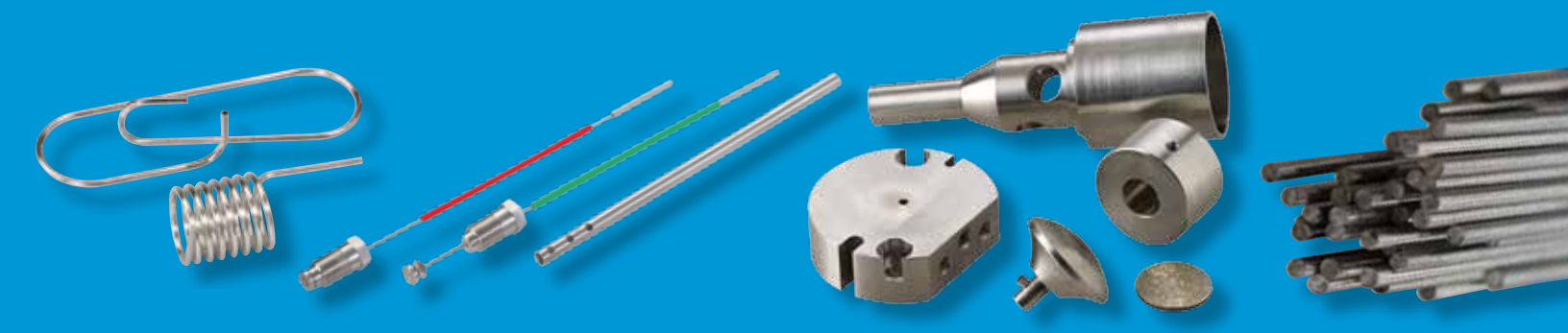
ISO 9001 ISO 13485

EAGLE STAINLESS

Advanced technology with the expertise to deliver stainless steel exactly as you want it.



"Never doubt that a small group of thoughtful, committed people can change the world. Indeed, it is the only thing that ever has."
Margaret Meade, Anthropologist

WORKING FOR YOU

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Eagle Stainless Tube & Fabrication, Inc.
10 Discovery Way • Franklin, MA 02038

Eagle Stainless' vision of being a world-class supplier of medical, aerospace, and high tech component parts is being achieved today. Eagle does business in all parts of the world such as Ireland, Israel, Australia and other European countries. We are expanding our customer base daily in these countries and expect in the future to have Eagle Stainless Tube & Fabrication be as familiar all over the world as it is in the United States.

– Robert J. Bubencik, Sr., Chairman

EXPECT A LOT FROM US

Mission Statement

Eagle Stainless Tube & Fabrication, Inc., is committed to each and every customer to provide the ultimate in quality, service and performance. Every item furnished by Eagle Stainless that comes in contact with another human being, will reflect the care and meticulousness of the Eagle Stainless employees, who have the highest regard for human life.

Quality Policy

"Eagle Stainless Tube & Fabrication Inc. will provide to its customers products and services that demonstrate quality, reliability of product, dependability of service, and on-time delivery. To fulfill our mission and policy, we will utilize a systematic approach to quality assurance and management. The processes used to support customer satisfaction and business performance will continuously be monitored and improved to achieve Performance Excellence".

The key to our success is the development of relationships with our suppliers and customers that emphasize continuous improvement, customer satisfaction and performance excellence.

Eagle stocks both seamless and welded stainless steel tubing for a variety of applications requiring strength, corrosion resistance and/or heat resistance. Typical end uses include mechanical applications, aerospace , heat exchangers, condensers, medical and instrumentation.

STAINLESS STEEL TUBING

Eagle Stainless Tube & Fabrication, Inc.
10 Discovery Way • Franklin, MA 02038

** Note: The allowances in this table are nominal allowances which have been satisfactorily used for many applications but are not necessarily adequate for all tubular products and methods of machining. For example, when magnetic particle inspection or aircraft quality requirements are involved, greater allowances than those shown in the foregoing table should be used.*

Table 1-1
Clean up or Machining Allowances for Round Tubing*

For Machined Parts Size, Outside Diameter, Inches	Machining Allowances on Diameter, Inches: Outside Diameter	Inside Diameter
Less than 3/32	0.008	0.008
3/32 ≤ 3/16	0.012	0.012
3/16 ≤ 1/2	0.015	0.015
1/2 ≤ 1-1/2	0.020	0.020
1-1/2 ≤ 3	0.040	0.040
3 ≤ 5-1/2	0.060	0.060
5-1/2 ≤ 8	0.080	0.080

Seamless Stainless Steel Tubing

Seamless stainless steel tube is produced by first having molten stainless steel formed into a billet. The billet is then extruded and turned into a tube hollow. The tube hollow will now go through several cold drawing reductions and annealing steps until the tube reaches its final dimensions and mechanical properties.

Eagle's seamless stainless tube is ordered to specifications that make the product versatile for general usage and capable of ready certification to more stringent requirements. Standard seamless tube sizes are typically certified to ASTM-A269/A213 (average wall) which ensure that the tubing meets the required mechanical property testing such as tensile, yield and elongation. Clean up or machining allowances for round tubing are shown in table 1-1.

Welded Stainless Steel Tubing

Welded stainless steel tubing is produced by having flat stainless strip roll formed and welded. The welding may be done by using either TIG or Laser welding process. Welded tube can be produced in various forms: As Welded (welded to size), Welded and Sunk Drawn (drawn with no ID mandrel) or Drawn over Mandrel (DOM). The welded and drawn tubes (both Sunk and DOM) then go through cold reduction passes similar to the seamless tube until the tube reaches its final dimensions and desired mechanical properties.

Eagle's welded stainless tube is ordered to specifications that make the product versatile for general usage and capable of ready certification to more stringent requirements. Standard welded tube sizes are typically certified to ASTM-A269/A249 (average wall) which ensure that the tubing meets the required mechanical property testing such as tensile, yield and elongation. Clean up or machining allowances for round tubing are shown in table 1-1

Hypodermic Tubing

Hypodermic Tube – Eagle stocks both T304 & T316 alloy tubing in a variety of gauge sizes from 3 STD to 33 STD. The hypodermic tube is typically a welded tube purchased to OD & ID requirements (see chart page 18) and is in the Full Hard Temper condition. T304 material is stocked to an ASTM-A908 specification.

To order stainless and other tubing please see pages 17 – 27

Eagle Stainless is a leading supplier of ultra high precision, cut-to-length, stainless steel tubing and bar for medical, electronic, semi-conductor, industrial and aerospace applications. Our manufacturing facilities enable us to cut and deburr any diameter tubing in quantities from a single piece to millions. . . and from lengths of .040" and longer with standard tolerances of ±.005. If you need even closer tolerances, talk to us. We have the desire and the capability to do what other suppliers can't!

PRECISION TUBING

World Class Burr-Free Cutting

- ***Burr-Free Production***
- ***No Work Hardening***
- ***No ReCast***
- ***Faster than EDM***

Eagle Stainless Tube & Fabrication, Inc.
10 Discovery Way • Franklin, MA 02038

CUT · TO · LENGTH

Ordering Your Tubing

Tubing is generally ordered to outside diameter and wall thickness, and is inventoried as Eagle Service Center Stock. Although tubing has three dimensions (O.D., I.D. and wall thickness) only two may be specified with tolerances; the third is theoretical. If inside diameter is the more important dimension for you, tubing can be specially produced by our mill to I.D. and wall, or to O.D. and I.D. dimensions. Tolerances in any tube are applicable only to two cross-sectional dimensions. Thus, if outside diameter and wall thickness are specified, the inside diameter may not necessarily conform to published tolerances.

Grades of Stainless Steel

Grades are important depending on your application. One grade may be better than others for certain environments and uses (see pages 20 - 21).

Get Tubing Cut to Exact Lengths

Our facilities enable us to cut and deburr any diameter tubing in quantities from 1 piece to 100,000 pieces or more. . . from lengths of 0.040" and longer. See the table at the right for standard cut to length tolerances. Closer tolerances are certainly possible. Talk to us!

Eagle Stainless Standard Cutting Tolerances

Outside Diameter 0.008" - 0.019"				
OAL	.040" - 6"	6" - 18"	18" - 36"	36" - 80"
TOL	± .010	± .030	± .060	± 1"
Outside Diameter 0.020" - 0.755"				
OAL	.040" - 6"	6" - 18"	18" - 36"	36" - 80"
TOL	± .005	± .010	± .030	± 1"
Outside Diameter 0.756" - 2"				
OAL	.750" - 6"	6" - 18"	18" - 36"	36" - 80"
TOL	± .010	± .030	± .060	± 1"

Finish of Tubing

Most stainless tubes are produced with a bright silvery finish, although in some cases a "pickled" or dull pewter finish is produced. Most of Eagle Stainless finishes are of the "Bright" variety. It is always suggested to specify the expected finish.

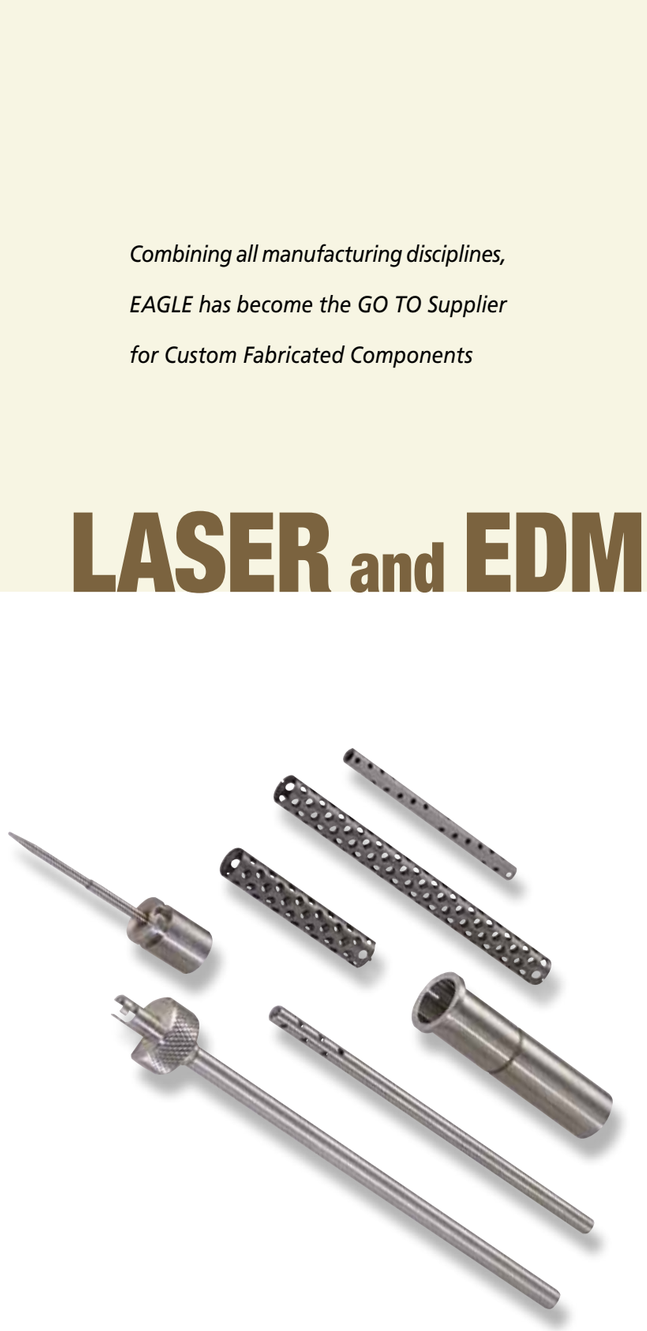
All cut-to-length materials are certified to applicable specifications

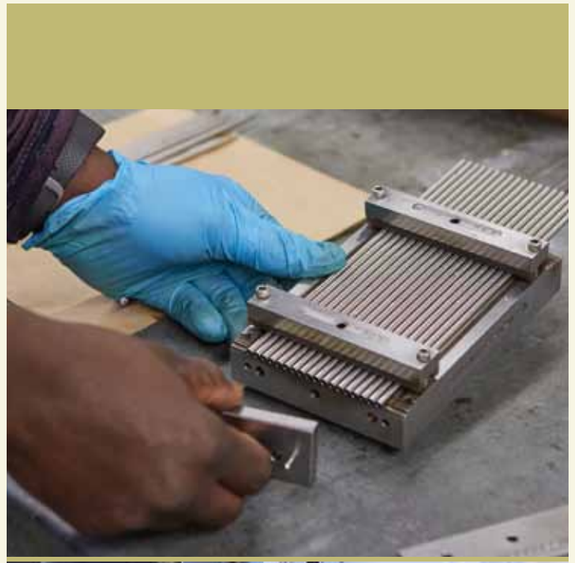
Combining all manufacturing disciplines,

EAGLE has become the GO TO Supplier

for Custom Fabricated Components

LASER and EDM





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MACHINING

WIRE EDM and LASER MACHINING

At Eagle Stainless, we're proud to offer a comprehensive suite of wire Electrical Discharge Machining (EDM) and Laser Machining Services. This advanced capability provides a close tolerance, high precision process for creating simple or extremely complex shapes and patterns. CNC controlled cutting patterns can be completed quickly on a wide range of stainless steel alloys, while maintaining a low Ra surface roughness. While standard roughness of approximately 60 Ra is typical, a lower roughness of ~16 Ra is possible, allowing us to offer our valued customers a truly customized product.

Laser Machining (above)
Eagle's bank of laser machining equipment enables extremely close-tolerance cutting, notching, etching and welding operations for a variety of applications.

Wire EDM Machining (left)

The most important advantage of wire EDM is that the process can provide high dimensional accuracy for close fitting parts. The process can make sharp inside corners. EDM can cut material thicknesses from only a few thousandths of an inch to several inches. Custom tooling is generally not needed. No matter your unique specifications of pattern, shape, or application, Eagle Stainless has the wire EDM equipment, experience, and expertise to provide a quick, precise solution.

Phone (800) 528-8650 • Fax (800) 520-1954 • Franklin, MA 02038

EAGLE is capable of providing close tolerance components made from Brass, Aluminum, titanium, nickel and nickel based alloys, as well as stainless.

If you can dream it, we can make it!

CNC HAS LASER TOOLS

Eagle Stainless Tube & Fabrication, Inc.
10 Discovery Way • Franklin, MA 02038

MACHINING

Eagle Eye Quality
follows your job along through the entire manufacturing cycle to insure that your finished product meets or exceeds your expectations.

Precision-machined parts fresh from a cutting oil bath in one of the Eagle CNC machining centers.

Specializing in CNC machining of parts having diameters ranging from .062" to 2", Eagle Stainless operates a state-of-the-art manufacturing facility. The company is capable of providing close tolerance components made from Brass, Aluminum, titanium, nickel and nickel based alloys, as well as stainless. Small parts can be manufactured to tolerances within .0005".

Experienced toolmakers will develop the intricate form tools required for your most demanding requirements.

Phone (800) 528-8650 • Fax (800) 520-1954 • Franklin, MA 02038

Eagle is a specialist for precision bending and coiling of stainless steel, copper, aluminum and other materials. Eagle provides precision bent components for use in surgical devices, heat exchangers, instrumentation and handling equipment. Sizes range from .032" to 1" diameters in a variety of wall thicknesses, with minimal radius and wall thinning requirements.

BENDING

High precision, bending machine in operation at Eagle.

Eagle Stainless Tube & Fabrication, Inc.
10 Discovery Way • Franklin, MA 02038

COILING

Eagle can bend a variety of tubing materials to your exact specifications: from simple to extremely complex shapes.

Bending

The ability to bend tubes without excessive distortion, wrinkling or fracturing is an art born of experience. Eagle's skilled craftsmen working with state-of-the art machinery supply uniformly smooth bends – meeting the tightest customer specifications and assuring satisfactory performance.

Coiling

For over three decades Eagle Stainless has been delivering some of the most intricately coiled stainless steel tubes imaginable. Working on diameters ranging from .032" to 1.00" we're ready to meet the needs of your most demanding custom tubing application.

All tooling is engineered and manufactured in-house. Sample parts show the wide range in size capability. Shown at the left is one of the high precision, bending machines currently in operation at Eagle.

Machining a custom-engineered bending die in the Eagle tool room.

Adjustments being made to a heat exchanger part after coiling operation.

Phone (800) 528-8650 • Fax (800) 520-1954 • Franklin, MA 02038

Since 1982 Eagle Stainless has been delivering some of the most intricately formed stainless steel parts imaginable. Now Eagle has added custom drawn tubing to the products we offer. Eagle can draw stainless and most any other malleable metals on the market. Size ranges from .040" to 1" and lengths up to 24 feet.

DRAWN SHAPES

CUSTOM SHAPED TUBING

Eagle will produce tubing in virtually any shape you require.

- **Round • Oval • Square • Triangular**
- **Rectangular • Hexagonal • and more!**

Eagle can draw stainless, titanium, copper and most other malleable metals in a size range from .040" to 1" and lengths up to 24 feet.

❖

✔ Choose the size you need

Eagle manufactures both seamless and welded tubing in a range of diameter from .040" through 1".

❖

✔ Choose your alloy

Eagle can meet your exact specifications in any of the following alloys:

- **Stainless Steel Alloys**
- **Nickel Alloys 200, 400, 600, 625, 800**
- **X750 • as well as Copper**

Eagle Stainless Tube & Fabrication, Inc.
10 Discovery Way • Franklin, MA 02038

Pictured at the right is a robot end-forming operation. Combining all manufacturing disciplines, EAGLE has become the GO TO Supplier for Custom Fabricated Components.

END-FORMING

TUBE END FORMING SERVICES

Eagle is proud to offer precision tube end forming services, customized to nearly any unique specification. Flaring and end reduction of tubing is an everyday precision process at Eagle. We've worked to perfect our processes, developing special tools and procedures to ensure repeatability for proper mating of flare and end reduction tubes.

✔ Closed End Tubes

Closed end tubes are spun closed and welded shut in various end configurations: round, flat or pointed. All tubes are tested to insure there is no porosity or leakage.

✔ Flaring, Bulging & End Reductions

End forming of tubing is an everyday precision process at Eagle. Special tools and procedures have been developed to insure repeatability for proper mating of flared, bulged and end-reduced tubes.

Flaring

Bulging

End reduction

Phone (800) 528-8650 • Fax (800) 520-1954 • Franklin, MA 02038

Eagle Stainless has become the go-to supplier for some of the most unique stainless steel assemblies imaginable. We stand ready to meet your most challenging product designs.

ASSEMBLY

PRECISION

What do you need? Eagle can do it all:

- Bending/Coiling
- EDM (ram type)
- Sand/Grit blasting
- Notching/slotting
- Re-drawing
- Swaging
- Welding/brazing
- Laser cutting
- Laser etching
- Passivation
- General machining
- De-burring
- Bevel cutting
- Knurling
- Annealing
- Spherical, pointed or flat end closures
- Flaring/flanging
- CNC screw machine
- Bulging
- Assembly
- End forming
- Centerless grinding
- Laser welding
- Laser notching
- Electropolishing
- Corsetting
- Drilling/reaming
- Honing
- Chamfering
- Threading
- Radius end closures

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10 Discovery Way • Franklin, MA 02038

✔ Assembly

Custom tube drawing and assembly of multiple parts to achieve a single component can be accomplished by various methods such as welding, threading, epoxy, etc. Eagle works to exact customer specifications, as well as the recommendations of our engineering experts, to achieve the lowest costs and the highest quality.

✔ Welding & Brazing

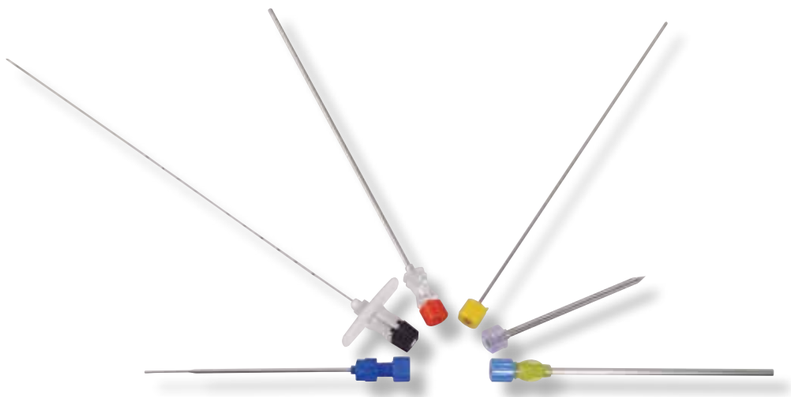
Welding, brazing or soldering of standard or custom made components to customer drawings or specifications are performed on state-of-the-art equipment including computer-controlled, laser machining centers as shown at the left.

Above note typical examples of laser welding, cutting and marking. (Please see page 9 for other examples of laser machining.)

✔ PLASTIC INJECTION MOLDING/BONDING

Eagle is proud to offer a comprehensive suite of plastic injection and insert molding and bonding services from design concept to finished molded products and components for our clients wide range of industries.

We provide full service plastic injection molding of all thermoplastic materials including Acrylic, ABS, Nylon, Polycarbonate, Polyethylene, Polypropylene, many engineered plastics, plus others such as PEEK, PTFE, FEP, PFA, and TPE.



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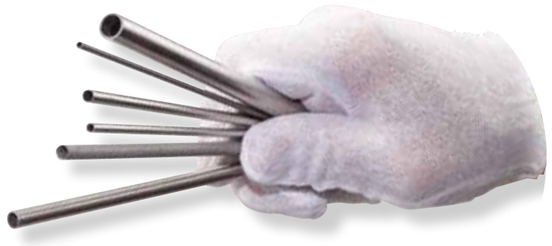
Hypodermic Tubing Selection Guide



The tubing below is available in standard 10 foot lengths. Eagle can cut your order to shorter lengths as required.

• Full hard #3 temper • T304 • T316

Gauge Size	O.D. Range (Inches)	Nominal Wall (In.)	I.D. Range (Inches)	Gauge Size	O.D. Range (Inches)	Nominal Wall (In.)	I.D. Range (Inches)	Gauge Size	O.D. Range (Inches)	Nominal Wall (In.)	I.D. Range (Inches)
3 STD	.258/.260	.015	.226/.232	13 STD	.094/.096	.012	.069/.073	20XTW	.0355/.036	.004	.026/.0285
4 STD	.236/.240	.020	.195/.201	13TW	.094/.096	.009	.075/.079	20V	.034/.0345	.004	.0255/.0275
5 STD	.218.220	.015	.187/.191	13 XTW	.094/.096	.005	.083/.087	20STD	.032/.0325	.006	.0195/.021
5 TW	.218/.220	.010	.196/.200	14 STD	.082/.084	.010	.061/.065	21 TW	.032/.0325	.005	.022/.024
6 STD	.202/.204	.015	.170/.1765	14 SP	.082/.084	.008	.065/.069	21XTW	.032/.0325	.002	.0280/.0295
6TW	.202/.204	.010	.180/.186	14 TW	.082/.084	.0055	.071/.073	21 V	.030/.0305	.0035	.023/.0245
6V	.187/.189	.010	.165/.171	14 XTW	.082/.084	.003	.075/.079	22 STD	.028/.0285	.006	.0155/.017
7 STD	.179/.181	.015	.147/.153	14 V	.077/.079	.007	.062/.066	22 TW	.028/.0285	.004	.019/.0205
7TW	.179/.181	.010	.158/.162	15 STD	.0715/.0725	.009	.0525/.0555	22 XTW	.028/.0285	.0025	.0225/.024
7V	.171/.173	.011	.147/.153	15 TW	.0715/.0725	.006	.0595/.0615	22 V	.026/.027	.003	.0195/.021
8 STD	.164/.166	.015	.132/.138	15 XTW	.0715/.0725	.004	.062/.066	23 STD	.025/.0255	.006	.0125/.014
8TW	.164/.166	.010	.143/.147	15 V	.0675/.0685	.007	.0525/.0555	23 TW	.025/.0255	.004	.0165/.018
8XTW	.164/.166	.009	.145/.149	16 STD	.0645/.0655	.009	.0455/.0485	23 XTW	.025/.0255	.002	.0185/.020
8V	.155/.157	.010	.133/.139	16 TW	.0645/.0655	.006	.0525/.0545	23V	.023/.0235	.003	.0165/.018
9 STD	.147/.149	.015	.115/.121	16XTW	.0645/.0655	.004	.055/.058	24 STD	.022/.0225	.005	.0115/.013
9TW	.147/.149	.010	.126/.130	16 V	.0615/.0625	.005	.0505/.0535	24XTW	.022/.0225	.003	.0155/.017
9XTW	.147/.149	.006	.134/.138	17 STD	.0575/.0585	.008	.0405/.0435	24V	.021/.0215	.002	.0155/.017
9V	.140/.142	.011	.117/.121	17 TW	.0575/.0585	.005	.0465/.0485	25 STD	.020/.0205	.005	.0095/.011
10 STD	.133/.135	.014	.104/.108	17 XTW	.0575/.0585	.003	.051/.053	25 TW	.020/.0205	.004	.0115/.013
10 TW	.133.135	.010	.112/.116	17 V	.0555/.0565	.005	.045/.047	25XTW	.020/.0205	.002	.0155/.017
10XTW	.133/.135	.008	.1165/.120	18 STD	.0495/.0505	.0085	.0315/.0345	25V	.019/.0195	.002	.0135/.015
10 V	.125/.127	.010	.104/.108	18 SP	.0495/.0505	.006	.0375/.0395	26 STD	.018/.0185	.004	.0095/.011
11 STD	.119/.121	.013	.092/.096	18 TW	.0495/.0505	.004	.041/.043	27 STD	.016/.0165	.004	.0075/.009
11 TW	.119/.121	.010	.098/.102	18 V	.0455/.0465	.0065	.0315/.0345	27 TW	.016/.0165	.003	.0095/.011
11XTW	.119/.121	.007	.104/.108	19 STD	.0415/.0425	.0075	.0255/.0285	27 SP	.016/.0165	.002	.0115/.0125
11 V	.114/.116	.010	.092/.096	19 TW	.0415/.0425	.005	.0315/.0335	28 STD	.014/.0145	.0035	.0065/.008
12 STD	.108/.110	.012	.083/.087	19 XTW	.0415/.0425	.0035	.034/.036	29 STD	.013/.0135	.003	.0065/.008
12 TW	.108/.110	.009	.089/.093	19 V	.0385/.0395	.006	.0255/.0285	30 STD	.012/.0125	.003	.0055/.007
12 XTW	.108/.110	.0045	.098/.102	20 STD	.0355/.036	.006	.023/.0245	30TW	.012/.0125	.002	.0065/.008
12 V	.099/.101	.008	.080/.083	20 TW	.0355/.036	.005	.025/.027	31 STD	.010/.0105	.0025	.0045/.006
								32 STD	.009/.0095	.0025	.0035/.005
								33 STD	.008/.0085	.002	.0035/.005

Note: Special sizes available on request!

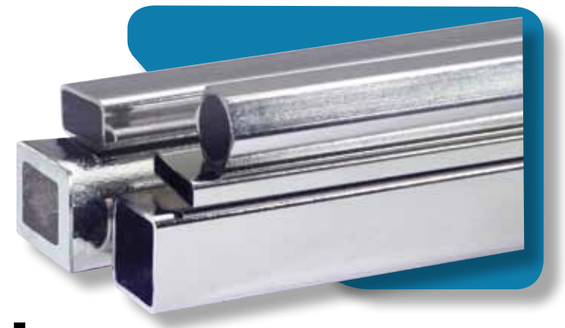
Lab Sample Kit

Here is a helpful kit featuring a large assortment of **T304 series** stainless steel hypodermic tubing well suited for test, evaluation and prototyping by designers and laboratory personnel. Filling the need for customers who want to experiment with a variety of sizes before placing production orders, the kit features 90 pieces of 40" long hypodermic tubing in a full range of sizes from 6 Gauge to 33 Gauge – all with a variety of wall thicknesses. A handy reorder form is included for ordering production quantities of required sizes with 24 hour delivery.

Metric Stainless Steel Tubing • T304 • Alloy 600 • T316 • T321 • Alloy 400 • T347

O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft
1 mm (.040")	.25 mm (.010")	.5 mm (.020")	.002	7 mm (.276")	1 mm (.040")	5 mm (.196")	.140	13 mm (.512")	1 mm (.040")	11 mm (.432")	.202	20 mm (.787")	1 mm (.040")	18 mm (.707")	.319
2 mm (.080")	.25 mm (.010")	1.5 mm (.060")	.005	8 mm (.315")	. 1mm (.040")	6 mm (.235")	.118	14 mm (.551")	1 mm (.040")	11.7 mm (.463")	.238	21 mm (.827")	1 mm (.040")	19 mm (.747")	.336
3 mm (.118")	.64 mm (.025")	1.7 mm (.068")	.015	9 mm (.354")	1 mm (.040")	7 mm (.274")	.134	15 mm (.591")	1.2 mm (.049")	12.5 mm (.493")	.284	22 mm (.866")	1.2 mm (.045")	19.6 mm (.777")	.395
4 mm (.158")	.5 mm (.020")	.3 mm (.118")	.034	10 mm (.394")	.5 mm (.020")	9 mm (.354")	.140	16 mm (.630")	1.2 mm (.049")	13.4 mm (.527")	.304	23 mm (.906")	1 mm (.036")	21 mm (.834")	.335
5 mm (.197")	.5 mm (.020")	4 mm (.157")	.038	10 mm (.394")	1 mm (.040")	8 mm (.314")	.151	17 mm (.669")	1.2 mm (.046")	14.7 mm (.577")	.306	24 mm (.945")	1 mm (.038")	22 mm (.870")	.368
6 mm (.236")	.5 mm (.020")	5 mm (.236")	.045	11 mm (.433")	.8 mm (.032")	9.3 mm (.368")	.045	18 mm (.709")	1.2 mm (.045")	15.8 mm (.620")	.319	25 mm (.984")	1 mm (.041")	23 mm (.902")	.413
6 mm (.236")	1 mm (.040")	4 mm (.156")	.063	12 mm (.472")	.9 mm (.035")	10.1 mm (.402")	.163	19 mm (.749")	1.2 mm (.049")	16.5 mm (.651")	.366	26 mm (1.024")	1.3 mm (.052")	23.4 mm (.920")	.540

Note: special metric sizes available upon request



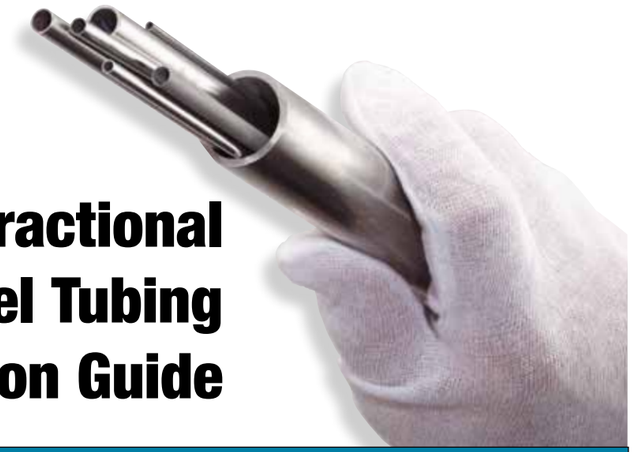
Tubing Selection Guide – Square & Rectangular

Eagle can re-draw standard tubing to provide you with the exact shape to meet your application requirements. Standard lengths are 10 to 12 feet.

Standard Tubing Square / Rectangular Sizing Chart

Available with Wall Thicknesses of .010" .020" .028" .035"

	.125	.187	.250	.313	.375	.437	.500	.625	.750	1.000	1.250	1.500
.125	✓	✓	✓	✓	✓	✓	✓	✓				
.187	✓	✓	✓	✓	✓	✓	✓	✓	✓			
.250	✓	✓	✓	✓	✓	✓	✓	✓	✓			
.313	✓	✓	✓	✓	✓	✓	✓	✓	✓			
.375	✓	✓	✓	✓	✓	✓	✓	✓	✓			
.437	✓	✓	✓	✓	✓	✓	✓	✓	✓			
.500	✓	✓	✓	✓	✓	✓	✓	✓	✓			
.625	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
.750								✓	✓	✓	✓	✓
1.000									✓	✓	✓	✓
1.250									✓	✓	✓	✓
1.500									✓	✓	✓	✓



Fractional Stainless Steel Tubing Selection Guide

• T304 • Alloy 600 • T316 • T321 • Alloy 400 • T347

O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft
1/16	.010	.042	.005	9/32	.028	.225	.076	5/8	.020	.585	.129	1-1/8	.028	1.069	.328
(.062)	.016	.030	.008	(.281)	.035	.211	.092	(.625)	.028	.569	.178	(1.125)	.035	1.055	.407
	.020	.022	.009						.035	.555	.221		.049	1.027	.563
	.028	.006	.012	5/16	.016	.281	.050		.049	.527	.301		.065	.995	.736
				(.313)	.020	.273	.062		.065	.495	.388		.095	.935	1.045
3/32	.010	.074	.009		.028	.257	.085		.083	.459	.480		.120	.885	1.288
(.094)	.016	.062	.015		.035	.243	.103		.095	.435	.537		.188	.750	1.881
	.020	.054	.016		.049	.215	.138		.120	.385	.647		.250	.625	2.336
	.028	.038	.020		.065	.183	.172		.188	.249	.877				
					.083	.147	.203					1-1/4	.028	1.194	.365
1/8	.010	.105	.015		.095	.123	.221	3/4	.020	.710	.155	(1.250)	.035	1.180	.454
(.125)	.016	.093	.019	3/8	.010	.355	.038	(.750)	.028	.694	.215		.049	1.152	.628
	.020	.085	.022	(.375)	.016	.343	.061		.035	.680	.267		.065	1.120	.822
	.025	.075	.025		.020	.335	.075		.049	.652	.366		.083	1.084	1.034
	.028	.069	.029		.028	.319	.103		.065	.620	.475		.095	1.060	1.172
	.035	.055	.033		.035	.305	.127		.083	.584	.591		.109	1.032	1.328
	.049	.027	.040		.049	.277	.170		.095	.560	.664		.120	1.010	1.448
					.065	.245	.215		.120	.510	.807		.188	.875	2.132
5/32	.010	.136	.019		.083	.209	.258		.156	.438	.990		.250	.750	2.670
(.156)	.016	.124	.034		.095	.185	.284								
	.020	.116	.040		.120	.135	.326	13/16	.028	.756	.235	1-3/8	.035	1.305	.500
	.028	.100	.060					(.812)	.035	.742	.290	(1.375)	.049	1.277	.693
	.035	.086	.082	7/16	.020	.398	.089		.049	.714	.399		.065	1.245	.909
	.049	.058	.096	(.438)	.028	.382	.123		.065	.682	.519		.120	1.135	1.608
					.035	.368	.150						.134	1.107	1.776
3/16	.010	.168	.019		.049	.340	.203	7/8	.028	.819	.253		.188	1.000	2.383
(.188)	.016	.156	.029		.065	.308	.258	(.875)	.035	.805	.314		.250	.875	3.004
	.020	.148	.035		.083	.272	.315		.049	.777	.432				
	.028	.132	.047						.065	.745	.562	1-1/2	.028	1.444	.440
	.035	.118	.057	1/2	.010	.480	.052		.083	.709	.702	(1.500)	.035	1.430	.547
	.049	.090	.073	(.500)	.016	.468	.082		.095	.685	.791		.049	1.402	.759
	.065	.058	.085		.020	.460	.102		.120	.635	.968		.065	1.370	.996
					.028	.444	.141		.156	.563	1.198		.083	1.334	1.256
7/32	.016	.186	.035		.035	.430	.173		.188	.499	1.379		.120	1.260	1.769
(.218)	.028	.162	.056		.049	.402	.236						.134	1.232	1.955
	.035	.148	.069		.065	.370	.302	1	.020	.960	.209		.156	1.188	2.239
					.083	.310	.418	(1.000)	.028	.944	.290		.188	1.125	2.634
1/4	.010	.230	.026		.095	.310	.418		.035	.930	.360		.250	1.000	3.338
(.250)	.016	.218	.040		.120	.260	.487		.049	.902	.497		.375	.750	4.506
	.020	.210	.049						.065	.870	.649	1-5/8	.049	1.527	.8248
	.028	.194	.066	9/16	.028	.506	.160		.083	.834	.812	(1.625)	.065	1.495	1.083
	.035	.180	.080	(.562)	.035	.492	.197		.095	.810	.918		.083	1.459	1.367
	.049	.152	.105		.049	.464	.257		.120	.760	1.128		.095	1.435	1.552
	.065	.120	.128		.065	.432	.346		.188	.624	1.630		.120	1.385	1.929
	.083	.084	.148		.095	.372	.474		.250	.500	2.003		.188	1.249	2.885
	.095	.060	.157		.125	.312	.584						.250	1.125	3.671
													.375	.875	5.006

Fractional Stainless Steel Tubing Selection Guide

• T304 • Alloy 600 • T316 • T321 • Alloy 400 • T347

O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft	O.D.	Wall	Theor I.D.	Weight Per Ft
1-3/4	.049	1.652	.8902	2-1/2	.049	2.402	1.283	3-3/4	.120	3.510	4.652	5-1/2	.065	5.370	3.773
(1.750)	.065	1.620	1.170	(2.500)	.065	2.370	1.690	(3.750)	.250	3.250	9.345	(5.500)	.120	5.260	6.895
	.120	1.510	2.089		.083	2.334	2.143		.375	3.000	13.520		.250	5.000	14.020
	.156	1.438	2.656		.095	2.310	2.440		.500	2.750	17.360		.375	4.750	20.530
	.188	1.374	3.316		.109	2.282	2.783		.625	2.500	24.030		.500	4.500	26.700
	.250	1.250	4.005		.120	2.260	3.050						.750	4.000	38.050
	.375	1.000	5.507		.134	2.232	3.386	4	.065	3.870	2.732		.875	3.750	43.220
	.500	.750	6.675		.156	2.188	3.905	(4.000)	.083P	3.834	3.472		1.000	3.500	48.060
					.188	2.125	4.642		.120P	3.760	4.973				
1-7/8	.065	1.745	1.257		.250	2.000	6.008		.188	3.624	7.654	6	.065	5.870	4.120
(1.875)	.095	1.685	1.806		.375	1.750	8.511		.226P	3.548	9.109	(6.000)	.083	5.834	5.245
	.120	1.635	2.249		.500	1.500	10.680		.250	3.500	10.010		.109	5.782	6.857
	.188	1.500	3.387		.625	1.250	12.515		.318P	3.364	13.180		.120	5.760	7.536
	.250	1.375	4.339						.375	3.250	14.520		.188	5.624	11.670
				2-3/4	.065	2.620	1.864		.500	3.000	18.690		.250	5.500	15.350
2	.035	1.930	.7345	(2.750)	.083	2.584	2.364		.625	2.750	22.530		.375	5.250	22.530
(2.000)	.049	1.902	1.021		.095	2.560	2.694		.636P	2.728	22.850		.500	5.000	29.370
	.065	1.870	1.343		.120	2.510	3.371		.750	2.500	26.030		.625	4.750	35.880
	.083	1.834	1.699		.188	2.375	5.144						.750	4.500	42.050
	.095	1.810	1.933		.250	2.250	6.675	4-1/4	.065	4.120	2.905		1.000	4.000	53.400
	.109	1.782	2.201		.375	2.000	9.512	(4.250)	.095	4.060	4.216				
	.120	1.760	2.409		.500	1.750	12.015		.120	3.880	5.293	6-1/4	.250	5.750	16.020
	.134	1.732	2.671		.750	1.250	16.020		.156	3.938	8.156	(6.250)	.375	5.500	23.530
	.156	1.688	3.072						.250	3.750	10.680		.500	5.250	30.710
	.188	1.625	3.638	3	.049	2.902	1.544		.313	3.624	13.160		.750	4.750	44.060
	.250	1.500	4.673	(3.000)	.065	2.870	2.038		.375	3.500	15.520		1.000	4.250	56.070
	.375	1.250	6.508		.083	2.834	2.586		.500	3.250	20.030				
	.500	1.000	8.010		.095	2.810	2.947		.688	2.874	26.170	6-1/2	.250	6.000	16.690
					.109	2.782	3.366		.750	2.750	28.040	(6.500)	.375	5.750	24.530
2-1/8	.049	2.027	1.086		.120	2.760	3.691						.500	5.500	32.040
(2.125)	.065	1.995	1.430		.134	2.732	4.102	4-1/2	.065	4.370	5.840		.625	5.250	39.220
	.095	1.935	2.060		.156	2.688	4.738	(4.500)	.120	4.260	5.613		.750	5.000	46.060
	.120	1.885	2.570		.188	2.624	5.646		.188	4.124	8.658		1.000	4.500	58.740
	.188	1.750	3.889		.250	2.500	7.343		.250	4.000	11.350				
	.250	1.625	5.006		.313	2.374	8.982		.375	3.750	16.520	7	.250	6.500	18.020
	.375	1.375	7.008		.375	2.250	10.510		.500	3.500	21.360	(7.000)	.375	6.000	26.530
	.500	1.125	8.678		.500	2.000	13.350		.625	3.250	25.870		.500	6.000	34.710
					.625	1.750	15.850		.750	3.000	30.040		.750	5.500	50.060
2-1/4	.049	2.152	1.152		.750	1.500	18.020		.875	2.750	33.880		1.000	5.000	64.080
(2.250)	.065	2.120	1.517												
	.083	2.084	1.921	3-1/4	.065	3.120	2.211	4-3/4	.120	4.510	5.934	7-1/2	.250	7.000	19.360
	.095	2.060	2.252	(3.250)	.083	3.084	2.807	(4.750)	.188	4.374	9.160	(7.500)	.500	6.500	37.380
	.120	2.010	2.730		.095	3.060	3.201		.250	4.250	12.020				
	.188	1.874	4.140		.120	3.010	4.011		.375	4.000	17.520	8	.120	7.760	10.100
	.250	1.750	5.340		.188	2.874	6.148		.500	3.750	22.700	(8.000)	.250	7.500	20.690
	.375	1.500	7.509		.250	2.750	8.010		.625	3.500	27.530		.375	7.250	30.540
	.500	1.250	9.345		.375	2.500	11.514		.750	3.250	32.040		.500	7.000	40.050
					.500	2.250	14.685		.875	3.000	36.210		.625	6.750	49.230
2-3/8	.065P	2.245	1.604		.750	1.750	20.025						.750	6.500	58.070
(2.375)	.083	2.209	2.032					5	.065	4.870	3.426		1.000	6.000	74.760
	.095	2.185	2.313	3-1/2	.065	3.370	2.385	(5.000)	.083	4.834	4.359				
	.109P	2.157	2.638	(3.500)	.083P	3.334	3.029		.120	4.760	6.254				
	.154P	2.067	3.653		.120P	3.260	4.332		.188	4.624	9.662				
	.188	1.990	4.391		.188	3.124	6.650		.250	4.500	12.680				
	.218P	1.939	5.022		.216P	3.068	7.756		.375	4.250	18.520				
	.250	1.875	5.674		.250	3.000	8.678		.500	4.000	24.030				
	.343P	1.689	7.444		.300P	2.900	10.250		.625	3.750	29.200				
	.375	1.625	8.010		.375	2.750	12.520		.750	3.500	34.040				
	.436P	1.503	9.029		.500	2.500	16.020		.875	3.250	38.550				
	.500	1.375	10.010		.625	2.250	19.190								
					.750	2.000	22.030								

Note: Larger sizes are available on request. Please consult factory.

"P" Designates pipe size

ALUMINUM TUBING

Selection Guide

Alloys • 2024 • 3003 • 5052 • 6061

O.D. Fraction	O.D. Decimal	Wall	I.D.	Type	Wt/ft
1/8	0.125	0.020	0.085	T6061-T6	0.0078
3/16	0.188	0.028	0.132	T6061-T6	0.0166
		0.035	0.118	T6061-T6	0.0198
		0.035	0.118	T5052-0	0.0197
		0.035	0.118	T2024-T3	0.0203
1/4	0.250	0.020	0.210	T6061-T6	0.0170
		0.028	0.194	T6061-T6	0.0230
		0.028	0.194	T2024-T3	0.0236
		0.035	0.180	T6061-T6	0.0278
		0.035	0.180	T2024-T3	0.0285
		0.035	0.180	T3003-T14	0.0268
		0.035	0.180	T5052-0	0.0276
		0.049	0.152	T6061-T6	0.0364
		0.049	0.152	T2024-T3	0.0374
		0.058	0.134	T6061-T6	0.0412
		0.065	0.120	T6061-T6	0.0445
5/16	0.312	0.028	0.256	T6061-T6	0.0294
		0.035	0.242	T6061-T6	0.0359
		0.035	0.242	T2024-T3	0.0368
		0.035	0.242	T5052-0	0.0356
		0.049	0.214	T6061-T6	0.0477
		0.049	0.214	T2024-T3	0.0489
3/8	0.375	0.020	0.335	T6061-T6	0.0263
		0.028	0.319	T6061-T6	0.0359
		0.028	0.319	T5052-0	0.0357
		0.035	0.305	T6061-T6	0.0440
		0.035	0.305	T2024-T3	0.0451
		0.035	0.305	T3003-T14	0.0424
		0.035	0.305	T5052-0	0.0437
		0.049	0.277	T6061-T6	0.0591
		0.049	0.277	T2024-T3	0.0606
		0.049	0.277	T5052-0	0.0587
		0.058	0.259	T6061-T6	0.0680
		0.065	0.245	T6061-T6	0.0746
		0.065	0.245	T2024-T3	0.0764
		0.083	0.209	T6061-T6	0.0897
		0.095	0.185	T6061-T6	0.0984
		0.095	0.185	T2024-T3	0.1009
7/16	0.438	0.035	0.368	T6061-T6	0.0522
		0.035	0.368	T2024-T3	0.0535
		0.049	0.340	T6061-T6	0.0705
		0.049	0.340	T2024-T3	0.0723
		0.065	0.308	T6061-T6	0.0897
		0.065	0.308	T2024-T3	0.0919
		0.095	0.248	T2024-T3	0.1236
		0.120	0.198	T6061-T6	0.1412
1/2	0.500	0.020	0.460	T6061-T6	0.0355
		0.028	0.444	T6061-T6	0.0489
		0.028	0.444	T2024-T3	0.0501

O.D. Fraction	O.D. Decimal	Wall	I.D.	Type	Wt/ft
1/2	0.500	0.028	0.444	T3003-T14	0.0471
		0.028	0.444	T5052-0	0.0486
		0.035	.0430	T6061-T6	0.0602
		0.035	0.430	T2024-T3	0.0617
		0.035	0.430	T3003-T14	0.0580
		0.035	0.430	T5052-0	0.0598
		0.049	0.402	T6061-T6	0.0818
		0.049	0.402	T2024-T3	0.0838
		0.049	0.402	T3003-T14	0.0787
		0.049	0.402	T5052-0	0.0812
		0.058	0.384	T6061-T6	0.0949
		0.065	0.370	T6061-T6	0.1046
		0.065	0.370	T2024-T3	0.1072
		0.065	0.370	T3003-T14	0.1007
		0.065	0.370	T5052-0	0.1039
		0.083	0.334	T6061-T6	0.1281
		0.083	0.334	T2024-T3	0.1313
		0.095	0.310	T6061-T6	0.1424
		0.095	0.310	T2024-T3	0.1459
		0.125	0.250	T6061-T6	0.1734
		0.125	0.250	T2024-T6	0.1778
9/16	0.562	0.035	0.492	T6061-T6	0.0682
		0.035	0.492	T2024-T3	0.0700
		0.049	0.464	T2024-T3	0.0953
		0.125	0.312	T2024-T3	0.2072
5/8	0.625	0.028	0.569	T6061-T6	0.0618
		0.028	0.569	T2024-T3	0.0634
		0.028	0.569	T3003-T14	0.0596
		0.028	0.569	T5052-0	0.0614
		0.035	0.555	T6061-T6	0.0764
		0.035	0.555	T2024-T3	0.0783
		0.035	0.555	T3003-T14	0.0736
		0.035	0.555	T5052-0	0.0759
		0.049	0.527	T6061-T6	0.1044
		0.049	0.527	T2024-T	0.1070
		0.049	0.527	T3003-T14	0.1006
		0.049	0.527	T5052-0	0.1037
		0.058	0.509	T6061-T6	0.1217
		0.065	0.495	T6061-T6	0.1347
		0.065	0.495	T2024-T3	0.1380
		0.065	.0495	T3003-T14	0.1297
		0.083	0.459	T6061-T6	0.1664
		0.095	0.435	T6061-T6	0.1863
		0.095	0.435	T2024-T3	0.1910
		0.125	0.375	T6061-T6	0.2313
		0.125	0.375	T2024-T3	0.2370
		0.156	0.313	T6061-T6	0.2707
3/4	0.750	0.028	0.694	T6061-T6	0.0748
		0.028	0.694	T2024-T3	0.0767

O.D. Fraction	O.D. Decimal	Wall	I.D.	Type	Wt/ft
3/4	0.750	0.028	0.694	T5052-0	0.0743
		0.035	0.680	T6061-T6	0.0926
		0.035	0.680	T2024-T3	0.0949
		0.035	0.680	T3003-H14	0.0892
		0.035	0.680	T5052-0	0.0919
		0.049	0.652	T6061-T6	0.1271
		0.049	0.652	T2024-T3	0.1303
		0.049	0.652	T3003-H14	0.1224
		0.049	0.652	T5052-0	0.1262
		0.058	0.634	T6061-T6	0.1485
		0.065	0.620	T6061-T6	0.1647
		0.065	0.620	T2024-T3	0.1689
		0.065	0.620	T3003-H14	0.1586
		0.065	0.620	T5052-0	0.1636
		0.083	0.584	T6061-T6	0.2048
		0.083	0.584	T2024-T3	0.2100
		0.095	0.560	T6061-T6	0.2302
		0.095	0.560	T2024-T3	0.2360
		0.125	0.500	T6061-T6	0.2891
		0.188	0.374	T6061-T6	0.3909
7/8	0.875	0.035	0.805	T6061-T6	0.1088
		0.035	0.805	T2024-T3	0.1115
		0.035	0.805	T3003-H14	0.1048
		0.049	0.777	T6061-T6	0.1498
		0.049	0.777	T2024-T3	0.1535
		0.058	0.759	T6061-T6	0.1753
		0.065	0.745	T6061-T6	0.1948
		0.065	0.45	T2024-T3	0.1997
		0.065	0.45	T3003-H14	0.1876
		0.083	0.709	T6061-T6	0.2432
		0.095	0.685	T6061-T6	0.2742
		0.095	0.685	T2024-T3	0.2810
		0.120	0.635	T6061-T6	0.3352
		0.120	0.635	T2024-T3	0.3436
		0.188	0.499	T6061-T6	0.4779
1	1.000	0.035	0.930	T6061-T6	0.1250
		0.035	0.930	T2024-T3	0.1281
		0.035	0.930	T3003-H14	0.1203
		0.035	0.930	T5052-0	0.1241
		0.049	0.902	T6061-T6	0.1724
		0.049	0.902	T2024-T3	0.1767
		0.049	0.902	T3003-H14	0.1660
		0.049	0.902	T5052-0	0.1712
		0.058	0.884	T6061-T6	0.2022
		0.065	0.870	T6061-T6	0.2249
		0.065	0.870	T2024-T3	0.2305
		0.065	0.870	T3003-H14	0.2165
		0.065	0.870	T5052-0	0.2233
		0.083	0.834	T6061-T6	0.2816

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Aluminum Tubing – Selection Guide

Alloys • 2024 • 3003 • 5052 • 6061

O.D. Fraction	O.D. Decimal	Wall	I.D.	Type	Wt/ft
1	1.000	0.083	0.834	T2024-T3	0.2887
		0.095	0.810	T6061-T6	0.3181
		0.095	0.810	T2024-T3	0.3261
		0.125	0.750	T6061-T6	0.4047
		0.125	0.750	T2024-T3	0.4148
		0.156	0.688	T2024-T3	0.4993
		0.188	0.624	T6061-T6	0.5648
		0.188	0.624	T2024-T3	0.5789
1-1/8	1.125	0.035	1.055	T6061-T6	0.1412
		0.035	1.055	T2024-T3	0.1447
		0.049	1.027	T6061-T6	0.1951
		0.049	1.027	T2024-T3	0.2000
		0.065	0.995	T6061-T6	0.2549
		0.065	0.995	T2024-T3	0.2613
		0.083	0.959	T6061-T6	0.3200
		0.083	0.959	T2024-T3	0.3280
		0.095	0.935	T6061-T6	0.3620
		0.095	0.935	T2024-T3	0.4526
		0.125	0.875	T6061-T6	0.4625
		0.125	0.875	T2024-T3	0.4741
		0.188	0.749	T6061-T6	0.6518
		0.019	0.749	T2024-T3	0.0789
		0.250	0.625	T6061-T6	0.8094
		0.250	0.625	T2024-T3	0.8296
1-1/4	1.250	0.035	1.180	T6061-T6	0.1573
		0.035	1.180	T2024-T3	0.1613
		0.035	1.180	T3003-H14	0.1515
		0.035	1.180	T5052-0	0.1562
		0.049	1.152	T6061-T6	0.2177
		0.049	1.152	T2024-T3	0.2232
		0.049	1.152	T5052-0	0.2162
		0.065	1.120	T6061-T6	0.2850
		0.065	1.120	T2024-T3	0.2921
		0.065	1.120	T5052-0	0.2830
		0.083	1.084	T6061-T6	0.3584
		0.083	1.084	T2024-T3	0.3673
		0.095	1.060	T6061-T6	0.4060
		0.095	1.060	T2024-T3	0.4161
		0.120	1.010	T6061-T6	0.5017
		0.120	1.010	T2024-T3	0.5143
		0.188	1.874	T6061-T6	0.7387
		0.188	1.874	T2024-T3	0.7572
		0.250	0.750	T6061-T6	0.9250
		0.250	0.750	T2024-T3	0.9481-
1-3/8	1.375	0.035	1.305	T6061-T6	0.1735
		0.035	1.305	T2024-T3	0.1779
		0.049	1.277	T6061-T6	0.2404
		0.049	1.277	T2024-T3	0.2464
		0.065	1.245	T6061-T6	0.3151
		0.065	1.245	T2024-T3	0.3229
		0.083	1.209	T6061-T6	0.3968
		0.083	1.209	T2024-T3	0.4067
		0.125	1.125	T6061-T6	0.5781
		0.125	1.125	T2024-T3	0.5926
		0.188	0.999	T6061-T6	0.8257
		0.188	0.999	T2024-T3	0.8463
		0.250	0.875	T6061-T6	1.0406
		0.250	0.875	T2024-T3	1.0666
1-1/2	1.500	0.035	1.430	T6061-T6	0.1897
		0.035	1.430	T2024-T3	0.1945
		0.035	1.430	T5052-0	0.1884
		0.049	1.402	T6061-T6	0.2631
		0.049	1.402	T2024-T3	0.2696
		0.049	1.402	T5052-0	0.2612
		0.065	1.370	T6061-T6	0.3451

O.D. Fraction	O.D. Decimal	Wall	I.D.	Type	Wt/ft
1-1/2	1.500	0.065	1.370	T2024-T3	0.3537
		0.065	1.370	T5052-0	0.3427
		0.083	1.334	T6061-T6	0.4352
		0.083	1.334	T2024-T3	0.4460
		0.125	1.250	T6061-T6	0.6359
		0.125	1.250	T2024-T3	0.5618
		0.188	1.124	T6061-T6	0.9126
		0.188	1.124	T2024-T3	0.9354
		0.250	1.000	T6061-T6	1.1563
		0.250	1.000	T2024-T3	1.1852
		0.375	0.750	T6061-T6	1.5609
1-5/8	1.625	0.035	1.555	T6061-T6	0.2059
		0.049	1.527	T6061-T6	0.2857
		0.049	1.527	T2024-T3	0.2929
		0.065	1.495	T6061-T6	0.3752
		0.065	1.495	T2024-T3	0.3846
		0.083	1.495	T6061-T6	0.4735
		0.125	1.375	T6061-T6	0.6938
		0.125	1.375	T2024-T3	0.7111
		0.188	1.249	T6061-T6	0.9996
		0.188	1.249	T2024-T3	1.0246
		0.250	1.125	T6061-T6	1.2719
		0.250	1.125	T2024-T3	1.3037
1-3/4	1.750	0.035	1.680	T6061-T6	0.2221
		0.035	1. 680	T5052-0	0.2205
		0.049	1.652	T6061-T6	0.3084
		0.049	1.652	T2024-T3	0.3161
		0.049	1.652	T5052-0	0.3062
		0.083	1.584	T6061-T6	0.5119
		0.083	1.584	T2024-T3	0.5247
		0.095	1.560	T2024-T3	0.5963
		0.125	1.500	T6061-T6	0.7516
		0.125	1.500	T2024-T3	0.7704
		0.188	1.374	T6061-T6	1.0865
		0.188	1.374	T2024-T3	1.1137
		0.250	1.250	T6061-T6	1.3875
		0.250	1.250	T2024-T3	1.4222
		0.375	1.000	T6061-T6	1.9078
		0.375	1.000	T2024-T3	1.9555
1-7/8	1.875	0.065	1.745	T 6061-T6	0.4358
		0.083	1.709	T6061-T6	0.5503
		0.125	1.625	T6061-T6	0.8094
		0.188	1.499	T6061-T6	1.1735
		0.250	1.375	T6061-T6	1.5031
2	2.000	0.035	1.930	T6061-T6	0.2545
		0.049	1.902	T6061-T6	0.3537
		0.049	1.902	T2024-T3	0.3626
		0.049	1.902	T3003-H14	0.3406
		0.049	1.902	T5052-0	0.3512
		0.065	1.870	T6061-T6	0.4654
		0.065	1.870	T2024-T3	0.4770
		0.065	1.870	T3003-H14	0.4481
		0.065	1.870	T5052-0	0.4621
		0.083	1.834	T6061-T6	0.5887
		0.083	1.834	T2024-T3	0.6034
		0.095	1.810	T6061-T6	0.6696
		0.095	1.810	T2024-T3	0.6863
		0.125	1.750	T6061-T6	0.8672
		0.125	1.750	T2024-T3	0.8889
		0.188	1.624	T6061-T6	1.2604
		0.188	1.624	T2024-T3	1.2919
		0.250	1.500	T6061-T6511	1.6188
		0.250	1.500	T2024-T3511	1.6592

O.D. Fraction	O.D. Decimal	Wall	I.D.	Type	Wt/ft
2	2.000	0.375	1.250	T6061-T6511	2.2547
		0.375	1.250	T2024-T3511	2.3111
		0.500	1.000	T6061-T6511	2.7750
		0.500	1.000	T2024-T3511	2.8444
2-1/8	2.125	0.125	1.875	T6061-T6	0.9250
		0.188	1.749	T6061-T6511	1.3474
		0.250	1.625	T6061-T6511	1.7344
2-1/4	2.250	0.049	2.152	T6061-T6	0.3990
		0.049	2.152	T2024-T3	0.4090
		0.065	2.120	T6061-T6	0.5255
		0.065	2.120	T2024-T3	0.5386
		0.083	2.084	T6061-T6	0.6655
		0.083	2.084	T2024-T3	0.6821
		0.125	2.000	T6061-T6	0.9828
		0.125	2.000	T2024-T3	1.0074
		0.188	1.874	T6061-T6	1.4343
		0.188	1.874	T2024-T3	1.4702
		0.250	1.750	T6061-T6511	1.8500
		0.250	1.750	T2024-T3511	1.8963
2-3/8	2.375	0.188	1.999	T6061-T6511	1.5219
		0.250	1.875	T6061-T6511	1.9656
2-1/2	2.500	0.035	2.430	T6061-T6	0.3192
		0.035	2.430	T5052-0	0.3170
		0.049	2.402	T6061-T6	0.4444
		0.049	2.402	T5052-0	0.4413
		0.065	2.370	T6061-T6	0.5856
		0.065	2.370	T2024-T3	0.6003
		0.065	2.370	T5052-0	0.5815
		0.083	2.334	T6061-T6	0.7423
		0.083	2.334	T2024-T3	0.7608
		0.095	2.310	T6061-T6	0.8454
		0.125	2.250	T6061-T6	1.0984
		0.125	2.250	T2024-T3	1.1259
		0.188	2.124	T6061-T6511	1.6082
		0.250	2.000	T6061-T6511	2.0813
		0.250	2.000	T2024-T3511	2.1333
2-5/8	2.625	0.065	2.495	T6061-T6	0.6148
2-3/4	2.750	0.065	2.620	T6061-T6	0.6457
		0.065	2.620	T2024-T3	0.6619
		0.083	2.584	T6061-T6	0.8190
		0.125	2.500	T6061-T6	1.2141
		0.125	2.500	T2024-T3	1.2444
		0.188	2.374	T6061-T6511	1.7821
		0.250	2.250	T6061-T6511	2.3125
		0.250	2.250	T2024-T3511	2.3703
		0.375	2.000	T6061-T6511	3.2953
		0.375	2.000	T2024-T3511	3.3777
3	3.000	0.035	2.930	T6061-T6	0.3840
		0.035	2.930	T2024-T3	0.3936
		0.049	2.902	T6061-T6	0.5350
		0.049	2.902	T2024-T3	0.5484
		0.065	2.870	T6061-T6	0.7059
		0.065	2.870	T2024-T3	0.7235
		0.083	2.834	T6061-T6	0.8958
		0.083	2.834	T2024-T3	0.9182
		0.095	2.810	T6061-T6	1.0211
		0.125	2.750	T6061-T6	1.3297
		0.125	2.750	T2024-T3	1.3629
		0.250	2.500	T6061-T6511	2.5438
		0.250	2.500	T2024-T3511	2.6073
		0.375	2.250	T6061-T6511	3.6422
		0.375	2.250	T2024-T3511	3.7332
		0.500	2.000	T6061-T6511	4.6250
		0.500	2.000	T2024-T3511	4.7406

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PIPE

Stainless Steel

Welded or Seamless

Eagle furnishes a full line of stainless steel pipe, fittings and flanges to handle any problem involving corrosion, temperature or pressure. We serve all major industries including chemical, petrochemical, nuclear, cryogenics, food, paper and pollution control.

In addition to stainless steel, Eagle can provide corrosion resistant piping products in such materials as aluminum, nickel alloys and special alloys.

Ordering Your Piping

Pipe is ordinarily ordered by its nominal diameter (pipe size) and wall thickness which is specified by a schedule number. The convenient Pipe Selection Guide at the right shows schedules with corresponding wall thicknesses as well as weights in pounds per foot of pipe length.

Stainless Steel Pipe

Eagle seamless and welded austenitic stainless steel pipe is stocked in the annealed and pickled condition, making it suitable for welding, bending, and fabrication of all kinds. Permissible size variations are shown in Table 1-2 below.

All Eagle seamless and welded stainless steel pipe can be furnished with complete material test reports including all chemical and mechanical data. Additional testing, including 100% X-Ray Test, Charpy Test, Dye Penetrant Test, etc., is available at an additional cost.

** Note: For dimensions and weights see opposite page.*

Standard Tolerances for ASTM-A 312 Stainless Steel Pipe

Nominal Pipe Size	Outside Diameter Tolerance Over	Under	Wall
1/8 to 1-1/2 incl.	1/64 (0.015)	1/32 (0.031)	+ 0.0%/–12.5%
Over 1-1/2 to 4 incl.	1/32 (0.031)	1/32 (0.031)	+ 0.0%/–12.5%
Over 4 to 8 incl.	1/16 (0.062)	1/32 (0.031)	+ 0.0%/–12.5%
Over 8 to 18 incl.	3/32 (0.093)	1/32 (0.031)	+ 0.0%/–12.5%
Over 18 to 24 incl.	1/8 (0.125)	1/32 (0.031)	+ 0.0%/–12.5%

Seamless Stainless Steel Pipe

Pipe can be certified to ASTM A-312, ASME SA-312. When surface finish is not a critical consideration, hot finished pipe is more economical product. Selected sizes of cold drawn pipe also meet MIL P1144D, which is similar to ASTM A-312, but with the important addition of an acidified copper sulfate test. Hot finished pipe will not meet MIL P1144D because of surface finish requirements. When surface finish is not a critical consideration, hot finished pipe is a more economical product.

<u>Cold Drawn Pipe</u> – is available from 1/8" I.P.S. to 8" I.P.S. in all wall thicknesses.

<u>Hot Finished Pipe</u> – is available in selected sizes to meet competitive market conditions.

Welded Stainless Steel Pipe

Eagle welded stainless steel pipe is supplied in the full finished condition. It has been annealed and pickled and meets all aspects of ASTM A-312, ASME SA-312.

Pipe Selection Guide

- GREEN Figures - indicate wall thickness in inches
- BLACK Figures - indicate weight in pounds/foot

Note: Aluminum pipe weighs roughly one third as much as steel pipe.

Seamless & Welded Stainless Steel Pipe • A.S.A. Pipe Schedules

Pipe Size	O.D. (Inches)	5S	5	10S	10	20	30	40S & Standard	40	60	80S & Extra Heavy	80	100	120	140	160	Double Extra Heavy
1/8	.405		.035	.049	.049			.068	.068		.095	.095					
			.1383	.1863	.1863			.2447	.2447		.3145	.3145					
1/4	.540		.049	.065	.065			.088	.088		.119	.119					
			.2570	.3297	.3297			.4248	.4248		.5351	.5351					
3/8	.675		.049	.065	.065			.091	.091		.126	.126					
			.3276	.4235	.4235			.5676	.5676		.7388	.7388					
1/2	.840	.065	.065	.083	.083			.109	.109		.147	.147				.187	.294
		.5383	.5383	.6710	.6710			.8510	.8510		1.088	1.088				1.304	1.714
3/4	1.050	.065	.065	.083	.083			.113	113		.154	.154				.218	.308
		.6838	.6838	.8527	.8527			1.131	1.131		1.474	1.474				1.937	2.441
1	1.315	.065	.065	.109	.109			.133	.133		.179	.179				.250	.358
		.8678	.8678	1.404	1.404			1.679	1.679		2.172	2.172				2.844	3.659
1-1/4	1.660	.065	.065	.109	.109			.140	.140		.191	.191				.250	.382
		1.107	1.107	1.806	1.806			2.273	2.273		2.997	2.997				3.765	5.214
1-1/2	1.900	.065	.065	.109	.109			.145	.145		.200	.200				.281	.400
		1.274	1.274	2.085	2.085			2.718	2.718		3.631	3.631				4.859	6.408
2	2.375	.065	.065	.109	.109			.154	.154		.218	.218				.343	.436
		1.604	1.604	2.638	2.638			3.653	3.653		5.022	5.022				7.444	9.029
2-1/2	2.875	.083	.083	.120	.120			.203	.203		.276	.276				.375	.552
		2.475	2.475	3.531	3.531			5.793	5.793		7.661	7.661				10.01	13.70
3	3.500	.083	.083	.120	.120			.216	.216		.300	.300				.437	.600
		3.029	3.029	4.332	4.332			7.576	7.576		10.25	10.25				14.32	18.58
3-1/2	4.000	.083	.083	.120	.120			.226	.226		.300	.300				.437	.600
		3.472	3.472	4.973	4.973			9.109	9.109		12.51	12.51					22.85
4	4.500	.083	.083	.120	.120			.237	.237	.281	.337	.337		.437		.531	.674
		3.915	3.915	5.613	5.613			10.79	10.79	12.66	14.98	14.98		19.01		22.51	27.54
4-1/2	5.000							.247			.355						.710
								12.53			17.61						32.53
5	5.563	.109	.109	.134	.134			.258	.258		.375	.375		.500		.625	.750
		6.349	6.349	7.770	7.770			14.62	14.62		20.78	20.78		27.04		32.96	38.55
6	6.625	.109	.109	.134	.134			.280	.280		.432	.432		.562		.718	.864
		7.585	7.585	9.289	9.289			18.97	18.97		28.57	28.57		36.39		45.30	53.16
7	7.625							.301			.500						.875
								25.57			38.05						63.08
8	8.625	.109	.109	.148	.148	.250	.277	.322	.322	.406	.500	.500	.593	.718	.812	.906	.875
		9.914	9.914	13.40	13.40	22.36	24.70	28.55	28.55	35.64	43.39	43.39	50.87	60.93	67.76	74.69	72.42
9	9.625							.342			.500						
								33.90			48.72						
10	10.750	.134	.134	.165	.165	.250	.307	.365	.365	.500	.500	.593	.718	.843	1.000	1.125	
		15.19	15.19	18.70	18.70	28.04	34.24	40.48	40.48	54.74	54.74	64.33	76.93	89.20	104.1	115.7	
11	11.750							.375			.500						
								45.55			60.07						
12	12.750	.156	.165	.180	.180	.250	.330	.375	.406	.562	.500	.687	.843	1.000	1.125	1.312	
		21.07	22.18	24.20	24.20	33.38	43.77	49.56	53.53	73.16	65.42	88.51	107.2	125.5	139.7	160.3	
14	14.000	.156		.188	.250	.312	.375	.375	.437	.593	.500	.750	.937	1.093	1.250	1.406	
		23.07		27.73	36.71	45.68	54.57	54.57	63.37	84.91	72.09	106.1	130.7	150.7	170.2	189.1	
16	16.000	.165		.188	.250	.312	.375	.375	.500	.656	.500	.843	1.031	1.218	1.437	1.593	
		27.90		31.75	42.05	52.36	62.58	62.58	82.77	107.5	82.77	136.5	164.8	192.3	223.5	245.1	
18	18.000	.165		.188	.250	.312	.437	.375	.562	.750	.500	.937	1.156	1.375	1.562	1.781	
		31.43		35.76	47.39	59.03	82.06	70.59	104.8	138.2	93.45	170.8	208.0	244.1	274.2	308.5	
20	20.000	.188		.218	.250	.375	.500	.375	.593	.812	.500	1.031	1.280	1.500	1.750	1.968	
		39.78		46.05	52.73	78.60	104.1	78.60	122.9	166.4	104.1	208.9	256.1	296.4	341.1	379.0	
24	24.000	.218		.250	.250	.375	.562	.375	.687	.968	.500	1.218	1.531	1.812	2.062	2.343	
		55.37		63.41	63.41	94.62	140.8	94.62	171.2	238.1	125.5	296.4	367.4	429.4	483.1	541.9	

WIRE
Stainless Steel

Eagle has a vast array of stainless steel wire available which is suitable for a variety of uses such as medical, aerospace and industrial. Wire is available in spools or straight lengths. Eagle also has the capability to provide value added services such as cutting, bending, beveling and forming.

Alloys: T302, T304, T304V, T316, T316V, T17-7 PH, T17-4 PH, MP35N, Alloy 600, X-750, Hastelloy, C276, T410, T420

Tempers: Annealed, Spring or Custom Tensile Range.

Surface Finish: Bright, Matte, or Centerless Ground.

Size Range: 0.002 – 0.150 (larger sizes available as round bar stock. Please see our section of bar stock sizes.)

Contact us today and let us help you with your stainless wire needs.

*13 Gauge stainless steel wire shown **above.***

WIRE Stainless Steel • 304 Series • 316 Series	Diameter	Standard Tolerance*
	0.004" to 0.019"	+/- .0003"
	0.020" to 0.041"	+/- .0005"
	0.042" to 0.150"	+/- .001

*Tighter tolerances available upon request.

CENTERLESS GRINDING

Eagle has the ability to have tube, bar or wire stock centerless ground to a particular specification. Centerless grinding of round stock is primarily performed to either achieve a particular diameter or tolerance which might not be achievable by drawing process or to achieve a particular RMS or RA surface condition. In some cases it is done for both reasons.

Centerless grinding equipment in operation.

Eagle furnishes a full line of stainless steel bar stock in round, square and flat configurations.

BAR STOCK
Stainless Steel

Ordering Your Bar Stock

Bar is ordinarily ordered by its nominal diameter. The chart below shows nominal sizes and provides convenient weight data.

However, for centerless grinding purposes when tolerances are tight, bar stock is generally ordered "oversize" to allow for sufficient material removal.

For example, if grinding 1/4" and 1/2" stock were required, 1/4" oversize and 1/2" oversize would be specified.

Round Bar Stock – Stainless Steel • 300 Series • 400 Series 17-4PH

Size Inches	Estimated Weight (lbs.) Per Foot	12 Ft. Bar	Size Inches	Estimated Weight (lbs.) Per Foot	12 Ft. Bar	Size Inches	Estimated Weight (lbs.) Per Foot	12 Ft. Bar	Size Inches	Estimated Weight (lbs.) Per Foot	12 Ft. Bar	Size Inches	Estimated Weight (lbs.) Per Foot	12 Ft. Bar
1/16	.010	.120	.505	.680	8.33	1/16	3.014	36.2	2.520	16.957	203.5	15/16	65.10	781.2
5/64	.016	.19	.510	.694	8.33	3/32	3.194	38.3	9/16	17.53	210.4	**5 –**	66.76	801.1
3-32	.023	.28	33/64	.710	8.52	1/8	3.379	40.6	5/8	18.40	220.8	1/8	70.10	841.2
7/64	.032	.38	17/32	.754	9.05	1.135	3.440	41.3	11/16	19.29	231.5	1/4	73.60	883.2
1/8	.042	.50	9/16	.845	10.14	9/64	3.470	41.6	3/4	20.20	242.4	3/8	77.15	925.8
.130	.045	.54	.5675	.860	10.32	1.145	3.50	42.0	2.770	20.49	245.9	7/16	78.95	947.4
9/64	.053	.64	.5725	.875	10.50	5/32	3.570	42.8	13/16	21.12	253.4	1/2	80.78	969.4
5/32	.065	.78	.5775	.891	10.69	3/16	3.766	45.2	7/8	22.07	264.8	5/8	84.48	1013.8
11/64	.079	.95	37/64	.892	10.69	1/4	4.173	50.1	15/16	23.04	276.5	3/4	88.29	1059.0
3/16	.094	1.13	19/32	.941	11.29	1.260	4.240	50.9	**3 –**	24.03	288.4	15/16	94.14	1130.0
.1925	.099	1.19	5/8	1.043	12.52	17/64	4.276	51.3	3.020	24.354	292.3	**6 –**	96.13	1153.5
.1975	.104	1.25	.630	1.060	12.72	1.275	4.34	52.1	1/16	25.05	300.6	1/8	100.2	1202.4
13/64	.110	1.32	.635	1.076	12.91	9/32	4.384	52.6	1/8	26.08	312.9	1/4	104.3	1252.0
7/32	.128	1.54	.640	1.093	13.12	5/16	4.600	55.2	3/16	27.13	325.6	1/2	112.8	1353.8
15/64	.147	1.76	41/64	1.096	13.15	3/8	5.049	60.6	1/4	28.21	338.5	3/4	121.7	1460.0
1/4	.167	2.00	21/32	1.150	13.80	1.385	5.218	62.6	3.270	28.55	342.6	7	130.9	1570.8
.255	.174	2.08	11/16	1.262	15.14	13/32	5.279	63.4	5/16	29.30	351.6	1/4	140.4	1684.8
.260	.181	2.17	.6925	1.280	15.37	7/16	5.518	66.2	3/8	30.42	365.0	1/2	150.2	1802.0
17/64	.188	2.26	23/32	1.379	16.55	1/2	6.008	72.1	7/16	31.55	378.6	3/4	160.4	1924.8
9/32	.211	2.53	3/4	1.502	18.02	1.510	6.21	74.5	1/2	32.71	392.5	8	170.9	2051.0
19/64	.235	2.82	.755	1.522	18.26	1-17/32	6.261	75.1	3.520	33.09	397.0	1/4	182.7	2180.0
5/16	.261	3.13	.760	1.540	18.48	9/16	6.520	78.2	3.530	33.27	399.3	1/2	192.9	2315.0
.3175	.269	3.29	49/64	1.565	18.78	5/8	7.051	84.6	5/8	35.09	421.1	3/4	204.5	2454.0
.3225	.277	3.32	25/32	1.630	19.56	11/16	7.604	91.3	11/16	36.31	435.7	9	216.3	2596.0
21/64	.287	3.44	13/16	1.763	21.16	3/4	8.178	98.1	3/4	.7.55	405.6	1/4	228.5	2741.8
11/32	.316	3.79	.8175	1.784	21.42	1.770	8.365	100.4	3.770	37.95	455.4	1/2	241.0	2892.0
23/64	.345	4.14	27/32	1.901	22.81	16/16	8.773	105.3	7/8	40.10	481.2	3/4	253.8	3045.6
3/8	.376	4.51	7/8	2.044	24.5	7/8	9.388	112.7	15/16	41.40	496.8	10	267.0	3204.0
.380	.386	4.62	.880	2.067	24.8	15/16	10.02	120.2	**4 –**	42.73	512.8	1/2	295.2	3542.4
.385	.395	4.74	.885	2.091	25.1	**2 –**	10.68	128.2	4.020	43.15	517.8	11	324.0	3888.0
25/64	.407	4.88	57/64	2.115	25.4	2.020	10.896	130.7	4.030	43.37	520.4	1/2	354.0	4248.0
13/32	.441	5.29	29/32	2.193	26.3	1/16	11.36	136.3	1/8	45.40	544.8	12	385.6	4626.7
27-64	.475	5.70	15/16	2.347	28.2	1/8	12.06	144.7	1/4	48.23	578.7	1/2	420.0	5025.0
7/16	.511	6.13	.9425	2.372	28.5	3/16	12.78	153.4	3/8	21.11	613.3	13	451.3	5415.5
.4425	.523	6.42	31/32	2.506	30.1	1/4	13.52	162.2	7/16	52.58	631.0	14	523.3	7512.0
.4475	.535	6.42	**1 –**	2.670	32.0	2.270	13.76	165.1	1/2	54.08	648.9	15	601.0	7212.0
29/64	.548	6.57	1.005	2.696	32.4	5/16	14.28	171.4	4.530	54.80	657.5	16	684.0	8208.0
15/32	.587	7.04	1.010	2.723	32.7	3/8	15.06	180.7	5/8	57.12	685.4			
31/64	.626	7.51	1/64	2.750	33.0	7/16	15.87	190.4	3/4	60.25	723.0			
1/2	.668	8.02	1.020	2.778	33.3	1/2	16.69	200.3	7/8	63.48	761.8			

Eagle has the knowledge, the expertise and the right equipment to give your finished parts the "look" you want.

FINISHES

Production sand blasting center for achieving various degrees of matt surface finishes.

✔ Sand blasting

Produces a matte finish with various grit sizes.
• 60 grit • 100 grit • 180 grit
• 220 grit • glass bead

✔ Electro-polishing

Produces a high / bright finish.

✔ Belt polishing

Produces a high luster finish using grits from 180 to 640.

✔ Black Oxide Finish

to minimize light reflection

✔ Centerless ground finish

✔ Commercially clean and capped

✔ Thermocouple clean and capped

✔ Passivation (Chemical Cleaning)

Passivation – Treatment of stainless steels after fabrication with oxidizing chemicals is known as chemical cleaning, or passivation. If iron particles or other substances have become embedded in the surface during fabrication or polishing operations, they must be removed. Otherwise, these minute particles may promote discoloration, rusting, or even pitting. Besides dissolving such particles, the oxidizing action of the bath also tends to enhance the corrosion resistance of stainless steels by fortifying the natural passive surface film.

This processing should be the final operation on a stainless steel part. It is generally done by immersing in a nitric or citric acid solution and then rinsing in clear deionized water and drying. If immersion of the stainless steel piece is impractical due to size, the acid solution may be applied with a suitable swab and removed by rinsing with water.

Nitric acid is recommended because it will dissolve any iron particles and leave the stainless steel unaffected. It is necessary that the surface of the steel be free of scale, heavy grease and oil if the chemical cleaning treatment is to be effective.

Eagle Reference Guide

WHY Stainless Steel

What is Stainless Steel?

The many unique values provided by stainless steel make it a powerful candidate in materials selection. Engineers, specifiers and designers often underestimate or overlook these values because of what is viewed as the higher initial cost of stainless steel. However, over the total life of a project, stainless is often the best value option.

Stainless steel is essentially a low carbon steel which contains chromium at 10% or more by weight. It is the addition of chromium that gives the steel its unique stainless, corrosion resisting properties.

The chromium content of the steel allows the formation of a tough, adherent, invisible, corrosion-resisting chromium oxide film on the steel surface. If damaged mechanically or chemically, this film is self-healing, provided that oxygen, even in very small amounts, is present. The corrosion resistance and other useful properties of the steel are enhanced by increased chromium content and the addition of other elements such as molybdenum, nickel and nitrogen. There are more than 60 grades of stainless steel. However, the entire group can be divided into four classes. Each is identified by the alloying elements which affect their microstructure and for which each is named.

Grades / Applications of Stainless Steel

400 Series Martensitic – Typical grade: 410
Straight chromium (12 - 18%); magnetic and can be hardened by heat treatment. Typical use: Fasteners, pump shafts.

400 Series Ferritic – Typical grade: 430
Straight chromium (12 - 18%); low carbon, magnetic, but not heat treatable. Typical use: Appliance trim, cooking utensils.

300 Series Austenitic – Typical grade: 304
Chromium (17 - 25%), Nickel (8 - 25%); nonmagnetic, not heat treatable. Can develop high strength by cold working. Additions of molybdenum (up to 7%) can increase the corrosion resistance. Typical use: Food equipment, chemical equipment, architectural applications.

Precipitation Hardening – Typical grade: 17-4
Chromium (12 - 28%), Nickel (4 - 7%); martensitic or austenitic. Develop strength by precipitation harden reaction during heat treatment. Typical use: valves, gears, petrochemical equipment.

Benefits of Stainless Steel

• **CORROSION RESISTANCE** – Lower alloyed grades resist corrosion in atmospheric and pure water environments; high-alloyed grades can resist corrosion in most acids, alkaline solutions, and chlorine bearing environments making their properties useful in process plants.

• **STRENGTH-TO-WEIGHT ADVANTAGE** – The work hardening property of austenitic grades, that results in a significant strengthening of the material from cold working alone, and the high strength duplex grades, allow reduced material thickness over conventional grades yielding considerable cost savings.

• **FIRE AND HEAT RESISTANCE** – Special high chromium and nickel-alloyed grades resist scaling and retain high strength at high temperatures.

• **HYGIENE** – The easy cleaning ability of stainless makes it the first choice for strict hygiene conditions, such as hospitals, kitchens and food processing plants.

• **AESTHETIC APPEARANCE** – The bright, easily maintained surface of stainless steel provides a modern and attractive appearance.

• **EASE OF FABRICATION** – Modern steel making techniques mean that stainless can be cut, welded, formed, machined, and fabricated as readily as traditional steels.

• **IMPACT RESISTANCE** – The austenitic microstructure of the 300 series provides high toughness at elevated temperatures ranging to far below freezing, making these steels particularly suited to cryogenic applications.

• **LONG TERM VALUE** – When the total life cycle costs are considered, stainless is often the least expensive material option.

Stainless Steel

Table 1-5a
Chemical Compositions and Major Characteristics

Type	Cr	Ni	C Max	Other Significant Elements	Major Characteristics
303	17.00-19.00	8.00-10.00	0.15	S 0.15 min	†Free-machining modification of Type 302.
303 Se	17.00-19.00	8.00-10.00	0.15	Se 0.15 min	†Free-machining version of Type 302. Produces better surface finish than Type 303.
304	18.00-20.00	8.00-10.00	0.08	–	†Low carbon variation of Type 302, minimizes carbide precipitation during welding.
304 L	18.00-20.00	8.00-10.00	0.03	–	†Extra-low carbon content eliminates harmful carbide precipitation due to welding.
309	22.00-24.00	12.00-15.00	0.20	–	†High strength and resistance to scaling at high temperatures.
310	24.00-26.00	19.00-22.00	0.20	–	†Higher alloy content improves basic characteristics of Type 309.
316	16.00-18.00	10.00-14.00	0.08	Mo 2.00-3.00	†Mo improves general corrosion and pitting resistance and high temperature strength over that of Type 302.
316 L	16.00-18.00	10.00-14.00	0.03	Mo 2.00-3.00	†Extra-low carbon version of Type 316. Eliminates harmful carbide precipitation due to welding.
317	18.00-20.00	11.00-15.00	0.08	Mo 3.00-4.00	†Higher alloy content improves basic advantages of Type 316.
321	17.00-19.00	9.00-12.00	0.08	Ti 5 x C, min	†Stabilized to permit use in 800-1500° F temperature range without harmful carbide precipitation.
347	17.00-19.00	9.00-13.00	.008	Cb + Ta 10 x C, min	†Characteristics similar to Type 321. Stabilized by Cb and Ta.
348	17.00-19.00	9.00-13.00	0.08	Ta 0.10 max Cb 0.20 max Cb + Ta 10 x C, min	†Similar to Type 347 but Ta reduced for atomic energy applications.
410	11.50-13.50	–	0.15	–	¥ Lowest cost general purpose stainless steel. Wide use where corrosion is not severe.
416	12.00-14.00	–	0.15	S 0.15 min	¥ Free-machining version of Type 410.
420	12.00-14.00	–	0.15 min	–	¥ Similar variation of Type 410 but higher carbon produces higher strength and hardness.
430 sion	14.00-	– 18.00	0.12	–	*Most popular of the chromium types. Combines good corro- and heat resistance and mechanical properties.
430 F	14.00-18.00	–	0.12	S 0.15 min	*Free-machining version of Type 430.
440 A	**16.00-18.00**	–	**0.60-0.75**	–	**¥ Series of high carbon types. Same basic composition with varying carbon content. Higher carbon produces higher strength and hardness but lower toughness. All Type 440 versions are corrosion resistant only in the hardened condition.**
440 B	**16.00-18.00**	–	**0.75-0.95**		
440 C	**16.00-18.00**	–	**0.95-1.20**		
446	23.00-27.00	–	0.20	–	*Similar to Type 442 but Cr increased to provide maximum resistance to scaling.
15-5 PH	14.00-15.50	3.50-5.50	0.07	Cu 2.50-4.50	• Similar in properties and characteristics to 17-4 PH but has superior transverse ductility and toughness.
PH 15-7 Mo	14.00-16.00	6.50 7.75	0.09	Mo 2.00-3.00 Al 0.75-1.50	• •Special type similar to 17-7 PH but with higher strength.
17-4 PH	15.50-17.50	3.00-5.00	0.07	Cu 3.00-5.00	•Special type that combines excellent corrosion resistance, high strength and hardness, low temperature hardening and good fabrication characteristics.
17-7 PH	16.00-18.00	6.50-7.75	0.09	AL 0.75-1.25	• •Special ultra-high strength type with good formability, excellent fabricating characteristics.

** Feretic, non-hardenable*
*** Ferritic, hardened by aging*
†Austenitic, non-hardenable by heat treatment
†† Martensitic, essentially non-hardenable
•Martensitic, precipitation hardened
• • Semi-Austenitic, precipitation hardened
°Austenitic, precipitation hardened
°°Austenitic, hardened by aging
¥Martensitic, hardenable

Eagle Reference Guide

Stainless Steel

Table 1-5b
Typical Physical and Mechanical Properties

Item — Physical Properties	302, 303 304, 304L 303MA	316 316L	321 347	410 416	418	430 430F	440C 440F	17-4 PH Condition H900	19-9DL
Density									
pounds/cubic inch	0.29	.029	0.29	.028	0.284	.028	0.284	.028	0.287
low carbon steel = 1.00	1.02	1.02	1.02	0.97	0.97	0.97	–	0.97	0.97
Specific Elec. Resistance at 68°F									
microhms/cm^3	72	74	72	57	61.7	60	60	77	78
mircohms/in^3	28.4	29.2	28.5	22.4	24.3	23.6	–	30.3	–
low carbon steel = 1.00	6.6	6.8	6.5	5.2	–	5.5	–	7.06	–
Melting range Degrees F	2550-2650	2500-2550	2550-2600	2700-2790	2650-2750	2600-2750	2620 prox	2500-2550	2600-2610
Structure	Austenitic	Austenitic	Austenitic	Martensitic	Martensitic	Ferritic	Pearlite-Carbide	Martensitic	Austenitic
Magnetic Permeability as annealed	μ=1.003***•	μ=1.003***•	μ=1.003***•	Magnetic	Magnetic	Magnetic	Magnetic	Magnetic	1.005-1.09
Specific Heat									
$cal.^3/deg.C./gm.$ (0 to 100°C)	0.12	0.12	0.12	0.11	–	0.11	–	11	–
BTU/°F./lb.(32 to 212°F)	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	–
low carbon steel =1.00 (0 to 100°C)	1.1	1.1	1.1	1.0	1.0	1.0	–	1.0	–
Thermal Conductivity									
$cal./cm.^2/sec./°C/cm.$ at 100° C	0.0390	0.0373	0.0385	0.0595	–	0.0625	–	0.0427	0.0348
BTU/sq. ft./hr./°F/in. at 212°F	113	113	112	173	140	181	203	124	101
low carbon steel = 1.00 at 100°C	0.34	0.34	0.33	0.52	–	0.54	–	0.38	–
$ca./cm^2/sec./°C/cm.$ at 500°C	0.0512	0.0512	0.0532	0.0686	–	0.0627	–	0.0540	–
BTU/sq. ft./hr./°F/in. at 932°F	149	149	154	199	–	182	–	157	–
Coefficient of Thermal Expansion									
per °F x 10^{-6} (32 to 212°F)	9.6	8.9	9.3	5.5	5.3	5.0	5.9**	6.0	8.5
low carbon steel =1.00 (32 to 212°F)	1.45	1.35	1.41	0.83	–	0.76	–	0.91	–
per °F x 10^{-6} (32 to 912°F)	10.2	9.7	10.3	6.4	6.2	6.2	–	6.6	9.7

Mechanical Properties at Room Temperature	Annealed	Annealed	Annealed	Annealed	Quenched & Tempered	Quenched & Tempered 975°F	Annealed	Annealed	Quenched & Tempered	Condition H900	Hot Rolled & Str. Rel. @ 1200°F
Tensile Strength, 10^3 lb/sq.in.	75-95	80-95	80-100	75-100	90-200	190	70-90	approx 100	96-250	200	118.3
Yield Strength, 10^3 lb/sq.in.	30-45	30-45	35-50	35-45	60-145	150	35-55	approx 60	55-220	185	69
Modulus of Elasticity, 10^6 psi	28	28	28	29	29	29	29	29.0-30.0	29.0-30.0	28.5	29.5
Elongation in 2 inches, %	60-50	60-40	50-40	35-20	28-15	15	35-20	max. 20	4 to 1	14	56
Reduction of Area, %	75-60	70-55	70-50	75-60	75-60	62	60-40	35.0	13	50	55
Izod Impact Strength, ft.-lbs	110-80	110-80	110-80	100-60	100-30	26	–	21	7	20	46¢
Endurance Limit, psi	30-55	30-55	35-60	30-50	40-100	95 see note	35-50	55	45-140	90	81 see note
Brinnel Hardness Number	135-185	135-185	135-185	max. 241	180-375	360	145-185	max. 240	200-600	420	241
Rockwell Hardness Number	B75-90	B75-90	B75-90	max. B100	C10-41	C39	B75-90	C-24••	C59-B93	C44	B100
Olsen Value, Inches	0.5-0.4	0.4-0.5	0.365-0.465	0.4-0.3	–	–	0.4-0.3	–	–	–	–
*Stress causing 1% elongation in 10,000 hours (Creep)											
at 1000°F, lbs/sq. ft.	17000	25000	19000	12000¥	25000	8500	–		–		41000
at 1200°F, lbs/sq. ft.	7000	11000	9500	2000¥	5900	2200	–		–		19000
at 1350°F, lbs/sq. ft.	3000	5200	4000	1400¥	2000¥¥	1200	–		–		10000
at 1500°F, lbs/sq. ft.	850	2000	850	–	–	–	–		–		6000
Scaling Temperature, °F (approx.)	1650	1650	1650	1300	1400	1550	1500		1500		1600
Initial Forging Temperature	2100-2300	2100-2300	2100-2300	2000-2200	2000-2100	1900-2050	2100		2150†		2150
Finishing Temperature °F min.	1700	1700	1700	1500	1600-1700	1500	1600		1850		–
Annealing Treatment	1900-2000 deg. F & quench	1900-2050 deg. F & quench	Heat to 1750-2050 deg. F Cooling	Furnace Cool to 1100 from 1500-1650°F or Air cool from 1400-1200°F	1500-1600 Slow cool to 1100 Air cool.	Air cool from 1500-1400 deg. F	1600-1650°F Furnace cool		1900†† (O.A.)†††		1800
	(A) (B)	(A) (B)	(A)	(D)		(E)	(D)				

(A) Preheat heavy sections slowly to 1600°F, then heat rapidly to the forging or annealing temperature.

(B) Cooling rate should be rapid enough to prevent harmful carbide precipitation which impairs corrosion resistance. Retarded cooling through, or heating in the temperature range of 1800 to 1500°F should be avoided in service or in heat treating. Anneal after welding for maximum corrosion resistance.

(D) Preheat slowly to 1450°F, then heat rapidly to initial temperature for forging. Full corrosion resistance is developed only in the heat treated condition.

(E) In forging, preheat slowly to 1450°F. Excessive grain growth takes place above 2000°F. Expert welding is required to avoid excessive grain growth. Prolonged exposure at 850 to 950°F produces cold brittleness. Re-anneal to restore ductility.

• Some sizes of round hexagon bar may be slightly magnetic because of cold drawing operations to improve machinability.

* Undetermined for type 303

** 68 to 212 °F

*** This value is a function of chemical composition and increases with cold work.

¥ Applies only to Type 410.

¥¥ At 1300°F

¢ Charpy

Note: (12-2W) at 1000°F = 49; (19-9DL) at 1000°F = 62

‡ Hardening treatment: Cool rapidly from 1700-1850°F

Tempering treatment: After hardening reheat to a selected temperature with the range 400-1400°F depending upon the properties desired.

† Furnace charge at 1200-2000°F, depending on size.

†† Furnace charge at 1200-1900°F, depending on size.

††† Oil or Air depending on size. (Water not recommended)

Properties of 15-5PH are available on request.

•• Use only in the hardened and tempered condition. Do not use above 750°F

Table 1-6
Chromium-Nickel Non-Hardenable Grades*

Type	Hardening	Annealing
301	For cold-worked material, to increase plastic properties 650°-700°... 1/2-2 Hours Cool in Air	Type 301 } 1900°-2050°F
302		Type 302 } 10 - 30 Min's
303		Type 303
304		Type 304 } 1850°-2050°F
304L		Type 308 } 15 - 20 Mins
308		Type 309
309		Type 316
310		Type 310–1900°-1950°F
316		Type 321–1750°-1950°F
316L		Type 347–1800°-1950°F
321		10–30 Minutes. Quench in Water
347		Hardness R/B 77-90

STABILIZING– Types 321 & 347 only. 1600°-1650°F... 2–4 Hours. Cool in Air of Water.
PRECAUTIONS–
Cool these grades rapidly through 800°-1500°F.
* Preheating is not necessary

Table 1-7
Precipitation–Hardening Grades

Type	Condition	How Attained	Typical Mechanical Properties: Tensile psi	Yield 0.2% psi	Hardness
*17-4ph	A (Solution Annealed)	1875°-1625°F 1/2 Hr. Air Cooled or Oil Quenched	–	–	–
	H900	900°F. 1 Hr.Air cooled	200,000	185,000	R/C 44
	H1025	1025°F. 4 Hrs. Air cooled	170,000	165,000	R/C 38
	H1075	1075°F. 4 Hrs. Air cooled	165,000	150,000	R/C 36
	H1150	1150°F. 4 Hrs. Air cooled	145,000	125,000	R/C 33
17-7PH	A (Annealed)	1950°F. 1/2 Hr. Air cooled	130,000	40,000	R/B 85
	T	1400°F. 90 Mins. Air cooled to 60°F within 1 Hour	–	–	–
	TH 1050	1050°F. 90 Mins Air cooled	200,000	185,000	R/C 43

When it is hardened, 17-4PH undergoes a slight dimensional contraction. It amounts to about .0004 to .0006 inches per inch for Condition H 900, and increases to approximately .0008 to .001 for Condition H 1150. This contraction must be taken into consideration in both machining and heat treatment. However, because the contraction is uniform from bar to bar and lot to lot, in can be compensated for in design.* 17-4PH should never be used in condition A because of its susceptibility to stress corrosion.

TEMPER – 300 Series Stainless Steel

Condition	Ultimate Tensile psi	Yield Strength	Elongation % in 2" Min
Fully annealed	100.000 Max	35,000–55,000	40%
1/4 Hard	100,000–125,000	55,000–75,000	35%
1/2 Hard	125,000–150,000	75,000–125,000	15%
3/4 Hard	150,000–175,000	125,000–135,000	10%
Full Hard	175,000–200,000	135,000–160,000	6%

Standard Tolerances for ASTM-A 312 Stainless Steel Pipe

Nominal Pipe Size	Outside Dia. Tolerance Over	Under	Wall
1/8 to 1-1/2 incl.	1/64 (0.015)	1/32 (0.031)	+ 0.0%/–12.5%
Over 1-1/2 to 4 incl.	1/32 (0.031)	1/32 (0.031)	+ 0.0%/–12.5%
Over 4 to 8 incl.	1/16 (0.062)	1/32 (0.031)	+ 0.0%/–12.5%
Over 8 to 18 incl.	3/32 (0.093)	1/32 (0.031)	+ 0.0%/–12.5%
Over 18 to 24 incl.	1/8 (0.125)	1/32 (0.031)	+ 0.0%/–12.5%

Standard Tubing Tolerances for ASTM-A 269 / A249 / A213 (Fractional or Metric)

Outside Dia. Inches	O.D. Inches	Wall
Less than 3/32	±.005	±15%
3/32 ≤ 3/16	±.005	±15%
3/16 ≤ 1/2	±.005	±15%
1/2 ≤ 1-1/2	±.005	±10%
1-1/2 ≤ 3-1/2	±.010	±10%
3-1/2 ≤ 5-1/2	±.015	±10%
5-1/2 ≤ 8	±.030	±10%

ASTM-632 Permissable Variations in Dimentions

Outside Dia. Inches	O.D. Inches	Wall
Less than 3/32	+.002/-.000	±10%
3/32 ≤ 3/16	+.003/-.000	±10%
3/16 ≤ 1/2	+.004/-.000	±10%

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Table 1-9
Theoretical Bursting & Bulging Pressures for Tubing

Outside Diameter (Inches)	Wall Thickness – Decimal Inch: BWG Equivalent .020 25	.028 22	.035 20	.049 18	.065 16	.095 13	.120 11	Fraction Equivalent .156 5/32	.187 3/16	.210 7/32	.250 1/4	.313 5/16	.375 3/8	.500 1/2	.625 5/8	.750 3/4	.875 7/8	1.000 1
1/8	3200	5200	5600	7840														
3/16	2133	2987	3933	5227														
1/4	1600	2240	2800	3920	5200	7600												
5/16	1280	1792	2240	3136	4160	6100												
3/8	1067	1493	1867	2613	3467	5067	6400											
1/2	800	1120	1400	1960	2600	3800	4800	6240	7480									
5/8	640	896	1120	1568	2080	3040	3840	4992	5984	7008								
3/4	533	747	933	1307	1733	2533	3200	4160	4987	5840	6667							
7/8	457	640	800	1120	1486	2171	2743	3566	4274	5006	5714	7154						
1	400	560	700	980	1300	1900	2400	3120	3740	4380	5000	6260	7500					
1-1/8	355	498	622	871	1156	1689	2133	2773	3324	3893	4444	5564	66673					
1-1/4	320	448	560	784	1040	1520	1920	2496	2992	3504	4000	5008	6000	8000				
1-3/8	290	407	509	713	945	1382	1745	2269	2720	3185	3636	4553	5455	7273				
1-1/2	267	393	467	653	867	1267	1600	2080	2493	2920	3333	4173	5000	6667	8333			
1-3/4	229	318	400	560	743	1086	1371	1783	2137	2503	2857	3577	4286	5714	7143			
2	200	280	350	490	650	950	1200	1560	1870	2190	2500	3130	3750	5000	6250	7500		
2-1/4	178	250	311	436	578	844	1067	1387	1662	1947	2222	2782	3333	4444	5556	6667		
2-1/2			280	392	520	760	960	1248	1496	1752	2000	2504	3000	4000	5000	6000	7000	
2-3/4			255	356	473	691	873	1135	1360	1593	1818	2276	2727	3636	4545	5455	6364	7273
3				327	433	633	800	1040	1247	1460	1667	2087	2500	3333	4167	5000	5833	6667
3-1/4				302	400	585	738	960	1151	1348	1538	1926	2308	3077	3846	4615	5385	6154
3-1/2				280	371	543	686	891	1069	1251	1429	1789	2143	2857	3571	4286	5000	5714
3-3/4				261	347	507	640	832	997	1168	1333	1669	2000	2667	3333	4000	4667	5333
4				245	325	475	600	780	935	1095	1250	1565	1875	2500	3125	3750	4375	5000
4-1/4					306	447	565	734	880	1031	1176	1473	1765	2353	2941	3529	4118	4706
4-1/2					289	412	533	693	831	973	1111	1391	1667	2222	2778	3333	3889	4444
4-3/4					274	400	505	657	787	922	1053	1318	1579	2105	2632	3158	3684	4211
5					260	380	480	624	748	876	1000	1252	1500	2000	2500	3000	3500	4000
5-1/2						345	436	567	680	796	909	1138	1364	1818	2273	2727	3182	3636
6						317	400	520	623	730	833	1043	1250	1667	2083	2500	2917	3333
6-1/2							369	480	575	674	769	693	1154	1538	1923	2308	2692	3077
7								446	534	626	714	894	1071	1429	1786	2143	2500	2857
7-1/2								416	499	584	667	835	1000	1333	1667	2000	2333	2667
8									468	548	625	783	938	1250	1563	1875	2188	2500
8-1/2										515	588	736	882	1176	1471	1765	2059	2353
9											556	696	833	1111	1389	1667	1944	2222
9-1/2											526	659	789	1053	1316	1579	1842	2105
10											500	626	750	1000	1250	1500	1750	2000
10-1/2											476	596	714	952	1190	1429	1667	1905

The above table is based on the best known and most widely used formula for calculating the bursting pressure of tubes, namely, Barlow's:

$$P = \frac{2St}{D}$$

P = Internal pressure in psi
S = Fiber stress of tube in psi
t = Wall thickness in inches
D = Outside diameter in inches

The table (S = 1000) affords easy calculations with appropriate multipliers shown right. For theoretical bursting pressures, use tensile values. For theoretical bulging pressures, use yield values. Working pressures will vary depending upon safety factors required for environmental conditions involved as determined by your design engineer and appropriate codes.

Material	Tensile (Multiplier)	Yield (Multiplier
6061-T6 Aluminum	42,000 psi (x 4.2)	35,000 psi (x 3.5)
Annealed low carbon steel	55,000 psi (x 5.5)	25,000 psi (x 2.5)
Annealed 18-8 Stainless.	75,000 psi (x 7.5)	30,000 psi (x3.0)
1/8 Hard 18-8 Stainless	105,000 psi (x 10.5)	75,000 psi (x 7.5)
Cold Dr. 21-6-9 Stainless	142,000 psi (x 14.2)	120,000 psi (x 12.0)

Hardness Value Conversions [1 2 3]

Hardened Carbon Steel and Hard Alloys

C	A	15-N	30-N	45-N	Knoop 500 Gr. & Over	Brinell 3000 Kg.†	Tensile Strength* Approx.
71	87.0	—	86.5	78.5	—	—	—
70	86.5	94.0	86.0	77.5	972	—	—
69	86.0	93.5	85.0	76.5	946	—	—
69	85.6	93.2	84.4	75.4	920	—	—
67	85.0	92.9	83.6	74.2	895	—	—
66	84.5	92.5	82.8	73.3	870	—	—
65	83.9	92.2	81.9	72.0	846	—	—
64	83.4	91.8	81.1	71.0	822	–	–
63	82.8	91.4	80.1	69.9	799	—	—
62	82.3	91.1	79.3	68.8	776	—	—
61	81.8	90.7	78.4	67.7	754	—	—
60	81.2	90.2	77.5	66.6	732	613	—
59	80.7	89.8	76.6	65.5	710	599	326
58	80.1	89.3	75.7	64.3	690	587	315
57	79.6	88.9	74.8	63.2	670	575	305
56	79.0	88.3	73.9	62.0	650	561	295
55	78.5	87.9	73.0	60.9	630	546	287
54	78.0	87.4	72.0	59.8	612	534	278
53	77.4	86.9	71.2	58.6	594	519	269
52	76.8	86.4	70.2	57.4	576	508	262
51	76.3	85.9	69.4	56.1	558	494	253
50	75.9	85.5	98.5	55.0	542	481	245
49	75.2	85.0	67.6	53.8	526	469	239
48	74.7	84.5	66.7	52.5	510	455	232
47	74.1	83.9	65.8	51.4	495	443	225
46	73.6	83.5	64.8	50.3	480	432	219
45	73.1	83.0	64.0	49.0	466	421	212
44	72.5	82.5	63.1	47.8	452	409	206
43	72.0	82.0	62.2	46.7	438	400	201
42	71.4	81.5	61.3	45.5	426	390	196
41	70.9	80.9	60.4	44.3	414	381	191
40	70.4	80.4	59.5	43.1	402	371	186
39	69.9	79.9	58.6	41.9	391	362	181
38	69.4	79.4	57.7	40.8	380	353	176
37	68.9	78.8	56.8	39.6	370	314	172
36	68.4	78.3	55.9	38.4	360	336	168
35	67.9	77.7	55.0	37.2	351	327	163
34	67.4	77.2	54.2	36.1	342	319	159
33	66.8	76.6	53.3	34.9	334	311	154
32	66.3	76.1	52.1	33.7	326	301	150
31	65.8	75.6	53.1	32.5	318	294	146
30	65.3	75.0	50.4	31.3	311	286	142
29	64.7	74.5	49.5	30.1	304	279	138
28	64.3	73.9	48.6	28.9	297	271	134
27	63.8	73.3	47.7	27.8	290	264	131
26	63.3	72.8	46.8	26.7	284	258	127
25	62.8	72.2	45.9	25.5	278	253	124
24	62.4	71.6	45.0	24.3	272	247	121
23	62.0	71.0	44.0	23.1	266	243	118
22	61.5	70.5	43.2	22.0	261	237	115
21	61.0	69.9	42.3	20.7	256	231	113
20	60.5	69.4	41.5	19.6	251	226	110

* Tensile Strength is psi x 1000.
† Hultgren ball.
‡ Value in ( ) is below normal value.

Soft Carbon Steel

B	F	15-N	30-N	45-N	A	Knoop 500 Gr. & Over	Brinell 3000 Kg.†	Tensile Strength* Approx.
100	—	93.0	82.0	72.0	61.5	251	240	116
98	—	—	—	70.0	60.5	241	228	109
96	—	—	80.0	68.0	59.0	231	216	103
94	—	—	78.5	66.0	57.5	221	205	98
92	—	90.5	77.5	64.5	56.5	211	195	93
91	—	—	77.0	63.5	56.0	206	190	91
89	—	89.5	77.5	61.5	55.0	196	180	87
88	—	—	75.0	60.5	54.0	192	176	85
86	—	88.5	74.0	58.5	53.0	184	169	81
84	—	88.0	73.0	57.0	52.0	176	162	78
82	—	—	71.5	55.0	50.5	170	156	75
80	—	86.5	70.0	53.0	49.5	164	150	72
78	—	86.0	69.0	51.0	48.5	158	144	—
76	—	—	67.5	49.0	47.0	152	139	—
75	99.5	85.0	67.0	48.5	46.5	150	137	—
74	99.0	—	66.0	47.5	46.0	147	135	—
72	98.0	84.0	65.0	45.5	45.0	143	130	—
70	97.0	83.5	63.5	43.5	44.0	139	125	—
68	95.5	—	62.0	41.5	43.0	135	121	—
66	94.5	82.0	60.5	39.5	42.0	131	117	—
64	93.5	81.5	59.5	37.5	41.5	127	114	—
62	92.0	—	58.0	35.5	40.5	124	110	—
60	91.0	—	56.5	33.5	39.5	120	107	—
58	90.0	79.5	55.0	31.0	38.5	117	104	—
56	89.0	79.0	54.0	29.0	—	114	101	—
54	87.5	—	52.5	27.0	37.0	111	87**	—
52	86.5	77.5	51.0	25.0	36.0	109	85**	—
50	85.5	77.0	49.5	23.0	35.0	107	83**	—
49	85.0	76.5	49.0	22.0	—	106	82**	—
47	84.0	76.0	47.5	19.5	34.0	104	80**	—
45	82.5	—	46.0	17.5	33.0	102	79**	—
43	81.5	74.5	45.0	15.5	32.0	100	77**	—
41	80.5	74.0	43.5	13.5	31.0	98	75**	—
39	79.0	—	42.0	11.0	30.5	96	74**	—
37	78.0	72.5	40.5	9.0	29.5	94	72**	—
35	77.0	72.0	39.5	7.0	28.5	92	71**	—
33	75.5	—	88.0	5.0	—	90	69**	—
31	74.5	—	36.5	3.0	37.0	88	68**	—
29	73.5	70.0	35.5	1.0	26.0	—	—	—
27	72.5	69.5	34.0	—	25.0	85	—	—
25	71.0	—	32.5	—	—	—	64**	—
23	70.0	68.0	31.0	—	23.0	—	—	—
21	69.0	67.5	29.5	—	22.5	—	—	—
(19)	68.0	67.0	28.5	—	21.5	79	61**	—
(17)	66.5	—	27.0	—	21.0	—	60**	—
(15)	66.5	66.5	25.5	—	20.0	76	59**	—
(13)	64.5	65.0	24.0	—	—	—	58**	—
(11)	63.5	—	23.0	—	—	73	—	—
(8)	61.5	63.5	20.5	—	—	71	—	—
(7)	61.0	63.0	20.0	—	—	—	56**	—
(2)	58.0	61.5	16.5	—	—	68	54**	—
(0)	57.0	—	15.0	—	—	67	53**	—

**Below Brinell 101 tests were made with 500 kg. load.
Conversions are never numerically exact.
The approximate tensile strength cross-reference holds for carbon steel only.
Further detail may be found by reference to ASTM E-140

Eagle Reference Guide

Why Your Supplier's QUALITY Management System MATTERS

✔ Quality management systems create overall value.

When a company implements a quality management system, it must examine itself from top to bottom to gain a thorough understanding of every operation. This approach to quality requires discipline throughout an enterprise that translates to efficiency. Suppliers who have accomplished this, like Eagle Stainless, find it benefits themselves as well as theIr customers.

✔ Products passing through quality management systems are right the first time.

To meet rigorous requirements of quality management systems, products undergo quality checks at each step of their production, and variances are corrected early. Any mistakes are analyzed and used to improve the process for future orders. All these systems ensure that you will get your order as specified without losing time on rework.

✔ Quality management systems improve delivery times.

The disciplined production, continuous process improvement, and quality checks required by quality management systems serve to speed production processes. An established quality management system will help get your product out the door faster with no mistakes.

✔ Reduce your own audit frequency with supplier quality management systems.

Having an established quality system assures you of regular audits through certifying bodies. So you don't have to worry about whether the audits are up to date, or if they meet industry standards.

✔ Quality management systems create atmospheres of teamwork and customer service.

Implementing a quality management system requires teamwork and employee empowerment. At Eagle, for instance, every employee is concerned with the quality of every product at every step of production. This extends from order entry and raw material purchasing to fabrication and QA to final test and shipping.

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