

## How to Use Sentinel R500C

### Heat-transfer fluid for ground source heat pump systems

Sentinel R500C is a concentrate designed for on-site dilution and subsequent use in Ground Source Heat Pump equipment to provide frost protection and minimise corrosion and deposition. Sentinel R500C should be pre-diluted with mains water in a minimum ratio of one part Sentinel R500C to two parts water in order to ensure freeze protection down to at least -22°C. The following guidelines should be followed in order to provide long-term protection of the ground source heat pump ground loop circuit when using Sentinel R500C.

#### New Systems

It is important that the system equipment manufacturers' instructions be carefully followed when cleaning or filling a ground source heat pump ground loop circuit.

#### Preparation before a New System is Filled with diluted Sentinel R500C

1. When the installation of the ground source heat pump system is completed, the ground loop circuit should be flushed to remove any foreign matter. After flushing, care should be taken to make sure that no unwanted materials are allowed to enter the installation before filling with diluted Sentinel R500C.
2. The quality of the water used for the initial flushing of the ground loop or used to pressure test the system should be tested using the Sentinel Sentinel R700 Test Kit to check the level of bacteria. There is a risk that if water contaminated with bacteria or fungi is used to flush or pressure test the circuit, any remnants of this water in the system may contaminate the thermal fluid. Bacteria and fungi feed and multiply on organic components in the thermal fluid and degrade it to form a viscous or jelly like material.
3. To prevent problems from bacteria and fungi during flushing or pressure testing of the new system add 1 litre of Sentinel R700 to the water. This can be added to the tank of the filling unit. For systems larger than 300 litres add 1 litre of Sentinel R700 per 300 litres. Circulate through the ground loop and filling unit tank for 30 minutes to allow mixing and distribution of the Sentinel R700 throughout the whole circuit. Use the Sentinel R700 test kit and measure the concentration of Sentinel R700 using the test strips. The correct dose will give a reading of 100ppm on the test strips. If the reading is found to be below 100ppm top up the system with extra Sentinel R700 until a reading of 100ppm is achieved.
4. After circulation of the water and pressure testing, the ground loop circuit is ready for filling with thermal fluid (see below) or it may be sealed off until the system is commissioned at a later date.
5. If the circuit is to be left in storage, take a sample of the circuit water prior to sealing and measure the bacterial level using a dipslide from the Sentinel R700 Test Kit. Using the comparison charts read and record the result after 48 hours storage period. If the dipslide result is showing  $10^3$  cfu/ml or above revisit the site, test the Sentinel R700 level with test strips and ensure that the reading is at 100ppm or above. Repeat the dipslide test several days prior to the end of system storage before commissioning full operation of the system.
6. In order to ensure that there are no obstructions to the flow of the heat transfer liquid, any in-line filters should be cleaned within 14 days of the equipment being filled with heat transfer fluid and put into operation for the first time.

## Older Systems

1. During routine service visits it is important to continue to monitor the condition of the thermal fluid in the ground loop circuit. After a number of years in the system, the fluid will need to be replaced. The Sentinel FrostCheck Test Kit allows you to determine exactly when the replacement is required.
2. Take a sample of the thermal fluid from a suitable drain valve on the system. Discard the first bottleful and refill the bottle.
3. Record the appearance of the thermal fluid on the "FrostCheck Survey Sheet". Ideally it will be a clear non-viscous liquid. If diluted Sentinel R500C is contained in the circuit it will be pale blue in colour. Other suppliers use alternative colours for their thermal fluids. After a period of operating at cyclic temperatures or if attack from bacteria has occurred the thermal fluid can become cloudy and the colour changes. The viscosity may also increase. These are clear indications that the thermal fluid needs to be changed.
4. Measure the antifreeze content using the refractometer as described in the instructions and record on the "FrostCheck Survey Sheet". Ideally the antifreeze content will be 30 - 35% to provide the necessary frost protection. If the antifreeze content is less than 30% it indicates that some degradation or dilution of the fluid has occurred. If losses of fluid occur due to leakage or sampling, the heat-transfer liquid in the system must be replenished with pre-diluted Sentinel R500C.
5. Measure the pH of the thermal fluid using the pH papers as described in the instructions. The recommendations for different pH levels are as follows:

Measured pH Level	Recommended Actions
Greater than 8.8	The flushing fluid has not been flushed from the system correctly. Ideally the system should be drained, flushed and refilled with Sentinel R500C.
7.7 - 8.8	pH is satisfactory. No action required.
7.0 – 7.6	pH is below ideal and more frequent checks are recommended
Less than 7.0	pH is too low indicating that the thermal fluid has deteriorated beyond an acceptable condition. The ground loop circuit must be drained and then cleaned with Sentinel R800. Refill with Sentinel R500C

## Replacing the Thermal Fluid in the Ground Loop Circuit

1. If the thermal fluid is cloudy or dark brown in colour and has a pH <7.0 this is an indication that it needs to be changed. The filling unit can be used to pump the flushing fluid Sentinel R800 in to the ground loop, which will force the degraded thermal fluid out of the system and it can be collected in a suitable container for correct disposal.
2. The spent flushing fluid should be collected in a suitable container for correct disposal\*. Clean the system and remove the degraded thermal fluid by flushing with Sentinel R800 (for procedural guidelines on how to flush, clean and refill a ground loop circuit using a filling unit, see the Technical Information Sheet 'Sentinel R800 Ground Source Heat Pump System Flushing Fluid - Application Guidelines' available at [www.sentinel-solutions.net](http://www.sentinel-solutions.net)).

3. After cleaning of the ground loop circuit has been performed with Sentinel R800 measure the pH of both the mains water and the final flushing water. **Ensure the pH of the final flushing water is the same as the mains water.**
  4. If the pH of the flushing water is higher than the mains water, repeat the flushing procedure until it is the same as the mains water.
  5. When the flushing procedures are complete drain and rinse out the tank. Ensure that all the water has been removed so that none remains in the ground source heat pump circuit.
2. When the ground source heat pump ground loop is filled with pre-diluted Sentinel R500C all the entrained air must be removed before the system is put into operation. The ground source heat pump system is designed as a closed circuit to eliminate entry of atmospheric oxygen which causes the premature degradation of the thermal fluids.
  3. The design of the system should ensure that the circulation cannot be disrupted by trapped air pockets in the installation and any air must be removed from the circuit after it has been filled with pre-diluted Sentinel R500C.
  4. Solutions of Sentinel R500C are generally compatible with most materials commonly found in a typical ground source heat pump ground loop circuits, but it is important to ensure that the manufacturer's recommendations state that all the seals and connectors used in ground source heat pump heating equipment are resistant up to the maximum operating temperature of the thermal fluid.

## Filling the Ground Loop Circuit with Sentinel R500C

1. Sentinel R500C should be pre-diluted with mains water in a minimum ratio of one part Sentinel R500C to two parts water and *thoroughly mixed* **before** introducing it into the ground loop.

*\*Note Always dispose of old, degraded thermal fluids and spent cleaning solution according to local regulations.*