

Reusable Cryogenic Connector

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FAMU-FSU
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Team 513



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Systems
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Joshua Leary

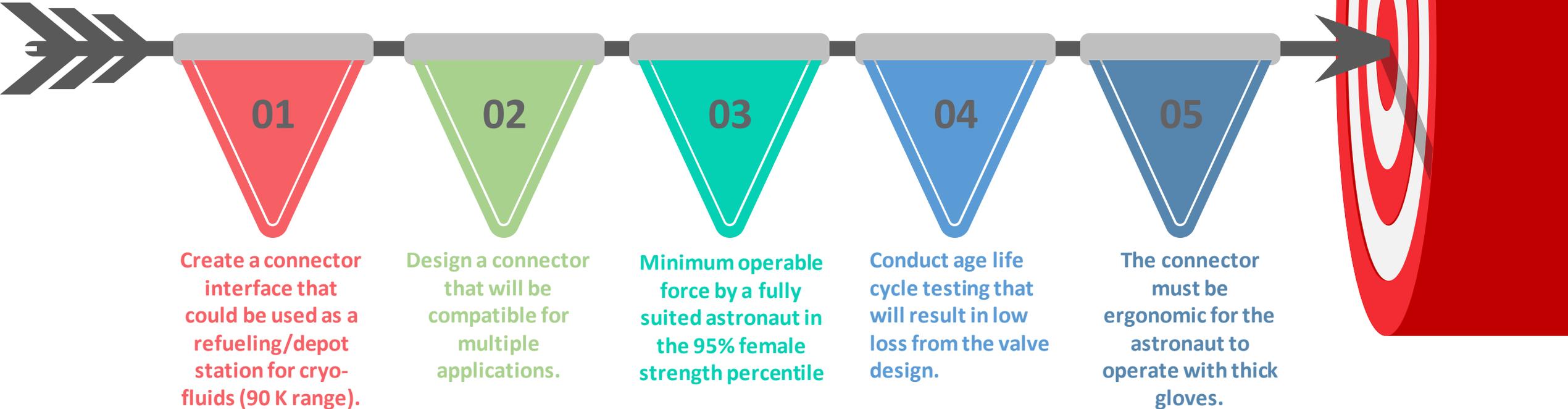
Objective



To design, build, and test a cryogenic connector interface and conduct life cycle testing with a focus on the seal/joint design.

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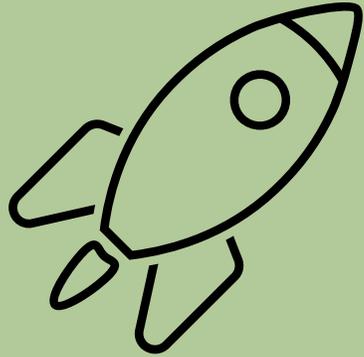
Key Goals



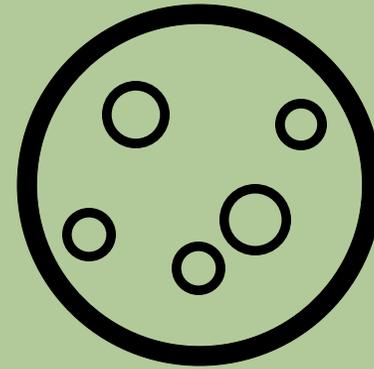
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Targets and Metrics

Critical Targets

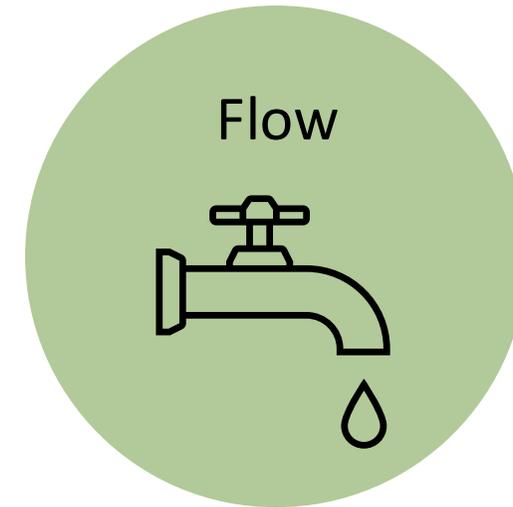
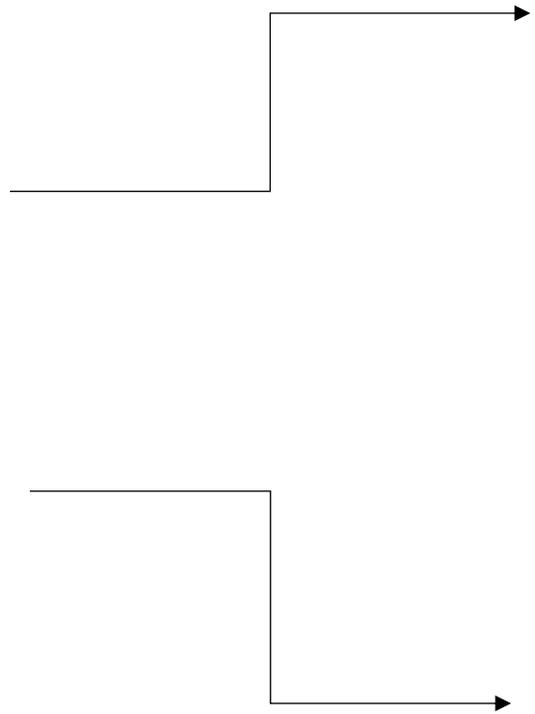


Secondary Targets



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Targets and Metrics



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Targets and Metrics



2.57 cm – 3 cm



< 48 N



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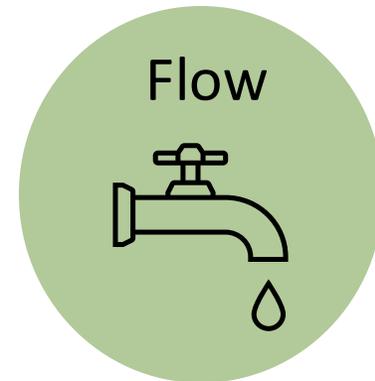
Targets and Metrics



0.1 in³/min

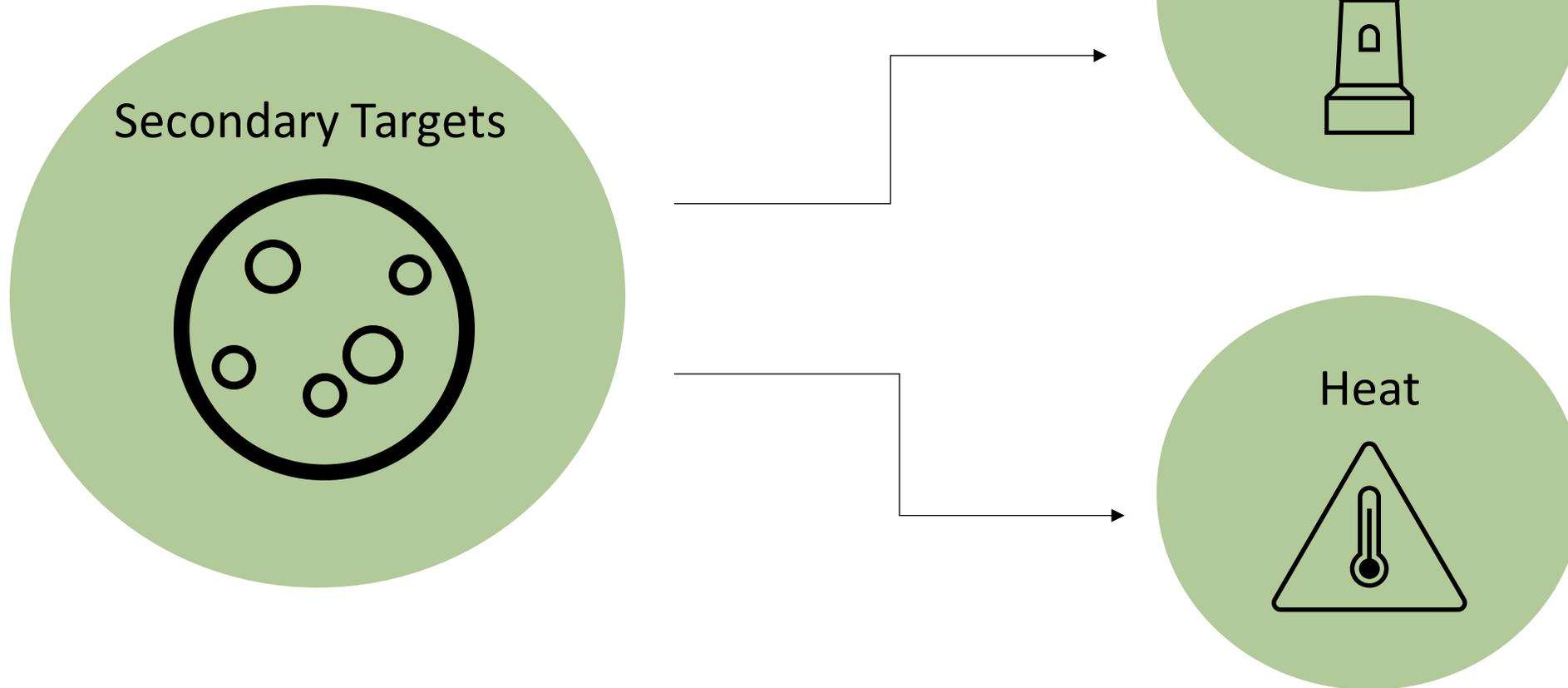


0.001 in³/min



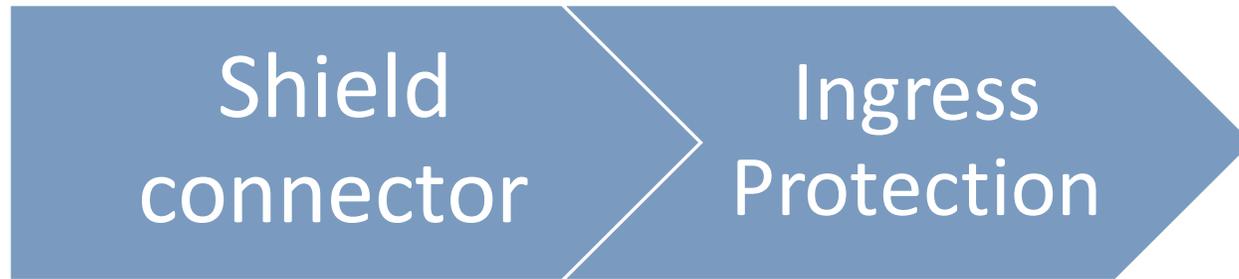
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Targets and Metrics



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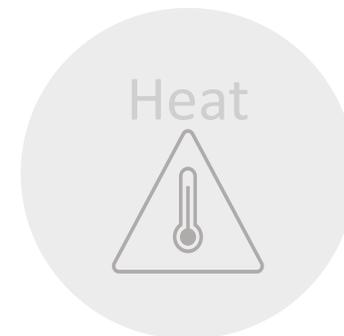
Targets and Metrics



IP64



500 MPa



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Targets and Metrics

Regulate thermal expansion

Expansion difference

0 mm

Protection



Control fluid dynamics

Boil off rate

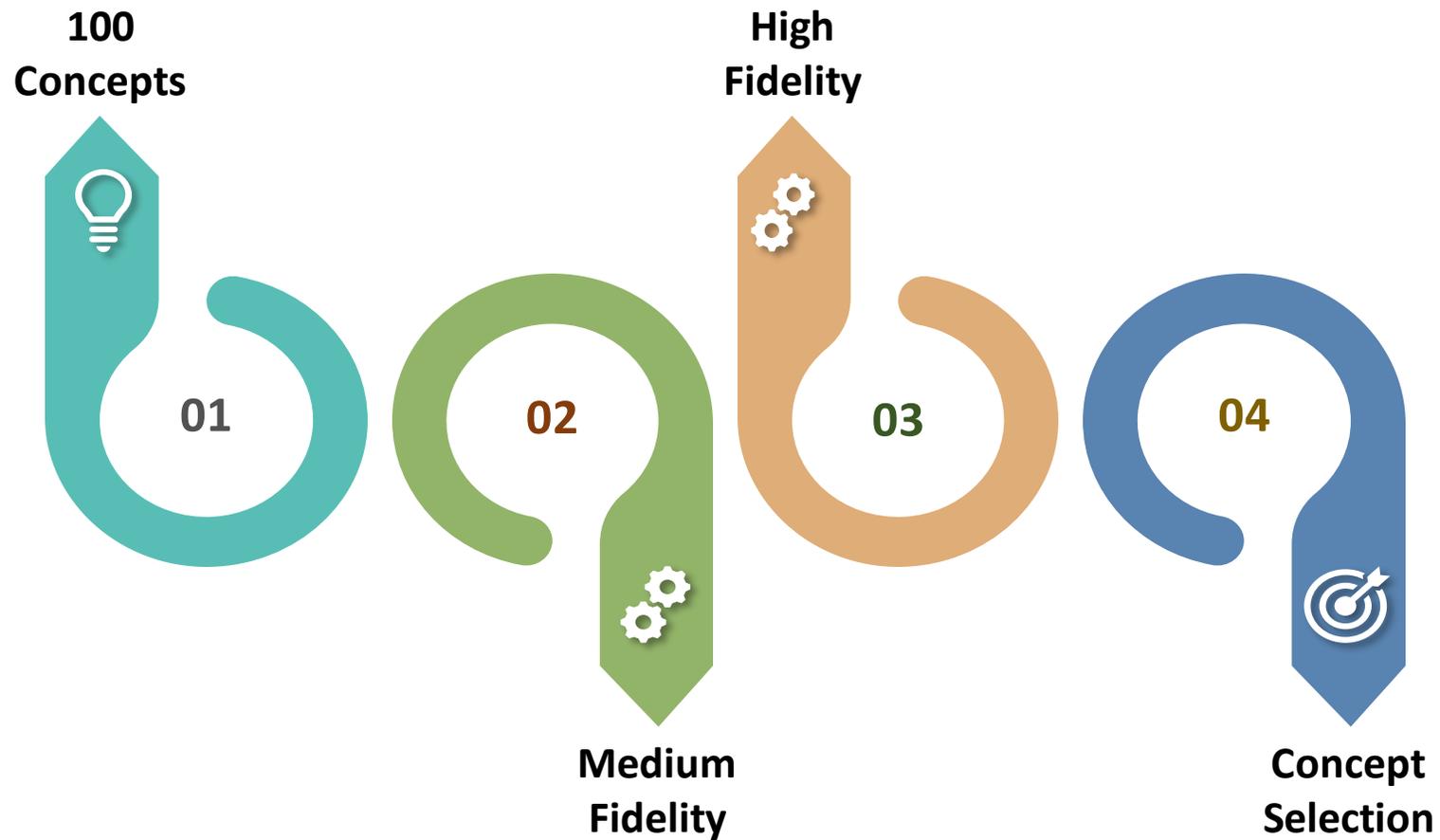
0.023 in³/min

Heat



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Concept Generation

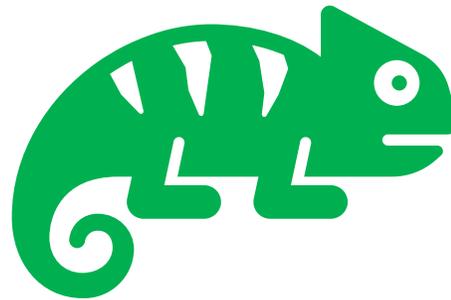


Mika Kuschnitzky

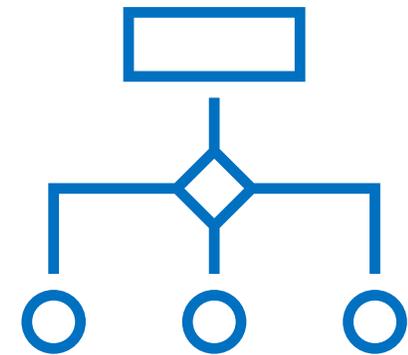
Concept Generation: 100 Concepts



Ideation



Biomimicry

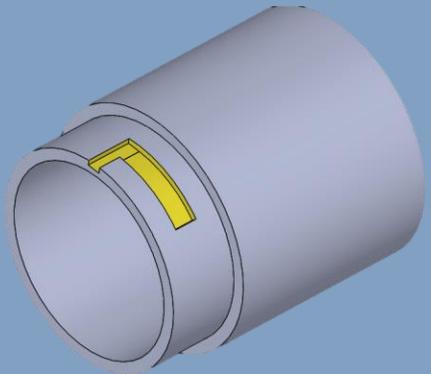


Morphological
Chart

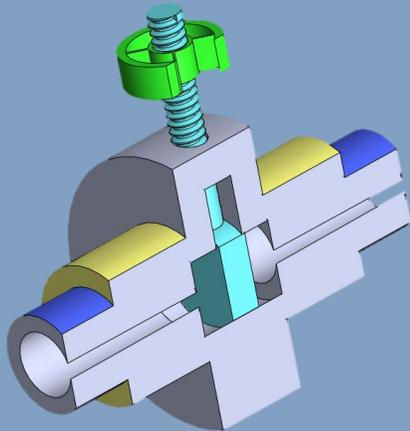
Mika Kuschnitzky

Concept Generation

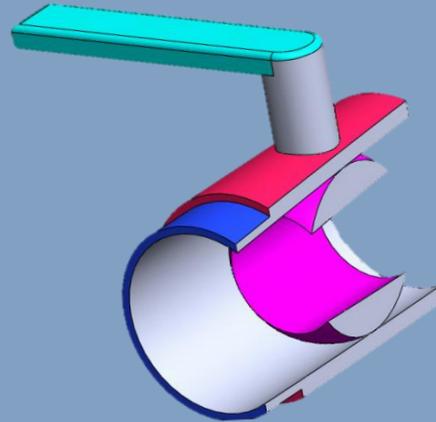
The Key



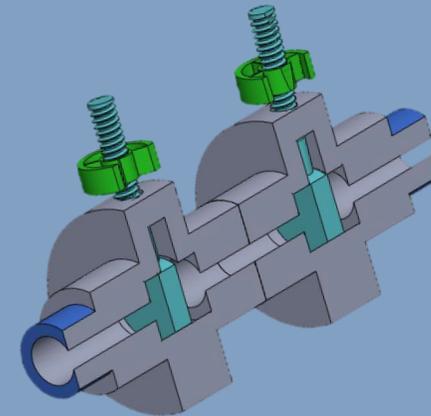
MLI Gate Valve



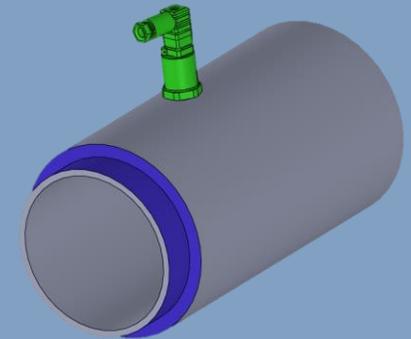
Fiber Glass Ball Valve



Non-insulate Double Gate

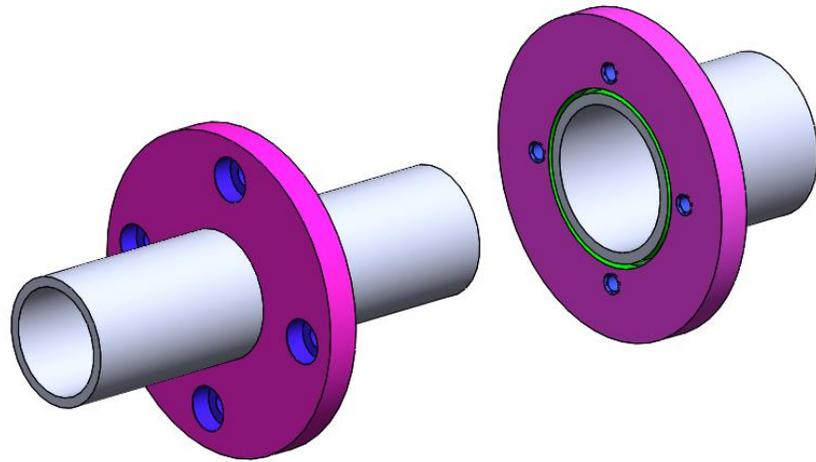


The Sensor



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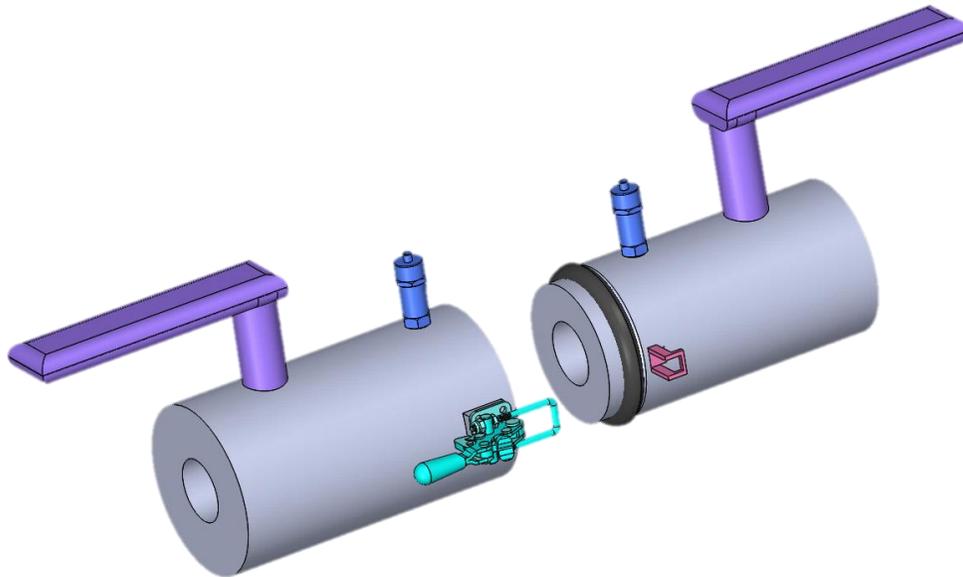
Concept Generation



Cryogenic Bayonet

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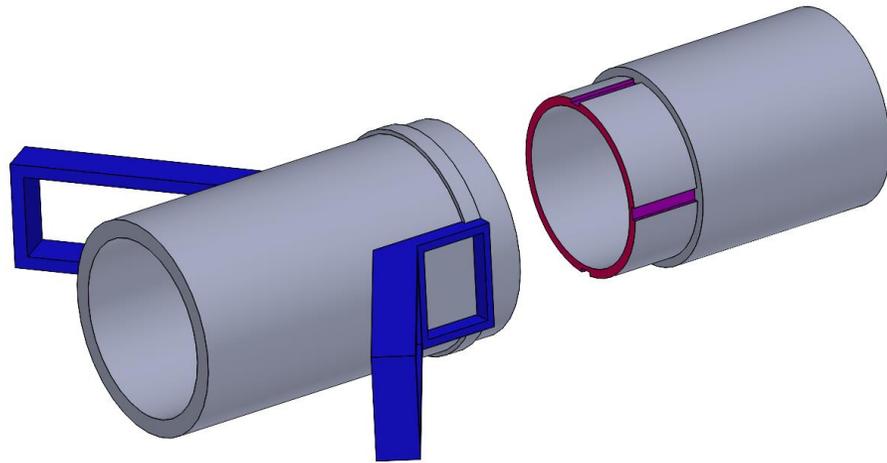
Concept Generation



Latch Sealing

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Concept Generation



Cryogenic Dry Connect

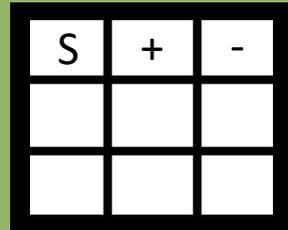
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Concept Selection

HOQ



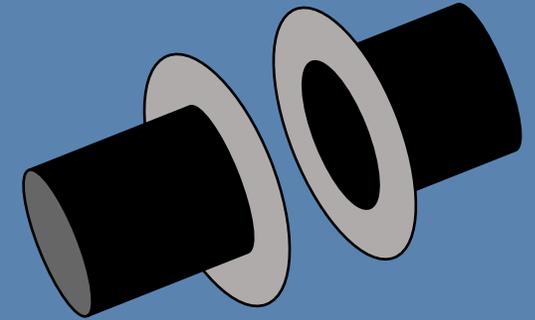
Pugh



AHP



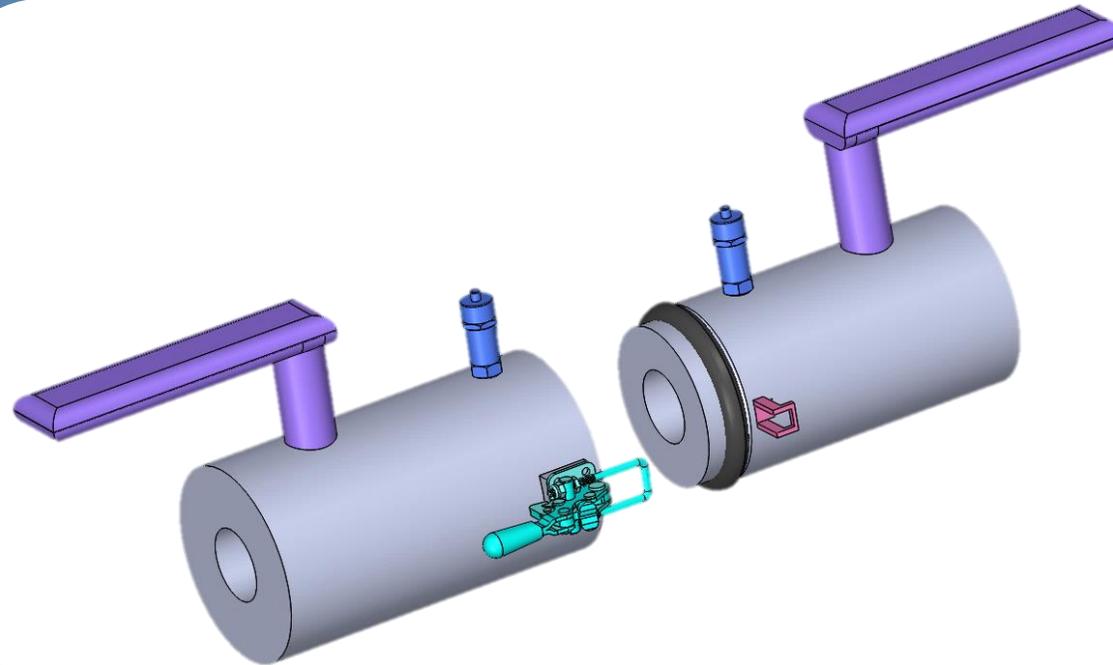
Selection



Joshua Leary

Concept Selection

Latch Sealing



HOQ

Pugh

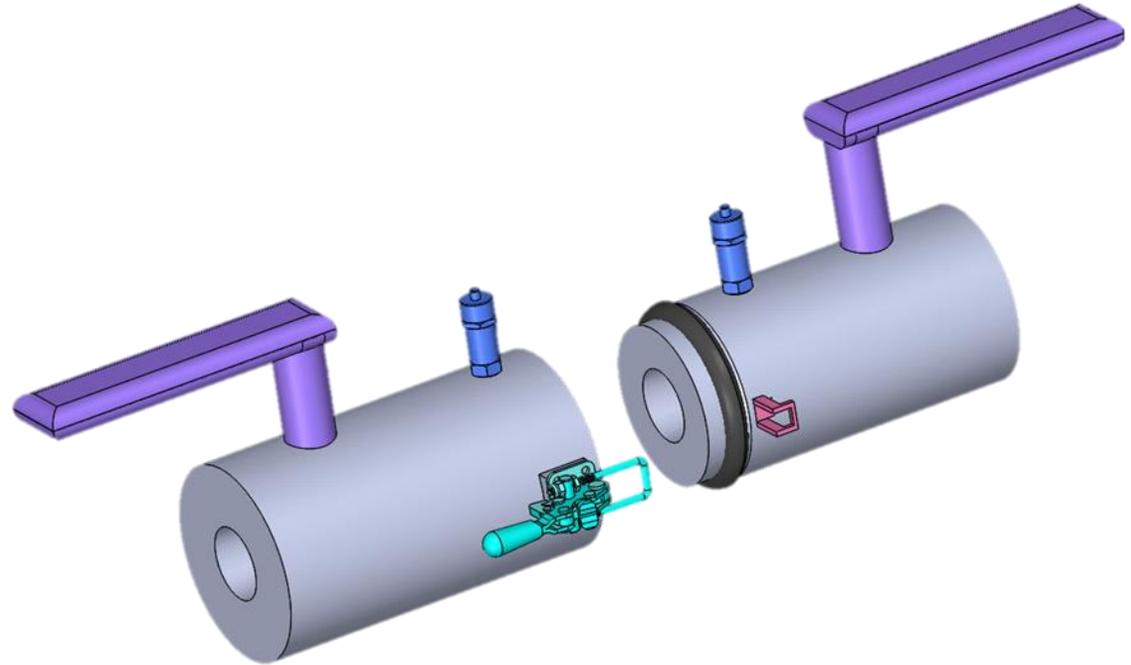
AHP

Selection

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Spring Updated Design

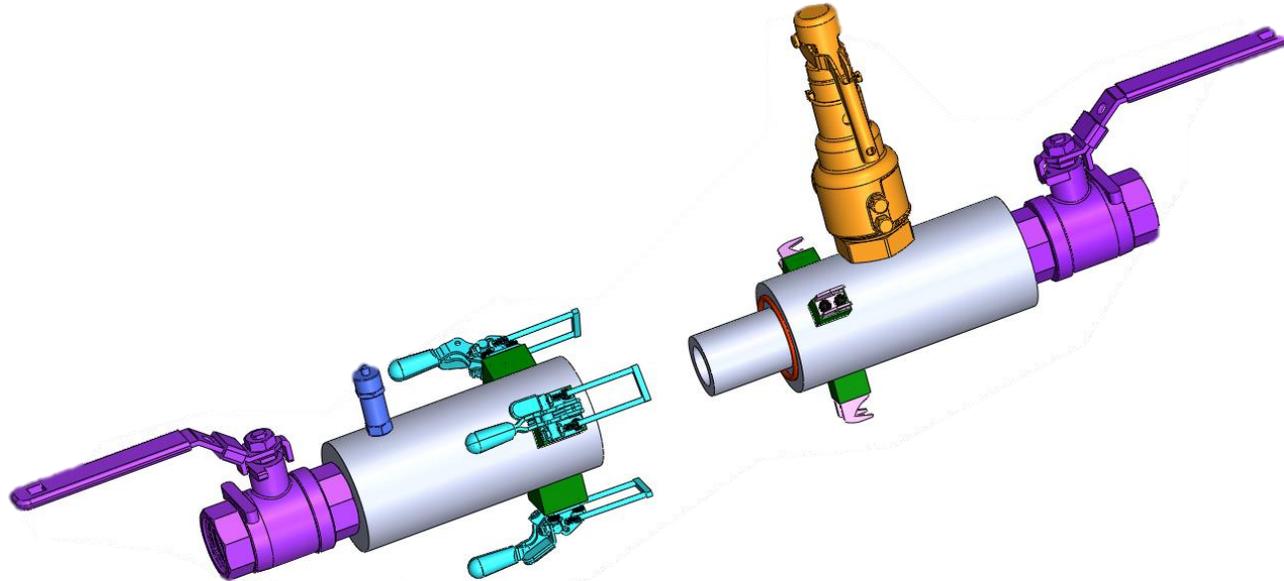
Fall Design



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Spring Updated Design

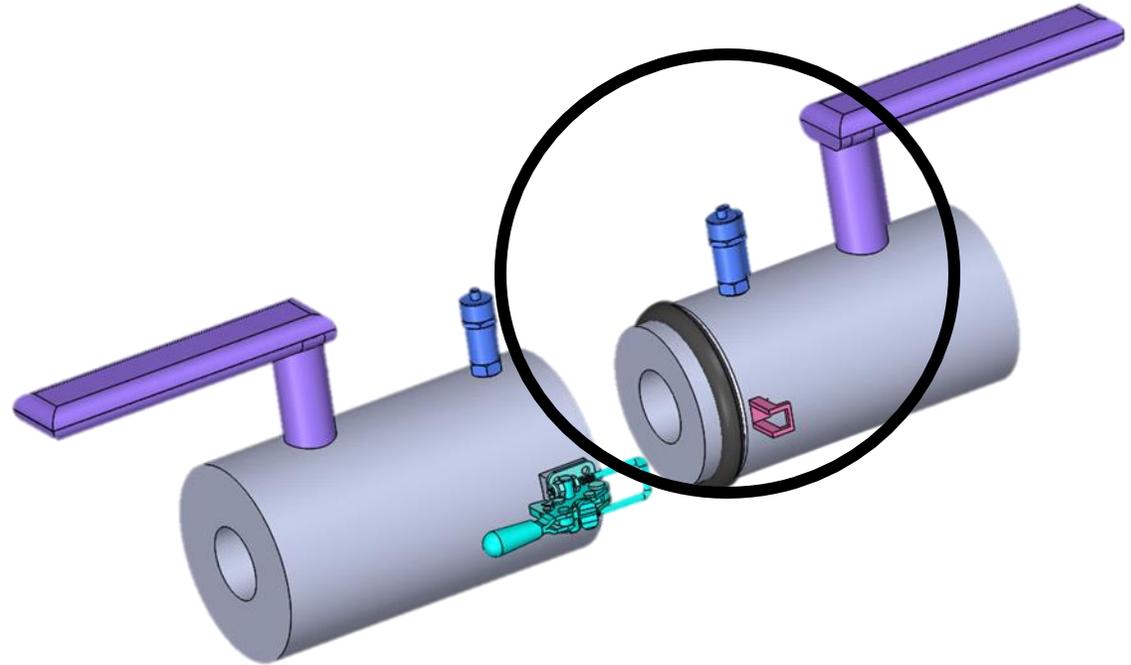
Spring Design



Mika Kuschnitzky

Spring Updated Design

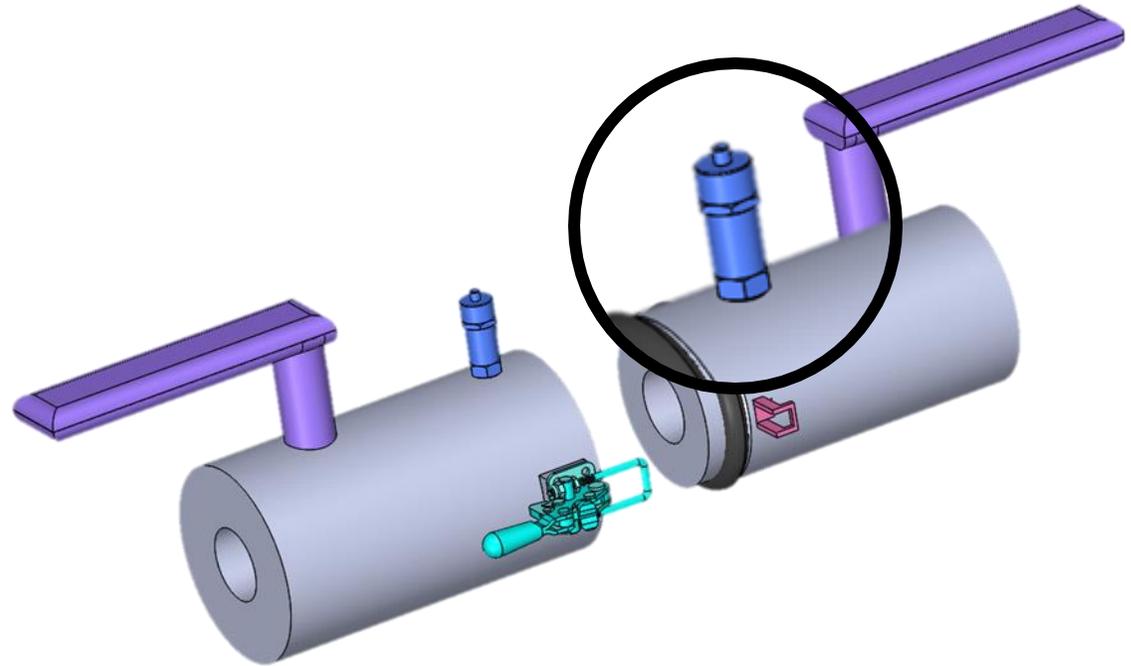
Manual Relief Valve



Mika Kuschnitzky

Spring Updated Design

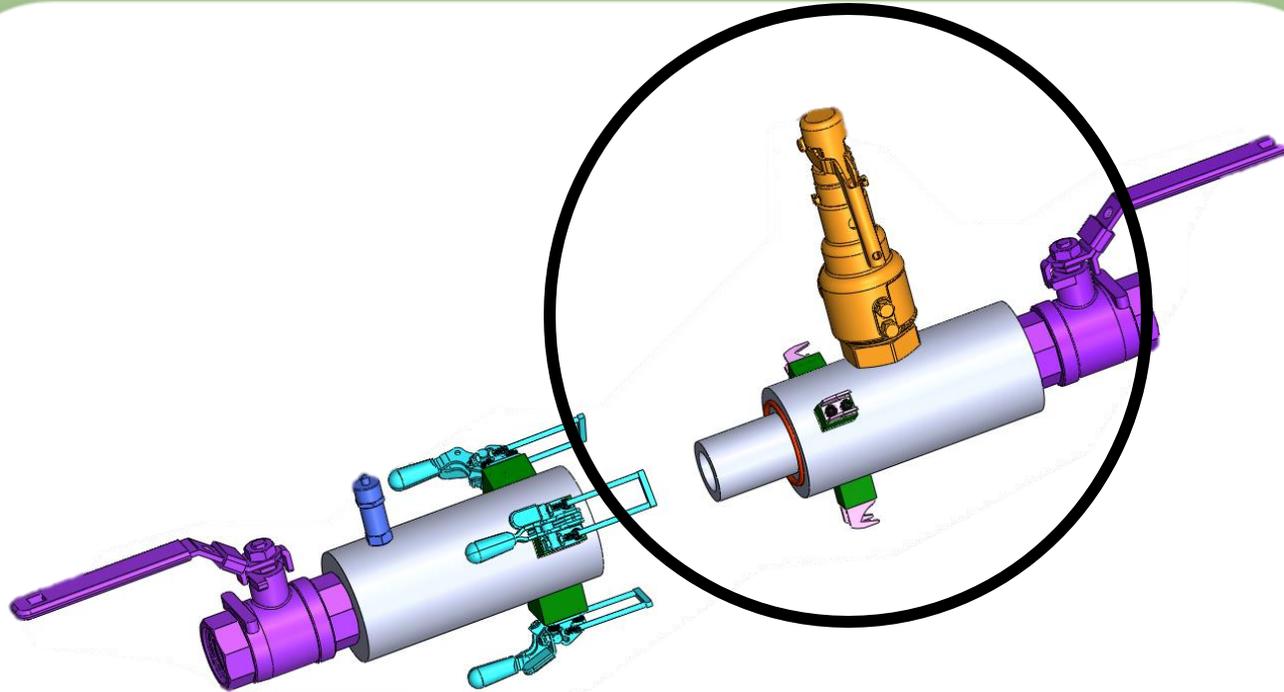
Manual Relief Valve



Mika Kuschnitzky

Spring Updated Design

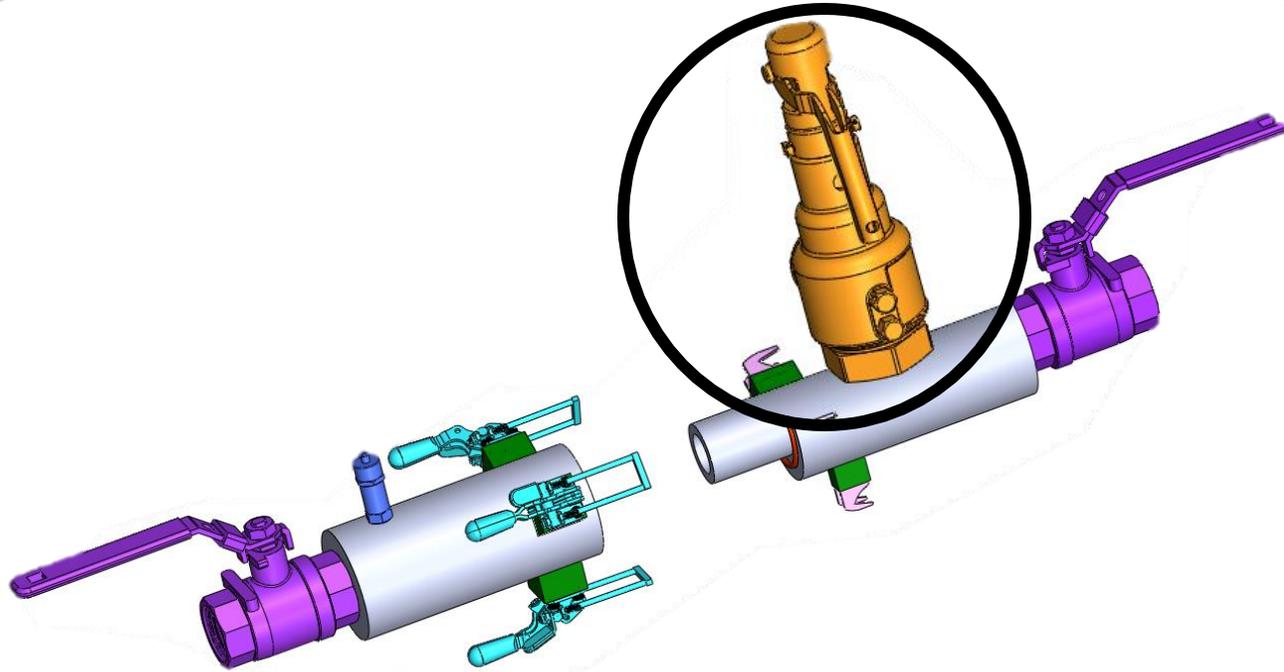
Manual Relief Valve



Mika Kuschnitzky

Spring Updated Design

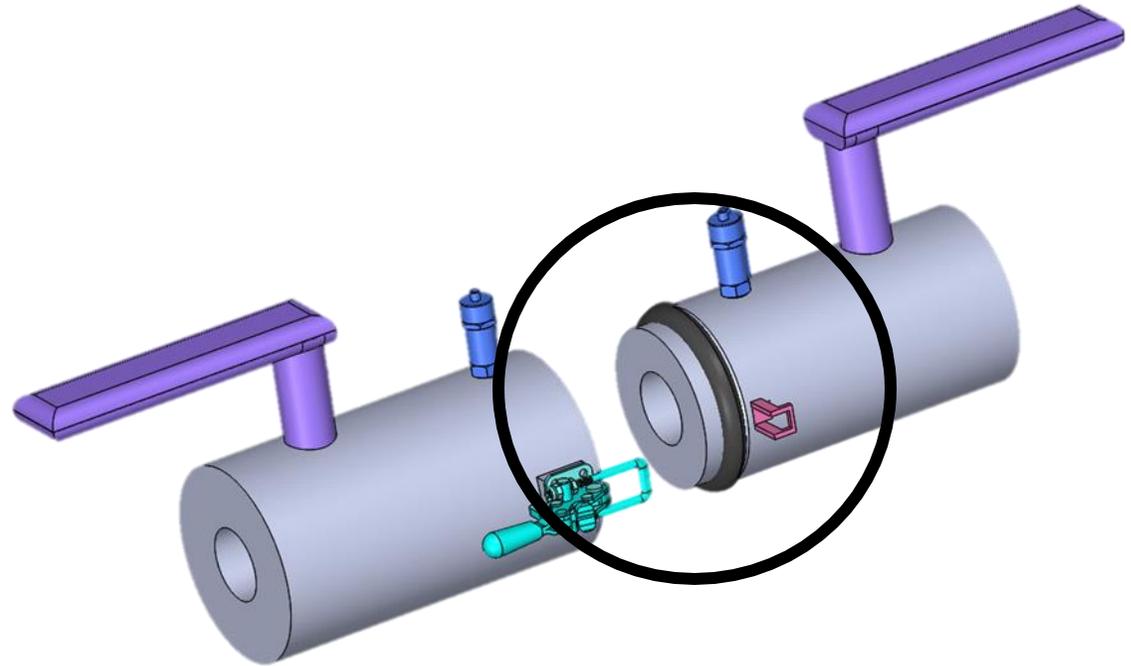
Manual Relief Valve



Mika Kuschnitzky

Spring Updated Design

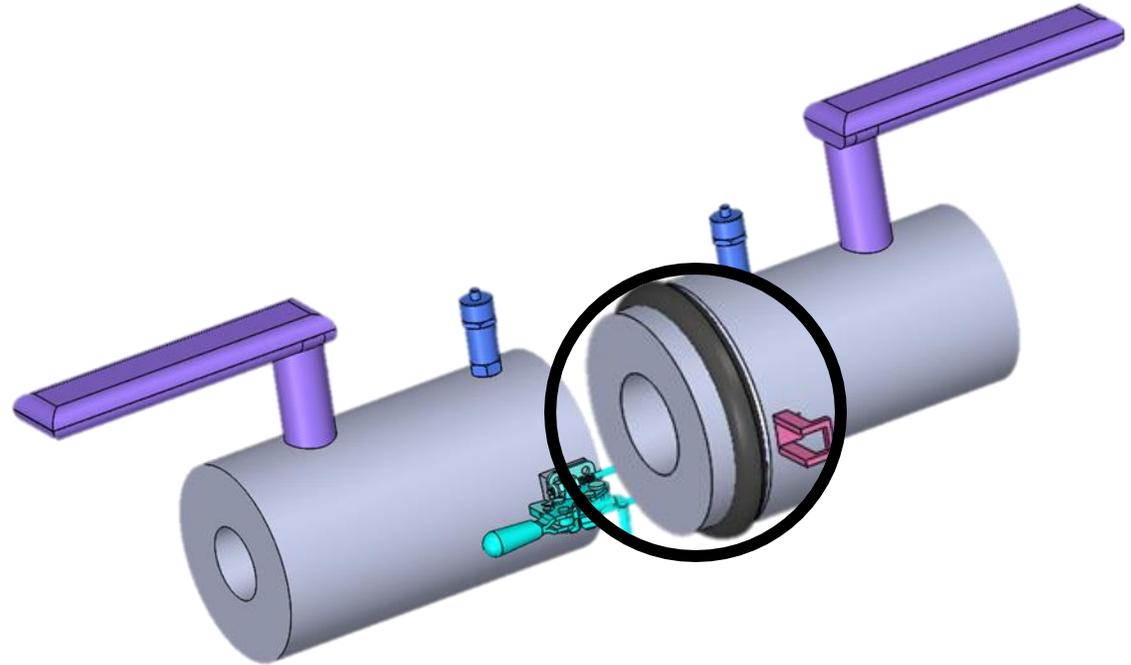
Surface Area of
Connection



Mika Kuschnitzky

Spring Updated Design

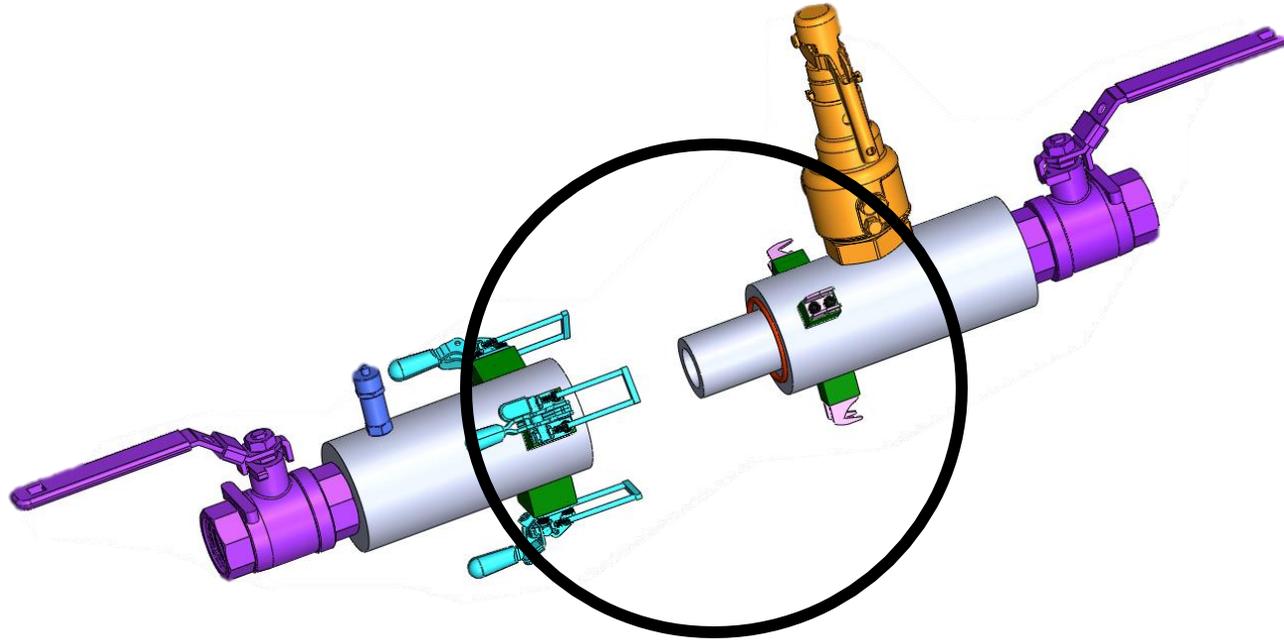
Surface Area of
Connection



Mika Kuschnitzky

Spring Updated Design

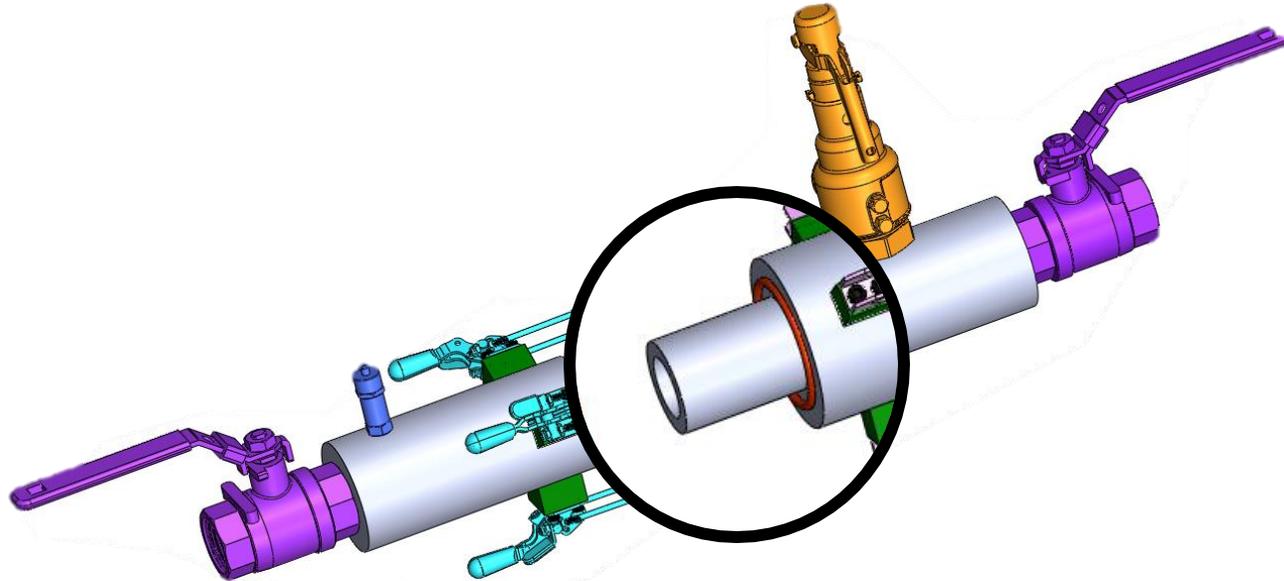
Surface Area of
Connection



Mika Kuschnitzky

Spring Updated Design

Surface Area of
Connection



Mika Kuschnitzky

Testing

Jackson Herrod



Testing Conditions

Lunar
Conditions

Atmosphere pressure = 0.3 nPa

In the sun = 400 K

In the shade = 140 K

Fuel
Conditions

MEOP = 50 psi

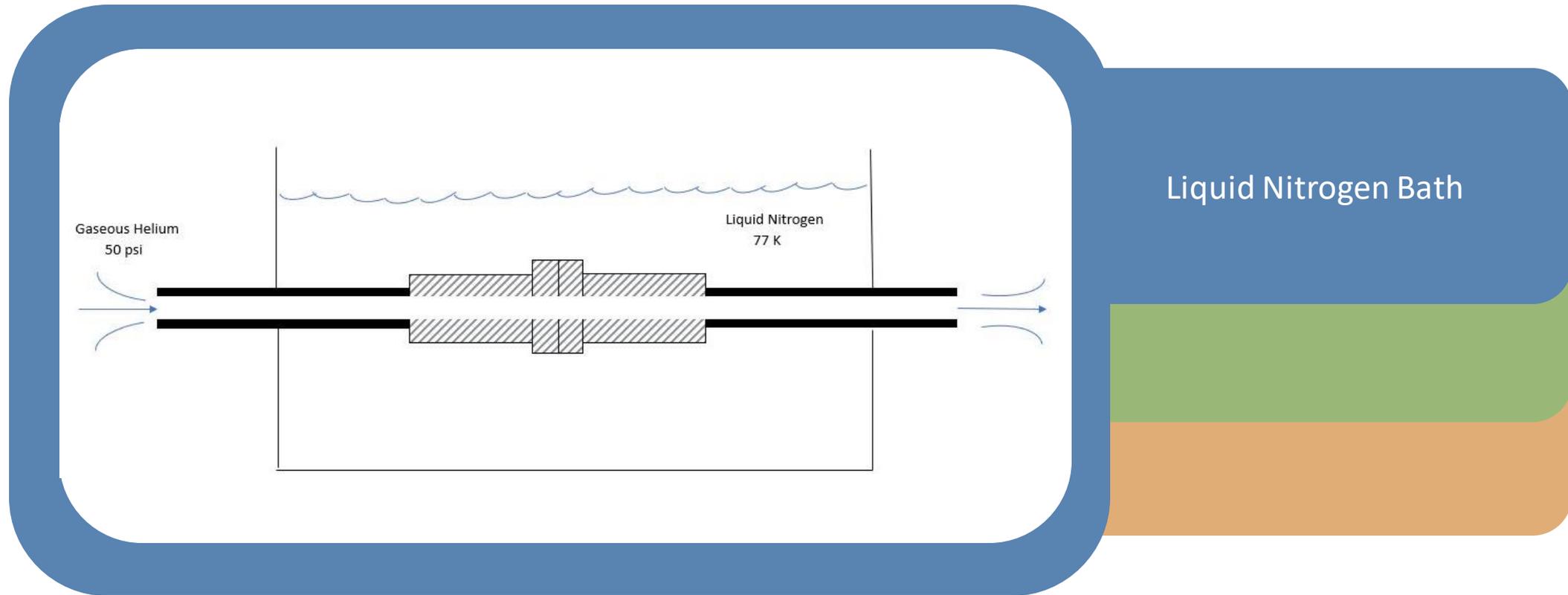
Cryo-fluids 90 K range

Flow rate < 0.1 SCIM ($\frac{cm^3}{min}$)

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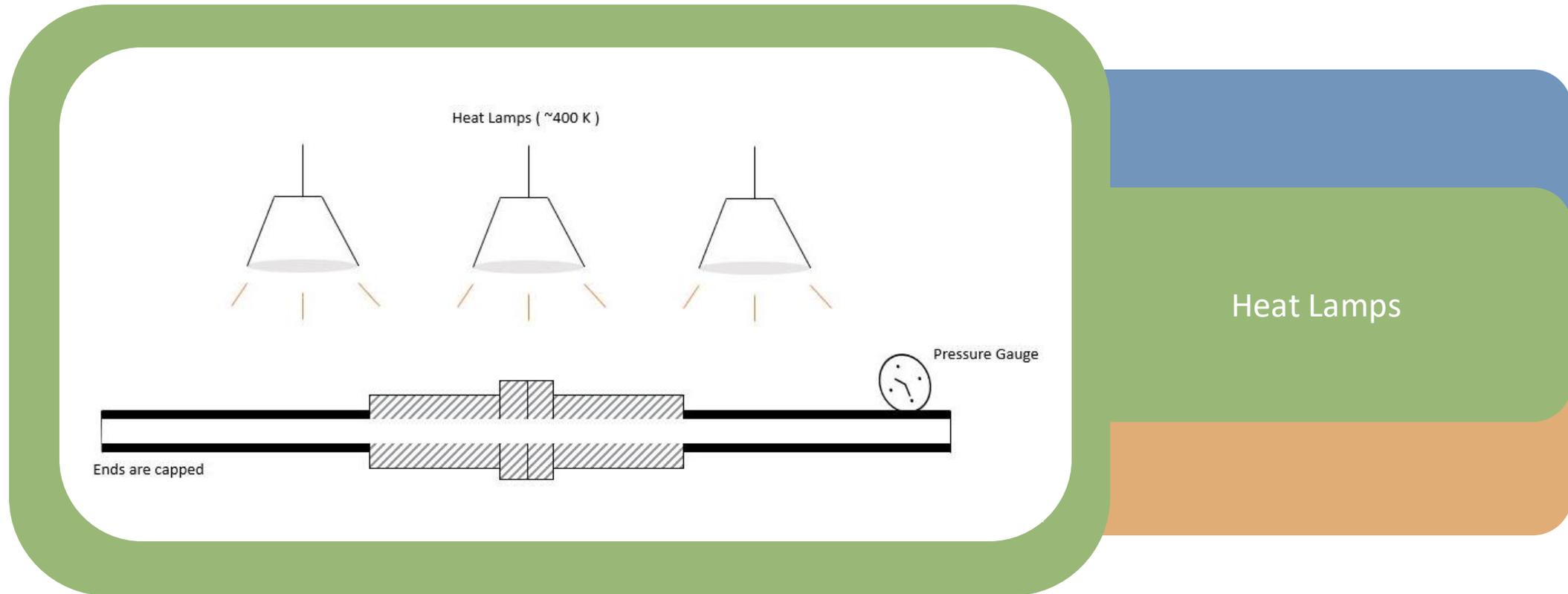


Methods of Validation



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Methods of Validation



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Methods of Validation



Leybold Phoenix L300i

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Future Work

Assembly and Testing

Test Data Analysis

Present on Final
Conclusions

Jackson Herrod



VOLC



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Systems
Engineer



Juan Valencia
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Engineer



Jackson Herrod
Test
Engineer



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