

PNNL-37391

WRPS Sampling and Transportation Tool

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Orlando Garayburu

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1.0 Introduction

During FY24, PNNL developed a tool to assist in the sampling and transportation of liquid samples. The tool was designed to remotely open and close a glass jar while fitting inside a 3-inch inner diameter pipe. It was also designed to be reusable, with as few single-use parts as possible to reduce machining costs. The final design consisted of a stepper motor with a linear action, a sleeve that attached to the stepper motor, a lid body that threads onto the glass jar, and a sealing lid that is opened and closed via the stepper motor. Secondary components included O-rings, screws, and a wave spring that keeps the lid pressed into place after the stepper motor is disconnected.

2.0 Design

Components were first printed on a filament deposition modeling 3D printer to evaluate the fit and tolerances of the parts. Differences between early versions of the parts included different O-Ring sizes, gaps between sealing surfaces, tolerances with the glass jar, and different threaded connections. Testing included repeated opening and closing of the lid onto a jar filled with dyed blue water, then checking for a complete seal by shaking the jar. Long term sealing was tested by submerging an empty sealed jar in water for up to a week and checking for ingress, as well as submerging a full jar of dyed blue water in a bath of clear water for up to a week and watching for egress.

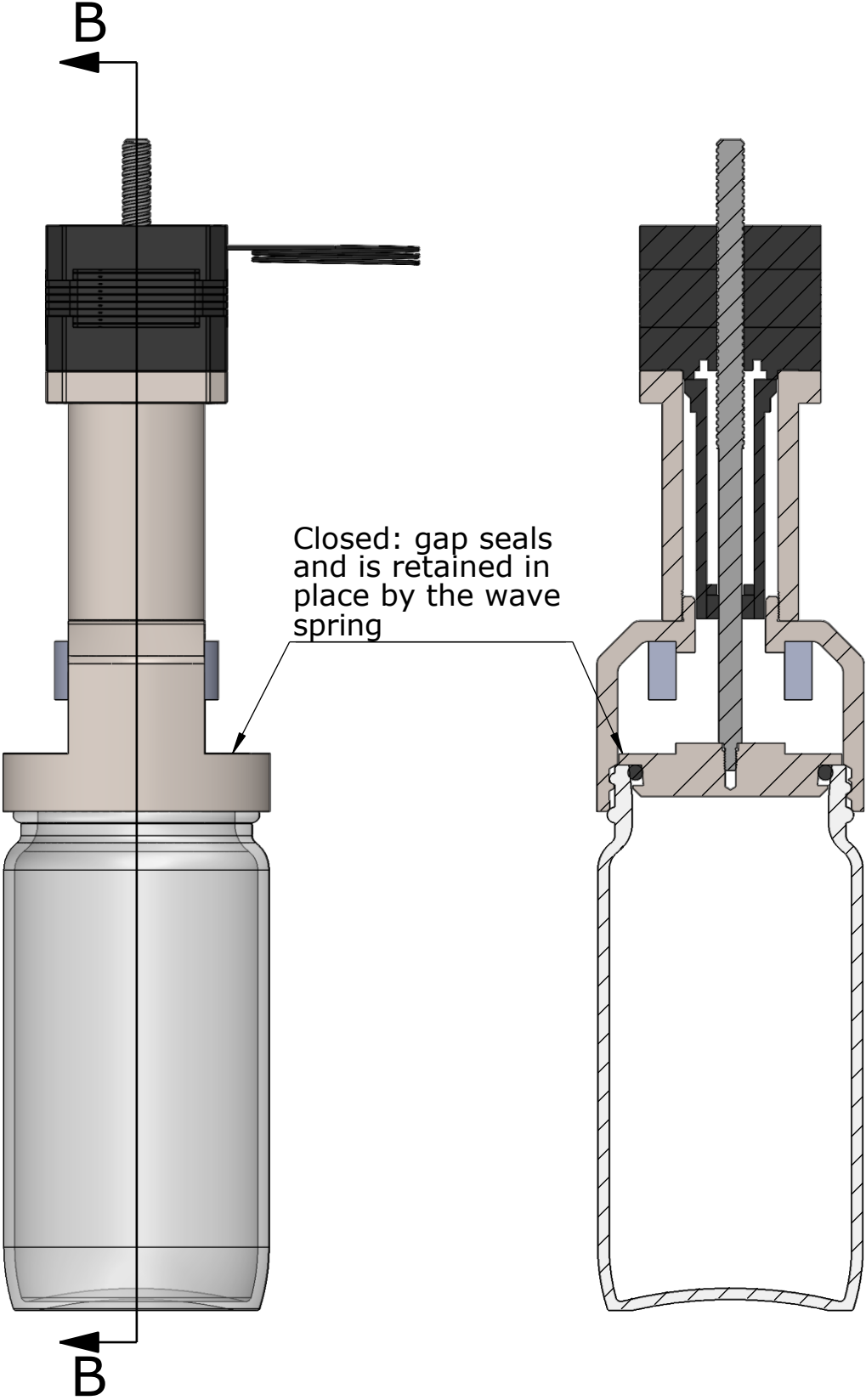
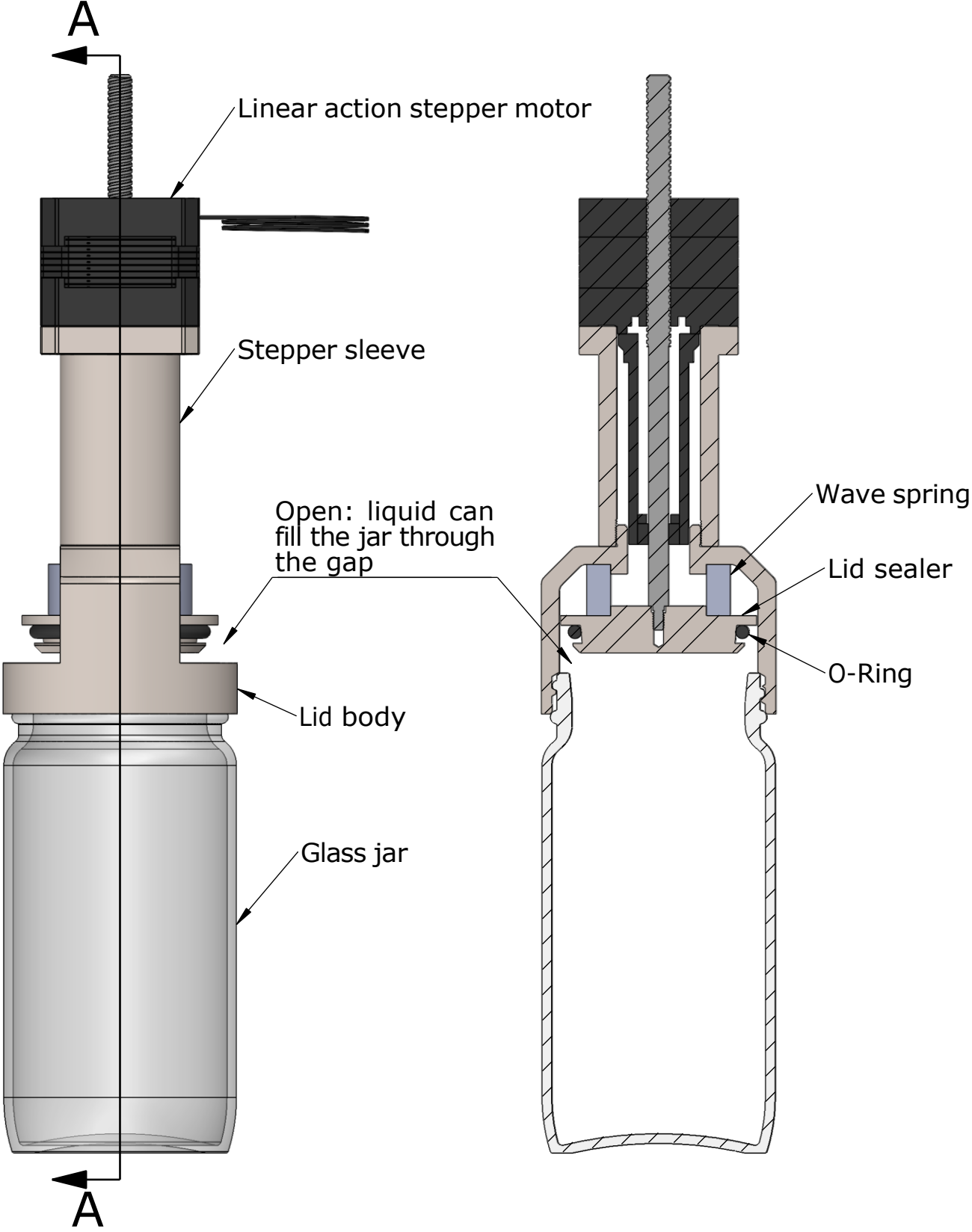
Several rounds of printing and testing were completed before settling on a design to machine from stainless steel. Unfortunately, part fabrication was delayed several times due to material availability and a long job queue. Once the parts were fabricated, we proceeded with testing the new parts in the same manner as the 3D printed parts. Surprisingly, the steel parts failed some of the tests that the 3D printed parts had passed. After further investigation, we found that the O-Ring groove on the steel part had been machined incorrectly, which led to occasional failed sealing. We made modifications to the design of the parts, but by the time we had finished the redesign we were no longer able to get parts machined before the end of FY24. The redesigned models and drawings have been included in the drawing package.

3.0 Parts and Drawings

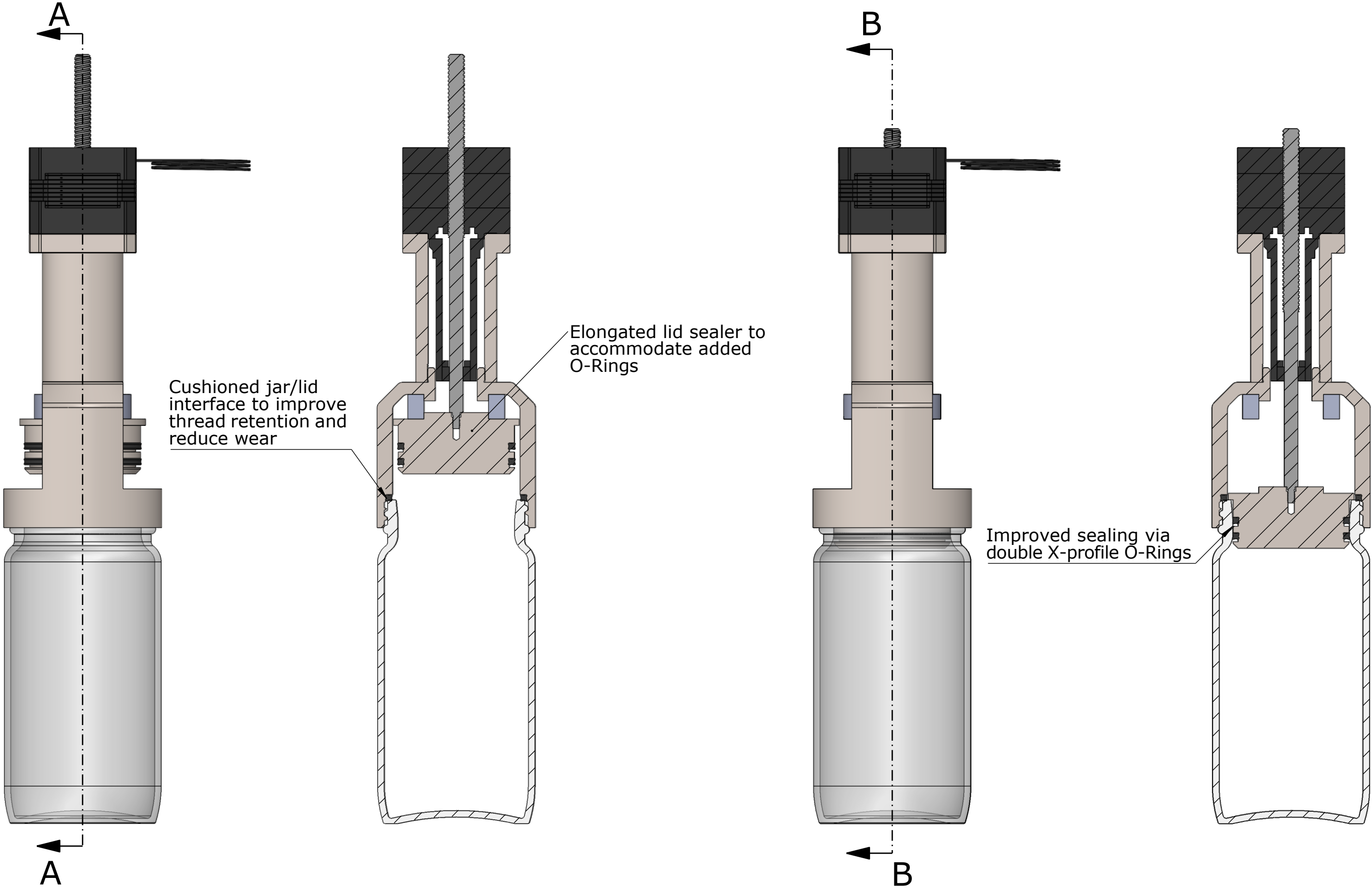
Drawings of the final design as well as the revised-but-not-fabricated design are included, as well as a folder with SolidWorks 2024 models. Drawings show both the open and closed configurations of the jar, as well as the reusable and expendable components. All components are either custom fabricated or purchased from McMaster-Carr, and all the purchased components have part numbers in the file name. It should be noted that the wave spring used during prototyping is McMaster-Carr part number 3762N28, which does not have a SolidWorks model directly associated with it.

Part Name	Vendor	Part Number
Stepper Sleeve	Custom	1
Lid Body	Custom	2
Lid Sealer	Custom	3
O-Rings	McMaster-Carr	9452K61
Linear Stepper Motor	McMaster-Carr	4290N11
Wave Spring	McMaster-Carr	3762N28

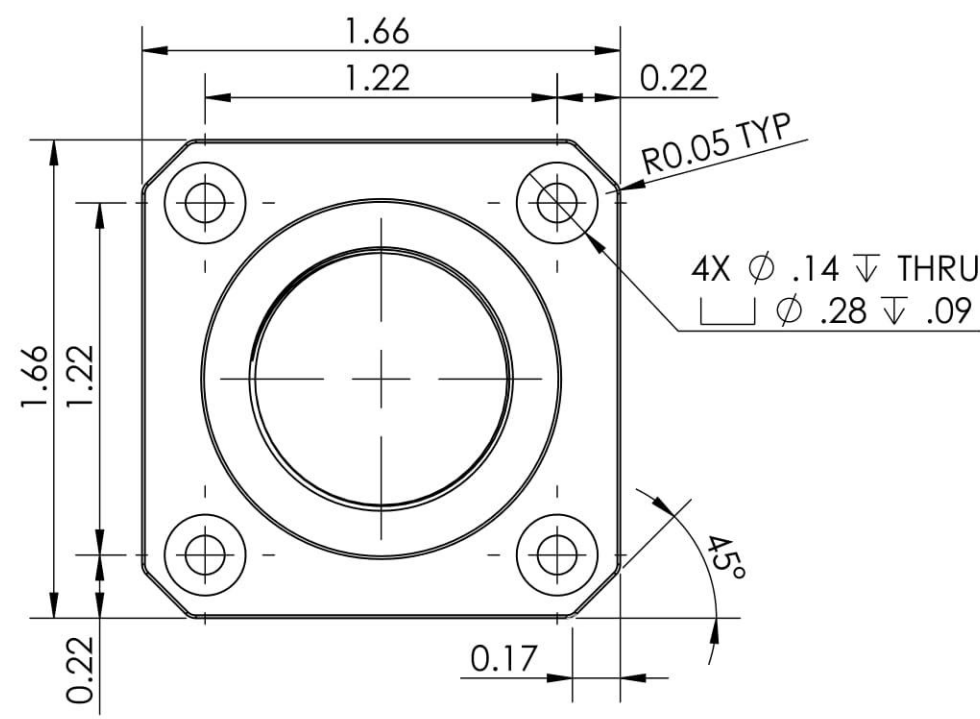
Current Lid Sampler and Transportation Tool



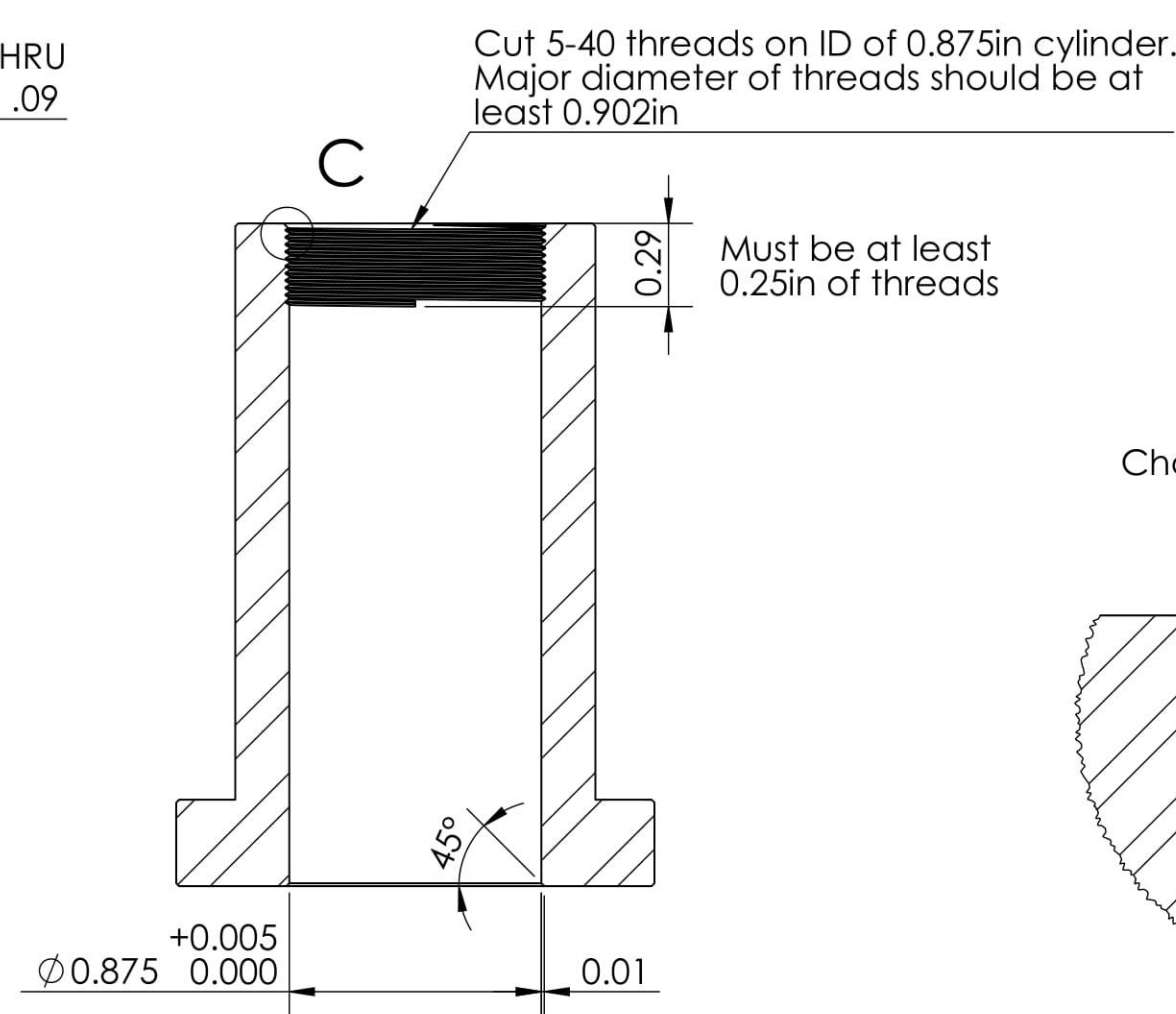
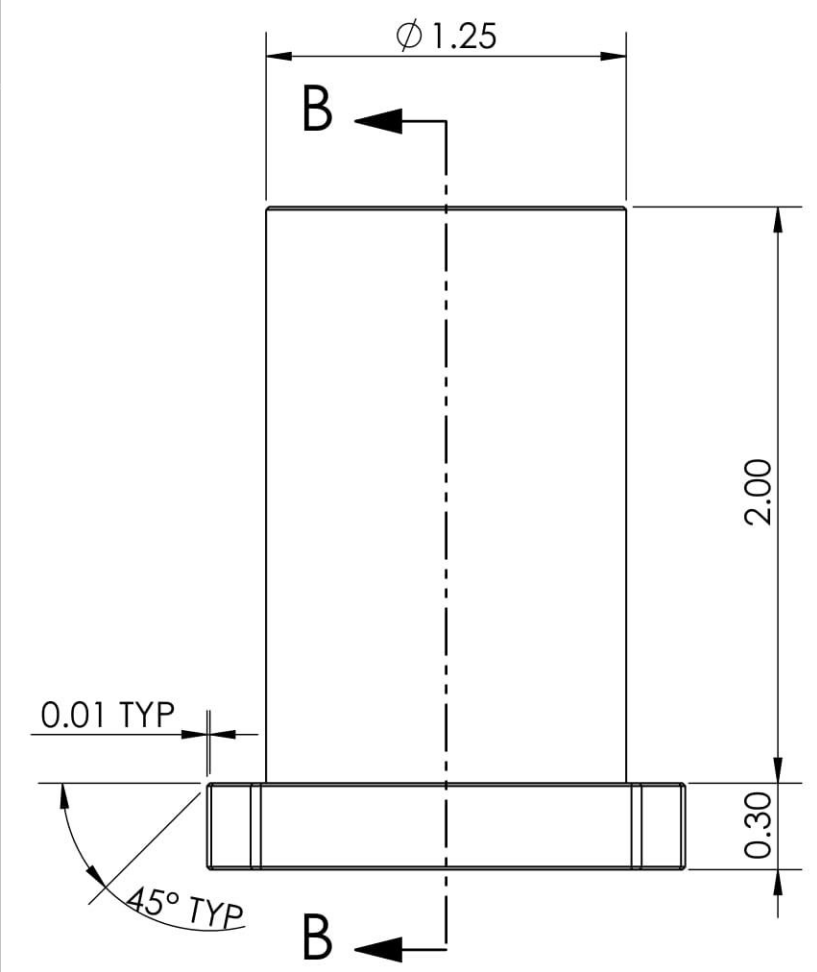
Modified Lid Sampling and Transportation Tool



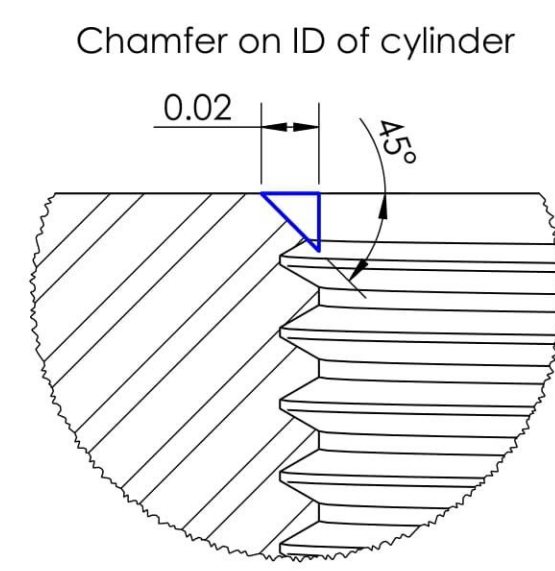
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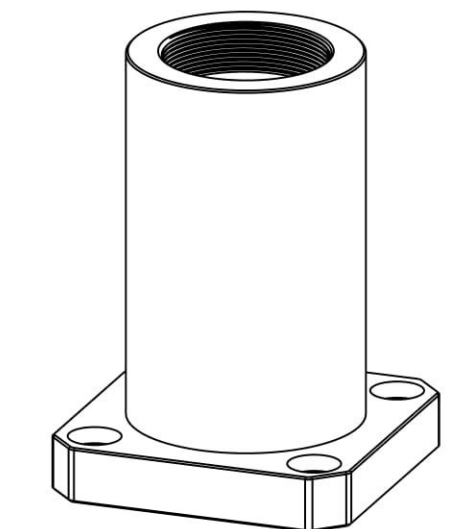
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SECTION B-B
SCALE 3 : 2



DETAIL C
SCALE 15 : 1



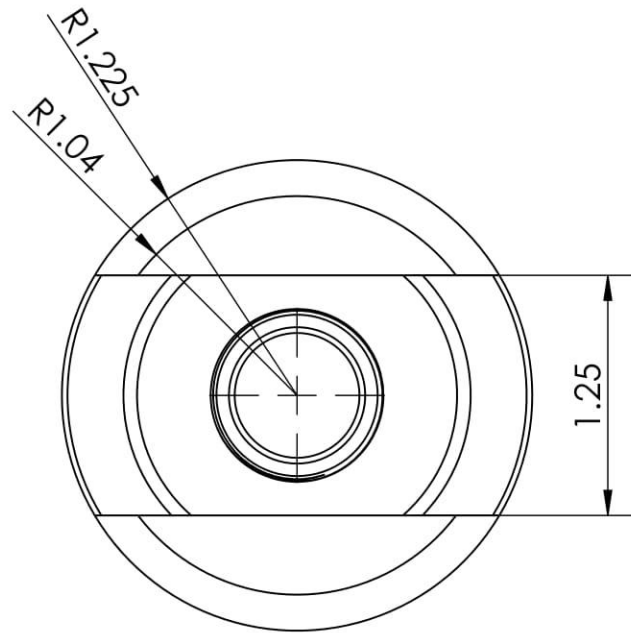
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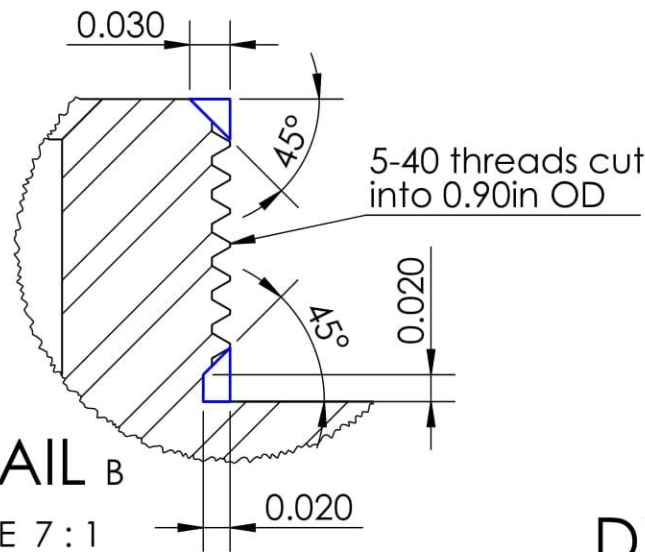
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			CHECKED							
			ENG APPR.							
			MFG APPR.							
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.			SIZE B				
		MATERIAL 304 Stainless Steel	COMMENTS:							
		FINISH As Machined								
E	NEXT ASSY	USED ON				DWG. NO.	1		REV	1
APPLICATION		DO NOT SCALE DRAWING				SCALE: 1:1	WEIGHT:		SHEET 1 OF 1	

B



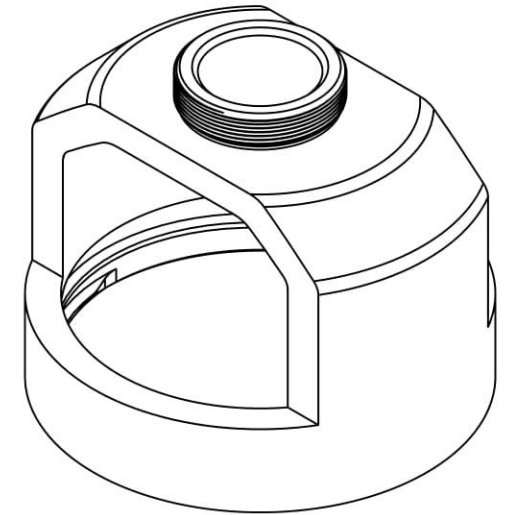
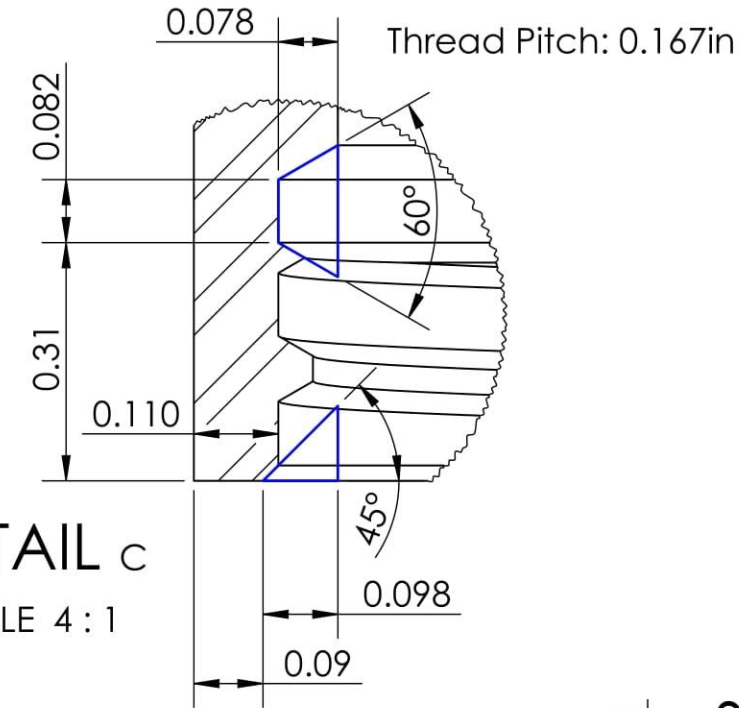
DETAIL B

SCALE 7 : 1



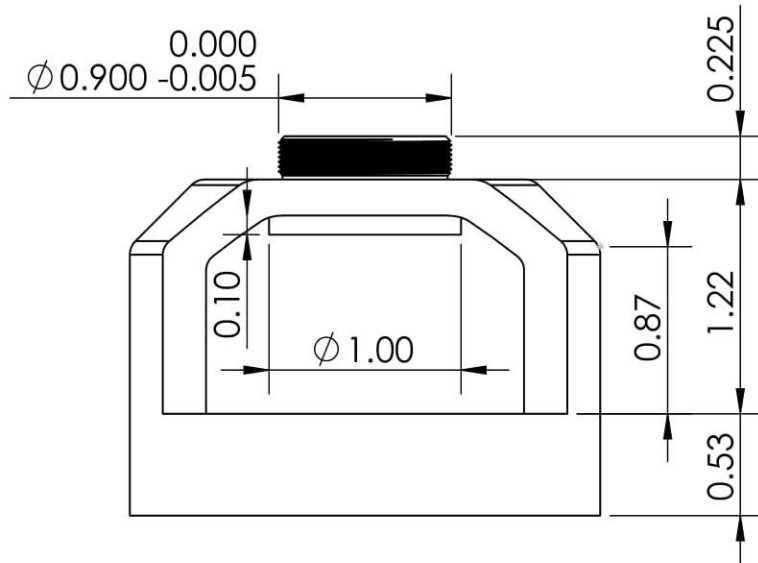
DETAIL C

SCALE 4 : 1

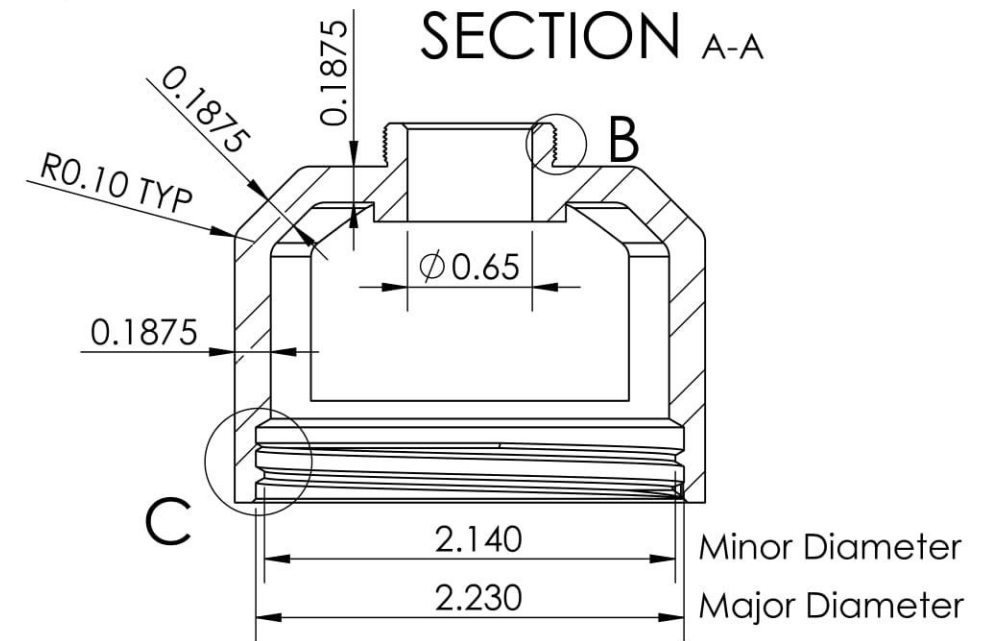
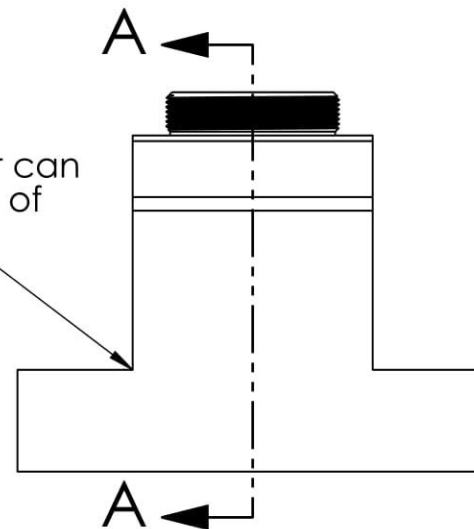


B

A



Interior corner can have a radius of up to 1/8in



A

Full custom thread on ID of part. Thread mates with a glass jar that will be provided for test fitting. Thread fitment has been tested with 3D printed parts but additional changes may be required with the machined version. Solid model has the thread geometry built in.

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			CHECKED						
			ENG APPR.						
			MFG APPR.						
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.			COMMENTS:			
		MATERIAL 304 Stainless Steel							
E	NEXT ASSY	USED ON	FINISH As Machined				SIZE B	DWG. NO. 2	REV 2
APPLICATION		DO NOT SCALE DRAWING					SCALE: 1:1	WEIGHT:	SHEET 1 OF 1

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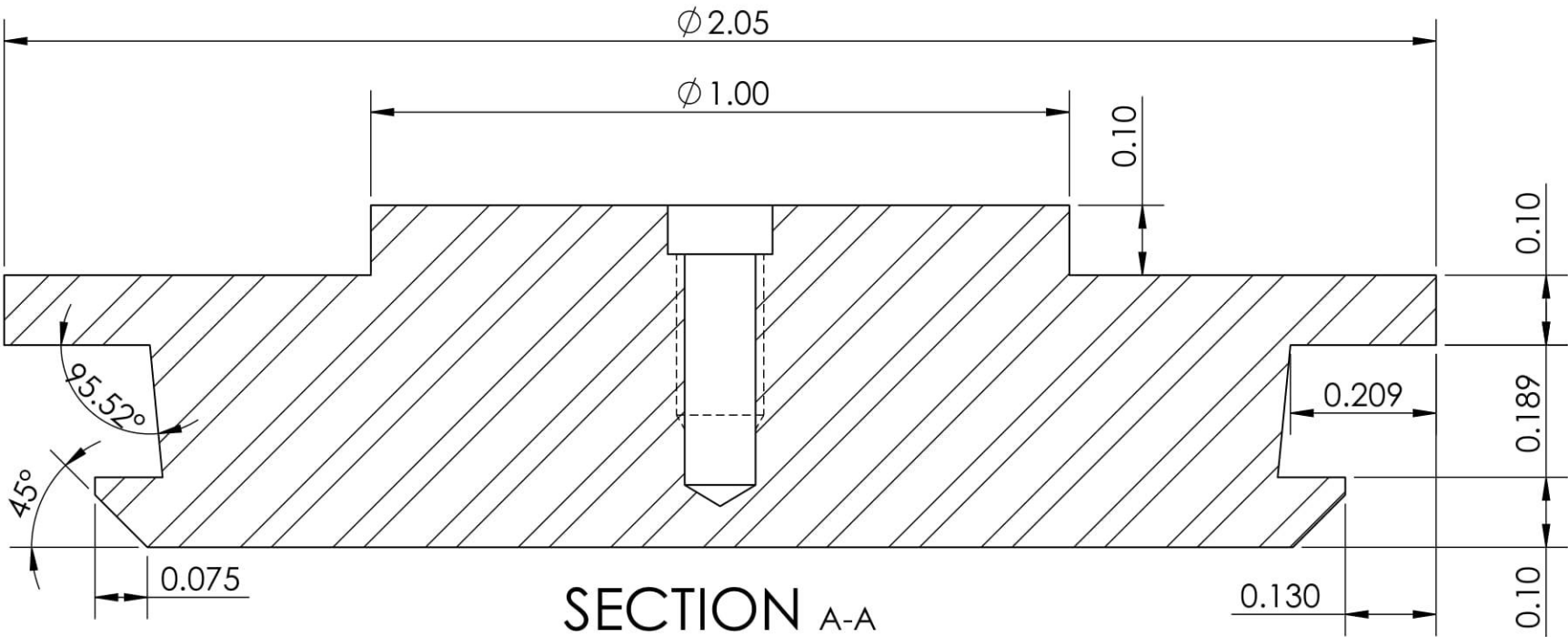
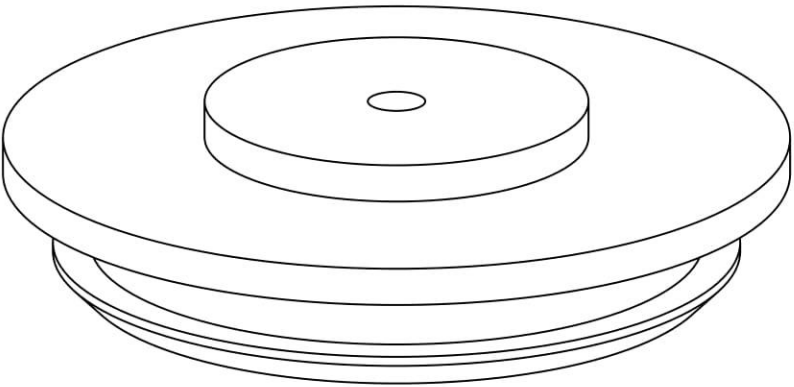
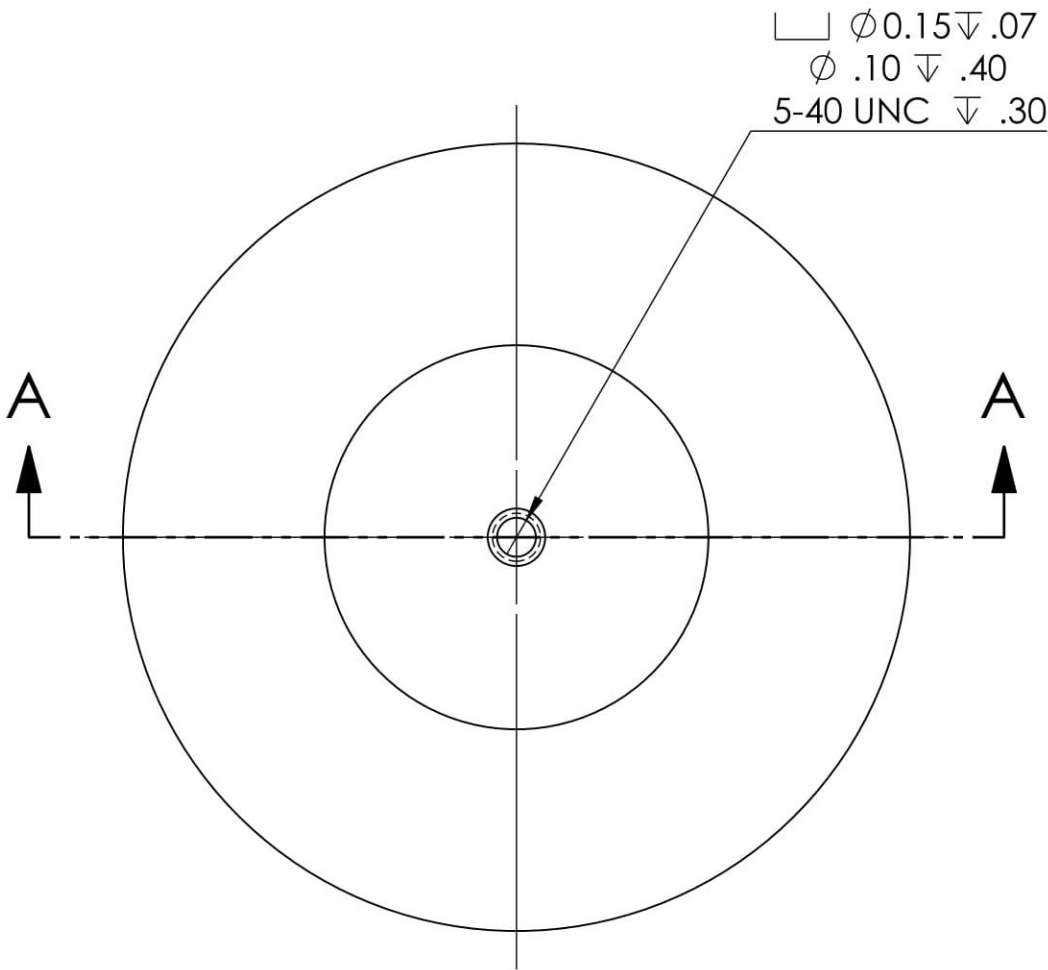
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B

B



SECTION A-A
SCALE 4 : 1

A

A

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NEXT ASSY	USED ON					SCALE: 2:1	WEIGHT:	SHEET 1 OF 1
APPLICATION		DO NOT SCALE DRAWING						

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