Random Packing
From competitive products to advanced solutions
The Highest Level of Application Know-how

Our team provides state-of-the-art expert know-how for more than 500 applications in 100 processes. This enables us to optimize the performance and your installation.

Fast and Reliable Turnaround Services

We don’t shut-down, when you shut-down. You can rely on Sulzer professionals, expertise and procedures to get you back and running in the shortest possible time.

Comprehensive Engineering and Technology Services

We provide a full scope of associated engineering and technology services to optimize or trouble-shoot your installation.

A Broad Range of Innovative and High-performing Products

Our more than 200 products cover a wide range of needs in the field of separation and mixing technology.

They have proven their performance in more than 100,000 columns, 40,000 gas/liquid separators and 100,000 mixers in operation worldwide.
Random packing has been used for fractionation, absorption and stripping operations in gas, refinery and chemical plants for many years and the benefits are well established. For example, in high liquid load and high pressure applications random packing has been historically preferred as it provides improved distillation or absorption efficiency and a reduced pressure drop.

Furthermore, ease of replacement and storage make random packing the ideal choice for systems with heavy fouling or corrosion where packing is frequently replaced.

With our NeXt evolution of random packing we bring the same or better performance of the established random packing types which when combined with Sulzer’s leading application know-how offers a reduction in both capital and operation cost of even your most demanding processes.

Sulzer’s broad established random packing portfolio includes Nutter Rings, I-Rings, C-Rings, P-Rings and R-Rings, and gives us the flexibility to offer the solution whatever your requirement.

Random Packing
NeXRing™
The NeXt generation random packing

The NeXRing™ is the latest high performance random packing developed by Sulzer. The NeXRing provides extremely large and uniform open area in every ring orientation allowing a high surface exposure to liquid and vapor while minimizing dry zones.

The NeXRing had been tested in both Sulzer’s leading in-house R&D facilities and independently. All results have shown improved hydraulic performance compared to established random packing types with the same efficiency.

Conditions
Diameter: 0.3 m, Bed height: 2.25 m
Liquid concentration: 4% NaOH
Conversion to carbonate (Na₂CO₃): < 1%
Inlet gas concentration: 400ppm CO₂
Temperature: 25 °C
F = 1.5 √Pa
Bracket indicates extrapolated data
Pressure drop performance curves

The NeXRing has:
- Reduced costs
- Reduced pressure drop
- Increased capacity
- Improved mechanical stability
- Improved anti fouling feature

The NeXRing enables you to:
- Reduce capital investment
- Reduce operating costs
- Reduce column size (greenfield)
- Increase capacity (brownfield)
- Increase efficiency
- Increase running time and reduce stoppage

Liquid Load $i$, m³/m² h

Air-water system, ambient conditions
NeXRing™
The NeXt generation random packing

Notable advantages compared to P-Ring (the 2nd generation random packing)

For nearly 60 years the P-Ring has been the standard random packing for distillation and absorption.

Sulzer's NeXRing demonstrates a significant improvement in performance in comparison to the P-Ring.

- Replacing P-Ring#1.5 to NeXRing#1, up to a 45% increase in capacity can be obtained with a 5% increase in efficiency.
- Replacing P-Ring#2 with NeXRing#1.5 will give up to 10% increase in efficiency and a 20% increase in capacity. If NeXRing#2 is used up to a 40% increase capacity is obtained with the same efficiency.
- Replacing P-Ring#3.5 with NeXRing#2 can achieve a 20% increase in efficiency with a 15% increase in capacity.

<table>
<thead>
<tr>
<th></th>
<th>P-Ring#1.5</th>
<th>NeXRing#1</th>
<th>NeXRing#1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>100%</td>
<td>105%</td>
<td>95%</td>
</tr>
<tr>
<td>Capacity</td>
<td>100%</td>
<td>145%</td>
<td>160%</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>100%</td>
<td>50%</td>
<td>30%</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>P-Ring#2</th>
<th>NeXRing#1.5</th>
<th>NeXRing#2</th>
</tr>
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<tbody>
<tr>
<td>Efficiency</td>
<td>100%</td>
<td>110%</td>
<td>100%</td>
</tr>
<tr>
<td>Capacity</td>
<td>100%</td>
<td>120%</td>
<td>140%</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>100%</td>
<td>50%</td>
<td>30%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>P-Ring#3.5</th>
<th>NeXRing#2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>100%</td>
<td>120%</td>
</tr>
<tr>
<td>Capacity</td>
<td>100%</td>
<td>115%</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>100%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Higher performance compared to I-Ring (the 3rd generation random packing)

I-Ring generation random packing is one of the most widely used in mass transfer applications worldwide recognized as giving high efficiency and capacity.

With development of the 4th generation of random packing the Sulzer NeXRing can provide an increase in column capacity by up to 10% compared to 3rd generation random packing with no reduction in efficiency and a lower investment cost.

- By replacing I-Ring #40 with NeXRing#1, a 10% increase in capacity can be achieved with a 5% increase in efficiency. For some applications, e.g. for further increase in capacity, increase in fouling resistance or decrease in pressure drop is needed NeXRing #1.5 can be used.
- I-Ring #50 can be replaced by NeXRing #2 for a 10% increase in capacity with no decrease in efficiency. NeXRing #1.5 can be used for a further increase in efficiency.

<table>
<thead>
<tr>
<th></th>
<th>I-Ring#40</th>
<th>NeXRing#1</th>
<th>NeXRing#1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>100%</td>
<td>105%</td>
<td>95%</td>
</tr>
<tr>
<td>Capacity</td>
<td>100%</td>
<td>110%</td>
<td>130%</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>100%</td>
<td>70%</td>
<td>50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I-Ring#50</th>
<th>NeXRing#1.5</th>
<th>NeXRing#2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>100%</td>
<td>110%</td>
<td>100%</td>
</tr>
<tr>
<td>Capacity</td>
<td>100%</td>
<td>100%</td>
<td>110%</td>
</tr>
<tr>
<td>Pressure Drop</td>
<td>100%</td>
<td>90%</td>
<td>75%</td>
</tr>
</tbody>
</table>

These comparisons are based on trials in a Sulzer column of 1 m diameter and 3.5 m packing height, with the chlorobenzene/ethylenbenzen test mixture at total reflux.

CMR™ is a trademark and IMTP® and Cascade Mini-Rings® are registered trademarks of Koch-Gitsch, LP. Pall Ring® is a registered trademark of BASF AG. amDEA® is a registered trademark of BASF AG.
Applications

Fertilizer, Acid Gas Removal, Gas Sweetening

Random packing is widely used in the removal of CO₂ and H₂S from natural or bio-gas by contacting with amine based solvents such as MEA, DEA, MDEA and Activated MDEA. A common characteristic of these solvents is the strong tendency to foam.

The Sulzer NeXRing can provide capital and operational cost reductions in these applications by giving a much lower pressure drop compared to older random packing types minimizing the hydraulic impact of foam. Sulzer’s NeXRing can directly replace existing previous generations of random packing either to hydraulically debottleneck the column or to increase the column efficiency by using a smaller ring size while keeping the same pressure drop.

NGL (Natural Gas Liquids) Treatment

NGL produced from liquids recovery plants contain H₂S, CO₂ and Mercaptans which need to be removed to satisfy gas purity requirements. Random packing is the industry standard for this application and the Sulzer NeXRing with its uniform surface area distribution and high open area helps to create a more uniform droplet dispersal compared to previous generation random packing while also minimizing the potential for back-mixing.

Replacing existing older types of random packing with Sulzer NeXRings combined with Sulzer’s high performance VSX continuous and dispersed phase distributors provides either an increased efficiency or increased capacity.

Butadiene

In butadiene production random packing is typically used in the main wash, rectifier and degasser columns due to their characteristically high specific liquid load.

Replacing previous generation of random packing with the equivalent Sulzer NeXRing can lead to higher capacities without loss of efficiency. In these unit operations it is fairly common to use divided wall columns. To prevent loss of efficiency or hydraulic performance a good understanding of liquid distribution is critical. With many divided wall columns in successful operation and a track record of performance since the 1960’s Sulzer can provide this critical and often missed design know-how to get the most out of your column.

Demethanizers

Separation of methane from heavy hydrocarbons is done at high operating pressure and low temperature. Due to the low surface tensions and small density differences leading to unstable liquid films ensuring good contact between the liquid and gas phase is critical.

Due to these characteristics random packing has been historically preferred for on-shore applications in comparison to trays or structured packing. The Sulzer NeXRing with its higher capacity and lower pressure drop enables a further increase in capacity for existing columns or decreased diameters and bed heights for new columns.
Nutter Ring™

• High-performance random packing designed by Dale Nutter in 1984
• Efficiency enhanced by lateral liquid spreading and surface film renewal
• Superior surface utilization allows for shorter packed beds
• Intensively tested by Fractionation Research Institute (FRI) which makes the Nutter Ring the best-known high-performance random packing in industry
• Geometry provides maximum randomness with minimum nesting and maximum mechanical strength

<table>
<thead>
<tr>
<th>Nutter Ring Types</th>
<th>NR #0.7</th>
<th>NR #1</th>
<th>NR #1.5</th>
<th>NR #2</th>
<th>NR #2.5</th>
<th>NR #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Surface</td>
<td>m²/m³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>226</td>
<td>170</td>
<td>124</td>
<td>96</td>
<td>85</td>
<td>66</td>
</tr>
<tr>
<td>ft²/ft³</td>
<td>68.9</td>
<td>51.8</td>
<td>37.8</td>
<td>29.3</td>
<td>25.9</td>
<td>20.1</td>
</tr>
<tr>
<td>Void Fraction</td>
<td>%</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

Material thickness can be adjusted to clients’ needs. Other sizes are available on request.

**K_g.a of Nutter Ring**

- Conditions
  - Diameter: 0.3 m, Bed height: 2.25 m
  - Liquid concentration: 4% NaOH
  - Conversion to carbonate (Na₂CO₃): < 1%
  - Inlet gas concentration: 400ppm CO₂
  - Temperature: 25 °C
  - \( \dot{F} = 1.0 \sqrt{\text{Pa}} \)
  - Bracket indicates extrapolated data

**HETP of Nutter Ring**

- Conditions
  - Valid for atmospheric distillation with standard organic test mixture at total reflux
I-Ring™

- Equivalent to IMTP Rings - industry’s first and most widely used high-performance random packing introduced in the late 1970s
- Geometry ensures low liquid hold-up and a great improvement in capacity compared to Pall Rings

<table>
<thead>
<tr>
<th>I-Ring Types</th>
<th>IR #15</th>
<th>IR #25</th>
<th>IR #40</th>
<th>IR #50</th>
<th>IR #60</th>
<th>NIR #70</th>
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</thead>
<tbody>
<tr>
<td>Specific Surface</td>
<td>m²/m³</td>
<td>305</td>
<td>226</td>
<td>151</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>ft²/ft³</td>
<td>93.0</td>
<td>68.9</td>
<td>46.0</td>
<td>30.5</td>
<td>24.4</td>
</tr>
<tr>
<td>Void Fraction</td>
<td>%</td>
<td>97</td>
<td>97</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

Material thickness can be adjusted to clients’ needs. Other sizes are available on request.

K_ga of I-Ring

Liquid Load, gpm/ft²

F, ft/s √Pa

Conditions
Diameter: 0.3 m, Bed height: 2.25 m
Liquid concentration: 4% NaOH
Conversion to carbonate (Na₂CO₃): < 1%
Inlet gas concentration: 400ppm CO₂
Temperature: 25 °C
F = 1.5 √Pa
Bracket indicates extrapolated data

HETP of I-Ring

Conditions
Valid for atmospheric distillation with standard organic test mixture at total reflux
C-Ring™
Also available in Plastic,’ Materials available are PP, PVC/C, PE, PVDF, ETFE, PFA

- Equivalent to the widely used Cascade Mini-Rings (CMR)
- Evolution of Pall Ring employing a much lower diameter-to-height ratio which favors orientation that results in lower pressure drop and higher capacity
- Excellent mechanical strength
- C-Rings excel in fouling media

<table>
<thead>
<tr>
<th>C-Ring Types</th>
<th>CR #1</th>
<th>CR #1.5</th>
<th>CR #2</th>
<th>CR #2.5</th>
<th>CR #3</th>
<th>CR #4</th>
<th>CR #5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Surface</td>
<td>m²/m³</td>
<td>244</td>
<td>187</td>
<td>142</td>
<td>126</td>
<td>101</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>ft²/ft³</td>
<td>74.4</td>
<td>57.0</td>
<td>43.3</td>
<td>38.4</td>
<td>30.8</td>
<td>21.3</td>
</tr>
<tr>
<td>Void Fraction</td>
<td>%</td>
<td>97</td>
<td>97</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

Material thickness can be adjusted to clients’ needs. Other sizes are available on request.

P-Ring™
Also available in Plastic,’ Materials available are PP, PVC/C, PE, PVDF, ETFE, PFA

- Equivalent to the widely used Pall Ring
- Design by BASF AG around 1940 based on the Raschig Ring
- Punched «shovels» leave «windows» on the outside facilitating vapor flow and enhancing capacity versus the R-Ring
- World’s largest collection of performance data is available for the Pall Ring

<table>
<thead>
<tr>
<th>P-Ring Types</th>
<th>PR #5/8</th>
<th>PR #1</th>
<th>PR #1.5</th>
<th>PR #2</th>
<th>PR #3.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Surface</td>
<td>m²/m³</td>
<td>350</td>
<td>222</td>
<td>144</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td>ft²/ft³</td>
<td>106.7</td>
<td>67.7</td>
<td>43.9</td>
<td>34.1</td>
</tr>
<tr>
<td>Void Fraction</td>
<td>%</td>
<td>95</td>
<td>95</td>
<td>97</td>
<td>97</td>
</tr>
</tbody>
</table>

Material thickness can be adjusted to clients’ needs. Other sizes are available on request.
Liquid distributors

High-Liquid-Load
- Tube Distributors VR
  - VRGF

Distributor/Collector VS
- VSI
- VSI/VSIR

Trough-Distributor VK
- VKG

Element-Distributor VE
- VEH

Standard-Load
- VKR2
  - VKG
  - VKGF
  - VKR2F

Low Liquid-Load
- VKPK
- VEPK

Specific liquid load [m³/m²·h]

Column Diameter [m]

0.05 0.25 0.8 3 20
0610 2501-5
0609 2500-7  0609 2500-2
0610 2501-4
0609 2500-3
0610 2501-3
0610 2501-2
0609 2500-4
0609 2500-5
0609 2500-6
0609 2500-1
0609 2500-2
0609 2500-7
0609 2500-3
0609 2500-5
0609 2500-6
0609 2501-4
0609 2500-2
0609 2500-4
0609 2500-5
0609 2500-6
**Internals for Random Packing Columns**

Sulzer high performance liquid collector/re-distributor, VSR is designed with combination of high performance liquid distributor and vane type liquid collector.

Compared to the conventional liquid collect/re-distributor, it has the following advantages:

- Lower pressure drop
- Excellent liquid distribution also to small liquid loads (from 1 m3/m2.hr)
- Possible to have high distribution density
- Improved liquid-mixing compared to VS type
- Minimized liquid leakage
- Reduced space requirement

**Distributor specifications:**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column Diameter</td>
<td>0.5~8 m</td>
</tr>
<tr>
<td>Liquid Load</td>
<td>1~80 m3/m2.hr</td>
</tr>
<tr>
<td>Equivalent Drip Point Density</td>
<td>60 to 200 drip point per m2</td>
</tr>
<tr>
<td>Turn Down Ratio</td>
<td>2.5 to 1 (max 10 to 1)</td>
</tr>
</tbody>
</table>

**Support grids**

**Collectors**

**Collector-distributor systems/Vapor distributor**

**Chimney trays**
Internals for Random Packing Columns

Column Internal for NeXRing

Liquid Feed Pipe

Liquid Distributor
Distribution liquid to the packing below, a proper selection and design of liquid distributor is important to overall efficiency

Mist Eliminator
Remove liquid droplet from vapor entrainment

Bed Limiter
Required above random packing bed to stop random packing being blow away

Random Packing
(Bed#1)

Gas Injection Support Plate
Served as packing support as well as to distribute gas from bottom, high open area is preferred

Liquid Collector
Used to accumulate liquids of above beds, side draw off can also be realized with the collector

Liquid Redistributor

Random Packing
(Bed#2)
Comprehensive Engineering Services Markets

Development and Technology

Sulzer makes every effort to support our customers and continuously improve our design tools. Engineers in the R&D lab develop new and improved products, analyze and optimize processes.

We maintain close relationships to universities and independent research organizations to support these efforts.

Engineering and Manufacturing

Sulzer has a long-standing manufacturing tradition. Sulzer owns dedicated factories in every region to produce mixers, columns, reactors, and heat exchangers.

For certain sizes and certain countries, we work with well-known and proven subcontractors who are bound by Sulzer manufacturing policies and quality standards.

Capabilities

Manufacturing according to PED 97/23/EC, ASME VIII Div.1, and ASME B31.3/U-Stamp, Gost (TR), China Stamp, Norsok, or NACE

Design codes acc. to AD2000, EN 13445, ASME Broad selection of material for construction available

Non-destructive testing (LPT, X-ray, pressure testing up to 500 bar, PMI, MT, UT etc. acc. EN and ASME)

Designing with SolidWorks

Strength calculations, FEM analysis, nozzle loads etc.

Certification for ISO 9001, ISO 14001 and ISO 18001

Experienced project management team

CFD Analysis

CFD calculations done in advance of fabrication can support the decision to go for a particular technology, and can save on the time required for commissioning and testing later. Sulzer uses CFD technology both for the modeling of existing and the development of new products.
Sulzer Chemtech Ltd, a member of the Sulzer Corporation, with headquarters in Winterthur, Switzerland, is active in the field of process engineering and employs some 4000 persons worldwide.

Sulzer Chemtech is represented in all important industrial countries and sets standards in the field of mass transfer and static mixing with its advanced and economical solutions.

The activity program comprises:

• Process components such as fractionation trays, structured and random packings, liquid and gas distributors, gas-liquid separators, and internals for separation columns
• Engineering services for separation and reaction technology such as conceptual process design, feasibilities studies, plant optimizations including process validation in the test center
• Recovery of virtually any solvents used by the pharmaceutical and chemical industry, or difficult separations requiring the combination of special technologies, such as thin film/short-path evaporation, distillation under high vacuum, liquid-liquid extraction, membrane technology or crystallization.
• Complete separation process plants, in particular modular plants (skids)
• Advanced polymerization technology for the production of PLA and EPS
• Tower field services performing tray and packing installation, tower maintenance, welding, and plant turnaround projects
• Mixing and reaction technology with static mixers
• Cartridge-based metering, mixing and dispensing systems, and disposable mixers for reactive multi-component material

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