



# Separator Internals

## Overview

HAT supplies a large number of internals used in separation service from the various Alpha product ranges. Many of these have uses in other applications, but some have been developed specifically for gas/liquid separation service in fields such as:

- **Oilfield Production (gas/oil/water) Separators (onshore, offshore and FPSO)**
- **Test Separators**
- **Free Water KO Drums**
- **Oil/Water Coalescers**
- **Compressor scrubbers**
- **Gas/Liquid KO Drums & Inlet Scrubbers**

### Inlet Devices:



**BID Bifurcator Inlet Distributor**



**VID Vane Inlet Distributor**



**CID Cyclone Inlet Distributor**



**BP Perforated Baffle Plates**

### Defoaming Internals:



**FB-V Foam Breaker Vanes**



**FB-M Foam Breaker Matrix**

### Coalescing Internals:



**FP Flat Plate Pack**



# Separator Internals

## Demisting Internals:



**MP Matrix Pack**



**DM Dual Media Coalescer**



**DS/GP/HE Wire Mesh Demisters**



**VV/VH Vane Mist Eliminators**



**SME Swirl Mist Eliminators**



**MCE Multi Cyclone Elements**

## Desanding Internals:



**SJ-HN Sand Jet H Spray System**



**SJ-HT Hydro Transport Removal**

## Other Devices:

**VB Vortex Breakers**

**SW Stilling Wells**

**WF/WA Fixed/Adjustable Weirs**

**SB Skimmer Boxes**

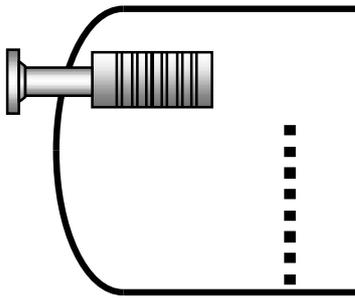


## Inlet Distributors

### Multi Vane Inlet Distributor

The AlphaPLUS™ VID is a multi-vane inlet device used in horizontal and vertical separators where there is a requirement for good flow distribution with minimum shear and pressure drop.

In horizontal vessels the VID is suited to both end entry as illustrated below, and top entry by means of an elbow directed towards the head. Benefits of this device compared with simpler deflectors include reduced agitation and hence improved 2 and 3 phase operational performance, more stable level control, and reduced foaming.

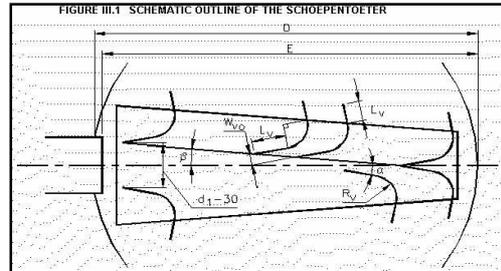


For vertical vessel installations, usually where there is a high gas flow relative to the liquid flow, the VID provides excellent vapour distribution allowing a reduced height to the mass transfer or mist eliminator internals.

The VID works by smoothly dividing the incoming flow into various segments using an array of curved vanes to suit the overall geometry of the inlet nozzle and distributor length. To achieve this effect the vanes start with a wide spacing and gradually reduce the gap, giving the unit its characteristic tapering shape.

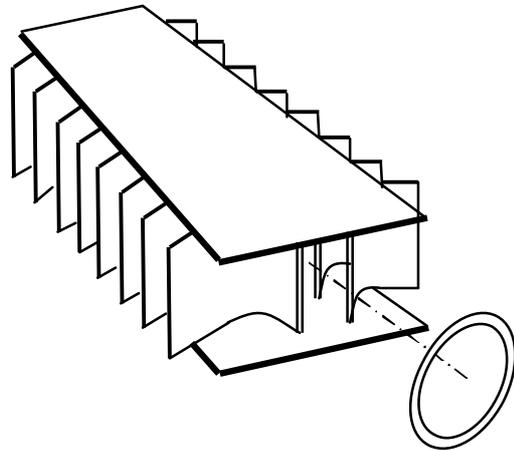
Based on the well proven Shell Schoepentoeter™ design, AlphaPLUS VID

units are installed in a wide range of applications.



The VID is usually constructed from stainless steel and is designed to be installed in sections through a vessel manway and assembled in the vessel.

When sizing the VID to match the inlet nozzle, we recommend the fluid momentum  $pv^2$  is in the range of 6,000 - 10,000.



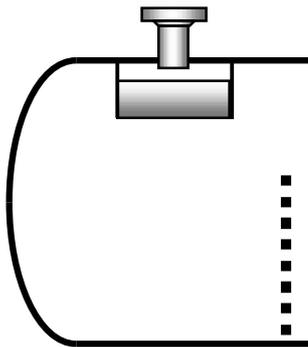


## Inlet Distributors

### Bifurcator Inlet Distributor

The **AlphaPLUS BID** is a simple, dual-vane inlet device used in horizontal separators where there is a requirement for reasonable flow distribution with low shear and pressure drop.

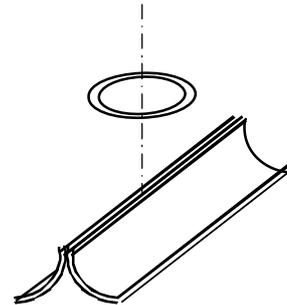
In horizontal vessels the BID is suited to top entry. Benefits of this device compared with simpler deflectors such as deflector plates or dishes include reduced agitation and hence improved 2 and 3 phase operational performance, more stable level control, and reduced foaming.



For liquid slugging applications, usually where there is a long incoming flowline, the BID provides excellent mechanical strength.

The BID works by smoothly dividing the incoming flow into two segments using curved vanes to suit the overall geometry of the inlet nozzle. The gas phase readily separates and disperses along the vessel, whilst the liquid phase velocity is reduced and the flow directed at the vessel walls where it further disperses and falls into the bulk liquid layer at relatively low velocity.

Based on well proven industry designs, HAT's BID units are installed in a wide range of applications.



When sizing the inlet nozzle for a BID installation, we recommend the fluid momentum  $\rho v^2$  does not significantly exceed 6,000.





## Inlet Distributors

### Cyclone Inlet Distributors

The AlphaPLUS™ CID is a cyclonic inlet device used in horizontal and some vertical separators where there is a requirement for high momentum dissipation, foam reduction and high capacity.

Developed originally in the 1960's for the treatment of foamy crude oil in production equipment, early inlet cyclone devices suffered from a range of mechanical and fluid instability problems, and were not widely adopted.

Development work continued, however, and the design of the inlet cyclones evolved over the next 4 decades from short, fat, single or dual cyclones into tall, thin, multi cyclone arrangements. The characteristics

of these devices became better understood, and reliable performance envelopes were developed.

A characteristic of the cyclones is their high flow capacity, meaning that more throughput is possible through any given size separator.

### Defoaming Mechanism

The primary purpose of the CID inlet cyclone is that of foam elimination inside a separator. Many crude oils exhibit moderate or severe foaming tendency and the traditional approach to these problems is through a combination of oversized equipment using foam breaking packs and chemicals.

Inlet cyclones work on the principle of enhanced gravity separation by accelerating any incoming foam to high g-force, when it breaks down into separate liquid and gas phases.

The oil/water is flung to the perimeter of the cyclone tubes and flows down them into the bulk liquid layers, whilst the gas forms a central vortex core and escapes through a top outlet hole into the gas space.

There are many factors to take into account when designing these devices so please refer to HAT for sizing confirmation.

### Easy to Install

Manufactured as components that fit through a standard manway, CID inlet cyclones comprises pre-stiffened cylinders and manifolds, requiring only simple supports and assembly within the vessel to achieve a secure fit.

HAT provides full installation guidelines to ensure process

### Modular Construction



*HAT's unique modular design means future changes are easily made should the production profile change over time, or not be as expected.*



## ***Inlet Distributors***

integrity is not compromised. If required, we can also arrange to inspect equipment prior to start-up.

### **Wide Performance Range**

HAT will design the cyclone cluster to meet your specific requirements, but the design envelope of the whole separator usually means that performance can be guaranteed all the way down to zero turndown. In many cases there will be little loss in performance also should an additional 10-20% flow be required through the system. CID inlet cyclones can be used at any operating pressure and temperature likely to be experienced.

When sizing the CID to match the inlet nozzle, we recommend the fluid momentum  $\rho v^2$  is in the range of 10,000 - 20,000.

HAT also sometimes recommends the use of inlet weirs and flow distributor baffles, depending on the application.

### **Long Life Construction**

Standard materials of construction are stainless steel grade 316 for all components. For very sour or corrosive service other materials such as Inconel can be furnished.

### **Applications**

Common applications for CID inlet cyclones include both horizontal and vertical:

- Production Separators
- Free Water Knock-Outs
- Degassing Vessels
- Slug Catchers





## Inlet Distributors

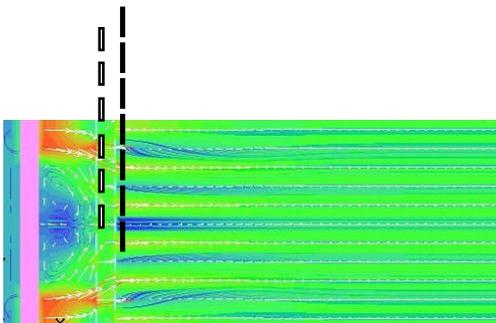
### Perforated Baffle Plates

A selection of **AlphaPLUS** Baffle Plates (**BP**) is available from HAT. These are available in a range of perforations and styles for installation in horizontal or vertical vessels.

Common applications include:

- Calming the inlet zone in horizontal separators
- Liquid flow redistribution in long vessels
- Surge suppression in vessels installed in offshore FPSO applications
- Gas distribution upstream or downstream of mist eliminators

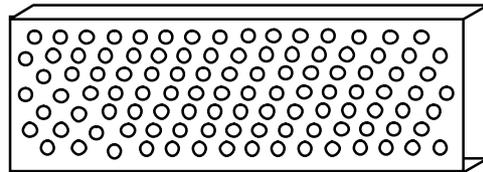
The flow distribution characteristic of perforated baffles is well established, but modern design tools such as CFD enable today's designers to tailor the baffle design to achieve optimum distribution by adjusting the hole size, % open area, number of baffles (BP-1 single and BP-2 dual) and their overlap as illustrated below.



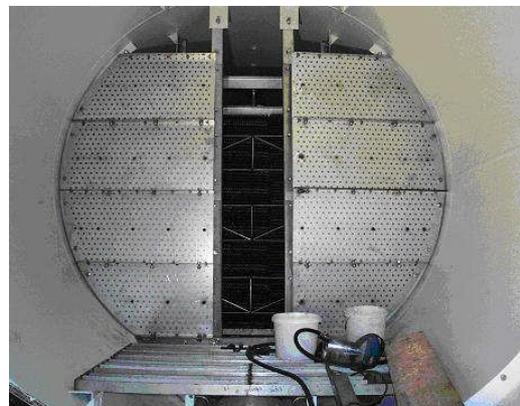
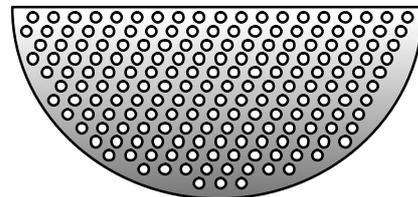
AlphaPLUS baffles are designed and manufactured to be installed in

sections through a vessel manway and are either self reinforced using webs on the panels, or in larger vessels may be

additionally supported with separate stiffening beams.



Construction of the BP's is usually in stainless steel and, thanks to the integral stiffening mentioned above, it is possible to utilise thicknesses as low as 2 or 3mm for many applications, reducing both installed cost and weight.





# Solids Removal

## OVERVIEW

Much work has been performed on the development of sand or sludge removal systems from separators over many years. However, no single “sand jet” system has evolved as clearly superior, rather there are a number of design features to choose from depending on the characteristics and nature of the problem. HAT tailor makes it's sand jetting systems based on a wide range of features as shown below, to ensure that the sand deposits can be fluidised and hence drained satisfactorily in the most economic way.

## SPECIFICATION OF SAND REMOVAL SYSTEM

HAT manufactures a comprehensive range of **AlphaPLUS®** standard and high performance wash systems as listed below.

### Standard Types:



#### **SJ-HP Pipe Header**

Basic design for low fouling or small systems, may or may not be fitted with jet nozzles.

### High Performance Types:



#### **SJ-HN Nozzle Spray Header**

Well proven, conventional design with directional pipes and specialist nozzles for improved coverage.



#### **SJ-HT Hydro Transportation System**

Latest generation design with vortex induced fluidisation for improved performance. HAT manufactures these systems for specialist process houses.



## Solids Removal

### Type

AlphaPLUS® SJ-HN  
Conventional Jet Nozzle System



### Benefits

Twin jet headers are placed either side of the centreline to provide maximum coverage. They can be split into several 'H' sections (partitioned) each separately fed with jet water, and separately drained so that sand deposition and flushing can be monitored and controlled at or above the critical Fluidisation Factor.

The headers are fitted with an array of smaller arms fitted with fan-jet nozzles to fluidise and sweep the solids most effectively.

The central sand pan prevents sand settling on the centreline and clogging the flushing out (sand removal) nozzles.

Segmentation of the sand area of the vessel is important for flushing purposes. It minimises jet water use and prevents fluidised solids from dissipating downstream. These segment lengths are calculated on an individual application basis. It is important to have the correct number and size of nozzles, although 'more' is not always good or necessary.

Large drain nozzles can interfere with the oil/water interface when flushing and drain-down is performed on-line, and may give excessive flows of slurry.



## Solids Removal

Type	Benefits
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### AlphaPLUS® SJ-HT Hydro Transportation System



Hydro transportation devices are considered by some to be the “latest generation” of sand removal devices.

Among these are:

- The HydroTrans device from Petreco
- The Tore device from Merpro
- The CyFlo device from DPS

The operating principle is the introduction of wash water in a vortex manner. As well effecting initial mobilisation of accumulated solid particles, an area of low pressure is produced at the centre of the induced vortex, which is utilised, by means of strategically placed piping, to transport the produced slurry out of the vessel.

The device prepares a slurry of liquid and solids to the required concentration and pressure, and transports the slurry into the transportation pipeline or downstream process system as may be required.

It can fluidize and transport a wide range of solids and particle sizes. HAT manufactures these systems for specialist licensors.