly details.
		Confirm your furnace fluxing practice has not changed and the instrumentation, which monitors the fluxing gases, is calibrated properly.

OMP's referenced:

6012 Furnace Fishing Procedure

6028 Leak Check Main Inert Lines

6017 Calibrate the Pressure Switches

6096 Cleaning and De-drossing procedure with 1-piece cover

6022 Torqueing the Spinning Nozzle Stator



OMP #: 6001

Approved Date: 6/3/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Auxiliary Inert Installation

Purpose:

To provide a separate inert gas source as an auxiliary supply (for idle flow only) to the spinning nozzle(s) in the event of a loss of main inert supply pressure (usually <60-70psi or <4.0-4.5kg/cm²).

Scope:

This procedure applies to all SNIF[®] systems.

Definition:

This operation is performed to prevent damage to the spinning nozzle(s) by metal infiltration passing the “graphite bearing area” (refer to picture 1) in the event of a loss of main inert supply pressure.

Policies:

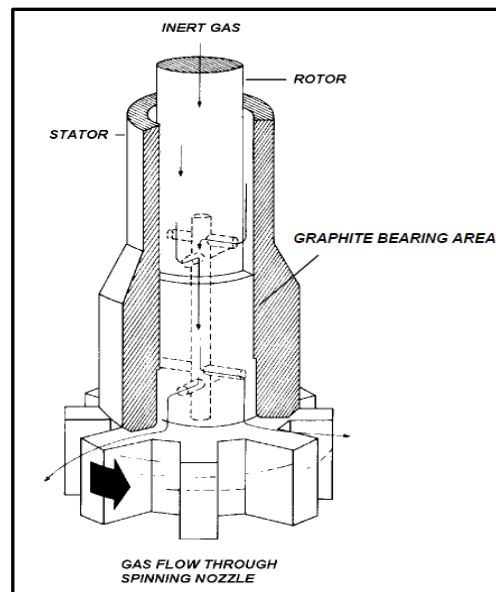
This document was developed based on a compilation of best available information, knowledge, field experience, and general industry practices to provide guidance to PYROTEK’s customers in performing the activities defined herein, in a consistent and standardized manner. This document does not contain regulatory or statutory requirements unless specified.

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Procedure:

- 1) Connect a separate inert gas source (other than the main inert supply) to the fitting on top of the Main Inert Control Panel Assembly marked “Auxiliary Inert”.

Note: This can be either a.) a dedicated argon cylinder(s) or b.) another inert gas supply (e.g. cryogenic nitrogen). If it’s not possible to connect a separate inert gas source, then the main inert supply



Pic.1 Cross section Spinning Nozzle

should be connected to it or the "Auxiliary Inert" connection should be plugged.

- 2) Set the separate inert gas source's regulator to a pressure of 30psi or 2.0kg/cm².
- 3) Ensure the spinning nozzle(s) are out of the molten aluminum before testing the auxiliary inert installation, as if this backup fails the spinning nozzle(s) could get damaged.
- 4) Check the auxiliary inert installation by closing the main inert supply valve:
 - a) Verify the alarm (i.e. "Main Inert Failure" alarm).
 - b) Verify the auxiliary solenoid valve in the Main Inert Control Panel will energize to activate the auxiliary inert gas supply from the separate inert gas source.
 - c) Verify the Idle flowmeter(s) in the Main Inert Control Panel Assembly indicate a flow between Apr. 0.2-0.5scfm or Apr. 0.3-0.5Nm³/h.
 - d) Verify (and adjust if necessary) that the separate inert gas source's pressure is 30 psi or 2.0kg/cm².
 - e) Re-open the main inert supply valve. The "Main Inert Failure" alarm should disappear when the main inert supply pressure is restored.
- 5) When the system is in Process-mode and the main inert pressure fails:
 - a) The alarm horn and "Main Inert Failure" alarm will activate.
 - b) The motor start circuit(s) will de-energize, and the system will switch from Process-mode to Stop-mode.
 - c) The auxiliary solenoid valve will energize (the auxiliary solenoid valve is a Normally Closed [NC] valve) to activate the auxiliary inert supply.
- 6) Once the main inert supply pressure has been restored, the auxiliary inert gas supply (i.e. from the separate source to the "Auxiliary Inert" connection on the Main Inert Control Panel Assembly) can be leak tested. Simply turn off the separate source's supply valve and observe the regulator's pressure gauge as it should remain unchanged. Any drop in pressure is an indication of a leak between the separate source's valve and the SNIF® Main Inert Control Panel Assembly, which needs to be fixed.
- 7) Once the leak testing of the auxiliary inert gas supply has been completed the separate inert gas source's valve should be opened again. Now the auxiliary inert gas supply is fully functional and on stand-by.

Accountability:

Customer Maintenance Personnel.
SNIF® Personnel.

References:

The piping schematic in the SNIF® Operating Manual Section 4
The nozzle description in the SNIF® Operating Manual Section 7

OMP #: 6012

Approved Date: 6/9/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Furnace Fishing Procedure

Purpose:

This procedure describes an efficient method of retrieving foreign material from the SNIF[®] furnace through the Nozzle porthole. If this method does not yield any results, See OMP-6139, SNIF Cleaning and Dross Removal Procedure - 1-Piece Cover Lift Units

Scope:

This procedure applies to all SNIF[®] furnaces.

Definition:

This procedure is required when a nonmetallic substance, which is denser than aluminum, enters the SNIF[®] furnace and causes repeated nozzle failures.

Policies:

This document was developed based on a compilation of best available information, knowledge, field experience, and general industry practices to provide guidance to PYROTEK's customers in performing the activities defined herein, in a consistent and standardized manner. This document does not contain regulatory or statutory requirements unless specified.

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Procedure:

- 1) Fabricate the required fishing tools required to perform this operation. Refer to Drawing #'s 2101858 and 2189315 in the Section-9 of the SNIF[®] operating manual for further details.
- 2) Precoat the tools with Boron Nitrite or equivalent.
- 3) With the Broken nozzle removed, carefully preheat the fishing tools through the hole in the cover. This can be performed by lowering them slowly just above the melt. Hold in this position for a couple of minutes and then submerge them slowly into the melt.
- 4) Clear dross from the melt surface. This will allow for a smooth surface to simplify the operation.

- 5) Insert the sweeper tool into the metal touching the floor. Gently sweep all material towards the middle of the furnace. For SHEER systems there is a rib extending across the refining chamber centered under the nozzle so the sweep must be done on either side of the rib. Take care not to damage the rib during this operation.

- 6) Insert the tongs and position them around the material. Close them and attempt to lift the material from the nozzle porthole. (This is a tedious operation, which may require multiple efforts.)

- 7) Repeat this procedure until you retrieve all the material.

See the pictures below of typical rotor damage and signs of debris in the bottom of the unit.



If after performing these steps you still are damaging or breaking nozzle graphite you may need to perform, these steps again or even empty the SNIF to visually locate then remove the debris causing the issue OR Raise the cover and repeat steps 4-7.

Accountability:

Maintenance and Operations Plant Personnel
SNIF® Field Engineering Personnel

References:

SNIF® Operating Manual. OMP-6139

OMP #: 6017

Approved Date: 7/17/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Calibrate the Pressure Switches

Purpose:

This procedure describes the most accurate way to calibrate the pressure switches for SNIF[®] operation.

Scope:

This procedure applies to all SNIF[®] units that utilize these switches.

Definition:

This procedure is required during the installation of a new or spare part.

Policies:

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Procedure:

Note: This part is identified under by P/N 2115277, which is available from SNIF customer service.

Typically, this procedure is performed by the instrument personnel at Panel Manufacturing and by the SNIF[®] Engineer. When checking the Main Inert Pressure switch be sure there is an auxiliary supply of argon connected or both nozzles must be fully removed from the melt. Otherwise, there is the risk of damage to the graphite.

- 1) Be sure you have an auxiliary supply of Argon gas connected before shutting the main inert gas off. Turn off the supply gas to the line you are installing the switch in. Install the pressure switch as described on the piping schematic in the SNIF[®] Operating manual.
- 2) Wire the switch for the normally closed or open contacts depending on your circuit design. (Refer to the electrical schematic in the SNIF[®] Operating Manual). The purple wire is common, and the blue wire is for normally closed operation.

- 3) Check the operation by turning off the supply gases for each of the pressure switches. The corresponding failure warning and alarm horn will energize when the pressure drops below:

60 PSIG (4.1 bar) for the SNIF inert panel (Main Inert Supply)

50 PSIG (3.4 bar) for the SNIF inert panel (Cover / Heater Block Gas Supply if present)

30 PSIG (2.1 bar) for the SNIF and HD-2000 chlorine panel (Chlorine Supply)

80 PSIG (5.5 bar) for the HD-2000 Inert Gas Supply / Supplies (Argon and/or Nitrogen Supply)

- 4) If the alarm does not sound the pressure switch setting must be calibrated (adjusted).

A) To raise the set point, turn the adjusting screw in the switch counter-clockwise (CCW).

B) To decrease the setting turn the adjusting screw clockwise (CW).

- 5) Once this operation has been performed check the operation by repeating step 3.

Accountabilities:

Customer maintenance and operations

SNIF® Engineer

References:

The SNIF® Operating Manual

The vendor literature for the pressure switch located in the SNIF® Operating Manual also with each new spare part.

OMP #: 6021

Approved Date: 6/3/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Restarting a Frozen SNIF[®] Furnace

Purpose:

This procedure describes the safest, most practical method of restarting a SNIF[®] system after it has been frozen with metal.

Scope:

This procedure applies to all SNIF[®] units.

Definition:

This procedure is performed to heat the metal back to a molten state.

Pyrotek cannot guarantee the metal will return to a molten state or that nozzle or refractory damage will not result.

Policies:

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Procedure:

- 1) Do not raise the cover under any circumstances. Switch OFF the breaker for Cover lift power pack.
 - a. for HB systems; nozzles and thermocouple protection tube are potentially at risk of damage
 - b. for Immersion systems; heater tubes, nozzles and thermocouple protection tube are might be at risk of damage.

- 2) Confirm that the metal in the unit is frozen, by checking the Bath temperature, and by visually checking at Airlock openings. HMI screen, (if available) should also list multiple Bath Temp alarms.

- 3) Check the condition of the heating elements and bath thermocouple. Verify the supply voltage and actual power parameters such as line voltage, current and power readings are within the specifications.
- 4) Check the cover sealing for integrity (visually, without lifting the cover!!!). If there are gaps, seal them with a ceramic blanket. Close the air locks with rolled-up ceramic blanket plugs. Close the cover exhaust vent with a ceramic blanket plug and check the side drain is sealed and tighten.
- 5) Check inert gas flow to the heater block (for HB systems) and cover gas (if present).
- 6) Start the heating system, and set the bath temperature at 720C (1328F) for HB systems set the element temperatures to 850C (1562F)
- 7) Total length of remelt duration depends on the starting temperature and the melting point of the alloy that is in the furnace. As an option ceramic blanket can be used to wrap the furnace and cover for minimizing the heat loss.

!!!WARNING!!! if solidified metal cooled down less than 500 C (993F), it is highly possible that solidification shrinkage and thermal contraction may have already caused physical damage on Sialon heater tubes, most probably in form of vertical cracks.

It is important to check the heaters when metal reaches around 660C, in case metal may start flowing inside the tubes and cause electrical short.

- 8) When metal reaches 720 C (1328F), reduce element setpoint to 800°C (1472 F) for HB systems. Wait for minimum 2 more hours to allow the SNIF® furnace refractory can be completely heat soaked.
- 9) After 2 hours of waiting, check the metal temperature through airlock openings with a hand-held device and verify that temperature is stable.
- 10) Prior to starting the nozzles in IDLE mode, turn the coupling by hand (CW or CCW depends on nozzle specification) to confirm the nozzles are free turning. If there is no rotation, there is a possibility that metal has penetrated the bearing surface, which means the nozzles must be replaced.
- 11) Confirm that all SNIF® operating parameters are back to steady state condition.

Note: Refer to your SNIF® operating manual for the proper set points.

Accountabilities:

Customer maintenance and operating personnel.

References:

The SNIF® Operating Manual.

OMP #: 6028

Approved Date: 7/17/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Leak Check Gas Supply Lines and Panels

Purpose:

The following procedure is designed to test for gas leaks in process gas lines and the Main Inert Control Panel Assembly.

Scope:

This procedure applies to all SNIF[®] systems.

Definition:

The procedure confirms that there are no inert gas leaks, which can damage the spinning nozzles. This procedure describes a.) the leak test during nozzle(s) replacement when the SNIF[®] system contains molten metal and b.) the leak test when the SNIF[®] system doesn't contain molten metal (i.e. the SNIF[®] system is drained). Please make sure to have the proper piping schematic on hand.

Policies:

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Procedure:

A. LEAK TEST WHILE REPLACING A FAILED NOZZLE

- 1) Identify which nozzle(s) potentially failed by monitoring bubbles existing the nozzle(s) when the cover is raised temporarily.
- 2) Disconnect the argon hose from the steel body assembly once the failed nozzle has been identified and lifted out of the molten aluminum (with the cover closed). This will help finding the mode of nozzle failure, because the idle gas will keep on running through the nozzle until removed from the molten metal. Inspect the idle gas flowmeter and pressure gauge, which should indicate zero flow and/or maintain line pressure.
- 3) If an idle flow is still present, then there must be a leak in either the process gas line and/or the Main Inert Control Panel Assembly. Maintenance staff should now be involved.
- 4) First check the quick-disconnect coupling and the connecting hose and fittings with a soapy water solution to identify the source of the leak. In many cases we have found the quick-disconnect coupling malfunctioning due to corrosion and the hose bridle due to heat exposure. Replace these parts if necessary and repeat the test.
- 5) If an idle flow is still present with the hose and/or fittings repaired, proceed to leak check your way back to the Main Inert Control Panel Assembly. First the hard piping and or piping connections towards the Main Inert Control Panel Assembly and finally the Main Inert Control Panel Assembly itself with a soapy water solution until the leak has been located.
- 6) As part of leak troubleshooting, it may be necessary to identify possible check valve bypass leaks. This bypass leak can improperly pressurize other parts of the Main Inert Control Panel Assembly. These possible check valve bypass leaks can only be checked when it's possible to close the main inert valve without damaging other nozzle(s) (e.g. when the system doesn't contain molten aluminum, or the nozzle(s) are out of the molten metal).

B. LEAK TEST WHILE THE SNIF® FURNACE IS EMPTY

- 1) Disconnect the argon hose from the nozzle(s) steel body assembly. Inspect the idle gas flowmeter(s) and pressure gauge(s), which should indicate zero flow. It's now also possible to close the main inert valve to check if the main inert supply pressure gauge is maintaining the line pressure. Depending on the length of the process gas line(s) it will take some time to reach equilibrium. Maintenance staff should now be involved.
- 2) If an idle flow is still present, then there must be a leak in either the process gas line and/or the Main Inert Control Panel Assembly.
- 3) First check the quick-disconnect coupling and the connecting hose and fittings with a soapy water solution to identify the source of the leak. In many cases we have found the quick-disconnect coupling malfunctioning due to corrosion and the hose bridle due to heat exposure. Replace these parts if necessary and repeat the test.
- 4) If an idle flow is still present with the hose and/or fittings repaired, proceed to leak check your way back to the Main Inert Control Panel Assembly. First the hard piping and or piping connections towards the Main Inert Control Panel Assembly and finally the Main Inert Control Panel Assembly itself with a soapy water solution until the leak has been located.

Note: As part of leak troubleshooting, it may be necessary to identify possible check valve bypass leaks. E.g. on multiple nozzle systems, closing the other Process Inert Flow Control Valve(s) of the one you are checking (if you are checking the #1 line for a leak, close the Main Inert Flow Control Valve on the other line(s)) may also be considered in locating the leak. Plugging off section(s) with a pipe plug may also be considered in locating the leak. If it's not possible to pinpoint the leak SNIF Field Engineering should be contacted.

Accountability:

Customer Maintenance Personnel

SNIF® Personnel

References:

The piping schematic in the SNIF® Operating Manual Section 4

The nozzle description in the SNIF® Operating Manual Section 7

OMP #: 6043

Approved Date: 8/18/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Maintain Molten Metal in the SNIF[®] Furnace During a Power Failure

Purpose:

To establish the most efficient way to keep the metal molten in the SNIF[®] furnace in case of a power failure.

Scope:

This procedure applies to all SNIF[®] systems.

Definition:

This procedure is designed to keep the metal in a SNIF[®] furnace in a molten state for as long as possible in case of a power failure.

Policies:

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Procedure:

In case of a power failure it's recommendable to prepare all the necessary for draining the SNIF[®] furnace.

- 1) Confirm that the inlet and outlet ports are sealed using multiple layers of ceramic blanket to prevent air penetration and any additional heat-loss.
- 2) Place a layer of ceramic blanket on top of the cover and wrap the entire SNIF[®] furnace in a ceramic blanket to minimize heat loss. Use at least 1" thick ceramic blanket.
- 3) Keep the spinning nozzle(s) installed on the SNIF[®] furnace. Turn off the circuit breakers feeding the spinning nozzle's Variable Frequency Drive(s) to ensure the spinning nozzle(s) are not damaged

during any solidification which may occur.

- 4) Periodically check the SNIF[®] furnace's bath temperature through the airlock using a hand-held thermometer to confirm the actual metal temperature, especially near the edges where the metal will solidify first.
Note: The bath thermocouple's connector can also be disconnected from the thermocouple cable and connected to a hand-held thermometer to monitor the bath temperature.
- 5) If the solidification phase of the molten metal alloy is approaching, prepare to drain the unit if possible (refer to OMP-6009 or OMP-6109).
- 6) If the SNIF[®] furnace was drained during the power failure and when power is restored proceed to heat up the SNIF[®] furnace as described in OMP 6056, or OMP 6135 for Immersion Systems. This should be performed from the point which coordinates with your present heater element temperature.
- 7) If the SNIF[®] furnace was not drained during the power failure and when power is restored the molten metal will absorb a significant amount of heat when heating up again.
- 8) If it was not possible to drain the SNIF[®] furnace during the power failure and the SNIF[®] furnace started to freeze refer to OMP-6021 for starting a frozen SNIF[®] furnace.
- 9) When the power is restored start heating the SNIF[®] furnace and periodically check the temperatures on the HMI.
- 10) Once the bath temperature has recovered proceed with normal operations.

Accountabilities:

Customer Maintenance and Operator personnel, SNIF[®] Field Engineers.

References:

SNIF[®] Operating Manual

OMP #: 6047

Approved Date: 7/8/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Installation of the Trough Airlock

Purpose:

To install the Trough airlock in the most efficient and safest manner.

Scope:

This procedure applies to all SNIF[®] R and P type Furnaces.

Definition:

The trough airlock is designed to keep air from entering the SNIF[®] Furnace and reducing the oxidation of the graphite components. It must be all time intact and properly functioning to lower the risk of damaging other components.

Policies:

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Procedure:

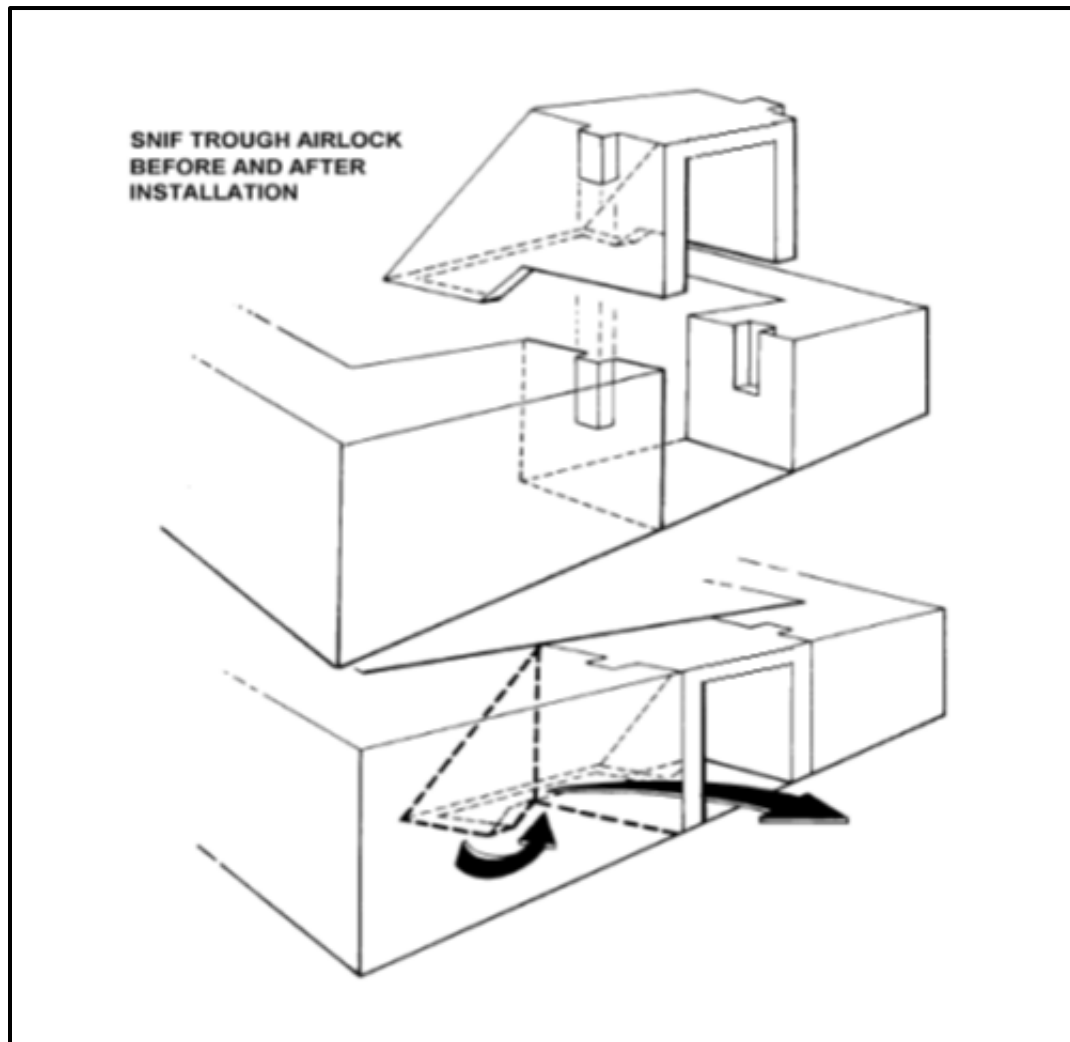
The most appropriate time and the easiest way to install this airlock is when the SNIF[®] furnace is empty, but it can also be installed when there is molten metal inside the SNIF[®] furnace and if there is no drain port to empty the unit, additional safety measures should be considered in this case.

The existing airlock (if present) must be completely removed and the trough areas must be clean of dross and solidified aluminum.

- 1) Preheat the new airlocks to remove moisture before installing,
- 2) Raise the cover or open the hatch to have enough space to remove the old airlock.
Note: If system has a bolt-on cover, it must be removed to perform this operation.

- 3) Install the airlock so the ears or tabs are positioned into the grooves, which are cut in the ports.
Note: The airlocks do not need to be cemented in place but if air gaps are observed above the casting metal level must be sealed with ceramic paper or refractory mastic.
- 4) The seal across the top of the airlock against the lift cover is vital to prevent air infiltration into the unit. The airlock height must be flush with the unit sill. In case a level difference observed on top, shims made from ceramic paper can be used at the bottom. **Note:** For bolt-on covers, some airlocks may not have a flat sealing surface on the top
- 5) Apply boron nitride to all surfaces.

See sketch below.



Accountability: Customer Personnel

References: Sales Literature on "New SNIF® Trough Airlocks", SNIF Operating Manual; Furnace Cartridge Assembly and B/M; General Assembly and B/M.

OMP #: 6079

Approved Date: 7/9/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Directions for Replacing the Refractory Lining of a 1-Piece Lift Cover

Purpose:

This procedure is designed to instruct our customer on how to replace the refractory lining of a 1-piece lift cover. in the most efficient and safest manner.

Scope:

This procedure applies to all SNIF[®] systems which have lift covers.

Definition:

This procedure is performed in the event the 1-piece lift cover needs to be relined using a SNIF[®] reline kit.

Policies:

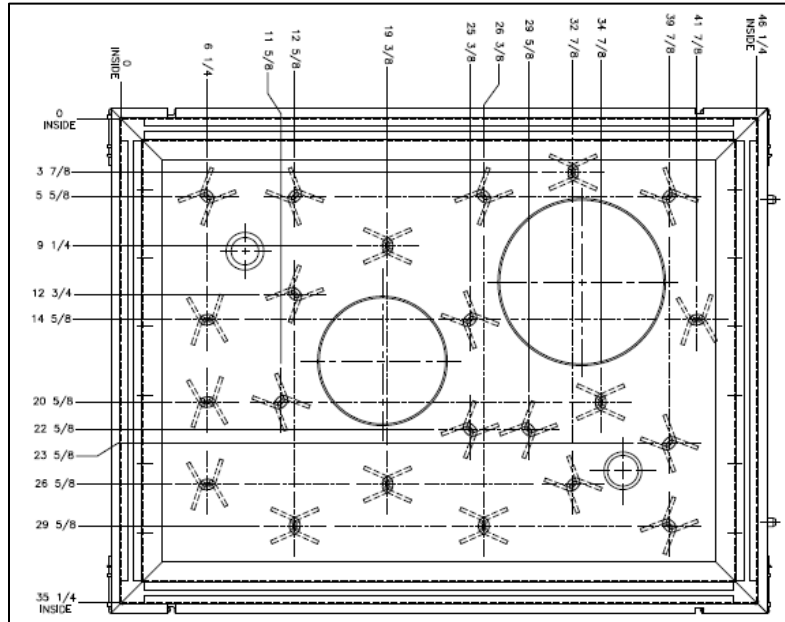
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Procedure:

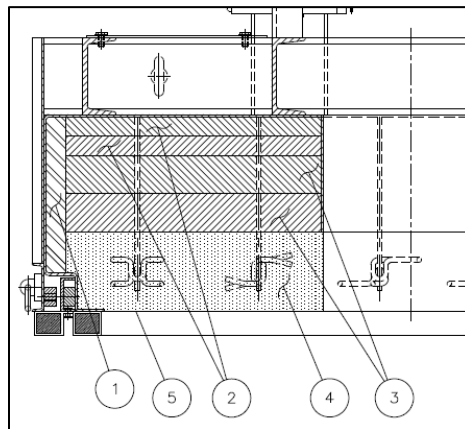
- 1) Clean out all the spent refractory and insulation boards and clean the steel cover shell. Repair or replace all steel work as required including the metal "cans" defining nozzle well and heater well (if applicable) as well as the "pipes" defining the vent, the thermocouple and the cover gas ports (if applicable).
- 2) The anchors are supplied in two (2) parts: The stems (refer to item 1 in 'Anchor detail') and the actual "V" anchor (refer to item 2 in 'Anchor detail'). Weld the new stainless-steel anchors stems in the proper locations on the bottom of the steel cover shell according to the drawing (refer to 'Anchor locations').

Note: Make sure the anchor stems are perfectly vertical.



Anchor locations (refer to the proper drawing)

- 3) Install one (1) 1" insulation board around all four (4) sides of the steel cover. Cut the boards and fit it against the sides of the steel shell (refer to item 1 in 'Cross section of cover').



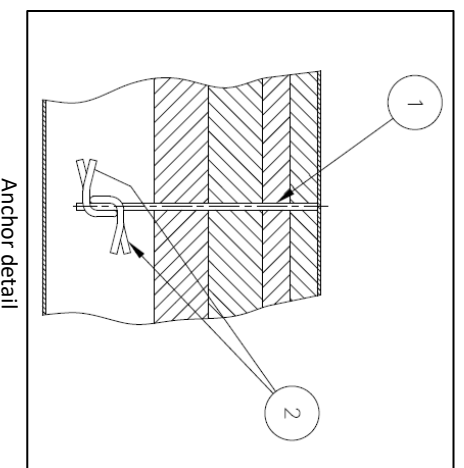
Cross section of cover

- 4) The insulation board set should be placed on top of the anchor stems.
 - a) Gently press the insulation boards on the cans and pipes to leave an imprint and cut the insulation boards accordingly.
Note: The insulation boards do not need to be 'staggered' and the first insulation board can be used as a template for the remaining boards going on top.
 - b) Gently press each cut insulation board on top of the anchor stems leaving an imprint.
 - c) Drill holes at the imprints straight through the insulation board with a proper drill.
 - d) Seal all voids with refractory mastic as the insulation boards are set in place.
 - e) Continue until all the insulation board layers are installed according to the drawing. Usually 2x 1" (refer to item 2 in 'Cross section of cover') and 2x 2" of insulation boards (refer to item 3 in

‘Cross section of cover’). All anchor stems should now pierce up through the insulation board set.

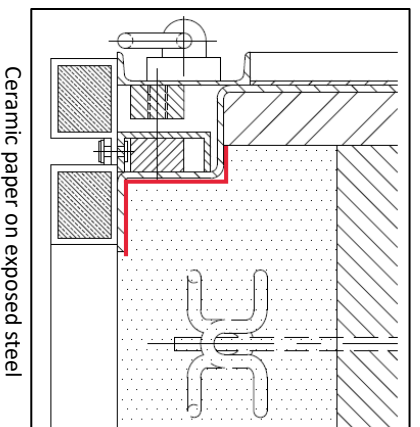
- 5) Coat the last exposed insulation board surfaces (including all sides) with a thin layer of Crisco grease. Adhere one (1) layer of aluminum foil onto the greased surface (between item 3 and 4 in ‘Cross section of cover’). The aluminum foil is used as a water barrier so that water of the refractory castable is not wetting the insulation boards.

- 6) Weld two (2) “V” anchor sections (refer to item 2 in ‘Anchor detail’) onto each anchor stem (refer to item 1 in ‘Anchor detail’) using 304 stainless welding rod according to the drawing. Be sure the anchors are not sticking out more than halfway into the section where the castable is to be poured (the castable is usually 4” thick). If required, bend the anchors down below the halfway point.



- 7) Wrap all anchors with 6 mils of standard masking tape or coat all anchors with a thick layer of wax. Note: Wrapping or coating is for expansion purposes.

- 8) On all exposed steel cover sides use ceramic paper (Apr. 3mm thick or 1/8”) for thermal expansion and adhere with a thin layer of Crisco grease (refer to sketch below).



- 9) Prior to casting, you may need to make a seam as detailed in the drawing using a piece of wood acting as a liner.

Note: For covers with 2 seams (i.e. P-180 system), the two outside sections are poured first.

- 10) Install the Styrofoam cylindrical pieces for the nozzle well and the heater well (if applicable) as well as the Styrofoam pieces for the vent, the thermocouple and the cover gas port(s) (if applicable).
- 11) Mix the refractory castable in a paddle mixer (Armorlite 85AL Castable ~ 55 Lb. Bag). Be sure to use clean potable water at room temperature (refer to the instructions on the bag). Mix the refractory castable in the mixer for Apr. five (5) minutes to allow for complete mixing. Pour the refractory castable into the cover and use a 1" pencil vibrator for moving and compacting the material into position.
 - a) After pouring the refractory castable use a straight edge to skim the refractory level with the bottom of the cover.
 - b) For seamed covers, place a layer of aluminum foil between the seams before pouring the last refractory castable section.

Note: The first refractory castable section(s) needs to be air-dried for 24 hours in a warm area before pouring the last refractory castable section.
- 12) After pouring the last refractory castable section (refer to item 4 in 'Cross section of cover'), it needs to be air-dried for 24 hours in a warm area.
- 13) After the cover refractory has set, place the cover into the oven and bake it to 340°C (or 650°F).
- 14) Use the following bake-out schedule for the cover:
 - Ramp from ambient to 120°C (or 250°F) during 2 hours;
 - Soak at 120°C (or 250°F) for 12 hours;
 - Ramp from 120°C to 340°C (or 250°F to 650°F) during 8 hours;
 - Soak at 340°C (or 650°F) for 12 hours.

Note: After the low-end temperature is achieved (i.e. 120°C (or 250°F), the rate of increase should not exceed 30°C (or 50°F) degrees per hour.
- 15) Slow cool to 82°C (or 180°F), during approximately 12 hours, before pulling the cover from the oven.
- 16) Coat all exposed refractory surfaces of the cover with a boron-nitride coating (refer to item 5 in 'Cross section of cover'). Let it air dry and apply another layer of boron-nitride coating.
- 17) The cover gasket can now be installed according to OMP-6157 and the cover can be placed into service.

References:

SNIF[®] Operating Manual
General Assembly Drawing
Cover Insulation Assembly Drawing

Accountability:

Plant Maintenance personnel and SNIF Field Engineering as required.

OMP #: 6096

Approved Date: 7/14/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Dross Reduction Procedure with a 1 Piece Cover Lifter / Airlock Units

Purpose:

To obtain the best quality metal by maintaining an oxygen free inert atmosphere thereby reducing the dross accumulation.

Scope:

To achieve the highest quality metal with minimal operating and maintenance requirements

Definition:

An inert atmosphere can be best achieved by observing the recommendations described below:

Policies:

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Procedure:

Dross removal and Cleaning the SNIF[®] Unit with a 1 Piece Cover Lifting Mechanism:

This type of SNIF[®] Unit will be better sealed than the SNIF[®] Units with front and side hatches. Therefore, the dross removal and cleaning frequency will be reduced, and nozzle life will be extended.

The amount of times the cover should be raised will depend on operating conditions.

Dross accumulation depends on many variables, these include:

1) Oxygen level in the SNIF® Furnace headspace:

The main objective is keeping the oxygen levels as low as possible 0-0.5% in the furnace headspace during the idle and operating modes. This can be performed by sealing the unit to the atmosphere.

2) Metal Level and Temperature:

The lower the metal level and the cooler the metal the more prone the aluminum will be to freeze to the cover. The aluminum will also turn into aluminum oxide if there is oxygen in the furnace headspace. In this case a more vigorous and frequent cleaning schedule will be required. The hotter and higher the metal level passing through the SNIF® the smaller amount of aluminum and in turn aluminum oxide will buildup on the cover. This in turn will reduce the amount of cleaning frequency and the amount of times the cover must be raised. The cover can be cleaned without damaging the refractory by cleaning hot. Raise the cover only far enough to insert a cleaning tool. Cleaning the cover immediately after a drop is optimal, but generally, only necessary if the cover is to be raised further for additional cleaning.

3) Alloy Grade:

There are certain grades of Alloys, which are more prone for dross accumulation than others are. For example, the 5000 series high magnesium alloy will generate more dross due to the attraction of magnesium to combine with oxygen.

4) The operating parameters in the SNIF® Furnace:

The nozzle speed to argon volume is a direct correlation to the bubble pattern and the amount of metal passing through the SNIF® Unit. If the bubble pattern is turbulent versus a nice smooth surface the unit will be prone for excessive dross accumulation and cover buildup. Therefore, it is recommended to operate the unit so there is a smooth surface with yellow flames breaking the surface. (Refer to Manual section 8 for more details on the operating parameters.)

As mentioned above the main objective is to minimize oxygen in the SNIF® headspace or the metal level to cover volume. If there is less oxygen, there will be less dross accumulation. This in turn will reduce the amount of times the cover will have to be raised and the unit cleaned. If there are questions or concerns dialing in or correctly setting up the SNIF® please contact SNIF® Field Engineering.

To Reduce Oxygen in the SNIF headspace, the following recommendations should be observed:

- 1) Confirm the airlocks are installed properly and in good condition mechanically. Refer to OMP-6047
- 2) The Cover Gasket is critical and must be kept maintained and effective. OMP-6157
- 3) Use Ceramic blanket in the inlet and outlet troughs between casts if the airlocks are damaged and cannot seal the headspace
- 4) Confirm the nozzle plug plates are compressed against the cover using a 1/8" (3mm) ceramic paper gasket.
- 5) Confirm the bath thermocouple is installed and sealed properly. Refer to OMP-6119

If the above recommendations are observed and the oxygen levels are kept below <0.5% the number of times the cover must be raised can be minimized to once daily or once or twice weekly depending on the cleanliness of the metal feeding the SNIF® and melting/alloying/operating practices of the plant.

This operation can be judged by a trial and error period after the initial commissioning of the SNIF®. The initial recommendation is to observe the amount of dross generated in the SNIF® furnace after one day of operation. If the dross accumulation and cover buildup is minimal extend it to every two days and so on. The unit will “self-seal” if left closed and dross formation will not substantially increase.

Note: The Cover exhaust vent must always be kept clear to eliminate pressure build up within the unit.

References:

- 1) SNIF® Operating Manual: OMP-6047, OMP-6119, OMP-6157

Accountability's:

Customer Operator Personnel, Customer Maintenance Personnel, SNIF® Field Engineers Training Program.

OMP #: 6097

Approved Date: 8/6/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Operating Procedure for the One-Piece Cover Lifting Mechanism

Purpose:

To develop an efficient and practical procedure to operate the Hydraulic or Mechanical Cover Lifting Mechanisms.

Scope: This procedure will apply to most SNIF Units that use a 1 Piece Cover Lifting Mechanism, including the single mast and dual mast one-piece cover units.

For Rotating Covers refer to OMP-6150, For Tilting Systems refer to OMP-6162.

Definition:

This procedure can be used to move the cover up and down via push buttons; with any of these purposes in mind; and should be done at regular intervals to prevent dross build-up. All OMP's can be found in Section-10 of SNIF[®] Manual.

- 1) Skimming, Cleaning and Draining.
- 2) Maintenance items; replacing the cover gasket and airlocks.
- 3) Visual inspecting the interior refractory, or cover components.
- 4) Clean the heater block on SNIF[®] (HB units) between drops or casts. This is especially important if the heater block build-up is suspected as the cause for a loss of heat transfer effectiveness from the heating system to the liquid metal.

Policies:

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Procedure:

- 1) Be sure to wear the proper Molten Metal PPE (Personal Protective Equipment) before operating this mechanism.
- 2) Check the surrounding area to be sure area is clear and all obstacles away from the furnace before operating the cover.
- 3) Make sure the SNIF system is in STOP mode. before raising the cover, the idle gas remains ON.
- 4) Operate the cover from the Remote Push Button Control Station for the Cover Lift Mechanism. Pushbutton Station must be installed at a place that operators have clear visual access to cover so they can see the surroundings before they move the over.

A) Press the UP/RAISE button to raise the cover

Note: The bath low temperature alarm may sound once the bath T/C cools down because the thermocouple is out of the molten metal. Press the Alarm Silence button on the furnace control panel or HMI and continue with this operation.

B) Press the DOWN/LOWER button to lower the cover

- Press “Safety Latch Release” button. You should hear the safety latch disengage from the rack. If you do not hear, raise cover slightly then press “Safety Latch Release” again.
- Then while pressing the Safety Latch Release also press the cover down push button.

If the safety latch still catches, see the note below regarding the safety latch operation.



**** Dual mast designs, a height difference between the 2 masts should be leveled:**

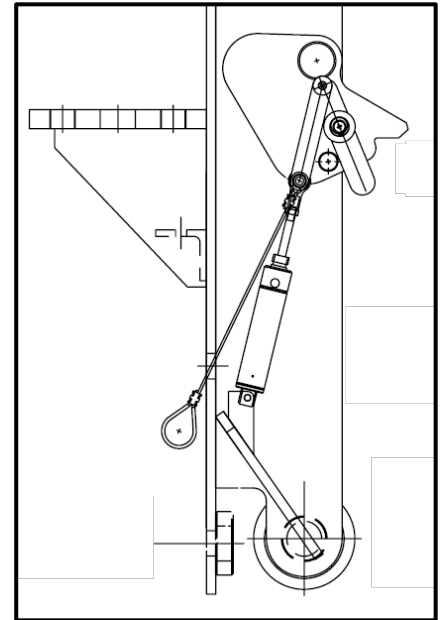
- i. Observe the position of the carriages with respect to each other. They should be in alignment. If the carriages are not in line, locate the hydraulic diverter valve on the mast assembly. This valve is on the pedestal mast (right side when viewed facing the rear of the furnace). At the side of the valve is a pull handle (mushroom type) while simultaneously pushing the Raise/Up button.
- ii. When this handle is pulled out and held, the mast/column (right side) operation is disabled/bypassed. Press the **UP** button if slave is too low or **Down** button if too high.
- iii. Release the handle when the covers are level with each Other



****Safety Latch Information (If equipped)****

The safety latch is a spring-loaded cam, which rides along a track inside the vertical lift-mast. During normal, upwards movement of the cover, the safety latch will catch at multiple points to prevent the cover from falling in the event of a major hydraulic failure. During downwards operation, a pneumatic cylinder will retract the spring-loaded safety latch to allow the cover to move down smoothly.

The pneumatic cylinder requires 60 psi (4 bar) of air pressure to operate properly, if enough air pressure is not available, the safety latch has been connected to a manual override cable which can be pulled to lower the cover. To lower the cover the cable must be pulled, and the Down Button must be pressed and held simultaneously. IF THE MANUAL OVERRIDE CABLE IS PINNED INTO POSITION (IN TENSION), THE SAFETY FEATURE WILL NOT BE FUNCTIONAL.



Refer to the Vendor Literature in the SNIF manual for detailed drawings of this safety mechanism.

- 5) Any gaps observed between the cover and the sill must be sealed to achieve an inert atmosphere inside the unit. If the cover gasket is damaged and does not seal properly, until the gasket can be replaced, lay a < 1" (25mm) thick (before compressing) layer of ceramic blanket wool around the sill of the unit to contact the gasket.
- 6) Ceramic blankets can be used to reduce heat loss through the airlocks.

Note: Once the cover is lowered give some time for the bath thermocouple and metal temperature to equilibrate to obtain an accurate temperature.

Note: Do not run the nozzles at Idle or Process Speed until they have been setting in the metal for approximately 5 minutes. Otherwise, you risk snapping the shaft and rotor due to the metal

being solidified between the shaft and rotor and the shaft. **Remember to restart the rotors after 5 minutes.**

****IF you cannot lower the cover via the push button station** example being button failure or power outage.**

In Extreme cases the cover can be/should be lowered to prevent heat loss

- 1) Make sure all employees and equipment (tools) are clear of the cover and mechanical parts associated.
- 2) Pull cable for mechanical latch release if it is free then proceed to 4)
- 3) If cable will NOT release the latch, then you must slightly lift up/raise on the cover by some method to release latch.
- 4) Pull the manual valve release on the solenoid valve to release hydraulic fluid back from cylinders into the tank and lowers the cover. See picture of example (right) the **red** knob needs pulled out to release pressure.



References: SNIF Operating Manual Section 10,
OMP-6138 Maintenance Schedule for SNIF Units
OMP-6150 Operating Procedure for SNIF Rotating Lift Cover Assembly
OMP-6162 Tall Lift-Mast Operating Procedure for Immersion Tilting Units

Accountabilities: Cast House Operators and Maintenance
SNIF Field Engineering

OMP: 6115
Approved Date: 7/10/2020
Approved By: Mike Klepacki
Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

25 kW Sialon Immersion Heater Assembly for Immersion Systems

Purpose:

The following procedure describes installing or replacing a 25kW Sialon heater assembly.

Scope:

This procedure applies to all SNIF[®] systems with immersion heater(s).

Definition:

This procedure is required to install a Sialon tube and/or a heating element.

Policies:

This document was developed based on a compilation of best available information, knowledge, field experience, and general industry practices to provide guidance to PYROTEK's customers in performing the activities defined herein, in a consistent and standardized manner. This document does not contain regulatory or statutory requirements unless specified.

PYROTEK is not responsible for the misuse or misinterpretation of the information presented herein. Under no circumstances shall PYROTEK be liable or responsible for any actions taken or omissions made by non-PYROTEK staff while performing this operation. It is the Plant's responsibility to ensure all safety policies and procedures are carried out while executing the steps of this procedure.

Procedure:

1. Care and Handling

- 1.1 Sialon Immersion Heater Tube
- 1.2 Silicon Carbide (SiC) Heating Element

2. Assembly and Installation

- 2.1 Installation of Sialon tube onto the cover of the SNIF furnace
- 2.2 Assembly of Heating Element Assembly
 - 2.2.1 Assembly of the support assembly and the SiC heating elements
 - 2.2.2 Location preparation and installation of the Element Thermocouple Assembly
- 2.3 Installation of Heating Element Assembly
 - 2.3.1 Connecting the SiC heating elements
 - 2.3.2 Connecting the Element Thermocouple Assembly

1. Care and Handling

1.1 Sialon Immersion Heater Tube

Caution

- Any mechanical impact against the Sialon tube such as hammering, etc. should be avoided.
- The Sialon tube should be well dried and preheated before immersion into molten aluminum.
- The Sialon tube should never be heated or cooled rapidly.
- The maximum allowable thermal shock (DT-Differential Temperature) for the Sialon tubes is 200°C.

The surface temperature of the Sialon immersion heater tube must be controlled within +/- 200°C of the molten aluminum temperature to prevent damage from thermal shock.

Surface treatment & cleaning after removal

- The Sialon tube is designed to remain in place until failure and is not to be removed while replacing heating element assemblies.
- Exterior surface cleaning is important in keeping the heat transfer rate to a maximum.
- Hot cleaning of the exterior surface should be done at least on a weekly basis using the supplied tool(s), preferably right after a cast. However, direct impact with (heavy) tools must be avoided.
- Cold cleaning of the exterior surface can be done using mechanical tools (e.g. grinder, hammer-chisel) or by bathing it in a hydrochloric acid or caustic soda (concentration <10%). However, such operation should be done with appropriate care.

1.2 Silicon Carbide (SiC) Heating Element

Caution

- Extreme caution must be taken while handling the silicon carbide (SiC) heating elements. The elements are extremely fragile and may break with very little force. The heating elements should remain in the manufacturer packaging until they are ready to be installed on the SNIF unit.

The Sialon tube must already be installed into the cover of the SNIF furnace before the heating element assembly can be installed. The heating element assembly (including the support assembly) must be pre-assembled prior to installation.

2. Assembly and Installation

2.1 Installation of Sialon tube onto the cover of the SNIF furnace

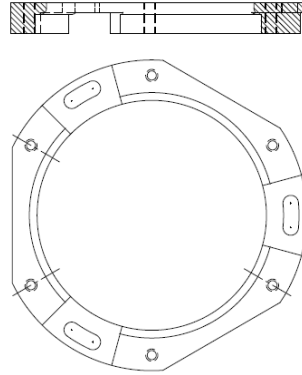
The Sialon tube (refer to picture 1) is supported by a mounting flange, which fits around the Sialon tube. Before the Sialon tube can be installed onto the cover of the SNIF furnace, the mounting flange (refer to picture 2) and retainer plate (refer to picture 3) should be removed from the cover of the SNIF furnace. Two (2) lifting eye-bolts should be diagonally fastened to the mounting flange using two (2) out of six (6) threaded holes.

Keep the Sialon tube upright (vertical) and slide the mounting flange (including the lifting eye-bolts) towards the top and lower both pieces through the heater tube well of the cover of the SNIF furnace using the lifting eye-bolts. Once the mounting flange and Sialon tube have been fully installed, the mounting flange needs to be bolted to the heater plate. The 1/4" (6mm) thick retainer plate needs be installed and bolted on top of the mounting flange.

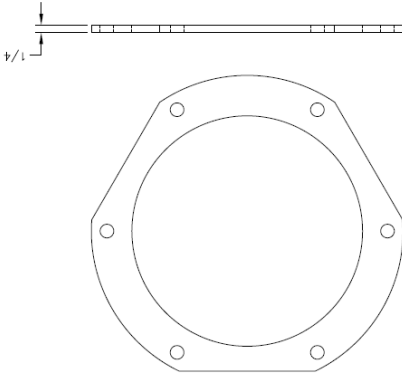
Pic.1 Sialon Tube



Pic.2 Mounting Flange



Pic.3 Retainer Plate



2.2 Assembly of Heating Element Assembly

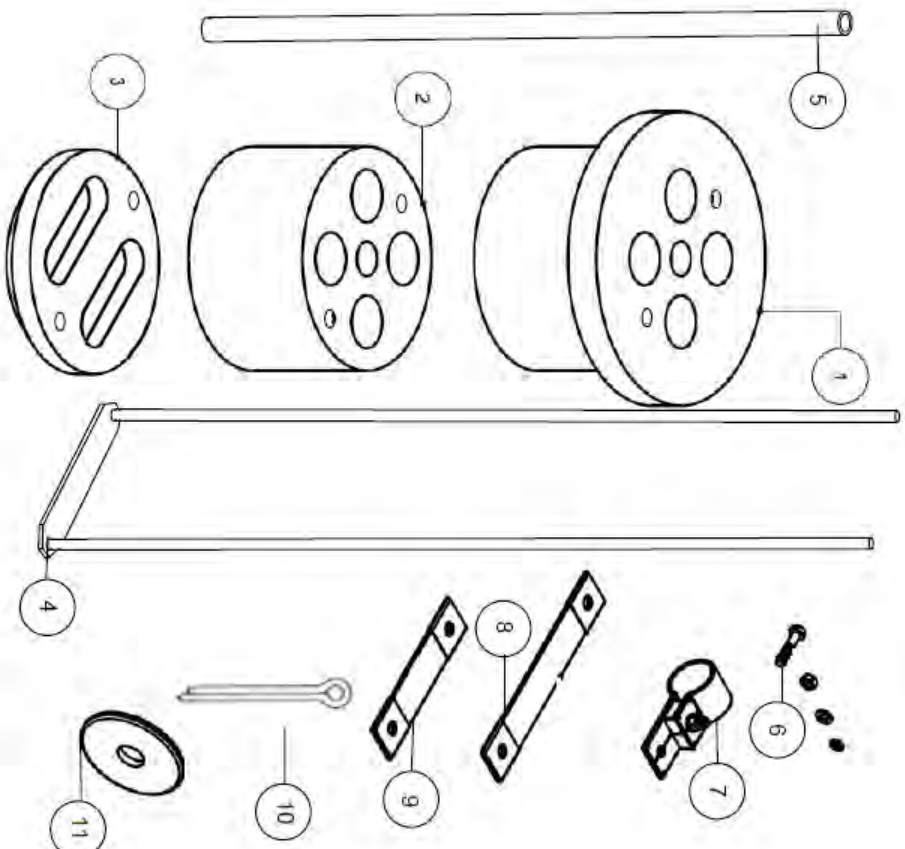
Caution

- The components of this assembly contain refractory ceramic fiber. When working with ceramic fibers, minimum safety precautions should include the use of an approved mask, to prevent inhalation of fibers, and the use of suitable gloves and eye protection. Other recommended or compulsory safety precautions may apply in different countries, and it is essential that local regulations should be consulted before attempting to work with any of the ceramic fiber components

- The entire assembly of the heating element assembly can be done away from the SNIF area. One (1) heating element assembly consist of two (2) boxes:
- The first box contains a pair of heating elements, a steel hanger bar, a pair of alumina spacers and the electrical connecting braids and fastening hardware.
 - The second box contains the upper flange block, the middle block and the lower block.

2.2.1 Assembly of the support assembly and the SiC heating elements

Check all the components and arrange them on a suitable work surface (refer to picture 4).



Parts List			
Item	Description	Dwg.No.	Quantity
1	Upper Flange Insulation Block	----	1
2	Middle Insulation Block	----	1
3	Lower Insulation Block	----	1
4	Hanger Bar	----	1
5	Alumina Spacer	----	2
6	M8 Bolt-Nut-Washer set	----	4
7	Braided Clamp Set	----	4
8	Connecting Braid	----	2
9	Connecting Loop Braid	----	1
10	Cotter Pin	----	2
11	Ø25mm Flat Washer	----	2

Pic.4 Parts of the SiC Heating Element

Note: The two (2) fiber blocks (i.e. the upper flange insulation block and the middle insulation block) have four large holes and three smaller holes. The four large holes are for the silicon carbide heating elements, the outer small holes are for the hanger bar, and the center hole is for the element thermocouple assembly.

The following steps are necessary to assemble the SIC Heating Element Assembly.

1. Hold the Hanger Bar upright (vertical).
2. Slide the Lower Insulation Block onto the Hanger Bar until the flat portion of the Hanger Bar is positioned in the slot of the bottom of the Lower Insulation Block.
3. Slide an Alumina Spacer onto each leg of the Hanger Bar (refer to picture 5).
4. Position the Heating Elements into the slots on top of the Lower Insulation Block.
5. Slide the Middle Insulation Block over the Heating Elements and the legs of the Hanger Bar. Make sure the tapered center hole is facing up (this will guide the Element Thermocouple Assembly). Make sure the Middle Insulation Block is resting on the Alumina Spacers, since this determines the distance between the Lower Insulation Block and Middle Insulation Block (should be at least 460mm, refer to picture 6).
6. Slide the Upper Flange Insulation Block over the Heating Elements and the legs of the Hanger Bar (refer to picture 7).



Pic.5 Hanger Bar+Lower Block+Spacers
Pic.6 Adding Middle Block
Pic.7 Adding Flange
Pic.8 Heating Element Assy
Pic.9 Braided connection

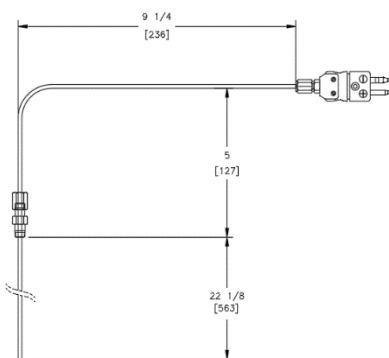
7. Slide an $\phi 25$ mm Flat Washer over each leg of the Hanger Bar and install a Cotter Pin through the hole of each leg of the Hanger Bar.
8. Apply some insulation tape (e.g. Scotch® Glass Cloth Electrical Tape - 27U) around the bottom portion of the Heating Elements and the Lower Insulation Block to keep the Heating Elements in the slots of the Lower Insulation Block (refer to picture 8 red circle).
9. Connect the Braided Clamp Sets to the Heating Element's legs and the electrical Connecting Braids to the Braided Clamp Sets using the fastening hardware. Make sure both Heating Elements are connected in series using the short Connecting Loop Braid. The longer Connecting Braids are used to connect to the power supply terminals (refer to picture 8 and 9).

Note: Connecting the Braided Clamp Sets to the Heating Element's legs should be done with some caution. This to avoid any stress on the Heating Element's legs.

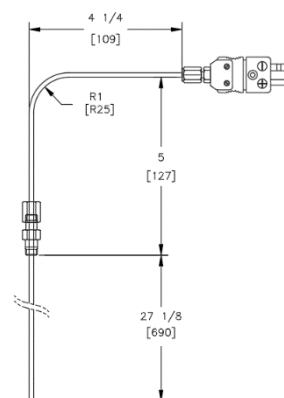
2.2.2 Location preparation and installation of the Element Thermocouple Assembly

The fitting on the Element Thermocouple Assembly is used to set the proper distance (refer to picture on the right, red circle).

For standard systems the fitting should be set to Apr. 563mm (refer to picture 10) and for U systems the fitting should be set to Apr. 690mm (refer to picture 11). The result will be that the tip of the thermocouple assembly is Apr. 60-65 mm below the Middle Insulation Block (i.e. inside the hot zone of the heating element).



Pic.10 Thermocouple for Standard Systems



Pic.11 Thermocouple for U System

2.3 Installation of Heating Element Assembly

The Heating Element Assembly (refer to picture 8) as a whole (without the Element Thermocouple Assembly) can now be inserted into the Sialon tube supporting/lifting it at the Upper Flange Insulation Block.

2.3.1 Connecting the SiC heating elements

Connect the two (2) longer Connecting Braids to the 240VAC power supply terminals. Make sure all electrical connections are tight.

2.3.2 Connecting the Element Thermocouple Assembly

Gently insert the Element Thermocouple Assembly into the center of the Heating Element Assembly. Connect the male thermocouple connector type K to the wired female thermocouple connector type K. Once the heater compartment has been closed, power can be applied.

Note: After the heating elements have been powered for several hours the power must be switched off and all the bolt/nut connections have to be retightened to compensate for thermal expansion.

Accountabilities

Pyrotek Field Engineering and customer maintenance personnel.

References:

SNIF[®] Operating Manual

OMP #: 6119

Approved Date: 5/16/2018

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Replacing the Bath Immersion Thermocouple with Graphite Protection Tube

Purpose: To advise when replacement of bath graphite protection tube and thermocouple is necessary.

Scope: All SNIF[®] systems using the bath immersion thermocouple with a graphite protection tube.

GENERAL:

- 1) Have reserve thermocouples available at all times.
- 2) The sounding of an alarm with an open thermocouple indication usually means the thermocouple requires inspection and/or replacement.
- 3) Maintain correct polarity (the yellow lead is positive and the red lead is negative) when connecting the lead wire to the thermocouple. The lead wire is usually color coded, and the thermocouple is marked, to identify the positive and negative connections.
- 4) Thermocouples provided by Pyrotek-SNIF, Inc. are Chromel-Alumel (Type K).

BATH IMMERSION THERMOCOUPLE:

NOTE: Preheat the bath thermocouple protection tube to "drive off" any moisture before inserting it into the aluminum bath.

BATH THERMOCOUPLE PROTECTION TUBE:

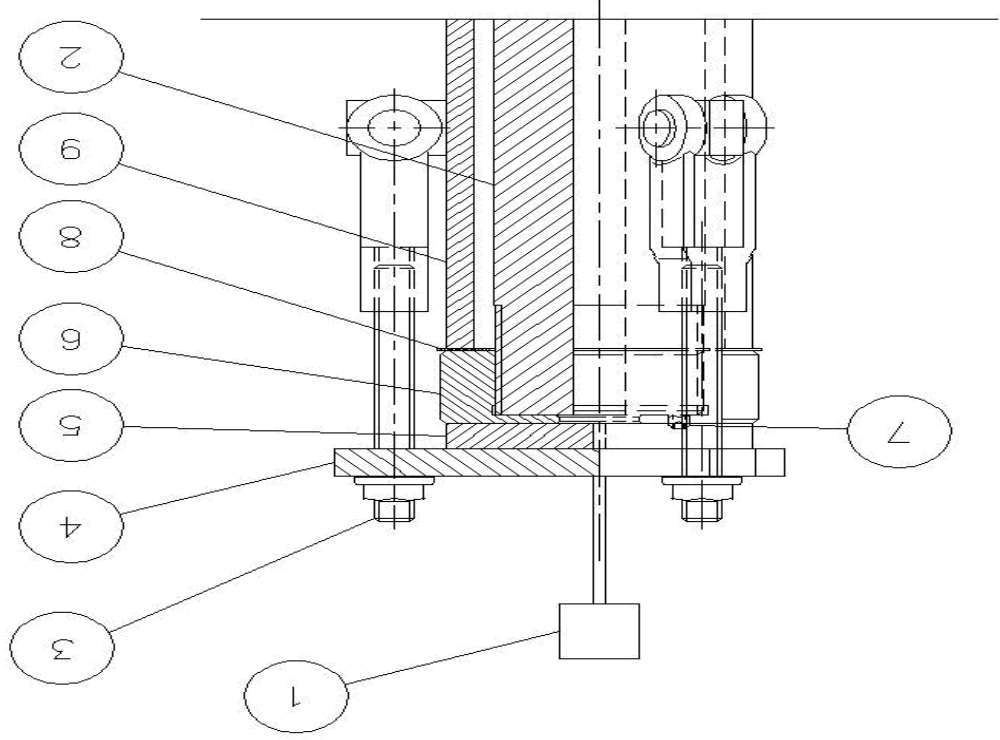
Safety Note: Both the thermocouple and the protection tube are hot. Heavy gloves should be worn.

PROCEDURE:

- 1) Disconnect lead wires and pull thermocouple (1) out of the graphite protection tube (2).
Insert a new thermocouple if the protection tube is not damaged. (Inspect from underneath the cover)
Proceed to step 2 to replace the protection tube if it has been in service for three months or more.
- 2) Loosen the three hold-down bolts (3), flip down the bolts and remove the triangular hold-down cap (4).
- 3) Remove the silicone rubber gasket (5) from the top of the assembly.
- 4) Grab the metal thermocouple protection tube cap (6) with a pipe wrench and lift the graphite tube (2) and metal out with a twisting motion.

- 5) With an allen key wrench, loosen the setscrew (7) which is located on the top of the metal protection tube cap (6)
- 6) Tighten the tube cap onto a new graphite protection tube and retighten the setscrew
- 7) Place a new thermocouple cap (8) on the pipe port (9). Preheat the protection tube assembly to "drive off" any moisture before installing it in the furnace.
- 8) Install the protection tube assembly into the pipe port.
- 9) Place a new silicone rubber gasket (5) on the thermocouple protection tube cap (6).
- 10) Replace the triangular hold-down cap (4) and firmly seat the silicone gasket with the hold-down bolts (3).
- 11) Pierce the center of the silicone rubber gasket (5) with a new thermocouple (1). Slide the new thermocouple into the protection tube as far as it goes. Plug in the lead wires.

See graphic for item numbers



Accountabilities:

Customer maintenance or operating personnel.
SNIF Field Engineers

OMP #: 6132

Approved Date: 7/13/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Cartridge Removal and Installation Procedure for all SNIF immersion Systems

Purpose:

This procedure is designed to instruct our customer on how to remove and install the SNIF[®] unit cartridge in the most efficient and safest manner.

Scope:

This procedure applies to all Immersion SNIF[®] systems ("I" units) and unheated units ("TD units").

Definition:

This procedure is performed in the event of a cartridge failure (severe refractory lining damage, leakage of the melt to the steel shell, etc.)

Policies:

This document was developed based on a compilation of best available information, knowledge, field experience, and general industry practices to provide guidance to PYROTEK's customers in performing the activities defined herein, in a consistent and standardized manner. This document does not contain regulatory or statutory requirements unless specified.

PYROTEK is not responsible for the misuse or misinterpretation of the information presented herein. Under no circumstances shall PYROTEK be liable or responsible for any actions taken or omissions made by non-PYROTEK staff while performing this operation. It is the Plant's responsibility to ensure all safety policies and procedures are carried out while executing the steps of this procedure.

Procedure:

The cartridge lining is a self-contained monolithic vessel which may include a dividing wall or center baffle, two drain holes, 2 or 4 trough ports (two of which must be plugged) and may include SHEER ribs. Immersion heater units and unheated units do not have a graphite heater block. The outer lining is an insulating castable with insulating boards strapped to it. Do not cut the strap otherwise, the insulating boards will separate.

Recommended Tools & Equipment:

- Forklift or crane to lift cartridge assembly and other parts
- Metric & English Socket / Wrench set
- Hammers / Chisels / Pry bar

- Vibrating tool to pack spacer sand during installation
- SNIF® cartridge spreader bar assembly (sold separately with first replacement cartridge)
- 2-4 Hydraulic Jacks (For lifting cartridge from furnace)
- Enough quantities of Lifting straps, chains, and come-a-long to remove the old cartridge 2 Pipe clamps.
- Proper PPE

Cartridge Removal:

- 1) Skim the dross off the metal surface.
- 2) Drain the metal from the furnace. (Observe OMP-6009).
- 3) Safely turn the power off to the heating elements and complete local lock-out / tag-out procedure.
- 4) Disconnect the motor cable and gas line and remove the SNIF® Nozzles from the cover.
- 5) Cartridge replacement can be performed hot or after the drained unit has cooled to room temperature. If it is performed hot, make sure the proper safety attire is worn.
- 6) The normal cooling down cycle of the furnace will be approximately 48 hours. The furnace cover can be raised to improve air circulation and speed cooling.
- 7) Remove the SNIF cover:
 Note: For rotating covers: it's not necessary to remove the cover.
 - A) Close the gas supply to the Gas Panel(s) and disconnect all gas hoses from the cover and verify flow is off.
 - B) Remove all fasteners holding the SNIF® cover in place and remove the cover from the steel shell.
 - C) Use the eyebolts located in each corner of the cover to lift it free. (Refer to the SNIF® Manual or packing list for the weight of the cover.)
- 8) Remove all the steel angle plates around the sill of the furnace between the steel shell and spent cartridge. All the steel angle plates are bolted in and some may require a pry bar to assist in extraction from the refractory.
- 9) Remove layer of sill refractory installed between the steel shell and the spent cartridge, concentrating on the four corner areas where the spreader bar assembly will lift the cartridge.
 Note: There will be a layer of sand exposed when the sill refractory layer is removed.
- 10) Locate the four (4) threaded pipes on each corner of the spent cartridge. Remove the sand to expose the threaded pipes. There should be a metal or plastic pipe plug installed in each threaded pipe, which will have to be removed and kept for reuse.
- 11) Remove the jacking bolts from the lower rear steel plate.

Remove all gravity side drains and drain cover plates from the furnace steel shell. Verify that gravity side drain assembly material (e.g. spacer) and or aluminum do not key the cartridge into place.

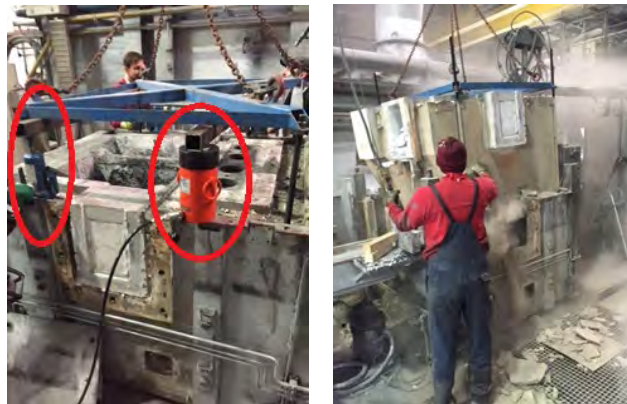
- 12) The spent cartridge can now be removed using the SNIF spreader bar. Attach the spreader bar to each of the threaded pipes by screwing in the long bolts.

Note: There may be some difficulties in tightening the spreader bar bolts due to damages on threads. Verify the proper bolts are used and are fully tightened before attempting to lift the cartridge.

Note: Refer to the SNIF[®] Manual for the weights and dimensions before installing any of the SNIF components.

- 13) Remove the spent cartridge from the steel shell.

- Verify no aluminum remains are protruding through the gravity side drain that may key the cartridge in place. Please verify no angle plates or cartridge jacking bolts remain.
- Verify that the cartridge's inlet and outlet trough port joints, as well as aluminum remains protruding through the trough joints, do not key the cartridge in place.
- Prepare to lift the cartridge assembly by connecting a crane or forklift to the spreader bar assembly. Make sure the capacity of the crane can handle the weight of the cartridge (and some extra weight for remaining aluminum.) Observe all safety precautions when performing this operation.
- Slowly and gradually lift the spent cartridge out of the steel shell. If the steel shell tends to rise with the spent cartridge, use hydraulic jacks as necessary between the steel shell and spreader bar (refer to picture).



Spent cartridge removal

Cartridge Installation:

NOTE: USE ANTI SIEZE LUBRICANT ON ALL FASTENERS TO ALLOW FOR EASY REMOVAL OF PARTS DURING NEXT CARTRIDGE REPLACEMENT.

- Check the condition of the steel shell and repair as needed. Furnace floor should be flat within maximum $\frac{1}{4}$ " (5 mm).
- Perform repair to the steel shell and its hardware. Center, align, straighten the bent & warped pieces as much as possible. Fix the damaged threads, etc.

- 3) There should be no visible rust on the interior metal surface of the steel shell. It is recommended prior to installing the new cartridge the steel shell should be sandblasted and painted.
- 4) Clean the interior of the shell and place a layer of refractory paper or ceramic blanket on the bottom. This will act as a parting line between the new cartridge and the steel shell if aluminum penetrates that area. A layer of ceramic blanket can provide the best heat insulation, but the corners must be cut to allow the shims to rest firmly on the metal shell.

Using steel shims and ceramic blanket

Prior to lifting the new cartridge in place, steel shims (Apr. 100x100mm) may be placed in the corners of the steel shell floor to raise the sill of the new cartridge, to level it with the existing steel shell.

a) At all four corners of the steel shell (interior) and new cartridge (exterior) measure the vertical distance from the bottom to the top: To the sill of the steel shell or sill of the new cartridge and complete the table below.

Column A Furnace Shell	Column B Replacement Cartridge	Column A - B (Shim needed)	
Front Left Corner			
Front Right Corner			
Back Left Corner			
Back Right Corner			

- b) In most cases, the measurements of the steel shell will be approximately ½" (12.5mm) more than the measurements of the new cartridge. The steel shims will be installed to make up that difference.
 - c) Install a ½" ceramic blanket on the floor and make cutouts where steel shims will sit on the ceramic blanket as shown in below picture.
- Place steel shims in the bottom corners of the steel shell so that the new cartridge's metal frame will rest on the steel shims when installed.



Steel shell interior with ceramic blanket on floor with square shims at corners

5) Attach the spreader bar assembly to the new cartridge and proceed to lower it into the furnace steel shell and to check level. Remove new cartridge and adjust shims if necessary. The safety chains (if present) on the spreader bar assembly are for safety to ensure suspension of the new cartridge if the threaded rods do not properly grip the lifting ball.
 Note: Before lowering the new cartridge fully disconnect the safety chain, because it will not be possible to remove the clevis pin when the cartridge is fully installed.



Spreader bar installation

6) Verify that the new cartridge and steel shell sill are level on top, all the way around, front and rear. Remove cartridge and adjust shims if level is not achieved at first time.



Leveling the new cartridge and steel shell

7) Center the cartridge in front face (inlet and outlet ports) and also at rear steel plate.



Centering the new cartridge in the steel shell

- 8) Disconnect and remove the spreader bar assembly from the new cartridge when the cartridge is properly leveled and center positioned within the steel shell.

Note: The cartridge can only be moved along the steel shell using the jacking bolts. Moving across the steel shell can be done using a crane or forklift.

- 9) Confirm there is equal distance between the shell and the cartridge and between the trough openings and the sides of the steel shell.

- 10) Install the gravity drain spacer in the active gravity drain port only. This gravity drain spacer goes between the gravity drain port and the cut out in the steel shell.

- a) The void between the cartridge and steel shell should first be stuffed around the gravity drain port with ceramic blanket before installing the spacer.
- b) Measure, mark and cut the gravity drain spacer to fit it flush between the gravity drain port and the steel shell exterior.

Note: The gravity drain spacer is very fragile and may break easily. As an alternative ramming refractory material can be used.



Stuffed active gravity drain port and gravity drain spacer installation

- c) Apply refractory material (refractory mastic) between the spacer and the cartridge and steel shell to ensure metal does not leak into the steel shell during draining.



Gravity drain spacer installation

- d) Install the drain sealing kit to plug the inactive (unused) gravity drain port(s). There is no need to install the gravity drain spacer in the inactive gravity drain port(s).
 Note: All the above parts are in the gravity drain sealing kit supplied with the new cartridge.
 Refer to OMP-6236

11) If the gravity drain spacer is installed and flush with the outer steel shell proceed and install the gravity drain trough cover plate. Proceed and install the gravity drain cover plate(s) on the plugged gravity drain ports.
 Note: Confirm there is a gasket (ceramic paper) installed before installing the plate(s). Secure the plate(s) by tightening all the bolts/washer/spring washer.

- 12) The voids between the active inlet and outlet trough ports and (if applicable) the other two (2) inactive trough ports against the steel shell need to be sealed.
 a) Fill and close the voids between the steel shell trough opening(s) and the refractory trough ports of the new cartridge. Voids can be stuffed and compacted with ceramic blanket, leaving an Apr. $\frac{1}{2}$ " deep surface gap, which then need to be filled with refractory mastic.



Sealed voids between the steel shell and cartridge trough ports and installed port plugs + steel port cover plates

- b) If the new cartridge has multiple ports, install the port plugs using the trough seal kit supplied with the new cartridge in the not active trough ports. The refractory plug facing the metal should be mortared in place with refractory mastic.
 Note: These port plugs may already be factory installed.
 c) The steel port cover plates can now be installed on the sealed and not active trough ports using ceramic paper gasket.
 d) Install the trough airlocks in the active troughs ports (refer to OMP-6047).
 Note: These airlocks may already be factory installed.



Installed airlocks and closed bolt holes with duct-tape



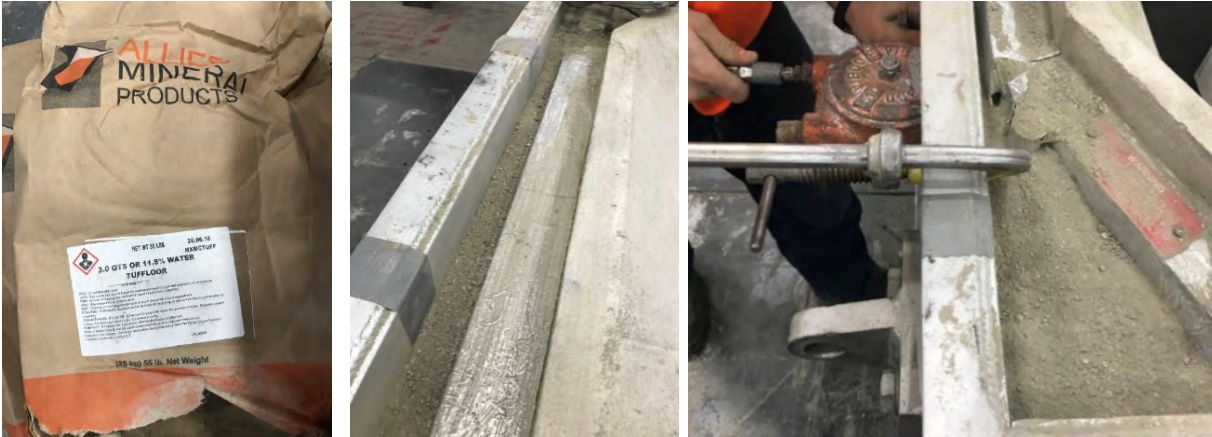
- 13) The dry-fill (refractory sand) can now be applied. This dry-fill is meant to fill the void between the new cartridge and the steel shell. It's important that all previous steps were executed to avoid that dry-fill will flow-out through possible voids.
- Check and confirm once more that all possible voids are sealed (jacking bolts at the bottom rear of the steel shell should be tightened, the active/inactive gravity drain ports and the active/inactive trough ports);
 - Close the bolt holes for the steel angle sill plates with duct-tape.
 - Protect the threaded pipes which were used to lift the new cartridge in place using plastic covers or a spare M24 bolt.



Protected threaded lifting pipes

- Apply the dry-fill in the void between the cartridge and the steel shell, which is supplied in bags with the general parts.
- The dry-fill must be compacted using a vibrating tool, mallet or a piece of wood on the exterior of the steel shell.
- Pour the dry-fill (refractory sand) until it is leveled with the cartridge insulation boards.

g) Make sure that the areas in where the steel angle sill plates need to be installed are cleared.



Dry-fill and cartridge in steel shell with dry-fill poured to proper level and threaded holes cover w/ duct-tape

14) Install the steel angle sill plates using the bolts back in their original locations between the steel shell and the cartridge.

Note: If the bolts were sheared off during the disassembly, it may be necessary to re-tap, re-drill or weld nuts on the bottom of each piece of the steel angle sill plates.



Cartridge in steel shell with sand poured and angle plates installed



Steel angle sill plates should be flush with the steel shell perimeter

- 15) After verifying the cartridge and the steel angle sill plates installed on previous step are leveled, mix and pour refractory around the perimeter of the cartridge.
 - C) Use the same dry fill material used to fill the voids. Add Apr. 20% (max) water to have a less viscos refractory cement for easier application.
 - D) Verify a level surface exists after the pour.
- 16) After the poured refractory completely dried apply 2 layers of boron nitride coating (1 hour in between) to the perimeter of the cartridge and allow it to dry completely.
- 17) Install the drain plug and "T" handle assembly. Confirm there is a ceramic cone installed on the end of the cast iron cone. Verify the cone is properly tightened to ensure a good seal.
- 18) Re-install and level the cover. Refer to SNIF® System Manual section 3.
- 19) Preheat the SNIF® System according to OMP-6135 for immersion systems.

References:

SNIF® Operating Manual
General Assembly Drawing
Furnace Shell Assembly Drawing

Accountability

Plant personnel.
SNIF® personnel.

OMP #: 6135

Approved Date: 6/3/2020

Approved By: Ozgur Cakmak

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Procedure for Preheating SNIF Immersion Heated Furnaces

Purpose

This procedure is designed to instruct our customer on how to safely preheat SNIF[®] immersion heated furnaces.

Scope

This procedure applies to all SNIF[®] units equipped with immersion heaters and is required to preheat a new or existing SNIF[®] furnace from ambient to operating temperature.

Definition:

This procedure must be followed to minimize the risk of a metal explosion or damage to the castable refractory. This procedure applies ONLY for those SNIF[®] furnaces, which have been cured at a Pyrotek manufacturing facility. The HMI controlled pre-heating process should comply with the preheat schedule in the following page of this procedure.

Policies

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Procedure:

- 1) Position the furnace in the final position and connect all electrical cables required for preheat. (Refer to the installation section of the SNIF[®] Operating Manual for further details.)
- 2) Check the cover gasket sealing for integrity. If there are gaps, seal them with a ceramic blanket. Close the inlet and outlet ports with rolled-up ceramic blanket plugs. Close the cover exhaust vent with a ceramic blanket plug and check the side drain is sealed and tighten.
- 3) Add a bag of charcoal in each chamber. This charcoal will act as an graphite oxidation inhibitor.
- 4) Assemble and install the spinning nozzle(s) (refer to the SNIF[®] Operating Manual).
Note: Be sure to install one ceramic paper gasket under each plug plate (P.N. 979990), and then proceed to tighten down on them with the jack down bolts.
- 5) Connect gas hoses to the nozzles and adjust IDLE gas flow on 1.0 Nm³/h on each nozzle.
- 6) On the HMI panel, select "PREHEAT MODE MENU". There are 2 heating alternatives - Manual preheat mode and Automatic preheat mode (preferably).
- 7) When selecting Manual preheat mode and pressing the "START MANUAL PREHEAT" button, the operator can independently set Element Setpoint (SP) (refer to the chart below).
- 8) When automatic mode (preferred method) is selected and pressing the "START AUTO PREHEAT" button, the PLC controller automatically proceeds with preheating according to the preset program.
- 9) At the end of preheat cycle (the actual bath temperature should have reached Apr. 700°C (1300°F)), click on the HMI panel "STOP PREHEAT" and then you can start filling the unit with metal. In this case, the finished alloy should already be in the holder and the time between the end of preheat and filling the unit should be minimal.
- 10) Turn the idle gases down to the normal settings (from 1.0 Nm³/h to 0.5 Nm³/h).
- 11) On the HMI panel, press the "PRESS TO SET EMPTY MODE" button and wait for the actual element temperature (PV) to decrease and is approximately equal to the element temperature Setpoint (SP).
- 12) Proceed to fill the unit in a controlled manner with metal at or within 20°F or 10°C of the actual bath temperature.
- 13) During filling, observe through the airlocks openings and check for IDLE gas present at the nozzle (bubbling of the gas around the nozzles when it's covered by molten metal).
- 14) On the HMI panel, press the "PRESS TO SET NORMAL HEATING MODE" button and check the BATH temperature setpoint.

SNIF PREHEAT For PLC controllers	HOUR	Element Temperature						Bath Temperature
		SP (C) (F)		PV1	PV2	PV3	PV4	PV
08:00 AM	0	400	752					
09:00	1							
10:00	2							
11:00	3							
12:00	4							
13:00	5	600	1112					
14:00	6							
15:00	7							
16:00	8							
17:00	9							
18:00	10	720	1328					
19:00	11							
20:00	11							
21:00	12							
22:00	13							
23:00	14							
00:00	15	840	1544					
01:00 AM	16							
02:00	17							
03:00	18							
04:00	19							
05:00	20	960	1760					
06:00	20							
07:00	21							
08:00	22							
09:00	23							
10:00	24	1050	1922					
11:00	25							
12:00	26							
13:00	27							
14:00	28							
15:00	29							
16:00	30							
17:00	31							
18:00	SNIF can be filled any time. Sooner would minimize the risk of oxidation of the Nozzles. Please wait for SNIF FE to fill SNIF							

Warning

- If at any time there is steam exiting the SNIF® furnace during preheat, preheat should be paused at those setpoints until the steam diminishes. Do not increase the set points or fill the SNIF® furnace, while there is still steam escaping. Failing in doing so, could cause a violent breakup of the refractory, and also a metal explosion.

Note: During preheat it's not unusual that some fumes or off-gassing from the insulation boards may occur. There is no reason to pause preheat or filling the SNIF® furnace if moisture is not present.

- To avoid equipment damage, do NOT fill the SNIF® furnace with actual element temperatures of more than 200°C differential temperature (DT) than metal temperature.

Accountability: Pyrotek-SNIF® Field Engineering and customer Maintenance and Operations personnel.

References : The SNIF® Operating Manual.

OMP #: 6138
Approved Date: 7/17/2020
Approved By: Mike Klepacki
Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Maintenance Schedule for SNIF Units

Purpose:

This procedure describes the recommended maintenance schedule for SNIF[®] degassers.

Scope:

This procedure applies to all SNIF[®] Degassers.

Definition:

This procedure spells out maintenance topics and frequencies for each. It is important to gather critical maintenance activities around scheduled and planned maintenance shutdowns.

Policies:

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DIFFERENT LEVEL OR PERIOD MAINTENANCE

- 1- **DAILY**
- 2- **WEEKLY**
- 3- **MONTHLY**
- 4- **SIX MONTHS**
- 5- **ANNUALLY**
- 6- **EVERY THREE YEARS**

During each Nozzle Change

- Check process gas lines and fittings for leaks. When hose is disconnected there should be no idle gas flow. **Refer to OMP-6203 for detailed information.**
- Check bearing package seals, bearing rotation and "O" rings.
- Record the nozzle failure including date and time, possible reason and position in unit.

Assembling a new Nozzle

- Check bearing package seals, bearing rotation and replace "O" rings.
- Check Inconel Shaft and Shur-Lok Bell for physical damages.
- Refer to Section 7 in System Manual.

Before Each Cast (Non continuous casters) (Each shift for continuous casters)

- Clean dross from airlocks and inspect (Cover does not need to be raised to do this)
- Verify cover seal (Inspect Gasket around cover edges for gaps or holes)
- Check for active alarms and alarm history on SNIF® HMI indicating **broken nozzle** or other problems

Daily

- Clean all cover gas ports (if present) and cover exhaust vent with steel rod
- Check the process parameters during cast if they are set in place as expected
- Clean SNIF® airlocks while unit is hot, (immediately after casting is good time)

Weekly

- Clean interior of SNIF unit
Clean cover, walls, and
Scrape the Heater Block face (if applicable)
For immersion units the Sialon protection tubes must be scraped clean
Skim dross. This may be performed more often as required
Check the status of refractory and others.
- Inspect nozzle(s) with cover raised
Verify the nozzle is NOT broken or wobbling by touching the stator with a cleaning tool.
(do not hit)
Visually verify gap between rotor and stator exists (1.6mm)
Confirm rotor vanes in good condition
Confirm the idle gas is bubbling around nozzle when graphite rotor is submerged.

Monthly

- Lubricate the pulleys pivot points on chain drive mast units.
- Lubricate the Tilt pivot points.
- For Rotating Covers lubricate the slewing ring bearing should have one shot of standard grease, inspect rotation limit switches for correct position and operation.
- Inspect and lubricate spring-loaded safety latch system on mast cover-lifter (Only necessary for non-rotating cover-lift style units)
- Check hydraulic fluid level and condition in tank or power-pack
- Check condition of hydraulic lines looking for cracks or leaks.
- Check for leaks on gear reducers for nozzles (if applicable)
- Remove air filters on panel doors with plant air.
- Inspect the cover gasket and replace if needed.
- Inspect the airlock for cracks/damage and replace if needed.
- Inspect the thermocouple protection tube and replace if needed.

Every six (6) months

- Clean the heater block with metal still in the SNIF, to improve heat transfer (As necessary). Refer to OMP-6131 for details.
- Check oil level of gear reducer(s). Refer to OMP-6123 for details. (Gear Reducer Nozzles Only)
- Grease bearings of gear reducer(s) and AC motor(s) with No.2 grease. Refer to OMP-6123 for details and lubrication points. (Gear Reducer Nozzles Only)
- For tilting and/or rotating units, lubricate pivot points on SNIF units at lubrication fittings.
*Lubricate the tilting unit pivot points every 200 cycles or every 6 months, whichever occurs first.
- On Heater Block style SNIF® units Remove and inspect the heater protection tubes, replace if showing signs of bulging.
- Replace the cover gasket.

Annually (Every 12 months)

- Inspect the bearing packages carefully and replace or rebuild as necessary. Refer to the spinning nozzle section of the SNIF System manual (Section 7) and drawings for bearing package information. (This should be tracked and documented while doing Nozzle exchanges/rebuilds.)
- Remove and inspect the HEATER BLOCK (if equipped) heater protection tubes, replace any tubes, which show any signs of deformation or damage. (Plan on replacing all heater tubes)
*Note: If the heater tubes are re-used, they must be re-inspected every 6 months. **Note: Since heating elements last from 12 to 18 months, a good practice is to remove the protection tubes for inspection and possible replacement when elements fail. This pertains to HEATER BLOCK units ONLY!***
- Remove mass flow meters/controllers (if so equipped) for annual calibration.
- Clean gas panel internal filters on gas supply lines. (It is good practice to have spare sealing rings and cartridge filters on hand in case one is damaged.)
- Check if all alarms are still fully functional (warning light and alarm horn).
- During annual shutdown perform a cold cleaning of SNIF®, check and note all refractory conditions. When back up to operating temps do a thermal scan of steel shell looking for hotspots.
- Check and measure Inconel Shaft alignment.
- Check the Steelbody.
- Replace the bath Thermocouple protection tube and its gaskets.
- Replace the hydraulic oil (or every 1000 operating hrs)

Every Three years

- Replace the Inconel Shaft
- Replace the Steel body if needed.
- Consider replacing refractory cartridge.
- Consider rebuilding the cover refractory.

NOTE: Average life expectancy of SNIF® refractory is 3-5 years with proper maintenance. Please track refractory condition and prepare accordingly. By keeping good records, you can plan your maintenance and reduce unplanned maintenance and emergencies.

Refractory issues if left unresolved can lead to further damage including steel frame deformation or even metal leaks.

	DAILY	WEEKLY	MONTHLY	SIX MONTHS	ANNUALLY	EVERY THREE YEARS
ALL SNIF® Degassers						
Check alarm history screens for recent alarms. Take required actions if not repaired already.	O					
Clean cover exhaust pipe.	O					
Clean inlet and outlet airlocks while hot.	O					
Clean inside cover (As needed)		O				
Clean walls, baffle plates (As needed)		O				
Clean Sialon tube (remove dross) (As needed)		O				
Skim Dross (As needed)		O				
Inspect nozzles		O				
Lube Chain drives (dry graphite)			O			
Check hydraulic unit for leaks repair and top off as needed			O			
Inspect the cover gasket			O			
Inspect the airlocks			O			
Inspect the thermocouple protection tube			O			
Inspect hydraulic hoses			O			
Inspect safety latch, lube and repair as needed			O			
Remove and clean panel air filters			O			
Lube all lube points (grease fittings)				O		
Grease bearings on motors and/or gearboxes				O		
Check oil level in gearboxes (if applicable)				O		
Replace the cover gasket				O		
Inspect and rebuild nozzle bearing pkgs as needed					O	
Clean and inspect all inline gas filters					O	
Remove mass flow meters/controllers for calibration					O	
Check and measure Inconel Shaft alignment					O	
Check the Steelbody					O	
Replace the Thermocouple protection tube and gaskets					O	
Replace the hydraulic oil (or every 1000 operating hrs)					O	
During extended outage/annually COLD clean inside of SNIF® and inspect refractory					O	
Replace the Inconel Shaft						O
Replace the Steel body if needed						O
Consider replacing refractory cartridge						O
Consider rebuilding the cover refractory						O
Heater Block Units						
Check gas flows settings for cover gas and HB gas		O				
Scrape HB face when full of metal		O		O		
Remove and inspect element protection tubes				O		
Tilting Systems						
Inspect and lube COVER/SNIF® furnace safety systems		O				
Lube pivot points at 6 months or 200 cycles				O		
Rotating Covers						
Inspect Hydraulic Motor and Brake hoses		O				
Lube slewing ring bearing			O			
Inspect rotation limit switches			O			

OMP #: 6139

Approved Date: 7/17/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

SNIF Cleaning and Dross Removal Procedure - 1-Piece Cover Lift Units

Purpose: To provide an efficient and safe procedure to clean and remove dross the SNIF[®] furnace and to have it perform up to its optimum operating potential.

Scope: This procedure applies to SNIF[®] units with 1-piece cover-lifts. (Rotating & Non-Rotating)

Definition: The procedure will enhance the SNIF[®] refining and performance capabilities and help make the highest quality metal.

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Procedure:

- 1) This operation should be conducted immediately after a cast to facilitate easier cleaning while.
- 2) Preheat and precoat the cleaning tools.
- 3) Be sure to wear the proper Molten Metal PPE (Personal Protective Equipment) before operating this mechanism.
- 4) Check the surrounding area to be sure area is clear and all obstacles away from the furnace before operating the cover.

- 5) Press the UP button until the cover is about one foot (30 cm) off the sill of the SNIF unit. For non-rotating units, refer to **OMP-6097, Operating Procedure for the Cover Lifting Mechanism**. For rotating units, refer to **OMP-6150, Operating Procedure for SNIF Rotating Lift Cover Assembly** for details. For Tall-Mast style units (TD style units), refer to **OMP-6162, Tall Lift-Mast Operating Procedure for Tilting Units**.
- 6) Use the scraper tool to remove metal splash build up from the cover. Excessive cover buildup can be due to metal freezing to the cover. This usually occurs from operating at low temperatures and a large distance from the metal operating level to the cover interface. Micro-spray from the argon bubble freezes to the cover. The most appropriate time to remove this build up is right after a cast has finished when it is the hottest. Be careful not to damage the fragile nozzles, the bath thermocouple on the cover and on immersion-heated units, the heater protection tubes.
- 7) Raise the cover to its full height. On rotating units, the cover may be rotated to allow easier access for cleaning.
Note: The bath low temperature alarm may sound because the bath thermocouple is out of the metal. Press the alarm silence button on the furnace control panel and continue with this operation. (Some PLC units will disable this alarm when the cover is up)
- 8) For **IMMERSION** systems; use the scraper tool to remove metal build up from the Sialon protection tubes. The supplied "V" shaped cleaning tool (part #2194950) can be effective if used every time when cover is raised for dross removal. Care must be taken to avoid striking the tube during the cleaning operation. Otherwise, build up on the outside of the tube especially at the metal level will retard heat transfer to the bath.
- 9) Skim the dross off the surface of the molten aluminum per normal plant procedure.
*On airlock units, clean the inlet and outlet airlocks of excessive buildup on the inside. Be careful not to damage the airlock refractory. If the airlock is damaged, it should be replaced to ensure an inert atmosphere inside the SNIF is maintained. Refer to **OMP-6047, Installation of the Trough Airlock**, for instructions on replacing the airlock
- 10) Make sure your hands are clear and there are no obstacles on the furnace. Press the down button to lower the cover. Once the cover is lowered give some time for the bath thermocouple and metal temperature to equilibrate.
- 11) Do not run the nozzles at Idle or Process Speed until they have been setting in the metal for approximately 5 minutes. You will risk breaking the shaft and rotor due to the metal being solidified between the shaft and rotor and the shaft. Remember to Restart the nozzles after five minutes.
- 12) On SOME immersion-heated systems, an action may be necessary at the HMI to release the temperature settings from a cover-up or ready-to-fill setting. (This is done to prevent thermal shock upon filling).

Note: If temperature recovery problems are experienced, the heating system may require cleaning.:
For heater block units: **Refer to OMP-6131, Procedure for Cleaning the Graphite Block on Heated SNIF® Units for recommendations.**

For Immersion tube heated systems: **Oxide build up on the tubes can be removed carefully using a metal or wooded scraper at a 45 deg. angle to the surface.**

Note: If dross accumulations require frequent cleaning, follow the dross reduction recommendations in **OMP-6096, Dross Reduction Procedure with a 1 Piece Cover Lifter / Airlock Units** to reduce the dross accumulation. Excessive dross buildup is an indication there is too much oxygen infiltration into the furnace headspace.

Note: These procedures should be performed with the appropriate tools supplied by Pyrotek. They include:

1. Rake / Bent Sweeper P/N-2189315.
2. Skimmer Spoon P/N-2174331.
3. Scraper P/N-2194950

Accountability:

Operations and Maintenance Plant Personnel

References:

The SNIF® Operating Manual
OMP-6047, Installation of the Trough Airlock
OMP-6096, Dross Reduction Procedure with a 1 Piece Cover Lifter / Airlock Units
OMP-6097, Operating Procedure for the Cover Lifting Mechanism
OMP-6131, Procedure for Cleaning the Graphite Block on Heated SNIF® Units
OMP-6150, Operating Procedure for SNIF Rotating Lift Cover Assembly
OMP-6162, Tall Lift-Mast Operating Procedure for Tilting Units.

OMP #: 6149

Approved Date: 7/10/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Recovering and Cleaning Sialon Immersion Heater Tube

Purpose:

This procedure is designed to instruct our customer on how to recover and clean a Sialon immersion heater tube.

Scope:

This procedure applies to all SNIF[®] systems, which have Sialon immersion heater tubes.

Definition:

This procedure is performed in the event of recovering and cleaning a Sialon immersion heater tube.

Policies:

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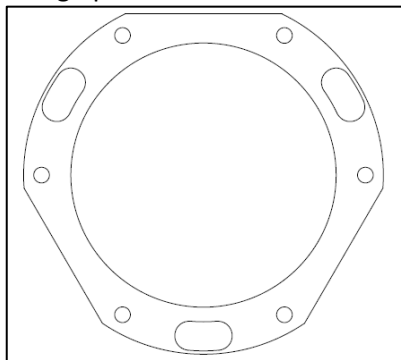
Procedure:

If it is desirable to re-use a Sialon immersion heater tube it can be recovered and cleaned before it can be utilized again.

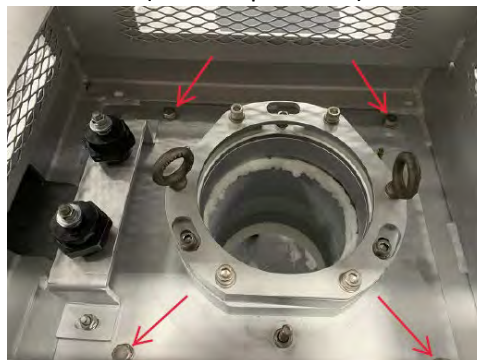
1) Recommended Tools & Equipment:

- (Pneumatic) Hammers / (Pneumatic) Chisels / Pry bar;
- Waste bin;
- Vacuum cleaner;
- Suitable (plastic) container to receive hydrochloric acid or caustic soda;
- Hydrochloric acid or caustic soda (concentration Apr. 10% in both cases).

- 2) Prior to recovering a Sialon immersion heater tube:
 - a) Verify that the SiC (Silicon Carbide) heating element assembly and thermocouple are removed from the Sialon immersion heater tube.
 - b) Verify that the retainer plate is removed (refer to picture 1) from the mounting flange and that both the element mounting plate and the mounting flange are loose (refer to picture 2).
 - c) Verify that the cover is removed from the SNIF[®] furnace and is placed on the floor in a suitable area resting upside down on the cover's nozzle stand (refer to picture 3).



Pic.1 Retainer Plate



Pic.2 Element Mounting Plate and Mounting Flange

Note: Proper care should be taken when positioning the cover upside down with the help of an overhead crane or similar as the Sialon immersion heater tubes are protruding and can be easily damaged.



Pic.3 Cover upside down resting on nozzle stand



Pic.4 Remove build-up using pneumatic chisel

- 3) Start removing the build-up which accumulated overtime around the Sialon immersion heater tube using a little pneumatic chisel (refer to picture 4). The build-up on the Sialon immersion heater tube itself can easily be removed as Sialon is a non-wetting material.

Note: Proper care should be taken when using (pneumatic) chisels around the Sialon immersion heater tube. It is not advisable to apply a (pneumatic chisel) directly on the Sialon immersion heater tube.

- 4) The build-up on the ceiling of the cover is hard to remove. It is however possible to get underneath the very hard pieces with a little pneumatic chisel and then take them out (little) piece by (little) piece (refer to picture 5).

Note: The insulation kit material could partly be transformed into a very hard material, almost like corundum as it was exposed to aluminum-oxide (Al_2O_3) and high temperatures ($>1000^\circ\text{C}$).



Pic.5 Sialon tubes loose



Pic.6 Sialon tubes removed from cover

- 5) When the Sialon immersion heater tube is removed from the cover, both the element mounting plate and the mounting flange are still in place (refer to picture 6) as it's not possible to remove them yet due to remaining build-up on the Sialon immersion heater tube.
- 6) Fill a suitable (plastic) container with either hydrochloric acid or caustic soda with a concentration Apr. 10% in both cases. This (plastic) container should be deep enough to submerge the affected area of the Sialon immersion heater tube (refer to picture 7).
- 7) Submerge and soak the Sialon immersion heater tube overnight (Apr. 18 hours). This treatment should be repeated if not all of the remaining build-up has been removed. If the element mounting plate can be removed from the Sialon immersion heater tube, it should be clean enough.
Note: It will not be possible to regain / restore the smooth outer surface of the affected area of the Sialon immersion heater tube as can be witnessed on a brand-new Sialon immersion heater tube or the upper portion of the cleaned Sialon immersion heater tube (refer to picture 9). It is important that the build-up is removed, and that heat can radiate to the aluminum bath without any obstruction (refer to picture10).
- 8) Air-dry the Sialon immersion heater tube for Apr. 24-48 hours (refer to picture 8). In addition, preheat the Sialon immersion heater tube for another Apr. 24-48 hours at Apr. 125°C ($\pm 25^\circ\text{C}$).



Pic.7 Container



Pic.8 Sialon tubes after treatment

- 9) Apply a Boron-Nitride coating(s) before putting the Sialon immersion heater tube into service.
- 10) Refer to OMP-6115 for assembly and installation of the Sialon immersion heater tube and heating element assembly.



Pic.9 Sialon tube (inside)



Pic.10 Rough but clean surface

Accountabilities

Customer Maintenance Personnel.
SNIF® Personnel.

References

The SNIF® Operating Manual.

OMP #: 6157

Approved Date: 7/31/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Replacement of Dual Bulb Cover Gasket

Purpose: Dual bulb cover gasket replacement procedure.

Scope: All SNIF lift covers with replaceable gaskets.

Definition:

This gasket was developed to keep air from entering into the SNIF[®] Furnace and reducing the oxidation of the graphite components. Gasket can be replaced periodically or when they are damaged.

Policies:

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Procedure:

Safety Note:

During the replacement, the dual bulb cover gasket, the bolts used for fixing and the steel profile might be extremely hot. Wear all your personal protections, incl, heavy gloves, protection glasses etc. Be sure to wear the proper Molten Metal PPE (Personal Protective Equipment) before operating. Check the surrounding area to be sure area is clear and all obstacles away from the furnace before operating the cover.

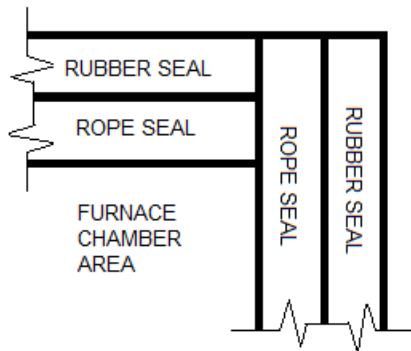
- 1) Loosen the bolts holding the gasket in place.
- 2) Raise the cover 10-15 inches (250 – 400mm) Do
- 3) Open the hatches (refer to Picture 1) cut and remove the silicon sealant at the corners and remove the old gasket.



Picture 1. Gasket hatch

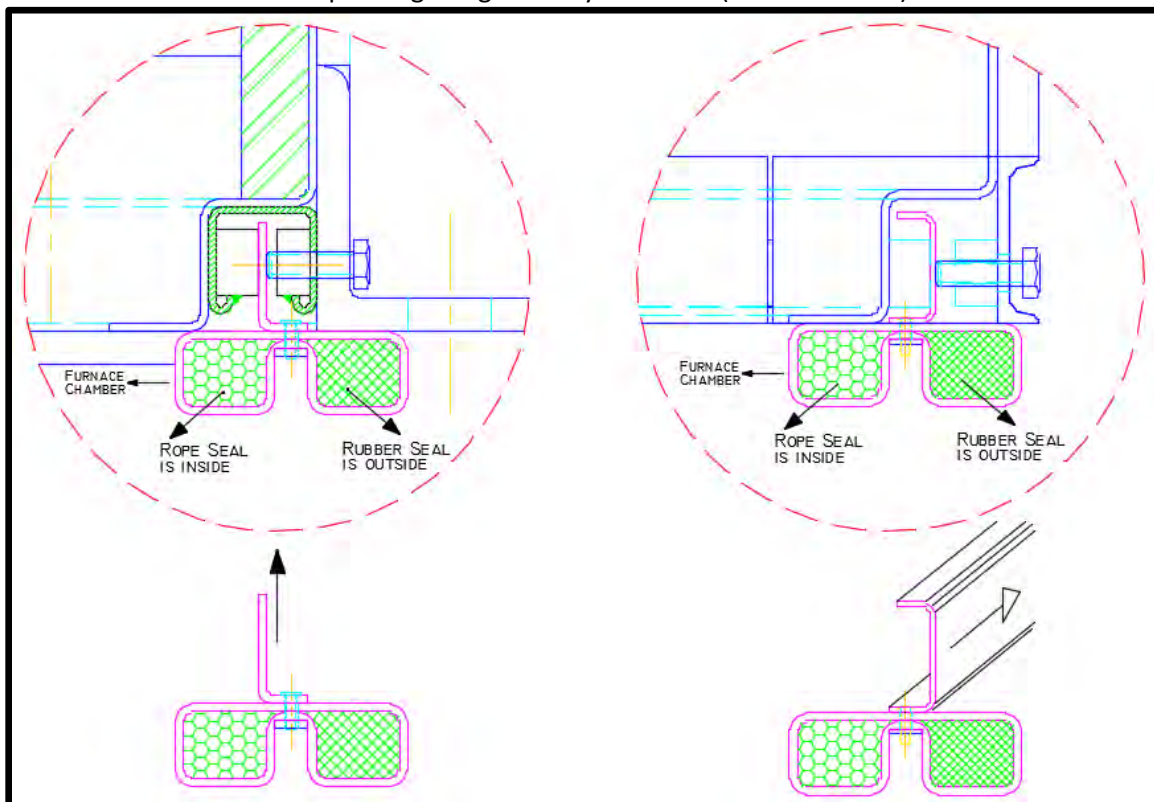
- 4) Replace the bolts, and repair the threads if they are damaged when removing the old gasket.

- 5) Check the channels to see if they are clean and free from any kind of debris .
- 6) New gasket comes as 4 prefabricated sections. Make sure that the gasket orientation is arranged as shown in the Picture 2.



Picture 2. Inner and outer bulb location

- 7) Install the new gasket in place ;
 - either from the bottom
 - or from the sides depending the gasket style in hand (refer Picture 3).



Picture 3. Gasket styles

- 8) While placing the gaskets take attention to position the “Rope Side” towards to the furnace side, and the “Rubber Side” to outside of the cover. Otherwise, the operation life of the gasket would be extremely short.

For HB systems or Dual covers, The Dual Bulb, should have two “Rope Seals” on both sides, must be used;

- a. either at rear side (heater block side),
- b. or in between covers (for dual cover systems)
- 9) Adjust each section to be in the center with equal gaps on both ends.
- 10) Lower the cover completely sit on the furnace sill , and have the gasket sections compressed in between.
- 11) Tighten the securing bolts.
- 12) Raise the cover 10-15 inches (250 – 400mm)
- a. Clean the gaskets joints with compressed air.
- b. Apply high temperature RTV sealant into the joint by inserting the nozzle to fill all the gaps in between two sections. (Refer to Picture 4)
- c. Repeat the same for all four corners.



Picture 4. RTV sealant application

- 13) Close the hatches and lower the cover.

Accountability:

Casthouse Personnel

References:

SNIF Operating Manual

OMP #: 6163

Approved Date: 8/18/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Suspending an Empty SNIF furnace From Production

Purpose:

This procedure describes the safest and most practical way to:

- 1) Prepare the SNIF furnace for a relining.
- 2) Prepare the SNIF furnace for long-term cold storage.
- 3) Prepare the SNIF furnace for short-term hot storage.

Scope:

This procedure applies to all SNIF systems.

Definition:

This procedure can be used when the SNIF furnace will be suspended from production for an extended downtime.

Policies:

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PYROTEK is not responsible for the misuse or misinterpretation of the information presented herein. Under no circumstances shall PYROTEK be liable or responsible for any actions taken or omissions made by non-PYROTEK staff while performing this operation. It is the Plant's responsibility to ensure all safety policies and procedures are carried out while executing the steps of this procedure.

Procedure:

This procedure describes how to:

- A) Prepare the SNIF furnace for a reline;
- B) Prepare the SNIF furnace for long-term cold storage or relocation to another casting station;
- C) Prepare the SNIF furnace for short-term hot storage.

For draining the SNIF furnace refer to OMP-6109 (Immersion System Draining Procedure) or OMP-6009 (Heater Block (HB) System Draining Procedure).

A) Preparing the SNIF furnace for a reline.

1. Drain the SNIF furnace according to OMP-6109 (Immersion System Draining Procedure) or OMP-6009 (Heater Block (HB) System Draining Procedure).
2. If the nozzle(s) and/or bath thermocouple assembly are to be re-used, they must be removed and stored (refer to Section 7 Removing a nozzle).
3. Proceed to cool down the SNIF furnace. Since the SNIF furnace will never be used again the power to the heating system can be a.) switched off or b.) the bath temperature setpoint should be lowered to ambient temperature if temperature monitoring is necessary.
Note: To speed up cooling down the SNIF furnace for a reline the cover can be left open or the cover can already be removed.
4. Whenever the SNIF furnace has been cooled down refer to OMP-6068 (Cartridge Removal and Installation Procedure for HB systems) or OMP-6132 (Cartridge Removal and Installation Procedure for immersion systems) for further instructions on how to remove and install a new cartridge.

B) Preparing the SNIF furnace for long-term cold storage or relocation to another casting station.

- 1) Drain the SNIF furnace according to OMP-6109 (Immersion System Draining Procedure) or OMP-6009 (Heater Block (HB) System Draining Procedure).
- 2) Double check that both inlet and outlet trough ports are closed / sealed with multiple layers of ceramic blanket and the cover is closed and sealed as per OMP-6109 or OMP-6009.
- 3) The nozzle(s) and/or bath thermocouple assembly can be kept installed if these do not have to be removed. If the nozzle(s) are removed, install the plug plates with ceramic gasket and connect the nozzle's gas hose to each plug plate.
- 4) For heater block (HB) systems its recommended to add a bag of charcoal in each chamber to minimize the risk of oxidizing the graphite components. The charcoal is acting as an oxidation inhibitor. The cover should be opened to add this charcoal and should be closed as soon as this is completed. If the nozzle(s) have been removed the charcoal can be added through the nozzle well(s).
- 5) Proceed to cool down the SNIF furnace. Since the SNIF furnace will be in long-term storage or relocation to another casting station the bath temperature setpoint should be lowered to ambient temperature and the actual temperature(s) should be monitored until cooling down is completed.
Note: It is not recommendable speeding up the cooling of the SNIF furnace. When the SNIF furnace is cooled down too fast all refractory materials like furnace lining, airlocks and SHEER ribs could develop cracks. The cover must be kept closed and idle gas and cover gas (if applicable) must be kept on for as long as the actual bath temperature $\geq 450^{\circ}\text{C}$ (or $\geq 840^{\circ}\text{F}$). Graphite components like heater block, nozzles and bath thermocouple protection tube will not oxidize when the bath temperature is $\leq 450^{\circ}\text{C}$ (or $\leq 840^{\circ}\text{F}$).

- 6) Once the actual bath temperature drops $\leq 450^{\circ}\text{C}$ ($\leq 840^{\circ}\text{F}$) the power can be switched off as well as the idle gas and cover gas (if applicable).
 - 7) When the SNIF furnace is not going to be moved and stays at the casting station location:
 - a) Cover the entire SNIF system with a piece of (plastic) tarp to protect it from dust and/or moisture.
 - b) The SNIF system is now in “mothballs” and should remain like this until it’s needed again.
 - 8) When the SNIF furnace is going to be moved either to storage or to another casting station location:
 - a) Disconnect all gas hoses, all electrical connections and thermocouple connections.
 - b) Disconnect the inlet and outlet troughing connections as well as the drain trough connection (if applicable).
 - c) If the cover lifter is going to be moved as well disconnect the extension arm from the cover lifter’s carriage and disconnect the cover lifter from the anchor stems.
 - 9) For storage:
 - a) The SNIF furnace / system should be kept in a warm and dry area.
 - b) Wrap the entire SNIF system in a plastic tarp to protect it from dust and moisture.
 - c) The SNIF system is now in “mothballs” and should remain like this until it’s needed again.
 - 10) For relocation to another casting station:
 - a) Move the SNIF furnace / system to another casting station.
 - b) If the cover lifter was also moved it needs to be secured to the cast house’s floor and reconnect the extension arm to the cover lifter’s carriage (if applicable).
 - c) Reconnect the inlet and outlet trough connections as well as the drain trough connection (if applicable).
 - d) Reconnect all gas hoses, all electrical connections and thermocouple connections.
 - e) Start preheating the SNIF furnace (refer to the proper preheat schedule).
- C) Prepare the SNIF furnace for short-term “hot” storage. This short-term “hot” storage should not be longer than one (1) week. If the SNIF furnace is suspended longer than one (1) week its recommended to cool it down as per step B).
- 1) Drain the SNIF furnace according to OMP-6109 (Immersion System Draining Procedure) or OMP-6009 (Heater Block (HB) System Draining Procedure).
 - 2) Double check that both inlet and outlet trough ports are closed / sealed with multiple layers of ceramic blanket and the cover is closed and sealed as per OMP-6109 or OMP-6009.
 - 3) The nozzle(s) can be kept installed if these do not have to be removed. If the nozzle(s) are removed, install the plug plates with ceramic gasket and connect the nozzle’s gas hose to each plug plate.
 - 4) For heater block (HB) systems its recommended to add a bag of charcoal in each chamber to minimize the risk of oxidizing the graphite components. The charcoal is acting as an oxidation inhibitor. The cover should be opened to add this charcoal and should be closed as soon as this is completed. If the nozzle(s) have been removed the charcoal can be added through the

nozzle well(s).

- 5) Proceed to cool down the SNIF furnace. Since the SNIF furnace will be in short-term “hot” storage the bath temperature setpoint should be lowered to Apr. 425°C (or Apr. 800°F).
Note: Graphite components like heater block (if applicable), nozzles and bath thermocouple protection tube will not start oxidizing when the bath temperature is $\leq 450^{\circ}\text{C}$ (or $\leq 840^{\circ}\text{F}$). In addition, all refractory materials like furnace lining, airlocks and SHEER ribs will not be subject to unnecessary wear (hot-cold-hot).
- 6) When the SNIF furnace is going back in service:
 - a) Start preheating the SNIF furnace.
 - b) Back install the nozzle(s) if they were removed.
 - c) Once the preheat is complete fill the SNIF furnace with molten metal.

Accountabilities:

Plant Maintenance Personnel
SNIF Field Engineering
Personnel

References:

SNIF Operating Manual
Customer Maintenance and Operating Procedures

OMP #: 6177
Approved Date: 7/15/2020
Approved By: Mike Klepacki
Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Guidelines to Trouble Shoot Immersion Heating Systems (SiC Models)

Purpose

This procedure is designed to instruct our customer on how to troubleshoot the heating system.

Scope

This procedure applies to all SNIF[®] units equipped with immersion heater(s) and SiC heating element(s).

Definition:

In the event that the heating system does not seem to be dissipating power and/or is not working properly, or premature Heating Elements Failures are experienced.

Policies

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Procedure: Refer to the SNIF® Operating Manual for installation and/or vendor literature details before troubleshooting the heating system.

Recommended Tools & Equipment for this procedure.

- True RMS (Root Mean Square) Clip-on Amp meter;
- True RMS (Root Mean Square) Multi meter (preferably with clip-on current transformer).

1- SLOW HEAT-UP RATE



A brand-new Sialon tube equipped with new heating elements should provide 20C/hr heat up rate. This rate may decrease in time due to reasons described below.

CAUSE	SOLUTION
Build up 	<ul style="list-style-type: none"> - May cause frequent power cycles, also wider(taller) hot zone over the Sialon tube. - Carefully clean Sialon tubes from buildup. Do not use excessive force while cleaning. USE SNIF® provided cleaning tools Refer to OMP – 6149 for deep cleaning instructions.
Heating element aging	<ul style="list-style-type: none"> - Overtime the heating element resistance will change(increase). The heating element will lose efficiency and need a replacement if deviation between SP and PV reaches $\geq 50\%$. (Refer to the additional steps at the end of this document). - It is possible the element will fracture and break before reaching this threshold. - A loose braided connection (clip or bolt/nut connections) may create additional resistance which will cause SCR to regulate the power and cause reduced power dissipation at the SiC designated hot zone. These braided connections should be tight (resistance value between the braid and the top of SiC element, should be preferably 0 Ω). Total resistance of the heaters connected in series with tight braids should be less than 2.5ohms on a brand-new system.
PARAMETER INCONSISTENCIES Power vs Temperature	<ul style="list-style-type: none"> - It is possible that power generation may be limited because temperature & power feedbacks are not accurate. - Incorrect feedback from thermocouple sensor(s). <ul style="list-style-type: none"> o Check sensors connections. (loose or jumpered) o Check if polarity is correct. - Check transducer's DIP-switches configuration. - Check the maximum power had not been limited to less than 20kW in HMI screen "HEATING SYSTEM TUNING" section.
Refractory damage	<ul style="list-style-type: none"> - If the refractory is too old and with cracks it is possible undesired metal penetration behind the refractory would act heat sink. - Check the steel shell temperatures in several areas looking for hotspots.

2- SIALON TUBE FAILURES (physical damages)

CAUSE	SOLUTION
Thermal Shock The moment when Sialon Tube contacts the molten metal.	<ul style="list-style-type: none">- Sialon can only stand +/- 200C temperature tolerance. Make sure that delta T is less than 200C.- Check if cover closed limit switch is setting theater at a lower temperature.- Activate the Thermal shock mode before filling SNIF®- When replacing the Sialon Tube follow the instructions on OMP-6213.
Operators Cleaning Methods	<ul style="list-style-type: none">- Too rough cleaning can damage the Sialon tube. Do not use too much force when cleaning.- Clean the Sialon tubes on a regular basis (1 time a week) to avoid large and difficult-to-remove build ups.
Assembly	<ul style="list-style-type: none">- Installation impact.- Install the Sialon tube carefully, avoiding bumps and drops.- If Thermocouple is positioned not inside of the hot zone, heating system will be at full power all the time, which will create a thermal shock.- Assembly should be done strictly according OMP-6115.

3- HEATING ELEMENT ASSEMBLY FAILURES

CAUSE	SOLUTION
<p>Aluminum braids break and burn</p> 	<ul style="list-style-type: none"> - Loose connection will create excessive heat and may burn the braids. - After 24 hrs of first installation retighten the screws to compensate thermal extension - It is recommended to replace the whole braid set at the same time replacing the heaters. - Overtightening the bolts may break the braids (as shown)
<p>Alumina spacers</p> 	<ul style="list-style-type: none"> - Alumina spacers may fail (crack) and Support hanger may warp, if they are used multiple times. It is recommended to replace the whole set at the same time. - Spacer damaging during assembly. - Middle insulation block will drop down on the heating element's hot zone causing the heating element to fail (the heating element can't dissipate the heat) and incorrect element thermocouple reading /control.
<p>Assembly and Installation Refer to OMP-6115</p>	<ul style="list-style-type: none"> - If thermocouple extended too long, it may touch the heaters and cause a short. - Operator may overtighten the braids and damage the heater element connection point. - Assemble the heater carefully, avoiding bumps and drops of components.
<p>Operation and Maintenance</p>	<ul style="list-style-type: none"> - Dust accumulation in the heater compartment can cause a short and/or ground fault alarm. - The heater compartment needs to be cleaned regularly to avoid dust accumulation.

4-NO POWER GENERATION

CAUSE	SOLUTION
Transformer failure	<ul style="list-style-type: none"> - Check all circuit(s) connections of the transformer. - Check the primary voltage of the transformer in accordance with the main supply voltage of the shop. - Check the secondary voltage of the transformer. Refer to the electrical schematics.
Cable(s) /cable connection(s) failure	<ul style="list-style-type: none"> - Check <u>all</u> necessary cables and/or cable connections for integrity (replace if necessary). Refer to the electrical schematics.
Circuit breaker failure	<ul style="list-style-type: none"> - Check all circuit breakers and/or circuit breakers connections (replace if necessary). Refer to the electrical schematics.
SCR issues	<ul style="list-style-type: none"> - Check if the SCR works properly (replace if necessary). - First check the fuse integrity and dip switch configuration is correct - Refer to the electrical schematics and vendor literature, for further investigation
Other Components	<ul style="list-style-type: none"> - Check if other heater control components work properly and replace it necessary. <ul style="list-style-type: none"> o Ground Fault Relay o PLC Modules o T/Cs and connections, fluctuation and grounding - Refer to vendor literature

VERIFYING AGED HEATING ELEMENTS

- 1) On HMI screen verify that heater SP and PV are App. 20kW value. If the values are different needs to investigate why.
- 2) Turn off the power at SCR panel following lockout and tagout procedures.
- 3) Remove the heater's cover and insulation blocks.
- 4) Verify that all braided connections (clip or bolt/nut connections) at the SiC heating element are tight (minimum resistance value between the braid and the top of SiC element, preferably 0 Ω).
A too high resistance value at these connections will result in high power (and temperature!) dissipation at these connections ($P [W, Watt] = I^2 [A, Ampere] \cdot R [\Omega, Ohm]$) and a – consequently – lower power dissipation of the actual heating element.
- 5) To verify the actual power, the heating system should be switched on and lockouts removed and set for maximum power demand.
This can be done by:
 - **When using temperature controllers;**
 - a) Increasing the bath temperature set point (SP) to a higher value than the actual bath temperature (PV).
 - b) Switching the Element Temperature Controller to Manual mode and ramp up 100% percent output value.
 - c) verify the analog output control signal is 20mA. (*This can be done using a multi meter (set to amps or voltage)*)
 - **When using a HMI (Human Machine Interface) screen;**

- a) Increasing the bath temperature set point (SP) to a higher value than the actual bath temperature (PV).
 - b) Switching the HMI screen to Preheat mode and ramp up the element temperature(s).
 - c) *Verify that power set point is set to 20kW (refer to OMP-6152 ???and vendor literature of SCR).*
- 6) When at maximum power demand;
- a. verify the output voltage to the SiC heating element by measuring with true RMS meter
 - b. verify the output current to the SiC heating element by measuring with true RMS meter
- 7) Verify the actual power to the SiC heating elements, by calculating the actual power using the formula
($P [W, Watt] = U [V, Volt] \cdot I [A, Ampere]$)
- If calculated power is significantly less than the power demand (SP), this may be because SiC heating elements might be too old and aged. Replace the elements and repeat the same calculation.
- If numbers are still different, contact SNIF Customer Service.

Accountability

Pyrotek-SNIF® Field Engineering and customer Maintenance and Operations personnel.

References

SNIF® Operating Manual

OMP-6115 Heater Assembly Procedure

OMP #: 6203

Approved Date: 7/10/2020

Approved By: Mike Klepacki

Language: English

SNIF® Quality System

OPERATING AND MAINTENANCE PROCEDURE

SNIF Nozzle Break Trouble Shooting

Purpose:

This procedure describes the methods of investigating repeated nozzle failures on a SNIF® Degasser.

Scope:

This procedure applies to all SNIF® Degassers.

Definition:

This procedure is suggested when a nozzle graphite failure occurs immediately or after a short period of time in operation. This OMP can be also used as a guideline to understand the failure modes of a SNIF® Nozzle.

It is extremely important to **understand the root cause of a Nozzle failure before assembling and installing the new nozzle**, to prevent the repeating Nozzle Failures.

For that reason, failed nozzle should be removed from the chamber as if it is still a good shape, without causing additional damage. Otherwise, it may complicate the efforts spent in finding the root cause

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This procedure must be performed carefully in order to minimize the risk of damaging the furnace refractory and SHEER rib if so equipped. There is also the possibility of damaging the nozzle when removing it from the furnace.

Procedure:

In most cases, there are **Three Main Reasons** when nozzle graphite breaks after a short time in operation.

- **Nozzle Assembly Mistakes**
This mostly happens when there is a change in crew, or someone performs the assembly without proper training. Nozzle assembly must be completed in accordance with the SNIF® Manual Section-7.
- **Foreign Material in SNIF® furnace**
If there is foreign material (a.k.a rocks) inside SNIF® furnace, it will eventually be carried with the metal flow to the last chamber and remain there and continue breaking nozzles until it is removed.
- **Loss of Inert Gas**
 - **Loss of Supply** to SNIF® Gas Panel, may cause damages to all existing nozzles, in case auxiliary (back up) supply not active. Metal infiltration occurs if there is no supply gas (main and back-up)
 - **Line Leak** would cause metal infiltration to the corresponding nozzle.

These factors usually result in different forms of failure modes (but are not limited to); such as , breakage at the attachment point of the graphite shaft to the Inconel drive shaft, at the top of the stator connection, or in other areas

Status Survey:

SNIF® Division can assist for further investigations. Before contacting Pyrotek SNIF® engineers it is highly recommended to check the following sections and fill out the survey below.

- 1) Investigate the damaged nozzle(s) carefully;
 - a. take pictures of the damaged rotor/stator.
 - b. get the serial numbers form both components.
 - c. check HMI alarms and alarm history screen and record all critical alarms may relate to nozzle failure.
- 2) Fill out the query below; please **circle** one.
 - a. Are the part being used original and supplied by Pyrotek SNIF®? **YES** **NO**
 - b. Is the failure repeating at the same chamber? **YES** **NO**
 - c. Is the failure repeating with the same Steelbody Assembly; **YES** **NO**
 - d. About Nozzle;
 - i. Is nozzle rotation correct? **YES** **NO**
 - ii. Is the nozzle seized? **YES** **NO**
 - iii. Is IDLE bubble visible?? **YES** **NO**
 - iv. Is stator broken? **YES** **NO**
 - v. Is shaft broken? **YES** **NO**
 - vi. Is rotor damaged/ broken? **YES** **NO**
 - vii. Any vibration observed before the failure? **YES** **NO**
 - e. Data check;
 - i. Get a record of all active system alarms and previous one from Alarm History.
 - ii. Study the list to see the alarms can be related to Nozzle failure.
 - iii. Any recent program upgrades, revisions in place? **YES** **NO**
 - f. Staff;
 - i. any new crew member in charge of nozzle assembly? **YES** **NO**

ii. any new operator?

YES

NO

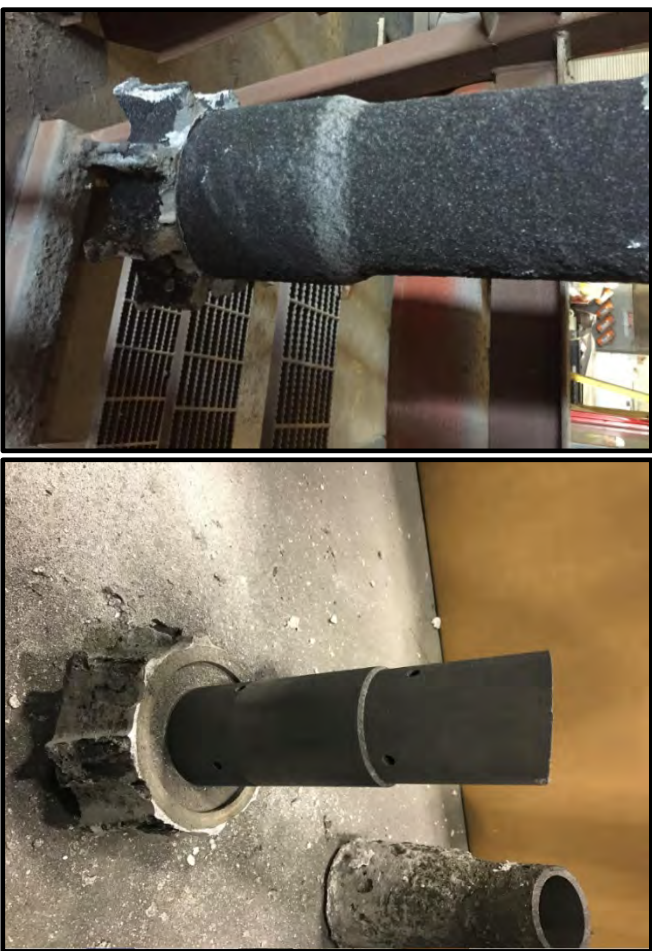
Typical Nozzle Failure Modes:

1. Nozzle Break Alarm on HMI screen

Nozzle Break Alarm is activated when there is not proper % Load feedback from the motor. During process RUN, PLC continuously monitors the load and warns the operators when a nozzle is suspected to be broken.

It is important to know if SNIF® is actively degassing during casting not to cause metal quality issues.

CAUSE	SOLUTION
1. Alarm SP may be too low	<ul style="list-style-type: none">- Check the alarm SP on HMI screen and adjust if necessary. If the alarm is real, report to maintenance to check the Nozzle at the end of the cast. !!!ALARM SP should never be permanently bypassed by setting a low SP!!!
2. Graphite Shaft might be broken	<ul style="list-style-type: none">- At the end of the cast, raise the cover and check the rotation. If rotor is broken and not spinning, replace the nozzle after root cause investigation is completed.
3. Rotor Blades might be extremely worn.	<ul style="list-style-type: none">- If rotor vanes(blades) are worn, the load will be too low and bubble shearing will be limited, which may prevent proper degassing. Report to maintenance and replace the nozzle.
4. RPM vs GAS FLOW	<ul style="list-style-type: none">- % Load feedback may be too low because;<ul style="list-style-type: none">o either rpm SP is too lowo or gas flow SP is too higho or both at the same time- correct the SP according recipe or rpm-gas flow chart. <p>The nozzle RPM and GAS flow should be adjusted accordingly within the limits as mentioned in SNIF® System Manual Section-8 to have proper degassing and eventual proper %Load feedback from the nozzle.</p>



A Rotor with Eroded Vanes

- This may trigger a Nozzle break alarm, but it will lower the degassing efficiency.
- Bad bubble distribution
- Bigger bubbles and splash

2. Nozzle Graphite Parts Broken

Graphite components of a SNIF® nozzle are; **Graphite Shaft, Rotor, and Stator.**

- Graphite Shaft and/or Stator mostly break due to a seized Nozzle causing excessive forces on graphite components. Most common failure modes are;
 - Damages, cracks or breakage on NEO® stator's SHURLOK® connection
 - breaks at the threaded joint of the graphite shaft.
 - damaged rotors,

Most common reasons are;

- Assembly Mistakes
- Solid contamination inside SNIF® furnace.
- Metal Penetration between Stator and Rotor.
- Pressure Loss
- Leaks on Process lines
- Leaks on Bearing package
 - o O'rings
 - o Nutrings
 - o Flange gasket
- Stator Oxidation

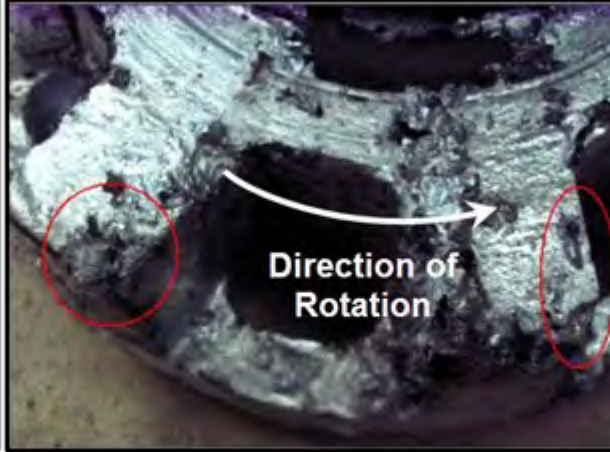
CAUSE	SOLUTION
1. Assembly Mistakes	<p>The main reason for nozzle failure is the assembly errors. Most of the time maintenance team and/or operators would not know whether the nozzle has been assembled wrong or not, and they would look for other reasons when failure been noticed.</p> <p>It is not possible to figure out after the failure, if there was an assembly mistake initially. The only way to prevent assembly errors is to build a two man-team for nozzle assembly and follow the procedures very carefully and thoroughly. A third person inspection to verify the assembly would be enough to catch the assembly errors.</p> <p>If Stator is not assembled accurately to provide gas-tight seal on top;</p> <ul style="list-style-type: none"> - Incomplete rotation - Installing in wrong direction - Incorrect pin orientation - Pins are not lined-up. <p>That may cause insufficient O’Ring compression and cause gas leak that will evolve to metal infiltration and completes Nozzle Seize.</p> <p>- The assembly instructions in Section-7 must be strictly followed for assembly accuracy.</p>

CAUSE	SOLUTION
2. Solid Substance (a.k.a Rocks)	<p>Any solid substance (rocks) heavier than the metal will sink at the bottom and will continue hitting and damaging the nozzle until it is broken. As long as rocks are not cleared from SNIF® Furnace, they would continue breaking every new nozzle.</p> <p>Most common rocks are;</p> <ul style="list-style-type: none"> o refractory pieces from Melting / Holding Furnaces o heavy inclusion settlement, and/or dross accumulation at the bottom o loose pieces from SNIF® <ul style="list-style-type: none"> ▪ refractory from cover and cartridge ▪ baffle plates ▪ ceramic T/C protection tubes ▪ Sialon heater tubes ▪ accidentally dropped objects that is denser than aluminum <p>- Perform the fishing procedure OMP-6012 and remove the rocks.</p> <p>- Draining may be necessary if rocks cannot be found.</p> <p>- Rocks from upstream troughing can be stopped entering SNIF® by using trough filters.</p>



A Rotor scrubbing on the Floor

- This may break Threaded Joint , or stator.
- May damage the the rotor blades.
- %Load values will be higher than normal.
- Vibration may occur.
- May cause VFD thermal overload fault.





Damages Caused by ROCKs

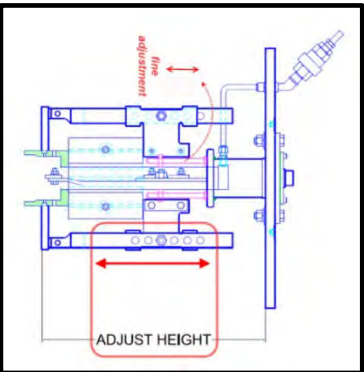
- Friction marks at the bottom of the rotor and impact marks on rotor blades and are the indications of a "rock" inside the chamber
- This will break Threaded Joint , or stator, if rocks are not removed.
- Rotor blades may get severely damaged that create vibration
- Cause short nozzle life.

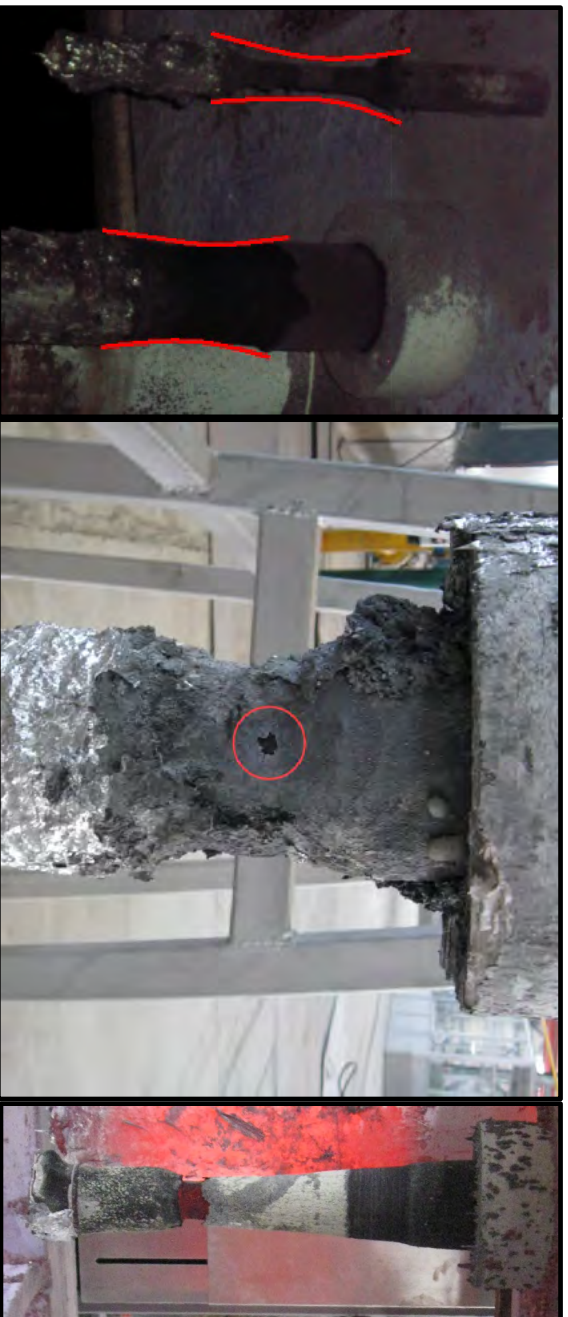


Sample Rocks inside the chamber, and a sample trough filter.



3. Graphite Shaft Broken (a.k.a. threaded joint) 	<ul style="list-style-type: none"> - This will trigger a Nozzle break alarm. - There would be no rotation. Seized Nozzle (explained seperatley) - Rotor and Graphite shaft may fall into the bath. If metal penetration is took place it may stay in place. <p>Possible reasons are</p> <ul style="list-style-type: none"> - Assembly mistake - Rocks inside the chamber - Heavy settlement over the floor. - Gas leak and metal penetration. - High % load (Rpm // gas flow mismatch) (either rpm high OR gas flot too low). - Load Hammering (Sudden Loss of Process Gas will create an instant pike on load) - Acceleration and deceleration rate of nozzle motor - Stator head is broken.(if both happens at the same time they fall inside the metal. - Bent Inconel Shaft.
4. Stator Head Broken 	<ul style="list-style-type: none"> - This will cause an increase in % load, because stator will sit on the rotor. This will grow into VFT Thermal overload alarm. - It may break the graphite shaft and rotor. - Even there is rotation on rotor, there will be no inert gas injection. <p>Possible reasons are;</p> <ul style="list-style-type: none"> - Assembly Mistake. - Rocks inside the chamber - Gas leak and metal penetration. - Harsh cleaning practice - Sudden Loss of Process Gas will create an instant pike on load which may break the graphite shaft and/or the stator
5. Excessive Load (torque)	<ul style="list-style-type: none"> - A high LOAD valuse will be shown on HMI screen. (check the load values are different from normal values or from the other nozzles) - It will trigger a VFD fault alarm. <p>Possible reasons are</p> <ul style="list-style-type: none"> - Assembly mistake - Seized Nozzle. - Heavy settlement over the floor in SNIF® furnace. - Gas leak and metal penetration. - Rpm // gas flow mismatch (either rpm high OR gas flot too low) - Acceleration and deceleration rate of nozzle motor - Stator head is broken. - Bad bearing package. - Bad bearing on Motor and gear reducer. - Dirty pipes(gas) carrying solid particles into the nozzle.
6. Mechanical Abuse	<p>Operator banging the stator or rotor while cleaning the cover. Harsh cleaning or handling may cause physical damage.</p> <p>Use caution while cleaning the cover. Observe OMP-6096, for the cleaning procedure.</p>

<p>7. Premature oxidation of the stator.</p>	<p>Graphite and will oxidize (burn) when oxygen levels reach beyond the tolerable limits of 0.5% in the furnace headspace during idle or process. It is normal to see oxidation in time, because it is impossible to create an oxygen free headspace inside SNIF®.</p> <p>When stator is oxidized to a level, it would start leaking gas and let aluminum penetrate in between stator and graphite shaft, or seize the nozzle.</p> <p>Possible reasons are</p> <ul style="list-style-type: none"> - Oxygen contact with graphite. - SNIF® kept empty too long. - SNIF® empty and not sealed. - Damaged cover gasket - Damaged airlock - Too frequent draining. - Too frequent cover raise. - Nozzle plate plug is not adjusted. <div>  </div>
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Graphite Oxidation

- Oxidation is the most common damage happens on a SNIF® graphite. It can occur very fast if the oxygen entry is not prevented.
- Glass hour look -) - indicates the oxidation is localized around the metal surface level, and took place during idle.
- More spread oxidation indicates the an empty and **HOT** SNIF® furnace.
- When oxidation reaches inside the stator, gas leak starts and metal infiltrates inside the Nozzle.

3. Nozzle Seizure

This failure mode defines a nozzle, which is physically locked up and cannot be rotated any more. There are the several reasons;

1. Metal Penetration between Stator and Shaft

- Gas Leak
 - Process Lines
 - Bearing Package
- Supply Gas Failure
- Severe Oxidation

2. Assembly Mistake

3. Bearing Package Failure

4. Motor/Gearbox Failure

5. Unified rotor&stator

Idle gas very critical to keep the Nozzle bearing surface clear from Aluminum.

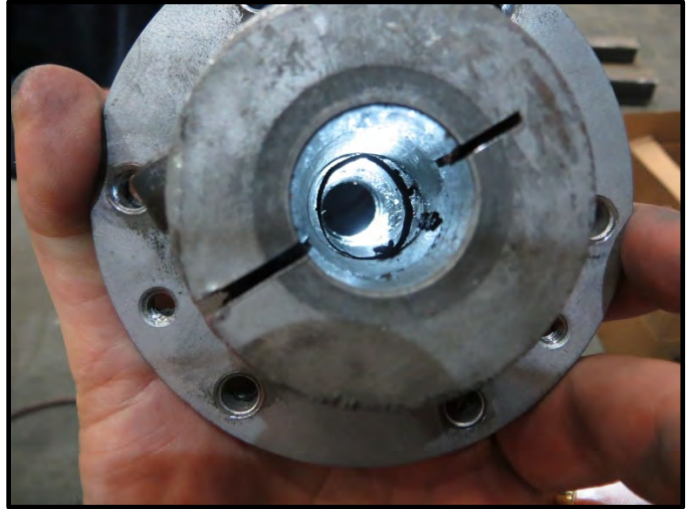
Nozzle seizure is most of the time is caused by having no IDLE GAS properly adjusted and running at all time. Having no IDLE GAS will cause metal infiltration between the stator and graphite shaft.

Idle gas must be “**ALWAYS**” ON when the to prevent Nozzles are in Aluminum

CAUSE	SOLUTION
1. Gas Leak in the process hose or/and gas panel. Refer to OMP-6028	Leak test is the cheapest and most efficient Preventing Maintenance that can be performed during every nozzle change <ol style="list-style-type: none"> 1. Raise the cover and check if bubbles are there. If there are bubbles, there is no leak. 2. If no bubbles seen, then confirm there is idle gas flow in the panel rotameters. 3. If rotameters show idle gas flow, <ul style="list-style-type: none"> ○ Disconnect the hose and check the idle flow again at rotameter. ○ If there is flow, there is a leak is either on the hose or panel. Find and repair the leak. ○ If there is no flow, then process hose is OK.
2. Leaking Bearing Package	Leak test described above only checks for the leaks up to quick disconnect. It is still possible to have leaks after quick disconnect. <ul style="list-style-type: none"> - Leak check bearing package and fittings with Snoop leak detector. If necessary; <ul style="list-style-type: none"> ○ Install new O-Ring, P/N 691118 ○ Replace Bearing Package flange gasket P/N 2106417 ○ Or Replace the Bearing Package, P/N 2110593 - Replace the bearing package, if it is jammed. SNIF® recommends replacing the bearing package on regular basis once a year, and replace the O-Rings every nozzle change.



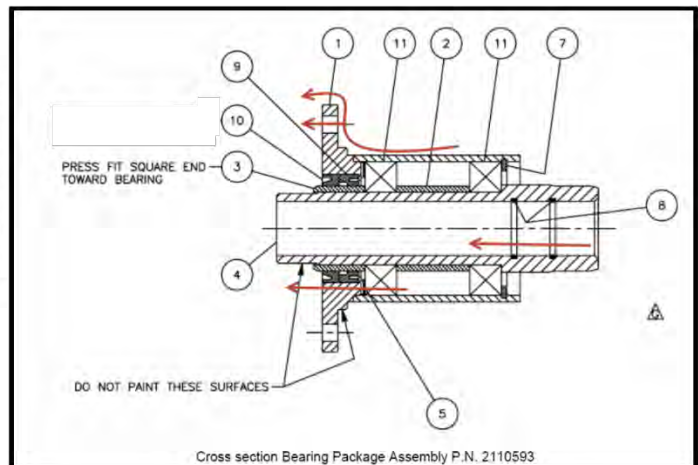
Leak Check at Bearing Package with leak spray

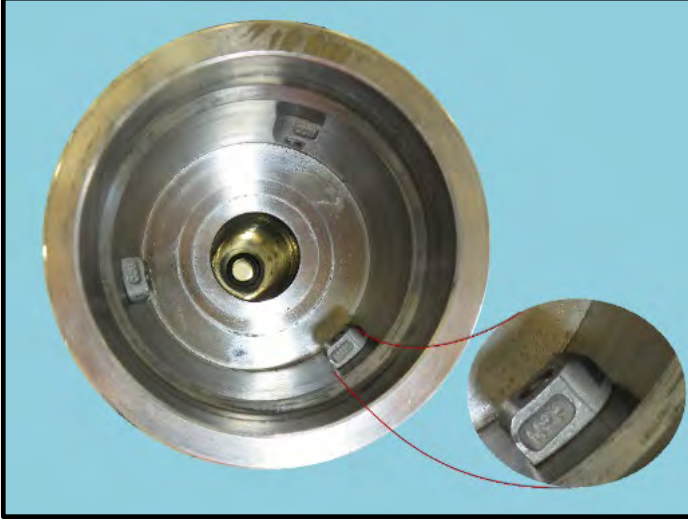



Failed O'ring

Item	Part Number	Quantity	Description
1	B-2108319	1	BEARING HOUSING ASSEMBLY
2	A-2110588	1	BEARING SPACER
3	A-2108313	1	RETAINING SLEEVE
4	B-2110620	1	DRIVE SLEEVE
5	V-2108307	1	WAVE SPRING WASHER
6			
7	V-2108310	1	RETAINING RING
8	V-691118	2	"O" RING, SHAFT, VITON
9	V-2108309	1	UPPER SHAFT SEAL-BEARING PACKAGE
10	V-2108308	1	OIL SEAL, VITON
11	V-2107778	2	RADIAL BEARING


Bill of Materials regarding P.N. 2110593



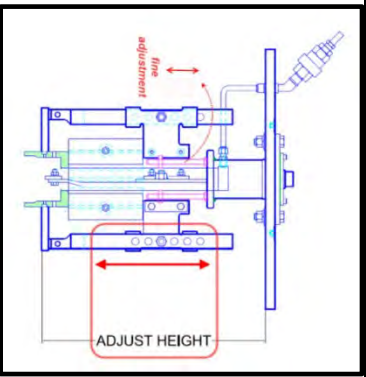


<p>4. Damaged Bell</p>	<p>The bell surface where the O'ring is compressed should be clear from and damages.</p> <p>Otherwise this would cause a gas leak and eventually metal penetration inside the Nozzle, which may end up with a complete seized nozzle.</p> <p>If there are imperfections on surface, bell should be repaired or replaced.</p>
<p>3. Leaking Stator (oxidation)</p>	<p>If there is an ongoing oxidation issue and Oxidation finally reached to an extreme level, this may cause a leak inside the chamber, and metal infiltration into the Nozzle.</p> 

<p>5. Assembly Mistake</p>	<p>Occasionally it is possible to experience rotor seizure immediately after the assembly during first time nozzle is RUN. This happens when;</p> <ul style="list-style-type: none"> - Inconel shaft is not fully tightened into the graphite shaft. - Or Rotor is not fully tightened to the graphite's shaft. - OR operators are unintentionally unscrewing them during assembly. OPERATORS SHOULD DO NOT TURN THE SHAFT OR ROTOR DURING ASSEMBLY, AS IT MAY UNSCREW THE STEEL SHAFT FROM THE GRAPHITE SHAFT. <p>NEO STATOR may leak at O’RING and cause metal infiltration, if;</p> <ul style="list-style-type: none"> - Stator is installed in wrong direction - Stator is not fully rotated - No setscrew installed - Setscrews and Pin Screws are not tight. - Pin configuration is wrong, (direction and alignment). <p>Nozzle replacement and assembly should be done according to Section-7</p>
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<p>6. Seized Rotor</p>	<p>Dross generation and accumulation on metal surface is one of the reasons that may seize up the nozzle. This can become a problem if cover is raised without skimming, and if rotor picks up a pile of dross from the metal surface</p> <p>Operators should protect the rotor blades from dross settlement over the rotor when;</p> <ul style="list-style-type: none">- Raising the cover- Or draining the SNIF® furnace, Draining must be strictly performed according to OMP-6109, or 6162. 
<p>7. Motor or Gear Reducer (if available) .</p>	<p>In this case, it is not guaranteed that dross will re-melt and rotor can be free to turn when cover is closed.</p> <p>To be able to help with this, IDLE speed can be kept activated at a lower rpm when cover is raised.</p> <p>Very rarely, Gear Reducer or Motor might be the reason for a Nozzle Seizure</p> <ul style="list-style-type: none">- Disconnect the coupling and confirm. Replace motor or gearbox bearings accordingly. Refer to Vendor literature in SNIF® system Manual.

4. OTHER rare Failure Modes

Stators Unscrewing	<p>This mode is not detectable if it happens since it would grow into another failure mode. Review Section-7</p> <p>NEO® Stator Assembly</p> <ul style="list-style-type: none"> - Stator is installed in wrong direction - Stator is not fully rotated - No setscrew installed - Setscrew is not tight. - Pin configuration is wrong <p>Threaded Stator Assembly</p> <ul style="list-style-type: none"> - Stator not torqued properly. - Check acceleration and deceleration. - Observe the torquing procedure described in OMP-6022.
Graphite Shaft / Rotor Unscrewing	<p>This only happens if nozzle is spinning in wrong direction.</p> <ul style="list-style-type: none"> - Check the spinning direction at drive coupling and fix accordingly
Excessive Nozzle Vibration	<ul style="list-style-type: none"> - Plug Plate not tightened down properly. Tighten down the jack bolts plug plate onto a gasket with the torque down bolts located on the clamp. - Check all bolted connections of the nozzle assembly. Nozzle should be installed and tightened to the cover stand so it doesn't move during operation. - Debris from process line may cause high grinding noise and vibration. <ul style="list-style-type: none"> - Purge the process lines between gas panel and nozzle. - Check and clean the panel filters. - When replacing or rebuilding nozzle, remove the bearing package and clean the interior of the Steelbody.  <ul style="list-style-type: none"> - Bad bearing package. Replace the bearing package if needed. P/N 2110593 - Rotor vanes damaged, or accumulation on vanes. - Bent Inconel shaft may cause vibration. SNIF® recommend replacing the Inconel shaft every three years. - Metal filtration in the nozzle graphite bearing surface. Observe the leak check procedure described in the OMP-6028.
No BUBBLE	<ul style="list-style-type: none"> - Gas supply failure - Line leaks - Bearing package failure - Stator is installed in wrong direction - Stator is not fully rotated

Nozzle Assembly and Replacement

Nozzle replacements should be tracked and logged.

- (i) Each Nozzle should be named, numbered or tagged for tracking purposes.
- (ii) Below table is a sample log file. Something similar can be generated.

Nozzles		A, B, C, D, E, F, G														
Replacement Date	P-140		P180			Spare Stand		Nozzle Life	Failure Mode	Root Cause / Resolution						
	inlet 1	outlet 2	inlet 1	2	outlet 3											
02/08/14	A	B	C	D	E	F	G	initial								
06/01/14			F			C		113 days	Rotor Damages	Rock in the furnace / Drained						
06/28/14		G				B		140 days	Nozzle Seizure	Leaking hose connection / Tightened						
08/15/14	C					A		188 days	Nozzle Seizure	Leaking hose connection / Replaced						
08/16/14				B		E		189 days	Rotor Damages	Rock In the furnace / Drained						
10/11/14			A			F		132 days	Nozzle Seizure	Too long waiting time with settlement on rotor / Nozzle replaced						
11/20/14				E		D		285 days	Oxidation	Normal Aging / Replaced						
01/13/15		F				G		199 days	Oxidation	Normal Aging / Replaced						
02/18/15				D		E		90 days	Nozzle Seizure	Bad Bearing Package / Replaced						
03/14/15	G					C		211 days	Oxidation	Normal Aging						
03/16/15	E					G		2 days	Nozzle Seizure	Bad Nozzle Assembly / Replaced / Training						
03/19/15					C	B		215 days	Oxidation	Normal Aging / Replaced						
04/01/15			G			A		172 days	Oxidation	Normal Aging / Replaced						
04/01/15				B		D		42 days	Nozzle Seizure	Airlock Broken / Replaced bot airlock and Nozzle						
04/21/15		A				F		98 days	Nozzle Seizure	unknown						
06/18/15	D					E		94 days	Damaged Nozzle	Cleaning Damage						

Eout - Ein = 94 days

Other Log files

Same type of log files also can be generated for;

Dross generation; (in lbs) an increase in dross means oxygen contact in SNIF®.

Heatup rate (in hrs/ temperature, a clean Graphite Block with new resistors should provide 70 F/hr), a decrease in heat up rate means dirty surface or old resistors

H2 removal vs Argon usage (per nozzle)

Argon usage (per ton metal)

Nozzle Load; an increase in load means gas leak (when all other parameters same)

Leak Test Plans ; -each nozzle replacement id the best time for a leak test.

Preventive Maintenance Plans and etc.

Accountability: Maintenance and Operations Plant Personnel

SNIF® Field Engineering Personnel

OMP #: 6213

Approved Date: 7/17/2020

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Replacing a SIALON TUBE and IMMERSION Heater Insulation KIT

Purpose:

This procedure is designed to instruct our customer on how to replace a Sialon Heater Tube and Insulation Kit.

Scope:

This procedure applies to all SNIF[®] Systems, which have Sialon immersion heater tubes.

Definition:

This procedure is performed in the event of a Sialon Heater Tube failure.

Policies:

This document was developed based on a compilation of best available information, knowledge, field experience, and general industry practices to provide guidance to PYROTEK's customers in performing the activities defined herein, in a consistent and standardized manner. This document does not contain regulatory or statutory requirements unless specified.

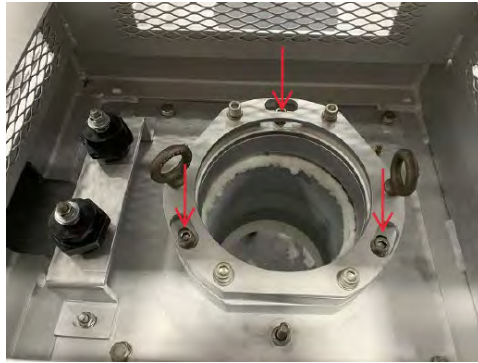
PYROTEK is not responsible for the misuse or misinterpretation of the information presented herein. Under no circumstances shall PYROTEK be liable or responsible for any actions taken or omissions made by non-PYROTEK staff while performing this operation. It is the Plant's responsibility to ensure all safety policies and procedures are carried out while executing the steps of this procedure.

Procedure:

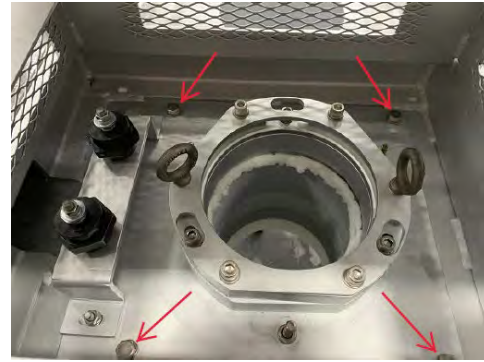
Removing the spent Sialon Heater Tube:

- 1) Safely power OFF the heating element on the failed Sialon Heater Tube and follow the required local safety instructions regarding lock-out / tag-out procedures.
- 2) Clean the Sialon tube as good as possible: Chop off the metal build-up around it. If it cannot be cleaned properly, it will damage the Insulation Kit. It must have at least a smaller diameter than the cover opening (i.e. heater tube well) otherwise cover refractory might be damaged. Usually Sialon tubes are changed together with the Insulation Kit (Refer to OMP-6149).
Note: It's recommended to drain the SNIF system to remove parts of the failed Sialon Heater Tube and to prevent possible metal freezing.

- 3) Disconnect the electrical connection braids from terminal block.
- 4) Remove the Heating Element Assembly from the failed Sialon Heater Tube.
- 5) Unscrew the three (3) socket head bolts/washer/spring-washer on the Mounting Flange that holds the Sialon Heater Tube (refer to picture 1).

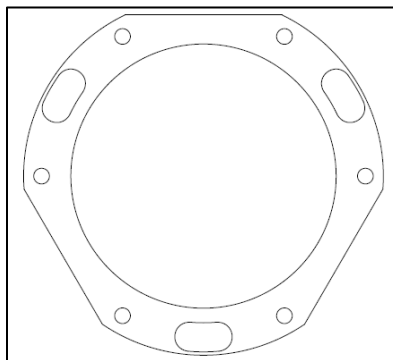


Pic.1 Mounting Flange's bolts



Pic.2 Element Mounting Plate w/ 4 bolts

- 6) Apply two (2) lifting eyebolts diagonally fastened to the Mounting Flange and Retainer Plate using two (2) out of six (6) threaded holes.
 - a. If the Sialon Heater Tube is clean enough it can be lifted out (together with the connecting Retainer Plate and Mounting Flange) through the Element Mounting Plate using a manual chain hoist connected to the overhead crane.
 - b. If the build-up on Sialon Heater Tube can't be cleaned enough then it's recommendable to unscrew the four (4) bolts/washer/spring washer that secure the Element Mounting Plate (refer to picture 2).
 - i) Make sure the Mounting Flange is secured to the Element Mounting Plate using the three (3) Socket head bolts/washer (refer to picture 1).
 - ii) If the Element Mounting Plate is loose the Element Mounting Plate + Mounting Flange + Retainer Plate + Insulation Kit + Sialon Heater Tube can be lifted out of the heater compartment using a manual chain hoist connected to the overhead crane.
- Note: A manual chain hoist is recommended for better controlling the lifting forces applied.



Pic.3 Retainer Plate

- 7) Once the Sialon Heater Tube + Mounting Flange + Retainer Plate (or Element Mounting Plate + Mounting Flange + Retainer Plate + Insulation Kit + Sialon Heater Tube) are removed proceed to clean the heater compartment.
- 8) Remove the Retainer Plate (refer to picture 3) by unscrewing the four (4) socket head bolts/washer and the two (2) lifting eyebolts and remove the failed Sialon Heater Tube.

If it was possible to lift out the Element Mounting Plate + Mounting Flange + Insulation Kit + Sialon Heater Tube (refer to previous step 7b), a new Insulation Kit can now be installed. If it was possible to lift out the Sialon Heater Tube together with the connecting Mounting Flange, through the Element Mounting Plate (refer to previous step 7a), you can skip the below section “Replacing the Insulation Kit” and continue with section “Installing a new Sialon Heater Tube”.

Replacing the Insulation Kit:

- 1) In case the Element Mounting Plate + Mounting Flange + Insulation Kit + Sialon Heater Tube have been removed together, proceed to detach the spent Insulation Kit from the Element Mounting Plate.
Note: The Insulation Kit is installed onto the Element Mounting Plate with three (3) threaded rods).



Pic.4 Element Mounting Plate w/ Insulation Kit

- 2) Prepare the new Insulation Kit (refer to picture 4). Before installing the Insulation Kit onto the Element Mounting Plate, confirm that it fits the immersion heater well on the heater compartment's cover.
- 3) Install the Insulation Kit onto the Element Mounting Plate using the three (3) threaded rods.
- 4) Put a piece of ceramic blanket on the top of the heater compartment's cover and back-install the Element Mounting Plate + Insulation Kit and secure the Element Mounting Plate using the four (4) bolts/washer/spring washer.
- 5) Install a new Sialon Heater Tube as per the below section “Installing a new Sialon Heater Tube”.

Installing a new Sialon Heater Tube:

- 1) Slide the Mounting Flange on a new Sialon Heater Tube.

- 2) Install the Retainer Plate (refer to picture 3) to the Mounting Flange using the four (4) socket head bolts/washer and the two (2) lifting eyebolts.
- 3) Lower the Sialon Heater Tube with the Mounting Flange + Retainer Plate (holding it on the eyebolts) carefully through the Element Mounting Plate.
Note: If the SNIF[®] furnace is full of metal, refer to Sialon Heater Tube submerging section at the end of this procedure.
- 4) Secure the Mounting Flange + Retainer Plate to the Element Mounting Plate using the three (3) Socket head bolts/washer (refer to picture 1).
- 5) Continue to install the heating element as per OMP-6115.

Submerging the Sialon Heater Tube into Melt:

- 1) Slide the Mounting Flange on a new Sialon Heater Tube.
- 2) Install the Retainer Plate (refer to picture 3) to the Mounting Flange using the four (4) socket head bolts/washer and the two (2) lifting eyebolts.
- 3) Connect the overhead crane to the eyebolts on the Mounting Flange + Retainer Plate.
- 4) Lower the Sialon Heater Tube with the Mounting Flange + Retainer Plate using the overhead crane carefully through the Element Mounting Plate.
 - a. Lower the Sialon Heater Tube Apr. 1-2" above the metal. Take measurements beforehand and mark reference lines on the Sialon Heater Tube if necessary.
 - b. Wait Apr. 10-15 minutes to drive out possible humidity from the Sialon Heater Tube.
 - c. Gradually submerge the Sialon Heater Tube and slowly lower until the Mounting Flange sits on the Element Mounting Plate. This submerging step should be completed in Apr. 2 minutes.
- 4) Secure the Mounting Flange + Retainer Plate to the Element Mounting Plate using the three (3) Socket head bolts/washer (refer to picture 1).
- 5) Continue to install the heating element as per OMP-6115.

Accountabilities:

Customer Maintenance Personnel.
SNIF[®] Personnel.

References:

The SNIF[®] Operating Manual.

OMP #: 6228

Approved Date: 5/16/2018

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

DRÄGER POLYTRON 7000 Chlorine Detector

Purpose

Proper setup and configuration of chlorine leak detector.

Scope

This procedure applies to all SNIF[®] units equipped with Dräger brand chlorine leak detector.

Policies

This equipment and procedure is designed to detect and alarm chlorine leaks within the SNIF chlorine control panel. SNIF[®] cannot be held responsible for any damage caused by noncompliance with the recommendations given in this OMP and Operating Manuals. The transmitter must be inspected and maintained regularly by trained maintenance personnel every six months and a record should be kept.

Note

Refer to the SNIF[®] Operating Manual for installation and/or vendor literature details before installing, configuring, or servicing. A sensor should be connected to the transmitter prior to configure the parameters, and set points.

Procedure

1. The default setting for the passwords are, “__ _1” for **Calibration** Menu and “__ _2” for **Settings** menu.
2. The Dräger chlorine detector is preset to alarm when the chlorine level increases above 3.0 ppm. When the level drops to below 2.0 ppm (hysteresis 1.0), the detector will reset itself automatically.
3. After installation /or replacement of the sensor, a “**zero point**” calibration is required. For zero calibration, select the; CALIBRATION: ZERO: EC-H₂S submenus respectively, and press [OK] key to access the function.
4. Wait until the displayed value stabilizes and confirm the decision with “**OK**”
Do not calibrate the sensitivity before “zero point” calibration. First check the zero point and calibrate the sensitivity if necessary.

Warning

CHANGE THE ALARM SETPOINT **ONLY IF ABSOLUTELY NECESSARY**, AS IT MAY CHANGE THE EFFECTIVENESS OF THE CHLORINE DETECTOR TO ALARM A CHLORINE LEAK. Care must be taken when in the configuration mode to avoid accidental changes.

Calibration can only be done after the unit has been in operation for at least one hour. Take care not to inhale the calibration gas.

Replace the sensor elements when a “fault sign” [X] is displayed on the monitor, with code #108, or every 36 months on regular basis.

For; “ **sensor replacement** ”, changing the “**alarm point** ” and the “**passwords** “, refer to “Vendor Bulletins” in SNIF® Manual.

Accountability

Pyrotek- SNIF® Field Engineering and customer Maintenance and Operations personnel.

References

The SNIF® Operating Manual.

Dräger Polytron 7000 User Manual

DrägerSensor® Electrochemical Sensor Data Sheet

OMP #: 6236
Approved Date: 7/20/2020
Approved By: Mike Klepacki
Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Installation of a Side Drain Sealing Kit

Purpose:

To provide installation instructions for the Side Drain Sealing Kits.

Scope:

For use when plugging the side drains on site, or on manufacturing facilities. This OMP covers the following Sealing Kits; 2182541, 2191525, 2193094, 2196653, 2199931

Definition:

Drain Sealing Kit is used to seal and permanently close the non-working drain port of the SNIF[®] furnace.

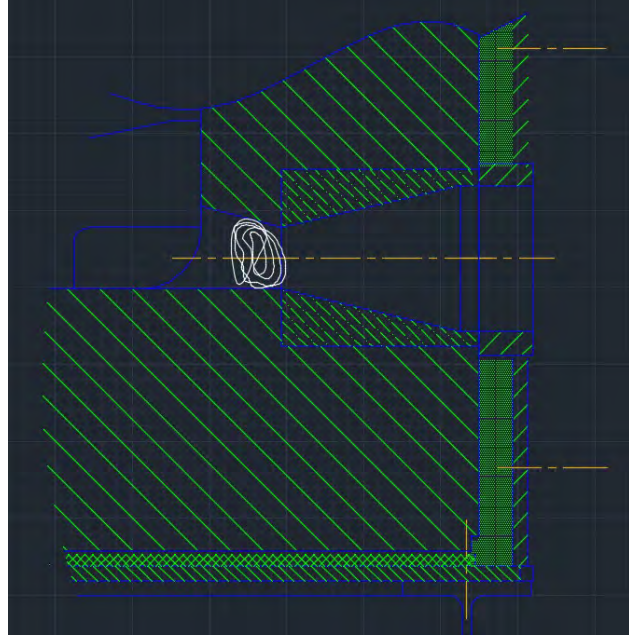
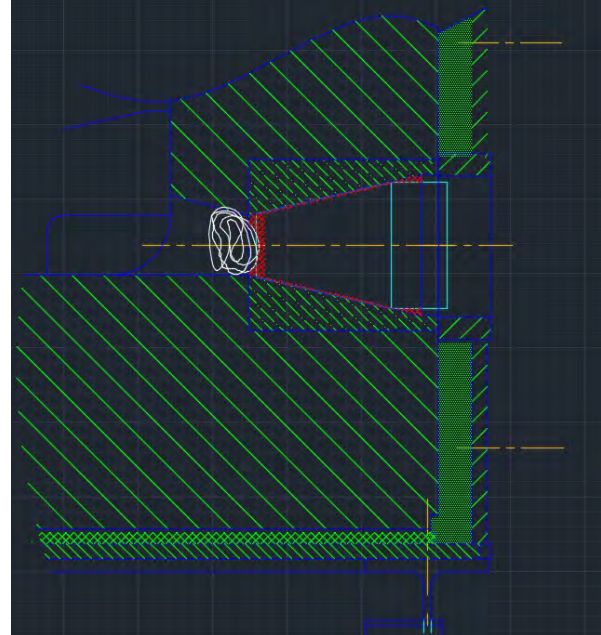
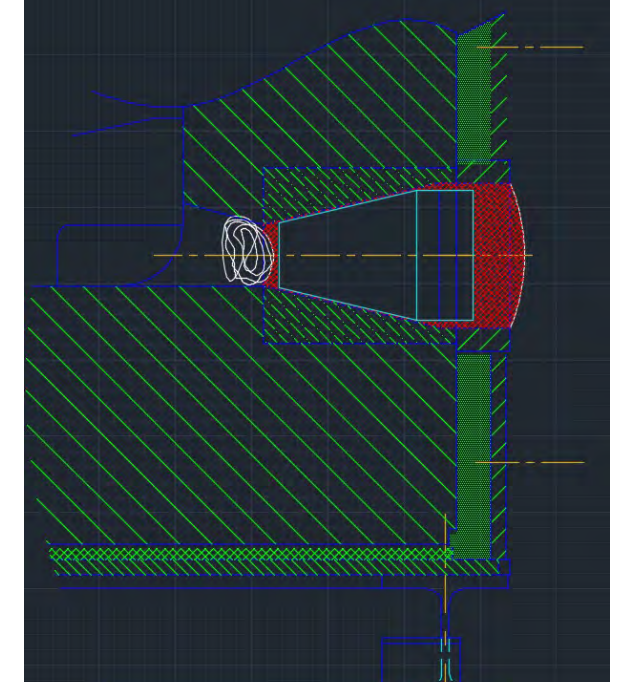
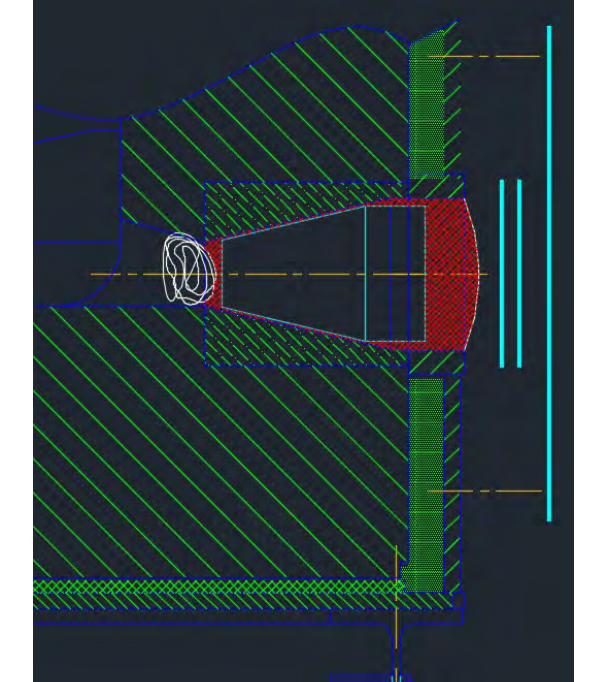
Policies:

This document was developed based on a compilation of best available information, knowledge, field experience, and general industry practices to provide guidance to PYROTEK's customers in performing the activities defined herein, in a consistent and standardized manner. This document does not contain regulatory or statutory requirements unless specified.

PYROTEK is not responsible for the misuse or misinterpretation of the information presented herein. Under no circumstances shall PYROTEK be liable or responsible for any actions taken or omissions made by non-PYROTEK staff while performing this operation. It is the Plant's responsibility to ensure all safety policies and procedures are carried out while executing the steps of this procedure.

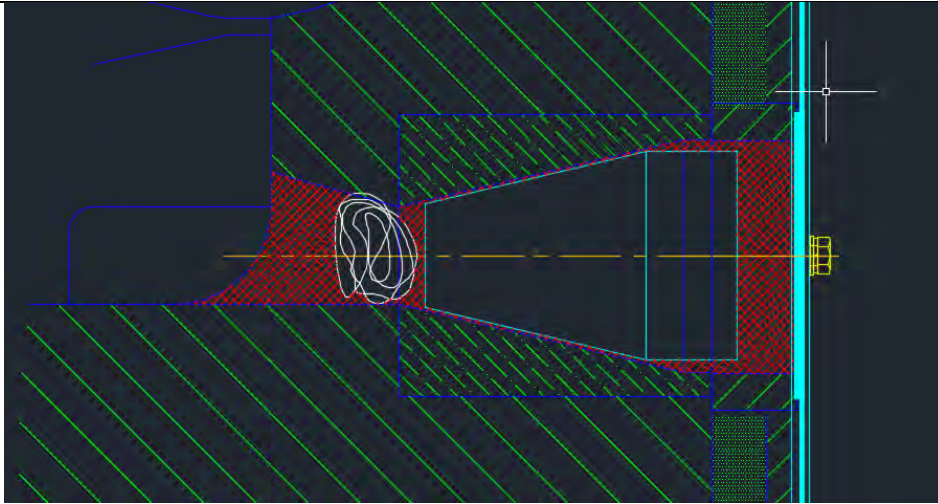
Procedure:

The graphics and photographs are meant to be representative to assist in the installation of the sealing kit. Each installation may vary.

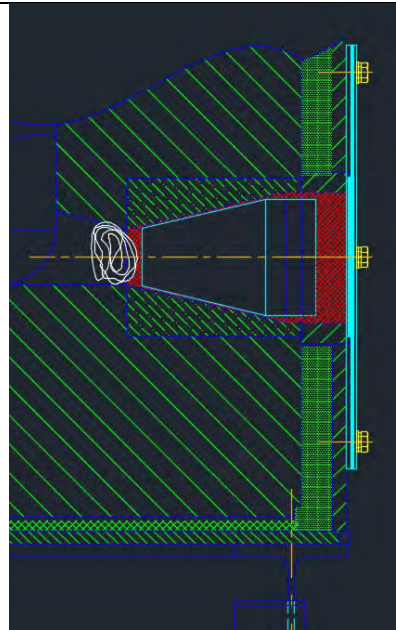
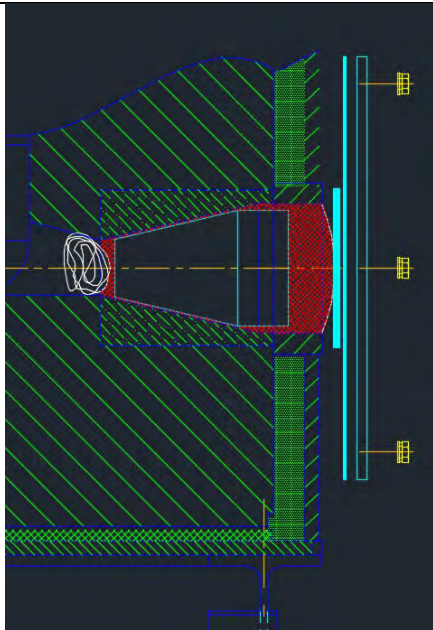
<p>Step-1</p> <p>Apply some ceramic fiber to plug the hole between concrete plug and furnace interior.</p>	<p>Step-2</p> <p>Install the concrete plug. Apply some patch compound refractory mastic on plug's tip and around the tapered area (in red on the picture) .</p>
	
<p>Step-3</p> <p>Apply more refractory mastic to fill the gap. Refractory mastic should be slightly more than required.</p>	<p>Step-4</p> <p>Put all supplied gaskets in position.</p>
	

Step-6

Apply some more refractory mastic from inside SNIF® chamber.

**Step-7**

Install the cover plate. Refractory mastic will be pushed in all cavities between the plug and the hole. Tighten the nuts gradually in a crossed pattern.

**Accountabilities:**

All Pyrotek or customer personnel responsible for start-up, commissioning and maintenance.

References:

SNIF® Operating Manual

OMP #: 6237

Approved Date: 5/16/2018

Approved By: Mike Klepacki

Language: English

SNIF[®] Quality System

OPERATING AND MAINTENANCE PROCEDURE

Setup Procedure for ABB ACS355 Adjustable Frequency Drive for SNIF Using Ethernet

Purpose:

To setup the ABB ACS355 inverters in the SNIF[®] control panels, prior to shipment, for control of the nozzle motors.

Scope:

This procedure applies to all SNIF[®] Units that use the ABB ACS355 motor drive unit, are setup, and tested at Pyrotek or vendor locations.

Policies:

This procedure will be used to setup all ABB ACS355 Inverters prior to shipment to a customer's location. It can also be used at a customer's location for setup of a new/replacement ACS355 Inverter after having been installed in the control panel.

Refer to the electrical schematic provided with the SNIF[®] unit for the proper wiring of the ABB ACS355 Inverter

Procedure:

Note: All program changes must be made while the SNIF[®] unit is in the off position.

Prior to programming the ACS355 Inverter, read and understand the section on setup of the drive unit in the vendor literature provided in the SNIF[®] Manual or with the new replacement unit.

Power must be applied to the drive when viewing or changing parameters. Previous programming may affect the drive status and operation when power is applied.

The following information describes the program changes that must be made to the instrument for proper SNIF[®] operation. Any program parameter not mentioned should be left at the factory default setting.

Under Parameter Menu

	Parameter	Name & Description	Factory Setting	Customized Setting
99	01	Language	0 (English)	1 (English AM)
	02	Applic Macro	1 (ABB Standard)	
	04	Motor Ctrl Mode	3 (Scaler:Freq)	1 (Vector:Speed)
	05	Motor Nom Volt	460 V	
	06	Motor Nom Curr	11.8 A	Gear Reducer: 4.7 A Direct Drive: 8.0 A NEO Direct D: 9.6 A
	07	Motor Nom Freq	60.0 Hz	
	08	Motor Nom Speed	????	3-5HP Motors: 1750 7.5-10 HP: 1760
	09	Motor Nom Power	7.5 HP	Gear Reducer: 3 HP Direct Drive: 5 HP NEO Direct D: 7.5 HP
10	01	EXT1 Commands	2 (DI1,2)	1 (DI1)
11	03	REF1 Select	1 (AI1)	2 (AI2)
12	01	Const Speed Sel	9 (DI3,4)	0 (NOT SEL)
13	04	Minimum AI2	0.0% (0mA)	20.0% (4mA)
15	01	AO1 Content Sel	103 (OUTPUT FREQ)	105 (TORQUE)
	02	AO1 Content Min	-100%	
	03	AO1 Content Max	100%	200%
	04	Minimum AO1	0.0 mA	4.0 mA
20	15	Min Torque 1	-300.0%	0%
	17	Max Torque 1	300.0%	200%
21	02	Stop Function	1 (Coast)	2 (Ramp)
22	02	Acceler Time 1	5.0s	120.0s
	03	Deceler Time 1	5.0s	120.0s

Ethernet Communications Changes in Additional to Above, Do In Order Listed

	Param#	Name & Description	Factory Setting	Customized Setting
11	03	REF1 Select	1 (AI1)	8 (COMM)
	05	REF1 MAX		1818 RPM
98	02	COMM PROT SEL	0 (NOT SEL)	4 (EXT FBA)
54	01	FBA DATA IN 1	0 (not in use)	4 (Status Word)
	02	FBA DATA IN 2	0 (not in use)	5 (Actual Value 1)
	03	FBA DATA IN 3	0 (not in use)	105 (TORQUE)
55	01	FBA DATA OUT 1	0 (not in use)	1 (Control Word)
	02	FBA DATA OUT 2	0 (not in use)	2 (REF1)
51	02	PROTOCOL	0	11 (PNIO ABB Pro)
	04	IP CONFIGURATION	1 (Dyn IP DHCP)	0 (Static IP)
	05-08	IP Address	0.0.0.0	Based on Program
	09	SUBNET CIDR	0	24 (255.255.255.0)
		Final Step		
	27	FBA PAR REFRESH	0 (DONE)	1 (REFRESH)

Accountabilities:

SNIF® Engineering Personnel

References:

ABB ACS355 User's Manual – Effective 06-12-2012

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