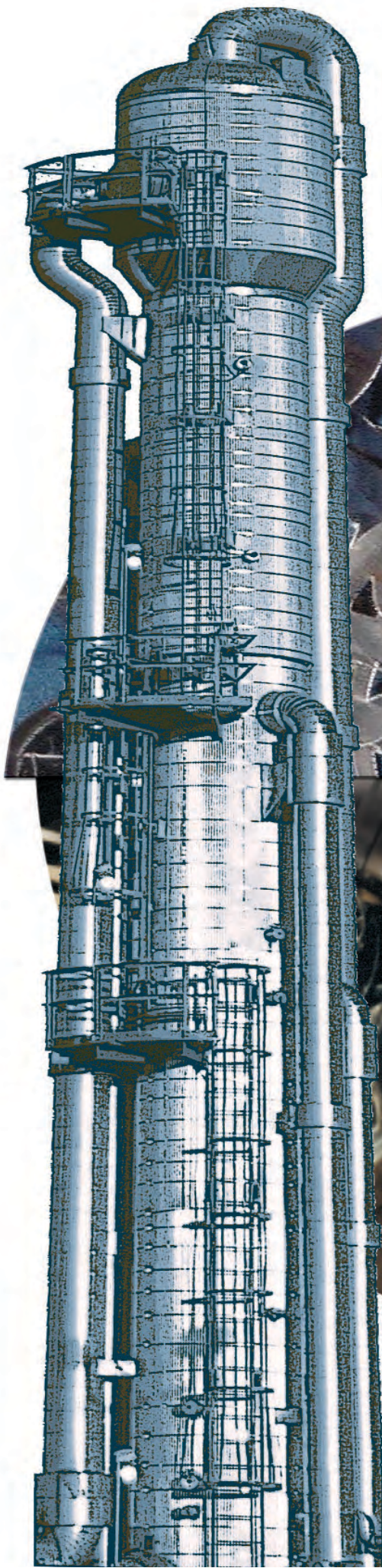


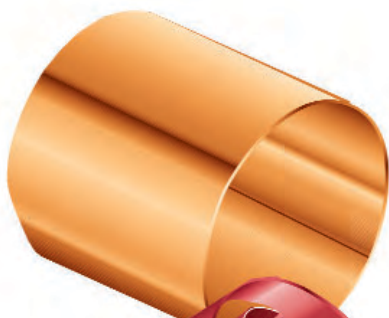
IntaloxTM
PACKED TOWER SYSTEMS

Metal Random Packing



K KOCH-GLITSCH[®]

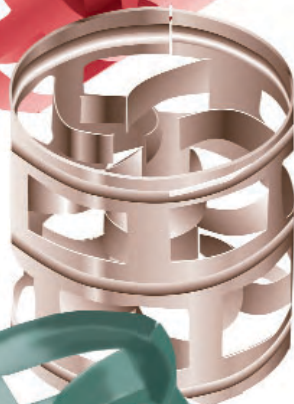
Introduction



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FLEXIRING®
Random Packing
Pages 5 and 7



HY-PAK®
Random Packing
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**CASCADE
MINI-RINGS®**
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IMTP®
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Please ask for Brochure
KGIMTP-1

For over 50 years random packings have been successfully used as an inexpensive but very effective means to increase a tower's capacity and/or efficiency. The original Raschig Rings have been superseded by new generations of improved products, and today Koch-Glitsch offers the widest spectrum of random packings available worldwide.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 to use tower packings are to reduce pressure drop through the column, increase the capacity compared to trays at the same efficiency, and/or reduce liquid holdup in the column.

This booklet provides information for quick sizing of packed columns for metal random packings. Information in the included charts enables hydraulic rating and provides 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 the website www.koch-glitsch.com

Emergency Delivery

Koch-Glitsch has the random packing – metal or plastic – to provide optimum performance whatever your application. In common materials, most packings are in stock for immediate shipment to get you back on line. For emergencies call the Hotline of your nearest Koch-Glitsch office.

In the US call the Hotline

1-888-KOCH-911

In Europe call

0044 1782 744 561

or your local Koch-Glitsch office

Koch-Glitsch offers a wide variety of random packings

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

- Meet specific process requirements
- Direct replacement of an existing packing
- Familiarity with the packing type and its performance
- Past experience using a specific packing in a particular application
- Use in a licensed process

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

As there are differences in packing types, Koch-Glitsch recognizes that packed tower applications have different liquid and vapor distribution requirements. In the majority of cases, traditional distributors are specified with the packings in this brochure. Working with you, our process engineers will help to select the proper packing, and match it with the appropriate tower internals to satisfy your process requirement.

When mass or heat transfer process requirements are stringent, an **INTALOX® Packed Tower Systems** is recommended. For more information on INTALOX Packed Tower Systems - the combination of high performance packing with state-of-the-art liquid and vapor distributors - as well as other column internals, please ask for brochure KGMTIG-1.

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.



Typical Applications

- Absorbers
 - CO₂ and H₂S selective absorption
 - Air pollution control scrubbers
 - Ammonia absorption
 - FCC absorbers
- Strippers
 - EO / EG
 - Water deaeration and decarbonation
 - Sour water stripper
- Heat Transfer
 - DC / AC
- Quench columns
- Light ends fractionators
 - Demethanizers
 - Deethanizer
- Degassing
- Liquid/liquid extraction

History and Technical Advances

The first ring type packing applied in mass transfer was the Raschig Ring. The original Raschig Ring is simply a cylindrical shaped tube with an aspect ratio of 1:1. The aspect ratio is defined as the ratio of the height to the diameter. Introduced at the end of the 19th century, Raschig Rings continue to be used today.

The Pall Ring, an improvement to the Raschig Ring, was introduced in the 1950's. The Pall Ring used the same cylindrical dimensions employing two rows of punched and formed fingers protruding inward from the cylinder wall. Both packing elements are formed starting with a piece of metal of identical dimensions and surface area. The two rows of punched fingers however provided a significant performance increase. The capacity and efficiency were both improved and the pressure drop was reduced. The significant performance improvement demonstrates that packing size, void fraction, packing factor and surface area are not the only parameters important in the determination of the hydraulic and mass transfer performance of a packing. Simply stated, the slotted style ring utilizes its surface area much more efficiently than the tubular shape.

Pall Rings are widely used today. They are specified in a number of licensed processes and have been tested by various researchers over the years. Koch-Glitsch **FLEXIRING**[®] packing is the industry recognized Pall Ring equivalent. Koch-Glitsch offers a unique High Strength FLEXIRING packing, with lower weight and improved mechanical strength, which provides an alternative to the 2-inch FLEXIRING packing. The mechanical strength of the High Strength FLEXIRING packing is attained through its engineered and patented shape.

An improvement to the FLEXIRING packing geometry is in the **HY-PAK**[®] random packing, introduced to the market in the late 1960's. Maintaining a 1:1 aspect ratio, the number of fingers were doubled. The mechanical strength was enhanced through the introduction of circumferential stiffening ribs. The new geometry allowed the rings to be made slightly larger, effectively providing a new packing with increased capacity, reduced pressure drop, and no noticeable reduction in efficiency. HY-PAK packing is widely used as a direct replacement for FLEXIRING or Pall Ring random packings of equivalent size in many applications.

In 1971, a new approach was taken to the slotted ring packing concept with the introduction of **CASCADE MINI RINGS**[®] or **CMR**[™] high performance random packing. It was demonstrated that the slotted ring packings benefited from the way they are oriented in the packed bed. When ring type packings are oriented with the cylindrical axis in the horizontal direction, they do not provide the lowest pressure drop and most efficient use of the surface area. Random packings with an aspect ratio of 1:1 have no preferred orientation.

In order to improve this shortfall, the CMR random packing utilizes an aspect ratio of 1:3, (height of the cylinder $\frac{1}{3}$ of the diameter). As a result the packing elements preferentially orient themselves with the cylindrical axis tending towards vertical. This preferential orientation better exposes both the interior and exterior surfaces of the rings to the liquid and vapor, providing more efficient use of the packing surface. At the same time, this orientation allows a less restricted flow for the vapor resulting in increased capacity while reducing pressure drop.



The low-aspect-ratio of CASCADE MINI-RINGS[®] high performance random packing (Top) favors orientation which exposes internal surfaces for excellent liquid film formation, intimate mixing and vapor/liquid contact. The high-aspect-ratio of the Pall-Ring random packing (Bottom), on the other hand, permits occlusion of interior surfaces and increased pressure drop.

CASCADE MINI RINGS random packing offers greater fouling resistance because there is less stagnant liquid and solids are more easily flushed through the packing by the liquid. CMR packing was the first high performance random packing introduced to the market and is preferred and specified in many licensed processes.

More recently, β -ETA RING® or BETA RING™ high performance random packing was introduced, providing an improvement over CMR packing with an optimized aspect ratio. The patented β -ETA RING random packing has an additional row of fingers with alternating arrangement of short and long tabs resulting in significantly more drip points than most other random packings. The variation in the length of the internal tabs ensures high efficiency and optimal distribution. The result is an uninterrupted flow of gas and liquid while providing additional drip points to enhance liquid film surface renewal for improved mass transfer. In addition, circumferential flanges added to the ring provide mechanical strength as well as enhanced liquid spreading characteristics.

Ultimately, Koch-Glitsch **INTALOX® Metal Tower Packing** or **IMTP®** high performance random packing has the best combination of performance properties today. Developed in the late 1970's, IMTP random packing combines the advantages of the saddle shape packing with that of modern high performance ring type packings. The inherent shape provides a lower pressure drop at the same vapor and liquid loads. IMTP random packing has been applied in countless distillation and absorption columns around the world. If performance is most critical, an INTALOX Packed Tower Systems combining INTALOX high performance internals with IMTP random packing provides the highest random packing performance available in the industry. For design information relating to IMTP random packing, please request brochure KGIMTP-I.



IMTP® high performance random packing for best mass transfer performance. Please request brochure KGIMTP-I.

Material of Construction

In addition to the size and style options, these packings are also offered in various materials of construction.

Metal

- Carbon Steel
- Stainless Steels, including Austenitic, Ferritic, Martensitic; types 409/410/430, 304 and 316 are readily available
- Duplex Stainless Steel
- Nickel and nickel alloys
- Aluminum
- Copper and copper alloys
- Titanium and zirconium
(not available for all types of packing)

Plastic

Versions of many of these random packings are available in most sizes in a wide variety of plastics. For information on plastic random packing, please request brochure KGPP-I.

Packing Characteristics



Raschig Ring Random Packing

Raschig Ring Packing Size*										
Nominal Size		$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	2	3
		mm	mm	mm	mm	mm	mm	mm	mm	mm
		inch	inch	inch	inch	inch	inch	inch	inch	inch
Void Fraction		%	%	%	%	%	%	%	%	%
		82	84	86	88	85	87	90	92	95

FLEXIRING® Random Packing

FLEXIRING® Packing Size							High Strength
Nominal Size		$\frac{5}{8}$	1	1 $\frac{1}{2}$	2	3 $\frac{1}{2}$	2
		mm	mm	mm	mm	mm	mm
		inch	inch	inch	inch	inch	inch
Void Fraction		%	%	%	%	%	%
		93	96	97	98	98	98
Bulk weight**		kg/m ³	kg/m ³	kg/m ³	kg/m ³	kg/m ³	kg/m ³
		535	325	208	198	135	141
		33.4	20.3	13.0	12.3	8.5	8.8



HY-PAK® Random Packing

HY-PAK® Packing Size					
Nominal Size		1	1.5	2	3
		mm	mm	mm	mm
		inch	inch	inch	inch
Void Fraction		%	%	%	%
		97	98	98	98
Bulk weight**		kg/m ³	kg/m ³	kg/m ³	kg/m ³
		262	180	161	181
		16.4	11.2	10.0	11.3



* various thickness' and special sizes available

** for stainless steel with standard material thickness

CASCADE MINI-RINGS® Random Packing



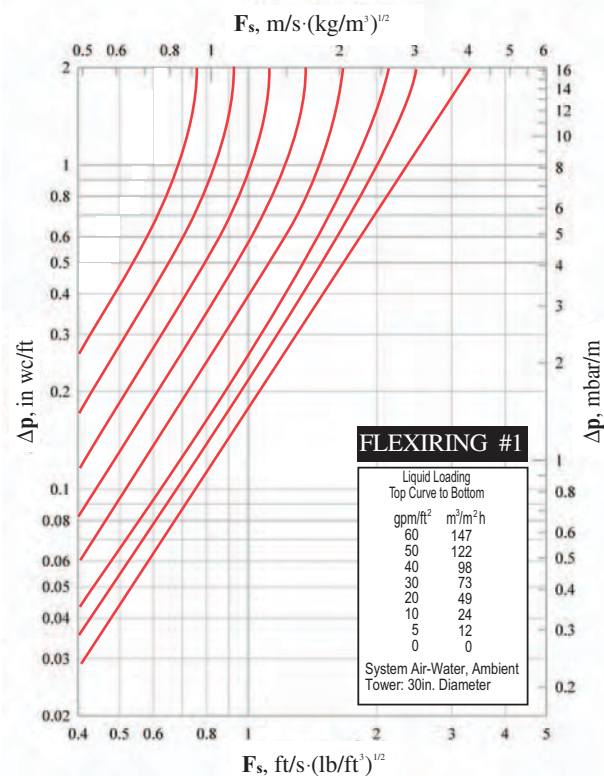
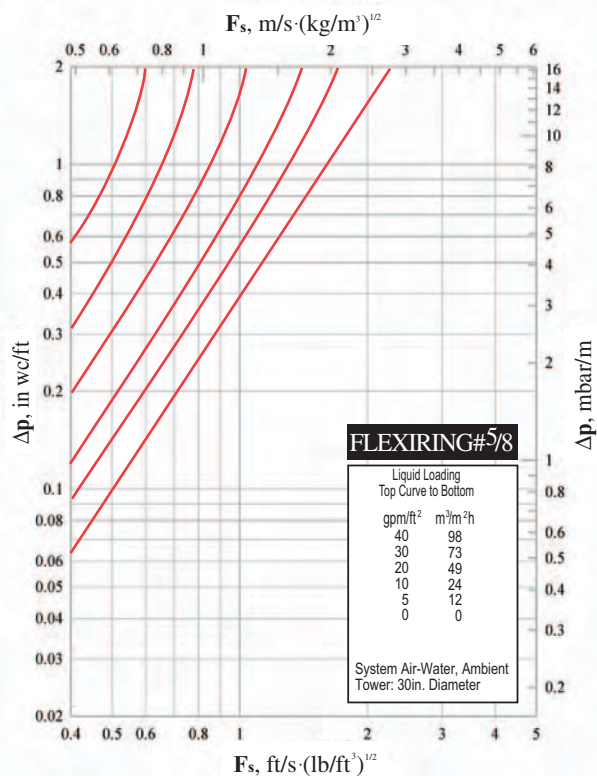
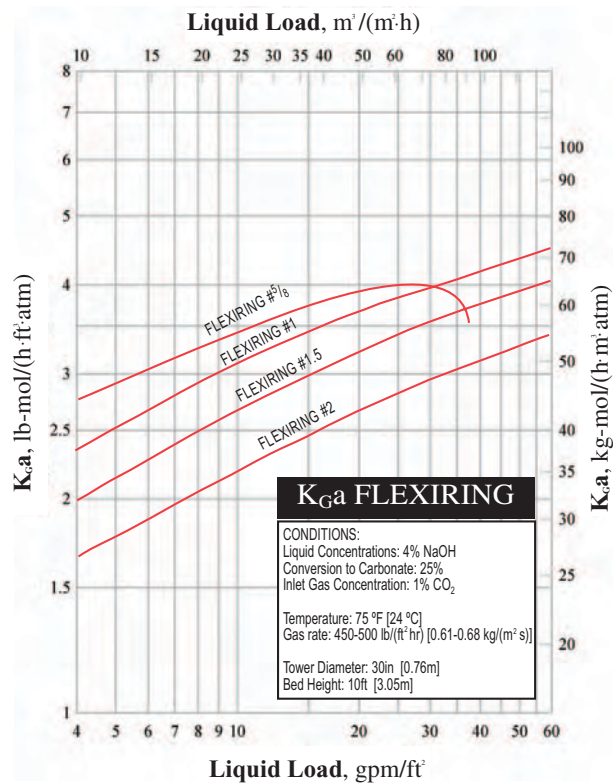
CMR™ Packing Size Nominal Size		1	1.5	2	2.5	3	4	5
	mm	25	38	44	50	63	90	125
	inch	1	1½	1¾	2	2½	3½	5
Void Fraction	%	97	96	97	97	98	98	98
Bulk weight**	kg/m³	237	285	241	202	160	125	108
	lb/ft³	14.8	17.8	15.0	12.6	10.0	7.8	6.7

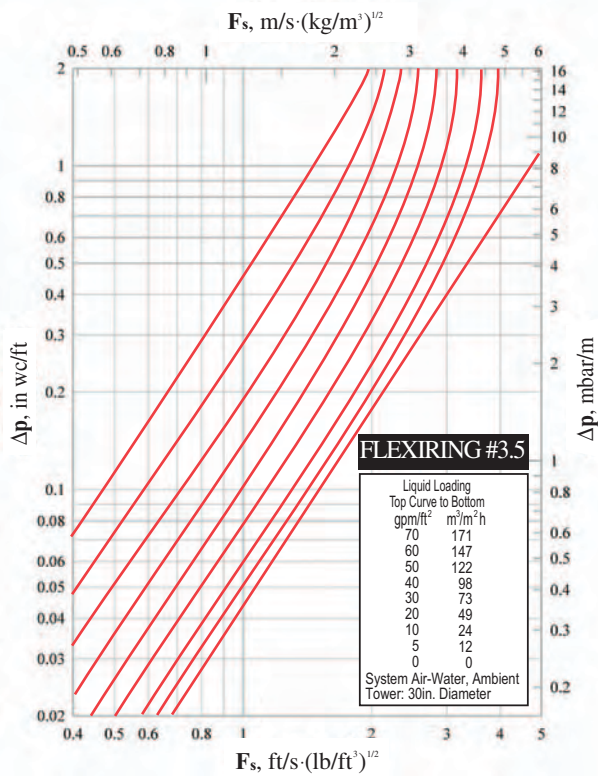
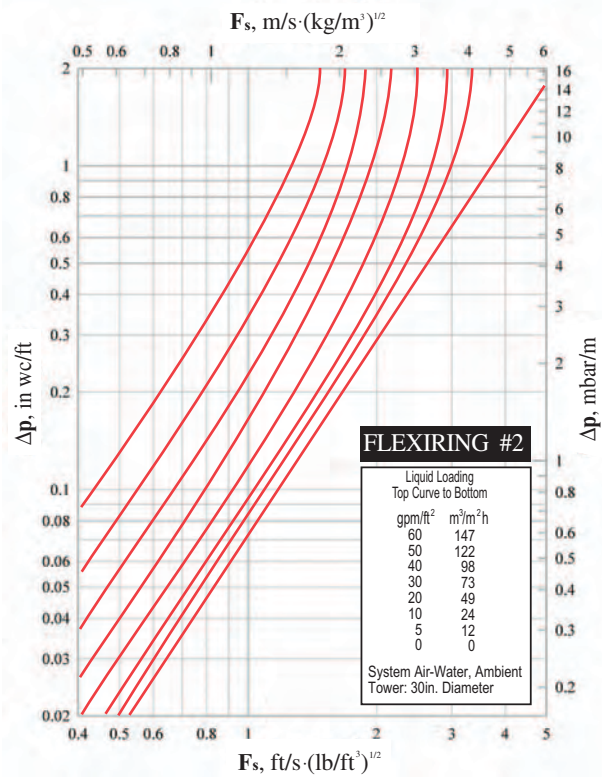
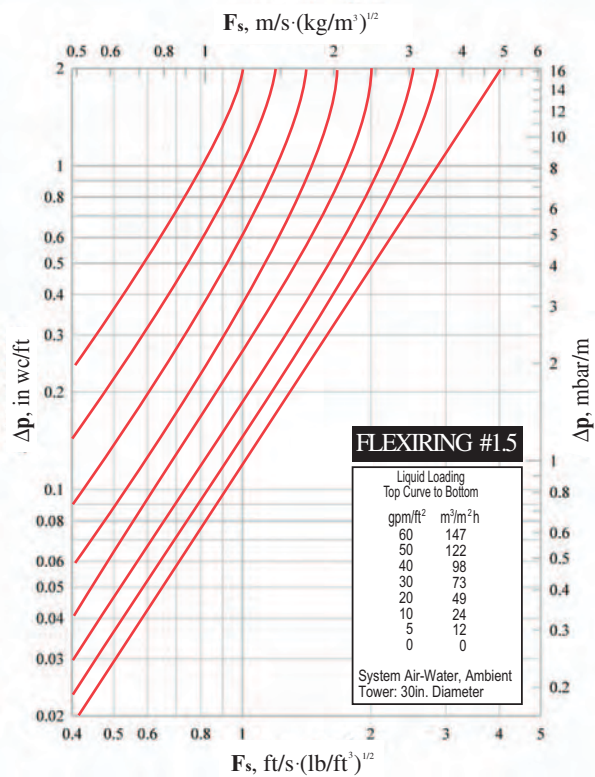
β-ETA RING® Random Packing



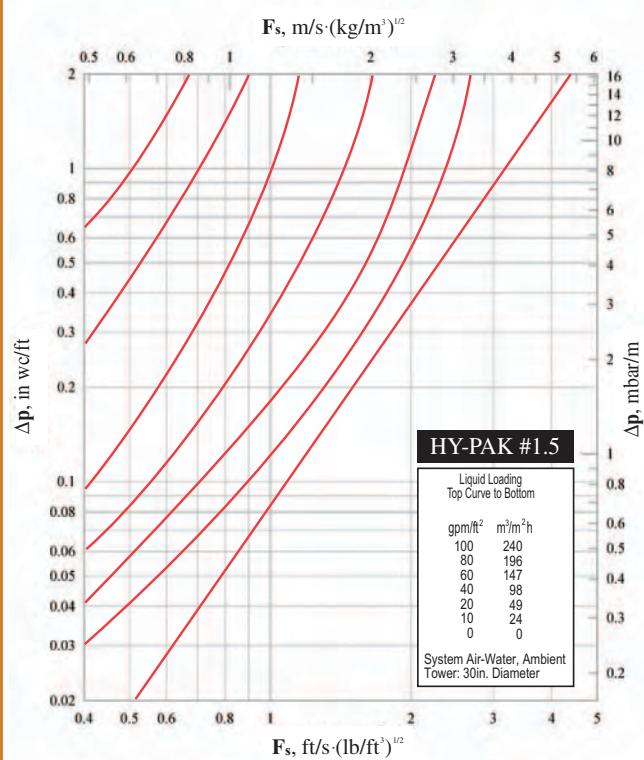
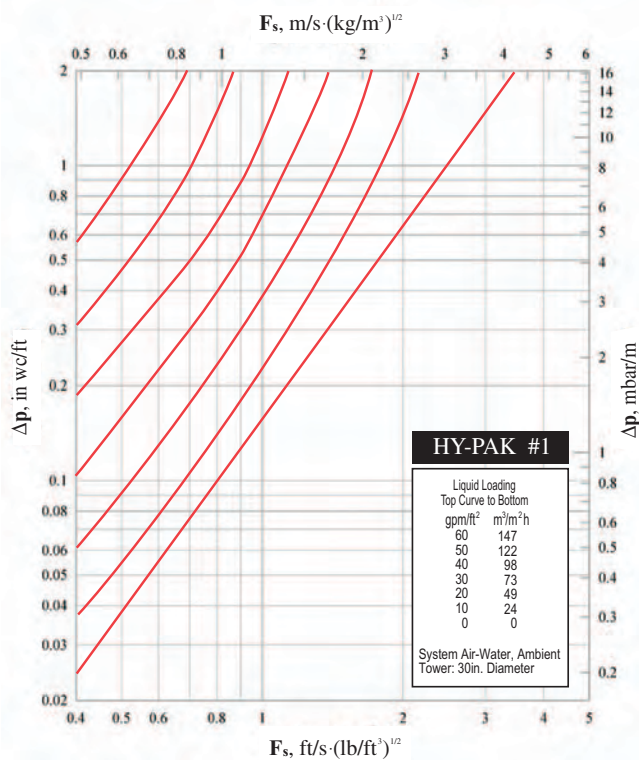
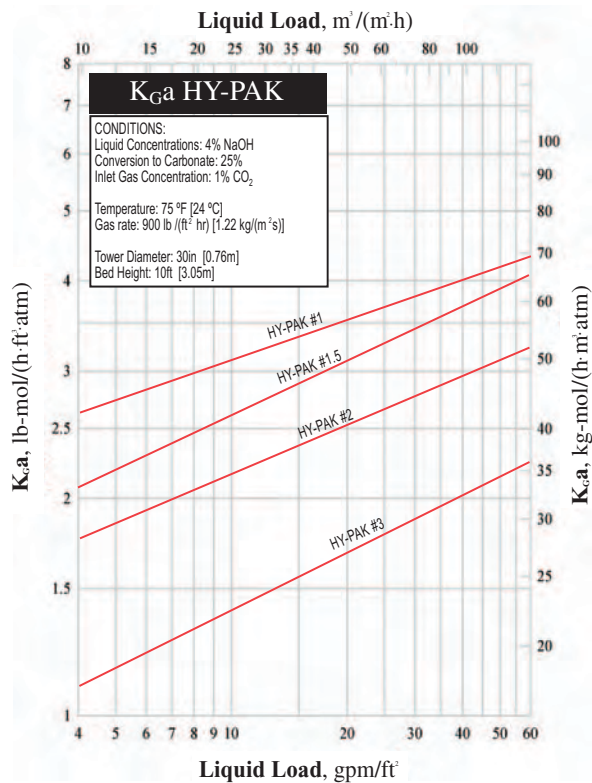
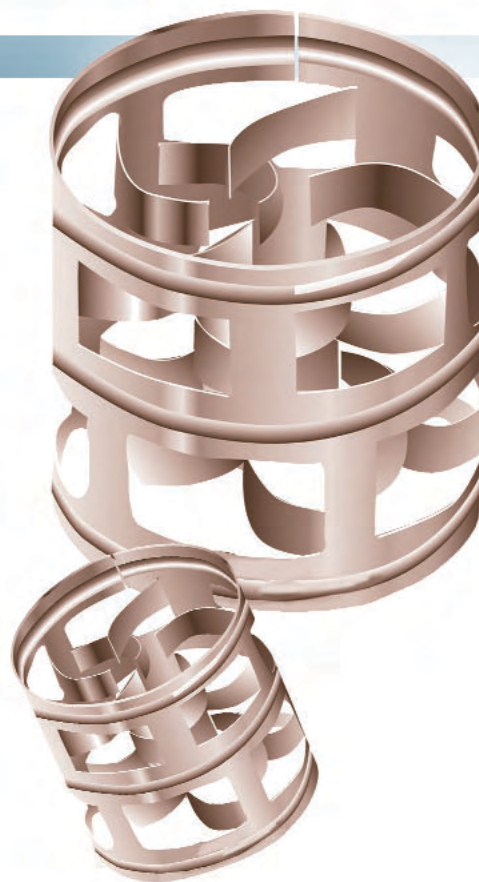
β-ETA Ring® Packing Size Nominal Size		1	2	2.5	3
	mm	19	25	38	50
	inch	¾	1	1½	2
Void Fraction	%	97	97	98	98
Bulk weight**	kg/m³	297	219	162	148
	lb/ft³	18.6	13.7	10.1	9.2

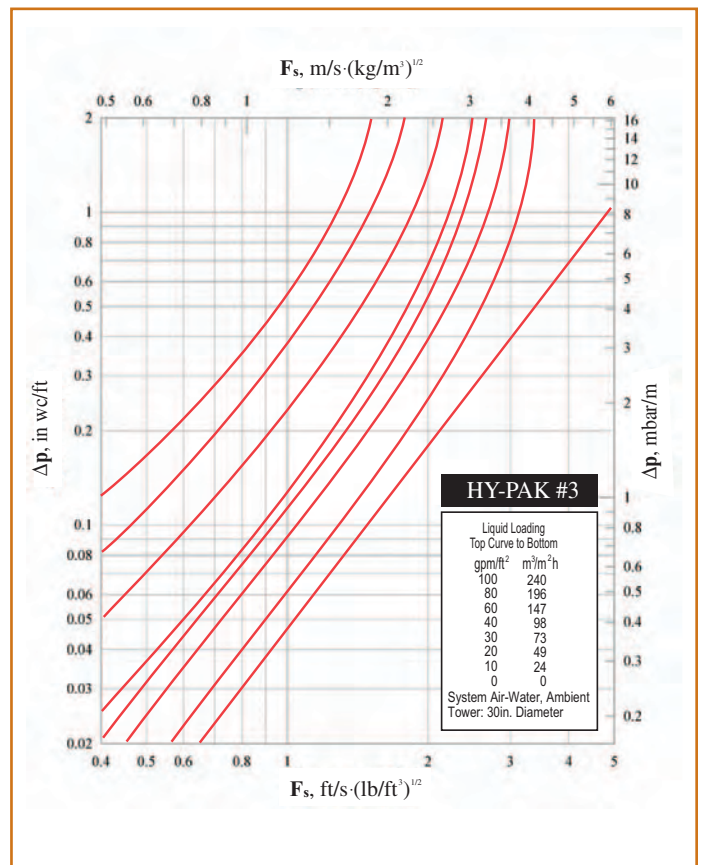
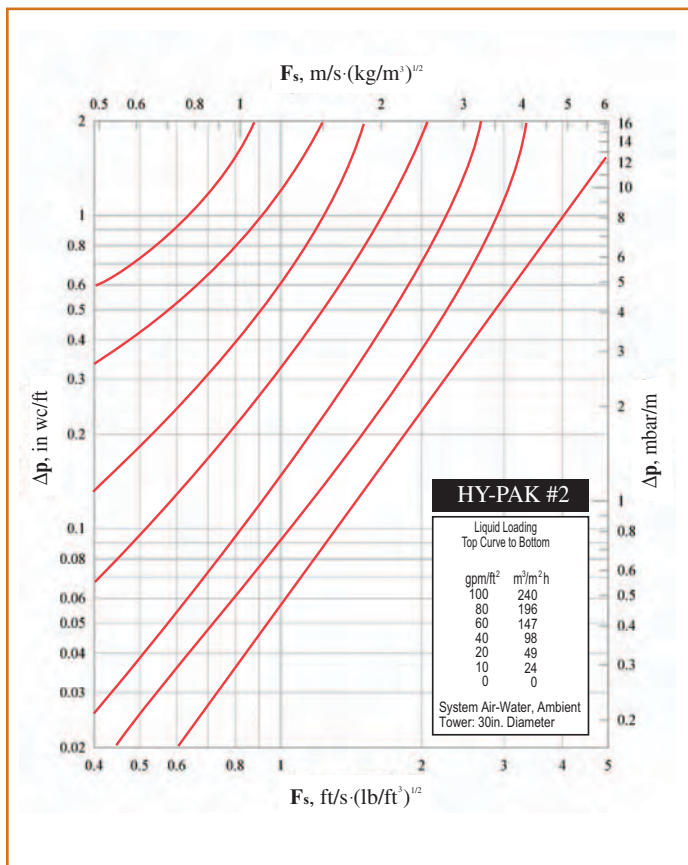
FLEXIRING® Random Packing



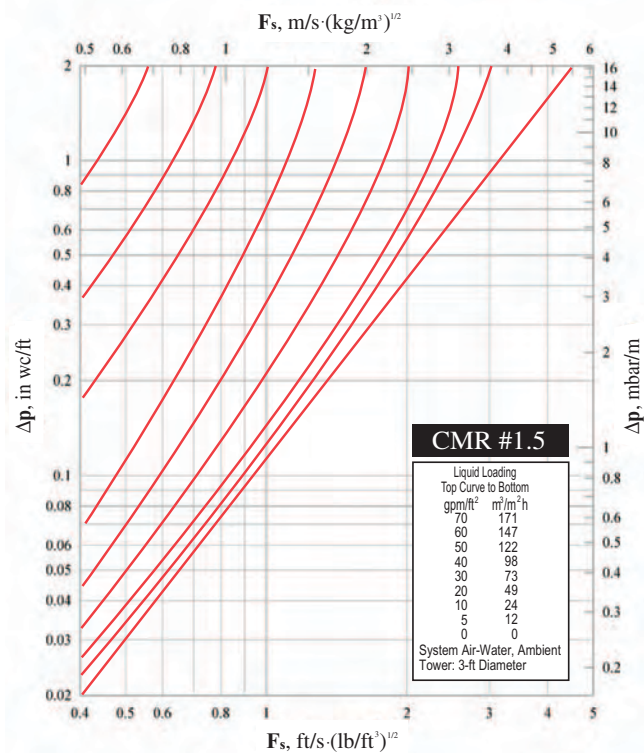
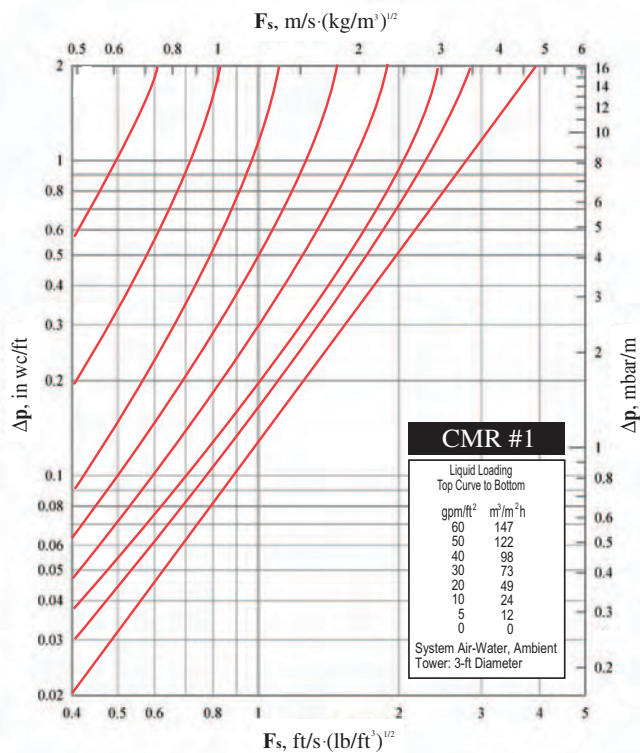
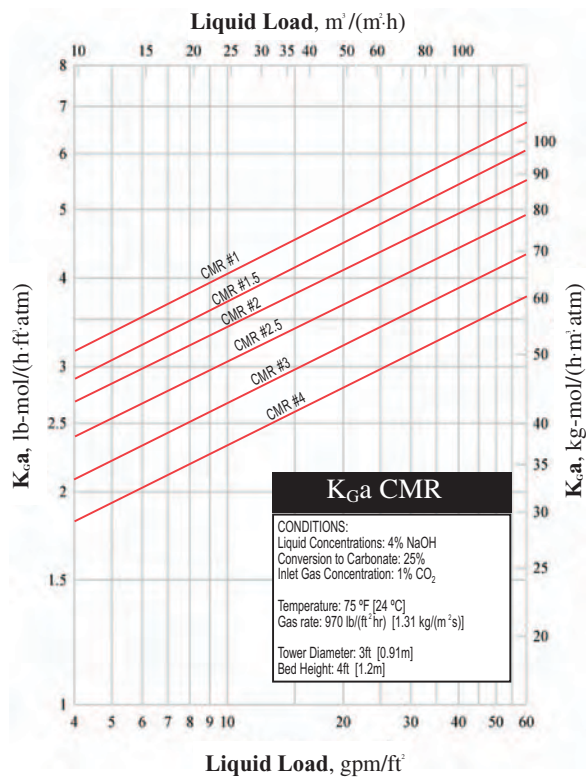


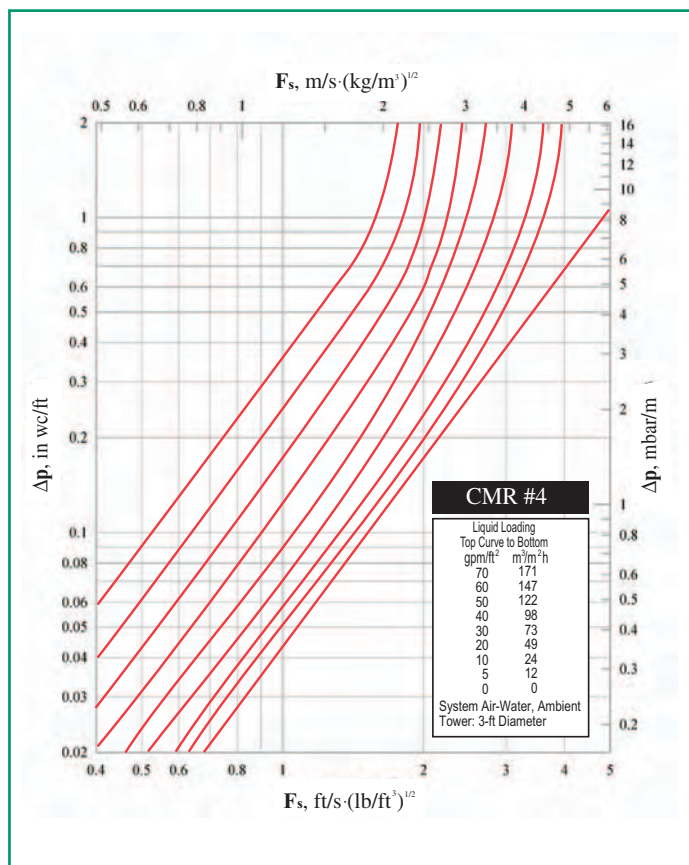
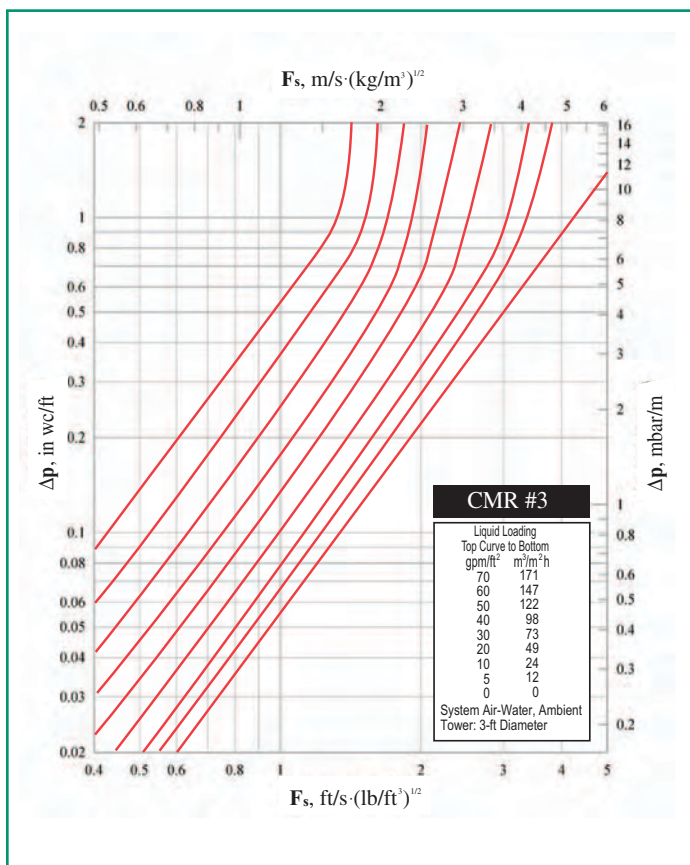
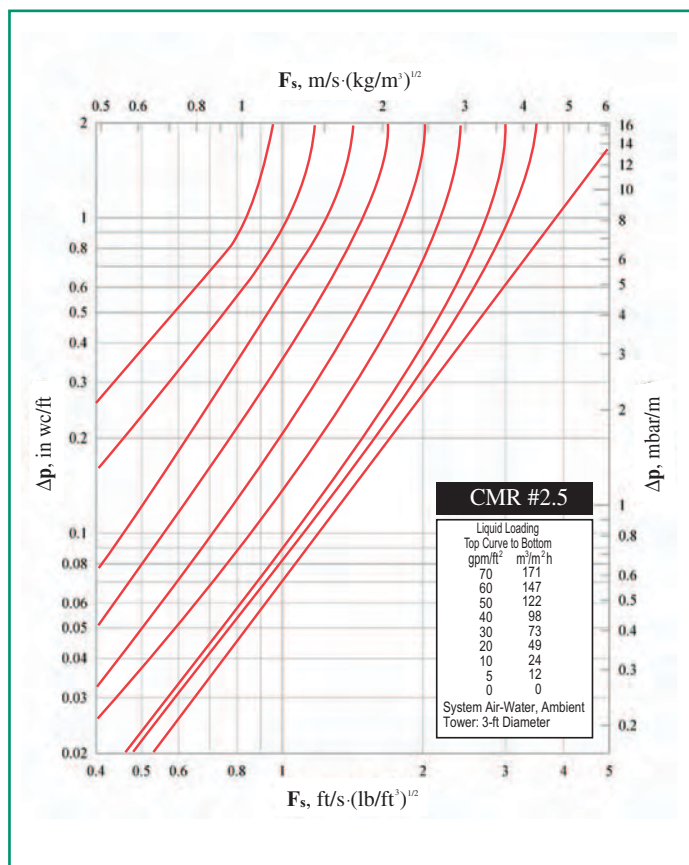
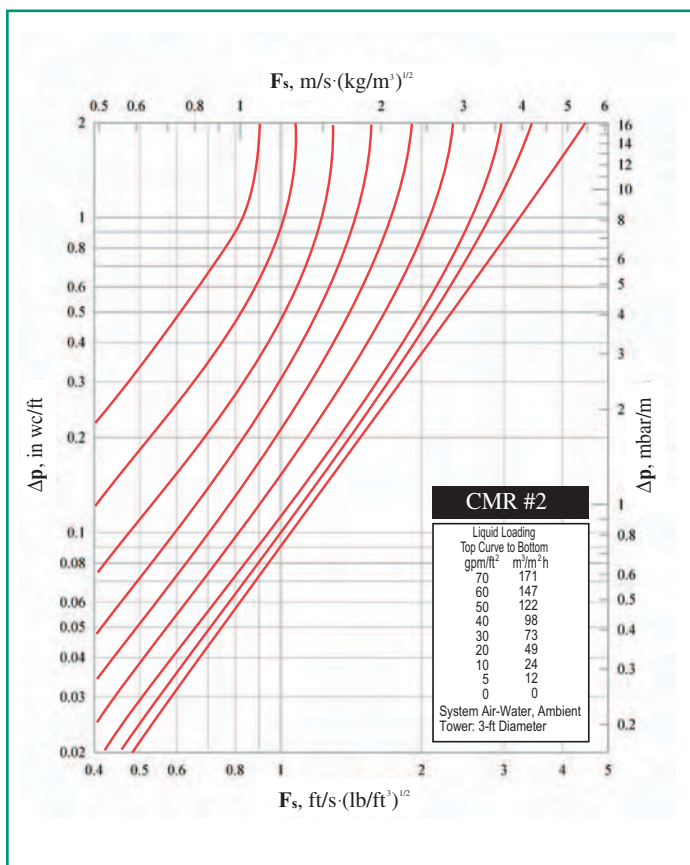
HY-PAK® Random Packing



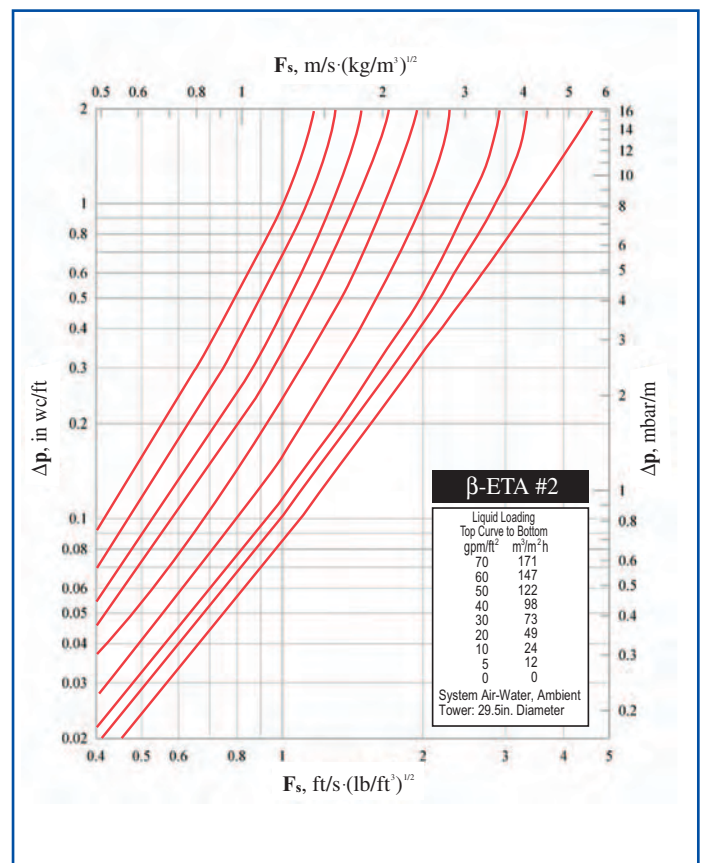
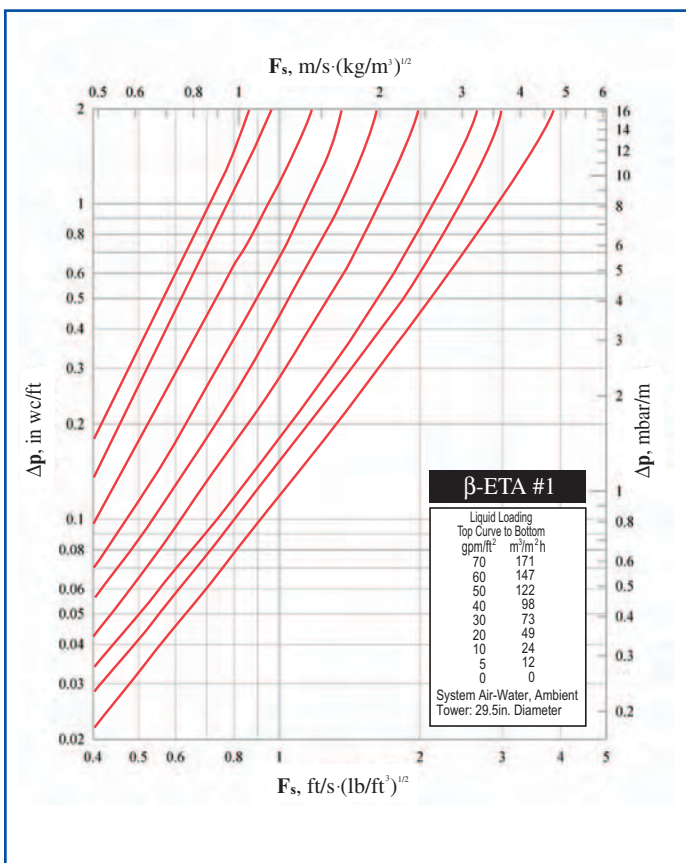
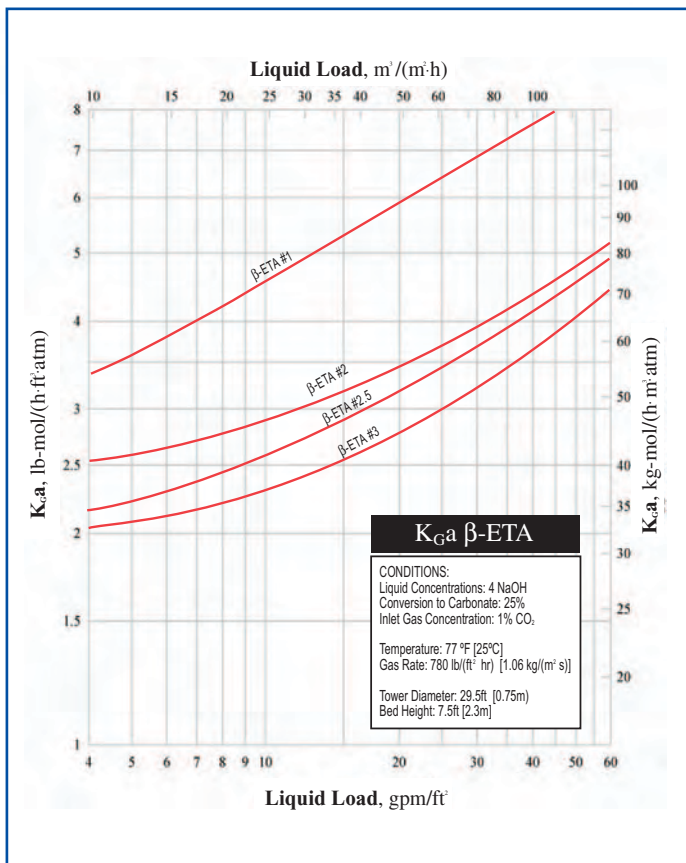
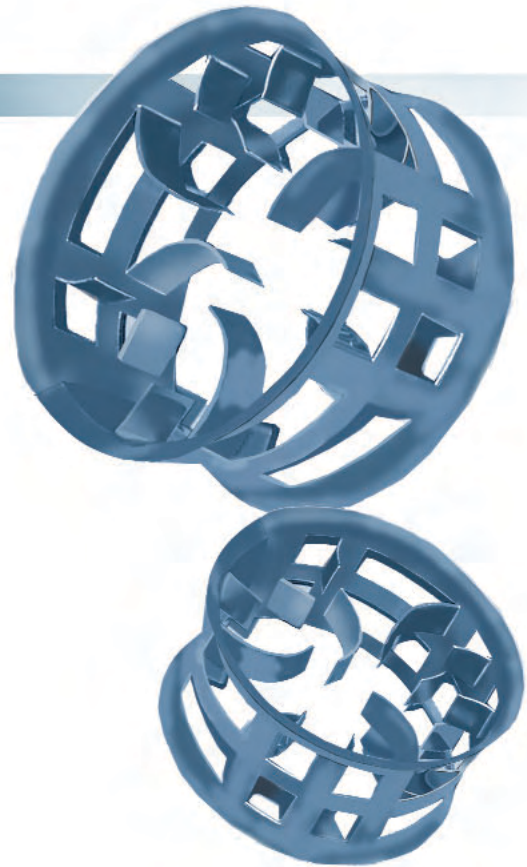


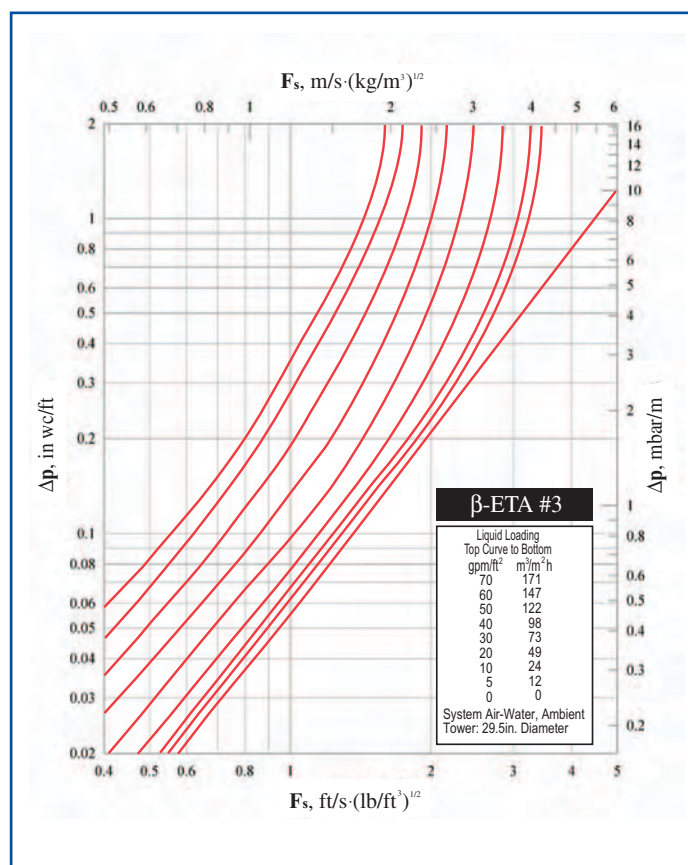
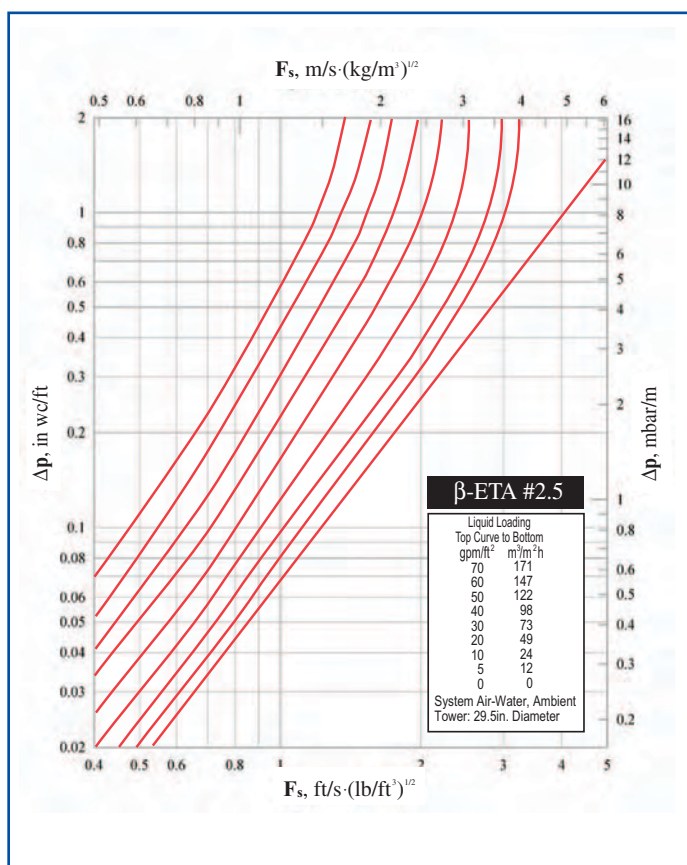
CASCADE MINI-RINGS® Random Packing





β -ETA RING® Random Packing





Reasonable minimum wetting rates

Operating limits for a column are set by the wetting rate (lower limit) and flooding (upper limit). With CMR and β -ETA RING high performance random packings, distillation towers operate successfully in the range of 20-90% of flood. Minimum wetting rates for aqueous systems are shown below. Packing efficiency remains relatively constant over 80% of the operating range.

Surface	gpm/ft^2	$\text{m}^3/\text{m}^2\text{h}$
Carbon steel or copper	0.3	0.7
Etched stainless steel	0.4	1.0
Stainless steel, tantalum, other alloys	1.2	3.0

The above values are based on a packing with a specific surface area $>43 \text{ ft}^2/\text{ft}^3$ [$140 \text{ m}^2/\text{m}^3$]. When operating below these value - as in vacuum distillation - new packings should be chosen which have better wetting characteristics. If materials with poorer wetting properties must be specified, the bed height may have to be increased and/or a more efficient packing should be utilized. As an alternative, structured packing may also be considered. For more information on Koch-Glitsch structured packing, please request brochure KGMSP-I. The minimum liquid rate also depends on liquid distributor type and design. Please refer to the internals brochure KGMTIG-I.

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, +44-1782-744561, or your local Koch-Glitsch office.

Asia Pacific: Contact your local Koch-Glitsch office.

Trademarks

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Patents

BETA RING, FLEXIRING, and IMTP technologies are protected by various patents worldwide.

NOTE: The information contained in this bulletin is believed to be accurate and reliable, but is not to be construed as implying any warranty or guarantee of performance.

