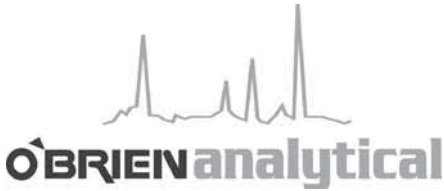


O'Brien Analytical



TrueTube™

TrueTube is a family of tubing products developed to provide best-of-breed performance in sample transport for process and emissions analyzers. O'Brien Analytical starts with select grade tubing and enhances its physical characteristics to improve dry-down, adsorption and corrosion resistance. We do this by controlling surface roughness, cleanliness, surface chemistry and reactive contaminants.

Surface Roughness

Surface roughness contributes to adsorption / desorption problems associated with analyzer sample lines. The microphotographs below illustrate one of the differences in tube material and selection. Surface roughness is only one factor to consider when specifying sample tube material. However, like other choices in sample system components, it can improve or limit the repeatable accuracy of the entire system.

Cleanliness and Reactive Contaminants

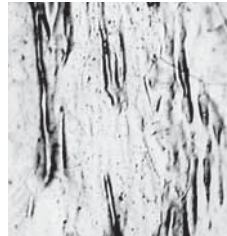
The O'Brien Analytical TrueTube process removes drawing oils and other contaminants that are often present in commercial grade tubing. At the same time surface iron is removed and the tube is left with an enriched Cr/Fe and CrO/FeO ratio which contributes to corrosion resistance.



Seamless 316L SS Tubing

Commercial grade seamless tubing may have a surface roughness of greater than 80 μ in. Because of differences in manufacturing processes the surface roughness of commercial grade seamless tubing can vary widely. Commercial grade

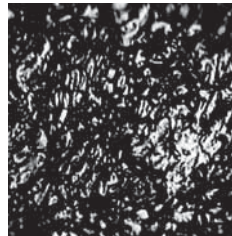
seamless tubing often has a higher surface roughness than a similar welded tube.



Welded 316L SS Tubing

The forming operations used to manufacture welded tubing produce a product that often has surface roughness in the 40-80 μ inch range. Because the weld area is considered inhomogeneous it is more susceptible

to corrosion, particularly pitting. Besides limiting the life of the installation corrosion also creates additional sites for the sample to "hang up" or collect.



TrueTube FS

A secondary process creates a Silcosteel® fused silica lining on base TrueTube CP seamless 316L stainless steel tubing. The fused silica coating improves the corrosion resistance and reduces the affinity of stainless

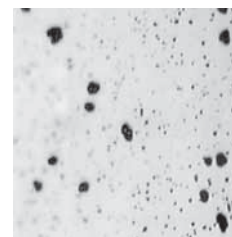
steel to many compounds such as H₂S. Fused silica lined Silcosteel tubes have found acceptance for transporting low concentration sulfur samples.



TrueTube EP

The photo illustrates the superior surface finish achieved by electropolished TrueTube. Electropolishing not only improves surface roughness but also provides enhanced corrosion resistance by

leaving a chromium enriched surface layer. With an average surface roughness of 25 μ inch this is the smoothest tube in the TrueTube family. TrueTube EP provides improved corrosion resistance and reduced dry-down time.



TrueTube EPS

The ultimate product for corrosion resistance and aversion to sulfur compounds. TrueTube EPS combines the advantages of electropolished and Sulfinert® fused silica coated tubing to produce a superior tube.

Electropolishing provides the best possible surface for the Sulfinert coating process. The TrueTube EPS combination delivers results that dramatically outperform either electropolishing or Sulfinert coating alone.

TrueTube



Tube Selection

Tube	General Uses	Characteristics
Commercial 316L Seamless SS	Standard instrument tubing. Free iron will react with most acids.	Average Surface Roughness: < 125 μ inch Limitations: Limited by chemical reactivity and oxygen levels. Subject to stress corrosion cracking. High Ra values of internal surface contribute to adsorption / desorption problems. Advantages: Inexpensive and readily available.
Commercial 316L Welded SS	Standard low pressure / temperature instrument tubing. Free iron will react with most acids. Weld containments may contribute to reduced corrosion protection compared to seamless tubing.	Average Surface Roughness: \pm 40 μ inch Limitations: Limited by chemical reactivity and oxygen levels. Subject to stress corrosion cracking. Pressure rating less than seamless products. May be more susceptible to corrosion than seamless products. Advantages: Inexpensive and readily available.
Fluoropolymer (Teflon®)	Low pressure sample and chemical lines where 316 SS is not acceptable. Used for applications requiring cleanliness.	Average Surface Roughness: NA Limitations: Limited by chemical reactivity and oxygen levels. Temperature and pressure limits vary by variety of fluoropolymer. Very permeable. Used for manufacture of permeable membranes. Advantages: Excellent chemical resistance. Flexible.
TrueTube CP	Analyzer sample lines where sample cleanliness is important	An O'Brien Analytical TrueTube Product Chemically Polished and Cleaned 316L Seamless SS Average Surface Roughness: less than 40 μ inch Limitations: Limited by chemical reactivity and oxygen levels. Subject to stress corrosion cracking Advantages: Improved surface finish and cleanliness. Free Fe contaminants eliminated
TrueTube FS	Moderate acid samples and sulfur.	An O'Brien Analytical TrueTube Product Electropolished and chemically treated 316L SS seamless tubing. Average Surface Roughness: 25 μ inch Limitations: Limited by chemical reactivity and oxygen levels. Advantages: Cr/Fe ratio better than 1.5:1 and CrO/FeO ratio better than 3:1 improve chemical resistance. Improved adsorption / desorption characteristics compared to commercial tubing.
TrueTube EP	Critical sample systems where adsorption / desorption is a problem.	An O'Brien Analytical TrueTube Product Electropolished and chemically treated 316L seamless tubing Average Surface Roughness: NA Average Surface Roughness of Base: 25 μ inch Advantages: Cr/Fe ratio better than 1/5:1 and CrO/FeO ratio better than 3:1. Covalently bonded elemental silica matrix reduces surface tension. Improved adsorption / desorption for moisture and sulfur species. Wide acceptance for transporting sulfur samples in ppb rang. Fastest response rate of any TrueTube product
TrueTube EPS	Critical sample measurements in the ppb range. Critical sample system where adsorption / desorption and corrosion is a problem.	An O'Brien Analytical Product Electropolished and chemically treated 316L seamless tubing Base surface roughnes: \pm 10 - 15 μ inch Advantages: Cr/Fe ratio better than 1/5:1 and CrO/FeO ratio better than 3:1 Covalently bonded elemental silica matrix reduces surface tension Improved adsorption / desorption for moisture and sulfur species Wide acceptance for transporting sulfur samples in ppb rang Fastest response rate of any TrueTube Product

O'Brien Analytical Product Applications



Probe Enclosures

Insulated enclosures provide a stable environment for the probe, piping components, and sampling equipment. Heated enclosures are also used to prevent temperatures from dropping below the dew point of the sample.

Sample Point Enclosures

Provides a weatherproof and insulated enclosure for sample take off, piping components, and vaporizing regulators.

Sample Point Heaters

Hazardous area heaters for sample point enclosures.

Enclosure Heaters

Consistent temperatures. Up to 200 Watts.

Installation Grips

End of line and mid line installation grips for bundles up to 3 1/2" (80mm) diameter.

Heat Shrink Entry Seals

Heat shrink entry seals provide a weatherproof entry where TRACEPAK or STACKPAK bundles enter an enclosure.

TRACEPAK®

Temperature controlled sample transport systems for process and gas analyzers. Single or multiple process tubes of 316SS, Monel, True Tube, Hastelloy, fused silica lined SS, heavy wall Teflon, and nylon are some of the choices.

STACKPAK™ and Probe Support Bundle

Heated and unheated lines for dilution and extractive stack gas applications. Stackpak will maintain uniform temperatures of gas samples such as SOX, CO2, and NOX.

Bottle Cabinets

Uninsulated as well as insulated and heated double door cabinets with cylinder clamps.

TrueTube™

TrueTube is available in long continuous lengths of electropolished (TrueTube EP) and electropolished tubing with a deactivated fused silica lining (TrueTube EPS). Non-permeable TrueTube is used for measuring NOx, SOx, corrosives, ammonia and mercury.

Sample Cabinets

VIPAK thermoformed or metal sample cabinets are available insulated and uninsulated.

TrueTube™

TrueTube EP and TrueTube EPS improve dry-down, adsorption and corrosion resistance. TrueTube is available in convenient sticks and weld fittings.

Hazardous Area Heaters

For traditional and modular design sample systems up to 400 Watts.

