**Check valves**

We need a check valve to ensure the fluid in the diaphragm pump can only exit one direction. The ideal check valve in this situation would be one with zero cracking pressure. This would mean that only a few cm of H2O would open the valve, allowing for continuous flow from the media reservoir into the diaphragm. The ideal check valve would also have zero closing pressure, so that upon contraction of the diaphragm the valve immediately closes. There are several different types of check valves, but there are three worth considering for this application.

* Swing valves
* Ball valves
* Poppet valves

These three types of valves tend to have the lowest cracking pressure available. Through research, several potential vendors were identified. The vendor CheckAll was chosen, as they produce valves with cracking pressure of 0.125psi, the lowest that could be found at a reasonable price. They also allow tunable materials so that the valve could be customized to our system.

<https://www.checkall.com/PDFfiles/U3.pdf>

<https://www.checkall.com/PDFfiles/application_guidelines.pdf>

**Sizing**

Going back to Cv, we want a valve that can allow for at least 5 L/min at as low of a pressure as possible. This will allow us to limit the necessary elevation of the media reservoir. CheckAll makes valves in multiple sizes, and the two that are most applicable are the ½” and ¾” sizes. These valves have Cv of 4.3 and 7.2 respectively.

Cv 4.3

Using the Cv equation, in order to get 5 L/min across this valve we would need a dP of 0.3psi or **21.6 cm H2O.**

Cv 7.2

Repeating the same calculation, we would need a dP of 0.183psi or **12.9 cmH2O**

These calculations lend that it would be best to go with a ¾” valve so that it is not necessary to elevate the media reservoir by nearly 22cm.

**Housing Material**

The three most common materials for valves are carbon steel, brass, and stainless steel. For our purposes, **stainless steel is the obvious choice**. Carbon steel is prone to rusting in aqueous environments, and brass’s lead content disqualifies it from use with potable water which is a solid reason not to be using it for allowing cell growth.

**Seat Material**

Two of the most common seat materials are BUNA-N and EDPM. BUNA is better suited for corrosive medias, oils, and hydrocarbons. **EDPM** is made specifically for water systems, making it the obvious choice.

½” 99.55

¾” 127.90

1” 179.15