



Membrane Electrode Cell - Best Practice Quick Reference Sheet

Formulas

Electrode surface area is estimated using one or more criteria (Rule) listed below:

- **4:1 Ratio** - Anode area is equal to 2 minutes worth of painted through-put / 4
- **Electrode current density** - When total amp amount is divided by the amount of anode area, the figures should not exceed 35 amps/SF (3.5 amps/SM) for high through-put systems that need redundancy or as much as 5 amps/ SF (50 amps/SM) for industrial Ecoat paint systems
- **Center-to-center cell spacing** - The center-to-center between ME Cells should be no more than 3 x and no less than 1 x the circumference (or arc length) of the electrode

Glossary of Terms

Electrode surface area is estimated using one or more criteria (Rule) listed below:

- **Anode:** Positive side of the DC rectifier
- **Anodic Paint:** Ware is the anode
- **Cathode:** Negative side of DC rectifier
- **Cathodic Paint:** Ware is the cathode
- **Electrode:** The metal part connected to the bus bar. For cathodic paint it is the **anode** for anodic paint it is the **cathode**
- **Electrolyte:** Fluid inside the ME Cell. For cathodic paint its called **anolyte**, for anodic paint its **catholyte**
- **Ware:** Object or part being painted

ME Cell Configurations

There are several different types of Membrane Electrode Cell designs or configurations, including:

- **Open Top:** The most common and typically the least expensive since it has fewer parts
- **Closed Top:** Sometimes called **Low Profile** or **Pressurized**, has a **Bulkhead** Fitting. Does not require as much space above the rim of the tank
- **Horizontal (i.e. Roof or Floor):** Another type of closed top Cell. Note the electrolyte discharge must be at the 12 o'clock position and sloped upwards at 2% to allow oxygen to leave the Cell

Vigorous Electrolyte Flow

Continuous motion of the electrolyte promotes cooling to extend electrode life and expel the oxygen bubbles that can cause corrosion

- 2 gpm/10 sf (8 lpm/sm) + 20% to size electrolyte pump
- Size supply manifold at 3-5 fps (1-1.5 mps) velocity
- Size return manifolds for no more than 3/4 full
- Do not mix up the supply & return tubing connections for Closed Top Cells as the cell can fill with oxygen
- PVC tubing with 3/32" (2.3 mm) min wall thickness
- Use 90° hose barbs to avoid kinked PVC tubing
- Limit supply pressure for Closed Top cells to 7 psi (0.5 bar) to avoid over pressurization & membrane failure

Fungus

Stagnant, warm electrolyte fluid will promote the growth of fungus. Some preventive actions to take:

- **Electrolyte Pump:** Do not turn off, keep operating 24/7
- **Raise Electrolyte Conductivity:** The higher the conductivity, the less attractive the food source. Talk to your paint supplier to discuss an increase to 1,800 or 2,000 micro S/cm to help reduce fungus
- **UV lamp:** If your DI water or RO water is stored in a tank, is there a UV lamp on the recirculation loop?
- **Approved Biocides:** Use approved biocides in the electrolyte tank. Avoid those with halides such as chlorine and bromine as they may accelerate corrosion of the 316L anode
- **Limit Hydrogen Peroxide:** To 3% strength and no more than 2 or 3 consecutive cleanings with paint company approval

Preventive Maintenance

Several activities can be performed during the year that may pay benefits, reduce surprises, & lessen down-time:

- Do not mix new and old ME cells in the same region of the Ecoat tank. Use a defined replacement strategy
- Keep Electrical connections tight with spring washers
- Train personnel on Confined Space & Lockout/Tagout
- Repair membrane tears less than 1 in (25 mm)
- Avoid membrane contact with strong oxidizers
- Use a carbon filter as part of the DI water system
- Discuss with paint vendor use of nitric acid to reduce 316L corrosion
- Record the mass loss of the 316L electrodes, rotate tubular Electrodes 4 x a year, or visually inspect precious metal anodes

Web Sources

Web links for more information:

- <http://ufsc.com/download.php> - then click on ME Cells
- Email service questions to - Service@ufsc.com
- Electrocoat Association - www.electrocoat.org
- Instrumentation products - www.jptechinc.com
- HMI/SCADA software - www.iconics.com
- Paint company websites
- Water treatment websites
- Equipment supplier websites
- Ecoat machine OEM websites

Baseline Data

Every system will change as it is operated. When trouble occurs, baseline data provides a valuable basis for comparison:

- **Voltage:** Consider voltage the human heart beat of the Ecoat system. Low voltage reduces energy consumption and require less cooling. Each different ware package may require a slightly different voltage based upon the customer's film thickness requirements.
- **Electrical Current, Amps:** The ability of the ME Cell to deliver work and a measure of how resistive the Cell is. Readings should be recorded every 30 days for the largest ware
- **Conductivity & Temperature:** Monitor these two parameters of the electrolyte circulation system and record daily