



Alpha Design 1

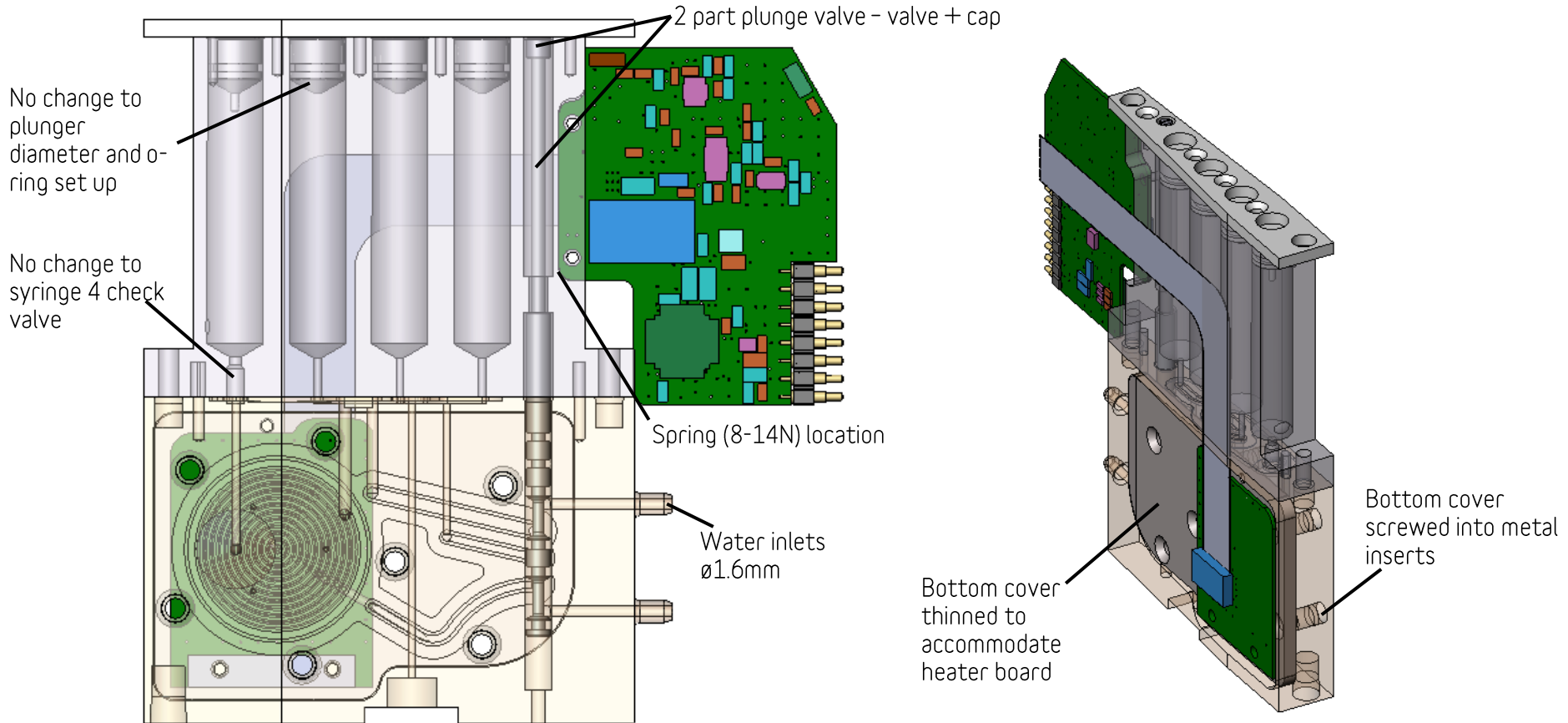
Nemo

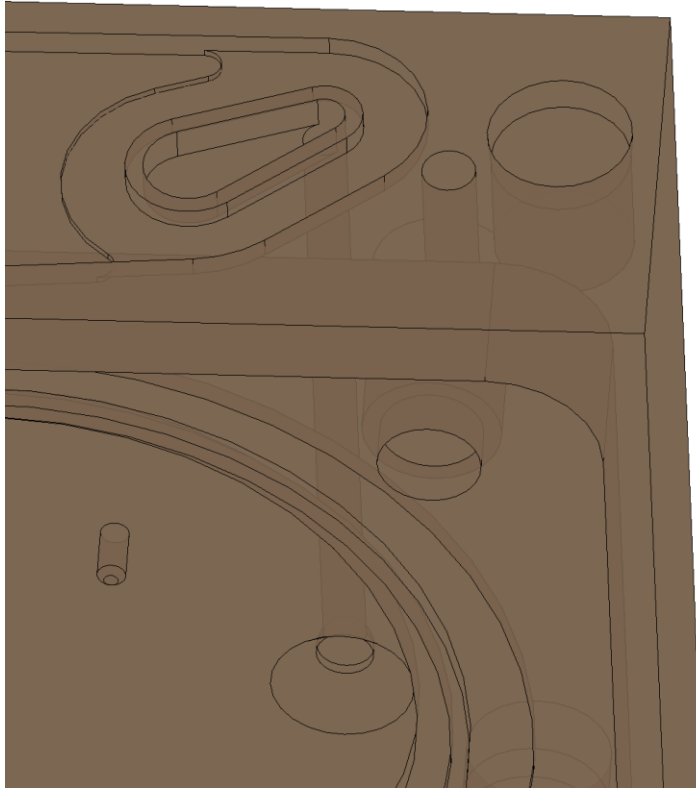
March 12, 2020



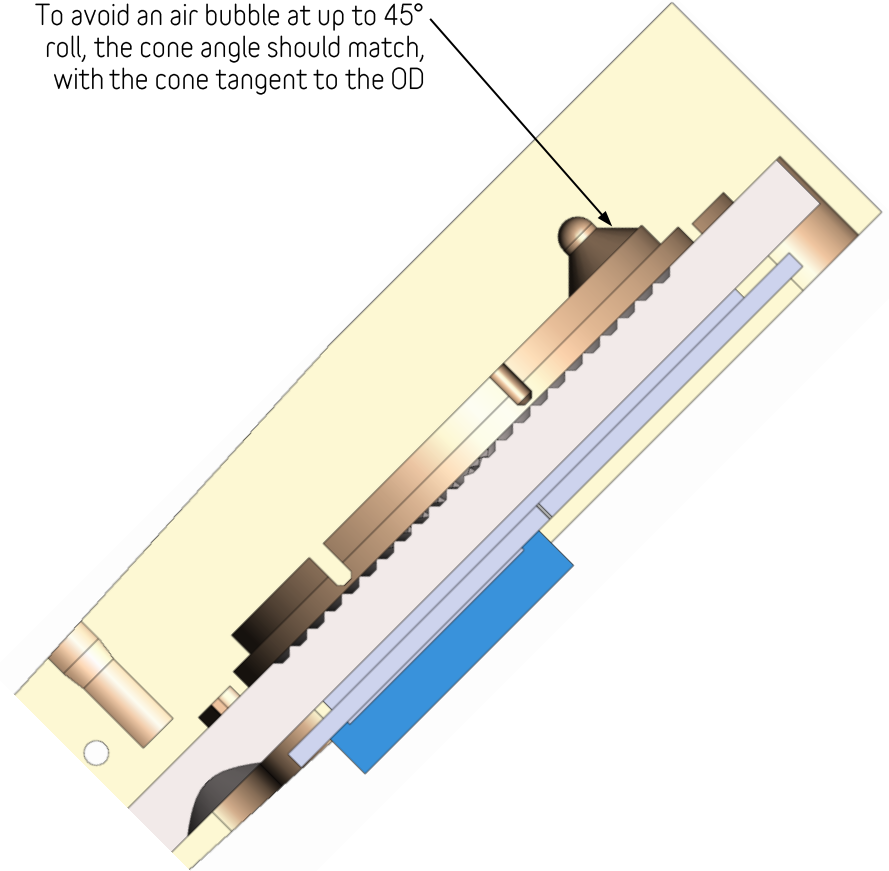
Overview

- Revisited concept LnG4 after MBARI feedback
 - Plunge valve vacuum seal
 - Add Syringe 1, magnetic plunger for now, MBARI will remove magnet in test fixture
- Detailed CAD layout (LnG 4)
 - Plunge valve spring layout
 - Add heater board
 - Assembly Plan
- Test Bed Changes
- Open Issues
 - Heater board attachment features
 - Cartridge locating features
 - Material Choice
- Preliminary BOM study





To avoid an air bubble at up to 45° roll, the cone angle should match, with the cone tangent to the OD

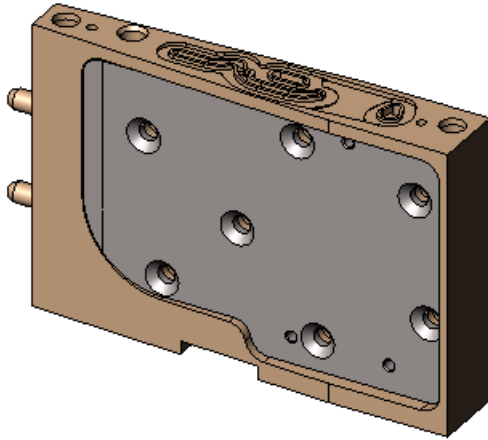


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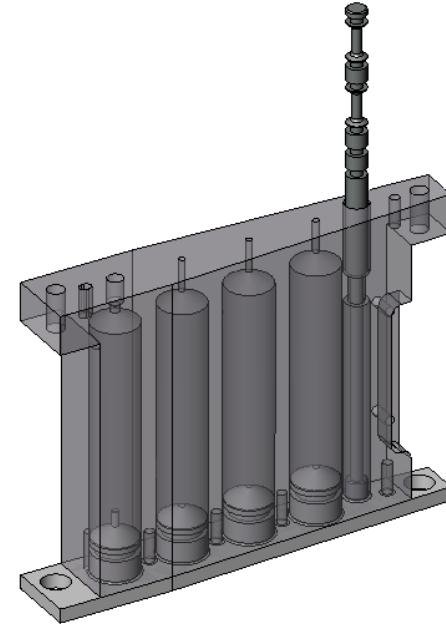
Installation Procedure



1. Assemble Cartridge, o ring, filter, gaskets and bottom cover



2. Assemble o-rings onto (plunge) Valve and plungers
3. Insert plungers, spring, and Valve into Syringe. Screw on Valve Cap to Valve. Attach Syringe Top with screws
4. Turn upside-down and fill syringes
5. Insert S4 check valve ball and spring

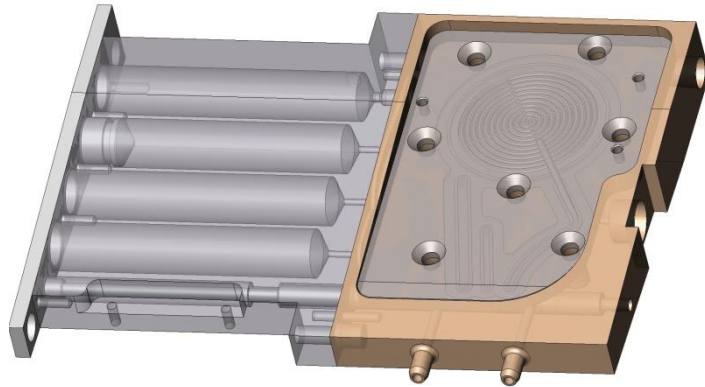


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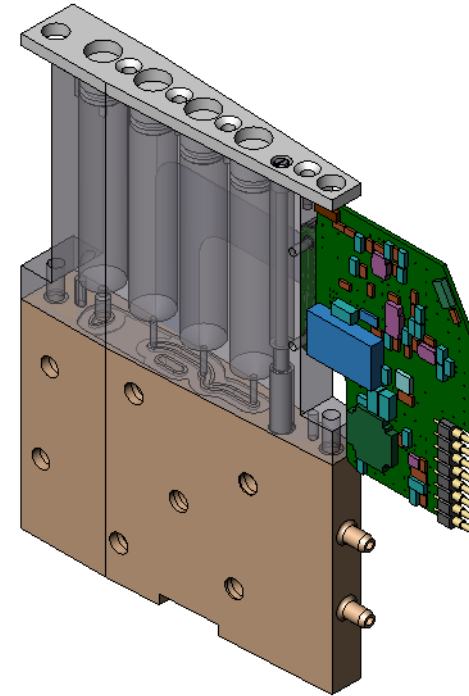
Installation Procedure

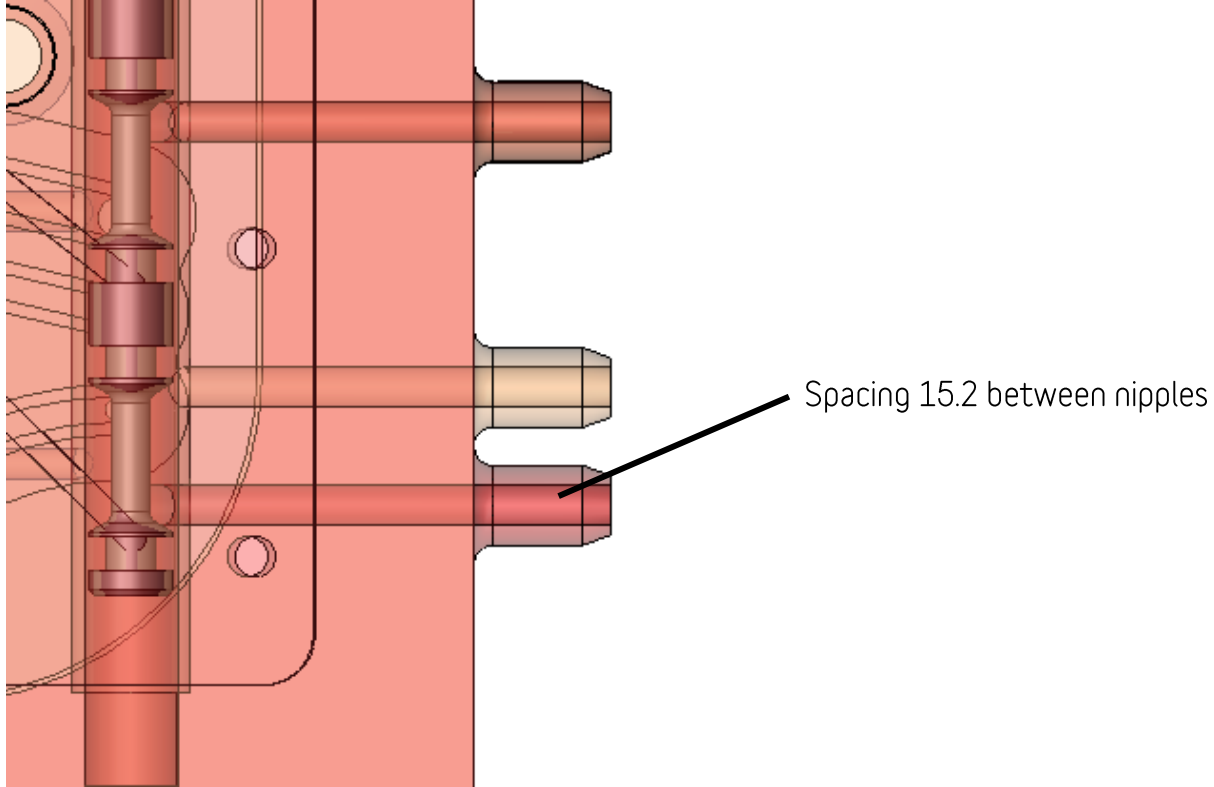


6. Assemble Cartridge and Syringe subassemblies horizontally (so check valve and manifold gasket do not fall out)



7. Attach PCBs



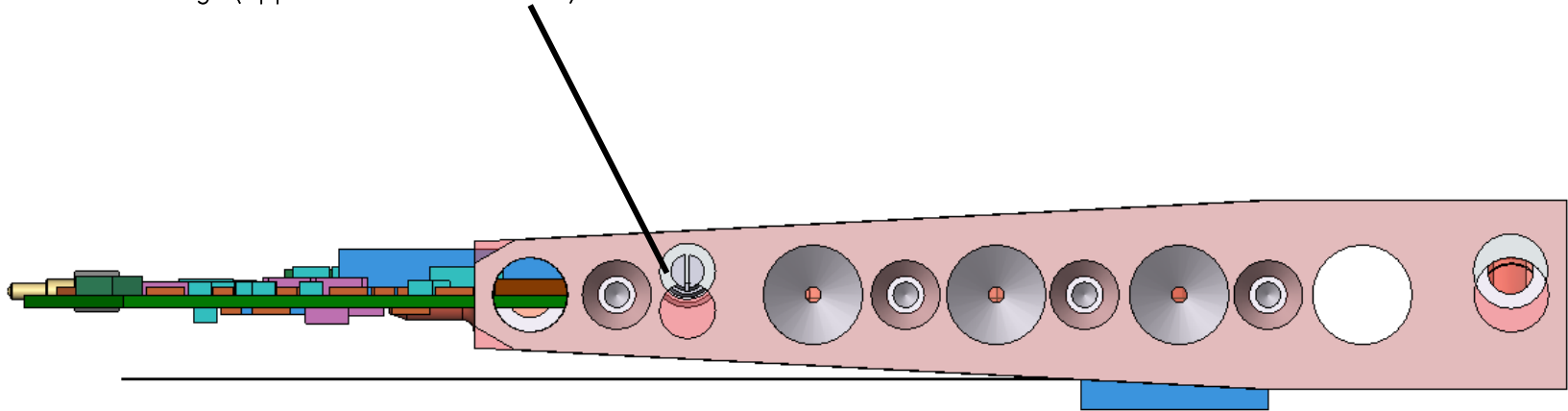


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Test Bed Changes - Actuator



Plunger valve actuator hole shifted 2.5mm towards front of cartridge (opposite of heater board)

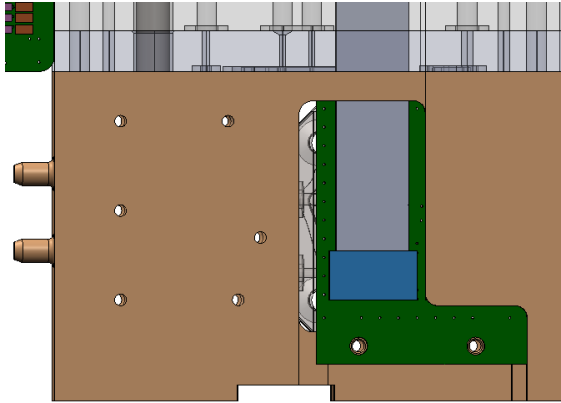


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Open - Heater Plate Attachment Plan

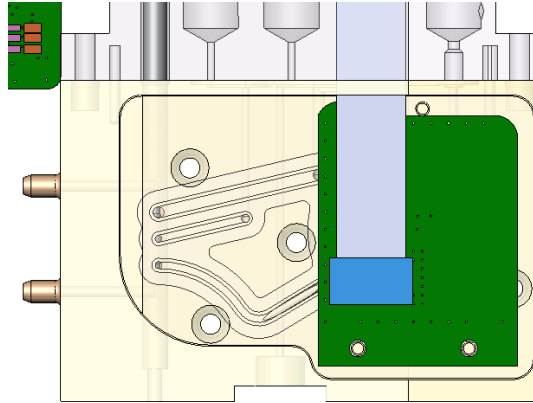


Current LnG



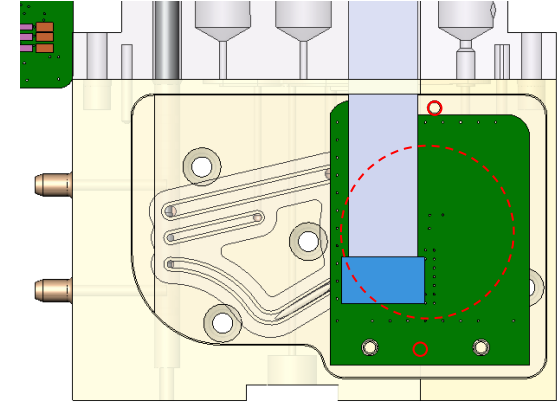
- Board slides into pocket, screwed on bottom with 2 screws

LnG 5 Alpha 1



- Board attached to Bottom with 3 wafer head screws
- Limited clearance for head height, especially with wedge shape

LnG 5 Long Term



Limited head height
due to wedge shape

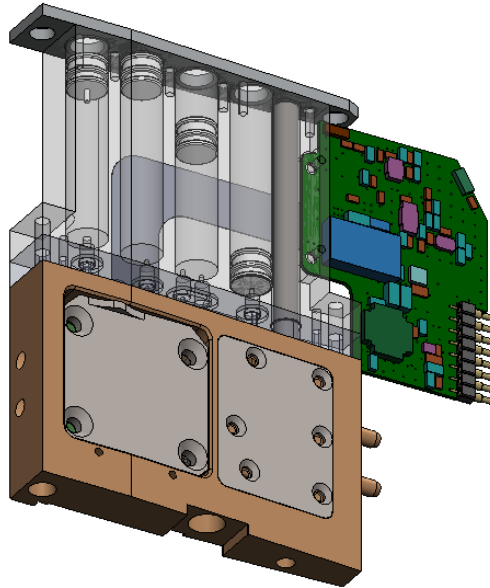
- Change heater board to have 2 screws on opposite sides of the puck?

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Open - Cartridge Locating Plan

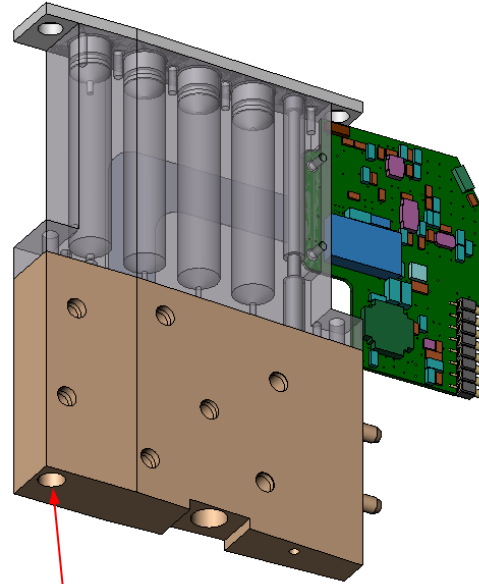


Current LnG



- Lower distal thread insert
- Syringe 1 actuator is extended
- Syringe top chamfers wedged in?

LnG 5 Alpha 1



- Tapped hole 6-32

LnG 5 Long Term

?

- Quick release?

Alpha Design 1

Open - Material Choice



Part	Current LnG	LnG 5 Alpha 1	LnG 5 POR
Syringe Top	Ti?	Ti (grade 2), PEEK	PEEK?
Syringe Block	Clear PC	Clear PC	Clear PC
Cartridge	PEEK	PEEK, clear vapor-polished? PC	PEEK
Plungers	PEEK w/ thread inserts (SS 440 material?)	Ni coated 17-4 SS, can also reuse LnG0 plungers if needed	Overmolded? Ni coated 17-4 SS?
Plunge Valve	Ti (grade 2)	Ti (grade 2)	Ti (grade 2)
Bottom Cover	Ti (grade 2)	Ti (grade 2), Ni coated Al, 316? (chemical testing on 2G, thermal testing), new cartridge for thermocouples	Ni coated Al?

Alpha Design 1

LnG 5 BOM Cost Reduction



1. Eliminated (\$240)

- Cartridge Wedge Piece (PC)
- Puck Top - L&G (Ti)
- Manifold Plate (Ti)

2. Injection Mold in production (\$300→\$20?)

- Syringe piece (PC)
- Cartridge Bottom (PEEK)

3. Nickel plated aluminum, SS, or other not Ti (\$260 →\$?)

- Top Plate
- Puck Bottom
- Flat Bottom Plunger
- Bossed Plunger
- Metal Plunger Insert
- Plunge Valve
- Valve Cap (add part)
- ME parts \$840→\$300, almost 1/3, plus any further reduction from 3

	per cartridge cost
Top Plate	\$ 25.33
Syringe piece--polycarb	\$ 127.22
Cartridge bottom--PEEK	\$ 191.23
Cartridge wedge piece--polycarb	\$ 59.14
Puck bottom	\$ 158.81
Puck top--L&G	\$ 127.71
puck spacer (2mm OR 1.8mm)	\$ 2.74
flat-bottomed plungers	\$ 14.55
bossed plunger	\$ 6.45
metal plunger insert	\$ 23.60
manifold plate	\$ 54.75
plunge valve	\$ 25.62
Assemble plunger inserts	\$ 4.76
M 2x6mm SS Screws	\$ 4.00
M4 X 0.7 Thread, 4mm Set Screws, Soft Nylon-Tip	\$ 4.60
M 2.5x16mm SS(316) Screws (for cartridge halves)	\$ 0.84
M3x8mm Screws (for pucks)	\$ 0.48
1/16 x 1/2 18-8 SS Dowel Pins	\$ 4.40
1x2mm EPDM o-ring (side of puck top)	\$ 0.01
1x2.5mm EPDM o-ring (wedge, syringe 1 w/cart bottom)	\$ 0.04
1x3 mm 70 EPDM O-ring (plunge valve & puck side)	\$ 0.08
1x4mm 70 EPDM o-ring (wedge, syringe 1,3,4 & cart top)	\$ 0.03
1X6 70 EPDM o-ring (plunger o-rings; wedge, syringe 4 & cart Bottom)	\$ 0.05
1x12 mm 70 EPDM O-ring (manifold plate)	\$ 0.05
1x15mm 70 EPDM O-ring (wedge and cart bottom)	\$ 0.02
1x16mm 70 EPDM O-ring (manifold plate)	\$ 0.03
1X25mm EPDM 70 A (puck o-ring)	\$ 0.16
Compression Spring 9.95 lbs/in	\$ 0.45
Compression Spring 3.99 lb/in	\$ 0.22
Check valve ball, 3/32", EPDM	\$ 1.00
Duckbill washer 316 stainless--0.109 x 0.05 x 0.01/0.02	\$ 0.18
Duckbill valve	\$ 1.60
mechanical	\$ 840
Pin-port insert	\$ 4.00
Cartridge controller board	\$ 103.42
Flex-connector	\$ 58.49
cartridge heater board	\$ 85.75
M2x6mm nickel wafer head mounting screws	\$ 1.32
electrical	\$ 253
total	\$ 1,093



Next Steps

- Integrate any feedback
 - Move both top syringe through holes back
 - Tap 6-32 bottom thread
 - Chamfer top syringe
- Add fasteners, gaskets, inserts, remaining details
- Ask about insert material
- Thermal tabulation
- Decide upon quantity (x2), decide on materials check SC4 EN plate
- Contact vendors to verify availability in case of coronavirus disruption ask