

Tubing MODULE TWO



Parker Autoclave Engineers Tubing

“All Tubing is Not Created Equal”



Not all tubing is created equal...

Tubing is an engineered part of our total system “package” - the same as any of our components.

We follow the strict design guidelines supplied by ASME code and enhance with our unique design specifications.



Everything Starts with Safety!

Safety is Our #1 Priority...

Working with pressures over 10,000 psi can be dangerous...

- Not only is safety a concern but we have to also consider tubing life as well as proper form and function
- Tube markings ensure complete traceability, including size, pressure rating, material heat numbers, material type, PAE specification number and our name
- This information tells you that you have the certified tubing needed to be used with Parker Autoclave components



Design Specifications for Tubing

- Tubing physical properties are derived using **ASME B31.3** providing a **safety factor of 2 to 1 on O.D. yield** (at least 2 times the design pressure to start O.D. yield)
- Tubing chemical composition is specified by ASTM
- Parker Autoclave “Autoclave Engineers Specification (AES)” such as **AES 222** are used to specify additional requirements
- Requirements such as **bore finishes, pressure testing, Eddy Current testing and all non-destructive** testing is specified by PAE
- The percentages of **test samples** are specified
- Bore inspection, milled sections, and tensile testing is specified
- **Tighter than normal dimensional tolerancing requirements, including O.D., I.D., wall thickness, and run-out**
- Tubing must be **DFARS 225.872-1 compliant**
- Parker Autoclave tubing is dual rated 316/316L and 304/304L



Design Differences

Special Design requirements by Parker Autoclave are what makes our tubing different from other suppliers as well as commercially purchased tubing

Tubing supplied by competitors or purchased direct from tubing mills/distributors is not same as PAE tubing and WILL have different dimensions.



Design Differences

Parker Autoclave tubing is supplied with **special outside dimensions** specifically designed for our tooling and fittings

PAE tubing dimensional tolerances as per catalog:

Nominal Tubing Size (Inches)	Tolerance/Outside Diameter inches (mm)
1/4"	.248/.243 (6.30/6.17)
3/8"	.370/.365 (9.40/9.27)
9/16"	.557/.552 (14.15/14.02)
3/4"	.745/.740 (18.92/18.80)
1"	.995/.990 (25.27/24.14)
1 1/2"	1.495/1.490 (37.98/37.85)

For example : 3/8" commercial tube to ASTM A269 will be 0.380" – 0.370"



Design Differences

Wall thickness, ovality, and run-out is controlled via tolerancing to maintain the required thickness throughout the tube providing a higher pressure rating

Parker Autoclave specifies tighter tolerances on tubing wall thickness and run-out for a more uniform wall thickness. This provides an even wall at the point of sealing and provides higher calculated design pressures.



Design Differences

Tubing is eddy-current tested AND hydro-tested

Parker Autoclave Eddy current defect acceptance are more stringent than commercial standards

ASTM A-213 and A-269 specify that either an eddy-current test OR hydro-test is required.

PAE specifications require BOTH are performed.

Acceptable defect allowances are larger in commercial tubing as compared to PAE specifications.



Design Differences

Hydro-test pressures are performed at PAE design pressure where commercial tubing is sold based on a calculation - resulting in a much lower (by less than half), design pressure

*For example a 9/16" 20K commercial tube will be hydro-tested to 7117 psi by calculations.
PAE Hydro-Tests our tube to 20,000 psi.*

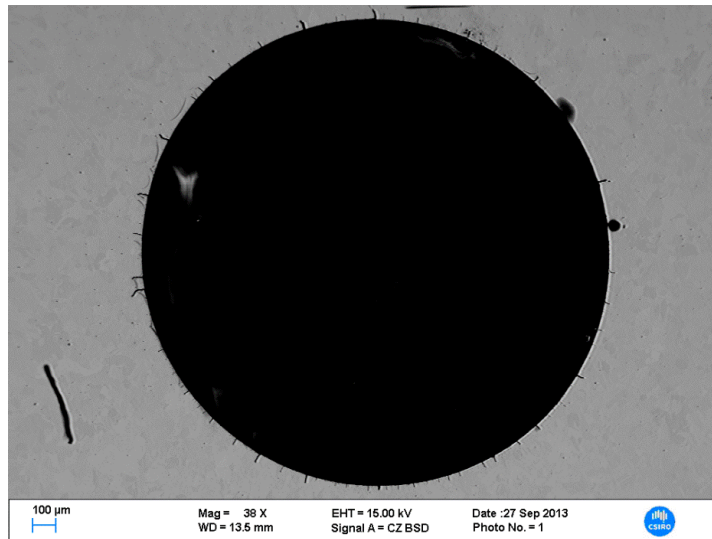
Commercial tubing is not usually certified to a working pressure rating.



Design Differences

Microscopic cross section bore examination required

PAE requires additional testing which are pieces of tubing cut and then sectioned to microscopically examine the bore finish.



Design Differences - Review

- Autoclave Tubing is made to AES specifications – **we control the strength properties and therefore the safety of the “system”**
- **Eddy current tested** in accordance with ASTM-E426
- Autoclave Tube is **traceable**
- Medium and High Pressure **tube is cold drawn**
- **Low Pressure tube has hardness limit** not specified in commercial tube
- Supplied in random lengths from 20 to 26.5 feet
- Can be supplied Autofrettaged or 100% hydro-tested as an option
- Tube for Sour Gas Applications has been annealed and as such has a reduced maximum working pressure
- **Must be purchased with Parker Autoclave Fittings to comply with warranty requirements**
- **Commercial tubing will not fit Parker Autoclave Fittings**



Parker-Autoclave Statement on Commercial Tubing

In order to design valve and fitting products that operate safely in extremes of pressure and temperature, Parker Autoclave Engineers have developed product specifications that meet or exceed the best practices of different engineering societies using ASME B31.3 as the primary design code. In so doing, we have designed our products (Valves, Fittings, & Tubing) to work together as a complete system where we specify and control both material and critical dimensions & tolerances to meet the conditions for which they are designed.

To control and maintain safe, functional high pressure, high integrity systems, Parker Autoclave Engineers tubing is manufactured to a specialized and tightly controlled set of design specifications that make it different than that of standard “commercial” tubing. The following statement is on all Parker Autoclave Engineers literature:

“Parker Autoclave Engineers Valves, Fittings, and Tools are not designed to work with common commercial instrument tubing and will only work with tubing built to Parker Autoclave Engineers AES specifications”. “Do not mix or interchange parts or tubing with those of other manufactures”. “Failure to do so will void warranty.”

It should also be noted that “Modifying Parker Autoclave Engineers components in any manner without prior written approval” could pose a significant safety risk, alter the pressure rating, will void warranty and may be subject to certain liability issues.



Parker-Autoclave Tubing

Tubing Sizes

- Low Pressure – from $\frac{1}{16}$ " to $\frac{1}{2}$ ".
- Medium Pressure – from $\frac{1}{4}$ " to $1 \frac{1}{2}$ "
- High Pressure – $\frac{1}{4}$ ", $\frac{3}{8}$ ", & then $\frac{9}{16}$ " @ 40ksi & 60ksi and 1" @ 43ksi
- Ultra High – $\frac{1}{4}$ " & $\frac{3}{8}$ " to 100ksi, $\frac{5}{16}$ " only for 150ksi
- 45 Different size/wall thickness (O.D. vs I.D.) options
- 46 Different Materials To-Date

