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ESSSA Group



# Repurposing of Existing Technologies for Custom Design Solutions

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# Overview



- Design Background
- Design Approach
- Three Professional Examples
  - Dual Seal Shutoff Valve
  - Peristaltic Pump
  - Live Loaded Valves
- Summary



# Design Background

- Georgia Institute of Technology Prototype Machine Shop
- Parker Hannifin Corporation Instrumentation Product Division (New Product Development)
  - Company with vast resources and multiple divisions.
  - Great opportunity to leverage one division's technologies for custom purposes.
    - Quick Disconnect Cap for air sampling.
- Mechanical Structural Design Branch at MSFC supporting the UPA.
  - Proto Flight System



# Design Approach



- Three expectations: (Are only two out of the three are achievable?)
  - On Time
  - Within Budget
  - Quality, i.e, the design works well the first time with minimal design changes needed
- All three are likely achievable in “practical” engineering with a design philosophy of repurposing existing technologies for the custom design solution.
- Use upfront design time researching existing core technologies that may work in the design application.
  - Getting this right shortens design life and cost while putting the design in a better position to meet performance or “quality” requirements.
- Critical to know specific requirements of Design to ensure this repurposing will be successful.



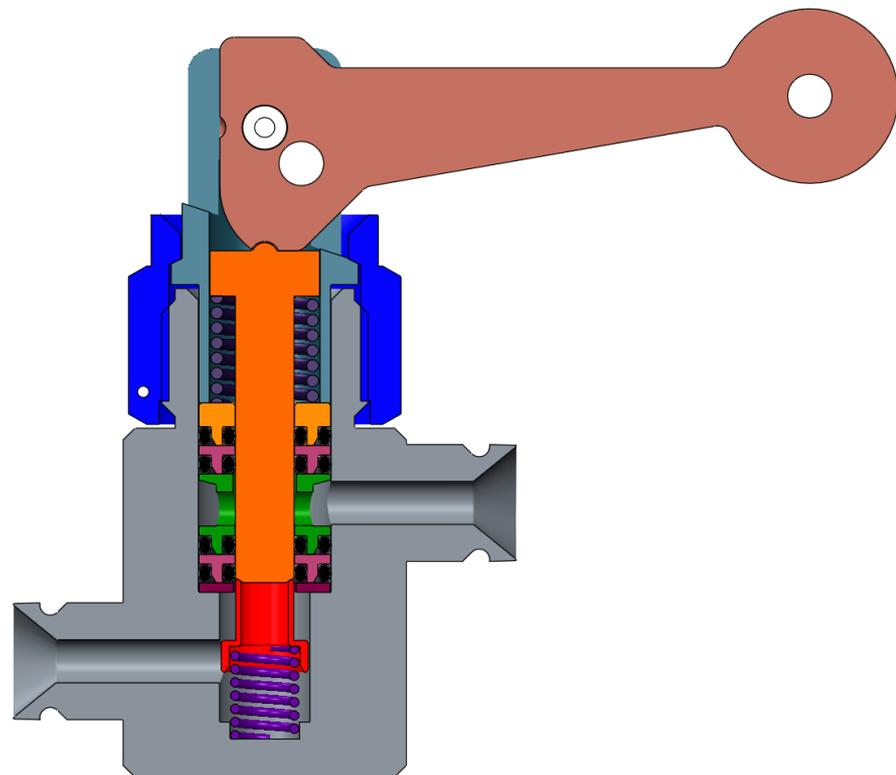
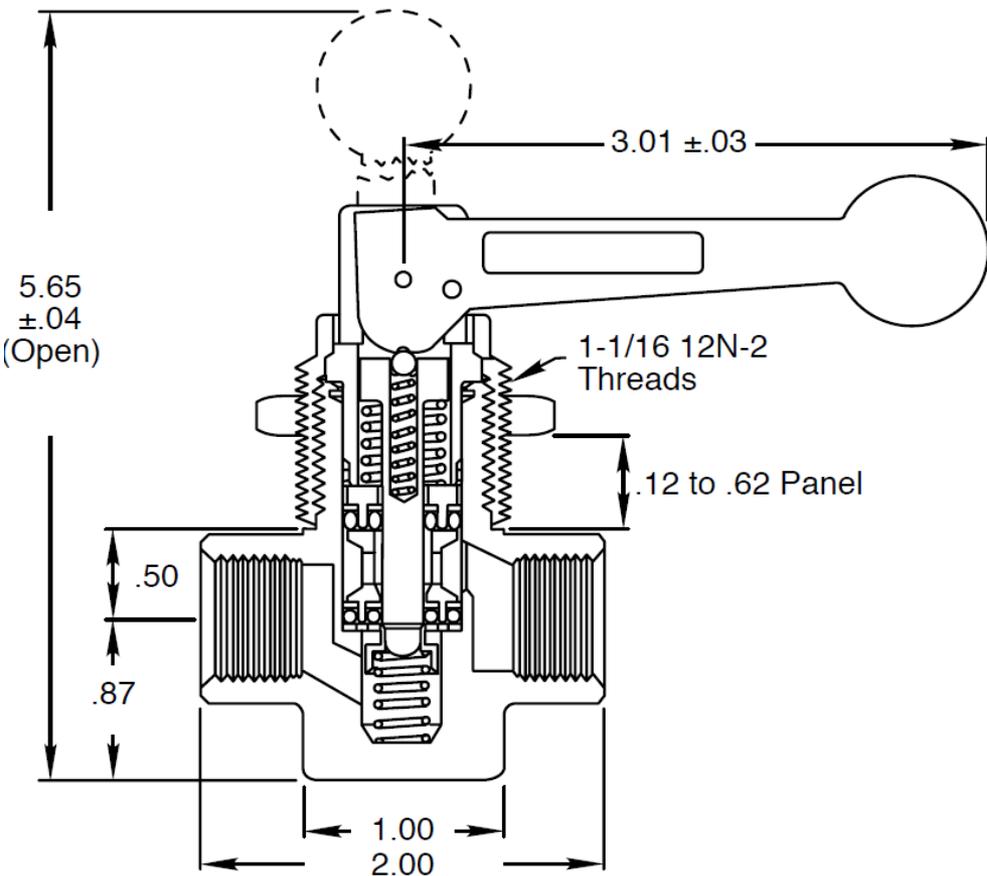
# Dual Seal Shutoff Valve



- Develop, build and certify condensate sampling port to be located at the Water Recovery System (WRS) 2 Rack Utility Interface Panel (UIP)
- New Sample Port design and location to be advantageous over existing hardware:
  - WRS2 RIP volume provides easier crew access(easier to schedule).
  - Eliminates hardware needed for sample which reduces time for set up and teardown.
  - 1 Crew member saving substantial time over current sampling method.
  - Reduces purge volume.
  - Less crew time required to purge dead leg.
  - Will not require a separate 1 liter bag for purge volume.
  - Eliminates reclaiming purge bags( saves 4 bags/ year).



# Dual Seal Shutoff Valve

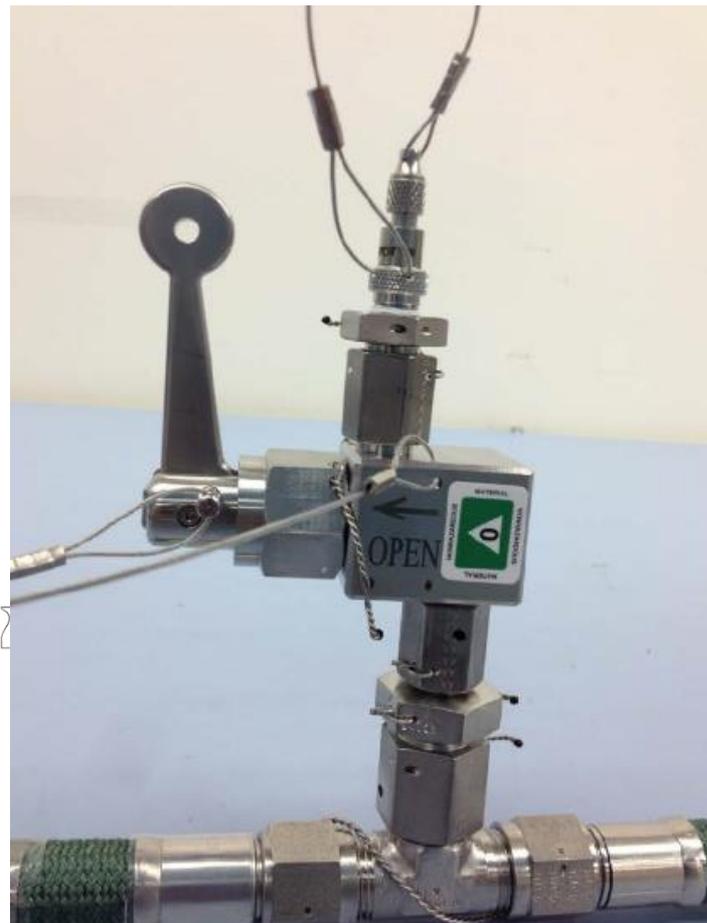
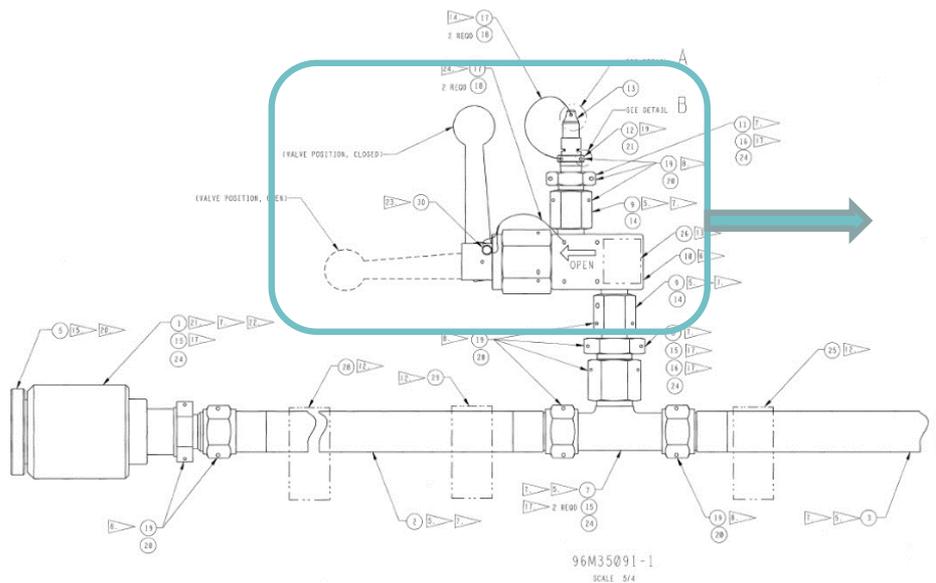


Manual Shutoff Valve, URL: [http://www.circle-seal.com/products/shutoff\\_valves/csc-msv\\_0506\\_lo.pdf](http://www.circle-seal.com/products/shutoff_valves/csc-msv_0506_lo.pdf)

Custom Derived Manual Shutoff Valve



# Dual Seal Shutoff Valve

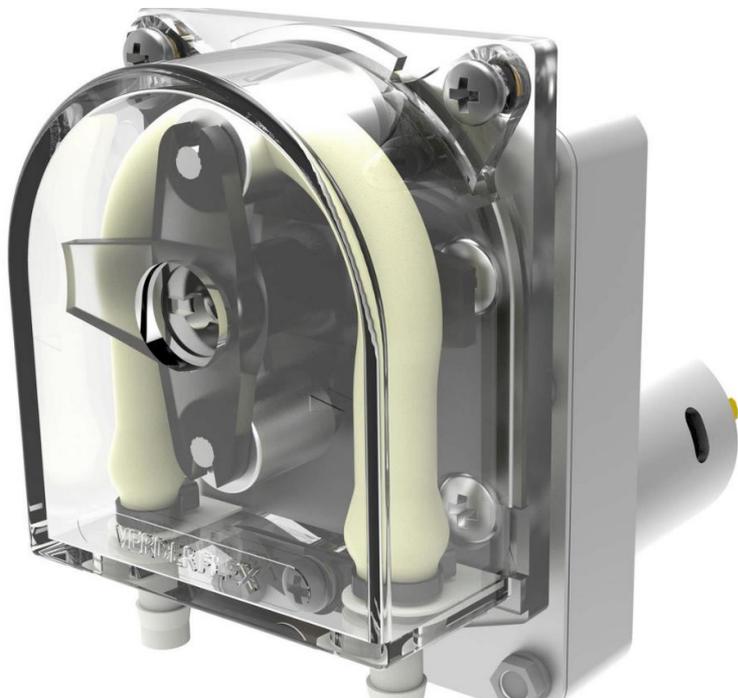


Final Custom Shutoff Valve Assembly



# Peristaltic Pump

- Develop, build and certify a pump for transfer of various fluids from one location to another in support of the water recovery system.
- Requirements for design lead to peristaltic pump option.



Peristaltic Pump Head, URL:  
[http://www.directindustry.com/prod/verderflex-peristaltic-pumps-14215.html#product-](http://www.directindustry.com/prod/verderflex-peristaltic-pumps-14215.html#product-item_343575)

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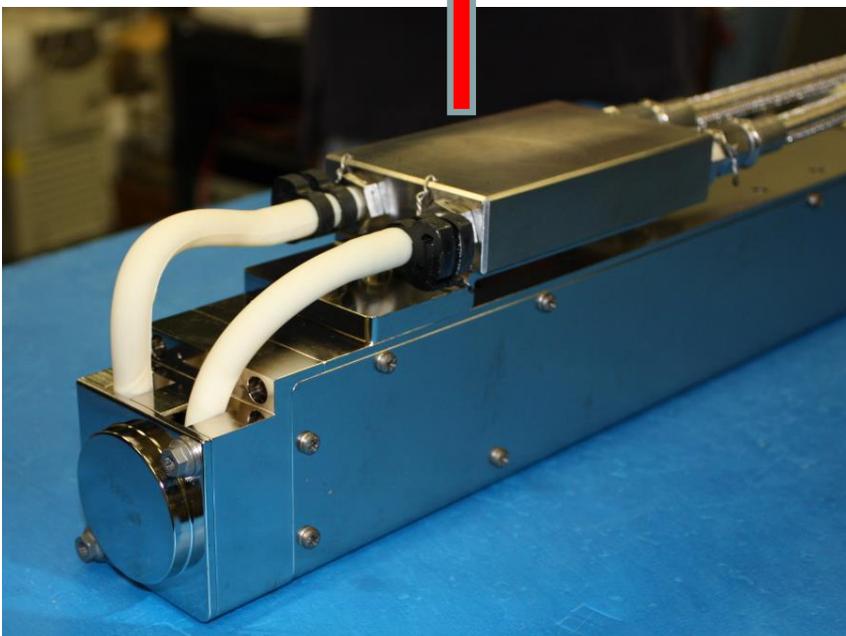
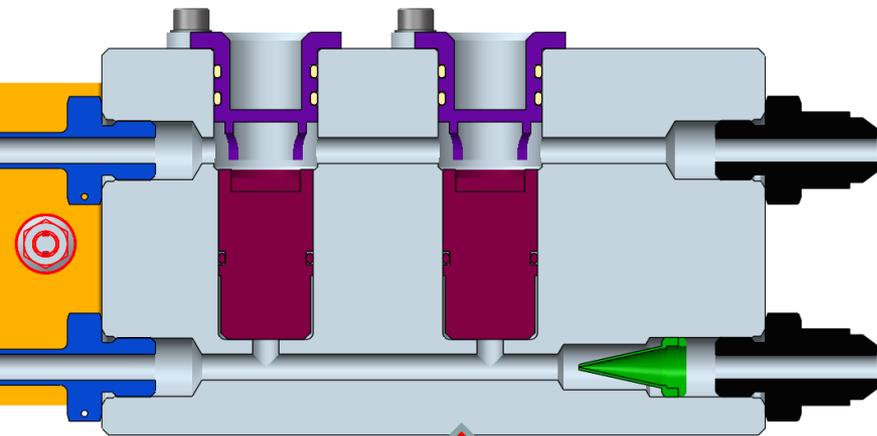
MAE 683

Custom Derived Peristaltic Pump Assembly

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# Peristaltic Pump



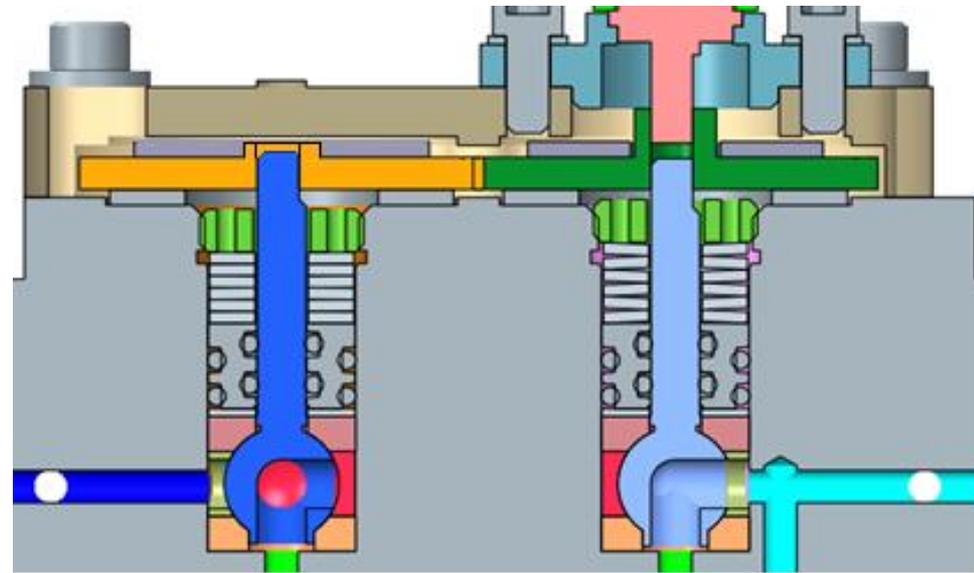
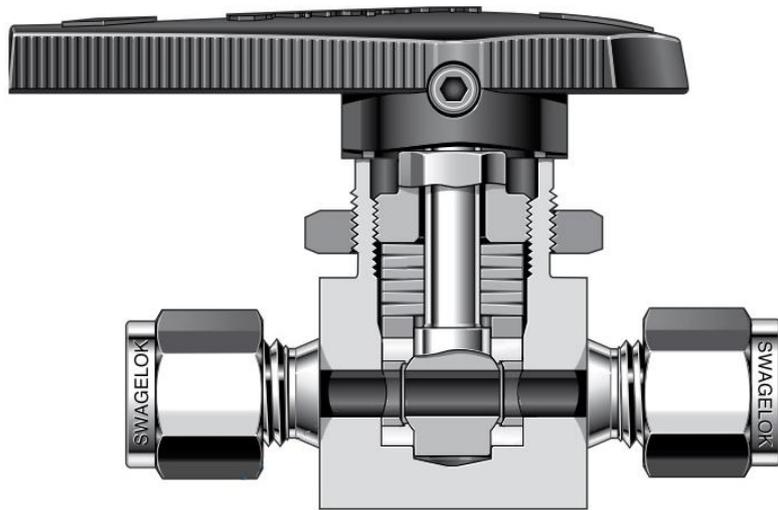
Station Pump Assembly





# Live Loaded Ball Valves

- Redesign ball valve assembly to prevent leakage during final environmental testing prior to shipment to the International Space Station (ISS).
  - Teflon packing cold flowing during elevated temperature testing creating loss of the sealing contact stress.
  - Need to maintain proper sealing contact stress through testing and life of valve without any manual adjustments on valve assembly.



Swagelok Ball Valve, URL:  
<https://www.swagelok.com/downloads/webcatalogs/en/MS-02-331.pdf>

Custom Derived Live Loaded Ball Valves



# Summary



- Very unlikely any of the aforementioned design solutions would have been as easily approved in design reviews with management if existing core technology was not being implemented.
  - Without the existing core technology there would have been uncertainty in a successful completion, budget, and on-time delivery.
- Repurposing existing technologies can be an effective design approach to meet all technical requirements, budget constraints, and schedule demands.
- This design philosophy should be a cognizant upfront approach for coming up with a solution to the problem.
  - Need to have much of an understanding of the requirements as possible to ensure existing technology will work.
  - Core technology should remain intact during the repurpose in order to provide the confidence to all parties involved that the design will be successful.
- Exposure to existing technologies can add to experience and make it easier to do the upfront research and narrow down possible areas to draw from.
  - Always be a student.