

# TESTING THE EARTH'S LIMITS

## OUR MISSION:

GRTI is dedicated to the responsible growth of the GeoExchange industry by providing support through first-hand, practical experience. We are committed to promoting the highest level of comfort while protecting the environment and reducing the demand on our natural resources while reducing the long-term investment in space conditioning for the general public.

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## FORMATION THERMAL CONDUCTIVITY TESTING

FOR

GEOTHERMAL HEAT PUMP  
APPLICATIONS USING  
GROUND-LOOP  
HEAT EXCHANGERS

GEOTHERMAL RESOURCE TECHNOLOGIES, INC.

# GRTI FORMATION THERMAL CONDUCTIVITY (FTC) TESTING

## FORMATION THERMAL CONDUCTIVITY:

Thermal conductivity is the physical property of a material that determines how easily heat can pass through it. Knowing the average thermal conductivity of the formation is a prerequisite for a properly designed geothermal ground-loop heat exchanger for any given location.

The process and procedures employed by GRTI during a formation thermal conductivity (FTC) test follow the recommendations of ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) and IGSHPA (International Ground Source Heat Pump Association).

The information that GRTI provides from a formation thermal conductivity test can be input directly into popular design software programs such as GSHPCalc ([www.GeoKiss.com](http://www.GeoKiss.com)).

## DATA MEASUREMENT AND ANALYSIS:

FTC is measured by injecting a constant amount of energy (heat) into a u-bend that has been installed into a borehole. The temperature of the circulating fluid is monitored over time with a state-of-the-art data acquisition unit.

Based on first hand experience and research funded by ASHRAE, GRTI believes that the thermal conductivity tests need to run for a minimum of 40 hours. Collected data is graphed (see Figures 1 & 2), then transient (line source) heat transfer theory is used to determine the average thermal conductivity of the formation.

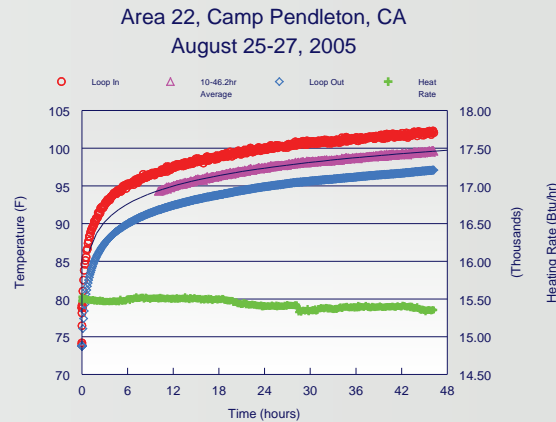


FIGURE 1: TEMPERATURE V. TIME

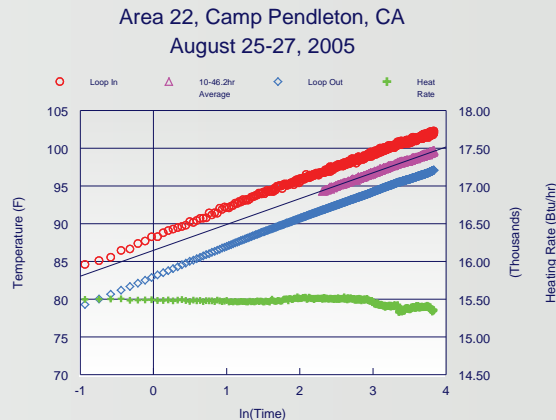


FIGURE 2: TEMPERATURE V. LN TIME

## WHAT CAN FTC TESTING DO FOR YOU?

- Enable ground loops to be sized to match the existing formation conditions.
- Provide a better estimate of installation costs.
- Save money on drilling, grouting and piping costs.
- Allow the system to run more economically.
- Simulate loop response under cooling design conditions.

## WHY CHOOSE GRTI FOR FTC TESTING?

- Conducting tests and analyzing data on a daily basis since 1998.
- Long test times provide reliable value for average formation thermal conductivity.
- Dedicated to quality testing and data analysis.

## WHAT IS SUPPLIED AT THE CONCLUSION OF A GRTI FTC TEST?

A written report which includes:

- The measured formation thermal conductivity.
- Estimated formation thermal diffusivity.
- Undisturbed formation temperature.
- Drill log to improve accuracy of contractor bids.

## EQUIPMENT LEASING:

In addition to running tests, GRTI leases test equipment on a daily and on an annual basis for those who prefer to run their own tests. At the conclusion of a test, data is remotely retrieved and the equipment is either returned or arrangements are made for additional tests by the user. Once data has been transferred, GRTI will analyze the collected data and provide a comprehensive written report.