



# Best Practices Membrane Electrode Cells

[www.ufsc.com](http://www.ufsc.com)



# Online Help

- Go to [www.ufsc.com](http://www.ufsc.com) for detailed help
  - Abbreviations used within, which can be seen at <http://www.ufsc.com/customercentermain.htm>
    - (SR) Service Reference
    - (TR) Technical Reference
    - (IR) Installation Reference
- Visit other vendor web sites
  - Paint
  - Water treatment

# ME Cell Types

Box



Tubular



C Cell



# Establish Baselines

- Record baseline values during start up for a basis of comparison as system ages
  - Under largest load & shortest cycle, measure maximum amps for each ME Cell location
  - Record required voltage for each different load type.
  - Anolyte supply manifold pressure not to exceed 0.35 – 0.46 Bar (5-7 psi)



# Replacement Strategy

- Do not intersperse new Cells with old Cells.
- Try to repair minor damage to Shells.
- Best practice is to replace all Cells at once.
- Good practice is to replace Cells at one time,
  - Monorail tank: Replace 1/3 or 1/2 and the remainder within 6 - 12 months. For details see SR entitled 'Membrane Shell Replacement Strategy' at [www.ufsc.com](http://www.ufsc.com) .
  - Hoist tank: 1/2 at one time, and the remainder within 6 - 12 months.



# ME Cell Installation

- New installation
  - Install new cells after the tank has been caustic cleaned.
  - Leak check ME Cells before paint fill.
- Open Top ME Cells
  - Secure Membrane Shell first.
  - Do not drop Electrode when inserting it into the Shell. Fill it ½ way with DI water first.
  - Keep anolyte return tubing short and down sloped to return manifold avoiding kinks.
- Low Profile (Closed Top) ME Cells
  - Use 2 persons since unit is heavier once Electrode is installed.
  - Pot any exposed electrical connection to insulate.
  - Do not reverse anolyte inlet and outlet fluid connections.
- Replacements - leak check cells before installation in paint tank
- See IR entitled 'All TECTRAN ME Cells' on [www.ufsc.com](http://www.ufsc.com) for more information.



## ME Cell Anolyte Flow Meters

- Every cell should have its own flow meter & isolation valve.
  - Easy to control proper anolyte flow.
  - Positive indication of anolyte flow.
  - Easy to locate cells with slow/fast anolyte flow.
  - Easy to isolate leaking ME Cells.



# Anolyte Tubing

- Tubing should be minimum of 2.3 mm (3/32 inch) wall thickness.
- Braided return tubing is preferred for hoist systems.
- Do not use wire ties to bundle/secure tubing.
- Use 45° or 90° hose barb fittings to avoid kinks in tubing due to weight of fluid.
- Protect tubing from mechanical damage.



# Anolyte Circulation

- Anolyte pump flow rate should be selected for minimum 120% of theoretical requirement of all Cells.
- 8 lpm/1 sm (2 gpm/10 SF) anolyte flow requirement.
- Double the anolyte flow requirement for any horizontal Cell to completely purge oxygen.
- Slope horizontal Cells upward at 1-2% & locate outlet at 12 o'clock to discharge ALL oxygen from inside the Cell.



# Anolyte Circulation (cont'd)

- Anolyte supply manifold sized to 1-1.5 m/sec (3-5 fps), with minimum size of 1-1/4" PVC Sch 80 pipe.
- Anti-siphoning device (with isolation valve) needed at termination of anolyte supply manifold.
- Cut anolyte return tubing at 45 deg angle before inserting into return manifold.
- Anolyte return manifold must be sloped downward at 20 mm per meter (1/4" per foot) and sized so it is no more than 3/4 full.
- Main trunks of anolyte manifolds to be 1 pipe size larger than branches.



# Anolyte Circulation (cont'd)

- Closed Top cells
  - Limit anolyte supply pressure to 0.35 – 0.5 Bar (5-7 psi) at inlet to ME Cell.
    - Over pressurization will stretch the ion-exchange membrane creating small leaks which are permanent and not reversible.
  - Do not reverse inlet & outlet anolyte fluid connections.
    - Inlet is usually 3/8" ID.
    - Outlet is usually 1/2" ID.
    - If connections are reversed then oxygen will not be allowed to exit and the interior will eventually become filled with gas and less and less current will be delivered. There will still be anolyte flow through the Cell, but since the Cell is not filled with fluid, there is no path for electrical conduction.



# Electrical Connections

- Use compression washer on all electrical joints to overcome thermal stress.
- Welding cable or DLO is best. THHN is adequate but not very flexible.
- Cover any quick disconnects to protect plastic housings from premature aging.
- Avoid any 'push on' connections as they do not perform well in thermal stress loads.



# Electrodes

- Rotate 120 degrees every 4 months.
- Chart the weight loss of 316L type over time, (i.e. every 6 months). Replace when 60% of mass is lost. Refer to SR entitled Stainless Steel Electrode Weight Sampling at [www.ufsc.com](http://www.ufsc.com) for details.
- Visually inspect Precious Metal anodes for signs of wear. Refer to SR entitled Precious Metal Electrode Inspection at [www.ufsc.com](http://www.ufsc.com) for details.
- Use carbon filter as part of DI water system.



# Ion-Exchange Membrane

- Roll type vs Sheet type
  - Roll type introduced as a cost reduction strategy from suppliers, must accept 2 x water permeability, not recommended for Low Profile Cells.
  - Sheet type was original configuration and has excellent mechanical properties.
- Resistivity increases with load & operation
  - Initially extremely low.
  - Becomes significant after 15 - 20k hours of operation.
  - If you have a 60 – 80 V increase & can not otherwise account for the increase then the ion-exchange membrane's resistivity has increased.
  - Possible to perform a bench top comparison between old vs new ion-exchange membrane.
- Strength can be compromised by oxidizers
- Wet – Dry cycles will cause membrane to shrink from original shape, keep this to a minimum over products lifetime



# Fungus

- Increase anolyte conductivity to 1800 – 2000 microS/cm or more.
- Use UV lamp on DI or RO water makeup to the anolyte system.
- Use paint vendor approved biocides.
- Keep hydrogen peroxide concentration to 3% (max) by volume and no more than 3 consecutive treatments to avoid over-exposure of the fragile ion-exchange membrane.
- Keep anolyte pump running 24/7.



# Other Considerations

- If anolyte pump fails, hook up DI water line and operate 10 minutes every hour to keep maximum temperature low.
- Keep ME Cells grouped by age & condition so they share load equally.
- Disconnect Electrical connection if anolyte must be turned off to a particular Cell.
- If high pressure spray washers have to be used they can easily cut through the membrane. Stay back 2 meters and use a medium pressure system. Test procedures on a sample Shell and then leak check to make sure there is no damage before proceeding to all the other Shells.
- Keep ion-exchange membrane moist.