The innovative NeXRing™ in practical use

Many companies are already using the innovative high-performance random packing NeXRing™. The main advantages reported by Sulzer customers using NeXRing for their separation processes are an increase in the capacity, lower pressure drop and less fouling tendency.

In the 3/2017 edition of the Sulzer Technical Review, we reported on the enlarged application range and theoretical advantages of the NeXRing family. While theoretical know-how is helpful, practical examples from the field are, however, more convincing. Sulzer is grateful to all the customers and other industry parties who share their experience with us.

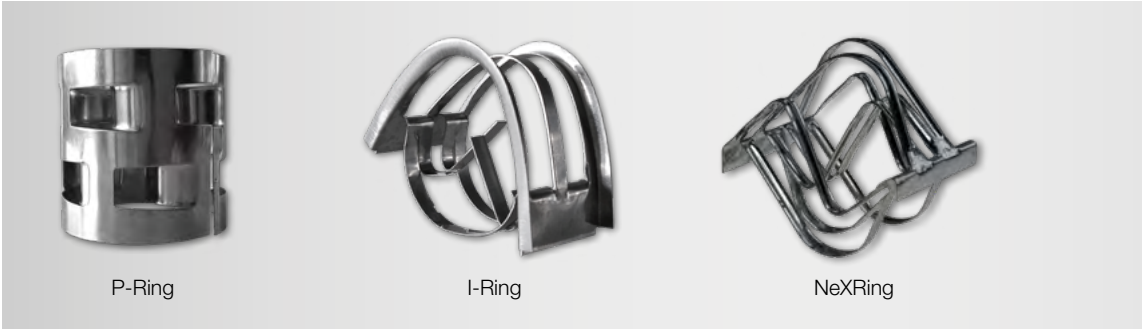


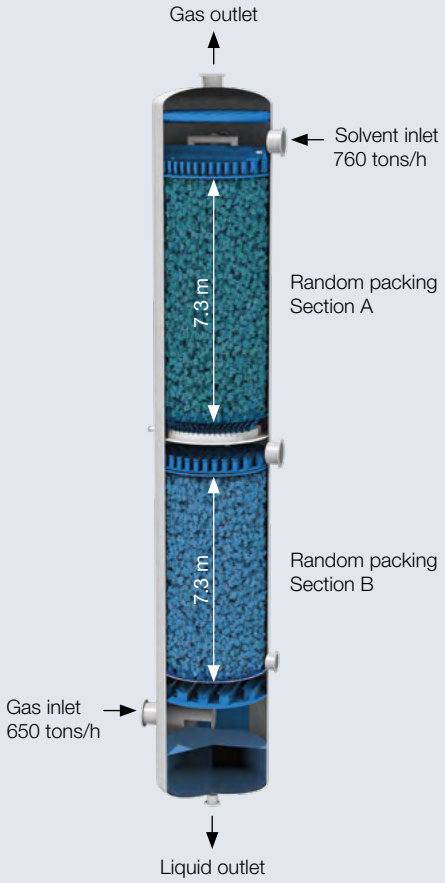
Fig. 1 Design of different ring types used for random packing.

NeXRing for carbon dioxide absorbers

Random packing is widely used for the removal of carbon dioxide (CO_2) and hydrogen sulfide (H_2S) from natural gas or biogas. This separation is achieved by contacting the gas with amine-based solvents such as monoethanolamine (MEA), diethanolamine (DEA), methyl diethanolamine (MDEA) and MDEA/piperazine mixtures (activated MDEA). A common characteristic of all these solvents is their strong tendency to foam, which disturbs the gas when passing through the column.

The NeXRing is the latest generation Sulzer random packing. It has the highest efficiency because it has the most open and accessible surface area compared with conventional random packings such as P-Ring and I-Ring (Fig. 1 on the previous page). This better-used surface area of NeXRing high-performance packings leads to separation that is more efficient with a lower pressure drop.

Thanks to the lower pressure drop, the hydraulic impact of foaming is reduced, and NeXRing can be used to debottleneck the column performance. Figure 2, based on calculations done for a European customer, shows examples how NeXRing could lead to improvements such as a reduction in pressure drop or an increase in gas and liquid load. Using a smaller ring size and keeping the pressure drop the same leads to increased column efficiency.



Pressure drop reduction at 100% load (design point)		
Packing type	Capacity	Pressure drop
I-Ring #50	70.30%	40.45 mbar
NeXRing #2	63.50%	30.8 mbar

Increased load at 80% capacity *		
Packing type	Max. load	Pressure drop
I-Ring #50	115%	56.4 mbar
NeXRing #2	125%	52.5 mbar

* Sulzer usually recommends 80% capacity as a maximum.

Fig. 2 Carbon dioxide absorption column – comparison of values with I-Ring and NeXRing.

NeXRing for methane separation after coal gasification plants

The worldwide gasification capacity is expected to grow significantly in the near future, with the primary growth occurring in the Far East and Asia. After coal gasification, the next step in the process is usually methane separation. In these plants, the feed gas stream is produced from coal, and it consists mainly of carbon monoxide (CO), hydrogen (H_2) and methane (CH_4). The column used for methane separation splits these three components into two different streams. One stream contains CO and H_2. The other stream is liquid methane (CH_4), which is sold commercially as liquefied natural gas (LNG). The liquefied gas can be easily transported in this condensed form. Fig. 3 on the following page shows the working principle of such a methane separation installation.

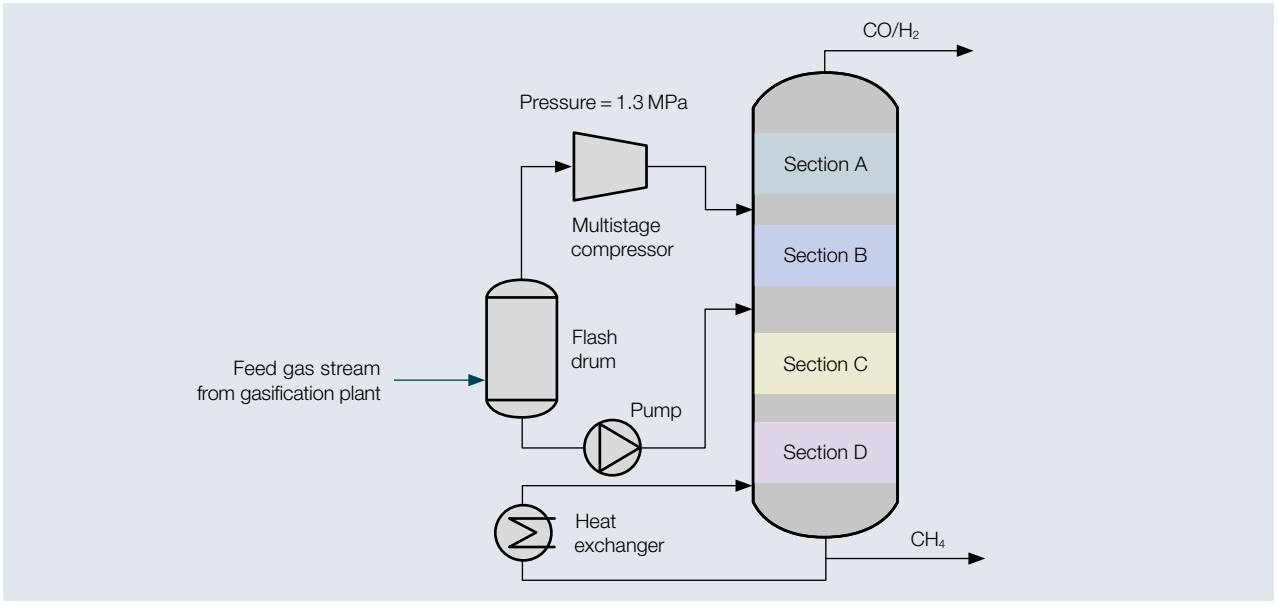
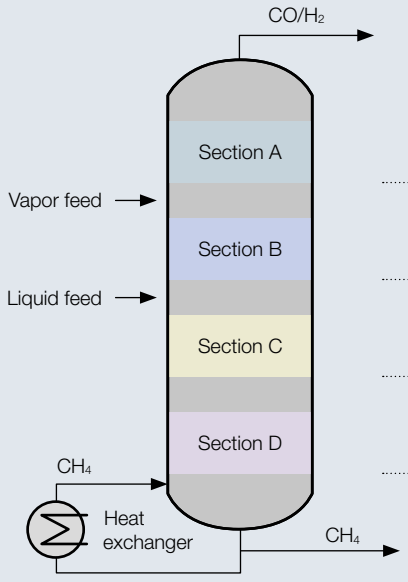


Fig. 3 Process workflow of a methane separation installation.

Practical experience in methane separation

A customer in China was operating a column for methane separation (Fig. 4) with four different separation sections (A, B, C, D) in the process. The operating conditions for the layout of the original column were based on a feed composition of 24.5% of CO, 58.7% of H_2 and 16.8% of CH_4. In practice, the customer used a different coal for gasification and the feed composition to the methane separator changed remarkably: 24.5% of CO, 51.5% of H_2 and 24% of CH_4. The separation capacity of the existing column was not sufficient to process the feed gas with this composition because of the increased load at the bottom sections (C and D).

Sulzer revamped the column and replaced the Nutter Ring #2 with NeXRing #2 random packings in section C and D. The customer was happy with the result. The change increased the separation capacity for the overall installation by 20%. Now that the column has been revamped with NeXRing random packings, the existing liquid distributor of section D has proven to be a bottleneck; if not for this, the customer would be able to increase the separation capacity even further.



	Original design	After revamp
Section A	Nutter Ring #2	Nutter Ring #2
Section B	Nutter Ring #1	Nutter Ring #1
Section C	Nutter Ring #2	NeXRing #2
Section D	Nutter Ring #2	NeXRing #2
	Load 100%	**Load 120%** New bottleneck: Liquid distributors

Fig. 4 NeXRing improves the capacity for methane separation.

Use of NeXRing in wastewater treatment

Sour water and sour gas are waste products produced from atmospheric and vacuum crude columns at refineries. Hydrogen sulfide (H_2S), ammonia (NH_3) and hydrogen cyanide (HCN) are typical components in sour water that need to be removed before the water can be reused elsewhere in the plant. Wastewater stripping towers are used to remove these components from the sour water. Applying heat, in the form of steam, releases H_2S and NH_3 from the sour water and both gases exit at the top of the tower.

Practical experience in wastewater treatment

An integrated power plant of a refinery in Asia could not achieve the governmental standards for the treated discharge water with its previous installation. Sour water and sour gas from the upstream process were being fed into the stripping tower. The customer observed fouling since the particles and dust inside the sour water had accumulated inside the random packing. These particles had caused an increase of the column pressure drop after a short time.

The company asked Sulzer specialists for help. Sulzer recommended a revamp of the random packing in sections B and C (Fig. 5), where the fouling was occurring. In 2017, the customer replaced the P-Ring #2 in both sections with NeXRing #2 random packings. After half a year of operation, the customer had not observed an increase in pressure drop in the revamped installation. Compared with the P-Ring, the NeXRing has a very open design. This allows small particles to pass through so that they do not stack up, and no fouling occurs in the sections. Additionally, the pressure drop in the column with the NeXRing was lower than with the previous setting using P-Ring in all sections. The customer regularly checks the pressure drop for quality assurance to ensure that the government standards are maintained.

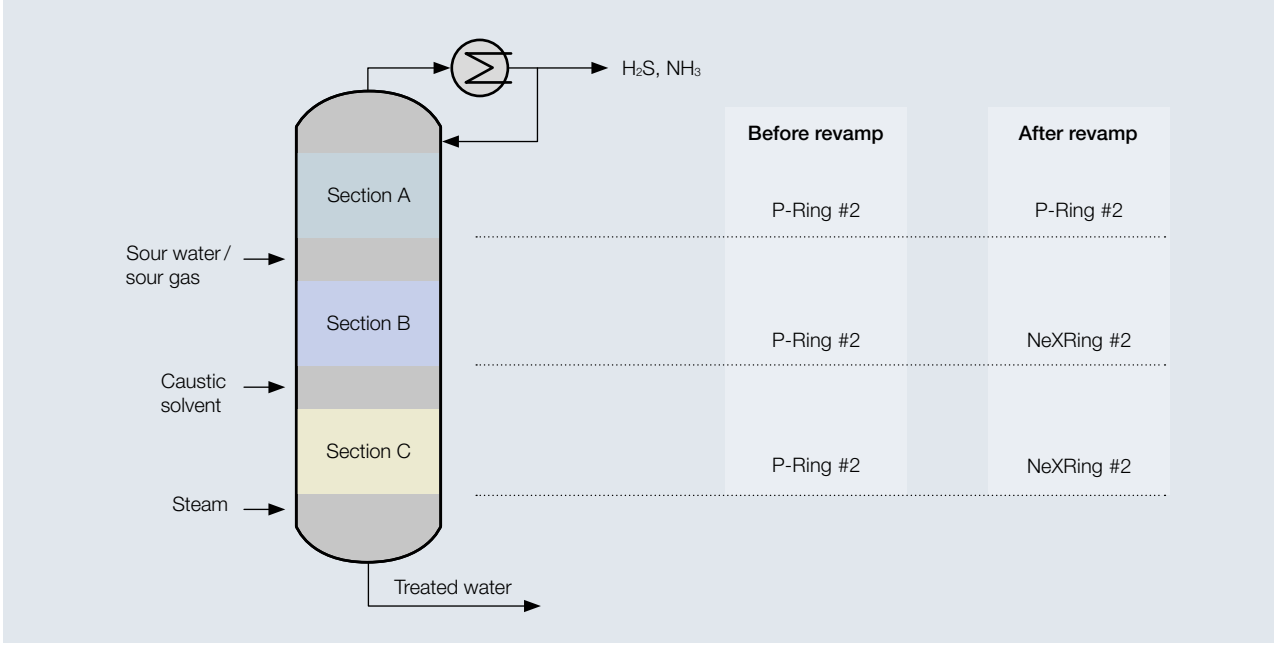


Fig. 5 Less fouling thanks to NeXRing in wastewater stripping tower.

Improved flue gas treatment with NeXRing

Sulfur dioxide (SO_2) gas is generated when burning fossil fuels that contain sulfur. Governments all over the world have set rigid standards to reduce global air pollution through SO_2 emissions. An Asian customer running a refinery plant could not meet the new standard for SO_2 emission with his existing installation. A new column had to be built to reduce the SO_2 content in the flue gas.

Practical experience in sulfur dioxide removal

Sulzer made calculations and created a design as to how the customer could meet the government standards with Sulzer products and a new process setup of the column. The new process (Fig. 6) uses water and caustic solvent in several stages within the column to remove the SO_2. The goal was to lower the SO_2 content of the vent gas below 50 ppm. The original column design contained I-Ring #40. For the new, optimized column design, NeXRing #1 high-performance packings were used. They provided similar capacity to the I-Ring #40 random packings but offered higher efficiency. Since some amount of dust is expected in the process, the anti-fouling performance of NeXRing also provided an advantage.

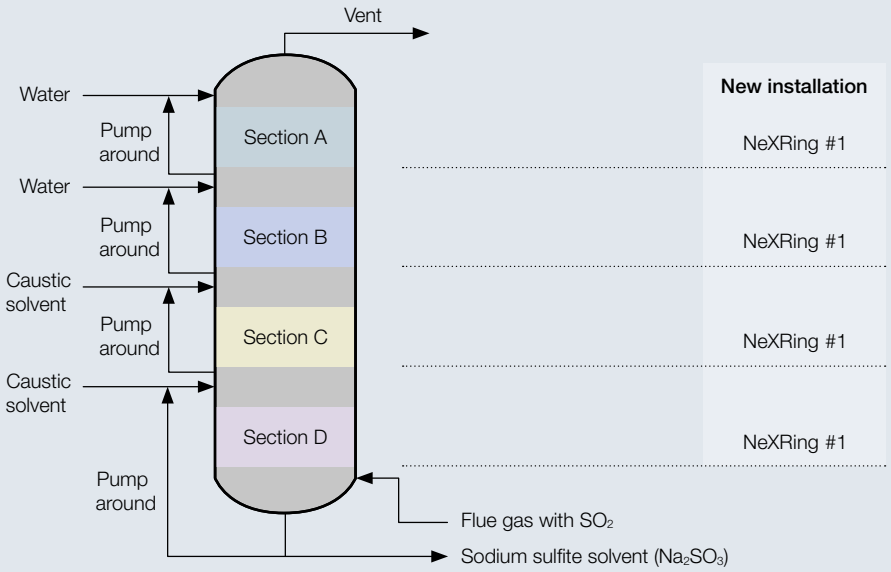


Fig. 6 NeXRing in a flue gas treatment column to reduce SO_2.

Based on the calculations, the customer was convinced that Sulzer products would meet the strict requirements and invested in a column equipped with NeXRing only. The column now operates successfully, and the SO_2 content has even been reduced to 35 ppm. The overall pressure drop is 40% less than required. This leads to remarkable energy savings and cost reduction over the operation time of the column.

Calculation tool for customers

To calculate efficiencies, Sulzer has collected experience and test values over years. Based on this know-how, the Sulzer engineers have developed a design program called Sulcol™ for our customers. It allows customers to design columns themselves; similar to the programs offered to design furniture, customers can configure columns in different sizes with different internals. With the help of the Sulcol program, the hydraulic capacity of these columns is calculated. Customers can configure columns with different random packings, trays or valves. Interested customers can ask for access to download the latest version of Sulcol from our website. Access is only granted to companies who are already using Sulzer products.
For more information: www.sulzer.com/sulcol

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Many Sulzer customers have realized that the NeXRing helps them to reduce capital and operational costs in several applications. Meanwhile, Sulzer installs over 90% of new columns with NeXRing random packings.