



**REQUEST FOR INTERPRETATION OF 3-A
SANITARY STANDARDS OR 3-A ACCEPTED PRACTICE CRITERIA**

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| Requester(s) Name and Address John Holroyd Enerquip 611 North Road Medford, WI 54451 | Standard/Practice Name and Number <i>3-A Sanitary Standards for Polished Metal Tubing, # 33-01</i> |
| Requester(s) e-mail johnholroyd@enerquip.com | Criteria Paragraph Number D1, (Surface Finish of Product Contact Surfaces) |

Specific wording (from standard) requested for interpretation

“D1: All product contact surfaces shall have a ground and/or polished finish at least as smooth as a No. 4 finish on stainless steel sheets free of imperfections such as pits, folds and crevices. (See Appendix Section F.)”

Interpretation specifics

- Question 1: Does electropolishing of the mill finish (i.e. unground) surface on the inside of tubing meet the requirements of this standard providing the surface roughness is below 32 m inches Ra., after polishing is completed and the surface is otherwise free of pits, folds and crevices? (Please see the attachment “A Brief Description of the Electropolish Process”.)
- Question 2: Does tubing that is manufactured from strip material which has a 2b mill finish meet the requirements of this standard providing the surface roughness is below 32 m inches Ra. and the surface is otherwise free of pits, folds and crevices. (Please see the attachment “In Defense of the 2B Mill Finish”.)

Supporting comments by Enerquip representatives

A Brief Description of the Electropolish Process

Electropolishing is the process of removing metal from the surface of a part by using an electrolyte and an electric charge. Electropolishing is accomplished by immersing the part to be polished in electropolish solution and connecting it to a battery charger like device called a rectifier. In a period ranging from 10's of seconds to 10's of minutes, metal is removed from the surface, which smoothes the surface in the process.

If we assume a 32 μ inch surface has a sinusoidal grind profile for the individual grind lines, then a distance of approximately .0001 inches or one ten thousandth of an inch separates the average peaks from the average valleys. The writer acknowledges that this is not an accurate model in any real world scenario, however, it is one that will permit us to visualize the scale of the grind lines or other surface irregularities with which we are dealing on a 32 μ inch surface and is valid for that purpose.

Electropolishing typically removes a metal thickness of around .0002 to .001 or in the range of two ten thousandths of an inch to one thousandth of an inch.

What that means is, that if you were to take a surface that would barely meet the surface finish requirements of the standard (i.e. 32 μ inch Ra) and give it a light electropolish in which the minimum of material was removed, all of the original surface would have been removed including peaks and valleys and in the process the difference in height from the peaks to the valleys would have been reduced. It would still be possible to see where the peaks and valleys of the courser grind lines were but they will be smoother, more rounded and will be completely fresh surfaces. It is widely held that a properly executed electropolish will result in a reduction in Ra of 50% but that is only true for certain cases and can only be relied on under strictly controlled conditions. The 50% is best regarded as an ideal to aim for rather than an automatic result. The one thing that is certain is that all ground in abrasive compounds will have been removed and any surface intersecting voids, such as smeared over grind lines, will have been either totally eliminated or at least opened up.

In summary, electropolishing:

- Removes all traces of the original surface providing the ultimate cleaning process.
- Reduces Ra
- Does not add grind lines nor does it smear the surface.
- Passivates the surface.
- Stress relieves the surface
- Renders the surface featureless on a microscopic scale
- Enhances the cleanability of the metal surface and in almost all cases the cleanability of an electropolished surface is at least equivalent to that of a mirror finish mechanical polish but without the risk of micro-contaminants from the buffing compound being shed by the surface.
- Eliminates galvanic foci thus enhancing corrosion resistance.
- Creates a chromium and nickel enriched surface which resists corrosion.

Grinding:

- Scores the surface and guarantees that the surface is NOT featureless.
- Leaves breakdown products from the abrasive media embedded in the surface.

- Smears the surface leaving trapped particulates.
- Creates areas that are potential foci for pitting (galvanic cells).

Requires passivation before use.

In Defense of the 2b Mill Finish

There are those that hold that a 2b mill finish is not a suitable finish for sanitary applications yet these same people have no problem with a ground finish in the same application. This would be risible if it were not so tragic. A ground surface is not an easily cleanable surface at the bacterial level and 32 μ inches Ra is not particularly smooth and is quite arbitrary.

A 2b mill finish is a surface that is created by running sheet material through a final surface improvement stage in which the material is put through a set of polished rolls. This gives the surface a characteristic smoothness that is typically around 15 μ inches Ra. and well below the 32 μ inches Ra that is expected of ground surfaces. This is a burnishing technique and burnishing is another name for polishing.

If the Ra of a surface has any relevance at all, when it comes to defining cleanability, then why is it that the ground surface (which has absolutely got to be one of the worst possible surface for cleanability) can be defined as being acceptable if it is at or below 32 μ inches Ra yet the relevance of the Ra measurement disappears when it comes to the 2b mill finish? This is capricious and illogical.

The dictionary definition of polish includes surface improvement by any means. It follows that putting the material through polishing rolls is a polishing process.

pol·ish (pŏl'ish)

v., -ished, -ish-ing, -ish-es.

v.tr.

1. To make smooth and shiny by rubbing or chemical action.
2. To remove the outer layers from (grains of rice) by rotation in drums.
3. To free from coarseness; refine: *polish one's manners*.
4. To remove flaws from; perfect or complete: *polish one's piano technique; polish up the lyrics*.

Despite the clarity of this definition and argument, there are those that dispute that 2b material is polished. On the one hand I am arguing supportable fact and on the other they are arguing opinion.

Conclusion:

Ra is clearly being used as a measure of surface performance (cleanability) when it comes to a ground surface. i.e. the surface must be less than 32 Ra to be acceptable.

A ground surface has geometry, when viewed at the micro level, which is clearly not suitable for easy cleaning and may be the second worst possible geometry. (Over pickled is worse)

If Ra is an adequate measure of performance for a ground surface, why would it not be an adequate measure of performance for a 2b mill finish which has a geometry more suitable for cleaning?

According to multiple dictionary definitions of the word “polish” a 2b mill finish is a polished surface.

The prohibition that has been created in which the 2b mill finish is held to be not suitable is based on personal opinion and not actual performance of 2b mill finishes in real world applications or of what the 3A standard actually says.

I ask that when you review the request to rule on the compliance of 2b mill finishes to the standard 33-01 section D1 you find that 2b mill finishes are polished surfaces and that as a result they do fully comply with the 3A standard.

Interpretation Committee’s Response:

It is a fact that the surface finish requirements appearing in Standard 33-01 differ from the Format & Style Manual requirements in that 33-01 contains the specific language that the surface must be “ground and/or polished”. Also, a “Number 4 finish” is equivalent to a 32 micro-inch finish, as per Appendix F in Standard 33-01.

During the deliberations the IC heard testimony from Robert Semerad, who stated that he was present during the development of Standard 33-01, which took place in the early 1990s under the old “caucus” method. He said that during the final approval caucus, a particular company representative in the room requested that the “All product contact surfaces shall have a ground and/or polished finish...” be included, in addition to the “No. 4 finish” requirement, because this person believed that the process of forming stainless steel tubing over a mandrel introduced surface imperfections that could only be removed by grinding or polishing. This person’s position prevailed. This is why the “ground and/or polished” requirement was included in this standard.

The inside of the tubing must be ground or polished for compliance with D1 of Standard 33-01, regardless of surface finish “roughness”. The surface finish requirements appearing in the *Format & Style Manual* does not apply, since D1 in Standard 33-01 deviates from the *F & S Manual*. The IC determined that the key question to be answered was “Is electropolishing a form of polishing?”

There is no 3-A SSI definition for “polish” or “ground” so the dictionary was consulted for the definition. **It was unanimously decided that “electropolishing” is a form of polishing, and therefore electropolishing of the mill finish surface on the inside of tubing meets the requirements of D1 of Standard 33-01, provided the surface roughness is at or below 32 μ inches Ra., after (electro)polishing is completed and the surface is free of pits, folds and crevices. The answer to Question 1 asked by Enerquip is “Yes”.**

The IC then discussed Question 2 and unanimously concluded that tubing manufactured from strip material which has a 2b mill finish DOES NOT meet the requirements of Standard 33-01, Section D1,

even though the surface roughness is 32 μ inches Ra, or less, and the surface is otherwise free of pits, folds and crevices. The answer to Enerquip’s Question 2 is “No”.

JUSTIFICATION: Standard 33-01 (Section D1) requires the product contact surface of the tubing to be “ground and/or polished”. There is no definition of “polish” in 3-A SSI to use to determine if “electropolish” is a form of polishing, so the IC looked at the dictionary definition, which is:

- pol•ish (p l' sh)
v., -ished, -ish•ing, -ish•es.
v.tr.
1. To make smooth and shiny by rubbing or chemical action.
 2. To remove the outer layers from (grains of rice) by rotation in drums.
 3. To free from coarseness; refine: polish one's manners.
 4. To remove flaws from; perfect or complete: polish one's piano technique; polish up the lyrics.

The IC concluded definition #1, above (“To make smooth and shiny by rubbing or chemical action.”), includes electropolishing. Thus “electropolishing” is a form of polishing. “Electropolishing” is an acceptable means of meeting the requirements of D1 in Standard 33-01, provided all other product contact surface finish requirements are met.

As for “does a 2b mill finish meet the surface finish requirements of Standard 33-01”, Section D1, specifically requires that the product contact surface be ground and/or polished. As for the cold-rolled milling process of the sheet stainless steel used to make sanitary tubing, the milling process does not constitute “grinding and/or polishing”. Even if the resulting surface finish is 32 micro-inches or less and if the material is free of pits, folds, and crevices, the surface finish requirements are not met. The product contact surfaces must be ground and/or polished in addition to meeting the other surface finish requirements stipulated.

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| Date received by 3-A SSI: September 10, 2007 | IC Chair |
| Date reviewed by IC: September 20, 2007 | Randy Elsberry |
| Date of response: September 24, 2007 | Date: September 24, 2007 |