Concept Generation

1.1 Concept Generation Tools

The group held brainstorming sessions to generate 100 possible design concepts to achieve the project goals, that can be found in Appendix D. To get all the ideas, the group used a variety of concept generation methods. These methods include the morphological chart, crapshoot, and biomimicry.

The morphological chart was the main method used by the team, generating 50 different concepts. This chart lists design solutions for each different function and concepts can be selected by selecting one solution from each column. The functions used in this chart were "locking" and "valve-opening." We researched possible lock and valve solutions, some of which included a spring-loaded connection, force-held lock, globe valve, single and double poppet valve, and more. All 50 concepts derived from the morphological chart were paired with a double vacuum wall insulation scheme and encapsulated seals.

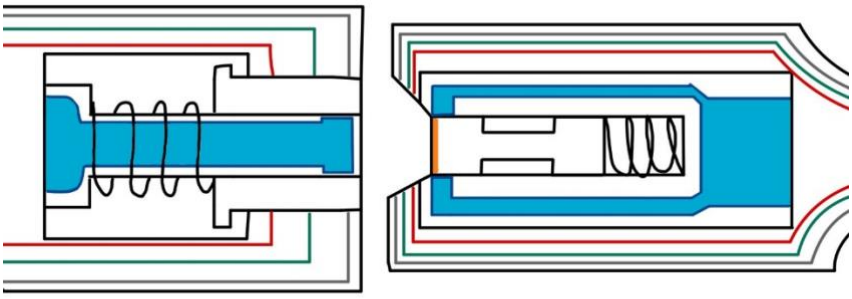
The crapshoot method was also employed to generate a large number of different concepts. This method involved the team writing down or sketching out any ideas that came to mind. Team members then discussed the ideas and refined them to come up with suitable design concepts.

Another method used by the team to generate multiple different concepts was biomimicry. The group gathered inspiration from nature, such as implementing a mechanism that "blooms" like a flower as both a locking and valve-opening solution.

1.2 High Fidelity Concept Analysis

Concept #33: Force held lock with double poppet valve, encapsulated O-ring seals, double vacuum wall and MLI.

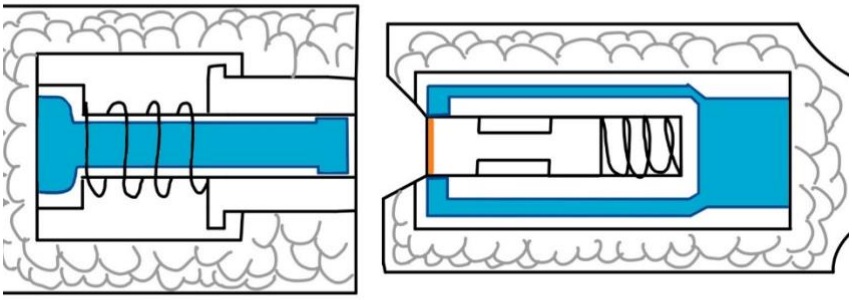
In this design, the two halves are held together through force instead of a mechanized locking with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include encapsulated O-ring seals to prevent leaks, as well as a double vacuum wall and Multi-Layer Insulation (MLI) to protect from heat transfer.



Force held lock with double poppet value, encapsulated o-ring seals, double vacuum wall with MLI

Concept #98: Force held lock with double poppet valve, encapsulated O-ring seals, double vacuum wall and SOFI.

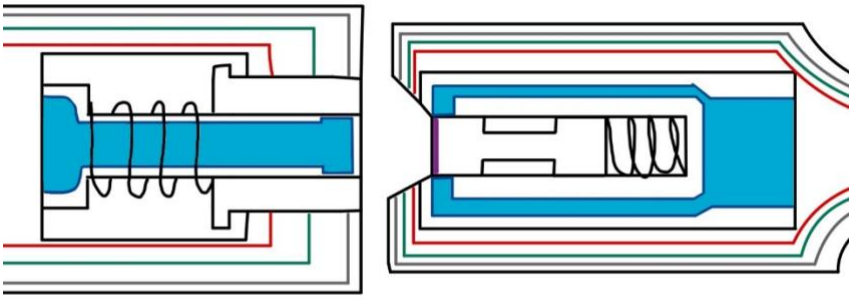
In this design, the two halves are held together through force instead of a mechanized locking with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include encapsulated O-ring seals to prevent leaks, as well as a double-wall vacuum and Spray-On Foam Insulation (SOFI) to protect from heat transfer.



Force held lock with double poppet value, encapsulated o-ring seals, double vacuum wall with SOFI

Concept #100: Force held lock with double poppet valve, Teflon seals, double vacuum wall and MLI.

In this design, the two halves are held together through force instead of a mechanized locking with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include PTFE (Teflon) seals to prevent leaks, as well as a double vacuum wall and Multi-Layer Insulation (MLI) to protect from heat transfer.

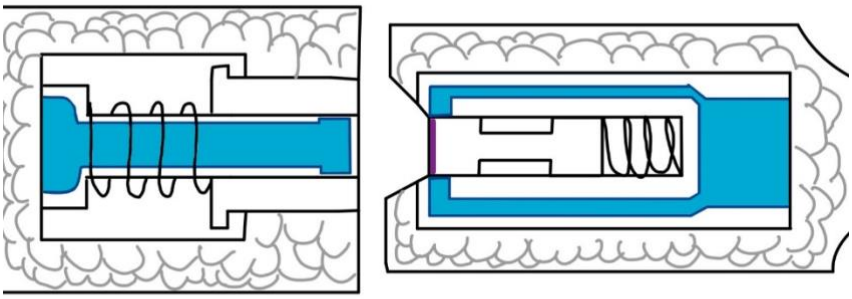


Force held lock with double poppet value, Teflon seals, double vacuum wall with MLI

1.5.3 Medium Fidelity Concept Analysis

Concept #99: Force held lock with double poppet valve, Teflon seals, double vacuum wall and SOFI.

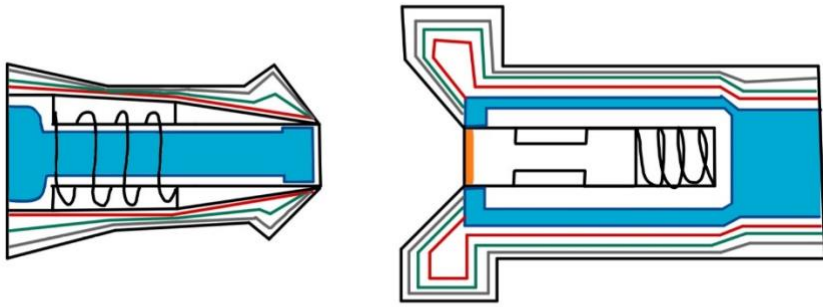
In this design, the two halves are held together through force instead of a mechanized locking with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include PTFE (Teflon) seals to prevent leaks, as well as a double vacuum wall and Spray-On Foam Insulation (SOFI) to protect from heat transfer.



Force held lock with double poppet value, Teflon seals, double vacuum wall with SOFI

Concept #82: Collet lock with double poppet valve, encapsulated O-ring seals, double vacuum and MLI.

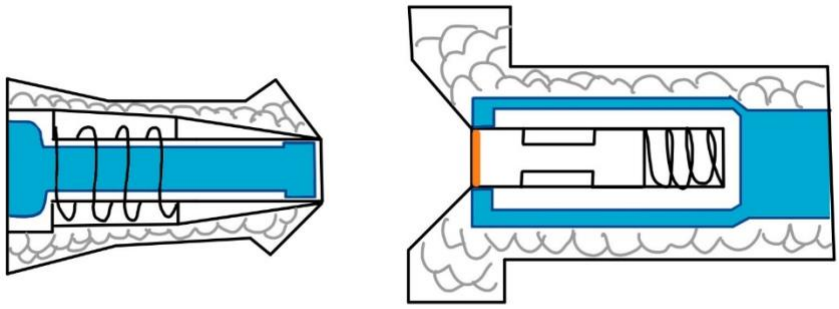
In this design, the two halves are held together using a collet locking mechanism with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include encapsulated O-ring seals to prevent leaks, as well as a double vacuum wall and Multi-Layer Insulation (MLI) to protect from heat transfer.



Collet lock with double poppet value, encapsulated o-ring seals, double vacuum wall with MLI

Concept #81: Collet lock with double poppet valve, encapsulated O-ring seals, double vacuum and SOFI,

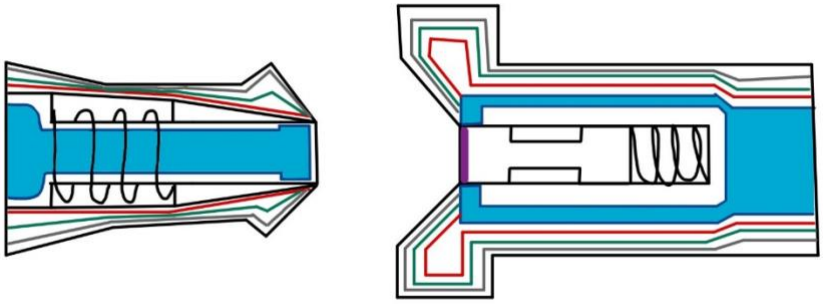
In this design, the two halves are held together using a collet locking mechanism with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include encapsulated O-ring seals to prevent leaks, as well as a double vacuum wall and Spray-On Foam Insulation (SOFI) to protect from heat transfer.



Collet lock with double poppet value, encapsulated o-ring seals, double vacuum wall with SOFI

Concept #80: Collet lock with double poppet valve, Teflon seals, double vacuum and MLI.

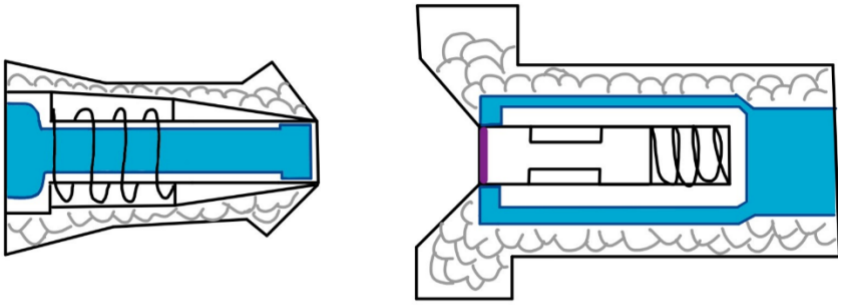
In this design, the two halves are held together using a collet locking mechanism with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include PTFE (Teflon) seals to prevent leaks, as well as a double vacuum wall and Multi-Layer Insulation (MLI) to protect from heat transfer.



Collet lock with double poppet value, Teflon seals, double vacuum wall with MLI

Concept #79: Collet lock with double poppet valve, Teflon seals, double vacuum and SOFI.

In this design, the two halves are held together using a collet locking mechanism with a valve that has two spring-loaded poppets that compress and allow for flow. This design will also include PTFE (Teflon) seals to prevent leaks, as well as a double vacuum wall and Spray-On Foam Insulation (SOFI) to protect from heat transfer.



Collet lock with double poppet value, Teflon seals, double vacuum wall with SOFI