BAL SEAL® ENGINEERING, INC.

Custom components that drive tomorrow's technologies.

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)

19650 Pauling
Foothill Ranch, CA
USA 92610-2610
t +1 949 460 2100
f +1 949 460 2300
www.balseal.com

Jollemanhof 16, 5th floor
1019 GW Amsterdam
The Netherlands
t +31 20 638 6523
f +31 20 625 6018
www.balseal.nl

Suite 901, Chinachem
Century Tower
178 Gloucester Road,
Wanchai, Hong Kong
t +852 28681860
f +852 22956753
www.balseal.com.hk

ISO 9001 ISO TS 16949

Contents

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.

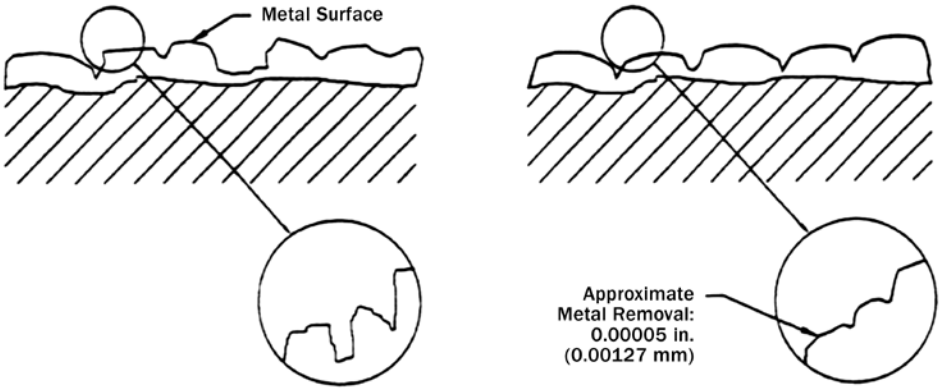
Electropolishing can be used in most ferrous and non-ferrous metals. The most common materials are stainless steels, high alloy steels, certain aluminum alloys, titanium, and other specialty metals.

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.



Surface Before Treatment Surface After Treatment

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 ±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*