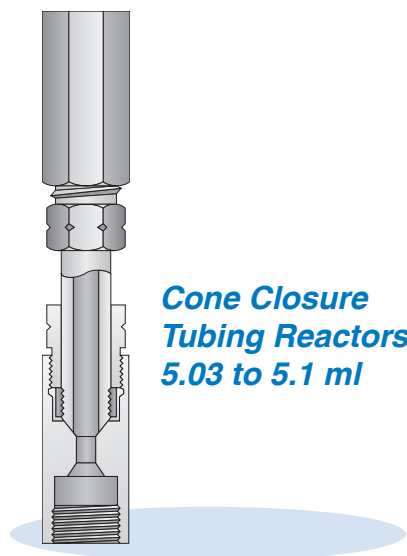


## Pressure Vessel Closure High Temperature / High Pressure Style Comparison

Autoclave Engineers' offers multiple vessel closure styles. Select the style that meets your requirements for ease of opening and closing, seal compatibility, as well as pressure and temperature performance.



Autoclave Engineers offers a 3/16" I.D. series of convenient, versatile and economical micro-reactors. Each are assembled from standard, readily available AE High Pressure tubing nipples and connection components. Applicable to many low-volume laboratory reaction studies, they provide the proven reliability of AE coned-and-threaded connections.

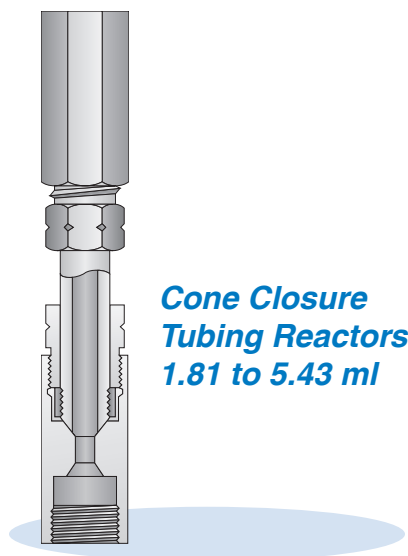
**MROP\*:** Up to 20,000 psi @ RT

**Volumes:** 5.03 to 15.1 ml

**Vessel Materials:** 316 Stainless Steel

\*Maximum Recommended Operating Pressure

- Type 316 SS tubing body with Type 316 SS couplings collars and glands.
- Accepts standard 9/16" (14.3 mm) AE High Pressure Connection Components
- Includes plug and gland on each end. (Not shown)
- Rated per ANSI / ASME B31.3



Autoclave Engineers offers a 3/16" I.D. series of convenient, versatile and economical micro-reactors. Each are assembled from standard, readily available AE High Pressure tubing nipples and connection components. Applicable to many low-volume laboratory reaction studies, they provide the proven reliability of AE coned-and-threaded connections.

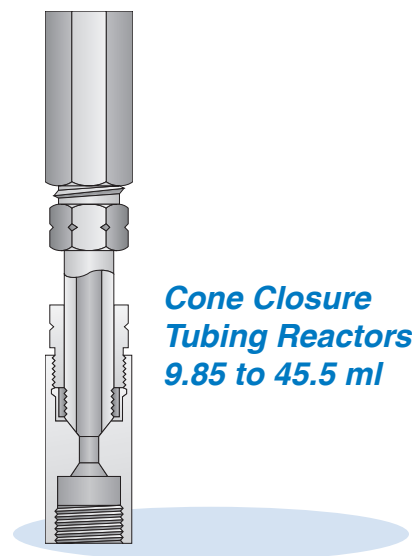
**MROP\*:** Up to 60,000 psi @ RT

**Volumes:** 1.81 to 5.43 ml

**Vessel Materials:** 316 Stainless Steel

\*Maximum Recommended Operating Pressure

- Type 316 SS tubing body with Type 316 SS couplings collars and glands.
- Accepts standard 9/16" (14.3 mm) AE High Pressure Connection Components
- Includes plug and gland on each end. (Not shown)
- Rated per ANSI / ASME B31.3



Autoclave Engineers offers a 3/16" I.D. series of convenient, versatile and economical micro-reactors. Each are assembled from standard, readily available AE High Pressure tubing nipples and connection components. Applicable to many low-volume laboratory reaction studies, they provide the proven reliability of AE coned-and-threaded connections.

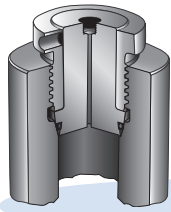
**MROP\*:** Up to 20,000 psi @ RT

**Volumes:** 9.85 to 45.5 ml

**Vessel Materials:** 316 Stainless Steel

\*Maximum Recommended Operating Pressure

- Type 316 SS tubing body with Type 316 SS couplings collars and glands.
- Accepts standard 3/8" (9.53 mm) AE High Pressure Connection Components
- Includes plug and gland on each end. (Not shown)
- Rated per ANSI / ASME B31.3



**O-Ring Closure**  
100 to 2,000 ml

Autoclave Engineers O-ring closure pressure vessels, model OR and O-ring closure compression cylinders, model OC and OD, offer a simple, reliable and economical alternative to the Autoclave Engineers self-sealing closure where high temperature operation is not required. Standard O-ring material is Buna-N; however, optional O-ring materials are available on special order. Autoclave Engineers welcomes your special product request.

Please contact the factory for review of your application. The main nut screws into the vessel body until it tightens the cover against the angle in the body, as shown in the figure.

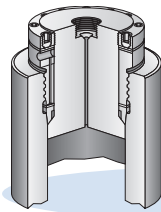
The groove in the cover is sized to put the proper squeeze on the O-ring to create a seal. The metal-to-metal contact between the cover and body prevents O-ring extrusion.

**MAWP:** 10,500 to 60,000 psi @ 72° F  
(724 to 4,137 bar @ 22° C)

**Volumes:** 100 to 2,000 ml

**Vessel Materials:**

316 Stainless Steel, Alloy Steel, A-286



**AE Closure**  
100 to 2,000 ml

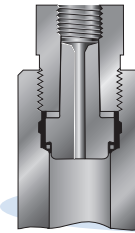
The "AE" self-sealing (modified Bridgman) pressure vessel utilizes the Bridgman Principle of "unsupported area." The AE closure significantly improves the original Bridgman concept by utilizing an all-metal seal configuration. This not only permits very high temperatures, but also facilitates opening and closing the vessel. It works by harnessing the internal vessel pressure to reinforce the seal; the higher the pressure (within rated limits), the tighter the seal.

**MAWP:** 10,500 to 30,000 psi @ 72° F  
(724 to 2,070 bar @ 22° C)

**Volumes:** 100 to 2,000 ml

**Vessel Materials:**

316 Stainless Steel, Alloy Steel, A-286



**Kuentzel Closure**  
103 to 206 ml

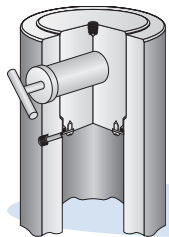
Autoclave Engineers' Kuentzel closure pressure vessel is a reliable and cost efficient reactor in smaller capacity applications requiring medium pressure operation at higher temperatures. The four-piece Kuentzel closure design is relatively simple and easy to clean and make up. Metal-to-metal sealing is achieved with 300 series stainless steel or copper gasket, (please specify) Kuentzel vessels are offered in both single and double-ended configuration, the latter providing greater ease of cleaning.

**MAWP:** 11,000 psi @ 72° F  
(758.4 bar @ 22° C)

**Volumes:** 103 to 206 ml

**Vessel Materials:**

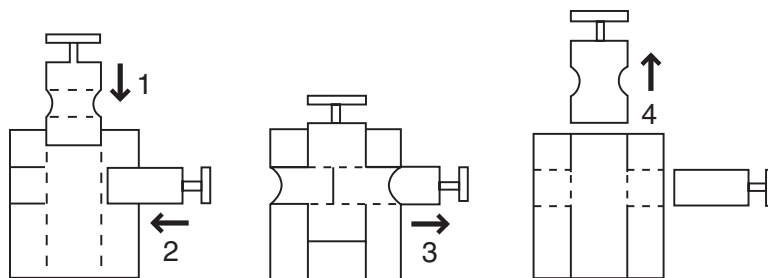
316 Stainless Steel, F-375-C



**Threadless Pin Closure**  
100 to 2,000 ml

The threadless pin quick-opening pressure vessels feature rapid cyclic operation with greatly increased vessel life.

The threadless pin closure replaces the bending stress that normally occurs in a threaded or breach closure pressure vessel. The pin closure provides a more uniform application of cover thrust in the vessel wall. Standard models include vessels sized for research as well as for production operation.



**MAWP:** 15,000 to 60,000 psi @ 72° F  
(1034 to 4,137 bar @ 22° C)

**Volumes:** 2,500 to 10,500 ml

**Vessel Materials:**



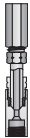
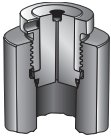
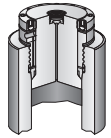
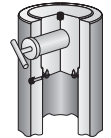
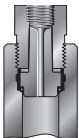
316 Stainless Steel, Alloy Steel, A-286

Autoclave Engineers threadless pin-closure, pressure vessels permit fast opening and closing of vessel for increased throughput and safety.

**To close:** (1) lower cover; (2) insert pin.

**To open:** (3) pull pin; (4) raise cover.

## Side by Side Comparison

	MAWP*	MROP**	Volumes	ID Range	Material
 <p><b>Cone Closure Tubing Reactor</b> 5.03 to 5.1 ml</p>	--	Up to 20,000 psi @ RT	5.03 to 15.1 ml	--	316 SS (Stainless Steel)
 <p><b>Cone Closure Tubing Reactor</b> 1.81 to 5.43 ml</p>	--	Up to 20,000 psi @ RT	1.81 to 5.43 ml	--	316 SS (Stainless Steel)
 <p><b>Cone Closure Tubing Reactor</b> 9.85 to 45.5 ml</p>	--	Up to 20,000 psi @ RT	9.85 to 45.5 ml	--	316 SS (Stainless Steel)
 <p><b>O-Ring Closure</b></p>	10,000-60,000 psi @ 72°F (724 to 4,137 bar @ 22°C)	--	100 to 2,000 ml	--	316 SS (Stainless Steel) Alloy Steel A-286
 <p><b>AE Closure</b></p>	10,500-30,000 psi @ 72°F (724 to 2,070 bar @ 22°C)	--	100 to 2,000 ml	--	316 SS (Stainless Steel) Alloy Steel A-286
 <p><b>Threadless Pin Closure</b></p>	15,000-60,000 psi @ 72°F (1034 to 4,137 bar @ 22°C)	--	2,500 to 10,500 ml	--	316 SS (Stainless Steel) Alloy Steel A-286
 <p><b>Kuentzel Closure</b></p>	11,000 psi @ 72°F (758.4 bar @ 22°C)	--	103 to 206 ml	--	316 SS (Stainless Steel) F-375-C

MAWP\* = Maximum Allowed Working Pressure    MROP\*\* = Maximum Recommended Operating Pressure

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