

OD Finishes on Fittings – MaxPure Light Polish OD Information

In our industry a substantial amount of research and information is available regarding ID (inside diameter) process contact surfaces. This is rightly justified and where our focus should be. The ID surfaces of fittings, tube, valves, and instrumentation that contact process media need to meet strict guidelines found within the ASME BPE standard. Typical end-user specification documents clearly call out specific SF (surface finish) and/or maximum R_a (roughness average) requirements. Many times, these same specifications leave you questioning what the customer requires for OD (outside diameter) non-process contact surfaces. In this article we will focus on OD surface finishes and review how the MaxPure Light Polish OD finish will meet most end-user specification documents.

(19) **Table SF-2.4.1-1 R_a Readings for Metallic Process Contact Surfaces**

Surface Designation	Mechanically Polished [Note (1)]	
	R_a Max.	
	$\mu\text{in.}$	μm
SF0	No finish requirement	No finish requirement
SF1	20	0.51
SF2	25	0.64
SF3	30	0.76
	Electropolished	
	R_a Max.	
	$\mu\text{in.}$	μm
SF4	15	0.38
SF5	20	0.51
SF6	25	0.64

GENERAL NOTES:

- (a) All R_a readings are to be in accordance with ASME B46.1.
- (b) All R_a readings are taken across the lay, wherever possible.
- (c) No single R_a reading shall exceed the R_a max. value in this table.
- (d) Other R_a readings are available if agreed on between the owner/user and supplier, not to exceed values in this table.

NOTE:

- (1) Or any other finishing method that meets the R_a max.

Current ASME BPE Table SF-2.4.1-1 shown above. Source: <https://www.asme.org/codes-standards/find-codes-standards/bpe-bioprocessing-equipment-1> © The American Society of Mechanical Engineers
 Typical end-user specifications will call out a SF surface finish designation requirement for process contact surfaces. This surface finish designation does not apply to OD non-process contact areas. Dip tube assemblies where the OD of the dip tube comes in contact with the process media would be an exception.

ASME BPE Part GR (General Requirements) defines many common terms utilized in the biopharmaceutical equipment industry. In this article, the term “process contact surfaces” is referenced. The current 2019 ASME BPE standard defines this as:

“process contact surface: a surface under design operating conditions that is in contact with, or has the potential to be in contact with, raw materials, in-process materials, APIs, clean utilities (e.g., WFI, CIP, pure steam, process gases), or components (e.g., stoppers) and where there is a potential for the surface to affect product safety, quality, identity, strength, or purity.”

When I first began my career in the high-purity stainless steel industry 20 years ago, ASME BPE was a very new standard and many fitting manufacturers already had established OD finish standards for their products targeted specifically for the biopharmaceutical markets. At that time, you had options of a polished $32 \mu\text{in } R_a$ or an unpolished finish. The polished OD that was offered then has not changed – $32 \mu\text{in } R_a$ is still required today.



Orbital weld end tee with $32 \mu\text{in } R_a$ Polished OD

The unpolished OD at that time was a dull surface and some manufacturers surfaces included finishing marks, scratches, and a very apparent longitudinal weld seam. Some end-users accepted the unpolished finish because the installation was insulated, or it was on process waste lines. I want to point out the ID process contact surface finish on these products still met the necessary surface finish requirements found in ASME BPE. Prior to 2007 the standard ID surfaces on fittings were called out as SFF1 or SFF5. Now the standard surface finishes for fittings and tube are referenced as SF1 and SF4. Those of you familiar with BPE surface finish references know about the transition from SFF (F=fittings), SFV (V=valves) and SFT (T=tubing) numbers to the current unified system of referencing SF for all process components.



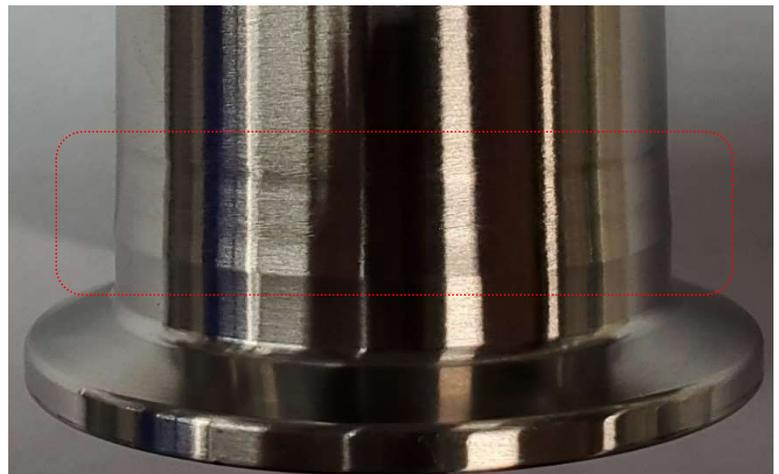
Unpolished / Mill finish OD

In the mid-2000's some end-users and equipment manufacturers voiced concerns regarding inconsistencies between manufacturers standards for the unpolished finish. To separate the MaxPure brand from this other group of manufacturers, our product was transitioned to have a light polish OD finish. This finish option eliminated all of the aesthetic blemishes clients were concerned about with unpolished finish options and immediately provided a cost effective option for areas where process lines are insulated and non-exposed. Some manufacturers chose a different direction and eliminated the unpolished finish OD option from their product offering. Even to this day, some of these manufacturers have standardized with only offering the 32 μin R_a polished OD option.



Orbital weld end tee with light polish OD – Take note of the visible weld where the branch meets the run. Compare this to the tee photo above. The weld line is the most noticeable difference on the light polish OD finish compared to the polished 32 μin R_a finish.

As end-users and equipment manufacturers have become more familiar with the light polish OD finishes, many have accepted this option for exposed process areas. Please note the OD R_a values are not measured during quality inspections on the light polish OD finishes but if readings were taken, they would indicate similar values as the polished OD finishes. The most significant difference between light polish and polished will be at the circumferential welds. The welds on the light polish fittings are not fully removed. The best way to understand this difference is visually comparing the fittings side by side.



The most significant difference between a light polish OD and a polished OD fitting is the OD weld line. In the photo above you can clearly see the OD weld line.

If you are considering writing new specification documents or have an installation requirement that could benefit from utilizing the light polish OD finish option, please reach out to your local MaxPure channel partner distributor for additional details. If you do not know who your local distributor is, please reach out to VNE directly and we would be happy to review the technical aspects of our products.



Many fittings have very slight visual differences. Can you identify which elbow has a polished OD and which has the light polished OD?

Below are some frequently asked questions I have received regarding the MaxPure PC/PD light polish OD finish fittings

Q: What does the current ASME BPE 2019 standard publish in regard to OD surface finish (non-process contact surfaces)?

A: Part SF is specific to process contact surface finishes and does not reference any requirements for non-process contact surfaces. Part SD has minimal reference to non-process contact surface finishes. Where SD does reference non-process (exterior) contact surfaces it is specific to equipment such as isolators, lyophilizers and cabinet washers. The only section that references OD R_a is Isolators Section SD-6.6.4. Simply stated, non-process contact surfaces should be compatible with the area/room classification as agreed to by the owner/user.

Q: What is the R_a value of the MaxPure light polish OD fittings?

A: There are no guaranteed R_a values on the light polish OD fittings. Various Scotch-Brite™ abrasive polishing wheels are utilized during the mechanical polishing operations on the OD tube and OD weld bead surface.

Q: Why can't you guarantee the R_a on the light polish OD fittings?

A: OD welds on the light polish OD fittings are not ground and polished like it would be on a 32 μm R_a polished OD surface. Since R_a values of the welds are not measurable, we are not able to

guarantee the OD R_a surface finish. Note that R_a finishes on the ID process contact surfaces meet all requirements of ASME BPE Part SF and are guaranteed.

Q: Do the OD welds on the MaxPure light polish OD fittings meet ASME BPE Part MJ requirements?

A: Yes, the OD welds meet the requirements in section MJ-8.4. For the non-process contact surfaces we conform to the Visual Examination Acceptance Criteria for Groove Welds on Metallic Tube-to-Tube Butt Joints in Table MJ-8.4-1. This is the same visual acceptance criteria for shop and field fabrication welds contractors perform.

Q: What products are available in the light polish OD finishes? (Surface code designations PC and PD)

A: Fitting products that are fabricated from tube raw materials have light polish OD finish options. Products that are completely machined (ferrules, clamp caps and reducers) come standard with the 32 μin R_a polish OD and are not available with the light polish OD finish. See below chart for MaxPure surface finish codes. These surface finish codes are incorporated into the MaxPure part numbers to designate specific ID/OD surface finishes. Light polish OD fittings are designated as PC and PD surface finish codes and 32 μin R_a polish OD fittings are designated as PL and PM surface finish codes.

Surface Finish:

Reference: ASME BPE, Part SF, Table SF-2.4-1.

Surface Finish Code	BPE Surface Designation	Ra Maximum		Inside Surface	Outside Surface
		$\mu\text{-in.}$	μm	Surface Condition	Surface Condition
PX	SF0			No finish requirement	No finish requirement
PC	SF1	20	0.51	Mechanically Polished [1]	Light Polish
PL	SF1	20	0.51	Mechanically Polished [1]	Mechanically polished to 32 Ra $\mu\text{-in.}$
PD	SF4	15	0.38	Mechanically Polished [1] & Electropolished	Light Polish
PM	SF4	15	0.38	Mechanically Polished [1] & Electropolished	Mechanically polished to 32 Ra $\mu\text{-in.}$
PR	-	10	0.25	Mechanically Polished [1] & Electropolished	Mechanically polished to 32 Ra $\mu\text{-in.}$

[1] Or any other finishing method that meets the Ra max.

About the Author

John Georgen has 20 years of experience working for VNE Corporation in various roles. These roles have allowed him to obtain invaluable knowledge and insight of fitting, valve, and tube manufacturing methods, quality management systems, and specification review. Under his current responsibilities as a regional sales manager he has performed many seminars promoting the BPE standards to Distributors, Contractors, OEMs, Engineering Firms, and Manufacturers.

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