

Technical Service Report (Industrial Drilling Products)		
Sample Identification	Requested By:	Jeff Walton at Thermal Dynamics Inc
	Date Submitted:	June 29, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs lab	oratory received a sample of BAROTHERM <sup>®</sup> GOLD
	Two-Part Thermally Conductive Grout System with graphite enhancement. The sample was from Thermal Dynamics Inc. for the Montevideo, Minnesota Veterans Home project. The sample container was labeled 1-Montevideo VA Home, 500 ft. loop #6, 6/21/22, 5:00 pm. The sample evaluation form indicated the sample was collected from a valve on the tremie line and is a BAROTHERM <sup>®</sup> GOLD Two- Part Thermally Conductive Grout System with graphite enhancement. The grout formulation concentrations were not provided. It is not known if the make-up water was treated with soda ash. The sample was submitted for standard thermal conductivity testing. IDP Account Representative Andrew Bailey confirmed the target thermal	
	conductivity for t	his project was 0.8 BTU/hr.ft.°F.
Tests Performed	A KD2-Pro v samples. After the mixed using a po- settling that may grout, and the pro- meter then collect minute period The KD2-Pro Method for Deter Rock by Thermal procedure was de materials. The sta for Ottawa, IL ind source methods.	was used to evaluate the thermal conductivity of the e grout samples reached room temperature, they were wer drill with a paddle attachment to account for any have occurred in transit. The probe was placed in the obe's temperature was allowed to equilibrate. The ted thermal conductivity measurements over a 5- complies with ASTM D 5334-08 Standard Test mination of Thermal Conductivity of Soil and Soft Needle Probe. The precision of the ASTM standard termined from well-known industry standard undard indicates a reported precision of between $\pm 10\%$ dustrial sand and $\pm 15\%$ for paraffin wax for line
Summary of Results	The measured was determined to precision for each	I thermal conductivity value of the submitted sample o be 0.71 BTU/hr.ft.°F. Based on ASTM D 5334, the n measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Hope Morris
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone



Technical Service Report (Industrial Drilling Products)		
Sample Identification	Requested By:	Jeff Walton at Thermal Dynamics Inc
	Date Submitted:	August 17, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs labor Two-Part Therma enhancement. The Montevideo, Min was labeled #1 M indicated the sam on the tremie line Conductive Grou indicated the hole formulation conce make-up water w for standard therm Andrew Bailey co	bratory received a sample of BAROTHERM <sup>®</sup> GOLD ally Conductive Grout System with graphite e sample was from Thermal Dynamics Inc. for the nesota Veterans Home project. The sample container (ontevideo VA Home #3. The sample evaluation form ple was collected on 8/10/22 at 3:20 pm from a valve and is a BAROTHERM <sup>®</sup> GOLD Two-Part Thermally t System with graphite enhancement. The form also e is 500 feet horizontal and 32 feet deep. The grout entrations were not provided. It is not known if the as treated with soda ash. The sample was submitted nal conductivity testing. IDP Account Representative onfirmed the target thermal conductivity for this BTU/br ft °E
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5- minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	thermal conductivity value of the submitted sample to be 0.74 BTU/hr.ft.°F. Based on ASTM D 5334, the measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Hope Morris
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone



Technical Service Report (Industrial Drilling Products)		
Sample Identification	Requested By:	Jeff Walton at Thermal Dynamics Inc
	Date Submitted:	August 17, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs labor Two-Part Therma enhancement. The Montevideo, Min was labeled #1 M indicated the sam on the tremie line Conductive Grou indicated the hole formulation conce make-up water w for standard therm Andrew Bailey co	bratory received a sample of BAROTHERM <sup>®</sup> GOLD ally Conductive Grout System with graphite e sample was from Thermal Dynamics Inc. for the nesota Veterans Home project. The sample container (ontevideo VA Home #2. The sample evaluation form ple was collected on 8/10/22 at 3:05 pm from a valve and is a BAROTHERM <sup>®</sup> GOLD Two-Part Thermally t System with graphite enhancement. The form also e is 500 feet horizontal and 32 feet deep. The grout entrations were not provided. It is not known if the as treated with soda ash. The sample was submitted nal conductivity testing. IDP Account Representative onfirmed the target thermal conductivity for this BTU/br ft °E
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5- minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	thermal conductivity value of the submitted sample o be 0.78 BTU/hr.ft.°F. Based on ASTM D 5334, the n measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Hope Morris
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone



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	Date Submitted:	August 17, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs labor Two-Part Therma enhancement. The Montevideo, Min was labeled #1 M indicated the sam on the tremie line Conductive Grou indicated the hole formulation conce make-up water w for standard therm Andrew Bailey co	bratory received a sample of BAROTHERM <sup>®</sup> GOLD ally Conductive Grout System with graphite e sample was from Thermal Dynamics Inc. for the nesota Veterans Home project. The sample container (ontevideo VA Home #1. The sample evaluation form ple was collected on 8/10/22 at 2:50 pm from a valve and is a BAROTHERM <sup>®</sup> GOLD Two-Part Thermally t System with graphite enhancement. The form also e is 500 feet horizontal and 32 feet deep. The grout entrations were not provided. It is not known if the as treated with soda ash. The sample was submitted nal conductivity testing. IDP Account Representative onfirmed the target thermal conductivity for this BTU/br ft °E
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5- minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	thermal conductivity value of the submitted sample to be 0.85 BTU/hr.ft.°F. Based on ASTM D 5334, the measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Hope Morris
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone



<b>Technical Service Report (Industrial Drilling Products)</b>		
Sample Identification	Requested By:	Jeff Walton at Thermal Dynamics Inc
	Date Submitted:	July 21, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs laboratory received a sample of BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement. The sample was from Thermal Dynamics Inc. for the Montevideo, Minnesota Veterans Home project. The sample container was labeled 3-Montevideo VA Home, #3 7/12/22, 4:40 pm. The sample evaluation form indicated the sample was collected from a valve on the tremie line and is a BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement. The grout formulation concentrations were not provided. It is not known if the make-up water was treated with soda ash. The sample was submitted for standard thermal conductivity testing. IDP Account Representative Andrew Bailey confirmed the target thermal conductivity for this project was 0.8 BTU/hr.ft.°F.	
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5-minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	thermal conductivity value of the submitted sample o be 0.77 BTU/hr.ft.°F. Based on ASTM D 5334, the n measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Karla Wolfe
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone



Technical Service Report (Industrial Drilling Products)		
Sample Identification	Requested By:	Jeff Walton at Thermal Dynamics Inc
	Date Submitted:	July 21, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs labo	oratory received a sample of BAROTHERM <sup>®</sup> GOLD
	Two-Part Therma enhancement. The Montevideo, Min was labeled 2-Mo evaluation form i tremie line and is Conductive Grou formulation conce make-up water w for standard therm Andrew Bailey co project was 0.8 B	ally Conductive Grout System with graphite e sample was from Thermal Dynamics Inc. for the mesota Veterans Home project. The sample container ontevideo VA Home, #2 7/12/22, 4:25 pm. The sample ndicated the sample was collected from a valve on the a BAROTHERM <sup>®</sup> GOLD Two-Part Thermally t System with graphite enhancement. The grout entrations were not provided. It is not known if the as treated with soda ash. The sample was submitted nal conductivity testing. IDP Account Representative onfirmed the target thermal conductivity for this TU/hr.ft.°F.
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5-minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	thermal conductivity value of the submitted sample o be 0.85 BTU/hr.ft.°F. Based on ASTM D 5334, the measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Karla Wolfe
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	Date Submitted:	July 21, 2022
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Background	The HIPs laboratory received a sample of BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement. The sample was from Thermal Dynamics Inc. for the Montevideo, Minnesota Veterans Home project. The sample container was labeled 1-Montevideo VA Home, #1 7/12/22, 4:17 pm. The sample evaluation form indicated the sample was collected from a valve on the tremie line and is a BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement. The grout formulation concentrations were not provided. It is not known if the make-up water was treated with soda ash. The sample was submitted for standard thermal conductivity testing. IDP Account Representative Andrew Bailey confirmed the target thermal conductivity for this project was 0.8 BTU/hr.ft.°F.	
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5-minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	thermal conductivity value of the submitted sample o be 0.72 BTU/hr.ft.°F. Based on ASTM D 5334, the n measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Karla Wolfe
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone



<b>Technical Service Report (Industrial Drilling Products)</b>		
Sample Identification	Requested By:	Jeff Walton at Thermal Dynamics Inc
	Date Submitted:	June 29, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs lab	oratory received a sample of BAROTHERM <sup>®</sup> GOLD
	Two-Part Thermally Conductive Grout System with graphite enhancement. The sample was from Thermal Dynamics Inc. for the Montevideo, Minnesota Veterans Home project. The sample container was labeled 3-Montevideo VA Home, 500 ft. loop #6, 6/21/22, 5:24 pm. The sample evaluation form indicated the sample was collected from a valve on the tremie line and is a BAROTHERM <sup>®</sup> GOLD Two- Part Thermally Conductive Grout System with graphite enhancement. The grout formulation concentrations were not provided. It is not known if the make-up water was treated with soda ash. The sample was submitted for standard thermal conductivity testing. IDP Account Representative Andrew Bailey confirmed the target thermal	
	conductivity for t	his project was 0.8 BTU/hr.ft.°F.
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5-minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	I thermal conductivity value of the submitted sample to be 0.82 BTU/hr.ft.°F. Based on ASTM D 5334, the measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Hope Morris
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone



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Sample Identification	Requested By:	Jeff Walton at Thermal Dynamics Inc
	Date Submitted:	June 29, 2022
	Sample Type:	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System with graphite enhancement.
Background	The HIPs lab	oratory received a sample of BAROTHERM <sup>®</sup> GOLD
	Two-Part Thermally Conductive Grout System with graphite enhancement. The sample was from Thermal Dynamics Inc. for the Montevideo, Minnesota Veterans Home project. The sample container was labeled 2-Montevideo VA Home, 500 ft. loop #6, 6/21/22, 5:15 pm. The sample evaluation form indicated the sample was collected from a valve on the tremie line and is a BAROTHERM <sup>®</sup> GOLD Two- Part Thermally Conductive Grout System with graphite enhancement. The grout formulation concentrations were not provided. It is not known if the make-up water was treated with soda ash. The sample was submitted for standard thermal conductivity testing. IDP Account Representative Andrew Bailey confirmed the target thermal	
Tracka Darie and	conductivity for t	his project was 0.8 BTU/hr.ft.°F.
Tests Performed	A KD2-Pro was used to evaluate the thermal conductivity of the samples. After the grout samples reached room temperature, they were mixed using a power drill with a paddle attachment to account for any settling that may have occurred in transit. The probe was placed in the grout, and the probe's temperature was allowed to equilibrate. The meter then collected thermal conductivity measurements over a 5-minute period The KD2-Pro complies with ASTM D 5334-08 Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe. The precision of the ASTM standard procedure was determined from well-known industry standard materials. The standard indicates a reported precision of between $\pm 10\%$ for Ottawa, IL industrial sand and $\pm 15\%$ for paraffin wax for line source methods.	
Summary of Results	The measured was determined to precision for each	I thermal conductivity value of the submitted sample o be 0.77 BTU/hr.ft.°F. Based on ASTM D 5334, the n measurement is $\pm 10\%$ .

References	BAROTHERM <sup>®</sup> GOLD Two-Part Thermally Conductive Grout System is a registered trademark of Halliburton.
Tested by	Hope Morris
Distribution	Ed Anderson, Buck Hammond, Andrew Bailey, Shantel Stone