

TECHNICAL REFERENCE

TOPIC: MEMBRANE ELECTRODE GLOSSARY OF TERMS

4 to 1 Rule - Commonly referred to method used to estimate electrode area. In the case of a cathodic ED system, multiply the Painted Throughput by 2 minutes and divide by 4.

-A-

AC - Alternating Current. Usually available at 480 or 600 volts.

Acetic Acid - Typical cathodic paint solubilizer.

Acetate Ion - Negative solubilizer ion produced in the ED process, which passes through the membrane of the Membrane Electrode Cell into the electrolyte fluid.

Acidity - See pH.

Acrylic Coatings - Coatings comprised of acrylic polymers characterized by excellent stability and UV exposure resistance.

Amine - Chemical used widely in anodic EDP paints to make the paint water dispersible. See Neutralizer.

Amps - Flow of electricity in coulombs/second.

Anions - Negatively charged ions that are attracted to the positively charged anode.

Anodic Paint - An ED paint that forms on the anode.

Anode - Positively charged electrode.

Anode Area - See Electrode area.

Anolyte - Solution surrounding the anode in the anolyte cell; sometimes referred to as solubilizer, it is essentially acetic acid and deionized water.

Anolyte Cell - An anode enclosed in a plastic housing and separated from the paint with a semi-permeable membrane; the membrane allows concentrated solubilizer to pass through, while excluding passage of paint molecules.

ANSI - American National Standards Institute

ASTM - American Society for Testing and Materials

Auxiliary Electrodes - Often portable, they are placed inside cavities of large objects. Increases the paint film build in specific areas of the part.



-B-

Bacteria - Often composed of single cell microorganisms that can contaminate some paint baths.

Bare Electrode - An Electrode that makes close contact with the ED paint bath.

Bath - A low solids (typically less than 25%) dispersion of paint solids combined with D.I. Water and other compounds.

Biologicals - Broad category applied to any organism (fungus, bacteria, etc.) that can thrive and multiply in any of the process fluids of the ED system.

Box Cell - Rectangular cell where the electrode is equal to the membrane area.

Bulkhead - Device used to separate or close off a region, but yet allows a passageway for fluid or electrical current.

Bus Bar - Rectangular copper bar that allows multiple Electrode connections.

-C-

Cable Lead, Long Half - Usually longer portion of the Cable Lead that connects to the bus bar.

Cable Lead, Pigtail - Usually shorter portion of the Cable Lead that connects to the Electrode.

Cap - Part of the TECTRON Membrane Shell that seals the end of the Membrane Shell.

Carrier - Mechanical device used to contain the substrate being painted as it moves through the paint bath.

Cathode - Negatively charged electrode.

Cathode Area - See Electrode area.

Cathodic Paint - An ED paint that forms on the cathode.

Cations - Positively charged ions that are attracted to the negatively charged cathode.

Center to Center - Distance from the center of a TECTRON[®] Cell to an adjacent Cell.

Chlorides - Any binary compounds of chlorine (Cl⁻) consisting of chromic phosphate and aluminum oxides.

Chrome Phosphate - Amorphous structure that enhances corrosion resistance.

Cleaner - Chemical that is designed to remove surface contaminants that may interfere with the deposition of the ED paint.

Collar - Part of the TECTRON Membrane Shell that connects the membrane to the upper portion of the Cell.

Compatibility - The ability of different materials to mix or combine together without an adverse reaction.

Conductive Primer - A primer when electrodeposited and cured will not act as an insulation of the coating metallic object, but will conduct current for the electrodeposition of a second coating or topcoat film.

Conductivity Specific - A property of a material or mixture that describes its ability to transfer electricity. Usually defined as the reciprocal of resistivity and known by the symbol 'k'. Expressed as microSiemens/cm (microMhos/cm).

Confined Space - A term defined by USA OSHA that must be checked for the lack of oxygen or the overabundance of other gases. Check with your safety department for more assistance.

Contamination - Any substance present in a solution or on a metal surface, which is detrimental to the process being formed.

Conveyor - Device used to move the ware through the various stages of the ED paint finishing system.

Corrosion - To eat away by chemical reaction (e.g. rust on steel).

Coulombic Yield - The weight of coating deposited per coulomb of current. This is usually expressed as coulomb/gram and is a measure of the electrical efficiency of the ED paint.

Cratering - A bowl-shaped depression (concave) in the ED paint film down to the substrate.

Crescent Shaped Cell - Similar to a box cell except shaped in a semi circle as seen from the top view.

Current - Amount of electrical flow, expressed as amps or coulombs/second.

Current Density - Current flowing per unit area, amps/m² (amps/SF).

Current Draw - The amount of electrical current flowing at a specific instant at a given point.

-D-

Darlington Module - Transistorized switching unit.

DC - Direct electric current.

Dead Entry - The first Electrode is placed a considerable distance away from the LPI point, so that very little current flows to the ware until it moves closer to the first Electrode.

Deionized Water - See D.I. Water.

Demineraized Water - Synonym for distilled water.

D.I. Water - Water purified by the removal of virtually all ionic species.

Dialysis - Separation of small molecules from macromolecules in a solution by means of a semipermeable membrane.

DIN - German industrial standards organization.

Diode - Any electronic device that restricts current flow to one direction.

Dirt - Particles in the ED paint film.

Dirt Bits - Small particles of ED paint solids, sometimes in combination with other contaminants, in the ED paint bath. These objects can cause a defect, usually on horizontal surfaces.

Dry Film Thickness - Measurement of paint film after drying and/or curing.

Dwell Time - The amount of time a part is completely immersed in the paint bath.-

-E-

E-Coat - See Electrocoating

ED - See Electrocoating

EDP - Acronym for electrodeposition of paint.

Eductor - Venturi nozzles located laterally across the floor and down the sidewalls of the ED tank that help agitate the paint solution.

Electro-chemical Equivalent - The weight of paint solids(in grams) deposited under the influence of one coulomb of electricity passed through the paint bath.

Electrocoating - An electrochemical process where a voltage difference is applied across two electrodes in an aqueous solution of organic material. The organic material migrates to one of the electrodes and forms a film on the electrode.

Electrodip - See Electrocoating

Electrodeposition - See Electrocoating

Elpo - See Electrocoating

Electroendosmosis - The movement of water and solvent away from the depositing electrode through the film during ED.

Electrode - Conductive surface that provides a voltage gradient and opposes the ware.

Electrode Area - Conductive surface area of the Electrode present in the Cell or Electrode Holder.

Electrode Holder - Non-conductive device to hold and shield the Electrode from possible contact with the ware.

Electrode Tab - Thin metal ribbon that is attached to the main portion of the Electrode.

Electrolysis - Passage of current via ions under the influence of a voltage gradient.

Electrolyte - Solution of D.I. Water and ions inside the Cells. In the case of cathodic ED paint, the pH is less than 7.0. For anodic ED paints, the pH is above 7.0.

Electrons - Negatively charged subatomic particles that circle the positive nucleus of atoms. Current flow is caused by the passage of electrons from atom to atom.

Electrophoresis - The movement of ions suspended in a polarized liquid.

Epoxy Acrylics - Replaced epoxy-esters as the best anodic detergent resistance primer.

Erosion - Natural process in the case of a metal anode, where the metal is sacrificed over a period of time by the prevailing electro-chemical reaction.

Evaporation - Conversion of a liquid into a gaseous state.

-F-

Film Thickness - Thickness of the coating after curing, expressed in microns (mils).

First Part Out (FPO) - Location where the largest ware starts to break through the liquid level of the bath.

First Electrode - In a monorail conveyer system, the Electrode that is positioned at the entry to the ED tank.

Fish Eyes - Very large craters usually due to silicone, oils, etc. contamination prior to the ED bath.

Flat Cell - An anolyte cell that has a flat, rectangular geometry. Extremely heavy, and difficult to maintain.

Floor Cell - Cell positioned along the floor of the ED tank.

Flow Meter - Mechanical or electrical detection device used to measure the flow rate through a pipe or other known cross section.

Flushable Electrode - See Membrane Electrode Cell

Freeboard - Vertical distance between tank lip and paint surface in tank.

Fuse - Electrical protection device.

-G-

Ground Electrical - An object so massive that it can gain or lose very large numbers of electrons without becoming perceptibly charged one way or the other. A good example is an earth ground.

-H-

Hash Marks - A film defect, which sometimes occurs on vertical surfaces as the part is being submerged, generally with live entry.

Heatsink - An aluminum device that allows the transfer of heat away from a component into the atmosphere either by natural convection or forced convection by the means of a fan.

Horizontal Settling - Dirt settling on the top side of horizontal surfaces.

-I-

Ions - Charged particles, either negative or positive.

Ion Exchange Membrane - Semi-permeable membrane that allows only particles of a certain charge to pass through while rejecting particles of the opposite charge.

Iron Phosphate - Amorphous structure consisting of a mixture of iron phosphate and iron oxides. Used to improve adhesion and corrosion resistance.

-J-

Job - See ware.

-L-

Laddering - See Hash Marks

Live Entry - The first Electrode is placed close to the LPI point, such that the ware is painted more quickly

Lockout - Method used by a person to place their own lock on the DC rectifier to keep the unit from being turned back on until the lock is removed.

Lug (connector) - A clamping device used to hold cable leads to the Bus Bar providing an electrical connection.

-M-

Membrane - Porous synthetic made with differing pore sizes that acts as a highly efficient filter. Allows the passage of ions, water, and other solvents and very small molecules, but almost impermeable to macromolecules.

Membrane Guard - Protective shield around the membrane.

Membrane Monitor™ - Monitoring device to measure the voltage drop across the Cell/Electrode.

Membrane Shell - Outer housing of the Cell that contains the membrane.

MEQ (Milliequivalents) - Concentration of ED solubilizer in the bath; usually expressed as MEQ/100 grams of paint solids or MEQ/liter for liquids.

Meter - Unit of distance in SI units.

Milliamp - 1E-3 Amps.

Millivolt - 1E-3 Volts.

Micron - Micrometer, or 1×10^{-6} of a meter, usually shown as the symbol, m., or μ .

MicroMho - 1×10^{-6} of a mho, a measure of conductivity.

MicroSiemens - 1×10^{-6} of a Siemens, a measure of conductivity.

Mil - Unit of measuring film thickness. 1 mil equals one thousandth of an inch (0.0001 inch).

-N-

Neck - The top most portion of the TECTRON Cell/Electrode.

Neutralizer - The ingredient in the EDP Paint, which makes the paint water dispersible. In anodic systems this is an amine, while in cathodic systems it is an acid.

Nipple - Commonly used term to describe a pipe with male threads on each end.

No-coat - A part that receives little or no ED paint film. Can be caused by a lack of electrical contact, no applied power (voltage), or a rectifier malfunction.

Non-volatile (NV) - Compounds that do not evaporate.

-O-

Ohm - Standard unit of electrical resistance.

Ohm's Law - Relationship between voltage, current and resistance for a DC circuit.

Ohmmeter - Measures electrical resistance.

Orange peel - Rough and uneven cured paint finish usually caused by high levels of iron contamination of the ED bath.

Overflow Nozzle - Usually a hosebarb adapter that connects the Return Tubing with the Return Manifold.

-P-

Painted Throughput - The amount of paintable surface area that passes through the ED system. For a monorail conveyor system, it is the amount of surface area, per minute, that passes through the ED bath. For a hoist system, it is usually expressed as the surface area per load (in the ED bath at one time) and the number of loads painted per hour.

Passivity - Lack of chemical activity.

Peak Current - The maximum current flow recorded during the ED process. This usually occurs very quickly after the ED process has started. The forming ED film has inherent resistance that will tend to limit current if the voltage is held constant.

Permeable - Porous to the passage or permeation of fluids.

Permeate - The fluid substance (water, solubilizers, and dissolved material) separated from the paint bath by ultrafiltration.

PLC - Programmable Logic Controller. A computer undertaking a multiple level of tasks that provides automation for production. The PLC sends, receives, and stores data and commands.

Pre Wet - Lineal distance from the LPI point to location of the first electrode, generally equal to a time of about 10 seconds, or more.

pH - The relative scale to judge the number of H⁺ ions in a solution with a range from 1 to 14. A pH of 7.0 is said to be neutral, a pH less than 7.0 is acidic, and a pH more than 7.0 is basic.

Phosphating - Metal treatment prior to the ED bath where a crystalline layer is applied to enhance the adhesion of the ED film layer.

Pinholing - Tiny round breaks in a paint film giving the appearance of a pinhole.

Plaguing - Rough film due to excess current.

Power on Distance, Monorail Type ED Conveyor Systems - Lineal distance from the location of the leading edge of the first Cell to trailing edge of last Cell.

Purge - Amount of permeate diverted to the waste stream in order to remove contaminants.

-Q-

Quick Electrical Connect - Electrical connection that can be connected or disconnected without tools.

-R-

Rectifier - Device to convert AC power to DC power.

Relay - Electrical device where a low voltage signal can control a higher voltage operation.

Replenishment - High solids paint concentrate added to the paint bath to maintain a proper balance of solids, MEQ, solvent, color, etc.

Resistance - Opposition to flow of current, expressed in ohms.

Resistor - Electrical device with a known resistance value.

Resistivity Specific - A property of a substance or mixture, usually expressed as Ohm-cm for a 1 cm x 1 cm x 1 cm cube. The symbol is r , or ρ .

Return Tubing - Generally a clear PVC tubing used to connect the Overflow Nozzle to the Return Manifold.

Ripple - The superimposition of alternating voltage on a DC output of a rectifier.

Roof Cell - Cell positioned along the roof of the auto body or top section of the ED tank.

Rub Rail - Usually PVC or fiberglass pipes positioned between the sidewalls of the ED tank and the ware. Used to protect the sidewalls from damage by a swinging ware.

Ruthenium Oxide Coated Titanium (RuO₂) - Ruthenium dioxide coated titanium. Used to extend life of electrodes and reduce ferric ion contamination of bath.

Rupture - Bursting of the ED paint film caused by the very rapid generation of gas at the surface of the part being painted. Usually due to excessive voltage.

-S-

Shunt - High quality resistor used in combination with a shunt-rated DC ammeter.

Shutdown - Ability of the wet ED paint to restrict the deposition of additional thickness once a certain amount of paint has been deposited.

Signal Conditioner - Electrical device used to transform a high voltage signal to a more usable low voltage/low current signal.

Siphon Breaker - Device used to stop a siphoning action. Usually used on Electrolyte Return manifolds to keep the Cells from losing their electrolyte solution.

Solids - Pigment and non-volatile vehicle components of paint.

Solubilizer - Paint stabilizer that aids in maintaining paint solids in solution.

Solvent - Component of a solution that dissolves other components.

Splash Guard - Protective device at the top of the Cell/Electrode used to keep ED paint out of the inside of the Cell/Electrode.

Stainless Steel - Metal alloy resistive to corrosion from most types of common atmospheric contaminants.

Substrate - Material on which the ED film forms.

Super Cell - See Crescent Shaped Cell.

Supply Tubing - Generally clear PVC tubing used to connect the Supply Manifold to the Cell.

Surface Conductivity - The electrical resistance of a particular surface.

-T-

Tagout - See Lockout

Throw Power - Relative measure of how far an ED paint will be deposited inside a narrow passageway.

Toroid Coil - Metal shaped toroid, wrapped with an insulated copper conductor. Used to detect the AC current through a conductor.

Turbidity - Relative measure of the opaqueness of a fluid stream.

Tubular Cell - Type of Cell where the membrane is a concentric cylinder around a cylindrical electrode.

-U-

UF - See Ultrafilter.

Ultrafilter - Semi-permeable membrane used to separate water and other low molecular weight compounds from the ED paint resins.

UV - Ultraviolet, invisible rays in the spectrum lying outside the violet end of the visible spectrum. Sometimes used to kill certain types of bacteria in a process stream.

-V-

VCO - Variable Current Overload

Voltage - A measure only of the potential difference (force or pressure) in electrical systems; it does not indicate amount of current.

VOC - Volatile Organic Compound

-W-

Ware - Parts to be painted. See Substrate.