



# **GOODLOE<sup>®</sup>**

*Tower Packing*



 **KOCH-OTTO YORK<sup>®</sup>**  
**SEPARATIONS TECHNOLOGY**

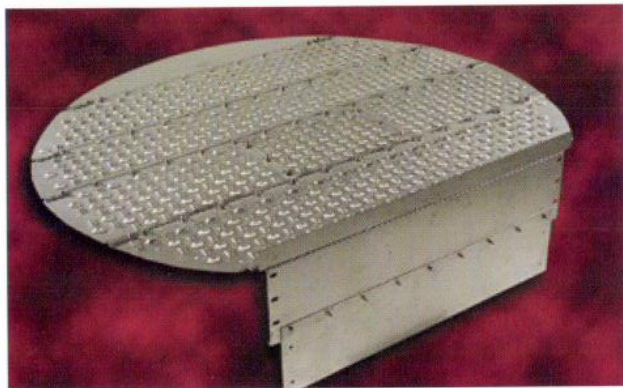
*A Koch-Glitsch business group*

**OTTO YORK<sup>™</sup>**



## Choice of Tower Internals

One of the most important steps in the design of any mass transfer operation, whether it be distillation, absorption or stripping, is the choice of what tower internals to use. The design engineer needs to decide whether the column will contain trays or packing, and if packing, whether it will be a random or a structured type of packing. The final selection is usually based on a combination of considerations such as process requirements, economics and past experience.



**Trays**



**Random  
Packing**



**Structured Packing**

When structured packing is the preferred selection, then the design engineer has the further decision on whether to use a sheet metal, wire gauze, or knitted wire type of structure. GOODLOE® tower packing falls into the latter knitted wire category of structured tower packing.



**The proprietary knitted wire design of GOODLOE® packings provides higher specific surface than any other kind of structured packing.**

## The GOODLOE® Tower Packing Niche

GOODLOE® tower packing fills a unique niche in the field of structured tower packings. The very high specific surface areas and controlled geometry which are achievable with its knitted wire structure result in very high efficiency with low pressure drop.

Some reasons to consider GOODLOE® packing are:

### *Difficult Separations*

- Its high efficiency makes it ideally suited when many theoretical stages are required.

### *Headroom Limitations*

- Its low height equivalent to theoretical plate (HETP) makes it ideally suited for installations where headroom is limited.

### *Heat Sensitive Materials*

- Its low pressure drop makes it ideally suited for distillation of heat sensitive materials such as fine chemicals, pharmaceutical compounds, flavors and fragrances.

### *Batch Distillations*

- Its wide operating range makes it ideally suited for multi purpose batch distillation systems.

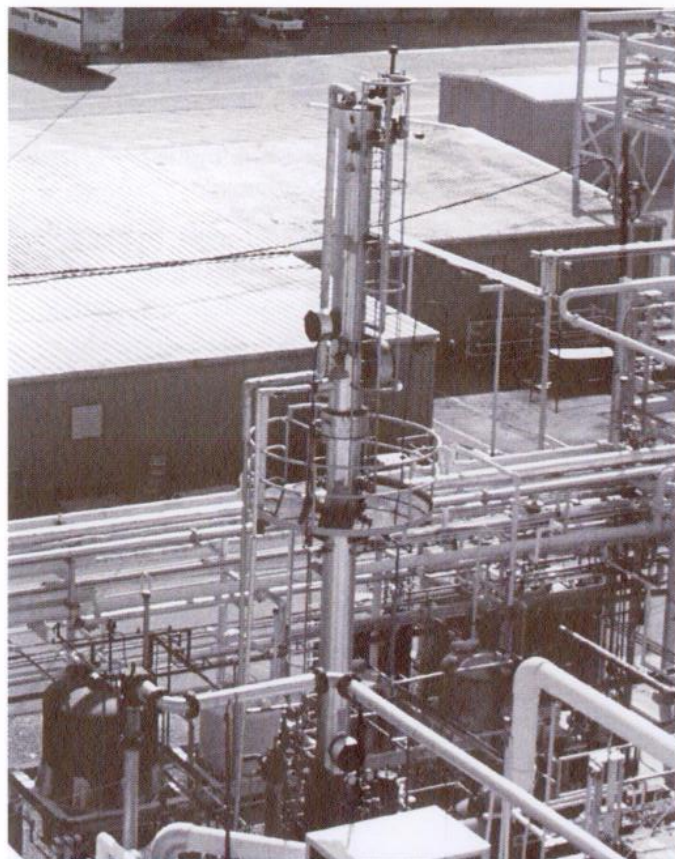
### *Corrosive Applications*

- Its availability in a wide range of materials of construction makes it ideally suited for corrosive environments.



## *Applications*

- Close boiling compounds
- Heat sensitive materials
- Flavor and fragrance compounds
- Pharmaceuticals and intermediates
- Limited headroom installations
- Multipurpose batch distillation systems
- Corrosive environments



**GOODLOE® packing has been used in more than 5,000 columns, ranging from 1" to more than 6' in diameter.**

## *Features*

- Proven technology
- High efficiency
- Low pressure drop
- Wide operating range
- Easy installation and retrofit
- Wide range of materials of construction

## *Benefits*

- Reduce column height requirement
- Increase column operating range
- Reduce column pressure drop
- Reduce column energy consumption
- Increase product purity
- Debottleneck existing installations



**The very high efficiency of GOODLOE® packing makes it ideally suited to the high purity requirements of pharmaceutical manufacturing.**



## Traditional GOODLOE® Tower Packing Sets the Standard

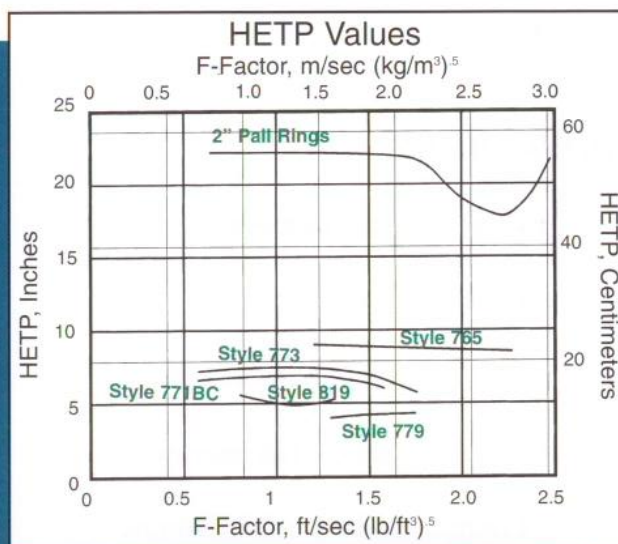
GOODLOE® packing has set the standard for high efficiency in structured packing since its introduction in 1957. Over the years Koch-Otto York has continued a comprehensive R&D program to increase the number of styles of this knit packing, providing the process engineer with a carefully engineered family of packings that offers numerous combinations of efficiency, capacity, pressure drop, turndown, liquid holdup, corrosion resistance and cost.



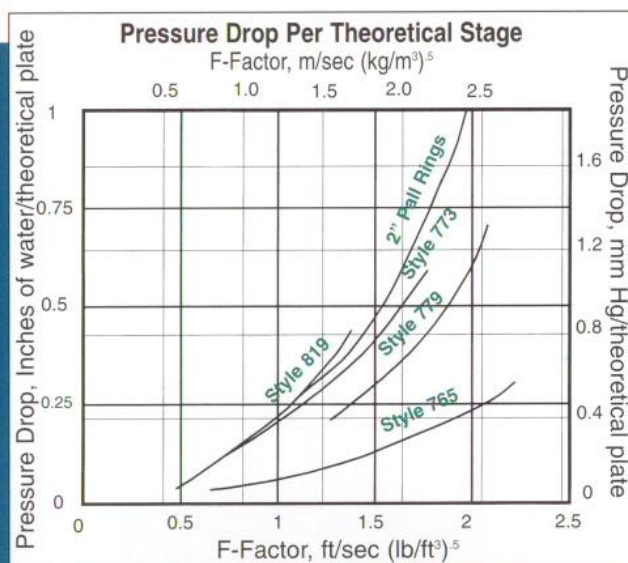
**The unique mesh structure of GOODLOE® packing provides very high efficiency and very low pressure drop.**

The packing is produced by knitting a multiplicity of fine metallic and/or non-metallic filaments into a sock form which is flattened, crimped, plied, and either spiral wound into cartridges (for columns up to a few feet in diameter) or layered in segments for manway installation in larger towers. The resilient properties of this construction assure firm contact with the wall so that channeling is eliminated. In addition, the inherent capillary action of the wire structure pulls liquid in three dimensions, causing redistribution of the liquid over the entire cross-section of the packed bed.

This unique structure permits GOODLOE® mesh packings to provide the highest efficiency available in tower packing today. The number of transfer units per meter (NTUM) can be as high as 13.1 in production columns (equivalent to an HETP of 3 inches). In pilot plant operation even higher efficiencies are possible (HETP values as low as 2 inches).



**Distillation efficiency versus capacity for commonly specified styles of GOODLOE® packing and 50 mm (2") Pall rings in vacuum**



**Pressure drop versus capacity for commonly specified styles of GOODLOE® packing and 50 mm (2") Pall rings in vacuum distillation.**

Above curves are based on the following test systems:

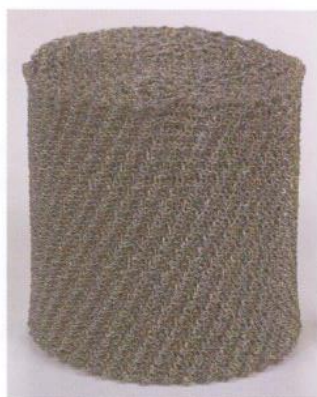
Packing	Bed (ID x HT)	Key Components	Pressure (mmHg)
765 high vacuum	15cm x3.2 meters (6-inches x 10ft - 6in)	cis/trans decalin	100
773 general purpose	15cm x3.2 meters (6-inches x 10ft - 6in)	cis/trans decalin	50
779 high efficiency	81cm x2.4 meters (20-inches x 8ft - 0in)	heavy/light water	125
819 general purpose (sectional)	46cm x1.5 meters (11-inches x 5ft - 6in)	methylcyclohexane/ toluene	200
771BC bi-component	15cm x4.5 meters (6-inches x 15ft - 0in)	chlorinated/ fluorinated hydrocarbons	50
50mm (2inch) Pall rings	51cm x2.0 meters (20-inches x 6ft - 6in)	ethylbenzene/styrene	100



## GOODLOE BC™ Packing Expands the Range

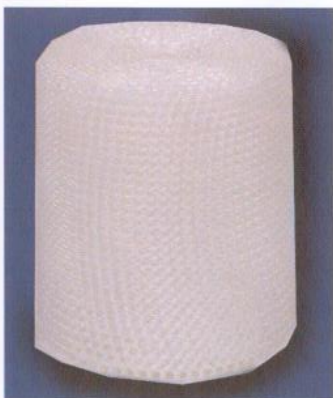
For critical separations or first of a kind type applications, the most recently developed high efficiency packings are several styles of GOODLOE BC™ packing. In corrosive service, these new styles provide performance comparable to that of traditional grades of GOODLOE® packing but at a lower installed cost per theoretical stage. For revamping columns now packed with plastics or exotic alloys, GOODLOE BC™ packing lets you develop many more stages in a given column height. Operating flexibility also improves significantly because separation efficiency actually increases with decreased loadings – even down to as low as 10% of design.

Key to the outstanding performance is the unique composite structure of GOODLOE BC™ packings in which metal wire and non-metal filaments are knit together into a proprietary mesh. The metal strand gives strength and maintains good open structure for high capacity. The non-metal fiber filaments provide up to 16,400 sq meter/ cu meter (5000 sq ft/cu ft) of mass transfer area compared with up to 1970 (600) for traditional GOODLOE® packing. The high surface area of the liquid films which form in the microscopic interstices of the filaments allows the packings to furnish very high mass transfer efficiencies (very low HETP values) at capacities which are comparable to those of commonly used rings or saddles. Service temperatures can range up to 204°C (400°F).



**Traditional GOODLOE® packing in stainless steel construction**

**Teflon GOODLOE® packing for corrosive applications**



**GOODLOE BC™ packing in stainless steel and Teflon**

The combination of metal wires which serve as the backbone and non-metal fibers which provide the surface gives GOODLOE BC™ packing its superior performance characteristics..

### GOODLOE® TOWER PACKING SPECIFICATIONS

NTUM:  $\leq 13.1$  in production columns  
 $\leq 19.7$  in laboratory columns

HETP:  $\geq 3$  inches in production columns  
 $\geq 2$  inches in laboratory columns

$\Delta P$ /theoretical plate:  
 0.13-1.3 mm Hg

Vapor load\*:  
 0.12-2.75 F-factor (0.003-0.0762 C-factor) (Metric)  
 0.1-2.25 F-factor (0.01-0.25 C-factor) (English)

Liquid load:  $\leq 87.5$  m<sup>3</sup>/m<sup>2</sup>/hr (35 gpm/ft<sup>2</sup>)

Liquid holdup: 3-10% w/w (varies with style)

Wetting: materials of construction \*\*can be suited to any interfacial conditions or corrosive environment

\*F-factor =  $V_s(\rho_v)^{1/2}$  C-factor =  $V_s[(\rho_v)/(\rho_l - \rho_v)]^{1/2}$   
 $V_s$  = superficial vapor velocity (m/sec or ft/sec)  
 $\rho_v, \rho_l$  = density of vapor and liquid (kg/m<sup>3</sup> or lb/ft<sup>3</sup>)

\*\*Metals: 300 & 400 series stainless steels, alloys 20, B, 276, 400, 600, 625, 800 and 825, aluminum, copper, nickel, phosphor bronze, tantalum, titanium, zirconium

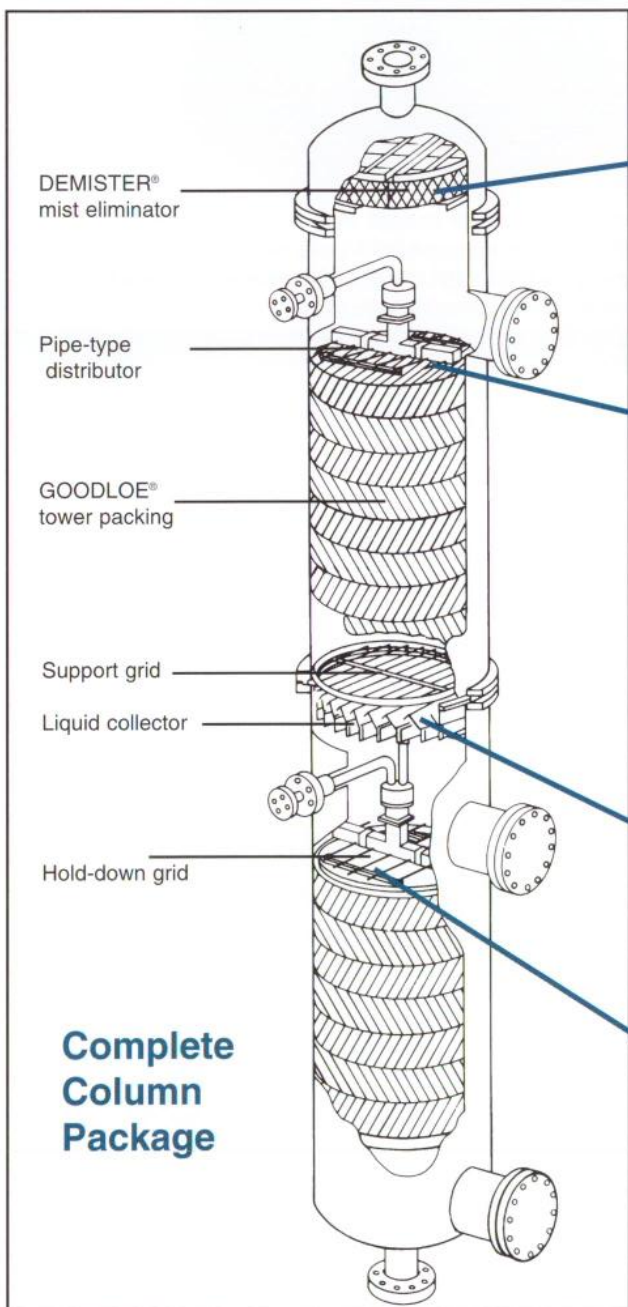
Non-Metals: ECTFE (Halar®), PVDF (KYNAR®), polyester, polyethylene, polypropylene, ETFE (Tefzel®), TFE (Teflon®)



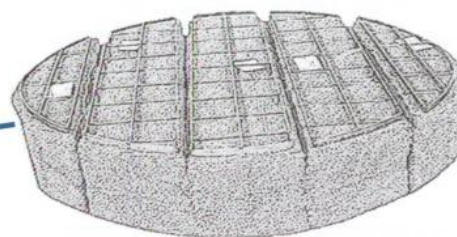
## Practical, Informed Assistance

As a business unit of Koch-Glitsch LP, a world leader in the design and manufacture of tower internals, Koch-Otto York can supply the complete package including vapor and liquid distributors, liquid collectors, support grids, mist eliminators, and even the column shell.

Because no two mass-transfer systems are alike, practical experience is always an important factor in any column design. Koch-Otto York has direct access to over 40 years of experience spanning more than 5,000 GOODLOE® high-efficiency packed columns up to six feet in diameter and up to 90 feet high. This experience is fully available to all our customers, as is our column-design capability.

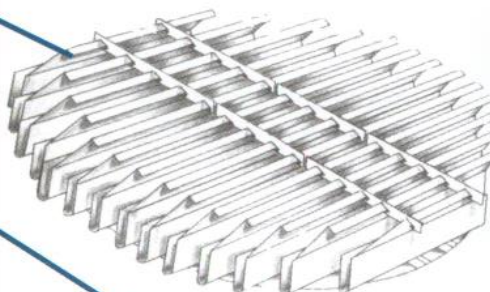
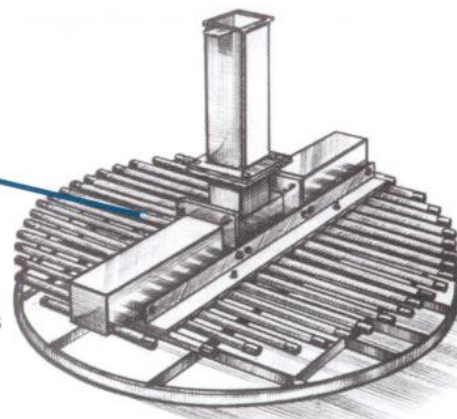


Koch-Otto York can provide a complete column package including the column, GOODLOE® packing, distributors, supports, and other required internals.



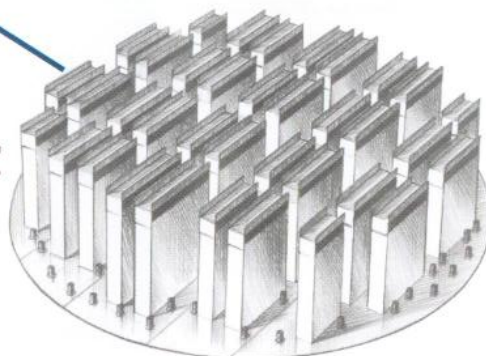
**A DEMISTER® mist eliminator can help maintain overhead product purity.**

**A tubular or pipe type distributor is used in non-fouling applications where packing efficiency is to be maximized.**



**Vane Collectors are low-pressure drop devices used to collect liquid for either redistribution or a side draw. They can be supplied in various configurations for column diameters from 500 millimeters (20-inches)**

**Orifice Plate Distributors are the most common liquid distributors for general-purpose, non-fouling applications. They can be supplied in column diameters from 150 millimeters. (6 inches)**





## Pilot Plant Testing Capabilities

For critical separations or first of a kind type applications, testing in a pilot plant is often the only way to obtain the necessary design data.

This testing is often conducted in small diameter (50-75 mm/ 2-3 inch) columns in the client's research facilities.

When this is not possible and/or larger diameter column tests are warranted, Koch-Otto York can offer the possibility of testing at Koch-Glitsch's pilot plant in Wichita, Kansas.

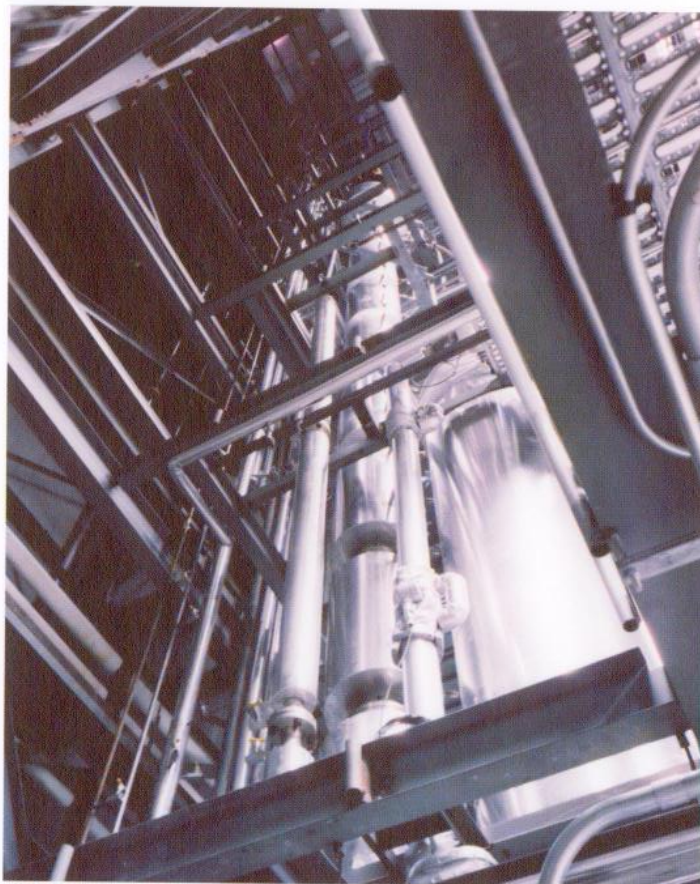
Koch-Glitsch has a complete range of testing capabilities for distillation and absorption applications. A fully equipped laboratory and more than 20 years of pilot plant testing experience ensure accurate analytical results. Based on compiled data, our staff can make precise recommendations to optimize tower design.

Koch-Glitsch operates both low-pressure and high-pressure pilot plants. Both are computer-controlled. The low pressure pilot plant has a design pressure of 7 bar at 330°C (100 psia 650°F). The high pressure pilot plant can operate up to a design pressure of 25 bar at 330°C (350 psia at 650°F).

Both handle hazardous and flammable materials while performing difficult and complex separations under vacuum or pressure conditions. The towers can be configured for a wide range of operating modes, from batch to continuous, with mixed-phase feed and product side-draw arrangements. Conditions can be controlled and varied to duplicate conditions in a specific tower to resolve uncertainties in existing vapor-liquid equilibrium or physical property data.



**Computer control/data acquisition console of Koch-Glitsch's pilot plant.**



**Koch-Glitsch's distillation pilot plant tower.**

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