Robotic Ocean, LLC

SEACIRCUIT HOUSINGS - Standardized Aluminum Pressure Vessels for Deep Water Applications

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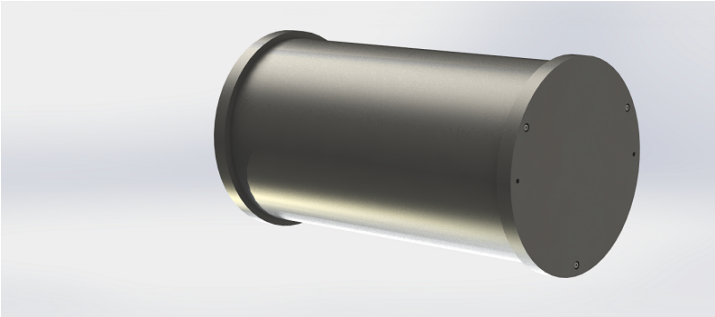
Robotic Ocean, LLC introduces the SeaCircuit housings product line. Anodized for corrosion resistance and built from 6061 aluminum, these instrumentation housings are designed for deep ocean and harsh environments. As always, our main objective is to reduce the costs of overpriced harsh environment enclosures while maintaining the durability and reliability of high quality builds.

As with our shallow water line of pressure vessels, we sought our what our clients want most; strong vessels without compromising dependability. Unlike our shallow water pressure housings, both deep water SeaCircuit housing endcaps are flat. These endcaps can be delivered blank, or can be customized to your needs setup with hole patterns for connectors, threaded vent holes, eyebolts, and/or through holes for LED housings.

Due to the varying diameters and wall thicknesses associated with each size, the depth and pressure limitations are not the same for all schedule sizes. Please refer to Table 1 to get the approved depth and pressure associated with each SeaCircuit housing size.

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

- LARGE SELECTION OF STANDARDIZED DIAMETERS



A SeaCircuit housing in the plain configuration

- LOW COST
- EACH SIZE IS PRESSURE AND DEPTH RATINGS AVAILABLE ONLINE
- WATER AND OIL RESISTANT
- GORGEOUS ANODIZED FINISH
- SHELL AND ENDCAPS CUSTOMIZABLE AND AVAILABLE A LA CARTE

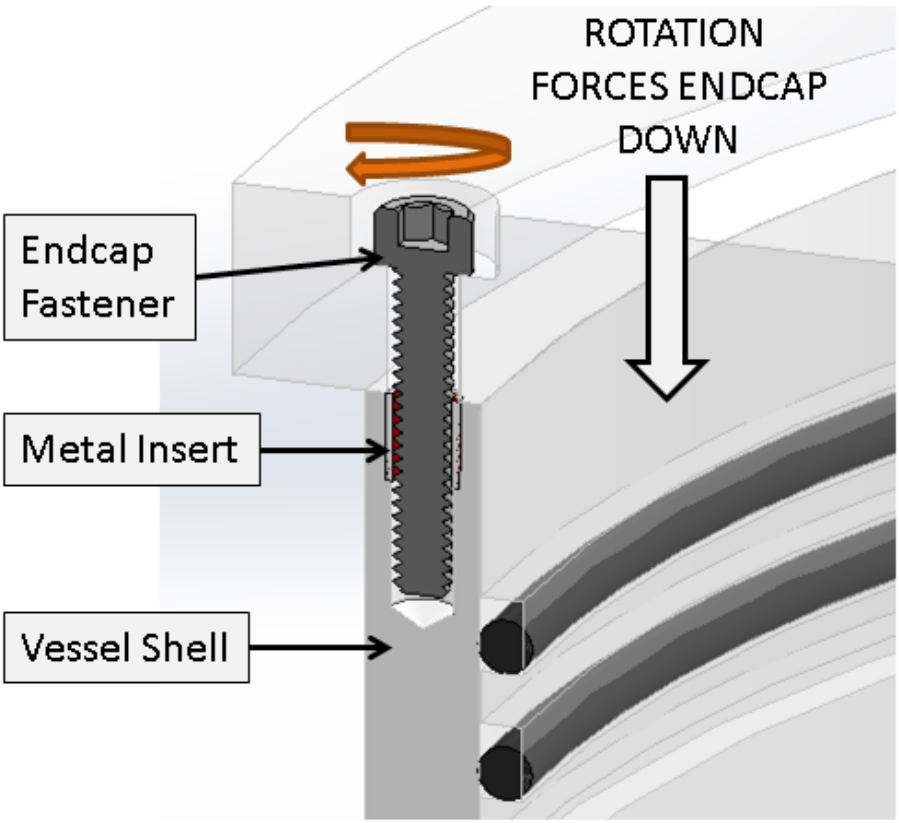
The standardized vessel is a good step toward efficiency and optimal pricing, but we know it may not fulfill all of your pressure vessel needs. Just let us know your constraints for the shell and each endcap (including connectors, size, and depth), and we will design the right enclosure for you.

A variety of material combinations are available

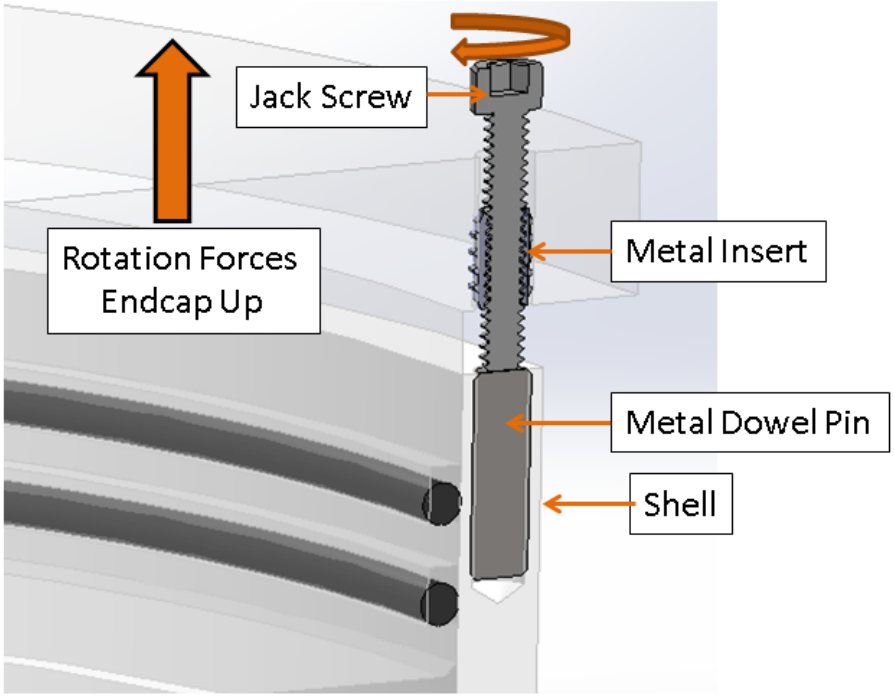
to suit the diverse needs of our customers. Besides Aluminum 6061, we can produce your endcaps and shells from PVC or acrylic (transparent/frosted). Please see our website (www.roboticocean.com) for the latest materials to be standardized and become a part of the SeaCircuit family of products.

Our standard unit comes with a single nitrile O-ring seal however, it is always possible to order your instrument housing with redundant seals, or add simple items like T-handles for ease of handling endcaps (see Table 2, ENDCAP CONFIGURATION TABLE).

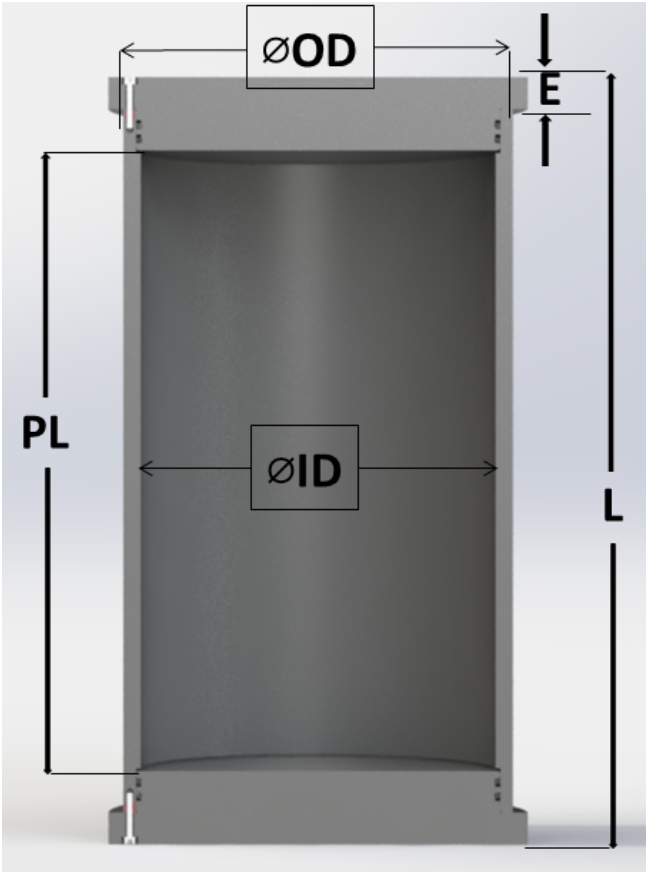
It is imperative that when ordering a pressure vessel an understanding of ENDCAP FASTENERS and JACK SCREWS is clear. Endcap fasteners pull the endcap down via the metal insert embedded in the shell wall, as depicted in figure below. This prevents the endcap from rotating and or loosening due to increased internal pressure. 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 damage to the endcap. Multiple jack screws are typically used to lift different sides of the endcap.



A section view of an endcap fastener securing an endcap



A section view of a jack screw gently raising an endcap



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

Table 1: *SEACIRCUIT STANDARDIZED PRESSURE HOUSING INFORMATION TABLE*

Size	⌀ID [in] (mm)	Max Pressure [psi] (Bar)	Max Depth [ft] (m)
1/8	0.249 (6.3)	5792 (399)	13016 (3967)
1/4	0.344 (8.7)	5532 (381)	12431 (3789)
3/8	0.473 (12.0)	4736 (327)	10643 (3244)
1/2	0.602 (15.3)	4524 (312)	10166 (3099)
3/4	.804 (20.4)	3848 (265)	8647 (2636)
1	1.029 (26.1)	3604 (249)	8098 (2468)
1 1/4	1.360 (34.5)	3056 (211)	6868 (2093)
1 1/2	1.590 (40.4)	2784 (192)	6256 (1907)
2	2.047 (52.0)	2384 (164)	5358 (1633)
2 1/2	2.445 (62.1)	2568 (177)	5771 (1759)
3	3.042 (77.3)	2268 (156)	5097 (1554)
3 1/2	3.512 (89.2)	2088 (144)	4692 (1430)
4	3.998 (101.6)	1952 (134)	4387 (1337)
5	5.016 (127.4)	1732 (119)	3892 (1186)
6	6.031 (153.2)	1584 (109)	3560 (1085)
8	7.942 (201.7)	1404 (97)	3155 (962)
10	9.976 (253.4)	1280 (88)	2877 (877)
12	11.889 (302.0)	1204 (83)	2706 (825)

The value of L is the total length of the unit from the top-most endcap fiber to the bottom-most endcap fiber. Vessel housing lengths are defined by their packing length (PL). This is the usable length of pressure vessel in inches which is typically the length between endcap bottoms. Using the part number schema setup by Robotic Ocean, use decimal values if necessary. For metric, append an 'M' to the value. Dimension 'E' is known as the 'endcap lip', and its length is .275" minimum. The part numbering scheme identifies the vessel's packing length (PL), however if total length 'L' is a more critical dimension, let us know and we will instead construct your housing based on 'L'.

Many endcap configurations are quite common, thus Robotic Ocean has produced a table (below) of common vessel features which can be selected via the part numbering system. If you do not see a feature listed in the table, it can be produced by contacting us with your endcap needs.

Table 2: *ENDCAP CONFIGURATION TABLE*

SINGLE SEAL ENDCAPS
A - PLAIN B - WITH RETAINING FEATURE C - WITH ENDCAP FASTENERS E - WITH ENDCAP FASTENERS, JACK SCREWS
DOUBLE SEAL ENDCAPS
F - PLAIN G - WITH RETAINING FEATURE H - WITH ENDCAP FASTENERS J - WITH ENDCAP FASTENERS, JACK SCREWS

The following terms from Table 2 and this document shall be defined. **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

Size	Shell Material	Packing Length	Endcap 1 Config	Endcap 1 Material	Endcap 2 Config	Endcap 2 Material
XXXXX	XXXX	XX	X	XXXX	X	XXX

Materials Table

Code	Material
PVC	Rigid PVC Type I/II
AL6	Aluminum 6061
ACR	Clear Acrylic
FAC	Frosted Acrylic

Append '**A**' to apply black anodize this assembly under MIL-A-8625, Type II, Class I. Please contact us to apply other coating classes, types or dyes.

Standard Sizes

Size	Code
1/8	0.125
1/4	0.250
1/2	0.500
3/4	0.750
1	1.000
1 1/4	1.250
1 1/2	1.500
2	2.000
2 1/2	2.500
3	3.000
3 1/2	3.500
4	4.000
5	5.000
6	6.000
8	8.000
10	10.00
12	12.00

The usable length (PL) in inches of the pressure vessel that is continuous and without axial curature. Use decimals if neccessary. For metric, append '**M**' to the value.

Materials Table

Code	Material
PVC	Rigid PVC Type I/II
AL6	Aluminum 6061
ACR	Clear Acrylic
FAC	Frosted Acrylic

Append '**T**' to have a T-Handle installed at the center of the endcap. Please contact us for other handles styles and locations.

Materials Table

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See Endcap Configuration Table

Endcap Configuration Table

Single Seal

Code	Material
A	Plain
B	With Retaining Feature
C	With Endcap Fasteners
D	With Retaining Feature & Jack Screws
E	With Endcap Fasteners & Jack Screws

Double Seal

Code	Material
F	Plain
G	With Retaining Feature
H	With Endcap Fasteners
I	With Retaining Feature & Jack Screws
J	With Endcap Fasteners & Jack Screws

An example of using this part numbering system might be for a size 12 SeaCircuit housing of packing length 30.5" using a single O-ring seal whose endcaps are made from aluminum in the standard configuration (aluminum assembly, anodized finish, each endcap equipped with T-Handles). The product part number shall be **12.00-AL6A-30.5-F-AL6T-F-AL6T**.

For all specified information, an assumed temperature 25°C is used to compute ratings. This product exceeds all NEMA ratings and is designed for full immersion for indefinite periods at or less than the rated depth. The SeaCircuit product line is an aluminum product and is in compliance with engineering standards, ASTM-B209 and ASTM-B221. Although a high safety factor was applied to obtain the hypothetical 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 strengths and applied loads.

All vessel customizations can easily be specified via our 'CUSTOMIZE A PRESSURE VESSEL' webpage. 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 information.

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 and accessories.

