Powder Mixing Application with Levitronix Parts

Levitronix Seminar

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Glossary

Better Pumps for Better Yield!

SU	Single Use
EHS	Environment Health and Safety
Rpm	rotations per minute
N2	Nitrogen
CDA	Compressed Dry Air

Content

Better Pumps for Better Yield!

- Motivation
- System Setup and Configuration
- Operating Procedure
- Discussion
- Alternative Setup

Motivation

- Goal is to facilitate powder introduction during media or buffer preparation for bioprocessing (inc. upstream and downstream) applications
- Focus on so-called eductor-based powder introduction system, which allows to pull powder (or similar substances like granulates) into the Levitronix pump discharge line
- Fan and / or vibrator based SU powder bag inflation during powder introduction to enable steady flow of powder

System Setup and Configuration

Powder Introduction/Mixing with Levitronix Pump and Eductor
High Level Setup *with Single-Use Bag*

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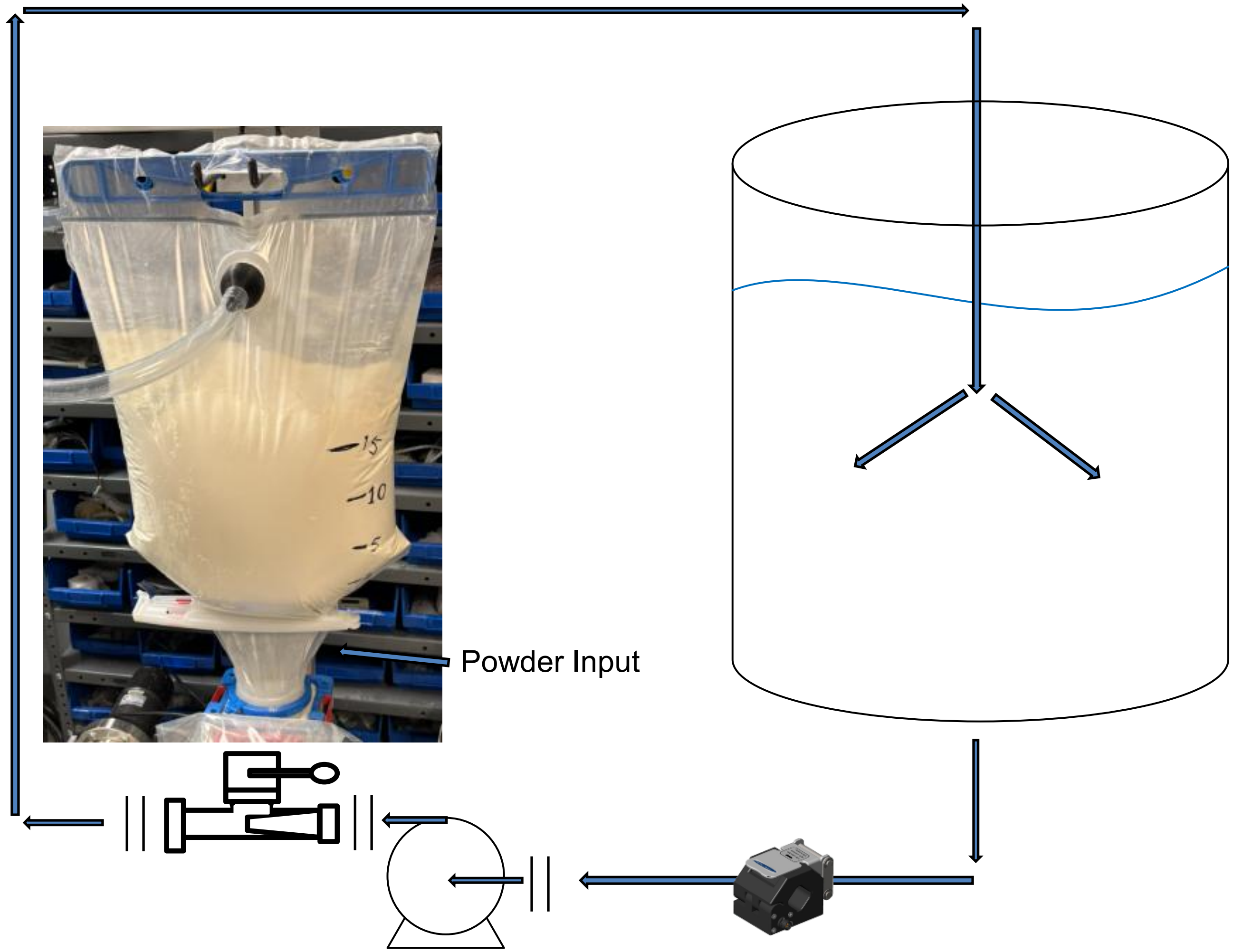

- Placement of powder Introduction assembly with eductor at discharge of pump offers high operational safety, as there is no risk of pump losing priming.
- Powder Introduction on ground floor offers operational safety ("EHS"). No staircase and lift station needed for powder intro.
- Improved Powder Mixing Performance enables time saving of powder mixing step
- Return line into vessel can be sub-surface or above surface. Based on vessel agitator performance above surface (or combined setup) could help in powder dissolution into liquid.
- Closed system to avoid powder contamination of environment

Bag Picture from www.Bioprocess Online.com.

Powder Introduction/Mixing with Levitronix Pump and Eductor
Key Components

LEVITRONIX®

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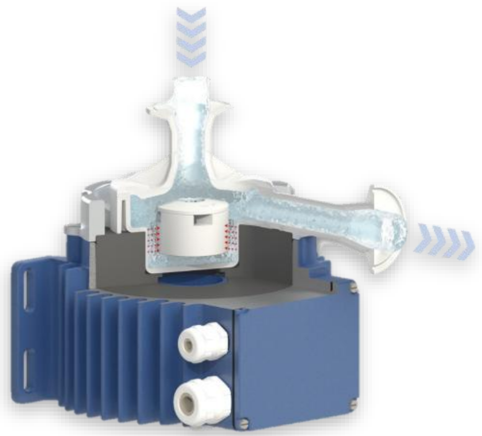
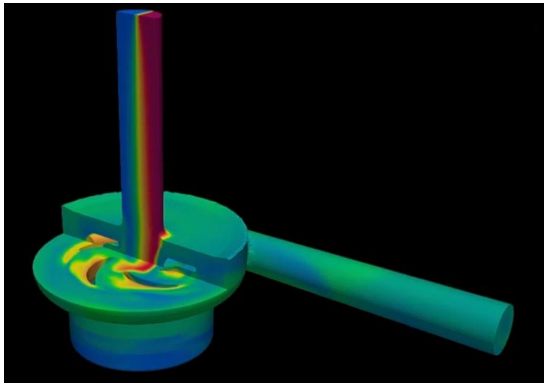
Levitronix Single-Use Pump



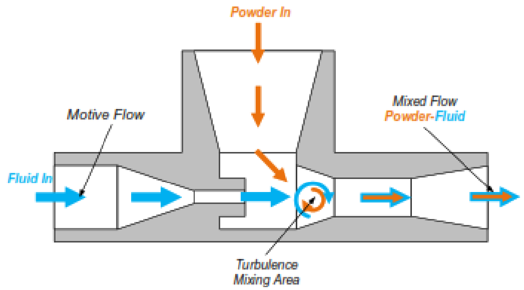
- High Flow Capabilities at smallest footprint
- Continuous, pulsation-free operation
- Additional, Inherent mixer

SYSTEM BENEFITS

- Operator friendly and safe ground floor introduction of powder (no stairways and lift stations).
- Fast mixing times even with sticky powders.
- High shear flow breaks up clogged particles.
- Improved mixing with floating powders as it is immediately mixed in the eductor.
- Scalable from 10 to 5000 (or higher) liter bags.
- Single-use eductor with hygienic design and reduced risk of powder clogging.
- Easy retrofit to existing single-use mixer bags.
- Overflow suction port monitoring with pressure sensor possible. Automated safety shut-off possible with Levitronix® pinch valves.
- No need for any shaking of powder funnel setup.
- Neglectable, if any, residue at the end.
- No danger of priming loss of the pump.



Levitronix Single-Use Eductor



- Integrated Pressure Sensor Port for operational safety

Basic System Configuration

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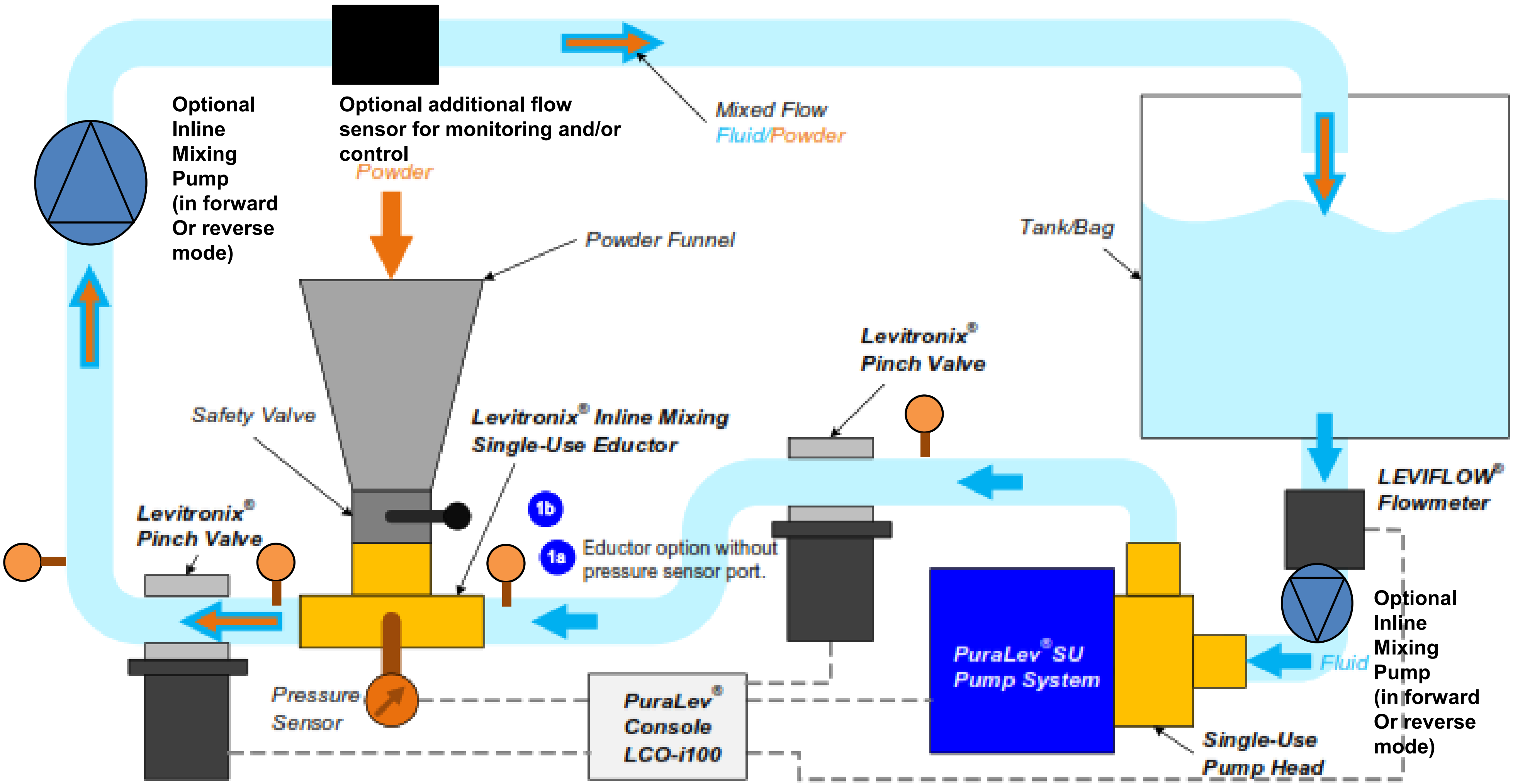
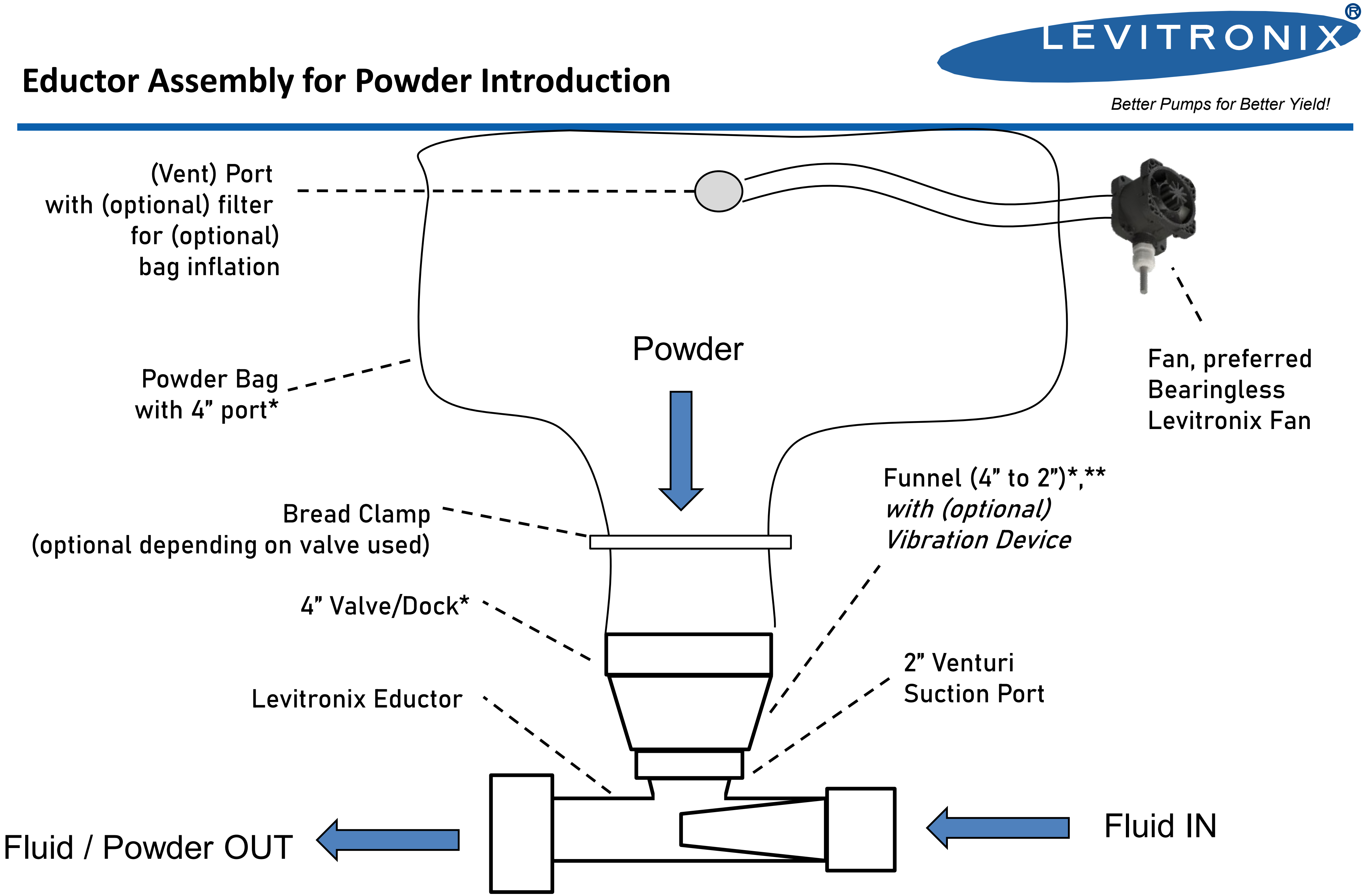


- Additional Pressure Sensors can be placed in loop for safety monitoring (for example, prior/after valves).

(Optional) Pressure sensors for safety monitoring and automated control

Eductor Assembly for Powder Introduction



*other (port) sizes possible
** longer funnel (about 10”) results in better performance

Video In Action

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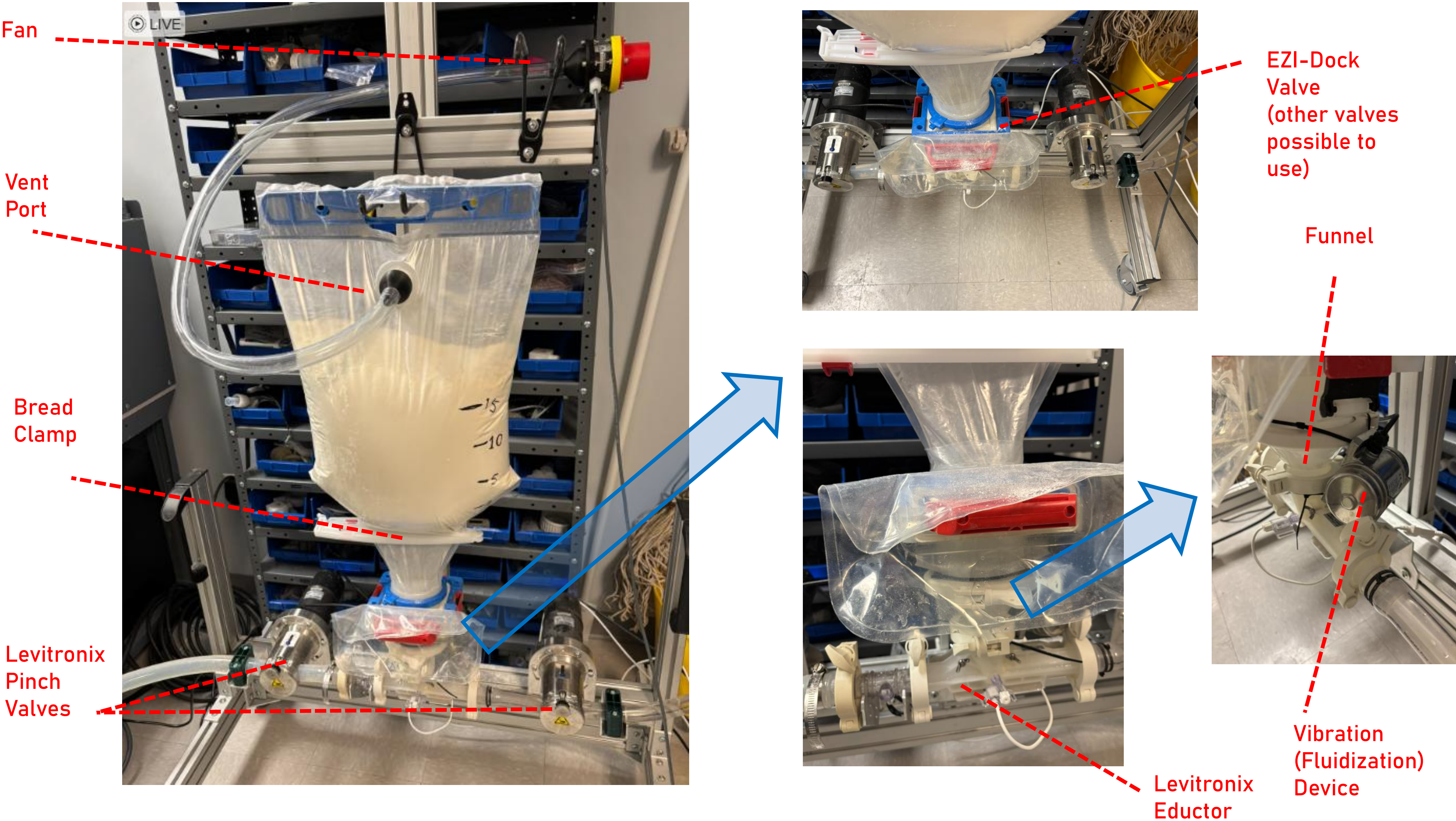
Example of Setup



Operating Procedure

Example for Operating Procedure

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1) Start up fan at 20,000rpm (other speed values feasible depending on setup)
2) Start Vibration device
3) Start Pump at 2000 rpm*
4) Open EZI-Dock valve (or other valve)**
5) Remove bread clamp**
6) When powder settles in bag neck, set Pump speed to 4000 rpm*
7) When powder bag is fully empty, set pump speed to 2000 rpm*
   (important to avoid splash up when valves close - water hammer)
8) Close EZI-dock valve
9) Stopped fan and pump and vibration device

* Exemplary Speed Values: flow/pressure values to be added as setup dependent

** Sequence of Valve / Clamp can be potentially modified based on valves used

Discussion

Inflation of Bag

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- The bag shall be pressurized/inflated. Without inflation, the bag (especially neck area of bag) could collapse and powder flow could step. Open vent might not be sufficient, it might need positive pressure in bag.

Options for Bag Inflation

- Fan, preferred Levitronix Fan for contamination free inflation of bag. Fan is inherently safe as pressure is inherently limited and over-pressurization of bag is not feasible.
  - Can be used with N2 or CDA
- N2 or CDA with or without pressure regulator

Valves, Use of Bread Clamp

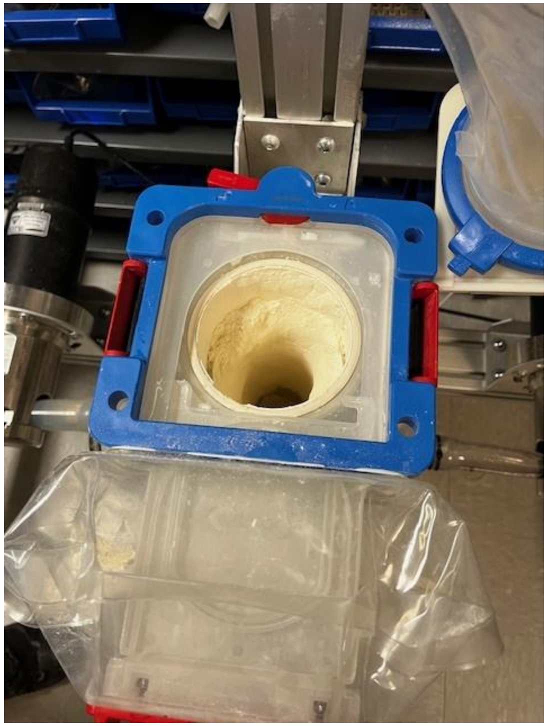
- Bread clamp needs to be removed last (at startup procedure) - when EZ-dock valve is used - for EZI-Dock valve to function properly.

- Other valve options (for example, AVAX valve) might not need such procedure and could offer benefits on operation in closed valve position.

Vibration Device

- Vibration Device mounted in eductor assembly (for example, funnel area) for vibration and (potential) fluidization of powder. Without vibration device, powder potentially sticks to surface of funnel and eductor suction inlet.

Without Vibration Device



With Vibration Device

- Alternative option for fluidization include air/gas via Tee fitting introduced parallel or perpendicular to the flow of powder. This can be done with CDA or Levitronix fan

Other Comments

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- Pump Speed at startup shall be relatively low (for example, 2000 rpm*). When powder settles in bag neck, Pump speed can be increased (for example, 4000 rpm*).

- Prior stopping pump at end of powder introduction process (powder fully introduced into liquid), pump speed shall be reduced again (for example, 2000 rpm*), otherwise there could be splash up (water hammer effect) back into the eductor assembly, which could wet surface. Alternatively, tuned automated valve closure procedure could be implemented.

- Operational, automated safety procedure on pinch valves closures and pump speed (as example) can be implemented (on Console with recipe, as example). Integrated Pressure Sensor on Levitronix Eductor offers monitoring and control capabilities of Suction Port Pressure.

- Powder Bag with Short Neck could offer potential operational advantages.

- Flushing of the bag with water to clean/rinse as a later step

*final speed numbers setup dependent

Alternative Setups

Flush

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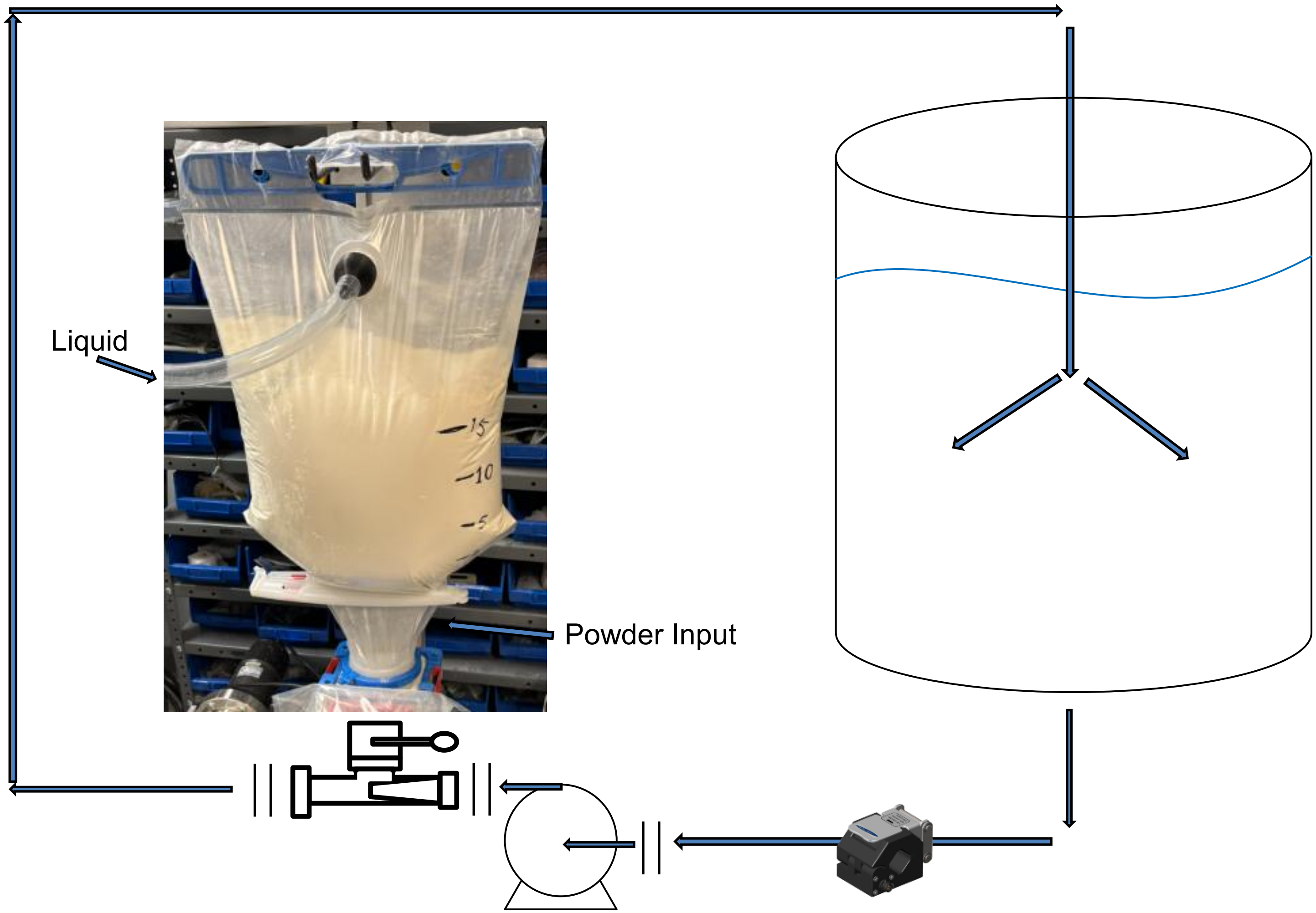
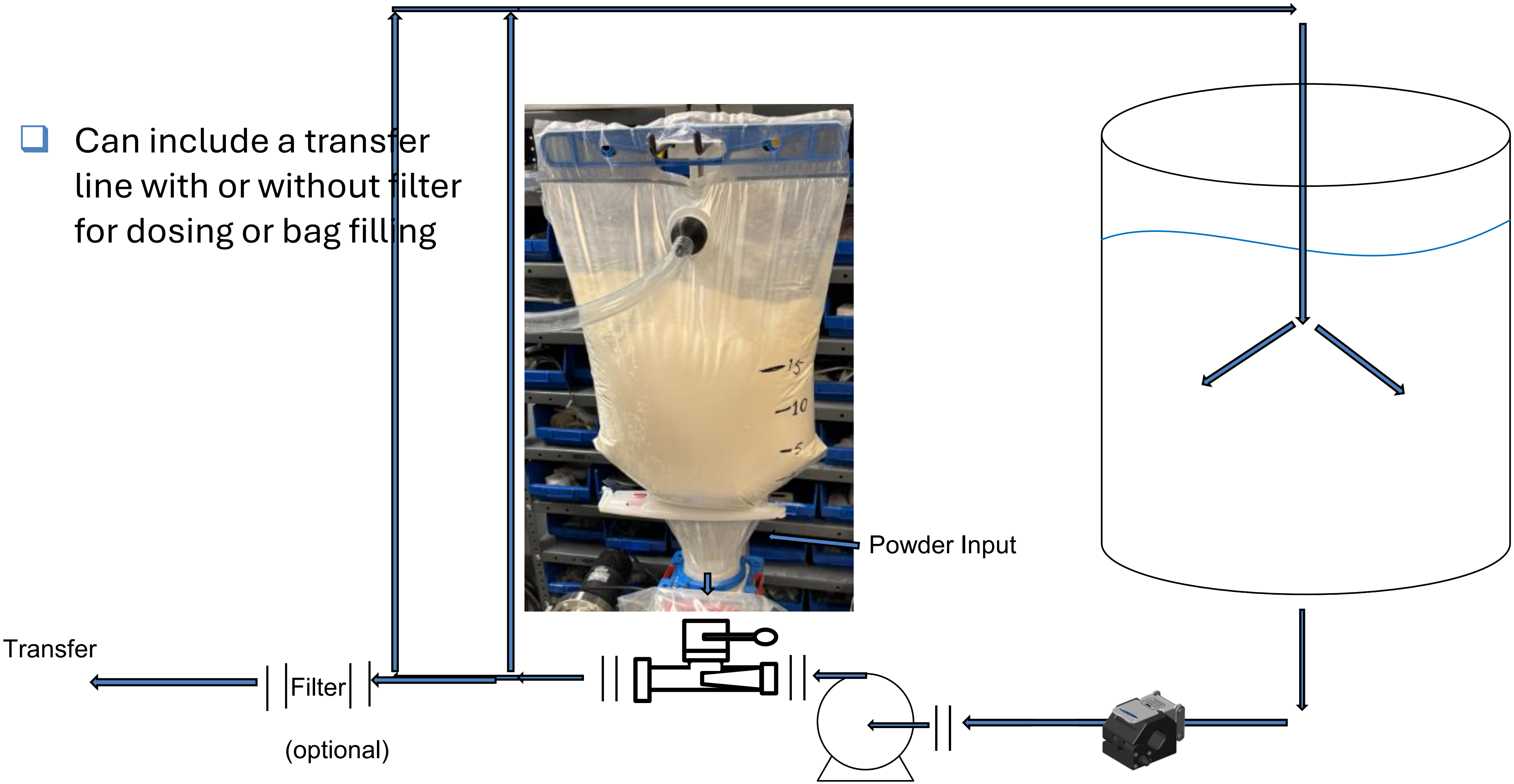
- Flushing of the bag with liquid (water or buffer) to clean/rinse as a later step to remove any residual powder in bag and powder intro assembly



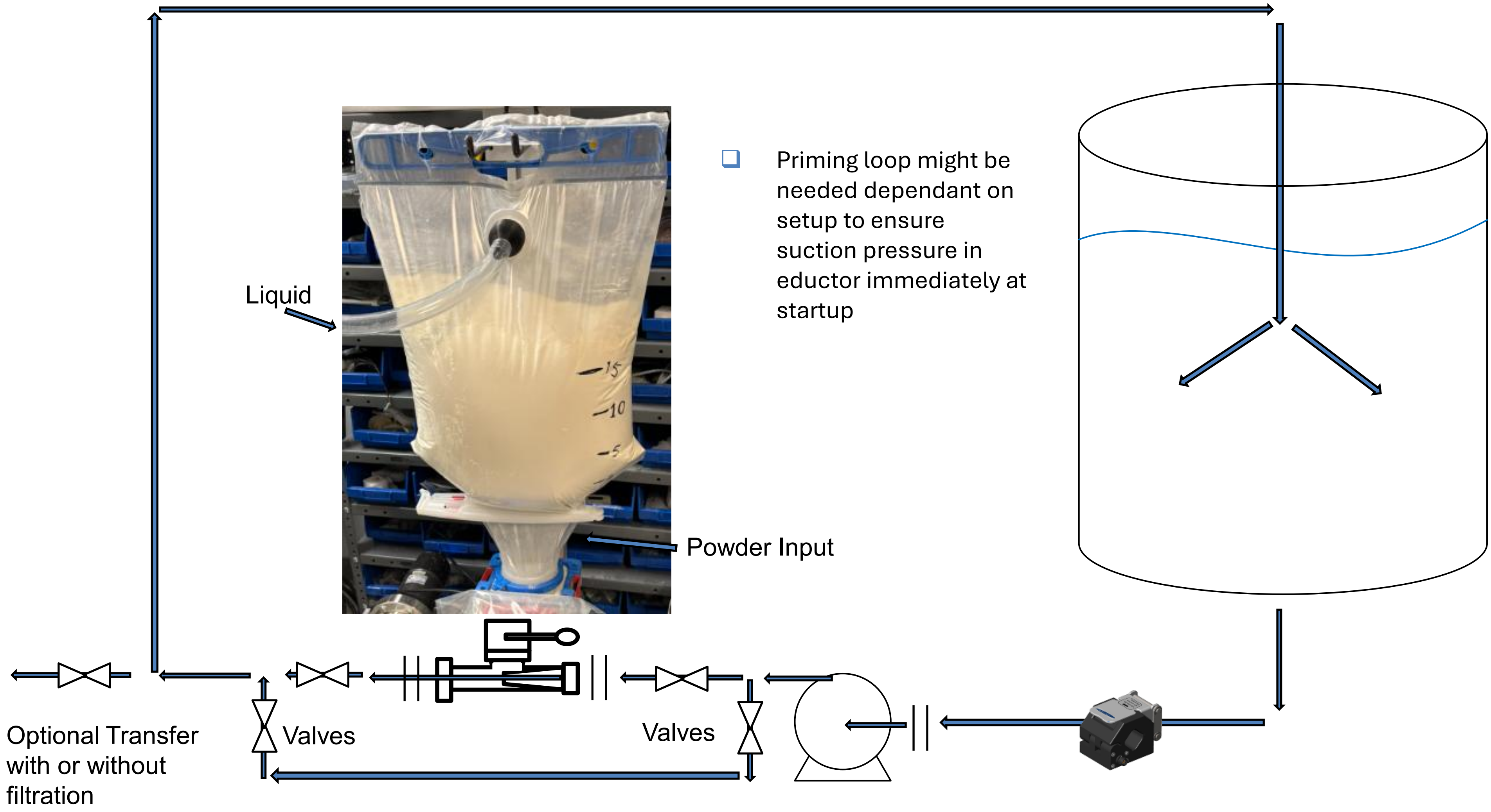
Transfer

- Can include a transfer line with or without filter for dosing or bag filling



Priming Loop
Option 1

- Priming loop might be needed dependant on setup to ensure suction pressure in eductor immediately at startup



Priming Loop
Option 2

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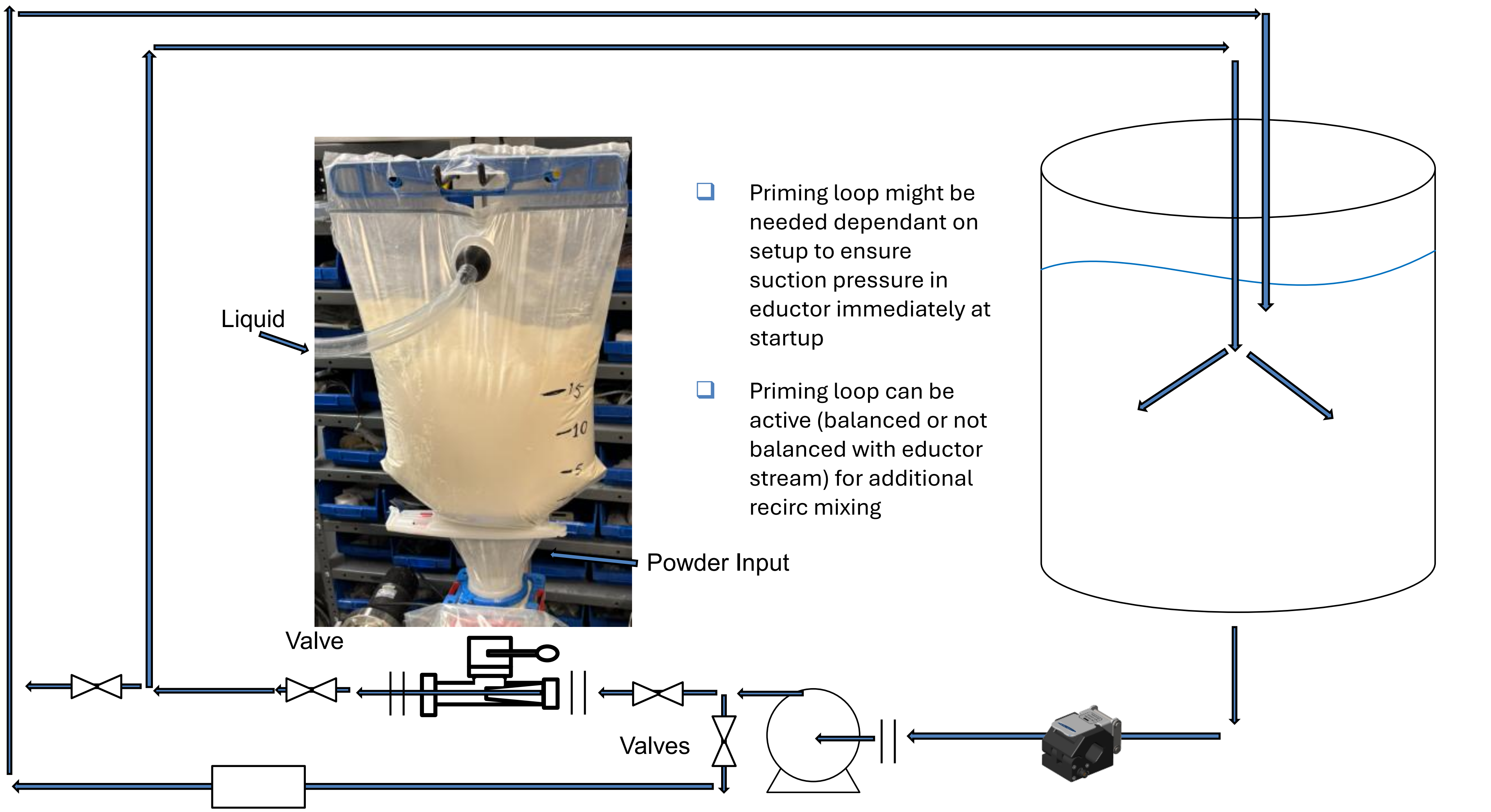

- Priming loop might be needed dependant on setup to ensure suction pressure in eductor immediately at startup
- Priming loop can be active (balanced or not balanced with eductor stream) for additional recirc mixing

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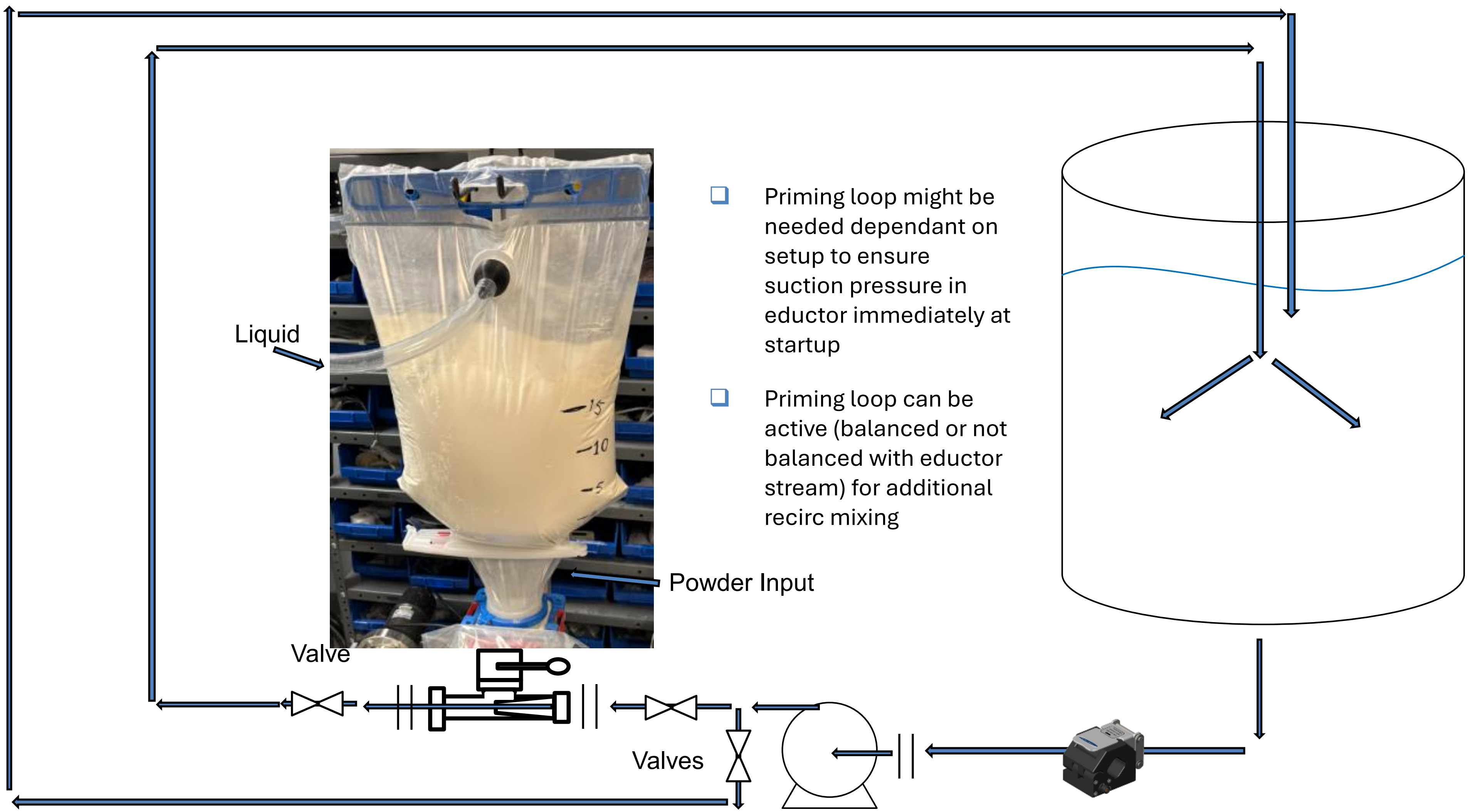
High Flow Mixing Loop



- Priming loop might be needed dependant on setup to ensure suction pressure in eductor immediately at startup
- Priming loop can be active (balanced or not balanced with eductor stream) for additional recirc mixing

High Flow Mixing Loop to improve mixing (in parallel or after completion of powder introduction)