



PANTAN



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FRACTIONATION TRAYS

PANTAN is a well-established leading designer and manufacturer of a complete range of Process Vessel internals for the Oil, Gas and Petrochemical Industries.

For well over a decade now, our company has developed a comprehensive range of products and services including:

- Fractionation Trays
- Packed Tower Internals
- Separator Internals
- Reactor Internals
- Site Services

FRACTIONATION TRAYS

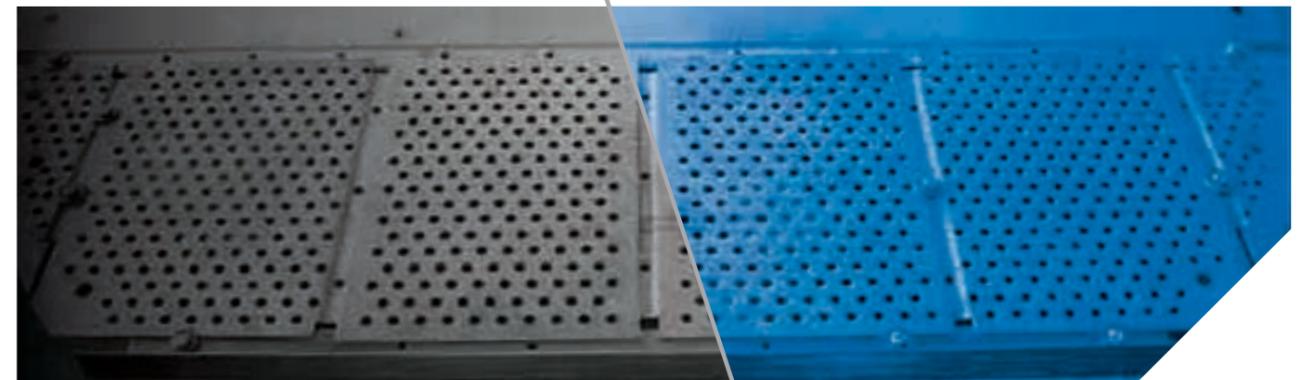
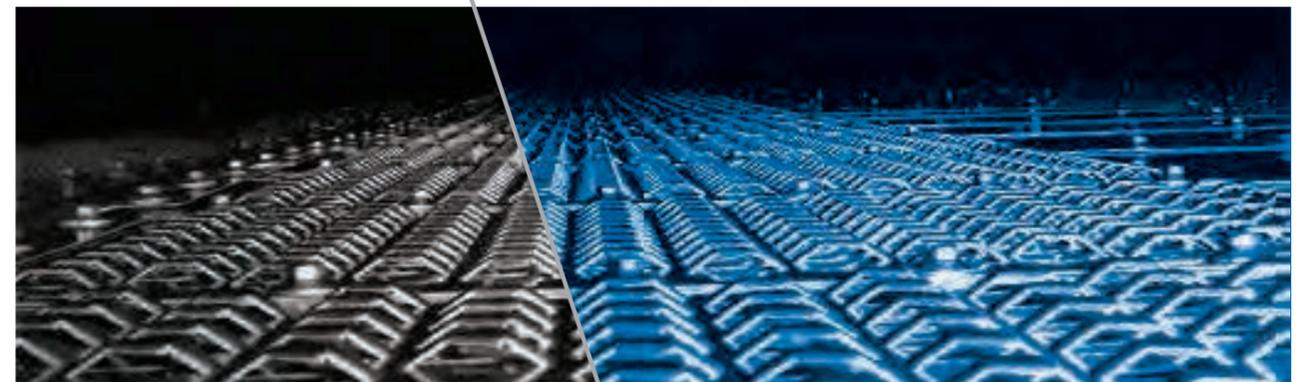
Tray columns play an important role in fractionating processes in the Oil, Gas and Petrochemical Industries. Characteristics which tend to favour trayed columns in fractionating and separation columns are:

- Operation flexibility
- High liquid load traffic handling
- Suitable for fouling systems
- Suitable for corrosive/erosive services.

SERVICES STAY FOR EVER



PANTAN certified according to ISO 9001:2015 for Designing and Manufacturing of Process Vessel Internals. Our principal focus is on improving products quality and customer satisfaction.





Tray Fundamentals

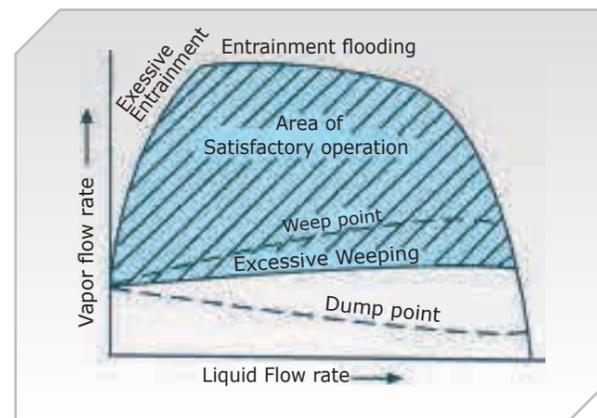
In classical hydraulic model liquid and vapor flow counter currently. The liquid phase flows horizontally across the tray decks from downcomer and vapor phase passes vertically upward from bottom tray to the upper tray and disperses through the continuous liquid phase creating a froth on each tray deck.

Effectively this creates a series of mixer-settlers with vapour-liquid mixing in the froth on the tray deck and subsequent vapour-liquid disengagement in the downcomers. In normal steady operation, the pressure loss across each tray deck will balance the liquid

head on each tray preventing the liquid from "weeping" through the tray deck area. result of this contact is a froth which flows over the deck during the traveling along tray. Some vapor separate from mixed phase and go upward and remaining froth releases over weir to the downcomer. In downcomer vapor phase disengages from mixture extensively and goes toward upper tray. In this normal flow regime most contacting surface area between phases will be provided but different direction of phases causes noticeable pressure drop.

Limitations of Tray Design and Operation

The Tray Operating Envelope shown in below Figure illustrates the relationship between liquid and vapor rates and the normal tray operating limits. The absolute locations of the envelope boundaries are a function of the tray layout and so each tray design will result in a unique set of operating limits. An ideal tray design would have the full range of expected column operation located within the envelope.

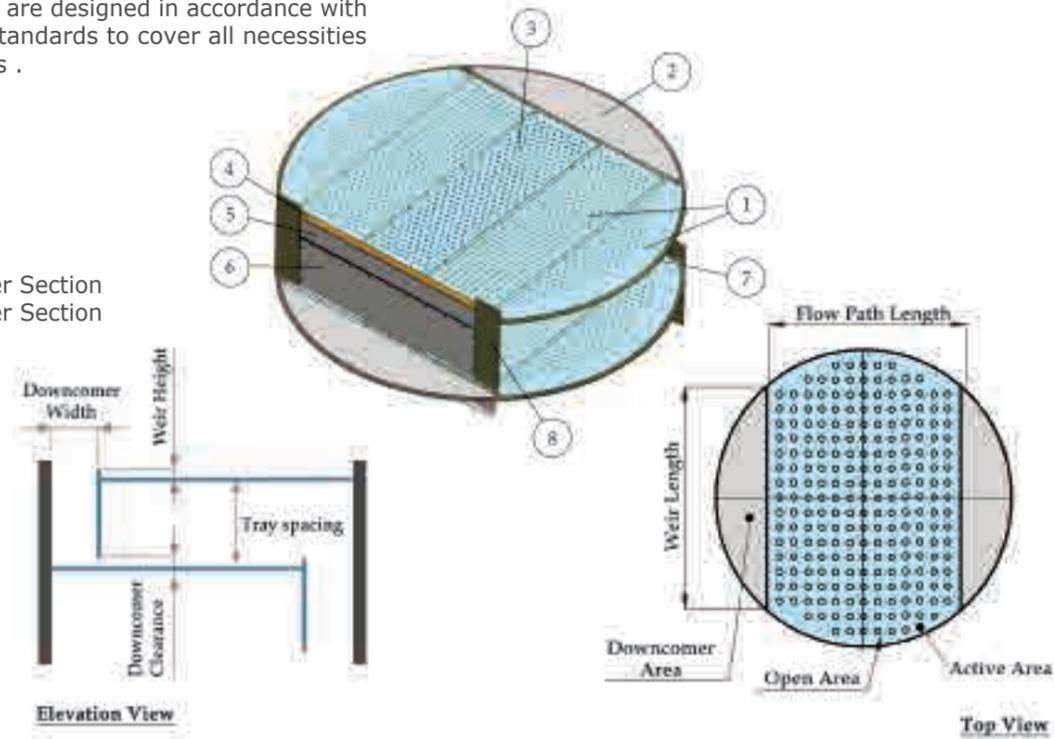


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Tray Arrangement

Tray style and parts are designed in accordance with accepted industry standards to cover all necessities of various processes .

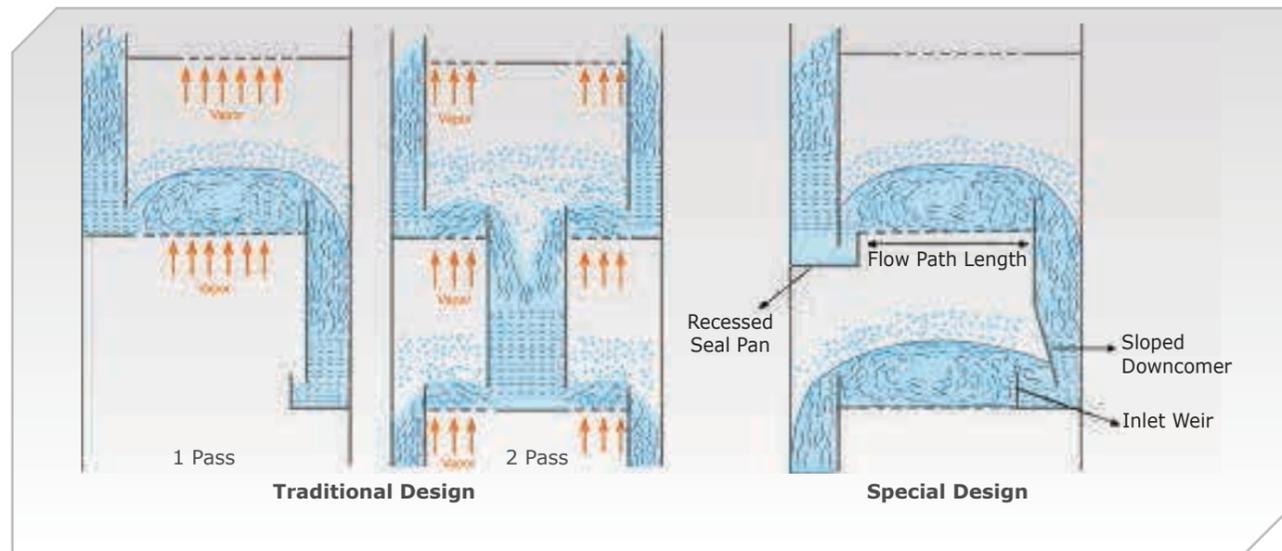
- 1- Tray Floor
- 2- Seal Pan
- 3- Manway
- 4- Outlet Weir
- 5- Downcomer Upper Section
- 6- Downcomer Lower Section
- 7- Support Ring
- 8- Support Bar



● Tray Parts Description and Geometrical Parameters

Graphical configurations of conventional 1 and 2 pass trays are shown below with various styles of liquid and vapor traffic.

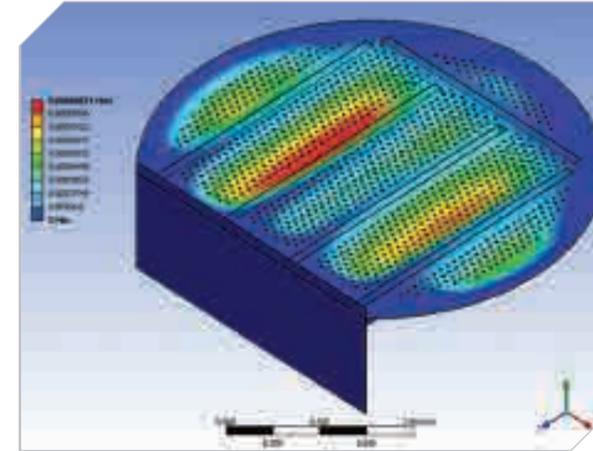
When high liquid rates are encountered, 2 pass and 4 pass trays are preferred because they provide lower weir load.



Depending on tray hydraulic, downcomer also can be designed straight and sloped in order to increase more tray active area.

Inlet weir and recessed seal pan are applied for achieving downcomer seal and where downcomer clearance is limited.

Mechanical Concepts & Fabrication Techniques



Fractionating Trays for columns larger than about 900mm diameter are manufactured in sections sized to fit through vessel manways and are assembled inside the vessel to form complete trays which conform to the required specific tray layout. The installed trays are therefore removable for maintenance purposes with one panel on each flow path designed as an inspection or access manway.

The basic design and technique for tray assembly is fairly standard to all the major tray manufacturers with differences in detail such as clamp design etc.. Typical PANTAN tray assembly is by through bolting together all tray panels with M10 threaded fasteners except for:

- Peripheral Tray Deck Panels are fixed to support ledges using lever clamps.
- Manway Panels are fixed using clamps that can be removed from above or below.

PANTAN standard Fractionating Trays are designed to withstand a uniformly distributed downwards load of 1.5 kPa which is the typical standard specified by major users. Tray decks panels are normally 2mm thick stainless steel (or 3mm thick Carbon Steel) with box section trusses folded below the deck designed to achieve the desired load bearing strength. The depth of the box sections is generally restricted to 20% of the normal tray space for both process and access reasons. In larger diameter columns where box section depth would be excessive, separate major beams are used. All major beams are through bolted to support brackets welded to the column wall.

The upper sections of downcomers generally functions as beam supporting tray deck panels and is therefore through bolted to the downcomer bolting bars. Lower downcomer sections may be clamped to the downcomer bolting bar.

To provide for installation fit up and adjustment, oversize bolt holes are used at tray joints. PANTAN's typical panel to panel assembly is based on using one 12mm and one 20mm diameter hole with M10 bolting at each fixing position. Bolting and clamping is generally arranged around all tray panels on maximum 150mm centres. Small gaps between some tray panels may be unavoidable and are acceptable on the tray active area. Where the size of the gap is excessive, bolted down seal plates should be used to cover the gap. Gaps on downcomer panels must be avoided altogether if possible. Also tray panel joints on the downcomer floor should be minimised or eliminated because the higher liquid levels in the downcomers may result in substantial leakage.



In some services the trays may need to be designed to withstand higher downwards or in some cases upwards loads. Heavy duty tray design may incorporate some or all of the following features to increase mechanical strength:-

- Manufacture from heavier gauge material
- Larger box/beam sections
- Increased number of major beams
- Tied-in box sections (ie bolted to wall cleats)
- Closer spacing of bolting and clamping.



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Products Introduction

● Bubble Cap Tray

This traditional tray type is used for low liquid rate and high turn down ratio.



● Sieve Tray

Consist of tray panels area uniformly punched with 13mm holes and approximately 10% open area which use because of their simplicity, versatility, capacity and cost effectiveness

● Features

- Simple and low cost
- Narrow operation flexibility over a range of 2:1 turndown ratio
- Tried and tested performance



● Float Valve Tray

Float Valve Trays are composed of punched tray decks fitted with movable valves to vary the tray open area with changing vapor load. In cases where high turndown ratios are considered, floating valve trays are an option. There are various valve types which may either have legs integrated to the valve disc to limit upwards movement or alternatively the valve disc movement is restricted by a cage fitted to the tray panel. Valve discs/caps are available in both round and rectangular shapes. The capability of floating valves makes these valves to control vapor flow so as a result, they provide better sustained efficiency over a wider operating range than sieve trays.



● Features

- Medium operating flexibility up to 5:1 turndown ratio
- Enhanced liquid-vapor contact
- Steady liquid movement across the tray deck
- Less froth height and weeping
- Turndown parameters adjustment by selecting suitable range of valve lift and weight
- More resistance against fouling or corrosive fluids
- Extra fatigue causes the legs to be damaged; cage valves solve this problem easily

● **Panta Valve™**



RE
(Std Rectangular Valve)



CG
(Std Cage Valve)



RO-1
(Std 3leg Valve)



RO-2
(Std 3leg Valve)



RO-3
(High efficiency 3leg Valve)

● **Fixed Valve Tray**

This type of valve tray has been developed to achieve both sieve and floating valve tray specifications as moderate pressure drop, turndown ratio and cost. Fixed Valve Tray is the preferred tray when fouling conditions are possible. However, it provides lower turndown and less efficiency than floating valve. Smaller fixed valves provide more capacity than larger valves owing to the fact that pressure drop and entrainment decrease.

● **Features**

- More resistance against fouling services
- Moderate operation flexibility about 3:1 turndown ratio
- Lower entrainment and pressure drop
- Higher Capacity as tray spacing can be reduced especially in existing columns it allows to increase the number of trays
- High efficiency is attainable over wide range of operational conditions
- excellent mechanical strength
- leakage is low



Products Introduction

Cartridge trays are typically used in flanged columns where the tower diameter is so low and no manhole is used.

Generally, for columns with diameters less than 900 mm any of tray products can be manufactured in cartridge-style construction.

This scheme can only provide up to 5 trays per cartridge they are joined together in bundles for easy installation.



High performance trays

In order to provide higher capacity and to reduce Jet Flood, PANTAN offer complete range of high performance trays based on optimum tray geometry design, such as high performance chordal downcomers, Swept-back Downcomers, Sloped Downcomers and Multi-downcomer trays, Special tray decks for enhancing vapor capacity with state-of-the-art downcomer technology.

These kinds of trays are suitable for column revamping and for reducing the size of new towers.

● **Features**

- Maximized active area
- Swept-back Downcomers
- Sloped Downcomers
- Micro Valves
- Jet Tabs
- Clear Liquid Separators

● **Results:**

- Increased Tray Efficiency
- Increased Capacity

● **Advantages:**

- More trays in the same space
- Lower reflux ratio
- Lower pressure drop

Feed Inlet Devices

Proper distribution of a vapor, liquid or vapor-liquid stream onto a tray is essential for reaching the hydraulic capacity potential of the internals.

Type of inlets in to a column classified as below:

- liquid feed
- Flashing Feed (Mixed liquid and vapor)
- Vapor feed

Feed devices help to distribute the inlet feed through the towers and they classified as below:

● **Liquid Feed Pipe**

Liquid only feed pipe is used when liquid is fed from outside the column for distributors. The incoming flow must contain less than 1% vapor by volume. A perforated pipe composed by a main header and secondary flanged branches is typically used for liquid inlets.

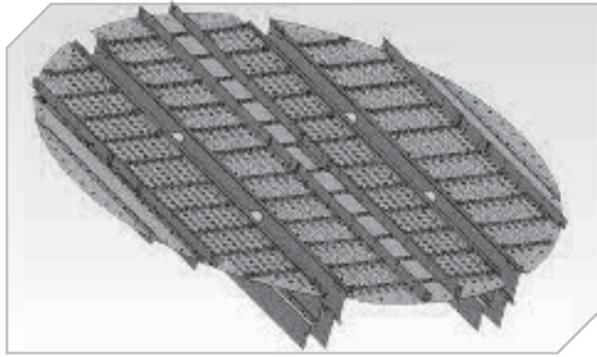


● **Flash Feed Gallery**

Flashing feed gallery is a feed device to accommodate mixed liquid/vapor or flashing feeds. The 2 phase liquid is fed to the column through a nozzle tangentially against the tower wall. The residence time allowing the vapor phase to disengage from the liquid and the clear liquid then flows directly to a distributor.



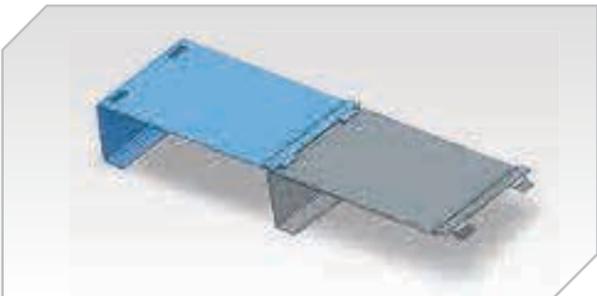
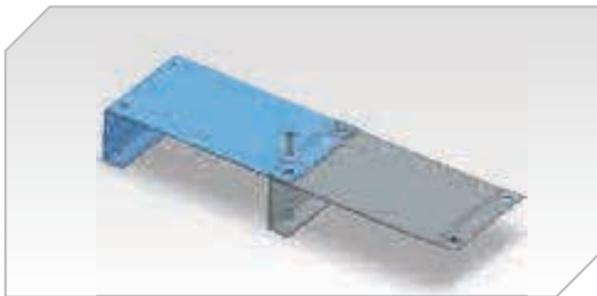
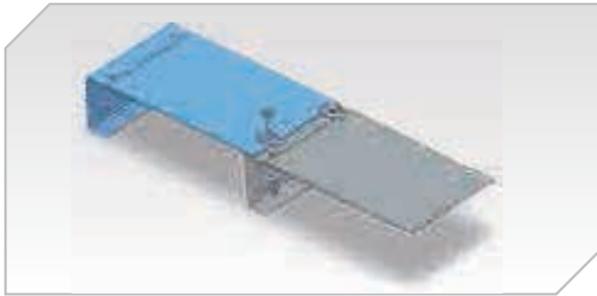
Design Tools



PANTAN has developed home based Tray design codes compatible with comprehensive Tray types which give efficient and accurate output with minimized cost. Depend on customer necessities, all hydraulic/rating and mechanical parameters such as jet flood, downcomer flood, pressure drops, stresses, deflections and etc will be fitted in the acceptable range. The results will be provided to customer in a standard output format. Based on rating and strength outputs, internal parts are designed by use of standard 3D or 2D drafting software then assembly and shop drawings are generated in CAD format.

Installation Layout

Tray panels join together and to the supports with a suitable quick fastening method which should not be loosened by vibration.



Selecting the assembly method depends on tray operation conditions and clients standard mandate. Normally tray panels are assembled through following methods:

● Clamping

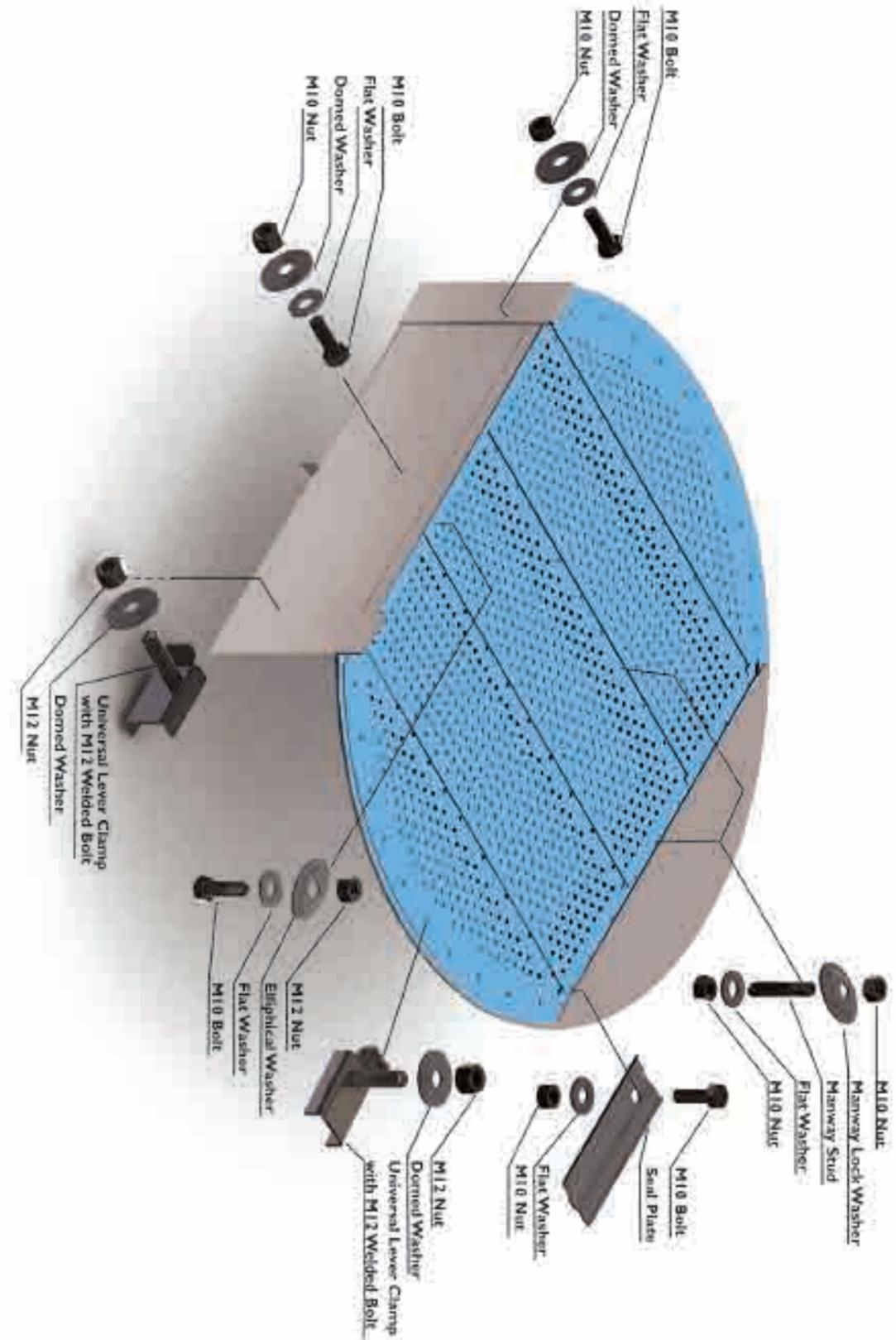
This method is used for jointing tray panels together with friction washers and also connecting tray panels to support ring or bars with universal/ lever clamp.

● Through bolted

Through bolted tray panel connection results in more rigid structure and ensures mechanical integrity, especially in case of considerable vibration. The parts which are designed for load bearing such as upper section of downcomer or major beam need to be through bolted to supports.

● Lip joint

This method is used for jointing tray panels together with friction washers and also connecting tray panels to support ring or bars with universal/ lever clamp.



STANDARD TRAY ASSEMBLY

Services

In addition to our high-quality products, PANTAN offer a range of services and technical expertise to his customer.

● Engineering

Effective design and responsive services are the main duties of PANTAN. It is not the case whether small diameter or large, new construction, revamp or replacement, we will provide reliable solutions to our customer's requirements at an economical condition.

● CFD Simulation

Based on the customer request, we provide CFD consultation for some industrial processes in order to design equipment based on CFD simulation instead of built and test approach. Moreover, we use CFD modeling for de-bottlenecking and process optimization purposes.

● Installation Supervision

Specialist Site Supervision is the commonly requested support service. Generally the installation or modification of vessel internals is carried out as part of an overall shutdown program and it is normally convenient to appoint a single contractor to carry out all site work. In the such situations, the Installation Supervisor provided by us would typically function as follows:

- To verify that installation procedure is compatible with the design and proper functioning of vessel internals
- Planning to ensure that adequate preparation is made for smooth installation compatible with the shutdown schedule
- Generally support the installation contractor with techniques and procedures to suit site conditions
- Assistance in overcoming any installation problems
- Final inspection of installed equipment.

● Spare Parts Support

PANTAN has developed procedures and resources to provide replacement column internals such as tray, tray parts and packings on a like for like basis in either planned or emergency shutdown. This service is available to users of Distillation Internals supplied by almost any manufacturer.



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SPARE PARTS SUPPORT
FLOAT VALVE TRAY

PANTAN
PROCESS VESSEL INTERNALS
ENGINEERING SERVICES
INSTALLATION SUPERVISION
LIQUID FEED PIPE PANTA VALVE™

FRACTIONATION TRAYS SIEVE TRAY

CFD SIMULATION

FLOAT VALVE TRAY

LIQUID FEED PIPE
FIXED VALVE TRAY

SIEVE TRAY

PANTAN HIGH PERFORMANCE TRAYS

FEED INLET DEVICES

BUBBLE CAP TRAY

SERVICES STAY FOR EVER

BUBBLE CAP TRAY
FIXED VALVE TRAY

FLOAT VALVE TRAY