**Target Catalog**

Table 1: *Critical Targets and Metrics*

| Function | Metric | Method of Validation | Target |
|---|---|---|---|
| Minimize fuel leakage | Fuel leakage rate | Measure change in volumetric flow rate over time using flowmeter | ≤ 50 SCIM internal<br>≤ 500 SCIM external |
| Limit heat from entering the system | Pipe interior temperature | Measure entrance and exit temperatures of fluid using thermocouples | ≤ 80 K |
| Tolerate vehicle misalignment | Angular displacement | Measure angular displacement of coupler halves using an RVDT | ≤ 0.25 in. maximum total non-concentricity |
| Maintain structural integrity | Material yielding | Measure strength of the chosen material using tensile testing | ≤ 5% plastic deformation of chosen material |
| Open/close valve | Angular displacement of valve mechanism | Measure angular displacement of valve mechanism using an RVDT | 180 degrees |
| Protect system from foreign matter | Particulate matter in system | Measure particle distribution and size using a laser diode | ≤ 50 ppm |
| Level pressure | Pressure difference | Measure pressure difference between coupler halves using a manometer | ≤ 100 psid |

| Function | Metric | Method of Validation | Target |
|---|---|---|---|
| Purge excess fuel | Internal pipe pressure | Measure pressure in each half of the coupler using pressure transducers | 1.45E-15 psia |
| Connect/disconnect coupler | Force between both mating halves | Measure connection/disconnection force using force transducer | $\geq$ 10 N |

Table 2: *All Functions and Targets*

| Function | Metric | Target |
|---|---|---|
| Close pipe valve | Angular displacement of valve mechanism | 0 degrees |
| Open pipe valve | Angular displacement of valve mechanism | 180 degrees |
| Minimize fuel leakage | Fuel leakage rate | $\leq$ 50 SCIM internal<br>$\leq$ 500 SCIM external |
| Limit heat from conduction | Pipe interior temperature | $\leq$ 80 K |
| Limit heat from convection | Pipe interior temperature | $\leq$ 80 K |
| Limit heat from radiation | Pipe interior temperature | $\leq$ 80 K |
| Tolerate vehicle misalignment | Angular displacement | $\leq$ 0.25 in. maximum total non-concentricity |
| Maintain structural integrity | Material yielding | $\leq$ 5% plastic deformation of chosen material |
| Protect system from foreign matter | Particulate matter in system | $\leq$ 50 ppm |
| Measure pressure difference | Pressure difference | $\leq$ 100 psid |
| Level pressure | Pressure difference | $\leq$ 100 psid |

| Function | Metric | Target |
|---|---|---|
| Seal the connection | Force between both mating halves | ≥ 10 N |
| Purge excess fuel | Internal pipe pressure | 1.45E-15 psia |
| Disconnect both halves | Force between both mating halves | [X] N |

## NASA-MSFC Provided Design Requirements

| | ID | Title | References | Description |
|---|---|---|---|---|
| Safety | 1 | External Pressure Boundary Proof Factor | AIAA-S-080 | External pressure boundaries shall have no detrimental yielding after proof testing to 1.5 times MDP including an ECF. |
| | 2 | External Pressure Boundary Burst Factor | AIAA-S-080 | External pressure boundaries shall have a burst pressure greater than or equal to 2.5 times MDP including an ECF. |
| | 3 | Internal Pressure Boundaries Proof Factor | AIAA-S-080 | Internal pressure boundaries shall have no detrimental yielding after proof testing to 1.25 times MDC including an ECF. Assumes non-hazardous LBB failure mode. |
| | 4 | Internal Pressure Boundaries Burst Factor | AIAA-S-080 | Internal pressure boundaries shall have a burst pressure no less than 1.5 times MDC including an ECF. Assumes non-hazardous LBB failure mode. |
| | 5 | Structure Safety Factor | NASA-STD-5012 | Non-pressure boundary parts of the valve assembly factor of safety shall be per NASA-STD-5012. |
| | 6 | Fasteners and Preloaded Joints | NASA-STD-5020 | Fasteners and preloaded joints factor of safety shall be per NASA-STD-5020. |
| Functional | 7 | Flow (ESEOD based on Cd=.65) | Design Goal | ≥ 2 inch |
| | 8 | Valve Maximum Upstream Pressure | Design Goal | 100 psig. |
| | 9 | Valve Maximum Differential Pressure | Design Goal | 100 psid. |
| | 10 | Valve Minimum Fluid Temperature | Design Goal | The valve minimum fluid temperature is -430 F. |
| | 11 | Valve Maximum Fluid Temperature | Design Goal | The valve maximum fluid temperature is 100 F. |
| | 12 | Valve Fluid Media Compatibility | Design Goal | The valve shall be compatible with GHe, GN2, LN2, GH2, LH2, LO2, LCH4 fluids. |
| | 13 | Actuation | Design Goal | Normally closed. Open upon mate |
| | 14 | Inlet and Outlet Joint Interface | Design Goal | Welded for flight, designers choice for development article. |
| | 15 | External leakage | Design Goal | ≤ 50 SCIM LN2 at 5 and 50 psig internal pressure. |
| | 16 | Internal leakage | Design Goal | ≤ 500 SCIM LN2 at 15 and 50 psid while demated. |
| | 17 | Maximum Initial Misalignment | Design Goal | .25" maximum total non-concentricity. Assumes vehicle will have capture feature with gross alignment. |
| Environments | 18 | Minimum Expected Temperature | Design Goal | -454 $^{0}$F, no requirement given, assume deep space, no heaters, insulated. |
| | 19 | Maximum Expected Temperature | Design Goal | +120 $^{0}$F, no requirement given, assumed. |
| | 20 | Minimum External Pressure | Design Goal | No requirement given, assume deep space, 1.45E-15 psia |
| | 21 | Maximum Expected Pressure | Design Goal | No requirement given, assume standard earth atmosphere 14.7 psia |
| | 22 | Vibration | Design Goal | No requirement given. Not considered in initial development test article design. |
| | 23 | Shock | Design Goal | No requirement given. Assume negligable. |