

# Electropolishing of metal surfaces and its effect on Bal Seal® spring-energized seal performance

Technical Report  
TR-26 (Rev. A; 07-29-15)  
(21-11-2)

## Contents

1.0	Summary	3
2.0	Discussion	3
3.0	Electropolishing and Bal Seal® Reliability	3
4.0	The Electropolishing Process	3
5.0	Advantages	4
6.0	Applications	4
7.0	U.S. Electropolishing Sources	4
8.0	References	4

The information, descriptions, recommendations and opinions set forth herein are offered solely for your consideration, inquiry, and verification and are not, in part or in whole, to be construed as constituting a warranty, expressed or implied, nor shall they form or be a part of the basis of any bargain with Bal Seal Engineering, Inc.. If any sample or model was shown to or provided by Buyer/User, such sample or model was used merely to illustrate the general description and type of goods. Such use is not to be construed as a warranty that the goods will conform to the sample or model. Furthermore, THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER WARRANTIES, IMPLIED OR EXPRESSED, ARE EXCLUDED AND SHALL NOT APPLY. This document provides product options for further investigation by Buyers/Users having technical expertise. The Buyer/User, through its own analysis and testing, is solely responsible for making the final selection of the products and for assuming that all performance, safety and warning requirements for the application are met. It is recommended that Buyers/Users run evaluation testing under actual service conditions to determine whether proposed Bal Seal Engineering products are suitable for the intended purpose. Nothing contained herein or in any of our literature shall be considered a license or recommendation for any use that may infringe patent rights. (LE-17)

PATENTS: The items described in this report include products that are the subject of the following issued United States patents: 5,979,904; 5,992,856; 6,050,572; 5,984,316; 6,161,838 and others, as well as foreign patents or products where patents are pending. (LE-88G)

©Copyright 2016 Bal Seal Engineering, Inc. U.S.A.

## 1.0 Summary

Electropolishing is a simple, efficient, and economical anodic bath process that electrocleans metals and removes sharp corners and some burrs from them. Electropolishing can improve a Bal Seal® spring-energized seal by minimizing sharp edges. This reduces the possibility of nicks or scratches to a Bal Seal®, especially during assembly or disassembly.

## 2.0 Discussion

Electropolishing changes the surface of metals by an electrolytic process in which the parts to be cleaned and polished are made the anode in an electrolyte solution and polished by removing surface material in the solution.

Metal is removed from the work pieces, because electropolishing is essentially electroplating in reverse. For the initial polishing, the amount of removed metal is directly proportional to the depth of scratches or machined marks. Subsequent cleaning by electropolishing, with the proper solution and operating conditions, is a gentle process that removes no additional metal.

Electropolishing can be used in most ferrous and non-ferrous metals. The most common materials are stainless steels, high alloy steels, certain aluminum alloys, titanium, and other specialty metals.

## 3.0 Electropolishing and Bal Seal® Reliability

Electropolishing smooths sharp edges and polishes surfaces, reducing the possibility of scratching the Bal Seal® surface, which could create leakage paths. Surface finishes can also be improved, which may result in lower seal abrasion; therefore, electropolishing tends to improve sealing ability.

## 4.0 The Electropolishing Process

Electropolishing is essentially a chrome plating process in reverse. It requires the use of a DC power supply, a solution tank, a rinse tank, an insulated anode, and cathode bars. First, the part must be degreased by solvent wiping or steam cleaning. This is followed by a hot water cleaning and rinsing process, because oil and grease contaminate and shorten the service life of the polishing solution. After cleaning, the parts to be polished are connected to the anode bar and placed in a non-toxic acidic or basic electrolyte solution. This solution is preheated to temperatures between 135 °F and 145 °F (57 °C and 63 °C), and an electrical current of 8 A is charged to the anode by the DC power supply. This current causes ions in the solution to flow toward the cathode bar and, in doing so, cleans, polishes, deburrs, and removes impurities from the metal surface. The metal-removal rate is approximately 0.0007 in. (0.01778 mm) per 30 seconds, depending on the temperature of the solution. As the temperature rises, the removal rate increases.

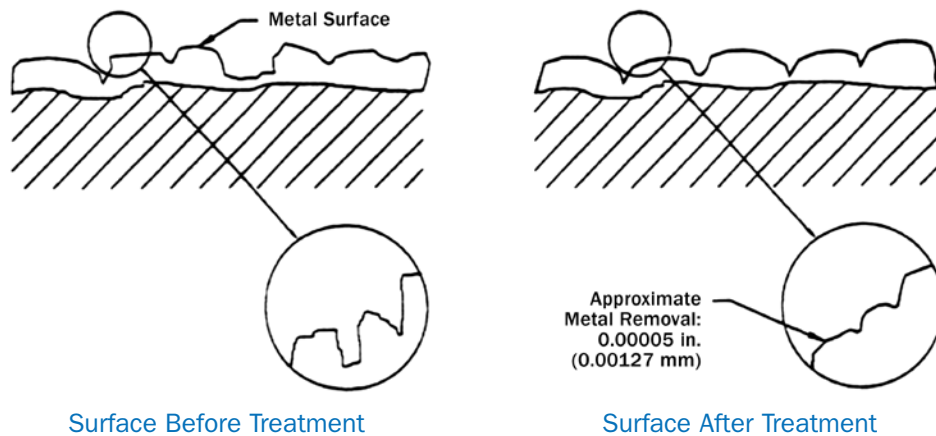


Figure 1.  
Magnified sectional (50X) view of an electropolished surface before and after treatment.

## 5.0 Advantages

The main advantage of electropolishing is that it provides a polished and shiny surface, breaks sharp edges, and removes some burrs. It also increases corrosion resistance, reduces brittleness, and reduces friction. The metal removal is controllable to a tolerance of  $\pm 0.00005$  in. (0.00127 mm). It can achieve a micro finish of as low as 7 RMS. It is relatively inexpensive compared with other polishing methods, and it is applicable to most ferrous metals.

## 6.0 Applications

Electropolishing is used to treat components such as valves for the medical, food processing, and life sciences industries; various types of processing equipment; aircraft and missile components; high precision instruments, etc.

## 7.0 U.S. Electropolishing Sources

Able Electropolishing  
2001 South Kilbourn Ave.  
Chicago, IL 60623  
(888) 291-5339; Fax: (888) 291-5339

American Bright Works  
8010 Ranchers Rd.  
Fridley, MN 55432  
(763) 572-0607; Fax: (763) 572-0575

Electropolishing Systems, Inc.  
24 Aldrin Rd.  
Plymouth, MA 02360  
(508) 830-1717; Fax: (508) 830-1789

Harrison Electropolishing L.P.  
13002 Brittmore Park Dr.  
Houston, TX 77041  
(800) 566-5641; Fax: (832) 467-3111

Kalamazoo Electropolishing Co. (KEPCO)  
145 North Leja Dr.  
Vicksburg, MI 49097  
(269) 649-5800; Fax (269) 649-5890

Metal Surfaces  
6060 Shull St.  
Bell Gardens, CA 90201  
(562) 927-1331; Fax (562) 927-0692

## 8.0 References

1. Molectrics Inc. Catalog
2. *Solid State Technology Processing & Production Buyers Guide*
3. Vacumetrics Inc., Catalog No. 50100, Electropolisher
4. Bal Seal DE-121 (74-21), *Designing for Electropolishing*