PLYMOUTH TUBE CO USA®

TRENT PLANT • EAST TROY, WISCONSIN

SANI-FLOW® Tubing

APPLICATION GUIDELINES

Scope

Plymouth Tube's SANI-FLOW® tubing, manufactured in our Trent Plant, is 304L (UNS # S30403) or 316L (UNS # S31603) welded stainless steel tubing that is mechanically polished. It maintains a corrosion resistant finish and an easily cleaned interior surface.

SANI-FLOW® tubing is used in hygienic services, such as dairy, food and beverage, pharmaceutical, and bio-tech, that require a high degree of purity and cleanliness in transporting products.

Applicable Specifications

To ensure optimal performance, ease of installation, and prolonged life, SANI-FLOW® tubing is manufactured in accordance with ASTM A270-S2, A249, SA249 and A269 as well as additional restrictions and criteria as outlined in internal Plymouth Tube specifications. ASME BPE and 3A specifications are also available upon request.

Ordering Information

When ordering SANI-FLOW® tubing, the following specifications must be provided:

- Dimensions
- Alloy
- Required certification to ASME BPE or 3-A
- Special Surface Finish and Packaging Requirements
- Specific Inspection/Testing Criteria
- Supplemental Testing

Manufacturing Process

SANI-FLOW® tubing is made from cold rolled 2B stainless steel strip whose chemical elements are specially controlled to enhance weldability. This results in a virtually undetectable longitudinal weld and a tube with a more uniform wall thickness which allows for high quality orbital welds in the field.

Manufacturing includes a Tungsten Inert Gas (TIG or GTAW) method of welding. The weld bead is then cold-worked to a full finished condition. Bright annealing follows in a controlled atmosphere in accordance with ASTM A270-S2.

The tubes are then mechanically polished via Plymouth Tube's state-of-the-art process. After polishing, each tube is cleaned by a nitric acid passivation and then a deionized water rinse. The tubes are dried with filtered compressed air. This process provides the smoothest mechanical polish finish available to the industry with optimal corrosion resistance.

Surface Condition

Internal Surface	
0.5"- 8" OD	20 µ in. max. (0.51µm)
10" OD	180 Grit
External Surface	180 Grit

Chemical Composition

The chemistry for 304L and 316L conform to the latest edition of ASTM A270-S2. Other grades are available upon request.

Chemical	304L	316L
C (Carbon)	0.035 max	0.035 max
Mn (Manganese)	2.00 max	2.00 max
S (Sulfur)	0.005 - 0.017	0.005 - 0.017
Si (Silicon)	0.75 max	0.75 max
Ni (Nickel)	8.0-13.0	10.0 - 15.0
Cr (Chromium)	18.0-20.0	16.0 - 18.0
Mo (Molybdenum)		2.00 - 3.00

Mechanical Properties

Property	304L	316L
Tensile Strength (min.)	70,000 psi	70,000 psi
Yield Strength (min.)	25,000 psi	25,000 psi
Elongation (min.)	35%	35%
Hardness Rockwell B (max.)	90	90

Testing

Plymouth Tube's rigorous quality control inspection and testing procedures ensure all high purity processing requirements are met and maintained. Continual visual examinations are performed throughout all processes.

Tubing must be capable of passing the flatten, flange, and reverse bend requirements of ASTM A1016. Each length is also eddy current tested to the requirements of ASTM A1016. Laboratory tests must meet A269, A249, SA249, and A270-S2.

Profilometer readings are taken after polishing to ensure that surface smoothness is maintained.

Reports showing the chemical analysis, mechanical properties, and results of all tests are furnished for each size and heat lot of tubing.

Additional inspection and testing such as auger, SEM, ultrasonic, ESCA, borescoping (tapes), liquid penetrant, and corrosion resistance inspections are available when specified.

Dimensions/Tolerances

Tolerances per A270-S2 as listed below for 1/2" - 4" sizes. Ovality allowance for 6" through 10" sizes is according to ASTM A269. Straightness is 0.030" maximum per 3' length. Lengths are 20' (-0"/+1/8").

	OD		Wall Thickness	
Size	Nominal	Tolerance	Nominal	Tolerance
0.5"	0.500"	±0.005"	0.065"	±10%
0.75"	0.750"	±0.005"	0.065"	±10%
1"	1.000"	±0.008"	0.065"	±10%
1.5"	1.500"	±0.008"	0.065"	±10%
2"	2.000"	±0.008"	0.065"	±10%
2.5"	2.500"	±0.010"	0.065"	±10%
3"	3.000"	±0.010"	0.065"	±10%
4"	4.000"	±0.015"	0.083"	±10%
6"	6.000"	±0.030"	0.083"	±10%
6"	6.000"	±0.030"	0.109"	±10%
8"	8.000"	±0.040"	0.109"	±10%
10"	10.000"	±0.040"	0.134"	±10%

Product Marking

Unless otherwise specified, each length is stencilled to show the plant, size, type, applicable ASTM and ASME specifications, surface condition, heat number, bundle number, date, shift, and mill order.

Packaging

Each SANI-FLOW® tube is end capped, sealed in a plastic sleeve, and boxed for shipping in a tri-wall box with wood end protection. Full wood crates and export crates are available upon request.

The information and data presented herein may be typical or average values and are not a guarantee of maximum or minimum values unless specifically stated. Applications specifically suggested for material described herein are made solely for the purpose of illustration to enable the reader to make his or her own evaluation and are not intended as warranties, either expressed or implied, of fitness for these or other purposes.

PLYMOUTH TUBE CO USA®

2056 Young Street
East Troy, WI 53120

Visit us online at www.plymouth.com

Phone: 262 642 8326
Fax: 262 642 9571
Corporate: 800 323 9506
Email: sales@plymouth.com

©2007 Plymouth Tube Company 12.07

PLYMOUTH TUBE CO USA®

TRENT PLANT • EAST TROY, WISCONSIN

15MAX® Electropolished Tubing

APPLICATION GUIDELINES

Scope

Plymouth Tube's 15MAX® electropolished tubing, manufactured in our Trent Plant, is a 316L (UNS # S31603) welded stainless steel tubing that is electropolished to a surface finish of 15 microinch Ra or smoother. It maintains a highly corrosion resistant finish and a contaminant-free interior surface.

15MAX® electropolished tubing is used in hygienic services, such as pharmaceutical, bio-tech, and semiconductor, that require the HIGHEST degree of purity and cleanliness in transporting liquids or gases.

Applicable Specifications

To ensure optimal performance, ease of installation, and prolonged life, 15MAX® electropolished tubing is manufactured in accordance with ASTM A249, SA249, A269, and A270-S2 as well as additional restrictions and criteria as outlined in internal Plymouth Tube specifications.

Ordering Information

When ordering 15MAX® electropolished tubing, the following specifications must be provided:

- Dimensions
- Alloy
- Special Surface Finish and Packaging Requirements
- Specific Inspection/Testing Criteria
- Supplemental Testing

Manufacturing Process

15MAX® electropolished tubing is made in our Trent plant from cold rolled 2B stainless steel strip whose chemical elements are specially controlled to enhance weldability. This results in a virtually undetectable longitudinal weld and a tube with a more uniform wall thickness which allows for high quality orbital welds in the field.

Manufacturing includes a Tungsten Inert Gas (TIG or GTAW) method of welding. The weld bead is then cold-worked to a full finished condition. Bright annealing follows in a controlled atmosphere in accordance with ASTM A270-S2.

The internal surface of the tubing is mechanically polished and then electropolished to a 15 microinch Ra (0.38µm) or smoother. The external surface of the tubing is then mechanically polished via Plymouth Tube's state-of-the-art process. After polishing, each tube is cleaned by a nitric acid passivation and then a deionized water rinse. The tubes are dried with filtered compressed air. This process provides the smoothest finish available to the industry with optimal corrosion resistance.

Surface Condition

Internal Surface	
0.5" - 4" OD	15 µ in. max. (0.38µm)
6" - 8" OD	20 µ in. max. (0.51µm)
External Surface	180 Grit

Chemical Composition

The chemistry for 316L conforms to the latest edition of ASTM A270-S2. Other grades are available upon request.

Chemical	316L
C (Carbon)	0.035 max
Mn (Manganese)	2.00 max
S (Sulfur)	0.005 - 0.017
Si (Silicon)	0.75 max
Ni (Nickel)	10.0 - 15.0
Cr (Chromium)	16.0 - 18.0
Mo (Molybdenum)	2.00 - 3.00

Mechanical Properties

Property	316L
Tensile Strength (min.)	70,000 psi
Yield Strength (min.)	25,000 psi
Elongation (min.)	35%
Hardness Rockwell B (max.)	90

Testing

Plymouth Tube's rigorous quality control inspection and testing procedures ensure all high purity processing requirements are met and maintained. Continual visual examinations are performed throughout all processes.

Tubing must be capable of passing the flatten, flange, and reverse bend requirements of ASTM A1016. Each length is also eddy current tested to the requirements of ASTM A1016. Laboratory tests must meet A269, A249, SA249, and A270-S2.

Profilometer readings are taken after electropolishing to ensure that the 15 microinch Ra (0.38 µm) maximum surface smoothness is maintained.

Reports showing the chemical analysis, mechanical properties, and results of all tests are furnished for each size and heat lot of tubing.

Additional inspection and testing such as auger, SEM, ultrasonic, ESCA, borescoping (tapes), liquid penetrant, and corrosion resistance inspections are available when specified.

Dimensions/Tolerances

Tolerances per A270-S2 as listed below for 1/2" - 4" sizes. Ovality allowance for 6" and 8" sizes is according to ASTM A269. Straightness is 0.030" maximum per 3' length. Lengths are 20' (-0"/+1/8").

	OD		Wall Thickness	
Size	Nominal	Tolerance	Nominal	Tolerance
0.5"	0.500"	±0.005"	0.065"	±10%
0.75"	0.750"	±0.005"	0.065"	±10%
1"	1.000"	±0.008"	0.065"	±10%
1.5"	1.500"	±0.008"	0.065"	±10%
2"	2.000"	±0.008"	0.065"	±10%
2.5"	2.500"	±0.010"	0.065"	±10%
3"	3.000"	±0.010"	0.065"	±10%
4"	4.000"	±0.015"	0.083"	±10%
6"	6.000"	±0.030"	0.083"	±10%
6"	6.000"	±0.030"	0.109"	±10%
8"	8.000"	±0.030"	0.109"	±10%

Product Marking

Unless otherwise specified, each length is stencilled to show the plant, size, type, specifications ASTM A270-S2, ASME BPE and ASME SA249, surface condition, heat number, bundle number, date, shift, and mill order.

Packaging

Each 15MAX® electropolished tube is end capped, sealed in a plastic sleeve, and boxed for shipping in a tri-wall box with wood end protection. Full wood crates and export crates are available upon request.

The information and data presented herein may be typical or average values and are not a guarantee of maximum or minimum values unless specifically stated. Applications specifically suggested for material described herein are made solely for the purpose of illustration to enable the reader to make his or her own evaluation and are not intended as warranties, either expressed or implied, of fitness for these or other purposes.

PLYMOUTH TUBE CO USA®

2056 Young Street
East Troy, WI 53120

Visit us online at www.plymouth.com

Phone: 262 642 8326
Fax: 262 642 9571
Corporate: 800 323 9506
Email: sales@plymouth.com

©2007 Plymouth Tube Company 12.07

PLYMOUTH TUBE CO USA®

TRENT PLANT • EAST TROY, WISCONSIN

10MAX® Electropolished Tubing

APPLICATION GUIDELINES

Scope

Plymouth Tube's 10MAX® electropolished tubing, manufactured in our Trent Plant, is a 316L (UNS # S31603) welded stainless steel tubing that is electropolished to a surface finish of 10 microinch Ra or smoother. It maintains a highly corrosion resistant finish and a contaminant-free interior surface.

10MAX® electropolished tubing is used in hygienic services, such as pharmaceutical, bio-tech, and semiconductor, that require the HIGHEST degree of purity and cleanliness in transporting liquids or gases.

Applicable Specifications

To ensure optimal performance, ease of installation, and prolonged life, 10MAX® electropolished tubing is manufactured in accordance with ASTM A249, SA249, A269, and A270-S2 as well as additional restrictions and criteria as outlined in internal Plymouth Tube specifications.

Ordering Information

When ordering 10MAX® electropolished tubing, the following specifications must be provided:

- Dimensions
- Alloy
- Special Surface Finish and Packaging Requirements
- Specific Inspection/Testing Criteria
- Supplemental Testing

Manufacturing Process

10MAX® electropolished tubing is made in our Trent Plant from cold rolled 2B stainless steel strip whose chemical elements are specially controlled to enhance weldability. This results in a virtually undetectable longitudinal weld and a tube with a more uniform wall thickness which allows for high quality orbital welds in the field.

Manufacturing includes a Tungsten Inert Gas (TIG or GTAW) method of welding. The weld bead is then cold-worked to a full finished condition. Bright annealing follows in a controlled atmosphere in accordance with ASTM A270-S2.

The internal surface of the tubing is longitudinally belt polished and then electropolished to a 10 microinch Ra (0.26µm) or smoother. The external surface of the tubing is then mechanically polished via Plymouth Tube's state-of-the-art process. After polishing, each tube is cleaned by a nitric acid passivation and then a deionized water rinse. The tubes are dried with filtered compressed air. This process provides the smoothest finish available to the industry with optimal corrosion resistance.

Surface Condition

Internal Surface	10 µ in. max. (0.26µm)
External Surface	180 Grit

Chemical Composition

The chemistry for 316L conforms to the latest edition of ASTM A270-S2.

Chemical	316L
C (Carbon)	0.035 max
Mn (Manganese)	2.00 max
S (Sulfur)	0.005 - 0.017
Si (Silicon)	0.75 max
Ni (Nickel)	10.0 - 15.0
Cr (Chromium)	16.0 - 18.0
Mo (Molybdenum)	2.00 - 3.00

Mechanical Properties

Property	316L
Tensile Strength (min.)	70,000 psi
Yield Strength (min.)	25,000 psi
Elongation (min.)	35%
Hardness Rockwell B (max.)	90

Testing

Plymouth Tube's rigorous quality control inspection and testing procedures ensure all high purity processing requirements are met and maintained. Continual visual examinations are performed throughout all processes.

Tubing must be capable of passing the flatten, flange, and reverse bend requirements of ASTM A1016. Each length is also eddy current tested to the requirements of ASTM A1016. Laboratory tests must meet A269, A249, SA249, and A270-S2.

Profilometer readings are taken after electropolishing to ensure that the 10 microinch Ra (0.26 µm) maximum surface smoothness is maintained.

Reports showing the chemical analysis, mechanical properties, and results of all tests are furnished for each size and heat lot of tubing.

Additional inspection and testing such as auger, SEM, ultrasonic, ESCA, borescoping (tapes), liquid penetrant, and corrosion resistance inspections are available when specified.

Dimensions/Tolerances

Tolerances per A270-S2 as listed below. Straightness is 0.030" maximum per 3' length. Lengths are 20' (-0"/+1/8")

	OD		Wall Thickness	
Size	Nominal	Tolerance	Nominal	Tolerance
0.5"	0.500"	±0.005"	0.065"	±10%
0.75"	0.750"	±0.005"	0.065"	±10%
1"	1.000"	±0.008"	0.065"	±10%
1.5"	1.500"	±0.008"	0.065"	±10%
2"	2.000"	±0.008"	0.065"	±10%
2.5"	2.500"	±0.010"	0.065"	±10%
3"	3.000"	±0.010"	0.065"	±10%
4"	4.000"	±0.015"	0.083"	±10%

Product Marking

Unless otherwise specified, each length is stencilled to show the plant, size, type, specifications ASTM A270-S2, ASME BPE and ASME SA249, surface condition, heat number, bundle number, date, shift, and mill order.

Packaging

Each 10MAX® electropolished tube is end capped, sealed in a plastic sleeve, and boxed for shipping in a tri-wall box with wood end protection. Full wood crates and export crates are available upon request.

The information and data presented herein may be typical or average values and are not a guarantee of maximum or minimum values unless specifically stated. Applications specifically suggested for material described herein are made solely for the purpose of illustration to enable the reader to make his or her own evaluation and are not intended as warranties, either expressed or implied, of fitness for these or other purposes.

PLYMOUTH TUBE CO USA®

2056 Young Street
East Troy, WI 53120

Visit us online at www.plymouth.com

Phone: 262 642 8326
Fax: 262 642 9571
Corporate: 800 323 9506
Email: sales@plymouth.com

©2007 Plymouth Tube Company 12.07