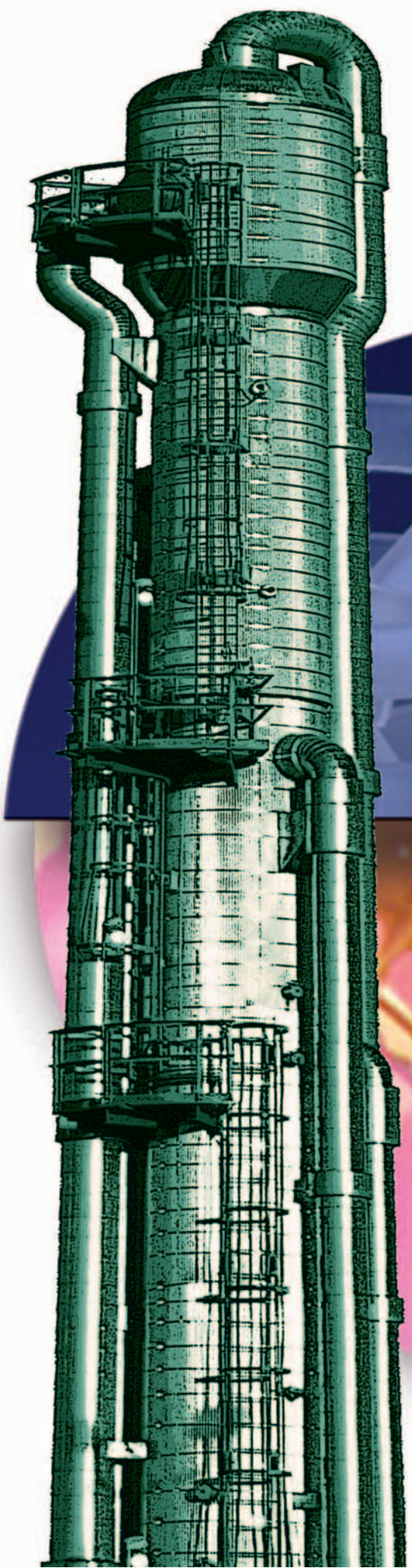
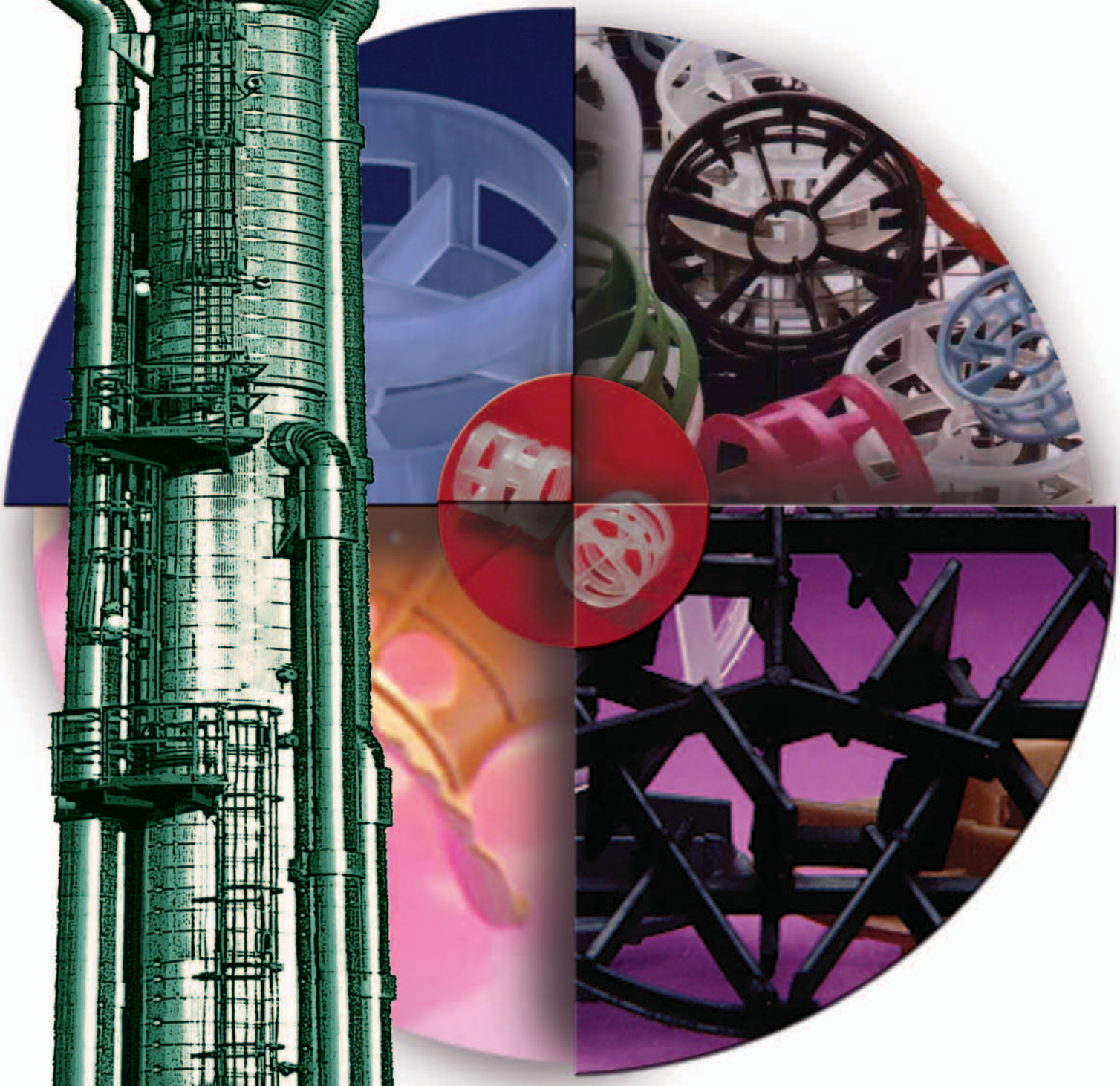
Intalox™
PACKED TOWER SYSTEMS

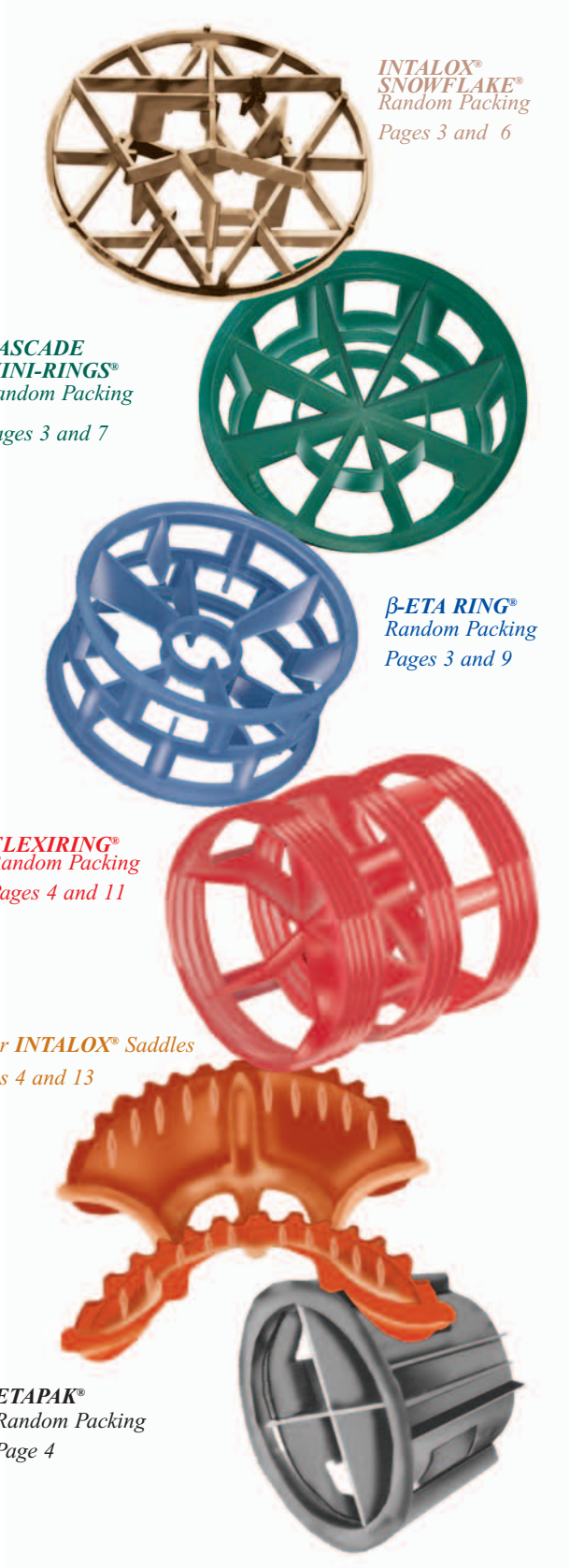
Plastic Random Packing





KOCH-GLITSCH®

Introduction



INTALOX® SNOWFLAKE® Random Packing
Pages 3 and 6

***CASCADE MINI-RINGS®** Random Packing*
Pages 3 and 7

***β-ETA RING®** Random Packing*
Pages 3 and 9

***FLEXIRING®** Random Packing*
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*Super **INTALOX®** Saddles*
Pages 4 and 13

***ETAPAK®** Random Packing*
Page 4

For more than 50 years, random packings have been used successfully as an inexpensive but efficient means to increase a tower's capacity and/or efficiency. The original Raschig Rings have been superceded by new generations of improved products and today, Koch-Glitsch offers the widest spectrum of random packings available worldwide.

There are numerous process advantages that can be realized by using packing in various applications. The predominant reasons for using tower packings are to reduce pressure drop throughout the column, to increase the capacity compared to trays at the same efficiency, and/or to reduce liquid holdup in the column. Plastic random packings are not as bulky as their ceramic equivalents and therefore offer higher capacity and lower pressure drop.

This booklet provides information for quick sizing of packed columns using plastic random packings. The charts provide hydraulic ratings and relative packing efficiencies (in terms of the K_Ga value for the absorption of CO_2 into a standard caustic solution). In addition, Koch-Glitsch offers the hydraulic rating program, **KG-TOWER™** Software, that may be downloaded from our website: www.koch-glitsch.com

Koch-Glitsch also offers a number of **FLEXIPAC®** and **FLEXIPAC® HC®** Structured Packing types in various thermoplastic materials. For more details, contact Koch-Glitsch.

Emergency Delivery

Koch-Glitsch has the random packing – plastic or metal – to provide optimum performance, whatever the application. Most packings are in stock for immediate shipment. For emergencies, call the Koch-Glitsch Hotline or your nearest Koch-Glitsch office.

In the US call the Hotline 1-888-KOCH-911
In Europe call 0044 1782 744 561
or call your local Koch-Glitsch office

Koch-Glitsch Plastic Random Packings

Koch-Glitsch is unsurpassed in offering the widest range of sizes and styles of traditional and high performance plastic random packings. Koch-Glitsch recognizes that while packing provides many valuable benefits, not all applications are equally demanding. The various packings presented in this brochure are of ring and saddle type construction and offer a variety of performance levels from traditional to high performance. Some considerations in choosing a particular style of packing are:

- To meet specific process requirements
- Excellent past experience using a specific packing in a particular application
- Familiarity of the process engineer with the packing type and its performance
- Direct replacement of an existing packing
- For use in a licensed process where the licensor specifies the equipment type

To enable the process engineer to optimize the system for cost and performance, several sizes are offered within each packing family. As the packing size increases within the family, the packing offers greater capacity and lower pressure drop at the expense of lower efficiency.

Plastic packings are used in corrosive applications with low to moderate operating temperature and can offer an economical advantage over metal materials.

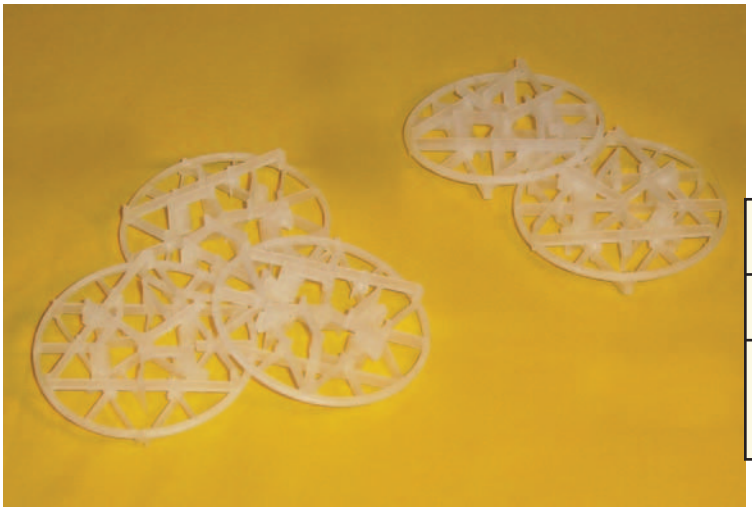
Where temperatures permit, plastic packings perform better than ceramic packings and are often less expensive than metals, particularly when exotic metals and alloys are required. Consequently, plastic packings are used mainly in absorption, scrubbing, stripping and heat transfer services.

GRP Flue Gas Condensing Scrubber

Typical Applications

- Absorbers
  - CO_2 absorption
  - SO_2, HCl and HF absorption or stripping
  - Chlorine absorption in water or caustic
  - Chlorine dioxide absorption
  - Chlorine drying
  - Hydrogen sulfide and mercaptan removal
  - Air pollution control scrubbers
  - Fume scrubbing
  - Odor control
  - VOC removal
- Degassing
  - Decarbonation
  - Deaeration
- Liquid/Liquid Extraction
- Water treatment
  - Waste water treatment
  - Drinking water preparation
  - Fish farming
- Heat Transfer
  - Humidification
  - Dehumidification

Packing Characteristics

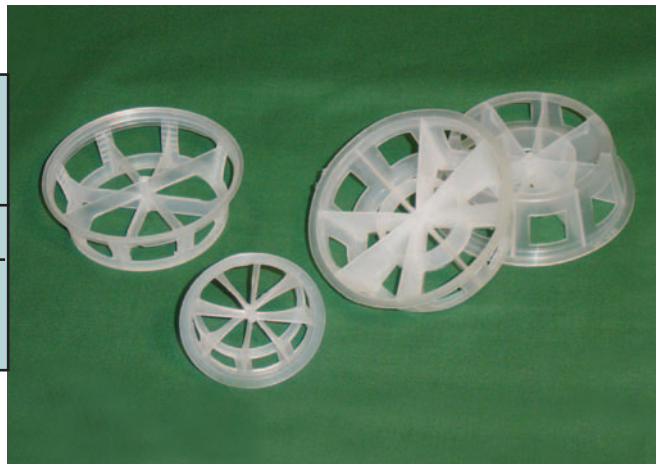


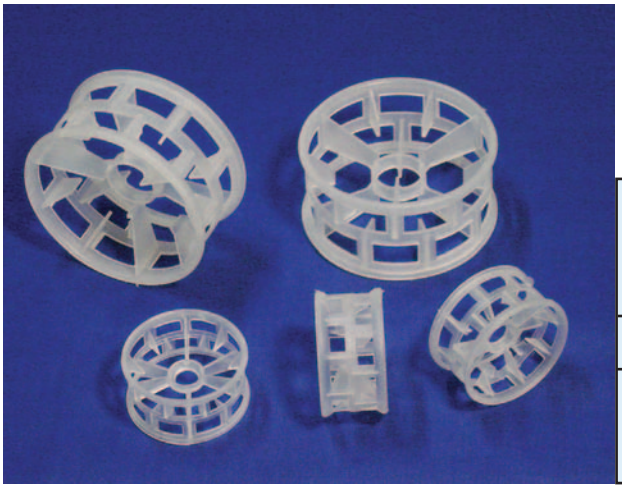
INTALOX® SNOWFLAKE® Random Packing

INTALOX® SNOWFLAKE® Packing		
Void Fraction	%	97
Bulk Weight*	kg/m³ lb/ft³	51 3.2

CASCADE MINI-RINGS® Random Packing

CMR™ Packing Size Nominal Size		1A	2	2A	3A
Void Fraction	%	97	97	97	98
Bulk Weight*	kg/m³ lb/ft³	53 3.3	43 2.7	46 2.9	40 2.5

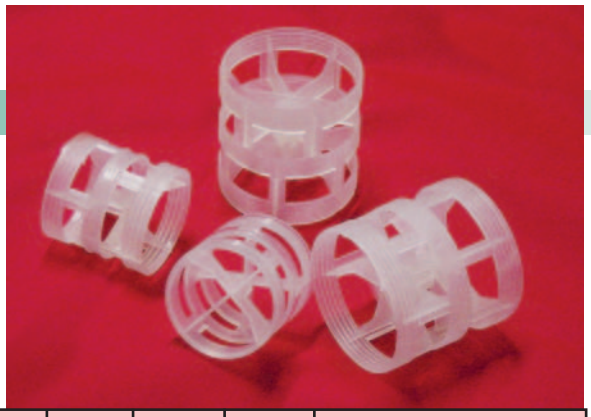




β-ETA RING® Random Packing

β-ETA RING® Packing Size Nominal Size		1	2	3
Void Fraction	%	94	94	96
Bulk Weight*	kg/m³ lb/ft³	53 3.3	54 3.4	38 2.4

** for polypropylene with standard material thickness*



FLEXIRING® Random Packing

FLEXIRING® Packing Size							High Performance	
Nominal Size		5/8	1	1 1/2	2	3 1/2	2	4
	mm	16	25	38	50	90	50	100
	inch	5/8	1	1 1/2	2	3 1/2	2	4
Void Fraction	%	87	92	91	93	95	93	96
Bulk Weight*	kg/m³	95	71	70	60	43	60	36
	lb/ft³	5.9	4.4	4.3	3.8	2.7	3.8	2.2

Super INTALOX® Saddles

Super INTALOX® Saddles Size				
Nominal Size		1	2	3
Void Fraction	%	90	93	94
Bulk Weight*	kg/m³	83	61	50
	lb/ft³	5.2	3.8	3.1

ETAPAK® Random Packing

ETAPAK® Packing Size			
Nominal Size		210	120
	mm	45	90
	inch	1 3/4	3 1/2
Void Fraction	%	85	95
Bulk Weight*	kg/m³	59	39
	lb/ft³	3.7	2.4

** for polypropylene with standard material thickness*

Materials of Construction

Plastic packings are often preferred because of their lightweight construction and resistance to breakage. Further, the availability of numerous types of plastic resins provides the designer with a broad range of chemical and thermal resistant materials. Koch-Glitsch plastic packings are made in a wide variety of thermoplastic materials. Most of the Koch-Glitsch packings are available in the materials listed in the table below. Other plastics are available by special request.

The mechanical strength of a plastic material decreases over time. Temperature limits for long-term service life depend on the load the packing must bear from its own weight and from liquid holdup. The following table shows the resin suppliers maximum recommend chemical resistance temperatures. The maximum operating temperature depends on system environment, packing size and bed height. In general, deep packed beds, weaker packing shapes and high liquid loads require lower temperature limits. Packed heights can be increased by using specially formulated filled resins. Typical fillers include glass fibers, carbon fibers and chalk. Contact Koch-Glitsch to determine a specific load limit for a particular Koch-Glitsch product at a certain temperature.

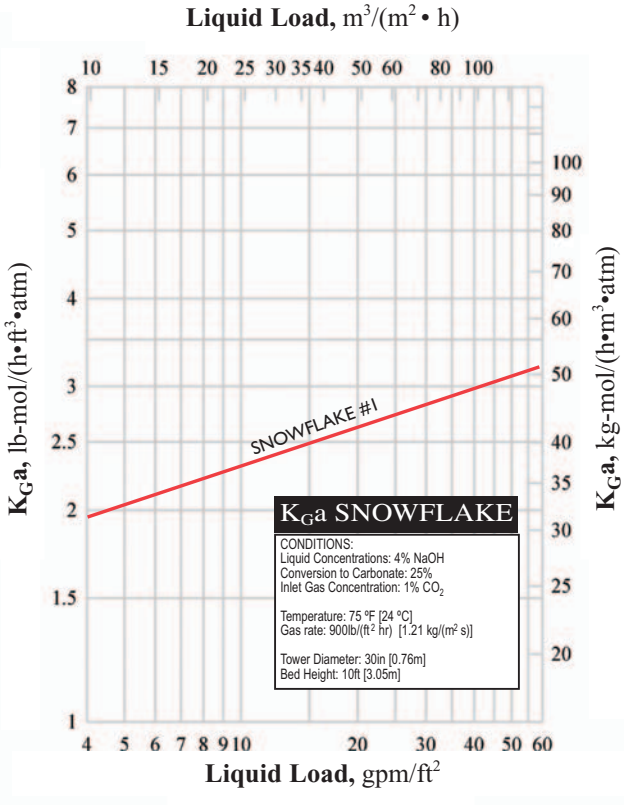
In addition to a wide range of plastics, Koch-Glitsch offers a complete range of metal random packings. For information on metal random packings, please request brochures KGMRP-1 and KGIMTP-1.

Type of Plastic	Maximum Recommended Chemical Resistance Temperature *	
	°F	°C
General Grade Polypropylene	220	104
LTHA Polypropylene	247	119
LTHA Polypropylene (10% Glass reinforced)	260	127
High Density Polyethylene	212	100
Low Density Polyethylene	190	88
PVC	150	66
CPVC	185	85
KYNAR[1] PVDF	290	143
HALAR[2] E-CTFE	305	152
TEFZEL[3] ETFE	300	149
TEFZEL[3] ETFE (25% Glass reinforced)	392	200
PFA	482	250

* *Maximum chemical resistance temperature according to resin suppliers' recommendations. Actual maximum operating temperature limits depend on the system environment, packing size, packed bed depth, etc. Please contact Koch-Glitsch for critical applications.*

Registered Trademarks
[1] *Atofina Chemicals, Inc.*
[2] *Ausimont U.S.A., Inc.*
[3] *E. I. Du Pont De Nemours and Company*

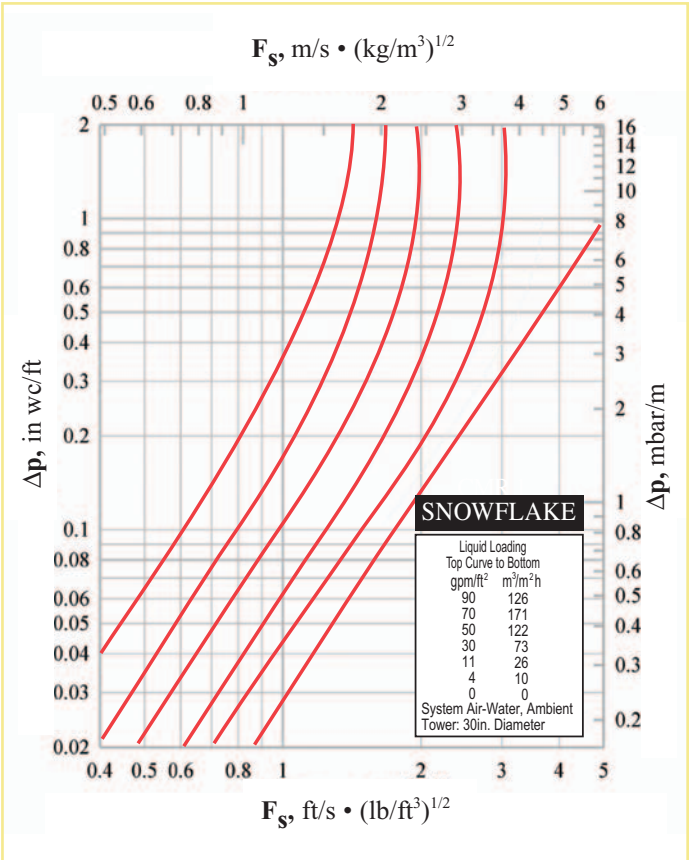
INTALOX® SNOWFLAKE® High Performance Random Packing



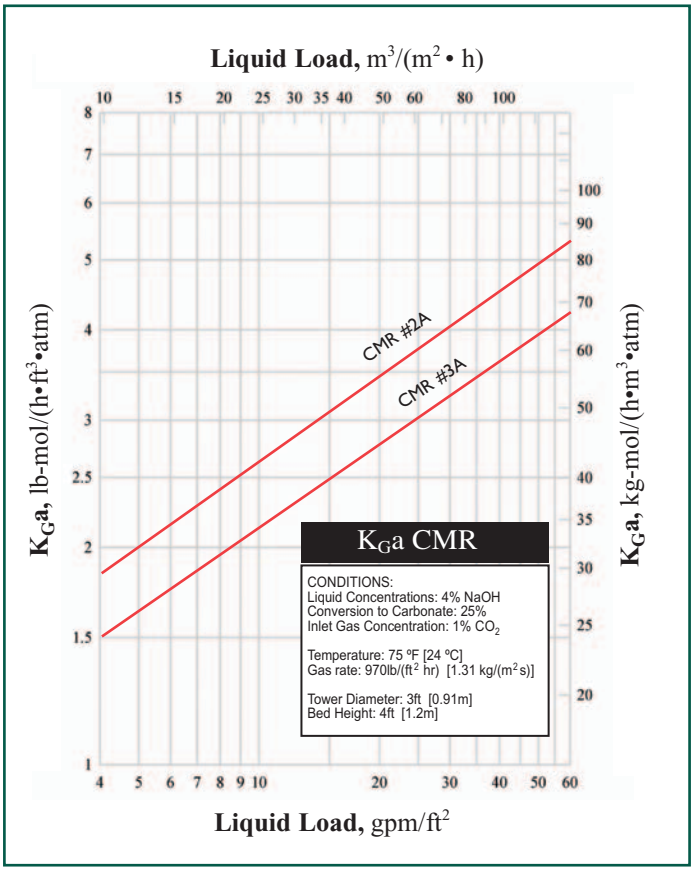
For maximum tower performance, **INTALOX® SNOWFLAKE®** High Performance Random Packing offers a unique combination of superior separation efficiency and high capacity. INTALOX SNOWFLAKE random packing is widely applied in the Chemical Processing Industry, including Chlorine and Bromine production. INTALOX SNOWFLAKE random packing is the preferred masstransfer device for emergency scrubbers in processes involving halogens because of its superior performance over a wide operating range. It is often used in environmental applications, such as scrubbing and stripping. Independent tests have proven that INTALOX SNOWFLAKE packing can achieve removal efficiencies higher than 99% for groundwater air stripping.

The unique shape of this packing offers a lower pressure drop, which substantially reduces energy consumption in applications requiring blowers or compressors. In typical system designs, INTALOX SNOWFLAKE packing can save more than 50% in energy cost as compared to #1 plastic saddles. In new installations, the pressure drop advantage of SNOWFLAKE packing enables the designer to significantly reduce the size of the tower and blowers.

The strong shape of SNOWFLAKE packing allows deep beds for multiple-transfer-unit absorption. Contact Koch-Glitsch for strength/depth ratings at a specific temperature.



CASCADE MINI-RINGS® Random Packing



CASCADE MINI-RINGS® (CMR™) Random Packing was developed and introduced to the market in 1971. It became the first commercially successful high performance random packing. Since its introduction, plastic CMR random packing has been utilized in thousands of successful installations around the world in a wide variety of absorption, stripping and heat-exchange columns.

CASCADE MINI-RINGS packing achieves better capacity and efficiency than standard Pall Rings. This improvement in performance is a result of the low "aspect ratio" of 1:3 (height of the cylinder is 1/3 of the diameter).

In a bed of Pall Rings, many of the rings are oriented with nearly-horizontal cylindrical axes. These rings impede vapor flow more than their nearly vertical neighbors. However, when a bed of CMR packing is installed, the lower aspect ratio causes most of the rings to lie with their axes nearly vertical. This preferred orientation better exposes both the interior and exterior surface of the rings to the liquid and vapor flows, providing more efficient use of the packing surface. CMR packing attains greater capacity for a given size/efficiency.

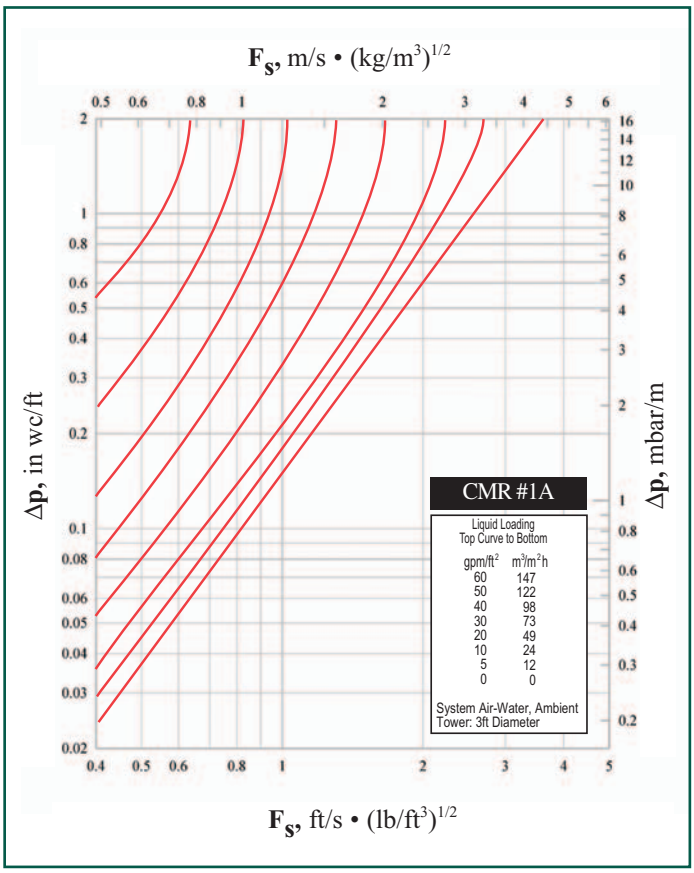
The low aspect ratio of the CMR rings, along with this preferential orientation, brings about substantial improvements in process performance:

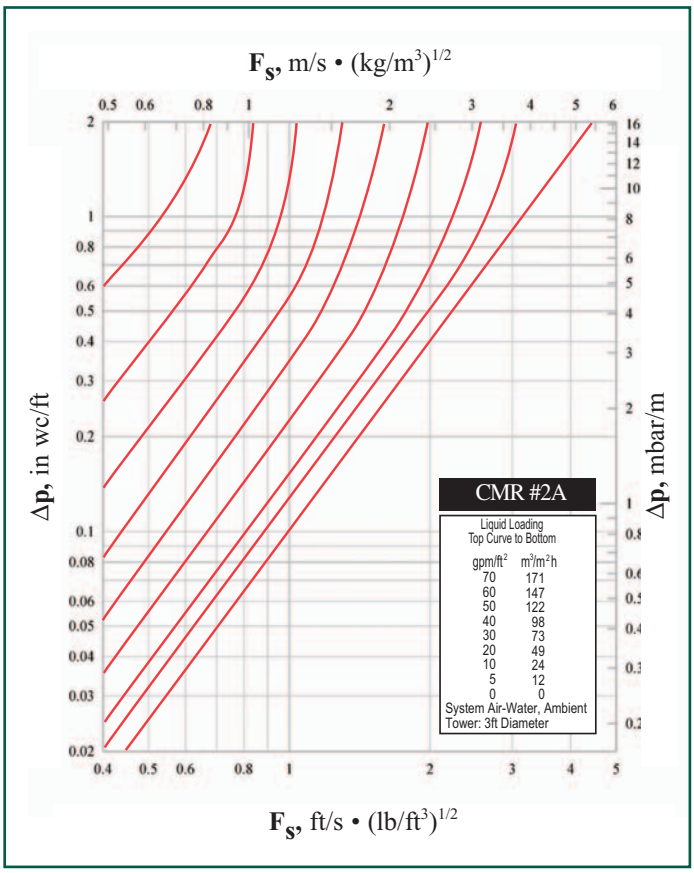
1. Lower pressure drop: Because the CMR ring's largest opening is predominantly in the direction of the vapor flow, vapor passes easily through the column, resulting in lower pressure drop.

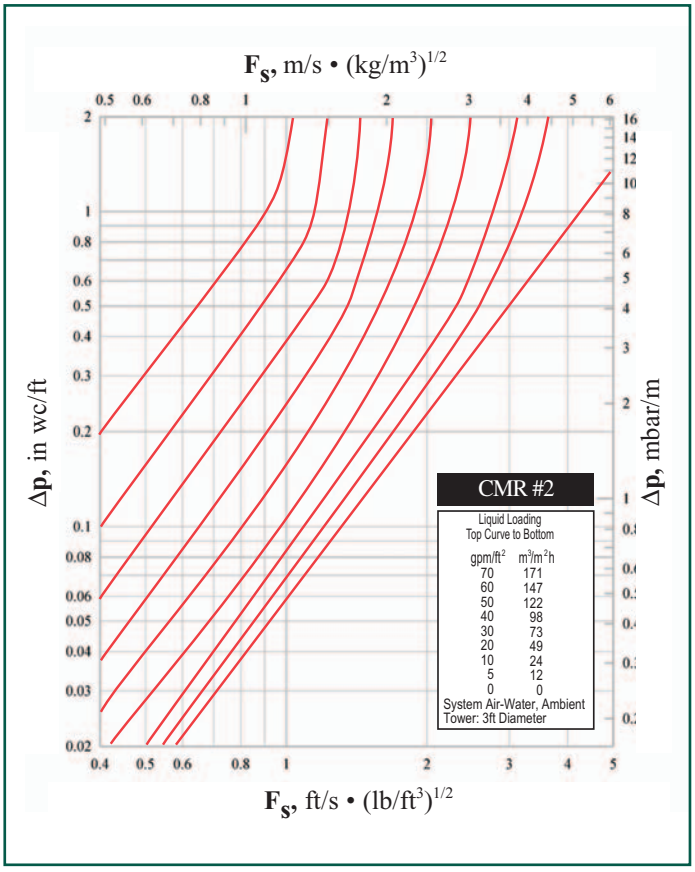
2. Higher capacity: The lower flow rate resistance of the lower aspect ratio rings results in a higher capacity.

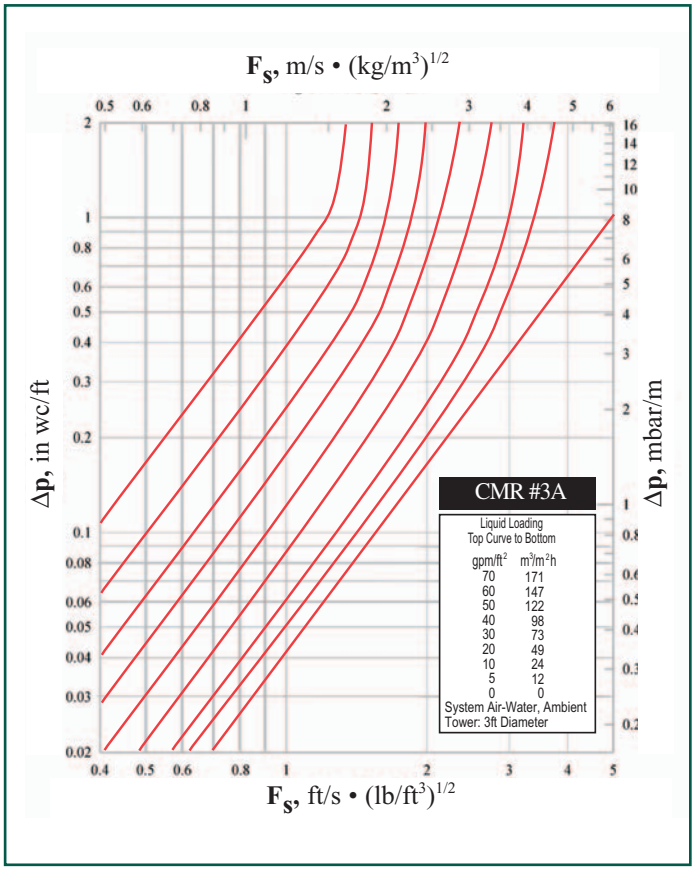
3. Better fouling resistance: Any solids entering the packed bed are more easily flushed through the packing matrix by the liquid.

4. Higher mechanical strength: The preferred orientation with the cylindrical axis in the vertical position increases the mechanical strength of the packed bed.

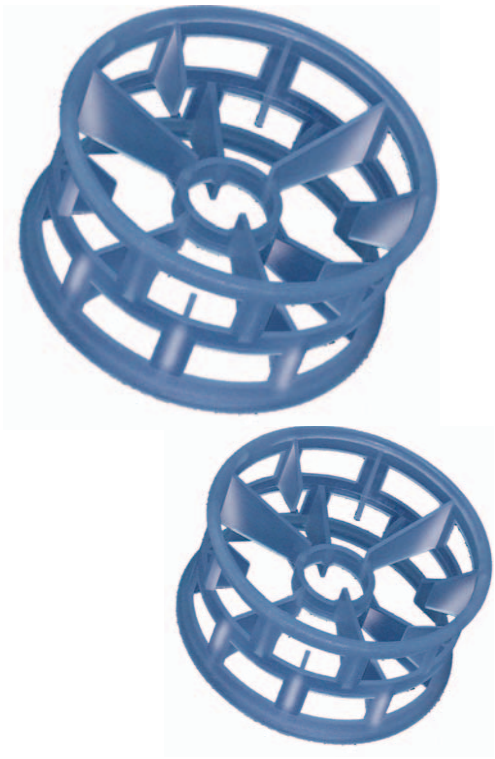

F_s, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_s, ft/s • $(lb/ft^3)^{1/2}$
CMR #1A
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
60 147
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 3ft Diameter

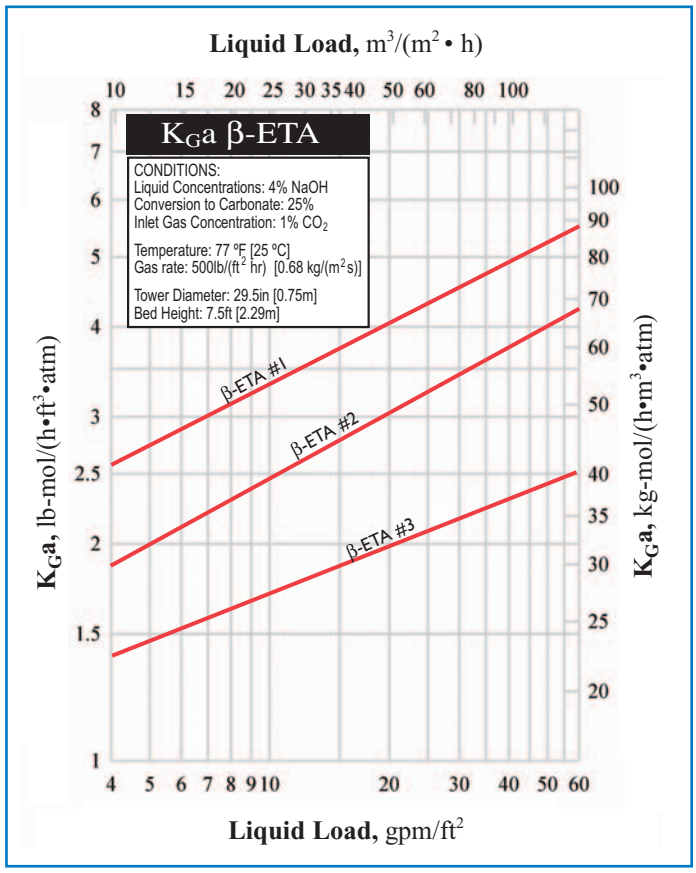

F_s, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_s, ft/s • $(lb/ft^3)^{1/2}$
CMR #2A
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
70 171
60 147
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 3ft Diameter


F_s, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_s, ft/s • $(lb/ft^3)^{1/2}$
CMR #2
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
70 171
60 147
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 3ft Diameter


F_s, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_s, ft/s • $(lb/ft^3)^{1/2}$
CMR #3A
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
70 171
60 147
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 3ft Diameter

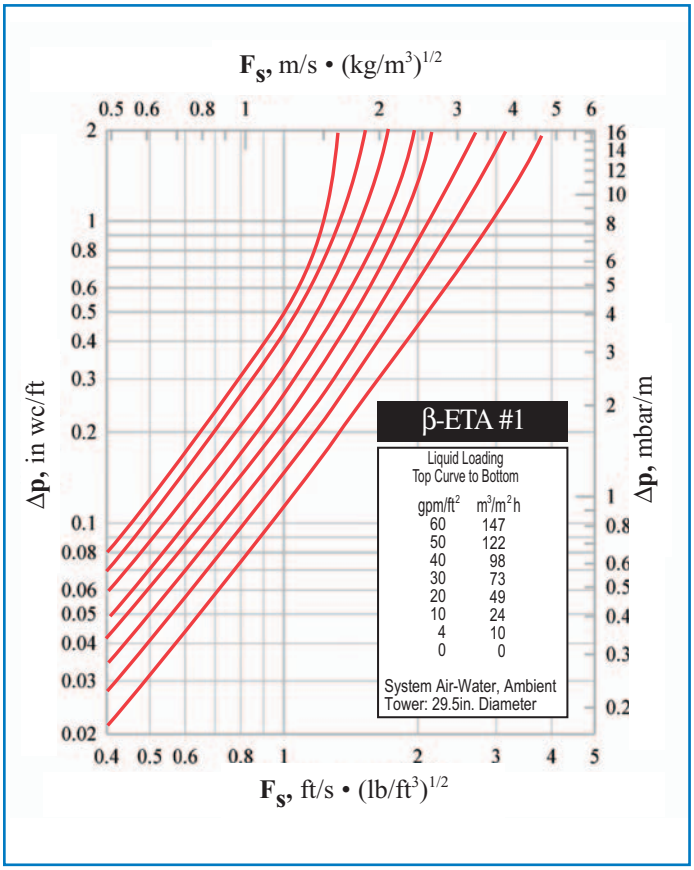
β-ETA RING® Random Packing

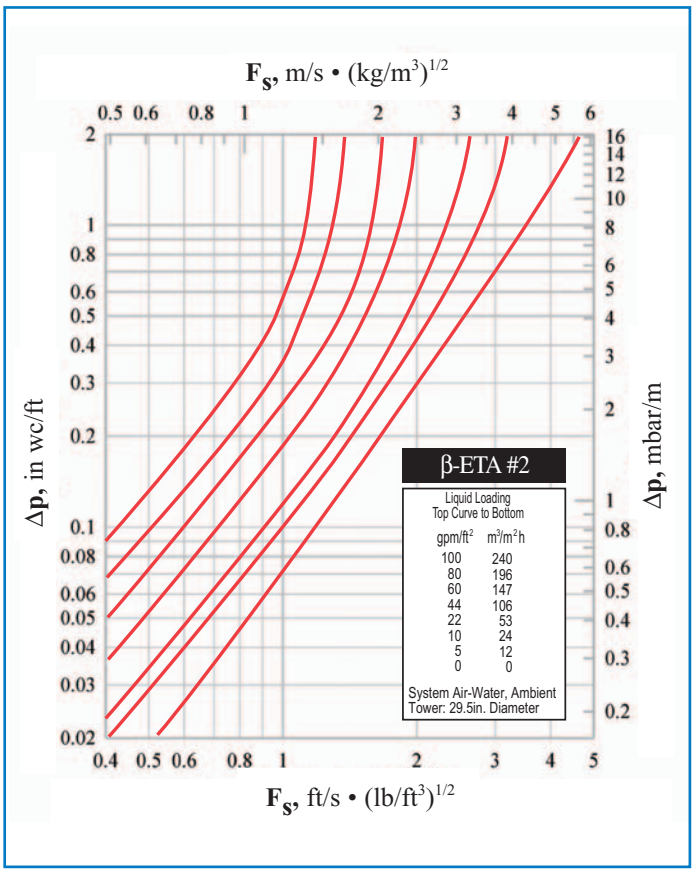


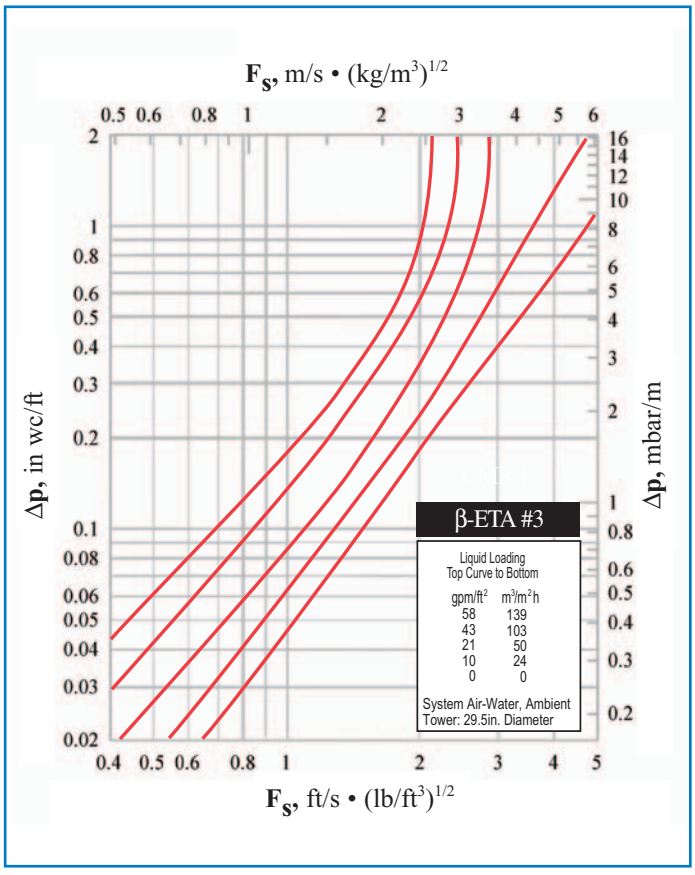


Recently, β-**ETA RING®** **(BETA RING™)** High Performance Random Packing was introduced, providing further improvement over the CMR packing. The strategic, patented size and placement of the slots and tabs provide an extremely effective use of packing surface area. The variation in the length of the internal tabs ensures high efficiency and optimal distribution. The result is uninterrupted flows of gas and liquid while providing additional drip points to enhance liquid film surface renewal for improved mass and heat transfer. Consequently β-ETA RING random packing is particularly well suited for applications where low pressure drop and high liquid handling capacity is important.

β-ETA RING and CMR packings have become the standard packings for several proprietary processes and represent the majority of operational experience in many processes.




F_S, m/s • $(kg/m^3)^{1/2}$
0.5 0.6 0.8 1 2 3 4 5 6
2 1 0.8 0.6 0.5 0.4 0.3 0.2 0.1 0.08 0.06 0.05 0.04 0.03 0.02
16 14 12 10 8 6 5 4 3 2 1 0.8 0.6 0.5 0.4 0.3 0.2
0.4 0.5 0.6 0.8 1 2 3 4 5
Δp, in wc/ft
Δp, mbar/m
F_S, ft/s • $(lb/ft^3)^{1/2}$
β-ETA #2
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
100 240
80 196
60 147
44 106
22 53
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 29.5in. Diameter


F_S, m/s • $(kg/m^3)^{1/2}$
0.5 0.6 0.8 1 2 3 4 5 6
2 1 0.8 0.6 0.5 0.4 0.3 0.2 0.1 0.08 0.06 0.05 0.04 0.03 0.02
16 14 12 10 8 6 5 4 3 2 1 0.8 0.6 0.5 0.4 0.3 0.2
0.4 0.5 0.6 0.8 1 2 3 4 5
Δp, in wc/ft
Δp, mbar/m
F_S, ft/s • $(lb/ft^3)^{1/2}$
β-ETA #3
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
58 139
43 103
21 50
10 24
0 0
System Air-Water, Ambient
Tower: 29.5in. Diameter

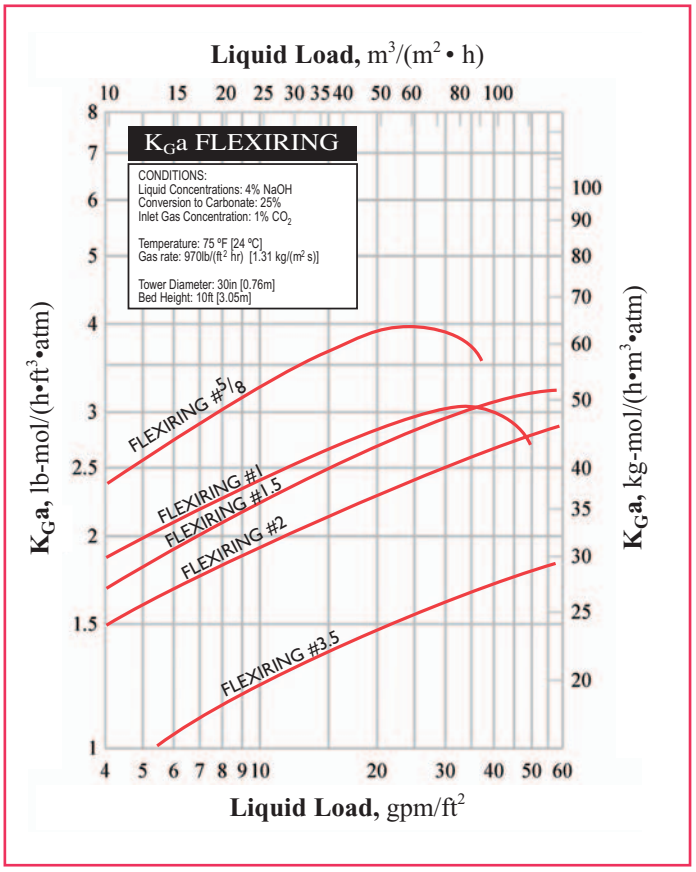
FLEXIRING® Random Packing

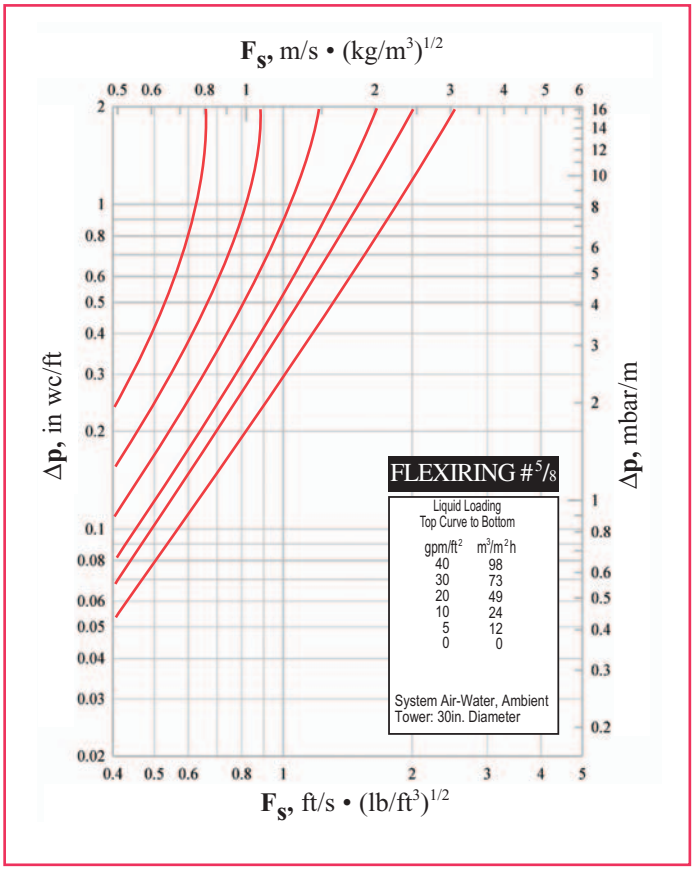
Plastic **FLEXIRING**® Random Packing and plastic Super **INTALOX**® Saddles have been used for many years and have become the standard for many designers and processes. Although these packings do not have the "high performance" characteristics of INTALOX SNOWFLAKE or β-ETA RING packings, they have been used extensively and therefore their performance is widely known. Further, they are less sensitive to liquid distribution quality and have higher liquid hold-up and residence time for those services that benefit from such characteristics.

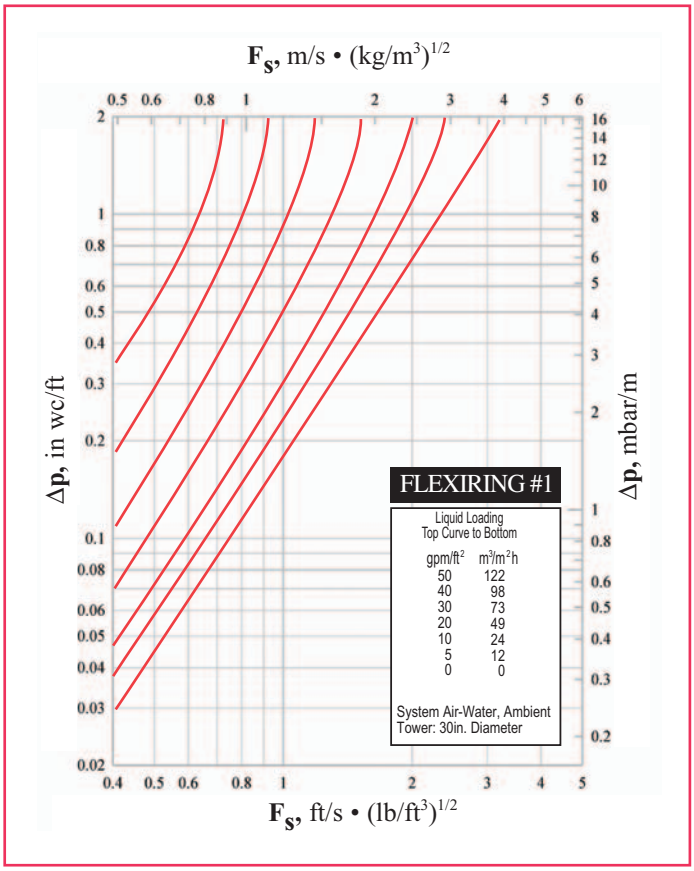
Generally, Super INTALOX Saddles are favored by designers and industries that once used ceramic saddles but now want the superior performance of plastic Super INTALOX Saddles.

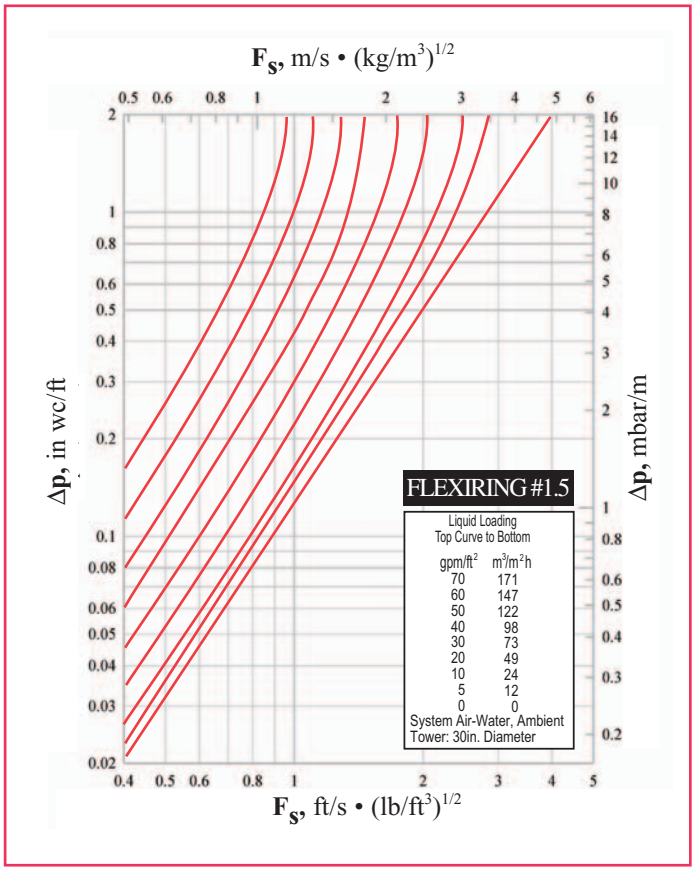
FLEXIRING random packing is favored by designers and industries that prefer metal FLEXIRING packing and other metal packings but now need the corrosion resistance of the plastic construction.

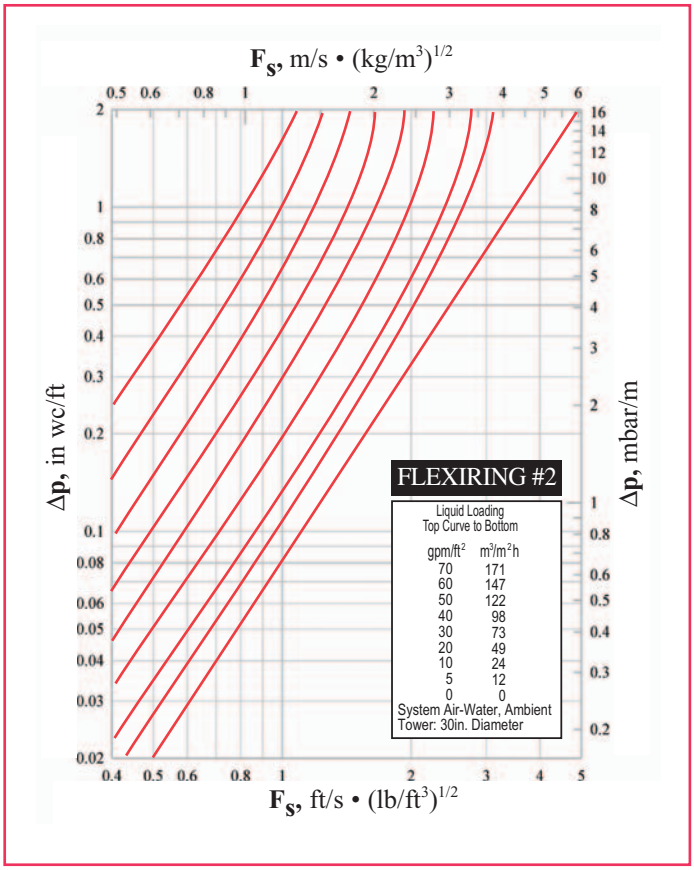
Koch-Glitsch offers two enhanced performance versions of FLEXIRING random packing: The 2-inch [50 mm] and 4-inch [100 mm] High-Performance FLEXIRING random packing. Extra vanes inside each of these rings produce more efficiency than their standard counterparts, without sacrificing any capacity. These two packings can be useful when a designer wants maximum efficiency from a 2-inch [50 mm] FLEXIRING packing or extra capacity then a 3.5-inch [90 mm] FLEXIRING packing.

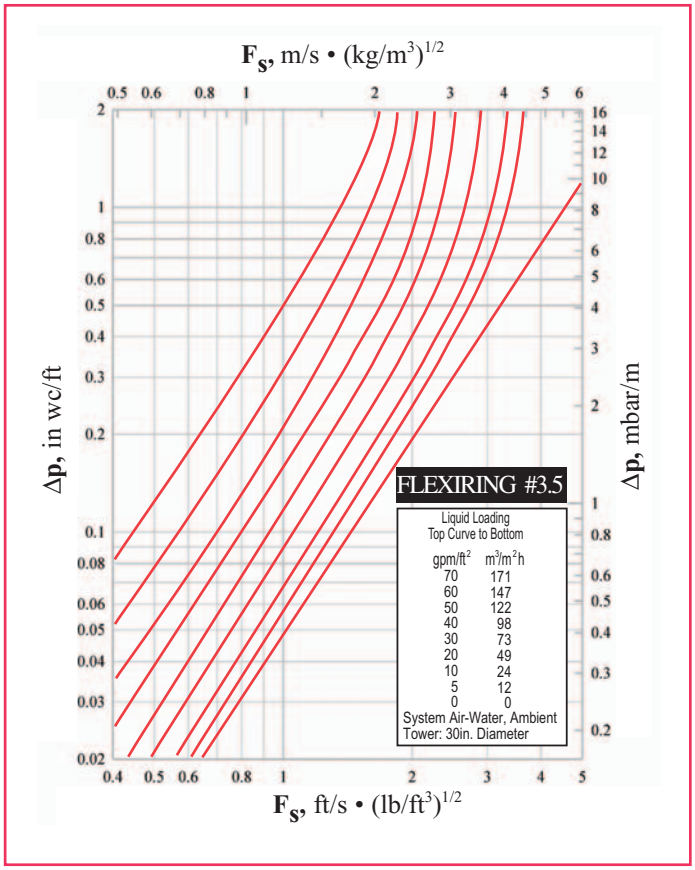




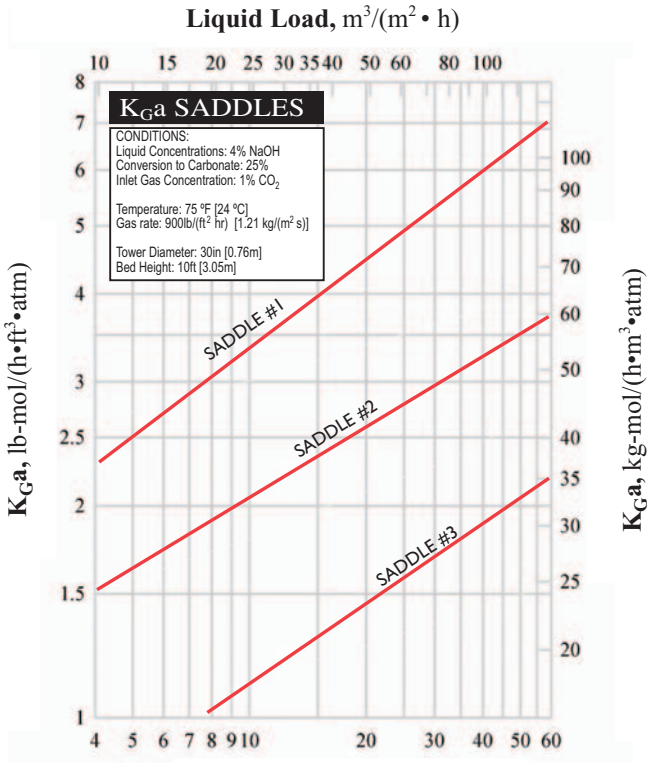

F_S, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_S, ft/s • $(lb/ft^3)^{1/2}$
FLEXIRING #1
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 30in. Diameter

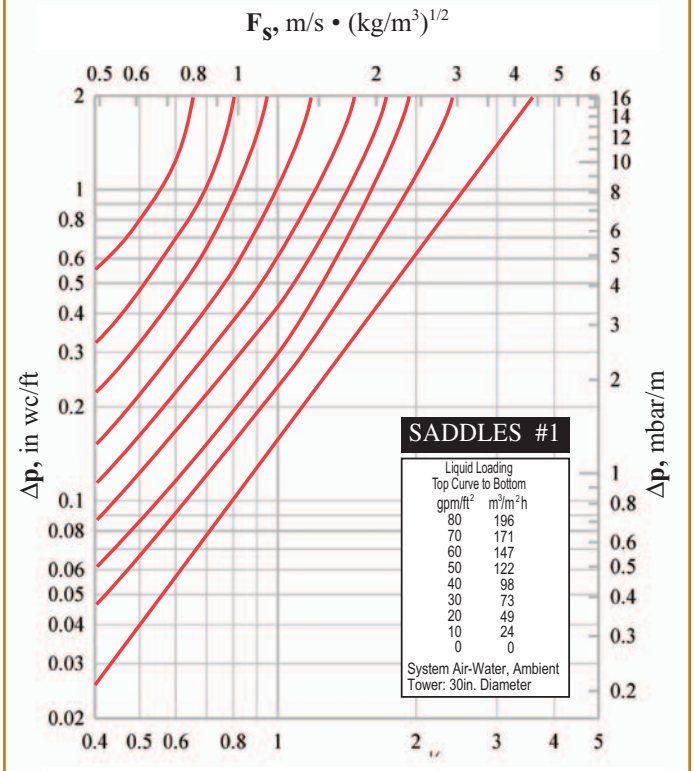

F_S, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_S, ft/s • $(lb/ft^3)^{1/2}$
FLEXIRING #1.5
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
70 171
60 147
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 30in. Diameter

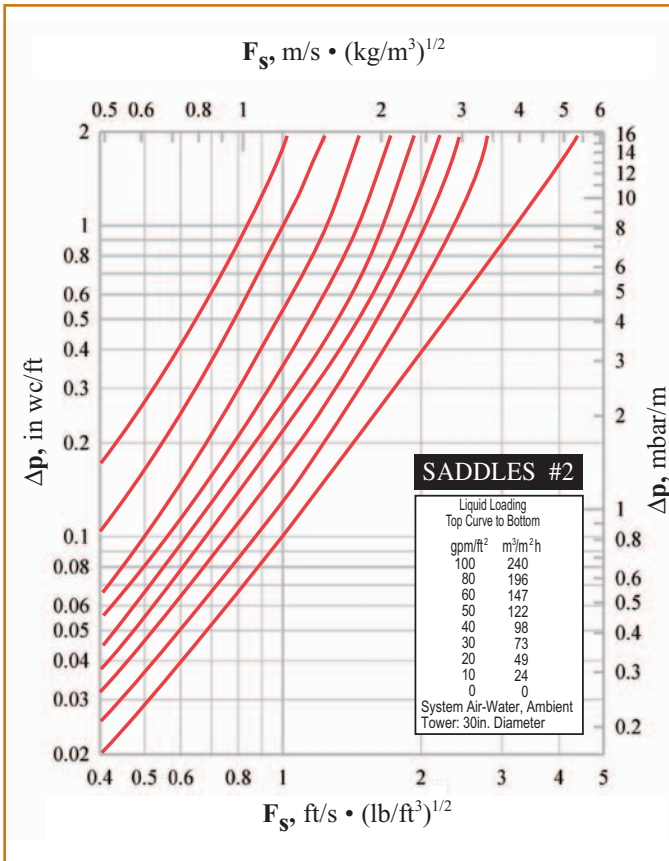

F_S, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_S, ft/s • $(lb/ft^3)^{1/2}$
FLEXIRING #2
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
70 171
60 147
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 30in. Diameter

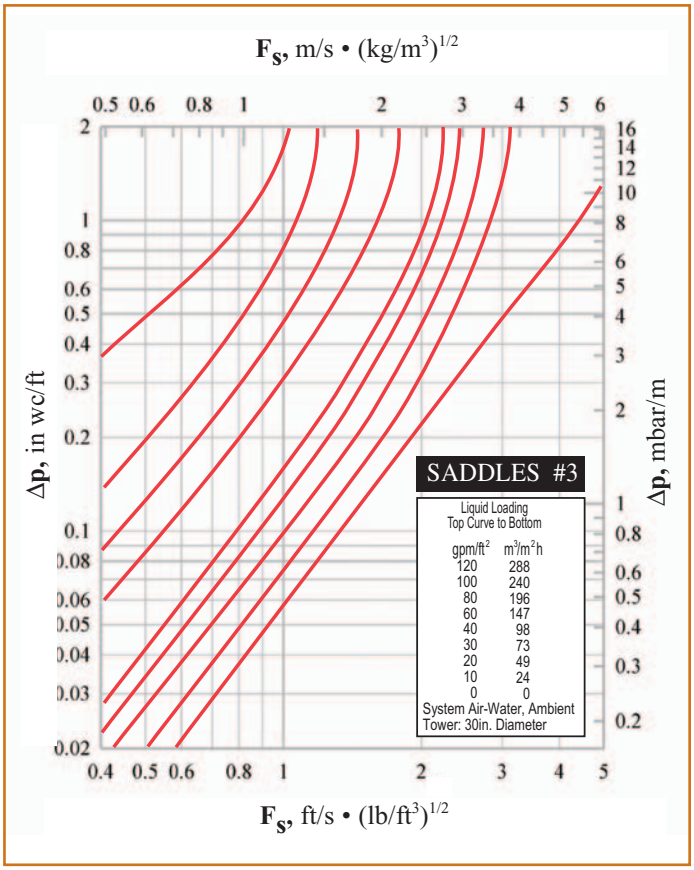

F_S, m/s • $(kg/m^3)^{1/2}$
Δp, in wc/ft
Δp, mbar/m
F_S, ft/s • $(lb/ft^3)^{1/2}$
FLEXIRING #3.5
Liquid Loading
Top Curve to Bottom
gpm/ft² m³/m²h
70 171
60 147
50 122
40 98
30 73
20 49
10 24
5 12
0 0
System Air-Water, Ambient
Tower: 30in. Diameter

Super INTALOX® Saddles









Column Internals

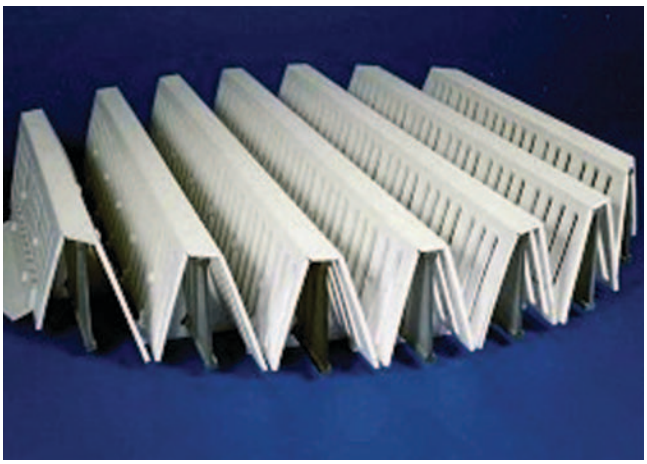
Koch-Glitsch plastic column internals are available in both thermoplastic and thermoset (e.g. Fiberglass-Reinforced Plastic -- FRP) materials. Occasionally, thermoplastic internals have different temperature limits than packing of the same material. Koch-Glitsch has an unsurpassed knowledge in recognizing these instances and can provide designs specific to any application.

FRP column internals use different designs than thermoplastic internals. FRP has better structural properties but greater fabrication restrictions. The Koch-Glitsch standard thermoset is one of the DERAKANE® brand resins, although other resins are available to suit a wide range of chemical and thermal requirements.

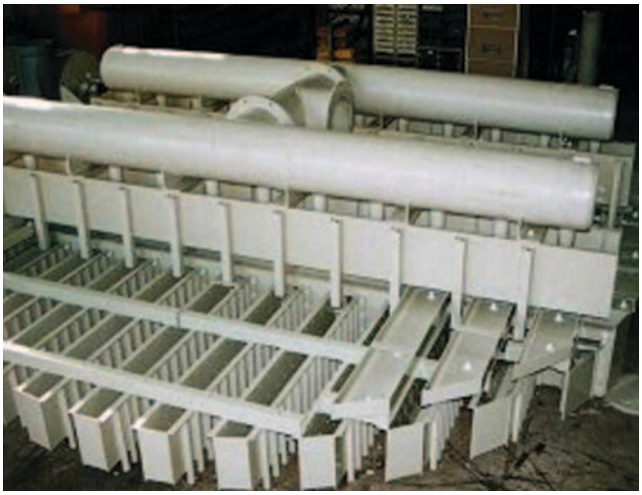
As with the packing type, Koch-Glitsch also recognizes that not all packed towers require state-of-the-art liquid and vapor distribution. In the majority of cases, traditional and intermediate performance distributors are specified with the packings in this brochure. For more information on liquid and vapor distribution technology as well as other column internals in thermoplastic or FRP, consult brochure KGPTIG-1. Many times, plastic packings will be combined with metal column internals (packing supports, bed limiters, liquid distributors, etc.) to provide the optimum combination of performance and cost. Koch-Glitsch brochure KGMTIG-1 provides more information about Koch-Glitsch metal column internals.

Koch-Glitsch process engineers will help select the appropriate style of packing and then match that packing to the optimum tower internals to create the **INTALOX®** Packed Tower System that best satisfies your specific requirements. Koch-Glitsch goes a step further by offering the single supplier/installer benefits of turnkey solutions. At your request, the Koch-Glitsch Field Service team is always available to provide faster, safer revamps with minimum down time.

DERAKANE® is a registered trademark of Dow Chemical Company



Model TP 804 Support Grid, PTFE/Carbon-Carbon



Model TP 286 Thermoplastic Trough Distributor with Drip Tubes

Model TS 236 FRP Liquid Distributor with Side Orifices

Koch-Glitsch Corporate Offices

Worldwide Headquarters

Koch-Glitsch, LP

4111 East 37th Street North	Wichita, KS 67220 – United States	tel: (316) 828-5110	fax: (316) 828-7985

Europe

Koch-Glitsch Italia S.r.l.

Viale Giulio Cesare 29	24124 Bergamo – Italy	tel: +39 035 2273.411	fax: +39 035 2273.400

Asia

Koch-Glitsch Korea, Ltd.

17-8, 8F, Dongsung Bldg. Yoido-dong, Youngdeungpo-ku	Seoul 150-874 – Korea	tel: +82-2-3276-7500	fax: +82-2-3276-7590

Koch-Glitsch (A division of Koch Chemical Technology Group India Pvt. Ltd).

Corporate Park II, 10th Floor Sion-Trombay Road	Chembur, Mumbai 400 071 – India	tel: +91 22 6771 7171	fax: +91 22 6771 7161

For a complete list of our offices and facilities, visit us on the Web at www.koch-glitsch.com.

Emergency Numbers

US: 1-888-KOCH-911.

Europe: +39-06-928-911, +44-1782-744561or your local Koch-Glitsch office.

Asia Pacific: Contact your local Koch-Glitsch office.

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