

# PennTech Newsletter

NL# 711

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## Quote of the Week

*"The greater danger for most of us is not that our aim is too high and we miss it, but that it is too low and we hit it."*

.... Michelangelo

## Next Weeks Topic

\* PennTech Dual and Single Trayloaders \*



PennTech Machinery Corp.  
103 Steamwhistle Drive  
Ivyland, PA 18974  
USA  
Phone: 215.396.2200  
Fax: 215.396.6774  
info@penntech-corp.com

Author: Vincent Smit  
vsmit@penntech-corp.com

## Understanding Electropolishing

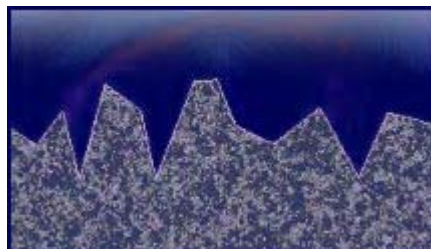
Electropolishing is an electrochemical process similar to, but the reverse of, electroplating. The electropolishing process smoothes and streamlines the microscopic surface of a metal object. As a result, the surface of the metal is microscopically featureless, with not even the smallest speck of a torn surface remaining.

In electropolishing, the metal is removed ion by ion from the surface of the metal object being polished. Electrochemistry and the fundamental principles of electrolysis (Faraday's Law) replace traditional mechanical finishing techniques, including grinding, milling, blasting and buffing as the final finish. In basic terms, the object to be electropolished is immersed in an electrolyte and subjected to a direct electrical current. The object is maintained anodic, with the cathodic connection being made to a nearby metal conductor.

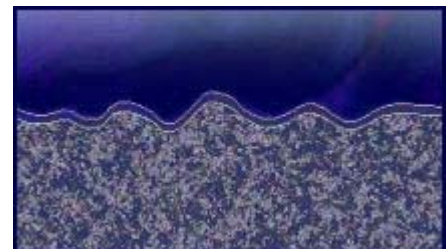
During electropolishing, the polarized surface film is subjected to the combined effects of gassing (oxygen), which occurs with electrochemical metal removal, saturation of the surface with dissolved metal and the agitation and temperature of the electrolyte.

Smoothness of the metal surface is one of the primary and most advantageous effects of electropolishing. During the process, a film of varying thickness covers the surfaces of the metal. This film is thickest over microdepressions and thinnest over microprojections. Electrical resistance is at a minimum wherever the film is thinnest, resulting in the greatest rate of metallic dissolution. Electropolishing selectively removes microscopic high points or "peaks" faster than the rate of attack on the corresponding micro-depressions or "valleys." Stock is removed as metallic salt. Metal removal under certain circumstances is controllable and can be held to 0.0001 to 0.0025 inch.

In summary, electropolishing removes metal. It does not move it or wipe it. As a result, the surface of the metal is microscopically featureless, with not even the smallest speck of a torn surface remaining. The basic metal surface is subsequently revealed – bright, clean and microscopically smooth. By contrast, even a very fine mechanically finished surface will continue to show smears and other directionally oriented patterns or effects.



Surface Profile Before Electropolishing



Surface Profile After Electropolishing

**Benefits of Electropolishing****Comparison Table****Understanding Passivation**

		Before Electropolishing		After Electropolishing	
Mill No.	Grit No.	Surface Roughness, RA		Surface Roughness, RA	
		micrometer	microinches	micrometer	microinches
3	60	3.56 max	140 max	1.78-2.25	70-90
4	120	1.14 max	45 max	0.57-0.75	23-30
4	180	0.64 max	25 max	0.32-0.40	13.16
7	240	0.20-0.51	8-20	0.10-0.26	4.1
8	320	0.15-0.38	6-15	0.08-0.19	3.8
8	500	0-10-0.25	4-10	0-05-0.13	2.5

**Enhanced Mechanical Properties**

Less friction and surface drag.

Increased production and duty cycles in process equipment. Electropolishing greatly reduces fouling, plugging, scaling and product build-up.

Surface retains the true grain structure and properties of the bulk metal.

Fatigue strength is not reduced. Electropolishing allows the true fatigue strength of a part to be accurately determined.

Higher fatigue strength can be promoted by particle-blasting the surface to reintroduce compressive stress without losing electropolishing's advantages.

Stress-relieving of the surface.

Reduces galling of threads on stainless and carbon steel and other alloys.

**Better Physical Appearance**

No fine directional lines from abrasive polishing.

Excellent light reflection and depth of clarity.

Bright, smooth polish; uniform luster of shaped parts.

**Ease of Cleaning**

Substantially reduces product contamination and adhesion due to the microscopic smoothness of an electropolished surface (much like a glass surface).

Decreases cleaning time. Electropolished surfaces can be effectively hydroblasted in less time and with less pressure. Some companies report that electropolished process equipment surfaces have reduced cleaning time by more than 50 percent.

Improves sterilization and maintenance of hygienically clean surfaces for food, drug, beverage and chemical processing equipment.

Provides best passivation of stainless steel. Unipotentializes stainless steel with the oxygen absorbed by the surface, creating a monomolecular oxide film.

Decarburizes metals.

Removes cold-worked metal oxides.

**Better Corrosion Protection**

Electropolishing yields maximum tarnish and corrosion resistance in many metals and alloys. Stainless steel contains metallic and non-metallic inclusions, which are unavoidably included during manufacture. Mechanical polishing not only fails to remove inclusions, but also tends to push them further into the surface and even increase them by further pick-up of abrasive materials. These inclusions eventually can become points of corrosion.

**How Electropolishing is Used in PennTech Vial Washers**

Given its many benefits, electropolishing (standard on the model RW-1150, optional on both the RW-800 and RW-500) is used on all WFI and Sterile Air contact parts to include: the wash chamber, all piping including change parts, outfeed plate, recirculation tank and instrumentation.