THERM-EX GROUT™ *PLUS*

WYO-BEN.

NSF Certified to NSF/ANSI 60

THERM-EX GROUT™ *PLUS* is an engineered system for use as backfill material in earth-coupled heat pump systems. Its elevated thermal conductivity and low permeability allow for excellent heat exchange while protecting groundwater supplies. THERM-EX GROUT™ *PLUS* should be pumped using a positive displacement pump capable of generating pressures in excess of 300 psi. Developed using high swelling Wyoming Bentonite, this new generation of grouting material offers efficient installation of closed-loop geothermal heat pump systems.

MATERIAL SPECIFICATIONS:

Thermal Conductivity:	1.13 Btu/hr-ft-^{o}F	1.2 Btu/hr-ft-^{o}F
Permeability:	6 x 10^{-8}	6 x 10^{-8}
Solid Content:	69 %	71 %
Slurry Weight:	14.1 lbs/gal	15.2 lbs/gal
Slurry Volume/Batch:	41 gals	41.5 gals

APPROXIMATE VOLUMES FOR GROUT

Drilled Hole Dia.	Loop Inside Dia.	Anlr. Vol. (cu.ft./ft.)	Anlr. Vol. (gal. ft.)
4	¾	0.08	0.57
4.5	¾	0.10	0.74
5	¾	0.13	0.94
5.5	¾	0.15	1.15
6	¾	0.19	1.39
5	1	0.12	0.88
5.5	1	0.15	1.10
6	1	0.18	1.33

APPLICATION RATE:

The combination of fresh water, THERM-EX GROUT™ *PLUS* and silica sand constitute "the system" for backfilling geothermal loops. Use locally available dry silica sand. For best results, use sand ranging in size from 30 mesh to 70 mesh (AFS GFN particle size classification 38 to 50).

Mix as follows:

	1.13 Btu/hr-ft-^{0}F	1.2 Btu/hr-ft-^{0}F
Water	21 gal	22 gal
THERM-EX GROUT™ *PLUS*	1 – 50 lb bag	1 – 50 lb bag
Silica Sand	350 lb	400 lb

Add the THERM-EX GROUT™ *PLUS* to the water while agitating. Mix for approximately one minute, then add the sand. Agitate until the sand is uniformly dispersed and pump into place using a tremie line. For best results, place the tremie line near the bottom of the loop and pump into place. Providing local regulations allow, slowly extracting the tremie line as you come up the hole reduces pump pressure, aids the grout in setting quicker, and reduces the opportunity for formation damage.

To increase work time for deep sets, you may add THINZ-IT® to the make-up water. Addition rates may vary, but generally 2 ounces to make-up water yields the desired results.

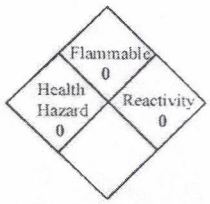
THERM-EX GROUT™ *PLUS* is packaged in 50 pound bags.

WYO-BEN, INC. **P.O. Box 1979** **Billings, Montana 59103**

Internet: www.wyoben.com **email@wyoben.com** **800-548-7055 or (406) 652-6351**

WYO-BEN, INC.

MATERIAL SAFETY DATA SHEET



NFPA FIRE HAZARD IDENTIFICATION SYSTEM

I. PRODUCT IDENTIFICATION

Trade Name(s): **THERM-EX GROUT™ PLUS**

Generic Name(s): Wyoming (Western) Bentonite; Bentonite Clay (CAS No. 1302-78-9)

Chemical Name(s): Sodium Montmorillonite (CAS No. 1318-93-0)

Manufacturer:	**WYO-BEN, INC.**	Telephone Numbers:	
Address:	P.O. Box 1979	Information:	(406) 652-6351
	Billings, Montana 59103	EMERGENCY:	(406) 652-6351

II. HAZARDOUS INGREDIENTS

Ingredient	CAS NO.	%	Hazard
Crystalline Silica (SiO_2) as Quartz	14808-60-7	See Note	Low concentrations of crystalline silica (SiO_2) in the form of quartz may be present in airborne bentonite dust. See Section VI for discussion of health hazard.

Note: Although the typical quartz content of western bentonite is in the range of 2 to 6% most of the quartz particles are larger than the 10 μ respirable threshold size. The actual respirable quartz concentration in airborne bentonite dust will depend upon bentonite source, fineness of product, moisture content of product, local humidity and wind condition at point of use and other use specific factors.

III. PHYSICAL DATA

Boiling Point (°F): NA	Specific Gravity (H_2O=1): 2.45-2.55
Vapor Pressure (mm. Hg): NA	Melting Point: Approx. 1450°C
Vapor Density (Air = 1): NA	Evaporation Rate (Butyl Acetate = 1): NA
Solubility in Water: Insoluble, forms colloidal suspension.	pH: 8-10 (5% aqueous suspension)
Density (at 20° C): 55 lbs./cu.ft. as product.	

Appearance and Odor: Bluegray to green as moist solid, light tan to gray as dry powder. No odor.

IV. FIRE AND EXPLOSION DATA

Flash Point: NA	Flammable Limits: LEL: NA UEL: NA

Special Fire Fighting Procedures: NA

Unusual Fire and Explosion Hazards: None. Product will not support combustion.

Extinguishing Media: None for product. Any media can be used for the packaging. Product becomes slippery when wet.

V. REACTIVITY

Stability: Stable

Hazardous Polymerization: None

Incompatibility: None

Hazardous Decomposition Products: None

NA = Not Applicable ND = Not Determined

Date Prepared: January 2, 2007

Doc #: 4370-00

VI. HEALTH HAZARD INFORMATION

Routes of Exposure and Effects:

Skin: Possible drying resulting in dermatitis.

Eyes: Mechanical irritant.

Inhalation: *Acute* (short term) exposure to dust levels exceeding the PEL may cause irritation of respiratory tract resulting in a dry cough. *Chronic* (long term) exposure to airborne bentonite dust containing respirable size (≤ 10 μ) quartz particles, where respirable quartz particle levels are higher than TLV's, may lead to development of silicosis or other respiratory problems. Persistent dry cough and labored breathing upon exertion may be symptomatic.

Ingestion: No adverse effects.

Permissible Exposure Limits: (for air contaminants)	OSHA PEL (8hr. TWA)	ACGIH TLV
Bentonite as "Particulates not otherwise regulated" (formerly nuisance dust)		
Total dust	15mg/m^3	ND
Respirable dust	5mg/m^3	ND
Crystalline Quartz (respirable)	0.1mg/m^3	0.1mg/m^3

Carcinogenicity: Bentonite is not listed by ACGIH, IARC, NTP or OSHA. IARC, 1997, concludes that there is sufficient evidence in humans for the carcinogenicity of inhaled crystalline silica from occupational sources (IARC Class 1), that carcinogenicity was not detected in all industrial circumstances studied and that carcinogenicity may depend on characteristics of the crystalline silica or on external factors affecting its biological activity. NTP classifies respirable crystalline silica as "known to be a human carcinogen" (NTP 9th Report on Carcinogens – 2000). ACGIH classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

Acute Oral LD_{50}: ND	Acute Dermal LD_{50}: ND	Aquatic Toxicology LC_{50}: ND

Emergency and First Aid Procedures:

Skin: Wash with soap and water until clean.

Eyes: Flush with water until irritation ceases.

Inhalation: Move to area free from dust. If symptoms of irritation persist contact physician. Inhalation may aggravate existing respiratory illness.

VII. HANDLING AND USE PRECAUTIONS

Steps to be Taken if Material is Released or Spilled: Avoid breathing dust; wear respirator approved for silica bearing dust. Vacuum up to avoid generating airborne dust. Avoid using water. Product slippery when wetted.

Waste Disposal Methods: Product should be disposed of in accordance with applicable local, state and federal regulations.

Handling and Storage Precautions: Use NIOSH/MSHA respirators approved for silica bearing dust when free silica containing airborne bentonite dust levels exceed PEL/TLV's. Clean up spills promptly to avoid making dust. Storage area floors may become slippery if wetted.

VIII. INDUSTRIAL HYGIENE CONTROL MEASURES

Ventilation Requirements: Mechanical, general room ventilation. Use local ventilation to maintain PEL's/TLV's.

Respirator: Use respirators approved by NIOSH/MSHA for silica bearing dust.

Eye Protection: Generally not necessary. Personal preference.

Gloves: Generally not necessary. Personal preference.

Other Protective Clothing or Equipment: None

IX. SPECIAL PRECAUTIONS

Avoid prolonged inhalation of airborne dust.

DEPARTMENT OF TRANSPORTATION HAZARDOUS MATERIAL INFORMATION

Shipping Name: NA (Not Regulated)	Hazard Class: NA
Hazardous Substance: NA	Caution Labeling: NA

Date Prepared: January 2, 2007 Doc #: 4370-00

TETRA TECH, INC.

REPORT OF GEOTECHNICAL TESTING

CLIENT: WYO-BEN INC.
PO Box 1979
Billings Montana 59103

PROJECT NO.: 7551107
REPORT NO.: 8817

AURTHORIZATION:Shoba
REPORT DATE:10/30/2006

PROJECT:Therm-Ex Grout

SERVICES: Performed Geotechnical Tests as Requested by Client

REPORT OF TESTS

Sample Identification

On September 20, 2006, we received two samples of Therm-Ex Grout and silica sand mixtures with instructions to perform a remolded hydraulic conductivity test on each sample. The tests were prepared as specified in your instructions and performed in accordance with ASTM D-5084 test procedures.

The test results are included on the attached plates and Geotechnical Test Summary. If you have any questions regarding this report or if we can be of any further service, please contact us.

Technician: George Gartner
Geotechnical Technician

George Gartner
Geotechnical Technician

Glenn Fournier
Construction Services Manager

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www.tetratech.com

TETRA TECH, INC.

Client: WYO-BEN Inc.
Project No.: 7551107
Report No.: 8817

Sample Indentification:	No.1 50# Therm-Ex Grout™ plus 400lbs. silica sand 22 gallons water	No.2 50# Therm-Ex Grout™ plus 350lbs. silica sand 21 gallons water
Cell Pressure(psi):	62	62
Effluent Pressure(psi):	60	60
Back Pressure(psi):	58	58
Specimen Diameter (inches):	2.51	2.59
Sample Height (inches):	3.24	1.90
HydraulicGradient:	17.11	29.23
HydraulicConductivity(cm/sec):	5.0×10^{-8}	6.9×10^{-8}