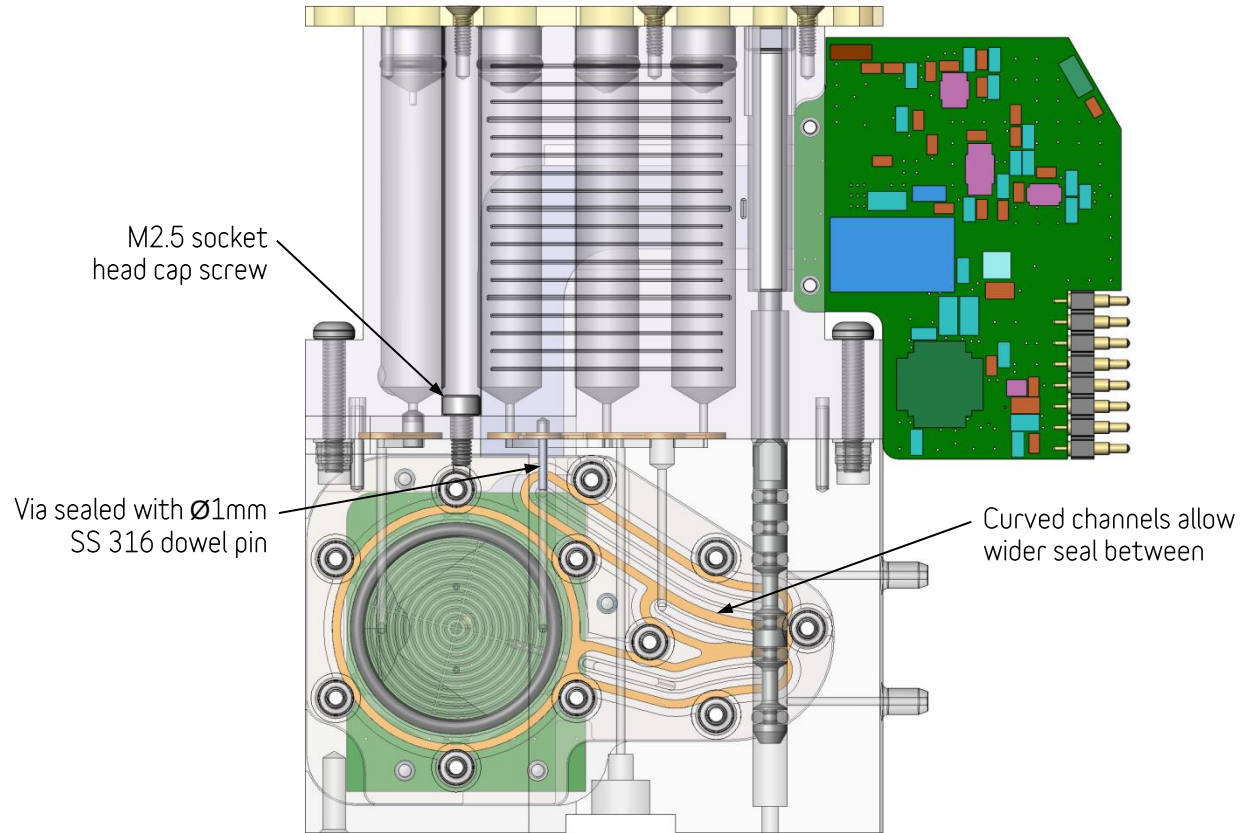


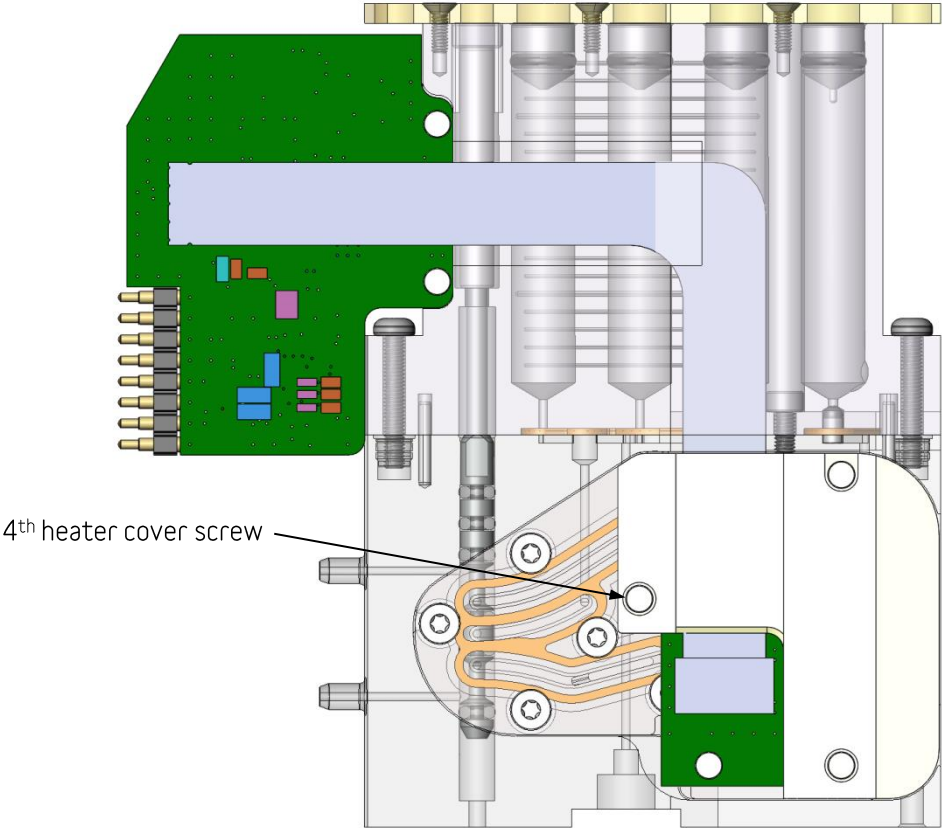


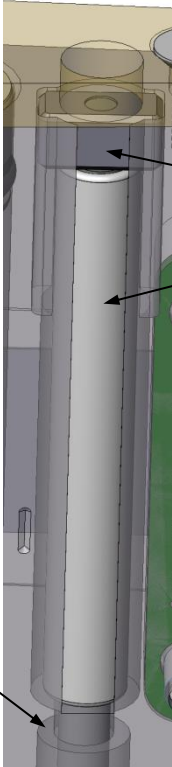
Alpha 3 CAD 2

Nemo

June 23, 2021







Rectangular nut in slot to avoid interference with adjacent cartridge

Longer spring, larger OD → no thickness left for plastic

Move limit stop to assemble longer spring

Valve	wire_dia	ID	l_free	n_coils	rate	max_load	l_solid	l_1	F_1	l_2	F_2	OD
		mm	mm		N/mm	N	mm	mm	N	mm	N	
70243S	0.58	2.59	38.10	31	1.086	13.789	18.00	29	9.88	21.4	18.14	3.75
70384S	0.61	3.35	44.45	27.1	0.753	13.345	16.50	29	11.63	21.4	17.36	4.57

Compression Spring - Cylindrical - Round Wire - 70384S

Material: **Stainless 302** Buckling Constraints: End fixation not known.

Hand: ☒ Optional ☐ Right ☐ Left End Type: ☒ Closed ☒ Ground ☐ User-defined SN data

Grade: ☒ Commercial ☐ Precision Condition: ☐ Preset ☐ Peened ☒ Autoadjust Inactive Coils

Input / Output Scenarios: ☒ Power User ☐ Two Load ☐ One Load ☐ Rate Based ☐ Dimensional ☐ Min. Weight (inputs for these five cases are indicated by green backgrounds)

Note: *Italicized labels indicate optional inputs.*

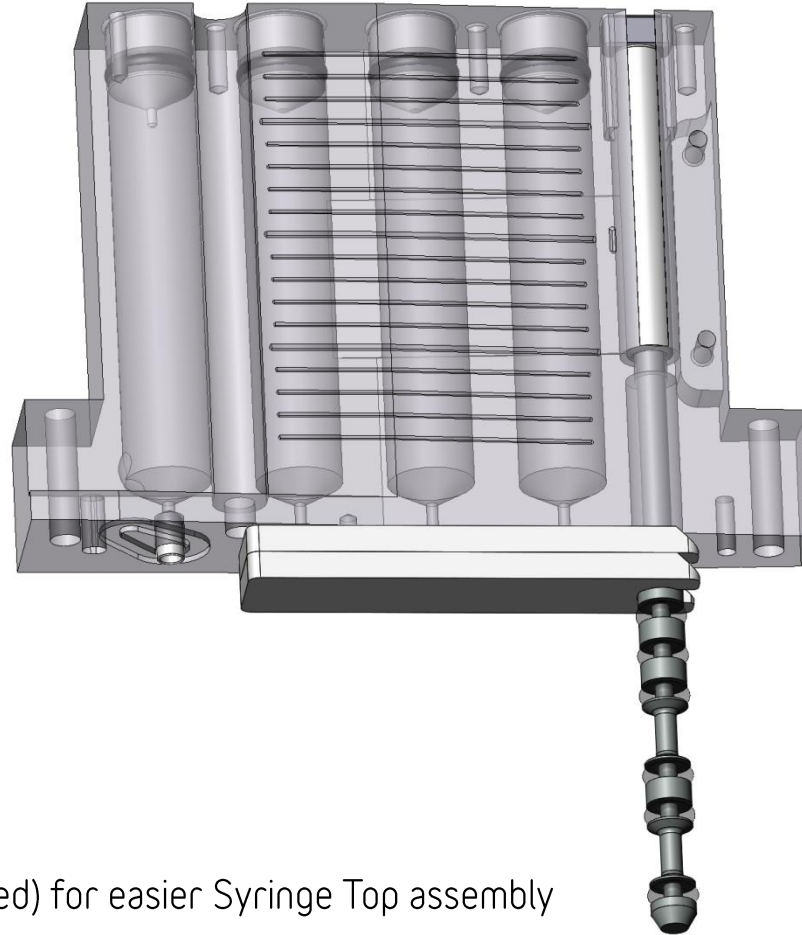
Wire Diameter	0.6100 mm	Arbor Diameter	2.9789 mm	Active Coils	25.100
Wire Dia. Tol (+/-)	0.0102 mm	Coil ID	3.3500 mm	Total Coils	27.100
Wire Length	340.0607 mm	Coil Mean Diameter	3.9600 mm	Dead Coils	0.0000
Wire Weight	0.00079 kg	Coil OD	4.5700 mm	Pitch	1.7223 mm
Minimum Tensile Strength (MTS)	2027 MPa	Coil Dia. Tol (+/-)	0.3048 mm	Pitch Angle	7.8820 deg
Spring Rate	0.7656 N/mm	Min. Coil ID (Free)	3.0452 mm	Free Length Tol (+/-)	2.2791 mm
Spring Index	6.4918	Shaft Diameter		Allowable Solid Length	
Natural Frequency	515 Hz	Hole Diameter			

Wire Available: ☐ No ☒ Next Smaller Wire: 0.6000 ☒ Next Larger Wire: 0.6500 ☐ Estimated Cycle Life: No data

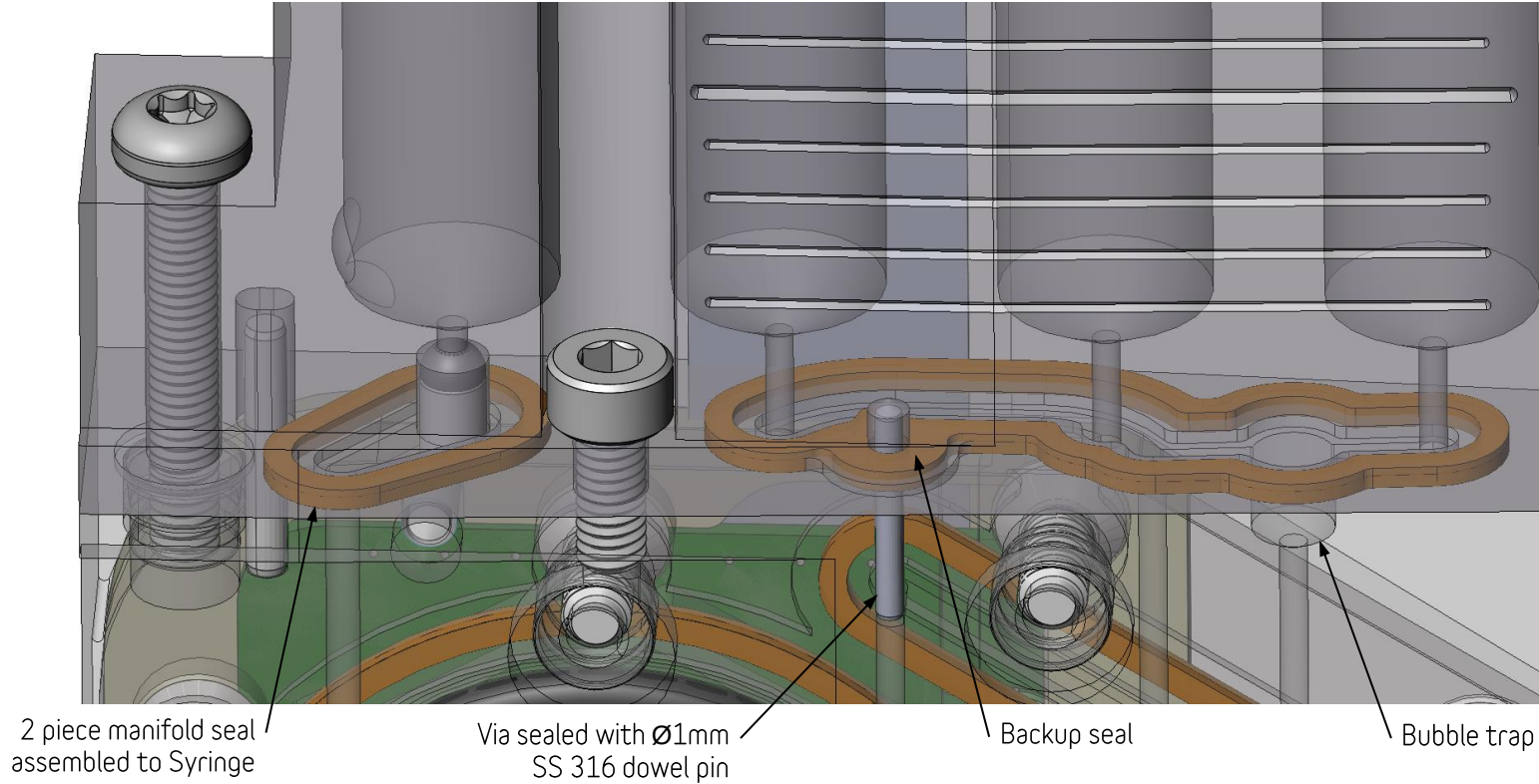
	Free	Minimum Cycle Load	Maximum Cycle Load	Other Load	At Solid	At Buckle
Load	0	11.828	17.647		21.374	N
Load Tolerance (+/-)	0	2.0287	2.1684			N
Length	44.4500	29.0000	21.4000		16.5310	mm
Deflection	0	15.4500	23.0500		27.9190	mm
% of Max. Deflection	0	55.3	82.6		100	
Corrected Stress	0	647	965		1169	MPa
Corrected % of MTS	0	31.9	47.6		57.7	
Uncorrected Stress	0	525	784		950	MPa
Uncorrected % of MTS	0	25.9224	38.6739		46.8432	
Expanded Coil OD		4.9056	4.9193		4.9275	mm



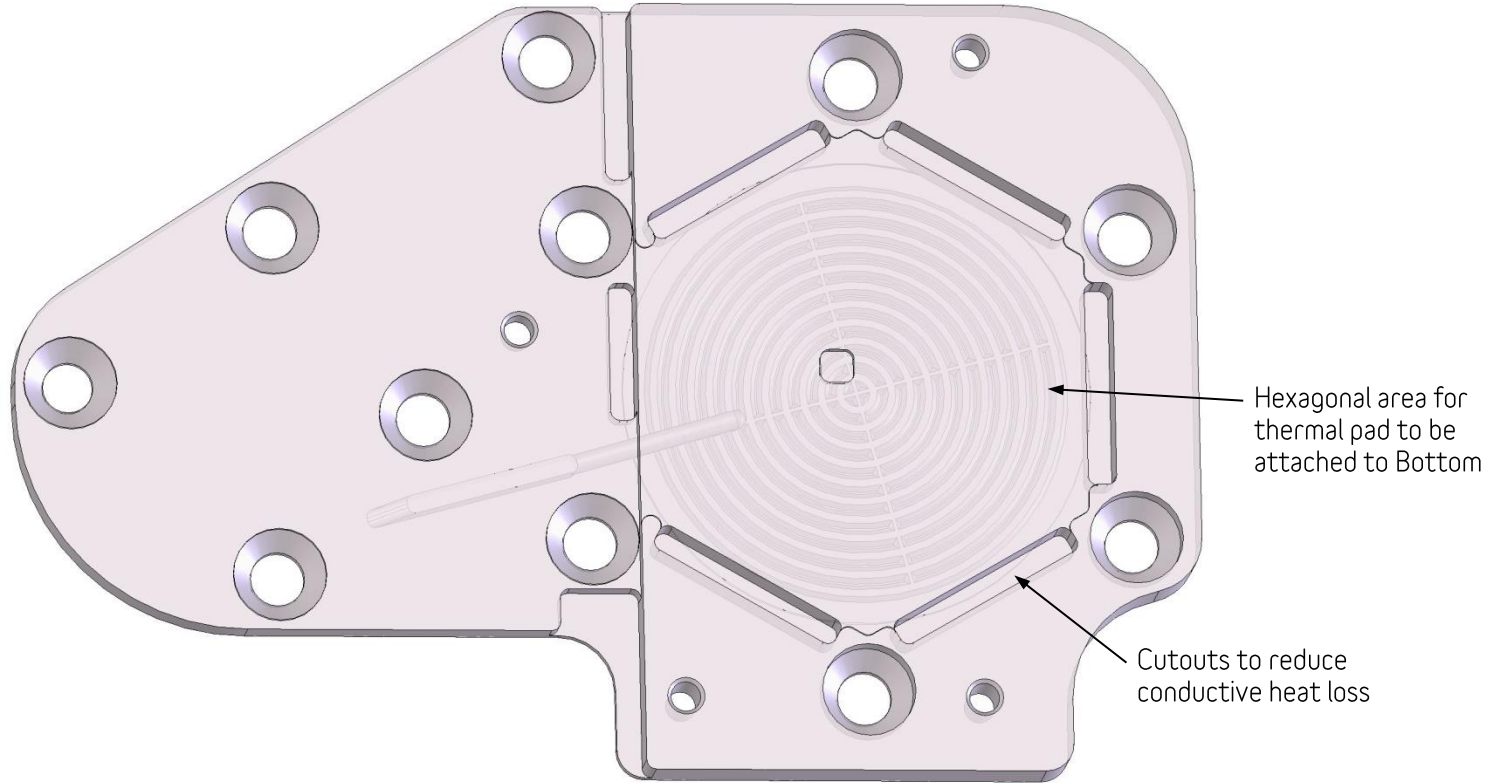
- Longer spring provides 1.2X return force at minimum compression



- 3mm wrenches (3D printed) for easier Syringe Top assembly



- 0.50mm gland height (vs. 0.79mm seal)



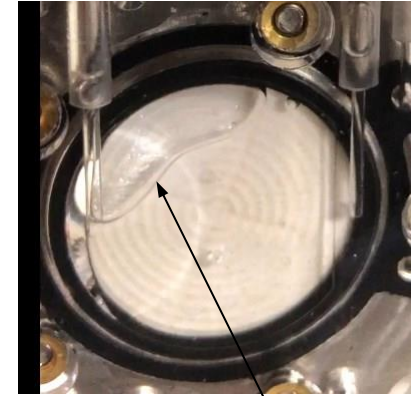
- Cutouts reduce conductive heat loss out of the puck area

Alpha 3 CAD 2

Cartridge



0.50mm gland height (vs. 0.79mm seal)



21° ramp vs. pitch at worst case bubble locations

-10° roll, +30 pitch bubble location

32° cone with circular exit at the top

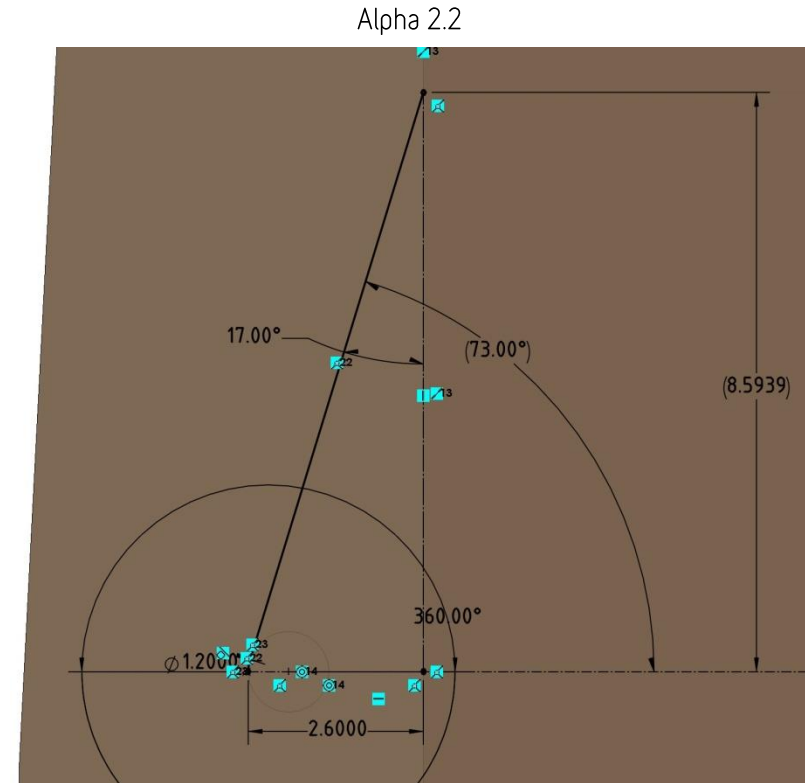
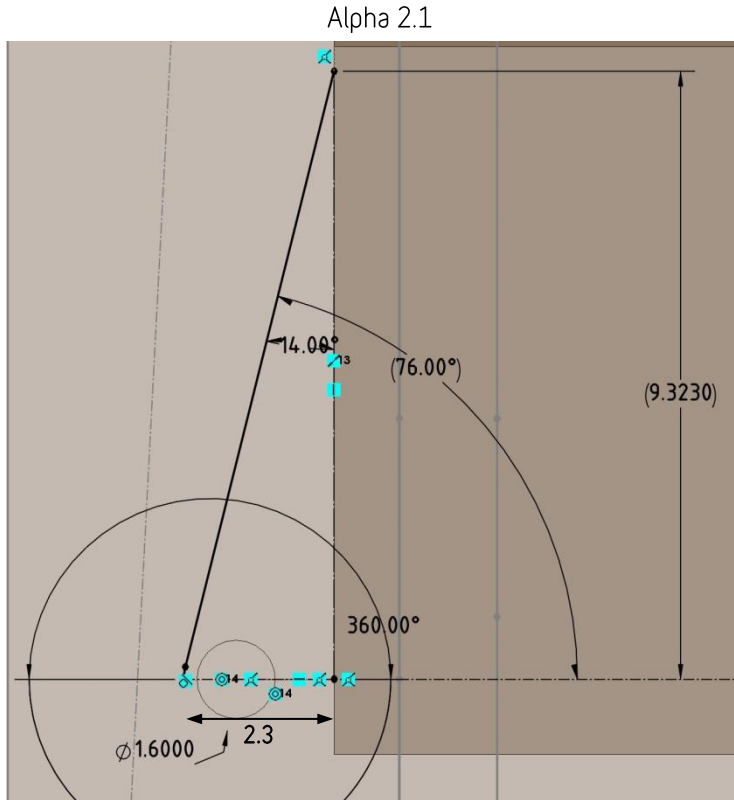
Cutouts reduce contact area for heat loss

- 21° ramp only where we expect a worst case bubble, almost full puck height
- What should the puck volume be adjusted to?

	puck volume
LnG0	918 mm ³
Alpha 2.1	1,023 mm ³
Alpha 2.2	931 mm ³



Alpha 2.1 vs. 2.2 Puck Cone



- Slightly larger radius cone (more puck area covered) for Alpha 2.1 may be the reason for better success at high pitch angles