A research organization in Cambridge, MA was attempting to resolve a mixing issue during the scale-up of a process step. The vessels in question contained 2.5 liters and 35 liters of nominal working volume. The high spatial resolution of the MSCTI (model 125) probe and its narrow diameter were the sought-after characteristics for addressing the problem. The probe was inserted through an open port on the bottom of each of the sealed vessels. A factorial design was used to optimize the conditions for the conductivity-mixing test, which consisted of injecting a small volume of high-conductivity tracer solution into the full vessel volume and monitoring the decay of the response until a stable value (defined as +/- 2.0% of equilibrium value) was attained. Because the mixing system consisted of several agitators, their total output was recorded as vessel-averaged power dissipation. The same five values were tested in each system, and the goal was to obtain a blend time around 15 seconds. This was considered to be significantly shorter than the reaction time and therefore should minimize any ill-effects upon scale-up. As the attached graph demonstrates, a value above 0.1 watts/liter (tested value = 0.13 watts/liter) is required to reach or exceed the target blend time for both scales. Blend time in the smaller vessel is shorter when scaling by constant power/volume due to the relationship:

$$\frac{\left(P/V\right)_2}{\left(P/V\right)_1} \approx \left(\frac{D_2}{D_1}\right)^2$$

The ratio of the agitator diameters corresponds to the power input required to match the blend time during scale-up.