



# SANITARY STAINLESS STEEL TUBING AND FITTINGS

## FREQUENTLY ASKED QUESTIONS

### **WHY ARE STAINLESS STEEL ALLOYS FOR THE FOOD AND BEVERAGE, PHARMACEUTICAL AND HIGH-PURITY MARKETS?**

For sanitary applications like those in the food and beverage, pharmaceutical and high-purity markets, stainless steel is a popular material choice. The high levels of chromium and nickel found in 304 and 316 stainless steel provide them with a strong resistance to heat, abrasion and corrosion. These alloys are known for their clean appearance and overall cleanliness. Additionally, the material's protective oxide layer helps prevent the formation of rust that could contaminate the products. There are different degrees of polish available depending on the final application.

### **WHAT'S THE DIFFERENCE BETWEEN 304 AND 316 STAINLESS STEEL?**

304 stainless steel is one of the most versatile and commonly used austenitic chromium-nickel alloys on the market. The chromium content in the alloy promotes excellent corrosion resistance, a high strength-to-weight ratio and remarkable ductility.

316 contains many similar chemical and mechanical properties as 304 stainless steel. However, 316 stainless steel incorporates molybdenum, which enhances its corrosion resistance, especially in harsh industrial environments. 316 stainless steel is more resistant to acidic material, industrial solvents, highly concentrated saline solutions and fatty acids at high temperatures.

### **WHAT IS 316L STAINLESS STEEL?**

316L is nearly identical to 316 stainless steel, except the carbon content has been further reduced. The lower carbon content further enhances the corrosion resistance imparted by the molybdenum, making 316L the most corrosion resistant of the three alloys.

### **WHICH MATERIAL IS BETTER, 304 OR 316 STAINLESS STEEL?**

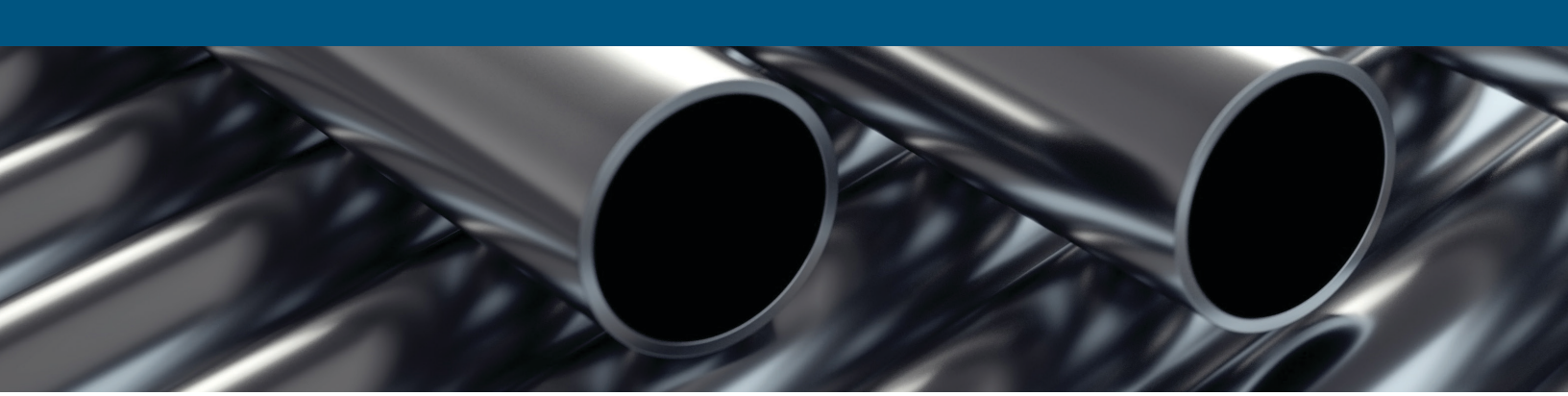
316 stainless steel is more resistant than 304 to salt and other corrosives, so it's the better choice for products that will often face exposure to chemicals or a marine environment. For products that won't require strong corrosion resistance, 304 is a practical and economical choice. For many applications, 304 and 316 are interchangeable.

### **WHAT IS BPE?**

BPE stands for bio-processing equipment, also commonly known as high-purity. BPE tubing and fittings adhere to a strict body of standards created by the American Society of Mechanical Engineers. These standards govern the design of equipment used in bioprocessing, pharmaceutical, personal care products and other industries with strict hygienic requirements. BPE standards regulate the system design, materials, fabrication, inspections, cleaning and sanitization, testing and certification of these products.

### **CAN SF1 AND SF4 BE USED INTERCHANGEABLY?**

Yes, Surface Finish 1 (SF1) and Surface Finish 4 (SF4) are often interchangeable, but it ultimately depends on the customer and application. The metallurgical and mechanical properties of both fall within the ranges set forth for ASME-BPE requirements. In many cases, the outer diameter roughness is indistinguishable, but the inner diameter roughness differs between SF1 and SF4.



**WHAT IS THE DIFFERENCE BETWEEN BPE SF1 PL AND PC AND SF4 PD AND PM?**

**SF1:**

The ASME-BPE guidelines call out a 20Ra inside diameter (ID) mechanical polish.

The only difference between the PL and PC is the outside diameter (OD) finish, which the ASME-BPE does not regulate:

- PL finish has an OD of 32Ra (Roughness Average)
- PC finish has no OD Ra requirement.

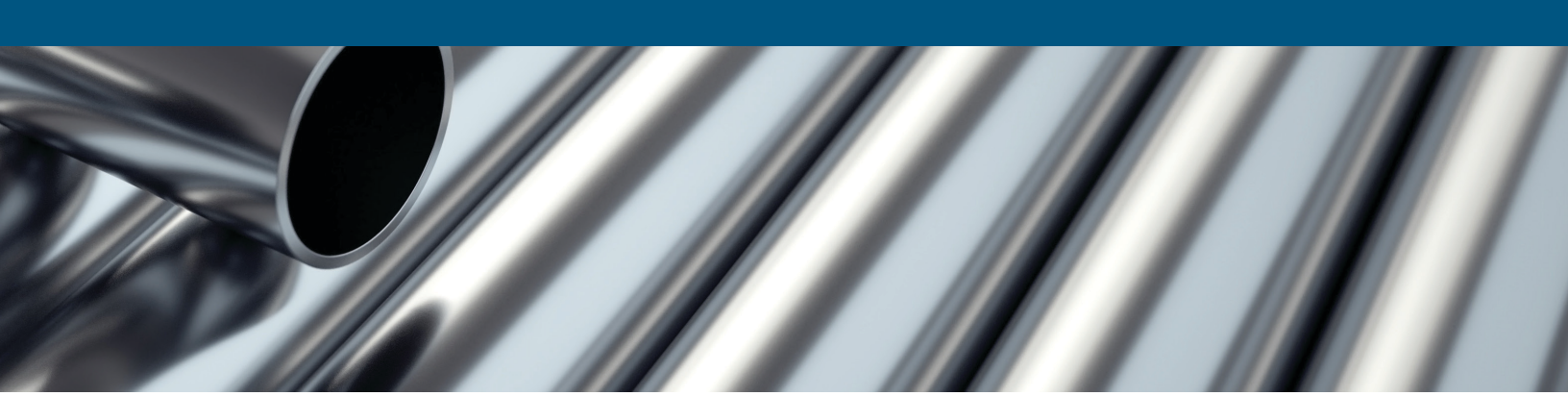
**SF4:**

The ASME-BPE guidelines call out a 15Ra ID electropolish. The only difference between the PM and PD is the OD finish:

- PM has an of OD of 32Ra.
- PD finish has no OD Ra Requirement.

**BIOPHARMACEUTICAL(BPE) SURFACE DESIGNATIONS**

ASME BPE Surface Designations	Inside Surface			Outside Surface		
	μ-inMax Ra.	μm Max Ra.	Surface Treatment	μ-in Max Ra.	μm Max Ra.	Surface Treatment
SF0	No Finish Requirement	No Finish Requirement	Mechanically Polished	No Finish Requirement	No Finish Requirement	No Finish Requirement
SF1	≤ 20	≤ .51	Mechanically Polished	≤ 32	≤ .8	Mechanically Polished
SF2	≤ 25	≤ .64	Mechanically Polished	≤ 32	≤ .8	Mechanically Polished
SF3	≤ 30	≤ .76	Mechanically Polished	≤ 32	≤ .8	Mechanically Polished
SF4	≤ 15	≤ .38	Mechanically Polished OD & Electropolished Polished ID	≤ 32	≤ .8	Mechanically Polished
SF5	≤ 20	≤ .51	Mechanically Polished OD & Electropolished Polished ID	≤ 32	≤ .8	Mechanically Polished
SF6	≤ 25	≤ .64	Mechanically Polished OD & Electropolished Polished ID	≤ 32	≤ .8	Mechanically Polished



### WHAT ARE ASME-BPE REQUIREMENTS?

BPE fittings are held to tighter tolerances and require a cleaner interior surface finish than standard fittings. The material requirements are also stricter than the 3-A Sanitary Standards for fittings typically used in food, beverage and dairy processing applications.

BPE requirements include the following:

- All BPE fittings must be dimensionally consistent, regardless of manufacturer.
- BPE fittings are required to have specific permanent markings on the outside of the fitting.
- BPE fittings must be capped and bagged for shipment.
- All BPE fittings are inspected for material verification using a Niton™ gun.



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### WHAT IS THE SANITARY 3-A STANDARD?

3-A Sanitary Standards, Inc., maintains a large inventory of design criteria for equipment and processing systems. These criteria were developed using a modern consensus process based on ANSI requirements to promote acceptance by USDA, FDA and state regulatory authorities.



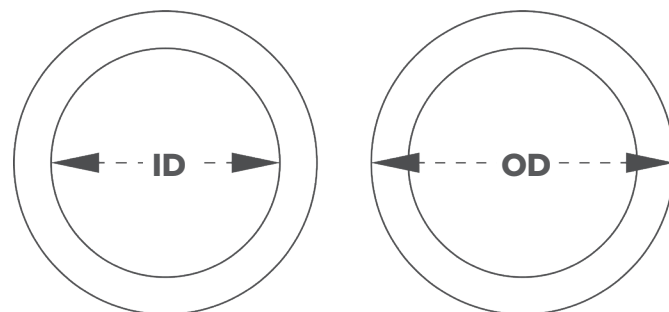
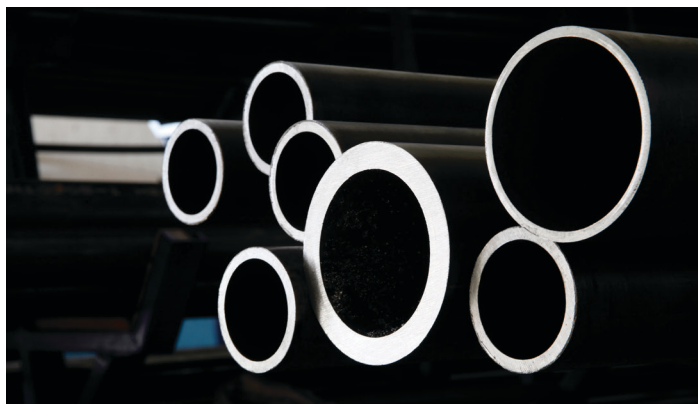
They oversee the 3-A Symbol Authorization program and other voluntary certificates to help affirm the integrity of hygienic processing equipment and systems and provide extensive knowledge resources to support the training and education needs in the rapidly changing food, beverage and pharmaceutical industries.

### WHAT IS ROUGHNESS AVERAGE (RA)?

Ra refers to the surface texture of stainless steel products. Ra measures the peaks and valleys of the surface of the steel. The lower the Ra, the smoother the surface. BPE fittings are typically offered in two finishes: 20Ra, and a smoother, 15Ra with electropolish.

### WHAT IS THE DIFFERENCE BETWEEN ID (INSIDE DIAMETER) AND OD (OUTSIDE DIAMETER)?

This refers to the diameter of a pipe. ID measures the distance between the tubing's interior walls. OD measures the distance from exterior wall to exterior wall. Wall thickness determines the strength of the tubing.



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