Low Profile Rings
Product Bulletin 800

Superior Performance by Design™
Raschig GmbH – Raschig USA Inc.
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Raschig USA – June 2013

In order to establish a new alliance in mass transfer business RASCHIG GmbH and its parent company PMC GLOBAL INC have integrated Raschig USA Inc (formerly known as Raschig Jaeger Technologies) as a wholly owned subsidiary as a major manufacturer of tower packings, column internals, and specialty trays that is very active in the Mass Transfer and Environmental Business. (PMC Group purchased Raschig GmbH and Jaeger Products, Inc. in 2006 and formed Raschig Jaeger Technologies, Inc.)

Raschig USA is part of the PMC network of highly specialized, internationally operating companies and thus prepared to meet increased globalization and further improved customer orientation. Wherever in the world – on all continents – Raschig USA is on the spot.

Synergies

This strategic move combining Raschig GmbH and Raschig USA into one larger group gives a great advantage to our customers giving them worldwide access to products and technology of both entities. It will create new dimensions in mass transfer technology. The advantages of our process engineering know-how and our technologies benefit even more the planning, modernization, and construction of our clients’ processes. Increasing capacity while not jeopardizing efficiency saves energy, investment and operating cost.

The new alliance offers a diverse array of products to meet the mass transfer needs of the industries. While specializing in high performance products, the comprehensive products line of Raschig USA also includes traditional fractional trays as well as structured and random packing types that best fit your application.

Leading In-house Distributor Test Facility

The company operates one of the largest in-house distributor test-facilities worldwide. Liquid distributors can be tested up to 12 m in diameter at a maximum liquid load of 2,400m³/hour.

All products of Raschig USA are the result of consistent development and decades of experience. Comprehensive quality management in all stages of production and the principle of offering complete solutions are the basis of our excellent reputation – worldwide.
Raschig Low Profile Rings

Features

• Low Profile Rings (LPR) have an aspect ratio (height/diameter) of only 0.3

• Low pressure drop

• Corrosion resistance

• Unique geometry, which maximizes turbulent mixing between phases, while allowing free gas flow through the packed bed.

Benefits

When randomly installed, the bed forms an integral reticulated structure with excellent resistance to deformation to allow higher bed heights than other types of packing.

• The low aspect ratio offers opportunity for efficient gas and liquid contact and increased performance.

• Low Profile Rings (LPR) have no protruding edges or appurtenances which minimizes the chance for nesting and offers more uniform liquid distribution.

• With low packing factors, Low Profile Rings (LPR) allow increased hydraulic capacity while maintaining a low pressure drop.
Specifications

Materials: Seventeen standard, injection moldable plastics are available:
Polypropylene (PP) TopEx® (LCP)
Polyethylene (PE) Kynar® (PVDF)
Polypropylene Halar® (ECTFE)
Glass-Filled (PPG) Teflon® (PFA)
Noryl® (PPO) Tefzel® (ETF)
Polyvinylchloride (PVC) Tefzel® Glass- Filled (ETFE-G)
CorzanTM (CPVC) Teflon® (PTFE)
Polyphenylene sulfide (PPS) Ryton®
Perfluoroalkoxy (PFA)

Other plastics are available on request.

Sizes: Plastic Low Profile Ring Packings are made in three sizes:
No. 1A 1" Nominal
No. 2A 2" Nominal
No. 3A 3 1/2" Nominal

Values are based on specific surface area >43 ft²/ft³. Wetting problems are observed most frequently with plastic packings, but generally become acute only at <2 gpm/ft². When operating below this value, as in vacuum distillation, new packings should be chosen which have better wetting characteristics than those replaced. Be certain to take capacity changes into account. If materials with poorer wetting properties must be specified, the bed height may have to be increased or a smaller size (more efficient) packing used.

IMPORTANT NOTE:
Design data presented in this bulletin are for preliminary calculations only. Contact Raschig before finalizing calculations.

Properties Table

<table>
<thead>
<tr>
<th>Type</th>
<th>Size</th>
<th>1A</th>
<th>2A</th>
<th>3A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geometric</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Area*</td>
<td>ft²/ft³</td>
<td>85</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>Packing Factor</td>
<td>1/ft</td>
<td>26</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Void Space</td>
<td>%</td>
<td>92</td>
<td>93</td>
<td>94</td>
</tr>
<tr>
<td>Weight</td>
<td>lb/ft³</td>
<td>4</td>
<td>3.5</td>
<td>3.2</td>
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</table>

Reasonable Minimum Wetting Rates

<table>
<thead>
<tr>
<th>Surface</th>
<th>gpm/ft²</th>
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<tbody>
<tr>
<td>PVC/CPVC</td>
<td>1.5</td>
</tr>
<tr>
<td>polypropylene</td>
<td>1.6</td>
</tr>
<tr>
<td>fluoropolymers</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Column Packing Comparison
1A Plastic Low Profile Rings

Pressure Drop vs. C-factor

\[ C \text{-factor} = \frac{V_s}{\sqrt{(\rho_\text{L} - \rho_\text{V})}} \]

where

\( V_s \) = Superficial vapor velocity in ft/sec

\( \rho_\text{L} \) and \( \rho_\text{V} \) = Density of Liquid and Vapor in lb/cu. ft
Pressure Drop vs. C-factor
1A Plastic Low Profile Rings

Ambient Air-Water Systems for Various Liquid Loadings (gpm/sq. ft)

C-factor = \( V_s \left( \frac{\rho_v}{\rho_L - \rho_v} \right)^{1/2} \)

where

- \( V_s \) = Superficial vapor velocity in ft/sec
- \( \rho_L \) and \( \rho_v \) = Density of Liquid and Vapor in lb/cu. ft
Pressure Drop vs. C-factor

2A Plastic Low Profile Rings

Ambient Air-Water Systems for Various Liquid Loading (gpm/sq. ft.)

\[ \Delta P \text{ (inches liquid/ft bed height)} \]

\[ \text{C-factor} = V_s \left[ \frac{\rho_v}{(\rho_L - \rho_v)} \right]^{1/2} \text{ where} \]

\[ V_s = \text{Superficial vapor velocity in ft/sec} \]

\[ \rho_L \text{ and } \rho_v = \text{Density of Liquid and Vapor in lb/cu. ft} \]
Pressure Drop vs. C-factor
3A Plastic Low Profile Rings

Ambient Air-Water Systems for Various Liquid Loading (gpm/sq. ft.)

\[ \Delta P \text{ (inches liquid/ft height)} \]

\[ C\text{-factor} = V_s \left[ \left( \rho_L / (\rho_L - \rho_V) \right) \right]^{1/2} \text{ where} \]

- \( V_s \): Superficial vapor velocity in ft/sec
- \( \rho_L \) and \( \rho_V \): Density of Liquid and Vapor in lb/cu. ft
Mass Transfer Efficiency vs. Liquid Rate
1A Plastic Low Profile Rings

1% CO₂ in 4% aqueous NaOH system
K_{ga} normalized to 25% conversion at 75°F
with C-Factor = 0.12
Mass Transfer Efficiency vs. Liquid Rate
2A Plastic Low Profile Rings

1% CO$_2$ in 4% aqueous NaOH system
$K_{ga}$ normalized to 25% conversion at 75°F
with C-Factor = 0.12
Mass Transfer Efficiency vs. Liquid Rate
3A Plastic Low Profile Rings

$K_{ga}$ (Ibmole/hr-ft$^3$-atm)

Liquid Rate (gpm/ft$^2$)

1% CO$_2$ in 4% aqueous NaOH system
$K_{ga}$ normalized to 25% conversion at 75°F
with C-Factor = 0.12
Recirculation Pipe to Reboiler or Bottom Product

Vapor Distributor GV-1

Random Packing JAEGER TRI-PACKS®

Structured Grid Packing

Liquid/Vapor Feed

Flashing Feed Distributor FB3/RP2

Support Plate SP-1

Liquid Collector Mixing Trough CV-2

Support Grid SP-P

Manway

Liquid Collector with Draw Sump CP-2

Raschig Super-Pak™ 250 structured packing

Liquid Feed

Bed Limiter HP-P

Liquid Distributor DT-1

Reflux from Condenser

Mist Eliminator ME1

Liquid Distributor DP-1

Bed Limiter HP-1

Manway

Gas/Vapor Outlet

Skirt
Locations / Production Sites

Ludwigshafen and Espenhain, Germany
Arlington, Texas
El Dorado, Kansas
Monterrey, Mexico

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