Known Issues

**Sanden Model**

The model for the Sanden HPWH will have accurate run times only within a limited range of ambient temperatures. The useful range is estimated to cover 35 to 90 °F, however, deviations from expected values were not tested. The cause of this problem is the assumption of linear input power response to ambient temperature. The Sanden unit has internal logic that attempts to maintain constant output capacity. COP, as measured in the lab, retains a linear response to ambient temperature, which implies that the input power, which is the capacity divided by the COP, must be non-linear. This is observed in the lab, with input power rising dramatically at lower ambient temperatures.

Since the COP response to ambient temperature is linear, our model still works and should give accurate COP estimates as well as total energy. The error in the input power model, however, will cause the length of run to be off, and consequently errors involving the time of day of running will develop. It is recommended that the current Sanden model be used with caution if at all.

**UA Losses**

The way the UA losses are calculated (see the Technical Explanation) can result in violation of entropy. Since the total UA loss is based on average tank temperature and divided equally, nodes that are colder than the ambient temperature will lose heat if the average tank temperature is above ambient. Although this is counterintuitive, it does not cause any serious discrepancy with measured data. Partially this is due to the relative rarity of this occurrence, and partially it is due to the fact that the total UA used for each model is measured. This means that the heat loss rate should be accurate, although the distribution of tank temperatures may be off.