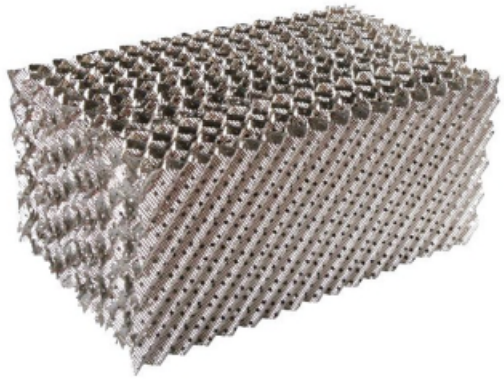
RVT Structured Packings RMP N 250Y and RMP S 250

Separation Efficiency and Pressure Drop

Separation efficiency and pressure drop of RVT structured packings RMP N 250Y and RMP S 250 have been characterized in the SRP (Separation Research Program) at the University of Texas in Austin (USA).

RVT structured packing RMP N 250Y is our conventional corrugated sheet structured packing with a corrugation angle of 45° (Y-type) and a specific surface area of 250 m²/m³. The metal sheet surface is provided with texturing and perforations as typically used in distillation.



Segment of RMP N 250Y

Structured packing RMP S 250 is RVT´s high capacity packing type. Higher capacity is reached through a smooth transition of the 45° corrugation angle in the middle of the packing body to a 90° corrugation angle at each end of the packing element. The metal sheet surface is identical to RMP N 250Y.

Segment of RMP S 250

The distillation performance of these two packing types has been measured using cyclohexane/n-heptane as test system at operating pressures of 0.165, 0.33, 1.65 and 4.14 bar in a 428 mm (i.d.) diameter column operated at total reflux. As a result, separation efficiency, capacity and pressure drop data for RMP N 250Y and RMP S 250 have been obtained under a wide range of operating conditions. These results are shown in the following diagrams.

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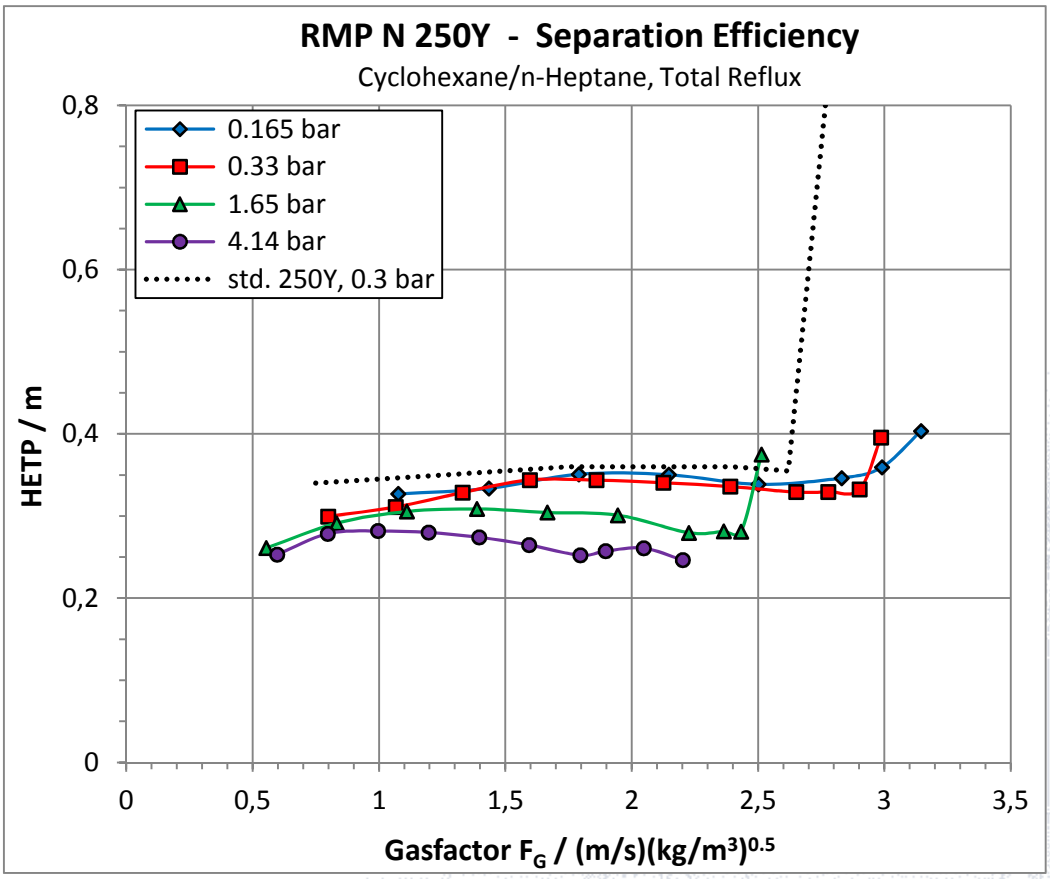
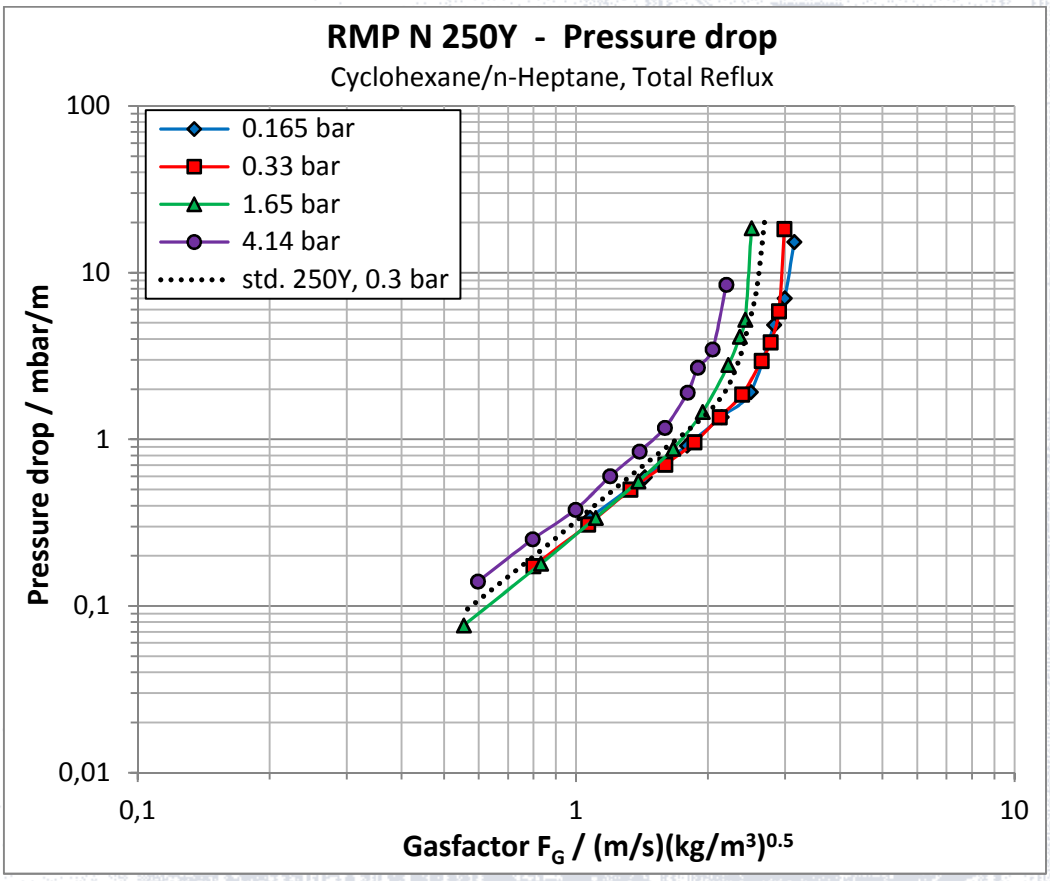

RMP N 250Y - Separation Efficiency
Cyclohexane/n-Heptane, Total Reflux
0.165 bar
0.33 bar
1.65 bar
4.14 bar
std. 250Y, 0.3 bar
HETP / m
0,8
0,6
0,4
0,2
0
0
0,5
1
1,5
2
2,5
3
3,5
Gasfactor F_G / (m/s)(kg/m³)$^{0.5}$


RMP N 250Y - Pressure drop
Cyclohexane/n-Heptane, Total Reflux
0.165 bar
0.33 bar
1.65 bar
4.14 bar
std. 250Y, 0.3 bar
Pressure drop / mbar/m
100
10
1
0,1
0,01
0,1
1
10
Gasfactor F_G / (m/s)(kg/m³)$^{0.5}$

RMP N 250Y – Analysis of the results

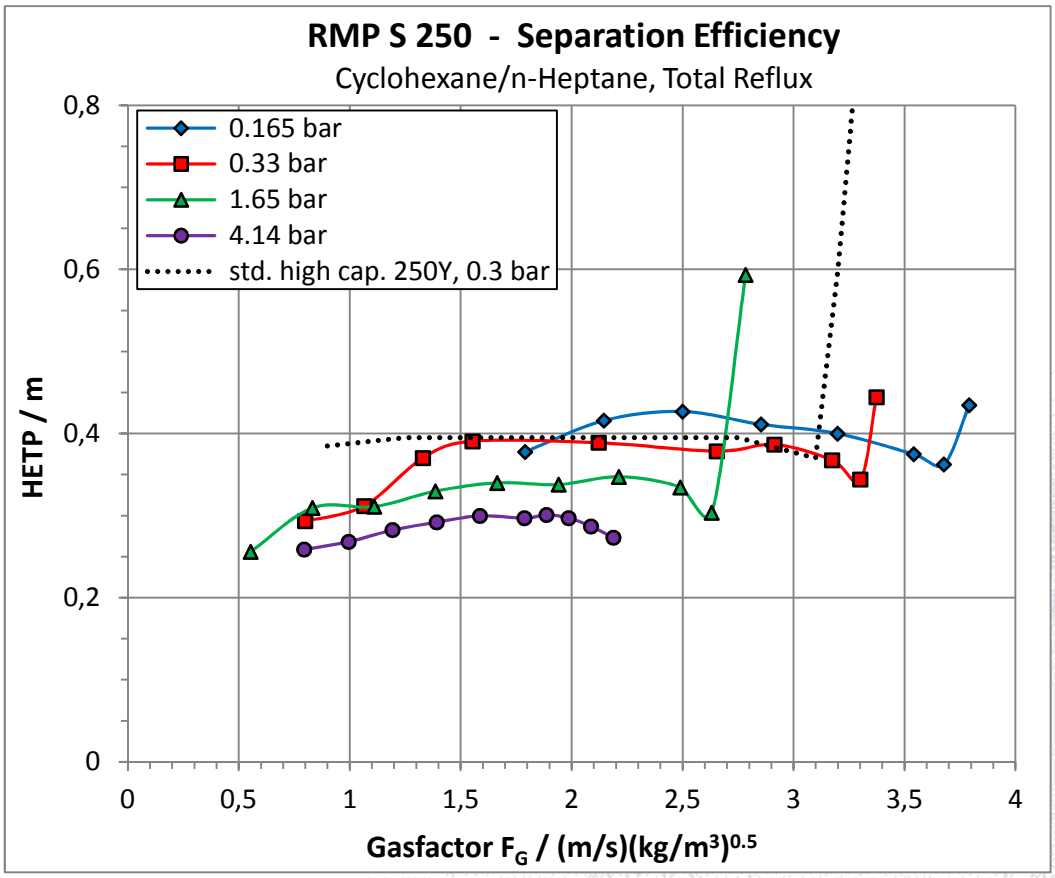
RVT´s RMP N 250Y structured packing exhibits an excellent mass transfer performance. The mass transfer efficiency, expressed as the height equivalent to a theoretical plate HETP (m), measured for the RMP N 250Y packing at the operating pressures of 0.165 and 0.33 bar are approx. 340 and 350 mm respectively. HETP values improve at the higher tested pressures: 300 mm at 1.65 bar and 260 mm at 4.14 bar. For all four operating pressures, HETP values are nearly independent of the gas factor F_G up to the loading region (approximately 85% of the flooding point).

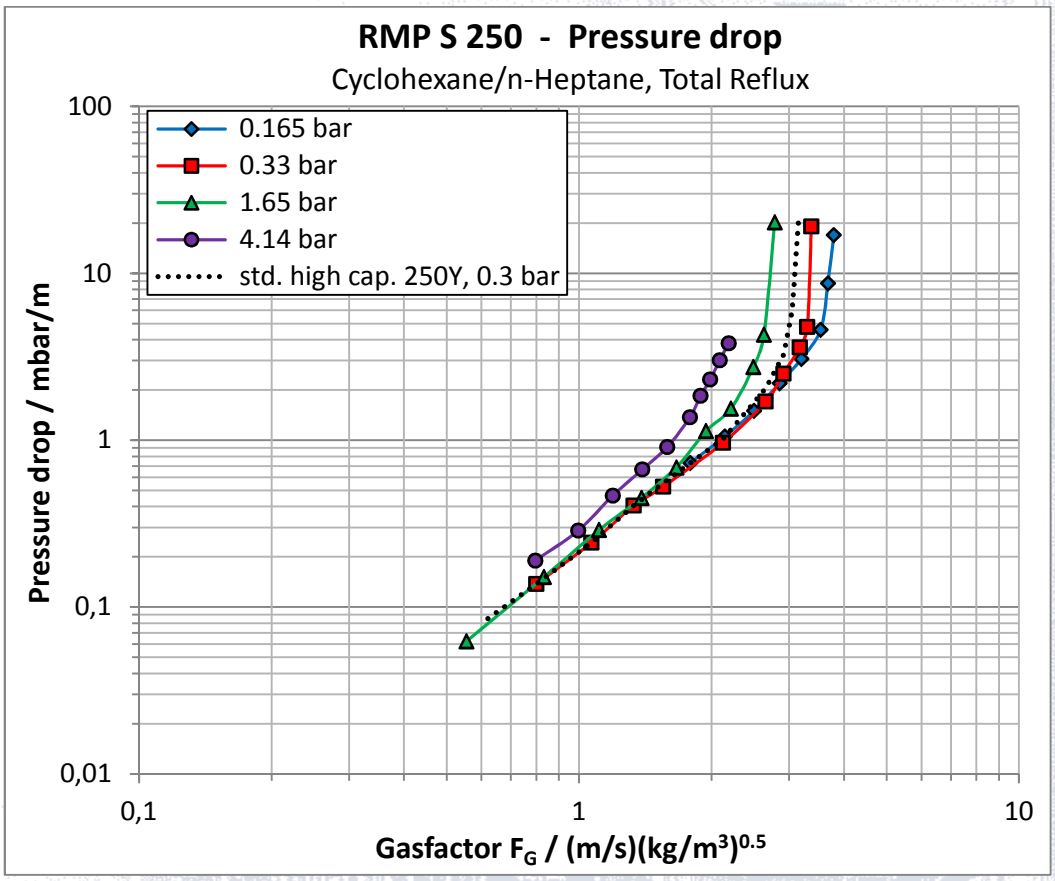
The RMP N 250Y packing also shows a very good capacity performance as compared to conventional structured packing of the same surface area. The flooding point is reached at gas factors of approx. 3 $m/s(kg/m^3)^{0,5}$ for the two vacuum operating pressures of 0.165 and 0.33 bar, whereas the conventional packing is limited to gas factors in the range of approx. 2.6. As expected, and demonstrated, the flooding point shifts to lower gas factors with increasing pressure: approx. 2.5 and 2.2 $m/s(kg/m^3)^{0,5}$ at 1.65 and 4.14 bar respectively.

The typical HETP and pressure drop profile of standard commercially available structured packings with 250 m^2/m^3 surface area and 45° corrugation angle at an operating pressure of approx. 0.3 bar have been included in the diagrams for the purpose of packing performance comparison. As can be observed, the RMP N 250Y´s mass transfer efficiency at the same operating pressure exceeds that of the standard 250Y packings by more than 10%, especially in the loading region and at low gas factors. The most distinctive performance feature of the RMP N 250Y is its superior capacity capability. The RMP N 250Y packing capacity is about 12% greater than the standard 250Y packings. In addition to its superior capacity the RMP N 250Y exhibits significantly lower pressure drop; by as much as 25 to 50% in the preloading and loading regions respectively.

These comparative performance features described here exemplarily for 0.3 bar system pressure are essentially maintained for the other three tested operating pressures.

These outstanding performance features makes RMP N 250Y packing be the best cost-effective packing for many industrial applications.


RMP S 250 - Separation Efficiency
Cyclohexane/n-Heptane, Total Reflux
0.165 bar
0.33 bar
1.65 bar
4.14 bar
std. high cap. 250Y, 0.3 bar
HETP / m
0,8
0,6
0,4
0,2
0
0
0,5
1
1,5
2
2,5
3
3,5
4
Gasfactor F_G / (m/s)(kg/m³)$^{0.5}$


RMP S 250 - Pressure drop
Cyclohexane/n-Heptane, Total Reflux
0.165 bar
0.33 bar
1.65 bar
4.14 bar
std. high cap. 250Y, 0.3 bar
Pressure drop / mbar/m
100
10
1
0,1
0,01
0,1
1
10
Gasfactor F_G / (m/s)(kg/m³)$^{0.5}$

RMP S 250 – Analysis of the results

RVT´s high capacity structured packing RMP S 250 distillation performance measurements demonstrate a superior capacity when compared to the standard RMP N 250Y packing.

Capacity enhancement is higher with decreasing operating pressure. A capacity increase of approx. 5 and 10% is reached at 4.14 and 1.65 bar respectively. For the two tested vacuum pressures, capacity further improves to 15 and 20% at 0.33 and 0.165 bar respectively. As expected, the flooding point shifts to lower gas factors with increasing pressure: approx. 3.7 and 3.4 m/s(kg/m^3)^{0,5} for 0.165 and 0.33 bar and approx. 2.7 and 2.3 m/s(kg/m^3)^{0,5} at 1.65 and 4.14 bar. As expected with a higher capacity structured packing, pressure drop with RMP S 250 is generally reduced between 20 and 40% when compared to RMP N 250Y.

HETP values for the RMP S 250 packing are slightly dependent on the gas factor and the operating pressure up to the loading region (approximately 85% of the flooding point). Mass transfer efficiency in the loading region is similar when compared to RMP N 250Y.

As done for RMP N 250Y previously, the typical HETP and pressure drop profile of standard commercially available high capacity structured packings with 250 m^2/m^3 surface area measured at approx. 0.3 bar have been co-plotted in the diagrams for a direct performance comparison. RMP S 250´s mass transfer efficiency at 0.3 bar is very similar to standard high capacity 250Y packings at moderate and high gas factors and significantly better at gas factors below 1.2 m/s(kg/m^3)^{0,5}. Packing capacity is about 8% greater. RMP S 250´s pressure drop is very similar to typical 250 m^2/m^3-high capacity packings except in the loading regions where pressure drop is significantly lower.

These comparative performance features described here exemplarily for 0.3 bar system pressure are essentially maintained for the other three tested operating pressures.