

Surface Finishes and Clean ability

The Design and Manufacture of Cleanable Equipment

Specifying the appropriate material, manufacturing process and surface finishing method to economically meet your hygiene goals

HOW TO SELECT A GRADE OF STAINLESS

- Stainless steels are engineering materials with good corrosion-resistance, strength and fabrication characteristics.
- They can readily meet a wide range of design criteria, including load, service life and low maintenance.
- Selecting the proper stainless steel grades involves weighing four qualities in the following order of importance:

HOW TO SELECT A GRADE OF STAINLESS

❑ Corrosion or Heat Resistance

the primary reason for specifying stainless. The specifier needs to know the nature of the environment and the degree of chemical / heat resistance required both during production and cleaning

❑ Mechanical Properties

particularly strength at production and cleaning temperatures. The combination of corrosion resistance and strength is the basis for selection.

❑ Fabrication Operations

how the product will be made e.g., forging, machining, forming, welding, stamping, roll forming etc.

❑ Total Cost

include material and production costs and consider the cumulative savings of a long lived maintenance-free product.

Chemical / Heat Resistance

❑ **Type 304** stainless steel is versatile and wide ranging. It serves a variety of industrial, architectural, consumer, and transportation applications. It offers a high level of resistance to corrosion but will eventually show signs of tarnish over time. 304's composition provides a better structural advantage and durability than other grades of stainless steel. For manufacturing purposes it's customizable and easy to fabricate; making it the most widely used commercial stainless steel today.

❑ **Type 316** stainless steel has molybdenum added to its alloy content during production. Molybdenum provides an even higher degree of corrosion resistance than 304 stainless steel. This is an advantage for objects that require resistance to extreme environmental conditions such as salt water, de-icing salts, brine solutions, or other chemical forms of chemical exposure. In laboratory and pharmaceutical settings, 316 stainless steel excels in resistance to acids, bromides, and iodides at high temperature.

Chemical / Heat Resistance

❑ It is difficult to tell the difference between 304 and 316 stainless steel by simply looking at the two. They both offer the same polished, chromed, grained, colored, or blasted appearance but 316 stainless steel costs more due to its enhanced chemical and production properties. Both grades will perform well if they are used in the correct environment

❑ 316 stainless is typically chosen over 304, in the dairy industry, due to its improved resistance to pitting and crevice corrosion in high temperature and/or high concentration chloride environments

❖ *Only specify what you need to meet your Hygiene requirements*

Mechanical Properties

□ MECHANICAL PROPERTIES OF TYPE 304 AT ROOM TEMPERATURE

Typical Mechanical Properties required for annealed material covered by ASTM A240. **Yield Strength .2% offset = 30,000** / **Ultimate Tensile Strength = 80,000** / Elongation = 50%. Hardness R = 90 max

□ MECHANICAL PROPERTIES OF TYPE 316 AT ROOM TEMPERATURE

Typical Mechanical Properties required for annealed material covered by ASTM-A240. **Yield Strength .2% offset = 30,000** / **Ultimate Tensile Strength = 80,000** / Elongation = 50%. Hardness R = 90 max.

Fabrication Operations

	General Characteristics	Alloy	Common Applications	Material Cost Factor	Machining Cost Factor
<u>Stainless Steel</u>	Designed for machining, non-magnetic	303	Electronic hardware, automotive, aerospace, medical instruments, and many applications requiring corrosion resistance	4.5	2.7
	Better weld ability and formability, slightly more corrosion resistant	304	Applications needing formability or weld ability	3.7	5.0
	Better corrosion resistance	316	Medical implants and surgical instruments, aerospace	4.3	5.6
	Excellent corrosion resistance and heat treatable	17-4 PH	Medical, aerospace, applications needing corrosion resistance and hardness	4.4	5.0

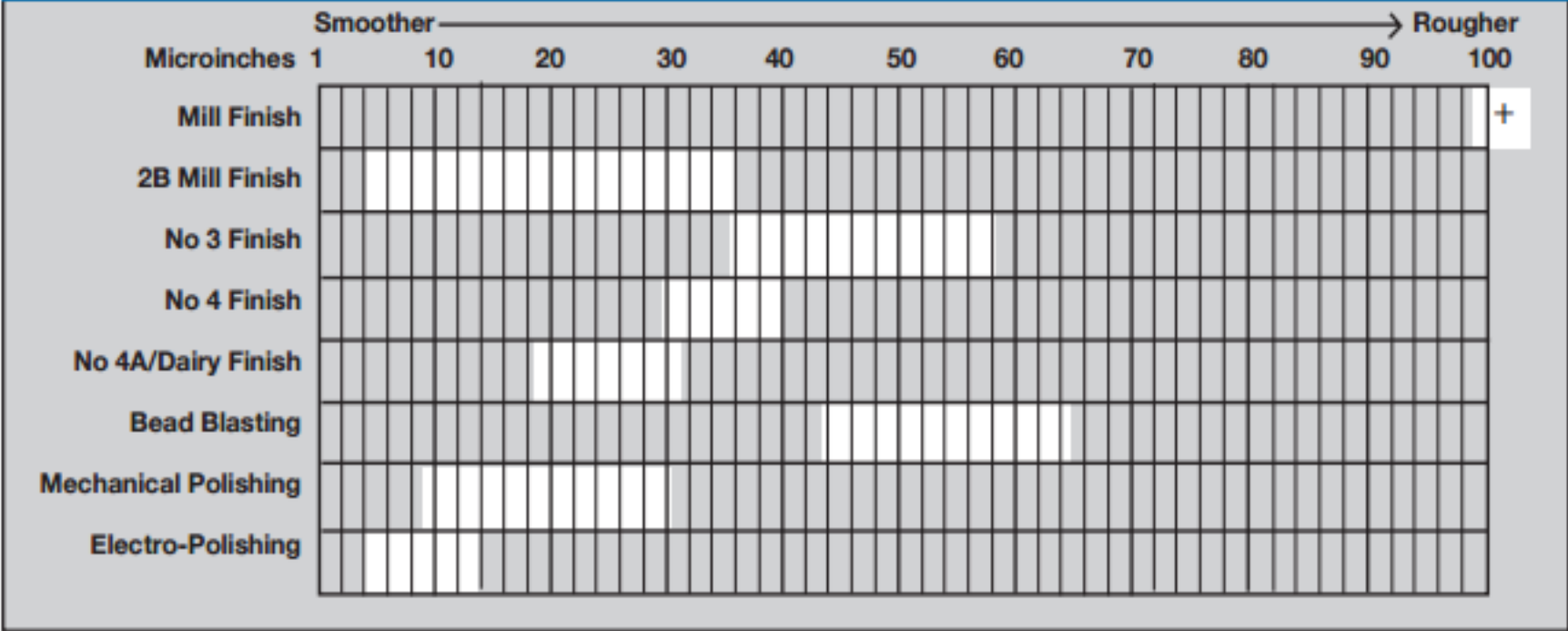
❖ *Only specify what you need to meet your Hygiene requirements*

Fabrication Operations

Surface Finish

3A Requirement <32RA

RA Surface Textures of Stainless Steel Finishes*



Fabrication Operations

Surface Finish

3A Requirement <32RA

FINISH DESIGNATION	
1-9 RA (1-10 RMS)	#8
4-13 RA (5-15 RMS)	2B (16 Ga. Sheet)
9-18 RA (10 - 20 RMS)	2B (14 Ga. Sheet)
13 -22 RA (15-25 RMS)	2B (12 Ga. Sheet)
18-27 RA (20-30 RMS)	2B (11 Ga. Sheet)
18-31 RA (25-35 RMS)	2B (10 Ga. Sheet)
22-36 RA (25-40 RMS)	2B (7 Ga. Sheet)
10-16 RA (11-18 RMS)	#7 (320 Grit)
13-27 RA (15-30 RMS)	#6 (240 Grit)
18-31 RA (20-35 RMS)	#4 Dairy (180 Grit)
29-40 RA (32-45 RMS)	#4 (150 Grit)

Passivation



Description

A chemical (typically nitric or citric acid) treatment that produces a formation of a protective passive film on stainless steel

Applications

Most stainless steel material is passivated, polished or treated in some way to prevent corrosion; passivation may also be a federal specification

Sanitation Environment

Passivated stainless material can withstand caustic wash down procedures

RA

RA values have no significant improvement after passivation*

Caution

Chemical passivation is a protective treatment, not a descaling process.

Federal Specification No.

A-967

Pickle Passivation



Description

Also referred to as descaling, pickle passivation removes the scale and leaves a clean matte finish free from contamination

Applications

Used in pharmaceutical industries as a federal specification and in food processing industries to reduce food safety risk

Sanitation Environment

Suitable for caustic, aggressive sanitary wash down environments

RA

Depending on material, pickle passivation can result in up to 25% increased smoothness measured in RA*

Caution

Partner with expert finishing specialists who perform the recommended procedures for best results.

Federal Specification No.

A-380

Electro-Polishing



Description

Surface metal is dissolved, removing all embedded contaminants, creating a smooth, mirror finish

Applications

Used in pharmaceutical industries as a federal specification and in food processing industries to prevent bacterial attachment and reduce food safety risk

Sanitation Environment

Highest grade of passive surface available, can be subjected to long term caustic wash down

RA

Depending on material, electropolishing can result in up to 50% increased smoothness measured in RA*

Caution

Partner with expert finishing specialists who perform the recommended procedures for best results.

Federal Specification No.

B-912

Total Cost

❑ Tests indicate that neither the alloy (AISI 304 / 316) nor the roughness of the surface 32µin / 8µin (0.8 / 0.2 microns) have a significant influence on the clean ability of stainless steel surfaces.

❖ *Only specify what you need to meet your Hygiene requirements*