

Robotic Ocean, LLC

SeaCircuit® HOUSINGS - Standardized Plastic

Pressure Vessels for Shallow Water Applications

www.roboticocean.com

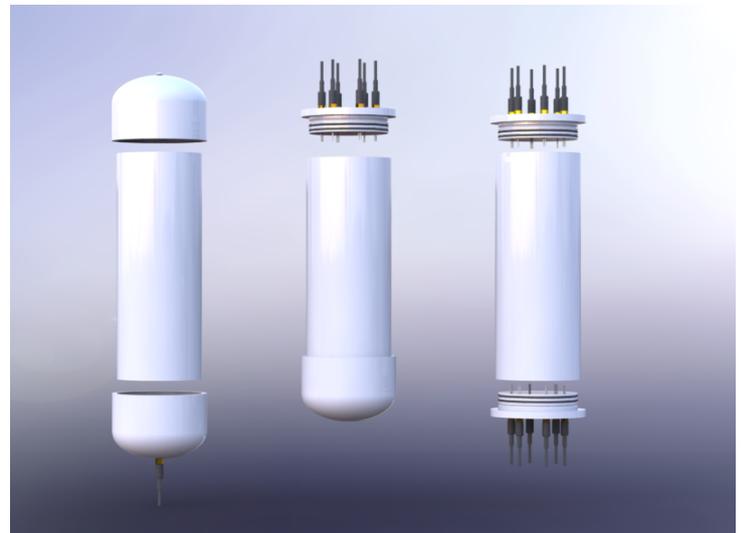
support@roboticocean.com

Robotic Ocean, LLC introduces 23 diameters of the shallow water SeaCircuit® line of enclosures whose objective is to reduce the costs of harsh environment enclosures while maintaining the durability and reliability of high quality builds.

Lighter and more affordable than our deepwater SeaCircuit aluminum housings, these shallow water pressure vessels are made from polyvinyl chloride, a plastic that can be utilized for subsea applications such as junction boxes, electrical instrumentation housings, sensor/battery enclosures, or chemical/biological containment. Due to the varying diameters and wall thicknesses associated with each vessel size, the depth and pressure limitations are not the same for all sizes. Please refer to Table 1 to get the approved depth and pressure associated with each vessel size.

The shallow water SeaCircuit product line offers the following advantages over alternatives offerings:

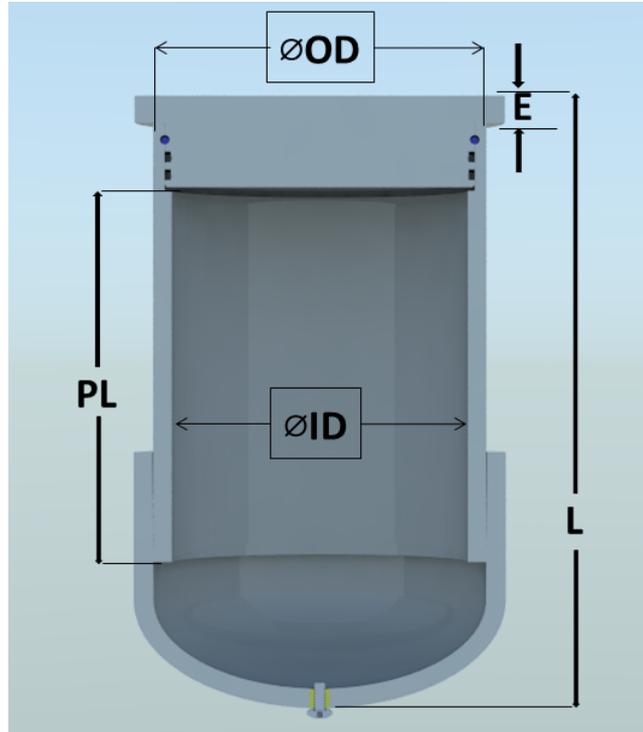
- LARGE SELECTION OF STANDARD SIZES ($\frac{1}{8}$ " - 24")
- PRICING AVAILABLE ONLINE FOR ALL SIZES (ORDER NOW)
- EACH SIZE IS PRESSURE/DEPTH RATED



The three shallow water SeaCircuit vessel configurations

- LOW COST AND LEAD TIME
- NO CORROSION, RUSTING, PITTING, NO ZINCOIDS REQUIRED
- STRENGTH NOT WEAKENED BY SUN
- SHELL AND ENDCAPS CUSTOMIZABLE

Standard SeaCircuit housing assemblies are available immediately for online purchase, however vessel customizations can be accomplished by emailing us or go to 'CUSTOMIZE A PRESSURE VESSEL' webpage. Most assemblies require additional features and accessories such as electrical



A section view of a SeaCircuit pressure vessel and various dimensional labels

Table 1: SHALLOW WATER STANDARDIZED SEACIRCUIT PRESSURE VESSELS

Size	ØID [in] (mm)	Max Pressure [psi] (Bar)	Max Depth [ft] (m)
1/8	0.249 (6.3)	856 (59.0)	1924 (586)
1/4	0.344 (8.7)	816 (56.3)	1834 (559)
3/8	0.473 (12.0)	700 (48.3)	1573 (480)
1/2	0.602 (15.3)	688 (46.1)	1501 (458)
3/4	.804 (20.4)	564 (38.9)	1268 (386)
1	1.029 (26.1)	528 (36.4)	1187 (361)
1 1/4	1.360 (34.5)	448 (30.9)	1007 (307)
1 1/2	1.590 (40.4)	404 (27.9)	908 (277)
2	2.047 (52.0)	344 (23.7)	774 (236)
2 1/2	2.445 (62.1)	372 (25.7)	836 (255)
3	3.042 (77.3)	328 (22.6)	737 (225)
3 1/2	3.512 (89.2)	300 (20.7)	675 (206)
4	3.998 (101.6)	280 (19.3)	630 (192)
5	5.016 (127.4)	248 (17.1)	558 (170)
6	6.031 (153.2)	224 (15.5)	504 (154)
8	7.942 (201.7)	200 (13.8)	450 (137)
10	9.976 (253.4)	180 (12.4)	405 (123)
12	11.889 (302.0)	168 (11.6)	378 (115)
14	13.073 (332.1)	164 (11.3)	369 (112)
16	14.940 (379.5)	164 (11.3)	369 (112)
18	16.809 (426.9)	164 (11.3)	369 (112)
20	18.743 (476.1)	156 (10.8)	351 (107)
24	22.544 (572.6)	152 (10.5)	342 (104)

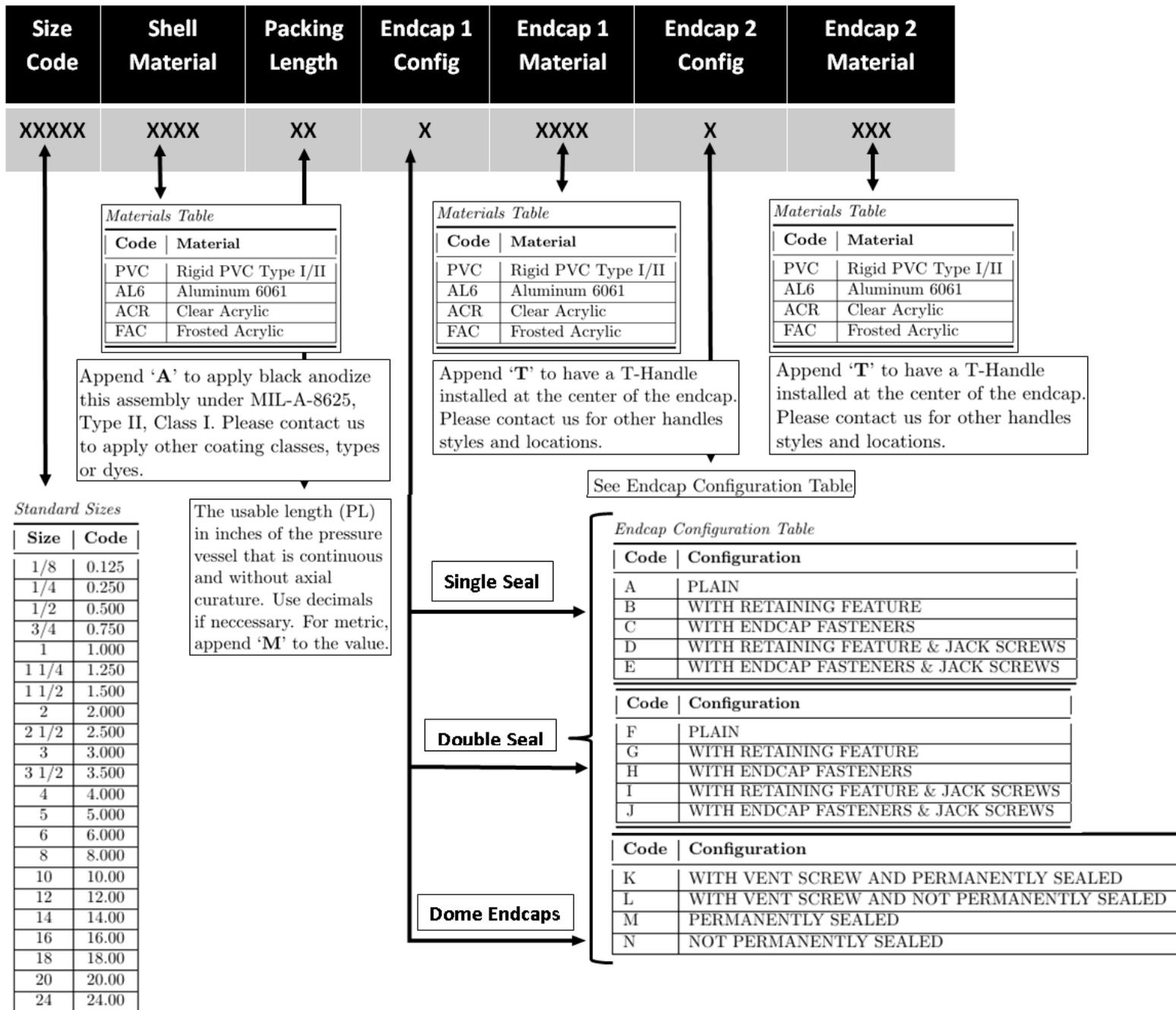
connectors, vent plugs, ported hole patterns, carry handles, acrylic windows, internal/external brackets or any other specialized vessel features. Hole patterns for your endcaps can be handled by sending us the precise information required to meet your needs. Please email us at support@roboticocean.com for other

more specific concerns, questions, or information.

This product exceeds all NEMA and IP67 / IP68 / IP69k ratings and is designed for full immersion for indefinite periods at the rated depth. SeaCircuit enclosures are in compliance with engineering standards ASTM-D1785 and ASTM-D2665. Although a safety factor was applied to obtain the theoretical pressures and depth ratings, please note that dimensional tolerances based on these engineering standards will slightly affect actual ratings. All pressures ratings based on compression yield strength.

A variety of material are available to suit the diverse needs of our customers. Besides polyvinyl chloride, clear acrylic (Perspex/Plexiglas), 6061 aluminum (aluminium) are also available materials by which all components can be made. Please see our website (www.roboticocean.com) for the latest materials to be standardized and become a part of the SeaCircuit family of products.

Use the following part numbering system to order/identify standard features of SeaCircuit housings:



The part numbering system is designed to concisely provide all the information necessary to fabricate the housing assemblies prior to any customization. In addition to this part number, you may provide the details of your customizations to clarify and expedite your order. From figure 2, the value of L is the total length of the unit from top endcap fiber to bottom endcap fiber. Housing lengths are typically defined by their packing length (PL). This is the usable length of pressure vessel in inches which is continuous and without axial curvature. Use decimal values if necessary. For metric, append an 'M' to the value. Dimension 'E' is known as the 'endcap lip' and shall be no less than .275". If you prefer to provide total length (L) rather than packing length, we can provide the associated packing length (PL).

An example of using this part numbering system for a size 16 shallow water SeaCircuit pressure vessel with a packing length of 36.5" using a single O-ring seal whose endcaps are made from PVC in the configuration as one flat endcap and one domed endcap shall be **16.00-PVC-36.5-A-PVC-M-PVC**.

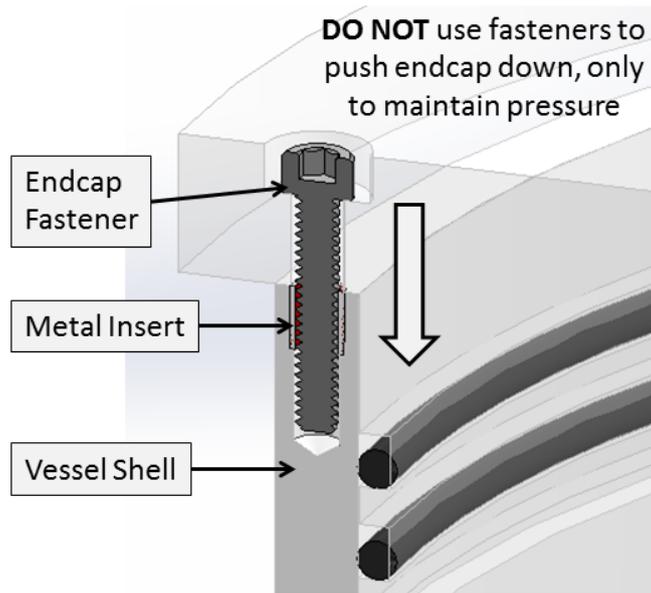
Terms from the part number graphic and this document shall be defined. A DOMED ENDCAP refers to an off the shelf cap end which ultimately becomes glued (either by you or by the factory). SINGLE and DOUBLE SEAL endcaps are flat endcaps that contain single or dual radial O-rings, respectively. A PLAIN endcap is flat, provides a watertight seal and has no other features. An endcap RETAINING FEATURE secures the endcap to the shell without screws. The RETAINING LINE is a plastic cord which is inserted into the retaining feature. This is an alternative to having ENDCAP FASTENERS, the traditional method of securing endcaps by using machine screws anchored to the shell. When possible, fasteners are typically longer than normal in order to serve as both jack screw and endcap fastener. JACK SCREWS aid in removing flat endcaps from their shell. As the jack screw is turned, it gently lifts up on the endcap pushing it away from the shell. Multiple jack screw holes are drilled in order to lift the endcap equally from multiple locations. VENT SCREWS allow the enclosure's pressure to equalize when installing/removing endcaps. A PERMANENTLY SEALED endcap is a domed endcap which is chemically fused to the shell.

It is imperative that when ordering a pressure vessel an understanding of ENDCAP FASTENERS and JACK SCREWS is clear. Endcap fasteners hold the endcap down via the metal insert embedded in the shell wall, as depicted in figure below. This prevents the endcap from rotating and or loosening due to increased internal pressure. DO NOT use the endcap fasteners to seat endcaps to their shell, this will damage the enclosure. With vent screws/plugs removed, always seat the endcap first to the shell so that there is no gap between the endcap lip and shell body when screwing down fasteners. JACK SCREWS act in the opposite direction. As jack screws are turned clockwise, the endcap must move upward because of the gripping action of the jack screw on the metal insert embedded in the endcap. This process is used to aid in the removal of endcaps. Be sure to remove the vent screw or vent plug prior to using jack screws to prevent damaging the vessel.

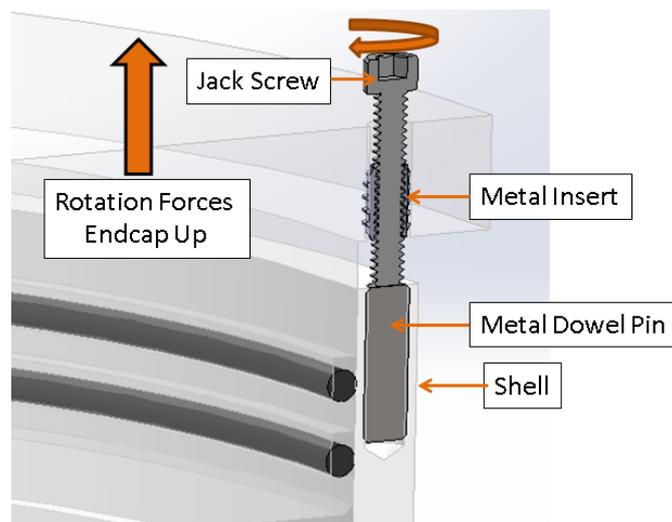
For all specified shallow water SeaCircuit ratings, an assumed temperature of 70°F (21°C) is used to compute ratings. Please note that mechanical properties such as yield strength do change with temperature.

These standardized pressure vessels are a good step toward efficiency and optimal pricing, but we know it may not fulfill all of your pressure vessel needs. Just let us know your constraints for the shell and each endcap (including connectors, size, and pressure/depth), and we will produce your vessel with your precise constraints. Please refer to our deep water aluminum SeaCircuit product line for deeper ocean applications.

At Robotic Ocean, LLC, our design is to lower costs for users of our products while optimizing ease of ordering, and time to consumer. Please visit www.ROBOTICOCEAN.com for the latest information pertaining to low cost water-tight enclosures. Designed and assembled in USA.



A section view of an endcap fastener securing an endcap



A section view of a jack screw gently raising an endcap