

UOP Distillation Trays

High-performance trays for grassroots and revamp applications

Introduction

For more than 25 years, UOP has been a leader in the supply of high performance trays for distillation, absorption, stripping and extraction.

Key Benefits

- Reduced column diameter in grassroots applications
- Increased capacity from existing columns
- Maximum number of trays in a given column height
- Easy scale-up to any diameters
- Fast, simple installation, reducing turnaround time
- Low sensitivity to out-of-levelness
- Minimized or eliminated foaming/fouling

Design Applications

Multiple Downcomer (MD™) trays are used for large liquid loads, particularly when the volumetric ratio between vapor and liquid rates is low. These situations occur in medium to high pressure distillation, absorption and stripping, and direct contact heat transfer applications.

MD trays reduce both the height and diameter of a new column compared to a column fitted with conventional multipass trays, and vessel shell costs are significantly lower using MD trays. When retrofitting an existing column, a greater number of MD trays can be installed, providing increased product purities and recoveries, as well as reduced reflux ratio for reduced energy consumption and/or increased column capacity.

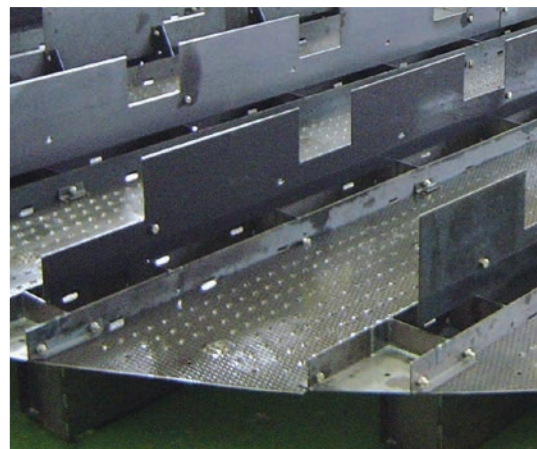
MD trays often reduce the number of columns needed in difficult separations, such as superfractionation of propylene-propane or of xylene isomers.

UOP continues to improve the design of its proprietary trays to meet customer needs. In recent years, the Parallel Flow (PFMD™) and Enhanced Capacity (ECMD™) trays were developed and have been installed to achieve specific distillation objectives. Both of these advanced trays are based on the same operating principles, design philosophies, and experience as the original MD tray.

UOP also provides other proprietary equipment, including the Multiple Upcomer (MU™) tray and Slotted Sieve™ tray, for various applications.

Features of MD Trays

- Long total weir length and large downcomer area provide high liquid handling capability
- No receiving pan area to detract from bubbling area
- 90° rotation of downcomers on successive MD trays promotes lateral mixing and provides easy scale-up
- Low crest heights over weirs permit close tray spacings



UOP's high-performance trays maximize column capacity, reduce capital and operating costs, reduce energy consumption and improve separation performance in grassroots and revamp applications.

- Typically provide structural support up to 30 foot diameters without center beams
- Supported on a 360° ring; no bolting bars are required
- Unique downcomer lengths give fast, simple installation
- Trays can be fabricated with an underflow weir and vapor seal downcomer options to achieve a large turndown ratio
- Tray efficiencies range from 70-90% in distillation service
- Low tray pressure drop of 0.06-0.09 psi

Turndown

MD trays can generally turn down to 70% of their design flow rates, particularly when they are used at large tray spacings. The use of sieve decks helps keep the tray efficiency constant as rates are being turned down. In columns where a large number of trays are required, only MD trays can be used at the requisite close tray spacings. In cases where additional liquid turndown capability is required, special "high rangeability" downcomers can be used.

General Design Considerations

The key to MD tray performance is the total weir length provided on each tray. This gives low liquid loads per unit weir length even at very high total liquid flow rates. The weir load on MD trays is usually about 1/4 to 1/3 of the weir load on conventional two- or four-pass trays. The low weir loads on MD trays allow the use of lower tray spacings at the same capacity factor or allow a higher capacity factor to be used at the same tray spacing compared to conventional trays. The result is a larger number of trays in a given column height and reduced column diameters. An additional advantage of MD trays is the absence of receiving pans, because downcomers terminate above the froth of the tray below. This provides extra bubbling area, reducing the column diameter required.

The tray spacing used for MD trays is sometimes determined by the backup of froth in the downcomer. The low weir loads on MD trays allow close control over the froth height on the tray, which is set by the weir height. As a result, weeping can be prevented with a lower dry tray pressure drop, further reducing the tray spacing required.

MD Tray Applications

Acetic acid/ water separations	Cryogenic separations	Ethylene oxide absorbers & strippers
Acetone/water separations	Debutanizers	Glycols dehydration heat transfer applications
Acetylene absorbers	Deethanizers	Phenol/cresol separation
Acid gas absorbers & strippers	Demethanizers	Propylene/propane splitters
Acrylonitrile absorbers & strippers	Depropanizers	Stabilizers
Butadiene absorbers	Dichlorobenzene purification	Tetraethylene glycol strippers
Butane splitters	Ethylbenzene-xylene splitters	Vinyl acetate purification
Cresol/xylenols purification	Ethylene-ethane splitters	Xylenes separation

High liquid loads on conventional trays often result in foaming and a reduction of efficiency from vapor entrainment through the downcomers. MD trays largely avoid these problems by the use of low liquid velocities across the tray, without costly and cumbersome antifoam additions.

Because of the short flow path length, MD trays operate only slightly above point efficiency. However, experience has shown that because of the adverse effects found on conventional trays, the tray efficiencies of MD trays and conventional multipass trays are usually comparable.

Commercial Applications

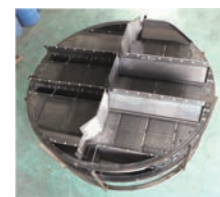
UOP trays have been proven to increase separation performance, reduce capital and operating costs, and/or increase column capacity in a wide range of applications. They are particularly effective for:

- Medium to high pressure distillation (MD tray, ECMD tray, PFMD tray)
- Medium to large diameter columns (Slotted Sieve tray, MD tray, ECMD tray, PFMD tray)
- Difficult, low relative volatility separations (Slotted Sieve tray, MD tray, ECMD tray, PFMD tray)
- Heat pumping applications (Slotted Sieve tray, MD tray, ECMD tray, PFMD tray)
- Low pressure and vacuum distillation (Slotted Sieve tray), (PFMD)
- Heavily liquid loaded absorbers and strippers (MD tray, ECMD tray)
- Low interfacial tension extraction systems (MU tray)

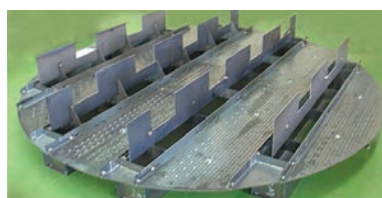
MD Tray for C₃ Splitter



ECMD Tray



PFMD Tray



For more information

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