RECHARGE COLORADO

## Thermal Conductivity Test Specification

1. Thermal conductivity test should be performed for a minimum of 48 hours.

2. The heat rate is to be 15 to 25 watts per ft. (50 to 80 W/m) of bore. These heat rates are the expected peak loads on the U-tubes for an actual heat pump system.

3. The standard deviation of input power is to be less than + 1.5 % of the average value and peaks less than + 10% or resulting temperature variation less than + 0.5°F (0.3°C).

4. The accuracy of the temperature measurement and recording devices are to be +0.5°F (0.3°C).

5. The accuracy of the power transducer and recording device is to be +2% of the reading.

6. Flow rates are to be in the range to provide a differential loop temperature of 6 to 12°F (3.5 to 7°C). This is the temperature differential for an actual heat pump system.

7. A waiting period of five days is recommended for low-conductivity soils [k < 1.0 Btu/hr-ft-°F (1.7 W/m-°C)] after the ground loop has been installed and grouted (or filled) before the thermal conductivity test is initiated. A delay of three days is recommended for higher conductivity formations [k > 1.0 Btu/hr-ft-°F (1.7 W/m-°C)].

8. The initial ground temperature measurement is to be made at the end of the waiting period by direct insertion of a probe inside a liquid filled ground heat exchanger at three locations representing the average or by the measurement of temperature as the liquid exits the loop during the period immediately following start-up.

9. Data collection should be at least once every 10 minutes.

10. All above ground piping is to be insulated with a minimum of 0.5 inch (1.25 cm) closed cell insulation or equivalent. Test rigs are to be enclosed in a sealed cabinet that is insulated with a minimum of 1.0-inch (2.5 cm) fiberglass insulation or equivalent.

11. If retesting a bore is necessary, the loop temperature should be allowed to return to within 0.5°F (0.3°C) of the pretest initial ground temperature. This typically corresponds to a 10 to 12day delay in mid to high conductivity formations and a 14-day delay in low conductivity formations if a complete 48-hour test has been conducted. Waiting periods will be proportionally reduced test terminations occurred after shorter periods.

12. Any of the public domain software programs tested in conjunction with ASHRAE 1118-TRP, with the exception of the Line Source method that only ignores the first 0.08 hours of data, can be used to evaluate thermal conductivity. It is suggested that multiple programs be used to further enhance reported accuracy.