

## Applications Note



### Economical solutions for ultra-high purity streams

- **SilcoNert** treated surfaces improve moisture wet-up or dry down performance by up to 3x compared to conventional surfaces.
- **Silcolloy** improves corrosion resistance tenfold, or more – increases component lifetime and maintains pure product stream.
- **Custom services:** can be applied to existing equipment.

For more information about SilcoNert and Silcolloy, visit us online at [www.SilcoTek.com](http://www.SilcoTek.com) or call us! 814-353-1778.



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# Improve Moisture Dry-Down and Corrosion Resistance with SilcoTek®

**SilcoNert® 2000 (Siltek®/Sulfinert®) treated tubing and system components offer improved analytical reliability and longer lifetimes.**

### Introduction

Gas transfer systems serving industry often require low moisture content and high resistance to corrosion. SilcoTek® coatings provide significant added value to conventional stainless steel substrates, by greatly reducing wet-up and dry-down times and dramatically improving corrosion resistance.

SilcoNert® 2000 is an amorphous silicon layer deposited onto, and into, the steel surface through a patented chemical vapor deposition (CVD) process. The SilcoNert® 2000 process (US Patent #6,444,326), has been optimized to reduce moisture hold-up and improve surface inertness.

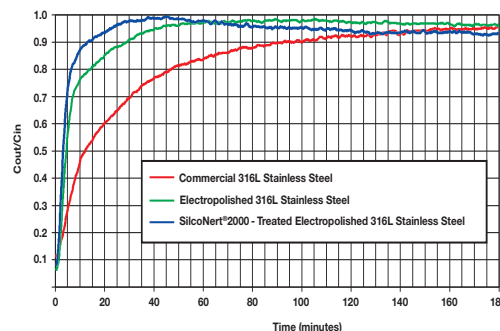
Data for wet-up and dry-down experiments, measuring the relative response time for moisture content change in SilcoNert 2000 treated electropolished stainless steel tubing, untreated electropolished stainless steel tubing, and standard 316L stainless steel tubing, demonstrate a significant advantage in treated versus untreated substrates.<sup>1</sup> Tubing used in the wet-up / dry-down experiments was supplied by Cardinal UHP (St. Louis, MO). All tubing was tested as 100 foot coils of 1/4" OD x 0.020" wall 316L stainless steel. Electropolished tubing had a surface roughness of 10 to 15 micro-inches. SilcoNert 2000 treated tubing is finished with up to 0.5µm of amorphous silicon, followed by a surface functionalization that increases inertness and hydrophobicity.

Wet-up curves for SilcoNert 2000 treated electropolished, conventional electropolished, and standard tubing are compared in Figure 1. Treated electropolished tubing reached the 98% saturation limit in 30 minutes,

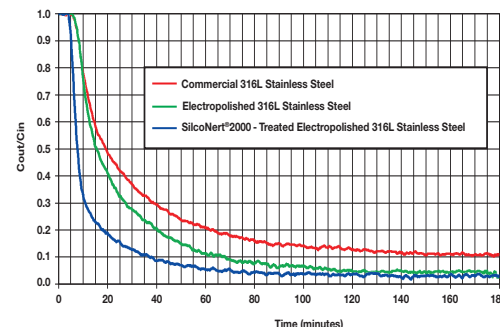
compared to 60 minutes for electropolished tubing. Standard tubing could only achieve a 96% uptake, after 180 minutes.

After the tubing was stabilized with 1ppm of moisture, dry-down properties were measured. Moisture dry-down curves for the three tubing treatments show treated electropolished tubing achieved dry-down in 35 minutes, electropolished tubing required 65 minutes, and standard tubing required 175 minutes (Figure 2). Table 1 compares time to various dry-down levels for tubing saturated with 10ppm of moisture.

**Figure 1** SilcoTek treated electropolished tubing stabilizes at 1ppm moisture much faster than conventional surfaces.<sup>1</sup>



**Figure 2** SilcoTek treated electropolished tubing dries much faster than conventional surfaces.<sup>1</sup>



**Table 1** SilcoTek treated electropolished tubing provides the shortest drying times.<sup>1</sup>

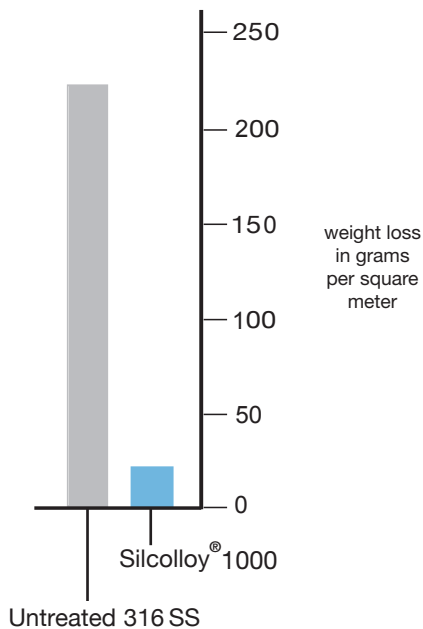
Moisture Concentration		Time Required to Detect Change (min.)		
From	To	SilcoNert2000 Treated Electropolished Tubing	Untreated Electropolished Tubing	Standard Tubing
10ppm*	5ppm	4	5	13
5ppm	1ppm	22	46	71
1ppm	500ppb	40	63	96
500ppb	100ppb	80	103	153
100ppb	50ppb	98	121	---

\*Initial moisture concentration.

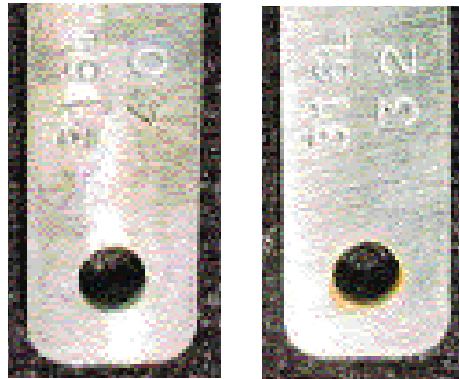
## Improve corrosion resistance with Silcolloy (Silcosteel®-CR)

In addition to rapid wet-up and dry-down, the other key advantage of SilcoTek treatment for 316L stainless steel is a dramatic improvement in corrosion resistance. The amorphous silicon layer is insoluble in many acidic environments encountered in industry. Figures 3, 4, and 5 briefly summarize the results of corrosion testing by ASTM methods. Comparisons between treated and untreated test samples illustrate the improvements in corrosion resistance offered by Silcolloy® 1000 treatment. For more information about corrosion resistance, request an information packet, or visit our website, [www.SilcoTek.com](http://www.SilcoTek.com).

**Figure 3** In chloride environments, Silcolloy 1000 treated stainless steel outperforms untreated metal by an order of magnitude (ASTM G 48, Method B).



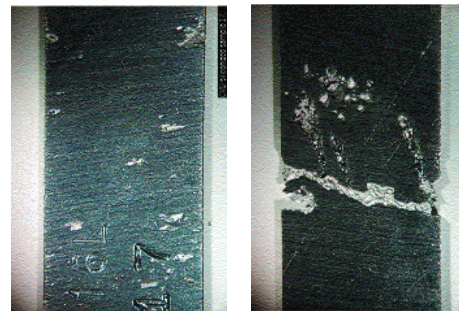
**Figure 4** Silcolloy 1000 treated 316L stainless steel coupons show no sign of attack after 4000-hour salt spray exposure, per ASTM B117.



Silcolloy1000 treated

untreated

**Figure 5** Silcolloy1000 treated 316L stainless steel coupons show no crevice corrosion and only slight pitting corrosion after 72-hour exposure to ferric chloride; untreated coupons exhibit severe crevice corrosion.



Silcolloy1000 treated

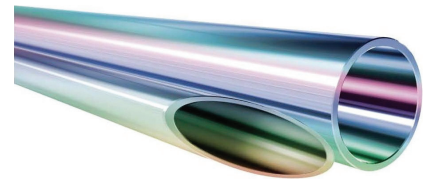
untreated

## Summary

When moisture considerations and corrosion concerns arise in transfer of ultra-high purity gas streams, SilcoTek treated tubing and system components will dramatically improve dry-down, reduce contamination from moisture carryover, and extend periodic maintenance cycles.

### SilcoTek Treated Electropolished Tubing

- Exceptional inertness.
- Improved reliability and reproducibility; longer lifetime.
- Use with treated fittings for the most inert sample pathway available.



### Reference

1. Relative Response Time of True Tube™ when Measuring Moisture Content in a Sample Stream Test Report, Haritec Scientific & Engineering Support, Calgary, Alberta, Canada, May 2004.

Reference courtesy of O'Brien Corporation, available on request from Restek.

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## Free Literature

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### Step 2 - Send in your parts!

Mailing instructions, shipping labels and service number will be forwarded to you along with your quotation. Box up your parts and send them to us. Your order will be processed in 10 working days or less.

Our 2 touch system means zero disappointments. We'll notify you when we receive your parts and when your order is ready to ship.



SilcoTek treatments are available worldwide through representatives in analytical instrumentation, tubing specialists, fitting manufacturers, and other technology industries. For a complete listing of where you can purchase SilcoTek treated products, go to our website [www.SilcoTek.com](http://www.SilcoTek.com)