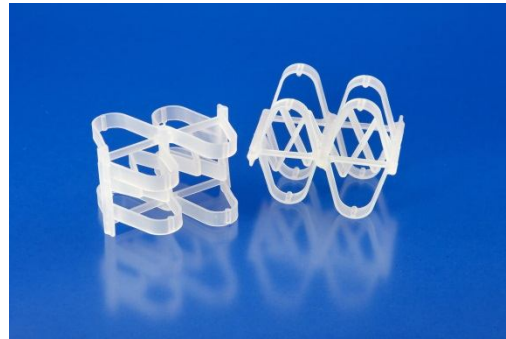


Raschig Super-Ring®
Metal and Plastic
Random Dump Packing
Product Bulletin 200



Superior Performance by Design™
Raschig USA Inc.



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Raschig Super-Ring® is a trademark of Raschig USA, Inc.



Raschig USA Inc. – 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 both Raschig GmbH and Jaeger Products in 2006.)

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 2,400 m³/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 Super-Ring®

Aspects involved in the Design of Modern Packing Elements

Packing elements are successfully used in the chemical industry and related sectors, as well as in environmental protection installations, i.e. in absorption, desorption, extraction and rectification columns. The manifold process engineering demands on modern packing elements are determined by these thermal separation processes.

High-performance packing elements are intended to bring about effective mass transfer between the phases flowing through the columns. Large interfacial area and uniform distribution of the phases over the column cross-section are desirable. A high loading capacity permits high column throughputs, while low pressure drop results in low operating costs.

Loading Capacity

Counter-current packed columns are preferably operated below, or in the immediate vicinity, of the so-called loading point, this being characterized by the fact that the falling film is backed up by the counter-current gas stream at higher loads. The loading point of a packing element is defined by its fluid dynamic properties. Fluid dynamic studies in the past have repeatedly shown that the droplets forming in a column packing are entrained earlier than down-ward flowing liquid films at high gas loads. In contrast to previous packing element designs, the Raschig Super-Ring meets this demand in that it was purposely designed without any projecting metal tongues which could act as dripping points.

Liquid and Gas Distribution

The most uniform possible distribution of the liquid and gas phase across the packing element itself and the entire column cross-section is one of the fundamental prerequisites for a column packing that works effectively. If, at the same time, a low resistance to fluid flow of the gas phase is to ensure the minimum possible pressure drop, the structure must be largely open. The alternating wave structure of the Raschig Super-Ring has not only created a form which is open on all sides but, at the same time, has also realized a large number of contact points for homogeneous liquid and gas distribution.



Raschig Super-Ring®

Mass Transfer

Effective mass transfer between the phases demands not only a large interfacial area, but also the most turbulent possible flow conditions and frequent renewal of the phase interfaces. With the Raschig Super-Ring®, several thin films of liquid displaying turbulent flow are formed on the sinusoidal webs and are constantly intermixed as the result of the recurrent contact points within the packing element.

Performance Data of the Raschig Super-Ring®

Experimental studies have confirmed the relationships described above. The following Figures show the pressure drop of the Raschig Super-Ring® as a function of the gas capacity factor at various liquid loads. As a result of a very open structure of the Raschig Super-Ring®, the pressure drop of the dry packing is already lower than that of a 50 mm metal Pall ring. The differences increases at higher liquid loads. The Raschig Super-Ring® generates also a substantially lower pressure drop than other high-performance packing elements made of metal with a nominal size of 50 mm.

The loading capacity of the Raschig Super-Ring® can also be seen from the following Figures. The Raschig Super-Ring® not only has a higher loading capacity than the 50 mm metal Pall ring, but also displays a substantially higher loading capacity than previous modern packing element designs.

The Figures show also the results of trials involving the absorption of ammonia from air in water. The separation efficiency of this new packing element is thus up to 14% better than that of a 50 mm metal Pall ring or previous high-performance metal packing elements.

Furthermore, the low specific packing weight of the Raschig Super-Ring® allows the design of low-cost supporting elements in the columns. The Raschig Super-Ring® is also lighter than other packing element designs, but without sacrificing stability. Experimental studies have shown that packing heights of 15 m and more can be realized owing to the alternating wave frequency and amplitude of the metal webs of the Raschig Super-Ring.

The alternating wave structure additionally prevents entanglement of the packing element within the packing, thus guaranteeing problem-free assembly and dismantling in a column. Owing to its open structure, the Raschig Super-Ring® is also suitable for liquids contaminated with solids. Table 1 shows the technical data of the Raschig Super-Ring®.



Raschig Super-Ring®

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Table 1: Technical Data of the Raschig Super-Ring®

Size	Material	Weight Kg/m ³	Number pc./m ³	Surface m ² /m ³	Free Vol. %
Raschig Super-Ring® Nr. 0.3	Metal	340	180,000	315	96
Raschig Super-Ring® Nr. 0.5	Metal	275	145,000	250	97
Raschig Super-Ring® Nr. 0.7	Metal	185	45,500	180	98
Raschig Super-Ring® Nr. 1	Metal	165	32,000	150	98
Raschig Super-Ring® Nr. 1.5	Metal	170	13,100	120	98
Raschig Super-Ring® Nr. 2	Metal	165	9,500	100	98
Raschig Super-Ring® Nr. 3	Metal	150	4,300	80	98
Raschig Super-Ring® Nr. 0.6	Plastic	62	54,000	206	93
Raschig Super-Ring® Nr. 2	Plastic	55	9,000	100	96

Raschig Super-Ring®

Compensation for the "decrease in volume" for Dumped Packings

The values indicated in the tables for dumped packings are valid for a diameter ratio of the vessel to the packing size of $D/d = 20$.

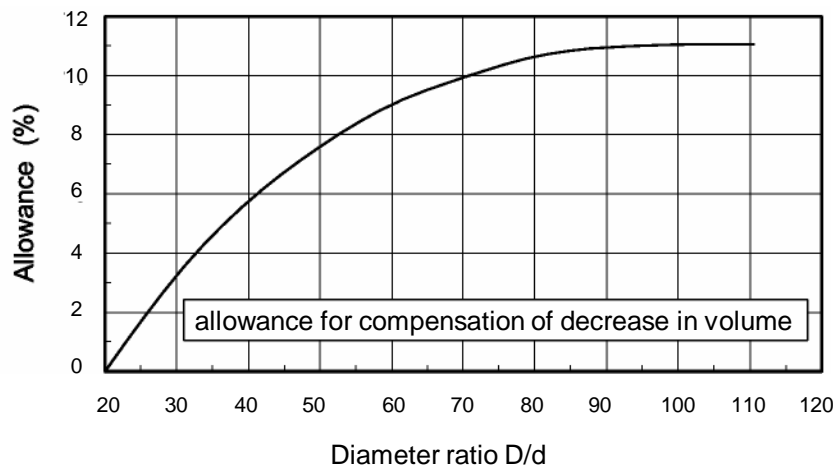
Since the arrangement of the packings is less compact near the vessel wall than in the interior of the bed, the number of packings per cubic meter increases with the diameter ratio.

The above diagram shows by which "allowance" the theoretically calculated vessel volume for diameter ratios of more than 20 must be increased in order to completely fill the space required.

If the plastic or metal packings are, for instance, thrown into the column, this may result in a further decrease in volume due to abnormally compact packing.

D = diameter of the vessel to be filled

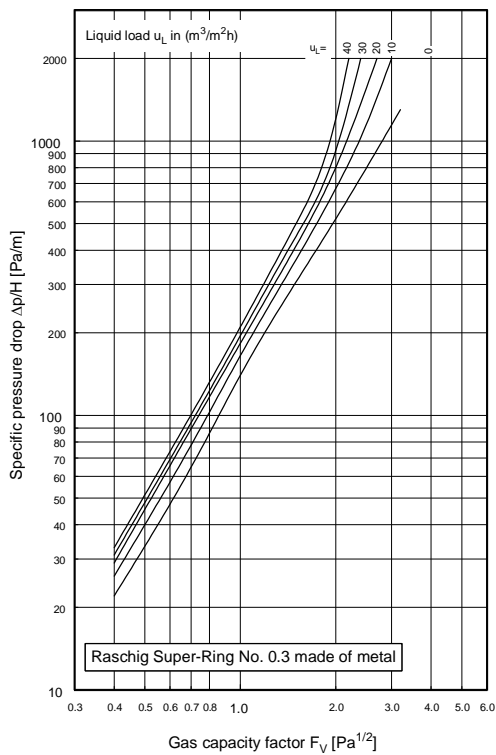
d = diameter or nominal size of the packings



Pressure Drop of metal RASCHIG SUPER-RING® system: air / water

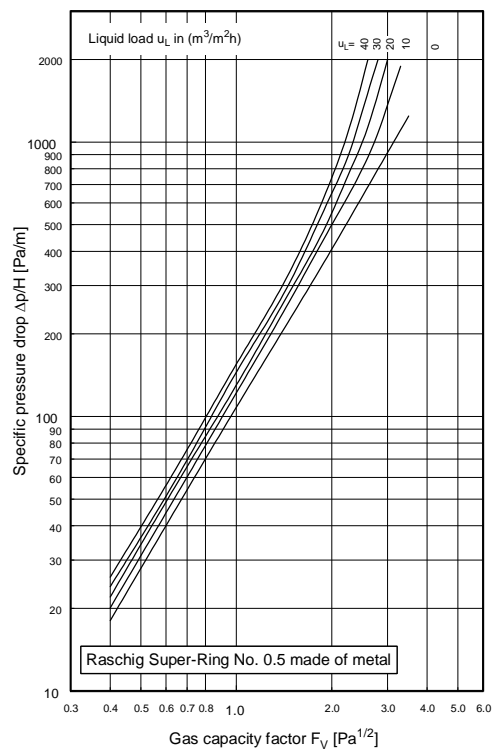
RASCHIG SUPER-RING® No. 0.3

Column diameter: 0.288 m
Packing height: 1.0 m



RASCHIG SUPER-RING® No. 0.5

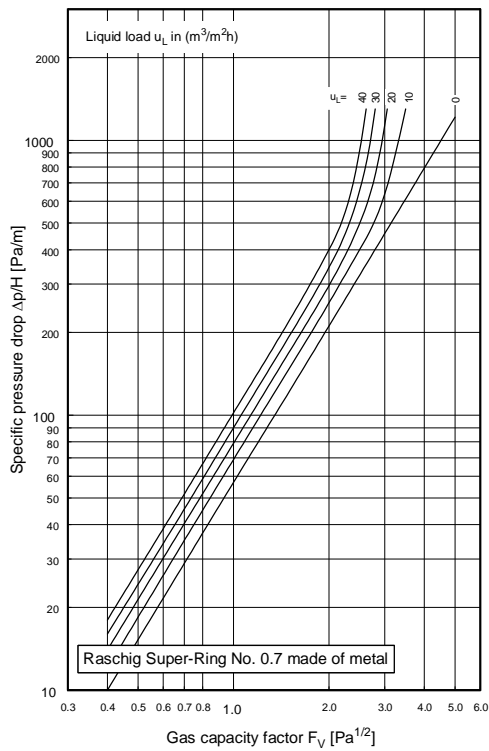
Column diameter: 0.288 m
Packing height: 1.0 m



Pressure Drop of metal RASCHIG SUPER-RING® system: air / water

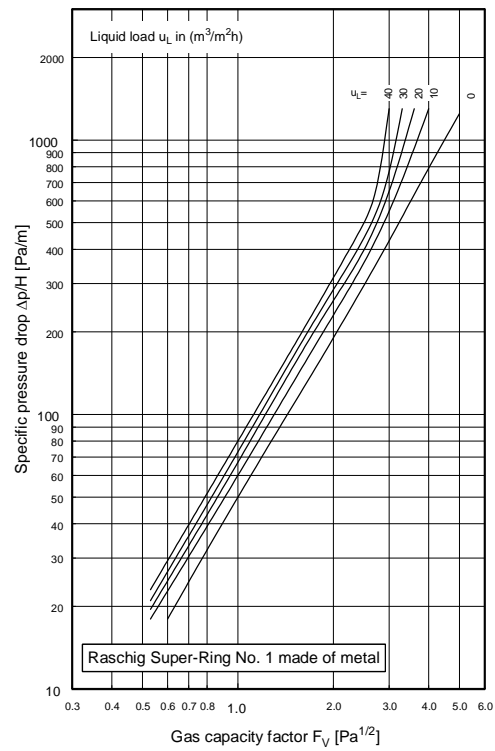
RASCHIG SUPER-RING® No. 0.7

Column diameter: 0.288 m
Packing height: 2.0 m



RASCHIG SUPER-RING® No. 1

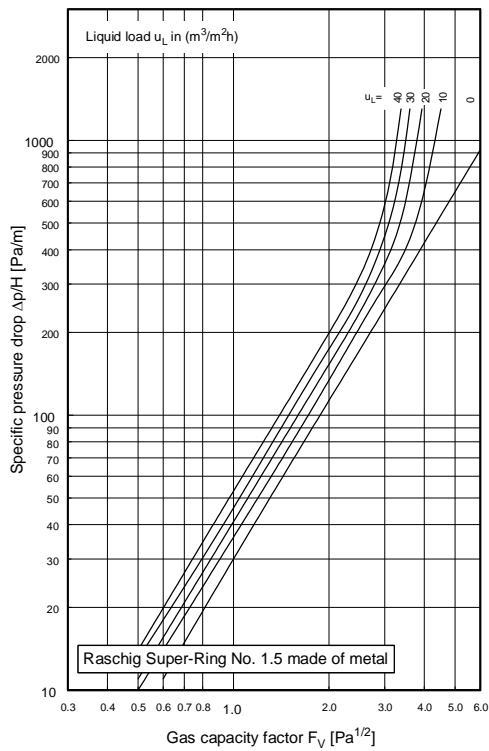
Column diameter: 0.288 m
Packing height: 2.0 m



Pressure Drop of metal RASCHIG SUPER-RING® system: air / water

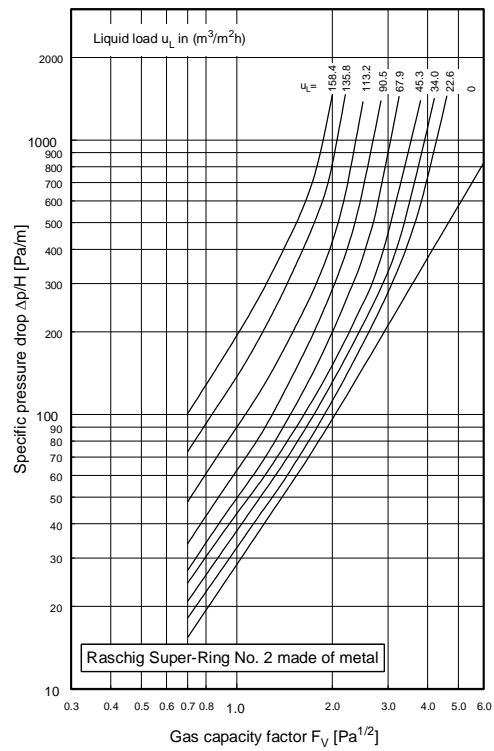
RASCHIG SUPER-RING® No. 1.5

Column diameter: 0.288 m
Packing height: 2.0 m



RASCHIG SUPER-RING® No. 2

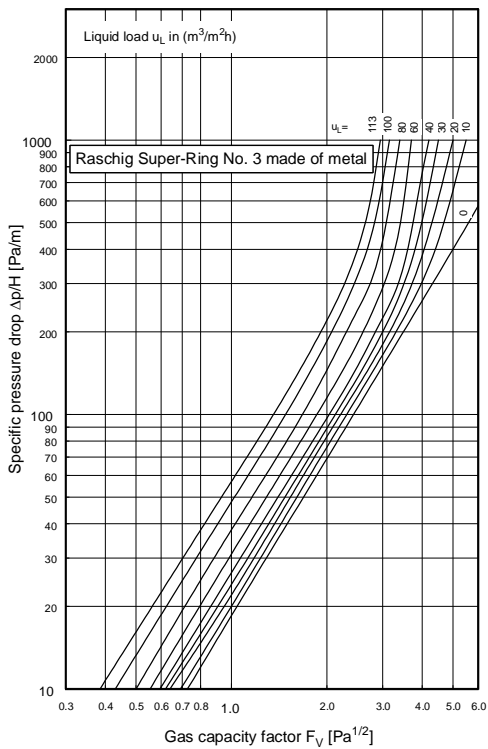
Column diameter: 0.75 m
Packing height: 3.0 m



Pressure Drop of metal and plastic RASCHIG SUPER-RING® system: air / water

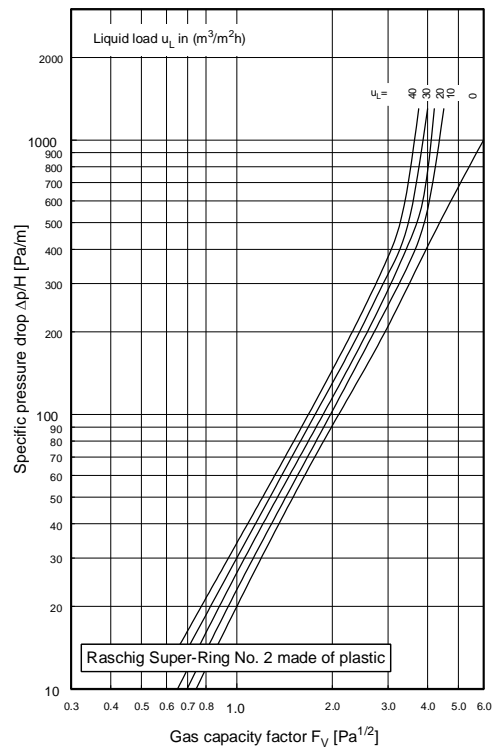
RASCHIG SUPER-RING® No. 3

Column diameter: 0.440 m
Packing height: 2.0 m

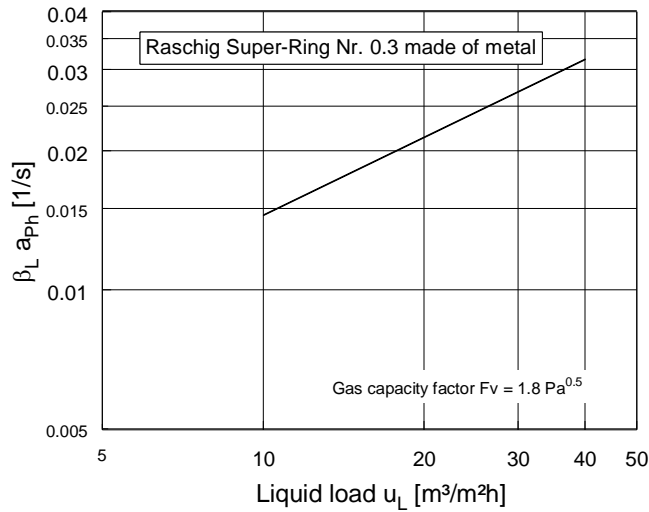


RASCHIG SUPER-RING® No. 2

Column diameter: 0.288 m
Packing height: 2.0 m

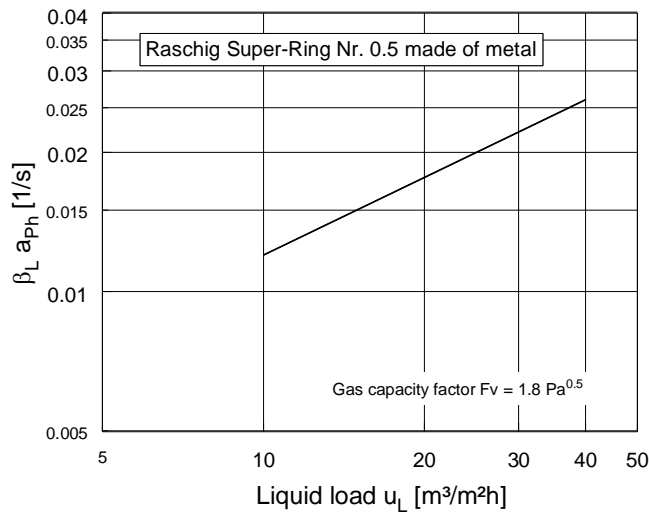


**Transfer Efficiency of metal
RASCHIG SUPER-RING®
in the desorption of CO₂ from water into an
atmospheric air-stream**



RASCHIG SUPER-RING® No. 0.3

Column diameter: 0.288 m
Packing height: 1.0 m

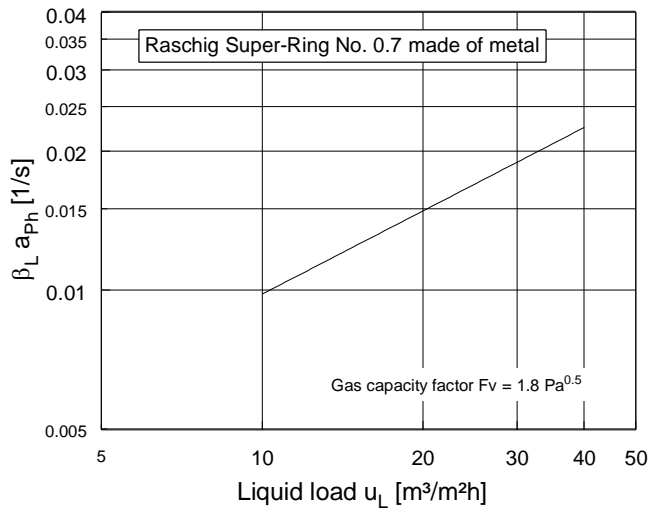


RASCHIG SUPER-RING® No. 0.5

Column diameter: 0.288 m
Packing height: 1.0 m

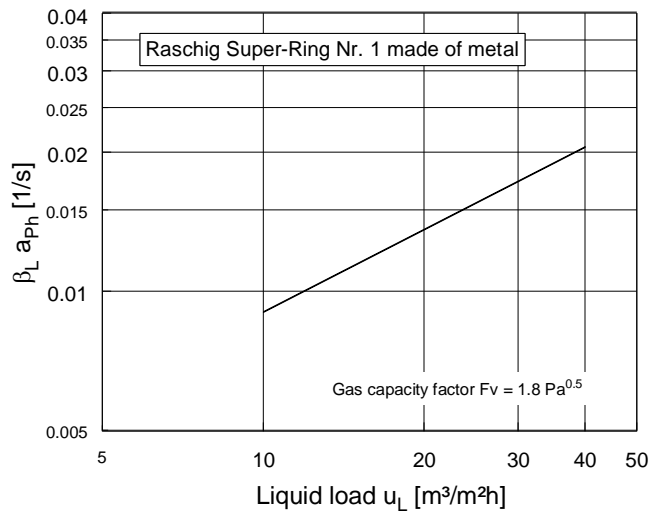


**Transfer Efficiency of metal
RASCHIG SUPER-RING®
in the desorption of CO₂ from water into an
atmospheric air-stream**



RASCHIG SUPER-RING® No. 0.7

Column diameter: 0.288 m
Packing height: 2.0 m

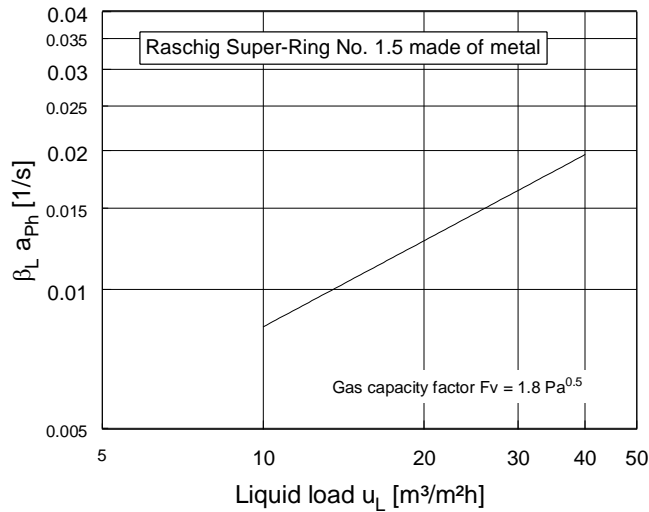


RASCHIG SUPER-RING® No. 1

Column diameter: 0.288 m
Packing height: 2.0 m

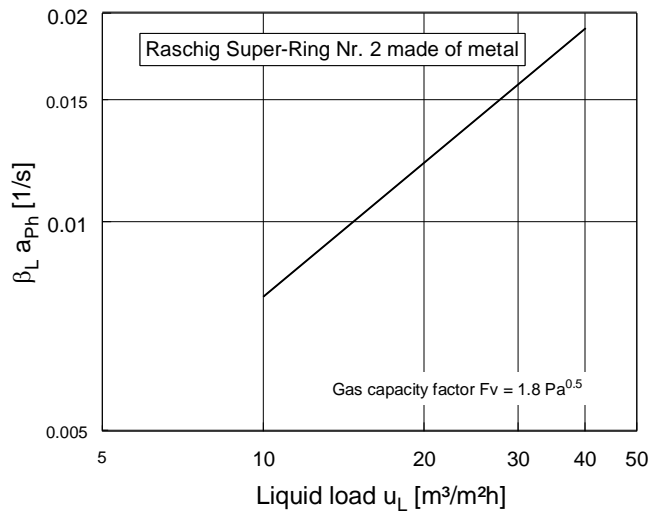


Transfer Efficiency of metal RASCHIG SUPER-RING® in the desorption of CO₂ from water into an atmospheric air-stream



RASCHIG SUPER-RING® No. 1.5

Column diameter: 0.288 m
Packing height: 2.0 m

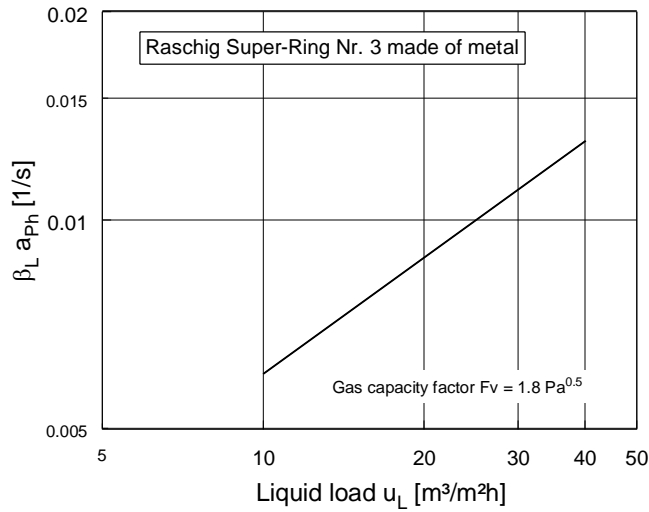


RASCHIG SUPER-RING® No. 2

Column diameter: 0.288 m
Packing height: 2.0 m

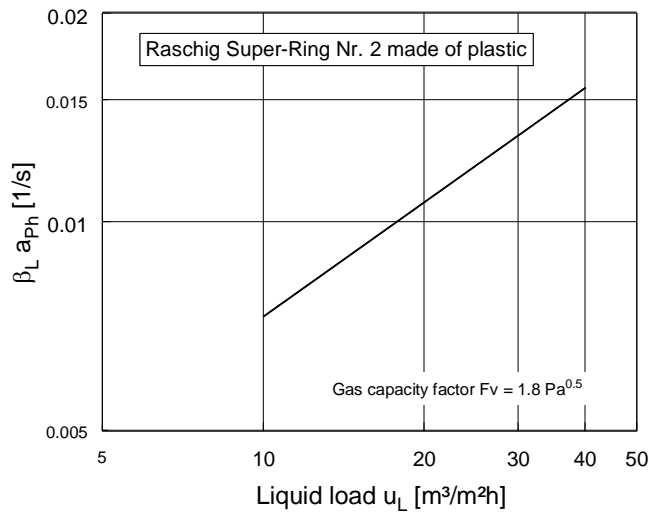


**Transfer Efficiency of metal and plastic
RASCHIG SUPER-RING®
in the desorption of CO₂ from water into an
atmospheric air-stream**



RASCHIG SUPER-RING® No. 3

Column diameter: 0.288 m
Packing height: 1.0 m

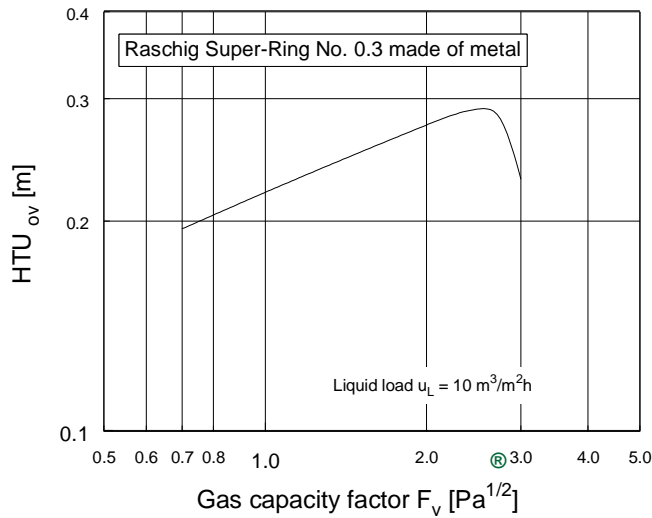


RASCHIG SUPER-RING® No. 2

Column diameter: 0.288 m
Packing height: 2.0 m

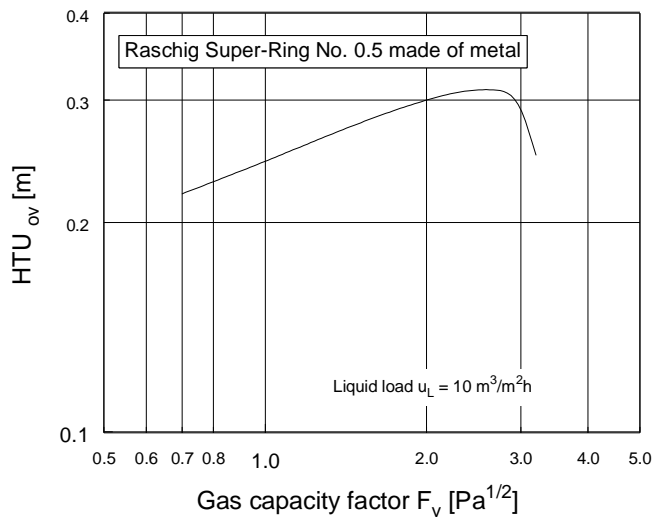


**Height of a Transfer unit HTU_{OV} for metal
RASCHIG SUPER-RING®
for the absorption of NH_3 from air in water in the
gaseous phase**



RASCHIG SUPER-RING® No. 0.3

Column diameter: 0.288 m
Packing height: 1.0 m

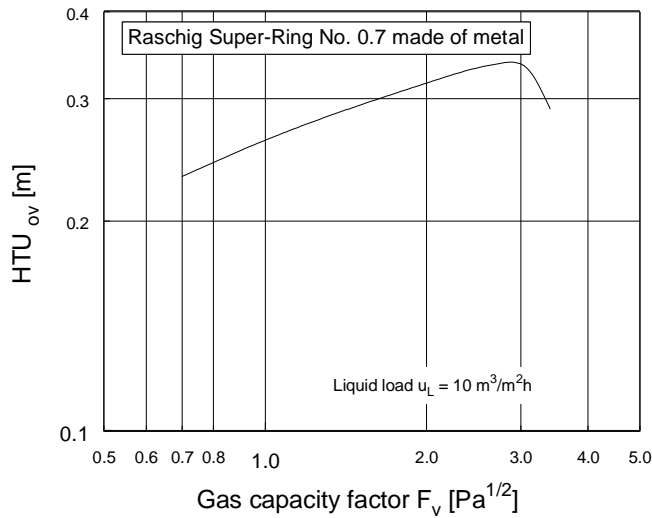


RASCHIG SUPER-RING® No. 0.5

Column diameter: 0.288 m
Packing height: 1.0 m

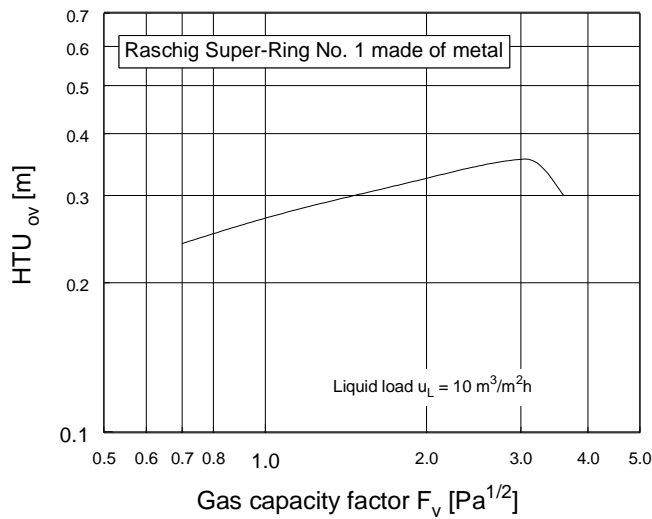


**Height of a Transfer unit HTU_{OV} for metal
RASCHIG SUPER-RING®
for the absorption of NH_3 from air in water in the
gaseous phase**



RASCHIG SUPER-RING® No.0.7

Column diameter: 0.288 m
Packing height: 2.0 m

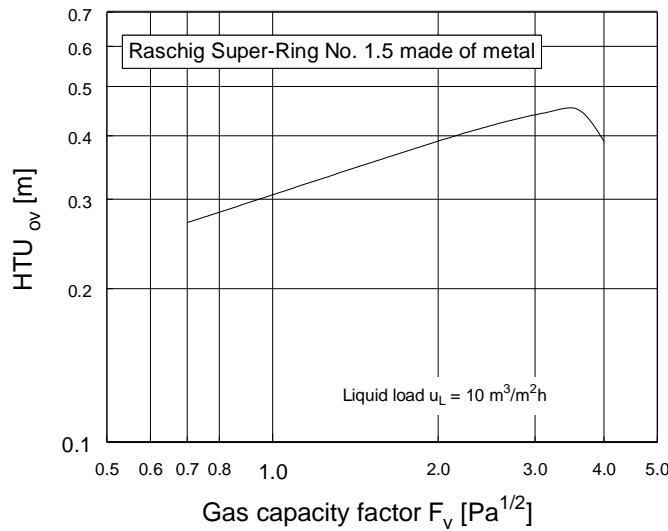


RASCHIG SUPER-RING® No. 1

Column diameter: 0.288 m
Packing height: 2.0 m

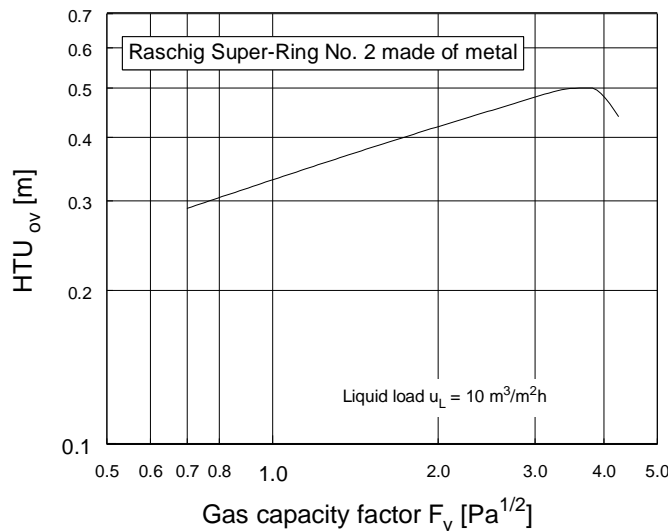


**Height of a Transfer unit HTU_{OV} for metal
RASCHIG SUPER-RING®
for the absorption of NH_3 from air in water in the
gaseous phase**



RASCHIG SUPER-RING® No. 1.5

Column diameter: 0.288 m
Packing height: 2.0 m

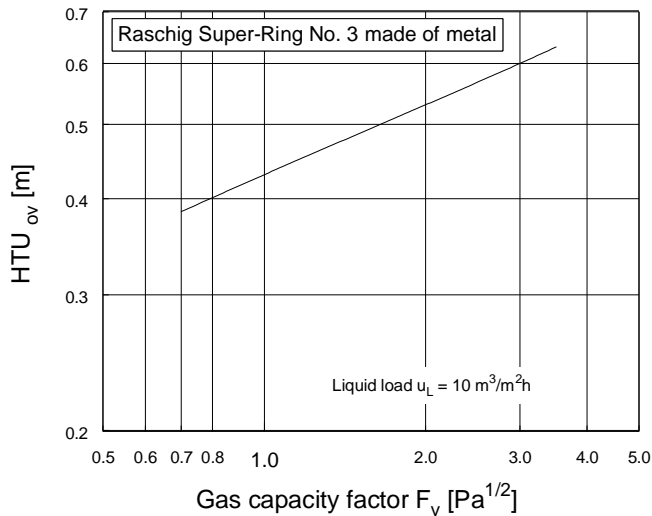


RASCHIG SUPER-RING® No. 2

Column diameter: 0.288 m
Packing height: 2.0 m

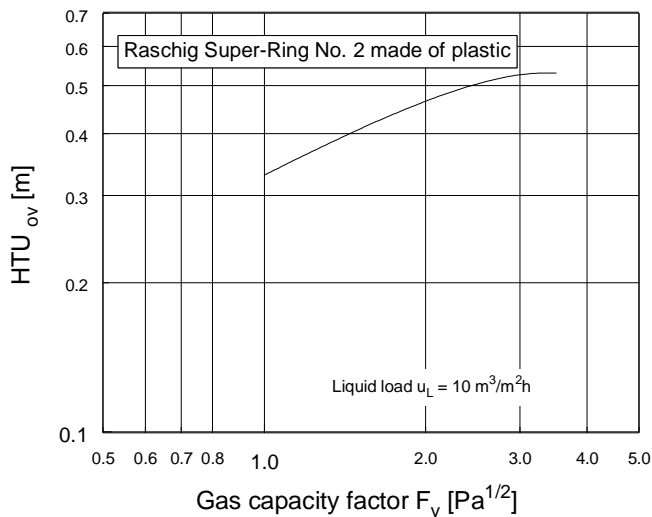


**Height of a Transfer unit HTU_{OV} for metal and plastic
RASCHIG SUPER-RING®
 for the absorption of NH_3 from air in water in the
 gaseous phase**



RASCHIG SUPER-RING® No. 3

Column diameter: 0.288 m
 Packing height: 2.0 m

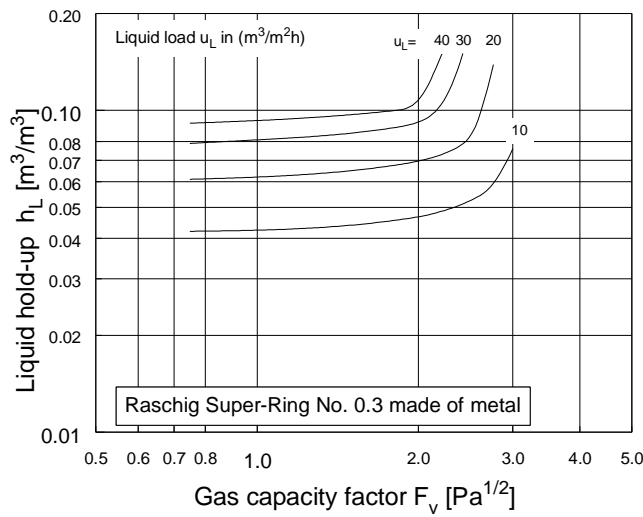


RASCHIG SUPER-RING® No. 2

Column diameter: 0.288 m
 Packing height: 2.0 m

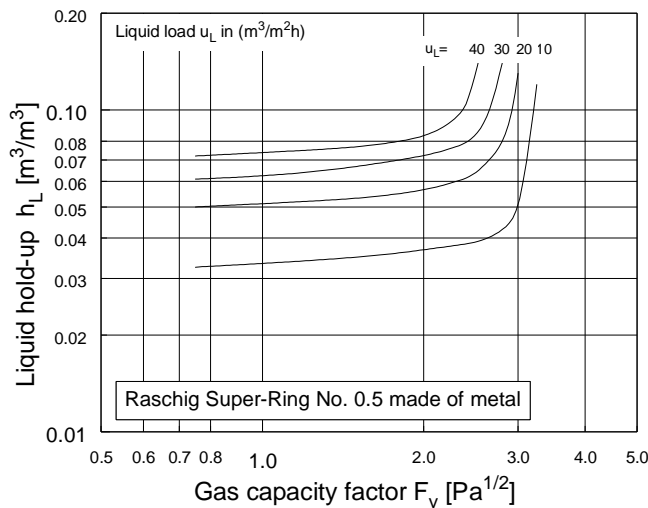


Liquid Hold-up in Columns with metal RASCHIG SUPER-RING® system: air / water



RASCHIG SUPER-RING® No. 0.3

Column diameter: 0.288 m
Packing height: 1.0 m

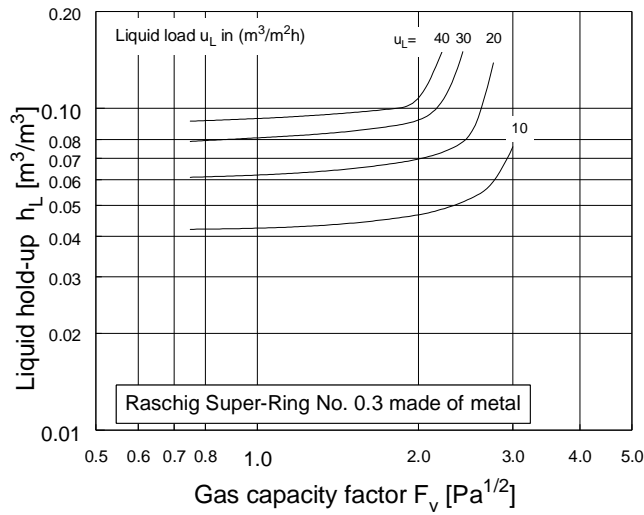


RASCHIG SUPER-RING® No. 0.5

Column diameter: 0.288 m
Packing height: 1.0 m

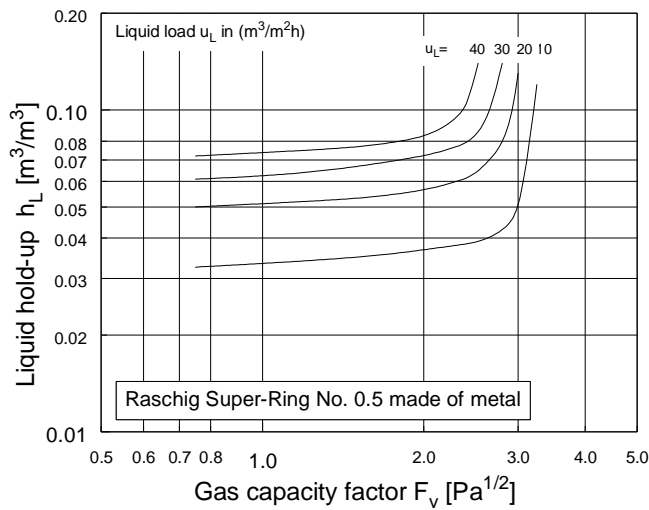


Liquid Hold-up in Columns with metal RASCHIG SUPER-RING® system: air / water



RASCHIG SUPER-RING® No. 0.3

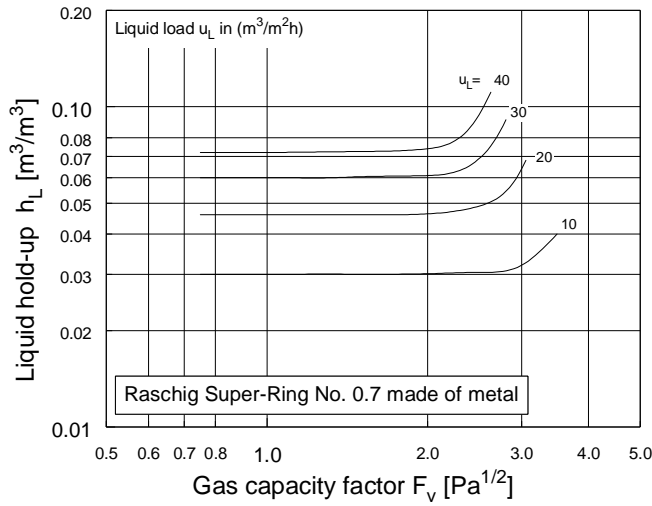
Column diameter: 0.288 m
Packing height: 1.0 m



RASCHIG SUPER-RING® No. 0.5

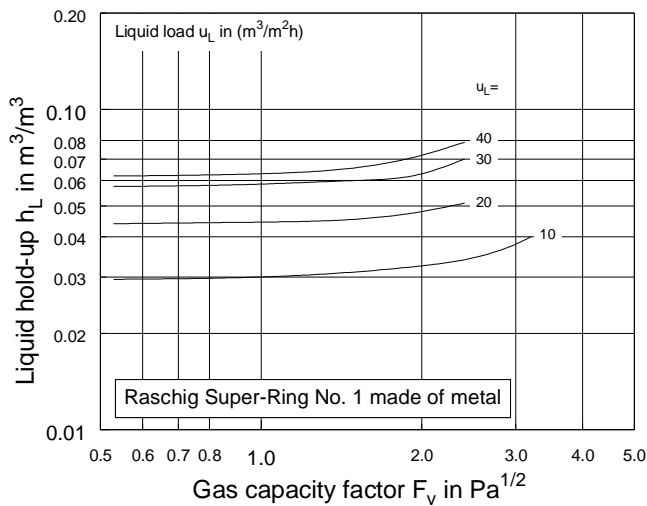
Column diameter: 0.288 m
Packing height: 1.0 m

Liquid Hold-up in Columns with metal RASCHIG SUPER-RING® system: air / water



RASCHIG SUPER-RING® No. 0.7

Column diameter: 0.288 m
Packing height: 2.0 m

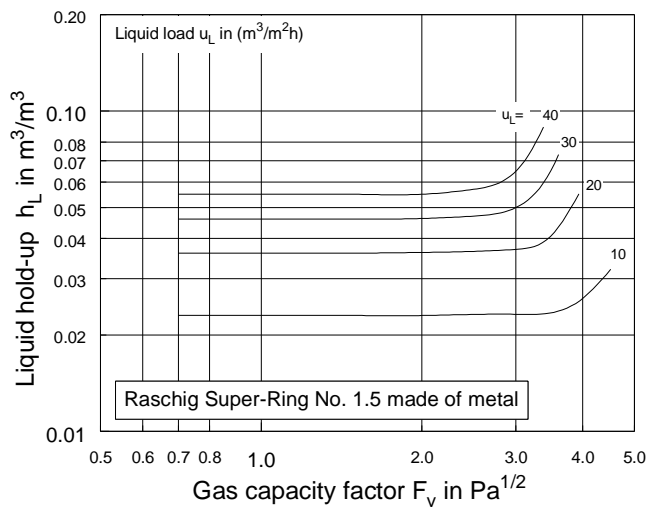


RASCHIG SUPER-RING® No. 1

Column diameter: 0.288 m
Packing height: 2.0 m

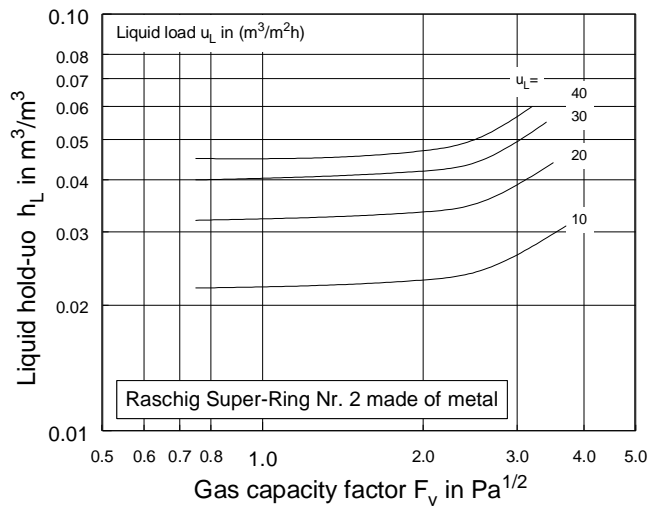


Liquid Hold-up in Columns with metal RASCHIG SUPER-RING® system: air / water



RASCHIG SUPER-RING® No. 1.5

Column diameter: 0.288 m
Packing height: 2.0 m

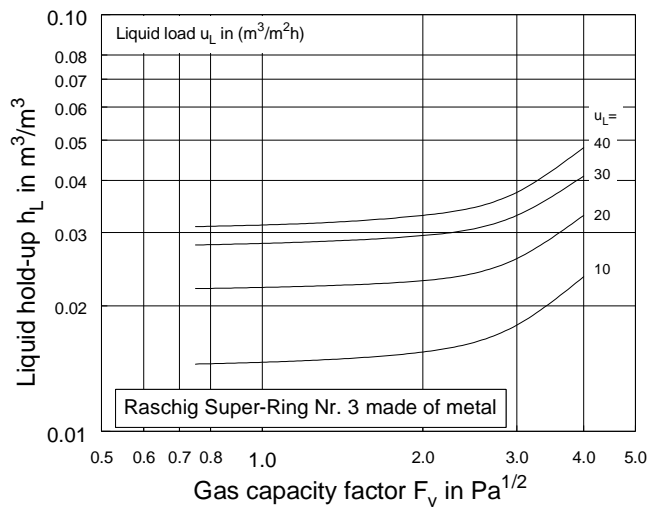


RASCHIG SUPER-RING® No. 2

Column diameter: 0.288 m
Packing height: 2.0 m

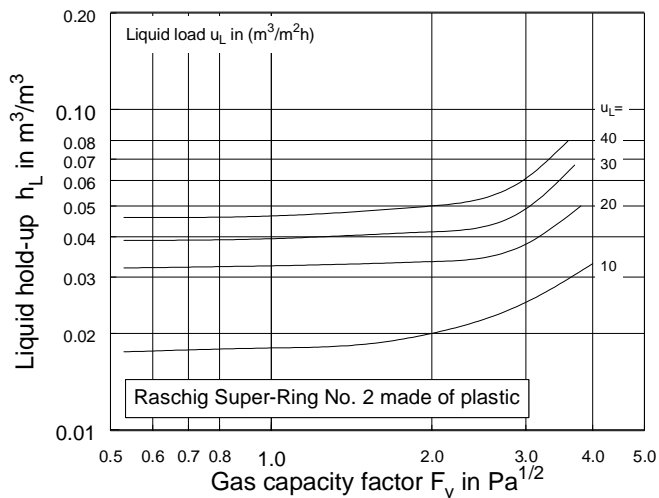


Liquid Hold-up in Columns with metal and plastic **RASCHIG SUPER-RING®** system: air / water



RASCHIG SUPER-RING® No. 3

Column diameter: 0.288 m
 Packing height: 2.0 m



RASCHIG SUPER-RING® No. 2

Column diameter: 0.288 m
 Packing height: 2.0 m



Concluding Remarks

The Raschig Super-Ring® demonstrates that this high-performance packing element meets the numerous demands of process engineering in an outstanding manner. The above description illustrates that a modern packing element design today must fulfil a number of fluid dynamic conditions. This is particularly true because, in most applications, only a fraction of the surface of a filling material is wetted and used for mass transfer between the phases. However, unused surfaces can easily corrode or generate unnecessary pressure drop. The Raschig Super-Ring® offers decisive advantage in this context, as its surface utilization has been optimised in terms of process engineering.

Raschig Super-Ring® is a registered trademark of Raschig USA, Inc.



100 General Product Information

200 Metal Random - RSR

300 Mist Eliminators – Wire Mesh

400 Fractionation Trays and Hardware

450 High Capacity – Nye Trays

475 High Capacity – CoFlo Trays

500 Metal Structured Packing – RSR

501 Metal Structured Packing – Super-Pak

550 Plastic Structured Packing – RSP

600 Plastic Random – Jaeger Tri-Packs/Hacketten

625 Plastic Random – RSR

650 Plastic Random – LPR

675 Plastic Random – Nor Pak

700 Plastic Random – Rings and Saddles

800 Ceramic Random Packing

900 Design Software

1000 Process Information

1100 Column Internals

1200 Reactor Internals

Locations / Production Sites

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

Raschig USA Inc.

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