

Pumps and the Inline SLIM:

Although the typical operation of the Inline SLIM does not require the use of pumps, the use of certain types of pumps can enhance its performance under certain conditions.

- **Centrifugal Pumps:**

Centrifugal pumps can be used to feed the liquid inlet of the Inline SLIM and/or to aid in the return of the discharge flow to the recirculation vessel. The use of a centrifugal pump on the inlet or outlet (discharge) side can often overcome many of the performance deficiencies caused by the factors described in earlier sections (i.e. long inlet/outlet piping, restrictions to flow, increasing viscosities).

When using a centrifugal pump on the inlet side, it is important to adhere to the following installation and operational guidelines:

1. Always install an adjustable valve between the outlet of the centrifugal pump and the inlet of the Inline SLIM (as close to the Inline SLIM liquid inlet connection as possible).
2. In order to optimize the SLIM performance, connect a vacuum gauge to the powder inlet connection.
3. Close the valve completely between the pump and the Inline SLIM
4. Start the Inline SLIM first and then the centrifugal pump.
5. With both the Inline SLIM and centrifugal pump running, open the valve slowly. Observe the vacuum gauge on the powder inlet. As soon as liquid begins to flow, you should start to see a vacuum reading on the gauge. Keep opening the valve as the vacuum level increases.
6. Continue to open the valve until the vacuum level peaks and begins to decrease. This should be considered the optimum setting for the valve. You should now shut down the system in the reverse order and remove the vacuum gauge.
7. Please note that, as conditions (such as viscosity) change, the valve setting may also need to be readjusted.

When using a centrifugal pump on the outlet (discharge) side, it is important to follow these suggestions:

8. Install a pressure gauge between the outlet of the Inline SLIM and the inlet of the centrifugal pump (as close to the Inline SLIM liquid outlet connection as possible).

1. Install an adjustable valve between the outlet of the centrifugal pump and your recirculation vessel.
2. In order to optimize the SLIM performance, connect a vacuum gauge to the powder inlet connection.
3. Open the valve completely between the pump and the Inline SLIM
4. Start the centrifugal pump first, then the Inline SLIM.
5. The purpose of the centrifugal pump is to reduce the discharge pressure of the Inline SLIM, as determined from the gauge on the outlet side. However, the centrifugal pump should not be starved of flow. If this occurs, close the valve on the discharge side of the centrifugal pump until the flow is constant.
6. Once a steady state is achieved you can observe the vacuum gauge on the powder inlet. Adjust the valve on the discharge side of the centrifugal pump to optimize the vacuum reading on the gauge.
7. Please note that, as conditions (such as viscosity) change, the valve setting may also need to be readjusted.

- **Positive Displacement Pumps:**

The Inline SLIM is a centrifugal device with a relatively high pumping rate. The use of positive displacement pumps to feed the Inline SLIM is usually **discouraged** for the following reasons:

- The high feed rates required by the Inline SLIM would necessitate the use of an unusually large positive displacement pump.
- Any blockage in the mixing chamber, or outlet piping, due to undispersed powders, could result in a dangerous pressure increase in the mixing chamber, or the discharge of liquid back through the powder inlet connection.

The only scenarios where positive displacement pumps should be considered are:

- The product is extremely viscous **and** it is possible to provide a positive displacement pump with the appropriate flow rate. In this case, the use of rupture discs or other pressure relief devices downstream of the pump is strongly recommended.