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Tower Technical Bulletin

Understanding the Design and Performance of High Performance Structured Packing

Background

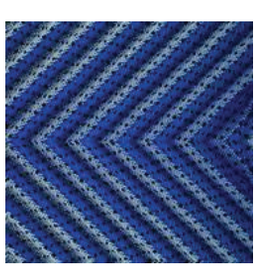
High performance structured packings have been on the market for around 10 years. They continue to gain market share because of their high capacity and excellent efficiency. This is especially true in vacuum tower applications where pressure drop is critical. High performance packings can yield substantial savings in capital and operating costs with increased capacity and lower flash zone pressure and temperature.

Packing Design Fundamentals

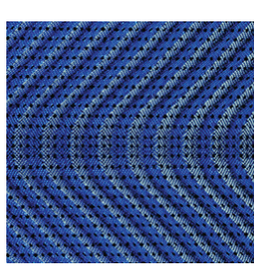
One of the fundamental characteristics of structured packings is that they have their greatest advantage in high vapor rate and low liquid rate applications. Structured packings take up very little cross section space within the column (around 1%) and allow vapor to flow through them in a continuous phase. In distillation systems, where liquid and vapor rates are dependant, vacuum applications have huge volumetric vapor flows. In high pressure distillation applications, the vapor volume may be 10 times greater than liquid volume, but in vacuum applications, the vapor volume may be over 10,000 times greater than the liquid volume. In these cases, the column internals must be able to efficiently handle these very large vapor flows. The open design of structured packings allow them to very effectively do just that.

High performance structured packings have the same operational characteristics as the standard packings only the high vapor handling capability is even more pronounced. For example, testing at Fractionation Research Inc. (FRI^{SM}), showed that MellapakPlus^{TM} 252.Y showed approximately 20% more useful capacity than standard Mellapak^{TM} 250.Y at 23.5 psia but showed fully 40% more useful capacity under vacuum conditions of 75 mm Hg. Because of this proven benefit, high performance structured packings can be used in commercial vacuum applications to allow significantly smaller column diameters and/or lower pressure drops and column flash zone pressures.

High performance structured packings achieve better results because they provide a smoother transition for the liquid and vapor to pass vertically between adjacent packing layers. With conventional structured packing, the discontinuity between 45° corrugated packing layers creates essentially a mitered 90 degree angle for vapor to flow through.

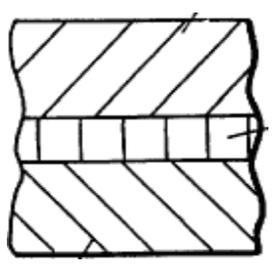


Mellapak

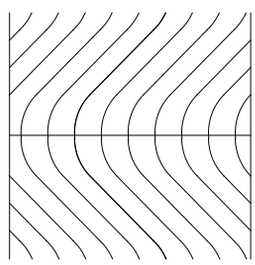


MellapakPlus

This sharp angle creates drag on the vapor side resulting in liquid holdup between the packing layers, leading to premature flooding. Sulzer originally published research results on the existence of a hydraulic limit between packing layers back in 1992, but it took some years to develop a mechanical packing design that would effectively limit this occurrence. MellapakPlus accomplishes this by using a patented S shaped packing corrugation that provides a smooth vertical transition between packing layers. Other packing manufacturers have tried to copy this feature with less than optimal chamfered designs.



Chamfered Transition



S Transition

Subsequent tests at FRI have quantified this advantage of the S design versus the chamfered design. Specifically, results show conclusively that the MellapakPlus “S” design has a 10% advantage in efficient capacity and a 20% advantage pressure drop under normal load conditions when compared with other high capacity packings. Under highly loaded conditions, this advantage increases. In vacuum applications, where columns can get quite large and pressure drop is at a premium, this advantage is critical.

Other Considerations

Successfully designing towers with high performance packing requires the right internals and expertise, but the payout is typically quite high. High performance packings operate where other devices cannot. Sulzer’s Applications team can help evaluate all possible options and provide an optimal solution for your tower.

The Sulzer Applications Group

Sulzer Chemtech has over 50 years of operating and design experience in mass transfer applications. We understand your process and your economic drivers. Sulzer has the know-how and the technology to provide an internals design with reliable, high performance.

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