INTALOX® ULTRA
Random Packing

YOU CAN RELY ON US.

KOCH-GLITSCH®

Bridging the gap between capacity and efficiency

With 30 years of experience in developing, commercializing, and supplying the market-leading IMTP® random packing, Koch-Glitsch engineers developed a clear understanding of the mass transfer and pressure drop characteristics of random packing. Going back to mass transfer principles and carefully investigating the important features required in a random packing, our research and development team produced a blueprint of the ideal random packing. This process resulted in INTALOX® ULTRA random packing, an innovatively designed structure that maximizes the effective surface area.

In a market that constantly pushes for more capacity, the alternatives were to:

- Switch from conventional random packing, such as Pall or FLEXIRING® random packing, to a high performance random packing, such as IMTP random packing.
- Install a larger size IMTP random packing, while sacrificing some efficiency.
- Build a bigger tower.

Now there is a better alternative

INTALOX ULTRA high performance random packing can help to increase the capacity of any random packing tower by up to 10% while maintaining the same efficiency compared to previous high capacity random packings, such as IMTP random packing. With older generation random packings, the benefits may be greater. The low pressure drop and high capacity of this packing:

- Allows smaller diameter for new columns
- Reduces energy consumption
- Reduces foam generation
- Reduces pressure drop
- Increases capacity

Typical challenges facing chemical processors and petroleum refiners

The need to increase capacity can push existing tower packing to its limits and can lead to:

- Excessive foaming
- Loss of efficiency
- Liquid carryover and solvent losses
- Unstable operation
- High pressure drop

The goal to reduce energy consumption and operating costs can be achieved by using less than desirable solutions:

- Increasing efficiency with a higher surface area packing that results in high pressure drop and decreased capacity
- Decreasing reboiler and/or condenser duty, which normally results in lower separation efficiency for the same feed rate
- Reducing stripping steam that results in higher contaminant levels in wastewater

INTALOX® ULTRA high performance random packing can meet these challenges

Increased capacity and lower pressure drop

- Reduces foaming tendency with lower pressure drop compared to similar sized packings
- Increases throughput without loss of efficiency compared to similar sized packings
- Reduces carryover and solvent losses with high vapor handling capacity
- Increases design capacity after vessel purchase without increasing vessel size
- Reduces vessel diameter and thickness in high pressure applications resulting in a significantly lighter vessel

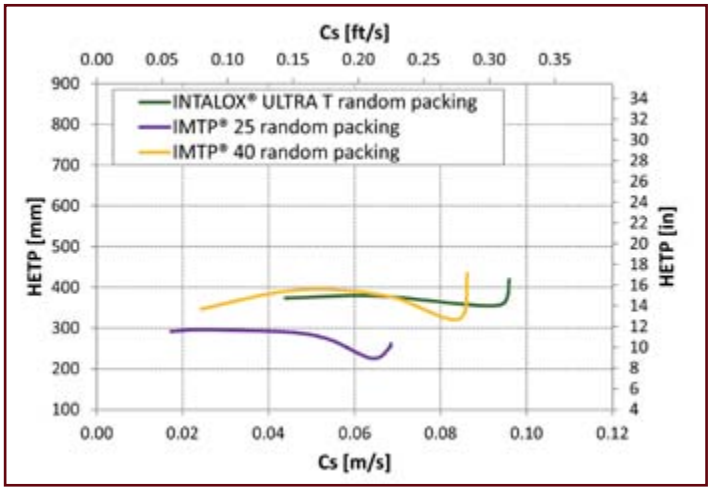
Higher efficiency

- Provides more efficiency without loss of capacity when revamping with the next smaller size packing
- Reduces reboiler/condenser duty and energy consumption when revamping with similar size packing
- Reduces vessel height compared to designs with similar sized packings
- Reduces stripping load compared to designs with similar sized packings

High mechanical strength

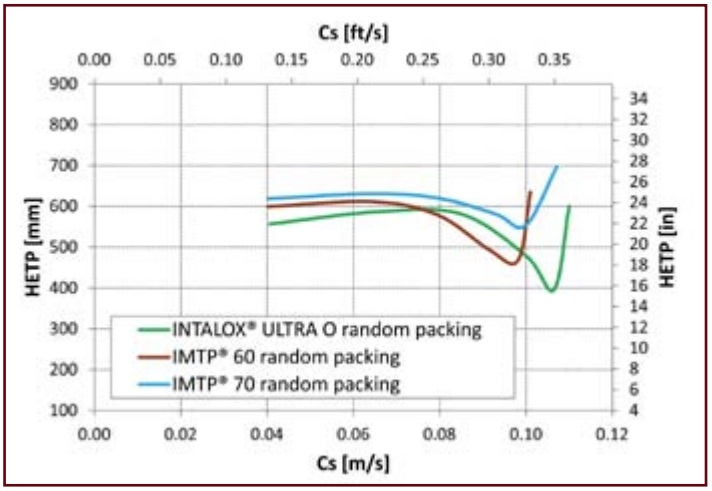
- Integral stiffening ribs and flanges provides high strength to weight ratio
- Low weight permits greater allowable bed depth

INTALOX® ULTRA T High Performance Random Packing



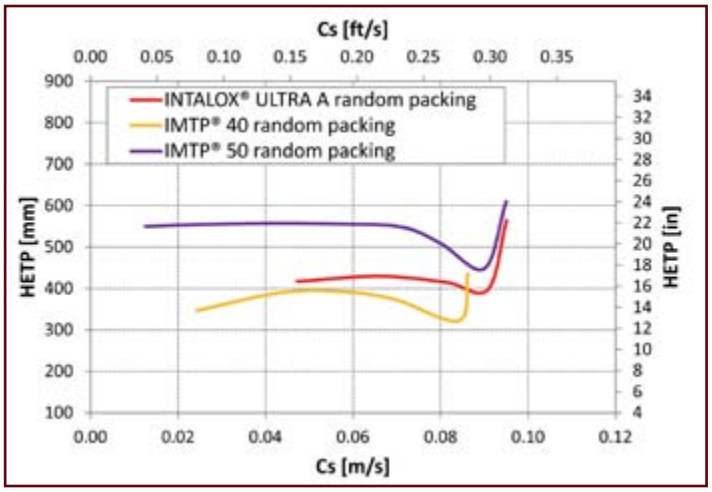
Light hydrocarbon distillation at 24 psia [1.65 barA] pressure.

INTALOX® ULTRA O High Performance Random Packing



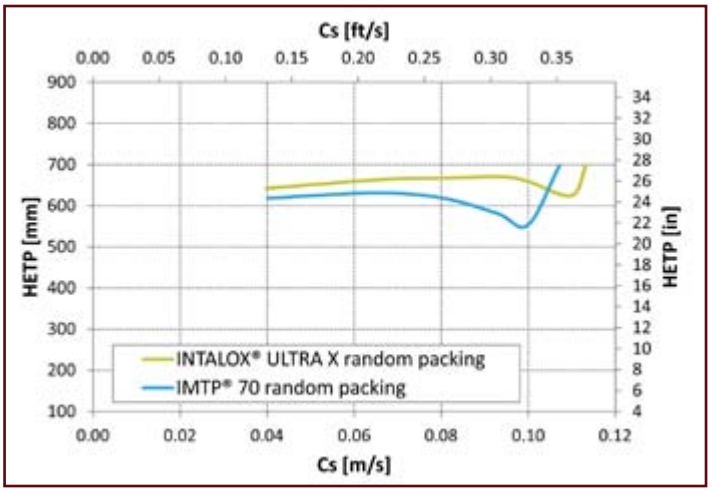
Light hydrocarbon distillation at 24 psia [1.65 barA] pressure.

INTALOX® ULTRA A High Performance Random Packing



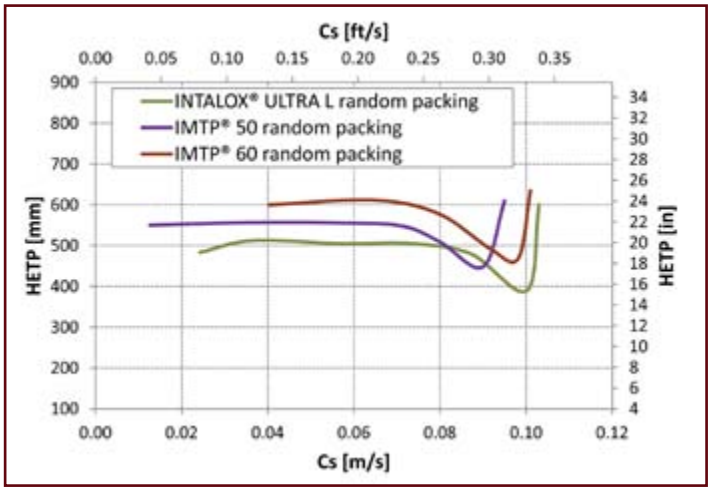
Light hydrocarbon distillation at 24 psia [1.65 barA] pressure.

INTALOX® ULTRA X High Performance Random Packing



Light hydrocarbon distillation at 24 psia [1.65 barA] pressure.

INTALOX® ULTRA L High Performance Random Packing



Light hydrocarbon distillation at 24 psia [1.65 barA] pressure.

Substitution Chart for INTALOX® ULTRA Random Packing

IMTP® Random Packing	Similar Efficiency Greater Capacity	Similar Capacity Greater Efficiency
40	A	T
50	L	A
60	O	L
70	X	O

INTALOX® Packed Tower Systems Technology

Predictable and reliable separation columns containing well-matched high performance packing and state-of-the-art liquid and vapor distributors.

Koch-Glitsch's global experience is second to none and includes thousands of columns in distillation, absorption, stripping, liquid-liquid extraction, and heat transfer applications. The combination of INTALOX® high performance internals and INTALOX ULTRA high performance random packing provides the highest random packing performance available in the industry.

Koch-Glitsch has developed a series of liquid distributors with attributes to maximize packed tower performance. These attributes are well understood and have been incorporated into INTALOX high performance distributors. Koch-Glitsch introduced a distributor rating system for quantifying distribution quality and performance. Distribution uniformity is rated as a percentage, where 100% indicates ideal uniform distribution. A low percentage rating indicates a high variation of liquid flow over the cross sectional area of the tower. In addition, the distributor must provide a sufficient gas passage area to avoid high pressure drop or liquid entrainment.

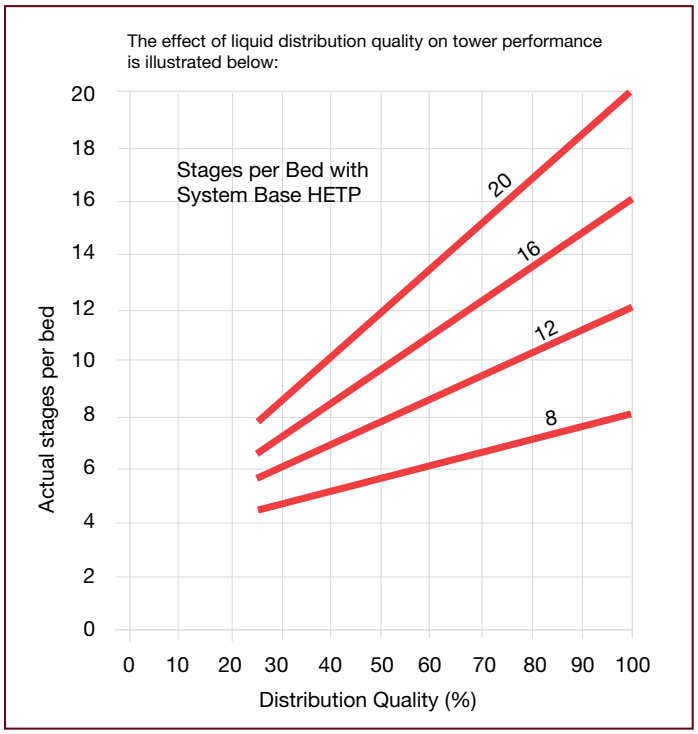
INTALOX distributors aim towards 100% distribution quality by applying the following criteria:

- Drip points are preferable on a uniform triangular pattern, or alternatively on a square pattern
- Drip points are uninterrupted by gas risers, panel joints or mechanical supports
- Drip points are properly spaced to the vessel wall
- Equal liquid flow from each drip point

The significance of the Koch-Glitsch distribution quality rating system is the accurate prediction of tower performance.

INTALOX distributors are applied in:

- Distillation services with high stage counts per bed
- Distillation services with low relative volatility
- High purity product distillation services
- Distillation services operating near the minimum reflux or close to an equilibrium pinch point
- Absorption and stripping applications with close approach to equilibrium
- Heat transfer services with close approach temperatures



A tower containing deep beds of INTALOX ULTRA high efficiency random packing, designed to achieve many theoretical stages or transfer units, is very sensitive to liquid distribution quality.

Feed devices are critical to the performance of the liquid distributor and the packed column. Depending on the specific service, Koch-Glitsch offers a wide range of INTALOX liquid, vapor, mixed phase, and flashing feed devices.

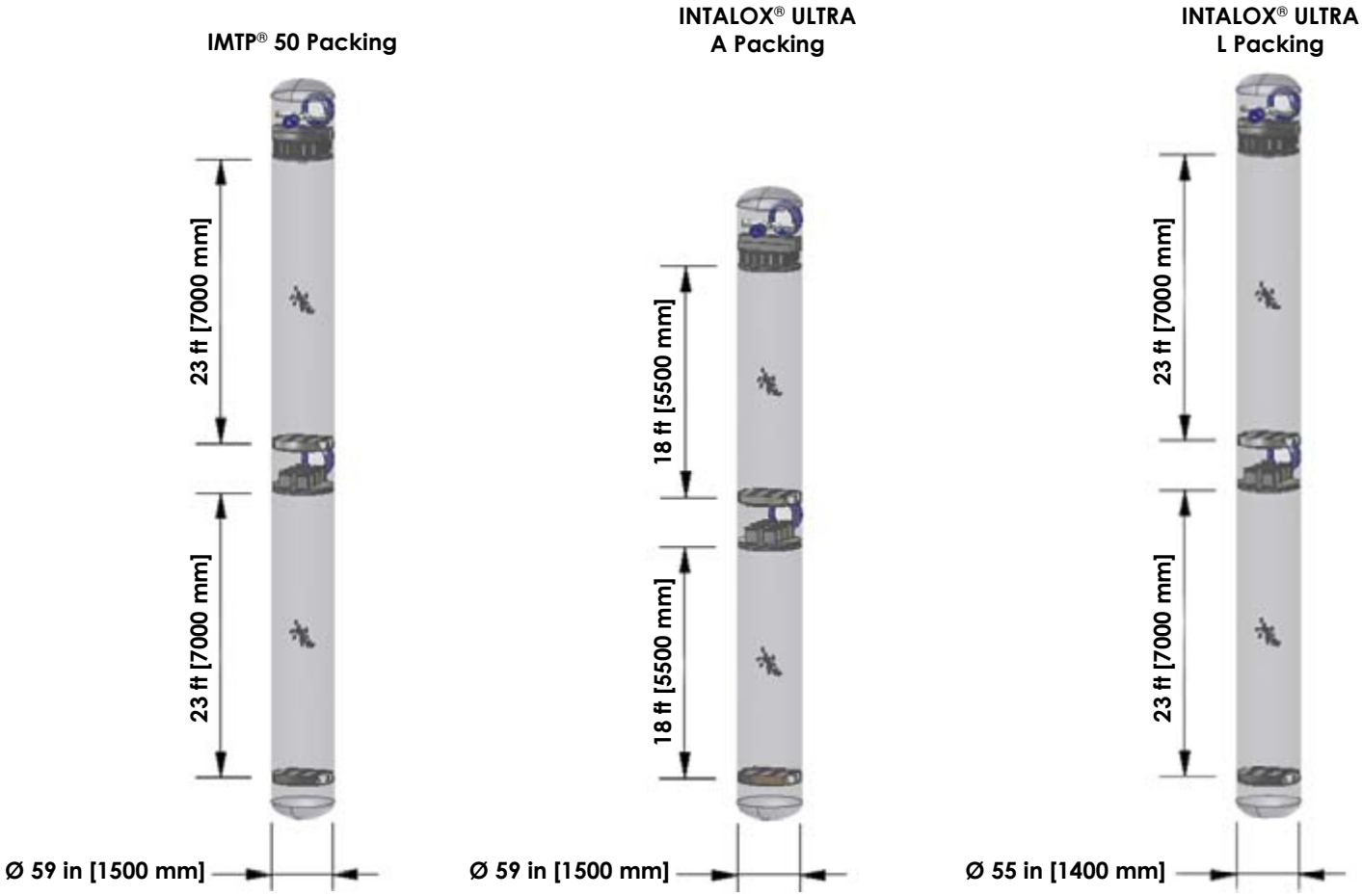
- INTALOX liquid phase feed pipes are designed to prevent excessive liquid velocity in the distributor to minimize liquid gradients and momentum effects.
- INTALOX vapor phase feed devices are designed to reduce the kinetic energy of the vapor feed before entering the packed bed.
- INTALOX mixed phase feed devices are designed to provide sufficient disengagement of vapor from the liquid prior to feeding the liquid distributor.
- INTALOX suppressed flashing feed devices are designed to avoid vaporization inside the pipe system and to provide sufficient disengagement of vapor from the liquid system prior to feeding the liquid distributor.

Amine Absorber Column Size Reduction

Using INTALOX® ULTRA packing to increase either the efficiency or capacity can optimize a typical amine absorber design.

The following example is based on an amine absorber with the following characteristics:

- Typical natural gas composition
  - 82 mol% methane
  - 4.7 mol% CO_2
- Inlet gas flow 3 MMSCFH [85,000 Nm^3/h] at 928 psig [64 barg] and 104 °F [40 °C]
- Absorption liquor 20 wt% MEA solution
- Exit gas specification of 50 ppm CO_2
- Base design using IMTP 50 packing



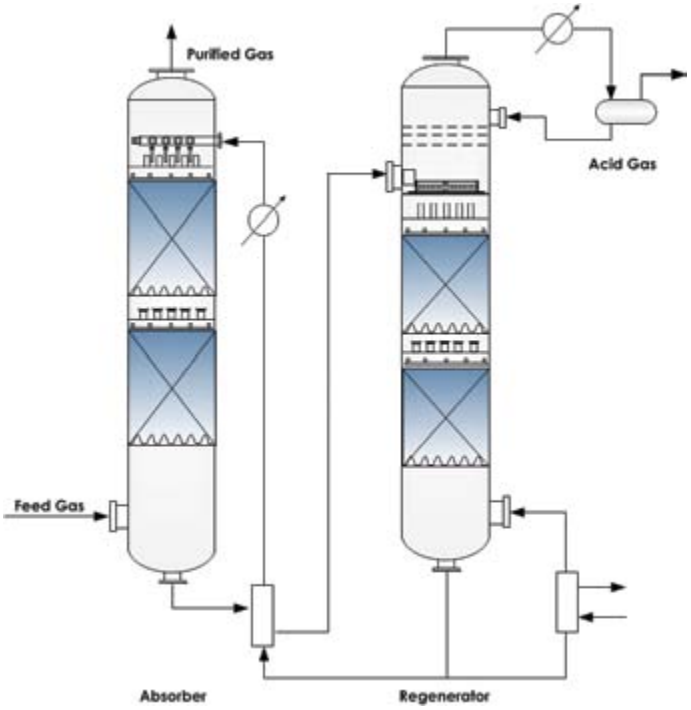
Packing Efficiency

Packing efficiency is generally expressed in terms of HETP (Height Equivalent to a Theoretical Plate) or HTU (Height of a Transfer Unit). Distillation, absorption, or stripping tests are the basis of efficiency values; however, it is not practical to test every system encountered in industry. The HETP values presented here are based on distillation of light hydrocarbons with low relative volatility at moderate pressures and are meant to provide a starting point in estimating packed bed depth. In distillation systems with high relative volatility between the key components, the packing will have a lower stage efficiency (higher HETP) than might be expected for a more ideal, low relative volatility system. Aqueous, reacting, and ionizing systems will also have higher HETP values. Contact Koch-Glitsch for assistance with estimating the packing efficiencies for these systems.

Acid Gas Removal

One of the most widely used commercial absorption processes is the removal of CO_2 and/or H_2S from a gas stream by contacting it with an amine solution such as MEA, DEA, or MDEA.

The activated forms of MDEA solution such as Ucarsol®, GAS/SPEC® and aMDEA® have also been widely used in this process. Installation of INTALOX® ULTRA packing in these towers offers lower pressure drop, which provides several benefits. This system is moderately foaming and the lower pressure drop provided by INTALOX ULTRA packing reduces foam generation and the use of costly anti-foam agents. Lower pressure drop also reduces energy consumption and solvent degradation due to higher operating temperatures. The predictable performance of INTALOX ULTRA packing, when used with INTALOX high performance distributors, and the packing's high mechanical strength allow the use of very deep beds. Koch-Glitsch has successfully packed amine absorbers and regenerators with beds well over 40 ft [12 m] deep. Column height normally occupied by a redistribution system can be used for additional packing. This reduces the cost of additional tower internals when replacing existing trays. These benefits can be extended to other gas treating systems, such as hot carbonate (e.g. Benfield) and physical solvent (e.g. Selexol®) systems. Koch-Glitsch has installed INTALOX ULTRA packing in many of the amine, hot carbonate, and physical solvent systems, as well as many other gas treating systems.

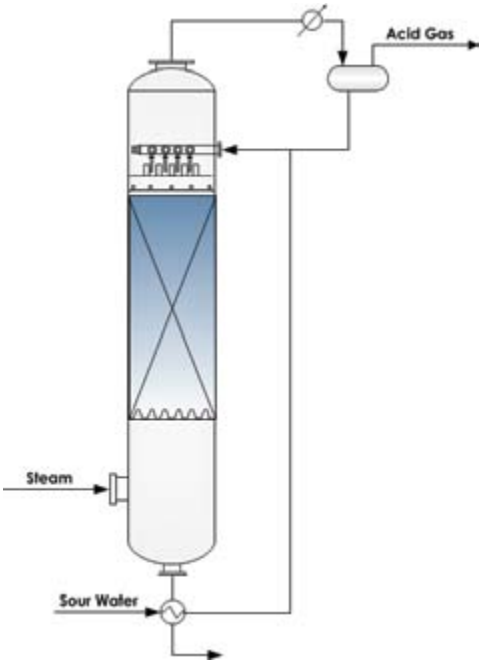


This vast experience can be used to ensure maximum performance of any gas treating system.

Sour Water Stripper

Sour water stripping is an important part of integrated industrial aqueous waste management, particularly in petroleum refineries.

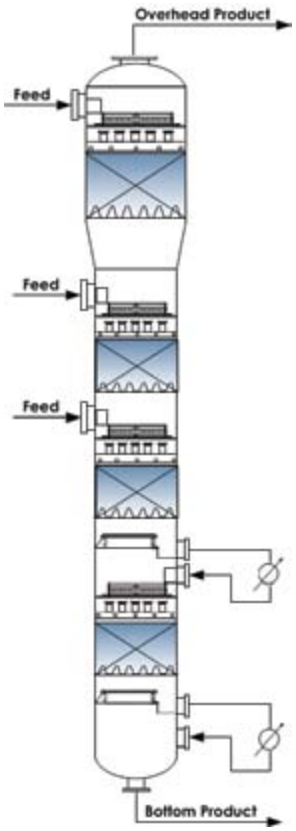
The sour water stripper is designed to remove H_2S and NH_3 from process water. This can be achieved by contacting the sour water with stripping steam in a packed bed. INTALOX ULTRA packing provides very high stripping efficiency allowing for shorter packed bed depths or the use of less stripping steam. Revamping a sour water stripper from trays or conventional random packing to INTALOX ULTRA packing can help refineries meet today's increasingly stringent effluent water quality regulations. Process water may contain contaminants that can cause scaling, fouling, or foaming problems. The very high void fraction and low pressure drop of INTALOX ULTRA packing help to alleviate these problems. Additionally, the wider operating range of INTALOX ULTRA packing provides the flexibility required to meet the additional stripping requirements during peak operation.



Demethanizer

One application that is common to both natural gas plants and olefins plants is the separation of methane from heavier hydrocarbons.

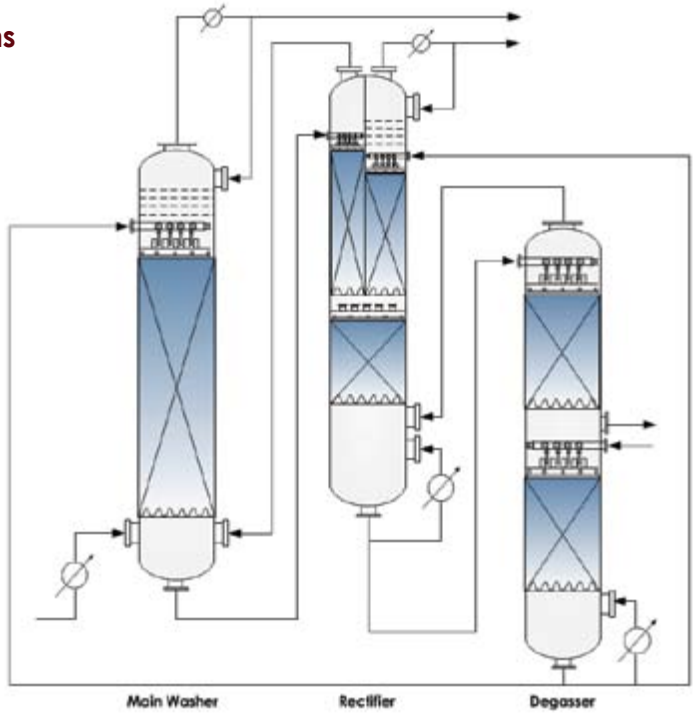
Generally, demethanizers are operated at high pressure and low (cryogenic) temperature. Installation of INTALOX® Packed Tower Systems in demethanizer columns provides several benefits. Well designed INTALOX Packed Tower Systems take into account the close liquid and vapor densities and low surface tensions of this system. High performance INTALOX tower internals in combination with INTALOX ULTRA high performance packing provide maximum separation efficiency. Increased efficiency permits operation at lower reflux ratios, reducing the condenser refrigeration requirement. In addition, INTALOX ULTRA packing provides increased capacity or throughput with low pressure drop. For new construction, the column diameter is minimized, reducing the required capital investment. In revamp projects, the use of INTALOX ULTRA packing allows maximum throughput for the existing column. INTALOX ULTRA packing is available in a wide range of materials, including aluminum, and in sizes ranging from L to O. In some cases, the benefits of INTALOX Packed Tower Systems can be extended to deethanizer columns as well. Koch-Glitsch has extensive experience packing hundreds of light hydrocarbon distillation towers to maximize performance.



Butadiene

The extraction of 1,3-butadiene from C4 hydrocarbons remains an important process for the production of synthetic rubber.

The high liquid loads in the main washer, rectifier, and degasser make the use of random packing ideal. High liquid rates in structured packing can lead to choking of the flow channels created by the crimped sheets. Liquid and vapor are segregated, leading to reduced efficiency. Random packing allows liquid to flow freely in all directions, eliminating this phenomena. Replacing existing random packing with a similar sized INTALOX ULTRA packing can help satisfy the ever increasing demand for product purity. A substantial efficiency increase can be realized with no loss in capacity or increase in pressure drop for revamp situations and allows the use of shorter packed beds for new designs.



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Patents

The following technologies are protected by one or more patents in the USA; other foreign patents may be relevant: INTALOX® ULTRA random packing (US7722945).

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