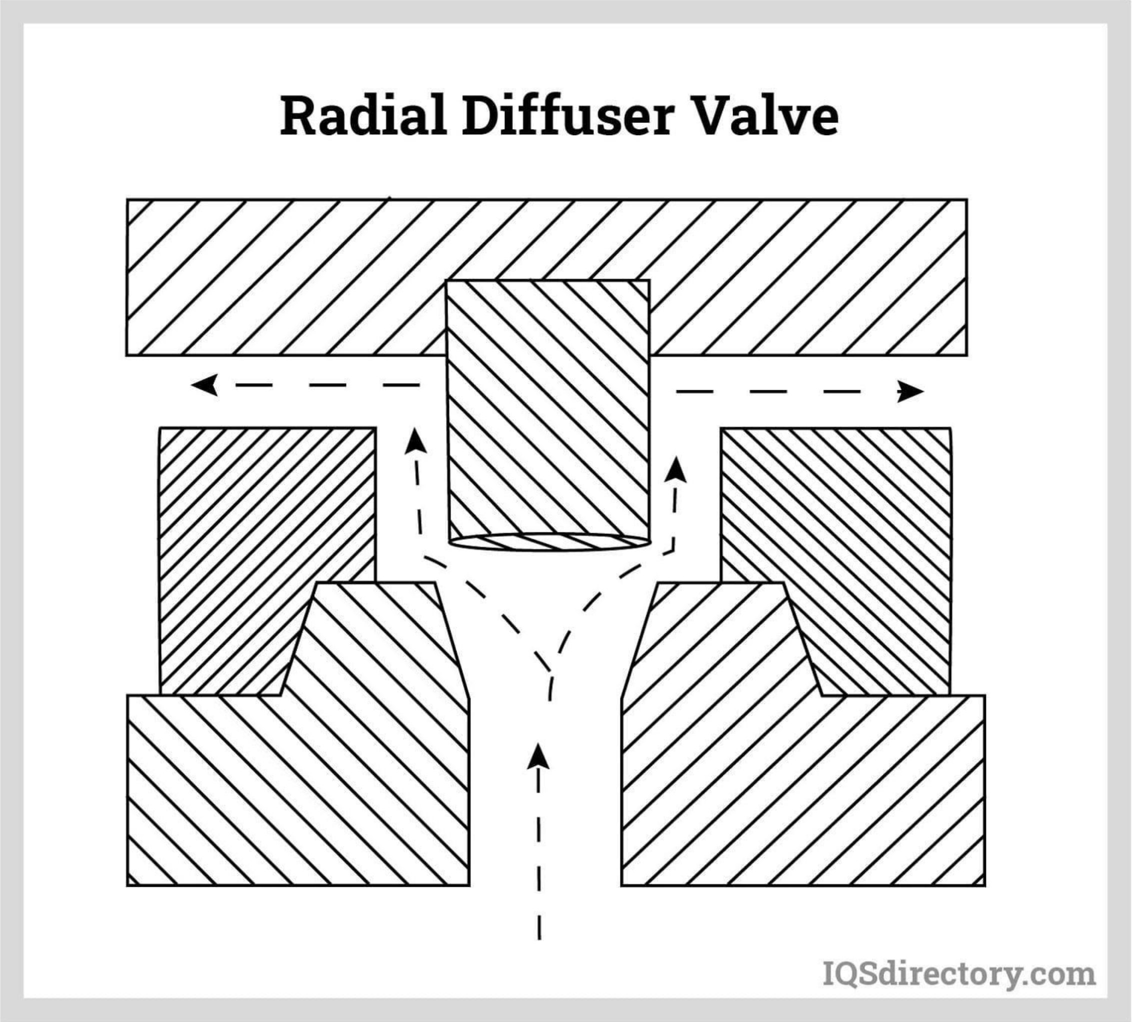
Homogenizer valve

The homogenization valve, as previously described, is composed of a seat, valve, and impact ring. As the premix fluid passes through the valve, its velocity increases, creating turbulence. The turbulence, in turn, develops eddies that break down the components of the premix. The small gap between the seat and the valve helps create strong shearing forces, which also contribute to the disruption of components. Upon exiting the gap, cavitation occurs. The implosion from the cavitating fluid creates shockwaves that break the components. Cavitation further improves the efficiency of the homogenizing process.

The homogenizer valve is the most important part of a homogenizer assembly. There are different types of homogenizer valves. Each type has its advantages and drawbacks; these make them suitable for a particular application. Below are the types of homogenizer valves.

Radial Diffuser Valve:

The radial diffuser valve is also known as the standard valve since it is the most extensively used in various industries. It consists of a plug and a seat. A typical design features a movable seat for adjusting the gap between the two parts.

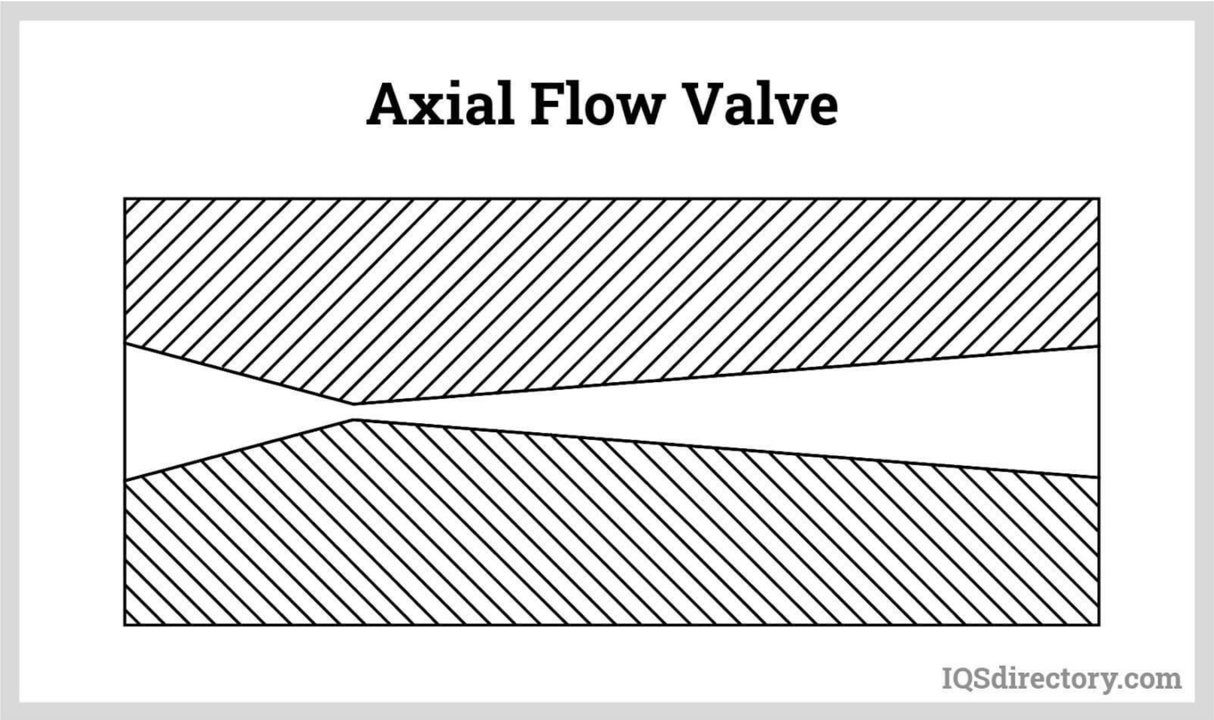


In this type of homogenizer valve, the premix fluid initially flows axially and is deflected at a 90° angle by the plug. This forces the fluid to flow radially along the small gap. After exiting the gap, the fluid stream hits an annular surface called an impact or wear ring.

The main advantage of a radial diffuser valve is its ability to control the homogenizing pressure by adjusting only the gap size while the flow rate is kept constant.

Axial Flow Valve:

An axial flow valve resembles an orifice valve. The small gap is created by an orifice, a venturi, or a short tube. Other axial flow valve designs feature a moving needle used to adjust the gap. The gap between the needle and the seat is oriented axially, hence the name. In a way, this is similar to a radial diffuser valve, which uses a plug.



The premix remains flowing axially as it passes through the orifice. Shearing, cavitation, and turbulence also take place within the small gap. Upon exiting the gap, the fluid jet is expanded without an impact chamber, unlike what is seen in a radial diffuser valve.

The design of axial flow valves varies depending on how the homogenizing pressure is controlled. Designs that only use static components control the homogenizing pressure by varying the flow rate. Designs that feature a moving needle control the pressure by adjusting the gap size.

Counter Jet Valve:

In a counter jet valve, the incoming stream of premix fluid is divided into two or more streams using microchannels. These microchannels serve as the gap for homogenizing the premix fluid. Upon exit, the streams are at a high velocity and are made to impinge on one another. The microchannels direct the streams into a small area called the interaction chamber.

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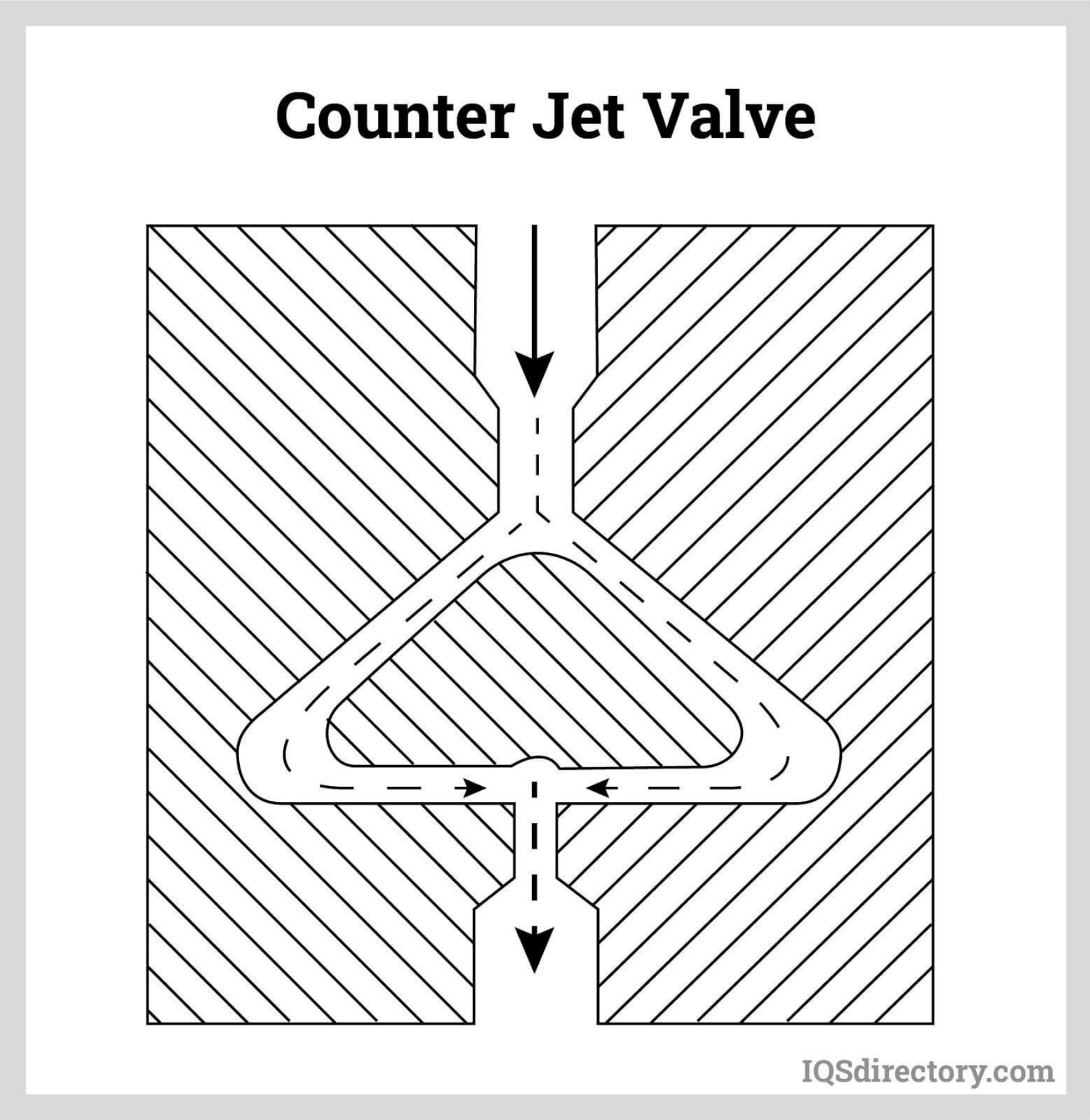

The benefit of using a counter jet valve is the operation without moving parts. Thus, they have greater reliability than radial diffuser valves. Moreover, no impact ring tends to wear over time due to the continuous impingement of the fluid.

However, the drawback is its dependence on flow rate to control the homogenizing pressure. On top of that, since it divides the premix stream using multiple channels, it needs a high flow rate to operate properly. This limits the homogenizing pressure attained by the valve.

Microfluidizer

With a microfluidizer, the product enters through an inlet reservoir and is pulled into a pumping system that pushes it into an interaction chamber at pressures up to 30,000 psi. In the chamber, the product is subjected to high shear rates, energy dissipation, and impact forces as it is pushed through microchannels, where it collides with the walls and its particles. The constant applications of the various forces disrupt cells to create uniform droplet size reduction.