

TrueTube™



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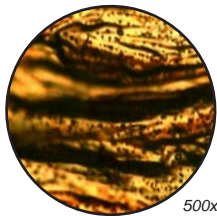
TrueTube is a family of tubing products developed to provide best-of-breed performance in sample transport for process and emissions analyzers. O'Brien Analytical starts with select ASTM grade tubing and enhances its physical characteristics to improve dry-down, adsorption and corrosion resistance. We 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

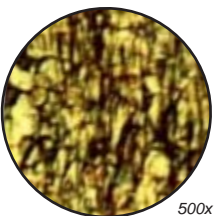
The O'Brien Analytical TrueTube process removes drawing oils and other contaminants that are often present in commercial grade tubing. At the same time surface iron is removed and the tube is left with an enriched Cr/Fe and CrO/FeO ratio which contributes to corrosion resistance.



Seamless 316L SS Tubing

Commercial grade seamless tubing may have a surface roughness of $\pm 120 \mu$ in. Because of differences in manufacturing processes the surface roughness of commercial grade seamless

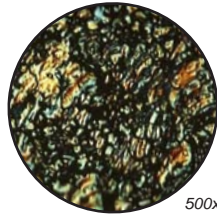
tubing can vary widely. Commercial grade seamless tubing often has a higher surface roughness than a similar welded tube.



Welded 316L SS Tubing

The forming operations used to manufacture welded tubing produce a product that often has surface roughness in the $\pm 40 \mu$ inch range. Because the weld area is considered inhomogeneous it is more susceptible to corrosion,

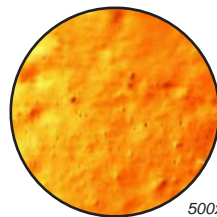
particularly pitting. Besides limiting the life of the installation corrosion also creates additional sites for the sample to "hang up" or collect.



TrueTube FS

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

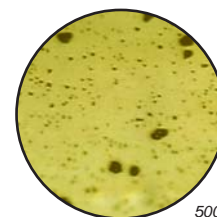
many compounds such as H_2S . TrueTube FS typically has a surface roughness of $20 - 40 \mu$ in. Fused silica lined tubes have found acceptance for transporting low sulfur samples.



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 15 to 20μ inch this is the smoothest tube we offer. 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 fused silica coated tubing to produce a superior tube.

TrueTube provides best-of-breed performance in sample transport tubing for process and emissions analyzers.

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Specialty Cleaning

O'Brien Analytical also provides thermocouple and CFOS cleaning for commercial grade tubing.

Thermocouple Cleaned

Thermocouple cleaned tubing is free of all drawing compounds, carbon, dirt, dust and other contaminants. After cleaning a swatch of lint-free cloth soaked in acetone is passed through the tube to verify cleanliness to ASTM A632-S3. The tubing is then capped to prevent contamination.

CFOS

O'Brien Analytical can also supply tubing which has been cleaned for oxygen service per ASTM G93A Level A and CGA G-4.1 requirements. After cleaning the tubing is capped to prevent contamination.

Orbital Weld Fittings and Tubing

We also offer specialty tube and orbital weld fittings from our sister company Cardinal Systems. Cardinal is a provider of high purity and ultra high purity tubing and fittings to the biopharm, medical, pharmaceutical and semiconductor industries. These products are available in sizes from 1/4" through 6". Tubing is provided in 20' straight sticks.

Orbital weld fittings eliminate the dead space and crevices associated with compression fittings so there is no place for sample stream components to collect and become entrapped.

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Tech 5 Tubing

- Surface roughness of 40µin / 1.0µm Ra.
- High quality seamless and welded 316L SS.
- Thermocouple cleaned per ASTM 632 Supplement S3.
- Purged with filtered nitrogen and capped.

Tech 10 Tubing

- Surface roughness of 25µin / 0.63µm Ra.
- High quality seamless 316L SS.
- Exceeds CFOS CGA G4.1 cleaning.
- Fully passivated with nitric acid.
- Rinsed with DI water, purged with filtered nitrogen and capped.

Tech 20 Tubing

- Chemically polished with a surface roughness of 15µin / 0.20µm Ra.
- High quality seamless 316L SS.
- Low particulate cleaning.
- Fully passivated with nitric acid.
- Final rinse with heated 18 megohm DI water, purged with filtered nitrogen until dry and capped.
- Final cleaning and packaging performed in a cleanroom.

Tech 25 Electropolished Tubing

- Electropolished to 10µin / 0.µm Ra.
- 316L SS tubing meets ASTM specifications for consistent physical, dimensional and chemical composition.
- Restricted sulfur content insures low non-metallic inclusions.
- Final cleaning and packaging performed in a Federal Standard 209 Class 10 cleanroom.
- 0.1µ filtered 18 megohm 60°C deionized water rinse until effluent surpasses 17.5 megohm.
- Dried with 0.005 µ filtered 120°C nitrogen and capped.

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