Raschig Super-Ring® Plus

Product Bulletin 251

The design of Raschig Super-Ring® was published in 1998 and had set new standards in the performance of random packings.
Nowadays it is called the first fourth generation random packing compared to earlier designs like Raschig-Rings, Pall-Rings and third generation packings. Soon after the Raschig Super-Ring® was available to the Industry it was a new reference line for packing comparisons in terms of pressure drop, capacity and efficiency.

FRI and SRP tested

A new Random Packing offers new advantages in performance

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Raschig Super-Ring® Plus

Raschig Super-Ring® Plus is the result of a consequent design development based on many years of research. The target was to stay with all advantages of Raschig Super-Ring® but improve capacity and reduce pressure drop.

The preferred principles of gas/liquid countercurrent flow, coming along with **Raschig Super-Ring® Plus** are as follows:

- **Minimize pressure drop** by arranging flat sinusoidal strips to an extreme open structure
- **Maximize capacity** by film flow preference on continuous sinusoidal strip arrangements
- **Maximize efficiency** by minimizing droplet formation inside the packing
- **Minimize foaming tendency** by minimizing droplet development and low pressure drop
- **Minimize fouling sensitivity** by generating continuous liquid films wetting the entire packing element
- **Maximize the effective surface area** by spreading the liquid film all over the packing
- **Maximize the open column cross section area** by optimized packing orientation
- **Increase mechanical strength** by strip rotation

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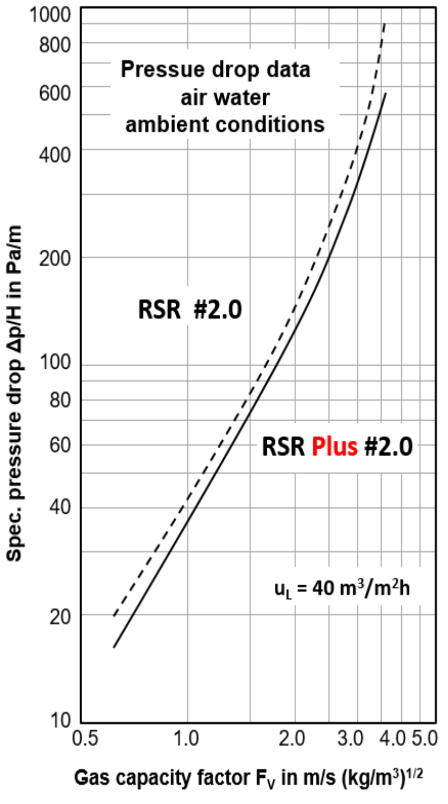
Raschig Super-Ring® Plus

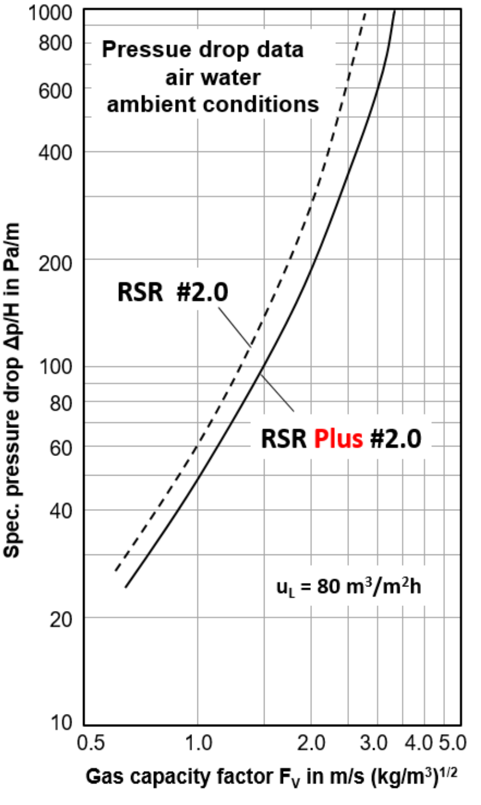
Technical data of the **Raschig Super-Ring® Plus**

Size	Material	Surface area m^2/m^3	Free Volume %
0.7	Metal	175	98
1	Metal	150	98
2	Metal	100	98

Raschig Super-Ring® Plus #2

The following figures demonstrate the pressure drop advantage of **Raschig Super-Ring® Plus** #2 compared to Raschig Super-Ring® #2.

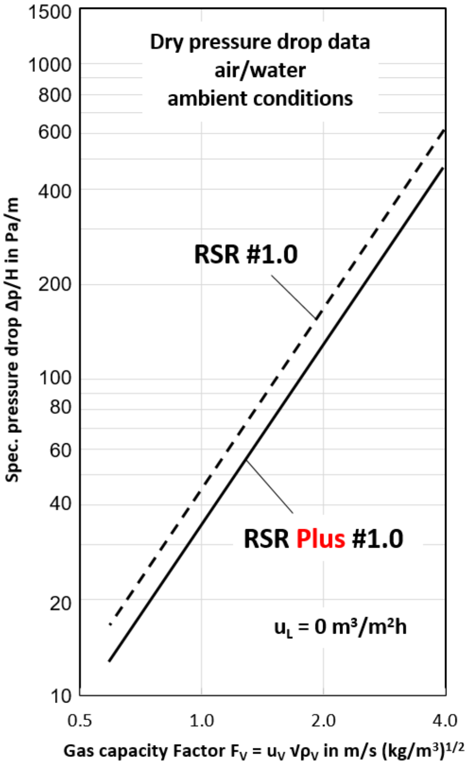


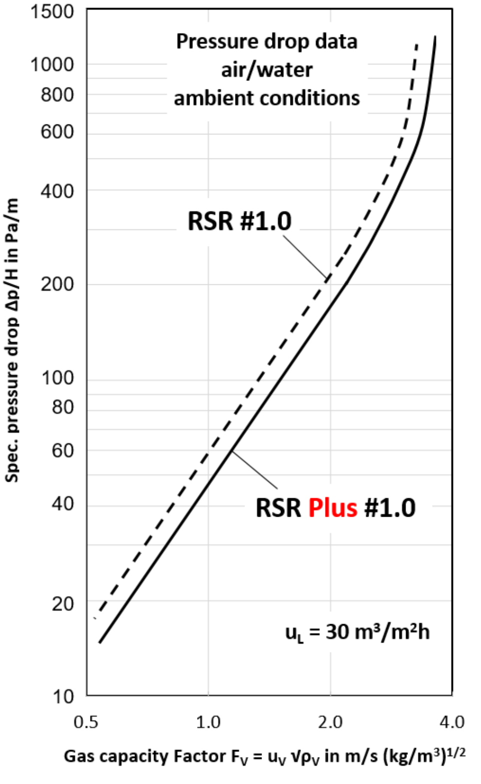


In the air/water simulator the pressure drop and capacity advantage of **Raschig Super-Ring® Plus #2** became obvious. The packing opens up the column cross section area by its special design which results in noticeable fluiddynamic benefits. A **capacity advantage of 8 %** and **pressure drop reduction of 10 %** was measured.

Raschig Super-Ring® Plus #1

The following figures demonstrate the pressure drop advantage of **Raschig Super-Ring® Plus** #1 compared to Raschig Super-Ring® #1.

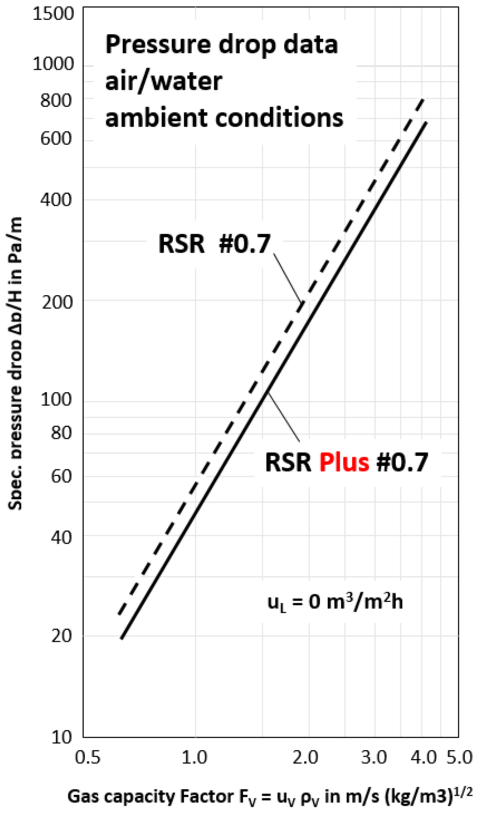


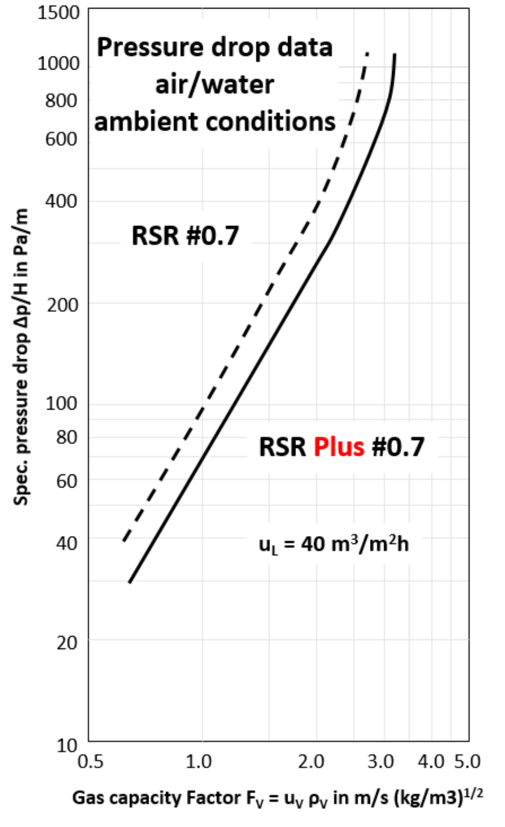


In the air/water simulator the pressure drop and capacity advantage is also proved for **Raschig Super-Ring® Plus #1**. A **capacity advantage of 8 %** and **pressure drop reduction of 10 %** was measured.

Raschig Super-Ring® Plus #0.7

The following figures demonstrate the pressure drop advantage of **Raschig Super-Ring® Plus** #0.7 compared to Raschig Super-Ring® #0.7.



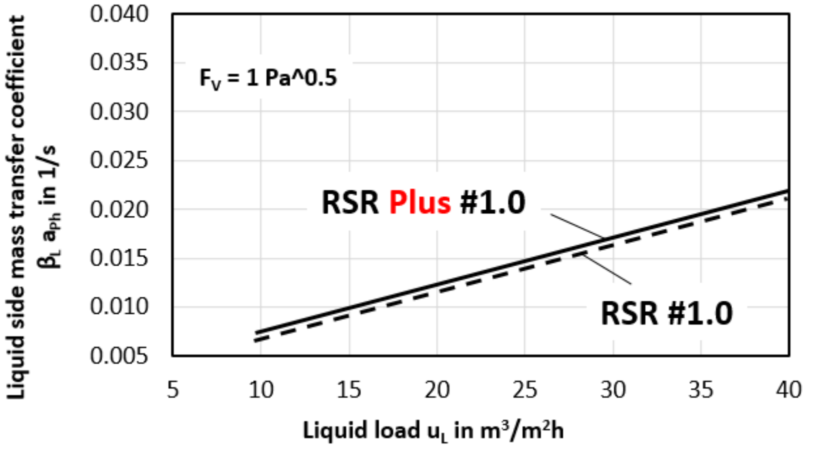


In the air/water simulator the pressure drop and capacity advantage is also proved for **Raschig Super-Ring® Plus #0.7**. A **capacity advantage of 8 %** and **pressure drop reduction of min. 10 %** was measured.

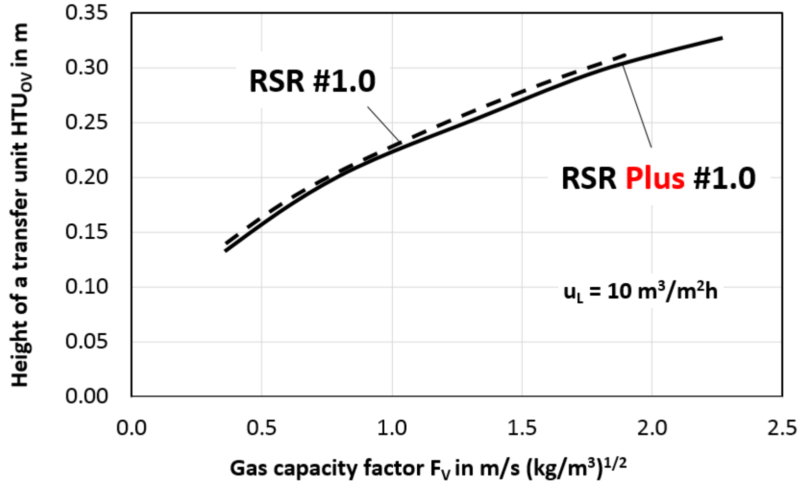
Raschig Super-Ring® Plus #1

Mass transfer efficiency of metal

Desorption of CO_2 from water into an atmospheric air stream



Absorption of NH_3 from air in water in the gaseous phase

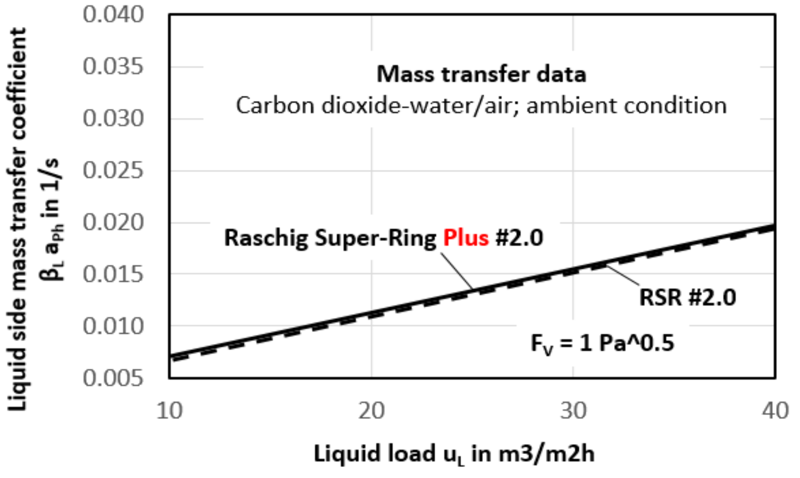


The efficiency of **Raschig Super-Ring® Plus #1** is practically the same as Raschig Super-Ring® #1

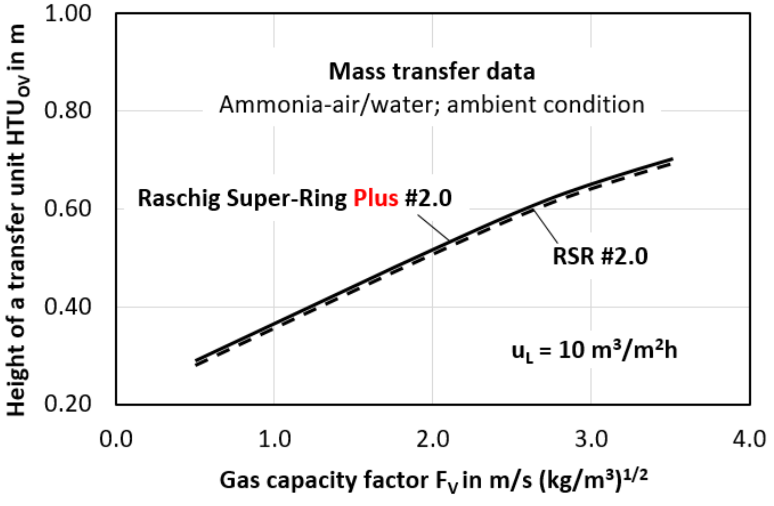
Raschig Super-Ring® Plus #2

Mass transfer efficiency of metal

Desorption of CO2 from water into an atmospheric air stream



Absorption of NH3 from air in water in the gaseous phase



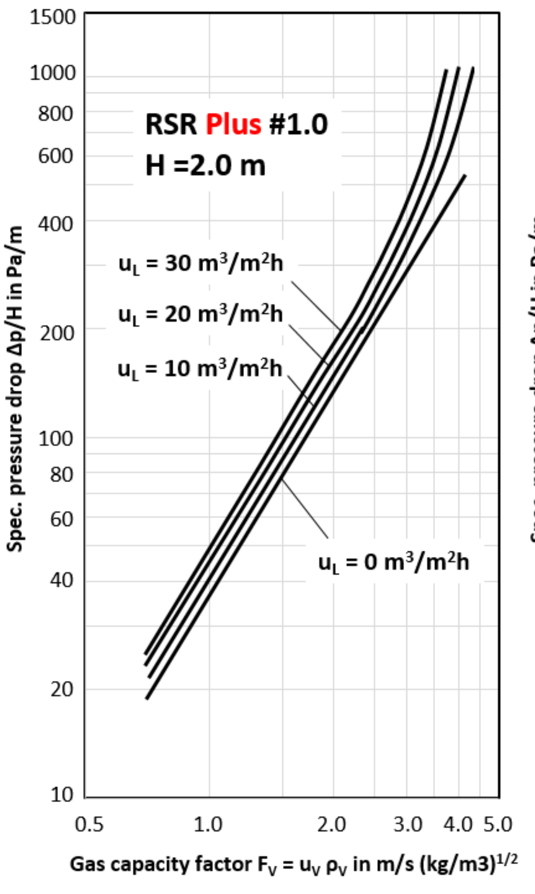
The efficiency of **Raschig Super-Ring® Plus #2** is practically the same as Raschig Super-Ring® #2

Raschig Super-Ring® Plus

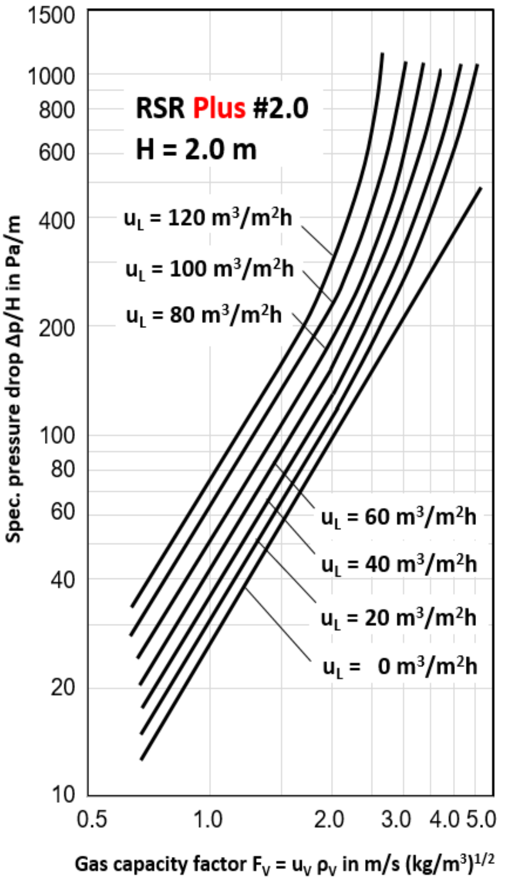
Pressure Drop data

system: air/water

Raschig Super-Ring® Plus #1
Column diameter: 0.288 m



Raschig Super-Ring® Plus #2
Column diameter: 0.450 m

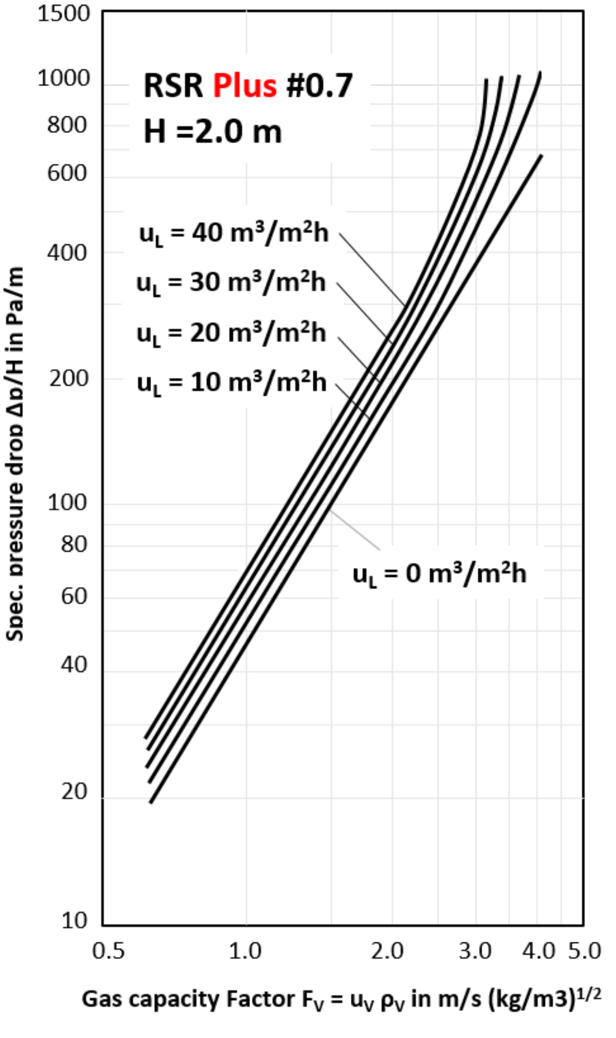


Raschig Super-Ring® Plus

Pressure Drop data

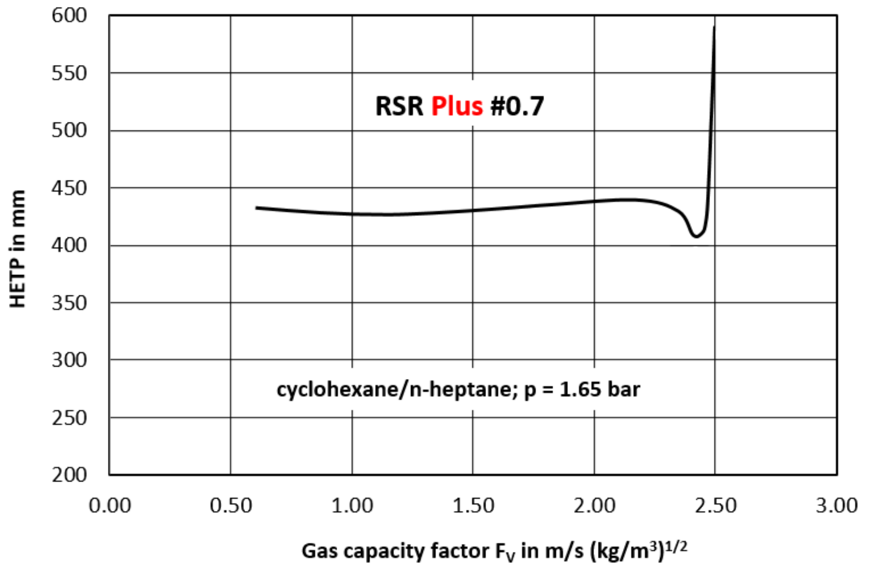
system: air/water

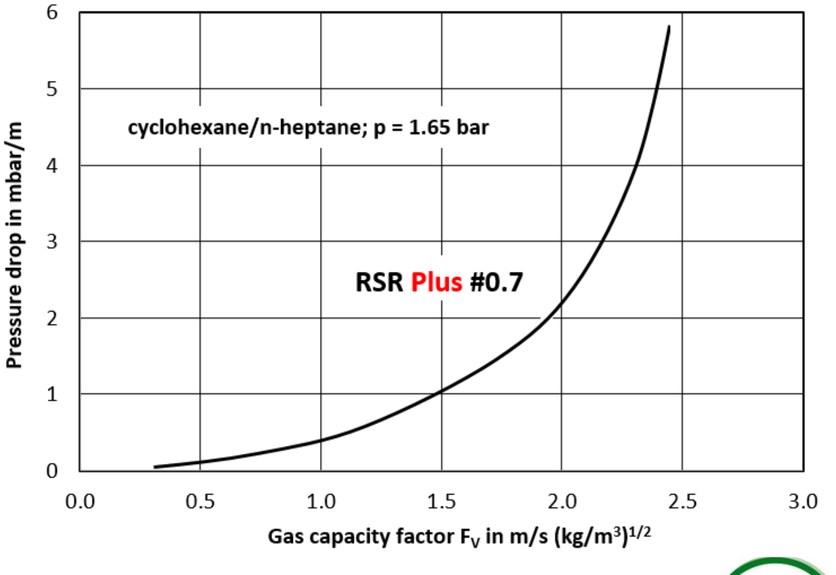
Raschig Super-Ring® Plus #0.7
Column diameter: 0.288 m



Raschig Super-Ring® Plus #0.7
SRP tested

Height equivalent to a theoretical plate HETP and pressure drop per meter of packing height for metal under distillation test conditions

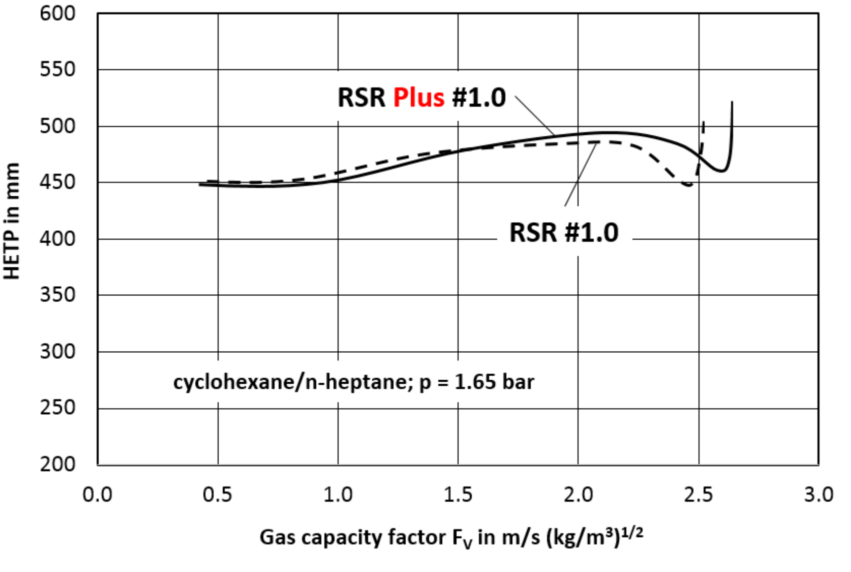


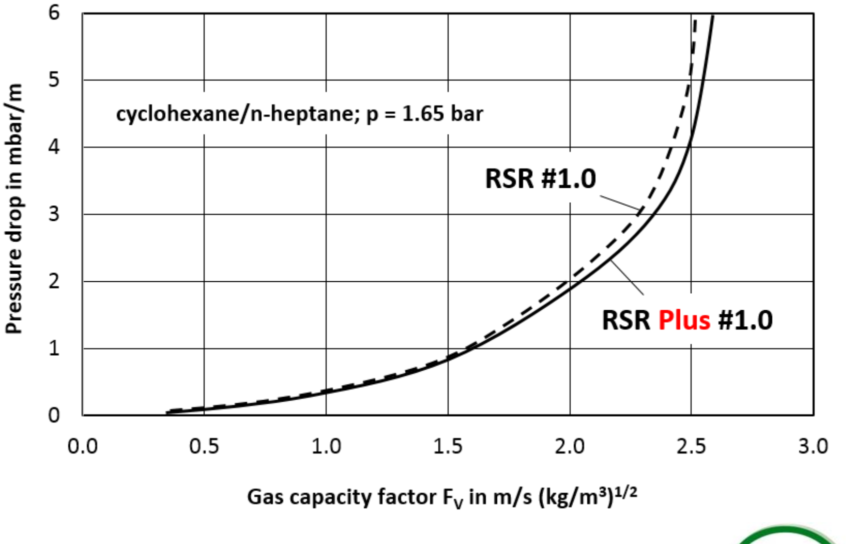


Raschig Super-Ring® Plus #1

SRP tested

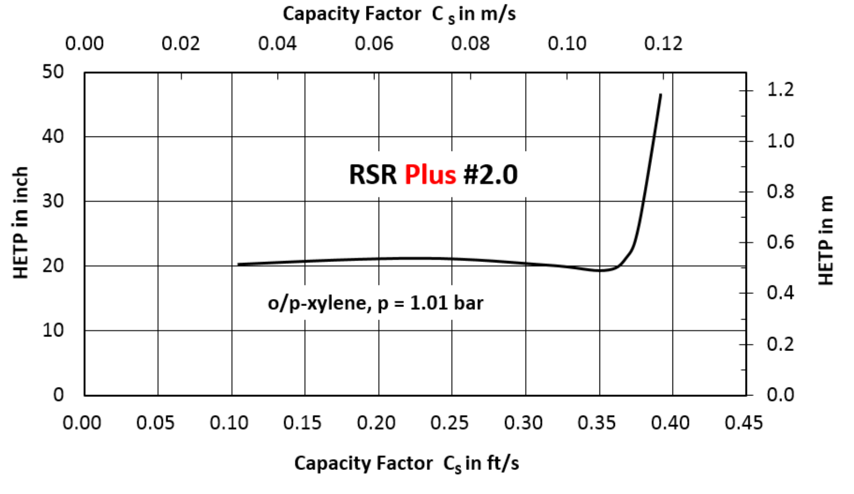
Height equivalent to a theoretical plate HETP and pressure drop per meter of packing height for metal under distillation test conditions

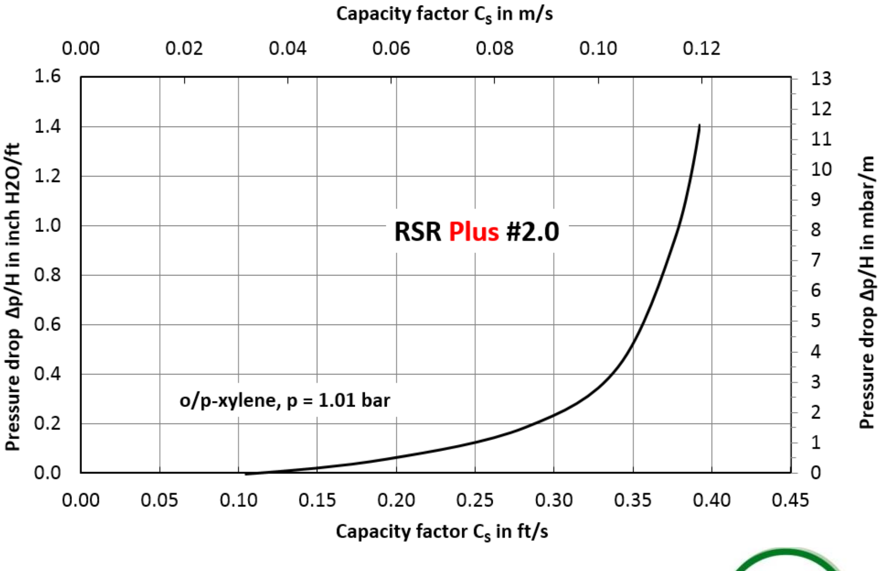




Raschig Super-Ring® Plus #2
FRI tested

Height equivalent to a theoretical plate HETP and pressure drop per meter of packing height for metal under distillation test conditions





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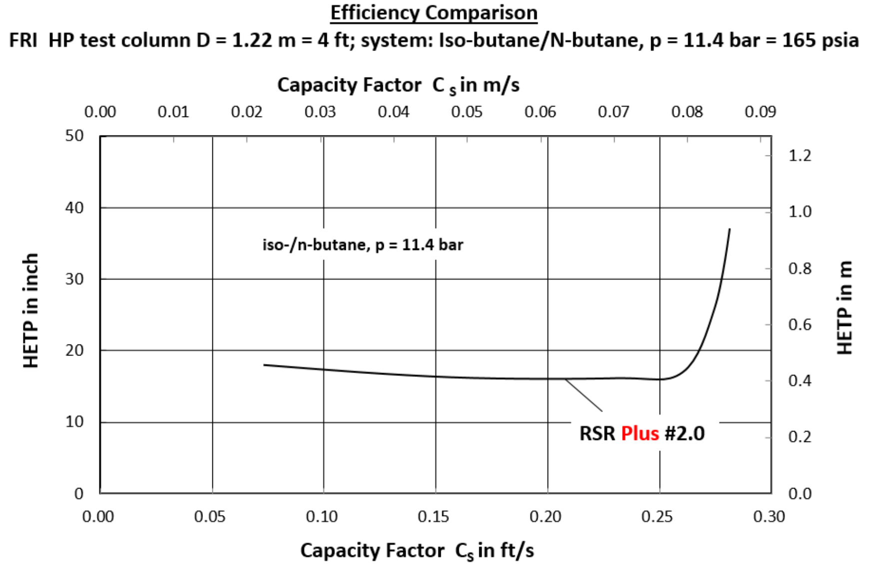
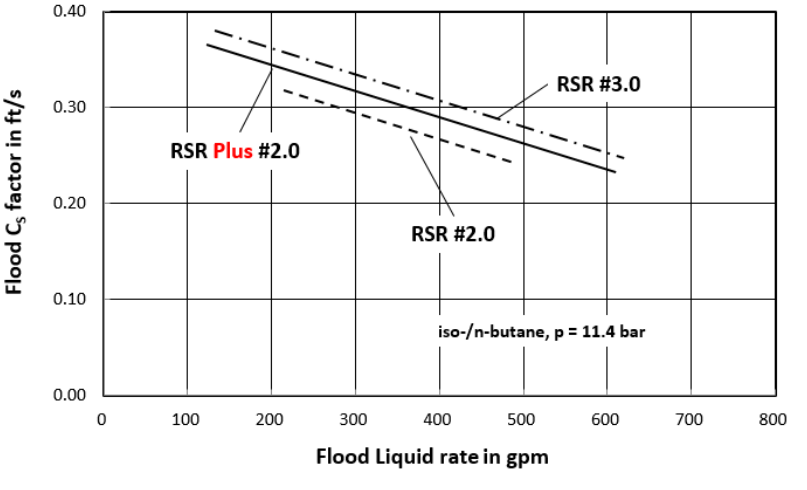
Raschig Super-Ring® Plus #2

Height equivalent to a theoretical plate HETP and flooding curve of packing for metal under distillation test conditions





Nomenclature

Latin symbols

a	m^2/m^3	specific surface area of packing
a_{Ph}	m^2/m^3	specific effective surface area of packing
C_S	m/s	$= u_V (\rho_V /(\rho_L - \rho_V))^{1/2}$ capacity factor
D_S, d_S	m	column diameter
F_V, F_G	$m/s\ (kg/m^3)^{1/2}$	$= u_V (\rho_V)^{1/2}$ gas capacity factor
F	-	Packing factor
g	m/s^2	$= 9.81\ m/s^2$, acceleration
H	m	section height
HETP	m	height equivalent to a theoretical plate
HTU_{OV}	m	overall gas side height of a transfer unit
$k_G a_{Ph}$	1/s	volumetric mass transfer coefficient in gas phase
$k_L a_{Ph}$	1/s	volumetric mass transfer coefficient in liquid phase
L	kg/h	Liquid mass flow rate
h_L	m^3/m^3	superficial liquid hold-up
n_{th}	-	number of theoretical stages
p	bar	pressure
u_L	m^3/m^2h	superficial liquid velocity
u_V	m/s	superficial gas velocity
V, G	kg/h	Vapor mass flow rate

Greek symbols

$\beta_V a_{Ph}$	1/s	volumetric mass transfer coefficient in gas phase
$\beta_L a_{Ph}$	1/s	volumetric mass transfer coefficient in liquid phase
ρ_L	kg/m^3	liquid density
ρ_V	kg/m^3	gas density
$\Delta p/H$	mbar/m	specific pressure drop
η	Pas, kg/(ms)	dynamic viscosity

Subscripts

Fl	flooding condition
L	liquid phase
V	vapour phase

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