



# UOP UPak™ Packing for the UOP Benfield™ Process

## Gas Processing

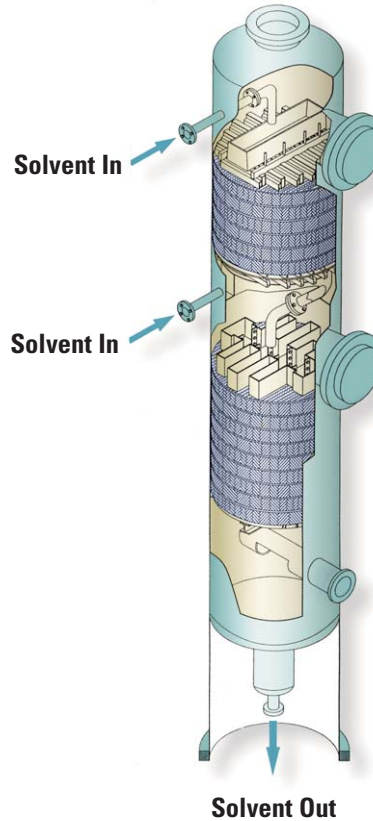
### Description

Upak packing is a structured packing manufactured from 300-series stainless steel, with characteristic surface structure which results in a high separation performance over a wide range of liquid loads. It has been specifically designed for the Benfield process. The alternating arrangement of the individual corrugated sheets forms intersecting open channels that effect an optimum inter-mixing of gas/liquid. Upak packing comes in different flow channel hydraulic diameters and different surface areas ( $m^2/m^3$ ), to obtain optimum hydraulic capacity and mass transfer characteristics for a given application. It has superior performance of these parameters compared to any random packing.

The Benfield process is a thermally regenerated cyclical solvent process that uses an activated, inhibited hot potassium carbonate solution to remove  $CO_2$ ,  $H_2S$  and other acid gas components. The Benfield process uses low cost chemicals available on the world-wide market. There are a variety of flow schemes available that permit process optimization and energy reduction with this near-isothermal unit operation.

### Advantages of UPak Packing (Compared to Random Packing)

- Shorter tower heights and/or smaller tower diameters (cost savings)
- Increased capacity for existing towers
- Reduced  $CO_2$  content in the product gas
- Decreased reboiler heat duty or solution circulation rate
- Greater mass transfer and hydraulic capabilities
- Twice the surface area per unit volume
- Higher allowable packed height per section (13 m)
- Less foaming tendencies
- Lower pressure drop
- Applicable for absorber and regenerator towers
- Tailored for Benfield process (liquid-phase mass-transfer controlled system)



### Scope of UOP's Equipment Package

- UPak packing in 304 SS or 316 SS metallurgy
- Column internals (liquid distributors, support grids, bolting required for assembly)
- Engineering design of packing and internals
- UOP project management
- Engineering design drawings (general arrangement drawings, column attachment drawings, and assembly drawings)
- Project data book (material certificates, production schedule, general installation instructions, and packing list)
- On-site technical service for installation and troubleshooting

**Example 1 ■ New Benfield Unit (2000 T/D NH<sub>3</sub>) Absorber Comparison**

	<u>High Efficiency Random Packing</u>	<u>UPak Packing</u>	<u>Savings</u>
<b>Trim Section</b>			
Diameter, m	2.5	2.3	
Number of packed beds	1	1	
Packed height, m	9.1	9.1	
<b>Bulk Section</b>			
Diameter, m	3.4	3.4	
Number of packed beds	2	1	
Packed height, m	9.1	12.8	
Vessel weight, kg	269,891	202,890	
Packing cost	\$194,600	\$298,000	<b>\$103,400 (-53.1%)</b>
Vessel cost	\$827,600	\$622,200	<b>\$205,400 (24.8%)</b>
Total purchase cost	\$1,019,200	\$920,200	<b>\$99,000 (9.7%)</b>
Total installed cost	\$2,548,000	\$2,300,500	<b>\$247,500 (9.7%)</b>

**Example 2 ■ Benfield Unit Revamp Comparison**

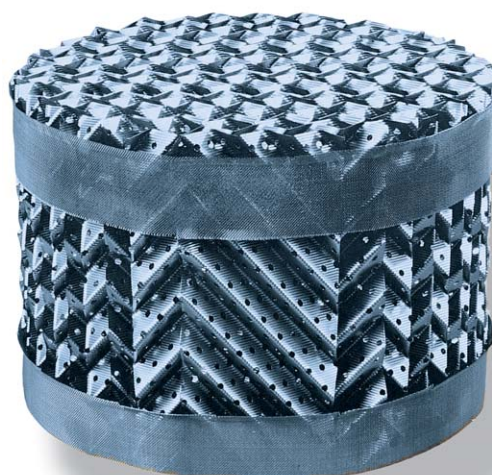
	<u>High Efficiency Random Packing</u>	<u>UPak Packing</u>
Ammonia feed, STPD	2000	2500
CO <sub>2</sub> removed, kgmole/hr	2123	2719
Lean circulation rate, m <sup>3</sup> /hr	1563	1903
<b>Absorber Trim Section</b>		
Diameter, m		2.5
Packed height, m		9.1
<b>Absorber Bulk Section</b>		
Diameter, m		3.4
Packed height, m		18.2
<b>Regenerator</b>		
Diameter, m		4.6
Packed height, m		22.9

## UOP Experience

<u>Country</u>	<u>Tower</u>	<u>Diameter, m</u>	<u>Pressure, bar</u>	<u>Type</u>
1) India	Absorber	3.8	25	Revamp
2) Belgium	Absorber/ Regenerator	2.0, 2.3/ 2.9	23/ 1	Revamp
3) Kuwait	Absorber	5.1	23.7	Grassroots
4) Canada	Absorber	4.7	23.0	Revamp
5) Egypt	Absorber/ Regenerator	2.4/ 3.0	86.0/ 1	Grassroots
6) Malaysia	Absorber	6.2	24.3	Grassroots

## Additional Information

- India:** Revamp of a 1000 TPD NH<sub>3</sub> plant's absorber bottom to accommodate a feed gas capacity increase to the unit.
- Belgium:** Revamp of the both absorber and the regenerator in an ethylene oxide plant in order to effect a large increase in capacity, both in feed gas rate and CO<sub>2</sub> removal rate, while decreasing CO<sub>2</sub> slippage.
- Kuwait:** Grassroots world scale ethylene oxide plant absorber.
- Canada:** Revamp of existing ethylene oxide absorber column to reduce the CO<sub>2</sub> slippage from the product gas due to implementation of new EO sensitive catalysts.
- Egypt:** Grassroots natural gas plant consisting of 2 parallel 210 MMSCFD trains, with Benfield process utilized for CO<sub>2</sub> removal. Both absorbers and both regenerators use Upak Packing.
- Malaysia:** Grassroots world-scale ethylene oxide absorber.



## For more information

For more information, contact your local UOP representative or our Des Plaines sales office:

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