C-22® Alloy Tubing & Fitting Specifications

1. All C-22® tubing and fittings supplied by Central States Industrial (CSI) are provided to the following criteria.

2. All C-22® tubing will meet dimensional criteria and mechanical properties as set forth per the current ASME SB 622 (seamless) or ASME SB 626 (welded) specification.

3. The American Society of Mechanical Engineers (ASME) has prepared a standard intended for design, materials, construction, inspection, and testing of vessels, piping and related accessories such as pumps, valves and fittings for use in the biopharmaceutical industry, referred to as ASME BPE. This document does not intend to address all the criteria as stated in the ASME BPE specification. See Interior Surfaces Finish Acceptance Criteria in this document for details of limits.

4. All C-22® fittings with –PL and -PC finish codes will be marked with BPE SF1 finish designation. All C-22 fittings with –P25 finish codes will be marked with BPE SF6 finish designation. In addition to surface finish designation, markings will also include UNS number N06022, Heat number, CSI logo and CSI Lot number.

5. Material Chemical Composition

Table 5-1 Typical Chemical Composition: UNS N06022 / C-22, Alloy 22 / Hastelloy C22

Element	Symbol	Element percentage % (UNS N06022)
Carbon	C	**0.015** Maximum
Manganese	Mn	**0.50** Maximum
Phosphorus	P	**0.02** Maximum
Sulfur	S	**0.02** Maximum
Silicon	Si	**0.08** Maximum
Chromium	Cr	20.00 – 22.50
Nickel	Ni	Remainder
Molybdenum	Mo	12.50 - 14.50
Tungsten	W	2.50 – 3.50
Vanadium	V	**0.35** Maximum
Cobalt	Co	**2.50** Maximum
Iron	Fe	2.00 – 6.00

6. Mechanical Properties:

The mechanical properties of the base material shall be in compliance with ASME SB 626 or ASME SB 622 specification.

7. Certification & Documentation:

- Materials of construction suppliers are compliant with EN10204, 3.1
- Material Test Certificate (MTR's) will be provided with the product.

8. Finish Designator:

Table 8-1 Finish Designator Codes and acceptance criteria

Finish Designator Codes	ID Surface Finish (Ra) Max. µ-inch (µ-meter)	OD Surface Finish (Ra) Max. µ-inch (µ-meter).	Electro-polished ID	BPE SF Code Reference	Dimensions Tolerance (BPE) (CSI)
-7	32µin. (.81µm)	32µin. (.81µm)	No	N/A	CSI
-P7	32µin. (.81µm)	32µin. (.81µm)	No	N/A	CSI
-PC	20µin. (.51µm)	Mill[3]	No	SF1	BPE
-PL	20µin. (.51µm)	32µin. (.81µm)	No	SF1	BPE
-P25	EP 25µin. (.64µm)	32µin. (.81µm)	Yes	SF6	BPE

Mill[3] = Surfaces without roughness limits and do not require roughness measurements.

Surface Finishes, Dimensions and Tolerances (BPE)

No single Ra reading shall exceed the Max Ra value in **Table 8.1** for the corresponding finish designator.

Ra readings of an electropolished process component will comply with **Table 8.1** after the electropolishing operation is completed.

Acceptance criteria for inspection of surface finishes, will meet the applicable requirements of Part SF in ASME BPE.

Acceptance criteria for dimensions and tolerances, will meet the applicable requirements of Part DT in ASME BPE for fittings. See table 9-1 for Tubing dimensions and tolerances.

Surface Finishes, Dimensions and Tolerances (CSI)

The Ra value specified in **Table 8.1** of the corresponding finish designator is a “target” and should be considered as an equivalent surface finish roughness.

Acceptance criteria for inspection of surface finishes will meet the appropriate requirements of Parts 33-01 and/or 63-02 in 3-A Sanitary Standards.

Acceptance criteria for dimensions and tolerances will meet the standards identified on CSI drawings or as defined in CSI standards.

9. Tubing: Dimensions and Tolerances

Table 9-1: Tubing: Reference Specifications for Dimensions and Tolerances

Size Description	Type: Welded (W) Seamless (S)	Outside Diameter Nominal	Wall Thickness Nominal	ASME Dimensional Tolerance Specifications	
				Welded	Seamless
0.50" OD x .065 wall	W, S	Ø 0.50” (Ø 12.7 mm)	0.065” (1.65 mm)	SB-751	SB-829
0.75" OD x .065 wall	W, S	Ø 0.75” (Ø 19.1 mm)	0.065” (1.65 mm)	SB-751	SB-829
1.00" OD x .065 wall	W, S	Ø 1.00” (Ø 25.4 mm)	0.065” (1.65 mm)	SB-751	SB-829
1.50" OD x .065 wall	W	Ø 1.50” (Ø 38.1 mm)	0.065” (1.65 mm)	SB-751	
2.00" OD x .065 wall	W	Ø 2.00” (Ø 50.8 mm)	0.065” (1.65 mm)	SB-751	
3.00" OD x .065 wall	W	Ø 3.00” (Ø 76.2 mm)	0.065” (1.65 mm)	SB-751	