

### Enhanced Type S™ Inlet Devices (ETS)

#### Features

- Achieves a considerable reduction of the vertical vessel height
- Reduces mist loading to downstream demisters increasing gas capacity
- Eliminates droplet shearing over conventional devices improving the separation efficiency
- Initiates even distribution of liquid and gas distribution
- Prevents or breaks down foam
- Easy to install in new or existing process equipment

#### What are Enhanced Type S Inlet Devices?

#### Background

Inlet devices play an important role in overall performance of a separation vessel or mass transfer column. Traditional inexpensive devices (Figure 1) that are commonly used at low momentum liquids but negatively affect separation at high momentum are: (A) impact plate, (B) dished head, (C) half-open pipe, and (D) open pipe at vessel head. However, for higher-momentum streams, these inlets can cause problems such as shearing of incoming liquid droplets (more difficult to separate), foaming and liquid short-circuiting or channeling.

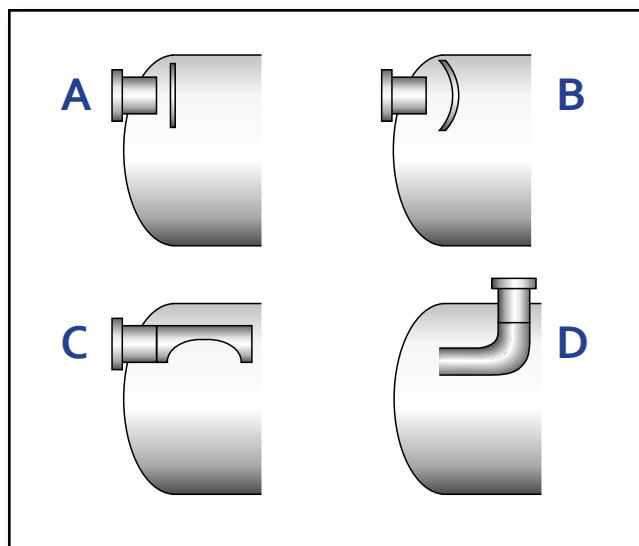
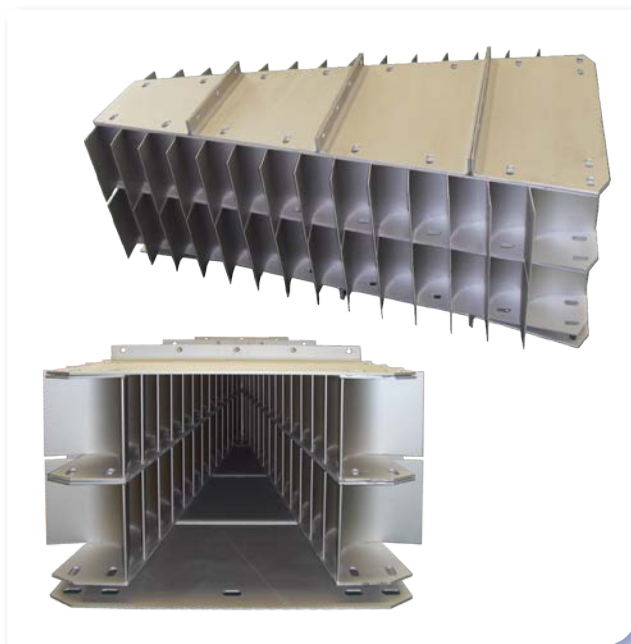


Figure 1  
Traditional inlet devices used in horizontal or vertical vessels



#### Superior Design

Enhanced Type S inlet devices offer superior design and operating performance versus traditional inlet devices in two ways. They are: uniformly decreasing the momentum of the incoming feed stream and evenly distributing the vapor in the gas section of the vessel.

Extending well into a vertical separator vessel cross section, these devices reduce momentum of the incoming feed giving ample residence time which allow for the removal of bulk liquids (liquid load) and solids present in the feed by gravity. Whether in a vertical or horizontal vessel, they provide even distribution of the inlet gas-liquid mixture over the entire cross section of a separator vessel in a very short and controlled way.

In mass transfer columns, it is important to prevent channeling of fluid, especially through the packed beds. Such channeling leads to reduced gas liquid contact and hence reduced efficiency of the column. Enhanced Type S Inlet devices enable the even distribution of gas over the inlet tray, thus preventing channeling of fluid to occur. This insures good gas liquid contact optimizing expected efficiency of the column packing or trays.

#### How do Enhanced Type S Inlet Devices work?

As gas and liquid enters a vessel or column, the Enhanced Type S inlet device splits the mixed phase feed stream into a series of curved vanes to suit the overall geometry of the inlet nozzle and distribution length. Lateral flowing streams gradually reduce the gap, developing a tapered shape. To determine proper nozzle size and design of the Enhanced Type S inlet device along with the specific number of vanes and their

pitch to achieve the targeted performance one must first determine the inlet momentum (measured in Pascals).

$$\text{Inlet momentum} = \rho v^2$$

Where:  $\rho$  = mixture density [kg/m<sup>3</sup>]

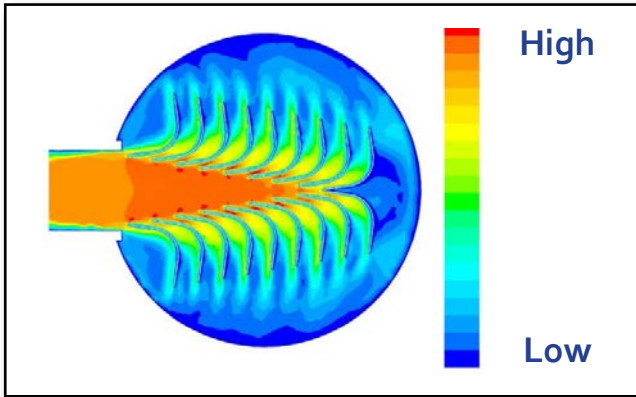
$v$  = velocity of the incoming mixture [m/s]

**Guideline**

- No inlet device < 1000 Pa
- Traditional devices < 1500 Pa
- ETS < 7000 Pa

However, the inlet momentum should not be used as the sole criteria for design. It serves as an indication of the severity of the inlet conditions. This information along with upstream piping layout and flow regime will provide a more meaningful design basis.

The spacing to the vessel wall and between the blades is designed using computational fluid dynamics (CFD) and modeling software to optimize uniform flow (Figure 2).



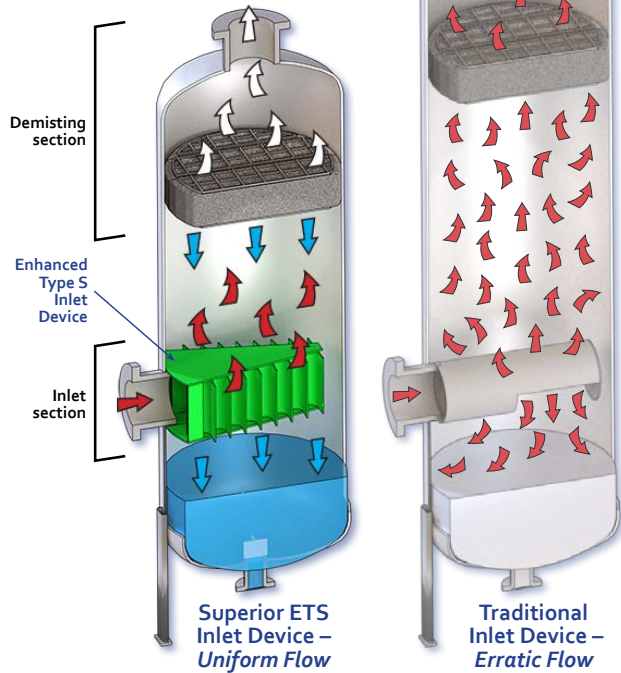
**Figure 2**  
CFD depicting velocity profile from high to low.

Typically, in a horizontal vessel, the length of ETS can be 3 to 6 times the inlet nozzle diameter and for a vertical vessel or column the length can be as long as 90% of vessel diameter.

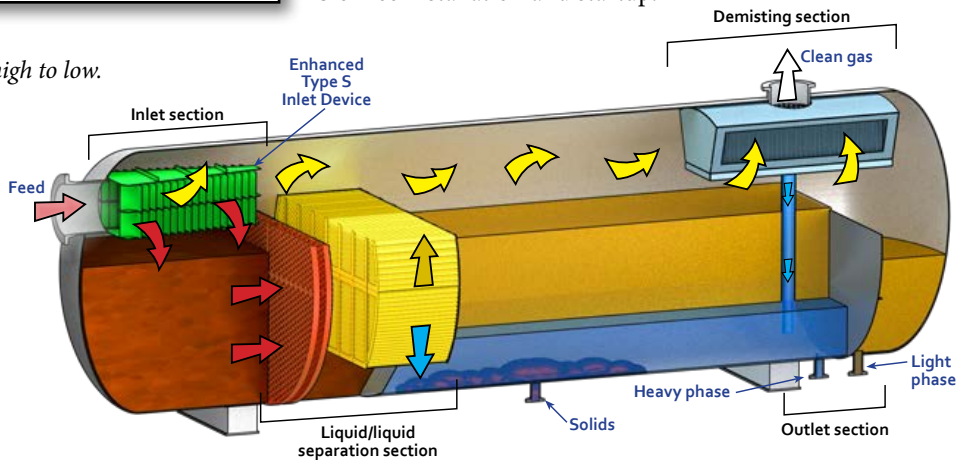
**Where are Enhanced Type S Inlet Devices used?**

Enhanced Type S inlet devices achieve a considerable reduction of the vertical vessel or column height when compared to conventional inlet devices (Figure 3). They are suitable for installation through a manway in new or existing horizontal or vertical two, three & four phase separators without welding to vessel if required (Figure 4). They can also be installed in vertical mass transfer columns.

**Figure 3**  
ETS device can reduce vessel height, as well as liquid load to demister section.



Experienced EIT process engineers can provide complete process modeling and design whether existing or new vessel to ensure expected efficiencies and flow rate along with trouble-free installation and startup.



**Figure 4**  
Successful operation, of all separator internals in large part, depends on a properly designed inlet device. EIT has various custom Enhanced Type S inlet devices for various schemes of horizontal vessels depending on piping layout, nozzle size, and whether there is a significant amount of gas and/or solids present as with Three or Four-Phase Separators.