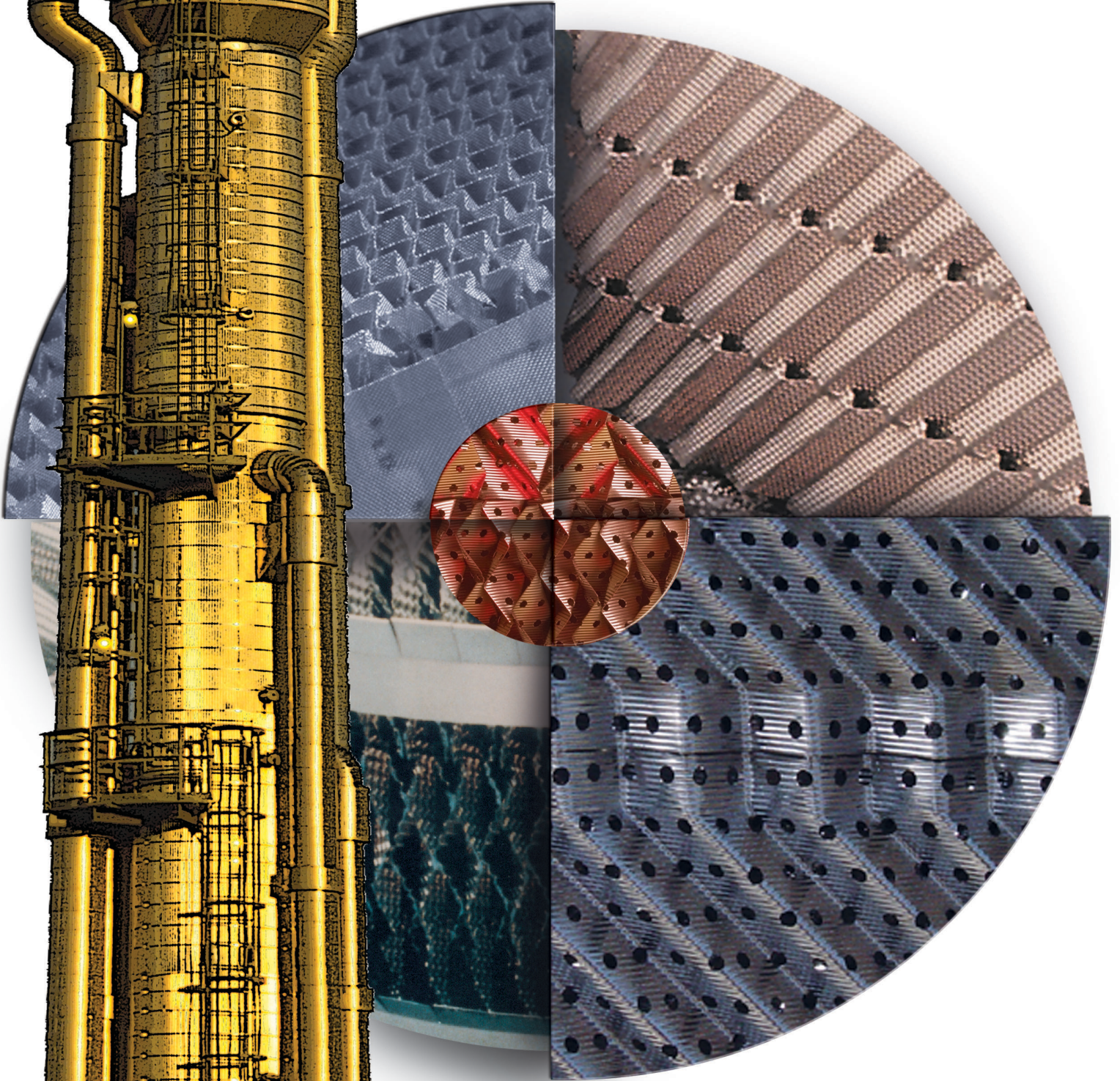
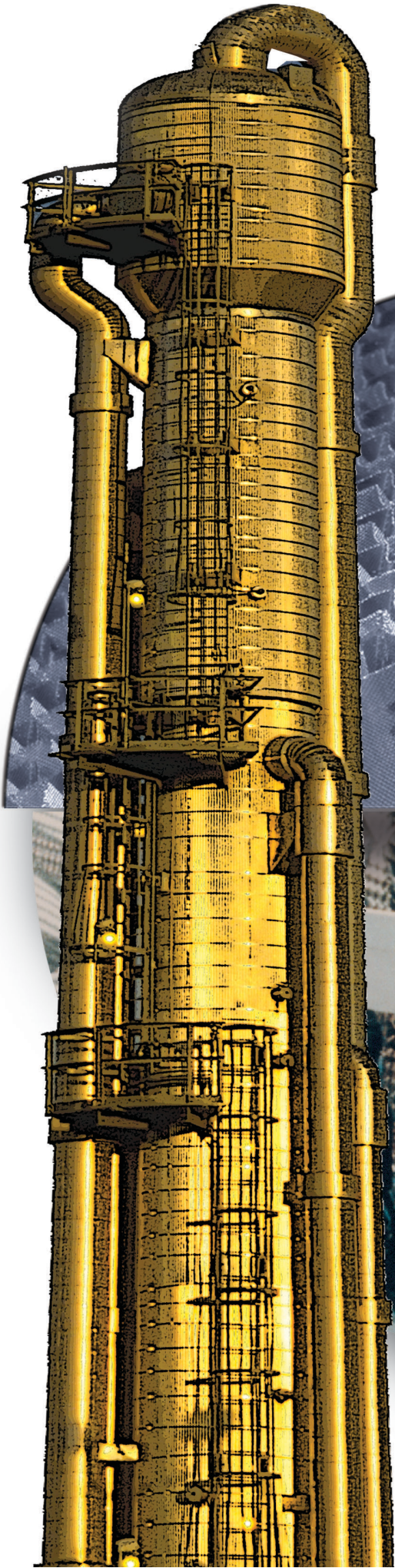


IntaloxTM

PACKED TOWER SYSTEMS

Structured Packing



KOCH-GLITSCH[®]

Introduction

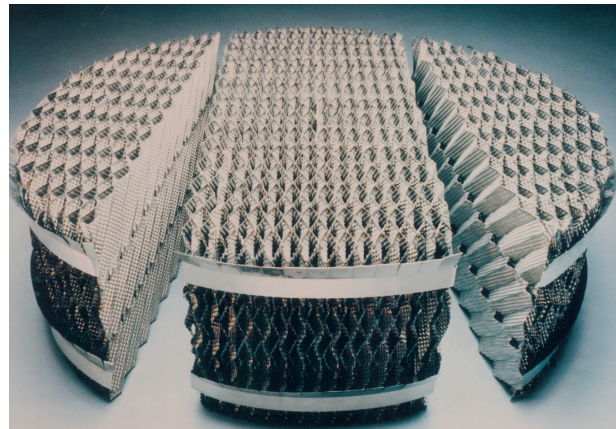
Commercialized in the 1970's, structured packings of corrugated sheet metal were developed and introduced to the market by Koch-Glitsch. **FLEXIPAC**® Structured Packing has been the industry standard since that time.

INTALOX® Structured Packing, introduced in 1986, demonstrated an increased capacity over other available structured packings. The most recent development, **FLEXIPAC**® **HC**® Structured Packing, was introduced in 1997. In addition to its high capacity, FLEXIPAC HC packing offers a lower pressure drop when operating near its maximum capacity. Each type of structured packing has a specific surface texture that contributes to its performance characteristics.

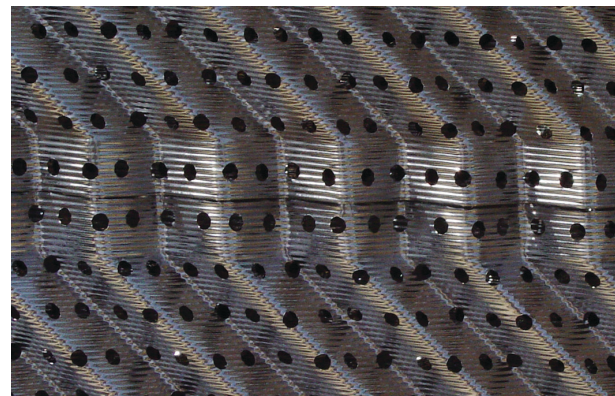


Stack of six layers of **FLEXIPAC**® Structured Packing

Structured packings are made out of corrugated sheets arranged in a crisscrossing relationship to create flow channels for the vapor phase. The intersections of the corrugated sheets create mixing points for the liquid and vapor phases. Wall wipers are utilized to prevent liquid and/or vapor bypassing along the column wall. Rotating each structured packing layer about the column axis provides cross mixing and spreading of the vapor and liquid streams in all directions. All types of Koch-Glitsch structured packings are available in a variety of corrugation sizes, providing the versatility to optimize the packing configuration to best meet the efficiency, capacity and pressure drop requirements for any particular application.



INTALOX® Structured Packing



FLEXIPAC® **HC**® Structured Packing

Koch-Glitsch structured packings offer excellent capacity and low pressure drop per theoretical stage. In order to best predict the benefits that can be realized with structured packing, it is recommended to use a rating software that has been developed based on extensive test data specific to each packing. **KG-TOWER**™ Software is available for download from the Koch-Glitsch website: www.koch-glitsch.com to aid in the hydraulic rating of Koch-Glitsch structured packings.

Materials of Construction

Koch-Glitsch structured packings are available in a variety of materials of construction including:

- Carbon steel (Koch-Glitsch does not recommend the use of carbon steel structured packing)
- Stainless steel alloys
- Aluminum
- Titanium
- Nickel alloys
- Copper alloys
- Zirconium

FLEXIPAC structured packing is also available in a variety of thermoplastic materials. For more information, please ask for brochure KGPP-1.

FLEXIPAC® Structured Packing

As the industry standard, FLEXIPAC structured packing has been used in thousands of columns worldwide. FLEXIPAC packing provides a lower pressure drop per theoretical stage and increased capacity compared to trays and conventional random packings. Columns packed with FLEXIPAC packing have resulted in:

- Improved product yields
- Improved product purities
- Reduced reflux ratios
- Increased throughput
- Lower pressure drop
- Reduced liquid holdup
- Increased heat transfer

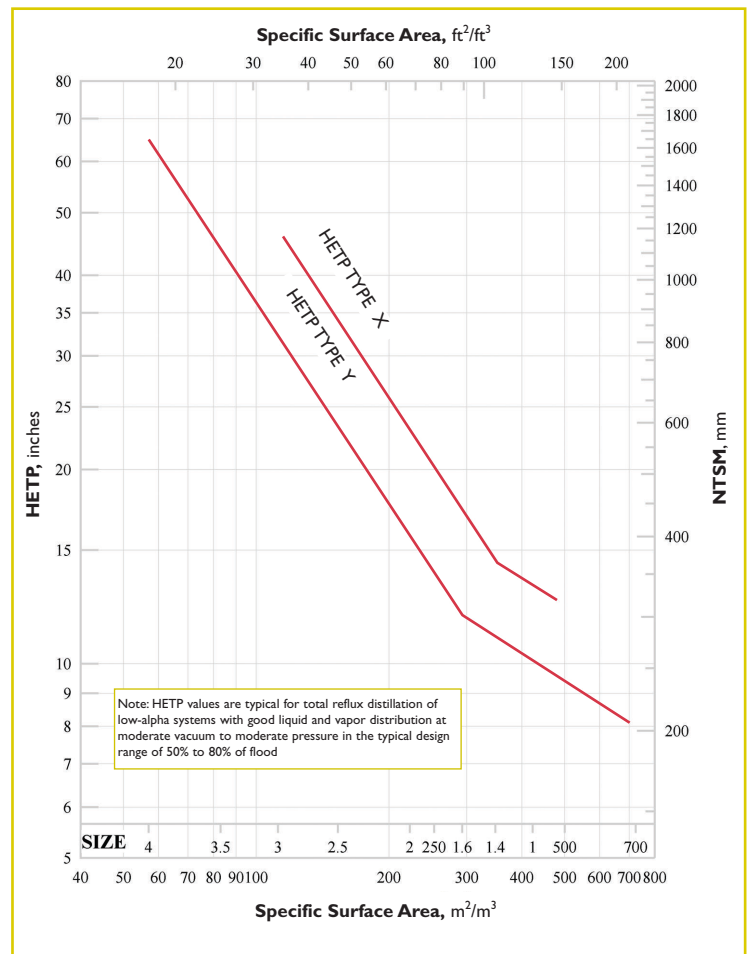
FLEXIPAC structured packing is available in a variety of corrugation crimp sizes, each at two inclination angles. The "Y" designated packings have a nominal inclination angle of 45° from the horizontal, and are the most widely used. The "X" packings have a nominal inclination angle of 60° from horizontal and are used where high capacity and low pressure drop are the overwhelming requirements for a specific application. The benefit of the "X" packings is that they provide a lower pressure drop per theoretical stage for the same surface area.



FLEXIPAC® Structured Packing with perforated and textured surface shown with attached wall wiper band

The plot below provides approximate efficiency information for FLEXIPAC structured packing as typically seen in distillation service of hydrocarbons operating under atmospheric to moderate vacuum conditions. From years of applications experience, Koch-Glitsch has an extensive collection of efficiency information for a wide variety of processes and operating conditions. Consult Koch-Glitsch for further information.

FLEXIPAC® Structured Packing Approximate Efficiency in Atmospheric Distillation.



← Increasing Capacity

→ Increasing Efficiency

FLEXIPAC® Structured Packing Surface Area													
	ft ² /ft ³	17	25	34	47	68	77	90	106	129	152	220	
	m ² /m ³	55	80	110	155	225	250	295	350	420	500	725	
Inclination Angle	45°	4Y	3.5Y	3Y	2.5Y	2Y	250Y	1.6Y	1.4Y/350Y	1Y	500Y	700Y	
	60°	4X	3.5X	3X	2.5X	2X	250X	1.6X	1.4X/350X	1X	500X	700X	

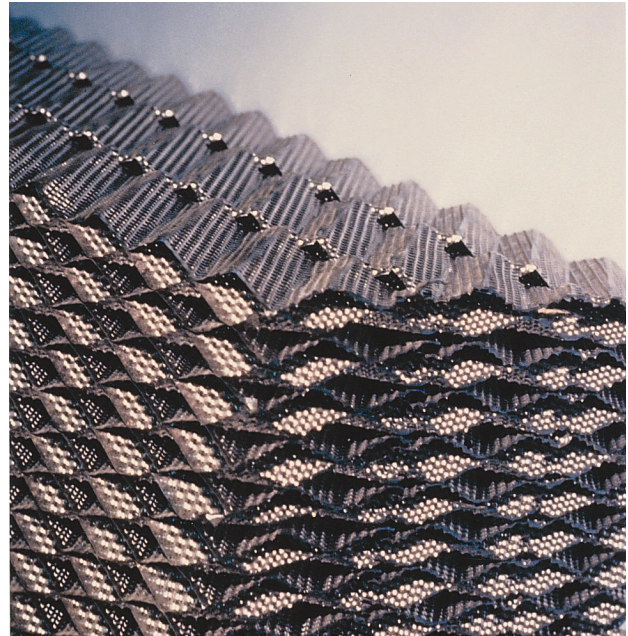
INTALOX® High Capacity Structured Packing

Introduced in 1986, INTALOX structured packing was shown to have greater "efficient capacity" than other structured packings. A patented, aggressively textured surface, combined with patented corrugation reversals in each packing layer, along with other subtle proprietary geometric features, give INTALOX structured packing a higher capacity.

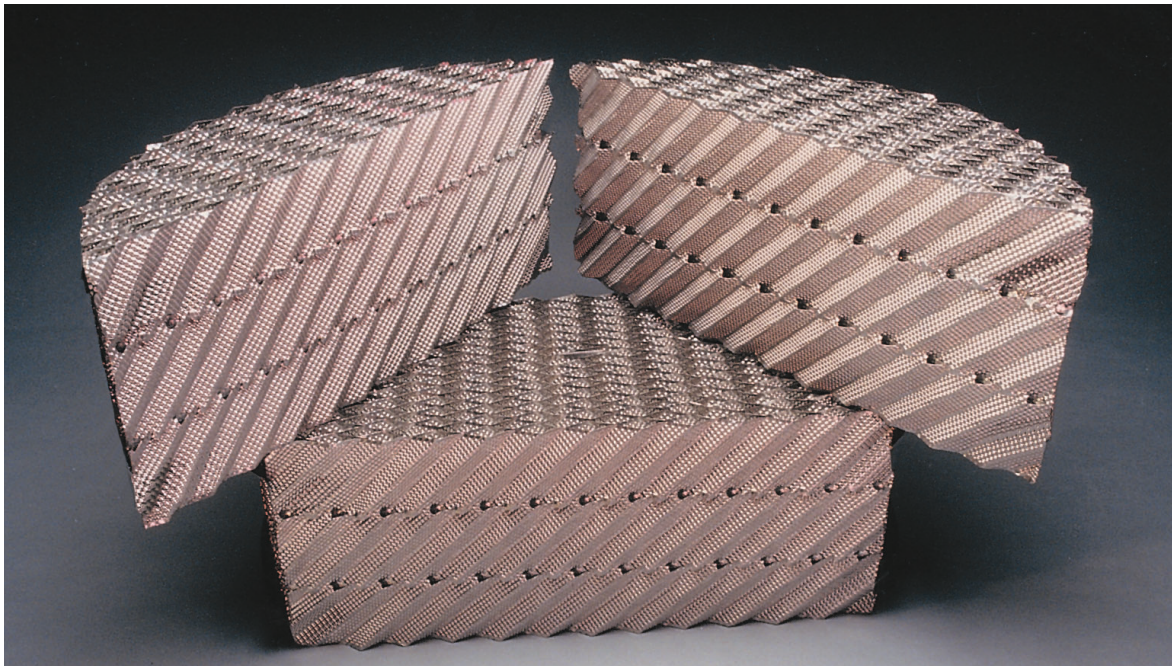
Combining excellent performance characteristics with a unique "efficient capacity" rating correlation, INTALOX structured packing has been successfully utilized in a variety of high liquid rate, high pressure systems besides the usual applications in vacuum and atmospheric processes normally reserved for structured packing. The aggressive surface texture of INTALOX structured packing provides excellent surface wetting, making this the preferred packing in aqueous distillation applications.

The advantages of INTALOX structured packing are particularly noticeable in the larger corrugation crimp sizes. Here, the physical uniqueness of the INTALOX packing provides superior efficiency compared to other structured packings of similar surface area, while maintaining excellent capacity and pressure drop characteristics.

Please refer to page 5 for recommended application guidelines and efficiency values.



INTALOX® Structured Packing – corrugation reversals and surface texture



INTALOX® Structured Packing

INTALOX® Structured Packing		5T	4T	3T	2T	1.5T	1T
Surface Area	ft ² /ft ³	27	41	52	65	77	95
	m ² /m ³	90	135	170	215	250	310

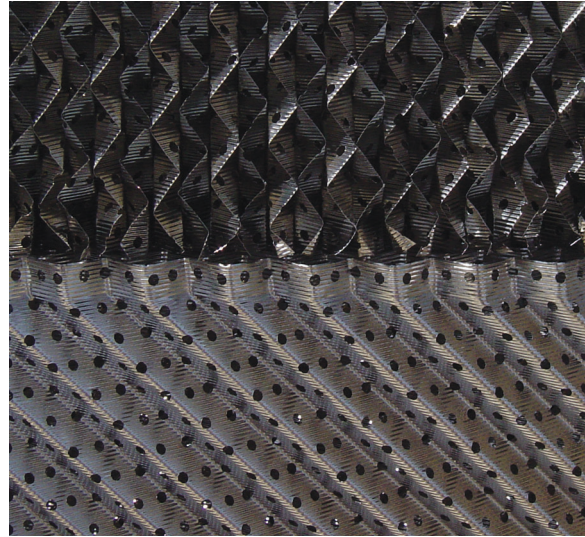
FLEXIPAC® HC® High Capacity Structured Packing

Since its introduction in 1997, FLEXIPAC HC structured packing has been used in hundreds of columns to increase capacity and reduce pressure drop both in new construction and for replacing standard sheet metal structured packings, conventional random packings and trays. Combining excellent capacity and efficiency characteristics along with a lower pressure drop per theoretical stage, it is the preferred packing for use in vacuum distillation applications.

FLEXIPAC HC is similar in construction to standard FLEXIPAC packing, except for a subtle modification in the geometry of the corrugation at the top and bottom of each packing layer. This relatively small change in geometry eliminates the abrupt change in flow direction of the liquid and vapor phases at the packing layer interface.

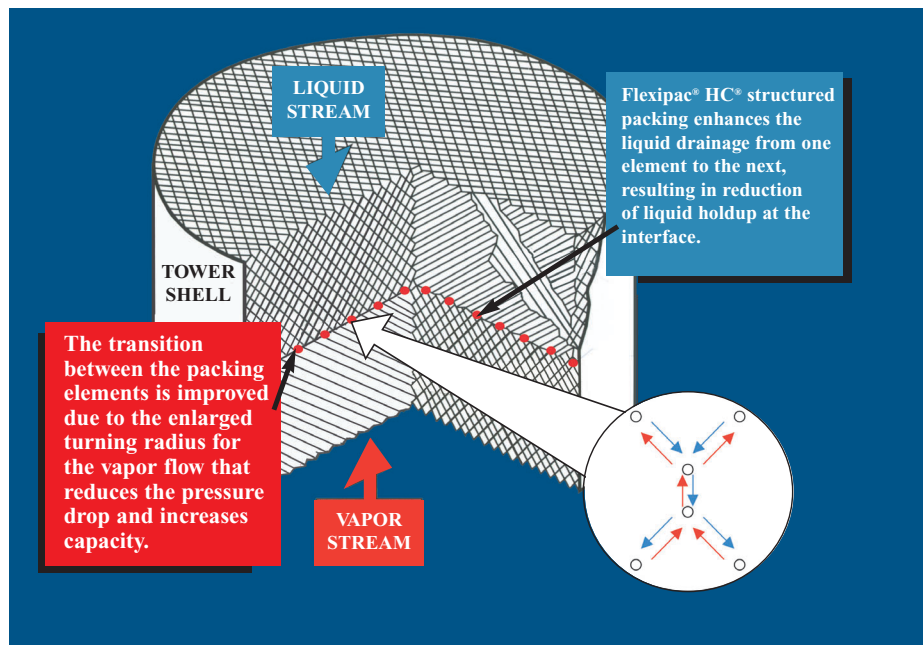
Conventional structured packing capacity is limited by flow interaction at the layer interface where the abrupt directional change limits the amount of counter-flowing liquid and vapor. As the liquid flow becomes restricted by the upward-flowing vapor, the liquid begins to build up at the layer interface which increases the pressure drop and may ultimately lead to flooding. The geometry of FLEXIPAC HC packing relieves this restriction. Since the premature build-up of liquid is eliminated, the low pressure drop characteristics of structured packing are better maintained throughout the efficient operating

range of the packing. The advantages of FLEXIPAC HC packing are particularly strong for smaller corrugation crimp size, higher surface area packings.



FLEXIPAC® HC® Structured Packing with a perforated and textured surface showing corrugation configuration at layer interface

Please refer to page 5 for recommended application guidelines and efficiency values.



FLEXIPAC® HC® Structured Packing	2Y	250Y	1.6Y	1.4Y/350Y	1Y	500Y	700
Surface Area	ft ² /ft ³	68	77	90	106	129	220
	m ² /m ³	225	250	295	350	420	725

Choice and Application of Koch-Glitsch High Capacity Structured Packings

Each type of Koch-Glitsch structured packing has strong performance characteristics. Under certain conditions or in specific applications, each has a particular strength which may make one style more desirable. Considerations in choosing a specific structured packing type are:

- To meet specific process requirements
- As a direct replacement of an existing packing
- Familiarity with the packing type and its performance
- Past experience of using a specific packing type in a particular application
- Specified for use in a licensed process

With more than thirty years of history, FLEXIPAC structured packing continues to be a strong performer in applications where the incremental capacity increase of high performance structured packing is not required.

When choosing a high capacity structured packing, FLEXIPAC HC and INTALOX structured packings each offer distinct advantages, depending upon the application. Through its wetting and liquid handling characteristics, the patented, aggressive surface texture of the INTALOX structured packing offers extremely efficient use of the available packing surface. For the larger corrugation size packings, INTALOX structured packing provides a better efficiency than other structured packings with similar surface area.

FLEXIPAC HC structured packing uses a less aggressive, perforated and textured surface style to provide excellent surface area utilization. This surface, along with the smooth channel transition at the layer interface, provides a less restricted flow channel and results in lower pressure drop as the packing reaches the loading region. This is particularly true for the smaller corrugation packing sizes. The table below provides guidance in choosing the recommended high capacity packing.

	← Increasing Capacity				Increasing Efficiency →						
INTALOX® Structured Packing	5T	4T	3T	2T	1.5T		1T				
FLEXIPAC® HC® Structured Packing				2Y	250Y	1.6Y	1.4Y	1Y	500Y	700Y	
Approximate HETP*											
inches	30	24	18	16	14	12.5	11	10	9	7.5	
mm	762	610	457	406	356	318	279	254	229	191	

* HETP values are typical for total reflux distillation of low-alpha systems with good liquid and vapor distribution at moderate vacuum to moderate pressure in the typical design range of 50% to 80% of flood

All Applications
Aqueous Service, High Pressure or High Liquid Rate
Low Pressure Drop Requirement

Special Purpose Structured Packings

INTALOX® Structured Packing 5TX

As the only high capacity, high efficiency packing available in the "X" (60°) corrugation configuration, INTALOX structured packing 5TX offers grid type packing capacity with good efficiency. INTALOX 5TX structured packing should be considered whenever fractionation or excellent heat transfer is required at the absolute maximum throughput.

FLEXIPAC® S, FLEXIGRID® and GLITSCH-GRID® Structured Packings

FLEXIPAC® S packing is similar in construction to FLEXIPAC packing but has a smooth surface and can be manufactured using thicker material. The smooth surface enables the packing to be used in moderately fouling systems while the thicker material gauge gives it greater mechanical strength and provides increased corrosion resistance. FLEXIPAC S packing is available in various sizes and in both the X (45°) and Y (60°)

corrugation configurations. Applications include top pumparound zones of Refinery Fractionators as well as Ethylene Water Quench Columns.

FLEXIGRID® and GLITSCH-GRID® structured packings are the packings of choice for applications in severe services subject to fouling, coking, erosion and high solids content, while providing a robust mechanical structure to resist damage during upsets. FLEXIGRID and GLITSCH-GRID structured packings are available in a wide variety of materials. Applications for these packings include Crude Atmospheric and Crude Vacuum Towers, FCC Main Fractionators, Coker Fractionators as well as Ethylene Plant Oil and Water Quench Columns. For further information on FLEXIGRID, GLITSCH-GRID and FLEXIPAC S packings for use in severe service, please ask for brochure KGSS-1.

Wire Gauze Structured Packing

Koch-Glitsch wire gauze packing is the recognized leader in distillation service for deep vacuum and low liquid rate applications. For processing specialty chemicals, pharmaceuticals and temperature sensitive materials, the very high efficiency and low pressure drop characteristics of this packing are unsurpassed. Used in thousands of diverse applications around the world, BX wire gauze structured packing is the most widely used. For even greater efficiency requirements, CY wire gauze structured packing is also available. DX and EX wire gauze structured packings are available for laboratory and pilot testing applications.



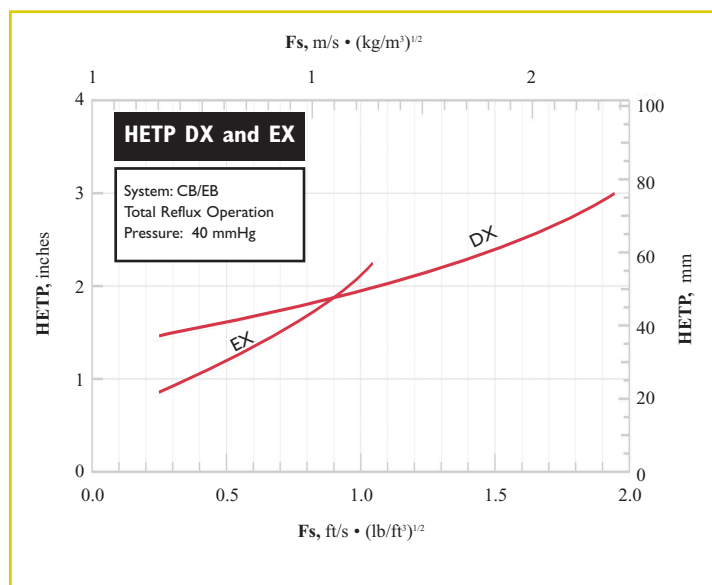
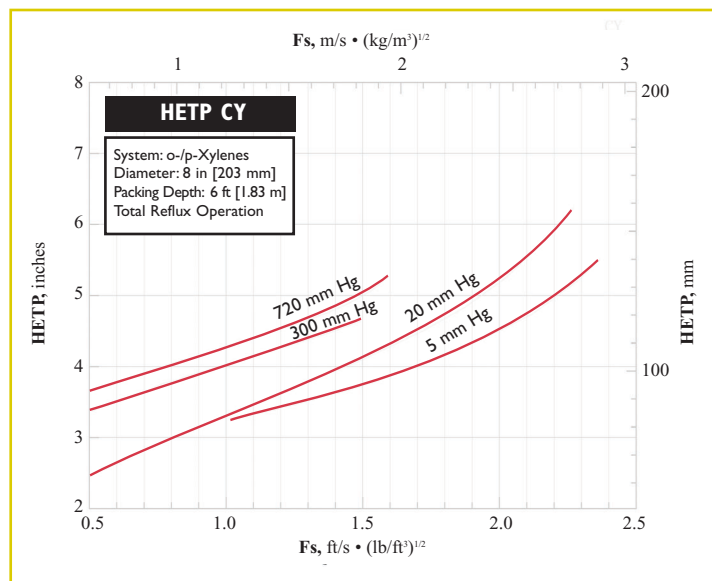
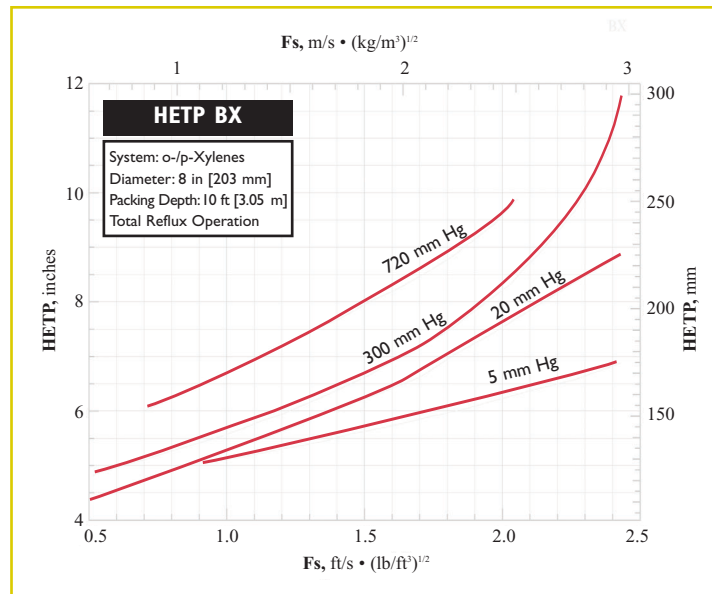
Koch-Glitsch Wire Gauze Packing with attached wall wiper bands

Wire gauze structured packing is generally used in medium to small diameter columns for separations where the requirement is to achieve the maximum number of theoretical stages in the minimum column height. Because of the capillary effect, the wire gauze material provides an extremely wettable surface, resulting in excellent mass transfer efficiency, particularly at very low liquid rates.

Random Packings and Tower Internals

Koch-Glitsch is the world leader in the supply of mass transfer equipment, offering a wide range of random packings in metal and plastic including **IMTP**[®], **CASCADE MINI-RINGS**[®], β -**ETA RING**[®] and **SNOWFLAKE**[®] High Performance Random Packings. Please ask for brochures KGIMTP-I, KGRP-I, and KGPP-I.

Koch-Glitsch offers a wide range of INTALOX High Performance Distributors as well as traditional tower internals to ensure optimal and predictable tower performance. Internals are available in various metals and plastic materials. Please ask for brochures KGMTIG-I and KGPTIG-I.



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www.koch-glitsch.com

For emergencies:
1-888-KOCH-911

INTALOX®, FLEXIPAC®, FLEXIPAC® HC®, GLITSCH GRID®, FLEXIGRID®, IMTP®,
CASCADE MINI-RINGS®, β-ETA RING® and SNOWFLAKE® are registered trademarks
of Koch-Glitsch.

INTALOX® STRUCTURED PACKING: U.S. Patents No. 4,670,196 & 4,740,334

NOTES:

Available exclusively from Koch-Glitsch, LP, FLEXIPAC® HC® Structured Packing
is protected by US Patent 5,632,934 and other patents worldwide assigned to
Praxair Technology, Inc. Koch-Glitsch, LP is the exclusive worldwide licensee
of Praxair Technology, Inc. for the manufacture and sale of this packing in all
markets except for industrial gas separation.

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performance.

KOCH-GLITSCH

The Fundamental Driving Force

IN MASS TRANSFER TECHNOLOGY